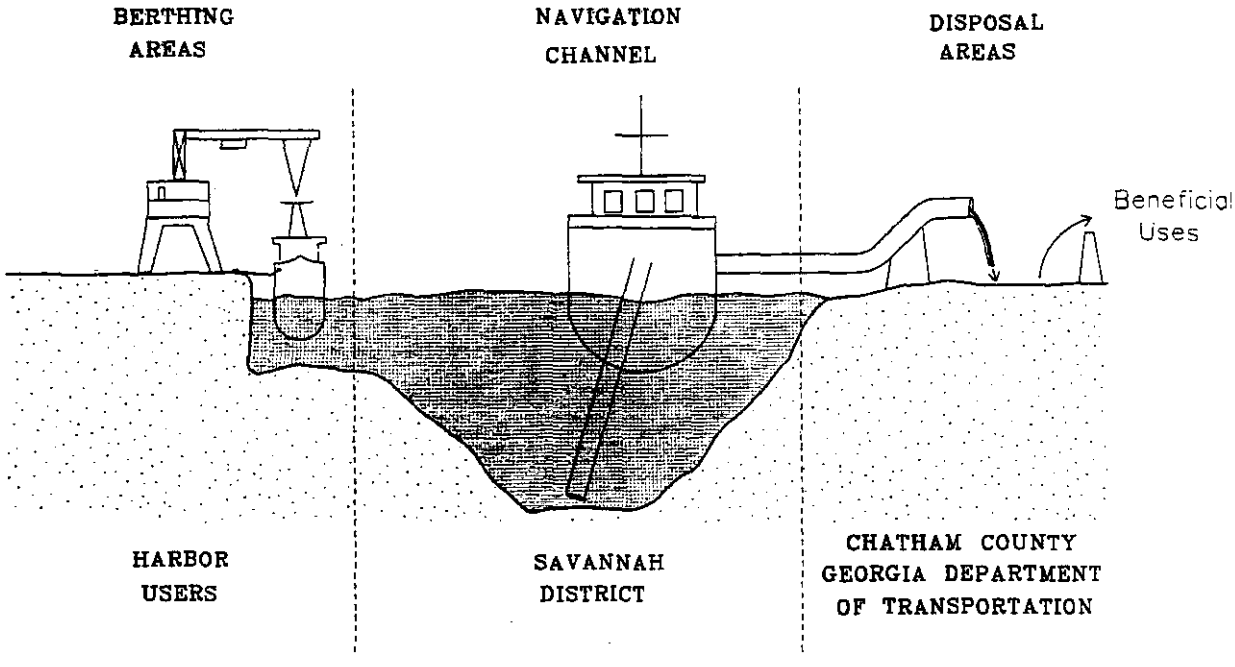
US Army Corps of Engineers
Savannah District
South Atlantic Division

SAVANNAH HARBOR
LONG TERM MANAGEMENT STRATEGY

August 1996



RECORD OF DECISION

SAVANNAH HARBOR LONG TERM MANAGEMENT STRATEGY
SAVANNAH HARBOR, GEORGIA AND SOUTH CAROLINA

I have reviewed the Long Term Management Strategy Final Environmental Impact Statement for operation of the commercial navigation harbor at Savannah Harbor, Georgia. Based on this review and the views of interested agencies and the concerned public, I find the management strategy recommended by the Savannah District to be economically justified, in accordance with environmental statutes, and in the public interest. The selected strategy incorporates the following features:

a) Rotational use of confined disposal areas in the middle and lower harbor, thereby extending their useful life;

b) Diking and use of Disposal Area 14A to allow implementation of the rotational program;

c) A Mitigation Plan to compensate for the wetland losses resulting from the diking of Disposal Area 14A and miscellaneous disposal area operations in South Carolina. This plan consists of the following features:

(1) Implementation of a water management strategy at the confined disposal areas used in the rotation program. The strategy is based on the best use -- for shorebirds and migratory birds -- of water pumped into those sites during disposal operations, depending on the date a disposal. operation ceases;

(2) Construction and maintenance of a total of fourteen 1-acre islands within the seven confined disposal areas used in the rotation program for the benefit of shorebirds and colonial nesting birds;

(3) Construction and maintenance of a 2-acre island located in the nearshore area off the Turtle Island Wildlife Management Area for use by shorebirds, colonial nesting birds, and endangered species;

(4) Clearing and maintenance of a 26-acre bare ground nesting area on high ground oceanward of the dike at Jones/Oysterbed Island for use by colonial nesting birds;

(5) Restoration/creation or protection of 25 acres of tidal wetlands in South Carolina. The SC DHEC-OCRM would select feasible sites in the future and identify either (a) construction actions necessary to improve/create wetlands at the site, or (b) measures which would be necessary to adequately protect the site from future development. The SC DHEC-OCRM would administer an escrow account established by the local sponsor or its designee to accomplish the necessary construction and acquisition.

(6) Installation of a water control structure at an existing 228-acre impoundment within the Savannah National Wildlife Refuge to increase fisheries resources;

d) Construction and use of an access road to Disposal Area 2A to allow deposited sediments to be removed, thereby extending the useful life of that site;

e) Miscellaneous disposal area operations consisting of the following: new pipe ramps, expansions of existing pipe ramps, installation of new weir/discharge pipes, replacement of existing weir/discharge pipes, and bank protection for eroding dikes along the Savannah River, including those at the Jones/Oysterbed Island Disposal Area;

f) A commitment to mitigate at a 2:1 rate for the wetland losses in Georgia stemming from construction of the access road to Disposal Area 2A and miscellaneous disposal area operations at existing confined disposal areas;

g) Installation of underdrains which would drain to either the Savannah or Back Rivers to allow faster drying of deposited sediments; thereby enhancing the removal of those sediments and extending the useful life of the confined disposal areas;

h) Beneficial uses of nearshore sediments, consisting of construction and maintenance of submerged berms south of the Bar Channel, construction and maintenance of a feeder berm off Tybee Island, and placement directly on the Tybee and/or Daufuskie Island beaches;

i) Hydraulic dredging of berths by dock owners with direct deposition of dredged material directly in confined disposal facilities, including deepening of berths by their owners to

increase the efficiency of hydraulic dredging of those sites and reduce the frequency of dredging events; and

j) Improvements in the following sediment control features to create additional off-channel storage for deposition of sediments: advance maintenance deepening at the Sediment Basin and turning basins, and deepening the existing advance maintenance section at the Kings Island Turning Basin. These actions would concentrate sediments out of the navigation channel, thereby extending the duration during which authorized channel depths are available.

Seven alternatives were developed and analyzed in addition to the No Action alternative. Those alternatives varied in disposal location, use of sediment control features, and use of material consolidation techniques. Alternative 8 was selected as the best management plan for efficient and effective operation of the harbor. That alternative includes components which address issues which do not affect the Federal costs of operating and maintaining Savannah Harbor. Those components describe the most environmentally-acceptable manner of maintaining adequate depths in berths and are contained in Alternative 6. The "Base Plan" for the Savannah Harbor Navigation Project -- which establishes the benchmark for Federal involvement in future operation of the harbor and the baseline for cost sharing purposes -- therefore consists of Alternative 8 without the features described in Alternative 6. Viewed from another perspective, the Base Plan consists of the combined use of Alternatives 3 (rotational use of the CDFs), 4 (underdrains), 5 (nearshore disposal options) and 7 (sediment control features in the inner harbor). The nearshore disposal location to be used for a specific dredging contract would be decided during project design and award based on identification of the least cost, environmentally-acceptable option. If disposal at a certain location is found to be more desirable for environmental or other reasons but would be more costly than one of the other acceptable options, it could be pursued using appropriate cost sharing authorities. The non-Federal sponsor is willing to fund the plan components for which it is responsible, with the most costly being the diking of Disposal Area 14A and implementation of its associated Mitigation Plan.

Major environmental issues centered on two areas: development of an acceptable comprehensive mitigation plan for expected wetland impacts, and development of project features which would either reduce the environmental impacts of current harbor operations or benefit the environment through changes in existing operational practices. Concurrence from resource agencies in the selected plan and the revised Mitigation Plan demonstrate the District's resolution of these issues from the perspective of those agencies.

The real estate rights contained within the specific easements in effect for the Navigation Project's confined disposal facilities are under review. Should the Corps determine that any additional real estate interests are necessary to implement provisions of the LTMS EIS, the local sponsor would be responsible for obtaining such interests. Any specific construction and/or management activities on those lands would be contingent upon obtaining all necessary interests. If components of the plan are found to not be implementable as a result of further real estate activity, they may be revised. Those revisions would be developed with input from Federal and state resource agencies, and the public. Depending on the extent of the revisions, additional NEPA documentation may be required.

Three Memorandums of Agreement (MOAs) were prepared. Two MOAs were developed to document actions the District will take concerning cultural resources listed on the National Register of Historic Places. Those sites are Old Fort Jackson and the CSS GEORGIA. Implementation of these MOAs will ensure the District's continued compliance with Section 106 of the National Historic Preservation Act. The third MOA documents actions Savannah District and the Environmental Protection Agency will take in their joint management of the Savannah Ocean Dredged Material Disposal Site (ODMDS).

Technical and economic criteria used in the formulation of alternative plans were those specified in the Water Resource Council's Principles and Guidelines. The District considered applicable laws, executive orders, regulations and local governmental plans in evaluating the alternatives. They incorporated into the recommended plan all practical means to avoid or minimize adverse environmental effects. Based on review of these evaluations, I find that the combined savings and environmental benefits from implementing dredging and disposal activities in the recommended manner outweigh the adverse effects.

3 Feb 1997

DATE

R. L. VANANTWERP
Brigadier General, U.S. Army
Division Engineer

SAVANNAH HARBOR
LONG TERM MANAGEMENT
STRATEGY (LTMS) STUDY

SAVANNAH HARBOR, GEORGIA

FINAL

ENVIRONMENTAL IMPACT STATEMENT

AUGUST 1996

Final
Environmental Impact Statement

Savannah Harbor Long Term Management Strategy Study
Harbor Operation And Maintenance
Chatham County, Georgia, and Jasper County, South Carolina

Lead Agency: U.S. Army Engineer District, Savannah.

Abstract: Savannah Harbor comprises the lower 21.3 miles of the Savannah River and has an authorized project depth of -42 feet Mean Low Water (MLW) from the river's mouth to Kings Island Turning Basin. Savannah District analyzed the ongoing management practices being implemented in the harbor area to determine if a need exists to modify those practices to improve the economic benefits which the harbor provides to the States of Georgia and South Carolina, as well as the entire Nation, or to reduce the environmental impacts of the harbor's operation. A separate report documents the study findings and other components of the Long Term Management Strategy (LTMS). This Final Environmental Impact Statement (EIS) documents the environmental analyses which were performed as components of the Savannah Harbor LTMS Study. Seven alternative management strategies were evaluated in addition to the Without Project conditions expected to occur independent of approval of the LTMS Study or this EIS. None of the proposed alternatives would result in significant adverse impacts to threatened or endangered species, salinity, or water quality. No plan would increase the amount of material required to be dredged annually for maintenance of the Navigation Project. Detailed analyses indicate that Alternative 8 would result in the most efficient operation of the harbor. The selected plan, Alternative 8, would result in (1) rotational use of the confined disposal facilities located in the inner harbor, (2) diking of Disposal Area 14A, (3) implementation of a Mitigation Plan to replace the functional values of wetlands which would be lost at Disposal Area 14A and as a result of miscellaneous disposal area operations in South Carolina, (4) development and implementation of a mitigation plan to compensate at a 2:1 rate for wetlands which would be lost as a result of miscellaneous disposal area operations in Georgia, (5) construction and use of an access road to Disposal Area 2A to allow deposited sediments to be removed by truck, (6) installation and use of underdrains which drain to the Savannah or Back Rivers, (7) construction and maintenance of submerged berms in the nearshore area along the south side of the Bar Channel, (8) construction and maintenance of a feeder berm off Tybee Island, (9) direct placement on eroded portions of Tybee and Daufuskie Islands, (10) direct placement of berth sediments by dock owners into confined disposal areas -- including those of the Navigation Project, (11) deepen berths below the authorized channel depth to increase the efficiency of

hydraulic cutterhead dredging operations, and (12) sediment control features to create off-channel storage of sediment, consisting of advance maintenance deepening of the Sediment Basin, berthing areas and turning basins; and additional advance maintenance deepening the Kings Island Turning Basin. Dredged material would be placed in existing confined disposal areas except for the following locations; (1) the Savannah ODMDS, (2) Disposal Area 14A -- which is presently undiked, (3) nearshore submerged berms, (4) a nearshore feeder berm, (5) direct placement on eroded portions of Tybee and Daufuskie Islands, (6) the nearshore Bird Island component of the Mitigation Plan, and (7) uplands at Jones/Oysterbed Island as a component of the Mitigation Plan. Advance maintenance would be used to concentrate sediment deposition so that dredging could be performed more efficiently. A Cultural Resources Management Plan was developed to ensure protection for (1) known cultural resources located on Corps owned or managed property along the navigation channel, and (2) other cultural resources which may become impacted by harbor operations in the future. Separate Memorandums of Agreement were developed for Old Fort Jackson and the CSS GEORGIA to specify actions which the District will take pertaining to these significant historic resources. The real estate rights contained within the specific easements in effect for the Navigation Project's confined disposal facilities are still under evaluation. Should the Corps determine that additional real estate interests are necessary to implement provisions of the LTMS EIS, the local sponsor would be responsible for obtaining such interests. If those interests are not obtained, the specific construction activity requiring that interest could not be performed.

If you would like further information on this Environmental Impact Statement, please contact:

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FINAL
ENVIRONMENTAL IMPACT STATEMENT

SAVANNAH HARBOR LONG TERM MANAGEMENT STRATEGY

CHATHAM COUNTY, GEORGIA, AND JASPER COUNTY, SOUTH CAROLINA

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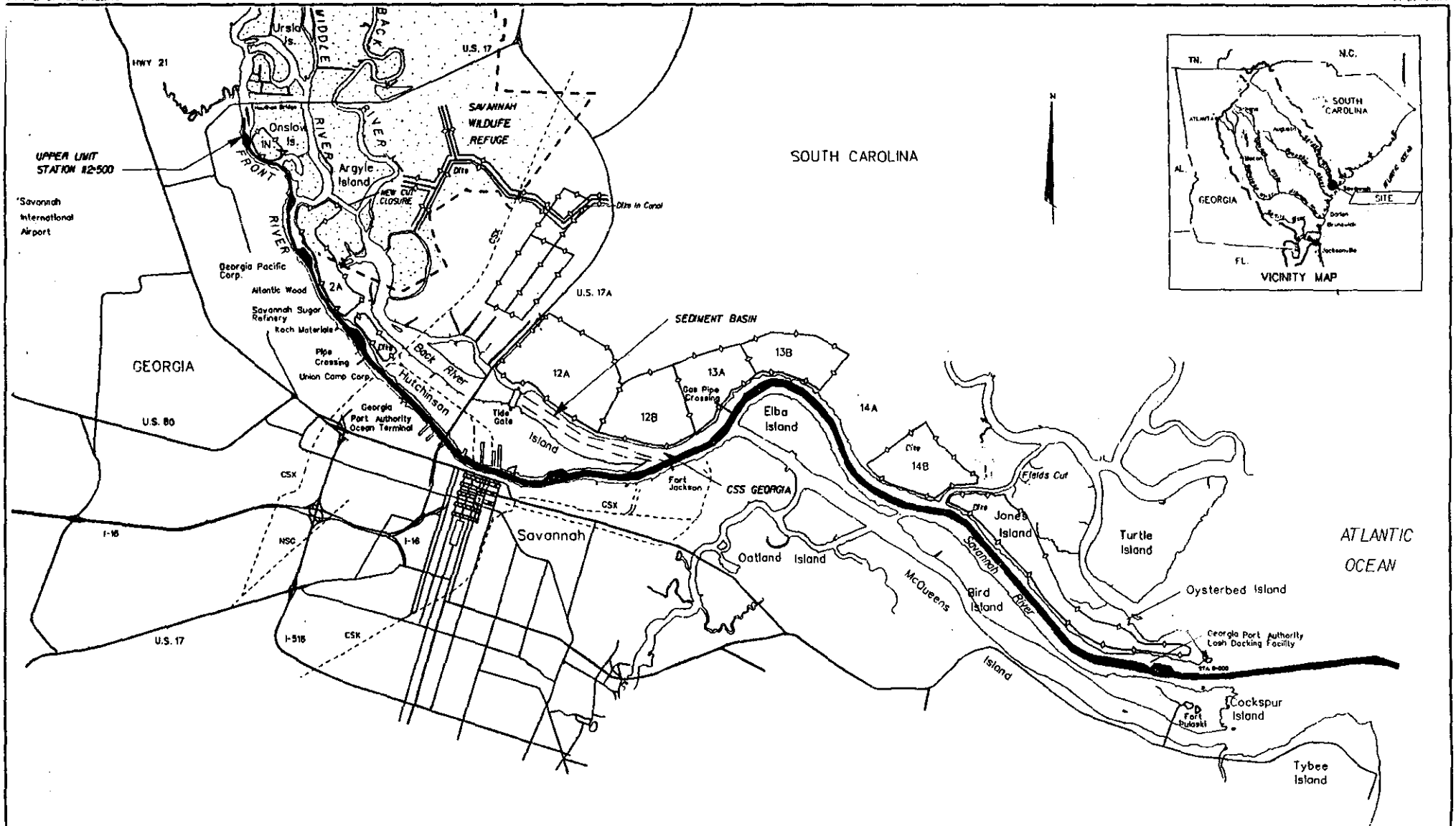
1.00 SUMMARY

1.01 Background. Savannah Harbor comprises the lower 21.3 miles of the Savannah River in Chatham County, Georgia, and Jasper County, South Carolina. The Savannah Harbor Navigation Project has several components, the primary one being an authorized navigation channel with a depth of -42 feet Mean Low Water (MLW) from the mouth of Savannah River to Kings Island Turning Basin (See Figure 1). The Long Term Management Strategy (LTMS) Study for Savannah Harbor was conducted in response to House Report 102-555, submitted on June 11, 1992, by the House of Representatives' Committee on Appropriations, and Senate Report 102-344, submitted on July 27, 1992, by the Senate Committee on Appropriations. Both those reports refer to the Energy And Water Development Appropriation Bill of 1993. In response to those reports, Savannah District analyzed the ongoing management practices being implemented in the harbor area to determine if a need exists to modify those practices to improve the economic benefits which the harbor provides to the State and Nation or reduce the environmental impacts of the harbor's operation. A separate report documents the study findings and components of the Long Term Management Strategy. This Environmental Impact Statement (EIS) documents the environmental analyses which were performed as components of the Savannah Harbor LTMS Study. After public review of this document, the EIS was finalized based on an evaluation of the comments received during review of the Draft EIS. A Record of Decision will be prepared documenting the final decisions made on the LTMS Study and outlining how the Savannah Harbor Navigation Project would be operated and maintained.

1.02 Findings of the Alternative Comparison: Seven alternative management strategies were evaluated and compared to the plan which is expected to occur independent of approval of the LTMS Study or this EIS.

1.03 In the Without Project Condition (Alternative 1), dredging would continue to be performed to maintain authorized depths in the channel, berthing areas and Sediment Basin. A major confined disposal facility located in the middle portion of the harbor would be filled by the year 1997. Dredging of the Bar Channel would continue to be performed by hopper dredges, with subsequent deposition of material in the Savannah Ocean Dredged Material Disposal Site (ODMDS). Dredging of berthing areas would continue to be performed primarily through agitation dredging, with subsequent deposition of most of the material in the navigation channel.



SAVANNAH RIVER , GEORGIA AND SOUTH CAROLINA

SAVANNAH HARBOR
NAVIGATION PROJECT

U. S. ARMY ENGINEER DISTRICT, SAVANNAH
CORPS OF ENGINEERS
SAVANNAH, GEORGIA

FIGURE 1

1.04 In Alternative 2, dredged material would continue to be deposited in the closest diked disposal area, as it is now, but Disposal Area 14A would be diked to allow deposition of material on that site. A Mitigation Plan is included to restore the functional values of wetlands which would be lost at Disposal Area 14A and as a result of miscellaneous disposal area operations in South Carolina. An access road would be constructed to Disposal Area 2A. A wetland creation/restoration plan would be developed and implemented to mitigate for wetlands which would be lost as a result of the road construction and as a result of miscellaneous disposal area operations in Georgia.

1.05 In Alternative 3, dredged material would be deposited in the confined disposal facilities on a rotational basis to extend the useful life of those sites. As in the previous alternative, Disposal Area 14A would be diked to allow deposition of material on that site and a Mitigation Plan would be implemented. An access road would be constructed to Disposal Area 2A. A wetland creation/restoration plan would be developed and implemented to mitigate for wetlands which would be lost as a result of the road construction and as a result of miscellaneous disposal area operations in Georgia.

1.06 In Alternative 4, underdrains would be installed and used which would drain to either the Savannah or Back Rivers. These devices would allow faster drying of material in the confined disposal facilities so that heavy equipment would have more time to work on the floor of the areas to remove material for dike improvement projects. Underdrains would also result in greater consolidation of the deposited material so that less storage space is used within a site, thereby extending the useful life of the site. Dredging and disposal procedures contained in Alternative 1 are included.

1.07 In Alternative 5, beneficial uses would be made for sediments excavated from the Bar Channel. These uses would consist of nearshore placement of the sediments to construct and maintain submerged berms, placement of the sediments to construct and maintain a feeder berm off Tybee Island, or placement on the Tybee and/or Daufuskie Island beaches. These placement options would result in the nearshore placement of material excavated from the Bar Channel which is presently deposited at the Savannah ODMDS. The submerged berms are expected to be dispersive, meaning that the deposited material would disperse throughout the nearshore area south of the navigation channel. Subsequent migration of the deposited material may reduce erosion of the Tybee Island beach. The feeder berm is also expected to be dispersive, with subsequent migration of the deposited material

being primarily toward the Tybee Island beach. Placement directly on eroding beaches at Tybee and Daufuskie Islands would protect those barrier island shorelines from damage from wind-generated waves. The disposal location to be used for a specific dredging contract would be decided based on identification of the least cost, environmentally-acceptable option at that time. If disposal at a certain location is found to be more desirable for environmental or other reasons but would be more costly than one of the other acceptable options, it can be pursued with appropriate cost sharing using Section 933 (WRDA 1986) or Section 204 (WRDA 1992) authorities. Other dredging and disposal procedures contained in Alternative 1 are included.

1.08 In Alternative 6, berth areas would be maintained by dock owners and the excavated material would be placed directly in confined disposal facilities, rather than in the navigation channel, as presently occurs. Deepening of berths would be allowed to six feet below the authorized channel depth to increase the efficiency of hydraulic cutterhead dredging operations. This procedure should reduce both the number of agitation dredging events and the environmental impacts of the present double handling of sediments. Other dredging and disposal procedures contained in Alternative 3 are included.

1.09 In Alternative 7, the effects of three changes to sediment control features in the harbor are evaluated. Those changes consist of (1) the use of an advance maintenance deepening section in the Sediment Basin to restore its sediment trapping efficiency, (2) a deeper advance maintenance deepening section at Kings Island Turning Basin where sediment accumulation rates are high, and (3) deepening turning basins to match the depth of the adjacent channel as a means of off-channel storage of sediments. These changes would result in sediment deposition being more concentrated in areas outside the navigation channel. This would extend the period when full channel depths are available and improve the efficiency of sediment removal operations. Other dredging and disposal procedures contained in Alternative 1 are included.

1.10 Alternative 8 consists of a combination of the procedures included in Alternatives 3 through 7. This would allow actions that were separately evaluated and found to be warranted to be implemented as a package.

1.11 The economic analysis found that total dredging and disposal costs in the harbor would be minimized through implementation of Alternative 8. Detailed site-specific engineering and economic evaluations would be required to document the justification of implementing the advance maintenance features in the inner harbor.

1.12 None of the proposed alternatives would result in significant adverse impacts to threatened or endangered species, salinity, or water quality. No plan would increase the amount of material required to be dredged annually for maintenance of the Navigation Project. Adverse impacts to wetlands in South Carolina would be mitigated through implementation of a wetland Mitigation Plan contained in this EIS. Impacts to wetlands in Georgia would be mitigated at a 2:1 ratio through development and implementation of an acceptable wetland mitigation plan.

1.13 Proposed changes in sediment control features are located in submerged areas which have already been surveyed and cleared for potential impacts to cultural and historic resources. Magnetometer and low-water shoreline surveys were performed on previously unsurveyed portions of the harbor for the potential existence of historic or cultural resources which could be impacted by continued operation of the Navigation Project. Placement of dredged material in various portions of the nearshore was considered in three alternatives. Although those deposition areas have not been surveyed for the potential existence of cultural resources, no impacts are expected to any sites which may exist there. Deposition of sediment materials at such sites would effectively place an additional protective covering over them.

1.14 The Venus Point Light Structure was found to be impacted by ongoing harbor operations. Savannah District determined the site to be eligible for the National Register of Historic Places. Since avoidance of the ongoing impacts was not feasible, documentation of the structure was performed to mitigate for the adverse impacts. Two other major cultural resources may also be experiencing impact from operation and maintenance of the existing Navigation Project; Old Fort Jackson and the Confederate ironclad, the CSS GEORGIA. A Memorandum of Agreement (MOA) was prepared for each resource with the Savannah District, the Georgia State Historic Preservation Officer (GA SHPO), the South Carolina State Historic Preservation Officer (SC SHPO), and the Advisory Council on Historic Preservation (ACHP) as signatory partners. The MOA's stipulate that Savannah District will fulfill the requirements of 36 CFR Part 800 by implementing the following actions:

1. Conduct underwater remote sensing (magnetometer, fathometer, side scan sonar, and/or sub-bottom profiler) surveys, as appropriate;

2. Map the side slopes and channel bottom in the areas of Old Fort Jackson and the CSS Georgia;

3. Test and recover ordnance from the portions of the CSS Georgia wreck located within the proposed channel prism;

4. Evaluate the status and stability of both resources;

5. Identify adverse impacts which each resource may be experiencing or have experienced in the past. Attempt to identify the causes of those adverse impacts and the contribution of each one to the present condition of the resource;

6. Develop and evaluate alternatives to reduce or eliminate adverse impacts which the resource may be experiencing as a result of the Navigation Project (develop an avoidance/mitigation program);

7. Coordinate all survey and test results, evaluations and recommendations with the GA SHPO, SC SHPO, ACHP, and other interested parties to determine the most appropriate avoidance/mitigation actions;

8. In coordination with the GA SHPO, SC SHPO, ACHP, and other interested parties, attempt to identify funding sources for avoidance/mitigation actions commensurate with the causes of the adverse impacts experienced to that point in time; and

9. Implement the portion of the avoidance/mitigation program for which the Corps is responsible.

1.15 A Cultural Resources Management Plan was developed to ensure protection for other cultural resources located on property which is (1) used for this project, and (2) located along the navigation channel which could be impacted by project operations. Implementation of the Cultural Resources Management Plan will ensure that the harbor can continue to be operated in compliance with existing laws and regulations protecting those resources.

1.16 In comparing the alternatives, each plan is evaluated based on consideration of all technical, economic, and environmental data. Based on the District's assessment of the beneficial and adverse impacts which would occur, Alternative 8 -- the combination alternative -- was identified as the best plan for management of the harbor and was selected for implementation.

1.17 The selected plan, Alternative 8, would result in (1) the rotational use of the confined disposal facilities located in the inner harbor, (2) diking of Disposal Area 14A, (3) implementation of a Mitigation Plan to restore the functional values of the wetlands which would be lost at Disposal Area 14A and as a result of miscellaneous disposal area operations in South Carolina, (4) installation and use of underdrains which drain to the Savannah or Back Rivers, (5) beneficial uses of nearshore

sediments (construction and maintenance of submerged berms, construction and maintenance of a feeder berm, and direct placement on Tybee and/or Daufuskie Island beaches), (6) hydraulic dredging of berths by dock owners with direct placement of excavated sediments into confined disposal areas, (7) deepening of berths by dock owners to enhance the efficiency of hydraulic dredging of those sites and reduce the frequency of dredging events, (8) sediment control features consisting of advance maintenance deepening of the Sediment Basin, additional advance maintenance deepening at the Kings Island Turning Basin, and advance maintenance deepening of turning basins to the elevation of the adjacent channel to create off-channel storage areas, (9) construction and use of an access road to Disposal Area 2A to allow removal of deposited sediments, and (10) development and implementation of a wetland restoration/ creation plan to mitigate for wetlands which would be lost at Disposal Area 2A and as a result of miscellaneous disposal area operations in Georgia. Dredged material would be placed in confined disposal areas except for six locations; the Savannah ODMDS, the nearshore submerged berms, the nearshore feeder berm, the nearshore Bird Island component of the Mitigation Plan, and the beaches of Tybee and/or Daufuskie Islands, completion of the previously authorized filling of New Cut. The nearshore disposal location to be used for a specific dredging contract would be decided during project design and award based on identification of the least cost, environmentally-acceptable option. If disposal at a certain location is found to be more desirable for environmental or other reasons but would be more costly than one of the other acceptable options, it could be pursued using appropriate cost sharing authorities. Advance maintenance would be used to concentrate sediment deposition so that dredging could be performed more efficiently.

1.18 The term "Base Plan" or "Federal Standard" for a harbor is the benchmark for Corps involvement in future operation of the harbor and the baseline for Federal cost sharing purposes. The Base Plan is the dredged material disposal alternative or alternatives which represent the least costly alternatives consistent with sound engineering practices and meeting environmental standards. Alternative 8 was selected as the best management plan for efficient and effective operation of the harbor. However, that alternative includes components which address issues which do not affect the Federal costs of operating and maintaining Savannah Harbor. Those components describe the most environmentally-acceptable manner of maintaining adequate depths in berths and are contained in Alternative 6. The Base Plan for the Savannah Harbor Navigation Project, therefore, consists of Alternative 8 without the features described in Alternative 6. Viewed from another perspective, the Base Plan consists of the combined use of Alternatives 3 (rotational use of the CDFs), 4 (underdrains), 5 (nearshore disposal options) and 7 (sediment control features in the inner harbor). The nearshore

disposal location to be used for a specific dredging contract would be decided during project design and award based on identification of the least cost, environmentally-acceptable option. If disposal at a certain location is found to be more desirable for environmental or other reasons but would be more costly than one of the other acceptable options, it could be pursued using appropriate cost sharing authorities.

1.19 Major Conclusions. Continued operation of the Savannah Harbor Navigation Project was found to be economically justified. Alternative 1 (Without Project Conditions) would produce average annual economic benefits of $56 million at an economic cost of $7.4 million. Alternative 8 was identified as the best plan for management of the harbor and was selected for implementation. That plan would increase the efficiency of navigation through the harbor by keeping the authorized depth available for a longer period of time. Dredging operations would be improved by concentrating sediments in certain advance maintenance areas, so that excavation can be performed more efficiently. The certainty of disposal operations would be improved through the rotational use of the confined disposal areas. The use of nearshore submerged berms would result in more material being available in the nearshore sand sharing system of Tybee Island, resulting in a decrease in erosion of that beach. Implementation of the wetland Mitigation Plan would result in an increase in wildlife use of the confined disposal areas in South Carolina. Use of underdrains would result in faster drying of sediments deposited in the confined disposal facilities, thereby providing heavy equipment with more time to work on the floor of the areas to remove material for dike improvement projects. The underdrains would also result in greater consolidation of the deposited material so that less storage space is used within those sites, thus extending their useful life.

1.20 Areas of Controversy.

1.21 Salinity. An area that has been a major concern in the past is the salinity levels in the upper harbor. Since no changes are being proposed in the channel geometry which would affect salinity, this issue was not of major concern during evaluation of the proposed management alternatives.

1.22 A review was performed of components of the Navigation Project which previously impacted salinity. Previous enlargements of the navigation channel have resulted in an increase in salinity levels in the upper harbor. Removal of the Tidegate from operation and the closing of New Cut were performed to decrease salinity levels in Back River. The limited monitoring which has been performed to date indicates those actions have been successful.

1.23 The Freshwater Control System was designed and implemented in the 1970's to provide freshwater to dikes within the Savannah National Wildlife Refuge (SNWR) and adjacent private landowners. Onsite inspections and surveys revealed that the diversion canal (McCoombs Cut) is smaller than its designed size. A hydraulic analysis indicates that this canal cannot transport the volume of water for which it was intended. Discussions with the SNWR indicate no desire on their part to have that channel enlarged at this time to increase the freshwater flow down Back River. They believe that decisions related to the future of the diversion canal should be postponed until the results of the striped bass egg and larval study currently being conducted by the Corps is complete. At that point, indications concerning the present value of Back River as habitat for striped bass would be available.

1.24 Life of the Diked Disposal Areas. Another major area of concern with any navigation project is the capacity of the existing disposal areas to hold the material which will be removed from the channel during future maintenance activities. The detailed evaluations revealed that the existing confined disposal facilities have a minimum of 2 years of remaining useful life. Based on projected dredging volumes, Disposal Area 2A would be filled at that time. The next areas which would be filled would be Disposal Areas 12B and 13A. Use of Alternative 2, which consists of the diking of Disposal Area 14A and construction and use of an access road to Area 2A, would result in the diked disposal areas being available beyond the 20-year period of analysis used in this study. Disposal Area 2A would only be available on a reduced scale after Year 6 of the project. The narrow configuration of the site severely limits the height to which the dikes can be raised while still providing significant increases in capacity. Alternative 8 -- which consists of the diking and use of Disposal Area 14A, construction and use of an access road to Disposal Area 2A, installation of underdrains, and the rotational use of the diked areas -- would maximize the useful life of the confined disposal sites.

1.25 Cultural Resources. During coordination of the Savannah Harbor Deepening Project's 1991 Feasibility Report/EIS, many comments were received expressing concern over the potential impacts which that project could have on known and unknown historic and cultural resources located in Savannah Harbor. Much work has been accomplished since that time related to cultural resources. Extensive investigations were conducted on known resources in the old Fig Island Channel. A low-water shoreline survey was performed to identify cultural resources along the entire harbor.

1.26 Separate Memorandums of Agreement were developed for the two major cultural resources which may be affected by the navigation channel; Old Fort Jackson and the Confederate ironclad, the CSS GEORGIA. In additional, a Cultural Resources Management Plan was developed for other cultural resources located along the navigation channel. Implementation of the Cultural Resources Management Plan will ensure that the harbor can continue to be operated in compliance with existing laws and regulations protecting those resources.

1.27 Wetland Mitigation. Since four of the proposed management alternatives include the diking of Disposal Area 14A and miscellaneous disposal area operations -- with their accompanying loss of wetland vegetation, an area of concern is the loss of those wetlands. A Mitigation Plan was developed which fully replaces the functional value of wetlands which would be lost in South Carolina. That Plan is a component of each alternative which includes the diking of Disposal Area 14A. Development of a mitigation plan is also proposed for the loss of wetlands which would occur with the construction of an access road to Disposal Area 2A and certain other disposal area operations in Georgia. The District commits to prepare plans for and implement a wetland restoration/creation project for such mitigation. Mitigation for the 3.2 acres of wetlands which are expected to be lost in Georgia would be at a 2:1 ratio.

1.28 Relationship to Environmental Requirements. Table 1 provides a list of applicable environmental laws and the relationship of each of these laws to the detailed alternatives.

2.00 NEED FOR AND OBJECTIVES OF ACTION

2.01 Background. Recent actions taken in Savannah Harbor include the widening of the ship channel near City Front, closure of New Cut, discontinued operation of the Tidegate, and finally the recent deepening of the majority of the navigation channel. These have modified the hydrodynamics of the harbor, altering historic shoaling patterns. These changes, together with the more stringent environmental restrictions and requirements such as dredging windows, are jeopardizing the timely, efficient, and effective maintenance of the Savannah Harbor Navigation Project. Ultimately, the ability of the Navigation Project to adequately serve the needs of deep-draft commercial navigation interests may be affected.

TABLE 1

RELATIONSHIP OF PLANS TO ENVIRONMENTAL REQUIREMENTS

FEDERAL POLICIES	ALL ALTERNATIVES
Anadromous Fish Conservation Act, 16 U.S.C. 757 et. seq.	In compliance.
Archaeological and Historic Preservation Act, as amended, 16 U.S.C. 469 et. seq.	Partial compliance. Surveys and mitigation for the selected plan will be conducted.
Clean Air Act, as amended, 42 U.S.C. 1857h-7, et. seq.	In compliance.
Clean Water Act, as amended (Federal Water Pollution Control Act) 33 U.S.C. 1251, et. seq.	In compliance. Water quality certification was received from both GA and SC.
Coastal Barrier Resources Act, as amended, 16 U.S.C. 3501, et. seq.	In compliance.
Coastal Zone Management Act, as amended, 16 U.S.C. 1451, et. seq.	In compliance. A Consistency Statement was received from the SC OCRM.
Endangered Species Act, as amended, 16 U.S.C. 1531, et. seq.	In compliance. Section 7 consultation was completed with both the US FWS and the NMFS.
Estuary Protection Act, 16 U.S.C. 1221, et. seq.	In compliance.
Federal Water Project Recreation Act, as amended, 16 U.S.C. 4601-12, et. seq.	In compliance.
Fish and Wildlife Coordination Act, as amended, 16 U.S.C. 661 et. seq.	Not applicable. The EIS was coordinated with the US FWS, NMFS, SC DNR, and GA DNR.
Fishery Conservation and Management Act of 1976, Public Law 99-659.	In compliance.
Land and Water Conservation Fund Act of 1985, as amended, 18 U.S.C. 4601-4, et. seq.	Not applicable.

TABLE 1

RELATIONSHIP OF PLANS TO ENVIRONMENTAL REQUIREMENTS
(CONT'D)

Marine Mammal Protection Act, 16 U.S.C. 1361 et. seq.	In compliance.
Marine Protection Research and Sanctuaries Act of 1972, 33 U.S.C. 1401, et. seq.	In compliance. Certification from EPA was received of the Section 103 Evaluation.
Migratory Bird Conservation Act, 16 U.S.C. 715, et. seq.	In compliance.
Migratory Bird Treaty Act, 16 U.S.C. 703, et. seq.	In compliance.
National Historic Preservation Act, as amended, 16 U.S.C. 470a, et seq.	Partial compliance. Draft MOAs for two sites were reviewed by the state SHPOs and the ACHP. The revised, unsigned MOAs are included in this document. Surveys and mitigation for the selected plan would be conducted as required.
National Environmental Policy Act of 1969 (NEPA), as amended, 42 U.S.C. 4321, et. seq.	Partial compliance. Filing of the Final EIS would fulfill the compliance requirements.
Rivers and Harbors Act, 33 U.S.C. 401, et. seq.	In compliance.
Wild and Scenic Rivers Act, as amended.	In compliance.
Principles and Guidelines, ER 1105-3-30.	In compliance.
Protection of Wetlands, E.O. 11990	In compliance.
Flood Plain Management, E.O. 11988.	In compliance.
Water Resources Council	In compliance.

2.02 This situation is further compounded by the fragmented responsibilities of the various parties and interests involved in providing and maintaining navigational improvements in Savannah Harbor. In day-to-day operation of the harbor, the Corps of Engineers is responsible for maintenance of the Federal navigation channel, Chatham County is responsible for maintenance of confined disposal areas, and dock owners maintain depths in the berthing areas. Each party has tended to focus primarily on its own individual functions and responsibilities and not necessarily on what would be best for all harbor interests.

2.03 Study Authority. In recognition of the benefits of long-term planning for the efficient use of resources, Congress authorized the development of a Long Term Management Strategy (LTMS) for the Savannah Harbor. The Savannah Harbor LTMS was conducted in response to House Report 102-555, submitted on June 11, 1992, by the House of Representatives' Committee on Appropriations, and Senate Report 102-344, submitted on July 27, 1992, by the Senate Committee on Appropriations. Both those reports refer to the Energy And Water Development Appropriation Bill of 1993. Funds were included in the FY 93 Federal budget to begin this work. Savannah District received funds and initiated work on this LTMS in December 1992.

2.04 Public Concerns. Savannah Harbor is a dynamic port. Commercial activities are seldom static and usually large investments are required to develop maritime facilities. Several organizations have made, and continue to make, investments in port-related infrastructure. Those organizations are concerned that the costs they are incurring to operate their facilities in the harbor are minimized; that the harbor is being operated efficiently and effectively. The competitiveness of those industries, and the port as a whole, rests on the efficient operation of the harbor.

2.05 Economic benefits, however, should not overshadow the environmental impacts associated with harbor operations. Permitted wasteload discharges, erosion from upstream non-point sources, and past Project improvements including operation of the Tidegate have affected salinity, toxicity and dissolved oxygen in the harbor. The harbor also contains valuable natural and cultural resources in which the public is interested. Cultural resources include the CSS GEORGIA, Old Fort Jackson, and Fort Pulaski National Monument. Natural resources include valuable wetland habitats, Savannah National Wildlife Refuge, anadromous fisheries, fisheries of recreational and commercial importance, threatened and endangered species, and wildlife. The public is

concerned with what impacts harbor operations has on these resources, both directly and indirectly, and they want the harbor to be operated in an environmentally sound manner.

2.06 Planning Objectives. Discussions with maritime interests and government officials indicated a desire to improve the efficiency of harbor operations. This required an overall review of the multiple activities conducted as components of harbor operations. This review was conducted to develop a comprehensive management plan which included all aspects of harbor operation. The plan would include both the dredging and disposal activities required to maintain the various project features, including the navigation channel, turning basins, and associated berthing areas. The Long Term Management Plan would result in the following items:

* Identify future dredging quantities and costs
* Identify expected life of existing disposal sites
* Identify need for additional disposal areas
* Estimate required future disposal area improvements
* Estimate costs of disposal site improvements
* Minimize total costs of harbor maintenance
* Identify actions required to comply with environmental laws and clearances
* Minimize environmental impacts of harbor operations

2.07 This EIS includes the identification and analysis of harbor activities which produce environmental impacts. The impacts expected to result from implementation of various alternative plans are evaluated. The Long Term Management Plan is contained in a separate document which accompanies this EIS.

2.08 Relationship of Project to Federal and State Authorities. The process of implementing Federal water resource development projects includes procedures to ensure that the project is in compliance with various statutes and regulations pertaining to the protection of the environment. Table 1 contained a list of applicable statutes and the relationship of these statutes to the alternatives considered in detail.

2.09 This EIS is being prepared to meet the requirements of the National Environmental Policy Act (NEPA). The draft document was circulated for review and comment with other Federal agencies, State and local agencies for a 45-day review period. The public was informed of the availability of the Draft EIS for review and comment. The Corps' final decision on the project will be documented in a Record of Decision. A notice of availability of the Final EIS and Record of Decision will also be coordinated for 30 days.

2.10 Since the LTMS Study is founded on a review of existing project operations, rather than being initially designed to consider ways of addressing specific navigational problems (such as inadequate depth) which may lead to a construction improvement, the LTMS Study is exempt from activities specified in the Fish and Wildlife Coordination Act (FWCA). Irrespective of that legal exemption, this study was coordinated with the same environmental agencies as would have done under the FWCA; the US Fish and Wildlife Service (US FWS), the National Marine Fisheries Service (NMFS), and the affected state fish and wildlife agencies to obtain their views on the potential environmental impacts of the project. Those agencies officially provided the District their views in response to their review of the draft EIS under the authority of NEPA. Those views were considered during the Corps' final evaluations on this proposed action and are included in Appendix Q of this Final EIS. In addition, the Charleston office of the US FWS's Ecological Services Office was deeply involved during the course of the study in the development of acceptable mitigation for wetland losses which would occur.

2.11 The proposed project would require disposal of dredged or fill material into waters of the United States and ocean waters. Weir releases from the diked disposal areas constitute a discharge of dredged material into waters of the United States. This discharge is subject to regulation under Section 404 of the Clean Water Act. As required by the Act, a Section 404 (b)(1) Evaluation has been performed and is included as Appendix C in this document. All plans include disposal of some maintenance material in the EPA-approved ocean dredged material disposal site. This discharge is subject to regulation under Section 103 of the Marine Protection, Research, and Sanctuaries Act of 1972, which specifies that all proposed operations involving the transportation and dumping of dredged material into ocean waters must be evaluated to determine the potential environmental impact of such activities. In accordance with the Act, a Section 103 Evaluation is included as Appendix D of this document.

2.12 In addition to the District's evaluation of weir discharges under Section 404 of the Clean Water Act, water quality certification must be obtained from the States of Georgia and South Carolina pursuant to Section 401 of that Act. Certification was obtained from the State of Georgia by letter dated September 5, 1995, and from the State of South Carolina by letter dated May 10, 1996. Both Section 404 certification letters are included in Appendix Q.

2.13 The State of South Carolina has a Coastal Zone Management (CZM) Program which was developed under the Coastal Zone Management Act. States which have an accepted CZM Program have some regulatory authority over Federal actions which may affect their coastal resources. Savannah District must obtain concurrence from the State of South Carolina with the District's

determination that the Project is in compliance with the state CZM Program to the maximum extent practicable. The District's Consistency Determination is included as Appendix M of this document. The South Carolina Department of Health and Environmental Control, Office of Ocean and Coastal Resource Management (SC DHEC-OCRM) administers the CZM Program in South Carolina and their views are included in Appendix Q of this Final EIS. The SC DHEC-OCRM certified the project as being in compliance with policies of their CZM Program in a letter dated January 8, 1996. The State of Georgia has a Coastal Zone Management Program which was developed under the Georgia Coastal Marshlands Protection Act. The Georgia CZM Program does not have regulatory authority over Federal actions at this time. The Coastal Resources Division of the Georgia Department of Natural Resources administers the CZM Program in Georgia, and their views are also included in Appendix Q.

2.14 All Federal water resource development projects must also be evaluated to determine any effects on threatened and endangered species as required by the Endangered Species Act (ESA) of 1973. This required Biological Assessment of Threatened and Endangered Species (BATES), is included in this document as Appendix B. Both the US FWS and the NMFS have responsibility for some species which could be impacted by the proposed project. Clearance under Section 7 of the ESA was provided by the NMFS in a letter dated August 23, 1995, and by the US FWS in a letter dated November 29, 1995, both of included are in Appendix Q.

2.15 One of the proposed sites for deposition of dredged material is the nearshore area in South Carolina off Turtle Island, where a Bird Island would be constructed and maintained. That site is within Unit SC-10P of the Coastal Barrier Resources System. Although that designation indicates the site is under the authority of a State agency, the US FWS -- which ensures compliance with the Coastal Barrier Resources Act -- was consulted to clarify that point and certify that the actions proposed in the EIS are in compliance with that Act. Although the South Carolina Department of Natural Resources manages the Turtle Island Wildlife Management Area located in SC-10P, the SC DHEC-OCRM oversees all South Carolina coastal resources and must approve construction of the proposed bird island. The SC DHEC-OCRM has approved the wetland Mitigation Plan, which includes construction and maintenance of the Bird Island. The Corps must obtain a real estate easement from SC DHEC-OCRM prior to implementation of that project feature.

2.16 Actions are also proposed on property managed by the Savannah Coastal Refuge. Approval from that component of the US FWS will be required, through their issuance of a Special Use Permit, before the proposed actions can be implemented on Refuge property. Personnel from the Refuge were involved in development of the Mitigation Plan for South Carolina losses and fully

support the components of that plan. On November 15, 1995, the District applied for a permit for the mitigation actions proposed on the Tybee National Wildlife Refuge. The District will submit permit requests for actions at other locations as construction details become better established for those sites and the actual construction time approaches.

2.17 Relationship to Previous Actions. The proposed project is related to several past projects performed in Savannah Harbor. These projects are described in the following paragraphs and their relationship to this Final EIS is explained.

2.18 Construction Projects.

2.19 Federal Project Improvements. The Savannah Harbor Navigation Project is the culmination of all past harbor improvement projects. Those projects greatly influence the existing environmental setting for this project as they establish the authorized channel dimensions. Commitments made for those projects are still applicable when (1) the commitments were made to mitigate expected impacts from the particular action, or (2) the commitment applied to future O&M of the Navigation Project. Several of the EIS's which addressed these modifications are listed below:

(1) Final EIS, Savannah Harbor Sediment Basin Project; 1974.
(2) Final EIS, Savannah Harbor Widening and Deepening; 1974.
(3) Final EIS, Savannah Harbor Operation and Maintenance; 1975.
(4) Final EIS, Savannah Harbor Widening Project; 1978.
(5) Final Supplement to Final EIS, Savannah Harbor Modifications (Kings Island Turning Basin); 1979.
(6) Final EIS, Savannah Harbor Deepening Project; 1993.

2.20 Non-Federal Project Improvements. The Savannah Harbor Navigation Project is also influenced by previous non-Federal harbor improvement projects.

2.21 Various dock owners have invested large sums of money in the landside infrastructure associated with the Navigation Project. Features such as storage buildings, material handling equipment such as cranes and conveyor systems, docks and berthing areas are facilities which are constructed and maintained by the dock owners.

2.22 The non-Federal sponsor of the Savannah Harbor Navigation Project -- Chatham County -- is responsible for providing and maintaining the confined disposal facilities. Land purchases are made, or easements obtained, to secure lands to be used for the Project. Dike improvement projects are scheduled and implemented to provide sufficient disposal capacity in the disposal areas. Weirs are normally installed or replaced during a dike improvement project. Underdrains were installed in some areas to reduce the drying time and increase consolidation of the deposited material. Large dike and road maintenance activities are scheduled and performed when needed. Smaller-scale maintenance actions are performed throughout the year. Regulatory permits are required for some maintenance actions and the sponsor has sought and obtained the required permits. All of these sponsor activities are required to operate the harbor and can result in adverse environmental impacts if performed improperly.

2.23 Savannah Harbor Section 1135 Project. Savannah District recently closed New Cut and removed the Tidegate from operation under the authority of Section 1135 of the Water Resources Development Act of 1986, as amended. These activities were completed in 1990. The project was intended to substantially reduce salinity levels in Back River and eliminate the flushing of striped bass eggs and larvae through New Cut to Front River, where survival is less likely. The project was also intended to result in a slower passage of striped bass eggs and larvae down Back River so that they could complete their development prior to reaching higher salinities in the lower Savannah River.

2.24 Studies and Evaluations. Several studies and evaluations have been conducted or are currently being conducted which significantly influence operation of the harbor. The major studies are outlined in the following paragraphs.

2.25 Savannah Harbor Maintenance Disposal Management Study. Savannah District conducted a study to determine the capacity of existing disposal areas and develop a management scheme for maximization of the life of those areas over a 10-year horizon. The Savannah Harbor Maintenance Disposal Management Report was prepared in 1982 and was used to determine where, within the existing disposal areas, and how material dredged from the proposed Deepening Project would be placed. Subsequent changes in the harbor (channel widening and deepening, and removal of the Tidegate from operation) have significantly reduced the accuracy of the projections in the 1982 report.

2.26 Waterways Dredged Material Containment Areas Study. The Georgia Department of Transportation (GA DOT) serves as the fee owner of about 60 percent of the confined disposal facilities in Savannah Harbor. It also assists Chatham County in providing all upland disposal areas for harbor sediments. GA DOT conducted a geotechnical study of the inner harbor disposal areas in the late 1980's. The study addressed the capacities of the existing disposal areas, predicted future dredging and storage requirements, as well as construction costs and schedules. The 1989 report provided a maintenance dredging management plan through the year 2000.

2.27 Agitation Dredging Studies. Two studies were performed in 1993 of the effects of agitation dredging. Those studies were components of the reviews made pertaining to the District's reissuance of dock owner's Section 404 Dredge and Fill Permits. One study evaluated two forms of agitation dredging operations. The commonly used technique of dragging an I-beam to resuspend deposited material was evaluated, as well as the technique of hydraulic dredging with direct deposition in the channel. That 1993 study was performed for Terminal Management Corporation by the Skidaway Institute of Oceanography. The other 1993 study was performed by EMC Engineering Services for a consortium of several terminal operators. The studies generally found the impacts of agitation dredging to be minor in nature and short-lived in duration. Results of those studies are included in the analyses documented in this EIS.

2.28 Relationship to Current Actions. The proposed project is also related to several ongoing activities related to Savannah Harbor. These actions are described in the following paragraphs.

2.29 Savannah River Watershed Project. EPA is currently facilitating a study of the Savannah River basin watershed (from the headwaters in North Carolina to the Atlantic Ocean). It will examine environmental impacts to the river and its tributaries, as well as develop an interagency action plan to address significant issues. Participants in the project include a broad spectrum of federal, state, and local agencies and interest groups. With state assistance, EPA is developing and will implement a monitoring plan for the basin that will assess the condition of basin resources with a known statistical confidence. A geographic information system (GIS) is also being developed with project participants to serve as a basin-wide management tool. A baseline assessment of six basin resource areas was developed with project participants. These assessments serve as the basis of the Initial Watershed Assessment and Prioritization Plan (WAPP) report, which was completed in September 1995. The WAPP identifies and prioritizes watershed impairments and

recommends appropriate solutions. The total study is in its initial stages and the WAPP will serve as a basis for future efforts on development of a watershed strategy.

2.30 Back River Wetland Vegetation Study. Savannah District funded a study of the tidal marsh in Back River above the Tidegate. The study was designed to document recovery of the tidal marsh after closure of New Cut and removal of the Tidegate from operation. A final sampling was conducted in the fall of 1994 and the final report was completed in February 1996. The study found that freshwater conditions have returned to much of the study area and marsh species diversity has increased.

2.31 Striped Bass Study. Savannah District is funding a 4-year study of the temporal and spatial distribution of striped bass eggs and larvae in Savannah Harbor. The study was started in 1994 and is being performed by the National Biological Survey. The study should provide information on what estuarine locations and time periods are critical for the most sensitive stages of this important estuarine fish. The information and findings will be provided to the GA DNR for its consideration in regard to the appropriateness of the Savannah Harbor dredging exclusion window placed in their Water Quality Certification to protect this species.

2.32 Method of Analysis. A systematic, interdisciplinary approach was used in the preparation of this draft EIS and in development and execution of the studies performed as a part of this evaluation. Results of the studies, along with the expertise of various agencies have been used by the interdisciplinary in-house study team to evaluate various alternatives for accomplishing project objectives.

3.00 EXISTING PROJECT

3.01 Harbor Location. Savannah Harbor is a deep-draft harbor located on the South Atlantic U.S. coast, 75 statute miles south of Charleston Harbor, South Carolina, and 120 miles north of Jacksonville Harbor, Florida. The harbor comprises the lower 21.3 miles of the Savannah River (which, with certain of its tributaries, forms the boundary between Georgia and South Carolina along its entire length of 313 miles) and 11.17 miles of channel across the bar to the Atlantic Ocean.

3.02 Harbor Operations. Many different types and sizes of vessels use Savannah Harbor, although its primary use continues to be for commercial navigation. Several different organizations have a part in operating the harbor. The Federal government, through the Army Corps of Engineers, is responsible for dredging accumulated sediment from the navigation channel to maintain the Congressionally authorized depths. Chatham County serves as the non-Federal partner in the Corps' activities. Through a resolution signed by the County on April 27, 1967, the County agreed to fulfill the responsibilities of a local sponsor for the Savannah Harbor Navigation Project. The Georgia Department of Transportation assists Chatham County in the engineering and financial aspects of its commitment. The full responsibilities of Chatham County are described in a later section.

3.03 The Savannah Pilots Association provides pilots for vessels transiting the harbor. The pilots guide the vessels through both the Bar Channel and the inner harbor channels. The pilots have extensive knowledge of the channel conditions (currents and depths) which are invaluable to the ship captains. Separate docking pilots take responsibility for guiding vessels between the navigation channel and the dock. The docking pilots have specialized knowledge of the capabilities of the harbor's tugboats which assist in maneuvering the large vessels in close quarters.

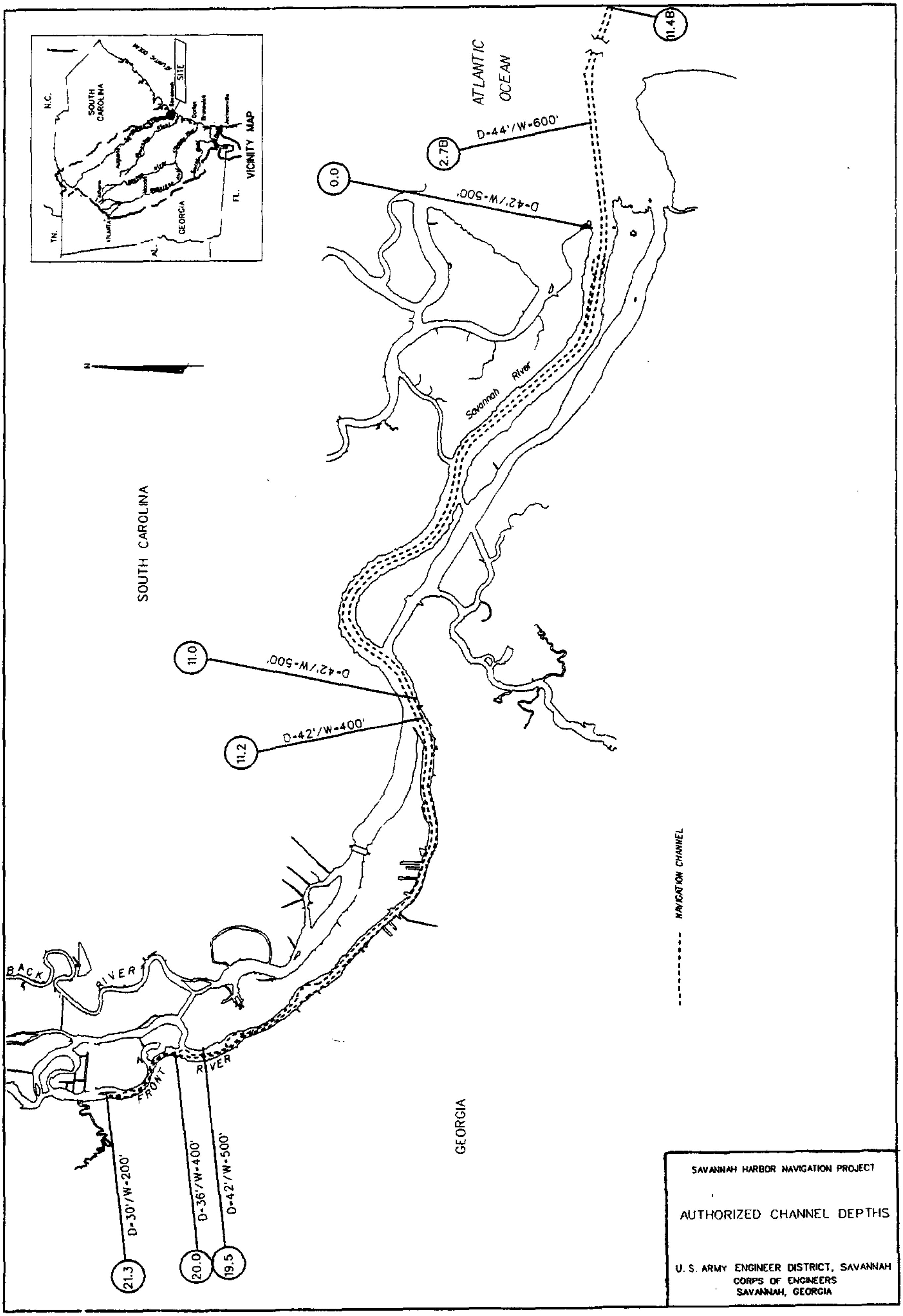
3.04 The docks across which the cargoes are transported have a variety of ownerships. Some privately-owned docks are used only for products used by one company, while others serve several companies and are willing to serve anyone. Still other docks are owned and operated by the Georgia Ports Authority (GPA), a public agency which operates several terminals in the harbor. The various docks generally serve different types of harbor users, but competition does exist between some dock owners. The number of privately-owned docks exceed that owned by GPA and comprise a substantial portion of the active berthing facilities in the harbor. The GPA facilities handle the largest vessels which call at the port.

3.05 Existing Federal Navigation Project.

3.06 Channel Depth. The navigation channel is 44 feet deep and 600 feet wide from deep water in the ocean (mile 11.17B) to the channel between the jetties (mile 2.6B), thence 42 feet deep and 500 feet wide to the harbor entrance (River Mile 0.0). From mile 0.0 to the upstream end of the Kings Island Turning Basin (River Mile 19.5) the channel is 42 feet deep and 500 feet wide. The channel is 36 feet deep and 400 feet wide from mile 19.5 to the upstream end of the Argyle Island Turning Basin (River Mile 19.9). The upper end of the harbor from River Mile 19.9 to its upstream limit at River Mile 21.3 is maintained at 30 feet deep and 200 feet wide. Figure 2 shows the location of the various channel depths.

3.07 Channel Location. Within the harbor limits, Savannah River is generally divided into two channels by a series of islands. From the Atlantic Ocean to river mile 10, where the river converges, the harbor is separated into South and North Channels. Within this area, the navigation channel is maintained in North Channel. After divergence of the river into Front and Back Rivers at River Mile 11, the navigation channel is maintained in Front River and passes by the business district of the City of Savannah. The navigation channel is maintained in Front River to the upper limits of the harbor at River Mile 21.3. The Atlantic Intracoastal Waterway (AIWW) crosses the navigation channel approximately 5.5 miles upstream of the entrance to the harbor. A navigation channel 9 feet deep and 90 feet wide is authorized from the upper limits of the harbor to River Mile 202.6 at Augusta, Georgia.

3.08 Advance Maintenance. Advance maintenance extends the length of time during which authorized channel depths are available. This sediment management technique is performed by enlarging the channel cross-section to provide storage for deposited sediments outside the authorized navigation channel. This technique also reduces annual maintenance costs by concentrating the sediment to be removed, thereby allowing maintenance dredges to operate at a higher efficiency. Under present Corps policy, a District office must request approval for all advance maintenance from higher Corps offices. Decisions to implement advance maintenance can be made at any time upon review of sediment accumulation records, and they are effective until future information indicates they are no longer necessary or cost effective. Environmental clearances must also be obtained prior to implementation of authorized advance maintenance features.



SAVANNAH HARBOR NAVIGATION PROJECT

AUTHORIZED CHANNEL DEPTHS

U. S. ARMY ENGINEER DISTRICT, SAVANNAH
CORPS OF ENGINEERS
SAVANNAH, GEORGIA

FIGURE 2

3.09 Figure 3 shows the locations of the various advance maintenance sections which have been approved for the harbor. Those sections are described as follows:

RIVER MILES / STATIONS	DEPTH (FEET)
0- 4.5 / 0+000- 24+000	2
4.5-13.3 / 24+000- 70+000	4
13.3-21.3 / 70+000-112+000	2

No advance maintenance is presently performed between Stations 58+000 and 59+000 to reduce potential impacts to the CSS GEORGIA, which is located along that reach.

3.10 Sediment Control Works. Authorized sediment control works in the harbor consist of the Tidegate structure across Back River and a sediment basin immediately downstream of the Tidegate. These structures were designed to concentrate sedimentation outside the navigation channel in a location close to confined disposal areas. Both the concentration of sediment and the short pumping distance which the shoaling location provided contributed to a reduction in the cost of sediment removal in the harbor. The Sediment Basin was authorized at a 40-foot depth, 600-foot width and approximately 2-mile length, with an entrance channel 38 feet deep and 300 feet wide. The Tidegate became operative in May 1977, but was taken out of service due to adverse environmental impacts in October 1990. A drainage canal, known as New Cut, located across Argyle Island was constructed along with the Tidegate. New Cut was closed in 1990 to reduce salinity levels in the Savannah National Wildlife Refuge, restore approximately 4,000 acres of freshwater marsh, and reduce the flushing of striped bass eggs and larvae into the Front River, thereby improving the striped bass fishery in the Savannah River. Closure of New Cut and removal of the Tidegate from operation resulted in a significant increase in the cost of maintaining adequate depths in the harbor.

CORPS OF ENGINEERS

U. S. ARMY

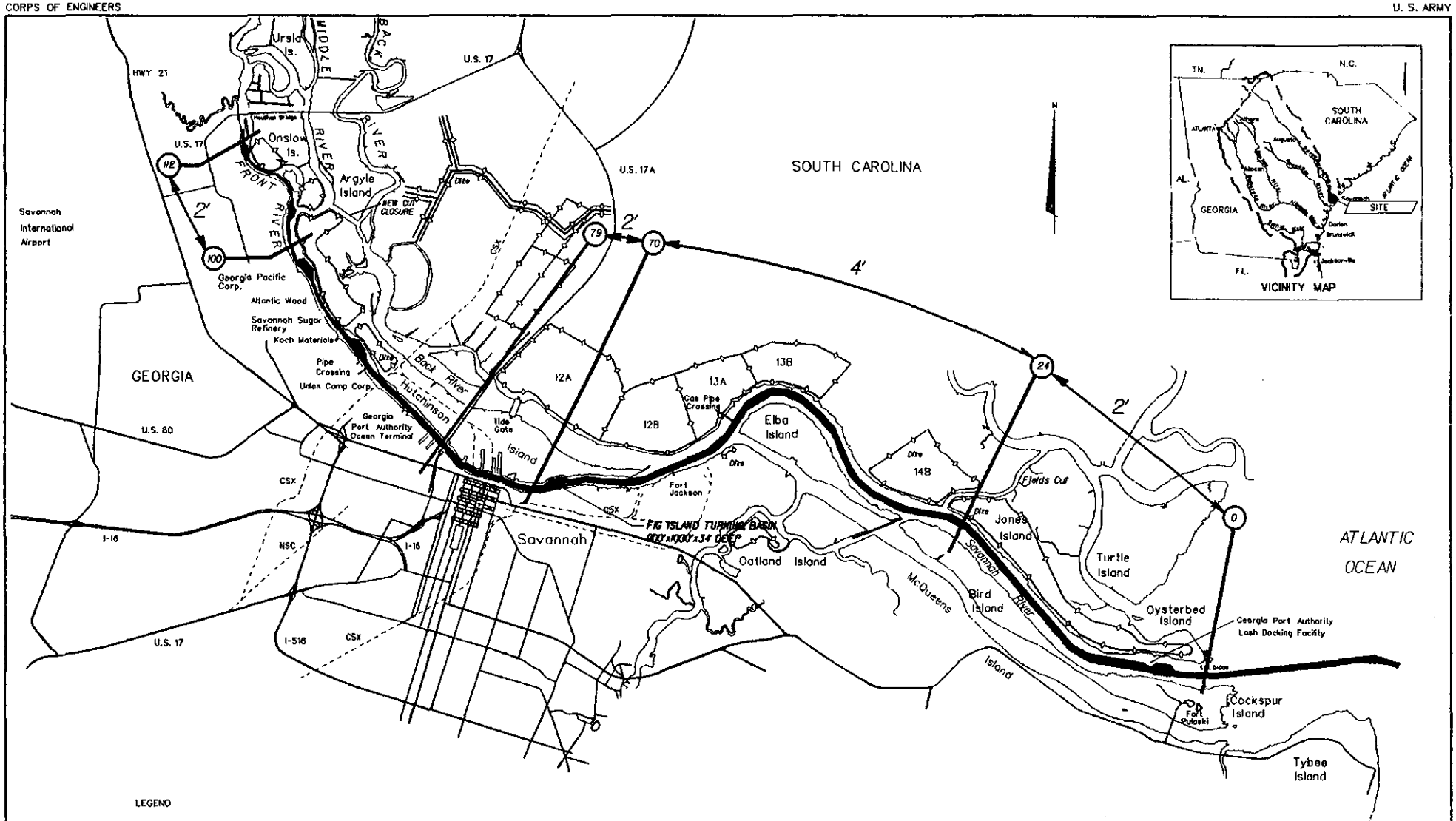


FIGURE 3

3.11 Freshwater Control Works. During the development of the Tidegate/Sediment Basin project in 1970, it was recognized that the saltwater wedge would move further upstream as a result of the project. This would have an unacceptable level of adverse impacts on freshwater marshes in the Savannah National Wildlife Refuge (NWR). To offset these impacts, a freshwater supply system was included in the project. This system had the following five components:

(1) a 5,500-foot long canal through McCoombs Cut to provide freshwater to the Savannah NWR (Figure 4). The canal was constructed with a 200-foot bottom width at EL -7' MLW and 2H:1V side slopes. The design flow through McCoombs Cut was 4,000 CFS.
(2) a channel in Middle River with a 90-foot bottom width at EL -6' MLW and 2H:1V side slopes. The design flow in Middle River was 1,500 CFS.
(3) a channel in Little Back River with a 200-foot bottom width at EL -5.1' MLW and 2H:1V side slopes. The design flow in Little Back River was 2,500 CFS.
(4) a 28,000-foot long freshwater supply canal with a 28-foot bottom width at EL -4' MLW, 2H:1V side slopes, and water control structures.
(5) a 3,700-foot long connecting canal with a 6-foot bottom width at EL -4' MLW, 2H:1V side slopes.

3.12 Congress also authorized a freshwater canal extending from the Savannah NWR to private lands located north of the US Highway 17A Bridge on the South Carolina side of the river (Figure 5). That canal was designed with a 6-foot bottom width at EL -4' MLW and 2H:1V side slopes.

3.13 The Federal government is responsible for maintenance of the Diversion Canal, the channels in Little Back River and Middle River, and the canals and control works for the Refuge. The non-Federal project sponsor, Chatham County, is responsible for the canal serving private lands southeast of the Refuge. Chatham County obtained easements from private land owners, provided water control structures and conducted routine maintenance of the dikes. In 1982, the County entered into a supplemental agreement with the private property owners, transferring responsibility for normal dike maintenance to those property owners. The County delivers sand to the area for the property owners' use in dike maintenance.

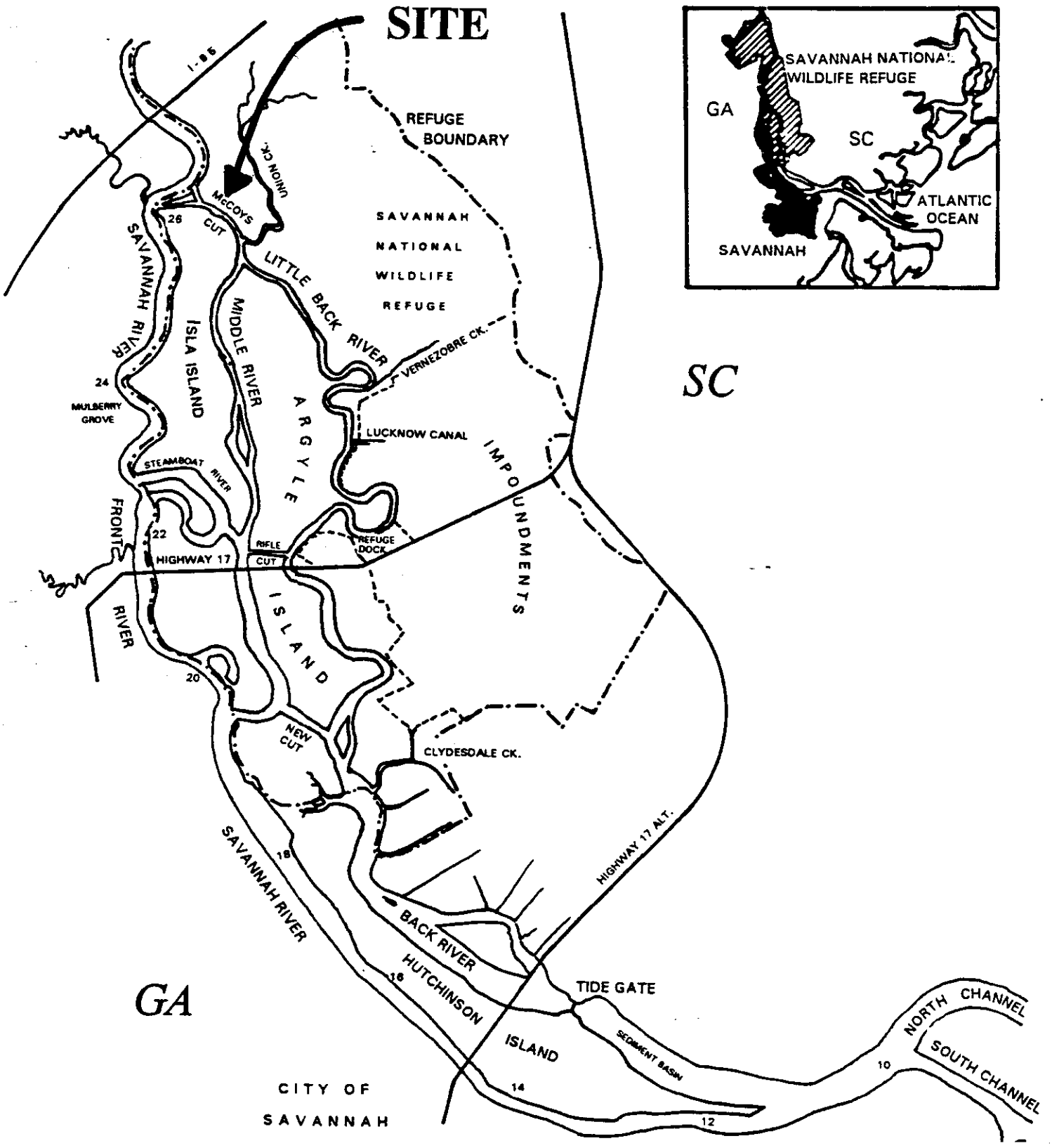

SITE
SAVANNAH NATIONAL WILDLIFE REFUGE
GA
SC
ATLANTIC OCEAN
SAVANNAH
REFUGE BOUNDARY
SAVANNAH NATIONAL WILDLIFE REFUGE
I-95
UNION CK.
McCOYS CUT
SAVANNAH RIVER
ISLA ISLAND
MIDDLE RIVER
LITTLE BACK RIVER
VERNEZOBRE CK.
ARGYLE ISLAND
LUCKNOW CANAL
IMPOUNDMENTS
MULBERRY GROVE
STEAMBOAT RIVER
FRONT RIVER
HIGHWAY 17
RIFLE CUT
REFUGE DOCK
NEW CUT
CLYDESDALE CK.
HIGHWAY 17 ALT.
BACK RIVER
HUTCHINSON ISLAND
TIDE GATE
SEDIMENT BASIN
NORTH CHANNEL
SOUTH CHANNEL
CITY OF SAVANNAH
26
24
22
20
18
16
14
12
10
1 1/2 0 1
MILES
N
FRESHWATER DIVERSION CANAL

FIGURE 4

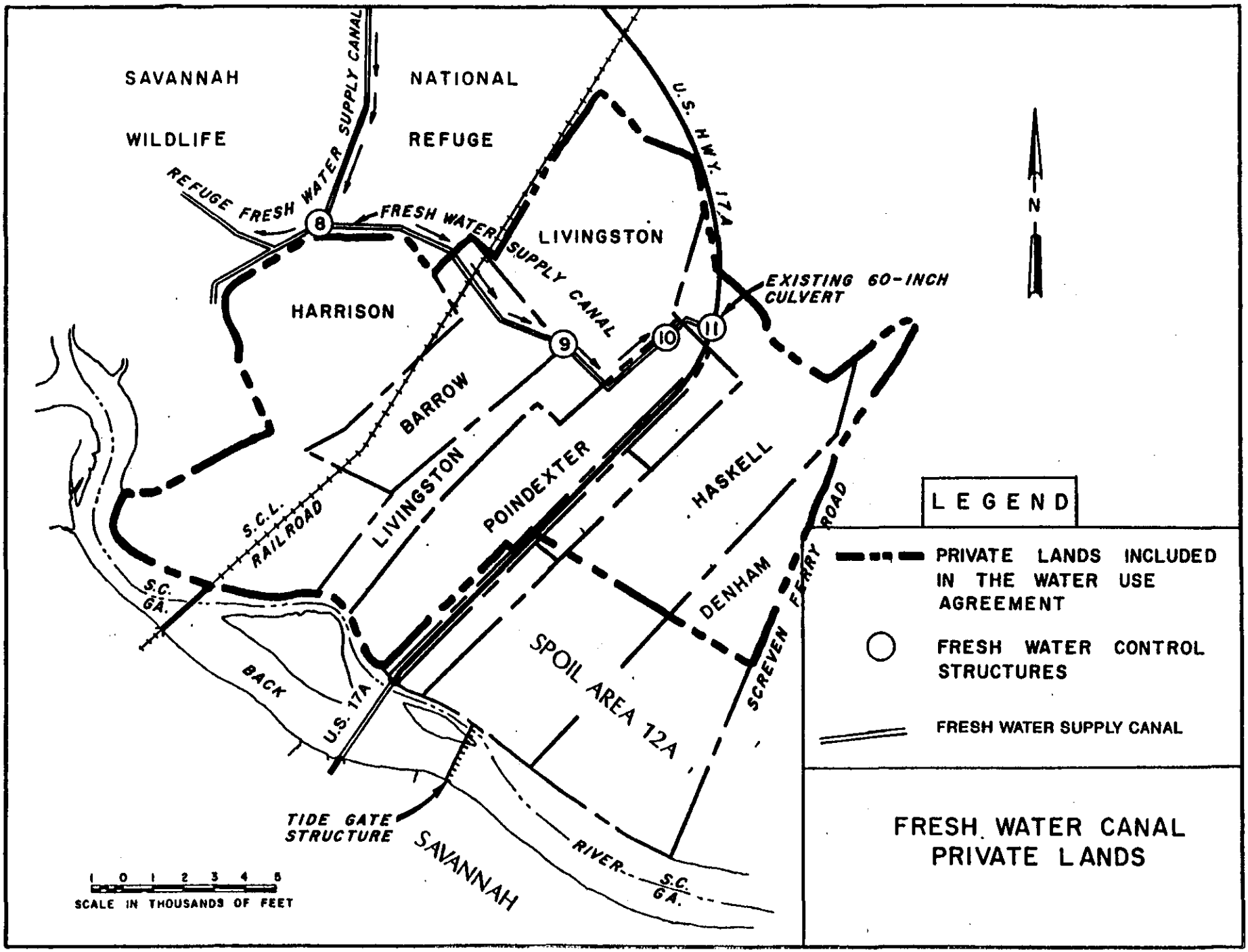

SAVANNAH
NATIONAL
WILDLIFE
REFUGE
REFUGE FRESH WATER SUPPLY CANAL
FRESH WATER SUPPLY CANAL
U.S. HWY. 17A
LIVINGSTON
HARRISON
EXISTING 60-INCH CULVERT
8
9
10
11
N
BARROW
LIVINGSTON
POINDEXTER
HASKELL
S.C.L. RAILROAD
S.C. GA.
BACK
U.S. 17A
SPOIL AREA 12A
SCREVEN FERRY ROAD
DENHAM
TIDE GATE STRUCTURE
SAVANNAH
RIVER
S.C.
GA.
1 0 1 2 3 4 5
SCALE IN THOUSANDS OF FEET
LEGEND
PRIVATE LANDS INCLUDED IN THE WATER USE AGREEMENT
FRESH WATER CONTROL STRUCTURES
FRESH WATER SUPPLY CANAL
FRESH WATER CANAL
PRIVATE LANDS

FIGURE 5

3.14 Turning Basins. Seven turning basins are located along the length of the navigation channel to allow ships to be turned before transiting the harbor. The turning basins are shown in Figure 6 and described as follows:

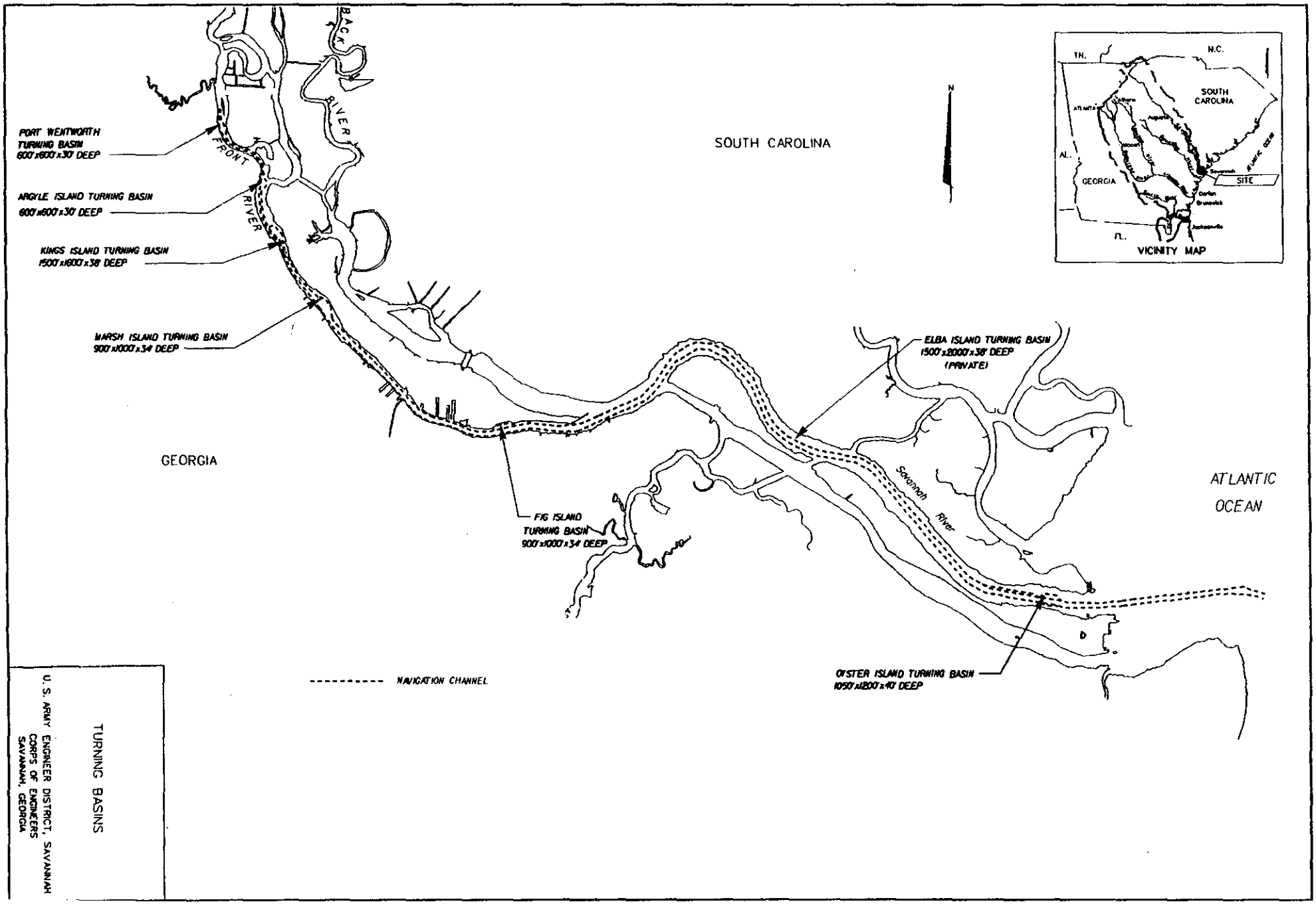
NAME	LENGTH (FEET)	WIDTH (FEET)	DEPTH (FEET)	LOCATION (RIVER MILE/STATION)
Oysterbed Island	1050	1200	40	0.7 / 3+500
Elba Island	1500	2000	38	6.8 / 36+000
Fig Island	900	1000	34	13.0 / 68+500
Marsh Island	900	1000	34	17.1 / 90+500
Kings Island	1500	1600	42	18.8 / 99+500
Argyle Island	600	600	30	19.6 / 103+500
Port Wentworth	600	600	30	20.9 / 110+500

3.15 A LASH facility Rehandling Basin, with approximate dimensions of 4,000 feet by 300 feet by 38 feet, is centered around Station 7+000.

3.16 A 2-foot advance maintenance deepening section is authorized for the Kings Island Turning Basin. That feature was implemented in early 1996.

3.17 Non-Federal Sponsor Responsibilities. As mentioned previously, through a resolution executed by the Chatham County Commission on April 21, 1967, Chatham County serves as the non-Federal sponsor for the Savannah Harbor Navigation Project. The responsibilities of Chatham County are as follows:

> "a. Provide without cost to the United States all lands, easements and rights-of-way required for the construction and maintenance of the project and for aids to navigation upon the request of the Chief of Engineers to be required in the general public interest for initial and subsequent disposal of spoil, and also necessary retaining dikes, bulkheads, and embankments therefor or the cost of such works;
>
> b. Hold and save the United States free from all damages due to the construction and maintenance of the project; and
>
> c. Provide and maintain at local expense adequate public terminals and transfer facilities open to all on equal terms in accordance with plans approved by the Chief of Engineers where appropriate.
>
> d. Provide and maintain at local expense depths in berthing areas commensurate with those in related project areas.



TURNING BASINS

U. S. ARMY ENGINEER DISTRICT, SAVANNAH
CORPS OF ENGINEERS
SAVANNAH, GEORGIA

e. In the event it is necessary to request the United States of America to acquire the necessary real estate interests by the use of its power of Eminent Domain, the assurer will furnish the District Engineer, Savannah, Georgia, the necessary funds for deposit in the United States District Court, and an amount sufficient to cover administrative expenses incurred by the Government, together with a surety bond in a penal sum sufficient to cover any excessive award of the court.

f. That in the acquisition of fee title or permanent easements, title evidence in the form of certificate of title, title insurance by a recognized title company or properly certified abstracts of title, will be furnished, continued to a date subsequent to recordation of the deed to the United States, or in the case of condemnation proceedings continued to a date subsequent to the filing of notice of the proceeding in Lis Pendens Docket. In the case of temporary easements, letter certification by a duly licensed Attorney at Law, as to the record owner and status of the title, and that the assurer has authority to grant permission for entry and use of the property by the United States."

3.18 Inherent in the above description is the assumption that the sponsor is financially responsible for any mitigation actions required as a components of an action for which they are directly responsible, i.e. providing suitable disposal areas. In addition, the non-Federal sponsor is responsible for funding any difference in cost which develops between the "Federal Standard" or "Base Plan" for operation of the harbor and a plan which has different features required by a non-Federal regulatory agency, which may cost more. The "Federal Standard" or "Base Plan" is further described at the end of Section 5.

3.19 Chatham County entered into a Memorandum Of Understanding with the Georgia Department of Transportation (GA DOT) on August 21, 1983, for jointly fulfilling the responsibilities of the non-Federal sponsor. Through that agreement, GA DOT administers any funds appropriated by the Georgia General Assembly for execution of the project's non-Federal responsibilities.

3.20 On June 10, 1982, Chatham County entered into a "Fresh Water Canal Maintenance Agreement" with the owners of the property (Murray Hill Plantation) on which the freshwater diversion dikes are located. Through the agreement, the landowner obtained responsibility for normal dike maintenance activities.

3.21 On January 28, 1969, the U.S. Fish and Wildlife Service entered into a "Water Use Agreement" with adjacent landowners concerning operation of a water supply canal on US FWS land leading to privately-owned property. In the agreement, the US FWS, acting through the Savannah National Wildlife Refuge, agreed to operate control structure No. 8 for the adjacent landowners' benefit after the twentieth day of each month.

3.22 Berthing Areas. Berthing areas are important to the Navigation Project as they allow vessels to dock outside the channel boundaries while cargo is loaded and unloaded. The areas extend from a dock face out to the navigation channel, and typically extend a short distance beyond each end of a dock. Maintenance of adequate depths at berths is legally required for continued operation of the Savannah Harbor Federal Navigation Project. Typically, each dock owner maintains the depth at their individual berth as needed, using either the dock owner's or a contractor's equipment. The dock owner applies to the Corps for a Department of the Army (DOA) Permit to excavate sediments from the berth, since the Corps regulates dredging under Section 10 of the Rivers and Harbors Act and the related discharge under Section 404 of the Clean Water Act. In accordance with Section 401 of the Clean Water Act, the dock owner obtains water quality certification from the State of Georgia Department of Natural Resources, as required. Currently, 11 dock owners have 14 DOA permits from Savannah District for berth maintenance dredging within Savannah Harbor. Figure 7 shows a plan view of a typical berth along the harbor.

3.23 Agitation Dredging. Removal of consolidated soil materials during the original construction of a berth typically requires hydraulic cutterhead dredging, with transport of the excavated sediments by pipeline to an upland confined disposal area. Subsequent removal of maintenance sediments which accumulate in berths in Savannah Harbor is usually performed through agitation dredging. In that process, a tug dragging an I-beam, or other equipment, is used to remove the sediments. Some material is directly drawn into the channel by movement of the I-beam or other equipment. Other material is temporarily resuspended (agitated) in the water column. In Savannah Harbor, the resuspended sediments are transported from berths by tidal currents, usually an ebbing tide since it produces stronger currents, taking advantage of the harbor's large semi-diurnal tide range. The bulk of the excavated berth sediments redeposit elsewhere in the harbor. An estimated 80 percent of the excavated material is either transported directly to the navigation channel or later redeposits in the navigation channel or along the channel side slopes. The remaining 20 percent redeposits in another berth, redeposits along the riverbank

outside the navigation project, or remains suspended in the water column and is transported out to the ocean. Berth sediments which become relocated to the navigation channel are removed by the Corps during its normal channel maintenance dredging and placed in the confined disposal areas.

3.24 The annual volume of material which is permitted to be removed from berths through agitation dredging through the 14 permits is 736,500 cubic yards. That volume is concentrated in a relatively few permits, as two permits comprise 73 percent of the total volume and four permits comprise 87 percent of the total volume. The volume of sediment reported by the dock owners as being removed by agitation dredging during 1994 and 1995 averaged approximately 177,000 cubic yards a year.

3.25 A variation from this process is the use of a hydraulic cutterhead dredge with a short pipeline to remove the materials from the berth and deposit them in the adjacent channel. In this process, a dock owner obtains the services of a hydraulic cutterhead dredge to remove sediments from his specific berth. The dredge's discharge pipe is placed so that it deposits material directly into the navigation channel. Studies performed in 1993 for Terminal Management Corporation by Skidaway Institute of Oceanography concluded that hydraulic pipeline dredging was more efficient than I-beams in moving sediment away from berths. This method also provides some control over the depth at which the resuspended sediments are reintroduced into the water column. The Corps estimates that this technique results in 100 percent of the excavated sediments redepositing in the navigation channel. This procedure has been permitted in Savannah Harbor by the Corps and the Georgia Department of Natural Resources.

3.26 Agitation dredging is a complete solution to the immediate problem of the berth owner -- which is removing sediments to provide adequate depth at a specific dock. However, the practice is an incomplete solution to the problem of removing sediments from the harbor which have accumulated in berths. Since this procedure doesn't remove the sediment from the aquatic system, that same material may adversely affect other aspects of the harbor -- including depths in the navigation channel and other berths. Additional environmental impacts stem from temporary increases in suspended solids that result from duplicative dredging operations performed before sediments are removed from the aquatic system. The full effect of these and other possible impacts is not fully known at this time. As a brief summary, in the past Savannah District issued Section 10 and 404 Permits to dock owners for maintenance of berths by agitation dredging based on information the owners provided indicating they had no available less environmentally damaging practicable alternative to their individual sediment accumulation problems.

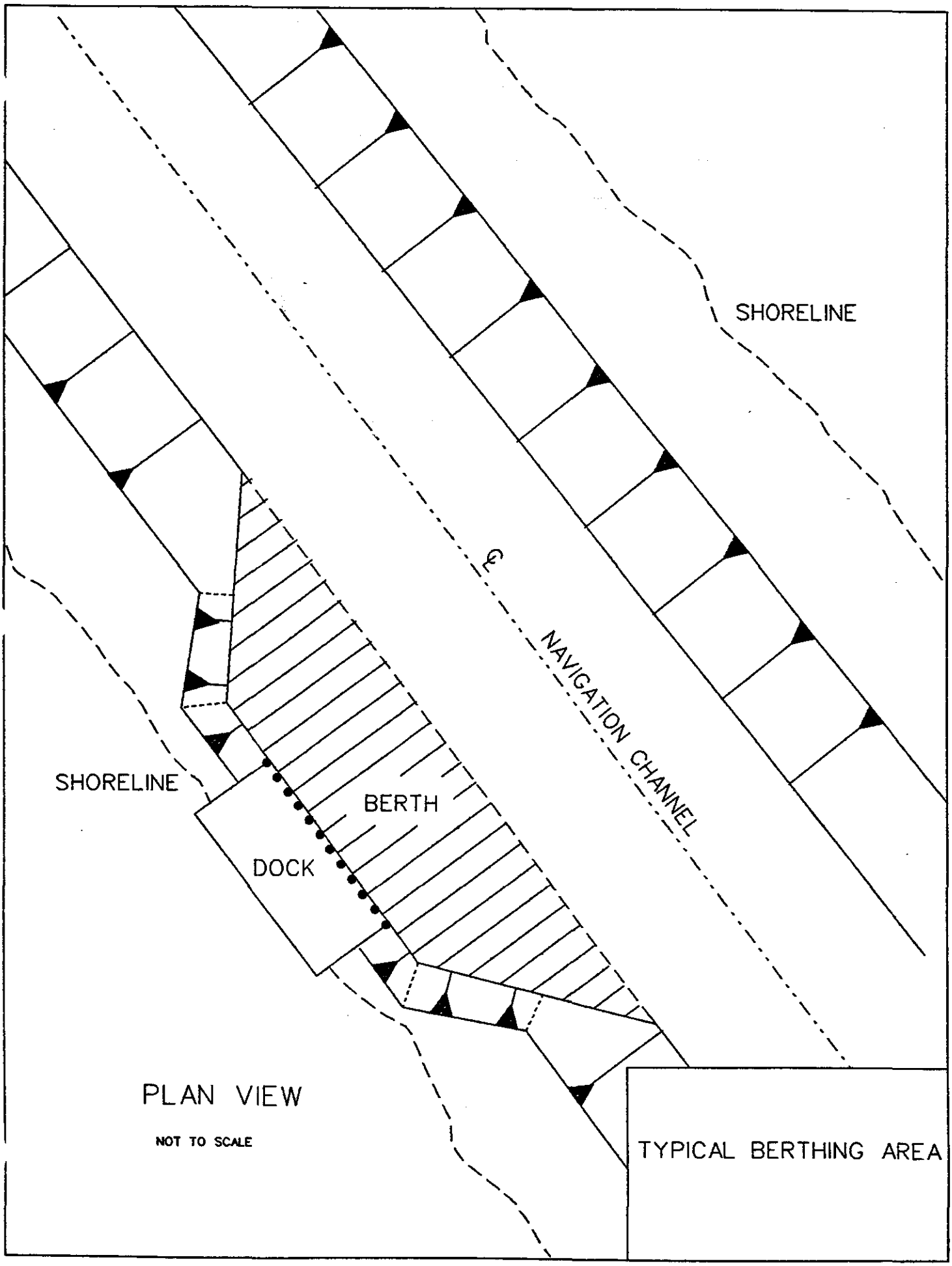

SHORELINE
℄ NAVIGATION CHANNEL
SHORELINE
BERTH
DOCK
PLAN VIEW
NOT TO SCALE
TYPICAL BERTHING AREA

FIGURE 7

3.27 From time to time, dock owners have used hydraulic cutterhead dredges to directly place excavated maintenance sediments in upland confined disposal areas. However, only a very small number of dock owners have private upland confined disposal areas. Occasionally, dock owners may have deposited sediments in the confined disposal areas used for the Federal Navigation Project. Those occurrences have generally been limited by two factors: (1) the non-availability of a specific requested disposal site when it was desired by a dock owner, as a result of other work then being conducted at that site, and (2) an inability of a dock owner to obtain the required approvals for deposition of specific berth sediments from the disposal site's fee owner, Chatham County, and the Corps.

3.28 In an effort to address all private berth maintenance dredging activities throughout Savannah Harbor, the District's Operations Division - Regulatory Branch will initiate development of a Regional Permit in the near future. Through the process of developing a draft Maintenance Dredging Regional Permit, the Corps would solicit input from dock owners, Federal and State resource agencies, and other interested parties. The potential use of all methods of maintenance dredging would be considered in the draft Regional Permit.

3.29 Coast Guard Regulations. In mid-1993, the US Coast Guard instituted new regulations for Savannah Harbor to ensure the safety of vessels docked at the berths and reduce the chances for spilled cargos which could harm the environment. The new regulations were the result of an incident that occurred while cargo was being unloaded from a docked vessel. In that instance, inadequate depths existed at the berth, and the vessel grounded during the falling tide. As a result of the grounding during the cargo unloading operation, an unsafe condition resulted where the vessel shifted suddenly, cargo spilled and entered the river. The Coast Guard regulation requires the dock owner to have sufficient depths throughout the berth so that the vessel would have 1 foot of underkeel clearance during all stages of the tide. If the berth cannot provide that clearance, the regulations state that the vessel cannot be docked at the berth. This regulation has resulted in (1) a higher priority being placed on the depths at the berth, and (2) the dock owners seeking approvals for sediment removal techniques which can be implemented promptly to allow them to respond to quickly developing shoals.

3.30 Disposal Areas. Approximately 7.2 million cubic yards (MCY) of sediments are removed each year from the Savannah Harbor Navigation Project by the Corps. The dredged material is placed in one of the eleven disposal areas which have been designated for use for the Project. These areas consist of upland diked disposal areas, upland undiked areas, and an unconfined ocean disposal site.

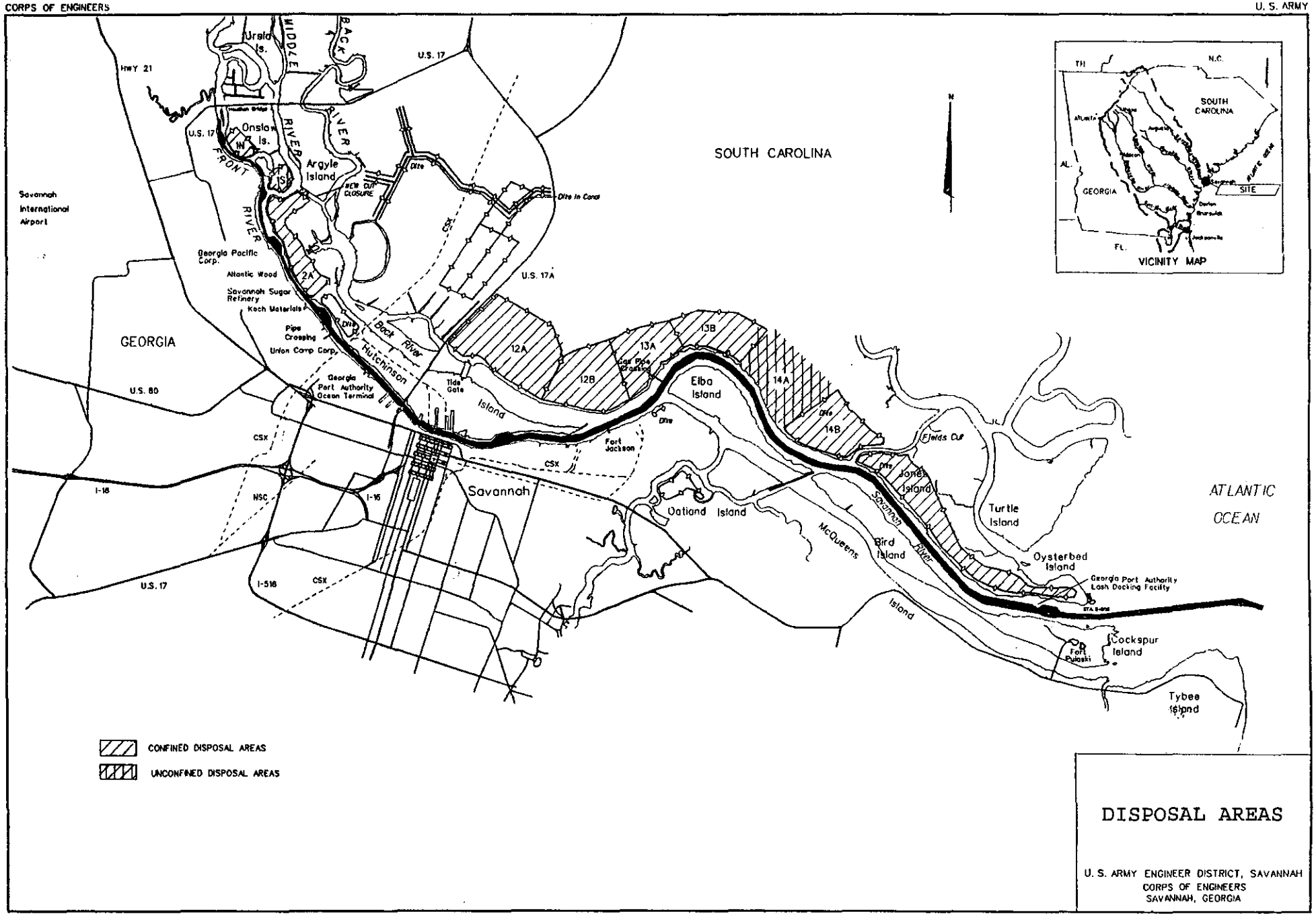
3.31 Confined Upland. The non-Federal sponsor has provided eight confined upland disposal facilities (Figure 8) for use for the Savannah Harbor Project. Those areas are as follows:

AREA NUMBER	AREA NAME	LOCATION (CHANNEL STATIONS)	SIZE (ACRES)
	Jones/Oysterbed	0+000 - 27+000	754
14B	--------	28+000 - 37+000	765
13B	--------	43+000 - 47+800	628
13A	--------	47+800 - 57+000 (-2+000BR)	690
12B	--------	57+000 - 6+600BR (-2+000BR)	710
12A	--------	6+500BR- 10+100BR	1123
2A	Argyle-Hutchinson	93+000 - 103+000	185
1N	Onslow - North	107+500 - 112+600	130

NOTE: "BR" indicates the stationing up Back River as shown on the Annual Survey.

3.32 Disposal Area 14B receives dredged material from both the Savannah Harbor Navigation Project and the Atlantic Intracoastal Waterway (AIWW), another waterway managed by the Corps of Engineers. The non-Federal sponsor for the Georgia portion of the AIWW project is the Georgia Department of Transportation. The South Carolina Department of Health and Environmental Control Office of Ocean and Coastal Resource Management (SC DHEC-OCRM) is the sponsor for the South Carolina portion of the AIWW. The other confined disposal areas only receive material from the Savannah Harbor Navigation Project, including the navigation channel, turning basins, the Sediment Basin, and berthing areas.

3.33 Unconfined Upland. The non-Federal sponsor has provided two unconfined upland disposal areas. The first site is Area 1S, located on Onslow Island, a part of the Savannah National Wildlife Refuge. The site is adjacent to channel Stations 104+200 to 107+000 and has previously been used for placement of dredged material. The site is inaccessible by land. Material



DISPOSAL AREAS

U. S. ARMY ENGINEER DISTRICT, SAVANNAH
CORPS OF ENGINEERS
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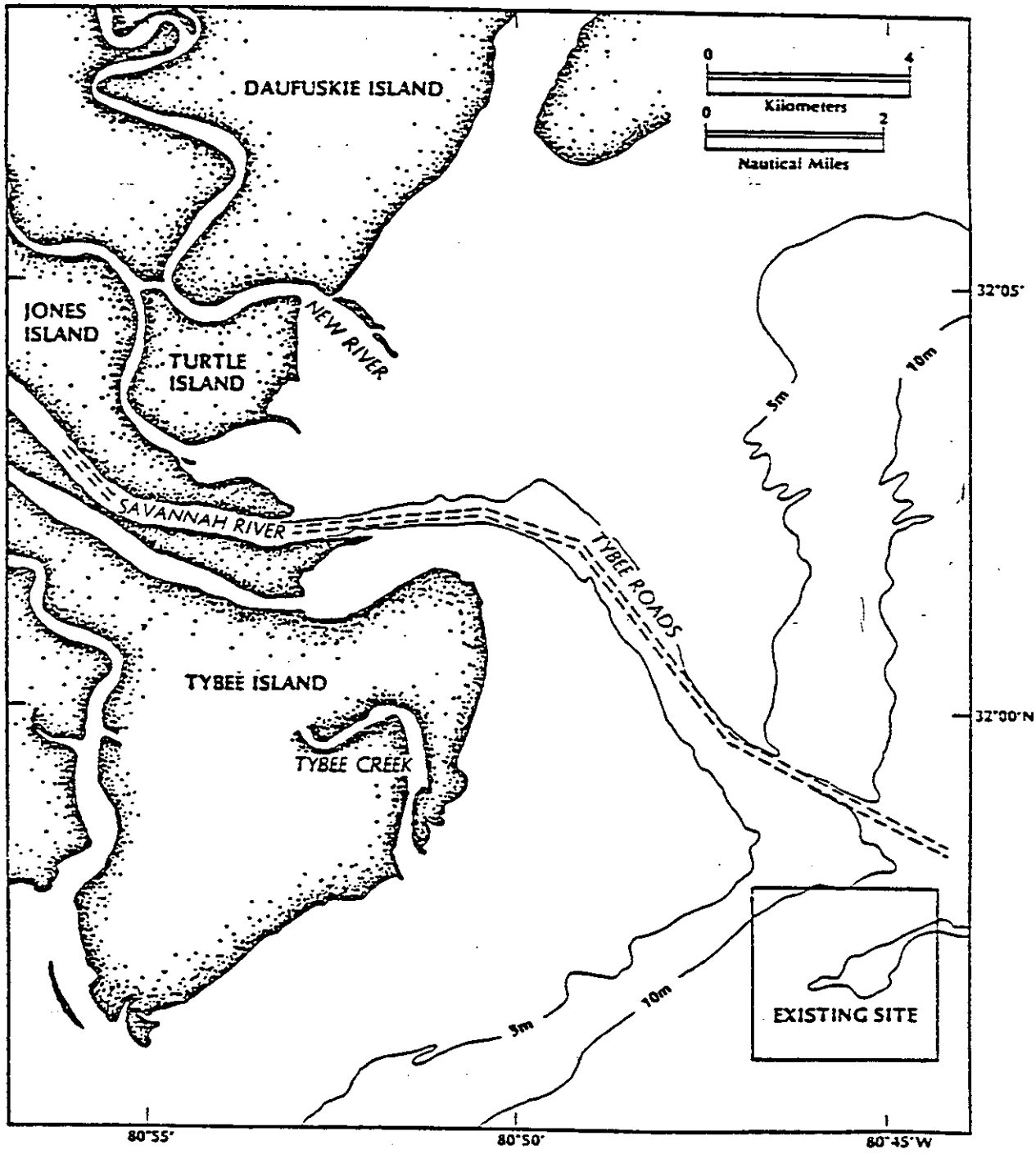
was placed on the site in a mounded fashion, with the present maximum height being about 32 feet. Upland vegetation has developed in the years since disposal activities occurred and the site now supports mature trees of up to 18 inches in diameter.

3.34 The second unconfined disposal site is Area 14A, located in South Carolina across the river from the Southern Energy facility on Elba Island. This site is adjacent to channel Stations 37+000 to 43+000. The 815-acre site has been used for placement of dredged material in the past. However, no sediments have been placed there recently as a result of the South Carolina Coastal Council's position that all dredged material disposal sites should be diked to confine the area of environmental impacts.

3.35 Ocean Dredged Material Disposal Site. Material removed from the Bar Channel (Stations 0+000 to 60+000B) is placed in the EPA-approved Ocean Dredged Material Disposal Site (ODMDS). This 4.26 square mile site is centered at 31 56' 54" N and 80 45' 34" W (Figure 9). The site is used for placement of the 1 million cubic yards of material which is removed by hopper dredges each year from that channel reach. The final designation of the site as an ODMDS was made by EPA on August 3, 1987. A Management Plan for the site is included as Appendix I to this EIS.

3.36 Disposal Area Management. In compliance with the terms of local cooperation agreed to by Chatham County in its role as the non-Federal sponsor of the Navigation Project, the County is responsible for providing, developing, and maintaining areas suitable for placement of material which is required to be dredged to maintain adequate depths in the Navigation Project. Those responsibilities encompass many activities which must be accomplished to effectively manage the resource which a tract of land, or easement to use a tract of land, represents. Those activities are performed by Chatham County, its partner in this effort the Georgia Department of Transportation, or their contractors. The activities performed at the disposal areas can be categorized as follows:

- Dike Raising
  - Design
  - Construction
- Maintenance
  - Weir Replacement
  - Routine Dike Maintenance
  - Ditching
  - Underdrains
  - Erosion Control
  - Mowing
  - Devegetation
  - Pipe Ramps



SAVANNAH OCEAN
DREDGED MATERIAL
DISPOSAL SITE

FIGURE 9

Those activities are described in detail in Appendix H LOCAL SPONSOR'S RESPONSIBILITIES.

3.37 The non-Federal sponsor has no responsibilities for the offshore disposal site, the Savannah ODMDS.

3.38 Environmental Considerations.

3.39 Disposal Area Maintenance. As with any construction activity performed in this day and time, environmental approvals ensure the work is performed in compliance with existing laws. The construction activities which the local sponsor implements at the disposal areas are performed in support of and as a part of the Federal Navigation Project. The construction, operation and maintenance of that project have already received the required environmental approvals. Therefore, as long as the sponsor and its representatives perform activities in agreement with the environmental documents which have already been approved, no further environmental approvals are required. If the work to be performed is outside that described in the environmental documents, additional approvals are required.

3.40 Georgia Water Quality Certification. The State of Georgia, Department of Natural Resources, Environmental Protection Division issued a Section 401 Water Quality Certification for the operation and maintenance of the Savannah Harbor Navigation Project on August 23, 1990. Except for dredging operations conducted during the Savannah Harbor Deepening Project, the District operated under the terms of that certification until February 1996.

3.41 Review of the Draft EIS by GA DNR and their subsequent issuance of a Water Quality Certification for the LTMS brought to light a misinterpretation which Savannah District had concerning the September 1991 Certification which GA DNR issued for the Deepening Project. Discussions between the District and GA DNR revealed that GA DNR intended the 1991 Certification to cover both the new work construction of Deepening and all subsequent maintenance dredging performed by the District in that improved channel. The District, however, had interpreted the 1991 Certification to apply only to the new work construction of Deepening since the Draft EIS for Deepening stated that harbor improvement would not affect channel maintenance operations. The District continued to operate under the terms of the 1990 Certification until this misunderstanding came to light in February 1996. As a result of this new information, the District will operate under the terms of the 1991 Georgia Water Quality Certification unless GA DNR modifies that certification or the LTMS is implemented.

3.42 The September 5, 1991, Section 401 Water Quality Certification was issued by GA DNR contingent on the following conditions:

"a. All work performed during dredging will be done in a manner so as not to violate applicable water quality standards.

b. No oils, grease, materials or other pollutants will be discharged to public waters. The Corps should inspect all dredging operations on a regular basis to insure no pipeline leaks exist and no excessive turbidities are occurring due to manner of dredge operation.

c) No dredging operations will be conducted during the striped bass spawning period from March 16 to May 31 of each year.

d) Before any dredging can be conducted during the period July 1 to September 30, approval from the Environmental Protection Division of a plan for monitoring of dissolved oxygen in the vicinity of the dredging site must be secured. The plan must include provisions for suspension of dredging during any periods when D.O. values drop below 3.0 mg/l. Results of the monitoring must be sent to the Georgia Environmental Protection Division, the Georgia Game and Fish Division, and the Georgia Coastal Resources Division within 30 days of the completion of each dredging operation.

e) Hopper dredging should be conducted during December through March. These are the times when sea turtles are less abundant in the area of the Savannah Ship Channel. Dredging outside of these months requires implementation of a conservation plan approved by Georgia Department of Natural Resources. The plan should include trawling to remove turtles from the path of the dredge.

f) During December through March, dredge and support vessel speeds should be limited to less than 5 knots during nighttime operations. A trained whale observer should be on watch during daylight hours. If daily aerial surveys are conducted for right whales, the nighttime vessel speed limitation would only need to be enforced when a whale was spotted within 15 miles of the project area during the previous daily survey."

3.43 A new Georgia Water Quality Certification was issued in response to this EIS in a letter dated September 5, 1995, which is included in Appendix Q. That certification was subsequently modified by clarifications in letters dated February 6 and 28, 1996. The conditions of the 1995 certification, as modified, will apply after completion of the Record of Decision for this project and the LTMS is implemented.

3.44 South Carolina Water Quality Certification. The State of South Carolina, Department of Health and Environmental Control, issued its Section 401 Water Quality Certification for the Savannah Harbor Deepening Project construction and resulting maintenance on December 6, 1991. This certification served as part of the Without Project condition for the LTMS Study. The South Carolina Section 401 Certification was issued contingent on the following conditions:

a. All effluent from Disposal Area 12 must be discharged to the Back River and none to the Wright River or its tributaries.

b. Dredging of the Savannah Harbor must be limited, if possible, to the winter months (November 1 through March 1).

3.45 A new South Carolina Water Quality Certification was issued in response to this EIS in a letter dated May 10, 1996, which is included in Appendix Q. The conditions of the new certification will apply after completion of the Record of Decision for this project.

3.46 Coastal Zone Consistency. The Savannah Harbor Deepening Project and subsequent maintenance operations are subject to the following conditions which were part of the South Carolina Coastal Council (SCCC) Consistency Certification issued on April 29, 1992. Restructuring within the South Carolina state government has resulted in the SCCC now being called the Office of Ocean and Coastal Resource Management (OCRM) located within the SC Department of Health and Environmental Control (DHEC). The following conditions were made part of the 1992 determination:

a. A study will be made of the discharges from the disposal area weirs located along the Wright River. This study will be made part of the Long Term Management Strategy (LTMS) Study. However, the study will be completed in three years regardless of the status of the LTMS Study.

b. The Council will be provided information indicating the techniques used to determine dike stability with a discussion of the results of past investigations concerning dike stability. Dike stability will also be further investigated as part of the LTMS.

c. Annually monitor the concentrations of metals in the Wright River to determine if concentrations are increasing.

3.47 The Wright River sediment study (Condition a.) was conducted as part of the LTMS. The results of the study were provided to the SC DHEC-OCRM in July 1994 and are summarized in Appendix E of this EIS.

3.48 The dike stability analysis (Condition b.) was prepared by the Georgia Department of Transportation. The District provided the analysis to the SCCC on December 8, 1993. GA DOT's analyses were a component of the technical investigations they made during their design for a dike raising contract. The investigations were designed to ensure the stability of the dikes both during construction and their subsequent future use. Based on the findings in those analyses, the dikes are considered stable and able to contain both the deposited material and its ancillary ponded water.

3.49 The SC DHEC-OCRM determined the LTMS to be consistent with the policies of the SC CZM Program in a letter dated January 8, 1996. The new Determination will apply to harbor operations after completion of the Record of Decision for this EIS.

3.50 Protection of Endangered Species.

3.51 Manatees. Manatees are a species which receive protection under the Endangered Species Act (ESA). The provisions of that Act, as they apply to manatee, are administered by the US Fish and Wildlife Service (FWS). The US FWS has issued standard manatee conditions which apply to all maintenance dredging operations conducted by Savannah District. These conditions state that to ensure the protection of manatees the permittee shall ensure that:

a. The contractor instructs all personnel associated with the project of the potential presence of manatees and the need to avoid collisions with manatees.

b. All construction personnel will be advised that there are civil and criminal penalties for harming, harassing, or killing manatees which are protected under the Marine Mammal Protection Act of 1972,

Endangered Species Act of 1973, and the Florida Manatee Sanctuary Act of 1978. The permittee and/or contractor may be held responsible for any manatee harmed, harassed, or killed as a result of construction activities.

c. Siltation barriers will be made of material in which manatees cannot become entangled, are properly secured, and are regularly monitored to avoid manatee entrapment. Barriers must not block manatee entry to or exit from essential habitat.

d. All vessels associated with the project will operate at "no-wake/idle" speeds at all times while in water where the draft of the vessel provides less than four feet clearance from the bottom and that vessels will follow routes of deep water whenever possible.

e. All construction activities in open water will cease upon sighting of manatees within 100 yards of the project area. Construction activities will not resume until the manatee has not been seen in the project area for at least 30 minutes.

f. Any collision with a manatee shall be reported immediately to the Corps of Engineers (912-652-5058), the U.S. Fish and Wildlife Service, Brunswick Field Office (912-265-9336), and Georgia Department of Natural Resources (Weekdays 8:00 a.m. to 4:30 p.m.: 912-264-7218 or 1-800-272-8363; nights and weekends: 1-800-241-4113).

g. A minimum of two 3-feet by 4-feet temporary manatee awareness construction signs labeled "Manatee Habitat - Idle Speed In Construction Area" shall be installed and maintained at prominent locations within the construction area/docking facility prior to initiation of construction. One temporary sign will be located prominently adjacent to the construction permit and, if required, a second temporary construction sign will be installed in a location prominently visible to water related construction crews. (A temporary construction sign criteria sheet was enclosed with the letter). Temporary signs will be removed by the permittee upon completion of construction.

h. The contractor will keep a log detailing sightings, collision or injury to manatees which have occurred during the contract period.

i. Following project completion, a report summarizing the above incidents and sightings will be submitted to the US Fish and Wildlife Service in Brunswick, Georgia.

3.52 Sea Turtles. Sea turtles are another group of species which receive protection under the ESA. The provisions of that Act, as they apply to sea turtles in the water, are administered by the National Marine Fisheries Service (NMFS). Impacts to endangered species from dredging of navigation channels in the southeast is currently covered by a regional Biological Opinion issued by the NMFS on August 25, 1995. The following conditions promulgated by the NMFS and South Atlantic Division apply to hopper dredging operations conducted by Savannah District to ensure the protection of sea turtles:

a. All hopper dredging will be scheduled for November 1 through May 31. No screening or monitoring is required during the period December 1 through March 31.

b. Hopper dredges will be equipped with 100 percent inflow screening or baskets to better monitor the intake (if possible) or, if inflow screening is not possible, 100 percent overflow screening for sea turtles and their remains. Screening at 100 percent is required during the periods November 1 through 30 and April 1 through May 31.

c. During periods when screening is required, a trained turtle observer will be placed on the hopper dredges to monitor for sea turtles for 100 percent of the period of dredging and transiting to and from the disposal area.

d. The water intake ports on the top of the draghead shall be screened with metal elliptical cages, or other suitable means to exclude sea turtles from entering the drag arm. No dredging shall be performed by a hopper dredge without a turtle deflector device in place.

e. Dredging shall be suspended in accordance with the criteria established by the NMFS. The current regional Biological Opinion requires reinitiation of consultation -- including a temporary cessation of dredging -- whenever more than one turtle is taken in a day, and/or once five or more turtles are taken. Reinitiation of consultation would also take place upon the taking of one hawksbill turtle. Dredging

operations will not commence again until NMFS remediation requirements are implemented, such as relocation trawling with a shrimp boat, to ensure compliance with the Endangered Species Act.

f. A report summarizing the take of sea turtles will be submitted to the NMFS immediately following completion of the project.

3.53 Whales. Whales also receive protection under the ESA. As with sea turtles, the NMFS administers the provisions of that Act. The August 25, 1995 regional Biological Opinion issued by the NMFS addressed potential impacts to right whales (Eubalaena glacialis) and humpback whales (Megaptera novaengliae) from dredging of navigation channels. The following conditions promulgated by the NMFS and South Atlantic Division apply to hopper dredging operations conducted by Savannah District to ensure the protection of whales:

a. There will be 100 percent coverage by endangered species observers with at-sea large whale identification experience to conduct daytime observations for whales between December 1 and March 31. Monitoring by sea turtle observers is allowed between April 1 and November 30.

b. During daylight hours, the dredge operator must take necessary precautions to avoid whales.

c. During evening hours or when there is limited visibility due to fog or sea states greater than Beaufort 3, the dredge must slow down to 5 knots or less when transiting between project areas if whales have been spotted within 15 nm of the vessel's path within the previous 24 hours.

3.54 Migratory Birds. Nesting migratory birds receive protection under the Migratory Bird Treaty Act. Under that Act, nests, eggs, or individual birds cannot be destroyed unless a depredation permit is obtained from the US FWS. Some species of migratory birds do nest within the Savannah Harbor disposal areas and on their confining dikes. Individuals of those species could be impacted by disposal operations or disposal area maintenance activities if those activities were conducted during the nesting season. Once the disposal area is flooded, nesting sites on the floor of the area are not available and disposal operations would not impact nesting migratory birds. Due to the lead time resulting from required contracting procedures, precise timing of the start of disposal operations or area maintenance work is generally not available. Therefore, some degree of uncertainty

often exists when those activities are scheduled for the disposal areas during the May to August nesting season. If nests are present when work is ready to start, three options are available: (1) delay the start of work until the young birds have left the site, (2) work in areas where no nests are located, or (3) attempt to obtain a Depredation Permit from the US FWS. Usually option #1 is used with disposal operations, while option #2 is used with disposal area maintenance practices.

4.00 FUTURE CONDITIONS WITHOUT THE PROJECT

4.01 Shipping Industry. U.S. commercial ports handle approximately 95 percent of this country's international trade. In 1990, the total waterborne commerce of the U.S. reached 1.9 billion metric tons. More than one billion tons of cargo were shipped through coastal seaports and the foreign commerce alone was valued in excess of $465 billion.

4.02 Ports are the critical link in the U.S. transportation chain and must have the ability to maintain and improve channels and berthing access to the land-based transportation network. Even in this Nation's advanced stage of intermodal development, investment in landside access to the ports is wasted if the navigation channels or berths restrict the ever-larger vessels from delivering and receiving their cargo.

4.03 Ocean carriers and railroads compete aggressively and seek the most efficient ports to conduct their business. In response, port authorities and commercial operators strive to provide better harbor service, inland connections, and storage facilities. To accommodate and attract their customers, ports have sought to provide deeper channels and more efficient docks.

4.04 Failure to maintain and improve the ports can increase the transportation costs to shippers. Inadequate channel and harbor depths can prevent fully loaded vessels from using the ports, and operating partially loaded vessels raises the cost of transporting cargo. Higher transportation costs result in higher consumer prices and make U.S. products less competitive in world markets.

4.05 Most U.S. ports are not naturally-deep harbors, but are instead located at the mouths of rivers where both cargos and sediment are carried downstream to the port. In those ports, extensive actions are taken to remove the sediment which accumulates in the navigation channel. If not effectively managed, the sedimentation would otherwise restrict the useful depth of the harbor, thereby limiting the cargos which could be effectively transported through the harbor. Today's modern vessels require deeper channels, turning basins and berthing areas to maximize the use of their designed cargo transportation efficiencies.

4.06 The South Atlantic U.S. is expected to out pace the average growth in the U.S. in employment and income. The South Atlantic's trade prospects are enhanced by strong potential export growth to Latin America and the Caribbean, while imports are expected to rise as a result of above average income growth. By the year 2050, imports are projected to increase fivefold, while exports are projected to grow even more at about eight-fold (COE, 1993, pg. 5-2).

4.07 Through the year 2050, South Atlantic containerized import trade is expected to grow an average of 2.8 percent per year while containerized export trade is expected to grow nearly 3.6 percent per year (COE, 1993, pg. ES-3). The present 1.9 million TEUs (Twenty-foot Equivalent Units) inbound and outbound volume of international trade through South Atlantic ports is projected to exceed 13 million TEUs by the year 2050, a volume that exceeds the present total U.S. containerized international trade (COE, 1993, pg. ES-4).

4.08 During this period, the fleet of containerized vessels is expected to evolve to include larger vessels with a capacity of greater than 4,000 TEUs. Such vessels have been designed (Ultra Container Carrier 4000 Design) and construction has begun by some shipyards. Less than 10 years ago, the concept of a 4,000 TEU container ship was considered unlikely to become a reality, today, it is regarded as almost a prerequisite for survival on the Europe-Far East trade route. These larger vessels, with their drafts exceeding 70 feet, will have important implications for the port industry concerning channel draft and adjacent landside facilities as investment decisions are made concerning the infrastructure necessary to accommodate those vessels in an efficient manner. Now that vessel operators are shifting routings around South America, rather than going through the Panama Canal, the future limitation on vessel sizes will be the ability of ports to effectively handle the capacity which the ships provide.

4.09 Shipping Through Savannah. Savannah Harbor is one of the major East Coast deep-draft ports. It is a first tier port for containerized traffic, as well as a major bulk cargo handling port. Both imports and exports represent major portions of the port's overall commerce. Local port interests, both public and private, have invested significant sums of capital in cargo handling facilities to support local industries, as well as foreign and inland markets. Many of the world fleet's most modern vessels call on Savannah.

4.10 Examination of records published in the Waterborne Commerce of the United States reveals that total tonnage through the harbor has grown at an average rate of 5.5 percent between 1970 and 1988 (COE, 1992, pg. A-4). Commodities are generally broken into three major categories, with one-third of the tonnage being in dry bulk form, one-third liquid bulk and the remaining third being general cargo/container commodities. Over that 1970 through 1988 period, nearly 75 percent of the volume through Savannah Harbor was comprised of the following 14 major commodities:

crude petroleum	asphalt, tars, and pitches
gasoline	distillate and residual fuel oil
sugar	grains
clay	gypsum
building cement	basic textile products
woodchips	pulp and paperboard
iron and steel shapes	fabricated metal products

4.11 Imports and exports of bulk commodities meet the needs of a hinterland served by Savannah which can be characterized as captive to the port. The competing ports of Charleston to the north and Jacksonville to the south are in similar positions with respect to bulk traffic. The high transport costs relative to the value of the commodity moved makes the transportation distance the most important factor in determining the bulk commodity hinterland served by a port. Therefore, transportation improvements in the navigation component of the harbor are not expected to induce the transfer of any additional bulk commodity tonnages to Savannah Harbor from its competitors.

4.12 The hinterlands served by containerized cargo are much more extensive due to the effects of intermodal containerized rail rates. Therefore, containerized cargo movements are much more sensitive to increased efficiencies gained through improvements in either the operational procedures or structural aspects of the harbor's navigation leg of commodity movements. The recent Savannah Harbor Deepening Project was economically justified on the basis of the reduction in transportation costs inherent in the larger container vessels which the deeper channel would allow to use the port. In the future, the lower transportation cost inherent in larger container vessels will continue to demand peak efficiencies in both the navigation and landside components of the port's infrastructure. On average, 15 to 20 deep-draft vessels per day transit the harbor.

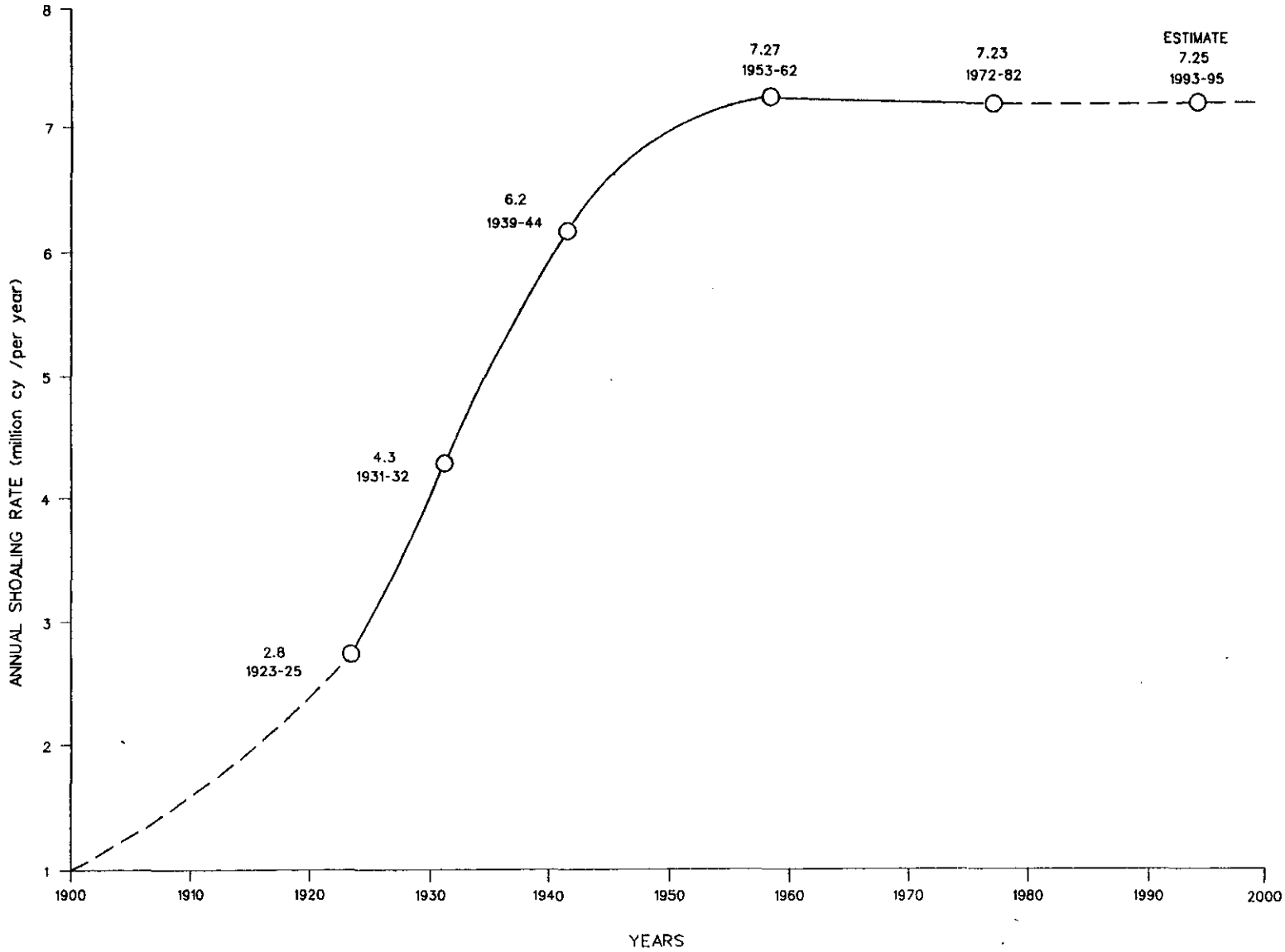
4.13 Maintenance Dredging. Due to the economic benefits which result from use of the harbor, continued maintenance of authorized channel depths is expected. Maintenance dredging of the navigation channel is typically performed on a yearly basis. Agitation dredging of the berths is usually required more often to accommodate the faster shoaling rates (6 to 18 inches per month) in those areas out of the main river currents.

4.14 Analysis of historic data reveals the following information on the annual shoaling rates experienced in the harbor:

TIME PERIOD	CHANNEL DEPTH (FEET BELOW MLW)	ANNUAL SHOALING RATE (MCY/YR)
1923 to 1925	26	2.8
1931 to 1932	26	4.3
1939 to 1944	30	6.2
1953 to 1954	34	7.2
1953 to 1962	36	7.3
1972 thru 1981	38	7.2
FY91 thru FY93	38	6.5

These data are also shown in Figure 10. The data show that the quantity of sediments required to be excavated from the Navigation Project each year has remained just above 7 MCY over the last forty years. That volume is expected to continue to be removed throughout the 20-year period of analysis.

4.15 Working in concert with the Sediment Basin, the Tidegate was constructed to concentrate the deposition of fine-grained sediments outside the Navigation Channel in a location close to the confined disposal facilities. Those two factors -- the concentration and the location -- both led to an annual reduction in the cost of removing a large volume of sediments from the harbor. Since the Tidegate was removed from operation in 1990 and New Cut was filled, the deposition of a large volume of fine-grained sediments has shifted back to the navigation channel in Front River. That shift has several ramifications related to maintenance dredging, including the following: (1) a reduction in the duration over which the fully-authorized channel dimensions are available for deep-draft navigation, (2) increased scheduling of deep-draft vessels to pass through Front River with a tidal advantage, and (3) increasing the distance between the site of the shoaling and the dredged material disposal site, with its accompanying direct increase in dredging cost. The District has estimated this increase in dredging cost to be about $6 million per year. Since Corps budgeting policies presently do not allow a significant increase in annual maintenance funding for a



HISTORIC AND PROJECTED SHOALING RATES

FIGURE 10

project, this increase in dredging cost would either be reflected in an overall reduction in the quality of channel maintenance in Savannah or a reduction in the maintenance of other projects within Savannah District.

4.16 Historic data indicates that increases in channel dimensions at Savannah generally result in an upstream shift in the location of channel sediments. Since the 1993 Deepening Project increased the channel dimensions, an upstream shift is expected. However, since only a relatively short period of time has occurred since the Deepening Project was completed, conclusive confirmation of this expectation is not available at this time. As a result of the combined effects of (1) the dispersal of shoal material along the length of the navigation channel, (2) the small shift expected in average location of deposited material, and (3) the good availability of disposal areas along the length of the channel, no significant impacts on the overall placement of dredged material is expected.

4.17 Disposal of Maintenance Dredging Material. Upland sites are used for placement of the material excavated from the inner harbor channel during maintenance operations. Without the evaluations documented in this EIS, no changes are expected in the sites used for the placement of that material.

4.18 Operation of the confined disposal facilities would continue to be managed around the potential for a delay in initiating work as a result of the protection which must be provided to nesting migratory birds. Nesting migratory birds receive protection under the Migratory Bird Treaty Act. Under that Act, nests, eggs, or individual birds cannot be destroyed unless a depredation permit is obtained from the US FWS. Some species of migratory birds do nest in the Savannah Harbor disposal areas and could be impacted when disposal operations flood the interior of the disposal sites. Once the area is flooded, nesting sites on the floor of the area are not available and disposal operations would not impact nesting migratory birds. Due to the lead time resulting from required contracting procedures, precise timing of the initiation of a disposal operation is generally not available. Therefore, some degree of uncertainty often exists when disposal operations are scheduled for the disposal areas during the May through August nesting season. That uncertainty is expected to be encountered throughout the 20-year project life.

4.19 Useful Life of Disposal Areas.

4.20 The dikes of the confined disposal areas are periodically raised to increase the storage capacity of the sites. With the continuation of that practice, all disposal areas except Disposal Area 2A has a remaining life which extends beyond this study's 20-year period of analysis. Calculations indicate that the dikes at Disposal Area 2A would have to be 100-feet high to retain all the material scheduled to be placed there during that period. That height is not acceptable, so alternate management options need to be pursued.

4.21 No major changes in the use of existing undiked disposal sites is expected. The position of the SC Office of Ocean and Coastal Resource Management (SC OCRM) that all dredged material disposal sites should be confined (diked) to minimize impacts to adjacent marshes is expected to remain throughout the study period. Based on that assumption, Disposal Area 14A will not be used again until dikes are constructed at the site. Without the evaluations documented in this EIS, such construction is not expected during the study period.

4.22 Dredged material was placed on the eastern side of the New Cut Closure Structure during the 1993/1994 Deepening Project, filling that side of the closure. Placement of dredged material in New Cut to fill the site to the height of adjacent marsh was evaluated in a Public Notice issued by the District on September 11, 1992, and an Environmental Assessment completed in February 1993. Complete use of the site was expected to result in the creation/restoration of about 36 acres of tidal marsh. The District deposited dredged maintenance sediments on the western side of that site in 1995. It is expected that additional dredged material will soon be placed on that side of that site, filling the site. The relatively small size of the site did not significantly influence the harbor management alternatives under consideration in this EIS.

4.23 Dredged material is typically placed at the Savannah Ocean Dredged Material Disposal Site (ODMDS) each year. The site is located in about 3.7 nautical miles offshore in 30 to 45 feet of water. Material generally migrates from the site, as no significant accumulation is evident even though the site has been used for the last 30 years. The Savannah ODMDS is expected to be used and to have sufficient capacity for such use throughout the 20-year period of analysis.

4.24 Need For Additional Disposal Areas.

4.25 Disposal Area 2A. Calculations performed during this study indicate that the first confined disposal facility (CDF) which will reach its storage capacity will be Disposal Area 2A. Since a considerable distance exists between that CDF and an adjacent one, costs to shift disposal operations to another site would be significant. Therefore, some management strategy must be pursued to extend the useful life of that site. This EIS does contain an evaluation of the impacts of constructing and using an access road to that site to allow deposited sediments to be removed from the site and used for beneficial purposes. A review by GA DOT indicated that there was a need for borrow material within typical hauling distances in Savannah, should access to the site be developed.

4.26 Disposal Area 14A. As described earlier, Disposal Area 14A is a previously used undiked disposal area located in South Carolina wetlands. The SC Office of Ocean and Coastal Resource Management (OCRM) has a policy that all dredged material disposal facilities should be confined (diked) to minimize impacts to adjacent marshes. Based on the assumption that the SC OCRM's position will not change in the near future, Disposal Area 14A will not be used again until dikes are constructed at the site. The SC Coastal Council, now named the SC OCRM, did approve an alignment of a dike at Area 14A in 1990. However, no other environmental approvals have been obtained for the diking to this point in time. This EIS does contain an evaluation of the impacts of diking that site and again using it as a dredged material disposal area.

4.27 Dike Maintenance Activities. Except for the one item explained in the following paragraph, no changes are anticipated in the maintenance practices and procedures which are performed for the disposal area dikes. The practices and procedures which are normally followed are described in Appendix H of this EIS.

4.28 As explained in Section 4.17, nesting migratory birds must be protected. Some species of migratory birds do nest on the Savannah Harbor disposal area dikes and could be impacted by dike maintenance activities, particularly mowing. To ensure that these birds receive the protection required while nesting, a change in the maintenance procedures will be instituted in 1996. This change calls for the dike side slopes to not be mowed from March 1 to July 15. The traveling surface (roadway) on the dike crest would continue to be mowed when necessary to allow safe movement around the dikes for inspection and disposal area use purposes. Mowing of dike side slopes would only be performed outside the March 1 to July 15 period.

4.29 Disposal Area Maintenance Activities. Except for the item explained in the following paragraph, no changes are anticipated in the maintenance practices and procedures which are performed for the disposal area. The practices and procedures which are normally followed are described in Appendix H of this EIS.

4.30 As a result of information which became available through the Wright River weir tests, the disposal area underdrains which drain to Wright River will be closed by the end of 1994. Three underdrains were operating in 1993/1994 when the weir testing was performed; all have since been closed. The testing revealed that the underdrains contain certain chemicals in sufficient quantities to cause environmental problems when they are discharged into small volume receiving waterbodies, such as the small tidal creeks (top width of 5 to 10 feet) which flow from the weirs to Wright River. This EIS includes an evaluation of the installation and operation of underdrains which discharge to the Savannah and Back Rivers. Discharging the underdrain effluents to those larger receiving waterbodies would have a much lower potential for causing environmental impacts.

4.31 The disposal areas would continue to be managed around the potential for work stoppage during the migratory bird nesting season to ensure compliance with the laws which protect the nesting of those species. As explained in Section 4.18, nesting migratory birds must be protected. Activities which are commonly used to maintain the disposal areas could result in impacts to those nesting birds if the activities were performed while the birds were nesting. Due to the lead time resulting from required contracting procedures, precise timing of field work is generally not available. Therefore, some degree of uncertainty often exists when construction activities are scheduled for inside the disposal areas during the March through August nesting season. That uncertainty is expected to be encountered throughout the 20-year project life.

4.32 Endangered Species Restrictions. For the purposes of this EIS, the District has assumed the following items related to threatened and endangered species:

a. No species which exist in the harbor area which are not presently listed by the FWS as threatened or endangered would become listed during the 20-year project life, and

b. No additional protective restrictions would be placed on actions which may impact species which are presently listed and, therefore, are already receiving protection. Essentially this means that existing restrictions would continue to be enforced by the regulatory agencies and observed during harbor O&M activities, but that no new restrictions would be enacted.

However, should additional information become available which indicates that the continued existence of a given species is in jeopardy, Section 7 consultations and negotiations would be reopened to determine what measures would be appropriate to enhance the survival of that species.

4.33 Cultural Resource Activities. Cultural resources which are found as a result of O&M activities of the navigation channel and Federal disposal areas will be evaluated for significance as specified by Section 106 of the National Historic Preservation Act. If the resource is identified as being significant by the District and the State Historic Preservation Officer (SHPO), impacts to the resource will be minimized. If avoidance is not possible, mitigation measures which the District and the SHPO agree to be appropriate would be performed. This procedure is described in detail in Appendix J CULTURAL RESOURCE MANAGEMENT PLAN.

4.34 One resource identified along Savannah River was the Venus Point Light structure. That structure was located on the north bank near River Mile 4 and was the remains of a brick structure serving as the base of a late 1800's harbor navigation light. After causally observing the structure becoming more exposed over the last few years as a result of streambank erosion, District archaeological staff made a field inspection of the site in the Spring of 1994. They found that the site had become exposed and information was in danger of being lost. The District made a preliminary determination that the site was eligible for nomination to the Federal Register of Historic Places and forwarded that recommendation the SC SHPO in March 1994, along with a recommendation that the District document the structure to HABS/HAER standards. After receiving no response from the SC SHPO, the District initiated efforts in September 1994 to fully document the site before the structure experienced further adverse impacts. However, by the time the archaeological contractor arrived on-site, the structure had succumbed to erosive forces and fallen into the river. The contractor documented the remaining site and included the data recorded by the District during previous inspections. The District met on-site with the SC SHPO and archaeologists from GA DOT in June 1995 to determine if any additional work should be performed. Due to the previous loss of most of the site's features and the lack of

uniqueness of the remaining portions of site, an agreement was reached with the SC SHPO for GA DOT to monitor the site each month in case additional features become exposed as a result of further bank erosion.

4.35 Ordnance from the CSS GEORGIA periodically slips down the channel slope into the boundaries of the navigation channel. This is one reason that dredging has not been performed recently in that area. The main reason, however, is that channel velocities are sufficient to maintain the authorized channel dimensions at that site. Before maintenance dredging will be performed in the future, the ordnance will be identified and removed by appropriate personnel. Magnetometers and side-scan sonars are expected to be used to identify individual pieces of ordnance, while trained divers are expected to be used to remove the objects from the channel floor. Shells removed from the site would be treated as fully armed and capable of exploding, until they are disarmed by personnel trained in such procedures. Decisions have yet to be made on how many shells would be preserved, as multiple examples of a same item provide little additional information about a particular cultural resource.

5.00 ALTERNATIVES.

5.01 Introduction. Operation of Savannah Harbor is very complex, with many activities being conducted by a variety of organizations. There are a number of ways in which each resource of the harbor could be managed, with many possible combinations of those individual management methods. Appendix A contains a discussion of individual resource management methods. The methods are grouped according to the goal that they are intended to attain. That discussion centers around the following goals:

* Minimizing Federal Dredging Costs
* Minimizing Non-Federal Dredging Costs
* Minimizing Total Dredging Costs
* Minimizing Disposal Area Costs
* Minimizing Environmental Impacts
* Maximizing Beneficial Uses of Dredged Material

The activities conducted to attain those goals can be combined in many ways. Eight of the most feasible combinations were designated as alternatives for detailed evaluation. A brief description of the alternatives is shown in Table 2 on the following page.

5.02 Alternatives (Plans Considered In Detail).

5.03 **Alternative 1 (Without Project Condition)**. Alternative 1 serves as the baseline from which potential project impacts would be measured. This plan is the Without Project Condition; those actions which would occur even if no alternative evaluated in this EIS is approved and implemented. The Plan consists of continued Federal use of the existing confined disposal areas and the EPA-approved ocean disposal site. In the inner harbor, the Corps would pump dredged material to the closest diked disposal area. Dock owners would continue to maintain their berths, primarily by agitation dredging, with redeposition of most of that dredged material in the Federal navigation channel. No new disposal areas would be developed or used. Disposal Areas 14A and 1S would remain undiked and would not be used in the future.

5.04 This plan includes those actions previously described in Section 3 EXISTING CONDITIONS and Section 4 FUTURE CONDITIONS WITHOUT THE PROJECT. The channel depths, turning basins, advance maintenance sections, sediment control works, freshwater control works, berthing areas, disposal areas, disposal area management and environmental restrictions would be as described in those sections. Where differences exist between the two sections, the actions and descriptions contained in Section 4 would govern.

TABLE 2

SUMMARY OF DETAILED ALTERNATIVES

ALTERNATIVE	DESCRIPTION
1	Without Project Condition Closest Disposal Area
2	Diking of Disposal Area 14A Closest Disposal Area Mitigation Plan Access Road to Disposal Area 2A
3	Rotational Use of Disposal Areas Diking of Disposal Area 14A Mitigation Plan Access Road to Disposal Area 2A
4	Alt 1 + Underdrains to Savannah River
5	Alt 1 + Beneficial Use of Nearshore Sediments Submerged Berms Feeder Berm Beach Placement - Daufuskie and Tybee Islands
6	Alt 3 + Direct Placement of Berth Sediments into Confined Disposal Areas Deepen Berthing Areas
7	Alt 1 + Sediment Control Features Deepen Sediment Basin Deepen Advance Maintenance Section at Kings Island Turning Basin Deepen Turning Basins
8	Combination Rotational Use of Disposal Areas Diking of Disposal Area 14A Mitigation Plan Access Road to Disposal Area 2A Underdrains to Savannah River Beneficial Use of Nearshore Sediments Direct Placement of Berth Sediments into CDFs Sediment Control Features

5.05 **Alternative 2.** Alternative 2 has two changes from the Without Project Condition contained in the previous alternative. The major change is the diking and use of Disposal Area 14A, while a smaller change is the construction and use of an access road to Disposal Area 2A to allow for periodic removal of deposited dredged material from that site. Material dredged from the inner harbor would continue to be pumped to the closest confined disposal area. Material removed from the Bar Channel would be placed in the ocean disposal site.

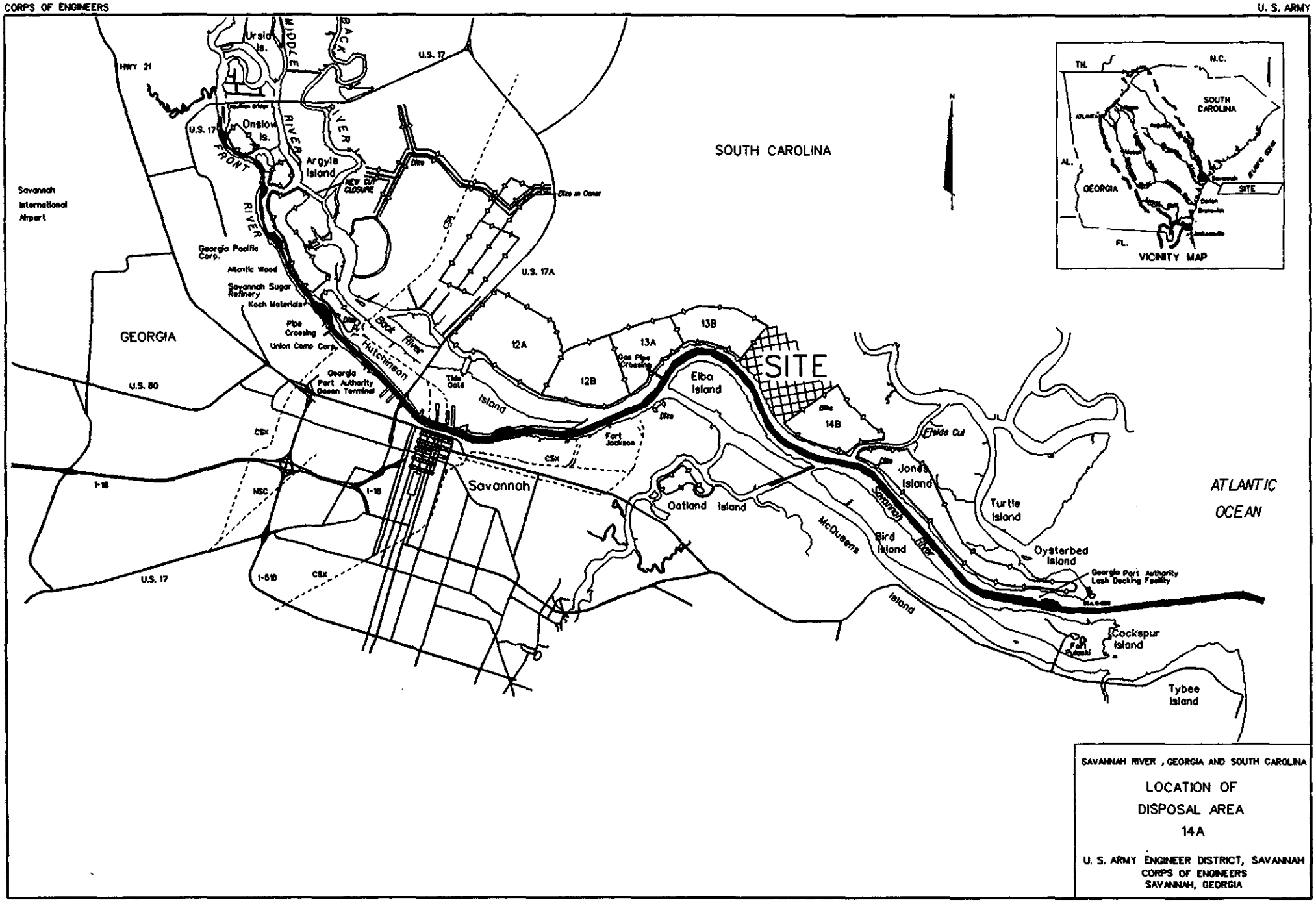
5.06 The location of Disposal Area 14A is shown in Figure 11. As described in Section 3.11, the Area is an 815-acre site which has previously been used for unconfined dredged material disposal. High ground currently exists on three sides of the area due to either past disposal actions (front side) or construction of the dikes which define adjacent disposal areas. A dike would be constructed along the back of the site to tie in the dikes of the adjacent Disposal Areas 13B and 14A. Approximately 9,000 feet of dike would have to be constructed to close in the disposal area. The alignment which would be used is that developed by GA DOT and approved by the SC Coastal Council in 1990. Effluent weirs would be installed along the Savannah River side of the facility. An interior spur dike may be constructed running from the Savannah River side of the area toward the Wright River side of the area. The spur dike would force water to flow toward the back of the disposal site, thereby extending the settling time and increasing the solids removal efficiency.

5.07 Using 1991 aerial photographs, Planning Division staff differentiated vegetation types in the area to be impacted. The vegetation types and wetland delineations were field verified from March to May 1994 by the Planning Division Biologist and another Biologist from the District's Regulatory Branch. Habitat which would be impacted by development of the site as a confined disposal area generally consists of the following:

HABITAT TYPE		# ACRES
Wetland		
Low/moderate value within old dike		33
Low value outside old dike		85
High value outside old dike		187
	Subtotal	305
Upland		
High value wildlife		43
Low value wildlife		467
	Subtotal	510
	Total	815

CORPS OF ENGINEERS

U. S. ARMY



SAVANNAH RIVER , GEORGIA AND SOUTH CAROLINA

LOCATION OF
DISPOSAL AREA
14A

U. S. ARMY ENGINEER DISTRICT, SAVANNAH
CORPS OF ENGINEERS
SAVANNAH, GEORGIA

FIGURE 11

High functional value wetlands at the site consist primarily of (1) Distichilis spp. and Juncus roemerianus marsh, which primarily functions as wildlife habitat, (2) Spartina cynosuroides marsh, which primarily functions as wildlife habitat and a source of detritus, and (3) Scirpus spp. marsh, which primarily functions as wildlife habitat and as a wildlife food source.

5.08 A Mitigation Plan was developed to replace the functional value of the wetlands which would be lost. This plan is included as Appendix G. The plan consists primarily of constructing additional wildlife habitat within existing diked disposal areas and operating those areas for increased use by wildlife. Water levels would be managed in Disposal Areas 12A, 12B, 13A, 13B, 14A, 14B and Jones/Oysterbed Island after completion of a disposal event to maximize use by shorebirds and waterfowl. A bare ground nesting area would be created outside the dike at the Jones/Oysterbed Island Disposal Area for use by migratory shorebirds. Nesting islands would be created within the confined disposal areas for migratory shorebirds. An offshore island would be created for colonial nesting birds and other shorebirds. These mitigation features would be maintained throughout the project life. As a form of in-kind mitigation, restoration/ creation or protection of 25 acres of tidal wetlands would also be performed in South Carolina at sites to be identified by the SC OCRM. To accomplish this work, Chatham County will establish an escrow account which the SC OCRM will administer to perform the wetland restoration/creation or protection measures it deems most appropriate as sites become available in the future. A water control structure would be constructed at an existing 228-acre impoundment within the Savannah National Wildlife Refuge to allow tidal flows to be established in the impoundment, thereby benefitting fishery resources. The plan would not fully replace wetland functional values which benefit living marine resources.

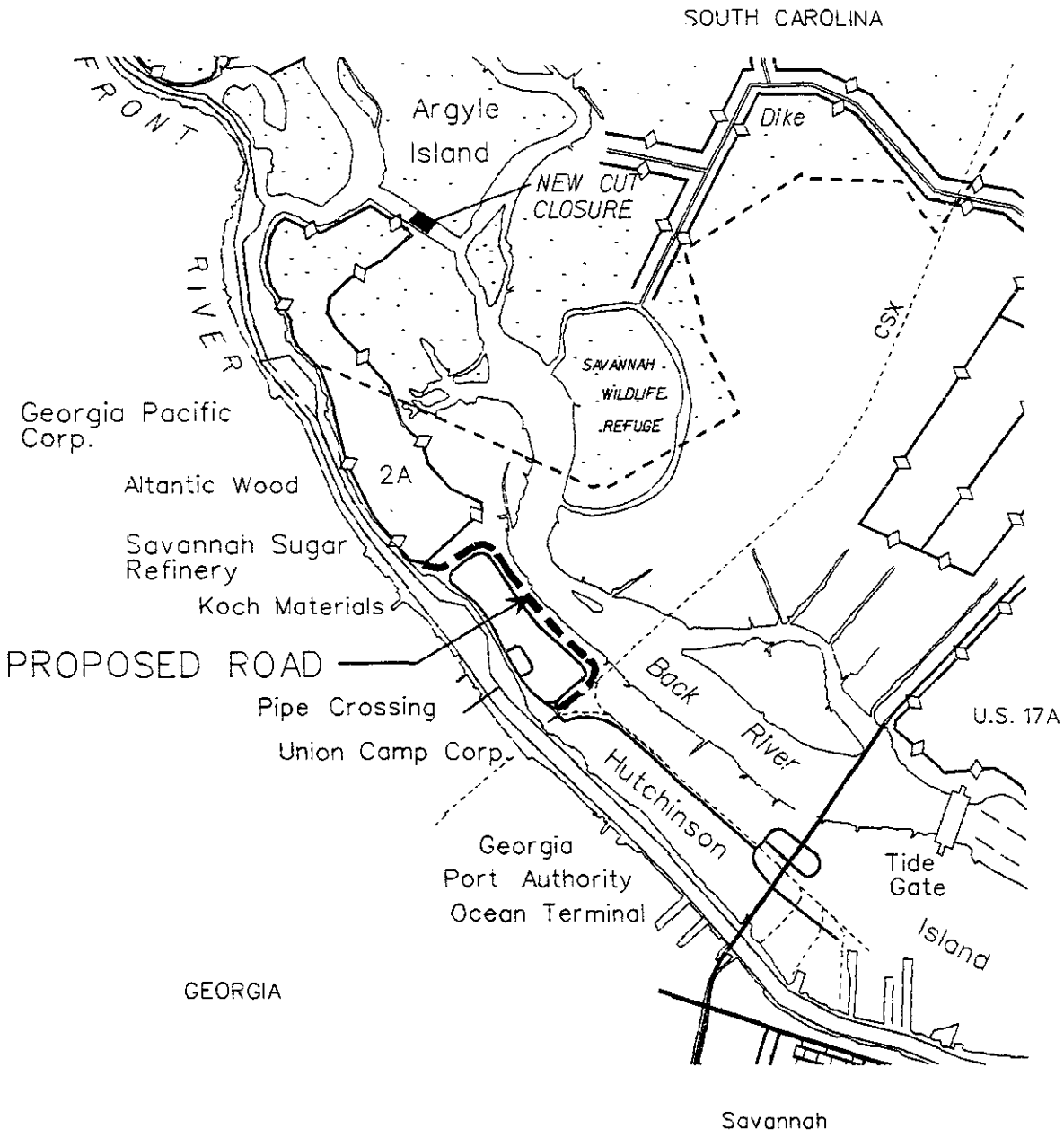
5.09 The location of Disposal Area 2A is shown in Figure 8. As described in Section 3.26, this Area is a 185-acre site which is presently used for confined disposal of dredged material. Engineering evaluations conducted during this study identified that area as the most critical disposal site in terms of its useful life. To accommodate the material expected to be placed there over the next 20 years, dikes surrounding the site would have to be raised about 100 feet. Since that was judged to be inappropriate at this time, removal of the deposited material was evaluated, as was shifting the placement of sediments from that portion of the channel to Disposal Area 12A. Construction of an access road and removal of the deposited sediments was found to be a lower cost alternative. The access road would be

constructed around the northern side of the Union Camp aeration lagoon on Hutchinson Island, as shown in Figure 12. Roughly 7,400 feet of roadway would have to be constructed. At this time, the road is expected to be placed about 150 feet outside the dike for the aeration lagoon, as shown in Figures 12 and 13, to minimize interference with that existing dike. Approximately 3.9 acres of tidal marsh and other wetlands would be impacted by construction of that road, with 1.0 acre of that being impacted only during the actual construction period. A wetland Mitigation Plan will be develop to replace the functional values of those wetlands, as well as an additional 0.18 acres of wetlands which are expected to be impacted by miscellaneous disposal area operations in Georgia. The Plan will be provided to the GA DNR Coastal Resource Division and the US FWS for approval. The NMFS will also be consulted. In light of the relatively small number of acres involved, it is expected that a site can be identified in the general Savannah Harbor area where the sponsor or the GA DOT can restore previously impacted marsh as a component of another construction project. Replacement of the 3.2 acres of wetlands which would be permanently lost in Georgia would be at a 2:1 rate, so that the Mitigation Plan will consist of the restoration of 6.4 acres of tidal marsh. This replacement rate is deemed appropriate due to the uncertainties in completely replacing the functional values of existing wetlands. Since wetlands are sites where soil, vegetation and organisms interact in complex ways, created or restored wetlands are not likely to fully replicate those interactions on a 1:1 basis. Both the US FWS and the GA DNR concur in the 2:1 replacement ratio for created or restored wetlands. Implementation of this wetland Mitigation Plan would occur before the access road is placed in service.

5.10 **Alternative 3**. Alternative 3 has one major change from the previous alternative, that being the rotational use of the diked disposal areas located in the middle of the harbor. Disposal operations would be rotated among adjacent areas which are grouped together. The groupings would be as follows:

* Disposal Areas 12A, 12B and 13A
* Disposal Areas 13B and 14A
* Disposal Areas 14B and Jones/Oysterbed Island

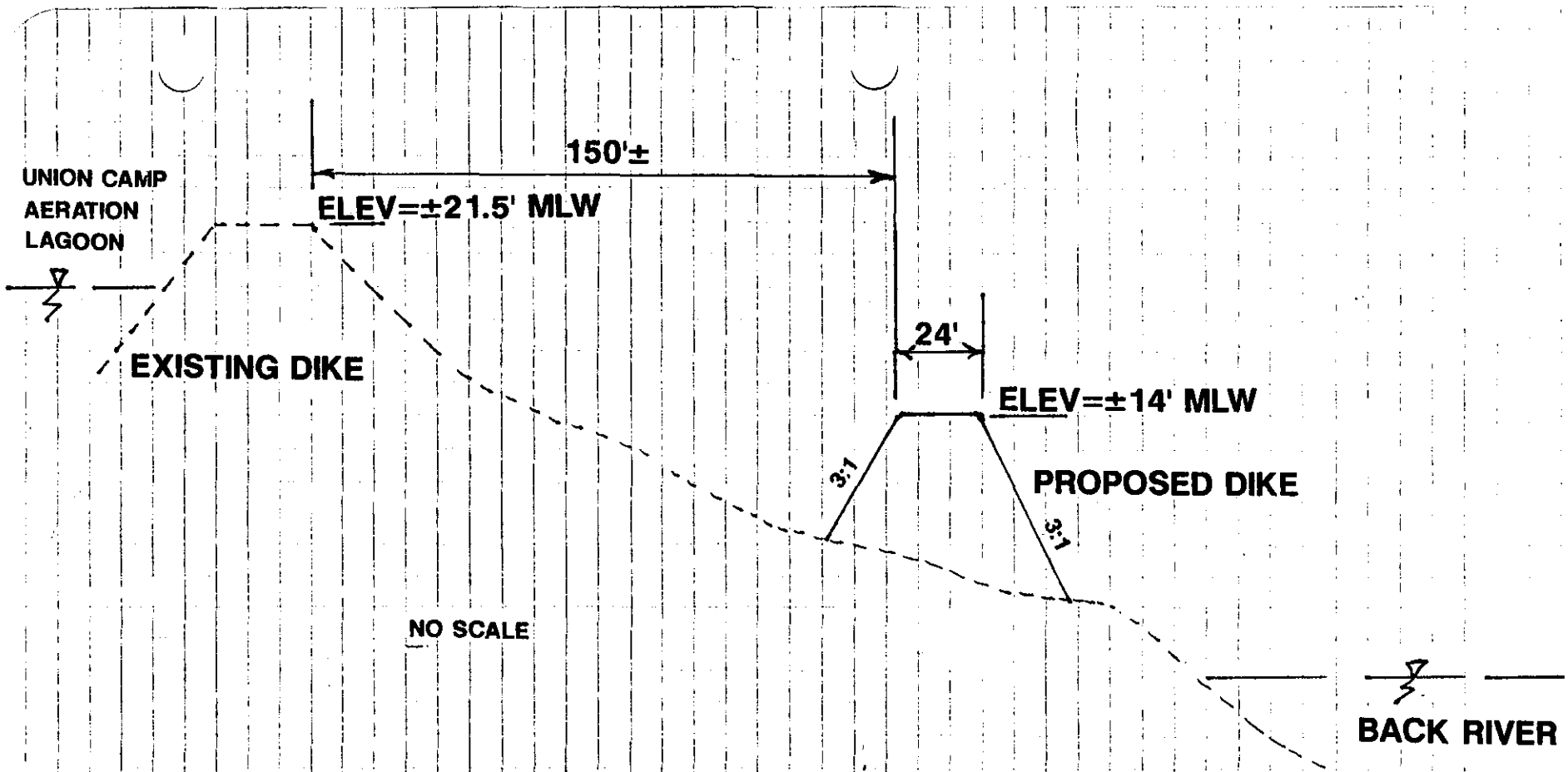
Disposal areas 1N, 1S, and 2A would not be included in the rotational program. Disposal Area 14A would be included in the rotational program after it is diked. The Mitigation Plan previously discussed for the diking of Area 14A and which is described in detail in Appendix G would be included in this Alternative. The Mitigation Plan required for construction of the access road to Disposal Area 2A would also be included in this Alternative.



DISPOSAL AREA 2A

ACCESS ROAD

FIGURE 12



CONCEPTUAL DESIGN OF A PROPOSED HAUL ROAD ACROSS PROPERTY CONTROLLED BY UNION CAMP

FIGURE 13

5.11 One of the main subfeatures of this alternative is the use of the crust construction method in some inner harbor disposal areas to allow material to be removed from the disposal sites. The material removed would be subsequently used to raise the height of adjacent or nearby dikes. The key to that technique is keeping the deposited material dry for a sufficient period of time to allow consolidation and development of sufficient strength to support the heavy equipment used to excavate and remove the soil material. A period of about two years is needed for the deposited material to consolidate and dry sufficiently to support the equipment. Rotational use of the areas would provide the needed drying time. The rotational program would, however, result in longer pumping distances during some years, with associated higher dredging costs.

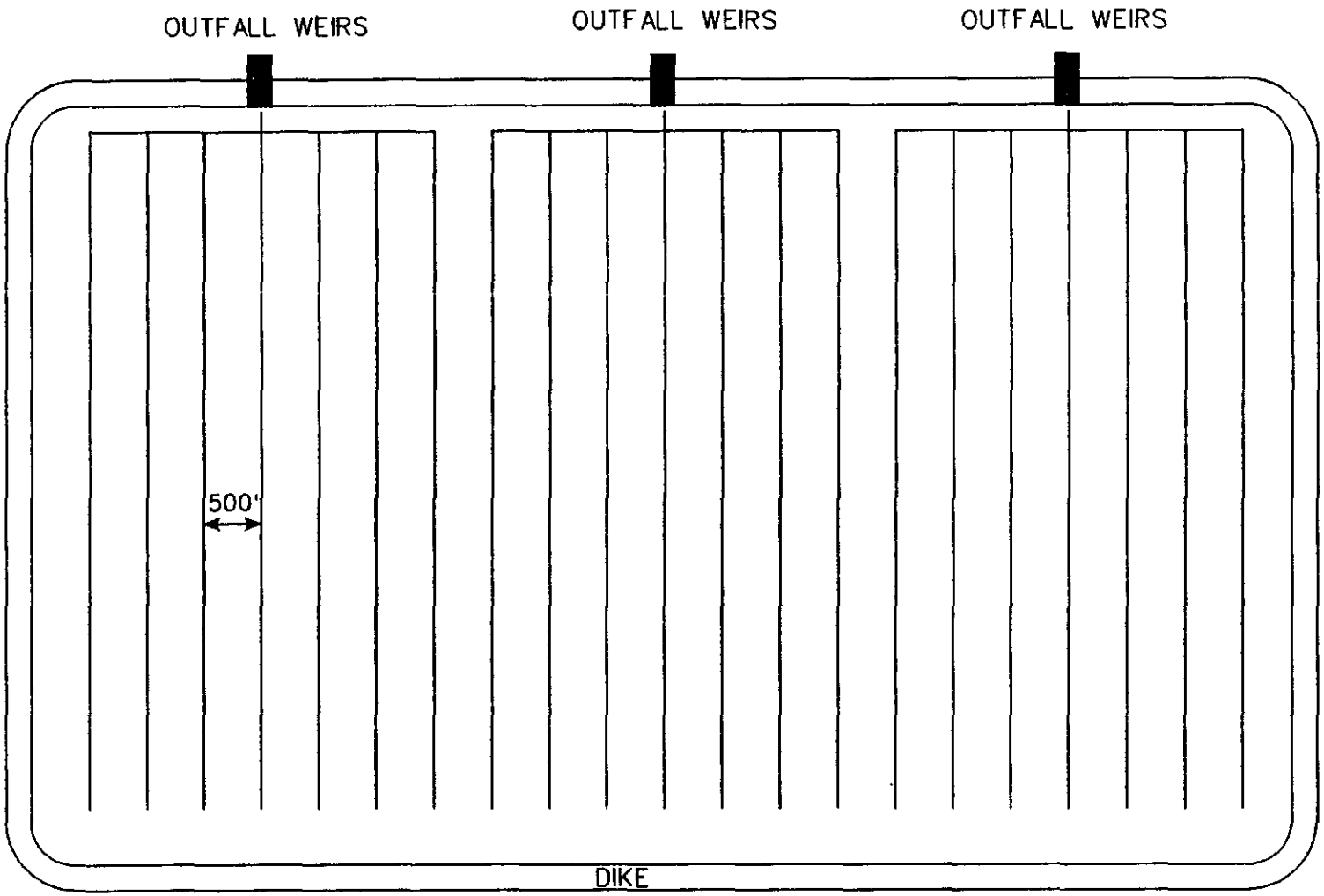
5.12 The crust construction method derives its name from the use of the silt crust and other deposited material for use as construction fill material in raising the surrounding dikes. This technique has the advantage of increasing the life of a disposal site by removal of material, while largely eliminating the need to haul sand/gravel into an area for dike construction. The process involves active dewatering techniques to consolidate the dredged material, but has the disadvantage of longer inactive periods for drainage between disposal events. Crust construction technology was initially considered largely because of the shortage and increasingly high cost of locating and transporting suitable diking materials. The supply of this material onsite was virtually depleted except for (1) the stockpile on Disposal Area 2A from the Kings Island Turning Basin project, (2) the material made available in Disposal Area 12A as a result of the 1989/1990/1991 Widening Project, and (3) the material recently made available as a result of the 1993/1994 Deepening Project. While alternative management techniques exist, they are judged not to be practical. One such technique would be removal of all dikes which separate Disposal Areas 12A and 14B, introduction of all dredged material into Area 12A and free flow throughout the single large area. There would be little or no drying time between pumping cycles. Rough calculations indicate that the capacity of the dikes on the approximately 5,000 diked acres would be filled within 8 years. This would be a premature exhaustion of storage capacity and result in the need for additional disposal sites, a complex and costly undertaking.

5.13 The crust construction technique would begin with the pumping cycle, which typically places up to 4 feet of newly dredged material over portions of the site. After approximately one month, the water introduced with the silt and/or sand would be drained off the top through a system of weirs located on the low side of the disposal area. Drying normally begins and desiccation cracks form about 2 to 3 months after dredging is completed. The cracks form what appear to be blocks of sediment

which then subdivide until the area reaches the "slaking stage", when the ground appears to be "crumbly." Two or three months following the completion of dredging, a 6-foot deep perimeter ditch would be excavated about 50 feet inside the toe of the existing dike, with sumps excavated in front of the weirs. Within a month or so, interior ditches would be dug on about 500-foot centers (Figure 14). These ditches would intercept the lateral flow of water through the previous dredging strata. Once the material dries to a proper degree, determined through experience (typically about 15 months after pumping), bulldozers would push 4 to 6 inches of surface material into windrows halfway between the ditches. The material would then be picked up from the windrows by self-loading pans and transported to the dike raising site for shaping into the dike's cross-section. At intervals, culverts would be placed in the ditches and back filled to allow movement of equipment across the floor of the disposal area. After a week or so of good drying weather, another 4 to 6 inches of material could be windrowed. A 6-foot lift is generally the maximum allowable in a given dike raising cycle due to limited time between dredging cycles. This parameter then controls the amount of material removed from the interior of the site. However, contracts would also specify the lowest elevation to which a contractor could excavate, forcing removal of a uniform layer of material. After construction is complete, ditches would be filled to make the area ready to receive more dredged material. Filling of the ditches would make them easier to re-excavate after the next dredging disposal cycle. If the ditches were not filled, the freshly dredged sediment would fill the 6-foot deep ditches and combine with a uniform thickness of up to 4 feet of newly deposited material over the area to produce a possible 10-foot thick layer of freshly dredged material over the ditches. That amount would be too thick to dry in the short allowable time. The ground would, therefore, not be stable enough to support equipment for future ditching and construction.

5.14 Experience with the crust construction methodology in Charleston, S.C. has yielded the following operational criteria:

* Each cubic yard of required in-place dike embankment requires 2 1/2 cubic yards of dredged material.
* Dike slopes are optimally 3:1.
* Vegetation must be removed, as very little can be incorporated into the dike.
* The top of the dike should be capped with sand to safely support inspection vehicles.
* Filter fabric is rarely used.
* When a man can first walk easily on the dried crust, a small dragline on mats can be safely operated.



TYPICAL INTERIOR DITCHES

FIGURE 14

* Bulldozers should distribute a low ground pressure (4 psi).
* Draglines or mats average 150 feet/day; amphibious rotary ditchers can average 1200 ft/hour.
* Weather is a major factor in work time.

5.15 The crust construction methodology appears to be initially implementable in Disposal Areas 12A, 12B, 13A and 13B. Eventually, it is expected to be applied to Disposal Areas 14A, 14B and Jones/Oysterbed Island when there is a sufficient depth of deposited sediment in the areas. Material for dikes could continue to be removed from the last three areas through normal borrow site excavation procedures until the crust method can be implemented.

5.16 Areas not targeted for crust construction are Disposal Areas 1N, 1S and 2A. Disposal Area 1N has sand removed by truck nearly as rapidly as it is deposited there, thus there are no capacity constraints which require dike raising. Disposal Area 1S is largely inactive since (1) there is no vehicular access to the site, (2) the site is undiked, and (3) it is currently not economically feasible to develop the area. Disposal Area 2A receives a large percentage of sand which can be removed and used for dikes. However, that site is presently used every year and shifting disposal to an adjacent area to allow time for drying and consolidation would require large increases in pumping distances which would drive the cost of dredging to unacceptably high levels.

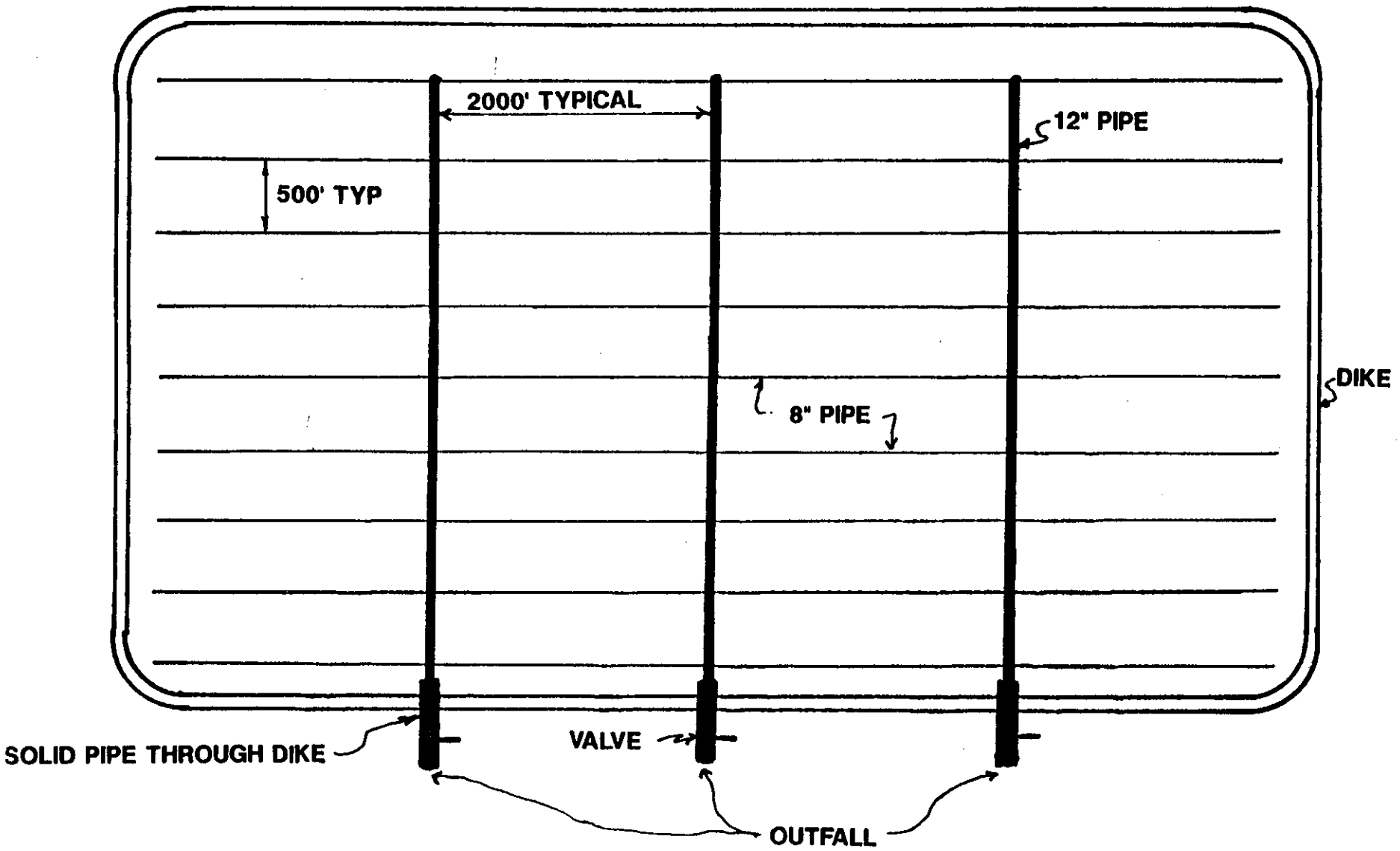
5.17 When a perimeter ditch is excavated around a disposal area, the 50-foot wide strip of land between it and the existing inner toe of the dike would be used for placement of the excavated material. The ditch would be trapezoidal in shape and about 6-feet deep. The interior ditches would probably be no further apart than 500 feet. Spacings of 500 feet, 250 feet and possibly other increments will be evaluated to determine the optimum spacing which maximizes settling and minimize the length of interior ditching. Interior ditches should be as deep as possible, probably about 6 feet, as long as they are not below the flow line to the weirs. The ditches would be initially dug 3 to 4 feet deep by either a dragline working on mats or an amphibious rotary ditcher. After the silt consolidates for 2 to 3 months, the ditches could be deepened with a backhoe or dragline working from mats or having an amphibious undercarriage. The bucket on the excavator should have a trapezoidal shape. The excavated material should be placed as far from the ditch as the equipment will allow. Breaks in the pile of excavated material would be provided to allow rainwater to flow to the ditches.

5.18 The ditches would be complimented by actions taken by the Chatham County Mosquito Control Commission (CCMCC). In the past, the CCMCC excavated ditches in the main confined disposal areas to drain mosquito breeding sites. This work had a secondary benefit the disposal site by aiding consolidation of the deposited sediments. Beginning in FY96, Savannah District ceased funding those activities. However, the District believes the CCMCC may continue to perform these activities in the disposal areas on an "as needed" basis. The CCMCC ditches were typically about 18 inches deep on 100-foot centers, and were excavated soon after the decanting of an area. Should this excavation continue, the alignment of the mosquito ditches would be coordinated with the subsequent alignment of the deeper interior ditches.

5.19 **Alternative 4.** Alternative 4 consists primarily of the Without Project condition (Alternative 1), with the addition of the installation and use of underdrains in the confined disposal facilities. Application of these devices is shown in Figures 15 through 17. The underdrains would be installed to drain to either the Savannah River or Back River. The underdrains in Disposal Areas 12B and 13A had drained toward Wright River, but the remaining functioning drains were closed at the end of 1994. Underdrains are proposed for Disposal Areas 12A, 12B, 13A, 13B, 14A, 14B, and Jones/Oysterbed Island. There currently is insufficient material in Disposal Areas 13B, 14A, 14B, and Jones/Oysterbed to warrant installation, but conditions would be suitable for use of this technique before the end of the 20-year period of analysis.

5.20 Underdrains serve essentially as covered ditches to remove water from the deposited material. Drying of the deposited material results in an increase in its bearing capacity. Faster drying after completion of a disposal operation allows earth moving equipment to work sooner on the floor of the disposal area to reclaim the dredged material for dike construction. Removal of the deposited material contributes to extending the life of the areas by restoring some of the site's previously used disposal capacity.

5.21 The local sponsor has found the following design to be the most effective and intends to use this design in future application of these drainage devices. Pipes are placed at a depth so that there is a minimum of 4 feet of soil coverage at the pipe's highest point. The pipes are sloped at 1 foot of fall per 1,000 lineal feet (0.1 percent slope). A main manifold is used consisting of 12-inch diameter pipes fed by a system of 8-inch diameter pipes spaced at 500-foot intervals. Several manifolds may be used within each disposal area, depending on the size of the site. The outfalls of the underdrain pipes would be



TYPICAL UNDERDRAIN LAYOUT

FIGURE 15

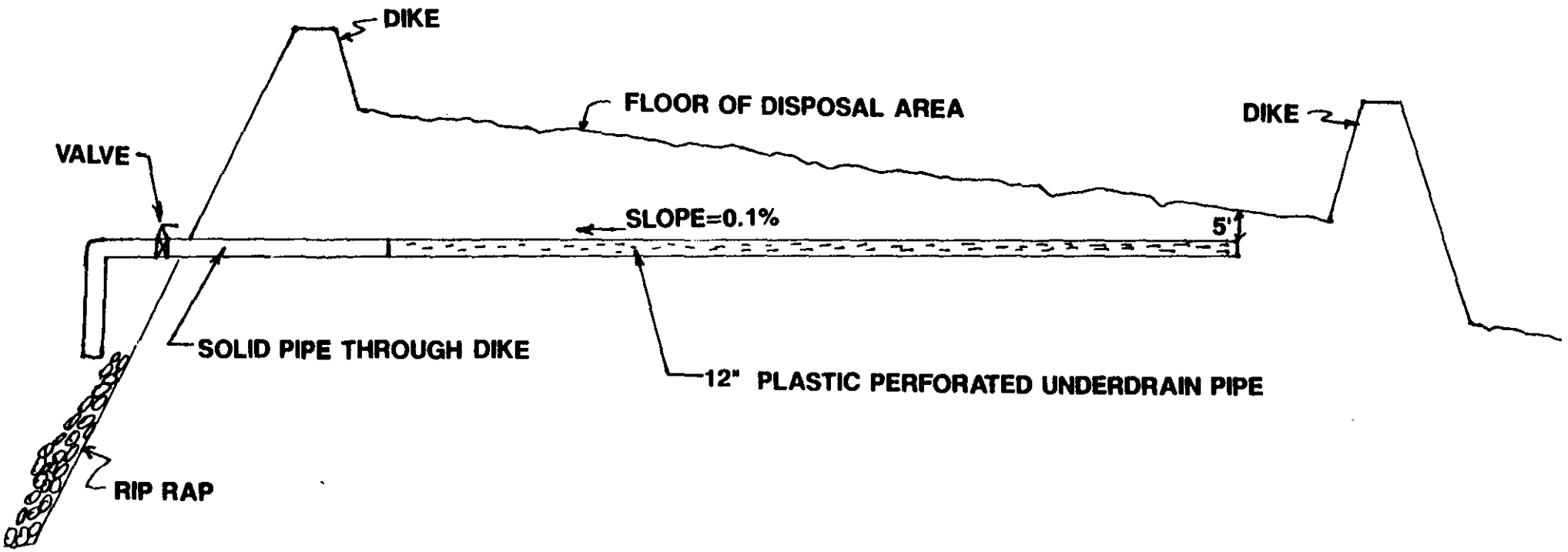
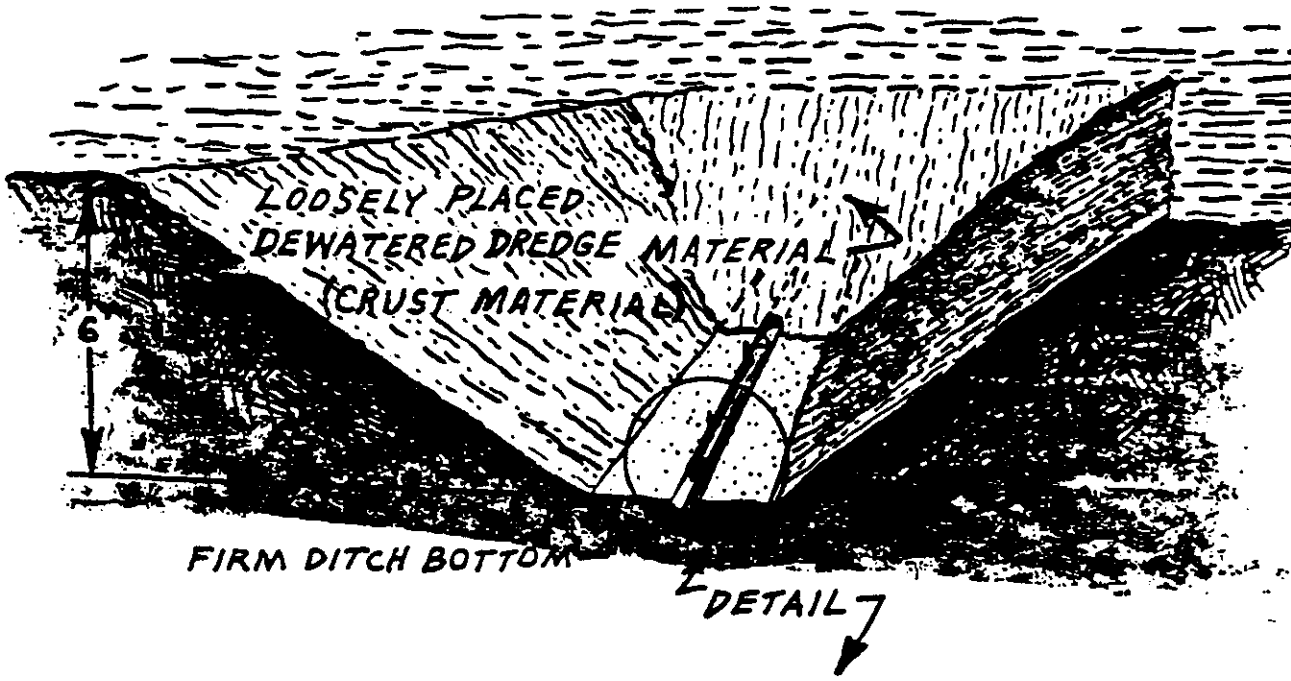


FIGURE 16

CROSS SECTION OF TYPICAL UNDERDRAIN OUTFALL

UNDERDRAIN PIPE



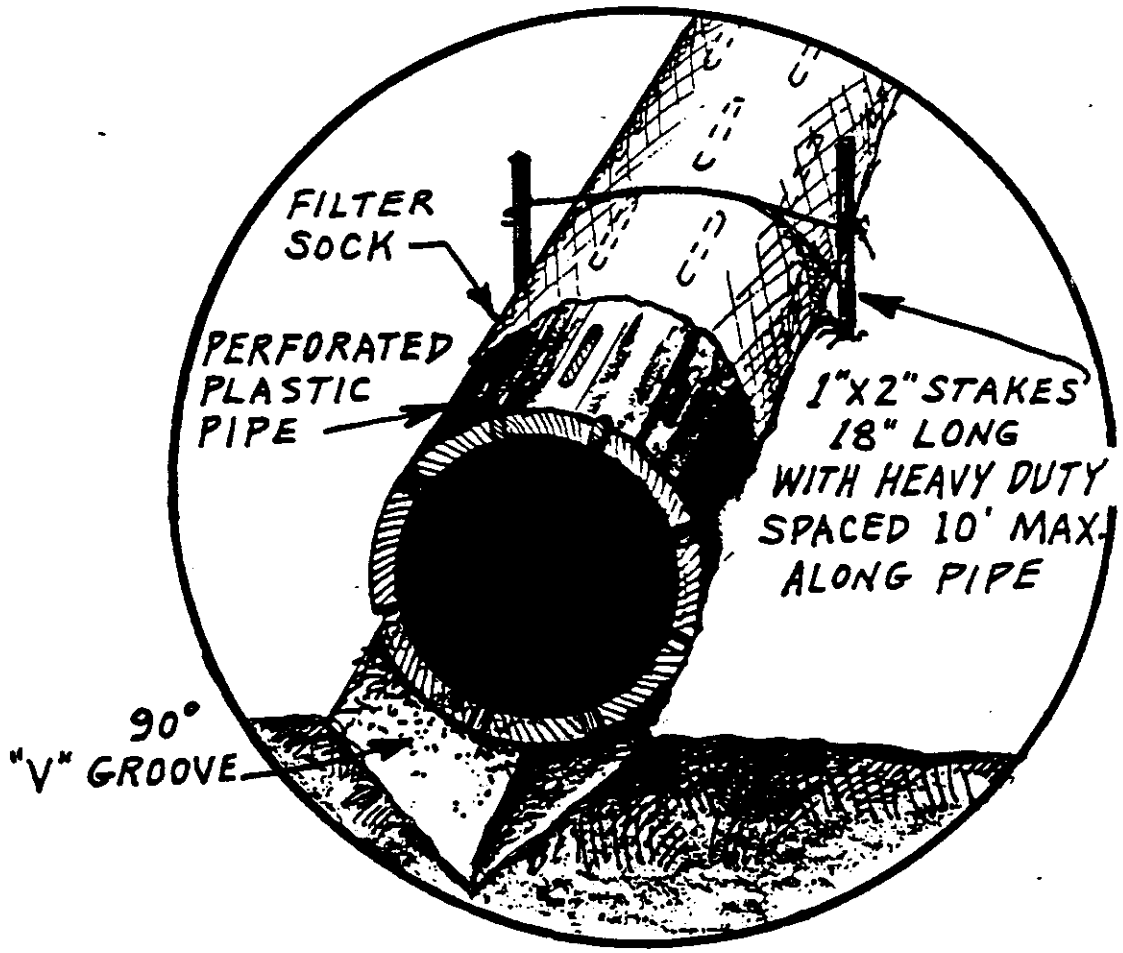


FIGURE 17

separate from the weirs which are used to drain the water ponded during a disposal event. The pipes are perforated plastic enclosed inside a fabric liner. The discharge pipes would extend through the dike and have a shutoff valve along the outside dike slope which would be easily accessible. This design would allow the flow to be regulated as needed for compliance with environmental standards. Riprap would be placed at the invert of the discharge pipe to prevent erosion of the outside dike slope.

5.22 The use of underdrains has several advantages in operation of confined disposal facilities. These are summarized as follows:

(a) Faster drying of the deposited material. This results in longer working periods for equipment on the floor of the site for removal of material from the storage zone of the site.

(b) Greater consolidation of the deposited material within a disposal area. The increased consolidation results in a given volume of material taking less space, thereby extending the useful life of the confined disposal facility.

(c) Lower costs for a given drainage capacity when compared to the deep ditches. The one-time placement costs of underdrains is less than the total of multiple (from 3 to 5) cycles of deep ditch excavation and backfilling.

5.23 Since installation of underdrains would require excavation below a +13 MLW elevation (less than 6 feet above MHW), there is a potential for adverse impacts to cultural resources located on those sites. A review will be performed of historic maps and archival records of sites known to be located on the disposal areas. If proposed underdrain alignments conflict with known or suspected cultural resource sites, a cultural resources survey would be conducted along the proposed underdrain alignments. If a cultural resource is found, either the underdrain alignment would be shifted to avoid the site or a mitigation plan would be prepared to determine the appropriate action. This procedure would be performed to ensure no significant cultural resources would be impacted. Approval from the SC SHPO of the survey's findings and proposed actions would be obtained prior to construction (underdrain installation) being initiated at the site.

5.24 **Alternative 5**. Alternative 5 consists primarily of the Without Project condition (Alternative 1), with the addition of various beneficial uses of nearshore sediments. Four specific beneficial uses were considered; (1) construction and maintenance of nearshore submerged berms, (2) construction and maintenance of a nearshore feeder berm off Tybee Island, (3) direct placement of

dredged material onto the Tybee Island beach, and (4) direct placement of dredged material onto the Daufuskie Island beach. The disposal location to be used for a specific dredging contract would be decided during project design and award based on identification of the least cost, environmentally-acceptable option. If disposal at a certain location is found to be more desirable for environmental or other reasons but would be more costly than one of the other acceptable options, it can be pursued with appropriate cost sharing using Section 933 (WRDA 1986) or Section 204 (WRDA 1992) authorities.

5.25 With the **submerged berms**, material dredged from the Bar Channel would be deposited in the nearshore area adjacent to that channel to construct and maintain underwater berms in that nearshore environment (Figures 18 and 19). Several berms may be constructed over a period of years. The berms would effectively serve as a nearshore disposal area for use by hydraulic dredges working in the Bar Channel. Presently, that portion of the project is dredged by hopper dredges, but the four-month window during which the sea turtle restrictions allow hopper dredges to be used severely limits the ability of the District to respond to rapidly forming or shifting shoals in that channel. There are no seasonal restrictions on hydraulic dredges since that equipment does not adversely affect sea turtles. The berms would provide a cost effective place for the hydraulic dredges to deposit the dredged material since they would be located relatively close to the channel. The proposed location of the berms is too shallow for use by hopper dredges. Using a mooring barge and the pumpout capability of some hopper dredges would make such placement technically feasible, but would probably increase the placement costs to unacceptable levels.

5.26 The proposed berms would be located south of, and at least 2,000 feet away from the channel, in water averaging about 15 feet deep. From 100,000 to 300,000 CY of material would be used to construct each berm. Maintenance would be performed when the size of a berm has been significantly reduced, but in no case would it be performed on a yearly basis. The berms would either be round or elliptical and oriented away from the channel so that tidal currents which converge and diverge from the channel would not be significantly restricted. The minimum 2,000 foot spacing between the toes of adjacent berms is another design feature which would ensure that tidal currents are not significantly restricted. The crest of the berm would be placed at about -5 feet MLW to ensure recreational boats could pass over the berms unaffected. No hard structures would be used in the formation or maintenance of the berms so that nothing would snag shrimp nets which may be dragged over the berms. Material would be transported and deposited at the site through use of a hydraulic

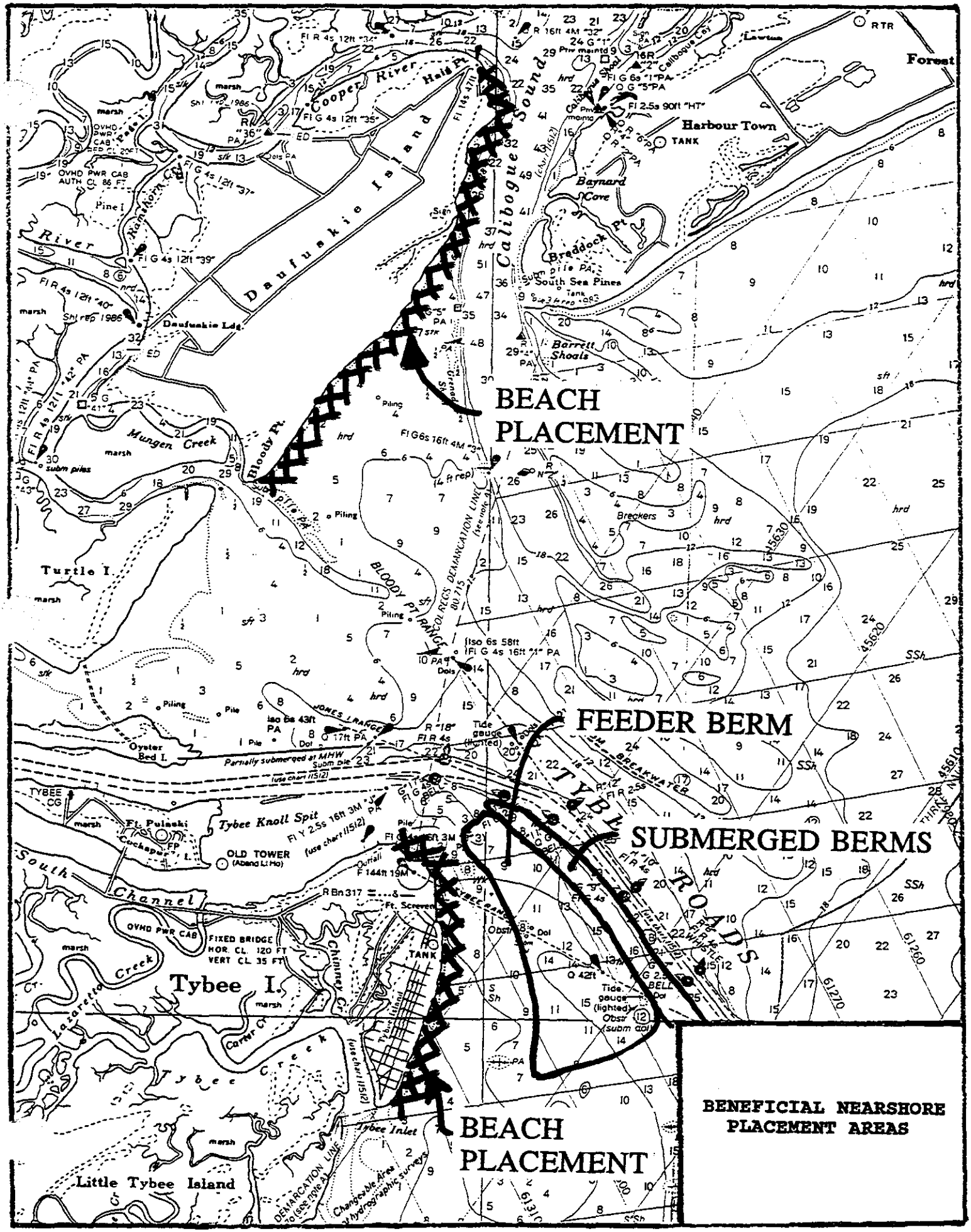

BEACH PLACEMENT
FEEDER BERM
SUBMERGED BERMS
BEACH PLACEMENT
BENEFICIAL NEARSHORE PLACEMENT AREAS
Daufuskie Island
Cooper River
Calibogue Sound
Harbour Town
Baynard Cove
Bloody Pt.
Mungen Creek
Turtle I.
Oyster Bed I.
Tybee Knoll Spit
Tybee I.
Little Tybee Island
South Channel
Lazaretto Creek
Tybee Creek
Tybee Inlet
Ft. Pulaski
OLD TOWER
FIXED BRIDGE
HOR. CL. 120 FT
VERT CL. 35 FT
Barrett Shoals
South Sea Pines
Breddock Pt.
Hald Pt.
Forest
Breckers
JONES I RANGE
BLOODY PT RANGE
TYBEE ROADS
BREAKWATER
DEMARCATION LINE
Changeable Area of Hydrographic survey
Tide gauge (lighted)
Obstr (subm dol)
Subm piles
Partially submerged at MHW
Subm pile
Piling
Pile
Dol
Tank
marsh
sft
hrd
SSh

FIGURE 18

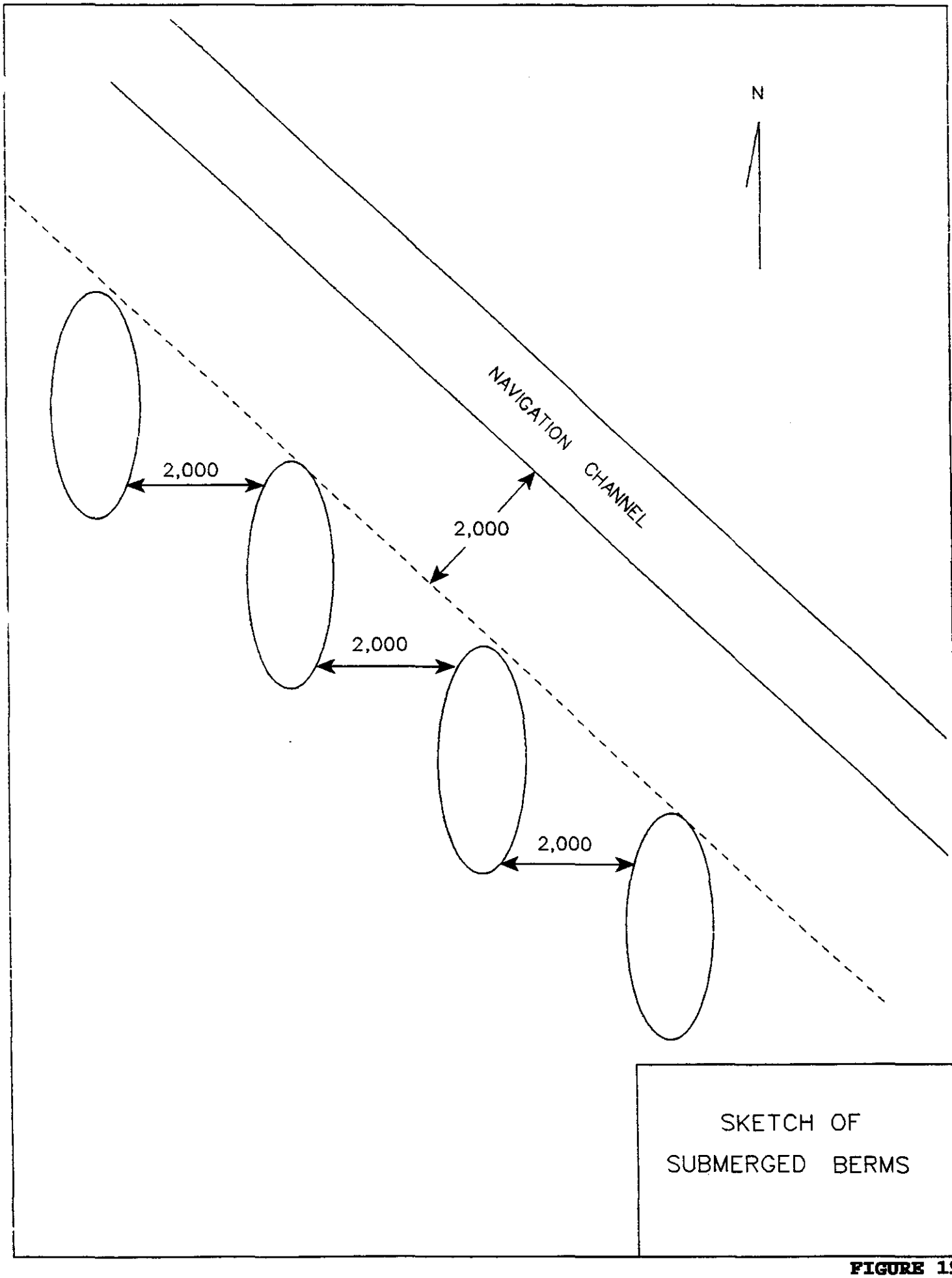

N
NAVIGATION CHANNEL
2,000
2,000
2,000
2,000
SKETCH OF
SUBMERGED BERMS

FIGURE 19

pipeline. The discharge point would be below the water surface to reduce turbidity. The sites would be located at least 4,000 feet offshore, so turbidity increases at the beach would not be significant.

5.27 No hard-bottom communities are known to be located at the proposed construction sites, but a side scan sonar investigation and a benthic survey would be performed prior to deposition to ensure that no hard bottom communities exist at the site which would be impacted. The berms would create diversity in the bottom contours, thereby increasing the habitat value of the nearshore area for fish.

5.28 No significant cultural resources are known to exist in the locations of the proposed berms. However, the side scan sonar would be used to investigate whether any resources are visible above the ocean floor. Should any be identified, the Georgia SHPO would be consulted. Deposition of dredged material on any unknown submerged cultural resource would not adversely affect it, but would instead provide additional protection from wave- or current-induced exposure and erosion.

5.29 The relatively shallow depths existing where the berms would be located will result in the mounds being unstable, such that waves are expected to move material from the berm into the nearshore sand sharing system. As waves expend energy moving material from the berms, the waves will have less energy to erode the ocean shoreline of the adjacent barrier island (Tybee Island). This would increase the stability of that shoreline.

5.30 Maintenance of the underwater berms would be performed in the same manner as the original construction and result in similar, but smaller scale effects. A smaller volume of dredged material would be involved in maintenance of the berms, so turbidity impacts would be lower for maintenance of the sites than for initial construction.

5.31 With the **feeder berm**, material dredged from the Bar Channel would be deposited off of Tybee Island to construct and maintain a submerged feeder berm in that nearshore environment (Figure 20). The proposed feeder berm would be constructed parallel to Tybee beach, about 4,000 and 7,000 feet offshore, in water with an average depth of about 8 feet MLW. The berm's crest would be up to 500 feet wide and would be at a depth of 5 feet MLW. Restricting the berm height to -5 feet MLW would ensure that pleasure boats could safely pass over the berm. The berm would be located at least 5,000 feet away from the channel. Approximately 66,000 CY of fill material would be needed per

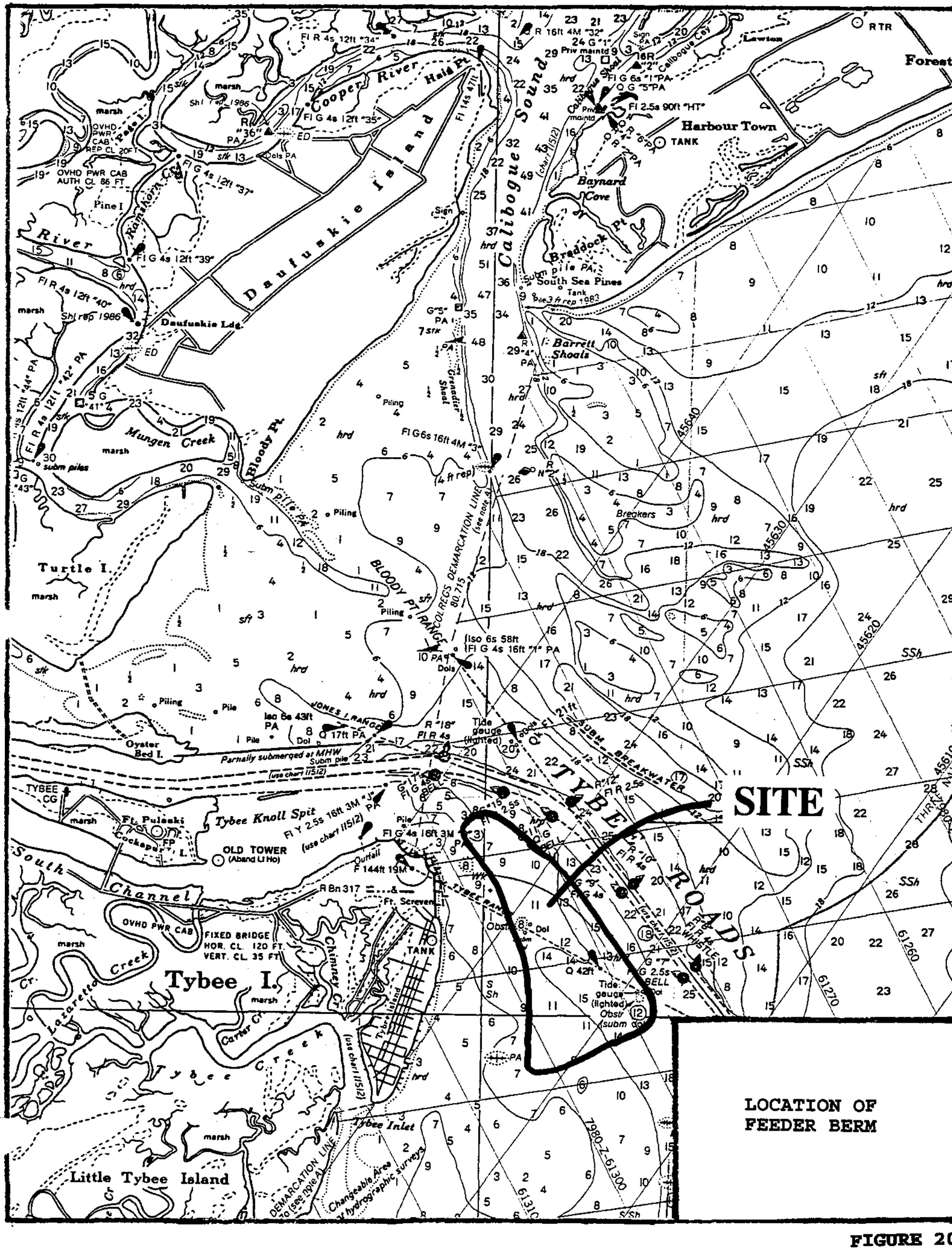

SITE
Calibogue Sound
Daufuskie Island
Cooper River
Harbour Town
Forest
South Sea Pines
Braddock Pt
Baynard Cove
Barrett Shoals
Daufuskie Ldg
Pine I
Ramshorn Cr
River
Mungen Creek
Bloody Pt
Turtle I.
Oyster Bed I.
TYBEE ROADS
SUBM BREAKWATER
BLOODY PT RANGE
JONES I RANGE
Tybee Knoll Spit
Ft. Pulaski
Cockspur I.
OLD TOWER
South Channel
Ft. Screven
TANK
Tybee I.
Lazaretto Creek
Chimney Cr
Tybee Creek
Tybee Inlet
Little Tybee Island
marsh
LOCATION OF FEEDER BERM

FIGURE 20

1,000 linear feet of berm. Assuming side slopes of 1(H) to 30(V) and a 50 percent loss of material volume during placement, 132,000 CY of channel dredging would be needed per 1,000 linear feet of berm.

5.32 The shallow depth of the area in which the berm would be constructed would result in the berm being dispersive, with the deposited sediments subsequently being moved offsite by waves. The relatively close proximity of the berm to the beach would increase the likelihood that the sediments would migrate to the beach. As waves expend energy moving material from the berms, the waves will have less energy to erode the Tybee Island shoreline. This would increase the stability of that barrier island.

5.33 No hard structures would be used in the formation or maintenance of the berms so that nothing would snag shrimp nets which may be dragged over the berms. As with the submerged berms, the feeder berm would effectively serve as a nearshore disposal area for use by hydraulic dredges working in the Bar Channel. Material would be transported and deposited at the site through use of a hydraulic pipeline. The discharge point would be below the water surface to reduce turbidity. The sites would be located at least 4,000 feet offshore, so turbidity increases at the beach would not be significant.

5.34 Maintenance would be performed when the size of a berm has been significantly reduced, but in no case would it be performed on a yearly basis. The berm's length could be extended with subsequent disposal events if maintenance of the previously placed fill is not required.

5.35 No hard-bottom communities are known to be located at the proposed construction site, but a side scan sonar investigation would be performed prior to deposition to ensure that no hard bottoms would be impacted. No significant cultural resources are known to exist in the locations of the proposed berms. However, the side scan sonar would be indicate whether any resources are visible above the ocean floor. Should any be identified, the Georgia SHPO would be consulted. Deposition of dredged material on any unknown submerged cultural resource would not adversely affect it, but would instead provide additional protection from wave- or current-induced exposure and erosion.

5.36 With the **direct placement of dredged material onto the Tybee Island beach**, sediments removed from the Bar Channel would be kept in the immediate nearshore sand sharing system. Portions of the beach at Tybee are eroding, so the placement of channel sediments on the beach would protect from the further damage to the island's shoreline. The environmental and cultural resource

impacts of placing dredged material onto the Tybee Island beach has been previously evaluated. Three Environmental Assessments (EAs) were recently prepared by Savannah District for that type of action. The most recent was an EA was prepared in August 1994 in response to a permit application by the Georgia Ports Authority for nourishment of the southern portion of the Tybee Island beach. An EA had been prepared in March 1994 as part of an evaluation to continue Federal participation in the Tybee Island Beach Nourishment Project. An EA had been prepared in November 1992 to evaluate the disposal of dredged material onto Tybee Island which would be obtained during the Savannah Harbor Deepening Project. All three evaluations found beach placement of dredged material to be environmentally acceptable. The earliest evaluation, that for the Deepening Project, has the most application to this proposal since the source of the material to be deposited on the beach is very similar. In both that evaluation and this proposal, sediments from the Bar Channel would be removed and placed on Tybee Island. The difference between the two actions is that the material removed during harbor deepening was new work material, whereas the material considered in this evaluation is that to be removed during normal maintenance dredging. Previous investigations have revealed that material removed during maintenance dredging generally consists of about 13 percent fines, while that removed in the Deepening Project was expected to be about 21 percent fines. Projections were made that 50 percent of the material excavated from the Bar Channel during the Deepening Project would remain on the beach. Hydrographic surveys performed after construction was complete revealed that about 52 percent of the deposited material remained in the beach template. Therefore, since the sediments removed during maintenance dredging generally consist of less fines than was excavated during the Deepening Project, placement of maintenance material should produce less adverse environmental effects than did the beach placement during the Deepening Project, which were determined to be acceptable.

5.37 The measures previously determined in the 1994 EA for the Tybee Island Section 934 Project to be necessary to protect endangered species as a result of the excavation of dredged material and its placement on the beach are included in both proposals for beach placement (Tybee and Daufuskie Islands) in this evaluation. These consist of measures for the protection of whales and sea turtles which are described in detail in Appendix B, Biological Assessment of Threatened and Endangered Species.

5.38 Material which is subsequently removed from the beach by waves is likely to be moved toward the ends of the island by flood tides. However, since both South Channel and the north jetty are located between Tybee Beach and the Navigation Channel, little material placed on the beach that subsequently erodes away is expected to redeposit in the channel.

5.39 With the **direct placement of dredged material onto the Daufuskie Island beach**, sediments removed from the Bar Channel would also be kept in the nearshore sand sharing system. Portions of the beach at Daufuskie are eroding, so the placement of channel sediments on the beach would protect from the further damage to the island's shoreline.

5.40 The environmental acceptability of the placement of maintenance material on that beach depends on the quality of the material, which was described in paragraph 5.31. That paragraph concluded that the water quality and fisheries aspects of the deposition proposal would be acceptable. The beach at Daufuskie Island has not been surveyed for cultural resources. However, deposition of dredged material on any unknown submerged cultural resource would not adversely affect it, but would instead provide additional protection from wave- or current-induced exposure and erosion. The acceptability of the dredging aspect of the proposal is dependent on the area to be dredged, which is the Bar Channel. Excavation of that reach by both hydraulic and hopper dredges has been determined to be acceptable as long as the prescribed endangered species measures are followed.

5.41 Material which is subsequently removed from the beach by waves is likely to be moved toward the ends of the island by flood tides. However, since Daufuskie Island is somewhat landward of the Savannah River entrance and is separated from the navigation channel by at least 3 1/4 miles, little material placed on that beach which subsequently erodes is expected to redeposit in the channel.

5.42 **Alternative 6**. Alternative 6 consists of the Alternative 3 (rotational use of the Navigation Project's middle harbor confined disposal areas), with the addition of the hydraulic cutterhead dredging of berths by dock owners to remove accumulated sediments, with direct placement of that material into confined disposal areas -- including Federal Project confined disposal areas. This dredging and disposal methodology is linked to Alternative 3 because the rotation program proposed in that alternative makes confined disposal areas continuously available for deposition of harbor sediments.

5.43 Berthing areas include the entire area of the river bottom located between a dock and the navigation channel. These areas, shown previously in Figure 7, are important to the Navigation Project as they allow vessels to dock outside the channel boundaries while cargo is loaded and unloaded. Maintenance of adequate depths at berths is legally required for continued operation of the Savannah Harbor Federal Navigation Project. Use of a hydraulic dredge to remove deposited material and place it directly in a confined disposal area would result in less

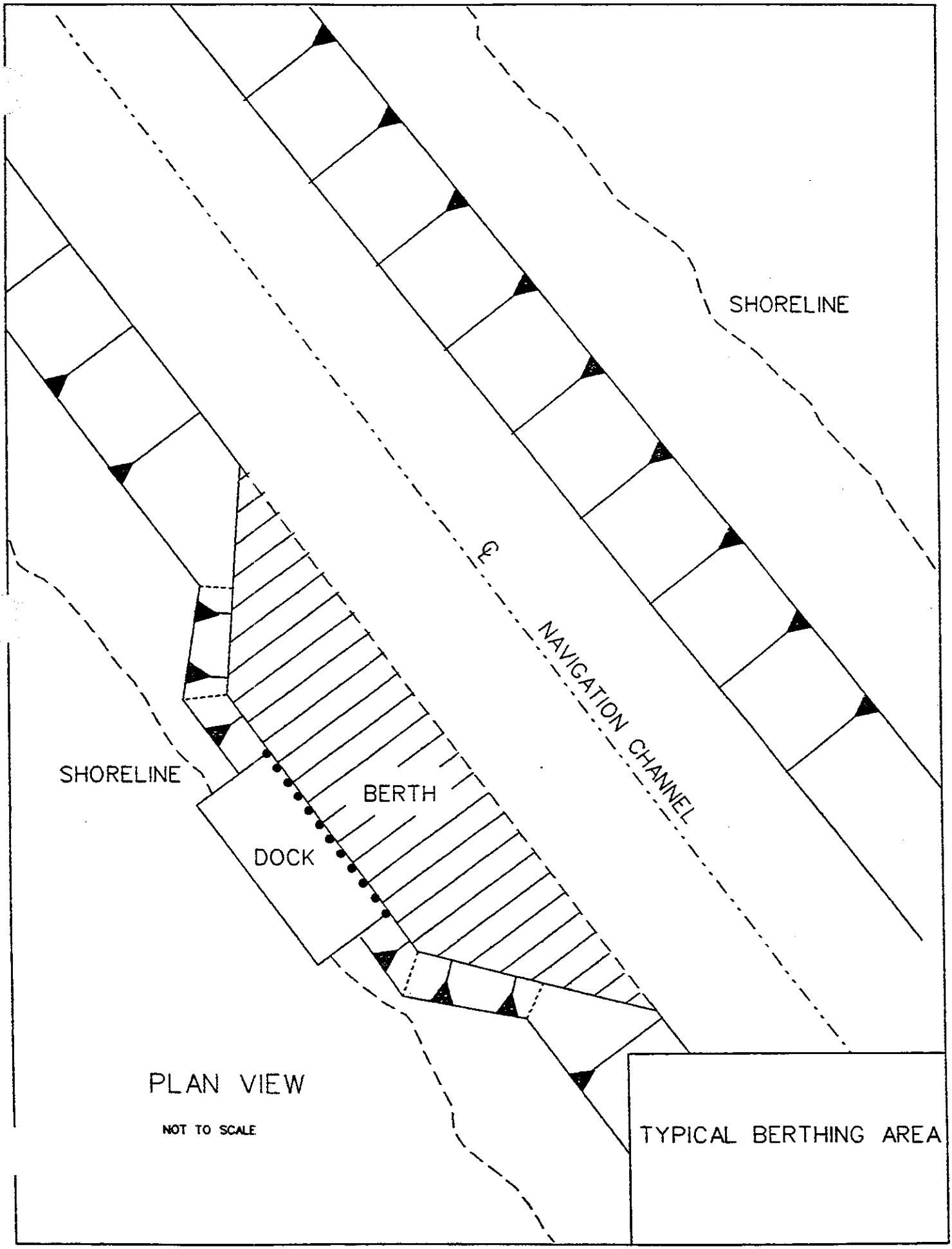

SHORELINE
℄ NAVIGATION CHANNEL
SHORELINE
BERTH
DOCK
PLAN VIEW
NOT TO SCALE
TYPICAL BERTHING AREA

FIGURE 7

handling, and thereby, fewer environmental impacts than the present system based on agitation dredging and subsequent excavation from the Navigation Channel by a Corps-contracted hydraulic dredge. Use of a clamshell dredge to remove sediments from a berth, with subsequent placement in a confined disposal area, would also be allowed under this alternative.

5.44 Under this alternative, the dock owner would obtain the services of a dredge. This would typically be accomplished by the dock owner separately contracting with a dredge to mobilize to the site and excavate sediments which have accumulated at his berth. Under certain limited conditions, the Corps may be able to temporarily release a hydraulic dredge which it has under contract to perform dredging in the harbor. If that were to occur, a berth owner would then directly contract with the Corps' contracted dredge to excavate his berth during the short time the dredge is released, and deposit the sediments in the same disposal area being used by the Corps (see conditions in paragraphs 5.46 and 5.47). Before the Corps would allow release of a dredge it has under contract, it must be assured that the dredging work which it had contracted with the dredge operator to perform would be completed on schedule.

5.45 This alternative is based on the presumption that berth sediments are of acceptable quality for dredging. This position reflects a District review of available channel sediment test data for Savannah Harbor. However, sediments at some berths have never been tested for chemical contamination and liability for the quality of deposited material can rest with the owner of the site where the material is deposited. Prior to implementation of this alternative at a specific berth, the District would perform an evaluation of a berth's sediment quality to confirm the acceptability of the sediments. The District would follow a tiered approach similar to that described in the joint EPA/Corp Regional Implementation Manual for ocean disposal of dredged materials. If there is a reason to believe that contamination may exist, chemical testing of the sediments would be required. The dock owner would be responsible for performing all sediment testing required by the District. Typically, a complete chemical scan would be required prior to the initial dredging to demonstrate that the material is safe for dredging and placement in the Project's disposal areas. Since new information is continuously being gathered concerning both sediment toxicity and Savannah Harbor's sediments, the approved scope of work for sediment chemical testing is periodically updated. Savannah District maintains the latest version of the testing scope of work which is acceptable to the Corps, EPA, US FWS, and GA DNR. The District will provide the current scope of work to a dock owner at their request. The fee owner of the confined disposal facility proposed for use must also be satisfied about the

quality of the sediment to be deposited on his property. The testing requirements of the fee owner of the confined disposal facility may differ from that of the Corps and EPA.

5.46 Once this initial sediment evaluation is performed and the levels of chemicals within the sediment are determined to be within acceptable limits, an annual sediment quality review must be performed by the dock owner and submitted to the Corps for approval. This review would constitute the first step of a tiered-testing approach and would be used to determine whether additional testing is needed. This review would demonstrate whether changes have occurred which would alter the previous determination that the berth sediments do not contain any chemicals at unacceptable levels. The annual review is not anticipated to require a major effort, but would be comprised of the following:

* Listing of the types of materials (identification of chemical compounds) handled at the berth since the previous maintenance dredging was performed.

* Listing of any reported spills at the dock and within one mile of the dock; type of material and quantity. (Information can be obtained from the US Coast Guard)

* Dates and volume of dredging performed at the berth within the previous twelve months.

* Description of how these factors lead one to conclude that the berth sediments are unlikely to contain any chemicals at unacceptable levels.

5.47 To implement this alternative at a specific berth, a dock owner would notify Savannah District of its intent to perform this permitted dredging. The dock owner would describe the actions he intended to perform (location, yardage, depth, etc.), provide information on the quality of the sediments to be excavated, and designate the confined disposal facility intended for use. Should a dock owner desire to deposit the sediments in a confined disposal facility commonly used by the Federal Navigation Project, he must request permission for such action. After receipt of such a request, the Corps would designate which disposal areas will be available for deposition over what time periods, and forward the dock owner's request to the disposal area's fee owner for approval. Approval from the site's fee owner would be required before sediments could be deposited in the disposal area.

5.48 After receiving approval from the District to conduct dredging operations -- and possibly disposal operations using Project confined disposal areas -- described in this alternative, the dock owner would not have to obtain additional environmental permits. The dock owner would be required to follow all environmental conditions contained in this EIS, including meeting the same water quality criteria and effluent quality criteria that are applicable to the Corps in its dredging and disposal operations.

5.49 Hydraulic or clamshell dredging with deposition of excavated materials into confined disposal facilities requires the mobilization and use of more equipment than do some other forms of dredging. To extend the time period over which adequate depths would be available at a berth, maximize the flexibility of timing maintenance dredging operations, increase the efficiency of maintenance dredging operations -- thereby reducing the unit costs, and minimize the number of dredging events required each year, limited deepening of berths is included in this alternative. A berth owner may deepen and maintain his berth to a maximum depth of 6 feet below the authorized channel depth. The maximum depth a berth could be maintained to would be -48 feet MLW. The maximum initial dredging depth could be -50 feet MLW (42-foot channel depth + 6 feet of sediment storage + 2 feet of allowable overdepth). The decision to deepen a berth to provide sediment storage would rest solely with the dock owner. This deepened area would be both initially constructed and maintained through the use of hydraulic or clamshell dredging with direct deposition of excavated materials into confined disposal facilities

5.50 Deepening berths, including the entire area between a dock and the navigation channel, may have beneficial effects on sedimentation within the Federal Navigation channel. A deepened berth may provide off-channel storage for sediments which would normally accumulate in the shipping channel. If deepening at a berth is expected to provide, or subsequently found to provide off-channel storage for channel sediments, designation of the site as an advance maintenance feature of the Federal Navigation Project may be appropriate. To arrive at such a determination, a document justifying such a designation would be prepared and submitted to higher Corps authorities for approval. As with other advance maintenance justification documents, the brief report must address engineering and economic issues, and identify the expected cost savings to the Federal government from the proposed designation, implementation, and maintenance of the site as an advance maintenance feature of the Savannah Harbor Navigation Project.

5.51 **Alternative 7**. Alternative 7 consists primarily of the Without Project condition (Alternative 1), with the addition of the following three changes in the Navigation Project's sediment control features:

(1) Implement a 6-foot advance maintenance deepening of the Sediment Basin. Since the Tidegate was taken out of operation, the sediment trapping efficiency of the Sediment Basin has decreased. Increasing the depth of the Basin would restore some of the efficiency of that project feature.

(2) An increase in the advance maintenance section at the Kings Island Turning Basin. A 6-foot deepening of the advance maintenance section in that area (Stations 97 to 102) would significantly increase the efficiency of sediment removal operations in that reach. The deepening would extend for about 5,000 feet and would occur within the confines of the navigation channel and turning basin. No changes would occur above the low water line to the boundaries of either the navigation channel or turning basin.

(3) Implement advance maintenance deepening at existing turning basins to provide off-channel storage for sediment deposition. The turning basins below the Kings Island Turning Basin which are not currently at project depth (-42 feet MLW) would be excavated to the depth of the adjacent navigation channel and maintained during normal channel maintenance work.

Figure 21 shows the locations of these proposed improvements.

5.52 The Sediment Basin presently has the following dimensions: 11,300-foot long, 600-foot wide and 40-foot deep. When originally constructed, the basin was 2 feet deeper than the authorized channel. Since no change was made to the basin during the 1993/1994 Deepening Project, the bottom of that feature is now positioned 2 feet above the elevation of the navigation channel. Such a configuration, combined with the non-operation of the Tidegate, significantly lowered the sediment removal capability of that project feature. Based on preliminary data, the Sediment Basin now appears to trap roughly 600,000 CY less sediment per year than it previously did. The proposed 6-foot advance maintenance deepening of the basin would result in a 4-foot depth offset from the channel depth. That offset is larger than the originally authorized 2-foot depth offset, but the additional 2-foot offset would help compensate for the loss in sediment trapping efficiency resulting from cessation of operation of the Tidegate. Deepening the basin as proposed would restore some of that lost sediment trapping efficiency. Economic evaluations would be performed to ensure that the advance maintenance deepening section is economically justified. The throat of the basin (2,000-feet long, 300-feet wide and 38-feet

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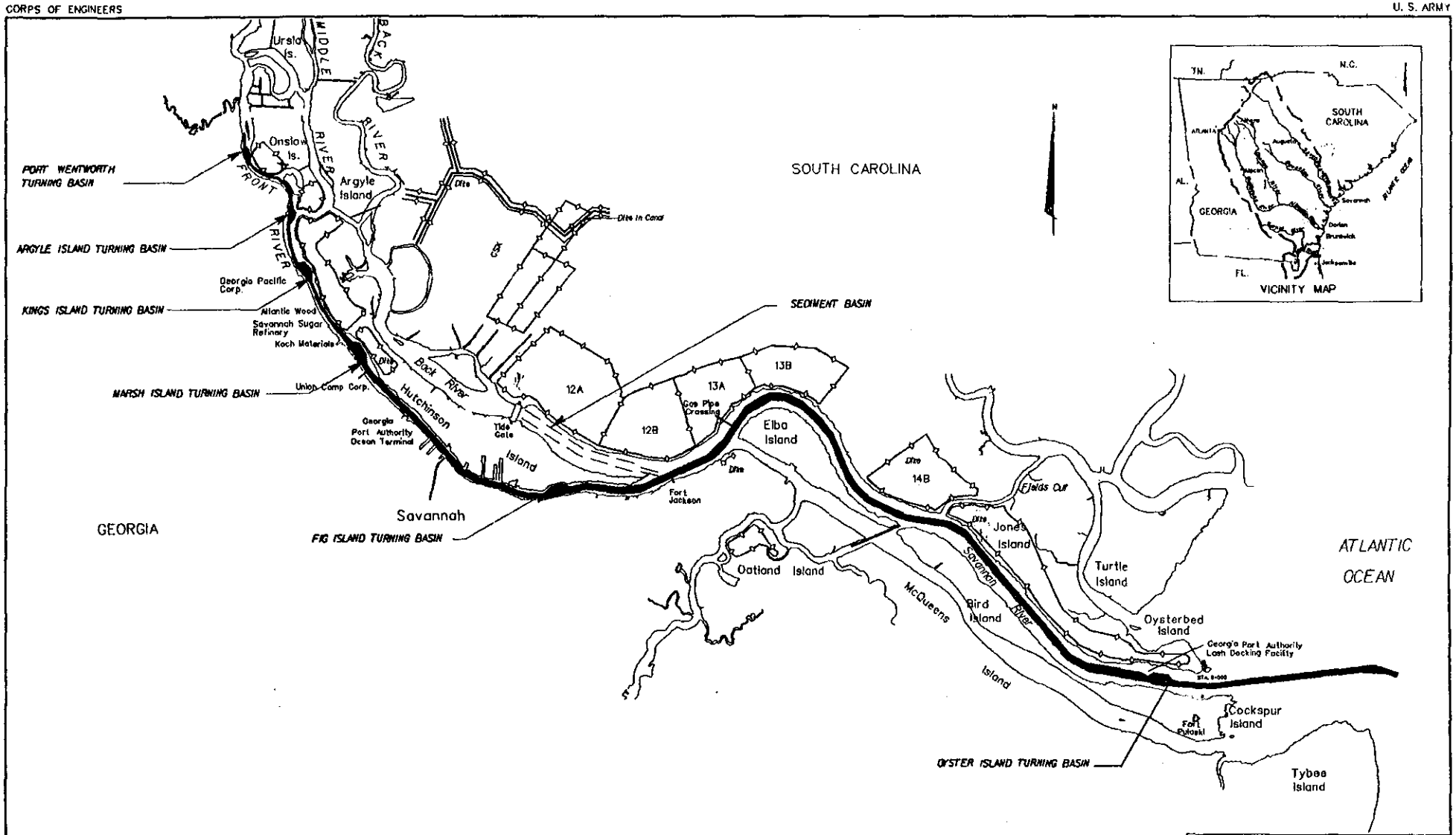

PROPOSED SEDIMENT CONTROL FEATURES

U. S. ARMY ENGINEER DISTRICT, SAVANNAH
CORPS OF ENGINEERS
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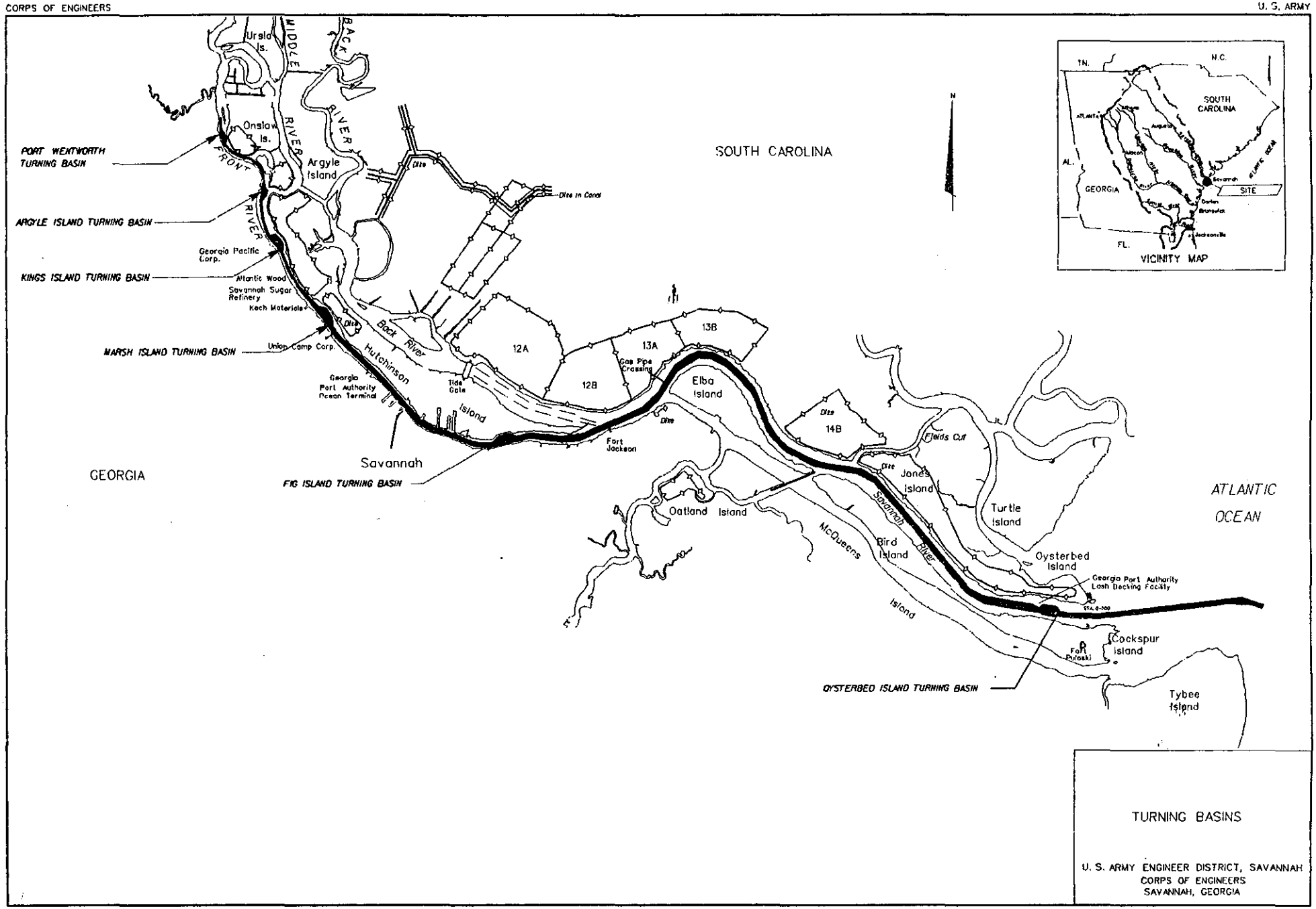
deep) would not be modified. The throat would remain at its current depth to ensure no additional salinity impacts occur to Back River from these modifications to the Sediment Basin. The proposed improvement of the basin would result in a widening of the basin as the side slopes adjust to an expected stable slope of 1 horizontal to 3 vertical. This change in basin width would not impact the shoreline above the low water line.

5.53 The Navigation Project presently includes a 2-foot deep advance maintenance section from Stations 100+000 to 112+000. This is the vicinity of the Kings Island Turning Basin. That reach experiences high sediment deposition rates and the turning basin has been a particular problem area since operation of the Tidegate ceased and New Cut was closed. Engineering evaluations indicate that deepening the existing advance maintenance section in that reach (Stations 97 to 102) would increase the efficiency of sediment removal operations. Economic evaluations would be performed to ensure that deepening the existing advance maintenance section is economically justified. The proposed deepening would be performed in the navigation channel to eliminate any impacts to adjacent high ground. The maximum dimensions of the proposed work would be 5,000-feet long, 1,000-feet wide and 6-feet deep. The advance maintenance deepening section in that location would have a total depth of 8 feet after this proposed action is implemented.

5.54 Advance maintenance deepening would be implemented at the turning basins to the depth of the adjacent navigation channel. This work would not result in construction of any additional turning basins or change the authorized depth of any existing basin. Turning basins are typically designed with a depth the same as that of the navigation channel to allow for safe turning of any vessel which safely transits the channel. However, only one turning basin, the Kings Island Turning Basin, was deepened during the 1993/1994 Harbor Deepening Project. The four basins located oceanward of that site are now perched above the navigation channel at various levels. This presents an opportunity from a sediment control perspective for construction of areas for off-channel storage of sediments. Advance maintenance deepening at those four sites (Figure 22) would be designed so that no changes would occur to the shoreline above MLW. Therefore, no land-side real estate would be effected. Depths at the turning basins would be maintained by the Corps' contract dredge during normal channel maintenance work. The excavated sediments would be placed in the Project's existing confined disposal facilities.



TURNING BASINS

U. S. ARMY ENGINEER DISTRICT, SAVANNAH
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FIGURE 22

5.55 A drastic increase in shoaling was experienced in the upper harbor after taking the Tidegate out of operation and closure of New Cut. In response to that occurrence, a 2-foot advanced maintenance deepening section was constructed in the Kings Island Turning Basin in early 1996.

5.56 **Alternative 8**. Alternative 8 consists of a combination of actions included in previous alternatives. This alternative would follow the basic dredging and disposal operations previously defined in Alternative 3, including rotational use of the confined disposal facilities located in the middle of the harbor. To that basic plan are added the features included in Alternatives 4, 5, 6 and 7; underdrains to Savannah and Back Rivers, beneficial use of nearshore sediments, direct deposition by dock owners of berth sediments into confined disposal areas, and modifications to the harbor's sediment control features. Those features were described previously in the explanations of those separate alternatives.

5.57 Selected Plan. The Selected Plan is Alternative 8. Although described previously, the following paragraphs (5.58 through 5.73) consolidate the previous descriptions of the plan and serve as a single source of the plan's definition.

5.58 Navigation Channel Dimensions.

5.59 a. Authorized Channel. The dimensions of the authorized channel remain unchanged. Table 3 shows the authorized dimensions. The channel width at the CSS GEORGIA was authorized by Congress for 500 feet. As a mitigation feature of the Savannah Harbor Deepening Project, the width was effectively narrowed by 100-feet until completion of mitigation actions prescribed in the Programmatic Agreement and subsequent site-specific Memorandum of Agreement developed as part of the LTMS Study. When those mitigation actions have been completed, the channel width can be expanded back to 500 feet without further Congressional action if either (1) the studies reveal that the Navigation Project is having no adverse impacts on the wreck, or (2) necessary actions are completed which remove the restriction which the wreck places on shipping passed that location. Concurrence from the GA SHPO, SC SHPO, and the Advisory Council are required before the mitigation actions are considered complete. Presently no advance maintenance is performed from Stations 58 and 59 to protect the CSS GEORGIA. When these studies and/or mitigation actions are complete, the 4-feet of advance maintenance authorized for this portion of the Navigation Channel would be implemented between Stations 58 and 59.

TABLE 3

CHANNEL DIMENSIONS

BEGINNING STATION	ENDING STATION	CHANNEL DEPTH (FEET BELOW MLW)	CHANNEL WIDTH (FEET)
OCEAN	-14B	44	600
-14B	58	42	500
58	59	42	400
59	103	42	500
103	105.5	36	400
105.5	112.5	30	200

5.60 b. Advance Maintenance. The dimensions of the advance maintenance sections are shown in Table 4.

5.61 Dredging.

5.62 a. Federal Dredging. The Federal government would maintain the authorized depths of the Savannah Harbor Navigation Project. Dredging would typically be performed annually, except in high shoaling areas. The standard dredging equipment for the inner harbor would be a hydraulic cutterhead dredge. The standard equipment for the Bar Channel would include both hydraulic cutterhead dredges and hopper dredges. Clamshell dredges would be used in special circumstances, such as debris areas. Dredging would be performed in the navigation channel, Sediment Basin and turning basins. This would include sites where advance maintenance has been determined to be feasible and environmentally acceptable.

5.63 b. Non-Federal Dredging. The project sponsor is responsible for maintaining adequate depths in berthing areas. Typically, dock owners perform this work at their own facility. The dock owner may deposit dredged sediments in the Project's confined disposal areas upon receiving written concurrence from the Corps, the project sponsor, and the fee owner of the disposal site. Savannah District may pursue development of a Regional Permit to ease implementation of hydraulic cutterhead and clamshell dredging of berths by non-Federal interests with deposition of the sediments in confined disposal areas. Prior to dredging and disposal under the auspices of this LTMS Project, the Corps would perform a sediment quality evaluation -- including review of sediment test data submitted by the dock owner -- to ensure the sediment is of acceptable quality. After receiving approval from the District for dredging and disposal under the auspices of this LTMS Project, the dock owner would not have to obtain additional environmental permits. Dock owners would follow all environmental protection conditions approved for use on the Savannah Harbor Federal Navigation Project. Approval from the fee owner would be required before sediments could be deposited in the disposal area. Separate environmental permits would be required if the dock owner uses a dredging technique, disposal site or construction timing which has not received clearance for use on the Savannah Harbor Federal Navigation Project.

TABLE 4

WITH PROJECT
ADVANCE MAINTENANCE SECTIONS

BEGINNING STATION	ENDING STATION	DEPTH OF ADVANCE MAINTENANCE (FEET)
CHANNEL		
0	24	2
24	70	4
70	112	2
OTHER		
Sediment Basin		6
Kings Island Turning Basin		6
Marsh Island Turning Basin		8
Fig Island Turning Basin		12
Elba Island Turning Basin		8
Oysterbed Island Turning Basin		4

NOTE: No changes in advance maintenance are proposed for the navigation channel. Changes are proposed at turning basins and the Sediment Basin for off-channel storage.

5.64 Disposal Area Management.

5.65 a. Areas To Be Used. The sediments excavated from the Navigation Project would be placed in a defined dredged material disposal area.

1. Confined Disposal Facilities. Confined disposal facilities (CDFs) which the sponsor has provided for use by the Project consist of Disposal Areas 1N, 2A, 12A, 12B, 13A, 13B, 14A, 14B, and Jones/Oysterbed Island. Disposal sites in the middle and lower harbor (Disposal Areas 12A, 12B, 13A, 13B, 14A, 14B, and Jones/Oysterbed Island) would be included in a 2-year rotation program (2 years on/2-years off) in accordance with the management strategy described below. Table 4A lists the CDFs and the channel reaches which they generally serve, although the environmental impacts of using the CDFs are not typically affected by the channel reach.

2. Unconfined Disposal Areas. Unconfined disposal facilities which the sponsor has provided for use by the Project consist of Disposal Area 1S and the western side of New Cut. No disposal is anticipated on Disposal Area 1S, and none would be performed without completion of an environmental assessment to analyze the impacts of unconfined disposal. Unconfined disposal also occurs at the EPA-designated Savannah Ocean Dredged Material Disposal Site (ODMDS). Easements would have to be provided prior to placement of dredged material on the beaches of Tybee and Daufuskie Islands. No easements would be required for placement of excavated sediments in the nearshore area to construct submerged berms or the feeder berm. Approval would be required from the State of South Carolina for placement of excavated sediments in the nearshore area off Turtle Island to create and maintain a nearshore island for bird nesting. A side scan sonar investigation and a benthic survey would be performed prior to deposition at new unconfined disposal sites to ensure that no significant cultural resources or hard bottom communities exist at the site. The Savannah River is not an approved dredged material disposal area, except for the placement of approved riprap materials on unvegetated portions of the shoreline for erosion control purposes.

Several submerged berms may be constructed over a period of years. The proposed berms would be located south of, and at least 2,000 feet away from the channel, in water averaging about 15 feet deep. The berms would be located at least 4,000 feet offshore and be either be round or elliptical, and oriented away from the channel. No hard structures would be used in the formation or maintenance of the berms. Material would be transported and deposited at the site through use of a hydraulic pipeline, with the pipeline's discharge point located below the water surface to reduce turbidity.

TABLE 4A

USE OF
CONFINED DISPOSAL FACILITIES

DISPOSAL AREA	CHANNEL STATIONS MAINTAINED
1N	112+500 - 105+000
2A	105+000 - 79+000
12A	79+000 - 63+000
12B	79+000 - 63+000
13A	79+000 - 63+000
13B	63+000 - 40+000
14A	63+000 - 40+000
14B	40+000 - 0+000
Jones/Oysterbed Island	40+000 - 0+000
12A, 12B, 13A	Sediment Basin
	TURNING BASINS
12A, 12B, 13A	Fig Island
2A, 12A, 12B, 13A	Marsh Island
2A, 12A, 12B, 13A	Kings Island

The proposed feeder berm would be constructed parallel to Tybee beach, at least 5,000 feet away from the channel, about 4,000 and 7,000 feet offshore, in water with an average depth of about 8 feet MLW. The berm's crest would be up to 500 feet wide and would be at a depth of 5 feet MLW.

The nearshore bird island would be constructed approximately 10,000 feet offshore of Turtle Island, about 3,000 feet north of the north jetty, in water averaging 6 feet deep. The island would be circular in shape with flat crown at +14 feet MLW with a minimum size of 2 acres. The side slopes from EL 14 to 8 are expected to be 1:10, with the slopes below +8 feet MLW being 1:35.

5.66 b. Overall Management Strategy. Savannah District would work with Chatham County, the Project's non-federal sponsor, to maximize the useful life of the dredged material disposal areas. As an overall strategy, beneficial uses would be pursued for the dredged material to (1) reduce the ultimate storage volume required, and (2) increase secondary benefits resulting from the storage and/or disposal operations. To reduce the required storage volume, sediments deposited in the CDFs would be used when fill material is needed to raise the height of the confining dikes. Deposited sediments would be removed as much as possible from Disposal Areas 1N and 2A for use as construction fill material on other government projects. New or enlarged CDFs in the upper harbor should be pursued in the future to reduce the costs of pumping dredged material to distant existing CDFs. Underdrains would be installed in Disposal Areas 12A, 12B, 13A, 13B, 14A, 14B, and Jones/Oysterbed Island to shorten the sediment drying time. A rotational program would be followed at Disposal Areas 12A, 12B, 13A, 13B, 14A, 14B, and Jones/Oysterbed Island to allow sufficient time for drying of the material so that construction equipment can safely work on the floor of the CDFs to remove sediments for dike raising purposes. The District will use a standard of 500 mg/l for acceptability of its weir effluents for suspended solids content. Selective placement of Bar Channel and other suitable sediments would be pursued when beneficial uses would be derived. As a component of the design process for maintenance dredging work, a review would be conducted of potential beneficial uses -- specifically alternative disposal sites -- for sediments to be excavated during that contract. The disposal location to be used for a specific dredging contract would be decided during project design and award based on identification of the least cost, environmentally-acceptable option. If disposal at a certain location is found to be more desirable for environmental or other reasons but would be more costly than one of the other acceptable options, it can be pursued with appropriate cost sharing using Section 933 (WRDA 1986) or Section 204 (WRDA 1992) authorities.

5.67 c. Mitigation Actions.

1. Mitigation For Disposal Area 14A. Mitigation for impacts to wetlands at Disposal Area 14A and from miscellaneous operations at confined disposal facilities located in South Carolina is covered in the Mitigation Plan found at Appendix G. The plan is based on a 2-year rotation cycle (2 years on/2-years off) for use of the middle and lower harbor CDFs; Disposal Areas 12A, 12B, 13A, 13B, 14A, 14B, and Jones/Oysterbed Island. In summary, the plan has six components. They are as follows:

(1) water level management within the CDFs at the end of disposal operations, as described in Table 5,
(2) construction and maintenance of a 26-acre bird nesting area on uplands outside the dike at the Jones/Oysterbed Island Disposal Area (Figure 23),
(3) construction and maintenance of two 1-acre bird nesting islands within each of the disposal areas used in the rotation program (Figure 24),
(4) construction and maintenance of a 2-acre bird nesting island in the nearshore area off Oysterbed Island and Turtle Island (Figure 25),
(5) restoration/creation or protection of 25 acres of tidal wetlands in South Carolina as in-kind mitigation. The SC OCRM would select feasible sites and identify either construction actions necessary to improve/create wetlands at the site, or measures which would be necessary to adequately protect the site from future development. The SC OCRM would administer an escrow account established by the local sponsor or its designee to accomplish the necessary construction and acquisition, and
(6) construction of a second water control structure at an existing 228-acre impoundment within the Savannah National Wildlife Refuge to provide a constant connection between the impounded water and the adjacent tidal waters.

2. Mitigation For Other Wetland Impacts. A wetland mitigation plan will be developed to replace 3.2 acres of wetlands which would be lost in Georgia as a result of constructing an access road to Disposal Area 2A and miscellaneous operations at confined disposal facilities located in that state. Replacement of the wetland acreage which would be permanently lost would be at a 2:1 rate. This replacement rate is deemed appropriate due to the uncertainties in completely replacing the functional values of existing wetlands. Since wetlands are sites where soil, vegetation and organisms interact in complex ways, created or restored wetlands are not likely to fully replicate

TABLE 5

MIDDLE AND LOWER HARBOR
(SOUTH CAROLINA)
CONFINED DISPOSAL FACILITY
MANAGEMENT TECHNIQUE

Date Disposal Operation Ends	Proposed Management Technique
1 Jan - 15 Mar	Hold water level as high as possible. Beneficial to waterfowl and wintering shorebirds. Draw down in the spring for migrating shorebirds.
15 Mar - 15 Jul	Option 1. Hold water as protection for nesting terns, plovers, nighthawks, and in preparation for fall draw down for fall migrating shorebirds. Option 2. Draw water down slowly for spring migrating shorebirds and nesting black-necked stilts and vegetation growth if flooded later for wintering waterfowl.
15 Jul - 15 Nov	Option 1. Draw down slowly for fall migrating shorebirds. Option 2. Hold for wintering waterfowl and shorebirds.
15 Nov - 31 Dec	Hold water level as high as possible for wintering waterfowl and shorebirds, and in preparation for spring draw down for spring migrating shorebirds.

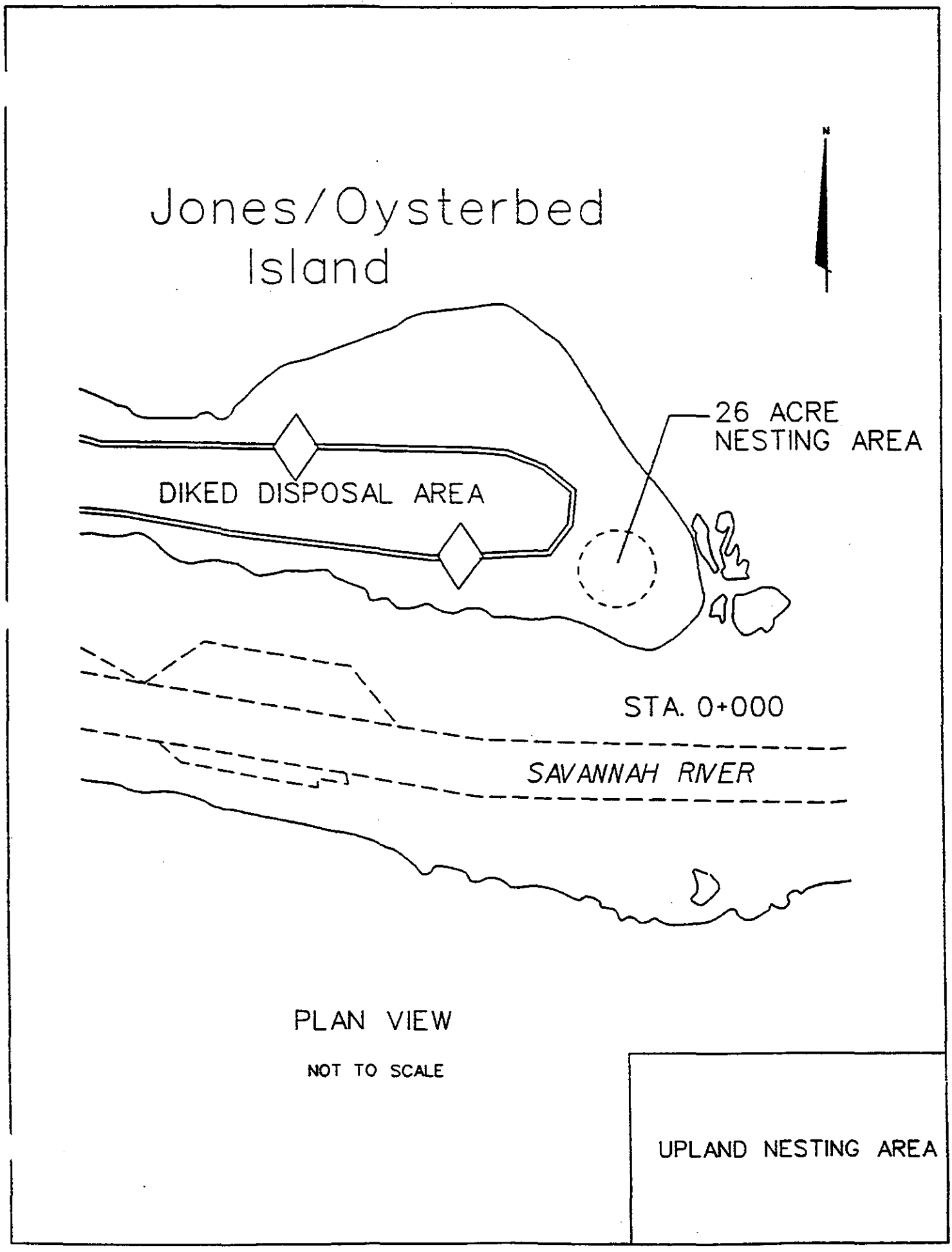
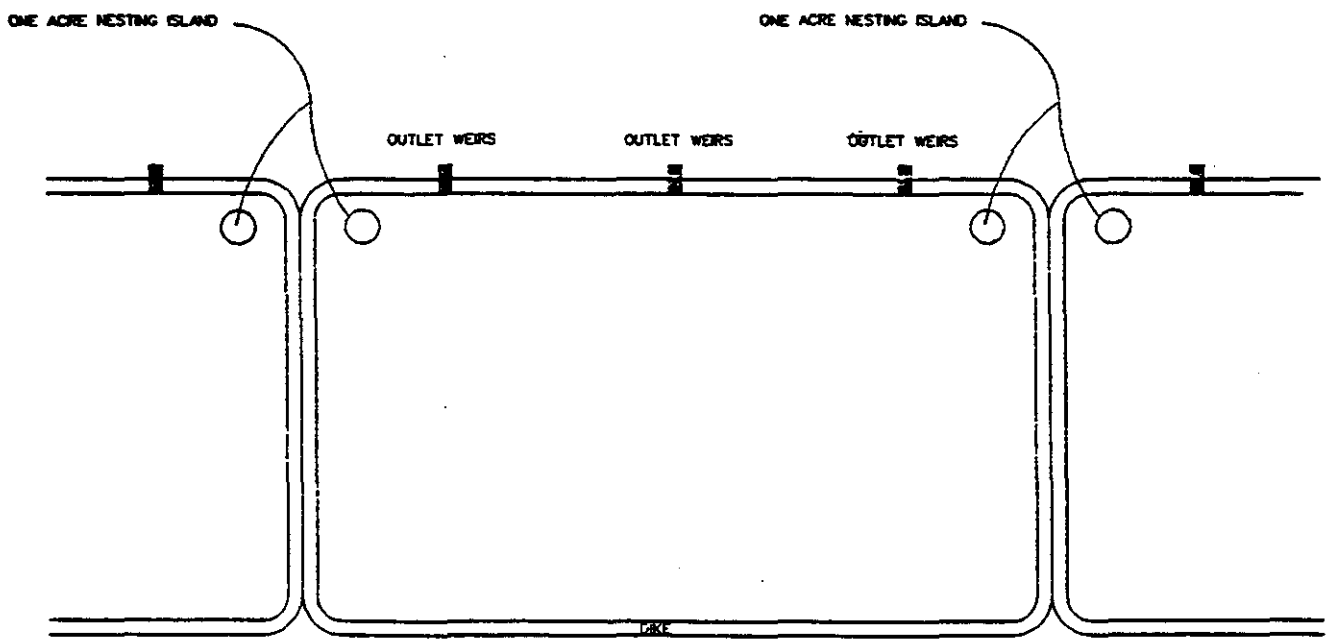

Jones/Oysterbed Island
N
26 ACRE NESTING AREA
DIKED DISPOSAL AREA
STA. 0+000
SAVANNAH RIVER
PLAN VIEW
NOT TO SCALE
UPLAND NESTING AREA

FIGURE 23



SAVANNAH RIVER

PLAN VIEW

NOT TO SCALE

TYPICAL NESTING ISLANDS WITHIN A CDF

FIGURE 24

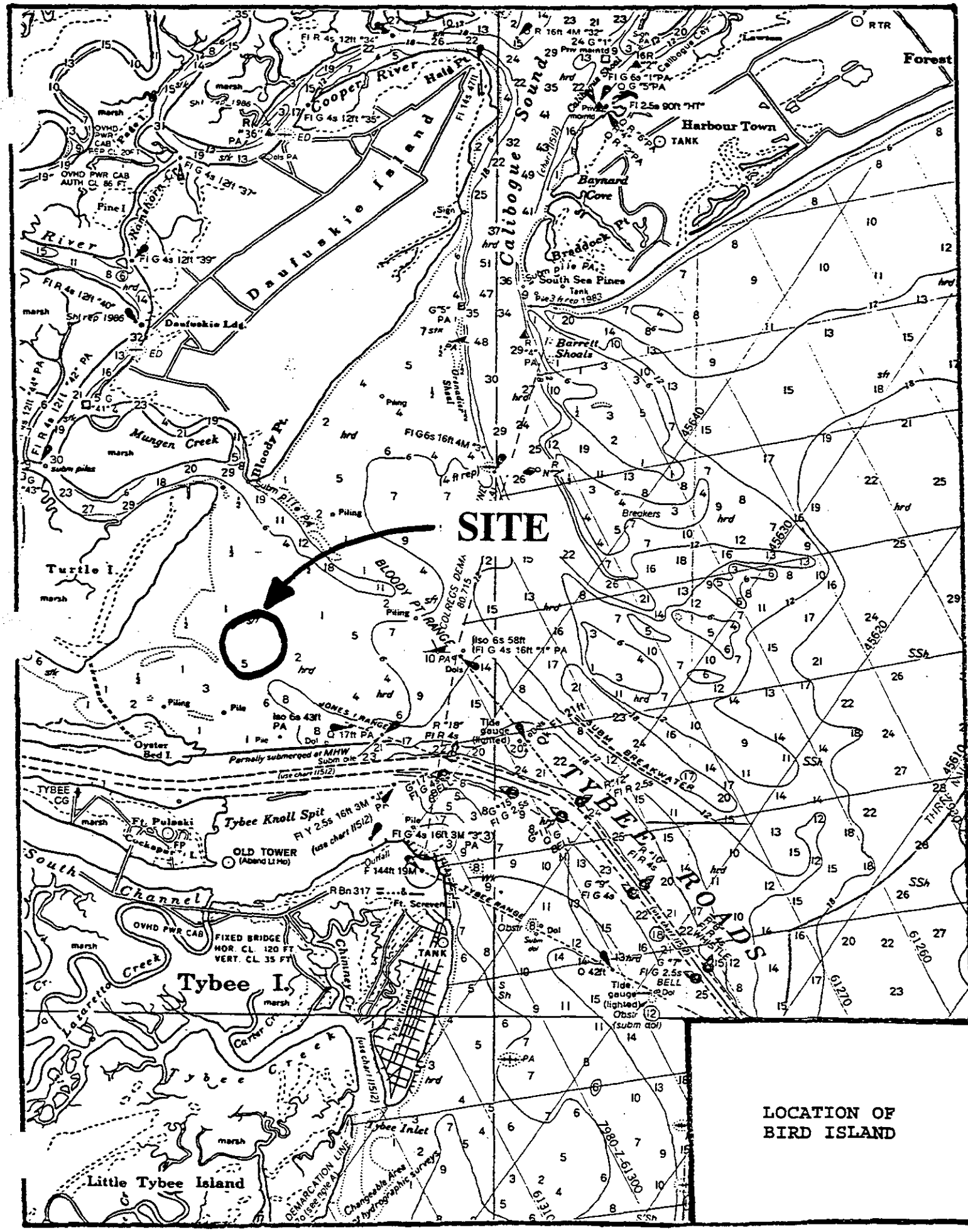

SITE
Daufuskie Island
Calibogue Sound
Cooper River
Hall Pt.
Harbour Town
Baynard Cove
Braddock Pt.
South Sea Pines
Barrett Shoals
Daufuskie Ldg.
Mungen Creek
Bloody Pt.
Turtle I.
Bloody Pt. Range
Oyster Bed I.
Tybee Knoll Spit
Ft. Pulaski
OLD TOWER
South Channel
Tybee I.
Lazaretto Creek
Tybee Creek
Tybee Inlet
Little Tybee Island
TYBEE ROADS
Tybee Range
Tybee Anchorage
Forest
LOCATION OF BIRD ISLAND

FIGURE 25

those interactions on a 1:1 basis. Both the US FWS and the GA DNR concur in the 2:1 replacement ratio for created or restored wetlands. In light of the relatively small number of acres involved, it is expected that a site can be identified in the general Savannah Harbor area where the sponsor or the GA DOT can restore previously impacted marsh as a component of another construction project. The mitigation plan would be coordinated with the GA DNR Coastal Resource Division and the US FWS for approval. The NMFS will also be consulted. Implementation of the plan would occur before the project feature causing the wetlands to be lost is placed in service.

3. Mitigation For Cultural Resource Impacts. Mitigation actions to reduce/eliminate Project impacts to cultural resources would be implemented primarily in four major areas. The first area is completion and implementation of the MOAs for the CSS GEORGIA and Old Fort Jackson. The second is implementation of the Cultural Resource Management Plan which is included in Appendix J. The third is performance of side scan and magnetometer surveys prior to the first use at proposed nearshore disposal sites. Results of those investigations will be coordinated with the appropriate SHPO. The final area concerns installation of underdrains at the confined disposal areas. A review will be performed of historic maps and archival records of sites known to be located on the disposal areas. If proposed underdrain alignments conflict with known or suspected cultural resource sites, a cultural resources survey would be conducted along the proposed underdrain alignments. If a cultural resource is found, either the underdrain alignment would be shifted to avoid the site or a mitigation plan would be prepared to determine the appropriate action. Approval from the SC SHPO of the survey's findings and proposed actions would be obtained prior to construction (underdrain installation) being initiated at the site.

5.68 Local Sponsor Responsibilities. The legal responsibilities of the non-Federal project sponsor for the Savannah Harbor Navigation Project remain unchanged by this LTMS. They are the same as those contained in the resolution executed by the Chatham County Commission on April 21, 1967. The full responsibilities are as follows:

"a. Provide without cost to the United States all lands, easements and rights-of-way required for the construction and maintenance of the project and for aids to navigation upon the request of the Chief of Engineers to be required in the general public interest for initial and subsequent disposal of spoil, and also necessary retaining dikes, bulkheads, and embankments therefor or the cost of such works;

b. Hold and save the United States free from all damages due to the construction and maintenance of the project; and

c. Provide and maintain at local expense adequate public terminals and transfer facilities open to all on equal terms in accordance with plans approved by the Chief of Engineers where appropriate.

d. Provide and maintain at local expense depths in berthing areas commensurate with those in related project areas.

e. In the event it is necessary to request the United States of America to acquire the necessary real estate interests by the use of its power of Eminent Domain, the assurer will furnish the District Engineer, Savannah, Georgia, the necessary funds for deposit in the United States District Court, and an amount sufficient to cover administrative expenses incurred by the Government, together with a surety bond in a penal sum sufficient to cover any excessive award of the court.

f. That in the acquisition of fee title or permanent easements, title evidence in the form of certificate of title, title insurance by a recognized title company or properly certified abstracts of title, will be furnished, continued to a date subsequent to recordation of the deed to the United States, or in the case of condemnation proceedings continued to a date subsequent to the filing of notice of the proceeding in Lis Pendens Docket. In the case of temporary easements, letter certification by a duly licensed Attorney at Law, as to the record owner and status of the title, and that the assurer has authority to grant permission for entry and use of the property by the United States."

5.69 Timing of Dike Raisings. Engineering analyses prepared during the course of the LTMS Study indicate the dike improvement schedule shown in Table 6 would be required. The schedule is based on the following assumptions:

ASSUMPTIONS:

* Confined Disposal Areas 1N, 2A, 12A, 12B, 13A, 13B, 14A, 14B, and Jones/Oysterbed Island would be used.
* Two-feet of storage area is needed for the ponding of water during disposal operations for water quality purposes.
* Two-feet of freeboard is needed for safety purposes.
* Dike improvements are typically performed in 4-foot increments.
* Dike improvements typically require one year (18 months) to construct, including drying time.
* Disposal activities would be performed on a 2-year cycle at those areas included in the rotation program; Disposal Areas 12A, 12B, 13A, 13B, 14A, 14B, and Jones/Oysterbed Island.
* Disposal activities would be performed annually at those areas not included in the rotation program; Disposal Areas 1N and 2A.
* Dredged material would be removed from disposal areas for use as construction fill material in the following rates: Disposal Area 1N - 146,000 CY/YR
  Disposal Area 2A - 233,000 CY/YR

5.70 The containment dikes for the CDFs will be raised periodically to increase the storage capacity of the sites. Those construction actions are the responsibility of, and would be performed by the project sponsor. Savannah District will provide the sponsor with an estimate of the volume of dredged material which would be placed in each CDF for each of the next five years. That information will be updated by the Corps each year. It is the sponsor's responsibility to have sufficient capacity available at each site when needed for the Corps to perform the scheduled dredging. Should sufficient capacity not be available when needed, the Corps will consult with the sponsor to determine what course of action the sponsor wants the Corps to pursue. One option would be for the Corps to place the dredged material in an adjacent CDF, with the sponsor paying the incremental placement costs. The other option would be for the Corps to postpone dredging until a suitable site with sufficient capacity is provided. The Corps would take no action after it notifies the sponsor in writing of the lack of capacity at a site, until it receives written direction from the sponsor.

TABLE 6

TIMING OF DIKE IMPROVEMENTS

DISPOSAL AREA	ANNUAL VOLUME OF SEDIMENT DEPOSITED (CUBIC YARDS)	PROJECT YEAR WHEN ADDITIONAL CAPACITY IS NEEDED
1N	146,000	---
2A	1,748,000	1 + 3
2A *	233,000	---
12A	4,153,000	3
12A *	5,657,000	6, 12 + 15
12B	4,153,000	1 + 4
12B *	5,657,000	7, 10, 13, 16 + 18
13A	4,153,000	1
13A *	5,657,000	6, 12 + 15
13B	2,185,000	10 + 16
14A	2,185,000	5, 11 + 19
14B	434,000	0
Jones/Oysterbed Island	434,000	2 + 19

NOTE: * 1,504,000 CY of material is shifted from Disposal Area 2A to the Area 12A/12B/13A complex after Year 6 due to restrictions on dike raisings at Disposal Area 2A.

* Fill material used for dike improvements will be obtained from within diked disposal areas. Material from one site may be used during construction at another area.

5.71 Beneficial Uses. It is general Corps policy to beneficially use excavated sediments from a Navigation Project wherever economically feasible and environmentally acceptable. Section 204 of the WRDA of 1992 authorizes the Secretary of the Army to undertake projects for the protection, restoration, or creation of aquatic and ecologically-related habitats when (1) the environmental, economic and social benefits of the project -- both monetary and non-monetary -- justify the costs, and (2) the project would not result in environmental degradation. The Corps' policy concerning this issue is stated in EC 1105-2-209, titled "Implementing Ecosystem Restoration Projects in Connection with Dredging." That document states that justification for such projects will be established by demonstrating that the monetary and non-monetary benefits (outputs) of the ecosystem restoration project exceed its incremental costs. In the analysis of costs, Savannah District intends to consider the avoidance of costs which would have been borne in any construction project conducted by a government entity which requires fill material and has already received approvals independent of using sediments from the Navigation Project. Cost sharing is required for actions which are more expensive than those in the harbor's Base Plan. In the normal conduct of the District's maintenance dredging work, it would conduct a review during the design process of potential beneficial uses -- specifically alternative disposal sites -- for the sediments to be excavated during that contract. The disposal location to be used for a specific dredging contract would be decided during project design and award based on identification of the least cost, environmentally-acceptable option. If disposal at a certain location is found to be more desirable for environmental or other reasons but would be more costly than one of the other acceptable options, it can be pursued with appropriate cost sharing using Section 933 (WRDA 1986) or Section 204 (WRDA 1992) authorities.

5.72 Specific beneficial uses which would be encouraged include (1) removal of sediments deposited in the CDFs for use as construction fill material, (2) removal of sediments deposited in the CDFs for other construction purposes, (3) deposition of Bar Channel sediments to construct and maintain berms in the nearshore area, (4) deposition of Bar Channel sediments to construct and maintain a feeder berm off Tybee Island, (5) direct placement of Bar Channel or suitable sediments on eroded portions of Tybee and/or Daufuskie Island, (6) deposition of Bar Channel or suitable sediments to construct and maintain an island in the nearshore area off Turtle Island for shorebird nesting, (7) deposition of Bar Channel or suitable sediments to maintain a bare shorebird nesting area on Jones/Oysterbed Island, and (8) specific placement of materials within or adjacent to CDFs to benefit wildlife.

5.73 Environmental Compliance Requirements. The environmental compliance requirements include those actions which are necessary for harbor maintenance activities to be performed in compliance with the clearances which have been obtained from regulatory agencies and the commitments made in this EIS. Those requirements are documented in Appendix O. Permits and certifications obtained from regulatory agencies in response to their review of the Draft EIS are also included in that appendix. Comments received from other agencies are included in Appendix Q.

5.74 Base Plan (Federal Standard). The "Base Plan" replaces the term "Federal Standard" for a harbor. That plan is defined as "the dredged material disposal alternative or alternatives identified by the Corps which represent the least costly alternatives consistent with sound engineering practices and meeting the environmental standards established by the Section 404(b)(1) evaluation process (Clean Water Act of 1972) or ocean dumping criteria (Section 103 of the Marine Protection, Research and Sanctuaries Act of 1972, as amended)." This standard establishes the benchmark for Corps involvement in future operation of the harbor and the baseline for cost sharing purposes. If requested, additional actions could be made a component of the harbor's normal management program, but those additional actions would need to be funded by an organization other than the Corps of Engineers.

5.75 Alternative 8 was found to be the best management plan for efficient and effective operation of the harbor. However, that alternative includes components which address issues which do not affect the Federal costs of operating and maintaining Savannah Harbor. Those components describe the most environmentally-acceptable manner of maintaining adequate depths in berths and are contained in Alternative 6. The Base Plan for the Savannah Harbor Navigation Project therefore consists of Alternative 8 without the features described in Alternative 6. Viewed from another perspective, the Base Plan consists of the combined use of Alternatives 3 (rotational use of the CDFs), 4 (underdrains), 5 (nearshore disposal options) and 7 (sediment control features in the inner harbor).

5.76 There may be certain situations when dredged material from outer portions of the harbor might be discharged at a beach nourishment, feeder berm or submerged berm site at a cost which is equal to or less than that using the ODMDS. The disposal location to be used for a specific dredging contract would be decided based on identification of the least cost, environmentally-acceptable option at that time. If disposal at a certain location is found to be more desirable for environmental

or other reasons but would be more costly than one of the other acceptable options, it can be pursued with appropriate cost sharing using Section 933 (WRDA 1986) or Section 204 (WRDA 1992) authorities.

5.77 Further engineering and economic evaluations are needed to document the site-specific justification of the advance maintenance components of the inner harbor sediment control features in Alternative 7. Those components could not be implemented until that documentation is complete and approved by higher Corps offices.

5.78 Additional real estate interests may be necessary to implement some aspects of the selected plan. Savannah District will seek confirmation from higher Corps offices of what interests are needed before the proposed actions are implemented at the various disposal area tracts. No action would be taken without either the District or the local sponsor possessing sufficient real estate interest to perform that action.

5.79 Storage capacity in Disposal Area 2A will become limited in the near future, resulting in a substantial increase in cost to pump the dredged material to Disposal Area 12A, located over 5 miles downstream. New or enlarged CDFs should be pursued in the upper harbor to minimize or eliminate that expected increase in pumping cost.

5.80 Since the environmental impacts of the Base Plan have been evaluated and determined to meet environmental standards, all components of the Base Plan receive the necessary environmental approvals at the same time. In addition, since the conclusions of the environmental analyses are not dependent on what organization implements the various components, whoever implements the actions described in the Base Plan does not have to obtain separate environmental approvals before carrying out those actions. As long as the actions are part of the Federal project and performed as described in this document, separate environmental approvals will not be required for their implementation. This includes work which may be performed by the Corps of Engineers, Chatham County, Georgia Department of Transportation, or others. Actions to be performed by any party as part of the Federal Project and under the auspices of this EIS must be coordinated with the Savannah District's Operations Division, who will coordinate the proposed action within the District for concurrence that the action is covered by existing environmental clearances. If the proposed action is found to not be in accordance with this document, the District will inform the organization which intends to perform the work that it needs to obtain separate environmental approvals. If construction occurs which is not in accordance with this document, the District will inform the organization and pursue normal procedures for actions performed without environmental clearances. Savannah District

retains the right to inspect construction sites either before work is initiated and/or after it is complete to insure that actions are implemented in accordance with the environmental approvals granted to the District through this EIS. If the proposed actions do not concern components of the Federal Project, the party proposing the action would have to obtain separate environmental clearances. If non-federal interests propose to implement the berth maintenance procedure recommended in this EIS, the District would conduct an expedited permit review procedure since that action would have already received public review and approval from environmental agencies through this EIS. A sediment quality evaluation would be required if new work dredging is proposed.

6.00 AFFECTED ENVIRONMENT

6.01 Introduction. This chapter describes the environmental components of the area that would affect, and that would be affected by, the alternatives considered, if they were implemented. The latter portions of the chapter also describe how the environment in the project area has been impacted by past harbor improvements.

6.02 Geography. The mainland on the south side of the harbor is dominated by the city of Savannah, Georgia. The city's historic downtown area is located on a south bluff approximately 18 miles above the river's mouth. Heavy industry and shipping facilities are along the south side of the harbor upstream from the city's historic downtown area to the head of the harbor. More heavy industries and a few shipping facilities line the harbor downstream from the historic downtown area of the city to the Atlantic Intracoastal Waterway (AIWW). From the AIWW to the river's mouth, both sides of the harbor are predominantly undeveloped areas consisting of islands, marshes, dredged material disposal areas, and other natural sites. The areas along the South Carolina side of the harbor are characterized by dredged material disposal areas, former rice fields constructed in the 18th and 19th centuries, and marshes. Land use on the South Carolina side of the Savannah River is basically agricultural, silvicultural, with some recreation. Wetland habitat types found along Savannah Harbor include saltwater aquatic, saltwater coastal flats, saltwater marshes, freshwater aquatic, freshwater flats, and freshwater marsh.

6.03 Climatology. The Savannah, Georgia, area has a temperate climate characterized by warm, humid summers and mild winters. The seasonal mean temperatures are 51 degrees F in winter, 64 degrees F in spring, 80 degrees F in summer, and 66 degrees F in autumn. Precipitation averages 48.9 inches per year, about half falling during summer thundershowers. Snow is rare. The frost-free season averages approximately 270 days. Hurricanes pose an occasional threat, principally in September or October. Delays to shipping activities in the Savannah area due to fog or inclement weather are relatively infrequent.

6.04 Geology and Soils. Savannah, Georgia is located in the Lower Atlantic Coastal Plain Physiographic Province. The majority of soils primarily have a sandy surface layer over a loamy or sandy subsoil or underlying layers. These soils are nearly level or gently sloping and occur as broad, smooth areas drained by wet depressions. They generally are seasonally wet or almost always wet, except for the better drained soils on the

slight ridges and dune-like relief. A band of marshes parallel the coastline and extends inland along the major streams. Limestones of tertiary and quaternary age underlying the Coastal Plain form one of the most productive aquifer systems in the country.

6.05 Groundwater. Studies were previously conducted to determine impacts of the 1993/1994 harbor deepening on the freshwater aquifer. Borings were taken to define the soil stratum at critical locations. Information from those and other borings show that the stratum bearing the drinking water aquifer would not be impacted by maintenance of channel depths in the authorized project. More than 50 feet separates the bottom of the deepest authorized excavation from the top of that water-bearing layer. According to work performed by Paul Huddleston, Georgia Geologic Survey, the US Geological Survey; and Dr. Vernon J. Henry, Georgia State University, the surfaces of the Early Miocene and Late Oligocene Age Aquifers appear to be sufficiently deep to prevent damage by even a project constructed to a depth of -50 feet MLW. An offshore geological structure known as the Beaufort Arch created an uplift to the Tertiary sediments in the vicinity of the Savannah Light. This uplift resulted in the Parachucla formation (of early Miocene Age) surfacing about -90 feet MLW which is the uppermost confined aquifer in the area. A more valuable freshwater aquifer, the Late Eocene aged Ocala Limestone (Upper Floridian) Aquifer, would be expected to be at no higher elevation than -190 feet MLW in this area. The uppermost freshwater aquifer is confined by the highly impermeable middle Miocene clays of 40 to 70 feet in thickness. These clays are overlain by clayey sands and soft limestones. Above the Upper Miocene are soft granular Pliocene and Pleistocene age deposits in which most of the recent harbor deepening took place, along with current soft deposits of the Holocene Age. Introduction of water into the upper Floridian Aquifer would require contact with a fissure, fault, or ancient stream channel which would lead to this strata. This is possible, but not likely. Another way for water to be introduced into the upper Floridian Aquifer would be for the entire Miocene Age cap to be removed to expose the underlying limestone. This would require dredging the harbor to -100 feet MLW. Based on this information, no impact to the upper confined freshwater aquifer or the principle confined artesian drinking water aquifer in Savannah Harbor was projected to occur from the recent harbor deepening or is expected to occur from continued maintenance of that Navigation Project.

6.06 The existing diked disposal areas are not lined, but are constructed on top of the soil substrate which was originally on the site. In most cases, soft organic soils supporting wetland vegetation previously covered the sites. Due to the unlined nature of the facility and the short-term ponding of water within

the diked disposal areas, there is a potential for migration of water down through the soil layers to levels of shallow groundwater. Groundwater can be found at various depths in the project vicinity, while drinking water is taken only from depths more than 100 feet below the surface. As described in the previous paragraph, clay lenses of 40 to 70 feet in thickness separate the various groundwater bearing strata. Those lenses effectively limit the depth to which migration could occur from the disposal areas.

6.07 Hydrology. The drainage basin of the Savannah River consists of an area of 10,577 square miles; 175 of which are in southwestern North Carolina, 4,581 are in western South Carolina and 5,821 are in Georgia. The headwaters are located in the high forested slopes of the Blue Ridge Mountains. From the mountains of North Carolina, the Tallulah and Chattooga Rivers combine to form the Tugaloo River at the Georgia-South Carolina border. Those mountains also produce the Whitewater and Toxaway Rivers, which combine to form the Keowee River in South Carolina. The Keowee River and Twelve Mile Creek join to form the Seneca River near Clemson, South Carolina. The principal headwater streams, the Tugaloo and the Seneca, combine near Hartwell, Georgia to form the Savannah River. From that point, the river flows about 300 miles southeasterly to discharge into the Atlantic Ocean near Savannah, Georgia. The major downstream tributaries include the Broad River in Georgia, the two Little Rivers in Georgia and South Carolina, Brier Creek in Georgia, and Stevens Creek in South Carolina.

6.08 The topography varies from elevation 5,500 feet at the headwaters of the Talullah River, to about 1,000 feet in the rolling hilly piedmont, descending to about 200 feet at Augusta, Georgia, to the nearly flat coastal plain from Augusta to the Atlantic Ocean. The basin is predominantly forested, with wetlands existing along the river floodplains. Extensive wetlands occur at the coast due to the high tidal range.

6.09 Runoff averages about 15 inches per year over the basin. Runoff at Augusta, Georgia averages about 19 inches per year, compared to the national average of 8 inches. Total streamflow varies considerably from year to year. In addition, there is also significant variation throughout the course of a year. Streams in the basin are typically high in the winter and early spring. During the warm summers, flows recede and remain low through autumn.

6.10 Freshwater discharges near Clyo, Georgia (River Mile 65) average 11,600 cubic feet per second (CFS), with maximum and minimum annual mean discharges of 20,900 CFS and 9,820 CFS, respectively, since 1962.

6.11 River Hydraulics. Savannah Harbor experiences a large semi-diurnal tide. Tidal fluctuations average 6.8 feet at the mouth of the harbor and 7.9 feet at the upper limit of the harbor. The tidal influence extends approximately 45 miles upstream to Ebenezer Landing, Georgia. Maximum velocities encountered in the navigation channel are approximately 4 feet per second on the flood tide and 5 feet per second on ebb tide. Ebb velocities are usually somewhat larger that flood velocities.

6.12 Salinity. Savannah Harbor is located in an estuary, an area where freshwater and salt water combine. Freshwater is defined as water having a salinity less than 0.5 parts per thousand (ppt), while ocean waters typically have salinities around 30 ppt. The harbor is basically a deepened river, so the fresh and saline waters do not mix over a wide geographic expanse, but instead transition from the upstream freshwater to the denser saline water over a distance along the river. The location of that transition zone varies in response to both tidal flows and the volume of freshwater discharge. Higher discharges and low tides shift the transition point downstream, while lower discharges and high tides move the transition area upstream. Higher discharges lengthen the distance of the transition zone. These variations result in large shifts in the salinity interface; as much as 8 miles in Savannah River and 7 miles in Back River. Sampling performed since the 1993 harbor deepening indicate that the interface is generally located around River Mile 24 on the Savannah River and River Mile 20 on Back River. Areas downstream of that reflect brackish or saline conditions. Therefore, the main berthing areas are located in brackish to saline conditions.

6.13 The Tidegate structure which was constructed in 1977 on Back River had an unacceptable level of effect on the salinity regime in the harbor. That structure was taken out of operation in 1990 to decrease salinity levels and restore 4,000 acres of freshwater marsh in Back River. Sampling performed since that time indicates that freshwater does exist further downstream in Back River than when the Tidegate was operating. Freshwater wetland vegetation is returning along that river. When the Tidegate was operating, average flow velocities between the structure and just above New Cut were reduced. The lower velocities resulted in shoaling of that portion of the Back River. After the Tidegate was taken out of operation, channel sediments eroded in response to the higher average flow velocities. Sampling performed in 1992 indicates that erosion was occurring and that maximum channel depths had generally reached those which existed when the Tidegate was first operated. The data obtained during that sampling are summarized in the table on the following page. Concerns have been expressed by the US FWS that the fishery habitat value of Back River may not have

TABLE 7

BACK RIVER CHANNEL DEPTHS
(DISTANCE UPSTREAM OF THE TIDEGATE)

STATION	FEB 1978	APR 1992	JUN 1992	AUG 1992	OCT 1992	DEC 1992
1+000	12.8	13.4	12.0	10.9	12.2	12.1
2+420	7.1	8.5	8.2	---	7.8	7.7
3+520	4.2	6.2	5.8	5.8	5.6	5.9
4+540	3.9	5.0	4.3	4.8	5.2	6.1
9+760	11.7	9.7	10.6	10.4	8.9	8.3
10+340	13.2	11.5	8.0	11.8	12.1	12.5
13+725	14.0	15.8	13.2	13.6	15.2	14.0
16+275	10.4	---	12.7	11.3	---	15.8
18+625	6.2	---	7.0	7.5	---	11.9
21+400	13.3	12.9	9.9	17.5	16.2	17.1
22+880	21.5	22.1	20.8	20.5	21.7	21.5

NOTE: Station 3+520 is the U.S. Highway 17A Bridge
Station 10+340 is the railroad bridge

been restored to its previous condition by the closure of New Cut and cessation of operation of the Tidegate. Tangible evidence of the present habitat value will hopefully be available after completion of the Corps' Striped bass egg and larval study.

6.14 Freshwater Diversion System. As described in Section 3.11, a Freshwater Diversion System was included in the Navigation Project in 1965 to offset the impacts which channel deepening and sediment control works would have on the salinity regime in the harbor. It was recognized that those changes in the Project would result in adverse impacts on freshwater marshes both in the Savannah National Wildlife Refuge and in private ownership on the South Carolina side of U.S. Highway 17A. The Freshwater Diversion System included a 5,500-foot long diversion canal to provide freshwater to the Savannah National Wildlife Refuge and smaller supply canals to transport the water to adjacent private properties.

6.15 Shoaling. Sediments which deposit in the harbor as a result of several factors. A large volume of material is transported down the Savannah River suspended in the river flow and as bedload material. These sediments are primarily sand and deposit in the upper end of the harbor. Material which accumulates in the Bar Channel is also primarily sand, although of a much finer grain size. That channel interrupts the southerly littoral drift and acts as a trap for suspended and bedload materials. Material which accumulates in the middle harbor reaches is much finer grained and contains a significant percentage of silt. Some of that sediment is organic material which is flushed from the adjacent coastal marshes by the tides. Inner harbor material also settles as a result of chemical reactions which occur as the result of the mixing of fresh and saline water. As an overall summary, maintenance material varies along the length of the harbor with sandy material depositing in the upper harbor, silty material in the middle harbor, and fine-grained sand depositing in the Bar Channel. The annual volume of sedimentation has generally reached a plateau at about 7 MCY per year in the inner harbor and an additional 1 MCY in the Bar Channel. As the harbor has been deepened over the past 20 years, the location of the shoaling has been shifted further upstream, but the total volume has remaining essentially unchanged.

6.16 Nearshore Hydraulics.

6.17 Tidal Currents. As expressed previously, the project area experiences a large semi-diurnal tide, with tidal fluctuations averaging 6.8 feet at the mouth of the harbor. Those large tides result in significant tidal currents which dominate and mask normal river discharges. Flood tide currents approach the jetties at the harbor entrance from a variety of directions,

somewhat like a funnel. On that tide, significant flows occur over the shallow nearshore areas as well as the deeper channel. Tidal currents are generally stronger on the ebb tide and are more confined to the orientation of the Bar Channel. A jet of water is produced on the ebbing tide which carries extensive volumes of sediment out through the inlet to the nearshore area. As the flow spreads out beyond the defined boundaries of the navigation channel, the velocity decreases, resulting in the deposition of sediments in ebb tide deltas.

6.18 Littoral drift. Waves predominantly pass across the Bar Channel from the northeast to southeast. Waves from those directions constitute 86 percent of the waves which reach the coast. Smaller southeasterly waves predominate in the summer, while larger northeasterly waves predominate in the winter. Because of the orientation of the coast, those waves produce an overall southerly drift of material in the nearshore waters. Due to this drift, material suspended in the water column or moved along the bottom by current or wave action tends to move in an overall southerly direction. This has implications for a navigation project in its effect on coastal sediments. Depths adjacent to and north of the Bar Channel tend to be shallow, whereas depths adjacent to and south of the channel tend to be deeper. Material removed from the channel and deposited in the ocean would have less likelihood of reentering the channel if they were placed on the south side of the channel so that the littoral drift could carry it further south and away from the channel. This was one of the reasons for the initial siting of the Savannah Ocean Dredged Material Disposal Site (ODMDS) south of the channel. A similar rationale would apply to potential siting of other disposal sites or features which could be created through deposition of dredged material (berms or islands).

6.19 Wetlands.

6.20 Types. The Fish and Wildlife Coordination Report for the Savannah Harbor Comprehensive Study, dated July 27, 1982, included detailed mapping of wetland resources in the harbor area. That study defined the following cover types as occurring in the Savannah Harbor study area.

1. Saltmarsh cordgrass: estuarine intertidal emergent wetland dominated by Spartina alterniflora.

2. High saltmarsh one: estuarine intertidal emergent wetland vegetated primarily with one or more of the following: Salicornia spp., Distichlis spicata, Batis maritima, Spartina alterniflora.

3. High saltmarsh two: estuarine intertidal emergent wetland vegetated primarily with Borrichia frutescens and/or Iva frutescens.

4. Black needlerush: estuarine intertidal emergent wetland dominated by Juncus roemerianus.

5. Giant cordgrass: estuarine intertidal emergent wetland dominated by Spartina cynosuroides.

6. Sand/mud: estuarine intertidal unconsolidated shore with sand or mud substrate.

7. Spoil: dredged material placed on a diked or undiked area. May be vegetated or unvegetated depending on time since last dredging cycle.

8. Giant cutgrass: riverine tidal emergent and estuarine intertidal emergent wetland dominated by Zizaniopsis miliacea.

9. Mixed fresh marsh: riverine tidal emergent wetland vegetated with species such as: Amaranthus cannabinus, Carex spp., Cladium jamaicense, Cyperus spp., Eleocharis spp., Erianthus giganteus, Orontium aquaticum, Peltandra virginica, Pontedaria cordata, Sagittaria spp., Scirpus validus, Scirpus spp., Spartina cynosuroides, Typha spp., Zizania aquatica and Zizaniopsis miliacea.

10. Cypress: palustrine forested wetland dominated by Taxodium spp.

11. Gum: palustrine forested wetland dominated by Nyssa aquatica, Nyssa sylvatica and Liquidambar styraciflua.

12. Cypress/gum: palustrine forested wetland dominated by Taxodium spp., Nyssa spp., and Liquidambar styraciflua.

13. Deciduous forested: palustrine forested wetland with species such as: Acer rubrum, Quercus nigra, Quercus michauxii, Nyssa spp., Liquidambar styraciflua and Fraxinus pennsylvanica.

14. Scrub-shrub: palustrine scrub-shrub wetland vegetated by such species as: Cephalanthus occidentalis, Taxodium spp., Nyssa spp., Acer rubrum and Salix spp.

15. Mixed brackish marsh: estuarine intertidal emergent wetland vegetated with such species as: Cladium jamaicense, Juncus spp., Scirpus spp., Spartina cynosuroides and Typha spp.

16. Bullrush/cattail: estuarine intertidal emergent wetland dominated by Scirpus spp. and Typha spp.

17. Deciduous forest: greater than 50 percent cover of upland hardwood (not wetland).

18. Diked impoundments: shallow impoundments formed by diking off estuarine emergent or riverine tidal emergent wetland.

19. Pine forest: greater than 50 percent cover of pines (not wetland).

20. Open water: primarily estuarine, subtidal, unconsolidated bottom wetlands but includes borrow pits located in upland areas.

21. Mixed fresh marsh/scrub-shrub: mixture or interspersion of types 9 and 14.

22. Pasture: included old fields in addition to pasture (not wetland).

23. Developed: residential/commercial areas, included some small gardens/truck farms adjacent to housing (not wetland).

6.21 Information was also included in that FWS report on the extent of emergent wetlands. The following information was included as Table 2 in that document (US FWS, 1982).

NO.	COVER TYPE	ACREAGE	PERCENT
1	Saltmarsh Cordgrass	2,160	9.5
2	High Saltmarsh One	217	1.0
3	High Saltmarsh Two	431	1.9
4	Black Needlerush	3,908	17.2
5	Giant Cordgrass	2,025	8.9
8	Giant Cutgrass	1,068	4.7
9	Mixed Fresh Marsh	4,572	20.1
15	Mixed Brackish Marsh	2,407	10.6
16	Bullrush/cattail	1,774	7.8
18	Diked Impoundment	4,157	18.3
Total		22,719	100.0

6.22 Information was also included in that FWS report on the extent of forested wetlands. The following information was included as Table 3 in that document (US FWS, 1982).

NO.	COVER TYPE	ACREAGE	PERCENT
10	Cypress	349	4.1
11	Gum	1,463	17.0
12	Cypress-Gum	4,330	50.5
13	Deciduous Forested	230	2.7
14	Scrub-Shrub	2,205	25.7
Total		8,577	100.0

6.23 Vegetation at Disposal Area 14A. During the conduct of the LTMS Study, Disposal Area 14A was identified as being critical to future disposal operations. A Biologist from the District's Planning Division used aerial photographs to identify the vegetation types in the area which would be impacted by the diking and use of the site as a confined disposal facility. The vegetation and wetland delineations were field verified from March to May 1994 by that Biologist and another Biologist from the District's Regulatory Branch. Table 8 displays the types and acreages of vegetation existing at the site.

6.24 Potential Mitigation Areas. Few large sites exist which could be used for wetland in-kind mitigation. Most high ground areas are already developed and the cost of obtaining such sites and grading them down to marsh elevations would be prohibitive. Some small sites with high ground which were created through previous dredged material disposal do exist in the general vicinity. However, their total acreage is relatively low and the sites currently provide significant wildlife habitat in their state. Shallow areas which could be filled to marsh elevations are generally recognized as having significant environmental value in their present state, and their loss to create wetland habitat is not regionally acceptable. During the course of the LTMS study, the District and resource agencies were unable to identify specific sites of significant acreage which could be used for in-kind mitigation at costs which the agencies agreed would be reasonable.

TABLE 8

VEGETATION TYPES
CURRENTLY AT
DISPOSAL AREA 14A

VEGETATIVE TYPE	VEGETATIVE CLASSIFICATION	ACREAGE
WETLANDS		
High value outside the old dike		
Open water	1	2.3
Spartina alterniflora	9	1.0
Spartina cynosuroides	2	49.9
Distichilis/Juncus	7	86.1
Sedges	3	10.6
Mixed inundated vegetation	5	36.6
SUBTOTAL		186.7
Moderate value outside the old dike		
Primarily Baccharis spp.	4	24.4
Low value outside the old dike		
Baccharis spp. (wet)	14	60.5
Mixed grasses/herbs	12	0.1
SUBTOTAL		60.6
Low/moderate value inside the old dike		
Spartina cynosuroides	2	1.6
Sedges	3	2.0
Mixed grasses/herbs	12	10.6
Primarily Baccharis spp.	4	19.0
SUBTOTAL		33.2
TOTAL WETLANDS ACREAGE		304.7
UPLANDS		
High value inundated borrow area	11	42.9
Moderate value mixed trees	8	76.1
Moderate value Myrica cerifera	6	71.5
Low value Baccharis spp.	10	228.7
Low value mixed grasses/herbs	13	91.1
TOTAL UPLANDS ACREAGE		510.3
TOTAL ACREAGE OF SITE		815.0

6.25 Sediment Quality.

6.26 Savannah River Sediment Testing. Savannah District has periodically evaluated river sediments prior to their being dredged. Those analyses have found the harbor sediments to be suitable for dredging and disposal in accordance with the guidelines pertaining to either Section 404 of the Clean Water Act or Section 103 of the Marine Protection, Research, Research and Sanctuaries Act, whichever is appropriate for that action. The materials have been found to contain various chemicals, but none at levels which would pose significant threats to aquatic life. Most chemicals were within background levels commonly observed in the Southeastern US (Conner & Shacklette, 1975). Sediment Quality is discussed further in Appendix F.

6.27 Wright River Sediment Testing. Weirs from several of the harbor's confined disposal facilities discharge into small tidal creeks which drain to the Wright River. As a result of concerns expressed by the SCCC about potential impacts which such discharges could be producing in that portion of the estuary, the District conducted chemical and biological tests of releases from those areas. The analysis included both effluent from the weirs and sediment from the small tidal creeks. The results of those tests are summarized in Appendix E WRIGHT RIVER SEDIMENT STUDY RESULTS.

6.28 Hazardous and Toxic Wastes. Dredged material is not generically considered as either a "hazardous substance" under the definitions of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) (42 U.S.C. 9601(14)) or a "hazardous waste" under the definitions of the Resource Conservation and Recovery Act (RCRA) (42 U.S.C. 6921 et seq.). As explained in previous sections, Savannah Harbor channel sediments have been tested and found to contain chemicals at concentrations below that which would cause significant threats to aquatic life. Sediments in the harbor cannot be considered as being highly contaminated. Some industries do transport goods through the harbor which could be considered hazardous or toxic. The U.S. Coast Guard establishes procedures for such movement to ensure those operations are done safely. No such movements have resulted in spills which caused widespread threats to human health or safety. One major oil spill did occur on December 4, 1986 when the Amazon Venture leaked a significant amount of oil into the harbor.

6.29 Water Quality.

6.30 South Carolina State Standards. South Carolina, by amendment dated May 28, 1993, to its Water Classifications and Standards, Regulation 61-68, has classified the portion of Savannah Harbor within its boundaries upstream from Fort Pulaski to the Seaboard Coastline RR as Class SB* and the portion oceanward as Class SA waters. Class SB is defined as tidal saltwaters suitable for primary and secondary contract recreation, crabbing, and fishing, except harvesting of clams, mussels, or oysters for market purposes or human consumption. These waters are also suitable for the survival and propagation of a balanced indigenous aquatic community of marine fauna and flora. Class SA is defined as tidal saltwaters suitable for primary and secondary contact recreation. Suitable also for uses listed in Class SB, with the same exception. Upstream of the Seaboard Coastline RR is classified as FW, which is defined as fresh waters suitable for primary and secondary contact recreation, and as a source for drinking water supply after conventional treatment in accordance with the requirements of the South Carolina Department of Health and Environmental Control. These waters are suitable for fishing and the propagation of a balanced indigenous aquatic community of fauna and flora. FW waters are also suitable for industrial and agricultural uses.

6.31 Georgia State Standards. The State of Georgia, through its Rules and Regulations for Water Quality Control, Chapter 391-3-6, Revised May 29, 1994, has classified the Savannah River from mile 0 at Fort Pulaski to the open sea (including the littoral waters of Tybee Island) as recreation waters. From Fort Pulaski to Mile 27.4 (Seaboard Coastline RR Bridge), the river is classified as Coastal Fishing. The latter stretch of the Savannah River used to be classified as Industrial/Navigation. However, studies were conducted by the Georgia Department of Natural Resources during the fall of 1985 which resulted in the reclassification of that stretch of the river to Coastal Fishing. The GA DNR (Water Quality in Georgia, 1990-1991) lists the harbor from Highway 17 to South Channel as not fully supporting the designated use of coastal fishing due to the violation of fecal coliform and copper criteria due to urban runoff/urban effects and municipal facilities incapable of providing sufficiently high quality effluent.

6.32 State Water Quality Certifications. Water Quality Certifications have been received for operation of the Savannah Harbor Navigation Project from both Georgia and South Carolina in their administration of Section 401 of the Clean Water Act. The conditions which those states placed on their certifications were described previously in Section 3.33 and 3.34.

6.33 Harbor Dissolved Oxygen. The GA DNR does not list dissolved oxygen (D.O.) as a problem in the harbor (Water Quality in Georgia, 1990-1991). Site-specific criteria for the coastal fishing classification in Savannah Harbor are minimum instantaneous D.O. readings of no less than 3.0 mg/l in June, July, August, September, and October; no less than 3.5 mg/l in May and November; and no less than 4.0 mg/l in December, January, February, March, and April (GA DNR Rules and Regulations for Water Quality Control, Chapter 391-3-6, Revised May 29, 1994). Studies by the State of South Carolina have documented low D.O. levels in the Sediment Basin during the summer.

6.34 During District monitoring of dredging impacts, background D.O. in the Savannah River has occasionally been observed to be below one of the state's criteria. This has primarily occurred with D.O. in the summer months when the oxygen demands associated with decomposition of organic detritus from the salt marsh exceeds the ability of the water to absorb oxygen from the air. Studies by the State of South Carolina have documented low D.O. levels in the Sediment Basin during the summer. Finer-grained materials accumulate in thicker layers and at deeper depths in that location. Those materials, which tend to be more organic in nature, have a higher oxygen demand per volume than sandier sediments which originate upriver. The greater water depths and slower current velocities near the sediment/water interface at the Sediment Basin increase the difficulty of sustaining satisfactory levels of D.O. at that location. See section 7 for a discussion of impacts.

6.35 Tidal Creek Dissolved Oxygen. Low dissolved oxygen is routinely found in the headwaters of small tidal creeks, with natural lows occurring during early morning ebb tides due to high nocturnal respiration rates (Scott, 1994). Low D.O. levels have been observed for longer periods of time near the weir outfalls, especially those with underdrains. See Section 7 for a discussion of impacts.

6.36 Disposal Area Effluent. Weir discharges have been studied recently (NMFS, 1994). The results of that study are discussed in Appendix E, WEIR EFFLUENT STUDY RESULTS.

6.37 Turbidity. The region's waters are highly turbid as a result of the suspended river sediments and organic detritus derived from the adjacent salt marshes. Harbor operations do contribute to that turbidity through (1)the resuspension of deposited sediments during dredging operations, (2)the discharge of suspended sediments in the effluent from the confined disposal facilities, and (3)the suspension of fine-grained sediments during disposal operations at the Savannah ODMDS. The use of agitation dredging and disposal at the Savannah ODMDS do result in significant increases in turbidity. However, those increases

are localized in extent and of short duration. They result in no long term or overall significant adverse effect on the area's water quality. The other harbor operations produce no significant increases in turbidity.

6.38 Air Quality. The air quality in the harbor area is generally good. The area is under no Federal or State restrictions for the purpose of improving air quality of meeting any air quality standard. Local industries have implemented process improvements over the last 5 to 10 years which have significant reduced the volume of substances emitted to the air. Concerns do exist among some in the community about the quality of the air and a community group has actively pursued methods of improving air quality. Maritime industries are not major air emitters, although some industries located along the harbor which discharge large amounts of substances do move their raw materials or processed goods through the harbor. Harbor maintenance activities do not generate significant amounts of air contaminants.

6.39 Threatened and Endangered Species. Several animal species listed as threatened or endangered have been observed in the Savannah Harbor area or their reproductive habitat exists there. These species have been designated as endangered or threatened pursuant to the Endangered Species Act of 1973. These species are discussed below. Further discussion can be found in the BATES for the project, at Appendix B.

6.40 Manatee (Trichechus manatus) have been observed in the Savannah Harbor. These mammals prefer sluggish rivers, sheltered marine bays, and shallow estuaries. This species has experienced a nationwide population decline, the reasons for which include low reproductive rates, habitat destruction, injuries from powerboat propellers, and poaching. Historically, manatees have been occasionally sighted in some Georgia coastal waterways during summer months. The majority of the manatees are found in Florida with few sightings in Georgia and South Carolina.

6.41 Individuals of the six species of endangered whales occurring in this area are rarely reported in the vicinity of Savannah Harbor; with the exception of Right whales. Right whales (Eubalena glacialis) are routinely observed offshore of Savannah Harbor as this species migrates to/from its calving grounds located off the northern coast of Florida.

6.42 In eastern North America the only recognized population of cougar (Felis concolor cougar) is found in southern Florida. However, reported sightings of the endangered felines are made every year from many other eastern states. It is not known whether these sightings represent remnants of former populations,

transient individuals migrating from disjunct populations, individuals escaped from captivity, or cases of mistaken identity. Little, if any, habitat exists for cougars in the Savannah Harbor area.

6.43 Bald eagles (Haliaeetus leucocephalus) are listed as endangered species in the states of South Carolina and Georgia. Several eagles are annually sighted in the Savannah Harbor area, especially over the dredged material disposal sites. According to the US FWS, there is one active eagle nest on the Savannah National Wildlife Refuge. Another active nest is located on private land near the refuge in South Carolina. The preferred habitat of the bald eagle requires suitable wetland areas for hunting and undisturbed lake shore or coastal areas in which large trees for roosting and nesting are available.

6.44 Kirtland's warbler (Dendroica kirtlandii) is an endangered bird species which migrates through coastal Georgia, and may utilize scrub-shrub wetlands or coastal hardwoods. This species does not nest in the Savannah Harbor area.

6.45 Wood storks (Mycteria americana) are birds of freshwater and brackish wetlands, primarily nesting in cypress or mangrove swamps, and feeding in freshwater marshes, flooded pastures, and flooded ditches. Particularly attractive feeding sites are depressions in marshes or swamps where fish become concentrated during periods of falling water levels. These large black and white birds have been seen in the Savannah Harbor area, particularly over the dredged material disposal areas; however, no nesting colonies are located in the harbor area.

6.46 The red-cockaded woodpecker (Picoides borealis) nests in a colony containing several cavity trees and seven or eight woodpeckers in the immediate area, but there is only one breeding pair in the group. The basic habitat requirement is for open stands of pines with a minimum age of 60 years. Longleaf pine is most commonly used, but other species of southern pine are also acceptable. There have been no recent sightings of these woodpeckers in the Savannah Harbor area and no suitable reproductive habitat is available.

6.47 Bachman's warbler (Vermivora bachmanii) is listed as an endangered species in the southeastern United States. Present distribution of the species is unknown; however, most authorities agree that if the species exists, it is most likely in the I'On Swamp area in Charleston and Berkeley Counties, South Carolina. There have been no recent sightings of these warblers in the Savannah Harbor area, and no suitable reproductive habitat is available.

6.48 The piping plover (Charadrius melodus) is listed as a threatened species along the Atlantic Coast. It is a fairly common transient and winter resident on the Georgia Coast. These birds nest on sandy beaches along the ocean and inland lakes; on dredged and alluvial islands in rivers; and on salt-encrusted bare areas of sand, gravel, or pebbly mud on interior lakes and ponds. This species was listed by the U.S. FWS on December 11, 1985, as being threatened along the Atlantic Coast. These birds could be found feeding on beaches at the mouth of the Savannah River during fall, winter, and early spring.

6.49 The eastern indigo snake (Drymarchon corais couperi) is known to exist in southeast Georgia and extreme southeastern portions of South Carolina. The species seems to be strongly associated with high, dry, well drained sandy soils, closely paralleling sandhill habitat preferred by the gopher tortoise; however, especially during the warmer months, indigos also frequent streams and swamps, and individuals are occasionally found in flat woods. Preferred habitat for this species is not found in the Savannah Harbor area.

6.50 Five species of sea turtles listed as endangered or threatened are found along Georgia and South Carolina coasts. These turtles nest on barrier island beaches. Loggerhead turtles nest in small numbers on Tybee Island, located adjacent to the mouth of the Savannah River. Trawling studies (WES, 1994) indicate that loggerhead turtles are present in the bar channel, mainly from April through November.

6.51 The only endangered fish species found in the Savannah Harbor area is the shortnose sturgeon (Acipenser brevirostrum). This fish occurs in the lower sections of larger rivers and in coastal marine habitats, mostly estuaries, along the Atlantic coast. The species' general pattern of seasonal movement appears to involve using an upstream spawning area in late winter to spring, spending summer and fall in the lower river near the mouth, and then moving out into a deeper and sometimes more saline environment for winter. This species has been recorded in Savannah Harbor, especially in the upper portion of the harbor near the Kings Island Turning Basin.

6.52 Fishery Resources. The State of Georgia performed a fishery survey in the Savannah River from July 1980 to June 1985 (Schmitt and Hornsby, 1985). They found that numerically, the striped mullet (Mugil cephalus) was by far the most abundant species sampled in the estuarine habitat followed by largemouth bass (Micropterus salmoides) and bowfin (Amia calva). Biomass in the estuary was composed primarily of common carp (Cyprinus carpio), bowfin and spotted sucker (Minytrema melanops). Compared to the non-game species, game fish were poorly

represented in the estuarine habitat. The principal species harvested in the estuarine portion of the river were shown to be croaker/spot (Micropogon undulatus /Leiostomus xanthurus), white catfish (Ictalurus catus), silver perch (Bairdiella chrysura), and spotted seatrout (Cynoscion nebulosus). Weights of fish harvested were represented principally by white catfish, red drum (Sciaenops ocellata), striped bass (Morone saxatilis), spotted seatrout, hardhead catfish (Arius felis), bluefish (Pomatomus saltatrix), and channel catfish (Ictalurus punctatus). Anadromous fish collected in the estuarine habitat included striped bass, American shad (Alosa sapidissima), hickory shad (Alosa mediocris), and blueback herring (Alosa aestivalis). Though neither species was encountered during the sampling by the State, both Atlantic sturgeon and shortnose sturgeon are known to inhabit the Savannah River estuary. In fact, shortnose sturgeon fingerlings are periodically released into the system by the FWS.

6.53 Each spring and fall, the main Savannah River, Back River, Middle River, and the numerous interconnecting tidal streams are hosts for the migration of three members of the herring family - (American shad (Alosa saoidissima), hickory shad (Alosa mediocris), and blueback herring (Alosa aestivals)), and the striped bass (Morone saxatilis), which are very important game and/or commercial fish. American shad enter the Savannah River in mid-January and begin spawning in mid-April. The river temperature at spawning is between 54 degrees F and 70 degrees F. The young shad leave the river in autumn; all are gone by December. Shad spawn in the main river, further upriver than do striped bass. The American shad is the most valuable commercial anadromous fish in the southeast.

6.54 Hickory shad enter the Savannah River in early January, begin spawning in the tributaries in March and complete spawning in April. Water temperature at spawning is between 64 degrees F and 69 degrees F. The young hatch 2-3 days after eggs are laid and leave the river from July to October. Blueback herring, which also enter the river in March and April, must have water temperatures of around 70 F to spawn.

6.55 Anadromous striped bass enter the Savannah River for their spring spawning runs in March, April, or May. The river temperature must be between 58 degrees F and 64 degrees F, and the salinity must be less than 1.7 ppt for optimum spawning success. The striped bass is a free spawner; the eggs must be suspended in the water, as they float with the river currents before they hatch 36-72 hours after being laid. The last eggs to be observed in the river are usually found at the end of May. Adult striped bass leave the river in August. One group of juveniles leaves the river in October and November when the water begins to cool; a second group apparently does not migrate. The largest traditional spawning site in the Savannah River basin is in Back River, 23 miles upstream from the mouth of the Savannah

River. However, population levels have been much lower in the last 20 years and a higher proportion of the spawning now appears to be occurring in the Savannah River a few miles upstream of the harbor (over 21 miles upstream from the mouth of the Savannah River).

6.56 Most striped bass along the east coast are considered to be anadromous; however, some populations have been found to complete their lives entirely in fresh water (Scruggs and Fuller 1955, McIlwain 1968). An upstream and downstream race of striped bass has been identified in the Cooper River, South Carolina (Raney 1952), and other races of these fish have been identified in particular rivers (Morgan et al. 1973). Studies done on striped bass in the Savannah River indicate they spend much of the year in freshwater, much like those elsewhere in the southeast (Dudley et al. 1976). The Savannah River population appears to be primarily riverine, rather than anadromous, (Dudley, Mullis, and Terrell, 1976), and reproduces in the various river channels near Savannah. Research conducted by Environmental and Chemical Services, Incorporated, in 1983 for E. I. duPont de Nemours and Company to determine density and distribution of ichthyoplankton in the upper Savannah River, indicated that some striped bass spawn in the vicinity of the Savannah River Plant. From the available research done on striped bass in the Savannah River, it appears that some are riverine, while others are anadromous. A major spawning ground for striped bass in the estuary was historically located in the Back River upstream of New Cut (Gilbert et al. 1985), while other spawning takes place in the Savannah River above the upper limits of the harbor. Back River functioned as a major spawning site prior to construction and operation of the Tide Gate. However, recent studies found very few eggs in the Back River, with most eggs collected from the harbor being found in the Front River. Low population levels have occurred in the Savannah River Striped bass population in the last 10 years. The present status of striped bass recovery and habitat use in the lower Savannah are unclear.

6.57 Due to the sensitivity of Striped bass to some environmental parameters, the State of Georgia has placed restrictions on dredging in the harbor to protect the remaining population. To obtain up-to-date information on this species, Savannah District is funding studies to determine the timing, distribution and numbers of Striped bass eggs and larvae in the harbor. Those studies began in 1994 and are now scheduled for completion in 1997. Until those field studies are complete and the results fully analyzed, questions will still remain about potential impacts to Striped bass eggs and larvae from dredging operations. Therefore, to remain in compliance with the Georgia Water Quality Certification and avoid possible impacts to the Striped bass population of the Savannah estuary, dredging will continue to be restricted to the lower harbor (River Mile 5.0 to 0.0) and the Bar Channel during the period from March 15 to May

31 of each year. Case-by-case exceptions to that condition require prior approval from GA DNR and the SC DHEC-OCRM. Should future research indicate that this restriction is unnecessary to protect Striped bass, the District would follow procedures agreed to by the state resource agencies.

6.58 Commercial and sport fishing within Savannah Harbor is low due to heavy vessel traffic levels and recurring maintenance dredging which removes bottom habitat and limits benthic communities. Several marine finfish taken around the mouth of the harbor include spotted sea trout, spot, croaker and other bottom species. Cobia and tripletail provide for a limited amount of sport fishing in the outer channel.

6.59 Wildlife Resources.

6.60 The Savannah National Wildlife Refuge (SNWR) is located on the uppermost reaches of Savannah Harbor and encompasses both impounded and unimpounded wetlands and marshes. The refuge consists of 26,500 acres of palustrine forested wetland, palustrine and estuarine emergent wetland, palustrine scrub-shrub wetland, riverine wetland, managed waterfowl impoundments and upland. Some high ground habitat can be found along the impoundment dikes and on scattered hammocks through the refuge. This facility serves as a wintering area for thousands of waterfowl and wading birds each year. Migratory warblers also pass through this area to and from their winter and summer habitats. SNWR provides feeding and nesting habitat for wood ducks and many species of wading birds, and habitat for several endangered or threatened species. Deer, feral hog, otter, marsh rabbits, mink, raccoon, opossum, and other mammals can be found year round in the area. Alligators, frogs, several species of turtles, and snakes also inhabit the refuge. Throughout the year, the naturalist, photographer, birdwatcher or other visitor can find a rich array of species inhabiting or migrating through this wildlife refuge. Approximately 213 species of birds have been observed at the refuge.

6.61 Private landholdings downstream and adjacent to the Refuge on the South Carolina side also provide habitat for species similar to those found at the refuge. These areas are managed primarily for hunting and provide habitat for deer, quail, hogs, waterfowl, snipe, and doves. Alligators and other reptiles and amphibians are found on these lands with numerous species of birds and mammals. Several recreationally important nongame wildlife species use these lands in large numbers. Red-tailed hawks (Buteo jamaicensis), red-shouldered hawks (Buteo lineatus) and marsh hawks (Circus cyaneus) are frequently seen hunting over the impoundments and marshes. The cypress/gum swamp on the northern part of the area contains a wading bird rookery with approximately 250 nests. Species using this area include snowy

egret (Egretta thula), anhinga (Anhinga anhinga), yellow-crowned night heron (Nyctanassa violacea), black-crowned night heron (Nycticorax nycticorax) and great blue heron (Ardea herodias).

6.62 Dredged material disposal areas used for harbor operations and generally located on the north side of Savannah Harbor are also inhabited by numerous species of wildlife similar to those found at the Savannah NWR and surrounding areas. Nesting terns and plovers can be found on the more sandy areas during spring and summer. Along the canals and inner ditches, wading birds and shore birds congregate and feed. Depending on the amount of water available and time of year, large numbers of waterfowl can be found in the impounded disposal areas. One section of former disposal area and one currently designated disposal area, consisting of portions of Bird Island, Cockspur Island, and Jones-Oysterbed Island, is designated as part of the Tybee Island National Wildlife Refuge. The 400-acre site serves as a resting spot for pelicans, seagulls, egrets, herons, and other birds. Nesting terns claim a part of the refuge to raise their young. Feral hogs, deer, raccoons, opossums, otters, rodents, and other mammals are also found on this site.

6.63 Migratory Birds. Many species of migratory birds use the harbor's confined upland disposal areas. A variety of species of birds are regularly observed in the scrub/brush habitat that surrounds the disposal areas. That habitat is present to some degree on other uplands throughout Chatham County. However, the existing confined disposal facilities provide unique habitat in the Project area for certain species of migratory birds. The disposal areas provide nesting habitat for only a limited number of migratory bird species; but, those species include some of special concern such as least tern, black-necked stilt, and Wilson's plover. Many other species of birds use the disposal areas outside the breeding season; some in high numbers. These avian species are discussed in detail in the following paragraphs in two groups, those using the disposal areas for nesting and those using those sites outside the nesting season.

6.64 Birds which use the confined disposal facilities during the breeding season can be broken into ten major groups as described below. The first eight groups are various species which frequently breed at the confined disposal facilities. The ninth group, Sporadic/Uncommon Nesters, consists of species which are known to breed at these sites, but that breeding does not occur regularly. The tenth group, Other Birds, consists of other species which nest in vegetation located on the outside of the dikes. In these sections, where no fledging times are available, 28 days is assumed to be the fledging period (time in which flightless young would be present at the site). It is also assumed necessary to have nesting habitat available two weeks prior to egg laying for courtship and nest site selection.

6.65 **Group #1.** Least tern. Nests for Least terns are depressions in sand. Egg dates are May 4 to July 26 (Post & Gauthreaux, 1989, and COE disposal area data). Chicks are expected to leave the nest within one day of hatching, but remain in area. Fledging is reported to occur 20 days after hatching (Wilbur, 1974, in COE, 1980). Flightless young would be expected no later than about August 15.

a. Nesting habitat: High, open sandy areas, especially with scattered pebbles and small shells. Generally nest on gradual hillside slopes. Areas usually have sparse scattered vegetation and other wood debris. Nesting area should be available April 20 to August 6.

b. Feeding habitat: Open water. Often seen feeding in the Wright River area. Have also been seen feeding in deep water within the confined disposal areas.

c. Resting habitat (after nesting is complete): Open flats and bars associated with shallow water.

6.66 **Group #2.** Black-necked stilt. Nests are usually loose collections of decaying plant stems. These may be formed of loose collections of shell and clay fragments. Egg dates are May 14 to July 10 (Post & Gauthreaux, 1989). Chicks are expected to leave nest within 1 day. Flightless young are expected no later than about August 13.

a. Nesting habitat: Nesting areas should be available May 1 to August 7. This species has been observed to nest in several different habitats within the confined disposal areas; (1) sandy ridges with scattered vegetation close to open water ditches, (2) silt/clay substrates, (3) bare mounds in rough broken terrain within 50 yards of open shallow water. Mounds are generally 1 to 4 feet in diameter and raised 1 to 2 feet above the surrounding dirt, (4) small (no more than 1 by 2 foot) slightly elevated bare mounds surrounded by open shallow water. Nests may also be built on mounds with scattered vegetation. Howe (1989) lists the following nesting sites as being typical for this species:

(1) Open flats or the edge of short grassy vegetation, usually where visibility is excellent in all directions.

(2) Clustered nesting (semi-colonial) rather than evenly distributed in suitable habitat. "Interest distance" may be 10 to 100 feet, as the birds adjust nest density to habitat conditions.

(3) Small islands in large pools are particularly favored nest sites.

b. Feeding habitat: Open shallow water and water edges within the disposal areas. Adults have also been seen

feeding at low tide on mud flats along Wright River.

c. Resting habitat (after nesting is complete): Open flats, bars, open shallow water, water edges, gently sloping grass hillsides (late in season).

6.67 **Group #3.** Wilson's plover. The nest is a shallow depression in sand, often associated with wood debris. Egg dates recorded in the Corps Disposal Area Data include: April 28, 1993, 2 eggs; and July 30, 1993, 1 egg and 2 chicks. Bent (1926) lists egg dates of April 14 to June 21. Chicks are expected to leave the nest within 1 day. Flightless young might be expected no later than about August 28.

a. Nesting habitat: Similar to the least tern, but may include areas with taller vegetation and more debris. Nesting habitat should be available from April 14 to August 28. According to Howe (1989), nests are rarely closer together than 35 m.

b. Feeding habitat: Seen foraging in nesting habitat. Also seen foraging in open damp areas adjacent to open shallow water.

c. Resting habitat (after nesting is complete): Generally the same as the feeding habitat. Most often seen resting on open flats and flats with scattered vegetation.

6.68 **Group #4.** Willet. The nest is made of grasses and placed on the ground in open grassed areas under overhanging grass stems. Egg dates are reported by Post & Gauthreaux, 1989 as being from March 10 to June 16. Chicks expected to leave nests within 1 day. Flightless young are expected no later than about July 14.

a. Nesting habitat: Nests within the disposal areas in tall grass areas (1 to 2 feet tall) where the grass grows in clumps, usually nests on road shoulders. Nesting habitat should be available March 1 to July 14. According to Howe (1989), willets nest throughout the high marsh and neighboring grassy dunes or man-made upland habitats, but ideal nesting cover is dense Spartina patens.

b. Feeding habitat: Within the disposal areas, feeds on damp and wet flats with or without scattered vegetation. Also seen feeding along edge of water.

c. Resting habitat (after nesting is complete): Generally the same as the feeding habitat. Most often seen resting on open flats and flats with scattered vegetation.

6.69 **Group #5.** Nighthawk. No nests have been found within the disposal area. Reported egg dates are from Apr 29 to June 23 (Post & Gauthreaux, 1989) and from May 17 to July 13 (Bent, 1926). District Disposal Area Data include a young chick on July 11, 1994 and a very young chick on July 8, 1995. Flightless young are expected for about 3 weeks (Bent, 1926).

a. Nesting habitat: Adults are seen on sand hills and flat sandy areas with scattered wood debris. Young chicks are found in open sandy area near wood debris and scattered weeds. Nesting habitat should be available April 15 to August 3.

b. Feeding habitat: Open air. Catches insects while flying. Feeds in open areas or above woods.

c. Resting habitat: Seen resting on wood debris in open areas with sparse vegetation. Will also rest in trees with open branches.

6.70 **Group #6.** Killdeer. The nest is an open depression lined with pebbles or shell fragments. Reported egg dates are from Mar 14 to July 9 (Post & Gauthreaux, 1989). District Disposal Area Data include a washed out nest on July 18, 1995 with 4 eggs present, and a bird incubating 2 eggs on that nest on August 28, 1995. Chicks are expected to leave the nest within one day. Flightless young are expected no later than about August 6, but may occur as late as September 25.

a. Nesting habitat: Nests in open areas. Areas may or may not contain scattered to moderate grasses and weeds. Nesting habitat should be available March 1 to August 6.

b. Feeding habitat: Seen feeding in nesting habitat. Also frequents damp flats and edges of water, with or without scattered short vegetation.

c. Resting habitat: Same as feeding habitat.

6.71 **Group #7.** Common moorhen (common gallinule). Reported egg dates are from April 9 to July 18 (Post & Gauthreaux, 1989). Young are expected to leave the nest within 1 day of hatching. Flightless young could be expected until August 15. No nests have been found within the disposal areas, but flightless young have been seen. Nesting habitat consists of damp and wet areas with tall vegetation. Found mostly in areas that stay wet for a long time. Feeding and resting areas would be the same. Nesting habitat should be available March 26 to August 15.

6.72 **Group #8.** Mottled duck. No nests have been found within the disposal areas. However, flightless young have been seen, including a total of 18 at two disposal areas on April 28, 1995. These birds are generally thought to be descendants of released birds. No egg dates are reported. Nesting habitat consists of damp and wet areas with tall vegetation. This species is found mostly in areas that stay wet for a long time. Feeding and resting areas would be the same. Occasionally seen resting on grassed dike shoulders.

6.73 **Group #9.** Sporadic/Uncommon Nesters. This group consists of those birds which are known to breed at the confined disposal facilities, but not regularly or recently.

a. Gull-billed tern. Has been observed nesting on bare sand mounds within Disposal Area 12A during the general period of 1970 to 1974 (US FWS, John Robinette, personal communication). Egg dates in South Carolina are May 8 to July 18 (Post & Gauthreaux, 1989). It is estimated that nesting habitat should be available from April 24 to August 14. Feeds on insects while flying low over marshes.

b. Black skimmer. Has been observed nesting on bare sand mounds within Disposal Area 12A during the general period of 1970 to 1974 (US FWS, John Robinette, personal communication). Egg dates in South Carolina are from May 10 to July 20 (Post & Gauthreaux, 1989). It is estimated that nesting habitat should be available from April 26 to August 16. This species would be expected to feed on small fish, primarily on the surface of tidal creeks outside the disposal sites.

c. Least bittern. Has recently been observed nesting in cattails in Disposal Area 13B (US FWS, John Robinette, personal communication). Egg dates in South Carolina are April 17 to July 20 (Post & Gauthreaux, 1989). It is estimated that nesting habitat should be available from April 3 to August 16. Nests are placed in cattails and other vegetation above shallow water (Bent, 1923). This species would be expected to feed on wet, but exposed areas within the disposal sites.

d. Pied-billed grebe. Sightings of downy young were reported in the Disposal Area 13B in 1993 (US FWS, John Robinette, personal communication). Egg dates in South Carolina are April 5 to September 18. It is estimated that nesting habitat should be available from March 22 to October 16. Floating nests are usually build over water less than 3 feet deep (Bent, 1919). This species would be expected to feed in inundated vegetated areas within the disposal sites.

6.74 **Group #10.** Other birds. A few other bird species may nest in vegetation within the disposal areas, but no nests have been found. Most likely nesters would include red-winged blackbird and common yellowthroat. Many other species nest within older vegetation existing along the outside of the dikes. These species include mourning dove, ground dove, painted bunting, prairie warbler, eastern kingbird, carolina wren, marsh wren, boat-tailed grackle, mockingbird, brown thrasher, catbird, yellow-billed cuckoo, cardinal, rufous-sided towhee, orchard oriole, loggerheaded shrike, red-bellied woodpecker, downy woodpecker, blue jay, Carolina chickadee, yellow-breasted chat, tufted titmouse, and bobwhite. One of the rarer species resident in the brushy areas of the disposal area is the ground dove.

6.75 Birds which use the confined disposal areas during non-breeding periods (includes non-breeding species occurring during the summer months) can be broken into the following five major groups:

a. Shorebirds. At least 33 species of shorebirds have been recorded in the disposal areas in recent years. Peak spring migratory periods for the southeast are reported as late March to late May (Helmers, 1992) and mid-April to late May (Howe, 1989). Peak fall migration is reported as August to early November (Helmers, 1992) and mid-July to mid-September (Howe, 1989). The highest numbers of migrating shorebirds in the disposal areas have recently been observed to occur between late April to early June (highest in May) and early July to early November (highest from July to September). The highest number of species usually occur in late April, May, and July. Bird counts exceed 20,000 to 30,000 birds during peak migration. Highest counts of wintering shorebirds occur from December to February.

The disposal areas are well known for attracting large numbers of migrating shorebirds, with several species being recorded there in larger numbers than anywhere else in South Carolina. Post & Gauthreaux (1989) list the harbor's confined disposal areas as the location for the highest counts of avocets (450) and black-necked stilts (450). Recently (July 16, 1993), 976 black-necked stilts were observed in the disposal areas. Other shorebird species have recently been recorded in the confined disposal areas in numbers that exceed the maximums listed for South Carolina in Post & Gauthreaux (1989). The species for which this has occurred are as follows:

(1) semi-palmated plover - 1600, May 18, 1993 and 1654 (Tom Smith, May 17, 1991; the previous record was 1300 in May 1984 (P&G, 1989);

(2) lesser yellowlegs - winter maximum of 150 on Dec 16, 1989, and 30 to 100 unidentified species on Feb 16, 1994; the previous record was 22 recorded on Dec 22, 1980 (P&G, 1989);

(3) Wilson's phalarope - 15, sighted on September 17, 1988; the previous fall coast record was 1 (P&G, 1989);
(4) stilt sandpiper - 700, sighted on May 18, 1993; the previous record was 40 in 1984 (P&G, 1989); and
(5) white-rumped sandpiper - 171, sighted on June 4, 1993; the previous record was 35 in May 1986 (P&G, 1989).

b. Waterfowl (ducks, geese, and swans). Twenty-three species of waterfowl have been recorded recently in the confined disposal areas. Dominant species wintering in the areas are blue-winged teal, green-winged teal and northern shoveler. The highest numbers have been seen from October to March. Blue-winged teal have been seen in the disposal area in July (3 seen July 11, 1994); green-winged teal have been seen in SC as early as August 16 and shovelers have been seen in SC as late as June 6 (Post & Gauthreaux, 1989). About 1,000 to 4,000 ducks commonly spend the winter in the disposal areas.

c. Herons, egrets, ibis, and wood stork. Most species, except the cattle egret and wood stork can be expected to occur in the disposal areas throughout the year, but more commonly during the summer months. Highest numbers are usually encountered from May to June and September to October. Cattle egrets are most likely to be seen during the summer, while wood storks are most likely to occur from August to October. Maximum recent counts are 490 great egrets and 120 snowy egrets in May 1994 and 439 white ibis in October 1993.

d. Gulls and terns. Various gulls feed near the head section discharge pipe when disposal operations are underway, primarily laughing gull, ring-billed gull, and a few herring gulls. Open flat areas, usually near water, serve as resting areas for many species throughout the year. With the exception of least terns, which nest in the disposal areas, other species of terns rest on open flats and bars at various times throughout the year. Fifteen species of gulls and terns were recently recorded in the disposal areas. Records indicate a high count of 665 gulls and terns of various species in the disposal areas in December 1995. Highest numbers are generally seen from December to March and May to June.

e. Other birds. The woodlands and grassy areas bordering the disposal areas contain a large variety of birds, with the species composition and numbers dependant on the time of the year. Large numbers of tree swallows feed at the disposal areas at certain times of the year (over 10,000 individuals have been seen feeding over the disposal areas in October). In addition, small numbers of many uncommon species have been sighted in the areas from time to time.

6.76 Several distinct areas constitute the existing major bird habitat features at the middle harbor confined disposal areas. Three sandy areas of at least 3 acres were available and used for nesting by least terns and other species in 1994. Nesting is thought to have been more successful in the two newer areas. None of the areas are isolated from predators and the two newer sites are expected to be less successful in the future. At least 3 acres of successful sandy nesting area have been present each year. An additional area of at least 50 acres of black-necked stilt habitat is generally available, although it is usually subject to drying and nesting failures. At least 100 acres of spring and fall migrant shorebird feeding habitat has been available, and probably the same amount of winter waterfowl/shorebird habitat.

6.77 Analyses were performed to identify the amount of acreage of various bird habitats which occur for some period of time within each middle harbor disposal site. Those analyses are summarized in Table 9.

6.78 The estuarine marshes which line the Savannah River at locations along its entire length are also areas which support wildlife. Cormorants, seagulls, mergansers, hawks, herons, egrets, ibis, rails and terns can be found resting and feeding in many of these areas. Diamondback terrapins and occasionally alligators also inhabit these estuarine wetlands, along with such mammals as otters, raccoons and minks.

6.79 Cultural and Historic Resources.

6.80 Overview. Savannah Harbor is a culturally rich area. The city of Savannah which directly adjoins the harbor was founded as a seaport in 1733. Savannah was the first "planned" city, as its grid of streets and squares was laid out when it was initially settled. Since the port has been a component of the city from its beginning, extensive maritime facilities were constructed along the shoreline. Since vast quantities of cargo have moved through the port for years, the harbor was heavily involved in the Civil War. Fortifications were built along the river, some of which remain today.

6.81 For the harbor, cultural resources can be divided into four major groups: wrecks, harbor modifications, terrestrial sites, and miscellaneous. The wrecks group includes all watercraft lost in the harbor, including those which were intentionally sunk to aid or impede navigation.

TABLE 9

CURRENT ACREAGE OF BIRD HABITAT
MIDDLE AND LOWER HARBOR CONFINED DISPOSAL FACILITIES
(IN ACRE-YEARS)

DISPOSAL AREA	USABLE SIZE	BARE GROUND NESTING	WETLAND NESTING	SHOREBIRD FEEDING	WATERFOWL FEEDING
12A	1117	13	59	150	47
12B	692	2	24	115	12
13A	669	--	---	75	6
13B	558	--	68	72	65
14A	815	--	154	128	266
14B	754	--	26	68	27
J/O	889	--	53	96	18
TOTAL	5,494	15	384	703	441

NOTE: Useable size was calculated from 1993 aerial photographs. The size listed for Disposal Area 14A is what is within the area being considered for diking.

6.82 Harbor modifications include all structures, except wrecks, put in the water to improve or impede navigation. Examples include obstructions; docks; wharves; and training walls. Terrestrial sites include prehistoric and historic archaeological sites, and standing structures which were designed and constructed on land. Indian shell middens and Old Fort Jackson are examples of this type of site.

6.83 The miscellaneous group includes all other resources. Examples include randomly dumped ballast piles, objects dumped into the river, and objects which have eroded into the river and are out of their original context.

6.84 Each of these groups will be described in the following paragraphs to put in context further discussions about the cultural resource investigations which have been conducted along portions of the river and the historic properties which have been identified.

6.85 Historical Context.

6.86 Wrecks. There are numerous accounts of vessels lost in the harbor. In 1980, Dr. Ervin Garrison conducted an archival search for reports of wrecks in the harbor. Savannah District personnel initiated an ongoing detailed shipwreck study of the Savannah Harbor area in 1987. These studies found records of many vessels lost in the harbor or on the bar. Some sank as a result of environmental and accidental circumstances; weather, fire, explosions, or grounding. Others were intentionally sunk in the Cross Tides and Fig Island Channels to improve navigation, or were sunk during times of war to impede navigation or avoid capture. Many more were abandoned along the banks when they had outlived their usefulness.

6.87 Some of the wrecks were refloated. Other wrecks were partially or totally salvaged; while others, if not obstructing traffic, if damaged beyond repair, or if lost in irretrievable environments, were left in the harbor. Many wrecks were never recorded and/or their final disposition is unknown or unclear. Wrecks reported as removed may have been totally salvaged or dragged to the side and abandoned.

6.88 The condition of a wreck is a product of both man-made and natural forces. Vessels lost in saline environments, unless buried under layers of sediment, have been impacted by marine borers. Saltwater intrusion caused by earlier harbor improvements has resulted in damage to wrecks which were originally lost in fresh water.

6.89 Some wrecks, such as those located in the Cross Tides and Fig Island Channels, were buried under disposal material when the channels were filled. Other wrecks have been impacted by previous harbor dredging, prop wash, shrimping, and unsuccessful or partial salvage attempts.

6.90 Only one wreck in the harbor has been positively identified and evaluated for significance, the CSS GEORGIA. This wreck is located across the river from Old Fort Jackson. The vessel was a Confederate ironclad scuttled in December 1864 to prevent her capture. She was struck by a dredge in 1968 during widening of the channel, and the vessel was impacted during maintenance dredging in 1969, 1970, 1974, and 1983. She was listed in the National Register of Historic Places in February 1987.

6.91 Harbor Modifications. The harbor has been altered by man since the 18th century. The modifications had three major purposes: to improve navigation, to provide docking facilities, and to impede harbor navigation during times of war. The first of these purposes, to improve navigation, is detailed at length in "Savannah Harbor, Its Origin and Development: 1733-1890" by M. L. Granger. Early harbor work was performed sporadically by the city, Commissioners of the Port and Pilotage, and U.S. Treasury Department. U.S. Army Corps of Engineers involvement began in 1826 but was limited to surveys until 1852 when it became the lead agency involved in navigation improvements to the near exclusion of others.

6.92 Most major navigation structures were built in a coordinated effort during the last quarter of the 19th century. They included training walls; wing dams; closing dams, and spur dikes. The overall purpose of the improvements was to restrict the major portion of the river's flow into a single channel for a deeper, faster flowing, and self-scouring navigation channel. The locations of these early structures are known and most are extant. Some are buried under dredge disposal material while others are still functioning. They are located throughout the harbor.

6.93 Little research has been conducted on early docking and mooring facilities in the harbor. Most structures were located from Old Fort Jackson to the Talmadge Memorial Bridge, the most industrialized portion of the harbor. This area has been subjected to the most disturbance. Only one 18th century wharf is known to remain and most of the few remaining 19th century structures are threatened by other port developments.

6.94 During the Revolutionary and Civil Wars, obstructions were placed in the channel to impede enemy navigation. During the first war, they consisted mostly of wrecks which are discussed elsewhere. During the Civil War, a labyrinth of cribs, pilings,

and wrecks were placed in various channel areas. The locations of the obstructions, as well as drawings of two crib designs, are shown on the Gillmore map of 1871. Most obstructions were removed shortly after that date. Some cribs located near the banks and away from the navigation channel were left in place. Those not covered by fill are being impacted by marine borers.

6.95 Terrestrial Resources. Prehistoric terrestrial resources in the harbor vicinity date from the Archaic through Mississippian Periods. They can be found in environments which range from low marsh to high bluff.

6.96 Historic terrestrial resources have been researched more than any others around the harbor. Of these, standing structures have been best documented and protected. Savannah boasts one of the nation's largest urban National Historic Landmark Districts, a portion of which borders the harbor.

6.97 Historic archaeological sites around the harbor are being destroyed at a rapid rate. There is a good market for historic period artifacts and an active bottle-hunting population to supply it. In addition, a number of historic archaeological sites have been buried under disposal material or are eroding into the harbor.

6.98 Miscellaneous. These resources consist of random ballast piles and objects which have been dumped or eroded into the water. These include ordnance, ship parts (e.g, old boilers), trash, and similar objects. While these objects have probably been moved around and resorted and, thus are out of context, some still may have significance.

6.99 Significant Cultural Resource Investigations. Numerous cultural resources investigations have been conducted within and in the vicinity of the Savannah Harbor Navigation Project. Only the more important surveys are described here.

6.100 In 1973, Savannah District contracted with the University of Georgia to conduct a survey of portions of the areas to be affected by the construction of the sediment control works. This survey area was to include the Tidegate construction area and proposed new disposal areas. At the time of the survey, construction of the Tidegate had already been initiated and only the disposal areas could be surveyed. Two prehistoric archaeological sites were located and judged potentially eligible for inclusion in the National Register of Historic Places.

6.101 In 1984, Savannah District contracted with Southeastern Archeological Services, Inc. to conduct a survey of the southern shoreline of Hutchinson Island prior to construction of improvements to Navigation Project. The survey identified two

sites that were believed eligible for inclusion in the National Register of Historic Places; Willink's Marine Railway and the Fig Island Channel Site. Willink's Marine Railway was later determined eligible for inclusion in the National Register and documented as part of a Section 10 and 404 permit for P.D. Oil and Gas Company wharf and slip construction. The work was carried out by Armstrong State College. Two vessels contained within the Fig Island Channel Site were recorded as part of the 1989/1990/1991 Harbor Widening project. The work was carried out by Tidewater Atlantic Research and S.S.I.

6.102 In 1987, a derelict vessel was noted eroded from the south shore of Hutchinson Island near Station 76+000. The vessel was subsequently determined eligible for the National Register and was the subject of a data recovery effort performed by O.S.M. Archaeological Consultants in 1988.

6.103 In 1992, the District contracted with Tidewater Atlantic Research, Inc. (TAR) to conduct a survey of the areas to be affected by the proposed Savannah Harbor Deepening Project. The survey included archival research, remote sensing, and shoreline inspection. The archival research concentrated on the existing disposal areas, the harbor navigation channel from Stations -60B+000 to +103+000, and the harbor in general. Remote sensing investigations included proton magnetometer, sidescan sonar, and sub-bottom profiler studies of the toes, sideslopes, and top of sideslopes of the navigation channel and the King's Island Turning Basin.

6.104 All but one of the anomalies identified by TAR were investigated by Savannah District and contract archaeological divers. None were found to represent significant cultural resources. The remaining anomaly was determined to be just outside the area of effect for the Deepening Project. In consultation with the Georgia State Historic Preservation Officer, it was agreed that before and after hydrographic surveys would be conducted in the anomaly vicinity to determine if harbor deepening resulted in some effect. The surveys were accomplished and no change in bottom profile was noted.

6.105 Only one shoreline site, the Fig Island Channel Site, was recommended for data recovery as part of the Deepening Project. From September 1993 to January 1994, nine data recovery contracts were carried out. Over 20 historic vessels and vessel remnants and a marine railway were excavated and documented for Savannah District by TAR, Mid-Atlantic Technology, and Panamerican Consultants.

6.106 In 1992, Savannah District contracted with TAR to conduct a survey of the areas to be affected by the Section 1135 Project to remove the Tidegate from operation and close New Cut. The survey included archival research, remote sensing, and shoreline

inspection of Back River from its mouth at the eastern end of Hutchinson Island to New Cut. The remote sensing survey included proton magnetometer, sidescan sonar, and sub-bottom profiler investigations of all submerged areas above the Tidegate and the toe, sideslope, and area between the top of sideslope and the high water mark below the tide gate. Seven magnetic and sonar targets and seven shoreline sites were identified and recommended for further evaluation. Cultural resources in the channel and along the shoreline of Back River have been addressed as part of the Section 1135 Project and cultural resources in that area (upstream of the Tidegate) are no longer within the potential impact area of the Savannah Harbor Navigation Project.

6.107 In 1993, Savannah District inspected the shoreline below the Tidegate and found that the sites were unaffected by the New Cut Closure Project. The District also inspected each of the anomalies using sidescan sonar and found no evidence for erosion and no effect from the New Cut Closure Project.

6.108 Also in 1993, the District contracted with had Mid-Atlantic Technology, Inc. (MAT) to conduct a survey of the remaining portions of the Savannah Harbor Navigation Project that had not been investigated as part of the New Cut Closure Project and Savannah Harbor Deepening Project. The survey area included the toes, sideslopes, and tops of slopes for all remaining turning basins (e.g. all except Kings Island) and the navigation channel from Stations 103+000 to 112+500.

6.109 As a result of these surveys, the entire riverine portion of the Savannah Harbor Navigation Project has been surveyed for cultural resources. This includes the underwater portion of the river, the adjacent river shoreline, the Bar Channel, and an area along the sides of the Bar Channel. All cultural resources have been identified and where impacts from operations were occurring, documentation has been conducted or is underway. The Memorandums of Agreement (MOAs) contained in this EIS for the remaining two significant sites, Old Fort Jackson and the CSS GEORGIA, specify the Corps future actions concerning those resources.

6.110 Identified Historical Properties.

6.111 A. Federal Lands Owned or Administered by Savannah District.

6.112 U.S. Army Corps of Engineers Depot.

6.113 The Engineer Depot is located on a portion of the Fig Island Channel Site. The site is located at the former mouth of Fig Island Channel, a channel that once separated Fig Island from Hutchinson Island. Beginning as early as 1804, local interests attempted to close this channel by placing derelict shipwrecks in

its mouth. This practice continued until the first quarter of the 20th century. Savannah District constructed a pile dam across the mouth in 1854, wing dams in the 1870's and 1880's, and a training wall in the 1890's. The area behind the training wall was backfilled with dredged material, completely blocking the old channel and creating high ground suitable for development. The archaeological site stretches for about 1,750 along the south shore of what is now known as Hutchinson Island. The extent of the site inland has not been determined. The Engineer Depot occupies the eastern 750 feet of the site. The shoreline portion of the site within the Depot area is protected by a bulkhead.

6.114 The Fig Island Channel Site was determined eligible for inclusion in the National Register of Historic Places. The site is significant at the local level under National Register criterium d. for its ability to provide information important in history. The channel contains the stripped and derelict remains of a large number of watercraft that once navigated Savannah Harbor. Studies of these poorly documented craft can provide new information on vessel types used historically in the harbor, vessel repair techniques, and on vessel abandonment. Questions about how long various vessels were in use, the uses to which various vessel designs were put, reuse of vessels over time, and reasons and procedures for abandonment can be addressed. Additional research questions concerning the methods that were used to prepare vessels for use as obstructions can also be addressed.

6.115 Excavations were carried out in 1991 and 1994 on non-Depot portions of this site as part of the mitigation for impacts associated with the 1989/1990/1991 Harbor Widening and 1993/1994 Deepening Projects. In the Engineer Depot portion of the site, with the exception of the boat ramp area, archaeological deposits are buried from 10 to 20 feet beneath dredge material. Present operation and maintenance practices at the Depot have no effect upon the site. However, any proposal to modify the bulkhead wall or boat ramp, or to construct facilities requiring ground disturbance to a depth of more than 10 feet would need to be evaluated for their effect upon this site.

6.116 Tidegate and Access Areas.

6.117 Since the Tidegate was already under construction at the time of the 1973 University of Georgia survey, this area was not surveyed prior to construction disturbance and backfilling to create a higher land surface. Archival research has revealed that the Hutchinson Island Tidegate access area was the site of Spaulding Plantation. An 1812 map indicates that main plantation village was located in the access area. It is not known if the archaeological remains of this occupation were destroyed during construction of the Tidegate. This area has been covered with fill material and the shoreline is riprapped. Present uses of

the access area are surficial in nature and do not affect any remaining buried archaeological deposits. If any new construction or use of the area is proposed involving excavations below +9 feet MLW, deep archaeological testing would need to be conducted to determine the existence and significance of remaining archaeological deposits.

6.118 B. Disposal Areas.

6.119 Only one confined disposal area, Area 12A, was surveyed prior to use. Two resources were identified as a result of that survey, Sites 38 JA 23 and 38 JA 24. The first, Site 38 JA 23, was described as a shell midden approximately 5-feet high, 80-feet wide and 180-feet long. Observed ceramics indicated an occupation spanning 800 B.C. and A.D. 1100. This site was located along the proposed north dike alignment. Impact was avoided during construction by realigning the dike away from the site. In 1981 information was received that unauthorized individuals were using the dike road to enter the area and loot the site. Inspection revealed that, while the dike missed the site, mosquito control ditches had ringed and bisected it. The mosquito control activity was stopped and the gate providing access to the area was locked.

6.120 A second, higher dike has been built inside the disposal area adjacent and parallel to the old dike. It is the inner dike that is now maintained and used as the access road. A 1994 inspection revealed that the site is not being impacted by dike modifications and maintenance.

6.121 This site is potentially eligible for inclusion in the National Register of Historic Places. It is not being impacted by Savannah Harbor Navigation Project activities. The gate providing access to the area is kept locked. Savannah District and Georgia Department of Transportation personnel monitor the area for trespassing and looting.

6.122 Site 38 JA 24 was identified as a sand mound 2-feet high, 200-feet long, and 60-feet wide. The site was believed to be a small burial mound dating sometime between A.D. 0 and the historic period. The site was subsequently buried by disposal activities.

6.123 Archival research was conducted by TAR on the existing upland confined disposal areas as part of the 1993/1994 Deepening Project. The research concentrated on old maps and documents that might indicate occupation and use of the areas. The draft report of this research has not been submitted.

6.124 The Ferry Wharf was located on the South Carolina bank of Back River near what is now the Tidegate. The Union/Screven Ferry Road ran north from the wharf site to uplands in South Carolina. This wharf was a center of activity from the 1770's until the early 20th century. There, individuals caught the ferry to Georgia to visit and conduct business in the city. The remains of small craft could be located in the river bottom in this area. Upland portions of the wharf were destroyed during construction of the Tidegate and disposal area dikes. The Union/Screven Ferry Road was incorporated into the dike system for the disposal areas, effectively burying the roadbed under many feet of fill. This location is not currently being affected by the Savannah Harbor Navigation Project. However, any future enlargements of the Sediment Basin could adversely affect any vessel remains lying near the wharf site.

6.125 All of the prehistoric and most of the historic resources that were located within the disposal area tracts will exist as archaeological deposits below elevation +10 feet MLW. The known exceptions are the Oysterbed Light Structure in the Jones/Oysterbed Disposal Area and the Civil War earthwork once located on Barnwell Island in Disposal Area 12B. When the draft TAR report is submitted, Savannah District will work with the Georgia and South Carolina State Historic Preservation Officers to determine avoidance depths for each potential resource area to insure that they are not impacted by future activities in the disposal areas (excavation for dike raising, installation of underdrains, or other purposes).

6.126 C. Sites Adjoining The Federal Navigation Channel.

6.127 National Monuments.

6.128 Fort Pulaski National Monument is located on the south shore of the navigation channel between Stations -2B+000 and +8+000. The site is significant at the national level for its architecture, association with events and people, and for archaeological potential. The site is administered by the National Park Service. It contains a lighthouse, the fort, and archaeological deposits associated with the fort and a quarantine station constructed in 1893. The Savannah Harbor Pilots Association and United States Coast Guard maintain structures and wharf facilities at Savannah Harbor Station +5+000. The site is not being affected by the Savannah Harbor Navigation Project. Any modifications to the Coast Guard and Pilot Association wharves would require a Section 10 or 404 permit from Savannah District and trigger Section 106 of the National Historic Preservation Act. Close coordination with the Superintendent of Fort Pulaski will be maintained regarding any Savannah District actions in the fort vicinity.

6.129 National Historic Landmarks.

6.130 The Savannah, Georgia, National Historic Landmark District abuts the navigation channel between Stations +72+000 and +77+000 (between Randolph Street and Martin Luther King Boulevard). The District is significant at the national level for its architecture, landscape architecture, and archaeology. New wharves and bulkheads were constructed for the district's entire length along the Navigation Project as part of a 1970's redevelopment project. It is not known if any remaining historic wharves were completely destroyed at that time, were cut down, or were built over. The district is not being affected by the Savannah Harbor Navigation Project.

6.131 National Register Listed Sites.

6.132 The Old Fort Jackson Historic Site is owned by the State of Georgia and administered by the Coastal Heritage Society. The site consists of a brick fort, moat, and surrounding, buried archaeological deposits. It is significant for its architecture and archaeology. It is located about 3 miles east of the city of Savannah at Station 58+500. The site is being impacted by bank erosion and is in danger of falling into the navigation channel. Savannah District prepared a Memorandum of Agreement (MOA) between itself and the State of Georgia and the Advisory Council on Historic Preservation (ACHP) which specifies procedures for determining the causes of the erosion problem, any possible Federal involvement with the problem, potential solutions, and funding sources. The text of the agreement is contained in Appendix K of this EIS. Savannah District received no comments from either the South Carolina SHPO or the ACHP during their review of the draft agreement. Comments provided by the Georgia SHPO have been included in the Final MOA. Although the parties have not yet signed the MOA, the District anticipates no unusual problems in consummating this agreement.

6.133 The C.S.S. GEORGIA is the wreck of a Confederate ironclad constructed in Savannah in 1862 and scuttled to prevent capture in December 1864. The wreck site is significant at the national level for its architecture, associations with events and people, and for its archaeology. The site was first located in 1968 when it was impacted by a harbor widening project. The site has been the subject of a number of Savannah District sponsored investigations to determine its geographic limits and condition. Savannah District prepared an MOA between itself and the states of Georgia and South Carolina and the ACHP which identifies impacts to the site, the Federal interest in mitigating these impacts, mitigation alternatives, and funding sources. The text of the MOA is contained in Appendix L of this EIS. Savannah District received no comments from either the South Carolina SHPO or the ACHP during their review of the draft agreement. Comments

provided by the Georgia SHPO have been included in the Final MOA. Although the parties have not yet signed the MOA, the District anticipates no unusual problems in consummating this agreement.

6.134 National Register Eligible Sites.

6.135 The Venus Point Light Structure is located in South Carolina near Station 15+000. It was located on the riverbank in front of the south dike for the Jones/Oysterbed Island Disposal Area. In 1993, District archaeologists visited the site and found the structure to be severely undermined and in danger of collapse. Savannah District determined the site to be eligible for inclusion in the National Register of Historic Places in 1994, based on the site's significance at the local level for its architecture and history. The District attempted to document the site to Historic American Engineering Standards, but the site collapsed into the river before the contractor arrived at the site. The contractor gathered historical documentation, photographs, and drawings, and used measurements taken in 1993 by Savannah District archaeologists to document the site. A draft report was provided to the South Carolina SHPO in the Summer of 1995. Subsequent coordination with the South Carolina SHPO resulted in an agreement that the remaining portions of the site did not warrant construction of physical protective measures, but that continued monitoring of the site would be performed to document any features which become exposed in the future. The Georgia DOT will perform this monitoring and archaeologists with GA DOT will periodically provide information on the status of the site to the District and the South Carolina SHPO.

6.136 The Fig Island Channel Site is located on both privately-owned and Federally-owned (Savannah District) lands. The site is located at the former mouth of Fig Island Channel, a channel that once separated Fig Island from Hutchinson Island. Paragraphs 6.113 and 6.114 have described details of the site's value. The site was determined eligible for inclusion in the National Register of Historic Places due to its significance at the local level under National Register criterium d.; for its ability to provide information important in history.

6.137 Excavations were carried out in 1991 and 1994 on portions of this site as part of the mitigation of impacts associated with the 1989/1990/1991 Harbor Widening and 1993/1994 Deepening Projects. The data recovery efforts were sufficient to document all wrecks and other features that would be impacted by slope destabilization resulting from the harbor deepening project. The private and state-owned portions of the site have not been bulkheaded. The present navigation channel spans most of the river channel between the Savannah National Historic Landmark District. Any change in harbor maintenance procedures or any channel modification would impact this site.

6.138 Potentially Significant Sites.

6.139 The Irene Mound Site, a Mississippian Period ceremonial center, was once located at the juncture of Pipemaker's Canal and the Savannah River. The site area was severely impacted by non-Federal port development activities in the 1960's. It is not known if any intact portions remain beneath existing structures. This site is not being impacted by Savannah District activities. This site will need to be taken into account if there is any change in Savannah District activities that might impact the area or if a change in land use is proposed that triggers a Section 10 or Section 404 permit.

6.140 Battery Lee is a Confederate earthwork located on the edge of the navigation channel. It is being impacted by dredging associated with a privately-owned wharf. A determination of National Register eligibility and a determination of effect should be performed if proposals are made to renew existing Sections 10 and 404 regulatory permits which allow agitation dredging near the site.

6.141 Turnbull's Tavern Site is the archaeological remains of a late 18th/early 19th century tavern and wharf located on the river shore. Any widening of the navigation channel could undermine this site.

6.142 Southeastern Shipyard is a World War II period shipyard that produced commercial ocean-going vessels. The upland buildings have all been removed or razed. The launching rails are still visible at low water. The site is not being impacted by the present navigation project.

6.143 Miller's Iron Foundry Site is the archaeological remains of an antebellum and bellum iron foundry. The foundry was a major supplier of local steam plants prior to the Civil War. During the war, it also produced ordnance. It was burned in December 1864 to keep it out of Union hands. For a brief period after the war it was used by Union troops. The site is not being affected by the navigation project.

6.144 Willink's antebellum and bellum shipyard was the largest shipbuilding facility in Georgia from 1840 to 1865. It produced intracoastal and river steamers, sailing pilot boats, and other craft. During the Civil War it completed one ironclad and nearly completed two others. It was burned in December 1864 to keep it out of Union hands. The site is not being affected by the navigation project.

6.145 Eleven potentially significant stripped and derelict vessels are eroding from the harbor shoreline. These vessels appear to include the remains of the following: a late 18th/early 19th century sloop or schooner; a late 18th/early 19th century

pole boat; an intracoastal steamer; a late 19th/early 20th century steel lifeboat(?); a mid to late 19th century steam powered, propeller driven vessel; two 19th century sailing vessels; and four late 19th/early 20th century wooden barges. While none are being affected by the Savannah Harbor Navigation Project, streambank erosion is slowly destroying all of them.

6.146 Terry Shipyard is a World War I period shipyard that apparently built tugboats for the war effort. No buildings have been preserved. However, the remains of at least three slipways and access wharves are present. The site is not being affected by the Navigation Project, however, streambank erosion is impacting the shoreline portions of the site.

6.147 The Krenson and Hawkes Shipyard was active from about 1840 to 1875. It constructed intracoastal steamers and tugboats during the antebellum period. During the Civil War it constructed one Maury Gunboat for the Confederate Navy and had an ironclad on the stocks when it was burned to prevent its capture in 1864. The yard was at least partially rebuilt after the war. At least one sailing pilot boat was constructed during that period. In the latter part of the 19th century, this was the site of a large steamship wharf. It is not known if any archaeological deposits are preserved beneath the present wharf facility.

6.148 The Ferry Wharf was located on the Georgia riverbank at the foot of what is now East Broad Street. This was a center of activity from the 1770's until the early 20th century. There, individuals caught the ferry to South Carolina and moored their sailing and rowing small craft when visiting the city. The remains of numerous small craft may be clustered in the river bottom in this area. This location is not being affected by the Savannah Harbor Navigation Project, however, any future channel widening or deepening, dredging for mooring vessels, or bulkheading could adversely affect this potential resource.

6.149 Federal Batteries were once located along the south shore of South Channel from the northeast tip of Tybee Island to Lazaretto Creek. The archaeological remains of these batteries may be preserved. Live ordnance may also be located in the river channel. If the remains of these batteries exist, they are of National Landmark significance due to their association with Fort Pulaski National Monument. Since these resources are located along South Channel, they are not being affected by the Savannah Harbor Navigation Project. Any development in this area should consider the area's archaeological potential and aesthetic effects upon the National Monument.

6.150 The archaeological remains of the 18th century Savannah quarantine station may still be at least partially extant. Portions of the associated cemetery exist. This site is not being affected by the Savannah Harbor Navigation Project.

6.151 Two possible 19th century crib wharves are located along the harbor shoreline. The wharves are not being affected by the Savannah Harbor Navigation Project but are being impacted by streambank erosion.

6.152 Submerged Anomalies. Sixteen uninvestigated submerged magnetic and/or sonar targets have been identified in the vicinity of the navigation channel or Sediment Basin. None are being affected by the Savannah Harbor Navigation Project or other harbor related activities.

6.153 Special Resources of Concern. Several environmental resources exist in the harbor which deserve special recognition and concern. Actions which could impact those areas may affect multiple resources, such as water quality, benthic communities and wildlife. To ensure these areas receive the recognition and concern which they warrant, they will be described separately and potential impacts to those sites will be evaluated separately. The special resources which warrant special concern include the Savannah National Wildlife Refuge, the Tybee Island National Wildlife Refuge, the Savannah Ocean Dredged Material Disposal Site and the nearshore area.

6.154 Savannah National Wildlife Refuge. The Savannah Refuge is located in the upper portion of the harbor (Figure 26) and consists of 25,600 acres of freshwater marshes, tidal rivers and creeks, and bottomland hardwoods. The Refuge was established in 1927 and is managed primarily for waterfowl and wildlife observation. The facility contains both impounded and unimpounded wetlands.

6.155 The Refuge is located at the upstream end of the harbor and both its location across the river from highly developed port facilities and its original purpose as a freshwater refuge present significant challenges to harmonious operation of the harbor with adjacent landowners. The Refuge has been damaged by increases in salinity which have accompanied previous harbor improvement projects, primarily channel deepening which allows saline water to travel further upriver. A Freshwater Control System was constructed in 1977 to mitigate for the salinity increase expected from the harbor deepening and sediment control features authorized in 1965. The Tidegate was removed from operation in 1990 and New Cut closed to alleviate impacts caused by those structures. The areas most susceptible to salinity impacts are the extensive unimpounded marshes.

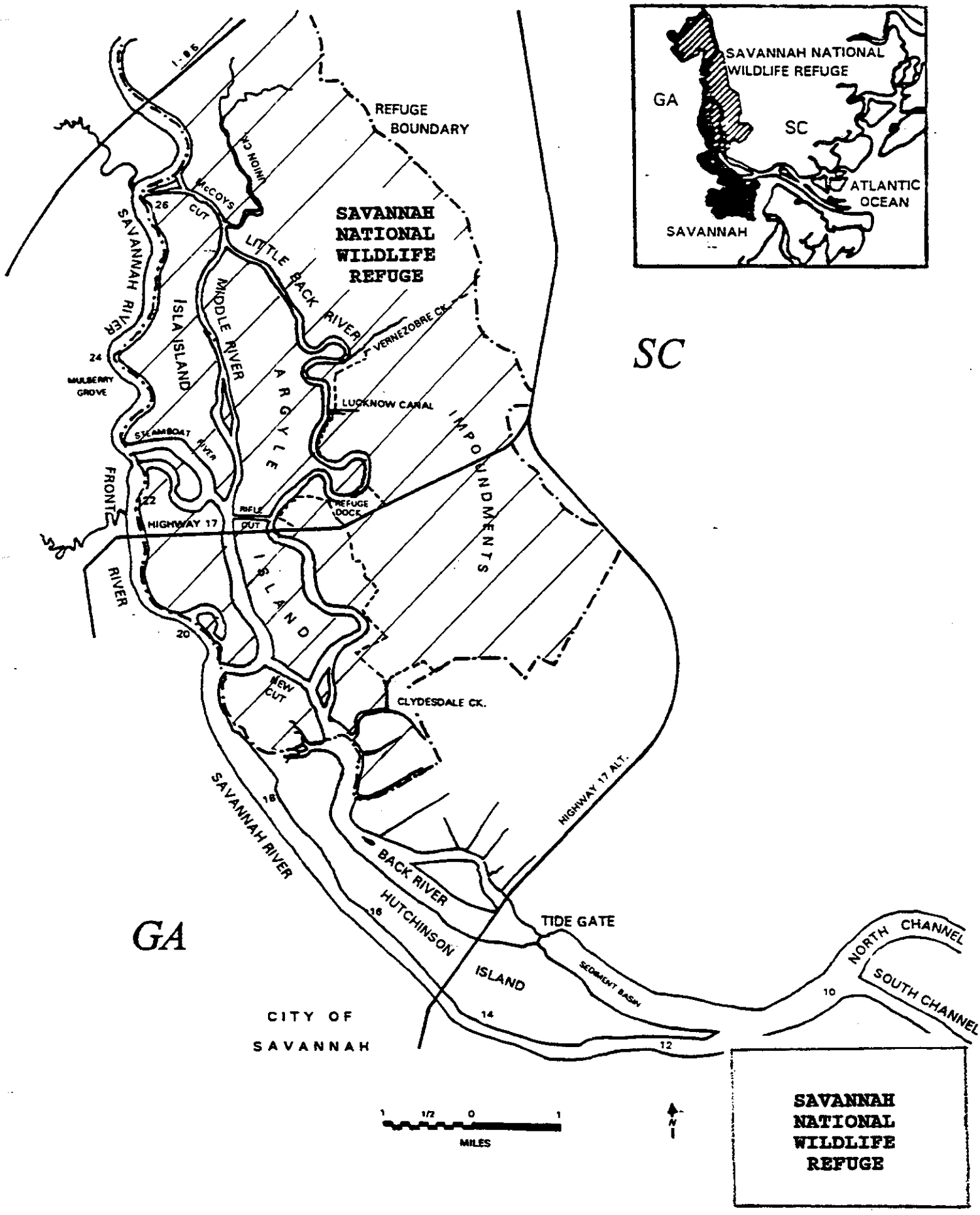

SAVANNAH NATIONAL WILDLIFE REFUGE
GA
SC
ATLANTIC OCEAN
SAVANNAH
REFUGE BOUNDARY
SAVANNAH NATIONAL WILDLIFE REFUGE
SC
GA
I-95
UNION CK.
McCOY'S CUT
SAVANNAH RIVER
ISLA ISLAND
MIDDLE RIVER
LITTLE BACK RIVER
VERNEZOBRE CK.
ARGYLE ISLAND
LUCKNOW CANAL
IMPOUNDMENTS
MULBERRY GROVE
STEAMBOAT RIVER
FRONT RIVER
HIGHWAY 17
RIFLE CUT
REFUGE DOCK
NEW CUT
CLYDESDALE CK.
HIGHWAY 17 ALT.
SAVANNAH RIVER
BACK RIVER
HUTCHINSON ISLAND
TIDE GATE
SEDIMENT BASIN
NORTH CHANNEL
SOUTH CHANNEL
CITY OF SAVANNAH
26
24
22
20
18
16
14
12
10
1
1/2
0
1
MILES
N
SAVANNAH NATIONAL WILDLIFE REFUGE

FIGURE 26

6.156 Unimpounded Refuge Marshes. The Savannah Refuge also contains extensive unimpounded wetlands along the Savannah, Middle and Back Rivers. Wetlands located below US Highway 17 are vegetated predominantly by salt marsh and brackish marsh species, while those above that point are predominantly freshwater or brackish species. It is the unimpounded wetlands which have experienced the most impact from development of the harbor, as the additional channel depths have introduced salinity further upstream. Operation of the Tidegate also allowed saline water to progress further up Back River.

6.157 Savannah District funded monitoring of tidal marsh adjacent to Back River by the FWS to record changes due to closure of New Cut and removal of the Tidegate from operation. Four sites (Figure 27) within unimpounded Refuge wetlands were evaluated as follows:

FORMER SALINITY REGIME	APPROXIMATE LOCATION
Freshwater	9,000 feet upstream of U.S. Highway 17
Oligohaline	1,500 feet upstream of U.S. Highway 17
Strongly Oligohaline	2,200 feet downstream of U.S. Highway 17
Mesohaline	500 feet downstream from Clydsdale Creek

6.158 Field sampling performed in June and October 1993 found that interstitial water salinities were lower at each of the four sites observed, with freshwater conditions (less than 0.5 ppt) being observed at all sites. Vegetation changes at formerly oligohaline and mesohaline sites indicate that freshwater conditions have been restored. Changes in species composition were most evident at the strongly oligohaline site. An additional sampling is scheduled for the Fall of 1994. Based on the initial monitoring, it would appear that closure of New Cut and removal of the Tidegate from operation has indeed reduced salinity levels in Back River and its adjacent marshes. Restoration of Refuge unimpounded wetlands to freshwater species should be more observable in the next few years as the vegetation continues to respond to the changed salinity conditions.

6.159 Impounded Refuge Marshes. The FWS currently manages 5,700 acres of diked impoundments for waterfowl in the SNWR. Those impoundments include 3,000 acres of freshwater pools. Two management schemes are primarily used for the impoundments; draw-down pools and permanently flooded pools. The draw-down pools are drained annually between March 15 and May 15 and manipulated to promote growth of emergent waterfowl food plants. These areas

Map of the Lower Savannah River with study site locations.

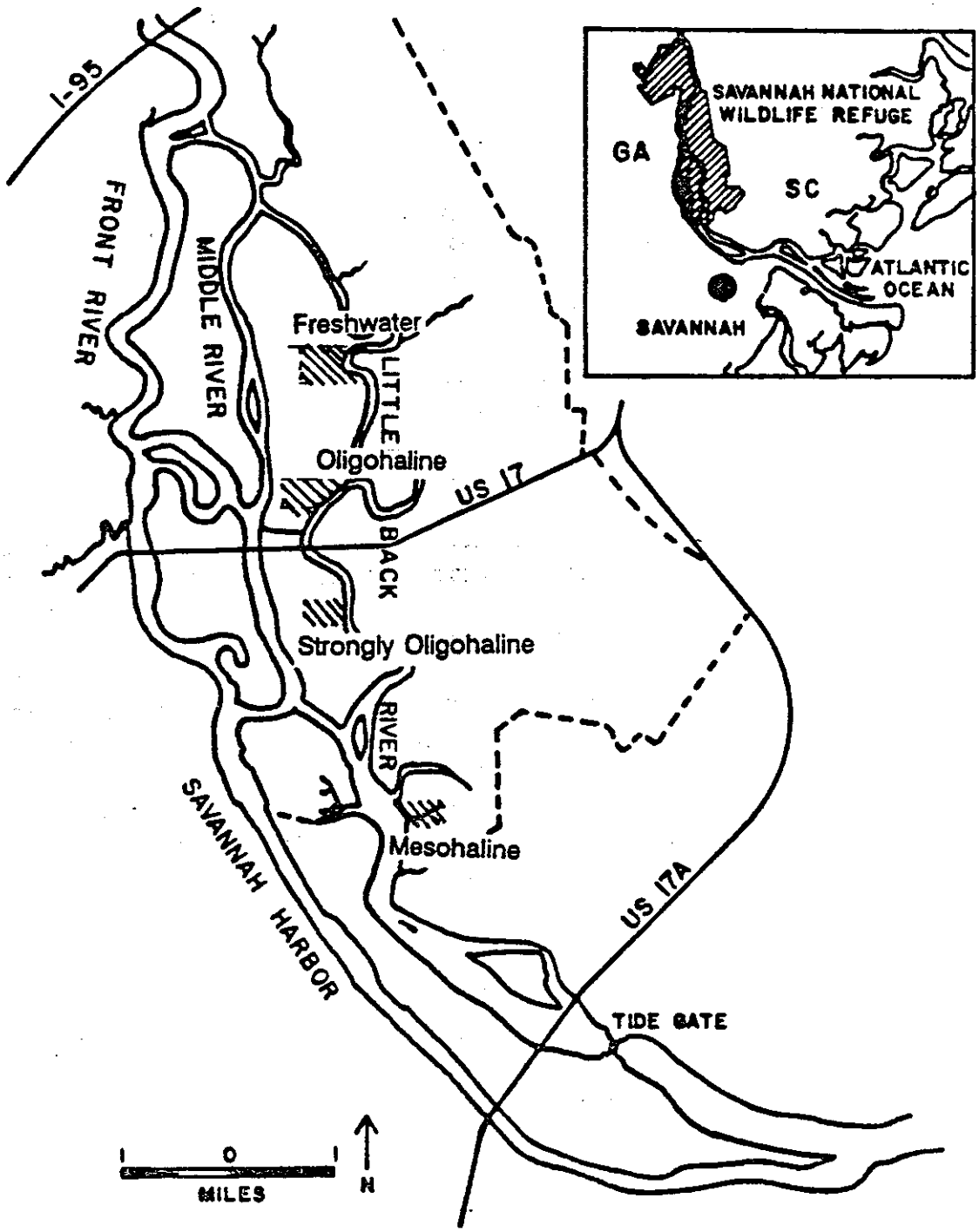


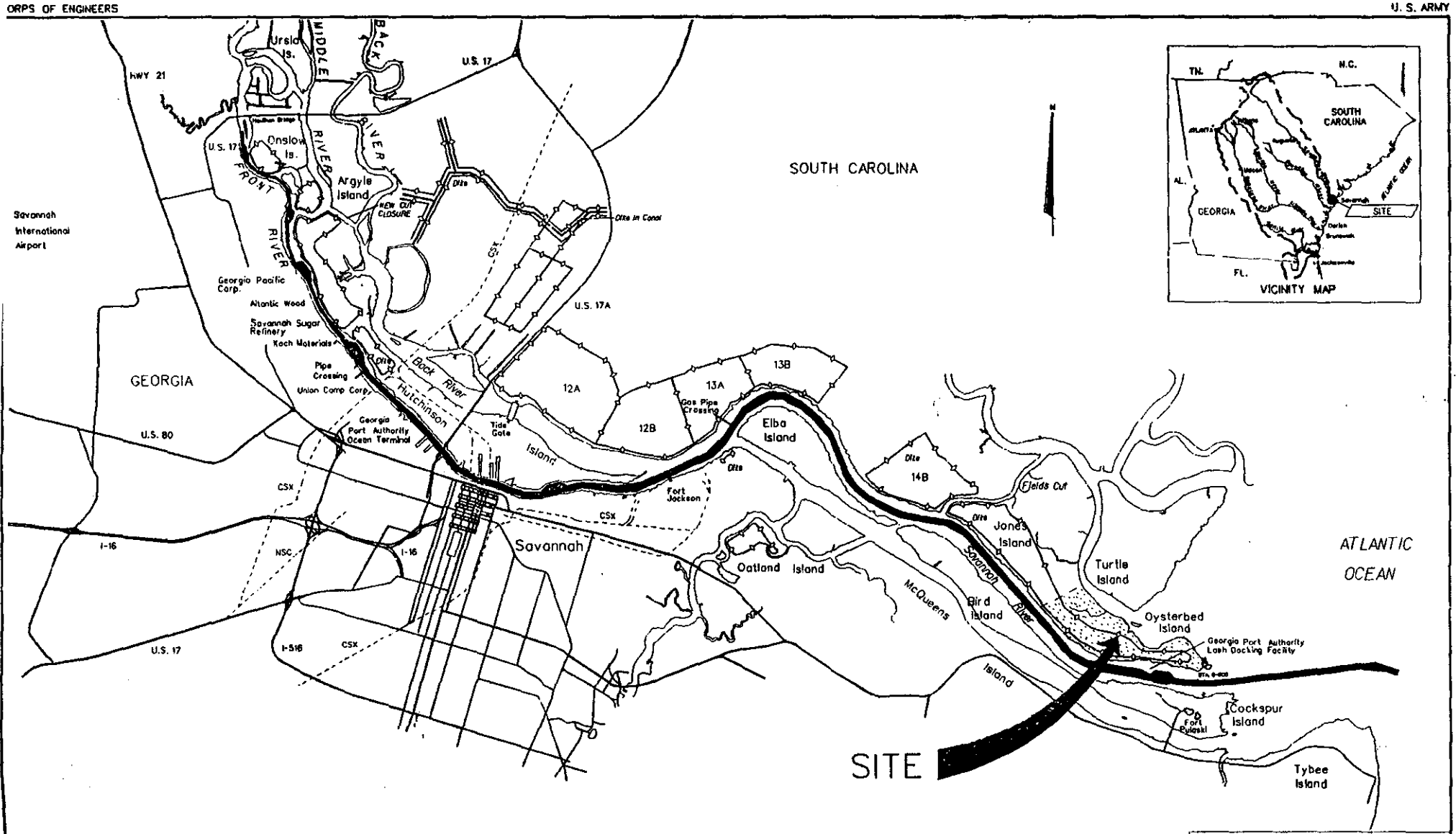
FIGURE 27

are reflooded in the fall of each year. Permanent pools remain flooded all year to promote growth of submerged aquatic plants and to provide wood duck brood rearing and alligator habitat. Permanently flooded pools are drained, dried, burned, and mowed when undesirable vegetation becomes a problem or productivity of desirable plants decreases. These pools may require additional water at any time to make up for transpiration and evaporation. The FWS also has an agreement with local landowners to provide them with freshwater after the first 20 days of each month.

6.160 The Refuge's Water Management Plan, dated January 3, 1983, states "Flooding of the diversion canal can normally be accomplished in a 24 to 48-hour period depending on the tide elevation. It is important, however, that flooding be done at the highest tide possible when using the diversion canal to provide water to flooded pools and to adjacent landowners, since only the highest tides produce the head volume to meet the needs." An analysis of data collected from April 1983 to March 1984 showed that an adequate supply of freshwater was available under normal river flow conditions for management of the impoundments. Under low flow condition, however, the Tidegate needed to be taken out of operation for the Refuge to be assured of adequate freshwater at the intake. Since that time, the Tidegate has been taken out of operation and the salinity has decreased in Back River so that freshwater is available for flooding of the impoundments under all expected flow conditions.

6.161 Tybee National Wildlife Refuge. The Tybee Refuge (Figure 28) was established in 1933 as a breeding area for migratory birds and other wildlife. The Refuge consists of 400 acres of wetlands and diked low lands located at the mouth of the Savannah River across from the river from the Fort Pulaski National Monument. Much of the site is diked and is used for placement of material dredged from the Savannah Harbor Navigation Project. The vegetated portions of the upland areas are densely covered with red cedar, wax myrtle, and groundsel. Saltwater marsh borders parts of the island. The low tide shoreline provides feeding and resting areas for shorebirds and migratory birds. The site is closed to public use.

6.162 Located adjacent to the Tybee Refuge on its northern side is the Turtle Island Wildlife Management Area (WMA), which is operated by the SC Department of Natural Resources. The 1,700-acre island was donated to the state in 1976 for waterfowl management purposes. The site is within Unit SC10P of the Coastal Barrier Resources System, so it receives protection from development which are specified in the Coastal Barrier Resources Act. The WMA contains 1,170 of low salt marsh, 90 acres of palm/palmetto forest with a wax myrtle and yaupon understory, and 50 acres of beach and dunes. High ground is situated in roughly



TYBEE ISLAND
NATIONAL WILDLIFE
REFUGE

U. S. ARMY ENGINEER DISTRICT, SAVANNAH
CORPS OF ENGINEERS
SAVANNAH, GEORGIA

FIGURE 28

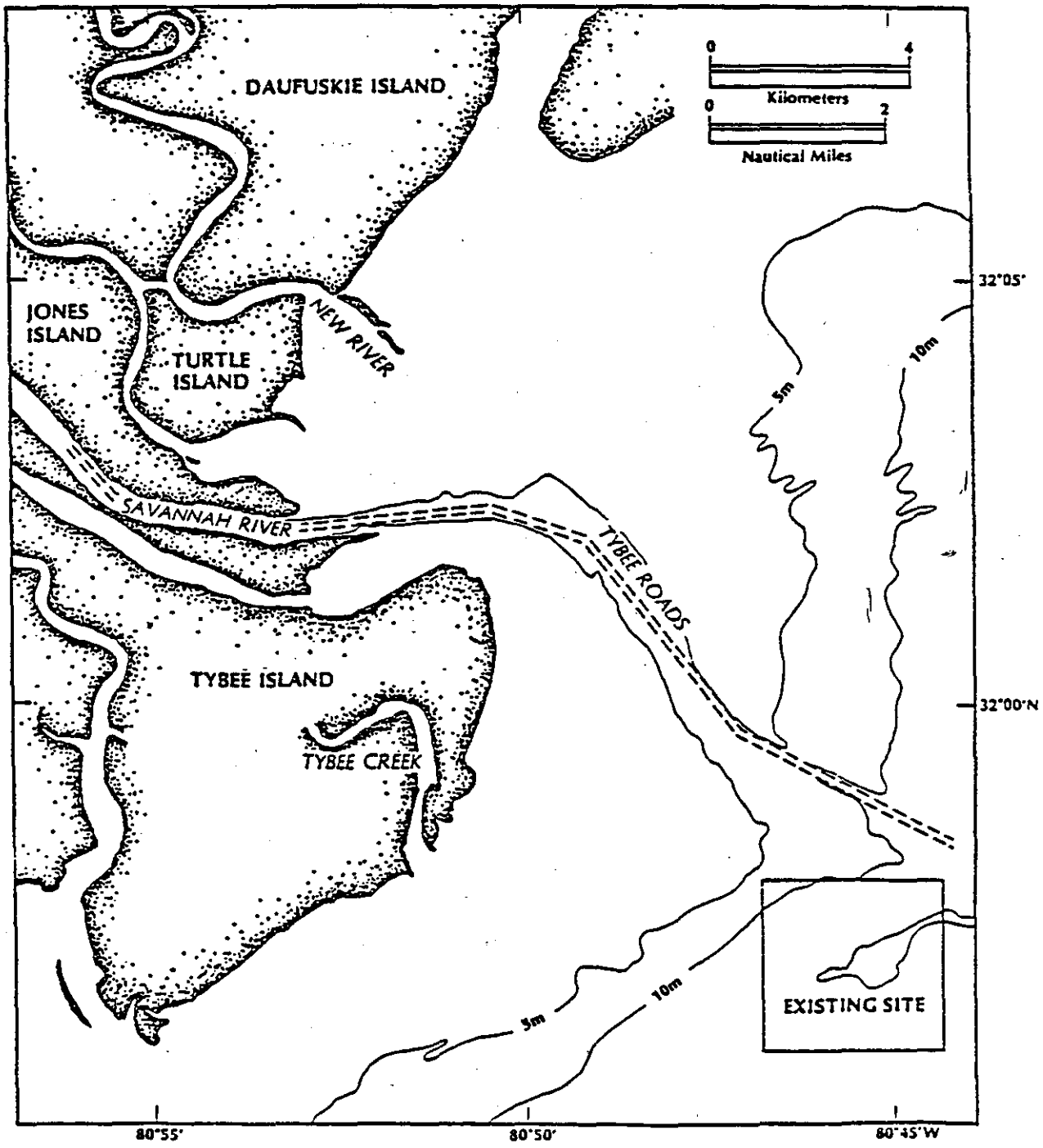
parallel strips which encircle 420 acres of high salt marsh. The high salt marsh provides the best habitat for waterfowl management and hunting. Public use includes waterfowl hunting, marsh hen hunting, beachcombing, fishing, bird watching, picnicking and camping (designated areas only). Public use is generally low since access is available only by boat.

6.163 Savannah Ocean Dredged Material Disposal Site (ODMDS). In 1987, EPA completed formal designation and approval of an offshore site located 3.7 nautical miles east of the coastline and about 0.25 nautical miles (1,500 feet) south of the navigation channel as a dredged material disposal site (Figure 29). The site's center is located at 31 56'54"N and 80 45'34"W. The designated site was the one which Savannah District had been using for many years for placement of material removed from the Bar Channel. Material is excavated from that reach by hopper dredges and then transported to the Savannah ODMDS for disposal. This procedure was previously evaluated in 1991 and determined to meet the criteria established to implement Section 103 of the Marine Protection, Research and Sanctuaries Act of 1972 (MPRSA), as amended (40 CFR Parts 220 to 228). This EIS contains an update of that evaluation in Appendix D SECTION 103 OCEAN DISPOSAL EVALUATION. More details on the historic use of the site can be found in that portion of this document.

6.164 Nearshore Area. The nearshore area is the shallow area immediately oceanward of the ocean shoreline. It warrants special attention because (1) the area is dynamic as it constantly responds to the changing conditions resulting from winds, waves and currents, (2) the area is heavily used by marine fish, shellfish and shorebirds, and (3) the area serves as nursery habitat for juvenile marine fish.

6.165 Aesthetics. The aesthetic resources of the study area are dominated by the following components: (1) the vast saltwater marshes which comprise the coastal estuary, (2) the historic city of Savannah, and (3) barrier island shorelines. Each of these components add to the quality of life for residents and serve as an attraction for tourists.

6.166 Recreation. Recreational use of the harbor is limited because of (1) the industrial development which dominates the southern shoreline, (2) the lack of development and public access to the northern shore, and (3) the dominance of the river by large ocean-going vessels. Little commercial or sport fishing occurs within the confines of the harbor. The maintenance of a clear channel may have reduced the normal variations in bottom topography which provide fish habitat. In addition, the repeated passage of large ocean-going vessels is intimidating to much



SAVANNAH OCEAN
DREDGED MATERIAL
DISPOSAL SITE

FIGURE 29

smaller craft. Those factors are probably large contributors to the lack of recreational and commercial fishing which occurs in the harbor's portion of the Savannah River. Several marine finfish are taken around the mouth of the harbor, including spotted sea trout, spot, croaker and other bottom species. Cobia and tripletail provide for a limited amount of sport fishing in the outer channel. Some recreational fishing does occur in Back River near the Tidegate, where success rates are among the highest in Chatham County. The lack of ready access to Back River for sport fishing does limit participation in that activity. Some sport fishing also takes place in Middle River and in freshwater areas above the upper limits of the harbor.

6.167 The harbor does not provide extensive opportunities for what would normally come to mind when an estuarine river or harbor are considered. The development of much of the harbor's shoreline for industrial purposes has greatly limited the space for dockage of pleasure boats. No marinas which service pleasure boats are located in the harbor. The few pleasure boats which do pass up and down the harbor tend to be associated with either hotels located on the river or with people acting as tourists viewing the riverfront. A commercial cruise line does exist which takes tourists on short river tours of the harbor.

6.168 Savannah, as historic city, does draw many tourists to the harbor area. A significant portion of the riverfront has been restored. It is known as River Street and is a popular tourist destination, with hotels, restaurants and small shops. A lengthy promenade, approximately 1/2 mile, has been established which is well used by both tourists and residents. Events are held which draw thousands of attendees. Therefore, extensive recreational use does occur along portions of the harbor. These uses stem from the historic and cultural aspects of the city, whose origin was directly tied to the harbor. Those uses have expanded to widespread commercial operations which serve both tourists and local residents.

6.169 Coastal Barrier Islands. The Georgia-South Carolina coast is typified by coastal barrier islands located in front of expansive estuarine salt marshes, which in turn front the mainland. The barrier islands which are located within 10 miles of the harbor entrance are listed from the north as follows: SC: Hilton Head, Daufuskie, Turtle, Oysterbed; GA: Tybee, and Little Tybee. If the boundaries are expanded to 20 miles, St. Phillips Island is added in South Carolina and Wassaw Island is added in Georgia. This region is unique in its lack of commercial development of its barrier islands. Of the eight islands listed within a 20-mile radius, only two are significantly developed; Hilton Head and Tybee Islands. Several receive special protection from the Federal government by their designation as

units in the Coastal Barrier Resources Act; St. Phillips, Daufuskie and Turtle Islands in South Carolina, and Little Tybee Island in Georgia. The site of the proposed nearshore Bird island off Turtle Island is within Unit SC-10P of the Coastal Barrier Resources System. Two other barrier islands are National Wildlife Refuges: Oysterbed Island in South Carolina, and Wassaw Island in Georgia. The islands also receive protection through various state laws or regulations. Turtle Island is owned by the State of South Carolina and is managed as a Wildlife Management Area. Little Tybee Island is owned by the State of Georgia and is managed as a Heritage Trust. Operation of the harbor is not resulting in significant adverse effects to these barrier islands. The southerly littoral drift essentially precludes impacts to islands located to the north. Potential impacts to Tybee Island, which is located immediately south of the harbor entrance, are not readily discernible. The region's large tidal flows dominate hydraulic conditions at the inlets, so potential impacts to Tybee Island from removal of channel sediments from the nearshore sand sharing system are not distinguishable from other events which could cause erosion of the Tybee Island shoreline or make that shoreline susceptible to erosion. No changes in shoreline erosion patterns have been identified after previous improvements to the harbor.

6.170 Maritime Industry. The port of Savannah plays a vital role in stimulating industrial growth and economic progress of the Savannah area and the State of Georgia. Job opportunities in port-related industries, access to sources of raw material via economical water transportation, and transportation for finished products have played a vital role in the growth of the economy of the Savannah area.

6.171 Savannah Harbor attracts business which employs many people. In 1980, 52 manufacturing firms in the Savannah Metropolitan Statistical Area (MSA) directly used Savannah Harbor for import and/or export purposes. These 52 firms employed in excess of 10,000 workers, or more than 71 percent of all manufacturing employees in Chatham County. These firms located in Savannah primarily because of accessibility to deep water transportation. In addition to this port-related manufacturing employment, more than 5,300 workers were employed in a broad category of port services, including towing, piloting, loading and unloading, banking, insuring, freight forwarding, and other activities. Total port related employment in the Savannah MSA in 1980 was more than 15,300 workers, representing almost 20 percent of the total MSA employment.

6.172 The real impact of Savannah Harbor on Savannah area economy may be measured through use of the multiplier concept. A study published in 1972, by the Georgia Institute of Technology, offers estimates of additional employment induced or supported by

base employment in various industry categories for the State of Georgia. Using these multipliers to estimate port-induced employment in Chatham County, this yields approximately 32,500 jobs in addition to the original 15,300 jobs more directly related to the port, or a total of 47,800 jobs. This represents almost 60 percent of the total Chatham County employment. These latter estimates do not include consideration of employment and income associated with tourism and expenditures in the local area on lodging, goods and services, all of which are associated with the unique history of the port of Savannah. These estimates leave little doubt as to the importance of Savannah Harbor in the local economy.

6.173 Transportation facilities serving Savannah Harbor are extensive. Two major railroads, the Seaboard System Railroad and the Norfolk Southern Corporation, directly serve the harbor. Interstate Highway 16 and 95 and US Highway 80 provide east-west and north-south access to the harbor area. US Highway 17 and State Routes 21, 30, and 204 also serve the port. The GA DOT is presently conducting a study of the intermodal nature of the harbor and connecting transportation routes.

6.174 An intensive study of vessel docking in Savannah Harbor in calendar years 1979 and 1980 revealed that vessels docked at 24 major facilities or facility complexes. These facilities and facility complexes included LASH, Elba Island (LNG), Marcona, Standard Oil, Union Oil, Koch Oil, Flintkote, MVA (wood chips), East Coast Terminals, GKI (Georgia Kaolin), Charter Oil, Atlantic Cement, Ocean Terminal, Colonial Oil, American Oil, National Gypsum, Southern Bulk, Garden City Terminal, Chevron Asphalt, Savannah Foods (sugar refinery), Atlantic Wood Industries, Georgia Pacific, and Continental Can.

6.175 Major commodities moving through Savannah Harbor in 1988 included residual and distillate fuel oil; gasoline; crude petroleum; limestone; sugar; basic chemicals; building cement; iron and steel shapes; fabricated metal products; basic textiles; clay; pulp, paper, and paperboard; wood chips; staves and moldings; asphalt, tar, and pitches; and corn, rice, wheat, soybeans, and oilseeds. Most remaining tonnages were internal and intracoastal movements. Total tonnages in 1988 were 13,980,978.

6.176 Fifty-one piers and wharves serve existing waterborne commerce of the port. These facilities, with use of dolphins, have a combined berthing space of 30,154 feet with water depths alongside ranging to -42 feet MLW. Included in the berthing space are five container berths. All have railway and highway connections. LASH facilities are located at the entrance to the harbor and have depths ranging to -38 feet MLW. The Georgia Ports Authority operates three major terminal complexes in Savannah Harbor. These include the LASH facility, Ocean

Terminal, and Garden City Terminal. Due to the present economies of barge movements and rough waters at the site, the LASH facility is not being used extensively and most LASH vessels using Savannah are docking at Garden City Terminal. Other terminal operators also operate large complexes which serve several industries. Multiple private docks also exist which serve individual industries.

7.00 ENVIRONMENTAL CONSEQUENCES

7.01 Introduction. As with any construction project, extensive environmental adverse impacts could result from operation of a harbor if the activities were conducted improperly. This section reviews the environmental consequences of the detailed alternatives. The impacts are identified and compared based on the environmental resource which would be impacted. Special issues, such as ocean disposal options and the Savannah National Wildlife Refuge, where multiple resources could be impacted are evaluated separately. The following resources were considered in detail:

- Threatened And Endangered Species
- Water Quality
- Fishery Resources
- Benthic Resources
- Wildlife Resources
- Wetlands
- Cultural and Historic Resources
- Special Resources of Concern:
  - Savannah National Wildlife Refuge (SNWR)
  - Tybee National Wildlife Refuge (TNWR)
  - Ocean Dredged Material Disposal Site (ODMDS)
  - Nearshore Area
- Groundwater
- Recreation
- Maritime Industry
- Others

7.02 The table on the following page shows where the descriptions of the expected impacts to those resources are found. Identification of the impacts is related to the action which would produce the impact; i.e. dredging the channel, dredging a berthing area, disposal in the Savannah ODMDS, etc.. The information is then summarized to allow an overall comparison of the detailed alternatives.

TABLE 10

LOCATION OF IMPACT DESCRIPTIONS

	GENERAL DESCRIPTION	ALTERNATIVE-SPECIFIC IMPACTS	SUMMARY
ENDANGERED SPECIES	7.03 - 7.04	7.05	7.06
WATER QUALITY	7.07 - 7.51	7.52 - 7.69	7.70 - 7.71
FISHERIES	7.72 - 7.77	7.78 - 7.79	7.80
BENTHIC	7.81 - 7.85	7.86 - 7.87	7.88
WILDLIFE	7.89 - 7.120	7.121 - 7.122	7.123
WETLANDS	7.124 - 7.134	7.135	7.136
CULTURAL	7.137 - 7.139	7.140 - 7.141	7.142
SNWR	7.143 - 7.146	7.147 - 7.149	7.150
TNWR	7.151	7.152 - 7.153	7.154
ODMDS	7.155	7.156	7.156
NEARSHORE AREA	7.157 - 7.201	7.202	7.203
GROUNDWATER	7.204 - 7.208	7.209	7.210
AESTHETICS	---	7.211	7.211
RECREATION	7.212	7.212	7.212
MARITIME INDUSTRY	7.213	7.213	7.213
ECONOMICS	7.215	7.215	7.216
OTHERS	7.217 - 7.241	---	---
SUMMARY	7.242 - 7.248	---	---

7.03 Endangered Species. As expressed previously, dredging and disposal operations, as well as disposal area maintenance have the potential to physically impact threatened or endangered species or their habitat. Impacts from the dredging operation could be produced by the dredge itself, the underwater plume it produces, or the attendant vessels which accompany a dredge. Disposal operations could affect endangered species primarily through either the turbidity plume at the Savannah ODMDS and proposed openwater disposal sites, or encounters with equipment at the disposal sites.

7.04 Dredging can adversely affect endangered species such as shortnose sturgeon, sea turtles and right whales. Disposal operations could affect species such as wood storks, sea turtles, and bald eagles. The threat to these species and precautions which would be included in each construction action to minimize those impacts are described in detail in Appendix B BIOLOGICAL ASSESSMENT OF THREATENED AND ENDANGERED SPECIES. Those precautions have been included in each of the detailed alternatives. As long as the precautions and measures listed in Appendix A are followed, operation of the harbor and disposal areas would not adversely affect endangered species.

7.05 Since the precautions to be observed in each of the detailed alternatives would result in construction occurring which does not unacceptably harm protected animals, fish, etc., or their habitat, no plan would produce unacceptable adverse environmental impacts to threatened or endangered species. Should harm occur to an individual which is classified as endangered in spite of the precautions taken, the US FWS or the NMFS would be consulted to determine what further actions would be appropriate. Since three alternatives (Alternatives 2, 3 and 8) contains a Mitigation Plan which includes construction and maintenance of a nearshore bird island that would also produce (1) valuable nesting habitat for endangered sea turtles, and (2) critical wintering resting areas for piping plover, those alternatives would result in greater environmental benefits for endangered species than the other alternatives. The same amount and quality of habitat would be produced in each of those three alternatives, so none of those plans would produce more benefits than the others.

7.06 Each of the alternatives was assigned a score based on their overall effects on threatened and endangered species. A scale of 0 to 10 was used, with 3 being the level of no effect. The results of this evaluation are displayed as follows:

ALTERNATIVE	ASSIGNED SCORE
2, 3 + 8	6
1, 4, 5, 6 + 7	3

7.07 Water Quality.

7.08 Suspended Solids At The Dredging Site. Water quality impacts from dredging operations could result from resuspension of solids at the dredge site. Potential site-specific impacts from suspended solids at the Savannah ODMDS and potential nearshore sites are described separately in the sections dealing with those sites.

7.09 In general, suspended solids affect aquatic biota less as the age of an organism increases. Larvae are generally the most sensitive life stage to environmental stresses. The causal factors by which suspended solids affect eggs and larval fishes are complex. The methods include direct mechanical abrasion of egg and larval surficial membranes, reduction of available light in the water column, and adsorption of contaminants carried by the sediments. Indirect effects of elevated suspended solids may also be of consequence. Examples include interference with feeding behavior of visually oriented larvae or delayed development resulting in asynchronous occurrences of larvae and their prey. Very little is known of the importance of synergistic effects resulting from combinations of causal factors, or how physical features of the suspended particles, such as size or angularity, contribute to the effects observed. Stresses caused by chemical, physical, or biological conditions may be manifested in chronic rather than acute biological responses, further complicating the determination of detrimental effects.

7.10 LaSalle et al., (1991) reported that acceptable ranges of turbidity for survival of aquatic organisms was between 500 and 1,000 mg/l and that turbidity levels greater than 500 mg/l significantly reduced survival of striped bass larvae. The same report stated that the LC10 (lowest concentration at which 10 percent would die) for striped bass subadults when exposed for 21 days was 4,000 mg/l. Results of the 1994 Wright River Weir

Effluent Study summarized in Appendix D indicated that weir sites which had turbidity levels exceeding 400 mg/l, elevated contaminant levels of Arsenic and Manganese, low salinity, and low dissolved oxygen levels also demonstrated high mortality of oysters, grass shrimp and sheepshead minnow. The precise cause of the observed mortality or the mechanism through which those factors may have worked in synergy is unknown.

7.11 Measurements of total suspended solids taken by Savannah District during dredging for the 1989/1990/1991 Widening Project and the 1993/1994 Deepening Project revealed information on the following two items:

(1) The relationship reported in literature of a reduction in turbidity with vertical distance from the bottom was generally observed in both the natural condition and in the dredge plume.

(2) Although the monitoring was not exhaustive, the 42 sampling events found the solids content in the dredge plume to be relatively low. Although the maximum concentration recorded at the bottom was 1,066 mg/l, 90 percent of the time the suspended solids readings were less than 390 mg/l.

Only two mid-depth readings (112 and 151 mg/l) -- which represent 5 percent of the sampling events -- were found to exceed 100 mg/l. No readings taken 3 feet below the surface were found to exceed 100 mg/l. The distribution of maximum suspended solids concentrations found in the dredge plume is as follows:

PERCENT LESS THAN	TSS CONCENTRATION (MG/L)
100	1070
95	410
90	390
80	275
70	120
65	95

Based on this information, the turbidity plumes generated at the dredge site during hydraulic dredging in Savannah Harbor are expected to produce minimal impacts to aquatic species.

7.12 Studies performed in 1993 for Terminal Management Corporation by Skidaway Institute of Oceanography included measurements of background turbidity levels throughout the harbor. Measurements were taken on five different dates and

revealed that the zone of highest background turbidity varied in both location and strength. The studies provided the following information about background turbidity levels in Savannah Harbor:

SAMPLE	GENERAL LOCATION OF PEAK TURBIDITY ZONE (CHANNEL STATIONS)	OBSERVED LEVEL IN PEAK TURBIDITY ZONE (MG/L)	EXTENT OF ZONE ALONG ESTUARY (NM)
1	79+000 to 104+000	> 200	8
2	46+000 to 79+000	> 300	> 8
3	30+000 to 46+000	> 500	5
4	0+000	> 400	3
5	36+000	> 300	5

These studies, therefore, reveal background turbidity levels through the entire length of the harbor that are in the same range as the maximum levels produced by the plume of a hydraulic dredge operating in the same river. This supports the position that the turbidity plume at the site of a hydraulic dredge has little impact on biota in Savannah Harbor.

7.13 Research indicates that suspended solids concentrations vary with the type of dredge used. Clamshell dredges exhibit higher levels and more widely dispersed impacts than do hopper dredges and cutterhead dredges, which exhibit the least impact (LaSalle 1991, pg 38).

7.14 Environmental impacts resulting from resuspension of sediments during a dredging operation are generally not expected to vary with the location of the dredge within the navigation channel, i.e. channel bottom, channel side slopes, or advance maintenance sections. One difference which is expected is a reduction in the spread of the turbidity plume when dredging is performed in the Sediment Basin or the turning basins, due to the lower current velocities in those areas.

7.15 Based on a literature review of existing research, all life stages of estuarine dependent and anadromous fish species appear to be very tolerant of elevated suspended sediment concentrations. In all probability, species that use naturally-turbid habitats as spawning and nursery grounds are adapted to and highly tolerant of elevated suspended sediment concentrations. In some cases (e.g. striped bass), their migration corresponds to periods of the year when highest natural suspended sediment levels are observed. This would indicate some degree of a tolerance of high suspended solid levels by those species. Dredge-induced elevated suspended sediment concentrations are of relatively short duration at a given location and do not prevail for sufficient lengths of time to

merit special concern (LaSalle, 1991, pg 47). However, open water disposal operations may be of sufficient durations to merit concern (LaSalle, 1991, pg 47).

7.16 Dredging in berthing areas also results in resuspension of sediments. The level of impacts from that resuspension would be similar to that experienced from channel maintenance dredging if the equipment used for excavation in berths were the same. However, berths in Savannah Harbor are typically maintained through agitation dredging. The procedures used during that process were described in Sections 3.22 through 3.24. In that procedure, resuspension with subsequent movement by tidal currents is the primary mechanism through which sediments are moved from the sites. The plume which results from that process has much higher turbidity levels than does that of a typical cutterhead dredge excavating material from the channel.

7.17 The plume resulting from hydraulic deposition in the channel during an agitation dredging operation was found in a 1993 study performed for Terminal Management Corporation by the Skidaway Institute of Oceanography to extend up to 1,650 feet from the discharge point (Flood Plume Survey 1). Maximum turbidity levels in the plume were slightly above 900 mg/l. When material was excavated from another berth (Ebb Plume Survey 2), the discharge plume could be traced 3,000 feet downstream. Peak turbidity levels approached 300 mg/l in that event. Another time (Flood Plume Survey 3), the discharge plume could be traced about 1,000 feet from the discharge pipe. The plume was found to last from 25 to 40 minutes after dredging operations stopped. When discharged from 6 to 10 feet below the surface, the plume tended to ride above the halocine (salinity wedge). Widths of the observed plumes varied from 200 to 400 feet when the discharge pipe was located close to a shoreline. The same study monitored the plume from agitation dredging events performed by dragging an I-beam. In that procedure, a plume was observed 1,750 downstream of the dredging site with a maximum width of about 300 feet (Ebb Plume Survey 6). On another occasion, a plume was observed about 800 upstream of the dredging site with a maximum width of about 500 feet (Flood Plume Survey 7). Maximum turbidity levels of about 850 and 1,075 mg/l were observed with I-beam dredging.

7.18 Generally, agitation dredging is performed in short discrete increments with the dock owners performing the operation at different times. A review of FY 1993 District files revealed that on average, a combined total of 81 hours of agitation dredging was performed each month by the 11 permittees who had such work conducted (total of 976 hours). That translates to about 7 1/3 hours of agitation dredging performed each month at each berth. Eight of the 11 permittees performed agitation

dredging during the July/August/September quarter when water quality conditions (dissolved oxygen) are most stressful in this harbor. The distribution of activity in FY 1993 was as follows:

# OF QUARTERS WHEN DREDGING WAS PERFORMED IN 1993	# OF PERMITTEES
4	2
3	1
2	6
1	2
0	4

7.19 The volume of sediment historically moved in the harbor through agitation dredging is somewhat uncertain. Based on the average production rate of 2,100 CY/hour for I-beam dredging determined during the 1993 study performed by EMC Engineering Services and the number of hours of agitation dredging reported by the terminal operators, a total of about 2,049,000 CY would have been removed in FY 1993. The Corps permits for agitation dredging issued in 1993 required dock owners to change their reporting technique and begin reporting the volume of sediment excavated based on the difference between "before" and "after" hydrographic surveys of the berth. Based on the dredging quantities reported by dock owners in 1994 and 1995, an average volume of about 177,000 cubic yards a year was removed by agitation dredging in those years. The 1993 Corps-issued permits allow agitation dredging of 736,500 cubic yards of berth sediments per year.

7.20 Since agitation dredging does not place the sediments into a confined disposal area but only moves sediment along the bottom and resuspends material into the water column, subsequent redeposition of that material in the navigation channel requires dredging to be performed a second time on the same sediments. The double handling of the material means that multiple adverse environmental impacts result when sediments are removed from berths by agitation dredging. Savannah District estimates that 80 percent of the material removed from berths by I-beam agitation dredging redeposits in the navigation channel. Hydraulic dredging with disposal in the channel results in 100 percent redeposition in the navigation channel. Dock owners are charged a fee by the Corps of Engineers based on those percentages for subsequent removal of those sediments from the Federal Navigation Project.

7.21 Based on the higher turbidity levels, length of the plume observed and multiple dredging events required, agitation dredging of berths results in more environmental impacts to aquatic life than would dredging of those areas with hydraulic cutterhead, clamshell, or hopper dredges. Use of a hydraulic cutterhead with disposal directly in the navigation channel would not significantly reduce those impacts, since multiple dredging of the material would still be required.

7.22 Agitation dredging is an incomplete solution to the overall problem of berth maintenance in Savannah Harbor. The procedure does solve the immediate problem of the berth owner, which is providing adequate depth adjacent to a specific dock. However, since it does not remove the sediment from the aquatic system, that same material may adversely affect other aspects of the harbor -- including depths in the navigation channel or other berths. In light of those factors and the comprehensive nature of this LTMS, a review was made of the District's 1993 Case Document and Environmental Assessment for the agitation dredging permits to assess the reasons agitation dredging is performed in Savannah Harbor. The following eight paragraphs summarize that review.

7.23 Dock owners applied to Savannah District for Section 10 and Section 404 Permits to perform agitation dredging for maintenance of adequate depths for ships at their berths. After a review of possible alternatives, the Case Document concludes that "the least environmentally damaging practical alternative for the applicants to accomplish their goal of quick and efficient dredging of their facilities is to continue use of the proposed agitation maintenance dredging method."

7.24 The unavailability of reasonable alternatives to individual dock owners has been one of the main reasons agitation dredging has been allowed in this harbor for maintenance of adequate depths in berths. The Case Document viewed the individual dock owner's options for sediment removal as being extremely limited. The lack of sufficient and available upland disposal sites for deposition of berth sediments was a critical factor. The high cost to mobilize a hydraulic dredge from other harbors for removal of sediment from one dock in Savannah was judged as so excessive that it rendered that option impracticable. A third factor was the rapid response capability of agitation dredging to remove new shoals which interfere with required depths for ships scheduled to dock in the near future.

7.25 The legal responsibility for maintenance of berths along Federal navigation channels rests with the local sponsor of that Project. That legal requirement is applicable nationwide and is based on cost sharing provisions contained

in the Water Resource Development Act (WRDA) of 1986. In other southeastern US harbors -- including those in North Carolina, South Carolina, Florida and Alabama -- provision of sufficient and available upland disposal sites is considered a component of the responsibility for excavating and disposing of sediments which accumulate in the berths. In both Charleston and Jacksonville Harbors, which are similar in size and geographically close to Savannah, dock owners must provide upland disposal sites for placement of sediments they remove from their berths. Sometimes a group of dock owners join together to develop and operate a disposal area which is then used by all members of the group. In Savannah, the lack of sufficient and available upland disposal sites was a factor in determining dock owners had no reasonably practicable alternative to agitation dredging for berth maintenance.

7.26 In Savannah, private dock owners' use of the Federal Navigation Project's confined disposal areas has been rare. That use has generally been limited by two factors: (1) the non-availability of a specific requested disposal site when it was desired by a dock owner, as a result of other work then being conducted at that site, and (2) an inability of a dock owner to obtain the required approvals for deposition of specific berth sediments from the disposal site's fee owner, Chatham County -- the non-Federal Project sponsor, and the Corps. With implementation of the rotation program proposed in the LTMS, one confined disposal area of each rotating pair would be available for sediment deposition at all times. Concerning obtaining approvals for deposition, both Chatham County and the Corps have generally indicated they would allow private interests to deposit in the Project's confined disposal areas as long as (1) such use did not interfere with other scheduled activities at the site, and (2) the sediments were not contaminated. With implementation of the proposed rotation program, availability of a confined disposal area is greatly increased. As for sediment quality, the Corps' permit evaluation process includes an assessment of the acceptability of the sediments for dredging and disposal, so sediments which the Corps allows to be removed by agitation or hydraulic dredging would typically be considered acceptable for deposition in the Project's disposal areas.

7.27 The high cost of mobilizing a hydraulic cutterhead dredge to remove the relatively small volume of sediment from one dock was identified as a factor in determining that procedure as being impracticable for a dock owner. It could cost roughly $500,000 to $1,000,000 to mobilize a large pipeline dredge and its accompanying equipment to the site from another harbor. That cost would be in addition to the costs of the actual sediment removal, which would be less than $50,000

(<20,000 CY @$2.50/CY). Savannah District cannot require dock owners to work collectively to jointly contract for the services of a hydraulic dredge to remove sediments from several docks, so one cannot assume that mobilization costs could be shared between users.

7.28 However, it is possible that the costs of obtaining the services of a hydraulic cutterhead dredge in Savannah Harbor may be lower than previously expected. Due to mobilization costs, dredges typically compete for work in a roughly defined geographic region. For large dredges which typically work on major projects, that region can be sizable and the accompanying mobilization costs can be quite high. Smaller dredges usually have less attending equipment and a smaller geographic range, generally resulting in lower mobilization costs. For a small dredge already located in the same harbor, those costs may be only in the $1,000's. It is the need to move a dredge, with its pipeline and accompanying equipment, long distances which quickly escalates the cost of mobilization. Therefore, the presence of dredges within a specific harbor is critical to determining the costs a dock owner would typically incur to obtain the services of a hydraulic cutterhead dredge.

7.29 Savannah District has typically had at least one hydraulic dredge employed in the harbor for 8 of the 9 months of the year that dredging is typically allowed in Savannah Harbor. However, even though the District may have had a dredge working in the harbor at a certain time does not necessarily mean that dredge was available to perform work for others at that time. The Corps enters into contracts with dredging companies for removal of sediment from the Federal Navigation Project. It generally includes a certain production rate or completion date in its contracts to ensure the contractor works continuously and makes reasonable progress on removing the sediments which the Corps has identified. A dredge may not have additional time to perform work outside its contract with the Federal government. Before the Corps would release a dredge it has under contract, it must be assured that the dredging work which it had contracted with the dredge operator to perform would be completed on schedule. Such temporary releases have occurred in the past and the Corps would attempt to work with harbor users and dredge operators in the future when completion of its contract can be ensured. Two other factors affecting the typical availability of hydraulic dredges in the harbor which a dock owner may employ are: (1) ongoing use of dredges by other dock owners for berth maintenance or berth improvement purposes, and (2) use of the harbor by a dredge operator as a temporary base while awaiting its next dredging contract. No investigation was made during this LTMS of the extent to which those two

factors increase the availability of hydraulic dredges in the harbor. However, in 1996 a Savannah Harbor-based firm did place a new 12-inch cutterhead dredge in operation with the goal of servicing berths and small dredging projects in vicinity of Savannah.

7.30 The need for a rapid response capability for quick removal of berth sediments is a balance between the sediment accumulation rate at a specific location and prior planning. Incorporation of a sediment storage layer below that needed at a berth specifically for the docking of vessels, as is used in similar harbors, provides the dock owner a longer time period to respond to accumulating sediments. Such sediment storage is included in Alternatives 6 and 8. Savannah District employs such procedures when it uses advance maintenance to allow it to extend its maintenance dredging cycle and reduce the frequency it dredges a given channel reach. Dock owners presently employ this technique to some degree, as they typically do not perform agitation dredging on a monthly basis. Expansion of this layer could reduce the frequency of maintenance events at a given berth, producing two beneficial effects: (1) providing more time to schedule maintenance dredging events and coordinate all required equipment and approvals, and (2) reducing adverse environmental impacts resulting from maintenance dredging. In this industrialized harbor, equipment necessary for barge-mounted clamshell excavation operations is often available. If an upland disposal area was available for deposition of the excavated sediments -- as would occur with the proposed rotation program, this dredging procedure may provide the rapid response capability desired by dock owners for emergency situations.

7.31 Suspended Solids In The Weir Effluent. Neither South Carolina or Georgia have a numeric turbidity standard in their Water Quality Standards. Neither state has placed a numeric turbidity standard in the Water Quality Certifications issued for the Savannah Harbor Navigation Project or any private dredging performed in the harbor. However, both states have qualitative criteria which prohibit discharges of materials which produce conditions which interfere with the receiving water's classified use. In addition, both states have standards for the amount of suspended solids in stormwater runoff from construction areas over 10 acres. In Georgia, this standard is 100 NTUs (roughly 200 mg/l) above background levels. In South Carolina, the standard for stormwater runoff is 50 NTUs (roughly 100 mg/l) above background levels. Mixing zones of various distances are used by those states in application of these standards. Alabama considers confined dredged material disposal areas to be construction sites over 10 acres and applies that stormwater runoff discharge limit to those sites. EPA's regulations for the

stormwater runoff permits include a statement that they expect temporary management practices for stormwater runoff from construction sites to be able to remove at least 80 percent of the solids.

7.32 Savannah District has used a criteria of 8,000 mg/l for monitoring the acceptability of effluent from confined dredged material disposal facilities, which are permanent structures specifically designed to retain solids. Using inflow suspended solids levels recorded at Savannah, that criteria roughly corresponds to a solids removal rate of 70 percent.

7.33 A review of monitoring data recorded by Savannah District for effluents from the harbor's weirs reveals that the average solids concentration in the weir overflows has been below 100 mg/l in all Project disposal areas except Disposal Area 2A, where it was just under 200 mg/l. The maximum solids concentration recorded in effluents from Project disposal areas was 516 mg/l. The solids removal efficiency of the District's disposal areas is quite high, being above 99.0 percent every time it has been measured. The efficiency is usually above 99.5 percent. Higher suspended solids levels have been recorded in effluents from private disposal areas which were used for disposal of Project material (Colonial Oil Disposal Area in early 1994). The most likely reason for the higher solids content with the non-Project sites is that those other sites are smaller, thus having a shorter retention time.

7.34 Results of the 1994 Wright River Weir Effluent Study summarized in Appendix E indicated that weirs with underdrains had higher turbidity levels than did the overflow weirs. Data from one underdrain was consistently above 600 NTUs (roughly 2,000 mg/l) throughout the eight-month sampling period. The effluent from that site was below 40 NTUs (roughly 65 mg/l) at the edge of the Wright River, a mixing zone of about 1,800 feet. That study found turbidity at the overflow weirs to be less than 50 NTUs (roughly 125 mg/l), except for one time (63 NTUs at Area 12B, Weir 3 on 12/1/93). Background turbidity was found to be as high as 60 to 75 NTUs (roughly 160 to 200 mg/l) at the reference site and up to 81 NTUs (roughly 225 mg/l) at a similar undisturbed SC estuarine site (Leadenwah Creek).

7.35 Based on both the District's weir monitoring data and findings of the 1994 Wright River Weir Effluent Study, the Project weir overflows generally do not release suspended solids at concentrations which cause impacts to aquatic life. Isolated instances may occur when releases do contain levels which may result in, or contribute to adverse impacts on aquatic species. Similar levels can occur naturally during periods of flood discharges.

7.36 Based on that finding of the study, with Alternatives 2 through 8 the District will use a standard for acceptability of its weir effluents of 500 mg/l. That level has been reported (LaSalle, 1991, pg. 47) as the level of suspended solids at which no impacts to fish would be expected. That standard would be used for the weir discharge, with no consideration of a mixing zone, to make monitoring easier to perform. The suspended solids level at the edge of a normal mixing zone is likely to be much lower than that measured at the weir. Water levels would be managed within the confined disposal facilities to obtain the settling time necessary to produce an effluent with suspended solids less than the standard of 500 mg/l. The maximum design height at which water can be held, in conformance with present dike construction practices, is 2 feet below the dike crest. Water held at those levels would result in maximum retention time of the sediment/water slurry, and thereby, maximum removal of the suspended solids.

7.37 Other Water Quality Parameters. Changes in water quality parameters can occur in relation to the extent of the dredge turbidity plume. Nutrients can be released from the resuspended material, as can heavy metals, pesticides and PAHs. Elutriate studies performed on Savannah Harbor sediments have found that release of the last three types of compounds is not likely during a dredging operation. The District will continue to monitor the water quality of its overflow weir discharges during disposal operations to ensure compliance with state water quality standards. The monitoring program is summarized as follows:

1) Water quality data will be taken on a weekly basis when controlled releases occur from dredged disposal management operations or wildlife mitigation operations.

2) The data collection will be for the following water quality parameters: salinity (ppt), pH, dissolved oxygen (mg/l & salinity corrected), and total suspended solids (mg/l). The following general information will be recorded when each sample is taken:
   (a) Date, time, location, tidal stage, and current direction.
   (b) Depth of water over the weir boards and ponding depth at the weir.

3) The above data will be collected at the outfall of each weir from which there is a discharge. In Disposal Areas 2A and 12A where the weirs empty into a drainage ditch, the data will be collected where the discharge leaves the ditch and enters the receiving water body.

4) If, during sampling, any of the tests reveal a violation of the state water quality standards listed below, the investigator will also collect data for the ambient condition in the receiving water near the discharge point. The investigator or the Contractor shall then immediately, within the hour, contact the COR and report the test results.

7.38 Dissolved oxygen can also decrease in a plume as a result of the additional respiration of organisms breaking down the newly available material. Results from District monitoring of hydraulic dredge plumes in the harbor over a three year period reveal only minor impacts to dissolved oxygen from the plume. In no case did the plume decrease the river's dissolved oxygen below either the Georgia or the South Carolina Water Quality Standards. Cases were observed where the background dissolved oxygen level in the river was below one of the state's standards outside the dredge's area of influence. In many cases, higher dissolved oxygen levels were recorded downstream of the dredge than were recorded upstream. Based on these findings, the District sees no value in further monitoring dissolved oxygen at the dredge site. As a component of Alternatives 2 through 8, no further monitoring would be performed at the dredge site for potential impacts to dissolved oxygen.

7.39 As a result of a review of the Draft EIS, the State of Georgia issued the LTMS Water Quality Certification in a letter dated September 5, 1995. That certification, which was subsequently modified by a letter dated February 28, 1996, requires daily monitoring of dissolved oxygen downstream of the dredge from July through September. Should dissolved oxygen levels be observed below the state standard, dredging is to be suspended until the levels rise above the state standard. Although the District's previous monitoring led it to conclude that the hydraulic dredge plume does not decrease dissolved oxygen levels below state standards, it will abide by the conditions of the Georgia water quality certification.

7.40 Agitation dredging also produces a plume which can impact dissolved oxygen. The 1993 study performed by EMC Engineering measured dissolved oxygen in the turbidity plume of two agitation dredging events. They found dissolved oxygen in the plume to drop 1.00 to 1.12 mg/l near the bottom. Although levels below 3.5 mg/l were recorded, neither event reduced the dissolved oxygen level below the Georgia water quality standard of 3.0 mg/l for the month of September. The South Carolina water quality standard does not vary by month, but remains at a daily average of 5.0 mg/l with an instantaneous minimum of 4.0 mg/l. The 1993 study of agitation dredging performed by the Skidaway Institute of Oceanography also examined dissolved oxygen in the turbidity plumes. Skidaway observed a maximum dissolved oxygen decrease of

about 2 mg/l. As with the EMC investigation, Skidaway's June and August 1992 tests found that dissolved oxygen did drop below 3.5 mg/l, but never below 3.0 mg/l. Both studies found that dissolved oxygen levels in the plumes remained above the state water quality standards when the agitation dredging was performed during winter months (January and February).

7.41 Low dissolved oxygen has periodically been observed in weir effluents from the confined disposal facilities. Although low dissolved oxygen (less than 1 mg/l) has routinely been found in headwaters of small tidal creeks in South Carolina, those conditions only occur naturally during early morning ebb tides due to high nocturnal respiration rates (Scott, 1994, pg. iii). Results from District monitoring of weir outfalls suggest that those conditions exist periodically at the disposal area weirs for sustained periods. Research indicates that grass shrimp and sheepshead minnow can survive low dissolved oxygen conditions indefinitely, as much of their ecology is predicated on such conditions. However, low dissolved oxygen may produce stress in other organisms and increase their potential exposure to contaminants as a result of the species' increased respiration in response to those conditions. To address this situation, a component of Alternatives 2 through 8 is the following procedure which would be followed at the confined disposal facilities:

(1) Should low dissolved oxygen levels (below state water quality standards) be observed during the weekly monitoring of weir effluent overflows during a disposal operation, daily monitoring would begin.

(2) Should sustained low dissolved oxygen levels (three consecutive days below state water quality standards) be observed in weir effluent overflows during a disposal operation, the pool elevation would be raised to the maximum height allowed by the condition of the dike (designed for full pool to be 2 feet below the dike crest).

(3) The pool elevation would be held at that height until the effluent dissolved oxygen levels exceeded state water quality standards for three consecutive days.

(4) The pool elevation may then be reduced as long as state water quality standards are maintained in the effluent.

(5) If the dissolved oxygen levels continue to remain below state water quality standards even with full pool conditions, the appropriate state water quality office would be notified by telephone (by District Environmental staff) and in writing (from the District Engineer or Contracting Officer's Representative) of the situation and what further actions were being taken to bring the Project back into compliance with its Water Quality Certification. The point

of measurement for determining compliance with state standards would be where the discharge enters the receiving body. Rocks placed at the discharge point during pipe installation to reduce erosion flows are considered appurtenances of the discharge pipe.

(6) After dissolved oxygen levels above state water quality standards are recorded for 14 consecutive, the monitoring frequency would be shifted back to a weekly basis.

7.42 District water quality monitoring indicate that although the overflow weirs have periodically discharged effluent with low dissolved oxygen levels, no adverse impact is observable in Wright River. Such releases do not occur on a yearly basis, but have been the result of deposition of some new work sediments, insufficient removal of vegetation from the floor of the disposal area prior to flooding of the site, or other unusual conditions within the confined disposal areas. Releases were allowed by the SC DHEC in 1993 which were below state water quality standards with the stipulation that the District monitor dissolved oxygen levels in Wright River to document impacts to that receiving water. The District found dissolved oxygen levels to decrease with distance up Wright River, independent of tide, with no discernible difference in concentration as that river flowed past creeks containing weir discharges of low dissolved oxygen. Based partially on that monitoring data, the District believes that its periodic discharges of low dissolved oxygen, although undesirable, have not caused extensive adverse impacts to the receiving waters.

7.43 As a result of a review of the Draft EIS, the state of South Carolina issued on May 10, 1996, a Water Quality Certification for the LTMS. That certification contained the following condition:

"2. The applicant must implement a water quality monitoring plan to insure that the effluent is in compliance with state water quality standards and to coordinate with the Department if any discharge is violating any state water quality criteria, as proposed. The applicant must conduct monitoring in accordance with an approved sampling plan specifying the location of sampling stations, parameters sampled, when samples will be collected, and how the sampling data will be reported. Appropriate ambient data from the Wright River must also be submitted."

7.44 Although the District has not yet submitted a water quality monitoring plan and obtained SC DHEC's approval, the District believes that it can fulfill the terms of Condition 2, stated above. The District does not believe that collection of ambient data from Wright River is necessary when the discharges meet all water quality standards, but will collect such data if SC DHEC requires it for approval of a monitoring plan.

7.45 Discharge from Weir Underdrains. The Georgia DOT installed underdrains in Disposal Areas 12B and 13A in 1990 to speed drying of the deposited material, thereby increasing consolidation of the material and shortening the time before equipment can enter a site to remove material for beneficial uses. The underdrains are located from 4 to 10 feet below the interior surface of the disposal area, depending on the mounding of the material. They serve to drain water from material deposited above their elevation. The 1994 Wright River Weir Effluent Study provided valuable information on the discharges from those underdrains. The study found the discharges to have elevated levels of arsenic, manganese and suspended solids, and have low levels of dissolved oxygen. The metals observed in the discharge apparently had dissolved into solution as a result of the oxidized conditions in the deposited sediments.

7.46 Analysis of data obtained during the 1994 Wright River Weir Effluent Study indicated that the water quality parameters of the underdrain effluents were such that impacts were likely to aquatic life in the small tidal creeks to which the drains were discharging. As a result of those findings, the two remaining underdrains to Wright River were closed.

7.47 A major factor in the environmental impacts resulting from the underdrain discharges was the fact that the discharges had been directed into the headwaters of small tidal creeks. The small volume of water in the receiving body resulted in little initial dilution. Data recorded where the small tidal creeks joined Wright River found that the undesirable concentrations of the water quality parameters had decreased to acceptable levels by the end of that roughly 1,800-foot distance. The small tidal creek essentially served as a mixing zone for those discharges prior to their release into Wright River at acceptable levels. Laboratory studies determined no statistically significant differences in the mortality of oyster larvae were observed when the effluent was diluted to a 10 percent concentration.

7.48 Since Chatham County and the GA DOT desire to continue to use underdrains for the beneficial impacts they have on disposal area life and management practices, underdrains would be installed draining either to the Savannah River or Back River. A further description of the installation and use of underdrains is

included in Appendix H LOCAL SPONSOR'S RESPONSIBILITIES. The larger volume and velocity of water in the receiving body would result in relatively rapid dilution of the discharge. Analyses of the chemical constituents of the underdrain effluent indicate that the water quality parameter which would require the most dilution is arsenic. Using that compound as the critical factor, a calculation was made of the mixing zone using the following assumptions:

(1) Complete mixture across a 16 square foot channel cross-section,
(2) River velocity of 1 foot/second,
(3) Discharge of 0.7 CFS from an underdrain pipe containing arsenic at 298 ug/L,
(4) Acceptable level of arsenic is 13 ug/L, and
(5) Background level of arsenic in receiving water is zero ug/L.

That calculation revealed that a maximum mixing zone of 10 feet would be required before the discharge from the new underdrains would meet acceptable water quality standards for all parameters. The 10-foot mixing distance is judged to be acceptable, as it is much less than the mixing zones of hundreds of feet which are typical for permitted industrial point discharges along the Savannah River. A chemical evaluation would be performed of the underdrain discharges every five years to ensure that all state water quality standards are being met in the receiving water at the edge of a 100-foot mixing zone.

7.49 Additional calculations were made using the procedures contained in the June 1994 draft EPA/Corps Inland Testing Manual. Appendix C to that document contains a section (C4) which describes formulas to use for mixing zones from confined disposal facilities which discharge in riverine conditions. Using those procedures, a discharge of 0.7 CFS into the shallow waters along the channel bank (average depth of 5 feet and a flow of 1 FPS) which contains 298 ug/l of arsenic would take 24 feet to reduce to a level of 13 ug/l. Section C6 of that Appendix describes other formulas to use for mixing zones from confined disposal facilities. Using those procedures and parameter values for discharge in estuarine conditions, the same discharge and receiving water conditions would require a 13-foot mixing zone to reduce the arsenic level to 13 ug/l. Those calculations reveal that mixing of underdrain effluents would occur within very short distances, much shorter than that typically given for industrial point source discharges.

7.50 As a result of a review of the Draft EIS, the state of South Carolina on May 10, 1996, issued a Water Quality Certification for the LTMS. That certification contained the following conditions:

> "3. The applicant must install flap gates at underdrain discharge points so that no effluent is discharged during low flow periods in receiving waters.
>
> 4. The applicant must monitor water quality 100 feet downstream of underdrain discharges to test for water quality standards compliance, as proposed. In addition, the applicant must conduct monitoring in accordance with an approved sampling plan specifying the location of sampling stations, parameters sampled, when samples will be collected, and how the sampling data will be reported."

7.51 Savannah District will ensure that flap gates are added to the design of the underdrain discharge structures. Although the District has not yet submitted a water quality monitoring plan and obtained SC DHEC's approval, the District believes that it can fulfill the terms of Condition 4, stated above.

7.52 Evaluation of Alternatives. In **Alternative 1** (Without Project Condition), no changes would occur from those actions presently being conducted. The plumes generated at the dredge site would continue to occur, but they would not produce significant adverse environmental impacts. The turbidity plume stemming from the site of an operating hydraulic dredge has generally been found to be within background levels observed in the harbor. However, the District will comply with conditions included in the Georgia Water Quality Certifications which state that no dredging be conducted during the striped bass spawning season of March 16 through May 31. Case-by-case exceptions to that condition require prior approval from GA DNR and the SC DHEC-OCRM. Weir discharges from the confined disposal facilities generally do not release suspended solids at concentrations which cause impacts to aquatic life. Isolated instances do sometimes occur when releases contain levels which may result in, or contribute to adverse impacts on aquatic species.

7.53 Monitoring of hydraulic dredge plumes in the harbor reveal only minor impacts to dissolved oxygen from the plume. In no case did the plume decrease the river's dissolved oxygen below either the Georgia or the South Carolina Water Quality Standards. Agitation dredging was found to decrease dissolved oxygen levels along the bottom by 1.00 to 1.12 mg/l. Conditions pertaining to dissolved oxygen are in effect between July 1 and September 30 on the permits for agitation dredging through the state water

quality certification process. Monitoring is to be conducted prior to and during agitation dredging events. No agitation dredging can be conducted if the dissolved oxygen level is found to be less than 4.0 mg/l prior to a dredging event, or less than 3.0 mg/l during an event. Monitoring of discharges from the confined disposal facilities has found instances where releases (as measured at the discharge point) do not meet state water quality standards for dissolved oxygen for extensive periods. The impacts of such releases are believed to be minor in scope since aquatic life in tidal estuaries is somewhat accustomed to periods of low dissolved oxygen. To ensure effluent from the confined disposal facilities meets state water quality standards, weekly monitoring would be conducted of the dissolved oxygen content of the discharges.

7.54 Elutriate studies performed on Savannah Harbor sediments have found that releases of nutrients, heavy metals, pesticides and PAHs are minimal during a dredging operation. No adverse environmental impacts from dredging or disposal operations are expected from such compounds.

7.55 Discharges from weir underdrains to Wright River were found to be unacceptable for that receiving water. In response to that finding, the releases were stopped by the end of 1994.

7.56 **Alternative 2** would have slightly less water quality impacts as Alternative 1. The District would implement a new suspended solids standard (500 mg/l) for determining the acceptability of discharges from the confined disposal facilities. A new procedure would also be implemented to ensure the dissolved oxygen content of weir discharges is as high as possible within the existing infrastructure of the confined disposal facilities. That procedure is described in Section 7.41. Since previous monitoring at the dredge site revealed no substantive effects on water quality from the dredging operation, no further water quality monitoring would be performed at the dredge site.

7.57 Diking of Disposal Area 14A would have only minimal and temporary impacts on water quality. The Mitigation Plan is not expected to have any long term adverse water quality impacts. The construction and use of an access road to Disposal Area 2A would have only minimal and temporary impacts on water quality. The mitigation for that action, presently expected to be restoration of degraded wetlands, is expected to have only minimal and temporary adverse impacts on water quality.

7.58 **Alternative 3** (rotational use of the confined disposal facilities) would have essentially the same water quality impacts as Alternative 2. Rotational use of the confined disposal facilities would have no direct impact on water quality. The confined disposal areas would be available for use by berth

owners for placement of berth sediments. This would likely benefit water quality if a reduction in the use of agitation dredging -- with its inherent multiple adverse environmental impacts -- occurs. The procedures in Alternative 2 for addressing suspended solids and dissolved oxygen in discharges from the confined disposal facilities are also included in this alternative. These procedures should have a beneficial effect on water quality over those presently employed (Alternative 1).

7.59 **Alternative 4** (Alternative 1 plus underdrains to either Savannah or Back Rivers) would have essentially the same water quality impacts as Alternative 2. The procedures in Alternative 2 for addressing suspended solids and dissolved oxygen in discharges from the confined disposal facilities are also included in this alternative. These procedures should have a beneficial effect on water quality over those presently employed (Alternative 1).

7.60 Weir underdrains would be installed in the confined disposal facilities in the middle harbor to drain to the Savannah or Back Rivers. The large volume and velocity of water in those receiving waters would result in relatively rapid dilution of the discharge. Calculations reveal that a mixing zone of 10 to 25 feet would be required before the discharge from the underdrains would meet acceptable water quality standards for all parameters. That short mixing distance is judged to be insignificant, as it is much less than the mixing zones of hundreds of feet which are typical for permitted industrial point discharges along the Savannah River. A chemical evaluation would be performed of the underdrain discharges every three years to ensure that all state water quality standards are being met in the receiving water at the edge of a 100-foot mixing zone. Monitoring of the underdrain discharge would be conducted, as required in the state of South Carolina's Water Quality Certification. This action would ensure the discharge would have no effect on water quality.

7.61 **Alternative 5** (Alternative 1 plus beneficial use of nearshore sediments) would have slightly more water quality impacts than Alternatives 1, 2, 3 and 4. Additional turbidity would be experienced in the nearshore area when sediments presently deposited at the Savannah ODMDS are, instead, used to either (1) construct and/or maintain submerged berms in the nearshore area, (2) construct and/or maintain the feeder berm off of Tybee Island, or (3) nourish the beaches of either Tybee or Daufuskie Islands. No significant increases in turbidity are expected from those disposal locations over that experienced at the Savannah ODMDS, but the turbidity will occur closer to recreational areas. Previous analyses have determined turbidity levels at the ODMDS during disposal operations to be at acceptable levels, so similar levels in the nearshore area are

also expected to be acceptable. Recent placement of dredged material on the Tybee Island beach during the 1993/1994 Deepening Project revealed that the turbidity is noticeable, but was not at unacceptable levels.

7.62 The procedures in Alternative 2 for addressing suspended solids and dissolved oxygen in discharges from the confined disposal facilities are also included in this alternative. These procedures should have a beneficial effect on water quality over those presently employed (Alternative 1).

7.63 **Alternative 6** (Alternative 3 plus direct placement of berth sediments in Project disposal areas) would have less water quality impacts than Alternatives 1, 2, 3, 4, 5 and 8. Excavation of sediments in the berthing areas by berth owners through the use of a hydraulic cutterhead or clamshell dredge, with subsequent placement directly in a confined disposal facility would eliminate the present multiple handling of that material and result in less turbidity in the harbor. Adjacent waters would be much less impacted by operation of hydraulic cutterhead and clamshell dredges than under present conditions with agitation dredging which intentionally disperses sediment into the water column. Before excavation could occur at a specific berth under this alternative, the District would perform a sediment evaluation -- using information provided by the dock owner -- to determine the environmental acceptability of those sediments for dredging. That evaluation would ensure no unacceptably adverse impacts on water quality result from this proposed excavation of berth sediments. The sediment storage areas proposed for construction and maintenance at berths would have a maximum depth of 6 feet below the authorized depth of the Navigation Channel. That depth was selected to minimize potential water quality problems stemming from reduced flushing rates in holes which accumulate fine-grained sediment. The depth limitation should ensure no unacceptably adverse impacts on water quality result from this proposed feature. Deepening berth areas is not expected to have any effect on salinity as the changes would not be continuous throughout the length of the harbor. The changes would widen the channel cross-section at those locations, but since the proposed excavation would only be performed at specific non-contiguous locations, no continuous increase would occur in the depth of the channel. As channel depth is the critical design parameter for determining salinity effects, no changes in salinity are expected from deepening berthing areas.

7.64 Alternative 6 does not address potential berth maintenance needs under emergency conditions. Agitation dredging presently meets the vast majority of berth dredging needs, including emergency dredging. The sediment storage areas proposed for construction and maintenance at berths would provide a longer time for storage to accumulate before removal is needed. This additional time should allow better scheduling of maintenance

dredging and reduce the need to perform emergency dredging. The sediment storage areas would also result in a larger volume of sediment being removed each berth dredging event, possibly resulting in a lower unit cost for the excavation.

7.65 The procedures in Alternative 2 for addressing suspended solids and dissolved oxygen in discharges from the confined disposal facilities are also included in this alternative. These procedures should have a beneficial effect on water quality over those presently employed (Alternative 1).

7.66 **Alternative 7** (Alternative 1 plus sediment control features) would have less adverse water quality impacts than Alternatives 1, 2, 3, 4, 5 and 6. Advance maintenance deepening of the Sediment Basin, the four turning basins, and additional advance maintenance deepening at Kings Island Turning Basin would concentrate deposition of sediments outside the navigation channel in those areas. This shifting of settlement patterns and clustering of material would result in greater depths of sediment in those areas, which would allow dredges to work more efficiently and with less fugitive turbidity.

7.67 Deepening the Sediment Basin is not expected to have any impacts on salinity as the shallower channel downstream of the deepened basin would act as a sill to keep water which is more dense and saline from reaching the basin. In addition, the bottom portion of the Tidegate which is located upriver would continue to act as another sill to keep denser more saline waters from extending up Back River. Deepening the advance maintenance section at Kings Island Turning Basin would also not have any effect on salinity as the shallower channel downstream of the deepened section would effectively act as a sill to keep water which is more dense and saline from reaching the basin. In the same way, the shallower channel upstream of the deepened area would act as a sill to keep any more dense and saline water from leaving that section. Deepening turning basins is not expected to have any effect on salinity as the changes would not be continuous throughout the length of the harbor. The changes would widen the channel cross-section at those locations, but since the proposed excavation would only be performed at specific non-contiguous locations, no continuous increase would occur in the depth of the channel. As channel depth is the critical design parameter for determining salinity effects, no changes in salinity are expected from deepening the turning basins.

7.68 The procedures in Alternative 2 for addressing suspended solids and dissolved oxygen in discharges from the confined disposal facilities are also included in this alternative. These procedures should have a beneficial effect on water quality over those presently employed (Alternative 1). Cessation of the monitoring at the dredge site is also a component of this plan. This item would have no effect on water quality.

7.69 **Alternative 8** (combination of Alternatives 3, 4, 5, 6 and 7) would have less overall adverse water quality impacts than Alternatives 1, 2, 3, 4, 5, and 6. The plan would have roughly the same overall water quality impact as Alternative 7. The effects of the individual component of this plan were described in previous sections. None of the beneficial aspects of the individual components are reduced when they are combined into this alternative and no additional adverse impacts result from the combination of components.

7.70 **In summary**, each of the alternatives would result in water quality impacts which are acceptable. All plans contain features to limit adverse impacts, and alternatives to the Without Project Condition contain features which would lessen impacts from discharges from the confined disposal facilities. Some plans (Alternatives 6 and 8) contain features which would reduce the number of agitation dredging events required to maintain adequate depths in berths, thereby reducing adverse impacts from maintenance of the harbor. Proposed changes in sediment control features would result in fewer water quality impacts than the Without Project Condition (Alternative 1).

7.71 Each of the alternatives was assigned a score based on their overall water quality effects. A scale of 0 to 10 was used, with 3 being the level of no effect. The results of this evaluation are displayed as follows:

ALTERNATIVE	ASSIGNED SCORE
7 + 8	7
6	6
2, 3 + 4	4
5	3
1	2

7.72 Fishery Resources. There is a potential for impacts to fish and other mobile aquatic life stemming from dredging and disposal operations. Impacts from dredging operations could result from physical impacts from the dredge or associated vessels and resuspension of solids at the dredge site. Impacts from disposal operations could result from water quality aspects (suspended solids, low dissolved oxygen, etc.) of effluent from the confined disposal sites. Potential impacts to fish from discharges from the confined disposal facilities were evaluated

in the sections describing water quality impacts. Potential impacts to fishery resources at the ODMDS and potential nearshore disposal sites are described separately in the section dealing with those sites.

7.73 Since adult fish are mobile and dredging impacts are very localized, the potential for adult fish being harmed due to physical impacts from a dredge and its attendant vessels is quite low. Savannah District performed an evaluation to assess the potential for entraining fish through a pipeline cutterhead dredge, the equipment most commonly used in the inner harbor to excavate channel sediments. Calculations revealed that for a 30-inch dredge working in medium sand, the approach velocity at the surface of a 6-foot cutterhead ball would be 1.3 feet per second (FPS). These velocities would be lower with finer-grained sediments, a larger cutterhead ball, and further distance from the cutterhead. Even if one assumes a doubling of the flow velocity due to non-uniform flow patterns when the cutterhead is working and is partially buried in sediments it is excavating, the resulting entrance velocity of about 2.5 FPS is not too strong to overcome most adult or subadult fish. Tidal currents in the Savannah River typically reach about 5 FPS on a daily basis. Fish entrainment is further reduced by the underwater noise produced by the rotating cutterhead as it scrapes the sediments, loosening them for removal through the suction pipe.

7.74 Eggs and larval fish are not as mobile as adults, so there is a higher potential for those early life stages to be impacted either by being entrained by a dredge or being physically damaged by materials in the dredge plume. Anadromous species which migrate up the Savannah River to spawn are of particular concern. American Shad ascend the river and spawn well upstream of the harbor; therefore, the eggs and larvae of this species are not expected to come in contact with a dredge or its plume. Some small fish are entrained through the dredges, but their numbers are low with no measurable impact on population levels. The potential for entrainment increases when operations take place during migration periods and when work is performed in heavily used narrow channel habitats. For those situations, a restriction has been recommended in other parts of the country that suction dredging be permitted during the migratory period only in water that is at least 15 feet deep to minimize entrainment of fry in the upper water column. That condition is met in this harbor as the authorized channel depth is -42 feet MLW.

7.75 Striped bass historically spawned primarily in the Back River prior to construction and operation of the Tidegate. Recent studies in Savannah Harbor found very few Striped bass eggs in Back River, with most eggs being collected in the Front River. The present status of Striped bass recovery and habitat use in the lower Savannah River system are unclear. However,

based on the historic spawning site and the subsequent down-current drifting of the eggs and larvae of this species, there is a potential for contact with the dredge and possible entrainment by the dredge. Due to the semi-buoyant nature of the eggs and larvae (typically found in the upper 6 feet of the water column) and the depth from which dredges withdraw their sediment/water slurry (greater than 20 feet), the likelihood of dredges entraining Striped bass eggs and larvae would appear low. The increased suspended sediment loads of a dredge plume also have the potential for coming in contact with Striped bass eggs and larvae. Larvae have been found to be a more sensitive life stage than is the egg stage (LaSalle 1991, pg 43). The survival of Striped bass larvae has been found to be significantly reduced when exposed for 2 to 3 days to suspended sediment concentrations which exceed 500 mg/l (LaSalle 1991, pg 44). Research indicates that the turbidity plume of a cutterhead dredge typically extends about 10 feet above the cutterhead and decreases exponentially to the water surface. This would indicate a minimal turbidity plume 20 feet above the cutterhead where Striped bass eggs and larvae are located (upper 10 feet of the water column). However, the area of turbidity impact is generally larger when tidal currents exceed 2 feet per second (LaSalle 1991, pg 34), which is a common occurrence in Savannah Harbor. Turbidity levels measured in Savannah Harbor in the plumes of cutterhead dredges indicate that levels are generally below that which produce adverse impacts to Striped bass eggs and larvae, and within that of background levels common in the harbor.

7.76 However, due to the recently low observed population levels and the sensitivity of Striped bass to some environmental parameters, Savannah District is funding studies to determine the timing, distribution and numbers of Striped bass eggs and larvae in the harbor. Those studies began in 1994 and are scheduled for completion in 1997. Until those field studies are complete and the results fully analyzed, questions will still remain about potential impacts to Striped bass eggs and larvae from dredging operations. Therefore, to remain in compliance with the Georgia Water Quality Certification and address concerns about impacts to the Striped bass population of the Savannah River, dredging will continue to be restricted to the lower harbor (River Mile 5.0 to 0.0) and the Bar Channel during the period from March 15 to May 31 of each year. Case-by-case exceptions to that condition require prior approval from GA DNR and the SC DHEC-OCRM. Should future research indicate that this restriction is unnecessary to protect Striped bass, the District would follow procedures agreed to by the state resource agencies.

7.77 One component of the proposed Mitigation Plan for wetland impacts in South Carolina is the installation and operation of a second water control structure at an existing 228-acre impoundment within the Savannah National Wildlife Refuge. The impoundment selected is presently operated without having a daily

connection with adjacent tidal waters. The impoundment currently has one water control structure with stop logs which maintain a constant water surface elevation. Once tidal flows enter the impoundment through the control structure, stop logs are placed across the opening to block further daily flows. This procedure traps the water -- and any fish present -- within the impoundment until a decision is made sometime later to drain the impoundment either partially or completely. The proposed second water control structure would generally be open to all tidal flows, thereby providing a constant connection between the impounded water and the adjacent tidal waters. Establishing this connection would result in a continual flushing of the impoundment, thereby substantially improving its water quality and making available the shallow areas to fish for feeding and spawning. The entire aquatic ecosystem at the impoundment would benefit from the increased flow and the action would directly benefit fishery resources.

7.78 **Alternative 1** would result in minimal impacts to fishery resources. The mobility of adult fish and the localized nature of dredging impacts, lead to a conclusion that the potential for adult fish being harmed due to physical impacts from a dredge and its attendant vessels is quite low. Some small fish are entrained through the dredges, but their numbers are low with no measurable impact on population levels. Dredging is performed at depths exceeding 15 feet, so entrainment of fry in the upper water column is not a significant concern. To avoid possible impacts to the Striped bass population of the Savannah River, dredging will continue to be restricted to the lower harbor (River Mile 5.0 to 0.0) and the Bar Channel during the period from March 15 to May 31 of each year. Case-by-case exceptions to that condition require prior approval from GA DNR and the SC DHEC-OCRM. Should future research indicate that this restriction is unnecessary to protect Striped bass, the District would follow procedures agreed to by the state resource agencies. Potential impacts to fish from discharges from the confined disposal facilities were described in the sections describing water quality impacts and were found to be localized in nature and have a low probability of occurrence.

7.79 The dredging and disposal aspects of Alternatives 2, 3, 4 and 7 are essentially the same in their potential effects on fishery resources and would have roughly the same level of impacts as Alternative 1. Substantial beneficial impacts would result from the component of the Mitigation Plan comprised of installation and operation of a second water control structure at an impoundment within the Savannah National Wildlife Refuge. That beneficial impact would occur with Alternatives 2, 3 and 8. The introduction of turbidity into the nearshore area in Alternatives 5 and 8 would cause more stresses to marine finfish and shellfish residing in the nearshore area. However, the

turbidity impacts would have a short duration and, therefore, are not expected to result in significant adverse impacts to that resource. The reduction in turbidity and decreased impacts to dissolved oxygen associated with implementation of Alternative 6 would be beneficial to fishery resources in the harbor. Establishment of underwater berms in Alternatives 5 and 8 would provide a variation in the relief of the ocean floor which should be beneficial to marine fishery resources.

7.80 In summary, each of the alternatives would result in impacts to fishery resources which are acceptable. Although dredging and disposal operations do adversely impact these resources, the amount of impact is small and does not affect the viability of any population. Each of the alternatives was assigned a score based on their overall effects on fishery resources. A scale of 0 to 10 was used, with 3 being the level of no effect. The results of this evaluation are displayed as follows:

ALTERNATIVE	ASSIGNED SCORE
2 + 3 + 6 + 8	5
5	4
1 + 4 + 7	3

7.81 Benthic Resources. Benthic communities in a dredging area are physically disturbed by dredging activities and most benthic communities would be lost where excavation does actually occur. After the excavation is complete, the area would be available for recolonization. The extent to which recolonization would occur would depend on the frequency of maintenance dredging required. Those areas dredged frequently (1 to 2 times per year) probably do not support benthic communities in an equilibrium condition.

7.82 Proposed changes to the harbor's Sediment Control Works includes of excavation of the Sediment Basin and turning basins. The environmental impacts resulting from those operations are similar to that performed in the navigation channel. One difference between those the channel and the other areas relates to the size of the material which settles out in them. Material which deposits in the Sediment Basin and in turning basins is generally finer-grained. In the Sediment Basin it is often difficult to determine exactly where the bottom is located, as the shoaled material is so fine-grained that some does not completely settle, so a distinct difference between the water column and the bottom is not readily apparent. In these areas

where a stable bottom surface does not exist, the benthic community is not very diverse. As a result, further accumulation at those sites would not have substantive effects on benthic life until a stable bottom surface is produced.

7.83 Since most of the biota in sediments exists within the top foot of the water/sediment interface, excavation of a thicker layer of sediments results in fewer impacts to benthic communities than does normal dredging in the channel where sediments are deposited in thinner layers. High shoaling areas where sediments accumulate in thick layers have less benthic life when measured per volume of sediment. More frequent dredging of these areas increases the number of times benthic communities existing there experience impacts, but the total impacts to benthic communities do not increase proportionately. Less overall impacts to benthic communities would occur when most of the sediment load accumulates in thick layers in small areas while most of the bottom surface receives only small deposition. That is the condition that advance maintenance can produce if that technique concentrates deposition in areas of limited size. Advance maintenance also lowers impacts to benthic communities by reducing the frequency at which dredging is performed. That allows a longer time for populations to reestablish in the excavated areas. Decreases in dissolved oxygen at the water column/sediment interface may be slightly larger in those areas where channel currents are lower and do not readily flush the site with new water with higher levels of dissolved oxygen. Such conditions could stress benthic communities residing at those sites.

7.84 Other potential impacts to benthic assemblages are impacts related to resuspension of sediments by the dredge. The major impacts of this resuspension are possible burial of organisms and the impacts which increased sediment loads may have on feeding, respiration, and/or photosynthetic activity. Benthic organisms of the Savannah Harbor area are adapted to and highly tolerant of naturally elevated suspended sediment concentrations for short periods of time. According to Hayes 1986, a hydraulic dredge operating in the Sediment Basin (a worse case scenario) produces increases in suspended sediments of less than 200 mg/l. Monitoring in Savannah River performed from 1991 to 1994 generally agrees with that finding. Naturally-occurring storm events often increase suspended sediments in the harbor well beyond the increase created by a hydraulic dredge. Therefore, the existing benthic communities in Savannah Harbor would not be adversely impacted by resuspension of sediments in the harbor due to either hydraulic, clamshell or hopper dredging. Agitation dredging does result in higher than normal deposition rates in areas of limited size. Benthic assemblages residing in those

locations could be adversely affected. However, most of the redeposition occurs in the navigation channel where benthic communities are already impacted on a recurring basis by dredging events.

7.85 Impacts to benthic communities will occur at the site of open water disposal operations. Sites which are presently used in this manner are the Savannah ODMDS and the remainder of New Cut. Impacts to benthic communities at both of those areas were previously evaluated in separate documents and determined to be acceptable. Impacts from disposal operations at the Savannah ODMDS are reviewed in the section dealing with that site. Potential impacts to nearshore benthic communities from disposal at the sites of the proposed submerged berms, adjacent barrier island beaches, and the bird island component of the Mitigation Plan are described in the sections which specifically address those sites. Potential impacts to benthic communities in nearshore waters will be minimized through the use of a side scan survey prior to initial use of a site to ensure no valuable hard bottom communities are present. Benthic surveys would also be conducted prior to initial use of a site to ensure no valuable benthic communities are present.

7.86 **Alternative 1** (Without Project) would result in continued adverse impacts to benthic communities residing in areas used by the Navigation Project. The periodic excavation required to maintain adequate depths results in recurrent adverse impacts through removal of the benthic populations. Recolonization of the excavation surface begins immediately, but equilibrium conditions are probably not reached within the benthic community before the next dredging occurs. Continued use of agitation dredging results in comparably large volumes of sediment depositing on relatively limited portions of the river bottom. That deposition takes place at a faster rate than do normal sedimentation processes, thereby stressing or possibly destroying benthic communities through the effects of smothering. However, as stated previously, periodic dredging of the navigation channel removes much of those communities from the channel floor at that time.

7.87 Alternatives 2, 3, and 4 would not result in significant changes in impacts to benthic communities since dredging operations would not be markedly different. Periodic dredging would still be a basic component of each of those alternatives. Alternative 5 (beneficial uses of nearshore sediments) would result in impacts to benthic communities near the locations of the dredged material placement. Communities would be directly lost through burial at the sites where material is placed. A benthic survey would be conducted prior to deposition at each new site to ensure that no hard bottom communities exist at the site. Additional short-term impacts would be experienced in adjacent areas as a result of the temporary increases in turbidity.

Alternative 6 (Dredging of berths with direct deposition in confined disposal areas) would result in less overall impacts to benthic communities through both (1) the reduction in the present multiple handling of sediments and its associated impacts resulting from the resuspension and subsequent redredging of material once located in the berths, and (2) the reduction in stress -- and possibly smothering -- presently produced by redeposition of sediments displaced through agitation dredging. The concentration of sediments in certain areas which would result from the sediment control features in Alternatives 7 and 8 would decrease impacts to benthic communities by reducing the rate of shoaling in the navigation channel. This would enable communities to better recolonize the channel surface between dredging events.

7.88 In summary, each of the alternatives would result in impacts to benthic resources, but those impacts would be acceptable. Although dredging and disposal operations do adversely impact these resources, this impact does not affect the viability of any benthic community within the estuary. Each of the alternatives was assigned a score based on their overall effects on benthic resources. A scale of 0 to 10 was used, with 3 being the level of no effect. The results of this evaluation are displayed as follows:

ALTERNATIVE	ASSIGNED SCORE
7 + 8	6
6	4
1, 2, 3 + 4	2
5	1

7.89 Wildlife Resources. Potential impacts to wildlife species could result from the dredging and disposal operations, as well as disposal area maintenance activities. The main area where direct adverse impacts are possible are at the confined upland disposal facilities. As described before, those areas provide extensive habitat for shorebirds and migratory birds. Small mammals are found in the narrow wooded vegetation which exists along some areas of the dikes. Large waterfowl concentrations use the disposal areas during migrations and when dredging operations are performed in winter months. Predacious birds such as hawks are also attracted to these areas due to high concentrations of prey species.

7.90 One component of several plans is the diking of Disposal Area 14A and associated the Mitigation Plan which would be required to replace the functional values of the wetlands which would be lost. A later section in this report will describe the impacts of that action on wetlands. The following paragraphs describe the logic behind development of the Mitigation Plan and the beneficial impacts on wildlife which implementation of that Plan would produce.

7.91 Early coordination with resource agencies revealed a degree of agreement on the functional values which would be lost and that should be replaced. The Distichilis spp. and Juncus roemerianus vegetation at Disposal Area 14A was judged to primarily function as wildlife habitat. The Spartina cynosuroides vegetation primarily functions as wildlife habitat and a source of detritus, while the Scirpus spp. marsh primarily functions as wildlife habitat and as a wildlife food source. Previous dredged material deposition at the site raised the ground elevation over a wide area, resulting in a shift in vegetative species from highly productive Spartina spp. to less valuable wetland species, facultative shrub species, and upland grasses. The distance of the site (about 4,000 feet) from the nearest defined tidal river severely limits the site's value as a fishery resource.

7.92 The first step in development of a Mitigation Plan was an attempt to identify sites which could be used to create wetlands similar to those existing at Disposal Area 14A. Replacement of similar habitat would restore the functional values of those wetlands which would be lost. Most high ground around the harbor is already developed and would be very expensive to purchase and then excavate to create a wetland. Savannah District was unable to identify any single high ground tract or combination of smaller tracts where sufficient acreage of wetlands could be created. The District consulted resource agencies, but they could not identify a suitable site or group of sites in the immediate project vicinity where sufficient high ground could be obtained and excavated. Therefore, excavation of high ground property was deleted from consideration as a method of wetland creation. Shallow water estuarine areas contain features which have significant environmental value. The filling of those areas to build up the elevation of a site so that marsh vegetation could flourish was judged to be unacceptable since deposition of material to fill the site would produce significant adverse impacts to benthic and aquatic resources. Therefore, the filling of shallow areas was deleted from consideration as a method of wetland creation. The infeasibility of these two approaches to wetland creation led to a conclusion that creation of a similar wetland in the immediate project vicinity to replace the functional values which would be lost at Disposal Area 14A was an unimplementable alternative.

7.93 The next step in development of a Mitigation Plan was identification of what resources were most important in the function of the Disposal Area 14A site within the harbor. This was an attempt to view the development of Disposal Area 14A in the larger context of the harbor's estuarine ecosystem. Agreement was reached between the agencies on the value of the site for wildlife habitat and the critical importance which the Project's disposal facilities provide to shorebird and waterfowl populations in the harbor area. The concept was then developed for mitigating lost wetland functional values through the creation of critically needed wildlife habitats; particularly habitats for migratory birds and endemic shorebirds. Mitigation efforts would be prioritized toward increasing wildlife values at the Project's existing confined disposal facilities. If sufficient habitat values could not be created at those disposal sites, offsite actions would then be investigated, but at sites within the Project area.

7.94 Migratory birds were identified as the target group of wildlife species which could most benefit from increases in habitat availability in the Project area. These birds include least terns, Wilson's plovers, black-necked stilts, and mottled ducks, as well as large numbers of other migratory shorebird and waterfowl species. Many land bird species also use the areas at times, especially the shrub habitat found along and adjacent to the dikes. The confined disposal areas provide valuable habitat for those species due to the availability of food and the isolated and open nature of the sites. Although a number of bird species reside in the project area throughout the year, habitat for migratory shorebird species appears to be especially critical since those species regularly occur in the spring and fall in the CDFs in large numbers. Ten basic management techniques were identified which would benefit those migratory birds which rely on the Project area for an important period of their lives. Those techniques are described in paragraphs 7.95 through 7.104.

7.95 Creating Nesting Islands. Nesting islands could be provided within each disposal area. These areas would be covered with sand and scattered wood debris and have a gentle slope to make them suitable for least terns and Wilson's plovers. Other criteria for proper nesting habitat may be developed. These nesting islands should be available and undisturbed from April 14 to August 6 (unless Wilson's plovers are present, in which case the areas should remain undisturbed until August 28). The islands could be disturbed earlier, if nesting species are not present. At least two 1- to 3-acre nesting islands could be provided within each disposal area. These islands could be located in each disposal area so that they would be surrounded by water or mud. Each island would be covered with coarse sand if the construction materials were not suitably sandy. This could result in 42 acres of wildlife benefit (two 3-acre islands in each of

seven disposal areas). Vegetation would be controlled annually. Islands would also serve as year round roosting areas (would be similar to the natural high marsh panne roosting sites cited by Howe, 1989).

7.96 Creating Upland Nesting Areas. Bare ground nesting areas could be provided on high ground outside the diked perimeter of a confined disposal area. These areas would be cleared of existing vegetation and possibly covered with dredged material to provide a sandy nesting substrate. As in the previous paragraph, the site would be graded to produce a gentle slope to make them suitable for least terns and Wilson's plovers. Other criteria for proper nesting habitat may be developed. These areas would generally remain undisturbed from April 14 to August 6 (unless Wilson's plovers are present, in which case the areas should remain undisturbed until August 28). These areas would not provide as high a quality nesting habitat as the islands described in the previous paragraph since the nests would be accessible to terrestrial predators.

7.97 Holding Ponded Water. At least 50 acres of water could be held in one of the disposal areas (Area 12A, 12B, 13A, 13B, 14A, 14B or Jones/Oysterbed Island) so that at least one 50-acre wet area would be present at any time during the year. This would result in at least 50 acres of wildlife benefit. Only a minimal depth of water would be needed, as the ponded area would primarily serve as a resting site for migratory waterfowl. For Disposal Area 14B, this would be in addition to the area currently inundated by tidal flow into the weirs. Maintenance of a constant water level would depend on rainfall to counter the effects of evaporation and infiltration, which lower the water surface.

7.98 Slow Release of Ponded Water. If sufficient rainfall is obtained, a constant water level could be maintained in the summer and winter and then slowly lowered through the spring and fall. The wet area would result in 50 to 100 acres of beneficial wildlife habitat.

7.99 Mowing of Dike Slopes. Mowing of dike slopes could be halted during the nesting season (March 1 to July 14) to provide additional vegetated upland habitat. The dike crest could continue to be mowed to allow needed access around the Disposal Areas.

7.100 Construction of an Offshore Bird Island. Construction and maintenance of a bird island north of the north harbor entrance jetty was identified as a valuable habitat enhancement feature. The island should be 3 to 10 feet above highest water level to prevent wave overtopping and should be at least 0.3 km from mainland to prevent predators

from swimming to the site. A 1-acre island at 14' above MLW would produce an 11-acre surface area above MLW (assuming a 1:35 slope). A 5-acre island with the same side slope would produce a 14-acre surface area above MLW.

7.101 Monitoring of Bird Nesting. Monitoring of bird nesting at the confined disposal areas could be performed on a regular basis by District Biologists. This would provide information on bird use of the sites which could be used for future management decisions.

7.102 Manage Existing Areas for Optimum Bird Habitat After Each Disposal Operation. Ideal beneficial management strategies were identified for the following four different groups of birds:

(a) For spring migrants, there should be fall flooding (1 month before heavy freeze) and a spring draw down at a rate of 2 to 3 cm per week (Helmers, 1992). The draw down should begin in late March to provide optimal foraging opportunities for late migratory dabbling ducks (Howe, 1989).

(b) For fall migrants, two schemes are available. A disposal area could remain flooded through the spring and early summer, with either slow draw down or natural evaporation during the fall. For areas that are dry, shallow disking followed by shallow flooding 2 to 3 weeks before summer/fall migration begins (Helmers, 1992) would optimize the site's habitat value. Howe (1989) suggests reflooding to 5 to 76 cm.

(c) For waterfowl, the ponded water in the disposal area would be drawn down in the spring to firm the substrate and initiate germination of widgeon grass. Pool levels would then be drawn down in April through early June. After plants germinate, the area would be gradually reflooded to 35 to 45 cm to allow plants to grow. During late fall and early winter, water depths would be decreased approximately 10 cm per month (Helmers, 1992). Irrigation at 10 cm per month would increase plant growth, but would be quite expensive.

(d) For nesting birds, a constant water level in the late spring and early summer would be maintained. This would be followed by a slowly dropping water level in the late summer. The wet area would be expected to cover a minimum of 50 to 100 acres.

7.103 Maintaining High Marsh Pannes. Natural high marsh pannes could be maintained to provide roosting and feeding sites (Howe, 1989).

7.104 Creating Roosting Islands. Islands could be created in managed non-tidal wetlands for use by birds as roosting sites. Vegetation at the sites would be controlled to optimize the suitability of the vegetation for roosting.

7.105 Public review of the draft EIS revealed that refinement of the proposed mitigation plan was necessary. After review of the draft mitigation plan, regulatory agencies felt that creating wildlife habitat to replace the wetlands which would be impacted by the proposed project did not fully address all the functional values inherent in those marshes. Some believed that some form of in-kind mitigation was required as a component of a comprehensive mitigation plan. The District reviewed the composition of the vegetation which would be lost through the diking and use of Disposal Area 14A. That review revealed that 50.9 acres of high value and 1.6 acres of low/moderate value Spartina marsh would be lost, for a total of 52.5 acres of Spartina marsh.

7.106 After reviewing the detailed information on vegetative types which would be impacted, the SC DHEC-OCRM stated that a minimum of 25 acres of in-kind mitigation would be necessary. The District and local sponsor agreed to include such a component in the final Mitigation Plan. During subsequent discussions with the SC DHEC-OCRM, they stated that they periodically become aware of sites where opportunity exists to restore or create wetlands, or purchase valuable habitats to protect them from development. The SC DHEC-OCRM indicated it would be willing to select sites for future wetland mitigation actions and oversee accomplishment of necessary mitigation actions. To accomplish this, Chatham County as the project sponsor -- or GA DOT as its designee -- would establish an escrow account which the SC DHEC-OCRM would administer to perform wetland restoration/creation or protection measures as it deems most appropriate as sites become available in the future.

7.107 Regulatory agencies also expressed concern about potential adverse impacts to wildlife as a result of possible toxicity problems associated with sediments deposited in the confined disposal areas. Savannah District has historically evaluated river sediments both prior to their excavation from the riverbed and when they are discharged from the confined disposal areas. Those evaluations reveal that the excavation and disposal activities can be conducted in an environmentally acceptable manner. Migratory birds do presently select these sites for nesting, feeding and resting, with no apparent adverse impact.

To ensure the wildlife habitat that would be produced through the proposed management techniques would not be harmful to wildlife, the District agrees that it is prudent to test the sediments located within the confined disposal areas. Therefore, Savannah District will conduct chemical testing of sediments in the areas where wildlife habitat will be produced.

7.108 Future disposal area operations will result in the loss of wetlands and their associated wildlife habitat values. Areas located adjacent to the confined disposal facilities would be the sites affected. The wetland impacts of those disposal site management operations are described in detail in the paragraphs following Section 7.124 Wetlands, but they are summarized as follows:

ACTION	WETLANDS LOST (ACRES) SOUTH CAROLINA		GEORGIA	
Access Road to Area 2A	----		2.89	
New Pipe Ramps	1.70		----	
Pipe Ramp Expansions	0.67		0.14	
Weir/Discharge Pipe Installations	0.10		----	
Weir/Discharge Pipe Replacements	0.43		0.04	
J/O Island Bank Protection	2.63		----	
Underdrain Installations	0.21		----	
	5.74	Total	3.07	Total
	6.00	Use	3.20	Use

The functional values of these wetlands would be lost as a result of their use for the Navigation Project. Therefore, mitigation is required for these losses.

7.109 Three potential specific management strategies were identified for the confined disposal areas. These strategies include the ten general management techniques which were previously described.

7.110 Strategy 1 - Operation as usual. With this method, disposal areas would be used as needed, with drying started immediately after disposal operations are complete. Some areas would be paired so that the drier of the pair would receive the next disposal event. Operations would be geared toward drying the areas as quickly as possible. Disposal areas would often not be available during the nesting season of May 1 through August 31 when nesting migratory birds are using a particular area, although take permits have been obtained in the past from the US FWS to allow operation during that time. The months of available use would range from 7.5 to 12 months per year. This is the

baseline condition against which the other operational methods are compared to determine their increased environmental benefits. The total acreage within the confined disposal areas which reasonably serve wildlife habitat functions when the areas are operated as usual are shown in Table 11.

7.111 Strategy 2 - Manage Disposal Areas And Plan Their Use For Maximum Benefits To Birds. Disposal area use would be keyed to either a spring shorebird schedule, a fall shorebird schedule, or a combination of both. In this management strategy, harbor dredging which includes use of middle harbor confined disposal facilities would be scheduled to derive maximum wildlife benefits at the disposal areas, while using channel depth availability and extended disposal area drying times as a secondary considerations. Dredging would be planned under one of two bird use schedules or a combination of both. Each of the schedules would maximize benefits for different groups of birds. The spring schedule would involve use of a disposal area from July 15 through March 15. Water would be held impounded from November 1 to March 15. Between March 15 and July 15, water levels would be gradually dropped. This scenario should be most beneficial to spring migrant shorebirds, summer breeding black-necked stilts, and wintering ducks. The fall schedule would involve use of a disposal area from November 15 through May 1 with waters being impounded and held between May 1 and July 1. Water levels would be gradually lowered between July 1 and November 15. This schedule would primarily benefit fall migrant shorebirds, summer breeding terns, and black-necked stilts. Several different combinations of these schedules were investigated. Six scenarios were developed which use this overall approach. Although these scenarios should maximize bird use within the disposal areas, they may unacceptably limit the availability of the areas for disposal operations, thus impacting the availability of adequate channel depths. The six scenarios are described as follows:

(a) Two ponds alternating use every two years, with two concurrent spring schedules followed by two years of drying. This schedule would allow 8 months of disposal area use each year, followed by 4 months of gradually lowering water levels. A disposal area could be available for use every other year by starting disposal operations during the nesting season. That schedule would result in a shortening of the intended two-year drying time by 4 months.

(b) Two ponds alternating use every two years, with two sequential fall disposal schedules followed by two years of drying. This schedule would result in disposal area use of 5.5 months, followed by 2 months of holding water during the nesting season, and then decreasing water levels for 4.5 months.

TABLE 11

CURRENT
WETLAND WILDLIFE HABITAT
IN
MIDDLE AND LOWER HARBOR
(SOUTH CAROLINA)
CONFINED DISPOSAL FACILITIES
(IN ACRE-YEARS)

DISPOSAL AREA	USABLE SIZE (ACRES)	BARE GROUND NESTING	WETLAND NESTING	SHOREBIRD FEEDING	WATERFOWL FEEDING	DETRITAL EXPORT
12A	1117	13	59	150	47	---
12B	692	2	24	115	12	---
13A	669	--	--	75	6	---
13B	558	--	68	72	65	---
14A	815	--	154	128	266	230+87
14B	754	--	26	68	27	---
J/O	889	--	53	96	18	---
TOTAL	5,494	15	384	703	441	230+87

NOTE: Useable size was calculated from 1993 aerial photographs. The size for Disposal Area 14A is that within the area being considered for diking.

(c) Two ponds alternating use every two years, with one spring disposal schedule followed by one fall disposal schedule and then two years of drying time. This scenario would result in alternating disposal area availability of 8.5 months and 9.5 months.

(d) Two ponds alternating use every two years, with one fall disposal schedule followed by one spring disposal schedule, and then two years of drying time. This schedule, over a 5-year period, results in the following disposal area availability: Year 1: 5.5 months; Year 2: 9.5 months; Year 3: 5.5 months; Year 4: 9.5 months; and Year 5: 4 months.

(e) Three ponds, each with a spring disposal schedule, fall disposal schedule, and a 20-month drying schedule. The 20-month drying time does not include the previous 4.5 months that the water level would be lowered as the area was slowly dried for fall migrants. This schedule over a 4-year period would result in a disposal area availability of 8 months in one year and 9.5 months in the other 3 years. During years 1, 2 and 4, the use could be extended to 12 months by beginning nesting season disposal operations during the last four months of the scheduled drying time (reducing the drying time by 4 months).

(f) Three ponds, each with two sequential spring disposal schedules followed by two years of drying. This schedule would result in a disposal area availability of 8 months each year. During years 1, 2 and 4, the use could be extended to 12 months by beginning nesting season disposal operations during the last four months of the scheduled drying time (reducing the drying time by four months).

7.112 Strategy 3 - Employ Rotating Disposal Area Use Schedules of 2 Years, with Modifications for Bird Use. In this scenario, each disposal area would be available for use in disposal operations for two years, followed by two years of drying. Mounds would be constructed and maintained in each area for use by nesting migratory shorebirds. Areas would be managed during each scheduled 2-year use period for the most environmentally appropriate outcome following each disposal operation. Dredging needs would have top priority, and management of the disposal areas would be a secondary consideration. The goal would be to have at least one disposal area each year functioning for each of the following four major categories of bird use: (1) spring migrants, (2) summer nesting shorebirds, (3) fall migrants, and (4) wintering shorebirds and waterfowl. Note that a disposal area may provide more than one function within a given year. For example, an area held wet for wintering shorebirds and waterfowl could be slowly dried during the spring for spring migrants.

(a) Nesting season constraints. Special considerations would apply to disposal operations taking place during the nesting season. Sand mounds would be constructed in each confined disposal area for use by nesting birds such as least terns, Wilson's plovers, killdeer and nighthawks. Portions of these or other mounds would be constructed for use by black-necked stilts. The crest of the mounds would be constructed above the height of the flooded pool to avoid inundation during disposal operations. Once these mounds are in place, it would be judged beneficial to flood the surrounding areas in the spring and early summer for both protection of the mounds from predators and stimulation of invertebrate prey populations. A disposal operation could proceed early in a nesting season where impacts to nesting individuals are judged to be minor in comparison to the later benefits expected to accrue to the species involved.

(b) Implementation. Management of a disposal area for birds would depend on the month in which the disposal operation is scheduled to end. Management options available after a disposal operation ended would be chosen based on the situation in other disposal areas and the availability of habitat for each major category of bird use (spring migrants, summer nesting shorebirds, fall migrants, and wintering shorebirds and waterfowl). It should be noted that maintenance of a constant water level within a disposal area may not be possible for extended periods due to the natural effects of evaporation and infiltration. However, discharges from the site through the weirs and underdrains could be stopped to retain as much water as possible. The disposal operation would be managed to ensure the successful attainment of the scheduled management scenario. This would include management of weir discharges to ensure a full pool upon completion of the disposal operation. Table 12 displays the actions which would be taken after completion of disposal operations. The critical factor used to decide which management technique would be implemented is the date when disposal operations are complete.

7.113 **Selection of Specific Management Strategy.** The specific management strategies were evaluated for both their expected benefits for birds, their impacts on expected disposal operations and their impacts on disposal site management activities. Strategy 1 reflects present operational practices. Certain disposal areas provide no suitable nesting habitat during some years. Other years, the areas may contain little or no water during the winter months when waterfowl often use the sites. Depredation Permits are sometimes required from the US FWS to allow contracted dredging operations to proceed without expensive delay costs (up to $25,000 per day). The ability to obtain those permits is not guaranteed, so uncertainty exists about the ability to perform disposal or disposal area improvement actions during the nesting season. The large uncertainty which arises

TABLE 12

MIDDLE AND LOWER HARBOR
(SOUTH CAROLINA)
CONFINED DISPOSAL FACILITY
MANAGEMENT TECHNIQUE

Date Disposal Operation Ends	Proposed Management Technique
1 Jan - 15 Mar	Hold water level as high as possible. Beneficial to waterfowl and wintering shorebirds. Draw down in the spring for migrating shorebirds.
15 Mar - 15 Jul	Option 1. Hold water as protection for nesting terns, plovers, nighthawks, and in preparation for fall draw down for fall migrating shorebirds. Option 2. Draw water down slowly for spring migrating shorebirds and nesting black-necked stilts and vegetation growth if flooded later for wintering waterfowl.
15 Jul - 15 Nov	Option 1. Draw down slowly for fall migrating shorebirds. Option 2. Hold for wintering waterfowl and shorebirds.
15 Nov - 31 Dec	Hold water level as high as possible for wintering waterfowl and shorebirds, and in preparation for spring draw down for spring migrating shorebirds.

concerning the availability of a specific disposal site for either disposal or regular management activities greatly hinders effective management of all the confined disposal facilities. Strategies 2 and 3 would provide significant improvements of the confined disposal facilities for bird habitat over that which is presently available. Strategy 2 maximizes bird use of the areas at the expense of disposal and regular disposal site maintenance activities. The procedure would result in repeated choices having to be made between using a site for disposal operations and having sufficient drying time of that site to conduct necessary disposal site management activities. This was judged to be unacceptable and causes that strategy to be infeasible since sufficient times are needed to conduct necessary disposal activities and perform required disposal site maintenance activities. Therefore, Strategy 3 (2-year rotational use of disposal areas with modifications for bird use) was selected for use. That strategy maximizes the benefits of the confined disposal facilities to birds while allowing sufficient periods for disposal operations and drying time through the rotational use of the sites.

7.114 **Mitigation Plan.** Habitat benefits were then quantified for four general areas: (1) those presently produced at Disposal Area 14A, (2) those currently produced at confined disposal facilities in the middle and lower harbor (Management Strategy #1), (3) those impacted by management operations conducted outside confined disposal facilities, and (4) those which would be produced inside the confined disposal facilities through the use of Management Strategy #3. A number of steps were necessary to quantify the habitat value of each site. Four categories were used to describe bird habitats; bare ground nesting, wetland nesting, shorebird feeding and wintering waterfowl. Another category was included to address the present detrital export function of Disposal Area 14A. A final category was included to address the functions beneficial to fisheries.

7.115 A variety of factors were applied to calculate the value of individual tracts for specific wildlife purposes. Based on past operational experience, the District identified the percentage of each area that is normally inundated during a disposal operation. That factor led to a determination of the maximum acreage within each site which would be available at some period of the year for various wildlife uses. District staff then examined the sites to determine what wildlife habitat functions would exist at each tract (acres of disposal area floor). The areal extent of the various wildlife habitat functions within the diked disposal areas was calculated. The normal duration of a disposal operation and subsequent drying period was then taken into account. The addition of that factor introduced the duration over which a tract would be available for

use by wildlife for a given habitat function. The calculations were performed for those functional values which would be produced both (1) during and immediately subsequent to disposal operations, and (2) after the initial draw-down of the area is complete. The following factors were then used to recognize the quality of a habitat or the scarcity of that habitat within the region:

* A factor of 1.0 was applied for typical bare ground nesting, wetland nesting, shorebird feeding and waterfowl feeding habitats.

* A factor of 2.0 was applied to the detrital function of Spartina marshes to reflect the importance of that function as the base of the estuarine and nearshore food webs. The sites affected are those in Disposal Area 14A and those adjacent to the existing confined disposal facilities.

* A factor of 0.5 was applied in recognition of the lower quality of 78 acres of existing previously impacted (lower value) wetlands (Baccharis halimifolia dominated) at Disposal Area 14A. This habitat provides a variety of minor benefits such as shorebird feeding, waterfowl nesting and waterfowl feeding. To simplify calculations, these functions were combined and expressed as shorebird feeding.

* A factor of 1.0 was applied to Spartina and other high value wetlands to reflect the importance of that vegetation to fishery resources.

* A factor of 0.5 was applied to moderate and low value wetlands to reflect the reduced value of that vegetation to fishery resources.

7.116 Table 13 shows a sample calculation. The culmination of these analyses are numbers which express the value of a particular disposal site for a certain wildlife function. That number is called a Habitat Unit (HU) since it represents the amount of a certain habitat which a site would produce. The different categories of functional values can be combined into a single number to represent all wildlife values of that disposal area. Table 14 displays the functional habitat values which the various disposal areas have under the Without Project Condition.

7.117 The analysis of habitat units revealed that the diking and use of Disposal Area 14A would result in a decrease in the site's wetland wildlife functional value from a level of 1018 HUs to a level of 177 HUs, for a loss of 841 HUs. Miscellaneous disposal area management operations would result in an additional loss of 18 HUs in South Carolina and 9 HUs in Georgia. Replacement of

TABLE 13

SAMPLE CALCULATION OF HABITAT VALUE

DISPOSAL AREA 12B
WITHOUT PROJECT CONDITIONS
SHOREBIRD FEEDING HABITAT

ITEM	GIVEN/ FACTOR	CALCULATED VALUE
DISPOSAL AREA	12B	
TOTAL SIZE (ACRES)	710	
AREA WITHIN DIKES (ACRES)	692	
PERCENTAGE INUNDATED	90	
AVAILABLE ACRES (692 * 0.90)		623
ACRES USED FOR SHOREBIRD FEEDING - DRYING	98	
ACRES USED FOR WATERFOWL FEEDING - DRYING	0	
ACRES USED FOR SHOREBIRD FEEDING DURING DREDGING (623 - 98 - 0)		525
AVAILABILITY OF FEEDING HABITAT DURING DREDGING EVENTS (MONTHS)	1	
ACRES USED FOR SHOREBIRD FEEDING - DREDGING (525 * 1/12)		44
AVAILABILITY OF FEEDING HABITAT DURING DRYING (MONTHS)	2	
ACRES USED FOR SHOREBIRD FEEDING - DRYING (98 * 2/12)		16
DISPOSAL EVENTS/YEAR	1.5	
ACRES USED FOR SHOREBIRD FEEDING/YEAR ((44 + 16) * 1.5)		90
DURATION OF SHOREBIRD FEEDING NON-DREDGING (MONTHS)	3	
ACRES USED FOR SHOREBIRD FEEDING - NON-DREDGING (98 * 3/12)		25
TOTAL ACRES OF SHOREBIRD FEEDING HABITAT (90 + 25)		115
HABITAT SUITABILITY FACTOR	1.0	
TOTAL SHOREBIRD FEEDING HABITAT UNITS (115 * 1.0)		115

TABLE 14

EVALUATION OF HABITAT FUNCTIONAL VALUES
AT
SOUTH CAROLINA
CONFINED DISPOSAL FACILITIES
UNDER WITHOUT PROJECT CONDITIONS
(IN HABITAT UNITS)

DISPOSAL AREA	BARE GROUND NESTING	WETLAND NESTING	SHOREBIRD FEEDING	WATERFOWL FEEDING	DETRITAL EXPORT /OTHER	TOTAL
12A	13	59	150	47	---	268
12B	2	24	115	12	---	154
13A	--	--	75	6	---	81
13B	--	68	72	65	---	205
14A	--	153	127	263	229/96	868
14B	--	26	68	27	---	121
J/O	--	53	96	18	---	166
TOTAL	15	383	702	438	229/96	1,863

those losses (865 HUs in South Carolina comprised of 197 acres of high value wetlands and 118 acres of low/moderate value wetlands; and 9 HUs in Georgia comprised of 3 acres of high value wetlands) is, therefore, the mitigation goal.

7.118 Strategy 3 alone was found to produce insufficient environmental benefits to adequately restore the habitat values which would be lost by diking Disposal Area 14A, as a total of only 1,614 HUs would be produced from the entire middle harbor disposal area complex. That amount is 422 HUs below that experienced in the Without Project Conditions. Designs were then developed using the most highly valuable general management options for inclusion as additional mitigation features. Various design options were evaluated for those general management options and those designs are described elsewhere in this EIS. The best designs consisted of the following features:

a. Clearing of upland areas adjacent to diked disposal sites for use by bare ground nesting species. A 26-acre site located oceanward of the dikes at the Jones/Oysterbed Island Disposal Area was selected (Figure 30). Maintenance of the site may include unconfined disposal of dredged material to ensure suitable material for nesting exists on the surface of the site.

b. Construction and maintenance of isolated nesting mounds within the confined disposal areas. A design was selected for two islands in each of the following disposal areas: 12A, 12B, 13A, 13B, 14A and 14B. The islands would have a 1-acre crest, which would be located at the same elevation as the surrounding dikes. The islands would be located near, but separated from the disposal area dikes (Figure 31). The exact location of the mounds would be determined by the Corps.

c. Construction and maintenance of a nearshore island located oceanward of the Turtle Island Wildlife Management Area (Figure 32). The area would be constructed using open water placement of dredged material obtained from or adjacent to the alignment of the navigation channel. The island would have a 2.0 acre crest located at +14 feet MLW. Due to the island's sloping sides, at elevation +10 feet MLW the island would be 6.8 acres.

d. Restoration/creation or protection of 25 acres of tidal wetlands in South Carolina. The SC DHEC-OCRM would select feasible sites in the future and identify either (1) construction actions necessary to improve/create wetlands at the site, or (2) measures which would be necessary to adequately protect the site from future development. The SC DHEC-OCRM would administer an escrow account established by the local sponsor or its designee to accomplish the necessary construction and acquisition.

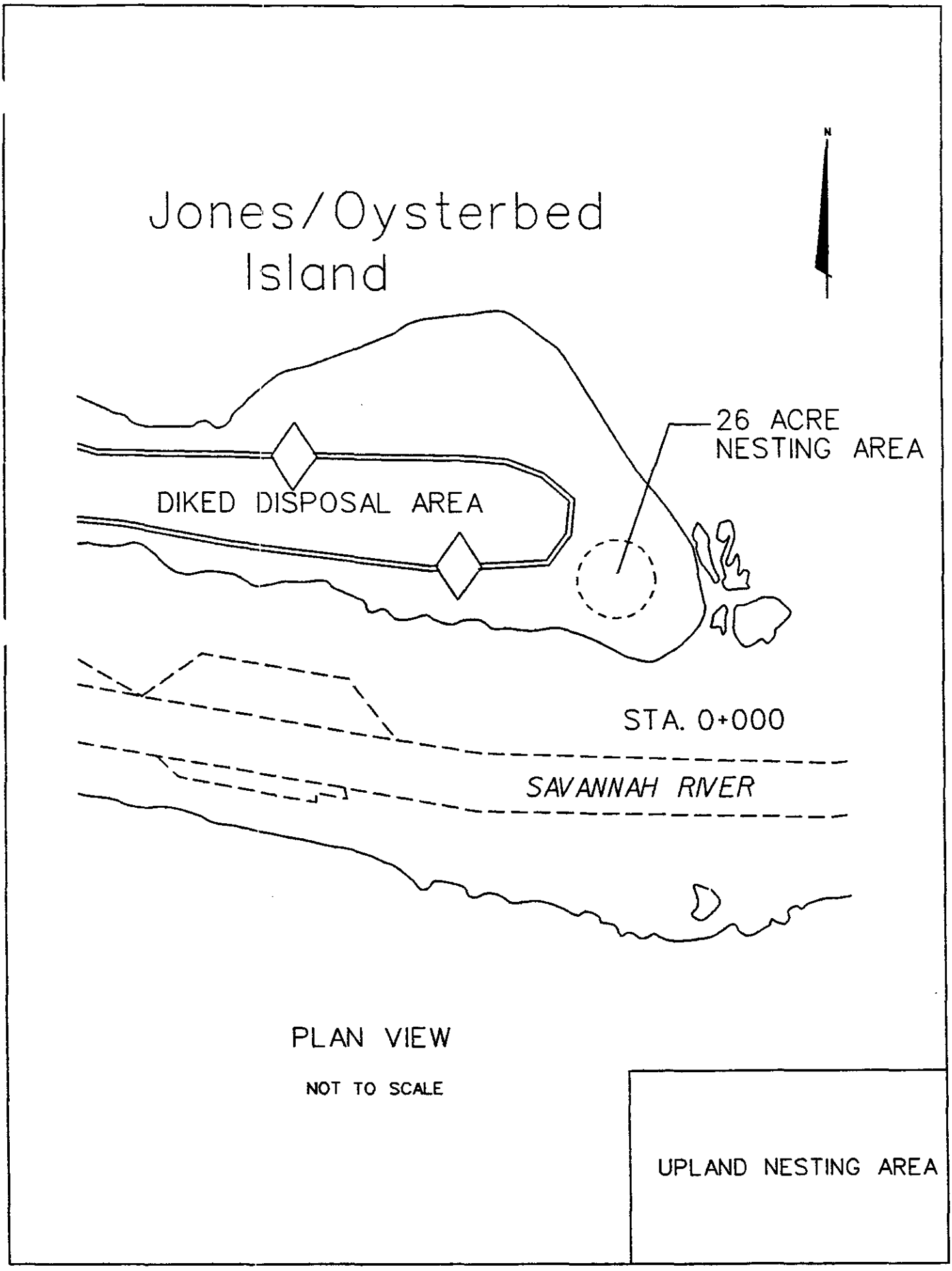
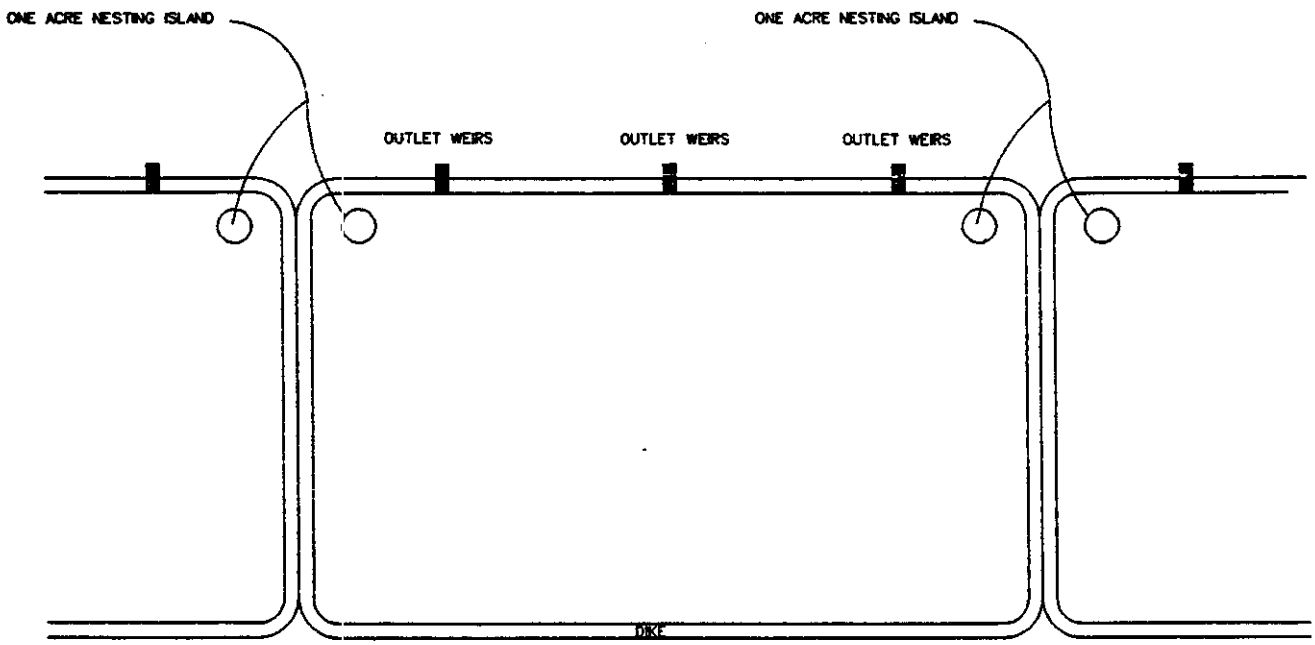

Jones/Oysterbed Island
N
26 ACRE NESTING AREA
DIKED DISPOSAL AREA
STA. 0+000
SAVANNAH RIVER
PLAN VIEW
NOT TO SCALE
UPLAND NESTING AREA

FIGURE 30



SAVANNAH RIVER

PLAN VIEW

NOT TO SCALE

TYPICAL NESTING ISLANDS WITHIN A CDF

FIGURE 31

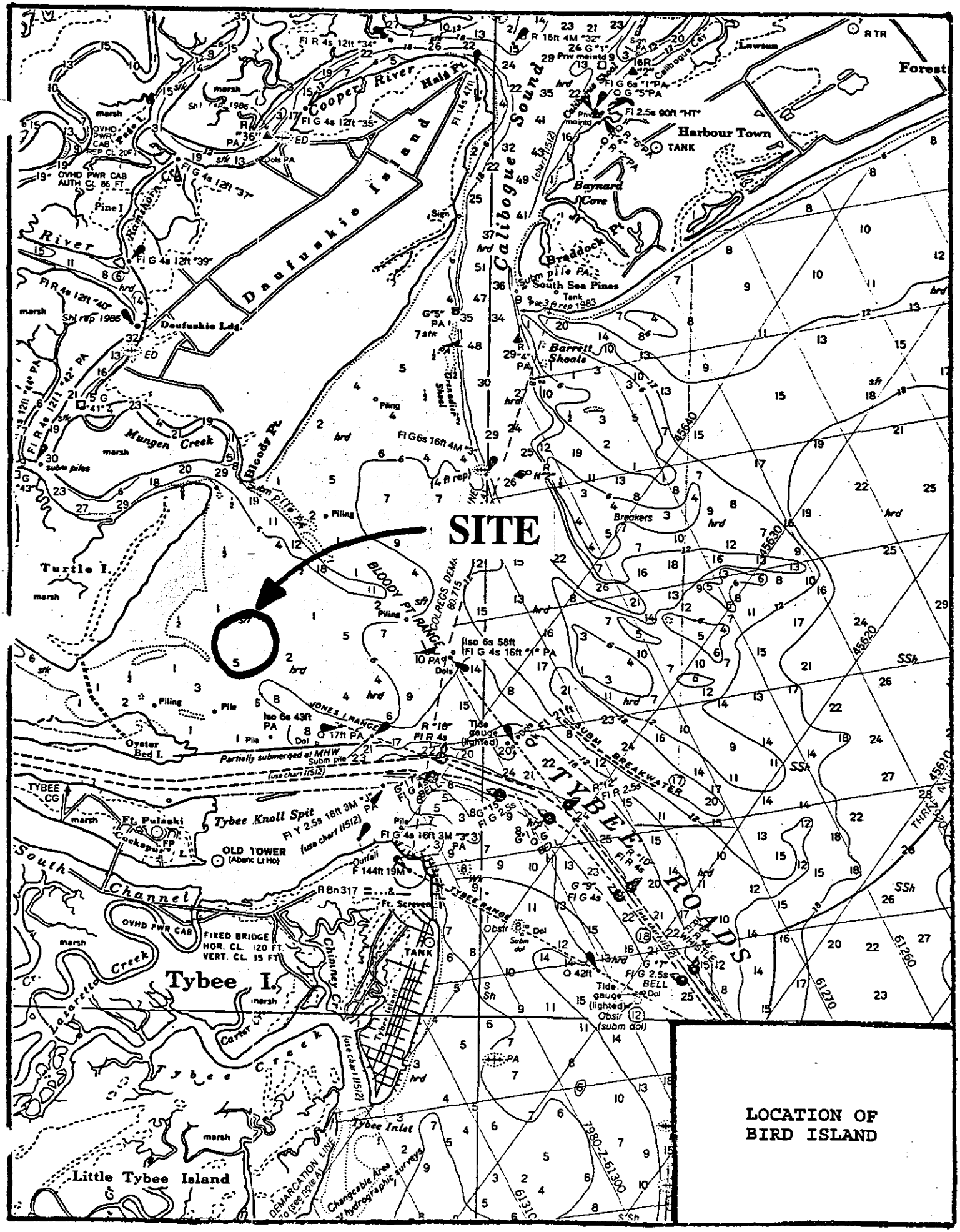

SITE
LOCATION OF
BIRD ISLAND
Tybee I.
Little Tybee Island
Tybee Inlet
TYBEE ROADS
South Channel
Cooper River
Daufuskie Island
Calibogue Sound
Harbour Town
Bloody Pt.
Mungen Creek
Turtle I.
Oyster Bed I.
Tybee Knoll Spit
Ft. Pulaski
OLD TOWER
Lazaretto Creek
Tybee Creek
Carter Cr.
Chimney Cr.
Barrett Shoals
Braddock Pt.
Baynard Cove
South Sea Pines
Daufuskie Ldg.
Pine I.
Ramshorn Cr.
Hall Pt.
Bloody Pt. Range
Jones Range
Tybee Range
Tybee Island
Forest
Laurel
Caibogue Cay
Caibogue Sound
Partially submerged at MHW
Changeable Area of hydrographic surveys
DEMARCATION LINE
(see note A)
FIXED BRIDGE
HOR. CL. 120 FT.
VERT. CL. 15 FT.
OVHD PWR CAB
AUTH CL 86 FT.
OVHD PWR CAB
REP CL 20FT
Tide gauge (lighted)
Obstr
Subm dol
Subm pile
Piling
Pile
Dols
Sign
Tank
Wk
Ch
Fl G 4s 16ft 3M "3"
Fl G 6s 16ft 4M "3"
Fl R 4s 12ft "34"
Fl G 4s 12ft "35"
Fl G 4s 12ft "37"
Fl G 4s 12ft "39"
Fl R 4s 12ft "40"
Fl R 4s 12ft "42" PA
Fl R 4s 12ft "44" PA
Fl G 6s 1" PA
Fl R 16ft 4M "32"
Fl 2.5s 90ft "HT"
Fl G 2.5s BELL
Fl R 2.5s
Fl Y 2.5s 16ft 3M "J" PA
Iso 6s 58ft
Iso 6s 43ft PA
Q 17ft PA
Q 42ft
F 144ft 19M
R 8m 317
(use chart 11512)
(4 ft rep)
Shl rep 1986
Subm pile PA
7 stk
10 PA
45640
45630
45620
45610
61260
61270
61300
7980-2

FIGURE 32

e. Construction of a second water control structure at an existing 228-acre impoundment within the Savannah National Wildlife Refuge. The second structure would generally be open to all tidal flows, thereby providing a constant connection between the impounded water and the adjacent tidal waters. Establishing this connection would result in a continual flushing of the impoundment, thereby substantially improving its water quality and making available the shallow areas to fish for feeding and spawning. The entire aquatic ecosystem at the impoundment would benefit from the increased flow and the action would directly benefit fishery resources.

7.119 The following factors were applied in the development of those new management options to recognize the quality of the habitat produced and/or the scarcity of that habitat within the region:

* A factor of 1.0 was applied to bare upland areas connected to diked disposal areas for their value to bare ground nesting species. A site would produce valuable habitat, but their accessibility to terrestrial predators would keep such an area from being considered "prime" nesting habitat.

* A factor of 2.5 was applied to small isolated islands within the disposal areas for bare ground nesting in recognition of their scarcity and high habitat value due to their traditionally high nesting success ratios. These islands would produce prime nesting habitat for those migratory species, something not readily found in this region.

* A factor of 4.0 was applied to high areas at offshore bird islands for use in shorebird (bare ground) nesting. This factor is in recognition of the scarcity and high habitat value of such areas due to the isolated nature of the sites, which traditionally lead to high nesting success ratios. These islands would provide prime nesting habitat -- which is rarely found in this region -- for a number of migratory bird species.

* A factor of 3.0 was applied to intertidal portions of offshore bird islands for shorebird feeding in recognition of their scarcity and high habitat value due to the isolated nature of the sites.

* A factor of 4.0 was applied to intertidal portions of offshore bird islands shorebird feeding in recognition of the expected winter use of that site by the endangered piping plover. That species winters in the area, and such isolated feeding and resting sites have become increasingly rare. Suitable habitat is one of the factors identified as limiting the recovery of that species.

* A factor of 1.0 was applied to wetlands restored/created or protected to account for the detrital function of those marshes and to reflect the importance of that function as the base of the estuarine and nearshore food webs.

* A factor of 1.0 was applied to wetlands restored/created or protected to account for wetland functions which would directly benefit fishery resources.

* A factor of 0.95 was applied to impounded waters where tidal flushing and daily access with adjacent water bodies would be established for their value to fishery resources. These improvements would significantly enhance the site's value for fisheries. However, the factor was set at <1 to reflect the unavailability of a small portion of the site to fishery resources.

7.120 When Strategy 3 is combined with the five most valuable general management options, a Mitigation Plan is produced which adequately replaces the habitat values which would be lost through the diking and use of Disposal Area 14A, and through miscellaneous disposal area operations in South Carolina. Table 15 displays the calculated habitat values at Disposal Area 14A under various conditions and the habitat losses in South Carolina from other disposal operations. Table 16 displays the calculated environmental benefits for the separate mitigation actions. The estimated costs for implementation of those actions are shown in Table 17. Although some management options produce Habitat Units at a lower unit cost than other options, resource agencies agreed that all these options had to be included in a comprehensive mitigation plan for that plan to effectively compensate for the varied functional values of the wetlands which would be destroyed. Collectively, the agencies determined that inclusion of each management option was required. Although the environmental value of the various options was measured in Habitat Units, the types of habitat produced by the different management options was distinct. Some features would produce spring nesting habitat for migratory birds, while another feature would produce wintering feeding and resting habitat for different migratory birds. Still another feature would produce fisheries

TABLE 15

HABITAT VALUES AT DISPOSAL AREA 14A
AND
LOSSES AT OTHER SC DISPOSAL AREAS
(IN HABITAT UNITS)

OPTION	BARE GROUND NESTING	WETLAND NESTING	SHOREBIRD FEEDING	WATERFOWL FEEDING	DETRITAL EXPORT/ FISHERY	TOTAL
CURRENT IN AREA 14A	--	153	127	263	229/246	1018
AREA 14A DIKED	--	43	106	27	---	177
LOSS AT AREA 14A	--	110	21	236	229/246	841
OTHER LOSSES AT SC AREAS	--	---	---	---	12/6	18

NOTE: The habitat functional values currently in Disposal Area 14A (1018 HUs) and the losses at other South Carolina disposal areas (18 HUs) are included in Strategy 1: Without Project Condition at CDFs.

TABLE 16

ENVIRONMENTAL BENEFITS
FOR ALTERNATE MITIGATION ACTIONS
IN SOUTH CAROLINA
(IN HABITAT UNITS)

OPTION	BARE GROUND NESTING	WETLAND NESTING	SHOREBIRD FEEDING	WATERFOWL FEEDING	DETRITAL EXPORT/ FISHERY	TOTAL
STRATEGY 1 W/O PROJECT AT CDFS	15	383	702	438	229/246 12/6	2,031
STRATEGY 3	--	450	659	505	---	1,614
UPLAND NESTING SITE	26	---	---	---	---	26
NESTING ISLANDS	28	---	---	---	---	28
NEARSHORE BIRD ISLAND	20	---	81	---	---	101
RESTORATION /CREATION	--	---	---	---	25/25	50
FISHERIES ENHANCEMENT	--	---	---	---	0/217	217
MITIGATION TOTAL	74	450	740	505	25/242	2,036
TOTAL HABITAT CHANGES	59	67	38	67	-216/-10	5

TABLE 17

ESTIMATED COSTS
FOR ALTERNATE MITIGATION ACTIONS
(COSTS IN $)
(BENEFITS IN HABITAT UNITS (HUs))

OPTION	INCREMENTAL COST	TOTAL COST		INCREMENTAL HUS	TOTAL HUS
SC DISPOSAL OPERATIONS	---	---		- 18	- 18
DIKING/USE OF DISPOSAL AREA 14A	1,000,000	1,000,000		-841	-859
STRATEGY 3	1,000,000	1,000,000		1,614	1,614
FISHERIES ENHANCEMENT	25,000	1,025,000		217	1,831
UPLAND NESTING SITE	52,000	1,077,000		26	1,857
NESTING ISLANDS	175,000	1,252,000		28	1,885
RESTORATION/ CREATION	300,000	1,552,000		50	1,935
NEARSHORE BIRD ISLAND	1,450,000	3,002,000		101	2,036
COMBINATION TOTAL	---	3,002,000		---	2,036
STRATEGY 1 WITHOUT PROJECT AT CDFs	---	---		2,031	2,031
COMBINATION PLAN	---	3,002,000		---	+ 5

habitat, for which the District made no claims of benefit to migratory birds. No single management option would adequately mitigate for the expected losses. The degree to which each management option was used -- the size of the construction/action proposed in each feature -- was selected by the District based on factors such as physical site limitations, declining wildlife value with increasing size, and number of Habitat Units needed.

7.121 Implementation of **Alternative 1** (Without Project) would not have significant adverse impacts on wildlife resources. Disposal operations and disposal area maintenance activities would generally continue to be conducted as they presently are. Conformance to provisions of the Migratory Bird Treaty Act would ensure that disposal operations and disposal area maintenance activities do not adversely affect nesting migratory birds. Temporary disturbances of wildlife would occur due to the noise and activity associated with disposal and maintenance operations. Some maintenance operations would temporarily reduce the value of the sites' wildlife habitat. These include actions such as mowing of the dikes and devegetating the interior of the disposal areas. Dike mowing is necessary to allow inspections and efficient maintenance of the dikes. Vegetation within the areas is removed to reduce the dissolved oxygen load on water passing through the disposal area during disposal operations. Disposal activities result in temporary improvements in waterfowl habitat. Dewatering the areas expose shallow areas which could serve as feeding and resting habitats for shorebirds and waterfowl. Miscellaneous disposal area operations would reduce the wildlife habitat value at the sites by 18 Habitat Units in South Carolina and 6 Habitat Units in Georgia.

7.122 Alternatives 2, 3 and 8 would result in increases of 5 Habitat Units of wildlife habitat due to implementation of the Mitigation Plan contained in those alternatives for the use of Disposal Area 14A. Although the net impact on wildlife habitat would be small, significant beneficial changes would occur in the types of habitat. Rare isolated habitats for shorebirds and migratory birds would be produced at the expense of more common habitats which also have a lower reliability of being available at these sites. The losses in wildlife habitat (841 Habitat Units) stemming from the diking of Disposal Area 14A would be offset by the mitigation actions taken at other sites. The losses of habitat (18 Habitat Units in South Carolina and 6 Habitat Units in Georgia) stemming from miscellaneous operations at the confined disposal facilities would be offset by the mitigation actions taken at other sites. Implementation of the Mitigation Plan would increase the value of existing confined disposal facilities to wildlife through both structural changes and modifications in water level management. Significant increases in extremely valuable wildlife habitat (101 Habitat

Units) also result from the Plan's creation and maintenance of a nearshore bird island. A detailed description of the selected Mitigation Plan is contained in Appendix G MITIGATION PLAN FOR WETLAND LOSSES IN SOUTH CAROLINA. The habitats to be created or improved through the Mitigation Plan are not commonly found in the project area and would represent substantial increases in the availability of certain scarce habitats for this region of the country. Alternatives 4, 5 and 7 would have no changes in effects on wildlife from that experienced in the Without Project Condition. Alternative 6 would have a beneficial impact on wildlife through the placement of additional water in confined disposal areas over that experienced in the Without Project Condition. As has been discussed, the availability of water in the disposal areas is a critical factor in determining the value of those sites to migratory birds.

7.123 Each of the alternatives would result in impacts to wildlife resources, some of which are beneficial while others are adverse. Impacts from disposal operations are generally localized and of short duration. The diking of Disposal Area 14A would result in long term adverse impacts to wildlife at that site, while implementation of the affiliated Mitigation Plan would produce a similar level of long term beneficial effects. The substantial increase in availability of certain scarce habitats which would be produced through implementation of the Mitigation Plan result in that Plan being an overall benefit to wildlife when compared to the habitat value of the existing wetlands. In summary, each of the alternatives evaluated would result in acceptable impacts to wildlife resources. Each alternative was assigned a score based on their overall effects on wildlife. A scale of 0 to 10 was used, with 3 being the level of no effect. The results of this evaluation are displayed as follows:

ALTERNATIVE	ASSIGNED SCORE
2, 3 + 8	7
6	4
1, 4, 5 + 7	3

7.124 Wetlands. The functional values of wetlands are being increasingly recognized by the public. Wetlands in the estuary serve several purposes, including the following: nursery areas for aquatic species, nesting areas for wildlife (primarily birds), food source (detritus) for aquatic species, and to filter pollutants from the water.

7.125 Maintenance dredging is not expected to impact wetlands along the banks of the Savannah River since no enlargements would occur in the channel side slope above the low water line. Bank erosion is occurring at isolated locations along the length of the navigation channel. The channel side slopes are selected based on the observed ability of soil at the Project site to retain its shape on a certain angle (stability of the soil), and the velocity of water in the channel. That angle is then used as the channel side slope. Construction or maintenance of the navigation channel is not the cause of the observed bank erosion since an extension of the excavated channel side slopes intersects open water, not high ground. That means that the constructed channel is stable and its top width will not enlarge during normal or flood periods. Impacts to wetlands may be occurring as a result of the wakes generated by passing ships or currents which are generated and/or concentrated by vessels while turning. These secondary impacts are the result of decisions made by users of the harbor and are not the responsibility of the Corps of Engineers.

7.126 All construction which increases the height of a dike would be designed and accomplished so that construction activities do not extend the outer toe of the dikes into adjacent wetlands. Therefore, no wetland impacts are expected from dike raising activities. Yearly disposal site management operations are also not expected to significantly impact this habitat.

7.127 Earthen ramps are constructed along the Savannah River/Back River side of each confined disposal facility for placement of the dredge pipe during disposal operations. The ramps allow the disposal pipes to transition in elevation from the river to the top of the disposal dike. An increase in the number of pipe ramps is anticipated at confined disposal areas located in South Carolina. Two new pipe ramps would be constructed to allow access to Disposal Area 14A. Other ramps are also likely to be constructed along the riverbank at Disposal Areas 12A, 12B, and 13B during the project life to provide three routes of access to those areas. Using designs of existing pipe ramps as a basis, a wetland area of 0.34 acres would be covered when each new ramp is constructed. Therefore, about 1.70 acres of wetlands are expected to be lost from construction of new pipe ramps over the 20-year project life. These impacts would occur with Alternatives 2, 3 and 8. Mitigation for those impacts would occur as part of the Mitigation Plan described in Appendix G.

7.128 Increases in the height of the dikes are anticipated. Enlargements to pipe ramps would be required during some of the dike improvement actions to allow disposal pipes which are subsequently placed on the ramps to reach the new dike crest. These ramp enlargements would be required about every other time a typical 6-foot dike raising is performed. A typical pipe ramp enlargement would cover 1,000 square feet (0.02 acres) of

wetlands. Based on the 24 dike raisings (2 in Georgia and 22 in South Carolina) projected to occur over the 20-year project life (from Table 6) and the expected existence of 9 ramps in Georgia and 22 ramps in South Carolina, 0.81 acres of wetlands (0.14 acres in Georgia and 0.67 acres in South Carolina) would be impacted by the enlargement of pipe ramps. Pipe ramp modifications, and their associated wetland impacts, would occur in Alternatives 2, 3 and 8. Mitigation for those impacts in South Carolina would occur as part of the Mitigation Plan described in Appendix G. Mitigation for impacts in Georgia would occur at a 2:1 rate through actions which have yet to be determined, but which would be implemented prior to the ramps being enlarged.

7.129 Some wetlands would be lost when weirs and discharge pipes are installed at Disposal Area 14A. This would probably result in the loss of wetlands in an area about 30 feet by 50 feet at each new discharge pipe, for a total loss of 0.10 acres of wetlands with the construction of three new weirs. These impacts would occur with Alternatives 2, 3 and 8. Mitigation for those impacts in South Carolina would occur through the Mitigation Plan described in Appendix G.

7.130 Minor losses of wetlands are expected on an infrequent basis when weirs are replaced and new discharge pipes are installed. Weirs are normally replaced when dikes are raised. Usually this occurs about every 5 years. When replacement occurs, a small area of wetlands (about 30 feet by 50 feet) could be lost at each new discharge pipe. However, ending the discharge and associated activities at the original discharge pipe would allow a nearly similar amount of wetlands to reestablish at that location. The pad that supports the discharge pipe generally are left in place after use of the pipes is terminated. Those pads are approximately 8 feet wide by 30 feet long. Based on the dike raising schedule shown in Table 6, replacement of the 36 weirs (6 in Georgia and 30 in South Carolina) over the 20-year project life would result in the loss of 0.47 acres of wetlands (0.04 acres in Georgia and 0.43 acres in South Carolina). These impacts would occur with Alternatives 2, 3 and 8. Mitigation for impacts in South Carolina would occur as part of the Mitigation Plan described in Appendix G. Mitigation for impacts in Georgia would occur at a 2:1 rate through actions which have yet to be determined, but which would be implemented prior to the weirs being replaced.

7.131 Wetlands are expected to be lost when bank protection is placed along the Jones/Oysterbed Island Disposal Area. Erosion is presently occurring along most of the island's shore. No wetland vegetation exists along most of that shore. Vegetation remains along approximately 25 percent of the 27,000-foot length Savannah River shoreline. When bank protection is placed, a depth of about 17 feet of wetlands would be impacted throughout

that reach. The type of construction which will be used will be determined thrcugh tests soon to be initiated along other Savannah Harbor CDFs where multiple designs for bank protection techniques will be placed and monitored. All designs under consideration are based on rock or concrete to withstand erosive currents. A tctal of 2.63 acres (114,750 square feet) of wetlands are expected to be impacted when this bank protection occurs. These impacts would occur with Alternatives 2, 3 and 8. Mitigation for these impacts in South Carolina would occur through the Mitigation Plan described in Appendix G.

7.132 Wetlands are expected to be lost when underdrain discharge pipes are installed. The loss is not expected to occur simultaneously, as sufficient depths of material may not exist for 10 years at Disposal Areas 14A and 14B to warrant installation at those sites. For each pipe installed, an area about 30 feet by 50 feet could be temporarily impacted during construction and a permanent loss of an area about 20 feet by 20 feet due to riprap installed below the pipe to prevent bank erosion. Since wetlands do not exist along the entire north bank of the Savannah River, not every underdrain discharge pipe would result in a loss of wetlands. At this time, it is estimated that 70 percent of the discharge pipes would result in a wetland loss, for a total loss of about 0.21 acres based on a general design with underdrains discharge pipes located roughly every 2,000 feet along a dike. For that design, 32 underdrain discharge pipes would be needed over time in the confined disposal facilities as follows:

DISPOSAL AREA	DIKE DISTANCE (FEET)	NUMBER OF UNDERDRAIN DISCHARGE PIPES
12A	7,000	3
12B	7,000	3
13A	9,500	5
13B	5,400	3
14A	5,800	3
14B	6,000	3
J/O ISLAND	24,600	12

These impacts would occur with Alternatives 4 and 8. Mitigation for those impacts in South Carolina would occur through the Mitigation Plan described in Appendix G.

7.133 Disposal Area 14A has previously been used for deposition of dredged material. Although a small dike had been constructed years ago, the placement essentially occurred in an unconfined manner. Because of a position taken by the SC OCRM, future deposition in the site is dependent on diking the area to establish a confined disposal facility. Diking the site would result in the direct loss of about 305 acres of wetlands. This consists of about 33 acres of low/moderate value wetlands within the confines of the old dike, about 85 acres of low value wetlands outside the old dike, and about 187 acres of high value outside the old dike. A Mitigation Plan (found in Appendix G) was developed which would replace the functional value of the wetlands which would be lost.

7.134 Direct placement of berth sediments into the Navigation Project's confined disposal facilities, rather than the present practice of resuspending those sediments and allowing them to settle outside the berths would -- in theory -- adversely effect wetlands. Under present practices, agitation dredging is accomplished in one of two ways: (1) moving and resuspending the sediments with an I-beam or similar equipment, or (2) relocating the material through use of a hydraulic dredge. With the first procedure, approximately 20 percent of the sediments are estimated to redeposit outside the Federal Project boundaries and are not redredged and placed in the Project's confined disposal facilities. With the second procedure, 100 percent of the sediments redeposit in the channel and are subsequently redredged and placed in the confined disposal areas. The placement of berth sediments directly in the Federal Navigation Project's confined disposal facilities is one method of implementing Alternative 6. If/when that occurs, a slight annual increase in the total volume of sediment placed in the Project disposal areas would occur. That increase would result in some shortening the life of those confined disposal areas and an advancement in the need to destroy wetlands to create new disposal areas. However, the relatively small difference in total annual sediment storage capacity required is not expected to have a measurable impact on the useful life of any of the Project's confined disposal facilities. Therefore, although Alternative 6 would theoretically advance the timing when additional wetlands would need to be destroyed to create new disposal areas, in practical terms the difference is not expected to be observable. In conclusion, direct placement of berth sediments in the Project's confined disposal facilities is expected to have no measurable impact on wetlands.

7.135 Alternative 1 (Without Project Condition) would result in no significant impacts to wetlands. Bank erosion at isolated locations may continue to occur, resulting in minor losses of wetlands, if users continue practices which exert hydraulic stresses on the emergent vegetation. Alternative 4, 5 and 7 would have the same effects on wetlands as would the Without Project Condition. Alternative 6 would not have a measurable effect on wetlands over that of the Without Project Condition. Changes in sediment control features (Alternatives 7 and 8) would be accomplished so that no expansion in the width of the channel would occur above the low water line. Alternatives 2, 3 and 8 would result in a loss in wetlands through the diking of Disposal Area 14A, but those plans include a Mitigation Plan that would result in restoration of the functional values of those lost wetlands. Therefore, there would be no overall permanent loss in wetland values in those three alternatives. Diking of the disposal area would likely occur prior to complete implementation of the Mitigation Plan. This would result in a temporary loss in wetland values, possibly extending up to 3 years.

7.136 In summary, some of the alternatives would result in significant direct loss of estuarine wetlands. The habitat values of those lost wetlands would be restored through implementation of a Mitigation Plan. Wetland functional values benefitting marine resources would be partially restored through mitigation activities performed by the SC DHEC-OCRM, using funds which are a part of the Mitigation Plan. The other alternatives would result in no significant effect on wetlands. The effects of all alternatives on this critical habitat type would be acceptable. Each alternative was assigned a score based on their overall effects on wildlife. A scale of 0 to 10 was used, with 3 being the level of no effect. The results of this evaluation are displayed as follows:

ALTERNATIVE	ASSIGNED SCORE
1, 4, 5, 6 + 7	3
2, 3, + 8	2

7.137 Cultural and Historic Resources. Several cultural resource investigations were performed during the course of the LTMS Study, including extensive documentation of historic resources along the old Fig Island channel, a low water survey of shorelines adjacent to the navigation channel and underwater remote sensing surveys consisting of magnetometer, fathometer, side scan sonar, and a sub-bottom profiler investigations. These studies and previous investigations have examined the channel floor, the side slopes and all berthing areas. All channel areas presently maintained or under consideration for excavation in the LTMS study have been examined. Intertidal areas at Disposal Area 14A and high ground within the confined disposal facilities have not been examined. The surveys identified several cultural resources located along the navigation channel. Three significant resources were identified which could have been impacted by channel construction or could be receiving impacts from channel maintenance activities. Impacts to those sites may also result from the wakes of vessels transiting the channel. Impacts from a vessel's wake are the responsibility of the vessel Captain, not the Corps of Engineers or the Coast Guard.

7.138 The three known significant cultural resources identified were the Venus Point Light Structure, Old Fort Jackson and the CSS GEORGIA. Documentation of the Venus Point Light Structure has essentially been completed. Future work at that site would consist of monthly monitoring to determine if any additional portions of the site become exposed. A Memorandum of Agreement (MOA) was developed for each of the other two known significant cultural resources for which there is a reasonable potential for impact from operation of the harbor; Old Fort Jackson and the CSS GEORGIA. Those Agreements are included as Appendices J and K to this EIS.

7.139 A Cultural Resources Management Plan was developed to document what actions the District will take in the future to ensure that harbor operations do not impact (1) cultural resources located on Project and other Corps lands, and (2) any cultural resources along the channel which may become discernible in the future. That Plan is contained in Appendix J CULTURAL RESOURCES MANAGEMENT PLAN.

7.140 Alternative 1 (Without Project Condition) would essentially result in no changes from ongoing harbor maintenance activities. Documentation of the Venus Point Light Structure fully addressed project impacts to that site. If impacts to Old Fort Jackson and the CSS GEORGIA are presently occurring, those impacts would continue to occur. The existence, cause and potential solution to project impacts would be addressed through implementation of the MOAs for each of those resources. Through implementation of the Cultural Resources Management Plan, cultural resources which are discovered in the future within the

area of operational impact of the Navigation Project would be addressed in conformance to existing laws. No impacts to cultural resources are occurring from disposal operations at the confined disposal facilities.

7.141 No changes in the dredging aspects of the Savannah Harbor Navigation Project are proposed in Alternatives 2, 3, 4 and 5. Therefore, no additional impacts from dredging operations are expected over that in the Without Project Condition. The Savannah River shoreline along Jones/Oysterbed Island has not been surveyed. Before bank protection is placed along that shore, a cultural resource survey would be performed to ensure no cultural resources would be impacted. Results of the survey would be coordinated with the SC SHPO and SHPO approval of the survey's findings would be obtained prior to any excavation. The nearshore areas and the Daufuskie Island shore where new disposal operations would occur have also not been surveyed. However, the deposition of dredged material on those sites would serve as further protection of any historic resources presently buried in that high energy environment, thereby beneficially affecting any cultural or historic resources located there. A side scan sonar investigation would be performed prior to deposition in nearshore areas to ensure no cultural resources would be impacted by sediment deposition. Therefore, use of the nearshore sites as proposed in Alternatives 5 and 8 is not expected to adversely impact cultural or historic resources. Potential impacts from installation of underdrains (Alternatives 4 and 8) would be evaluated prior to excavation to ensure no significant cultural resources would be impacted. Archival information would be reviewed to determine if any proposed underdrain alignment had the potential for impacting any known cultural resource sites in the confined disposal areas. If there was a significant potential for adverse impact to a known site, a cultural resource survey would be performed of the underdrain alignments and approval of the study's findings from the SHPO would be obtained prior to excavation. Impacts from excavation at berths (Alternatives 6 and 8) are not expected, since those areas have already been dredged and previous surveys identified no items within those areas which are believed to be cultural resources. Areas proposed for dredging in Alternatives 7 and 8 for additional sediment control were previously evaluated and no items were identified which are believed to be cultural resources. The provisions of the two MOAs and the Cultural Resources Management Plan would be implemented as components of each alternative to the Without Project Condition.

7.142 In summary, periodic monitoring of the Venus Point Light Structure, implementation of the Cultural Resources Management Plan, and implementation of the MOAs for Old Fort Jackson and the CSS GEORGIA will address Project impacts to existing cultural and historic resources and any future resource which may become discernible. Proposed changes in the Navigation Project would

either have no effect on cultural and historic resources or have a beneficial effect through covering with additional sediments. All of the alternatives considered would have acceptable impacts on cultural and historic resources. Each alternative was assigned a score based on their overall effects on cultural and historic resources. A scale of 0 to 10 was used, with 3 being the level of no effect. The results of this evaluation are displayed as follows:

ALTERNATIVE	ASSIGNED SCORE
2, 3, 5 + 8	4
1, 4, 6 + 7	3

7.143 Savannah National Wildlife Refuge. As described in Section 6, the Savannah Refuge is located in the upper portion of the harbor and is very susceptible to impacts from development and operation of the harbor. The main avenue of those impacts is through changes in the salinity of water which passes through the unimpounded Refuge wetlands adjacent to the navigation channel or that is introduced into the Freshwater Diversion System which feeds the Refuge's impoundments. The Refuge was originally created and is still managed as a freshwater Refuge. This provides ample opportunity for conflicts with development and operation of a harbor dependent on transportation of goods across the ocean.

7.144 Continued operation of some of the Freshwater Control System is necessary to alleviate salinity impacts from the 1978 harbor improvements, consisting of channel deepening and construction of the Tidegate, Sediment Basin and New Cut. Removal of the Tidegate from operation in 1990 and New Cut alleviated impacts caused by those structures. As previously described, the tidal marsh monitoring which the District funded indicates that actions taken at the Tidegate and New Cut have indeed reduced salinity levels in Back River and its adjacent marshes. Restoration of Refuge unimpounded wetlands to freshwater species should be more observable in the next few years as the vegetation continues to respond to the changed salinity conditions. Since the Tidegate has been taken out of operation, the salinity has decreased in Back River so that freshwater is available for flooding of the impoundments under all expected flow conditions. Since freshwater is now available in Back River, maintenance of the freshwater canals which serve the private lands is no longer necessary. The non-Federal sponsor need not maintain those canals as long as the Tidegate is not operated.

7.145 Questions still remain about the present value of Little Back River as a spawning and nursery habitat for Striped bass. That area had been a prime spawning and nursery area for that species, but population levels of that species were observed to drop significantly in the 1970's. Some believe that construction and operation of the Tidegate resulted in salinity changes in Back River to the extent that the estuary was not suitable as a nursery area for that species. The tidal marsh monitoring which the District funded indicates that salinity levels were indeed reduced in Back River and its adjacent marshes after the recent actions taken at the Tidegate and New Cut. Savannah District is also funding a Striped bass egg and larval study to determine their spatial and temporal distribution in the Savannah estuary. That study should provide valuable information on the quantity and success of Striped bass spawning activities in Little Back River. Until those field studies are complete and the results fully analyzed, questions will still remain about potential impacts to Striped bass eggs and larvae from dredging operations. Therefore, to comply with a condition in the Georgia Water Quality Certification designed to avoid possible impacts to the Striped bass, dredging will continue to be restricted to the lower harbor (River Mile 5.0 to 0.0) and the Bar Channel during the period from March 15 to May 31 of each year. Case-by-case exceptions to that condition require prior approval from GA DNR and the SC DHEC-OCRM. Should future research indicate that this restriction is unnecessary to protect Striped bass, the District would follow procedures agreed to by the state resource agencies.

7.146 One component of the Mitigation Plan would be implemented on Refuge property and is designed to benefit fishery resources within and immediately adjacent to one of the Refuge's impoundments. The impoundment selected currently has one water control structure with stop logs which maintain a constant water surface elevation. Once tidal flows enter the impoundment through the control structure, stop logs are placed across the opening to block further daily flows. This procedure traps the water -- and any fish present -- within the impoundment until a decision is made sometime later to drain the impoundment either partially or completely. The proposed installation and operation of a second water control structure at an existing 228-acre impoundment would establish a constant connection between the impounded water and adjacent tidal waters. Providing this connection would result in a continual flushing of the impoundment, thereby substantially improving its water quality and making available the shallow areas to fish for feeding and spawning. The entire aquatic ecosystem at the impoundment would benefit from the increased flow and the action would directly benefit fishery resources. Approximately 217 Habitat Units of fishery habitat would be produced through this proposal.

7.147 Continued operation of the harbor with no significant changes (Alternative 1) will continue to periodically result in conflicts between the Savannah National Wildlife Refuge and the harbor. The Refuge has been impacted from previous harbor improvement projects, but those impacts were identified prior to Congressional approval of the improvements and features deemed appropriate were included in the project to compensate for those impacts. Never-the-less, Refuge operations continue to be hindered by harbor (salinity) related items. Although the Freshwater Diversion Canal (McCoys Cut) has been found to be unable to carry its designed flow rate, Refuge Managers indicate that they presently have no interest in seeing the canal enlarged. They believe it would be appropriate to wait until the Corps' study of Striped bass in Back River is complete before discussions are held on the advisability of increasing freshwater flows down that river.

7.148 Continued removal of sandy material from Disposal Area 1N, which is located on Refuge property approximately from channel Stations 108 to 113, is to be pursued as that procedure extends the useful life of that disposal site. There are presently no proposals for further use of Disposal Area 1S, which is an undiked site located on Refuge property adjacent to channel Stations 104 to 107. Recent changes in US FWS regulations concerning the compatibility of alternate uses of Refuge property with the original purpose for which the Refuge was authorized may render some disposal activities unacceptable at that site. Removal of deposited material from Disposal Area 2A, which is located on Refuge property approximately from channel Stations 93 to 103, should be pursued, since that procedure would extend the useful life of that disposal site.

7.149 Alternatives 2, 3, 4 and 5 have no features which would adversely impact the Savannah Refuge. Installation of the water control structure, which is part of the Mitigation Plan of Alternatives 2, 3, and 8 would significantly benefit habitats and management capability and flexibility on a portion of the Refuge. The sediment control features of Alternatives 7 and 8, and the construction and periodic maintenance of sediment storage capacity at berths in Alternative 6 constitute items which could possibly impact the Refuge. These impacts would be through changes in water quality resulting from these proposals. Previous sections on water quality described the effects which are expected from these proposals. To recap, no salinity changes are expected from these separated deepening actions since the construction would not be extensive in length or continuous. Shallower areas, which would act as a sill to retain more dense saline water, would remain both upstream and downstream of the excavated areas. Deepening berths would essentially widen the channel. Berths excavated below the depth of the existing channel would not be continuous along the length of the channel,

so sills would be in place blocking potential upstream movements of salinity. As salinity movements are primarily a function of channel depth, and not width, deepening of berths is not expected to result in changes to existing salinity patterns.

7.150 In summary, the Savannah National Wildlife Refuge has been impacted by past harbor development. Previous impacts have been significantly reduced by the recent cessation of operation of the Tidegate and closure of New Cut. Presently a peaceful coexistence exists between the Refuge and the harbor as managers of both facilities respect the existence of the other and grow in their understanding of the other's goals and limitations. However, the potential for future conflicts remain as long as the Refuge and the harbor share a common river. Neither existing harbor operations or any proposed alternative are expected to result in new adverse impacts to the Refuge. Each alternative was assigned a score based on its overall impacts to the Savannah National Wildlife Refuge. A scale of 0 to 10 was used, with 3 being the level of no effect. The results of this evaluation are displayed as follows:

ALTERNATIVE	ASSIGNED SCORE
2, 3 + 8	3
1, 4, 5, 6 + 7	2

7.151 Tybee National Wildlife Refuge. The Tybee Refuge (TNWR) was established as a breeding area for migratory birds and other wildlife. The Refuge consists of 100 acres of wetlands and diked low lands and is located at the mouth and on the north side of the Savannah River. Much of the site is diked and serves as a portion of the Jones/Oysterbed Island Disposal Area. The site is not accessible to the public and is closed to public use. The disposal activities do not conflict with the authorized purpose of the Refuge as the deposited material provides nesting habitat for colonial nesting birds. To maintain the deposited material as high quality nesting habitat, vegetation must be periodically removed. This has not been done in the past on a regular basis, so the nesting habitat has not been optimized. Deposition of new material to cover existing vegetation is another way of maintaining a vegetation-free surface which is desired by colonial nesting birds. The configuration of the island (long and narrow) limits the potential nesting habitat value because of the higher likelihood of nest predation from raccoons which inhabit the adjacent marsh.

7.152 Channel dredging activities included in each alternative would result in no impacts to the Tybee Refuge. Disposal activities on this site are included in each alternative and such actions generally support the original intent of the site by increasing the tract's value for migratory birds. The Mitigation Plan -- which is a component of Alternatives 2, 3 and 8 -- includes the clearing and maintenance of a 26-acre high ground portion of the Refuge located outside the diked disposal area. This construction would provide bare ground nesting habitat for colonial nesting birds. Construction of the site would require the removal of existing vegetation, and possibly unconfined disposal of sandy dredged material. Maintenance of the nesting area would consist of clearing of emergent vegetation and possibly more deposition of sandy dredged material. Another component of that plan is the creation of a bird island offshore of the Refuge's ocean shoreline. Although not technically a part of the Refuge, that island would promote the original purpose of the Refuge by significantly increasing the value of the area to migratory birds, shorebirds and endangered sea turtles. Nesting habitat would be provided for colonial birds and sea turtles. The site would provide rare and valuable isolated year-round resting and feeding habitat for shorebirds. A more detailed description of the impacts expected from construction of the Bird Island are included in Sections 7.158 through 7.182.

7.153 The Turtle Island Wildlife Management Area (WMA) is located adjacent to the Tybee Refuge on its northern side and was established for wildlife management purposes. This area is not directly impacted by operation of the Navigation Project, however, the general purposes of the site would be promoted by the Bird Island component of the Mitigation Plan. That feature would significantly increasing the value of the area to shorebirds and waterfowl.

7.154 In summary, each of the proposed alternatives would result in acceptable impacts to both the Tybee National Wildlife Refuge and the Turtle Island Wildlife Management Area. Components of the Disposal Area 14A Mitigation Plan would have positive impacts on both the TNWR and the Turtle Island WMA. Each alternative was assigned a score based on its overall impacts to the Tybee Refuge and the Turtle Island WMA. A scale of 0 to 10 was used, with 3 being the level of no effect. The results of this evaluation are displayed as follows:

ALTERNATIVE	ASSIGNED SCORE
2, 3 + 8	6
1, 4, 5, 6 + 7	4

7.155 Ocean Dredged Material Disposal Site (ODMDS). Present disposal practices for sediments removed from the Bar Channel consist of excavation by hopper dredges and subsequent transportation and disposal of the material at the Savannah ODMDS. The transportation and disposal of material from the Bar Channel was previously evaluated in 1991. That evaluation found that such actions were environmentally acceptable and determined that the operation met the criteria established to implement Section 103 of the Marine Protection, Research and Sanctuaries Act of 1972 (MPRSA), as amended (40 CFR Parts 220 to 228). This EIS contains an update of that evaluation in Appendix D SECTION 103 OCEAN DISPOSAL EVALUATION. Environmental impacts from transportation of dredged material to, and subsequent disposal at the ODMDS are fully described in that portion of this document.

7.156 All of the alternatives include use of the Savannah ODMDS. Continued use of the site would be conducted in an environmentally acceptable manner. Construction and maintenance of nearshore submerged berms, included as components of Alternatives 5 and 8, would result in less dredged material being placed at the ODMDS. Therefore, impacts from using the site would be less with those two alternatives than with the others. Each alternative was assigned a score based on its overall impacts to the Savannah ODMDS. A scale of 0 to 10 was used, with 3 being the level of no effect. The results of this evaluation are displayed as follows:

ALTERNATIVE	ASSIGNED SCORE
5 + 8	4
1, 2, 3, 4, 6 + 7	3

7.157 Nearshore Area. Four new actions were considered for the nearshore area. As a component of the Mitigation Plan for diking Disposal Area 14A, a nearshore island would be created and maintained to produce habitat for shorebirds. The other three actions stem from the beneficial use of sediments excavated from the Bar Channel and navigation channel adjacent to Jones/Oysterbed Island. One beneficial use of the excavated sediments is the creation and maintenance of underwater submerged berms adjacent to the south side of the Bar Channel. Another beneficial use is the creation and maintenance of underwater feeder berms oceanward of Tybee Island. The third beneficial use is the direct deposition of sediments on the eroded barrier

island beaches of Tybee and/or Daufuskie Islands. The impacts which are expected from each of these actions will be described separately in the following sections.

7.158 **Nearshore Bird Island.** Deposition of material in the nearshore area north of and adjacent to the harbor entrance would allow construction and maintenance of an island in the nearshore area. The main purpose for construction of the island would be to provide an isolated nesting area for shorebirds, a rare habitat in this region. Additional valuable environmental benefits would be gained as endangered sea turtles are also expected to use the site for nesting. High sandy beaches which are isolated provide excellent nesting habitat for that species. This island would provide such habitat, which is not common in this region. The island would also provide a year-round resting area for various species of shorebirds and gulls. Continued periodic deposition of sandy dredged material on the island crest would allow (1) restoration of the size of the island from losses due to wind and wave erosion, and (2) maintenance of the high areas in a vegetation-free state to maximize the value of the site to nesting shorebirds and sea turtles.

7.159 As human populations in coastal areas have increased, natural areas have been altered and occupied by man. That alteration and occupation has reduced the wildlife habitat value of those areas, particularly the beaches. Beach erosion has added to the loss of highly valued wildlife habitat. As a result, sandy isolated areas for use by wildlife are rare today.

7.160 One hundred years of dredging and open-water disposal operations by the Corps of Engineers, state agencies, and private enterprise have resulted in the creation of over 2000 man-made islands throughout the coastal United States' rivers, riverine waterways and the Great Lakes (Corps of Engineers, 1986). These dredged material islands have provided vital wildlife habitat in many areas.

7.161 The primary wildlife species needing habitat provided by dredged material islands are 37 species of colonial-nesting birds. Among these are pelicans, cormorants, anhingas, herons, egrets, ibises, spoonbills, gulls, terns and skimmers. Several of these species are rare, threatened, or endangered throughout large parts of their ranges. Some are migratory and receive protection under Federal laws and international treaties. An estimated 1,000,000 birds nest on dredged material islands each year along the Atlantic and Gulf coasts (Corps of Engineers, 1986). It was estimated that in 1977, 59 percent of the ground-nesting colonial waterbirds nesting in Florida used dredged material islands. In North Carolina the percentage was 75 percent. As coastal development has accelerated in the past

15 years, wildlife habitat has continued to be lost and the importance of these islands as critical habitat for colonial nesting birds in this country has greatly increased.

7.162 The proposed island would be located about 3,000 feet away from the north jetty in water averaging about 6 feet deep (Figure 33). From 700,000 to 1,500,000 CY of material would be used to construct the island. Maintenance is expected to be necessary every 4 to 5 years and would be performed when the size of the high beach of the island has been significantly reduced. The island would be circular. The size of the island above MHW would be limited to (1) reduce potential impacts from changes in the tidal currents which pass through the shallow area, and (2) reduce potential future problems stemming from unwanted growth of upland vegetation. The crest of the berm would be about +14 feet MLW to ensure that nesting sites located on the crest would not be flooded by Spring tides.

7.163 Geotextile materials or rock may be used to ensure stability of the outer perimeter of the island. Sand-filled fabric tubes may be used to establish the perimeter of the island and improve the stability of that surface to wave impacts. Shell hash may also be placed on the island's ocean face to increase stability. Dredged material would be transported and deposited at the site through use of a hydraulic pipeline. Significant dispersal of turbidity is expected during dredged material placement until the discharge point can be located above the water line on the newly-formed island. The turbidity would be short-lived since the construction would be of short duration and take place in a high energy environment where the water is highly mixed. The site would be located about 10,000 feet offshore of an undeveloped island, so turbidity increases at the shore would not impact recreational uses of a beach.

7.164 The adjacent shoreline is part of the Turtle Island Wildlife Management Area and this habitat created by the island would enhance the wildlife value of that Area. Boats are required for access to the site, so human impacts to the island are somewhat limited. Signs would be placed around the perimeter of the island to inform the public of the purpose of the island and that no trespassing would be allowed.

7.165 Experience with other dredged material disposal islands indicates that new islands should generally be no smaller than 5 acres and no larger than 50 acres. However, birds will nest on both smaller and larger islands, and nest site selection is a highly site and species specific process. Islands with crowns ranging in initial size from 1 to 40 acres were considered in this project. Larger stable islands would generally be more

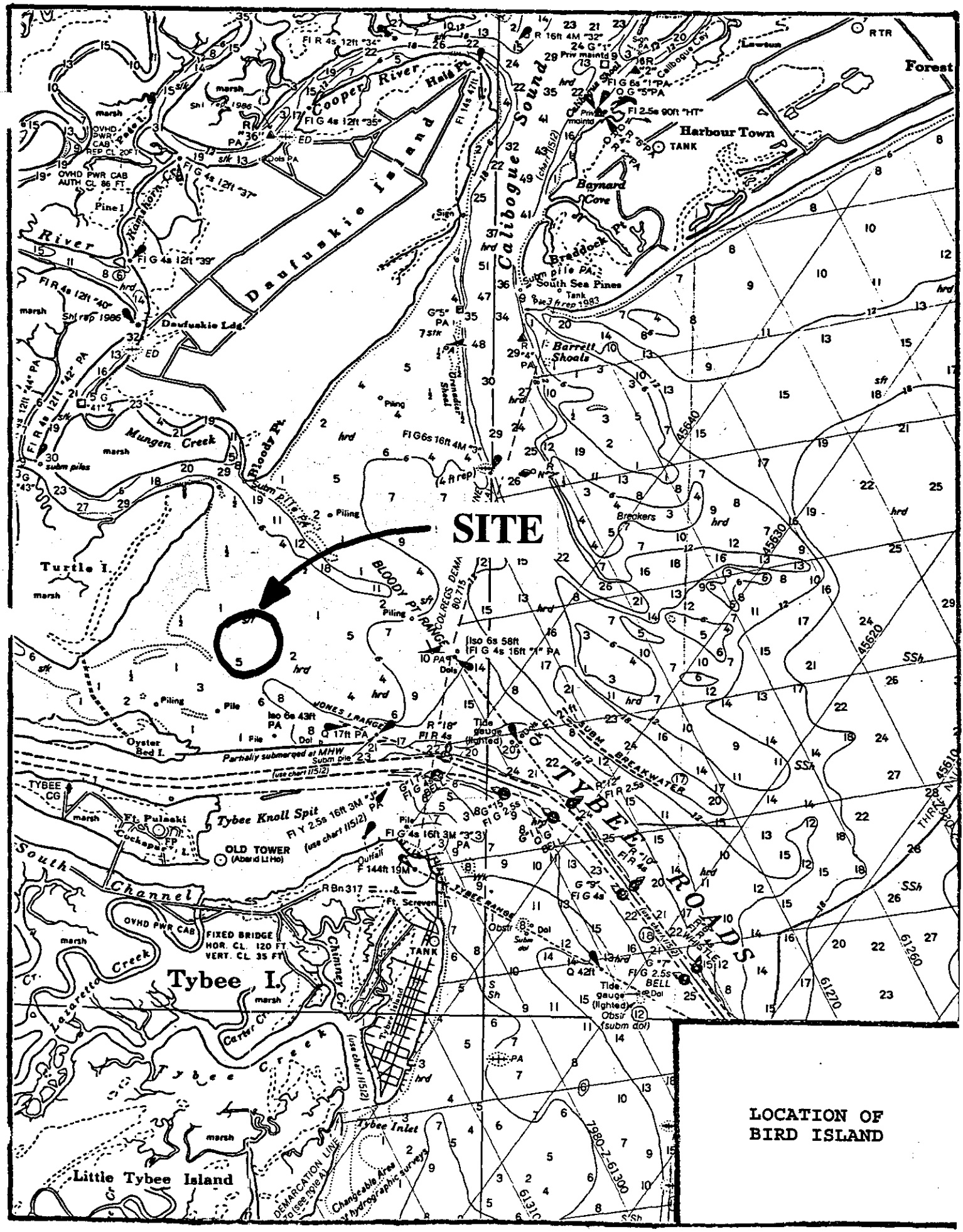

SITE
Tybee I.
Little Tybee Island
Turtle I.
Oyster Bed I.
Tybee Knoll Spit
Daufuskie Island
Calibogue Sound
Cooper River
Mungen Creek
Bloody Pt.
Barrell Shoals
Harbour Town
Baynard Cove
Braddock Pt.
South Channel
Lazaretto Creek
Tybee Creek
Tybee Inlet
Chimney Ck.
Carter Ck.
Ft. Pulaski
OLD TOWER
TYBEE ROADS
FIXED BRIDGE
HOR. CL. 120 FT
VERT. CL. 35 FT
Forest
LOCATION OF
BIRD ISLAND

FIGURE 33

difficult to manage since predator populations such as rats, snakes, feral cats and dogs, and raccoons could develop. Islands between the two extremes in size can generally be managed more easily (Corps of Engineers, 1986).

7.166 Since the proposed construction of this island would be a separate feature from the normal channel maintenance, the size of the island is not dependent on the availability of material, but instead on the amount of habitat which needs to be created. The mitigation goal for this feature was the creation of 102 Habitat Units of nesting habitat for colonial nesting birds. Various sizes islands were evaluated around the acreage necessary to fulfill the mitigation goal. Literature reviews of nesting in other states were combined with experience from nests sites located in Savannah District to estimate the shorebird nesting which would be expected.

7.167 The generally recommended maximum size of bird nesting islands is 50 acres. At larger islands, problems with predators and undesirable vegetative growth are sometimes experienced. The problems associated with terrestrial predators are not expected at this offshore site since the design of the island would result in the toe of the deposited material remaining separated from the low tide shore of both the adjacent island and north jetty. Vegetative growth is also not expected to be a severe problem. At other sites, vegetation has been found to take approximately 10 years to progress to a point where it inhibits nesting of bare-ground nesting species. The open exposure of this site should inhibit the growth of large trees. Should excessive densities of vegetation establish on portions of the island, additional dredged material would be placed on the site to restore the site's habitat value to bare ground nesting species.

7.168 Several island sizes were considered. The following data summarize the size analyses which were performed. The losses of fine material expected during the construction process (50 percent) were subtracted before size calculations were performed.

ISLAND SIZE AT CROWN (ACRES)	ISLAND SIZE ABOVE MEAN HIGH WATER (ACRES)	SURFACE AREA ISLAND SIZE AT BASE (ACRES)	SURFACE AREA OF INTERTIDAL SIDE SLOPES (ACRES)
1	9	48	18
2	11	54	20
5	17	67	24
10	26	83	28
15	34	96	30
20	41	108	33
25	48	120	36
30	55	130	38
40	68	150	42

7.169 From the data above, it is apparent that the smallest island evaluated would have 1 acre of prime habitat available for use by nesting birds, plus additional 8 acres of lower quality between the island crown and MHW. The base of that island would cover 48 acres. Existing populations of benthic communities in that 48 acres would be lost due to the smothering effect of material deposition. However, for that same island, 18 acres of intertidal substrate and 21 acres of subtidal substrate would be created on the side slopes of the island for recolonization by benthic communities.

7.170 The physical design of an island is a major factor in its success as bird habitat. Islands must be permanently emergent at high water levels to provide good nesting habitat. Birds have been found nesting on all sizes and shapes of islands as long as the islands met this crucial breeding requirement. Intertidal islands are valuable for many types of avian behavior, such as resting, preening, and feeding, but only totally emergent areas are useful for nesting and roosting.

7.171 Elevations of a constructed island should be high enough to prevent flooding of nested areas but not so high that wind erosion will prevent the substrate from becoming stabilized. The optimum elevation for an island has been found to generally be between 3 and 10 feet above MHW (Corps of Engineers, 1986). The bird islands considered for this project would be emergent with a

design crown elevation of +14 feet above MLW (7.4 feet above MHW). The intertidal area surrounding the island's crown would provide additional valuable isolated habitat for resting, preening, and feeding activities.

7.172 The shape of a constructed island should depend on the target wildlife species. Steep slopes such as those found on some dikes should be avoided for all species. From experience on other bird islands, a slope no greater than a 3-foot rise per 100 feet has been recommended. Many bare-ground nesters must have gentle slopes to prevent their eggs from rolling from nest scrapes. The crown of the proposed island would be flat, the area between +14 and +8' MLW is expected to have a 1(V) to 10(H) slope, while the area between +8 and +0' MLW is expected to stabilize of a slope of 1(V) to 35(H). Calculations of material quantities were based on a constant slope of 1(V) to 35(H) from the crown to the base. This would tend to overestimate the volume of material actually expected to be placed.

7.173 The proposed bird island would be constructed in the shape of a circle to maximize the longevity of the island. Should a larger island, with its additional nesting area, be desirable in the future, it could be constructed in the shape of an oval with the long axis generally being parallel to the north jetty and navigation channel. The orientation of the long axis of the island would reduce the impacts on existing tidal currents which pass through the area. Should an oval island be oriented parallel to the shoreline, the additional exposure of the long axis to the ocean waves would tend to increase the island's erosion rate and shorten its useful life for colonial bird nesting. There is evidence that the formation of a bay or pond within an island makes it more attractive to certain species of nesting birds. However, creation of such a sheltered spot would likely foster increased growth of vegetation. The vegetation would result in the island being less useful for bare-ground nesting species, the primary target species for this island.

7.174 Coarse material such as sand or gravel usually makes better nesting substrates due to its greater stability. Fine material such as silt and clay are subject to wind and rain erosion and usually develop desiccation cracks, settling and ponding. Material to be obtained from the navigation channel would have a some amount of fine material. However, most of the fines are expected to be lost to the receiving waters during the construction process. The remaining exposed fines in the intertidal area are expected to be removed within the first year by the sorting action of waves. Fines on the island crest which are exposed after construction are expected to be removed by winds within the first year.

7.175 Dredged material islands provide important sites for resident and migratory sea and wading birds to nest, rest and breed. Numerous examples of this have been documented in the literature (see Schreiber and Schreiber, 1978; and Soots, 1978). For example, over 3,500 individuals representing 23 species were observed on 46 of the 163 islands in two study areas in 1977. In Georgia, large areas of undeveloped marsh exist, but undisturbed areas of high ground along the beaches are very limited. Extensive undisturbed bare ground sites are rare. Few natural islands are available for undisturbed use by birds in the State of Florida. Therefore, this bird island would provide a high quality habitat for birds that is not readily found along the South Carolina-Georgia-Florida coast.

7.176 Construction of the bird island would provide much needed nesting habitat for many of the migratory and endemic water birds of the area. The island will be designed to provide nesting habitat for bare-ground nesting birds. This includes not only the Least tern, which receives Federal protection under the Migratory Bird Act, but also other avian species that are not threatened, endangered, or considered rare, such as the gull species, pelicans, etc. Endangered sea turtles seek similar habitats to nest and this island would also provide high quality habitat for that species. These species would benefit from this type of island since the habitat would not be readily accessible to man or terrestrial predators. Such isolated areas are usually selectively chosen over other sites which are not remote.

7.177 Construction of a bird island would not only provide nesting habitat for those avian species, but it would also provide an isolated area for birds to feed, rest, preen and perform other normal daily activities. Small intertidal sand bars in the area do provide some of this habitat, but the availability of that habitat is limited to both the lower portions of the tide cycle and days of calm seas. Several bird species which use the marine environment as a food source are expected to use the island as a resting place. The island would also be used by migratory bird species as a resting spot during their migrations. Use by the endangered Piping plover is also expected as a few individuals have frequented the northern end of Tybee Island. The paucity of suitable wintering sites is a limiting factor for these birds on the Atlantic coast (EVS, 1990). Other species which overwinter in the area can be expected to use this site for many of their activities. All of the bird species are more inclined to use a site if it is isolated from human activity or located in an area with difficult access for people. An offshore island would maximize this isolation.

7.178 While one cannot accurately predict the number of nests that would be constructed by birds on a new bird island, estimates can be made based on what has occurred at similar sites in the region. However, there are no unvegetated offshore islands in this region, so no local data is available.

7.179 Data from other areas indicate that the first year after construction of a bird island, nesting birds are likely to be predominantly American oystercatchers and Black skimmers. The following year Wilson's plovers, Least terns, Royal terns, Sandwich terns, Gull-billed terns, and Common terns are likely to use the site. If vegetation grows on the island, Forester's terns, and Eastern willets could nest at the site by the third year. Within a given species, individuals using the island during the first nesting cycle can be expected to be only those individual birds that "discover" the island. In future years when the young have grown and matured, they can be expected to return to the island. Others are likely to follow them to the island and remain due to the good nesting habitat. After a few years, the bird island can be expected to be used by several different species and many more mated pairs of each species than are likely to use the island the first year.

7.180 In a report published in 1978 by the Waterways Experiment Station, titled "Development And Management Of Avian Habitat On Dredged Material Islands", the number of birds observed using bare-ground habitats on undiked dredged material islands in North Carolina was documented. Those islands were well established, so the data likely overestimates, to some degree, the bird use which would occur during the early years at the proposed island. However, this data is much more likely to be representative of colonial bird use of the proposed nearshore island than would data from the confined disposal facilities in the inner harbor. The bird use data from the 1978 WES report is summarized as follows:

	Birds/Hectare	Birds/Acre
WINTER	4	11
SPRING	3,687	9,111
SUMMER	2,752	6,800
FALL	3	6

7.181 Table 18 presents a summary of the costs expected for construction of a bird island offshore of the northern harbor entrance jetty. The costs are derived from use of an incremental unit price of $1.00/CY. This is based on the combination of the $1.72/CY experienced for the removal of dredged material and disposal at the ODMDS during the 1993 harbor Deepening Project

TABLE 18

INCREMENTAL ANALYSIS OF NEARSHORE BIRD ISLANDS

ISLAND SIZE AT CROWN (ACRES)	CONSTRUCTION COST	INCREMENTAL* CONSTRUCTION COST	INCREMENTAL* CONSTRUCTION COST/ACRE
1	$ 1,190,000	$1,190,000	$1,190,000
2	1,445,000	255,000	255,000
5	1,973,000	528,000	176,000
10	2,647,000	674,000	135,000
15	3,211,000	564,000	113,000
20	3,761,000	550,000	110,000
25	4,311,000	550,000	110,000
30	4,741,000	430,000	86,000
40	5,733,000	992,000	99,000

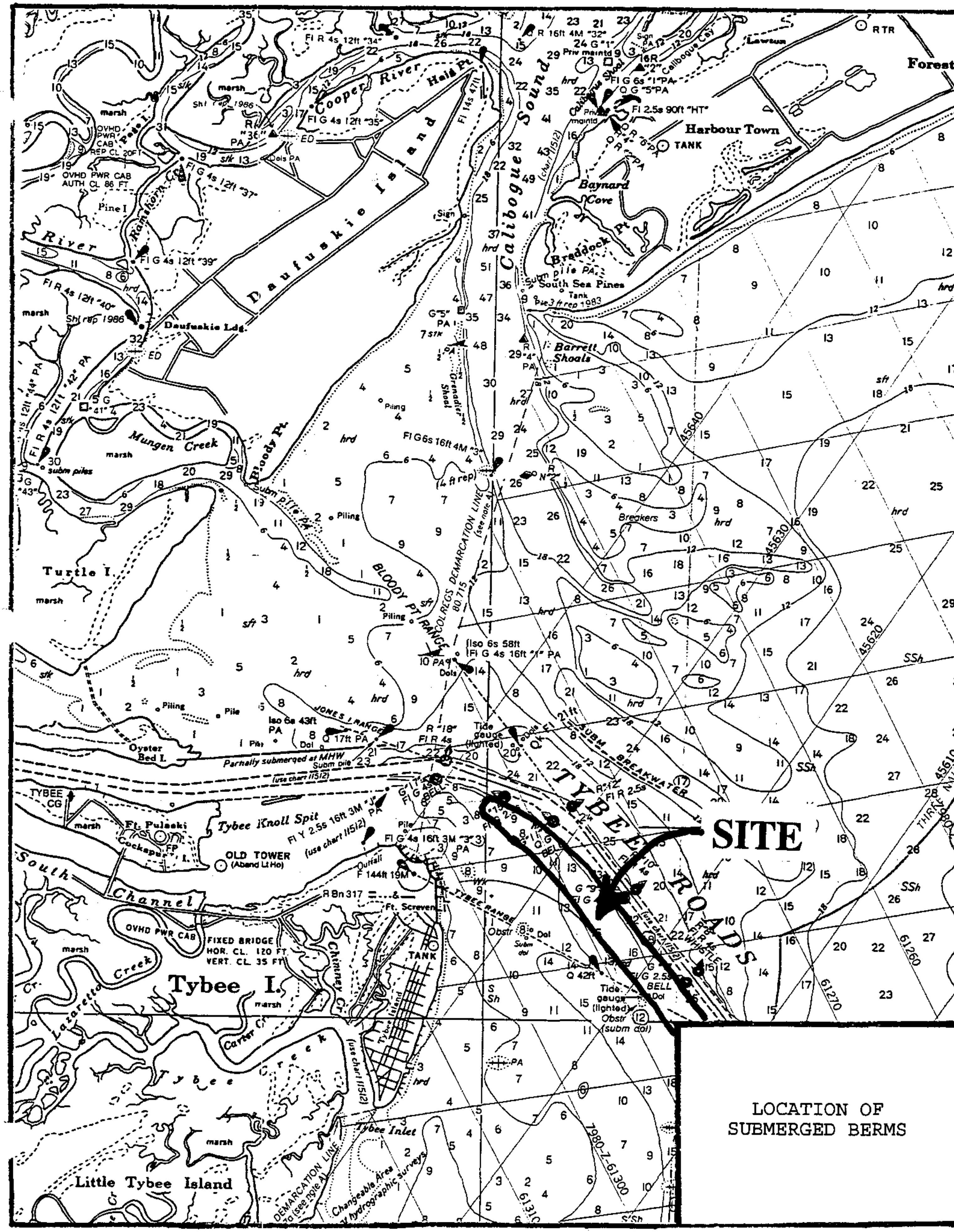
and the $2.45/CY experienced for the removal and placement of dredged material on Tybee Island during that same project. Assuming the costs to construct a bird island would be similar to those experienced to place sediments on Tybee, the incremental costs to construct the island would be roughly $0.75/CY. This unit price was increased by 1/3, to a total of $1.00/CY, to account for design costs and contingencies. The unit costs may differ somewhat from that experienced during the 1993 Deepening Project because of the significantly shorter pumping distance which would be necessary than was necessary with the disposal on Tybee. The Tybee disposal action covered dredging a relatively thin layer over a 38,000-foot length of channel, whereas excavation for this action would be much deeper, extending below the authorized channel depth, and would be made over a much shorter distance since the primary goal would be to obtain a large volume of material efficiently. Material may also be excavated from the bank of the channel adjacent to the shipping channel. No mobilization costs are included since this action would be combined with a scheduled channel maintenance contract. Material for construction and maintenance of this island would be obtained from the navigation channel and minimal impacts are expected to result from that dredging since the excavation site would refill with sediments in the near future. The costs shown in the table represent initial construction costs and do not include costs for maintenance of the island. Maintenance would be performed in the same manner as the initial construction and would use the same borrow source. The island would be maintained in a manner so that it continued isolated from Turtle Island and the north jetty. Maintenance would be performed after winds and

waves have reduced the crest of the island (+14 feet MLW) by 50 percent. The creation of a certain number of nesting sites is not the goal of the Mitigation Plan, but it is the creation of a certain number of habitat units, which are derived from a certain acreage. Therefore, the assessment of the island's wildlife benefit is not dependent on predictions of the number of birds expected to nest on the island on different years. Since such predictions are fairly speculative, the District does not believe that developing such estimates would be worthwhile.

7.182 Data gathered in the preparation of this analysis show that the construction of a bird island to create shorebird nesting habitat is possible and desirable for the benefit of the resident and migratory birds of the area. Based on the island's construction cost per acre, costs among the sizes evaluated would be optimized by construction of an island with a 30-acre crown. However, only a smaller island was needed to create the number of habitat units required for the Mitigation Plan to reasonable equal existing habitat levels at the confined disposal facilities. Sufficient habitat units would be produced by an island with a 2-acre crown. Therefore, that design was selected for inclusion in the Mitigation Plan.

7.183 The nearshore/offshore disposal location to be used for a specific dredging contract would be decided during project design and award based on identification of the least cost, environmentally-acceptable disposal option. If disposal at a different location is found to be more desirable for environmental or other reasons but would be more costly than the one designated as the least cost, environmentally-acceptable, it could be pursued using appropriate cost sharing authorities.

7.184 **Nearshore Submerged Berms.** Deposition of material adjacent to the Bar Channel would allow construction and maintenance of underwater berms in that nearshore environment. The proposed berms would be located about 2,000 feet south of the channel in water averaging about 15 feet deep (Figure 34). From 100,000 to 300,000 CY of material would be used to construct each berm. Maintenance would be performed after the size of a berm has been significantly reduced, but in no case would it be performed on a yearly basis. The berms would either be round or elliptical and oriented away from the channel so that tidal currents which converge and diverge from the channel would not be significantly restricted. The minimum 2,000-foot spacing between the toes of adjacent berms is another design feature which would ensure that tidal currents are not significantly restricted. The crest of the berm would be limited to about -5 feet MLW to ensure recreational boats could pass over the berms unaffected. Various designs were considered, as shown below. All designs assume the



LOCATION OF
SUBMERGED BERMS
SITE
Calibogue Sound
Daufuskie Island
Cooper River
Harbour Town
Baynard Cove
Braddock Pt
South Sea Pines
Barrett Shoals
Mungen Creek
Bloody Pt
Daufuskie Ldg
Turtle I.
Oyster Bed I.
Tybee Knoll Spit
Ft. Pulaski
Cockspur I.
OLD TOWER
South Channel
Tybee I.
Tybee Creek
Lazaretto Creek
Chimney Cr.
Tybee Inlet
Little Tybee Island
TYBEE ROADS
SUBM BREAKWATER
BLOODY PT RANGE
JONES RANGE
TYBEE RANGE
COLREGS DEMARCATION LINE
FIXED BRIDGE
HOR. CL. 120 FT.
VERT. CL. 35 FT.
Forest

FIGURE 34

material is placed on a 1(V) to 35(H) slope and that 50 percent of the material volume would be lost from the immediate construction site during placement of the dredged material.

SUBMERGED BERM
DESIGN ALTERNATIVES

CREST WIDTH (FEET)	CREST LENGTH (FEET)	FOOTPRINT (ACRES)	IN PLACE VOLUME (CY)	PUMPED VOLUME (CY)
0	0	9	48,000	95,000
50	50	10	49,000	98,000
50	100	14	51,000	101,000
50	500	21	62,000	125,000
50	1,000	29	79,000	158,000
50	2,000	46	110,000	221,000
50	3,000	64	142,000	284,000

7.185 Material would be transported and deposited at the site through use of a hydraulic pipeline. The discharge point would be below the water surface to reduce turbidity. Significant turbidity is still expected, however, but it would be short-lived and located in a high energy environment where the water is highly mixed and relatively rapid dispersion is expected. The sites would be located at least 4,000 feet offshore, so turbidity increases at the beach would be limited. The expected turbidity would impact estuarine fish which reside in the nearshore area, but the mobile nature of those individuals would allow them to move away from the impact area during the construction period. The NMFS stresses that nearshore areas in the vicinity of ocean inlets are important locations where subadult fish and invertebrates congregate. Activities which cause significant elevation of turbidity levels and modification of local currents could adversely affect recruitment of aquatic organisms into estuarine waters. The District believes that the relatively small scale of the proposed berm construction and the episodic maintenance minimize potential impacts to larval fish which reside in the nearshore area.

7.186 Initial construction of a berm would smother the shellfish and benthic community within the footprint of the mound. No hard-bottom communities are known to be located at the proposed construction sites, but a side scan sonar investigation and benthic survey would be performed to ensure no hard bottoms would be impacted. Recruitment to the newly deposited material is expected to be rapid as species residing in the highly energy environment quickly respond to natural changes in the bottom topography. The side slopes of the mound would result in an increase in habitat for benthic communities beyond that existing at the site, although the stability of that slope as a habitat substrate would be less than the existing bottom. The relatively shallow depths existing where the berms would be located will result in the mounds being unstable, such that waves are expected to move material from the berm into the nearshore sand sharing system. As waves expend energy moving material from the berms, the waves will have less energy to erode material from the barrier island shoreline. This will increase the stability of benthic communities on the beach.

7.187 Maintenance of the underwater berms would be performed in the same manner as the original construction and result in similar, but smaller scale effects. A smaller volume of dredged material would be involved in maintenance of the berms, so turbidity impacts would be lower with maintenance of the sites.

7.188 The berms would create significant diversity in the bottom contours, thereby increasing the habitat value of the site for fish. The area where the berms would be constructed has an average depth of 15 feet MLW, so the placement of a berm with a top elevation of -5 feet MLW would impose a very distinct feature in the bottom topography.

7.189 Placement of sediments at the berm construction sites could cost up to 2.50/CY based on the costs experienced for hydraulic pipeline work during the 1993 Tybee Island beach disposal component of the Deepening Project. That unit cost is higher than the normal costs for placing channel sediments at the Savannah ODMDS; typically around $1.75/CY. However, the additional placement costs would be warranted if dredging is required to be performed within the seasonal windows imposed on the use of hopper dredges to protect threatened and endangered species present in the vicinity of the Bar Channel.

7.190 Tybee Island is located immediately landward of the berm locations and the predominant wind/wave direction is from the east toward the beach. Material removed from the berms by the forces of winds and waves is generally expected to move toward the Tybee shoreline. When that material arrives at the shoreline, it would substitute for other shore material, thereby reducing the normal loss of that beach material. Since the

submerged berms would be located closer to the shoreline than the navigation channel, sediments located at the berms are more likely to move toward Tybee beach than are bottom sediments located in or close to the channel. The existence of a submerged berm in the path of the predominant waves should have another beneficial effect on the adjacent beach by reducing the height of the waves which strike that shoreline. This would reduce the beach's erosion rate. If the District determines the rate and direction of movement of materials from the constructed berms, and/or the expected reduction in the beach's erosion rate, the economic benefit which the submerged berms would have on Tybee beach and the Tybee Island Shore Protection Project could be quantified.

7.191 The nearshore/offshore disposal location to be used for a specific dredging contract would be decided during project design and award based on identification of the least cost, environmentally-acceptable disposal option. If disposal at a different location is found to be more desirable for environmental or other reasons but would be more costly than the one designated as the least cost, environmentally-acceptable, it could be pursued using appropriate cost sharing authorities.

7.192 **Nearshore Feeder Berm.** Deposition of material off Tybee Island would allow construction and maintenance of a feeder berm in that nearshore environment. The proposed berm would be located about parallel to the beach, about 4,000 and 7,000 feet offshore, in water with an average depth of about 8 feet MLW. The berm's crest would be up to 500 feet wide and would be at a depth of 5 feet MLW. Restricting the berm height to -5 feet MLW would ensure that pleasure boats could safely pass over the berm. The berm would be located at least 5,000 feet away from the channel. Assuming a 50 percent loss of material volume during placement, approximately 132,000 CY of channel dredging would be needed per 1,000 linear feet of berm.

7.193 The shallow depth of the area in which the berm would be constructed would result in the berm being dispersive, with the deposited sediments subsequently being moved offsite by waves. The relatively close proximity of the berm to the beach would increase the likelihood that the sediments would migrate to the beach. As waves expend energy moving material from the berms, the waves will have less energy to erode the Tybee Island shoreline. This would increase the stability of that barrier island.

7.194 No hard structures would be used in the formation or maintenance of the berms to allow free migration of the deposited sediments after the initial placement. Material would be transported and deposited at the site through use of a hydraulic pipeline. The discharge point would be below the water surface

to reduce turbidity. The sites would be located at least 4,000 feet offshore, so turbidity increases at the beach would not be significant.

7.195 Maintenance would be performed when the size of a berm has been significantly reduced, but in no case would it be performed on a yearly basis. The berm's length could be extended with subsequent disposal events if maintenance of the previously placed fill is not required.

7.196 No hard-bottom communities are known to be located at the proposed construction site, but a side scan sonar investigation and benthic survey would be performed prior to deposition to ensure that no hard bottoms would be impacted. No significant cultural resources are known to exist in the locations of the proposed berms. However, the side scan sonar would indicate whether any resources are visible above the ocean floor. Should any be identified, the Georgia SHPO would be consulted. Deposition of dredged material on any unknown submerged cultural resource would not adversely affect it, but would instead provide additional protection from wave- or current-induced exposure and erosion.

7.197 The nearshore/offshore disposal location to be used for a specific dredging contract would be decided during project design and award based on identification of the least cost, environmentally-acceptable disposal option. If disposal at a different location is found to be more desirable for environmental or other reasons but would be more costly than the one designated as the least cost, environmentally-acceptable, it could be pursued using appropriate cost sharing authorities.

7.198 **Direct Beach Placement.** Direct deposition onto the shorelines of Tybee and/or Daufuskie Islands would constitute a beneficial use of sediments excavated from the Bar Channel and the navigation channel adjacent to Jones/Oysterbed Island. As expressed earlier in this document, the value of the Tybee Island beach is something that has previously been established, as both the state of Georgia and Congress have funded beach nourishment projects for that shore. Congress also recognized the value of Daufuskie Island as it included the island in the Coastal Barrier Island System. The state of South Carolina has recognized the uniqueness of that site and could fund shoreline protection projects for portions of that island.

7.199 The shorelines of both Tybee and Daufuskie Islands experience erosion, so the direct placement of suitable dredged material onto those shorelines would benefit those sites by protecting their existing beach soil materials. Placement of dredged material would temporarily protect existing beach materials from the erosive damage of wind-generated waves. At

Tybee Island, placement of suitable dredged material would also fulfill the need for a portion of the beach-quality material needed to be periodically placed there to maintain the Tybee Island Shore Protection Project. Such placement would benefit that project by extending the time before the next scheduled nourishment event.

7.200 Significant turbidity would be produced during the disposal operations, but the dispersive nature of the nearshore would result in the adverse impacts quickly dissipating. Disposal operations would be scheduled outside the spring and summer periods, as much as possible, to reduce the potential for adverse impacts to fishery resources.

7.201 The nearshore/offshore disposal location to be used for a specific dredging contract would be decided during project design and award based on identification of the least cost, environmentally-acceptable disposal option. If disposal at a different location is found to be more desirable for environmental or other reasons but would be more costly than the one designated as the least cost, environmentally-acceptable, it could be pursued using appropriate cost sharing authorities.

7.202 Only Alternatives 5 and 8 include the beneficial use of nearshore sediments (submerged berms, feeder berm and direct beach placement) as a project feature. Therefore, the adverse and beneficial impacts identified in the previous paragraphs would only occur with implementation of those plans. The submerged berm design, feeder berm design, beach placement design, and construction timing is the same in both alternatives, so no difference exists between those two plans in the impacts which are expected.

7.203 In summary, each of the alternatives include dredging in the nearshore area to maintain authorized depths in the Bar Channel. That activity does not result in unacceptable impacts to the nearshore environment. Two alternatives include the open water disposal of nearshore sediments for beneficial purposes. Disposal operations would be directed to create and maintain submerged berms, feeder berms, bird islands and/or valuable ocean shorelines. Although deposition of the dredged material would result in some short-term adverse impacts, substantial beneficial effects would also result. The submerged berms should increase the fish habitat value of the sites and result in sandy material being more available to the Tybee Island sand sharing system. The feeder berms would result in more sandy material being available to the Tybee Island sand sharing system. The bird island would provide rare isolated colonial bird nesting habitat. Direct beach placement would protect eroded barrier island shorelines. Each alternative was assigned a score based on its

overall impacts to the nearshore environment. A scale of 0 to 10 was used, with 3 being the level of no effect. The results of this evaluation are displayed as follows:

ALTERNATIVE	ASSIGNED SCORE
5 + 8	5
1, 2, 3, 4, 6 + 7	3

7.204 Groundwater. Section 6 AFFECTED ENVIRONMENT, contained paragraphs on groundwater which provided information on studies previously conducted to determine potential impacts of the 1993/1994 harbor deepening on the freshwater aquifer. Those investigations revealed that dredging the harbor to a depth of -100 feet MLW would be required before significant concern need to be expressed about potential impacts of harbor dredging on the drinking water aquifers. Based on that information, no impact to the upper confined freshwater aquifer or the principle confined artesian drinking water aquifer in Savannah Harbor is expected to occur from continued maintenance of the Navigation Project.

7.205 The confined disposal facilities are not lined, so there is a potential for migration of water down through the soil layers to levels of shallow groundwater. Since drinking water in the project vicinity is taken from depths more than 100 feet below the surface and clay lenses of 40 to 70 feet in thickness separate the various groundwater bearing strata, there is essentially zero probability that migration is occurring of water from the disposal areas to the drinking water aquifer.

7.206 Questions have been raised by some individuals about the potential for migration of contaminants off the confined disposal facilities. Movement of sediment particles and chemical compounds from the disposal areas does occur. Although designed and operated to retain solids, the areas are not 100 percent efficient, and some solids and affiliated chemical compounds are discharged through the overflow weirs. Quarterly monitoring performed by the District and the 1994 Wright River weir effluent study confirm that compounds are released through the weirs overflows, but in quantities which pose no environmental risk. The weir effluent study revealed that flows from the underdrains do contain materials in sufficient quantities to warrant their management. Those materials could pose a risk to aquatic life when discharged into headwaters of small tidal creeks. Therefore, discharges to Wright River were stopped by the end of 1994. This EIS includes an analysis of installation and operation of underdrains which discharge to the Savannah or Back

Rivers. The evaluation found that such releases would be at levels which pose no threat to aquatic life within a 100-foot mixing zone, a distance common for industrial discharges to surface waters.

7.207 Underdrain releases do represent a form of groundwater movement as the flows are the result of drainage through the deposited soil material. Since the concentrations found in the underdrain flows would result in no adverse impacts to aquatic life after allowable mixing with waters of the Savannah or Back Rivers, there appears to be little evidence of concern for the migration of contaminants through groundwater.

7.208 This position is further supported by the following factors:

(1) If significant chemical contamination exists at the confined disposal facilities, adjacent vegetation and/or biota would die or, at a minimum, show signs of stress. In the same manner, if significant chemical contamination were moving off the sites, some impacts to the adjacent environment should be discernible. Neither condition appears to be occurring. Vegetation and biota located both within and surrounding the disposal areas show no signs of stress which would be considered related to contaminants. Nothing in the environment surrounding the diked sites shows signs of chemical contamination.

(2) Assuming downward migration of significant contamination were occurring, the groundwater lenses to which chemicals would be moving is distinctly separate from the deep drinking water aquifer. The shallow groundwater aquifer drains to adjacent creeks and the ocean. As expressed previously, those areas show no signs of contamination effects.

7.209 Alternatives 1 (Without Project Condition) consists of essentially a continuation of existing harbor operational practices. There is no indication that any of these practices are adversely affecting groundwater. The Mitigation Plan contained in Alternatives 2, 3 and 8 includes maintaining water in the confined disposal facilities for extended periods of time. If migration from those sites is occurring through shallow aquifers, that procedure could increase the migration to the groundwater. However, as expressed previously, Savannah District is not aware of any adverse impacts around the confined disposal facilities which could be attributed to either chemical contamination or the offsite migration of materials. Alternatives 4 and 8 include the installation and use of underdrains. The 1994 weir effluent study revealed that chemicals were in the underdrain effluent at levels which were higher than acceptable for release into the headwaters of small tidal creeks. This alternative would result in use of

underdrains being reinstated with their discharge being to a larger receiving water where dilution would occur within an acceptable distance (less than 100 feet). Use of the underdrains would be beneficial to groundwater by removing substances from the site that could enter the shallow aquifer if they continued to migrate through the underlying soil substrate. Alternative 5 contains no features which could result in different impacts than are presently occurring. The dredging associated with the sediment control features in Alternatives 7 and 8, and the sediment storage feature of Alternative 6 would be at an depth that would not result in impact to groundwater.

7.210 In summary, each alternative was evaluated for potential impacts to groundwater. No alternative was identified which would have adverse impacts on this resource. Two alternatives would reduce the potential for substances to migrate from the confined disposal facilities into the shallow aquifer. Each alternative was assigned a score based on its overall impacts to groundwater. A scale of 0 to 10 was used, with 3 being the level of no effect. The results of this evaluation are displayed as follows:

ALTERNATIVE	ASSIGNED SCORE
4 + 8	4
1, 2, 3, 5, 6 + 7	3

7.211 Aesthetics. None of the proposed alternatives would impact the aesthetic nature of the historic city of Savannah. Alternatives 1 and 7 would have no effect on aesthetics. Alternatives 2, 3, 4 would result in some degree of adverse impacts to saltwater marsh, but those impacts are not expected to result in significant impacts to the aesthetic quality of the study area. Alternatives 5 and 8, with their placement of dredged sediments directly on eroding beaches of Tybee and Daufuskie Islands would have beneficial effects on the aesthetic quality of those barrier island shorelines. Alternative 6 would minimally benefit aesthetics through temporary reductions in turbidity in the Savannah River, as agitation dredging events are replaced by direct placement of berth sediments in the confined

disposal facilities. Each alternative was assigned a score based on its overall impacts on aesthetics. A scale of 0 to 10 was used, with 3 being the level of no effect. The results of this evaluation are displayed as follows:

ALTERNATIVE	ASSIGNED SCORE
5 + 8	5
1, 6 + 7	3
2, 3 + 4	2

7.212 Recreation. Savannah Harbor does not provide extensive opportunities for what would normally come to mind as recreational activities when an estuarine river or harbor are considered. This was described previously in Section 6. The main recreational activities in the harbor are tourism and a limited amount of sport fishing in Back and Middle Rivers. There would be no adverse impacts to existing recreational activities in the harbor from any of the proposed alternatives. Therefore, there are no differences between the plans in relation to their effect on recreation.

7.213 Maritime Industry. The maritime industry is dependent on maintenance of adequate depths in the navigation channel. Contracts are made and multi-million dollar equipment is scheduled for use assuming the availability of certain channel drafts. Alternative 1 (Without Project) would allow continued maintenance of the Federal Navigation Project. This would allow the maritime industry in the harbor to compete on their merits and not be restricted by the harbor acting as a limitation in their transportation infrastructure. The alternatives considered would increase the efficiency or cost-effectiveness of maintenance activities in some manner. Any such increase would benefit the local maritime industry and increase both the national and international competitiveness of industries which transport goods through Savannah Harbor. Alternative 6 would result in the dock owner having a confined disposal area available to deposit excavated berth sediments. Alternatives 6 and 8 -- which include deepening the berths -- would extend the time over which adequate depths would be available at berths. This would provide increased certainty to the dock owners of adequate depth, thereby benefiting dock owners.

7.214 Since each alternative considered would result in a maintained navigation channel, the maritime industry would benefit from implementation of any of the plans considered. Two alternatives would extend the time over which adequate depths at berths would be available. Each alternative was assigned a score based on its overall impacts to the maritime industry. A scale of 0 to 10 was used, with 3 being the level of no effect. The results of this evaluation are displayed as follows:

ALTERNATIVE	ASSIGNED SCORE
7 + 8	7
6	5
1, 2, 3, 4 + 5	4

7.215 Economic Impacts. Operation of the harbor does result in significant and widespread economic benefits. An extensive maritime industry exists in Savannah, and shipping through this port greatly influenced the historic development and growth of the city. Each harbor improvement project performed by the Corps of Engineers must be shown to be economically justified before construction approvals and funding are received. Alternative 1 (Without Project) would allow continued operation of the navigation project and the economic benefits (direct revenues and jobs) which result from the passage of cargos through the local industries and through the city. Several of the alternatives considered would increase the efficiency or cost-effectiveness of maintenance activities in some manner. Any decrease in costs now expended by the Federal government at Savannah could reduce the overall level of government expenditures, or be used elsewhere to reduce increases in Federal taxes. Any decrease in locally-incurred costs (disposal area and berth maintenance) would reduce the cost structure of industries which transport goods through Savannah Harbor, thereby increasing their national and international competitiveness. Alternatives 3, 4 and 8 would increase the useful life of the confined disposal facilities, thereby reducing the costs of providing disposal sites. The beach placement features of Alternative 5 may reduce total combined expenditures on channel maintenance and beach maintenance projects. Although Alternative 6's use of hydraulic dredges may increase the cost of removing sediments from berths, the direct placement of those sediments into confined disposal facilities would reduce the current double-handling of berth sediments and the duplicative costs of redredging those sediments

from the navigation channel. The deepening of berths in Alternative 6 would increase the efficiency of hydraulic dredging operations to maintain depths at those facilities, thereby minimizing the costs of those operations. Alternatives 7 and 8 would increase the efficiency of dredging operations, thereby reducing the costs of maintaining the navigation channel.

7.216 Each alternative considered would result in a continuation of cost-effective transportation of goods through Savannah Harbor. This is an economic benefit to the region and the nation as it limits the cost of raw materials and consumer goods. Two alternatives would increase the efficiency of maintenance dredging. Each alternative was assigned a score based on its overall economic impacts. A scale of 0 to 10 was used, with 3 being the level of no effect. The results of this evaluation are displayed as follows:

ALTERNATIVE	ASSIGNED SCORE
7 + 8	7
3	6
4, 5 + 6	5
1 + 2	4

7.217 Secondary Impacts. Operation of the harbor does result in extensive secondary impacts, primarily concentrating on the adjacent landside properties. As described previously, a long-standing and significant maritime industry exists in the port, with the facilities located along the banks of the river. Development and operation of those facilities would constitute a secondary impact of harbor operation. The economic benefits which those industries bring to the regional economy have been discussed in previous sections. The physical development of their landside facilities does produce adverse environmental impacts. When those impacts occur to wetlands, an examination of their extent and the overall value of the development project is made by regulatory agencies prior to granting the permits required for that construction to occur.

7.218 Another source of secondary environmental impacts stem from the transit of large deep-draft vessels through the navigation channel. Due to the constant deposition of river sediments on the channel floor, the proximity of the vessel bottom to the channel floor, and the extensive hydraulic currents which large vessels produce, turbidity plumes are typically produced as vessels pass through the harbor. Those impacts are

readily observable and recurring, but they are also short term as the sediments resettle to the channel floor after passage of a vessel has occurred.

7.219 Another potential secondary impact of harbor development and operation is the erosion of the adjacent shoreline. Savannah Harbor is a riverine harbor, rather than a development in a large open coastal bay. The harbor extends upriver about 21 miles from the ocean. Maritime facilities are located along that length of river. Since rivers are not stationary, but tend to wander and change their course over time. Flows tend to concentrate in areas of deep water on the outside of bends, while shallow areas on the inside of bends tend to shoal. This natural variation tends to result in erosion of portions of a river's shoreline. The passage of large deep-draft vessels create strong currents and large waves close to the vessel. When that vessel passes through a relatively confined navigation channel, those currents and waves can impact the nearby shoreline, causing it to erode. It is often quite difficult in the field to identify the precise cause of bank erosion at a specific site. In fact, the erosion may be the result of a combination of factors. In any case, bank erosion does occur in portions of the harbor and that occurrence may be aggravated through operation of the harbor.

7.220 Cumulative Impacts. Cumulative impacts are the effects on the environment which result from the incremental impact to those experienced as a result of other past, present, and reasonably foreseeable future actions. All other actions would be considered, regardless of what agency or person undertakes them. Impacts described in the Environmental Consequences section of this document were determined in light of other Savannah Harbor Federal and private harbor improvements and maintenance procedures. As described in Section 4, previous harbor development resulted in increases in upstream salinities of as much as 9 parts per thousand, loss of approximately 4,000 acres of freshwater tidal wetlands, and a decline in striped bass egg production of approximately 95 percent. Most of those impacts apparently relate to salinity increases experienced following the harbor deepening implemented in the 1970's and the 1977 construction and subsequent operation of the Tidegate structure. A large portion of those impacts were identified prior to Congressional approval of the improvements, and mitigation features deemed appropriate at the time were included in the project to compensate for those impacts.

7.221 The tidal marsh monitoring which the District funded indicates that the 1990 cessation of operation of the Tidegate and closure of New Cut has reduced salinity levels in Back River and its adjacent marshes. Since the Tidegate has been taken out of operation, the salinity has decreased in Back River so that freshwater is available for flooding of the impoundments under

all expected flow conditions. Restoration of Refuge unimpounded wetlands to freshwater species should be more observable in the next few years as the vegetation continues to respond to the changed salinity conditions. Never-the-less, Refuge operations continue to be hindered by harbor-induced problems, primarily salinity. Although the Freshwater Diversion Canal (McCoys Cut) has been found to be unable to carry its designed flow rate, the Refuge Managers indicate that they presently have no interest in seeing the canal enlarged. They believe it would be appropriate to wait until the Corps study of Striped bass in Back River is complete before discussions are held on how and/or whether to increase freshwater flows down that river.

7.222 Other private or government potential projects in the harbor could affect the Refuge primarily through impacts on salinity, noise levels or air quality. At present, the District is aware of no firm plans for such development. There is the potential for upstream harbor expansion since the Georgia Ports Authority (GPA) owns land (Mulberry Grove) located above the upper limit of the harbor and across the river from the Refuge. Development of that site for port facilities would increase salinity levels in the river and adjacent undiked marshes. At this time, GPA has not sufficiently developed its plans for that site to allow a thorough evaluation of likely environmental impacts. Industries in the upper portion of the existing harbor have requested the Corps deepen the navigation channel near their facilities, but no action is underway or scheduled at this time on that proposal. If the channel were deepened in that area, salinity levels upstream of the harbor would be expected to increase. That area does include Refuge property. Another potential action which could affect the Refuge is the eventual disposition of the Tidegate structure. Complete or partial removal of the structure could affect flows through Little Back River and, thereby, salinity levels in that portion of the estuary. Development of the Tidegate site for recreational purposes could increase recreational use of Back River, the level of human visitation of that area and the amount of fishing pressure placed on populations in that area.

7.223 The potential for future conflicts between the Refuge and the harbor remain as long as the Refuge and the harbor share a common river. The purpose for which the Refuge was established, a site for freshwater estuarine habitats, does not easily harmonize with the saline aspects of a highly industrialized coastal port. Neither existing harbor operations or any alternative evaluated in this document is expected to result in new adverse impacts to the Refuge.

7.224 As far as potential impacts of any foreseeable private projects, the only known projects are the mixed use development of Hutchinson Island and the proposed construction of lay berths just west of the Talmadge Bridge. Impacts associated with construction of these projects would not be expected to be increased by the proposed harbor maintenance alternatives, nor would the impacts of harbor maintenance be increased by their construction.

7.225 There is presently no Federal interest in harbor expansion, nor is there any advocacy on the part of the Corps of Engineers to expand the harbor. In addition, no private firm has applied for a Department of the Army permit to expand the harbor. Therefore, upstream expansion is not considered a foreseeable project at this time. At the request of GPA, the District requested funds to study the feasibility of harbor expansion and a Reconnaissance Study is underway. That study will briefly evaluate the engineering and economic feasibility of harbor expansion, as well as assess the environmental impacts of such an action. Should it appear that the project may be economically justified, environmentally acceptable and in the Federal interest, further detailed studies would be pursued at the request of a local sponsor. Potential impacts of harbor expansion on the proposed harbor maintenance alternatives would be identified and evaluated as part of the feasibility analysis of harbor expansion. Those impacts are not expected to be either increased or decreased by implementation of any of the proposed harbor maintenance alternatives.

7.226 Some of the harbor maintenance alternatives would result in additional discharges, as use of underdrains in all the Project confined disposal facilities in the middle harbor would increase the total volume of water discharged from those sites. Impacts from the underdrain discharges are expected to be minor and within state water quality standards. To ensure this, periodic monitoring would be performed. Changes in sediment control features (deeper advance maintenance sections at Kings Island Turning Basin and new advance maintenance at the Sediment Basin and other turning basins) and sediment storage features (deepening below berths) could decrease dissolved oxygen concentrations in the water column at those specific locations, although the removal of sediments from exposure to the water column through burial may well lower the total dissolved oxygen demand which those sediments place on the aquatic environment. That action could tend to increase dissolved oxygen levels during the critical summer months. This increase would diminish existing dissolved oxygen deficits in the harbor stemming from industrial and non-point discharges. By improving ambient conditions in the harbor, the proposed changes to the harbor's sediment control features may reduce the adverse impact of local industries' effluent discharges on river water quality.

7.227 The proposed project is not expected to affect the size or frequency of deep-draft vessels using the harbor. However, the more efficient operation of the harbor may increase the national and international competitiveness of the harbor's maritime businesses. If that does occur, then additional vessels transits through the harbor may develop. Alternatives 7 and 8 would alter the sediment deposition patterns and may result in increases in the length of time over which the authorized channel depths are available. If that increase in time is substantial, shippers may view the harbor as having a deeper effective draft, thereby allowing them to alter their transportation patterns.

7.228 Past harbor development projects have adversely impacted both historic and cultural resources. A Cultural Resource Management Plan (found in Appendix J) has been developed for the harbor and will be implemented as part of normal harbor maintenance actions. As part of that Plan, the District will study the cumulative impacts which harbor operations and issuance of Department of the Army permits has had upon cultural resources in the harbor.

7.229 Mineral Resources. Harbor maintenance will require excavation of about 7 million cubic yards of sediment each year. A large portion of that material is predominantly sand and is valued as a building resource. The state of Georgia claims ownership of this resource, since it is located below the MHW line. The State allows the Federal government to use this resource for valid harbor management purposes. However, private use of the excavated material is not allowed without specific approval. No private mining of sand for commercial use is included in any proposed alternative. Each alternative would allow reuse of the majority of these sediments for dike construction, thereby avoiding the need for borrowing material from another source for future dike improvements. Use of sediments deposited in Disposal Area 1N for use on State and County construction projects is included in each alternative. Sandy sediments located in the Bar Channel are removed and placed in the Savannah ODMDS, a site located outside State boundaries. Materials deposited at that site migrate offsite as a result of waves and currents and become a component of the littoral drift system. Alternatives 5 and 7, which include construction of nearshore submerged berms, would keep more of that resource within State boundaries, but may result in the material being somewhat more dispersed. None of the plans would have a significant adverse impact on this resource. Use of sediments in the upper harbor for civic construction projects is a beneficial use that mineral resource. Use of Bar Channel sediments to construct and maintain dispersive submerged berms would be a beneficial use that mineral resource since it would decrease erosion on Tybee Island.

7.230 Energy Requirements And Conservation Potential. The main direct energy requirements for this project would be the fuel needed to power the dredges and the other heavy equipment used for these construction activities. Secondary energy requirements would be for the fuel needed to power the ocean vessels, railroads and trucks which transport the goods shipped through the harbor. The primary potential for significant energy conservation in the harbor would be through possible increases in efficiencies in the landside transportation system. Other potential conservation activities which would likely have less impact on energy requirements include the more efficient operation and maintenance of the heavy equipment used to maintain the Navigation Project.

7.231 Alternative 3 (rotational use of disposal areas) would result in significant reductions in fuel use since fill material would not have to be transported from offsite for dike improvement projects. Rotational use of the areas would result in the floor of the sites being sufficiently dry and stable so that heavy equipment could remove deposited sediments for use in raising nearby dikes. Alternative 4 (use of underdrains) would extend the life of the confined disposal facilities, thereby conserving other sites. Alternatives 6 and 8 would result in a decrease in total energy requirements by reducing the double handling of harbor sediments. This would be accomplished by the direct deposition of excavated berth sediments into confined disposal areas. This operation would eliminate the double handling of harbor sediments presently resulting from agitation dredging. Alternative 7 would decrease the Project's total energy requirements through more efficient sediment trapping and removal techniques. The deeper layers of sediment in the advance maintenance areas would result in more efficient operation of the maintenance dredges and possibly less shoaling impacts on deep-draft vessels. Since Alternative 8 includes the features of Alternatives 3, 4, 6 and 7, that combination alternative is the one with the most energy conservation potential.

7.232 Possible Conflicts With Federal, State and Local Land Use Plans. Most of the high ground areas bordering the Savannah Harbor are being used or are zoned to be used for port-related industry or as dredged material disposal areas. The proposed action does not involve an expansion of the harbor; therefore, no conflicts with existing land use plans are anticipated. Alternatives which include Federal dredging of berthing areas or changes in sediment control features would not increase salinity in the upper harbor, so no conflicts with land use plans of the Savannah National Wildlife Refuge would occur. None of the alternatives conflicts with the long term land use plans outlined in 1987 Special Area Management Plan for the Lower Savannah River which was prepared by the SC Coastal Council. That Plan was adopted by the SCCC and is now a component of that state's

Coastal Zone Management (CZM) Program. This Final EIS will be provided to the GA DNR Coastal Resources Division Ecological Services Section, which administers Georgia's CZM Program. The EIS will be provided as a basis for development of a Special Area Management Plan for the harbor in Georgia's CZM Program.

7.233 Natural And Depletable Resource Requirements. The natural or depletable resources required for implementation of the proposed harbor management alternative consist primarily of the fuel for operation of maintenance equipment, the land required for dredged material disposal, and the sediments to be removed from the Savannah River estuary. Fuel which would be used would be lost from the resource base. However, this loss is not considered to be significant. Land used for disposal of the dredged material is generally being used for this purpose, so no net loss of land would be realized. Disposal Area 14A has been used in the past for placement of dredged material. The Georgia Department of Transportation owns the site and retains it for the purpose of dredged material disposal. Sand excavated from the river would either be placed in diked disposal areas or in the Savannah ODMDS. Sand placed in the diked areas would remain as a useable resource as it would be used either onsite for maintenance of the disposal area dikes or offsite as construction fill material. This reuse of the excavated sediments would avoid the need for obtaining similar materials from some other source. Sand placed in the nearshore area and in the Savannah ODMDS would become part of the littoral drift system which nourishes Georgia's beaches.

7.234 Probable Irreversible And Irretrievable Commitments Of Resources. Other than the fuel used for operation of the construction equipment, there would be no irreversible or irretrievable commitment of resources. The effects of all activities which were evaluated could be reversed by either cessation of the activity (advance maintenance sections), excavation of deposited material (diking of Disposal Area 14A), or filling of the excavated site (underdrains).

7.235 Opportunities For Wetland Establishment. In accordance with EC 1105-2-209 and Section 150 of Public Law 94-587, the potential for using dredged material from this project in beneficial ways -- including the creation of wetlands -- was investigated. Due to the narrowness of the Savannah River, suitable sites adjacent to the navigation channel are generally not available for wetland creation. Other low areas not adjacent to the channel already contain wetlands or shallow water areas. Filling those shallow areas is generally not pursued as that action would result in the loss of valuable shallow water habitats.

7.236 Relationship Between Man's Short-Term Use Of Man's Environment And The Maintenance And Enhancement Of Long-Term Productivity. The harbor management alternatives proposed would not result in the permanent loss of any resources other than the fuel for operation of construction equipment. Existing confined disposal facilities would be used and the material deposited in those areas would be suitable for use in dike construction, thereby extending the useful life of those disposal areas. Use of the material for dike construction would delay the need for future disposal areas and extend the period that any proposed site for a disposal area could be used in a productive manner. Use of sediments deposited in the upper harbor disposal areas (Area 1N and 2A) for offsite construction purposes is a beneficial use of that material and reduces the need for development of other sources of suitable construction material. Use of Bar Channel sediments to construct and maintain submerged berms would decrease erosion of Tybee Island and extend the life of erosion control efforts on that beach. Construction of such berms would result in dredged materials being retained in Tybee Island's nearshore sand sharing system. These effects would tend to increase the productivity of the nearshore aquatic environment and result in less overall impacts to the nearshore area by reducing the need to excavate other areas to obtain beach nourishment material. Overall, operation and maintenance of the Savannah Harbor Navigation Project would have little impact on the long-term productivity of man's environment.

7.237 Mitigation For Adverse Impacts. Mitigation is defined by the President's Council on Environmental Quality as a five-step process. The steps are as follows:

a. Avoiding the impact altogether by not taking a certain action or parts of an action;

b. Minimizing impacts by limiting the degree or magnitude of the action;

c. Rectifying the impact by repairing, rehabilitating, or restoring the affected environment;

d. Reducing or eliminating the impact over time by preservation and maintenance operations; and

e. Compensating for the impact by replacing or providing substitute resources or environments.

7.238 The first two steps of mitigation were accomplished in the alternative analysis. Eight alternatives were evaluated based on both environmental and economic considerations. That evaluation resulted in a determination that the least costly, environmentally sound plan that would accomplish the project objectives is Alternative 8. By selecting Alternative 8, potential environmental impacts of operating the Savannah Harbor Navigation Project would be minimized. Minor water quality impacts associated with dredging and disposal operations would occur. No impacts are expected to cultural resources. No impacts are expected to salinity. Major adverse impacts would be avoided, except for those resulting from diking of Disposal Area 14A (Alternatives 2, 3 and 8). Impacts from that project feature would require mitigation. Step C, rectifying the impact, would not be feasible since the site would continue to be used as a diked disposal site and growth of wetland vegetation would not harmonize with disposal activities. Step D, using preservation or maintenance activities to eliminate the impact over time, would not be feasible for the same reasons as in Step C. Therefore, a Mitigation Plan was developed to compensate for the impact by replacing or providing substitute resources or environments. The Plan would restore the habitat values of the wetlands which would be lost by that project feature. The Mitigation Plan is an integral component of those alternatives which include diking of Disposal Area 14A and the yearly components of that Plan would be funded and implemented along with other harbor maintenance activities. With inclusion of the Mitigation Plan as an integral project component, the overall environmental effects of Alternatives 2, 3 and 8 would be significant, but would be acceptable. All alternatives contain provisions to minimize impacts to threatened and endangered species. Those actions are described in Appendix B BIOLOGICAL ASSESSMENT OF THREATENED AND ENDANGERED SPECIES. No other feature of the alternatives considered would result in significant adverse impacts, so no other mitigation is necessary.

7.239 The District believes that where they can be quantified, unexpected impacts of past harbor improvements should be mitigated. The LTMS Study or this EIS did not specifically quantify previous harbor impacts or link them to specific harbor improvement projects. Congress has established several authorities under which the Corps could evaluate and rectify previous harbor impacts. One of those authorities, Section 1135 of the Water Resources Development Act of 1986, as amended, provided the legal authority to close New Cut and remove the Tidegate from operation. That authority, as well as the others, requires a non-Federal sponsor to initiate action and share in implementation responsibilities. As funding allows, the Corps is ready to evaluate and pursue mitigation activities which a sponsor proposes.

7.240 Two significant cultural resources were identified which may be impacted by harbor operations. Separate Memorandums of Agreement (MOAs) have been developed for mitigation of Project impacts to both Old Fort Jackson and the CSS GEORGIA. Signatory partners of the MOA's are Savannah District, the Georgia State Historic Preservation Officer (GA SHPO), the South Carolina State Historic Preservation Officer (SC SHPO), and the Advisory Council on Historic Preservation (ACHP). The MOA's state that Savannah District will fulfill the requirements of 36 CFR Part 800 by implementing the following actions:

1. Test and recover ordnance from the portions of the CSS GEORGIA wreck located within the proposed channel prism;

2. Evaluate the status and stability of both Old Fort Jackson and the CSS GEORGIA. This would likely include mapping the side slopes and channel bottom in the areas of those resources. The investigations may include underwater remote sensing (magnetometer, fathometer, side scan sonar, and/or sub-bottom profiler) surveys, as appropriate;

3. Identify adverse impacts which each resource may be experiencing or have experienced in the past. Attempt to identify the causes of those adverse impacts and the contribution of each one to the present condition of the resource;

4. Develop and evaluate alternatives to reduce or eliminate adverse impacts which the resource may be experiencing as a result of the Navigation Project (develop an avoidance/mitigation program);

5. Coordinate all survey and test results, evaluations and recommendations with the GA SHPO, SC SHPO, ACHP, and other interested parties to determine the most appropriate avoidance/mitigation actions;

6. In coordination with the GA SHPO, SC SHPO, ACHP, and other interested parties, attempt to identify funding sources for avoidance/mitigation actions commensurate with the causes of the adverse impacts experienced to that point in time; and

7. Implement the portion of the avoidance/mitigation program for which the Corps is responsible.

7.241 A Cultural Resources Management Plan has been developed for the Savannah Harbor Navigation Project. The Plan has two purposes, both of which revolve around documenting the procedures that the District will implement in the future. The Plan documents procedures which the District will follow to: (1) properly manage cultural resources known to be located on Corps owned property and property over which the Corps has a

degree of management control; and (2) identify and avoid or mitigate impacts to presently unknown, but later discernible significant cultural resources within the Navigation Project impact area. The Plan also commits the District to conduct a study of the long and short term impacts of the Federal operation and maintenance activities, removal of the Tidegate from operation, and issuance of Department of the Army permits within the harbor on cultural resources. The Plan is found in Appendix J CULTURAL RESOURCES MANAGEMENT PLAN. All cultural resources studies performed under the Management Plan will be coordinated with the Georgia and South Carolina State Historic Preservation Officers, and, when appropriate, with the Advisory Council on Historic Preservation. This coordination will be performed prior to implementation of additional harbor maintenance work which may impact the identified resource. Further construction work at the site would be performed after completion of activities developed during the coordination process.

7.242 Summary. Table 19 summarizes the values which were assigned to the effects which the proposed alternatives would have on the various environmental resources. It is recognized that the assignment of values was not made as a result of obtaining a consensus among the numerous harbor interests, but the represent the views of the Savannah District. Those values do not reflect precise measurements or determinations, so they are only intended to be used to detect large differences between the alternatives.

7.243 Continuation of the Savannah Harbor Navigation Project was determined to be economically warranted as it provides significant financial benefits to the regional and national economies. There are no reasonable alternatives to maintaining authorized depths in the navigation channel which would fulfill the project purpose, that of providing an efficient marine infrastructure for movement of cargo through the port.

7.244 Alternatives which included the diking and use of Disposal Area 14A would result in significant adverse impacts to wetlands, However, those impacts were minimized through the designed location of the dike. In addition, the Mitigation Plan would replace functional values of the lost wetlands in areas in or near the harbor. Other wetlands in South Carolina lost as a result of miscellaneous disposal area operations over the period of analysis would also be mitigated through the approved Mitigation Plan. Wetlands in Georgia which would be lost as a result of miscellaneous disposal area operations would be mitigated at a 2:1 rate through the restoration and/or creation of tidal marsh at other sites in the harbor area. The restoration/creation would be accomplished as a component of other construction performed by the non-Federal sponsor or the GA DOT.

7.245 The proposed changes to sediment control features of the Navigation Project would increase the efficiency of maintenance dredging and reduce adverse environmental impacts associated with existing sediment management and removal practices.

7.246 The proposed beneficial uses in the nearshore area of Project sediments would have an overall beneficial impact on the environment.

7.247 Implementation of the Memorandums of Agreement (MOAs) for Old Fort Jackson and the CSS GEORGIA would ensure that any Project impacts on those valuable cultural resources are properly addressed. Implementation of the MOAs is also required for compliance with Section 106 of the NHPA. Execution of the Cultural Resources Management Plan would ensure that cultural resources in the harbor which are under the management control of the Savannah District would be properly administered.

7.248 The selected plan (Alternative 8) would increase the efficiency of harbor maintenance activities while reducing their adverse environmental impacts, and provide beneficial impacts in the nearshore area, at an acceptable environmental implementation cost.

TABLE 19

SUMMARY OF EXPECTED
ENVIRONMENTAL IMPACTS

	ALT 1	ALT 2	ALT 3	ALT 4	ALT 5	ALT 6	ALT 7	ALT 8
ENDANGERED SPECIES	3	6	6	3	3	3	3	6
WATER QUALITY	2	4	4	4	3	6	7	7
FISHERIES	3	5	5	3	4	5	3	5
BENTHIC	2	2	2	2	1	4	6	6
WILDLIFE	3	7	7	3	3	4	3	7
WETLANDS	3	2	2	3	3	3	3	2
CULTURAL	3	4	4	3	4	3	3	4
SNWR	2	3	3	2	2	2	2	3
TNWR	4	6	6	4	4	4	4	6
ODMDS	3	3	3	3	4	3	3	4
NEARSHORE AREA	3	3	3	3	5	3	3	5
GROUNDWTR	3	3	3	4	3	3	3	4
AESTHETICS	3	2	2	2	5	3	3	5
RECREATION	3	3	3	3	3	3	3	3
MARITIME INDUSTRY	4	4	4	4	4	5	7	7
ECONOMIC	4	4	6	5	4	5	7	7
SUMMARY	48	61	63	51	54	59	63	81

8.00 PUBLIC INVOLVEMENT

8.01 Scoping Process. The Savannah Harbor LTMS received its initial funding in December 1992. The initial work efforts centered on the development of base engineering data. The scoping process for the Environmental Impact Statement (EIS) began in the fall of 1993 through informal coordination with environmental resource agencies which have authority over the Savannah Harbor Navigation Project. The coordination was conducted with the following agencies:

U.S. Fish and Wildlife Service;
Fish and Wildlife Enhancement Office, Charleston
Savannah Coastal Refuges, Savannah
National Marine Fisheries Service;
Habitat Conservation Division, Charleston
Georgia Department of Natural Resources;
Coastal Resources Division
South Carolina Department of Wildlife and Marine Resources
South Carolina Coastal Council (Office of Ocean and Coastal Resource Management)

8.02 A proposed Table Of Contents for the EIS was reviewed by the agencies in October 1993 and revised to incorporate additional items which were suggested. The revised Table Of Contents was provided to the Georgia Ports Authority, the Georgia Department of Transportation and the Georgia Conservancy in the Spring of 1994 for information on the status of the overall LTMS.

8.03 A notice of the District's intent to prepare an EIS was announced in the Federal Register on February 8, 1994. One individual requested a copy of the Draft EIS when it became available. No other concerns or comments were received.

8.04 Public Review. The Draft EIS was coordinated with the following agencies for official comment:

Federal
Fish and Wildlife Service;
Fish and Wildlife Enhancement Office
Savannah Coastal Refuges
National Marine Fisheries Service;
Habitat Conservation Division
Protected Species Division
Environmental Protection Agency;
Office of Federal Activities
Environmental Protection Agency, Region 4
Advisory Council on Historic Preservation

Georgia
Department of Natural Resources;
Coastal Resources Division
Environmental Protection Division
Department of Transportation
Georgia Ports Authority
State Historic Preservation Officer

South Carolina
Department of Natural Resources
Department of Health and Environmental Control,
Office of Ocean and Coastal Resources Management
Division of Water Quality and Shellfish Management
State Historic Preservation Officer

Other
Chatham County, GA
Jasper County, SC
City of Savannah
Georgia Conservancy
Sierra Club
Ogeechee Audubon Society
Coastal Heritage Society
Savannah Chamber of Commerce;
Maritime Council
Savannah Pilots Association

8.05 A notice of availability of the Draft EIS was sent on November 30, 1994 to those individuals and organizations which were on Savannah District's mailing list for having previously expressed an interest in Savannah Harbor or the LTMS. The notice of availability was published in the Federal Register on December 9, 1994. The Draft EIS was available for comment for 45 days after the notice was released.

8.06 As part of the South Carolina water quality certification process, two additional public notices were issued. The first was published in the Savannah daily papers on March 1, 1995, stating that comments would be received by the South Carolina Department of Health and Environmental Control (SC DHEC) until March 15, 1995. The second notice was issued on October 27, 1995, stating that appeals to the proposed certification must be received by SC DHEC by November 13, 1995.

8.07 Response to Comments. Comments received during public review of the Draft EIS were considered as final evaluations were made on this project. Appendix Q of this Final EIS contains each comment received on the Draft EIS and the District's response to the comment. Although four individuals requested a public

hearing, the District decided that a public meeting was not warranted due to (1) the insufficient interest shown by the general public in such a meeting, and (2) the likelihood that additional information, of which the District is not already aware, would be gained through the conduct of a public hearing. Since release of the Draft EIS, changes were made to the proposed project to reflect refinements in the proposed harbor operations. In addition, as a result of comments received on the Draft EIS, changes were made to the Mitigation Plan. On an overall basis, changes made to the proposed project after release of the Draft EIS were judged to be minor in scope and environmental impact in relation to the total proposed project and, therefore, did not warrant release of a revised Draft EIS or a supplement to the Draft EIS.

8.08 The November 30, 1994 Public Notice stated that comments related to water quality issues or water quality certification were to be provided to either the GA DNR Environmental Protection Division or the SC DHEC, whichever was appropriate. Neither agency received any comments.

8.09 SC DHEC received no responses related to water quality issues or water quality certification from the March 1, 1995 Public Notice.

8.10 SC DHEC received a response from one individual concerning their proposed water quality certification as described in the October 27, 1995 Public Notice. Based on SC DHEC's policies and procedures, that response triggered a review by a SC DHEC Administrative Law Judge on the appropriateness of the agency's proposed action -- issuance of the SC Water Quality Certification. The individual withdrew his appeal on May 2, 1996 and the SC DHEC issued its Water Quality Certification on May 10, 1996. The conditions included by SC DHEC in their certification are acceptable to Savannah District.

8.11 Remaining Process. This document will be forwarded to the Corps South Atlantic Division (CESAD) office in Atlanta for review and approval. The CESAD Division Engineer will issue a Public Notice concerning completion of the evaluation and availability of the Final EIS. The Notice and a copy of the Final EIS will be provided directly to state and Federal resource agencies which have demonstrated a continued interest in this project. A notice of availability of the Final EIS will also be published in the Federal Register. The Final EIS will be available for comment for 30 days after the notice is published. At the completion of that time, the District will review the comments received. It will consolidate the comments and prepare

responses for the CESAD Division Engineer's review prior to his making a final decision on this project. If the Division Engineer decides to proceed with the project, he will sign a Record of Decision to complete the EIS process.

8.12 Issuance of SC Water Quality Certification by SC DHEC was contingent upon development and approval of a water quality monitoring plan. Certain reqirements to be included in the plan were specified by SC DHEC. Savannah District has not yet prepared the monitoring plan, but does not forsee any major problems in reaching agreement with the SC DHEC on this issue.

8.13 Before construction can proceed at Disposal Area 2A, a mitigation plan is to be developed specifying what actions will be taken to mitigate wetland losses in Georgia. That plan will be provided to the GA DNR and the US FWS for approval. Actions specified in the plan would normally be completed before the construction activity causing the wetland loss is placed in service.

8.14 Before dike construction work can proceed at Disposal Area 14A, the local sponsor or its designee, must submit detailed dike designs and an Erosion Control Plan to the South Carolina Department of Health and EnvironmentaL Control, Office of Ocean and Coastal Resource Management (OCRM) for approval. The SC DHEC-OCRM has indicated the general information contained in Appendix N (EROSION AND SEDIMENTATION CONTROL PLAN) appeared consistent with its policies, but that completion of a detailed dike design would be needed before it could approve the plan for this specific construction project. SC DHEC-OCRM approval is needed before the construction could occur.

8.15 Before construction can proceed for the nearshore bird island to be located oceanward of Turtle Island, detailed design studies must be completed. Those studies include side scan sonar and magnetometer investigations to determine if cultural resource sites would be impacted by the proposed island. The results of those investigations would be coordinated with the SC SHPO for approval. Biological investigations must be performed to ensure that populations of critical benthic species are not residing at the proposed construction site. The results of those investigations would be coordinated with the US FWS, NMFS, and SC DHEC-OCRM. Approval from the SC DHEC-OCRM must be obtained for use of the South Carolina marine bottoms for construction of the island. The SC DHEC-OCRM has indicated that unless the new site-specific information conflicts with the general site description contained in this EIS, it would provide an easement for construction of the island.

8.16 The Draft Memorandums of Agreement (MOAs) specifying the District's actions required to remain in cultural resource compliance for the CSS GEORGIA and Old Fort Jackson are contained in Appendix K and L. Those MOAs need to be signed and implemented. After the Record of Decision is signed by the CESAD Division Engineer, Savannah District will provide a copy of each of those agreements to the signatory parties for sequential signature. After endorsement of the MOAs by all parties, the District will proceed with implementing the terms of the agreements.