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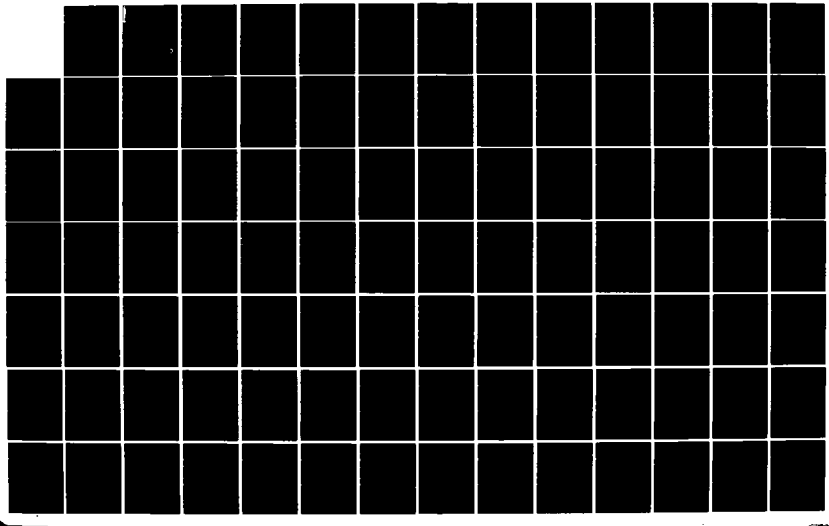

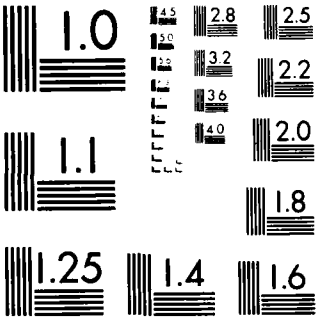

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AD-A149 547

FINAL

ENVIRONMENTAL STATEMENT

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CHARLESTON HARBOR DEEPENING PROJECT

CHARLESTON HARBOR AND SHIPYARD RIVER, SOUTH CAROLINA

U. S. ARMY ENGINEER DISTRICT
CHARLESTON, SOUTH CAROLINA

APRIL 1976

SUMMARY

CHARLESTON HARBOR DEEPENING PROJECT, CHARLESTON HARBOR AND SHIPYARD RIVER, SOUTH CAROLINA

( ) Draft (X) Final Environmental Statement

Responsible Office: U. S. Army Engineer District, P.O. Box 919, Charleston, S. C. 29402 (AC 803-577-4171)

1. Name of Action: ( ) Administrative (X) Legislative

2. Description of Action: The recommended plan of improvement consists of the deepening of the entrance channel to Charleston Harbor from a depth of 35 feet to a depth of 42 feet and the extension of this channel from Mile -10.4 seaward to the 42-foot depth contour (Mile -11.2); deepening the existing harbor channels from a depth of 35 feet to a depth of 40 feet from the Entrance Channel (Mile 0.6) to Mile 15.7 at Goose Creek; deepening of the Shipyard River channel from 30 feet to 38 feet; enlargement of the upstream and downstream turning basins in Shipyard River to provide a 1,000 foot diameter turning area and to widen the connector channel between the two basins to 250 feet; enlargement of the anchorage basin near the harbor mouth by deepening to a depth of 40 feet and by extending the south side by 1,400 feet; enlargement of the turning basin at the head of the commercial channel at Goose Creek; dredging a new turning basin adjacent to the Columbus Street docks; widening the North Charleston and Filbin Creek reaches to 500 feet; easing the bend at the intersection of the channel and Wando River; and the relocating of channels near terminals to provide 125-foot clearance between piers and the edge of the channel.

3. a. Environmental Impacts: Water quality changes including temporary and localized increases in turbidity and levels of dissolved materials; localized adverse effects on plankton and primary productivity; minor losses of larval and juvenile fishes near the dredge and disposal areas; detraction of the visual appearance of the harbor by the presence of the dredge boats and pipelines; minor air discharges and noise pollution from diesel powered equipment; preemption of present uses of disposal areas.

b. Adverse Environmental Impacts: Localized adverse effects on water quality and aquatic animals; detraction of the visual appearance of the harbor by the presence of the dredge boats and pipelines; minor air discharges and noise pollution from diesel powered equipment; preemption of present uses of disposal areas.

4. Alternatives:

a. Other channel depths
b. Lighterage system
c. Offshore ocean terminal
d. Terminal at Cummings Point
e. Pipeline from source
f. No action
g. Combinations of various dredging techniques

5. Comments received from:

Soil Conservation Service, USDA
Department of Health, Education, and Welfare
Federal Power Commission
United States Department of Interior
United States Environmental Protection Agency
United States Department of Commerce
United States Coast Guard
Advisory Council on Historic Preservation
South Carolina State Ports Authority
South Carolina Wildlife and Marine Resources Department
Approximately 50 other organizations and individuals

6. Draft Statement to CEQ 16 September 1974 .
Revised Draft Statement to CEQ 26 March 1975 .
Final Statement to CEQ 29 March 1976 .

F I N A L

ENVIRONMENTAL STATEMENT

CHARLESTON HARBOR DEEPENING PROJECT

CHARLESTON HARBOR AND SHIPYARD RIVER, SOUTH CAROLINA

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APPENDICES

1.0. Project description.

1.01. Project authorization. The Charleston Harbor Navigation Study is authorized by Section 6 of the Rivers and Harbors Act of 1945 and Seven Congressional Resolutions; the latest adopted 19 October 1967 by the Committee on Public Works of the United States House of Representatives. The study is intended to determine if the existing project should be modified in any way at this time (deepening, widening, or extending existing channels).

1.02. Project purpose. The purpose of this project is to provide safe navigation for existing and prospective large vessel traffic by deepening existing channels (shown on Figure 1), providing new and enlarged turning basins, and providing minor alignment changes and easing of bends.

1.03. Proposed plan of improvement. The proposed plan of improvement for Charleston Harbor, shown on Figures 2 and 3, consists of the following:

a. Deepening the existing entrance channel from a depth of 35 feet to a depth of 42 feet. The channel width will not be changed. This reach extends from Mile 0.6- seaward to the 42-foot contour, a distance of approximately 11.8 miles.

b. Deepening the existing harbor channels from a depth of 35 feet to a depth of 40 feet from the Entrance Channel (Mile 0.6) to Mile 15.7 at Goose Creek. Widths will be variable because of minor alignment changes and easing of bends.

c. Deepening of the Shipyard River channel from 30 feet to 38 feet. In addition, the alignment of the upstream and downstream turning basins and connector channel will be shifted in a northeasterly direction (see Figure 3), to provide a 125-foot buffer zone between the channel edge and existing piers on the

on the southside of the river. The realigned turning basins will provide 1,000 feet diameter turning basins and the connector channel between them will be widened to 250 feet. The width of the entrance channel will not be changed.

d. Enlargement of the anchorage basin at the harbor mouth. The basin will be deepened to 40 feet and the south side will be extended 1,400 feet.

e. Enlargement of the existing turning basin at the head of the commercial channel (Figure 2).

f. Dredging a new turning basin adjacent to the Columbus Street docks as shown on Figure 2 (Insert "A").

g. Widening North Charleston and Filbin reaches to 500 feet.

h. Shifting of channels near the various terminals as shown on Figures 2 and 3 to provide 125 feet between existing piers and the edge of the channel.

1.04. Proposed dredged material quantities and placement plan. The initial amount of material to be dredged for the various reaches within the harbor, including the entrance channel, are as follows:

Federal dredging	Cubic Yards
Entrance Channel (mile .6 - seaward)	12,095,000
Enlarged Anchorage Basin	2,383,000
Mount Pleasant Range to Myers Bend (mile .6 to mile 8.2)	2,982,000
Custom House Reach	3,233,000
Myers Bend to Head of Commercial Project (mile 8.2 to mile 15.7)	3,854,000
Shipyard River	2,530,000
TOTAL FEDERAL	27,077,000

Docks and Berthing Areas (Non-Federal Dredging)

Union Street	34,000
Columbus Street	45,000
North Charleston Reach	69,000
Filbin Creek Reach	126,000
Port Terminal Reach	114,000
Shipyard River	176,000
TOTAL NON-FEDERAL	564,000

Of the total 27,077,000 cubic yards of material to be removed from the Federal project area, 12,095,000 cubic yards from the entrance channel are scheduled for open water disposal in a currently used offshore area located approximately 8 miles offshore at Latitude 32° 38' 38" N and Longitude 79° 44' 39" W in about 40 feet of water. This offshore dump site complies with EPA recommendations and was selected on the basis of recommendations provided by the South Carolina Wildlife and Marine Resources Department. Of the remaining 14,982,000 cubic yards of material, 2,383,000 cubic yards from the turning basin would be placed in the currently used disposal area on Morris Island and 12,599,000 cubic yards from the inner harbor would be placed on upland areas of Daniel Island.

Approximately 1,116 acres of diked upland disposal area would be needed for the deepening project and about 49 acres (20 acres for Charleston Harbor and 29 acres for Shipyard River) would be

needed on an annual basis during the 50-year economic life of the project for disposal of the additional shoal material (approximately 1,737,000 cubic yards annually) expected to be generated as a result of the harbor deepening. The project sponsor has indicated that it would be desirable from his position to locate the upland disposal areas on and northward of Daniel Island. The Daniel Island site and area northward is of sufficient capacity to accommodate anticipated quantities of dredged material to be removed from the harbor during its 50-year economic life with and without rediversion of the Cooper River.

A pipeline dredge would be utilized to accomplish the required dredging in the inner harbor and a hopper dredge would be utilized for the entrance and outer bar channels. The entrance and outer bar channel will be dredged concurrently with the inner harbor deepening with approximately 21 months being required for dredging the inner harbor and 30 months for the entrance and outer bar channel.

Estimates of costs for harbor deepening are based on (a) use of Morris Island and the offshore disposal area for the anchorage and entrance channel, respectively; and (b) inland disposal areas above existing marshes for the upper harbor reaches. The inland disposal areas would be located only on and northward of Daniel Island proper as local interests have indicated they believe the magnitude of cost and acquisition problems associated with lands located adjacent to the south bank of the Wando River would be excessive. The decision to utilize inland diked disposal areas for cost estimates resulted from the following considerations affecting implementation of ocean disposal:

(1) Conditional requirement of successful operation of a small scale pilot program;

(2) Objections of EPA to disposing of shoal material located upstream of a line from Sullivans Island to Cummings Point at sea because of its chemical constituents; and

(3) The current congressional moratorium on plans for replacement or modification of government-owned dredges.

Benefit and cost data are presented in Appendix A of this EIS.

The benefit-cost ratio is 1.92 for Charleston Harbor and 1.44 for Shipyard River.

1.05. Special studies. Under the aforementioned authorizations, the following studies were conducted:

a. Long-range disposal of dredged material: During the conduct of this study of long-range disposal of dredged material, eight plans were evaluated to determine feasibility and costs of meeting the dredging requirements of the existing project as well as related projects for a 60-year period, 1965 to 2024. As discussed in the preceeding section, the recommended disposal plan for this deepening project does not strictly follow any of these eight plans. Cost estimates were prepared for maintaining the navigation features located upstream of and including the anchorage basin for the current maintenance method and nine alternate plans. An estimate of cost for maintenance dredging utilizing the current practice (pipeline dredge and harbor-side disposal areas) was prepared for a 100-year period of analysis and adopted as the base to which the relative merits of the various alternate methods were compared monetarily. The considered dredging and disposal plans are summarized as follows:

Plan 1 - Removal of shoal material by pipeline dredge to a permanent land disposal area adjacent to the harbor - that is, continuing the present dredging and disposal method.

Plan 2 - Removal of shoal material and conveying it to a disposal area at sea, all by hopper dredge.

Plan 3 & 3A - Removal of shoal material by pipeline dredge, placing it in one intermediate disposal area, then conveying it to sea by pipeline, by diesel powered booster stations (Plan 3) or electrically powered booster pumps (Plan 3A).

Plan 4 & 4A - Removal of shoal material by pipeline dredge, placing it in two intermediate disposal areas, then conveying it from the intermediate disposal areas to sea by pipeline, by diesel powered booster pumps (Plan 4) or electrically powered booster pumps (Plan 4A).

Plan 5 - Removal of shoal material by pipeline dredge, placing it in an intermediate disposal area, then conveying it by barge to sea.

Plan 6 - Removal of material by pipeline dredge placing it in intermediate disposal areas, then conveying it from these areas to remote inland disposal areas by pipeline.

Plan 7 - Removal of material by pipeline dredge, placing it in an intermediate disposal area, then conveying it from this area to remote inland disposal areas by truck.

Plan 8 - Removal of shoal material by a special dredge designed to utilize barges, and the use of these barges to convey the material directly to sea.

b. Estuarine values study:

In order to evaluate (1) the plans considered in the long-range dredging and disposal study beyond a strictly monetary comparison of plans, and (2) the environmental effects of recommended improvements and/or modifications to the existing navigation project, the Corps requested the Bureau of Sports Fisheries and Wildlife to accomplish the estuarine values study evaluating the effects of the foregoing on fish and wildlife resources. To aid the Bureau of Sports Fisheries and Wildlife in their evaluations, the following special studies were contracted for and funded by the Corps of Engineers:

(1) evaluation and interpretation of bottom sediment samples, (2) physical and chemical identification of bottom sediments, (3) bioassay studies, and (4) inventory and evaluation of marshlands and potential offshore disposal areas.

Based on these special contracted studies and the Corps' long-range disposal study, the Bureau of Sport Fisheries and Wildlife made the following recommendations concerning dredging and disposal practices:

1. Disposal of dredged material within the confines of the harbor or its adjacent marshlands be discontinued;

2. The most desirable method of disposing of dredged material from an ecological basis is at sea via special dredge and barge (Plan 8). Further, implementation is conditional to the favorable findings of a small scale pilot program indicating the dredged material can be properly transported and disposed of at sea; and

3. The most desirable alternative to sea disposal environmentally would be disposal in diked areas located inland above the marshes. The best plan accomplishing both the economical and environmental considerations would be Plan 6 of the long-range disposal study.

c. Charleston Harbor and Shipyard River Modifications. Improved project depths of 38, 40, 42, and 45 feet were considered for existing waterways. Each improved waterway depth or plan considered for Charleston Harbor included construction of a new turning basin adjacent to the Columbus Street Docks, enlargement of the existing turning basin at the head of the commercial channel (Goose Creek), enlargement of the anchorage and other easing of bends and minor alignment changes.

The waterway and items of improvement are shown in detail on Figures 2 and 3. In addition, 125 feet will be maintained by non-Federal interests between existing piers and the edge of the channel for berthing areas. Where necessary existing channels will be deauthorized to provide the required clearance as shown in green on Figures 2 and 3. The most economical plan of improvement for the existing waterways are channel depths of 40 feet for Charleston Harbor and 38 feet for Shipyard River.

d. Channel extensions. Consideration was given to extending the commercial navigation channel upstream on the Cooper and Wando Rivers to serve commercial interests. Three extension plans were considered on the Cooper River and consisted of extending navigation upstream to:

(a) Approximately mile 25 (vicinity of South Carolina Electric & Gas Company's steam powered electric power generating facility).

(b) Approximately mile 23, and

(c) To Big Island adjacent to Verona (Bay Chemical Corporation), the least costly effort to provide deep draft navigation to Bushy Park.

The economic analysis of these 3 plans were all unfavorable. Consideration was given to extending navigation upstream on the Wando River to Highway 41 at Cainhoy. It was concluded from the studies that extension of navigation up the Wando River to Highway 41 is not feasible at this time.

The projected container commerce exceeds the existing facilities at Columbus Street and North Charleston. This excess projected tonnage is expected to be handled at the proposed State Ports Authority Wando Terminal at this time. Currently, studies contracted for by SPA to evaluate the environmental effects and possible alternatives to the Wando Terminal have been completed, and an application for the required Construction Permit from the U.S. Army Corps of Engineers is being considered by the Charleston District Office. Therefore, it has been recommended that a decision concerning this channel extension be deferred until the required permit is obtained and construction or other activity begun which commits this location.

1.06. Relationship to other projects. The relationship of the Charleston Harbor Project to other Federal, State or local government projects varies from a lack of any significant relationship to some form of enhancement. There is no direct relationship between the proposed project and the AIWW since the dimension of the latter is considerably less than that of the existing harbor. The same applies to the Ashley River project although it is inactive. The Charleston [illegible] with and without the Cooper [illegible] has been found to have a favor- [illegible] richer condition, although it is [illegible] depth without the rediversion project [illegible] requirement would be much higher. [illegible] the naval facilities just above [illegible] the potential use by certain vessels [illegible] the harbor. Deepening of the harbor has [illegible] with projects of other agencies except

for that aspect associated with the disposal of dredged material. In this regard, there is no consideration given to the use of such areas for disposal of dredged material. Examples of such projects are Forts Sumter and Moultrie of the National Park Service and Hog Island which is the site of a proposed naval museum.

2.0. Environmental Setting Without the Project.

2.01. General. Charleston Harbor is located at about the midpoint of South Carolina's Atlantic Coast, 140 statute miles southwest of the entrance to Cape Fear River, North Carolina, and 75 miles north of Savannah Harbor, Georgia. The lower harbor is formed by the confluence of Ashley, Cooper and Wando Rivers. Vast tidal marsh areas lie on either side of the entrance to Charleston Harbor. Those marshes to the northeast separate the barrier islands from the mainland and are intersected by the Intracoastal Waterway and numerous tidal streams. Those to the southwest back Morris Island, a rapidly eroding barrier island, and are found on the southeastern side of James Island. Docking and maintenance facilities of the harbor are concentrated along the west shore (right descending side) of Cooper River extending from Battery Point of peninsular Charleston to the mouth of Goose Creek at mile 15.7, the upstream limit of authorized Federal projects. The locality is shown on U. S. Coast and Geodetic Survey Charts 470 and 1239, and on Figure 1 of this report.

2.01.1 The harbor covers an area of approximately 14 square miles with depths ranging between 10 and 25 feet at mean low tide except within project channels which are dredged to a depth of 35 feet. The harbor is faced with a serious shoaling problem that is principally due to the Santee-Cooper Project which was constructed by the S. C. Public Service Authority in 1942. Prior to this time, the lower harbor required little maintenance dredging and natural depths in some areas ranged up to about 75 feet.

2.02. Tributary Waters.

2.02.1 Cooper River. The Cooper River Basin comprises 720 square miles of coastal plain in South Carolina. The Cooper River has its origin at the confluence of its East and West Branches (locally termed "The Tee") from which it flows 32 miles southward to its outlet in Charleston Harbor. The East and West Branches of the Cooper River extend some 20 miles inland in a northward direction to their origins as small ill-defined channels in a

low-lying area of Berkeley County known as Ferguson Swamp. Lake Moultrie in the upper part of the Cooper River Basin was constructed by the S. C. Public Service Authority in 1942 as part of the Santee-Cooper Project. This lake intercepts drainage of about 300 square miles of the Cooper River Basin. Except for short intervening reaches, the west bank of the Cooper River is lined with Federal, State, and private docking facilities.

2.02.2 Ashley River. The Ashley River is a small coastal stream having a watershed of about 350 square miles and an outlet in the west part of Charleston Harbor. The upper portion of the Ashley River is flanked by woodlands interspersed with scattered residences and farmland. Most of the lower Ashley River Basin down to the marsh is occupied by residential or commercial development.

2.02.3 Wando River. The Wando River is a small coastal stream having a watershed of about 120 square miles and an outlet in the east part of Charleston Harbor. The lower Wando River is bordered by a rather large expanse of salt marsh which in turn is bordered by scattered residences and subdivisions. The extent of marshes diminishes with distance upstream and the extent of woodland increases until the uppermost part of the Wando is entirely in woodlands.

2.02.4 Shipyard River. Shipyard River, a small tidal tributary about two miles in length, flows in a southeastward direction along the southwest boundary of the U. S. Naval Reservation to Cooper River at a point opposite the southern tip of Daniel Island at mile 8.7. Docking facilities are located along the west shore of the lower mile of channel, while the east shore is bounded by tidal marshland along its entire length.

2.02.5 Shem Creek. Shem Creek is a small tidal tributary which flows in a southwestward direction to Charleston Harbor at mile 4. The city of Mount Pleasant is located to the southeast and new residential areas are being developed along the northwestern

shore. The lower reach, that reach downstream of U. S. Highway 17, is used as a base for essentially all commercial fishing vessels operating out of Charleston Harbor.

2.03. Existing Project. The existing Charleston Harbor project, authorized by the Rivers and Harbors Act of June 18, 1878, and by subsequent acts, of which the latest were dated October 17, 1940, March 2, 1945, September 3, 1954, and July 14, 1960, provides for the following work:

A channel for commercial purposes 35 feet deep and 1,000 feet wide from the sea to the inner end of the jetties, thence 600 feet wide to the U. S. Naval Shipyard, and thence 400 feet wide to the mouth of Goose Creek, a total distance of 21.9 miles, with a turning basin 1,100 feet wide at the Port Terminals; and for a channel 35 feet deep and 500-700 feet wide through Town Creek; for a channel in Shem Creek 10 feet deep and 110 feet wide from a flared entrance from Hog Island Channel to and including a turning basin 130 feet wide and 400 feet long with the upper end 250 feet upstream from the Mount Pleasant public wharf, thence 10 feet deep and 90 feet wide to the bridge on U. S. Highway No. 17; and for maintenance of a channel 10 feet deep and 90 feet wide in Hog Island Channel from Shem Creek to the Atlantic Intracoastal Waterway. The project also includes the maintenance of 2 entrance jetties of stone on log mattress foundation; the north jetty is 15,443 feet long, and the south jetty, 19,014 feet long; the distance between their axis at the outer end is 2,900 feet. The project also provides for the following work, which was authorized to be prosecuted only as found necessary in the interest of national defense: a 40-foot channel, 1,000 feet wide from the sea to the inner end of the jetties, thence 600 feet wide to the south pier at the Navy Yard, and then 1,000 feet wide to the Commandant's wharf; and an anchorage area 30 feet deep between Castle Pinckney and Fort Moultrie.

The project has been completed except for the 40-foot, national defense project.

2.03.1 All depths refer to the plane of mean low water. The mean range of tide is 5.2 feet, and the extreme range of spring tides is about 7.5 feet. As of June 1971, the controlling depth at mean low water was 35 feet in the Entrance Channel and Cooper River; and 10.0 feet in Shem Creek.

2.04. Other Federal Projects.

2.04.1. Ashley River. The existing project, authorized by the Rivers and Harbors Act of July 25, 1912 and August 26, 1937, provides for:

A channel 30 feet deep at mean low water and 300 feet wide from the mouth to the Standard Wharf, a distance of 7.4 miles; suitably widened at bends and at head of the improvement; and for maintenance, to a depth of 12 feet and a width of 100 feet from the approach channel to the municipal yacht basin. The project was completed in 1940.

The controlling depth at mean low water in July 1970 was 15 feet for a width of 300 feet from the mouth to the downstream highway bridge; thence 14 feet to the head of the project. This project is now inactive.

2.04.2. Shipyard River. The existing project, authorized by the Rivers and Harbors Act of July 3, 1930, and by subsequent acts, of which the latest is dated March 2, 1945, provides for the following work:

A channel 30 feet deep at mean low water and 200 feet wide, widened to 300 feet at the entrance from deep water in Cooper River to the vicinity of the plant of Airco Alloys and Carbide Company, with a turning basin 30 feet deep opposite the Gulf Oil Corporation terminal, and another turning basin 30 feet deep at the upper end of the project with a flared entrance; total length of the project is 1.2 miles. The project was completed in June 1951.

The controlling depth at mean low water in October 1970 was 37.0 feet.

2.04.3. The Atlantic Intracoastal Waterway (AIWW). Charleston Harbor forms part of the route of the Atlantic Intracoastal Waterway. One section of the waterway extends southwestward from Winyah, S. C., to Charleston Harbor through the Sullivans Island Narrows, and another section extends from the harbor by way of Wappoo Creek, a tributary of the Ashley River, southwestward to Beaufort and Port Royal, S. C. The existing project provides for a channel 12 feet deep at mean low water and not less than 90 feet wide.

2.04.4. Cooper River Rediversion Project. This project was authorized by the Rivers and Harbors Act of 1968 (Public Law 90-483, 90th Congress, S. 3710, 13 August 1968) and provides for the construction of a rediversion canal from the northeast portion of Lake Moultrie to the Santee River near Lake Mattassee and construction of a powerhouse, fish lift, and fish hatchery. The rediversion canal will be about 11.5 miles in length and will consist of a 2.5 mile entrance channel in Lake Moultrie, an intake canal about 4.0 miles long and a tailrace canal about 5.0 miles long. Rediversion will decrease the average discharges through the Pinopolis Dam to about 3,000 cfs and will increase average flows in the Santee River. The purpose of the project is to "redivert" the major portion of the waters from the Santee basin from the Cooper River to the Santee River thereby effecting the reduction of harbor shoaling and related costly dredging operations in Charleston Harbor. A discussion of the Charleston Harbor shoaling problem is presented in the following paragraphs.

2.04.4.1. Beginning in 1942, a phenomenal increase occurred in the rate of shoaling in Charleston Harbor. Deposits of black muck material began to settle in the harbor and large shoals began to form in the project channels. Comprehensive studies conducted by the Corps of Engineers revealed that most of this shoaling was

directly related to operation of the Santee-Cooper development which increased the average discharge in Cooper River from 72 cfs at Pinopolis to about 15,600 cfs. Most of the material creating these shoals was found to be of piedmont origin and only a small amount was found to be attributed to bank erosion. The increased freshwater flow has resulted in the formation of density currents in the harbor having a predominant upstream bottom flow which traps sediment within the harbor.

2.04.4.2. The increased shoaling rate has created two major problems: (1) an enormous increase in the cost of maintaining project depths by dredging; and (2) an increase in the rate of depletion of available disposal sites within the harbor area.

2.04.4.3 Prior to this increased shoaling rate, materials removed for maintenance dredging were placed in deep water areas of the harbor convenient to the site of dredging. This practice was continued for a time after shoaling became severe until it became evident that much of the sediment remained in suspension for a time and then drifted back into the channels. As a result, a policy of diking land areas, mostly marshlands, for containment of dredged materials was established to reduce reshoaling and costs. The heavy shoaling rates which have prevailed over the past several years have resulted in a severe depletion of areas in which to deposit dredged materials. Cancellation of certain disposal area easements and the short-term nature of other easements, together with the continued heavy shoaling rate, combine to intensify the seriousness of the disposal area situation. Figure 4 shows the location of all disposal areas which have been used to date.

2.04.4.4 Most disposal areas are used over a period of years, so an estimate of the annual need for disposal areas is meaningful only if considered over a number of years. Based on estimates of annual dredging rates for average freshwater inflows of 15,600 and 3,000 cfs (Table 1) without harbor deepening, the future demand for disposal

areas will be about 413 acres annually without rediversion and about 124 acres annually after rediversion. These acreages are based on the assumption that the compaction ratio of dredged material will be 2:1 and that the disposal areas will be used until the dredged material accumulation is approximately 15 feet deep.

2.04.4.5. The quantities listed under 3,000 cfs in Table 1 may not be achieved until about 10 years after the project is implemented. This time-lag is anticipated because the entire harbor contains silt deposits and as silt is removed from the harbor channels during maintenance dredging, silt deposits outside the channel will tend to move laterally into the channel. The annual maintenance requirements will increase slightly if the harbor is deepened as proposed.

2.05. Non-project associated facilities. There are 20 commercially important installations of wharves, docks, and piers, both public and privately-owned along Charleston Harbor. These installations have approximately 14,765 linear feet of berthing space and 632,000 square feet of transit shed area. There are also 50 acres of open storage areas plus 305 steel storage tanks having a total capacity of approximately 8,600,000 barrels. The harbor is broken down into six important commercial areas. These are the Union Pier Terminal, Columbus Street Terminals, Shipyard River Terminal, North Charleston Terminals, Port Terminal facilities, and Wando River Terminals.

2.05.1 In addition to the commercial terminals, a large number of government-owned wharves are located on Cooper River, including the Navy Fleet Landing, the wharves at the Navy Yard and Minecraft base, the Charleston Army Depot and the Naval Weapons Station. The U. S. Navy also has modern facilities for construction and maintenance of naval vessels including nuclear submarines.

2.06. Tides. The mean range of tide in the harbor is approximately 5.2 feet with spring and neap tide ranges of about 7.0 feet and 4.2 feet, respectively. Maximum current velocities in the harbor for normal conditions are about 4.0 to 5.0 feet per second at the surface and somewhat less at the bottom. The presence of a salinity differential between top and bottom strata of the harbor causes the bottom flood currents to predominate over the bottom ebb currents, relative to velocity and duration. Thus, the resulting upstream movement of bottom currents within the harbor constitutes an effective sediment trap, preventing sediment transport to the sea and causing the buildup of extensive shoals.

2.07. Geology and soils. The following discussion of geology of the Charleston Harbor was prepared by the Department of Geology, University of South Carolina for the Charleston District, Corps of Engineers as part of the Charleston Harbor, S. C., Estuarine Values Study (Reference 1).

2.07.1. Geology. Charleston and its surrounding suburbs are constructed on Sangamon (Late Pleistocene) landforms deposited in shoreline environments between 147,000 to 86,000 years before the present (Reference 2). During this interval of time the sea level rose to approximately 42 feet above mean sea level and then retreated with pauses at 33 feet, 26 feet, 17 feet, and possibly 8 feet, above its present surface. During the initial Late Pleistocene transgression, a thin barrier island chain was developed along a line from Jamestown through Huger toward Ladson, South Carolina. Landward of this barrier island, marsh and deltaic sediments from the Santee River were layed down. Seaward of this barrier island chain the Paleogene sediments (mostly the Cooper Marl in this area) were again eroded and planed off to an elevation between 0 and 2 feet above mean sea level. [illegible] water continental shelf were laid down blue-grey calcareous, sandy, silty marls of late Pleistocene age which occasionally occur up to 10 feet in thickness.

2.07.1.1 With the drop in sea level from 42 feet to approximately 33 feet, a second barrier island chain was deposited. The shoreline of this barrier island extends along the Charleston-Berkeley County line from the Santee River south through Cainhoy (Wando) through Charleston at approximately 6 mile hill. The wave scoured plain developed on the Cooper Marl under this feature lies at an elevation of from sea level to 2 to 3 feet below mean sea level. Landward of this geomorphic feature, marsh clays in the Charleston area and deltaic sediments in the Hell Hole Bay area were deposited above the sandy marl to elevations as high as 33 feet above mean sea level. Subsequent Pleistocene erosion has altered this original geomorphic surface in the vicinity of the Cooper and Santee Rivers, but the surface is well preserved over large areas of Berkeley County. Seaward of the latter barrier island chain the land surface drops abruptly to elevations of 17 and/or 3 feet above mean sea level, reflecting former Late Pleistocene marsh surfaces, until another barrier island chain appears along the route of Highway 17 between Awendaw and the Cooper River. Wave scour on the Cooper Marl in this area, while the shore rested against the former barrier island along the Charleston-Berkeley County line, depressed the elevation of the Cooper Marl significantly further. Over 100 holes drilled in Charleston County from the Santee River to the south end of Folly Island have not encountered the Cooper Marl at elevations higher than 20 feet below mean sea level anywhere and it is frequently at much greater depths. The Cooper Marl is overlain by blue-grey Late Pleistocene marls in nearly all of these holes. The marl is succeeded by dark grey clays of Pleistocene age underlying the former marsh surfaces or by fine-grained poorly graded sands underlying the former barrier islands.

2.07.1.2 Observation of the elevation of the top of the Paleogene Cooper Marl formation in the Charleston estuary area as reported by Bond, Chapell & Colquhoun, 1969 (Reference 3),

has been confirmed. Previously drilled holes approximately 200 to 300 yards downstream of the Cooper River Bridges (Highway 17) did not penetrate the Cooper Marl at depths of less than 30 feet below mean sea level. The lack of penetration is caused by scouring of the Cooper Marl surface during the Pleistocene. The scouring is caused either by river incisment during low stands of sea level during the Pleistocene, or by estuarine scour during subsequent rises. In either case the broad channel indicated by previous drilling extends seaward along the course of the Charleston Estuary and then southwest under Morris Island and the northernmost expanse of James Island toward the continental shelf. This entrenchment has been filled with minor gravel, sand, and marsh and estuarine muds deposited during the Pleistocene and Holocene Epochs.

2.07.1.3 Landward of this area the Cooper Marl generally lies much nearer the surface of the channel bottom and frequently forms the floor of the channel either through natural scouring or through artificial dredging. Never, however, either within the channel itself or on the land adjacent to the channel does the Cooper Marl extend more than 1 or 2 feet above mean sea level for reasons indicated previously. In some localities the Cooper Marl is either encountered at excessively low depths (as much as 90 feet below sea level) or not penetrated. These areas lie within regions where Neozene low stands of sea level have caused previous river incisement so that channel fill material is found where the Cooper Marl would be expected. These scoured channels have been infilled with deposits of gravel, sand, and shell debris which may overlie either Pleistocene shell sediments or the Cooper Marl.

2.07.1.4 Landward of the Highway 17 bridge over the Cooper River, elevations of the Cooper Marl can occur within a few feet above mean sea level and may be expected to be encountered in dredging operations. Seaward of the Highway 17 bridge within the Cooper estuary the Cooper Marl will never occur at elevations higher than 40 feet

below mean sea level. Seaward of the Highway 17 bridge over the Cooper estuary, Pleistocene blue-grey marls may commonly be expected to be encountered at elevations near sea level while poorly graded fine-grained sands up to 30 feet thick will occur in sand hills regions, and relatively loose Pleistocene clays up to 20 feet thick will occur in flatland regions. Whereas the Cooper Marl may be encountered at lower elevations than expected due to channel incisement, it in no case occurs at higher elevations than those previously summarized.

2.07.2. Soils. Soils show considerable variation within the project area. The narrow beach fronting on the Atlantic Ocean consists mainly of sand and shell fragments with a smaller amount of silt. Most of the ocean beaches in the project area are eroding due to the action of waves and longshore currents. Inland from the barrier beach zone to the normal upstream limit of saltwater intrusion (3 feet msl) is a tidal marsh with soils comprised of dark loams, clays and mucks or peat and a medium to high organic content. If drained, these tidal marsh soils may develop into an extremely acidic plastic clay known as "cat clay". Soils in this condition will not support plant life and are difficult to reclaim. Extending inland from the marsh for about 10 miles are a group of poorly drained soils occupying areas that are generally below 15 feet msl. These soils generally have dark grayish surface layers and dark sandy clay loam to sandy clay subsoils. Further inland on higher elevations in gently rolling areas are dark sandy loams with clay subsoils that are moderately well drained. On more level areas such soils may be poorly drained.

2.07.3. Mineral Resources. There is no significant commercial production of mineral resources in the project area. The Charleston area, however, was formerly the most productive area of phosphate in the state. The phosphatic material, a common marine phosphate known as carbonate-fluorapatite, is phosphatized Cooper marl reworked into the lower part of the Ladson formation. Phosphate

[illegible] has been insignificant since 1920 and ceased [illegible] (Reference 4). In addition to the above-mentioned [illegible] other minerals of possible economic value are [illegible], sand and gravel (Reference 5).

[illegible] of Charleston estuary bottom sediments.

[illegible] General. Examination of physical size characteristics [illegible] Charleston Harbor bottom sediments indicates several major [illegible] deposited within the Charleston estuary. These include [illegible] continental shelf sand component being deposited [illegible] the mouth of the estuary itself, and Holocene sand bars [illegible] the landward rivers. Components can be delineated [illegible] analysis of parameters associated with the size analy- [illegible] report they are illustrated in Figure 3 in which [illegible] than 25 percent silt and clay (dominantly fine to [illegible] are grouped together with samples containing more than 25 percent silt and clay. The sand-silt dividing line is taken at 50%. Nearshore drift shelf sand is concentrated both in the [illegible] of the harbor mouth where it grades seaward into continental [illegible] as well as along the north half of the estuary to the [illegible] of Mt. Pleasant. Bottom samples obtained in the [illegible] of the jetties and landward between Ft. Sumter and Ft. [illegible] contain over 90 percent sand size materials. Landward of these locations the sand fraction is intermixed with silt and clay [illegible] content of silt and clay increasing abruptly toward the [illegible] more gradually toward the north.

[illegible] Sand also occurs in bottom sediments in the Cando [illegible] as indicated in Figure 5. The accumulations here are related to Holocene and Recent channel deposits. In the Ashley [illegible] sand deposits occur at depth, but surficially are buried [illegible] silt deposits.

[illegible] Between the two sand components the floor of the [illegible] is dark-to-black mud consisting of more than 75 per-

cent silt and clay. Within the area of occurrence of the sludge indicated in Figure 9, there is no apparent relationship between textural size characteristics of this lithology and water depth or harbor currents. It is assumed that the silt-clay fractions are present in the fluid state such that their aggregated masses behave possibly as much coarser particles.

[illegible] Chemical characteristics of bottom sediments. The study of the chemical characteristics of bottom sediments was conducted by the Environmental Protection Agency during March, 19[illegible]. The Charleston District obtained 41 bottom samples from [illegible] District [illegible] an EPA representative. The sample locations are shown in Figure 6. The samples were all shipped in a frozen condition to EPA where they were analyzed for volatile solids, oil and grease, organic nitrogen, total kjeldahl nitrogen, total phosphorus, chemical oxygen demand, heavy metals, and radioactivity. The results of their analysis are presented in Table 2.

[illegible].[illegible].[illegible]. EPA's evaluation and interpretation of the data which was furnished the Charleston District in letter report [illegible] October 19[illegible]. They (EPA) concluded that all sediments [illegible] from Sullivans Island to Cummings Point should be disposed [illegible] upland areas, and sediments located seaward of [illegible] be removed by hopper dredge with disposal far enough [illegible] to prevent fine particles in the sediment from [illegible] beaches. In this case, upland disposal was defined [illegible] above the mean high water mark.

[illegible] study of bottom sediments [illegible] Commission collected [illegible] the Cooper River, Intracoastal Waterway, [illegible] and Stono River for analysis by the Laboratory [illegible] Pollution Control Authority. The [illegible] are presented in Table 3. Station locations [illegible], 11, 12, and 13.

2.08.3. Pesticides in bottom sediments. As part of the above study (Reference 6), the U. S. Geological Survey collected and analyzed Cooper River bottom sediments for pesticide content. The results of this study are presented in Table 4. Although pesticide levels appeared to be rather low at most stations, it should be noted (see footnotes to Table 4) that the ubiquitous polychlorinated biphenyl (PCB) compounds were detected in high enough concentrations to interfere with the determination of pesticide levels in all but three samples.

2.09. Hydrology.

2.09.1. General. Charleston Harbor, historically one of the finest natural harbors on the Atlantic Coast, is formed by the confluence of the Cooper, Ashley, and Wando Rivers. It has an area of about 14 square miles and a depth generally between 10 and 75 feet at mean low tide. The harbor is characteristic of a stratified estuary with two well defined density layers. The tidal prism is about 738,000 acre-feet and the average freshwater inflow is about 15,000 cfs. The mean tidal range in Charleston Harbor is about 5.2 feet.

2.09.1.1 Charleston Harbor is normally stratified by salinity, with the surface layers being much fresher throughout most of the year. Extended periods of high river flow in the Cooper River cause the seawater in the vicinity of the harbor mouth to become diluted with the result that the water entering the harbor during [illegible] lowered salinity.

As mentioned above, the three major rivers which [illegible] to Charleston Harbor are the Ashley, the Cooper, and [illegible]. The Wando is a coastal river which meanders along the [illegible] of the City of Charleston and drains an area of about 350 square miles. The Ashley River is subject to tidal influence throughout [illegible] length and the tidal prism is much greater than fresh-

water inflow. The Wando River is similar to the Ashley and drains about 115 square miles. The Wando is also tidal for its entire length with minor freshwater inflow.

2.09.1.4 The Cooper River is the most important tributary in that it provides the major source of inflow. The Cooper was originally a relatively small coastal plains stream having a watershed of 720 square miles. Its average flow at the "Tee", the confluence of its East and West Branches where most of its inflow had been received, was about 72 cfs. The diversion in 1942 of a part of the Santee River's flow into the Cooper River basin for hydropower generation increased the average flow of the Cooper River to 15,600 cfs. Data on discharges through the Pinopolis power plant are presented in Table 5.

2.09.2 Ground water. A compilation of existing data on ground water was recently prepared by the U. S. Geological Survey in cooperation with the South Carolina Water Resources Commission (Reference 7). Pertinent excerpts from this report are presented in the following paragraphs.

"The aquifers in the study area may be divided for the purpose of discussion into unconfined aquifers, those in which the water producing sediments are not bounded by impermeable material, and confined aquifers which are bounded. In many cases unconfined aquifers and surface drainage are parts of one system and there is an hydrologic interchange of water between the confined and unconfined aquifers. Most of the dry-weather flow in many streams may be rejected recharge of confined aquifers underlying the area. The relation between the surface-water and ground-water parts of the system should be kept in mind during the following discussion.

Unconfined Aquifers

Outcrops of southeastward dipping rocks of marine origin, surficial dune, beach sands, and possibly some old filled stream channels compose the material for the shallow unconfined aquifers in the area.

The principal use of unconfined aquifers in the study area is on some of the coastal islands. These systems utilize a fresh-water lens floating on salt water in beach and dune sands. The fresh-water-salt-water interface is likely a zone of mixing in which the salt content increases rapidly both vertically and laterally. Because of the relatively small difference in the specific gravity and infrequent fluctuation of the levels, a water system using a fresh-water lens floating on salt water must be carefully planned and managed. Overpumping will produce a mound of salt water under the well in response to excessive drawdown thereby contaminating the system. Although systems such as these have been successfully used for years on these islands they have limited use as sources of large supply of fresh water. Their dependence on timely rainfall for recharge makes these systems particularly vulnerable to encroachment of salt water during extended dry periods. They are also very vulnerable to contamination from the surface.

Confined Aquifers

Several separate hydrologic zones that are bounded by relatively impermeable beds occur below the unconfined aquifer in the study area. The quality of water in these zones varies both areally within the same aquifer as well as between aquifers. ...

Water Properties of the Confined Aquifers

Cooper Marl. - Shallow confined aquifers may be present where the Cooper Marl of Oligocene age occurs or where the old stream channels, as described by Bond (1970) were bounded by relatively impermeable sediments. However, the use of these aquifers is very limited.

Santee Limestone. - The Santee Limestone of middle Eocene age is widely used as an aquifer in the study area. Wells completed in the Santee Limestone yield about 200 to 500 gpm (gallons per minute)

(12.6 to 31.5 l/s) (liters per second) and range in depth from less than 50 feet (15 m) to about 500 feet (152 m) in the vicinity of Charleston. Water levels were reported as much as 150 feet (46 m) below mean sea level in the aquifer near Charleston in 1963. Excessive lowering of water level could cause movement of water with a high chloride content to contaminate some wells. While the source of the poor quality water is not known, it may be old sea water (connate water) diluted with fresh water (incomplete flushing of the aquifer) or salt water entering the aquifer in coastal areas as the result of the removal of fresh water by pumping, or inadequate and faulty well construction. Reported chloride in water taken from the aquifer range from less than 20 to 4,500 mg/l (milligrams per liter)....

Black Mingo Formation. - Producing wells within the aquifers of this formation range from about 100 feet (30 m) in the northern part of the area to more than 500 feet (152 m) in the Charleston area. Yields from these wells vary from a few tens of gallons a minute (a few liters per second) to several hundred gallons a minute (several hundred liters per second)....

Peedee and Black Creek Formations. - These formations are late Cretaceous in age and lithologically are similar, so much so that they are undifferentiated in most logs. Characteristic shifts in the natural gamma ray logs help to discern similar zones and aid in tentative picks of formation breaks. The depth to the top of the Peedee ranges from about 150 feet (46 m) in the northern part of the area to about 700 feet (213 m) in the Charleston area. The thickness of the Peedee Formation varies slightly but is generally about 400 feet (122 m).

The Black Creek Formation unconformably underlies the Peedee Formation and the depth to the top is about 550 feet (168 m) in the northern part of the area to about 1,000 feet (305 m) at Charleston. The Black Creek Formation thickens considerably coastward, ranging from about 550 feet (168 m) in the northern part of the area to more than 1,000 feet (305 m) at Charleston.

The water producing zones in the Peedee Formation have low transmissivities and yield small amounts of poor quality water especially along the coast. Water from wells greater than 700 feet (213 m) in depth generally has chlorides in excess of 500 mg/l.

The major producing aquifer in the Black Creek Formation is a coarse sand near the bottom of the formation. Other minor water producing sands occur in the upper part of the formation but the water is of questionable quality.

Possibly the first known well drilled into this zone was in Charleston near Queen and Meeting Streets in 1817. The exact location of the well is not known and the records have apparently been lost. Water in this well was reported to have been under pressure head sufficient to raise it 20 to 30 feet (6 to 9 m) above land surface. In 1823, the first well drilled by the Charleston City Council... was drilled at the fire station at Wentworth and Meeting Streets. This well was drilled to a depth of 1,260 feet (384 m) and had an artesian head of 25 feet (8 m) above land surface. The yield was reported to have been small. A second well was reported to have been drilled near this site in 1849, and a third in 1856, for which little or no record is available. They are both reported to have small yields.

A well drilling at Marion Square in Charleston in 1878 to a depth of 1,970 feet (600 m) was reported to have a static head of more than 92 feet (28 m) and a yield of 465 gpm (29.4 l/s).

A well at Fort Moultrie (well 16) was drilled to a depth of 1,385 feet (422 m) in 1904. This well was reported to have flowed at 100 gpm (6.3 l/s).

Well 64 drilled at the Charleston Water Department on George Street to a depth of 1,435 feet (437 m) was reported to have flowed at 300 gpm (18.9 l/s).

Several wells ranging in depth from 1,800 to 2,300 feet (549 to 701 m) have been drilled in the vicinity of Charleston and Mount Pleasant. One of these wells was a test well drilled to a depth of 2,292 feet (699 m) by the town of Mount Pleasant in 1969. This well (163) was reported to have a static water level of 32 feet (9.8 m) above land surface and produced 750 gpm (47.3 l/s) with a drawdown of more than 132 feet (40 m). The production well at this site was drilled to a depth of 1,919 feet (585 m) and produced 800 gpm (50.4 l/s). A later production well (167) constructed by the town of Mount Pleasant was drilled to a depth of 2,035 feet (620 m).

The water from these wells is a sodium bicarbonate type of water. The chloride content is within acceptable limits except for the well (16) at Fort Moultrie on Sullivans Island. However, the fluoride content is several times the recommended level for drinking water in all these wells.

Dissolved solids determined from water samples from wells 163 and 167 ranged from 1,000 to 1,300 mg/l.

Tuscaloosa Formation. - The Tuscaloosa Formation of early Late Cretaceous age is a regional aquifer in much of the Coastal Plain of South Carolina. This formation unconformably underlies the Black Creek Formation. The top of the Tuscaloosa ranges from about 1,000 feet (305 m) in the northern part of the area to more than 2,100 feet (640 m) in the Charleston area. The need to drill wells deep enough to penetrate the Tuscaloosa Formation in the area has not been necessary because of the abundance of water in the shallower aquifers.

A well 20 miles (32 km) (kilometers) south of Charleston at Seabrook Island was drilled into the Tuscaloosa but did not encounter any water producing sands. Until more data can be obtained the productivity of the Tuscaloosa Formation along the coast cannot be stated."

2.10. Water Quality.

2.10.1 Charleston Harbor. The water quality of Charleston Harbor is similar to that of the Ashley, Cooper, and Wando Rivers from which it is formed. According to the latest state classifications, Charleston Harbor is not suitable for swimming or the harvesting of oysters for market purposes. The water quality of the outer harbor is usually higher because of the diluting effect of the ocean. Recently constructed waste treatment facilities along the lower Cooper and Ashley Rivers have led to an improvement in the water quality of the harbor from the condition described in the Federal Water Pollution Control Administration report of 1966 (Reference 8). A trend of continued improvement in water quality is expected as a result of these facilities and others in the planning or construction stage. Recent water quality data collected by the S. C. Department of Health and Environmental Control are presented in Table 6.

2.10.2. Cooper River. The water quality of the Cooper River is generally good but according to the latest state classifications, that portion of the river from U. S. Highway 52 to a point approximately 30 miles above the junction of the Ashley and Cooper Rivers is classified as Class B (waters suitable for domestic supply after complete treatment in accordance with requirements of the South Carolina State Board of Health, also for propagation of fish, industrial and agricultural uses and other uses requiring water of lesser quality) and that portion below that point to the junction of the Ashley and Cooper Rivers is classified as Class SC

(waters suitable for crabbing, commercial fishing and any other usages except bathing or other shellfishing for market purposes, also for uses requiring water of lesser quality) (Reference 9). These restrictions are based on bacterial concentrations, the source of which is thought to be drainage from storm sewers, septic tanks, malfunctioning treatment plants, point sources of untreated human wastes, and domestic livestock wastes.

2.10.2.1. All domestic sewage discharged into the lower Cooper River is now subjected to primary treatment and chlorination. Approximately 10 percent of the sanitary wastes from North Charleston and practically all of such wastes from the community of Mt. Pleasant receive secondary treatment. Sanitary wastes from Charleston are discharged after primary treatment into the mouth of the Ashley River. A list of discharge sources, their approximate daily discharges, and type treatment are presented in Table 7.

2.10.2.2. The West Virginia Pulp and Paper Company has by far the largest volume of industrial discharge into the Cooper River. These wastes are now subjected to primary treatment before being discharged into the Cooper River about 5 miles above Charleston, and will be subjected to secondary treatment by 1975. United Piece Dye Works discharges approximately 3.0 million gallons daily of untreated wastes into Goose Creek which empties into the Cooper River about 6 miles above Charleston. Facilities to convey this waste to the North Charleston Municipal sewage treatment plant are now under construction. All other industrial effluents, with the exception of cooling water, receive at least primary treatment.

2.10.2.3. The South Carolina Public Service Authority operates four steam generating units below the Pinopolis Dam having a capacity of 412,000 kw. Cooling water is obtained from [illegible] returned to the tailrace canal. The volume of flow in the tailrace canal is sufficient to prevent a violation of state standards relating to thermal pollution.

2.10.2.4. One of the major industrial developments along the Cooper River is the Bushy Park Industrial Area which consists of land set aside for industrial development between the Back and Cooper Rivers. The development includes a dam across Back River which forms a reservoir and a diversion canal from the West Branch of the Cooper River into the Back River Reservoir. Bushy Park was originally a joint venture of Charleston and Berkeley Counties and the City of Charleston to attract industries to the Charleston area. The City of Charleston now owns about 80 acres and the remainder (about 4,300 acres) is distributed among the following industries: S. C. Electric and Gas Company operates steam generating facilities, Verona Corporation operates a chemical plant, General Dynamics operates a plant which makes liquid natural gas tanks, Du Pont is building a "Dacron" polyester plant, and Moore-McCormick has acquired land but has not begun construction. There are no vacant sites remaining at Bushy Park.

2.10.2.5. The effluent from industries at Bushy Park is discharged into the Cooper River after treatment, which is considered adequate to prevent degradation of water quality in the river. S. C. Electric and Gas uses a 105 foot square oxidation pond for treating sanitary wastes of about 50 employees. Retention time in the pond is about 30 days and the effluent is discharged with the cooling water into the Cooper River. The volume of cooling water is about 463 mgd and under conditions of the state permit must not raise the ambient water temperature more than 4 degrees fahrenheit during the fall, winter, or spring and 1.5 degrees fahrenheit during the summer months. The Verona Corporation has a permit to discharge up to 25 mgd, but recent actual measurement by the S. C. Pollution Control Authority showed a discharge of about 2.6 to 3.5 mgd. Treatment facilities include an equalization and neutralization chamber, two aeration [illegible], and two stabilization and settling ponds. General Dynamics has a state permit to discharge up to 15,000 gallons per day. Waste treatment includes passage through a mixed activated sludge package treatment facility and chlorination. The

Du Pont plant is not completed but their sanitary permit allows a discharge of 2,000 gallons per day. This effluent will be treated in an extended aeration package treatment plant and chlorinated.

2.10.2.6. The most recent comprehensive water quality studies on the Cooper River were conducted by the U. S. Environmental Protection Agency during October and November, 1971. These studies were published in April, 1974 by the S. C. Water Resources Commission as part of the Cooper River Environmental Study (Reference 10). The main objective of the study was to develop some capability for predicting changes which might result from rediversion of the Cooper River. To accomplish this objective, the EPA collected samples during periods when the daily discharge to the Cooper River from Lake Moultrie averaged 20,550 cfs (October 1971) and about 3,000 cfs (November 1971). A discussion of the pertinent data contained in this EPA report is presented in the following paragraphs. The stations referred to in the following paragraphs are shown in Figure 14. A summary of all physical, chemical, and microbiological data collected at each station during the two sampling periods is presented in Table 8.

a. Temperatures. Average water temperature at the sampling sites ranged from 20.8 to 22.1°C during the October study and 17.2 to 18.3°C during the November study. Extremes in temperature were 20.0 to 23.5°C during October and 14.5 to 22.5°C during November.

b. pH. Average pH values at the EPA sampling sites ranged from 7.2 to 7.7 in October with extremes of 6.4 to 8.3 units. The extremes in November ranged from 6.3 to 8.5 units with average values of 7.3 to 7.7 units.

c. Dissolved oxygen. Dissolved oxygen (DO) concentration extremes in the reach studied ranged from 3.4 to 8.4 mg/l during October and 5.0 to 8.9 mg/l in November. Average

DO concentrations ranged from 5.9 to 7.8 mg/l in October and from 6.3 to 8.3 mg/l during November. During October, both the minimum DO concentration and the lowest average concentrations were measured at the lower stations (1, 3, and 4). In November, the lowest DO concentration encountered (5.0 mg/l) occurred at Station 7 at the bottom. The following text table presents average DO saturation values at each of the river stations at high and low slack tide.

Average Surface and Bottom Values of Percent Saturation of Dissolved Oxygen

	October		November	
Station	HWS*	LWS**	HWS	LWS
1–Surface	70.9	75.9	70.5	72.5
1–Bottom	70.5	67.7	77.7	73.2
3–Surface	81.0	86.6	71.0	75.4
3–Bottom	68.5	69.8	68.3	73.9
4–Surface	82.6	88.6[1]	76.7	77.5
4–Bottom	79.0	84.7	73.0	73.5
5–Surface	87.6	89.8	80.0	79.6
5–Bottom	86.3	88.5	80.4	79.3
6–Surface	85.7	84.5[1]	80.3	80.5
6–Bottom	87.5	85.6[1]	79.6	80.5
7–Surface	84.3	90.9[1]	73.7	78.9
7–Bottom	84.3	89.8[1]	72.7	82.4
8–Surface	87.8	92.1[1]	89.4	91.0
8–Bottom	88.3	93.1[1]	89.9	90.6
9–Surface	82.8	—	75.6	76.5
9–Bottom	82.4	—	75.2	71.0

* High Slack Tide
** Low Slack Tide
[1] Single determination

Percent DO saturation decreased downstream from Station 8 during both sampling periods. This reduction in the lower reaches of the river generally corresponded to an increase in dissolved solids and chlorides. There was no significant difference in DO saturation between surface and bottom samples in November, however, in October, a significant difference existed between Stations 3 and 4 at high slack tide and Stations 1, 3, and 4 at low slack tide. Again, this difference was primarily attributed to increased chloride concentrations occurring near the bottom of the water column.

d. Biochemical oxygen demand. The five-day biochemical oxygen demand (BOD_5) levels measured in both the October and November studies were low at each station (Table 8). In October, average BOD_5 levels ranged from 0.8 to 1.1 mg/l with the highest individual value (2.6 mg/l) occurring at Station 3. In November, BOD_5 concentrations ranged from 0.3 to 1.0 mg/l.

e. Chlorides. Chloride concentrations ranged from 7 to 13,400 mg/l during the October study period and 8 to 14,800 mg/l during the November study. An average chloride concentration of 8 mg/l is considered to be the background level entering the Cooper River from Lake Moultrie. In October, surface to bottom chloride ratios (S/B ratios) at high slack tide indicated that a well stratified condition existed in the lower reach of the river with ratios of 0.266, 0.193, and 0.171 at Stations 1, 3, and 4, respectively, as shown in the following table.

Surface To Bottom Chloride Ratios

Station	October		November	
	HWS*	LWS**	HWS	LWS
1	0.226	0.137	0.567	0.802
3	0.193	0.915	0.499	0.614
4	0.171	1.083	0.532	0.401
5	1.250	1.000	0.827	1.241
6	1.000	1.000	1.067	1.100
7	0.889	1.000	0.846	1.000
8	1.000	1.000	1.000	1.000
9	0.889	1.000	1.090	1.083

* High Slack Tide
** Low Slack Tide

At low slack tide, S/B ratios indicated that vertical stratification occurred only at Station 1 with average S/B ratios changing from 0.317 at Station 1 to 0.915 at Station 3. Maximum saltwater intrusion extended as far upstream as Station 4 at high slack tide and between Stations 3 and 4 at maximum low tide.

In November, chloride concentration extremes ranged from 8 to 14,800 mg/l with average concentration ranging from 10 to 9,030 mg/l. An average background concentration of 10 mg/l was being discharged from Lake Moultrie during the sampling period. Surface to bottom chloride ratios at high slack tide were indicative of vertical stratification at Stations 1, 3, and 4 where average readings were 0.567, 0.499, and 0.532, respectively.

At Station 5, the S/B chloride ratio was 0.827 indicating a non-stratified condition. At high slack tide during the November study, salt water intruded upstream between Station 5 and Station 6. At low slack tide, S/B chloride ratios indicated a rather weak vertical stratification at Stations 1 and 3. An average S/B chloride ratio

of 1.241 at Station 5 along with an average bottom chloride concentration of 29 mg/l indicated a well-mixed, essentially freshwater condition.

f. Residue. Total nonfilterable residue (total suspended solids) ranged from an average of 9 mg/l at Station 8 to an average 37 mg/l at Station 1 during October. In November, total suspended solids ranged from 6 mg/l at Station 8 to an average of 45 mg/l at Station 3. In both the October and November studies, the higher concentrations of total suspended matter were measured near the bottom in those areas affected by saltwater intrusion, tidal mixing, and industrial pollution.

Volatile suspended matter followed the same general pattern as the total suspended solids. Volatile solids ranged from an average concentration of 3 mg/l at Station 8 to 14 mg/l at Station 1 during October and from 2 mg/l at Station 8 to 12 mg/l at Station 1 during November. As with total suspended solids, the higher concentrations of volatile solids occurred near the bottom at the lower river stations.

g. Nitrogen. Total Kjeldahl nitrogen (TKN) concentrations were low throughout the study reach during both the October and November sampling periods. Extreme values ranged from 0.23 to 0.59 mg/l in October and from 0.12 to 1.00 mg/l in November.

Ammonia nitrogen concentrations were low at all stations during both sampling periods. Concentrations ranged from 0.01 to 0.12 mg/l during October and from less than 0.01 to 0.08 mg/l during November.

Nitrite-nitrate nitrogen concentrations ranged from less than 0.01 to 0.12 mg/l in October and 0.01 to 0.21 in November.

h. Phosphorus. Total phosphorus (as/P) concentrations were low at all stations during the October study period and ranged from 0.02 to 0.08 mg/l. Average concentrations ranged from 0.03 to 0.05 mg/l. Orthophospate concentrations (as/P) ranged from less than 0.01 to 0.07 mg/l during the same period. The highest

total and orthophosphate concentrations were measured at Station 1.

During the November study period, total and orthophosphate concentrations were generally low at all stations. Total phosphate concentrations (as/P) ranged from 0.01 to 0.20 mg/1 and orthophosphate concentrations (as/P) ranged from less than 0.01 to 0.10 mg/1.

i. Organic carbon. Total organic carbon (TOC) was found to be consistently low at all stations during the October sampling period. Concentration extremes ranged from 4.0 to 6.0 mg/1 and average concentrations ranged from 4.2 to 5.2 mg/1.

During the November study, TOC extremes ranged from 3.0 to 10.0 mg/1 and average concentrations ranged from 4.6 to 7.7 mg/1. In general, average TOC concentrations measured in November were slightly higher than October.

j. Metals. Concentrations of copper, chrominum, lead, zinc, manganese, iron, and mercury were measured by the EPA at Stations 1, 6, 7, and 9 during the October and November study periods. As might be expected, the highest concentration of metals was found at the more saline station, Station 1. A summary of metals data is presented in Table 8.

k. Pesticides. Pesticide concentrations were measured by the EPA during the October study period only. Eighteen pesticides were analyzed from composite water samples collected at each station. The following table lists the [illegible] pesticides and the minimum detection limit of the ana[illegible] procedure. No pesticide levels were detected above the detection limits used.

Pesticides Analyzed For and Minimum Dectection Limits

Pesticide	µg/1 Minimum Detection Limit
Aldrin	<0.005
Lindane	<0.002
Chlordane	<0.05
Chlorobenzilate	<0.5
DDD	<0.01
DDE	<0.01
DDT	<0.02
Dieldrin	<0.01
Endrin	<0.02
Heptachlor Epoxide	<0.01
Heptachlor	<0.005
Methoxychlor	<0.1
Toxaphene	<0.25
Diazinon	<0.2
Guthion	<0.5
Malathion	<0.2
Methyl Parathion	<0.02
Parathion	<0.04

1. Bacteria. Station 1 had the highest fecal coliform densities found during the October and November study period with counts of 830/100 ml and 460/100 ml, respectively. The lowest densities were found at Station 8 where the respective October and November counts were 26/100 ml and 30/100 ml. There was a general increase in densities downstream from Station 8 with a noticeable increase occurring in the vicinity of Stations 6 and 7. The higher levels at Station 7 were possibly caused by an adjacent housing development. Coliform densities also increased downstream of Station 4 most likely as a result of wastes entering the river from Goose Creek and from the municipal and industrial development downstream.

During October, the mean surface coliform density at Station 1 was four times higher at high slack tide than it was at low slack tide. A similar observance was made during November except that densities were only about twice as high at high slack tide. These data suggest a possible upstream movement of wastes on an incoming tide.

2.10.3. Wando River. The quality of waters in the Wando River system is being studied in detail by the S. C. Water Resources Commission as part of the Wando River Environmental Quality Study. An interim report on this study was published in April 1973 (Reference 11). The summary and conclusions section of the water quality portion of the above report is presented below. Station locations are shown on Figure 15.

"1. Dissolved oxygen remained fairly high during the sampling period (January, 1973) ranging from a low of 7.7 mg/1 to a high of 11.4 mg/1 with most of the readings greater than ten. Dissolved oxygen saturation was above 85 percent most of the time. The lowest dissolved oxygen saturation reading during the sampling period was 60 percent and this was coincident with a water temperature of 4°C. The highest DO saturation was recorded as 100%. There is an apparent defect in the lower Wando River as measured by this criterion. Readings are progressively lower from the Cooper River (Station 1) upstream to the head of Hobcaw Creek at Station 4 where the lowest average DO saturation was experienced above Hobcaw Creek (Stations 5-8) DO saturation improved dramatically. Five-day Biological Oxygen Demand (BOD) readings ranged from 1.25 mg/1 to 5.2 mg/1 with an average of 2.68 mg/1. BOD readings were generally higher at the stations nearer the river mouth. In this study BOD was probably about normal considering the range of water temperatures which prevailed. While no rigid standards have been established for water quality based upon oxygen content alone, the net indication from arbitrary

criteria for oxygen regimes is that a moderately high water quality exists in the Wando River as compared to other waters in the Charleston harbor environs.

2. Turbidity as measured by Secchi disk readings and by turbidimeter is generally low indicating a lack of suspended or colloidal material. Turbidity readings are somewhat higher at those sampling points nearer the harbor.

3. Fecal coliform bacteria were detected in such numbers as to substantiate assignment of "SB" classification to these waters. Some of the individual samples give rise to the belief that standards could be greatly exceeded at certain times of the year and under varying flow regimes. Station No. 4 located at the head of Hobcaw Creek gave consistently higher readings than did Station No. 3 located at the mouth of the tributary. Stations 1-4 produced generally higher counts than the upstream sampling points No.'s 5 through 8. The sources of human-waste pollution thus appear to be associated with Cooper River materials which ultimately enter the Wando and are transported upstream, and with materials that enter Hobcaw Creek presumably from the adjacent residential areas.

4. Heavy metals consisting of cadmium, chromium, copper, lead, and mercury were tested for and all except lead appeared singly or in combination in some of the samples. None of the samples were lead positive. No other metals were assayed.

Cadmium was detected in water samples on three of the sampling days but not at all stations simultaneously. Concentrations ranged as high as 45 ug/l which is within the range of some drinking waters (.04 ug/l to 60 ug/l) but exceeds the U. S. Public Health Service maximum allowable for interstate carriers (10 ug/l). Toxic levels of 200 ug/l are reported to be lethal to fish.

Chromium was detected on only one sampling day and at only one of the eight stations. This single reading was

543 ug/l which is about ten times the maximum U. S. Public Health Service standard for drinking water. The magnitude of this reading and the fact that only one of eighty samples was positive, casts some suspicion on the accuracy of the test or in recording findings. While no inference is drawn from this particular assay, it is not likely that chromium offers any health problems. In any future quality assessments, chromium detection processes should be conducted with especial care.

Mercury occurred in 74 of the 80 samples and ranged in concentration between 0.1 ug/l and 3.10 ug/l. These readings averaged 0.73 ug/l which exceeds the U. S. Public Health Service standard of 0.50 ug/l, or ½ part per billion. The naturally occurring abundance and distribution of mercury in soils and waters accounts for a portion of the detected amounts of this element. For example, a recent study of mercury in soils over the nation (Shacklette, 1971) showed a geometric average of 96 parts per billion (ug/l) for the eastern United States. Soils and sediments usually exhibit higher background concentrations than does water. This is the result of the affinity of mercury for muds and soil material together with the otherwise general insolubility of mercurial compounds. In addition, natural sea water contains .3 ug/l of mercury. (H & M, 1959). The presence of mercury does not necessarily imply a point source of pollution.

[illegible] from the results of aqueous sample testing [illegible] of "heavy" metals occur and that no [illegible] is expressed.

[illegible] water not only contains measurable [illegible] discussed as well as others, but that [illegible] elements are essential to cell growth

in some of the plants and animals that are a part of the local ecosystem."

2.10.4. Ashley River. The Ashley River is somewhat turbid and its banks are highly urbanized. According to the latest state classifications, the Ashley River is not suitable for swimming or the harvesting of oysters for market purposes. Although no recent data are known to be available concerning quality of Ashley River waters, it is believed that considerable improvement in water quality has recently been achieved as a result of newly constructed waste treatment facilities. Prominent among these are the two secondary sewage treatment facilities operated by the St. Andrews Public Service District which handle most of the wastes from the urban area adjacent to the Ashley River. In addition, all sewage discharged into the mouth of the Ashley River from the City of Charleston receives primary treatment and chlorination. S. C. Electric and Gas Company's Hagood electric generating plant discharges 67.82 mgd of cooling water into the Ashley River. Current discharge sources along the Ashley River, their approximate daily discharge and type of treatment are presented in Table 9.

2.11. Air Quality. The Charleston County Health Department monitors air quality in the project area. Air quality varies with industrial development, the volume of automobile traffic, and local air circulation patterns. These factors interact in such a way that the highest suspended particulate content is found over parts of peninsular Charleston. The average suspended particulates measured during the period July through September 1973 at a station on the corner of Calhoun Street and Lockwood Drive ranged from 29.48 to 37.66 ug/m^3. Another peninsular station is located on the Queen Street Fire Station, where the geometric mean level of suspended particulates was reported to be 48.1 ug/m^3 during the period November 1972 to March 1973. These levels are well within the Federal standard which is 75 ug/m^3 and the State standard which is 60 ug/m^3.

2.12. Climate. The prevailing winds are southerly in the spring and summer and northerly during the fall and winter. The

proximity of the ocean has a tempering effect on Charleston's climate. In winter, the minimum city temperature may register from 10 to 15 degrees higher than that recorded at the airport located 10 miles inland; this marine influence may also cause the city's maximum temperatures to be lowered several degrees.

2.12.1. The winter months, December through February, are mild with rainfall averaging 18 percent of the annual total; spring rainfall from March through May averages about 20 percent of the annual total. A temperature of 20 degrees or less is seldom experienced. Some chance of snow flurries may occur in January, but a significant amount is rarely measured.

2.12.2. The summers are warm and humid; however, the temperature seldom reaches 100 degrees. Forty-one percent of the annual rainfall occurs in summer, mostly from scattered thunderstorms. The weather is moderate and sunny from late September to early November. The coastal area is subject to hurricanes during the summer and fall, with hurricane visitation occurring most often in August. The highest recorded hurricane storm tide was 11.2 feet above mean low water during the August 1893 hurricane.

2.12.3. The information below was compiled by the National Weather Station at the Charleston Municipal Airport, Charleston, S. C., and published by the Environmental Data Service, National Oceanic and Atmospheric Administration, U. S. Department of Commerce.

METEOROLOGICAL DATA FOR PERIOD OF RECORD

TIME	NORMAL DAILY TEMPERATURE (°F)		NORMAL TOTAL PRECIPITATION (INCHES)	PREVAILING DIRECTION OF WINDS	HEAVY FOG DAYS
	MAXIMUM	MINIMUM			
No. of Years	29	29	29	14	20
January	64.2	38.3	2.54	SW	4
February	62.5	40.4	3.29	NNE	2
March	68.0	45.4	3.93	SSW	2
April	76.9	52.7	2.88	SSW	2
May	83.9	61.8	3.61	S	2
June	89.2	69.1	4.98	S	2
July	89.2	72.0	7.71	SW	1
August	88.8	70.5	6.61	SW	1
September	84.9	66.2	5.83	NNE	2
October	77.2	55.1	2.84	NNE	3
November	67.9	43.9	2.09	N	4
December	61.3	38.6	2.85	NNE	3
Year	75.9	54.5	49.16	NNE	28

2.13. Biological Resources.

2.13.1. Plants. In 1971, the Marine Resources Division of the South Carolina Wildlife and Marine Resources Department prepared an inventory and evaluation of wetlands to determine the quantity and quality of tidal marshlands within the Charleston Harbor estuary. This study was conducted under a contract with the U. S. Army Corps of Engineers as part of an estuarine values study and was published in December, 1972, (Reference 12). The

final report is available for public review in the Charleston District office. A discussion of the pertinent aspects of this report is presented in the following paragraphs.

2.13.1.1. Charleston Harbor historically has been recognized for its value to fish and wildlife resources. The productive role of lands in this area has been profoundly illustrated and stressed by Lunz (References 13 and 14). The vegetation of the marshlands complex in Charleston Harbor is varied and it is now recognized that the types of vegetation present play a key role in the processes of biological productivity. Research by Odum (Reference 15) has shown that salt marsh grasses, by converting inorganic nutrients and sunlight into plant tissue, act as energy transfer mechanisms to consumer organisms in the estuarine system. Field observations and experimental trawling operations in the harbor system have clearly shown that tremendous quantities of dead marsh vegetation are transported to adjacent estuarine waters during the winter and early spring at times of extremely high tides. Teal (Reference 16) has calculated that approximately 45 percent of the total plant material is transported out of Georgia salt marshes into the estuary. This is also true in the Charleston area where the tidal range is large. Dead grass may become waterlogged and sink to the bottom or may be physically as well as biologically disintegrated into particulate organic detritus, becoming food for various invertebrates. These organisms are in turn eaten by small fish which are subsequently consumed by larger predators, etc. Thus, the link between fish and marsh is evident according to Smalley (Reference 17). It is estimated that only about 7 percent of the marsh grass is eaten by insects, with the remainder being consumed by detritus feeding organisms such as amphipods, isopods and decapod crustaceans (shrimp and crabs), and fishes.

2.13.1.2. The importance of marshlands to estuarine productivity is not limited to the detritus they produce. Applying Teal's work (Reference 16) to comparable spartina marsh in the harbor, we postulate that algae may account for up to one-fourth of the organic material produced in a salt marsh. In fact, it has been shown by Pomeroy (Reference 18) that net algae production is constant throughout the year.

2.13.1.3. Productive salt marshes of Charleston Harbor are dominated by smooth cordgrass which occurs as tall, intermediate and short forms, depending on elevation. Tall cordgrass grows vigorously in areas below an elevation of 1.59 m. (5.2 feet) msl in Charleston Harbor and is the most productive of the three types. Odum (Reference 15) reported that smooth cordgrass produces approximately 2,000 g/m^2 or 10 tons per acre (dry weight) in Georgia marshes; this figure is applied to the entire crop of this species in Georgia. While there is evidence to infer that Georgia marshes do not average 10 tons per acre (actually 2,240 g/m^2) as reviewed by Wass and Wright (Reference 19), there are data indicating that smooth cordgrass averages more than 4.4 (985 g/m^2) in North Carolina saltmarsh (Reference 20). These data suggest that annual production in South Carolina saltmarshes would range between 2.9 and 4.4 tons per acre at a minimum. Charleston Harbor marshes would probably be somewhat higher in production than the State's average since the cordgrass so prevalent in this area appears to be extremely vigorous in certain areas. Nutrients from sewage pollution in years past may have been beneficial in stimulating growth even though the water quality was degraded. Marshall (Reference 21) showed that cordgrass marsh receiving sewage plant effluent produced more biomass, reached its peak biomass sooner and was apparently not injured by fertilization.

2.13.1.4. Black needlerush is also commonly found in Charleston Harbor marshlands. It is generally considered the least important of the common marsh plants (Reference 22) and is usually associated with higher fringe areas above the mean high water line.

However, during this survey black needlerush was found in mixed stands with smooth cordgrass in upstream locations of transition from salt to brackish and fresh water.

2.13.1.5. In the upper Cooper River near Goose Creek and upstream to the "Tee", the marsh vegetation gradually changes to a brackish and freshwater type. Brackish water marshes in the Charleston Harbor study area occupy a transitional zone area between true salt marsh and fresh water marshes. These marshes are prevalent in the upper Cooper from the area of its confluence with Yellow House Creek to the vicinity of Bushy Park and Moreland Landing. While many of the salt marsh species still occur in this area, there is a trend toward greater diversity including such species as bulrushes, cattail, giant cordgrass, etc.

2.13.1.6. Plant zonation in the lower harbor is more subtle and difficult to define where unconsolidated stands of smooth cordgrass are found. Generally, there are four zones that can be delineated from the water's edge to the woodland: (1) the "edge marsh" or tall smooth cordgrass zone; (2) the "low meadow" or medium smooth cordgrass; (3) the "saltgrass meadow" or stunted smooth cordgrass - salt grass, salt meadow cordgrass zone; and (4) the "high meadow" or salt meadow cordgrass - black needlerush - glasswort - sea ox-eye zone.

2.13.1.7. The different plant zones in the Charleston Harbor area are assigned to a single priority based on overall value to marine resources. These priorities are as follows:

Priority I. To include areas of highest value to fisheries and wildlife resources; consisting primarily of regularly flooded, high salinity marshes. Regularly flooded, brackish marsh could be included dependent on location. Vigorous smooth cordgrass (medium and tall growth) as described in vegetative zones (1) and (2) above is the dominant vegetative type.

Priority II. To include areas of second highest value to fisheries and wildlife resources; consisting primarily of regularly flooded salt and brackish marsh. Regularly flooded fresh marsh could also be included. Smooth cordgrass (medium growth) as described in vegetative zone (2), is the dominant vegetative type. Regularly flooded black needlerush, giant cordgrass and related brackish and fresh types are included dependent on location.

Priority III. To include areas of third highest value to fisheries and wildlife resources; consisting of irregularly flooded salt, brackish and fresh marsh, flats and barren zones. Black needlerush, salt meadow cordgrass, sea ox-eye, salt grass, glasswort, and stunted smooth cordgrass are generally found in vegetative zones (3) and (4). Areas within this priority are classified as realistic for management.

Priority IV. To include areas of little value to fisheries and wildlife resources; consisting of irregularly flooded salt and brackish marsh, flats, barren zones and areas significantly altered by development. These areas are not classified since they have very little potential for management. Outer margins of diked spoil areas, undiked spoil areas and areas fouled by industrial or other wastes are characteristic of this type.

2.13.1.8. The S. C. Wildlife and Marine Resources Department has assigned the following priorities to the marsh areas along the river systems (Wando, Cooper, Ashley) of Charleston Harbor. The marsh along the Wando River System is made up of 5,471 acres of Priority I marsh and 976 acres of Priority II marsh. There are essentially no areas of either Priority III or IV along this system.

2.13.1.9. The Cooper River System has 9,172 acres of Priority II marsh, 30 acres of Priority III marsh and 1,641 acres of Priority IV marsh. There are no Priority I marshes within this system.

2.13.1.10. The Ashley River System has 2,760 acres of Priority I marsh, 1,527 acres of Priority II marsh, 568 acres of Priority III marsh and no Priority IV marsh.

2.13.1.11. Charleston Harbor contains 3,148 acres of Priority I marsh 2,066 acres of Priority II marsh, 116 acres of Priority III marsh and no Priority IV marsh.

2.13.1.12. Other abundant plant species in the Charleston Harbor area include but are not limited to wax myrtle, sea-myrtle, marsh elder, cabbage palmetto, pokeweed, sedge, stiff fimbristylis, crab grass, eastern red cedar, loblolly pine, sweetgum, southern magnolia, black gum, red bay, black cherry, water oak, live oak, sandspurs, bermuda grass, greenbriar, soft-stem bulrush, southern wild rice, alligatorweed, narrow-leaved cattail, chinese tallow-tree, pennywort, spike-rush, smartweed, salt-cedar, aster, coco, and marsh mallow.

2.13.2. Wildlife. With its great natural resources and variety of habitat types which include marshes, high lands, swamps, and fresh and salt waters, Charleston Harbor and surrounding areas abound with a wide variety of wildlife species. Not only are there a large number of resident species, but there are many seasonal visitors which breed, overwinter and/or pass through this section of the U. S.

2.13.2.1. Birds. There are a great number of resident and seasonal birds within the Charleston Harbor area. Many water-fowl species may be seen during various times of the year including the mallard, black duck, pintail, American widgeon, blue-winged teal, green-winged teal, wood duck, redhead, canvasback, ring-necked duck, greater and lesser scaup, common goldeneye, buffle-head, ruddy duck, American coot, common gallinule, and purple gallinule.

2.13.2.1.1. Other species associated with freshwater or brackish habitats include the common egret, snowy egret, cattle egret, belted kingfisher, marsh hawk, double-crested cormorant, common loon, pied-billed grebe, great blue heron, Louisiana heron, little blue heron, green heron, black and yellow-crowned night herons, American bittern, least bittern, glossy ibis, white ibis, Virginia rail, sora rail, king rail, clapper rail, long and short-billed wren, red-winged blackbird, boat-tailed grackle, common snipe, the eastern brown pelican, and osprey.

2.13.2.1.2. Shorebirds and gulls found in the area at various times of the year include the American oystercatcher, semipalmated plover, Wilson's plover, willet, dunlin, short-billed dowitcher, sandpipers, black-necked stilt, herring gull, laughing gull, ring-billed gull, royal tern, and killdeer.

2.13.2.1.3. Upland species include the turkey vulture, black vulture, sharp-shinned hawk, red-tailed hawk, red-shouldered hawk, osprey, sparrow hawk, turkey, bobwhite, American woodcock, rock dove, mourning dove, ground dove, yellow and black-billed cuckoo, screech owl, great horned owl, short-eared owl, barn owl, barred owl, chuck-will's-widow, whip-poor-will, common nighthawk, common flicker, pileated woodpecker, red-bellied woodpecker, yellow-bellied woodpecker, hairy woodpecker, downy woodpecker, eastern kingbird, tree swallow, purple martin, blue jay, common and fish crow, tufted titmouse, red-breasted nuthatch, white-breasted nuthatch, brown creeper, house wren, Carolina wren, mockingbird, catbird, brown thrasher, robin, eastern bluebird, blue-gray gnatcatcher, loggerhead shrike, starling, solitary vireo, various warblers, common yellowthroat, eastern meadow lark, cardinal, rufous-sided towhee, many sparrows, Carolina chickadee, and slate-colored junco.

2.13.2.2. Mammals. Although the immediate Charleston Harbor area offers only limited habitat for most mammal species due to extensive development, suitable habitat is available in the marshes

and uplands associated with the numerous tidal creeks and rivers which enter the harbor. Mammals commonly associated with these areas include the opossum, various shrews, eastern mole, various bats, raccoon, long-tailed weasel, mink, river otter, striped skunk, gray fox, bobcat, eastern gray and fox squirrels, southern flying squirrel, numerous mice and rats, eastern cottontail rabbit, marsh rabbit, white-tail deer, and feral pig. The only marine mammals commonly observed in the harbor are the Atlantic common dolphin and Atlantic bottle-nosed dolphin.

2.13.2.3. Reptiles and Amphibians. The most common marine reptile in the area is the diamondback terrapin. Other turtles that occur in the harbor and offshore waters include the Atlantic loggerhead and the Atlantic green turtle.

2.13.2.3.1. Within the three river systems and in the harbor itself, there are a great number and variety of reptiles and amphibians. Animals commonly found in the freshwater aquatic habitats are the alligator, common snapping turtle, spotted turtle, eastern mud turtle, river cooter, chicken turtle, Florida and spiny softshell turtle, black swamp snake, banded water snake, brown water snake, eastern cottonmouth, dwarf waterdog, lesser and greater siren, leopard frog, green frog, bull frog and river frog.

2.13.2.3.2. In the drier upland habitats are found the garter snake, eastern hognose snake, southern ring-necked snake, black racer, eastern coachwhip, rough green snake, yellow rat snake, scarlet snake, scarlet king snake, eastern king snake, southern copperhead, pigmy rattlesnake, canebrake rattlesnake, eastern diamondback rattlesnake, southern toad, spring peeper, green treefrog, and cricket frog.

2.13.2.4. Rare and endangered species. There are 10 threatened species, 1 peripheral species and 3 status undetermined

species which occur or possibly occur in the Charleston Harbor area (Reference 23).

a. Threatened species. Threatened species can be defined as those "whose prospects for survival and reproduction are in immediate jeopardy. Their peril may result from one or more causes--loss of habitat or change in habitat, overexploitation, predation, competition or disease."

Threatened species are:

Fish	
Shortnose sturgeon	Acipenser brevirostrum
Reptiles and amphibians	
American alligator	Alligator mississipiensis
Green turtle	Chelonia mydas
Birds	
Eastern brown pelican	Pelecanus occidentalis carolinensis
Southern bald eagle	Haliaeetus l. leucocephalus
Peregrine falcon	Falco peregrinus
Bachman's warbler	Vermivora bachmanii
Kirtland's warbler	Dendroica kirtlandii
Eskimo curlew	Numemius borealis

The brown pelican is commonly observed in coastal areas of South Carolina. The green turtle is a resident of the open sea and may occassionally be observed when it comes onto coastal beaches at night to lay eggs. The alligator is commonly observed in freshwater lakes and rivers. The bald eagle is a permanent resident of the state and is usually found around lakes, rivers and coastal bays. The bald eagle has not been sighted in the immediate harbor area in recent years. The peregrine falcon, Kirtland's warbler, and Eskimo curlew are transient species. According to the U. S. Fish and Wildlife Service, Bachman's warbler, one of the rarest of our small birds, has been observed in I'on swamp.

b. Peripheral species. A peripheral species--"is one whose occurrence in the United States is at the edge of its natural range and which is threatened with extinction within the United States although not in its range as a whole." The only peripheral species known to occur in the project area is the roseate spoonbill (Ajaia ajaja) which is a transient.

c. Status undetermined species. A status undetermined species--"is one that has been suggested as possibly being rare or endangered, but about which there is not enough information to determine its status." The following species are in this category:

American osprey	Pandion haliaetus carolinensis
Wood ibis	Mycteris americana
Eastern pigeon hawk	Falco c. columbarius

The osprey is locally common and the other species have been seen in the area.

2.13.3. Fish. The vast complex of salt and freshwater marshes, sounds, tidal creeks, and rivers in the project area, provides excellent habitat for a diverse array of marine and freshwater fish species.

2.13.3.1. Cooper River. The principal freshwater sport fishing areas are located in the Cooper River and contiguous waters. The Cooper River is characteristic of a large river because of the large volume of water released from Pinopolis dam for power generation. Peak discharges frequently inundate about 7,300 acres of marshes and abandoned rice fields. The inundation of these low-lying areas provides habitat for small fishes and invertebrates which contribute a significant amount to the overall productivity of the Cooper River. This high productivity is reflected somewhat in the large number of fish species (73) collected from the river during a recent study.

2.13.3.1.1. The Cooper River annually receives large runs of anadromous fish with large numbers of striped bass, blueback herring, and American and hickory shad ascending the river to spawn, mainly in the West Branch between the "Tee" and Pinopolis Dam. Just below the dam and adjacent to the tailrace canal, the South Carolina Wildlife and Marine Resources Department operates a striped bass hatchery. Fry produced at this hatchery come from eggs which are stripped from Cooper River striped bass captured in the tailrace canal.

2.13.3.1.2. The transition from a marine to a freshwater environment usually occurs in the general vicinity of the junction of Goose Creek and the Cooper River. The best freshwater fishing and the most heavily utilized areas are the East Branch of the Cooper River and the tailrace canal. The Back River Reservoir is also heavily fished, partly because of convenience of access. Good fishing is also provided by the West Branch of the Cooper River between the "Tee" and the vicinity of Goose Creek.

2.13.3.1.3. Principal species appearing in the sport fisherman's catch on the freshwater portions of the Cooper River and contiguous waters are striped bass, largemouth bass, bluegill, black crappie, redbreast sunfish, redear sunfish, warmouth, spotted sunfish, channel catfish, chain pickerel and bullheads.

2.13.3.2. Charleston Harbor and contiguous waters. Recent studies on the value of Charleston Harbor to marine resources were conducted by the Marine Resources Center of the South Carolina Marine Resources Department in cooperation with the U. S. Army Corps of Engineers (Reference 12). The purpose of this study was to evaluate the adult and juvenile fish fauna in the system and to incorporate these findings into an overall assessment program for the coastal zone.

2.13.3.2.1. Research trawling for this study was conducted during 1970-1971 on a monthly basis and has provided pertinent data on various faunal elements which definitely establishes the Charleston Harbor area as an important nursury area. As might be expected, the trophic structure of the estuary varies from season to season with biological activity reaching a low point in the winter as many species become relatively inactive or migrate to offshore waters. In the spring, there is a rapid rise in ecosystem metabolism and productivity increases at all levels.

2.13.3.2.2. Sampling stations occupied during this study were located in the Ashley River and Beresford Creek and near Ft. Johnsen and Hog Island. A summary of the species captured in the Charleston Harbor area and Morris Island area during this study are presented in Tables 10 and 11, respectively. A total of 70 species of fish were captured, many of which are valuable in the makeup of commercial and sport fisheries in the project area. As shown in the tables, some of the species captured are year-round residents and are found in all zones of the harbor while others are migrant forms that utilize the harbor as a nursery area and then move into offshore waters. The great diversity of species found during this study tends to document the fact that the Charleston Harbor area is a valuable asset to the area's marine resources.

2.13.3.2.3. The harbor and adjacent inshore and offshore waters support an intense sport fishery. Principal species caught in inshore waters by surf, pier, and small boat fishermen include but are not limited to red and black drum, sheepshead, northern kingfish, striped bass, bluefish, spotted seatrout, spot, croaker, whiting, flounder, Florida pompano, toadfish, black sea bass, gafftopsail catfish, sea catfish, ladyfish, and Spanish mackerel.

2.13.3.2.4 In addition to the aforementioned inshore fishing, there are many charter boats, head boats and large private boats which fish the offshore waters for king and Spanish mackerel, bluefish, dolphin, white and blue marlin, sailfish, wahoo, cobia, crevalle jack, barracuda, little tunny, skipjack tuna, amberjack, black sea bass, groupers, red and vermillion snapper, red porgy and triggerfish.

2.13.3.3. Ashley River. The Ashley River contains the common freshwater and marine forms found in other coastal streams of this area, although studies reported on in 1964 (Reference 24) indicate that biological productivity in the river appears to be lower than that of other coastal streams. This condition was attributed to domestic and industrial pollution, which occasionally became severe enough to cause fish kills. However, significant improvement in water quality of the Ashley River has occurred since this report was written as a result of improved waste treatment practices. Although biological studies of the scope of those conducted in 1964 have not been conducted recently, local reports indicate that fish kills no longer occur and fisherman use and success have been increasing as a result of improved water quality. The Ashley River also serves as a nursery for blue crabs, brown and white shrimp, and various marine finfish.

2.13.3.4. Wando River. The Wando River generally contains the same fresh and saltwater fishes found in other coastal streams. Most sport fishing is by small boat for spotted seatrout, red drum, flounder, striped bass, and spot. Sports fishermen also take blue crabs and castnetters take a few shrimp.

2.13.3.4.1. The river is classified in the SB category which permits bathing, fishing, crabbing and other uses but prohibits the taking of oysters and clams except for transplanting to other waters from which they can ultimately be gathered. Recent information indicates that sub-tidal seed oysters occupy about 390 acres in the Wando River.

Scattered concentrations of intertidal oysters also occur in the river. Commercial fishing is limited to a small blue crab fishery.

2.13.3.4.2. The Wando River also serves as an important nursery for many marine forms which later contribute to area sport and commercial fisheries.

2.13.4. Commercial fisheries. Annual fishery landing statistics compiled by the National Marine Fisheries Service in cooperation with the South Carolina Wildlife and Marine Resources Department show that commercial fishing in the Charleston area is a multi-million dollar industry. Principal species landed include shrimp, oysters, blue crabs, clams, alewives, American eels, flounder, whiting, black sea bass, and spot. Other species marketed include bluefish, croaker, black drum, red drum, groupers, grunts, king mackerel, menhaden, mullet, pompano, porgy, gray seatrout, spotted seatrout, shad, sharks, sheepshead, red snapper, vermillion snapper, Spanish mackerel, sturgeon, and squid. Landing data for the period 1964 to 1973, which may include species captured in areas other than Charleston, are presented in *Table 12*.

2.13.4.1. Upstream of the harbor in the tailrace canal and in Lake Moultrie, there is a commercial fishery for herring. During the spring of 1973, a total of 363,600 pounds or 805,000 herring were harvested from the Cooper River between March 5 and April 18. This represents a decline in both fishing pressure and harvest when compared to 1972. The herring catch on Lake Moultrie totaled 63,340 pounds in 1973 (Reference 25).

2.13.5. Invertebrates. Macroinvertebrates commonly associated with the saltmarsh environment in the project area include a variety of crustaceans, mollusks, and polychaetous annelids. Benthic fauna in the offshore disposal area was found by the South Carolina Wildlife and Marine Resources Department to be impoverished with little diversity and very small numbers of individuals as compared to inshore areas.

2.13.5.1. Crustaceans found in the area include two species which are commonly observed during periods of low tide, the mud fiddler crab and sand fiddler crab. The mud fiddler crab lives primarily on the clayey or muddy intertidal flats among the roots of cord grass while the sand fiddler crab generally inhabits the sandier substrates in areas near the high tide line. Other small crabs which are common in the marsh are the mud crab, flat mud crab, and wharf crab. The mud crab is found in areas containing heavy oyster growth or shell accumulation; the flat mud crab occurs on the muddier substrates in the lower portions of the marsh; and the wharf crab is found near the high tide line where it actively crawls about on wharves and stone jetties or rests in shallow burrows along the shores. Other crustaceans commonly found in and around the marsh at various times of the year are blue crabs, hermit crabs, brown and white shrimp, mantis shrimp, grass shrimp, isopods, amphipods, and barnacles.

2.13.5.2. The American oyster is the most common pelecypod mollusk found in the area's marshes and generally occurs in clumps or large beds in the small tidal creeks. The collecting of oysters for human consumption is prohibited in the harbor area because of bacterial levels which exceed state standards. These beds do, however, provide seed oysters and habitat for many species of fishes and invertebrates. The Atlantic ribbed mussel and the hard shell clam are also found in the area. The ribbed mussel is generally found in sandy mud or attached to oyster shells while the hard shell clam is found on sandy or muddy bottoms, between the tides and in shallow water.

2.13.5.3. Gastropod mollusks commonly observed in marshes around the harbor include the common marsh periwinkle, eastern mud snail, and the salt marsh snail. The periwinkle is generally found on cordgrass in the higher regions of the marsh near sandy substrates

while the mud snail occurs in low areas where the substrate is always wet and muddy. The salt marsh snail is usually found near the high tide line under windrowed plant debris.

2.13.5.4. Polychaete worms also inhabit the salt marsh, sometimes in large numbers, and are found on a wide variety of substrates.

2.13.5.5. Although much of the salt marsh in the project area provides suitable habitat for the numerous invertebrates mentioned above, suitable habitat is somewhat limited in the deeper portions of the estuary. Samples collected during September, 1965, by the former FWPCA for the Charleston Harbor pollution study revealed that adverse conditions for benthic organisms existed in many of the deeper reaches of the harbor. As a result, population numbers were generally found to be low with polychaete worms being the most common group of animals collected. The lower reaches of the Ashley and Cooper Rivers were found to be highly polluted and lacked bottom associated organisms at mid-channel stations. Moderately polluted areas were found in the main harbor from the mouths of the Ashley, Cooper and Wando Rivers to near Ft. Sumter. The only benthic organisms collected in these reaches were polychaete worms. Seaward of Ft. Sumter, benthic environments were not found to be polluted to any great extent. Animals collected in this reach included polychaete worms, shrimp, and crabs.

2.13.5.6. Economically, the most important invertebrates found in the estuary are the brown and white shrimp and blue crabs. As shown in Table 12, the 1973 commercial shrimp landings in the Charleston area amounted to over 4 million pounds valued at almost 4.5 million dollars. Blue crab landings for this same period amounted to over 2 million pounds valued at over 400,000 dollars.

2.13.5.7. Aside from direct economic values, all invertebrates in the estuary are available as food for other marine invertebrates and fishes at some stage in their life cycle. For example, two studies conducted in Florida showed that invertebrates constituted the principal source of food for more than 94 percent of the fishes harvested in Florida's valuable sport and commercial fisheries (Reterences 34 and 35). A similar condition probably exists in the Charleston Harbor area.

2.13.6. Zooplankton.

2.13.6.1. Available information on species composition and abundance of plankton populations in the Charleston Harbor area is rather limited. One of the first studies of the abundance of these organisms in the harbor area was completed by Bears Bluff Laboratories, Inc., in 1964 under a contract with the U. S. Fish and Wildlife Service (Reference 24).

2.13.6.2. The Bears Bluff report gives the following account of plankton populations in the Ashley, Cooper, Wando and Santee Rivers:

"Information from Plankton studies indicates that all of the river systems studied are areas of abundance for many zooplankton forms, including larvae and postlarvae of commercial species of fish and shellfish. The Santee River system was found to have the greatest recruitment of fish larvae and postlarvae, chiefly spot, croaker, and menhaden, over the study period. Blue crab larvae were most plentiful in the Wando River. Penaeid shrimp postlarvae were not plentiful in any of the rivers surveyed during 1963-1964, and this was reflected in the very low commercial shrimp catch over this period. Although the Ashley River was not found to be a region of comparatively great abundance for the larval and postlarval forms of commercial species, this river nonetheless ranked high in the abundance of copepods, mysid shrimp, etc., indicating that it is an area of high zooplankton productivity. On the basis of total zooplankton productivity it appears that of the four river systems

[illegible] with the Ashley River
[illegible] of very low
[illegible] commercial
[illegible]

[illegible] compared with
[illegible] throughout South
[illegible] river system
[illegible] here reported
[illegible] conditions of
[illegible] or abnormal.

[illegible] reproduced from
[illegible] present data
[illegible] catch per unit
[illegible]

[illegible] collected
[illegible] were used.
[illegible] species collected per twenty
[illegible] per unit of effort for that
[illegible] particular form
[illegible] the number of tows made in
[illegible] catch per unit
[illegible]

[illegible] (1971) the National
[illegible] determined standing crop
[illegible] benthic macro-organisms
[illegible] River system (Figure
[illegible]). A total of 45 species
[illegible] representing 28 families
[illegible] periods (Table 17). A
[illegible] the fall, 33 in the summer,
[illegible] of individuals, however,

was taken in the summer (502,523/acre) and spring (189,131/acre). The average in the fall sample was 122,164/acre. The average standing crop for the three surveys combined was 271,273 organisms/acre.

2.13.6.5. Of the 45 fish species collected during the three survey periods, 10 species accounted for 95 percent of the total catch and three of these species accounted for 75 percent of that total. Listed in decreasing order of abundance, the 10 most abundant species were Atlantic croaker, Atlantic menhaden, mummichog, bay anchovy; spot, freshwater goby, striped mullet, silver perch, tidewater silversides, and southern flounder.

2.13.6.6. Invertebrates collected included grass shrimp, white shrimp, and blue crabs. Numerically, the invertebrates were most abundant accounting for 89 percent of the total collections. Grass shrimp made up 95 percent of the invertebrate catch.

2.13.6.7. Mean biomass was also dominated by invertebrates as they made up 63 percent of the 249 pound/acre average. Grass shrimp accounted for 131 pounds/acre and blue crabs 19 pounds/acre. The dominant fish species was the American eel at 16 pounds/acre, followed by striped mullet (13.1 pounds/acre), croaker (12.9 pounds/acre) and menhaden (12.6 pounds/acre).

2.13.6.8. The authors of this study concluded that "the studies strongly emphasized the importance of tidal streams as nursery areas as 65 percent of all organisms collected were marine euryhaline species, and many of the predominant forms were represented almost entirely by larval, post-larval, and juvenile stages." They also stated that: "Unquestionably, the Cooper River upstream of Charleston, S. C. is a dynamic system supporting diverse populations of freshwater, marine, and anadromous fishes and invertebrates. All of these species are either esteemed as game fishes, commercially valuable, or important as forage species.

In contrast, the tidal streams of the lower Cooper River system were considerably more productive than those of the Port Royal Sound estuarine system surveyed in 1970. Although a greater diversity of species (67) occurred in the Port Royal tidal streams, the standing crops of aquatic organisms were by far greater in the Cooper River study areas. An average of only 8,585 organisms, with a biomass of 60.7 pounds per acre was collected in the Port Royal study areas; the Cooper River tidal streams supported 32 times that number and four times that biomass of organisms."

4.13.7 Offshore disposal area. During the late fall of 1971 and winter of 1972, the Marine Resources Division of the South Carolina Wildlife and Marine Resources Department made five cruises to the offshore hopper dredge dumping grounds and adjacent areas to ascertain the biological productivity of these areas. This study was conducted under a contract with the U. S. Army Corps of Engineers as part of an estuarine values study (Reference [3]). The final report is available for public review in the Corps' district office. Pertinent aspects of the report are presented in the following paragraphs.

A total of 78 fish species (see Table 18) was collected during experimental trawling operations in the offshore dumping area. This list was checked against a comparable sample from a nearby area collected by the Bears Bluff Laboratories' [illegible] in the 1960's. The comparison did not indicate any significant difference in species diversity and/or numbers of in-

[illegible] Examination of Table 19 which, as it represents [illegible] data collected at Ferris Ground, indicates the [illegible] and southwest of the dumping grounds is more [illegible] attributed to differential produc-[illegible] rates and/or other effect(s).

[illegible] of trawls in the offshore disposal [illegible] sand, mud and shell with [illegible] attributable

buildup of deposited dredged materials. The benthic fauna (see Table 19) were found to be impoverished with relatively little diversity and very small numbers of individuals, as compared to inshore typically estuarine areas. However, the S.C.W.M.R.D. felt that this was a normal community for this type of bottom and concluded that the direct effect of dumping on the benthic fauna appeared to be limited. Most mollusks probably could manipulate to the surface after shallow burial.

2.13.7.4 The open shelf habitat from the 60-foot (10 fathom) curve to 108 feet (18 fathoms) is characterized by a rough bottom with coral, limestone and vast invertebrate communities. Beyond 108 feet (18 fathoms), broken or live bottom areas are generally more scattered and out to 150-180 feet (25-30 fathoms), the shelf contour is relatively smooth and has a very gradual slope. The shelf edge habitat off Charleston is characterized by a wide variety of bottom types. The dominant feature of this area is the remains of an ancient reef which runs approximately parallel to the coastline at depths of 150-210 feet (25-35 fathoms). This is a rich area for fishing with tremendous growths of invertebrates, sponges and corals and will be avoided during disposal of dredged material.

2.13.7.5 Generally, the bottom area to the east and southeast of the dumping site out to the continental shelf has live bottom areas interspersed at various localities. These are characterized by outcrops of rock with attachments of sessile organisms, sponges, etc. and are populated by a variety of fish species. No dredged materials will be placed in these areas.

2.13.8 Description of existing diked disposal areas.

2.13.8.1 Daniel Island. The Daniel Island disposal area is located at the junction of the Cooper and Wando Rivers and is currently under easement to the South Carolina State Ports Authority until 1980 or until such time that it is filled to an elevation of 18 feet above mlw. A total of 686 acres of the 789 acres under easement have been diked. Previous studies indicate that once the material is in the disposal area it will consolidate to about 50 percent of its shoal volume. Applying this factor to the current rate of filling, it is calculated that Daniel Island is being filled

at a rate of about 1.6 feet per year. At this rate, 18.0 feet mlw will be reached after maintenance dredging in 1977. It has been recommended that the easement be amended to permit filling to 22 feet mlw thus extending the life of this area through 1980 and possibly beyond 1980. Due to the additional drying time that would be required before dikes could be raised, the District Engineer has asked the project sponsor (the State of South Carolina) to initiate steps to renew the Daniel Island easement, extending the time and deleting the restrictions on height of fill, and begin negotiations for an additional disposal area suitable for Lower Charleston Harbor maintenance requirements.

2.13.8.1.1 The area currently being utilized for deposition of dredged materials is located on the southern end of the island. Due to the frequency of dredging, the interior of the disposal area is mostly recently deposited sediment and there is little vegetation. Wildlife use in the disposal area is limited to feeding herons, egrets, plovers, sandpipers, dunlin, willets, black-necked stilts, gulls, crows, various other bird species, and small mammals.

2.13.8.1.2 Morris Island. The Morris Island disposal area is located at the mouth of the harbor west of the entrance channel. A total of 703.5 acres are under easement to the South Carolina State Ports Authority for a period of 25 years from 21 December 1967. The diked area currently being used for disposal covers [illegible] acres. The average elevation is currently 7.0 feet mlw. Assuming a maximum filled elevation of 23.0 feet and a compaction ratio of 2:1, the Morris Island disposal area will hold about [illegible], 000,000 cubic yards of compacted material or 28,160,000 cubic yards of in situ material.

2.13.8.1.3 Vegetation in the disposal area is sparse and wildlife utilization is similar to that described for Daniel Island. The area on the northeast end of the island is composed of [illegible] and upland areas which are utilized by small mammals, reptiles and amphibians, waterfowl, and wading and passerine birds. There are no plans for diking this area and using it [illegible] the present time.

2.1.6.3 Drum Island. Drum Island is located just south of Daniel Island and is bounded by Town Creek on the west and the Cooper River on the east (Figure 2). The Cooper River bridges pass over the southern portion of the island. The original 300 acre easement was for five years beginning 1 December 1968. The easement expired in 1973, however, the South Carolina State Ports Authority is renegotiating with the owner and anticipates that the area will be available for disposal in the near future. Most of the outer perimeter of the island has been diked forming a disposal area of approximately 300 acres which is being utilized for deposition of a portion of the shoal materials removed from lower Charleston Harbor during Federal, state, and local maintenance dredging. Vegetation in the disposal area is sparse and wildlife utilization is similar to that in the Daniel Island disposal area. A major heron rookery is located outside of the diked area on the north side of the island. This fifteen acre area is densely vegetated with sea-myrtle, salt cedar, mulberry, wax myrtle, cabbage palmetto, Spanish bayonet, cord grass and Juncus. This rookery is used primarily by American egret, snowy egret, Louisiana heron, little blue heron, black-crowned night heron, glossy ibis, white ibis, cattle egret, and yellow-crowned night heron.

2.1.6.4 Clouter Creek. The Clouter Creek disposal area is located on the east side of the Cooper River between Mile-11 [illegible] during Corps of Engineers maintenance [illegible] the north half of the [illegible] to the South [illegible] under [illegible] renewable through 25 [illegible] elevation is contours 11.0 [illegible] of [illegible] section of the Clouter Creek disposal [illegible] 2,650,450 cubic [illegible] yards of shoal or in situ material.

2.13.8.4.1 In addition to the area used by the Corps of Engineers, the U. S. Navy uses a 703 acre area on the southern portion of the island to dispose of materials removed during their maintenance dredging of docks and slips. Current elevations in this area are about 15 feet mlw. Using the same assumptions as above, this area has a capacity of 8,998,400 cubic yards of compacted material or 17,996,800 cubic yards of shoal or in situ material.

2.13.8.4.2 The perimeter of the disposal area is classed as Priority IV wetlands. Plant species found around the perimeter include smooth cord grass, big cord grass, black needle rush, cattails, sedges, bulrushes, silverline, tamarisk, hackberry, Chinese tallow tree, wax myrtle, rattlebox, Russian thistle, dog fennel, giant ragweed, goldenrod, loblolly pine and various clovers. Inside the dike, vegetative cover varies from none to dense. The southern half of the area is covered with recently deposited dredged materials and is sparsely vegetated. The northern portion is vegetated with grasses, Aster spp., Solidago spp., Russian thistle, baccharis, tamarisk, smooth cord grass, Juncus spp., and cattail. Wildlife utilization of the disposal area is limited due to the general absence of suitable habitat. Wildlife species most likely to occur in the area are marsh hawk, clapper rail, killdeer, herons and egrets, sandpipers, plovers, various dickeys, marsh rabbit, raccoon and rodents.

2.13.8.5 Yellow House Creek. The Yellow House Creek disposal area is located on the east side of the Cooper River at about Mile-19. The South Carolina State Ports Authority has a total of 951 acres under perpetual easement from 10 September 1958. A total of 597 acres has been diked and the area has been filled to about 8.0 feet mlw. With a maximum filled elevation of 23 feet and a [illegible] ratio of 2:1, this disposal area has a capacity of about [illegible] cubic yards of compacted material or 28,656,000 cubic yards of [illegible] in situ material.

2.13.8. [illegible] with Clouter Creek, lands outside the diked [illegible] as Priority IV wetlands by the South Carolina Wildlife [illegible] Resources Department. Vegetation in this area [illegible] around the Clouter Creek disposal area. [illegible] mainly vegetated with cattails, [illegible] big cord grass, and widgeon grass. Wildlife utilizing the area inside the dike include sandpipers, killdeer, plovers, shovelers, little blue heron, great blue heron, Louisiana heron, snowy egret, common egret, black-necked stilt, gulls, coots, scaup, marsh hawk, clapper rail, raccoon, marsh rabbit, [illegible], mice, rats, and water snakes.

2.13.9. [illegible] of proposed disposal areas. Those [illegible] for the purpose of making cost [illegible] and northward of Daniel Island. [illegible] lands with scattered oak- [illegible] few tidal creeks bordered by a [illegible], no consideration is being given [illegible] purposes. The principal [illegible] are long-leaf pine, turkey [illegible] black oak. The understory includes [illegible], sassafras, persimmon, wax myrtle, [illegible], and herbs such as wiregrass, broomsedge, [illegible] berry, poison ivy and catbrier. Wildlife [illegible] include deer, squirrel, rabbits, [illegible], rats, mice, and several [illegible].

[illegible] lands are natural [illegible] [illegible] Agricultural fields that are [illegible]

...t.

...t of Charleston. The Port of Charleston

... of the economic of the State of South

... the port primarily serves the

... part of its export tonnage moving through are

... in North Carolina, Georgia, and Tennessee.

... imports are utilized by firms in these states as

... in South Carolina measured by value of

... port is the Greenville-Spartanburg industrial

... port handled over 7.4 million short tons of

... , of over 3.3 million being export tonnage.

... 96.3 percent (7,199,801 short tons)

... the remaining 3.7 percent (276,774 short tons)

... are traffic paths over the Atlantic

... between points within the harbor. During

... , waterborne commerce increased at the

... great, while total waterborne commerce

... at about 5-6.5 percent per year. The

... through the port over the past several years

... development of the South Atlantic Region

... Carolina. Imports and coastwise receipts are greater

... shipments and this trend is expected to

... or petroleum (residual fuel oil), farm

... , metal sand and wood. Major receipts

... export consist of

... products, and textile products.

... Future traffic and others

... Charleston Harbor are keyed to

... Department of Commerce,

Bureau of Economic Analysis (BEA) Economic Areas Nos. 28, 29, 30, and 31. These economic areas have been delineated by the BEA and the Economic Research Service (ERS), Department of Agriculture, who have made national and area economic projections to 2020 for the Water Resources Council. The projections dated September 1972 have been adopted as the current appraisal of the long-range national trends for planning purposes. These projects are designated as "OBERS Projections". Thirty-five of the forty-six South Carolina counties are included in BEA Economic Areas 28, 29, 30, and 31, which are considered as representative of the general cargo tributary area of the Port of Charleston. Various combinations of these areas would be representative of the various petroleum products tributary area. The discussions presented in the following paragraphs are keyed to BEA Areas 28, 29, 30 and 31.

2.14.2.2 Population. The 1970 population of the State of South Carolina was 2,590,516, an increase of 8.7 percent over its 1960 population and a decrease from the 12.5 percent increase registered during the 1950-1960 decade. BEA Economic Areas 28, 29, 30, and 31, with 1970 populations of 805,960, 610,800, 400,739, and 430,761, respectively, registered changes over their 1960 populations of 19.3, 10.7, -1.3, and 16.9 percent, respectively. Almost all of the population increase in the immediate project area can be attributed to the growth of the North Charleston - Hanahan, St. Andrews, James Island, and Mt. Pleasant areas. About 47.6 percent of the state's 1970 population resided in urban areas as compared with only 41.2 percent of the 1960 population.

2.14.2.3 Income. The total personal income of residents living in the State of South Carolina amounted to about $7,550 million in 1970 and averaged $2,908 per capita, or about 74 percent of the national average. This represents an increase of about 60 percent in real per capita income over 1960 as compared with about 35 percent for the nation as a whole. The per capita income of BEA Areas 28, 29, 30, and 31 generally parallels that of the state as a whole.

2.14.2.4. Employment. The average annual employment in the state in 1970 totaled 1,036,800 with 5.0 percent of the labor force unemployed. About 340,000 persons or about 23.8 percent were employed in manufacturing activities, 66,200 or about 6.4 percent were employed in agriculture, 148,800 or about 14.3 percent were employed in government, 142,400 or 13.7 percent were employed in wholesale and retail trade, and the remainder were either self-employed or in contract construction, transportation, communication, utilities, finance, insurance, real estate, unpaid family workers, or domestics.

2.14.2.5. Industrial development. The types of industry within the State of South Carolina are many and varied. Industry has expanded greatly in recent years. Manufacturing accounted for about 33 percent of the employment in the state in 1970 and construction accounted for about five percent. The major industries are textiles, chemicals and allied products, non-electrical machinery, food and kindred products, electrical equipment and supplies, stone, clay, glass, and paper and allied products. As an indication of the industrial development in the state, the "value added by manufacture" has increased by a factor of 2.5 in constant dollars during the period 1954 to 1967. This trend is expected to continue.

2.14.2.6. Agriculture. Agriculture plays an important role in the economy of the state. The value of crop production in 1969 was over $260 million. However, the number of farms has decreased from 86,000 in 1960 to 52,000 in 1970 and the land in farms has decreased from 10,000,000 acres in 1960 to 8,300,000 acres in 1970. To partially offset this decrease in the number of farms and total acreage in farm lands, the average size farm has increased from 116 acres in 1960 to 161 in 1970.

2.14.2.7. Transportation facilities. An excellent network of Interstate, U. S., State and local highways, railroads and airlines adequately connect the population centers of the state with the port at Charleston and with all metropolitan and other centers in the nation. The State Highway Department considers local highway facilities within the Charleston Metropolitan area inadequate to meet present needs.

[illegible] archaeological and historical elements. Charleston is the site of one of the oldest permanent settlements in the United States and has many areas and structures of great significance in the history of the country which span the period between the Revolutionary War and the post Civil War and Reconstruction period. Prominent among these is Fort Sumter which was the site of the first battle of the Civil War when it was fired upon by South Carolina troops from nearby Fort Johnson. Fort Sumter is a National Monument on a small manmade island in Charleston Harbor. Another old fort and also a National Monument is Fort Moultrie on the southwest end of Sullivans Island near the mouth of Charleston Harbor. The original palmetto fort was built in 1776 and has been rebuilt several times. [illegible] General Francis Marion, who was a Revolutionary War [illegible] located near Pineville, just northwest of the project area. [illegible] an estate of about 738 acres just north of Charleston [illegible] granted to Major John Boone, who received the land as a [illegible] from the Lord Proprietors on behalf of the King of [illegible]. The mansion, kitchen-house, and slave houses have been restored [illegible] a part of local heritage and culture of the pre-[illegible] era.

[illegible] the latest edition of the National Register of [illegible] lists 38 sites in Charleston County and 6 sites in [illegible] National Register Properties in Berkeley County [illegible] are outside the project area. Several of [illegible] Charleston County sites are located in and around [illegible] and are listed below.

[illegible] Historical District. Located on [illegible] Charleston.

[illegible] Sumter National Monument. Located on [illegible] in Charleston Harbor.

[illegible] Fort Charles Town. Located on [illegible].

[illegible] Pinckney. Located on Sewee Bay [illegible].

[illegible] National Register properties in the Charleston Harbor area
are:

[illegible]
- [illegible], Offices, Barns and Associated Railroad Structures
- [illegible]
- [illegible] Music House
- [illegible], Dibble, Porter
- [illegible], Robert, House
- [illegible] and Farmers National Bank of South Carolina
- [illegible] and Provost
- [illegible] Building
- [illegible], Zillie, House
- [illegible], [illegible], House
- [illegible], Chas., Studio
- [illegible], [illegible], House
- [illegible], St. [illegible] Episcopal Church
- [illegible] Island House
- [illegible] the State Arsenal (Old Citadel)
- [illegible], [illegible] Row, House
- [illegible] House

[illegible]
- [illegible]
  - [illegible]
  - [illegible]

[illegible] with an average annual temperature
[illegible] days during the year when some
[illegible] possible in the Charleston area.
[illegible] in the area include boating, both
[illegible]. There are [illegible] small boat launching
[illegible], [illegible] 20 miles of the city which
[illegible] fishing areas. There are also
[illegible] of the old city and more than
[illegible]. The beaches in the area are also
[illegible] recreation grounds are within
[illegible] and oysters may be harvested

[illegible] available on various deep sea fishing boat[illegible] Gulf Stream on an individual or charter [illegible] operate from the Charleston Marina, the Isle of Palms [illegible] and Shem Creek at Mt. Pleasant.

[illegible] fisherman, the Santee-Cooper lakes and the [illegible] Cooper River are less than one hour's drive [illegible] specific fishing for striped bass, largemouth [illegible], crappie, [illegible], catfish, and other fresh water species.

[illegible] are located within an hour's [illegible], on the Edisto River, has excel- [illegible] and Edisto Beach Park, on the Atlantic [illegible], [illegible], picnicking areas and rental cottages. [illegible] Wildlife Refuge offer the opportunity to observe birds and animals in their natural [illegible]. [illegible] Wildlife Service provides regular [illegible] Marina, which is about 15 miles from [illegible].

[illegible] is also noted for its wildlife [illegible] abundance of game species. The [illegible] are located on U. S. Forest Service and [illegible] there are also a number of privately- [illegible] the public may hunt for a fee.

[illegible] recreational opportunities available in [illegible] golf courses, one of which is [illegible], four public swimming pools [illegible] and three ocean beaches.

[illegible] within without the project.

[illegible] to accommodate a growing [illegible] will be achieved at [illegible] to recreational [illegible] to the [illegible] is three [illegible] popula- [illegible] Areas 25, 29, 30 [illegible] 2,000, the popula-

Carolina. This represents a 9.3
ation over 1969 for the BEA Economic
increase for the entire state as compared
se for the United States. The state
projected to increase at an average
over the next 60-year period. The
areas was set at 52 percent of their
the case as for the state. This
through 2030, the same as projected
growth rate of real per capita income
average 2.1 percent annually and increase
percent of the United States average per
60-year period. Because of the
development, it is anticipated that
take place on the Cooper, Wando, and
the project.

3.0. Relationship of the Proposed Action to Land Use Plans.

The Berkeley-Charleston-Dorchester Regional Planning Council prepared a preliminary development plan for the three-county area to set forth major policies relating to desirable future development. In its present form, it is too non-specific to permit a determination of its relationship to the Charleston Harbor Navigation Project. There are no other land-use plans covering any area that would be affected by the proposed project.

4.0. The Probable Impact of the Proposed Action on The Environment.

4.01. General considerations. Prior to the completion of the Santee-Cooper project in 1942, Charleston Harbor was considered one of the finest natural harbors on the Atlantic Coast with depths in many areas exceeding 70 feet. After completion of the diversion project, the rate of shoaling rapidly increased and silt began to accumulate in all parts of the harbor. As a result, annual maintenance dredging requirements increased from less than 500,000 cubic yards up to approximately 10,000,000 cubic yards. Because of this shoaling problem, the Charleston Harbor estuary has been subjected for many years to water quality changes and associated dredging effects similar to those expected to result from the proposed project.

4.01.1. The major effects of this dredging relate to effects on water quality and on the ecosystems within the harbor and disposal areas. Water quality is affected mainly by localized short-term increases in turbidity and sedimentation of adjacent water areas because of the bottom disturbance by the dredge cutterhead and the suspended and dissolved material in the effluent from the disposal areas. The effects on disposal areas include the smothering of plant and animal communities and the prevention of any substantial regrowth or colonization as long as the area continues to be used as a disposal area.

4.02. Water Quality. An evaluation of available data presented in Section 2 of this EIS indicates that the deepening of Charleston Harbor, as proposed, will not create any long-term or large scale adverse impacts or detrimental effects on the water quality of Charleston Harbor estuarine system.

4.02.1. It is characteristic of any hydraulic dredging project that water turbidity in the vicinity of the dredge will

increase as a result of the mechanical action of the dredge cutterhead. Observations of maintenance dredging in the harbor indicate there will be a temporary increase in turbidity in the area of dredging and, although visible at the surface only in the immediate vicinity of the cutterhead, the subsurface plume may extend several hundred feet either upstream or downstream as determined by tidal currents. Some increase in turbidities can also be expected adjacent to the upland disposal area on Daniel Island and Morris Island, although construction of dikes and weirs should greatly reduce the sediment content of the effluent. The water turbidity in the offshore disposal area will also increase. The temporary and localized effects on resident biota of increased water turbidity are not considered to be of a magnitude to affect long-term productivity.

4.02.2. In addition to increasing turbidities, the disturbance of bottom sediments by the dredge may resuspend chemical substances, possibly increasing levels of nutrients, toxic substances, and B.O.D. Such effects would be most noticeable in the immediate vicinity of the dredge and would not extend any appreciable distance beyond the source. The disturbance of these sediments will not have any significant affect on the long-term productivity of the harbor ecosystem because of the low natural productivity of these fine sediments.

4.03. Biological Impacts. The major concern associated with dredging in Charleston Harbor relates to concern over the effect of the removal of bottom materials and their subsequent discharge into open water or upland disposal areas on the existing ecosystem or man's use thereof. A discussion of the probable project effects on existing flora and fauna is presented in the following paragraphs.

4.03.1 Upland disposal areas. The Charleston Harbor estuary contains thousands of acres of productive salt marshes, none of which would be affected by the proposed project since dredged materials would

be disposed of on upland sites or in approved offshore areas. As discussed previously, the project sponsor has indicated that it would be desirable from his position to locate these upland disposal areas on and northward of Daniel Island. There are two types of upland areas potentially available for disposal on Daniel Island, woodlands and agricultural lands. The impacts of utilizing each of these types is discussed below.

4.03.1.1 Woodlands. Woodlands now appear to be one of the two most likely areas to be selected for disposal of dredged material from the harbor deepening project and maintenance dredging when the currently used disposal areas are used to capacity. Woodlands are one of the largest environmental types in the Charleston Harbor area, and the rationale for preservation of individual tracts of marsh does not apply to these woodlands. Woodlands are also less expensive than urbanized areas and would, therefore, be more suitable from the project sponsor's viewpoint.

4.03.1.1.1 Prior to the use of any wooded tract of land, the owner [illegible]. In any event, dense stands would be removed to permit a more even distribution throughout the disposal area of the hydraulically dredged material. Any trees not removed and all understory plants would be killed when their roots become covered to a sufficient depth. Vegetation regrowth would probably consist of poke berry and other herbs and shrubs such as silverline and wax myrtle, and trees of most of the same species growing prior to dredging.

4.03.1.1.2 Practically all significant animal life except for some small birds would be displaced during and shortly after the use of a wooded disposal area. Raccoons, opossum, and some small rodents might continue to forage without interruption in the disposal area. As vegetative regrowth begins, foraging by the other species that were displaced during the preparation and clearing and subsequent use of the area will increase. Plant and animal life will fluctuate from a low during and shortly after deposition of

[illegible] just before a dredging operation. When [illegible], a reversion to a wooded state by sweetgum, pines, hackberry, oak and other upland species will occur unless man's activities intervene through use of the area for cultivation [illegible].

5.03.1.2 Agricultural Land. Agricultural lands, along with woodlands, appear to be some of the most likely areas to be selected for the disposal of dredged material from the harbor deepening project. Here again, some of the basic restrictions operating against the selection of [illegible] and urbanized areas do not apply to these areas. The impact on wildlife of using cultivated land for the disposal of dredged material depends on the length of time since the land was last cultivated. Recently cultivated land usually has very little utility for wildlife because of the common practice of clean farming, and the use of such an area for disposal would have little impact on wildlife. Fields that are left fallow for some time provide habitat for a number of small animals. Most of these would be displaced by dredged material. Vegetative regrowth would begin [illegible] after the area dries with pioneer species such as [illegible], and other herbs and grasses being the first to appear. [illegible] and waste cattle and trees such as sweetgum and [illegible] would appear shortly afterwards. As vegetative regrowth progresses, foraging by animals displaced during dredging [illegible]. The extent of this foraging will also depend on [illegible] if such a disposal area were [illegible] of animal life might forage [illegible] were bordered by cultivated fields. [illegible] from a low luring and shortly [illegible] high just before a [illegible] has been reached, a reversion [illegible], hackberry, oaks, and other [illegible] cultivation is resumed or the area [illegible] development.

4.03.2. Birds. Birds will not be adversely affected to any extent by the proposed project. Species which utilize the proposed upland disposal areas will probably be temporarily frightened away be construction noise and will temporarily stress populations in other areas as they compete for available food and roosting space. On the positive side, many species have been observed congregating around active disposal areas to feed on organisms in the dredged material.

4.03.3. Mammals. Although many species of mammals occur in the general vicinity of the proposed project, the only one which is common in the harbor proper is the bottlenose dolphin and it will not be adversely affected by the project. Some small mammals may be displaced in the proposed upland disposal area on Daniel Island. Since the Morris Island disposal area is currently being used it is doubtful that any mammals would be displaced.

4.03.4. Reptiles. Reptiles in the project area, except for the diamondback terrapin, are mainly offshore forms which occasionally wander into lower Charleston Harbor or land forms which generally are not associated with the harbor proper. The diamondback terrapin is found in the vicinity of coastal marshes, tidal flats, or, in general, any sheltered unpolluted body of salt or brackish water where it forages on fish, crustaceans, mollusks, and insects. Due to its habitat preferences, the terrapin will not be affected by the proposed project.

4.03.5. Plankton. In 1972, the Belle W. Baruch Coastal Research Institute, under contract to the Corps of Engineers, studied the effects of Charleston Harbor sludge on photosynthesis,

standing crop and growth of natural phytoplankton communities under laboratory and field conditions (Reference 27). The study was divided into two sections: (1) the effects of dredged material on phytoplankton and (2) the effects of dredged material on certain invertebrate zooplankton.

4.03.5.1. Phytoplankton studies. Both laboratory and field studies were conducted for the phytoplankton studies.

4.03.5.1.1. Laboratory studies.

4.03.5.1.1.1. The first laboratory experiment was designed to test the direct effects of suspended sludge on primary productivity. Studies conducted with Charleston Harbor mud showed that as turbidities increased, primary production decreased which suggests that production in turbid waters is limited by low light intensities.

4.03.5.1.1.2. The second set of experiments was designed to determine whether toxic materials could leach out of resuspended sludge and influence phytoplankton growth. The results showed that the sludge extract enhanced the growth of Charleston Harbor phytoplankton.

4.03.5.1.2. Field studies.

4.03.5.1.2.1. For these studies, primary production was measured at three sites in Charleston Harbor during actual dredging operations. The three stations sampled were located: (1) north of Goose Creek; (2) south of Goose Creek; and (3) at the mouth of the Cooper River. At site 1 (salinity 0°/oo), primary production [illegible] mile upstream from the dredge, decreased [illegible] reached its lowest value 250 yards below and [illegible] stream. The results at site 2 were similar [illegible]. At site 3, however, the highest production

[illegible] concentrations were found at the dredge [illegible] before the dredge were not signi-[illegible].

[illegible] concluded that: "From the [illegible] on the primary [illegible] inhibitors due to in-[illegible], however, takes place downstream."

[illegible] on the effects of [illegible] zooplankton were [illegible].

[illegible], effluent samples from different [illegible] with seawater; the parti-[illegible] to the bottom; and the super-[illegible], Zn, and Mn concentration. The [illegible] the effects of the lower concen-[illegible], but at the higher concentration, [illegible] were all modified markedly. [illegible] concentration could possibly be [illegible].

[illegible] detected during an actual dredg-[illegible], water was collected from [illegible] stations, water samples [illegible] vicinity of the dredge, [illegible]. The results [illegible] the final area was [illegible] downstream and finally

[illegible], [illegible] on that al-[illegible] reduced [illegible], the [illegible] total is [illegible] from the

dredging operation. As a result, the proposed dredging is not expected to have any significant long-term effect on plankton populations.

4.03.6. Invertebrates. In most dredging projects, one of the most significant short-term impacts is the destruction of benthic invertebrates in the path of the dredge cutterhead. This gross effect has been well documented in many studies and field investigations conducted along both the Atlantic and Gulf coasts (References 28, 29, and 30) and can be expected to occur to some extent during the deepening of Charleston Harbor.

4.03.6.1 As discussed in Section 2 of this EIS, the greatest concentrations of benthic invertebrates in the Charleston Harbor estuary occur in the shallower portions in and around the salt marshes, not in the deeper-channelized areas. In addition, sediments in much of the harbor contain toxic substances which, according to the National Marine Fisheries Service; "essentially eliminated all benthic organisms from the harbor bottom." Since only the deeper portions of the estuary will be affected by the proposed project, the impact on benthic invertebrates will be insignificant.

4.03.6.2. Benthic organisms inhabiting the offshore disposal area will probably be smothered as materials dredged from the entrance channel are deposited. This will be a short-term impact as organisms destroyed will be replaced by recruitment from surrounding areas.

4.03.7. Fish. As stated in Section 2 of this statement, the Charleston Harbor estuarine system supports a diverse array of fishes. Although many of these species are occasionally found in the deeper portions of the estuary, the majority are usually associated with salt marshes and shallow water areas which will not be significantly affected by the proposed project.

4.03.7.1. Available data indicate that fish populations, unlike benthic invertebrates which are relatively immobile and may undergo population reductions that may be locally severe, are less likely to be adversely affected by dredging operations. For example, Stickney (Reference 31) in his study of the Atlantic Intracoastal Waterway in Georgia found no indication of fishes being killed during dredging operations. In some areas, dredging could even be considered to be beneficial to certain species of fish. As a dredge works its way along a channel, benthic animals which would normally be buried in the sediments are dislodged and become susceptible to predation. This sudden availability of food quite often results in higher than normal concentrations of fishes near the dredge. Dredging of the entrance channel and ocean disposal could create a similar situation.

4.03.7.2. Although it would appear that fish are relatively unaffected by dredging, there has been some concern in the last few years over the possible effects of increased turbidities and siltation associated with dredging. As a dredge moves along the channel, it invariably creates some type of turbidity plume, the size of which will vary considerably depending on the type of sediments being dredged, strength of currents and other factors. The magnitude of the impact of suspended particles on fishes will, in most cases, be dependent on the concentration, composition, sorbed minerals or toxins, and the tolerance of particular species.

4.03.7.3. Sherk (Reference 29) found that, in general, [illegible] species are the most tolerant of suspended solids, [illegible] are most sensitive, and that juvenile forms were more sensitive than adults. Goodwin, in Chesapeake Biological [illegible] (Reference 10), has cited seasonal and geographical [illegible] in population density and species composition of zooplankton, but a certain amount of the variation could be attributed

to environmental modification. No indications of mortality attributable to the dredging and disposal operation with respect to fish eggs and larvae in the project area were obtained, although Dovel (in the same report) found larval and juvenile stages of freshwater, estuarine, and marine spawners in that area from April through August. He thought that this was the most critical period for these developmental stages, i.e., when they would be most vulnerable to dredging and disposal. Also, since he found that postlarval and young fishes were present in deeper areas from November through January, he advised that channel alterations should be avoided during that period.

4.03.7.4. Sherk and Cronin (Reference 32) found that under experimental conditions, fish subjected to extremely high concentrations of suspended solids have died from suffocation due to clogging of the gills and opercular cavities. However, under normal circumstances, fish avoid turbid waters and have the ability to clear gill membranes of accumulated silt upon entering undisturbed water. However, as pointed out previously, not all species are equally susceptible to suspended solids and different suspensoids vary in their effect.

4.03.7.5. As a general rule, it has been found that fish can tolerate high turbidities except when they are accompanied by low levels of dissolved oxygen, acids, alkalies, or other substances which may interfere with respiration, injure gills or prevent their normal function, and, although Stickney found they generally did not leave the immediate dredging area, they are quite capable of doing so.

4.03.7.6. Turbidity plumes created by the proposed project will primarily be restricted to the channel area with some adjacent spading depending on wind and tidal velocities. As mentioned previously, fish species which could have the highest probability of being affected are the filter feeders (principally menhaden, herring and [illegible] juvenile [illegible]. Estimates of the relative abundance

AD-A149 547 CHARLESTON HARBOR DEEPENING PROJECT CHARLESTON HARBOR AND SHIPYARD RIVER SOUTH CAROLINA(U) CORPS OF ENGINEERS CHARLESTON SC CHARLESTON DISTRICT APR 76 2/3

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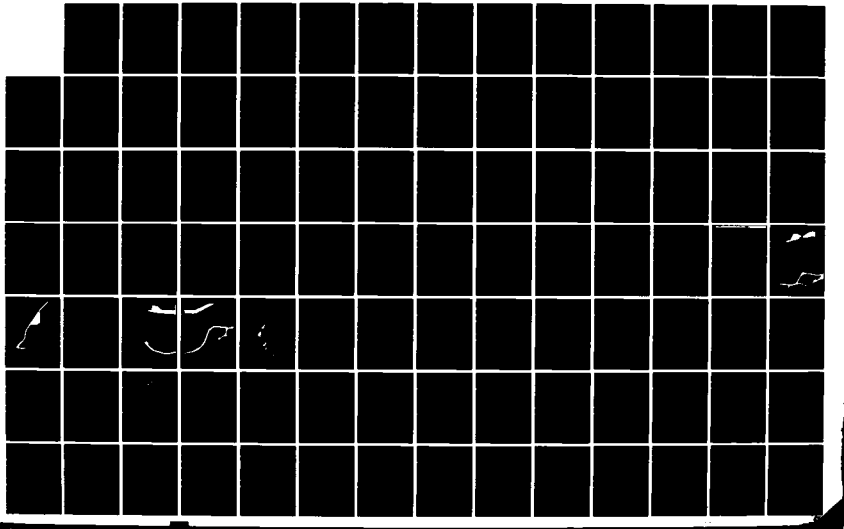

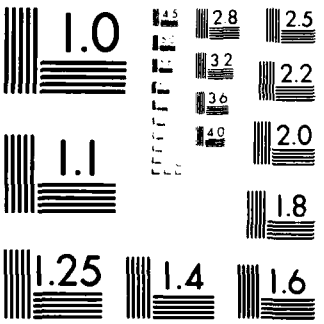

of these species in the channel area at any given time varies so that it is not practical to attempt a precise determination of impact on these species. Based on (1) research which has been accomplished in other areas and (2) available information on the effects of current dredging practices in the harbor, it is felt that any impacts resulting from the proposed deepening will be of a short-term, localized nature and will not significantly affect the fish stocks in the Charleston estuarine system.

4.03.7.7 Larval fish. The National Marine Fisheries Service, under contract to the U. S. Army, Corps of Engineers, studied the effects of dredged harbor sediments on larval estuarine fish common to Charleston Harbor as part of the estuarine values study (Reference 33). Their final report was submitted to the Corps in April, 1973 and is summarized in the following paragraphs.

4.03.7.7.1 For this study, the NMFS exposed the larvae of five species of estuarine fish (Atlantic menhaden, pinfish, flounder, spot, and Atlantic croaker) to seawater-sediment extracts for periods of up to 14 days. Sediments for the study were collected by the Corps of Engineers at pertinent stations in the harbor. In the NMFS laboratory, the sediments were added to filtered seawater, shaken for two hours, and allowed to settle. The supernatant was then diluted for testing at seven concentrations ranging from 0 to 100%.

4.03.7.7.2 The general conclusions reached by NMFS are as follows: "Despite the shortcomings imposed by limited time and money, certain general conclusions can be drawn from this research. Though we have not determined the toxicant (or toxicants) present in the extract, it is obvious that the materials are soluble in seawater and that the leaching of these unknown compounds into the water column may be detrimental to larval fish populations under

certain conditions. This was demonstrated in the bioassay tests where survival of larval fish was quite low or zero at certain high concentrations of sediment extract. Indications are that survival of larval fish will be different for different species. We also found a relative difference in toxicity of the sediments depending on where the sample came from in Charleston Harbor. Of the samples we tested, those from Station 5, Shipyard River, and Station 8 were the most acutely toxic.

In addition to the acute response (mortality) our results also indicate that sublethal mechanisms are acting to cause physiological changes in the larval fish. This change is observed as a reduction in the growth rate of the larval fish at certain concentrations of the sediment extract. This lack of growth would suggest an overall weakening of the fish which in turn could affect the fishes' chance for survival.

Our behavioral test did not provide enough data to draw any conclusions. We feel, however, that our test of behavioral responses to sediment extract indicated that menhaden and flounder may be affected behaviorally (which could lead to more substantial ecological effects) and these organisms should be tested further using this criteria."

4.03.7.7.3. The above study presents evidence that larval forms of certain fish species may be adversely affected by the proposed dredging and that some mortality will no doubt occur. However, since laboratory data are not directly applicable to field situations, the impacts cannot be quantitatively evaluated. Some larval fish will be destroyed either as a result of (1) the mechanical action of the dredge, (2) being exposed to turbid water, or (3) being exposed to toxic substances in sediments. However, as stated previously, any impacts will be temporary and will be limited to the immediate vicinity of the dredge or disposal areas and will not significantly affect fish stocks in the Charleston Harbor estuarine system.

4.03.7.8. Commercial Fisheries. As discussed in Section 2. the principal species marketed in Charleston are shrimp, blue crabs, oysters, clams, alewives, American eels, flounder, whiting, black sea bass, and spot. A majority of these species are captured in offshore fisheries which will not be affected by the proposed project. Oysters and clams are found in shallower areas of the harbor and will not be affected by the project. The clams and oysters marketed in Charleston come from other areas along the coast. Shrimp and blue crabs are found throughout the estuary and there is a definite possibility that some will be killed if they come in contact with the dredge cutterhead. Although numbers destroyed could be quite large, the impact will be temporary and will not significantly affect recruitment to the offshore fishery.

4.03.7.8.1. Many of the commercial fish species spend a portion of their life cycle in the estuary and could be adversely affected by turbidities or could be picked up by the cutterhead. As discussed in Section 4.03.7, the impact on fish is expected to be temporary and insignificant.

4.03.8 Ocean disposal site. The proposed plan includes the use of an existing offshore dumping area for disposal of sediment removed from the entrance channel. Since Fiscal year 1965, from 367,460 to 1,410,000 cubic yards of material have been dumped in this offshore area with little evidence that any buildup is occurring. To evaluate the impacts of this type of disposal, the Corps, as part of the estuarine values study, contracted with the S. C. Wildlife and Marine Resources Department to study the biological condition of the present offshore disposal area and to determine probable effects of continued use. In general, they found that: "This large area has been utilized for at least six years as a disposal site with no evidence of silt buildup or adverse ecological effects." They also stated that: "However, the possibility exists that the buildup of mud deposits on the bottom could result in the enhancement of adjacent areas by creating habitat for valuable species such as Penacid shrimp. This in turn, would generate

potential for increased or, at least, more productive commercial fisheries. It is felt that the existing hopper dredge disposal area is the best suited location available within reasonable distance of Charleston Harbor for the deposition of non-toxic materials. Disposal in this area has resulted in no significant conflicts with commercial or recreational fishing interests, as would probably be the case if the site were located farther inshore or offshore."

4.03.8.1.1. Although the impacts of offshore disposal are difficult to quantify, it would appear that the proposed plan would be the least damaging to the marine environment and under certain conditions might even be beneficial.

4.03.9. Rare and Endangered Species. The brown pelican is the only endangered species which is common in the project area and there is no reason to believe it would be affected by the proposed deepening project. The project will not affect any other rare and endangered species.

4.04. Archaeological and Historical Sites. Deepening of the Charleston Harbor project channel an additional five to seven feet would have no impact on archaeological or historical resources. Charleston Harbor required significant dredging only after the completion of the Santee-Cooper Project in 1942. Since most of the material to be dredged from the lower reaches of the harbor is sediment deposited since 1942, there is little likelihood of disturbing anything of historical value. Any archaeological resources which might have been present in the other reaches were probably removed during excavation for the 35-foot project. The National Register of Historic Places has been consulted and it has been determined that the proposed project will not result in the transfer, sale, demolition, or substantial alteration of potential or existing National Register properties. The proposed project will have no effect on the preservation and enhancement of non-Federally owned districts, sites, buildings, structures, and objects of historical, archaeological, architectural, or cultural significance.

4.05. Aesthetics. Aside from the physical presence of the dredges and floating pipelines that will be in the harbor during the construction period, the deepening of the channel will have little or

no effect on aesthetics. The upland disposal site may be aesthetically displeasing to users of adjacent lands.

4.06. Air Quality. There will be a very minor increase in air pollution as a result of operation of the diesel and gasoline engines on the dredge and support vessels; however, the effects will be temporary as well as insignificant and probably not measurable at existing air quality stations.

4.07. Noise. In view of the large expanse of open water, noise levels from dredge operations during the construction period will not be raised objectionably above present levels.

4.08. Economic Impact. The proposed deepening of Charleston Harbor will have a very favorable economic impact on the area. Transportation savings for vessels carrying petroleum, containerized cargo and dry bulk cargo are estimated to average $5,930,000 per year over the project life for Charleston Harbor. Savings in Shipyard River for vessels carrying petroleum and dry bulk cargo are estimated at $1,364,000 for the life of the project. These direct benefits will be obtained because of a reduction in hazards to navigation and use by larger vessels. Intangible monetary benefits which will be derived from the proposed project will be an increase in the number of jobs in the area as a result of the improvements, an increase in U. S. Customs collections resulting from increased volumes of commerce, and increased property taxes paid to the local government. The total investment cost for the recommended plan for deepening Charleston Harbor to 40 feet plus overdredging is $27,186,000 plus an additional $3,191,000 for Shipyard River. The annual costs are $3,099,000 for Charleston Harbor and $944,000 for Shipyard River. The benefit-cost ratio is 1.92 for Charleston Harbor and 1.44 for Shipyard River.

4.09. Maintenance Dredging. As with the existing project, maintenance dredging would be required each year averaging an additional 1,737,000 cubic yards (including 641,000 cubic yards to be removed by hopper dredge). This material would be disposed of in the same general areas as the initial dredging work. About

49 acres of upland (29 acres for Shipyard River and 20 acres for Charleston Harbor) would be required annually for disposal of the shoal material. The impacts of maintenance dredging would be similar to those expected to result from harbor deepening although they would generally be of a lesser magnitude.

4.10. Existing Projects. The effects of the Charleston Harbor Project on other Federal, state and local projects varies from a lack of any significant effect to some form of enhancement. There will be no direct relationship between the proposed project and the AIWW since the dimension of the latter is considerably less than that of the existing harbor. The same applies to the Ashley River project although it is inactive.

The Charleston Harbor deepening project has been evaluated with and without the Cooper River Rediversion Project and has been found to have a favorable benefit/cost ratio under either condition although it is favorable at a lesser depth without rediversion. The initial estimates of cost used to determine the economic justification of the deepening plan assumed that the Cooper River Rediversion would be implemented resulting in a substantial reduction of harbor shoaling. In order to evaluate the effect possible delays in construction of the Cooper River Rediversion Project might have on harbor deepening and to respond to the numerous past inquiries made regarding the economic effect of rediversion on harbor deepening, the deepening plans were formulated without rediversion being accomplished to see if an economical plan could still be developed. This effort revealed the following:

(1) The most economical plan of improvement (maximized) for Charleston Harbor without rediversion would be reduced from 40 to 38 feet; and (2) the most economical plan of improvement (maximized) for Shipyard River would be reduced from 38 to 35 feet. These reductions result from the large quantities of shoal material which would have to be removed annually.

Implementation of this interim plan of improvement would require the removal of an estimated 9,170,000 cubic yards of material from the inner harbor and 7,796,000 cubic yards of material from the outer

bar and entrance channel. Disposal acreages required for this plan would be about 759 acres for initial construction and 79 acres per year for the additional maintenance dredging generated by the project.

The impacts of initial construction would be the same as those resulting from the recommended plan. The numbers of acres required for disposal of maintenance dredging materials would, of course, be much greater under this plan. The approximate volume of material which would be removed during annual maintenance dredging under both harbor deepening plans with and without rediversion is shown in Table 1.

The harbor project would benefit the naval facilities just above Goose Creek by offering the potential of use by certain vessels such as the Trident submarine which could not now use the harbor. Deepening of the harbor has no potential of interacting with projects of other agencies except for that aspect associated with the disposal of dredged material. In this regard, there is no consideration given to the use of such areas for disposal of dredged material. Examples of such projects are Forts Sumter and Moultrie of the National Park Service and Hog Island which is the site of a proposed naval museum.

4.11 Mosquitoes. The use of diked disposal areas creates favorable habitat for mosquitoes, particularly the salt-marsh mosquito, Aedes sollicitans, which is a vicious biter and has a long flight range. Characteristics of diked disposal areas that make such areas productive of mosquitoes is the elimination of regular tidal flooding and the temporary ponding of water due to uneven settling of dredged material and poor drainage. The cracks that normally form during the drying of disposal areas provide very favorable oviposition sites. Natural controls such as the maintenance of stable water levels or the achievement of rapid drainage would greatly limit the production of mosquitoes in disposal areas, but neither method appears practical because of physical characteristics of the disposal areas and material

dredged from the harbor and also because of operational requirements of disposal areas. Although the Corps of Engineers is funding research on mosquito production in disposal areas, mosquito control measures were not provided for in the Acts of Congress authorizing the construction and maintenance of Charleston Harbor. Mosquito control operations at disposal areas are conducted by local government within the overall mosquito control program for Charleston County. The most commonly used insecticide is Flit M. L. O., an oil larvicide which dissipates quickly and has no effect on important forms of aquatic life. Since Flit has no residual effect, a control program utilizing oil larvicides requires frequent inspection and respraying.

5.0 Any Probable Adverse Environmental Effects Which Cannot Be Avoided.

A detailed discussion of all environmental impacts expected to result from the project is contained in Section 4.0. Some of these impacts are considered unfavorable, but cannot be avoided by any practical means within the authority and scope of the proposed project. Such impacts are summarized in the following paragraphs.

5.01 The principal adverse effects will be related to temporary changes in water quality and its effect on the harbor and disposal areas ecosystems. These effects include: increased turbidities and siltation in the vicinity of the dredge and disposal areas; a temporary decrease in primary productivity resulting from turbid waters reducing the euphotic zone; a possible loss of organisms through the leaching of toxic substances from the upland disposal area; and a possible reduction in dissolved oxygen levels as a result of the dredge disturbing organic materials undergoing anaerobic decomposition.

5.02 In addition, some benthic organisms may be destroyed by the dredge cutterhead and others may be covered in the offshore disposal area. Wildlife species inhabiting the upland disposal area will be displaced by deposition of dredged materials. The existing vegetation will be killed and regrowth prevented until the use of such areas ceases.

6.0 Alternatives to the Proposed Action.

6.01. Alternatives meeting all project objectives. The objectives established for the Charleston Harbor Navigation project as a result of the various studies conducted in response to various congressional resolutions are: (a) the deepening of the existing harbor channels and anchorages to permit larger ships to load and unload cargoes; (b) the development of a practical long-range solution to the disposal of dredged material with particular reference to estuarine values. The only alternatives that can meet these two objectives are the ones providing for channel deepening. The various means considered to provide a solution to the problem of disposing of the material dredged to construct and maintain these channels is discussed in Section 6.05, Dredging alternatives. Although all deepening alternatives meet to some extent these objectives, it is obvious that depth restrictions decrease directly as channel depth is increased. In the studies of deepening the existing channels and anchorages, several depths were evaluated. All depths considered had favorable benefit/cost ratios, but the alternative that was selected had the highest excess of benefits and other considerations being approximately equal, it was therefore selected. The environmental impacts of these alternatives are similar and vary mainly in connection with the volume of material to be dredged and the impacts associated with its disposal. The magnitude of the disposal operation would increase with channel depth and the disposal options which require the use of upland disposal sites would require larger disposal areas. The environmental impacts for each alternative would be similar to those described for the selected alternative in Section 4, and would vary in the size of area so affected. Disposal options which require ocean disposal would involve the deposition of all materials in the ocean. The impact of this is difficult to define, but in consideration of the existing off-shore disposal operation, it is not expected to be of great significance. A relatively non-

productive bottom area is currently used for ocean disposal and investigations of this dumping ground by the South Carolina Wildlife and Marine Resources Department have failed to detect any significant alteration of the bottom as a result of the disposal operation. The dredged material is apparently dispersed rapidly and little evidence of accumulations can be found. The impacts associated with the dredging operation would be similar for each alternative. Since the time required for construction and maintenance dredging varies directly with channel depth, impacts associated with the dredging operation would be felt over a period of time commensurate with the time required for the dredging to be accomplished. Included are impacts of lesser significance such as the aesthetic effect of the dredging operation, effects on water quality including localized turbidity, and localized adverse effects on the biota including planktonic and larval forms.

6.02. The following deepening alternatives were evaluated.

. 38-foot channel in Charleston Harbor and Shipyard River. This alternative would require the removal of 15,454,000 cubic yards of material from the Federal project in Charleston Harbor and 2,543,000 cubic yards from Shipyard River. The amount of non-Federal material to be removed from docks and berthing areas would . The Federal cost for this alternative would . The non-Federal cost would be $3,774,000.

. 42-foot channel in Charleston Harbor and a . This alternative would require material from the Federal the same amount of material as in . The non-Federal material to be 734,000 cubic yards. $3,095,000 of the

c. A 45-foot channel in Charleston Harbor and a 38-foot channel in Shipyard River. This alternative would require the removal of 40,042,000 cubic yards from the Federal project in Charleston Harbor and the same amount of material as in Alternative I for Shipyard River. The non-Federal material to be removed from docks and berthing areas would be 940,000 cubic yards. The Federal cost for this alternative would be $51,893,000 and the non-Federal cost would be $7,634,000.

6.03. Alternatives that meet project objectives in limited fashion.

a. Lighterage system. One alternative to channel deepening that would accommodate tankers and container ships would be some form of lighterage system. A lighterage system as conceived would consist of a channel, of greater depth than the remainder of the project, connecting the entrance channel and a protected anchorage. While in the anchorage, fully loaded vessels with drafts exceeding the safe design draft of channels to the terminal facilities would be partially unloaded directly onto barges using ship-contained facilities. When the vessels have been unloaded sufficiently to permit safe navigation, the light loaded vessels would proceed to the land based terminal facilities for final unloading. The procedure would be reversed for outgoing cargo. The practice, however, would not be practical for containerized cargo because of the specialized equipment required to handle containers. The roll and pitch of the anchorage area is believed to be too severe for ship contained crane and boom operations over the risk and/or injury factor. There are also operational disadvantages for the receiving petroleum commerce vessels. Lightering is an unsafe practice.

Many tanker owners and charter parties prohibit the use of lighters for materials of low flash point. This exclusion is written into many sales contracts where the buyer furnishes the vessel. Lightering also introduces problems of quality and quality control. Where tankers take on cargoes of several products, the cargo configurations which control list and draft could result in serious imbalance in qualities of commodities to be lightered. Because of these operational disadvantages, a lighterage system was deemed to be impractical and was not considered further. The environmental impacts of this alternative would be similar to those of the selected alternative but would be of a lesser magnitude because of a smaller construction and maintenance dredging requirement.

b. Offshore ocean terminal. An offshore ocean terminal would require the constructing of a common unloading terminal in water approximately 45 to 50 feet deep with overland and submerged pipelines connecting the existing terminals at Charleston. An offshore terminal would provide a workable solution for common handling of petroleum and petroleum products; however, it would present several complex problems of product handling and quality control and would be expensive both to construct and operate. As with the lighterage system, this alternative system would be unacceptable for container ships. The tremendous cost of an offshore terminal, total investment estimated over $70,000,000 with annual charges approaching $7,000,000 would also remove this alternative from consideration. This alternative would not have the environmental impacts associated with the dredging operation that would characterize the selected alternative. It would have other impacts such as the destruction of marsh and alteration of upland sites that would be required during the construction of the pipelines connecting the offshore terminal and existing terminals at Charleston.

c. Terminal at Cummings Point. This alternative would require the construction of a common terminal and storage tank farm

[illegible] west side inside the jetty channel. The terminal [illegible] connected to the existing oil companies terminal in [illegible] pipeline. The products would be pumped through [illegible] to these various terminals. The tank farm would provide [illegible] storage facilities for simultaneous loading [illegible] tanker vessels. This alternative would require [illegible] acres for unloading and storing container [illegible] that can be shipped to the regular terminal. The [illegible] terminal at Cummin Point would range from [illegible] to annual charges approaching $5,000,000. This [illegible] account the double handling necessary for the [illegible] ent in a vessel to shuttle container cargo [illegible] in Point. The cost of this alternative makes [illegible]. The impacts associated with channel dredging [illegible] for this alternative than for the selected alternative, the channel dredging would not proceed landward [illegible]. Other impacts that would result from this alternative include the destruction of high quality marsh and water bottoms [illegible] the terminal and storage tank farm and [illegible] connecting the terminal and storage areas to existing [illegible] at Charleston.

[illegible]. Pipeline from source. Petroleum would be the only [illegible] which could be moved by pipeline from its source. [illegible] the Gulf of Mexico could be moved by pipeline [illegible] would be higher. However, since over 30 percent [illegible] of petroleum products are imported from [illegible], this alternative was considered impractical and [illegible] in detail.

[illegible]. This alternative, under which no [illegible] would be made, envisions the [illegible] at the dimensions of the existing [illegible] and the availability of funds for maintenance [illegible] of this alternative are

similar to those of the recommended plan and the other channel alternatives, differing mainly in that the impacts of no action are of lesser magnitude. In view of the critically short supply of disposal areas, the same techniques of disposal of dredged material will probably be used in the near future for this alternative as would be used for the selected alternative. In addition to these impacts, this alternative would also adversely affect the local and regional economy. Future growth and expansion will also occur at a slower rate. Certain shipping interests have stopped visiting Charleston Harbor and others may follow in the future because of the inability of the harbor to accommodate the deeper draft vessels now in vogue. This alternative was rejected to avoid forfeiture of the economic benefits to the local area and region which would accrue to this project at relatively small environmental cost.

6.05. Dredging alternatives. Studies of the dredging operation were conducted in response to Congressional directives to develop a practical long-range solution to the disposal of material dredged from Charleston Harbor with particular reference to estuarine values. Ten plans were evaluated and these are discussed in the following paragraphs. More detailed information on these dredging alternatives is contained in the Report on Long-Range Disposal Study, Charleston Harbor, S. C., which is available for review in the Charleston District Office. Since that part of the dredging operation that is concerned only with the removal of the shoal deposits is similar under all plans in that it involves the use of a cutterhead and pipeline, the environmental impacts associated with this part of the overall operation will not be repeated here. The means and methods of disposal vary and these will be discussed in greater detail.

Plan 1. Continuation of the presently used method which involves the removal of shoal material by pipeline dredge and per-

[illegible] disposal in diked areas adjacent to the harbor. This is [illegible] a viable long-term solution because existing areas [illegible] expected to last [illegible] over with the expenditure [illegible] of the 3 upriver sediment traps. Other high [illegible] areas are not available for this purpose. Because the [illegible] are highly sensitive to the maintenance of estuarine and [illegible] areas, further use of these areas for the disposal of [illegible] material is [illegible] impractical. The estimated annual [illegible] for this [illegible].

[illegible] restrictions and conveyance of shoal material to an [illegible] disposal area in the outer harbor. The use of hopper [illegible] at the Corpus Christi harbor project area is impracti- [illegible] the [illegible] area, restricted channel widths in the [illegible] area, and the sharp turns in the Navy channels. The [illegible] annual cost of this plan is excessive when compared with [illegible], being $1[illegible],000,000. Although this plan is similar to [illegible] dumping operation that is discussed in Section 2 and 3, its impact on the biota of the offshore area could be greater. The present use of hopper dredges is limited to the outer harbor and has been found to have any significant adverse effect on the [illegible] area. However, this alternative would involve a much greater [illegible] material. In contrast to the sediment in the outer harbor, [illegible] from the inner harbor is considered polluted because [illegible] concentrations of certain constituents exceed criteria established [illegible] unpolluted sediment. Consequently, the total impact [illegible] on the offshore dumping area would exceed that which [illegible] due to quantity alone.

[illegible] by pipeline dredge and the [illegible] material to the [illegible] Island disposal area,

which would function as a temporary disposal area until the material could be transported to an offshore disposal area by pipeline. The initial dredging would be accomplished by privately-owned dredges under contract and the later transfer of the shoal material to sea would be accomplished by a government-owned and operated unit consisting of a long pipeline into the ocean with electric booster stations as required to cope with the long distances involved. The estimated annual cost of this plan is $4,814,000. The impact on the ocean dumping ground would be similar to that of Plan 2 but a greater accumulation of material might result under this plan since the dumping operation of the hopper dredge results in the greatest possible dispersion and resuspension of shoal material. Greater accumulations of shoal material would not be significant because this area now consists of fine to coarse sand and shell and its natural productivity is relatively low. There would be no significant environmental impacts resulting from the use of an existing disposal area on Daniels Island as a temporary disposal area. The pipeline and booster stations will be routed through open water areas and would not have significant impact on water bottoms.

Plan 3A. This plan is identical to Plan 3 except that diesel powered booster units would be used instead of electric power units. The estimated annual cost of this plan is $4,879,000. Its environmental impacts would be similar to those of Plan 3.

Plan 4. Removal of shoal material by pipeline dredge and the transfer of this material to the Daniels Island disposal area and Area I just above Goose Creek, which areas would function as temporary disposal areas until the material could be transported to an offshore disposal area by pipeline. This plan is identical to Plan 3 except that approximately 20 percent of the shoal material would be initially pumped into Area I instead of entirely into the Daniels Island disposal area. This plan was developed in an effort

to reduce costs by using a temporary area closer to the shoals in the upper part of the harbor project. The estimated annual cost of this plan is $4,759,000. Its environmental impacts would also be similar to that of Plan 3.

Plan 4A. This plan is identical to Plan 4 except that diesel powered booster units would be used instead of electric power units. The estimated annual cost of this plan is $4,821,000. Its environmental impacts would be similar to those of Plan 4.

Plan 5. Removal of shoal material by pipeline dredge and the transfer of this material to the Daniels Island disposal area, which would function as a temporary disposal area until the material could be transported to an offshore disposal area by barge. The estimated annual cost of this plan is $5,325,000. The environmental impacts of this plan most closely resemble those of Plan 2 in that under both plans, all of the dredged material is transported to the offshore disposal area where it would be discharged at the waters surface.

Plan 6. Removal of shoal material by pipeline dredge and the transfer of this material to the Daniels Island disposal area and Area I just above Goose Creek, which areas would function as temporary disposal areas until the material could be transported to remote inland disposal areas by pipeline. This plan is similar to Plan 4 except that the material would be transported to diked inland disposal areas instead of to the offshore disposal area. The tentative location of inland disposal areas is along the Mando River. Most of these areas would be high land but some higher marshland would be included. Major tidal creeks would be avoided. This represents a compromise between economics (land costs) and marsh preservation. The estimated annual cost of this plan is $4,247,000. Complete avoidance of all marsh land would increase the costs of this plan. All vegetation in these disposal areas would be killed

and these areas would lose what value they may have as wildlife habitat. Each area may be used for some years so that this loss represents a fairly long-term commitment. When filled to capacity, these areas will be revegetated and eventually tree growth characteristic of upland habitat will become established. In the upland areas, this tree growth may be similar to the natural growth present before their use as disposal areas. The use of high marsh areas will result in their permanent conversion to upland tree habitat after they have been used to capacity. The loss of this high marsh represents a loss of some of the least productive of estuarine areas. The upland habitat that would be taken out of productivity for a relatively long time is a common habitat type throughout the area.

Plan 7. This plan is similar to Plan 6 except that the dredged material would be transported to the remote inland disposal areas by truck instead of by pipeline. The estimated annual cost of this plan is $10,672,000, which is considered excessive in comparison with other plans. The environmental impacts would also be similar to those of Plan 6.

Plan 8. Removal of shoal material by a special dredge designed to utilize barges and the use of these barges to convey the material directly to the offshore disposal area. This plan is similar to Plan 2 except that the dredged material would be transported to the offshore disposal site by barge instead of by hopper dredge. The estimated annual cost of this plan is $2,710,000. The environmental impacts would also be similar to those of Plan 2.

7.0. The Relationship Between Local Short-Term Uses of Man's Enviornment and the Maintenance and Enhancement of Long-Term Productivity.

7.01. The principal long-term effect of the project relates to its stimulus of the local and regional economy which would result from improved navigability of the deeper channels in the harbor. These deeper channels would permit the unrestricted use of the harbor by most of the larger ships which now must either use other ports or use Charleston Harbor light-loaded.

7.02. The principal short-term effects of the project relate to the actual deepening of Charleston Harbor by hydraulic dredge and the disposal of the material so dredged in remote disposal areas. Since the first feature represents the removal of recently deposited and unconsolidated fine sediments having little utility to any important life forms, the actual deepening would not conflict with other long-term uses. The action of the cutterhead dredge would have temporary and localized effects on water quality which are not considered to be of a magnitude to affect long-term productivity. If inland disposal areas are used, the effluent from such areas would also have a temporary and localized effect on water quality.

7.03. The disposal of the material dredged from the harbor has some potential for long-term consequences depending on the means and method taken for its final disposal. Two plans have been recommended for further consideration. The plan providing for offshore disposal of all dredged material has an undetermined potential for adversely affecting biological productivity in the offshore disposal areas. The other method which involves the disposal of dredged material in remote inland sites will result in long-term losses of natural areas and the utility these areas may for wildlife. These areas have not been definitely selected, but

will not include any areas that are critical or have outstanding value in any particular resource.

5.5. As Irreversible or Irretrievable Commitments of Resources which would be Involved in the Proposed Action Should it be Implemented.

The project will not cause any known significant commitment of resources given its anticipated beneficial uses of the local environment. Certain resource commitments will be required for the disposal of material dredged from the harbor. Upland disposal areas will consist initially of naturally vegetated habitats and non-vegetated flats which will persist during the period they are used for disposal of dredged material. When used to capacity, these disposal areas will go through a vegetative succession beginning with grasses and herbs and ending with trees or shrubs that will generally consist of pine and mixed hardwoods. If no significant impacts on the offshore biota have been detected, the continued use of this area for disposal of material dredged from the inner harbor should not represent a permanent commitment of resources in this area.

The proposed project will involve a total commitment of the resources of oil required for dredge operations during the construction period.

9.0. Coordination With Others.

9.01. A public meeting was held on 29 May 1968 to obtain the views of the public regarding proposed navigation improvements in Charleston Harbor and various methods of disposing of dredged material. All in attendance at this meeting expressed a desire for harbor improvements in the interest of economic development. Some expressed concern regarding the effects of dredging on environmental values.

9.02. A second public meeting was held on 20 June 1974 to inform the public of the status of project studies and to solicit the views and comments of public and private interests on the preliminary findings. The majority of those in attendance expressed approval of the proposed development and a desire for prompt implementation of the project. A few expressed doubts about the need or practicality of the proposed project and questioned its desirability in view of what were seen as significant adverse environmental impacts.

9.03. In response to a request to the U. S. Fish and Wildlife Service for an evaluation of the effects of dredging and of various disposal methods on the area ecosystem, the Service formed an ad hoc committee of experts in affected natural resource fields to develop and coordinate a plan of study and to evaluate the results of these studies. As a result of the recommendations of this committee, the following reports were prepared under contract to the U. S. Army Corps of Engineers:

a. A report on regional and local stratigraphy and sedimentation in the Charleston Harbor area, Department of Geology, University of South Carolina, D. J. Colquhoun.

b. Bioassay studies, Charleston Harbor, South Carolina; and The effects of dredging harbor sediments on Plankton, Belle J. Baruch Coastal Research Institute, University of South Carolina.

c. Effects of dredged harbor sediments on larval estuarine fish common to Charleston Harbor, South Carolina, National Marine Fisheries Service, Beaufort, North Carolina.

d. A study of the Charleston Harbor Estuary with special reference to deposition of dredged sediments, Office of Marine Conservation, Management and Services, South Carolina Wildlife and Marine Resources Department.

The ad hoc committee administering these studies is chaired by a representative of the U. S. Fish and Wildlife Service and this agency will prepare and submit a report containing the conclusions and recommendations of the Service relating to the proposed project.

9.04 Coordination of draft EIS.

a. Government agencies.

U. S. Department of Agriculture, Soil Conservation Service

Comment: Appropriate members of my staff have reviewed the draft environmental impact statement for the Charleston Harbor Deepening Project and we have no comments to offer.

Response: No response is required.

Department of Health, Education, and Welfare

Comment: We have reviewed the subject draft Environmental Impact Statement. Based upon the data contained in the draft, it is our opinion that this proposed action will have only a minor impact upon the human environment with respect to the concerns of this Department.

Response: No response is required.

Federal Power Commission

Comment: A review of the report indicates that the proposed plan would have no significant effect on such facilities. However, if there are any electrical power transmission facilities or natural gas facilities existing in the vicinity, these should be protected during construction.

Response: Any electrical power transmission facilities or natural gas facilities existing in the vicinity will be protected during construction.

U. S. Department of Interior

1. Comment: We are pleased to note that initial steps have been taken to comply with the requirements of the Advisory Council on Historic Preservation's "Procedures for the Protection of Historic and Cultural Properties" (Federal Register Section 800, January 25, 1974).

(4) The National Register of Historic Places lists known cultural (historic, archeological, architectural) resources. It is the responsibility of the constructing or licensing agency to identify such resources in the area of project impact which may be eligible for nomination or in the process of nomination, as well as those already listed in the National Register.

(5) Because cultural resources are nonrenewable, special care should be taken to preserve them and minimize project impacts upon them. The State Historic Preservation Officer should be consulted for information on cultural properties and his comments included in the final statement. If there are areas within the zone of project impact that have not been professionally evaluated, then it is the responsibility of the Federal agency to see that such an evaluation is made. Results of the evaluation should also be included in the final statement. Significant cultural resources, especially those subsurface or underwater, which are subject to destruction or damage by the project should be salvaged.

Response: (a) The proposed project as presently defined will not affect any property listed on the National Register of Historic Places or any property that is eligible for nomination to the Register. If the proposed project is authorized by the Congress, historical aspects will be considered during post authorization planning.

(b) The EIS has been coordinated with the State Historic Preservation Officer. Every effort will be made to protect and salvage any items of historical or cultural significance that may be uncovered during project construction.

3. Comment: We suggest that a clarification be made to differentiate "recommended channel deepening" and "recommended deauthorization" in figure 3.

Response: The differentiation has been clarified in the Final EIS.

3. Comment: 1.0 Project Description:

(a) The term "upland disposal" is defined on page 22 as "disposal above the highwater mark." Throughout the statement the term "upland" is used frequently, without further explanation. The term "upland" appears to have been used only as a means to differentiate areas that are above from areas that are below the mean high water line. We believe such a usage is misleading and suggest it be clarified.

Response: As stated on page 22, the phrase "disposal above the high-water mark" is terminology used by the EPA in their letter dated 29 November 1972. The assumption that upland refers to areas above the mean high water line is correct.

4. Comment: 1.04:

The last paragraph indicates that approximately 1,110 acres of new diked disposal areas would be needed, probably on Daniel Island proper. It is our understanding that these disposal areas have not been selected. The environmental impact statement should either provide a general description of the probable locality on Daniel Island or state why such a description has been omitted, e.g., that a disposal area has not been selected.

Response: The acquisition of disposal areas, which is the responsibility of the State of South Carolina as the project sponsor, will not be accomplished until after the project is authorized by the Congress. However, a general description of the areas used for cost estimates has been added to Section 2.13 of the EIS.

5. Comment: 2.0 Environmental Setting Without the Project: 2.07.3:

No mineral production has been recorded in recent years in Charleston County. Sand, an abundant resource in the area, has been produced in the recent past in the county. The statement indicates that, "The Charleston area. . . was formerly the most productive area of phosphate in the state," (but) ". . . mining in the area has been insignificant since 1920 and ceased entirely in 1938. . . "

Investigations by the U. S. Geological Survey indicate the presence of heavy minerals on James Island and on nearby Isle of Palms and Folly Beach. However, the statement does not indicate the possible presence of heavy minerals in the project area. Section 2.07.3 should be expanded to reflect consideration of heavy minerals as potential resources. The impact of the project on these resources should be discussed in sections 4.0, 5.0 and 8.0.

Response: Heavy mineral resources on James Island and on nearby Isle of Palms and Folly Beach will not be affected by the proposed project. As a result, a detailed discussion of these resources would add little to the EIS.

6. Comment: 2.16:

We suggest the statement contain maps of sufficient scale to clearly depict the location of all cultural resources in the Charleston area within the zone of project impact.

Response: Other than existing navigation channels, the only area to be affected by the project is the upland disposal area which will not be acquired by the project sponsor until the project is authorized by Congress. Cultural resources of any potential disposal site will be considered during post authorization studies. A map showing the location of all cultural resources in the Charleston area would add little to the EIS since these resources will not be affected in any way by the project.

7. Comment: 4.0 The Probably Impact of the Proposed Action on the Environment:

(a) The entire perimeter of the Daniel Island site, as shown by a comparison of figures 4 and 10, is near sea level and must be marsh unless the former marsh has already been destroyed by spoil deposition. Such deposition on marshland has not been indicated on figure 10, nor has it been mentioned in the text. Figure 10 also shows that the former disposal area is diked and that the spoils were clearly deposited on marshland, as the perimeter of the spoil area is ringed by surviving marsh. The fact that all present spoil areas shown on figure 4 extend to the water's edge, or beyond, suggests that marsh bordering the shore will inevitably be destroyed, or already has been during recent disposal operations. We suggest these apparent discrepancies be clarified.

(b) It is stated that "The Charleston Harbor estuary contains thousands of acres of productive salt marshes, none of which would be affected by the proposed project since dredged materials would be disposed of on upland sites or in approved offshore areas." We feel that this statement needs to be supported by map documentation, as maps now provided (e.g., figure 10) suggest that the disposal areas delineated on figure 4 include considerable marsh. That map is highly generalized with regard to disposal area limits, being at a scale of only 1:175,000 (about 2.7 miles equal 1 inch). Disposal areas should be delineated in sufficient detail to show the location of existing or proposed dikes with respect to shorelines, tidal inlets, and the limits of marshlands.

Response: (a) Figure 4 was included in the EIS to give the reviewer a general overview of the locations of disposal areas used for past and present Charleston Harbor maintenance dredging. These disposal areas have, in most cases, been used for several years for the deposition of materials generated by maintenance dredging and are not going to be used for the harbor deepening project. Dredged materials generated by the proposed project, as discussed in the EIS, will be

deposited on (1) upland areas on and north of Daniel Island which are not delineated on Figure 4, (2) in an existing disposal area on Morris Island, and (3) in an approved offshore area.

Figure 10 is a reproduction of an old navigation chart of the Wando River and was included only to show the location of sediment sampling stations in the Wando River. The boundary shown for the Daniel Island disposal area is not an accurate representation of the current boundary.

(b) As discussed in the EIS, the only areas being considered for disposal of dredged materials generated by the harbor deepening project (both initial construction and maintenance dredging) are upland areas on and northward of Daniel Island, an existing disposal area on Morris Island, and an approved offshore area. As a result, the statement paraphrased in paragraph (b) of this comment is correct since none of the productive marshes in Charleston Harbor will be affected by the deepening project. A detailed delineation of disposal areas in the harbor as requested in this comment is not considered to be necessary since none of the existing areas will be utilized, however, a description of these areas has been added to Section 2.13 of the EIS.

8. Comment: 4.04:

The National Register lists only known cultural resources. The construction agency cannot take for granted that all such resources in the project area are known. Despite the fact that most of the material to be removed by dredging has been deposited in modern times, it is possible that historic shipwreck sites will be disturbed. Charleston Harbor and the mouth of the Cooper River were extensively utilized by naval vessels during the Revolutionary and Civil Wars, and many ships were sunk in this vicinity. Although modern debris would make a preproject underwater survey impractical, arrangements should be made to notify the Office of the State Archeologist in the event evidence of historic shipwreck is revealed during dredging so that artifactural material may be salvaged and preserved.

Response: The Office of the State Archeologist will be notified in the event evidence of an historic shipwreck is revealed during dredging so that artifactural material may be salvaged and preserved.

9. Comment: 4.10:

Reference is made to the Cooper River Rediversion project. This reference should be expanded to stress the significant relationship of this project to the future of the Charleston Harbor project. It should be spelled out that the long-term planning presented in this environmental impact statement is based on the assumption that the rediversion project will be completed, and without rediversion, the environmental impact statement would require major revision.

Response: A detailed discussion of the relationship between the harbor deepening project and the Cooper River Rediversion project has been added to the referenced section.

10. Comment: 6.0 Alternatives to the Proposed Action:

The special studies conducted at the request of the Corps of Engineers resulted in the recommendation by the Fish and Wildlife Service that the most desirable alternative to sea disposal environmentally would be disposal in diked areas located inland above the marshes. We believe the environmental statement should be expanded to discuss the consideration given to such an alternative.

Response: As discussed in the EIS, materials dredged from the entrance channel could be placed in an approved offshore area, materials dredged from the turning basin would be placed in the Morris Island disposal area and materials dredged from the harbor and Shipyard River will be placed on upland areas of Daniel Island which are located inland of the marshes. The impacts of these various disposal methods are discussed in detail in Section 4 of the EIS.

Environmental Protection Agency

1. Comment: We have reviewed the Draft Environmental Impact Statement for the deepening of Charleston Harbor and Shipyard River in South Carolina and find that exceptionally good coverage is given to the overall environment. However, there are several areas of concern to which further consideration should be given: (1) A better description of each of the upland disposal sites, (2) a detailed account of the biota on these sites, and (3) the effect of disposing of soil containing saltwater on these sites.

Response: The acquisition of disposal areas, which is the responsibility of the State of South Carolina as the project sponsor, will not be accomplished until after the project is authorized by the Congress. Although the selection of specific disposal areas is an item of post-authorization planning, the project sponsor has indicated that it is desirable from his position that these disposal areas be located on and northward of Daniel Island and on Morris Island. A general description of existing disposal areas and those areas used for cost estimates has been added to Section 2.13 of this EIS.

2. Comment: Furthermore, although eight plans for the disposal of spoil are discussed, it does not appear that any decision has been made as to which plan will be used. It is noted, however, that in the Interim Review of Reports on the Charleston Harbor, preference is given to disposal of materials at sea via special dredge and barge (Plan 8). It is also noted that implementation of Plan 8 is conditional to favorable findings of a pilot program indicating that dredged material can be properly transported and disposed of at sea.

It is stated further that the most desirable alternative to sea disposal (economically and environmentally) would be disposal in diked areas located inland above the marshes (Plan 6).

[illegible] environmental reservations concerning these alternatives [illegible] the need for additional information. Consequently, [illegible] a rating of 3-2 to the project and Impact [illegible].

[illegible] with regard to the possible [illegible] on groundwater aquifers and on inland vegetation, including trees, [illegible] alone drainageways leading from the proposed [illegible] sites.

[illegible] during the course of the long-range study of disposal [illegible] material, [illegible] discussed in Section 1.05 of the draft [illegible], eight plans were evaluated to determine feasibility and cost of meeting the dredging requirements for Charleston Harbor and related projects for a 50-year period, 1965 to 2024. The purpose of this study is explained in greater detail in Section 1.05 of this [illegible]. The recommended method of disposal of dredged material for [illegible] project was developed partially from input of this long-range study and is described in Section 1.04 on page 3 of the draft [illegible]. The recommended plan differs from each of the eight plans evaluated in the long-range disposal study, and the reasons for its adoption are also discussed in Section 1.04 on page 4 of the draft [illegible]. It is pertinent to note that the EPA informed the Corps by letter dated 29 November 1977 that the evaluation and interpretation of [illegible] of bottom sediment samples from Charleston [illegible] indicated that all sediment upstream from the [illegible] Ashley and Cooper Rivers to Hog Island and Drum Island to Cummings Point [illegible] was suitable for inland areas, and that sediment outside [illegible] would be suitable for hopper dredge and disposed of offshore. [illegible] the recommended plan, the environmental reservations [illegible] disposal methods appear unwarranted [illegible] specific recommendations of EPA on how [illegible] were adopted.

3. Comment: We also recommend re-evaluation of Plan 8 in light of the Final Regulations and Criteria for Ocean Dumping published in the Federal Register of October 15, 1973 (Volume 38, No. 198, Part III). Tests should be made of materials to be dredged (as outlined in Chapter 227,61) to determine whether spoil is polluted, in accordance with the new regulations. If such materials are found to be polluted, special attention should be given to Chapter 227.64 which states in part: "Polluted dredged material may be disposed of in the ocean if it can be shown that the place, time, and conditions of dumping are such as not to produce an unacceptable adverse impact on the areas of the marine environment cited in 227.60 (c)." The proposed pilot study should determine whether this is feasible.

Response: A similar comment is discussed in response to comment number 2 of this letter. As discussed in the EIS, the only materials which will be disposed of in the offshore area are those non-polluted sediments to be removed from the entrance channel by hopper dredge, as recommended by the EPA in their letter of 29 November 1972.

4. Comment: Chapter 4.03.1 should give a more complete description of vegetation on the upland sites and of the possible effect of salt-water on this vegetation.

Response: A general description of vegetation on the upland sites has been included in Section 2.13 of this EIS. Also see response to comment 1 of this letter. As stated in Section 4 of this EIS, upland vegetation will be destroyed in disposal areas.

5. Comment: Chapter 5.02 should include a description of the upland vegetation affected on the various sites. This should include an

evaluation of whether areas other than the actual disposal site may be affected, such as drainageways leading from the site, with a resultant reduction in aesthetics and property values in the area.

Response: A similar comment is discussed in response to comment number 1 of this letter.

6. Comment: Chapter 2.08 should re-evaluate the data outlined. This is necessary because of the new ocean dumping regulations; however, EPA's conclusions that certain sediments are polluted is still valid for inland waters (our letter of November 29, 1972).

Response: A re-evaluation of the data presented in Section 2.08 of this EIS is not considered necessary since materials removed from the inner harbor will be disposed of in upland areas. Also see responses to comments 2 and 3 of this letter.

7. Comment: We also find the Statement contains discrepancies and contradictions regarding benthic populations, the effect of the project on such populations, and recovery.

Response: There are no discrepancies or contradictions regarding benthic populations.

8. Comment: It is stated (paragraph 4.035.1) that toxic sediments have "essentially eliminated all benthic organisms from the harbor bottom." However, paragraph 4.03.6.2 states that the smothering of benthos at the ocean disposal site will be short-term as the destroyed organisms will be "replaced by recruitment from surrounding areas." We suggest that if this material is toxic enough to eliminate benthic organisms in the harbor its toxicity should also preclude repopulation at the disposal site.

Response: As stated in the EIS, materials dredged from the harbor bottom referred to in paragraph 4.03.6.1 (4.03.5.1 in the draft EIS)

will be disposed of on upland areas of Daniel Island and not in the offshore disposal area. Only non-polluted materials removed from the entrance channel by hopper dredge will be placed in the offshore disposal area. Therefore, the impacts presented in Section 4.03.n.2 of this EIS are correct.

9. Comment: We further suggest that if the channel bottoms are devoid of benthic organisms, the discussion (paragraph 4.03.7.1) of resuspension of invertebrates into the water column at the dredged and disposal sites by ocean disposal operations is not relevant to this project.

Response: As stated in the response to the preceeding comment, the channel bottoms that are devoid of benthic organisms are located in the inner portion of the harbor. The discussion referred to in Section 4.03.7.1 applies to the dredging of material from the outer harbor and its deposition in the offshore disposal area.

10. Comment: Paragraph 4.03.7.4 says studies show that fish will avoid turbid waters if possible. This, too, indicates that any feeding at the disposal site will be limited because of high turbidity. Further, it is indicated that the dredged material may increase the BOD, while paragraph 4.03.7.5 reveals that, although fish can tolerate high turbidities, they cannot do so when turbidity is accomplished with high BOD.

Response: Section 4.03.7.5 contains a general statement about the interaction of certain water quality parameters insofar as they normally affect fish life. The EPA incorrectly states that this Section reveals that fish can not tolerate high turbidities in the presence of high BOD. This section does not specifically mention BOD. However, it is assumed that the above comment is directed to the impacts of increased turbidities in the offshore disposal area. As discussed in the EIS, materials which will be placed in this offshore area will be dredged from the entrance channel by hopper dredge. These materials

are mostly coarse-grained and contain only small quantities of organic material and silt. As a result, it is not anticipated that turbidities generated by the hopper dredge will be sufficient to significantly affect fish populations.

11. Comment: Finally, it is noted that the peninsula of Charleston has a particulate problem, often greatly exceeding national primary standards for ambient air quality. Because of this problem, we recommend that the final environmental impact statement give assurance that contributions of dust will not accrue from transportation, temporary storage or permanent land storage of dredged material.

Response: Air quality on the Charleston peninsula becomes a problem only during temperature inversions. These inversions persist only during periods of low wind speed. In view of the considerable distance across the Cooper River, it is extremely unlikely that a wind of sufficient velocity to carry dust from a disposal area on Daniels Island would be insufficient to break up the inversion over the peninsula. Morris Island is further yet from peninsular Charleston. Furthermore, the dredging operation for the deepening project will be similar in all respects to the dredging requirement for the existing project, and the existing project has never created any dust problems. Because this problem is in the nature of one having little or no probability of ever materializing, it is not considered necessary to address it in the EIS.

12. Comment: In addition, in paragraph 4.06, the types of pollutants expected should be identified, and the word "temporary" should be clarified since continued maintenance and dredging will be required.

Response: The pollutants referred to in this paragraph would be of the type normally expected in exhaust gases from diesel and gasoline powered internal combustion engines which are used to power the dredge and its support vessels. Since the number of engines involved is very low, and the dredging operation is continually moving, it is highly

unlikely that pollutants will be measurable at existing air quality stations. Since the dredge is not now nor will it become a permanent fixture in the harbor, the impacts on air quality in any given locality are considered to be temporary.

U. S. Department of Commerce

1. Comment: 1.0 Project Description

1.04 Proposed Dredged Material Quantities and Placement Plan

Page 9, paragraph 3. This paragraph is not clear with respect to the location of the 1,110 acres required for diked upland disposal or the 39 acres needed annually for disposal of additional shoal material generated each year as a result of harbor deepening. The statement should describe and specify the location of these areas.

Response: A similar comment has been discussed in response number 4 to letter from the U. S. Department of Interior.

2. Comment: 2.0 Environmental Setting Without the Project

2.13 Biological Resources

2.13.4 Commercial Fisheries

Page 57, paragraph 2.13.4.1. If the statement indicating that "... a total of 363,600 pounds or 8,054,000 herring were harvested ... were this, the average weight of these herring would be [illegible] ounces. We urge that these values be verified.

Response: The total number of fish harvested has been corrected in the [illegible].

3. Comment: 3.0 The Probable Impact of the Proposed Action on the Environment

3.04 Maintenance Dredging

Page 84. The location and description of the 49-acre upland disposal site must be given before the impacts of maintenance dredging can be predicted. We suggest that this section be readdressed after the disposal site has been selected.

Response: The project sponsor has indicated that the 49 acres would be located on or northward of Daniel Island but cannot make a definite committment on the exact location of these areas until the project is authorized by Congress.

4. Comment: 4.10 Existing Projects

Page 85. Since the proposed project would have a favorable cost-benefit ratio at a lesser depth without the Cooper River Rediversion Project, we recommend that this section be expanded to consider the possibility and the consequences of not rediverting the Cooper River. For example, if the Cooper River were not rediverted, what depths would result in a favorable cost-benefit ratio for the Charleston Harbor project, and what would be the impact of the required dredging on the quantity of dredged material and the area needed for its disposal?

Response: If the Cooper River were not rediverted, the deepening project would have a favorable benefit/cost ratio at 38 feet instead of 40 feet for Charleston Harbor and 35 feet instead of 38 feet in Shipvard River. These major changes in depth result from the large quantity fo shoal material which would have to be removed annually. In addition to the added expense of dredging, approximately twice as many acres of disposal area would be required during the life of the project.

Additional information on the dredging requirements of the Charleston Harbor Deepening Project under a condition of no rediversion of the Cooper River has been added to the EIS.

U. S. Coast Guard

Comment: As requested in your letter of 24 September 1974, the subject EIS has been reviewed by this office and no conflicts within Coast Guard mission areas were noted.

Response: No response is required.

Advisory Council on Historic Preservation

Comment: This is in response to your request of September 24, 1974, for comments on the environmental statement for Charleston Harbor Deepening Project, Charleston, South Carolina. Pursuant to its responsibilities under Section 102(2)(C) of the National Environmental Policy Act of 1969, the Advisory Council on Historic Preservation has determined that while you have discussed the historical, architectural, and archeological aspects related to the undertaking, the Advisory Council needs additional information to adequately evaluate the effects on these cultural resources. Please furnish additional data indicating:

Compliance with Executive Order 11593 of May 13, 1971.

a. In the case of land under the control or jurisdiction of the Federal Government, a statement should be made as to whether or not the proposed undertaking will result in the transfer, sale, demolition, or substantial alteration of potential National Register properties. If such is the case, the nature of the effect should be clearly indicated.

b. In the case of lands not under the control or jurisdiction of the Federal Government, a statement should be made as to whether or not the proposed undertaking will contribute to the preservation and enhancement of

non-federally owned districts, sites, buildings, structures, and objects of historical, archeological, architectural, or cultural significance.

c. We are particularly concerned about the effects of dredging and disposition of spoils on archeological resources.

d. To insure a comprehensive review of historical, cultural, archeological, and architectural resources, the Advisory Council suggests that the environmental statement contain evidence of contact with the appropriate State Historic Preservation Officer and that a copy of his comments concerning the effects of the undertaking upon these resources be included in the environmental statement. The State Historic Preservation Officer for South Carolina is Mr. Charles Lee, Director, Archives Department, 1430 Senate Street, Columbia, South Carolina 29211.

Response: a. The suggested statement has been included in this EIS.

b. The suggested statement has been included in this EIS.

c. A similar comment has been discussed in response to comments 1 and 8 in the letter from the U. S. Department of Interior.

d. The Draft EIS was coordinated with the State Historic Preservation Officer through the State Clearinghouse. Comments received during this coordination will be included in this EIS.

South Carolina State Ports Authority

Comment: The State Ports Authority expressed support for the project and provided information on the importance of the project to the shipping industry and on the impact of the State Ports Authority on South Carolina's economy. They also urged that the project proceed on the basis of using upland areas for the disposal of dredged materials but recommended that ocean disposal be implemented as soon as possible.

Response: The proposed project is essentially as recommended by the State Ports Authority and no further response is required.

South Carolina Wildlife and Marine Resources Department

1. Comment: As you know, the above is focused on improvements of Charleston Harbor and existing ship channels to accommodate deep-draft vessels which are so prevalent today with the adoption of containerization. Modern trends clearly indicate that the present 35-foot channel depth is not adequate for a competitive port city. Although this project may be justified, the problem of dredged materials disposal in this case, 27 million cubic yards, is a major factor to consider in evaluating the EIS.

This Department conducted an estaurine values study under contract to the Corps of Engineers and our results and recommendations are adequately reflected in the EIS. In general, the EIS presents an accurate project description and the probable impact of the proposed work is well summarized. In our review, we found several details which should be commented on as a matter of suggested revision in the final draft. They are as follows:

Response: No response is required.

2. Comment: We do not necessarily agree with the recommendation on Page 6 concerning disposal alternatives. The disposal of materials at sea is not the most desirable alternative under all circumstances. In our opinion, upland disposal in selected diked areas would be far more desirable as well as safer than offshore disposal. We feel relatively confident that biological repercussions would occur if toxic sediments were dumped at sea.

Response: As stated on Page 6 of the draft EIS, the recommendation for offshore disposal of dredged material was submitted by the Bureau of Sport Fisheries and Wildlife as being the most desirable method of disposal but is not the method recommended for this deepening project. The recommended plan of disposal provides for the disposal in upland areas of material dredged from the inner harbor and for offshore disposal of material dredged from the entrance channel.

3. Comment: On Page 3, it is stated that approximately 1,110 acres of diked upland disposal area would be needed for the deepening project. We suggest that the impact of disposal in this area be described and the area be specified as to the selected nature of the site. We can only assume it is on Daniel Island, but there is no information on type of habitat displacement.
Response: A similar comment has been discussed in response number 4 to letter from the U. S. Department of Interior and response number 1 to letter from the Environmental Protection Agency.

4. Comment: On Page 85, the rediversion project is briefly mentioned as it relates to benefit-cost ratio. It should be expanded relative to its overall importance to the harbor maintenance project in the future. Quantitative predictions on decreased sediment rates with rediversion should be included. Also, it appears that a statement is necessary to explicate the status of the EIS in the event that rediversion does not occur.
Response: Additional information has been added to Section 4.10 of this EIS.

5. Comment: On Page 97, Reference 7.03 and 8.0, offshore disposal especially of polluted bottom sediments could have long-term effects on certain types of bottoms such as natural reefs, sea bass banks, etc. These effects could be more serious than inland disposal on relatively barren areas. We feel that the statements under 7.03 and 8.0 are too general in comparing the potential effects of offshore versus inland disposal.
Response: Section 7.03, which contains specific reference to the disposal plan that provided for the offshore disposal of all dredged material has been revised to indicate that this plan could have adverse effects on the offshore biota. Section 8.0 is a discussion

of the irreversible and irretrievable commitments of resources that would be required of the recommended plan. The recommended plan provides for offshore disposal of only that material dredged from the outer harbor, and this has been clarified in this section. More detailed discussions in Section 7 and 8 would be repetitious of material in Sections 4 and 5.

6. Comment: Appendix B - A comprehensive listing of birds, mammals, etc., is presented. The river otter (Lutra canadensis) and harbor seal (Phoca vitulina concolor) should be added to the list. The invertebrates list is incomplete and should be broadened to include the more common species such as Palaemonetes spp., squid (Loliguncula), Polynoidae, hooked mussel, etc.

The scientific names for white shrimp and the eastern mud snail are [illegible].

Response: Voluminous appendices such as Appendix B are not included in EIS's prepared subsequent to the draft EIS unless major revisions are suggested during coordination of the draft EIS. The additions and corrections suggested above have been noted, however, they are not considered to be significant enough to warrant the inclusion of a revised Appendix B in this revised draft EIS.

7. Comment: Page 93, plan #2 - Although hopper dredge material dumped in the offshore disposal area has not been found to have adverse effects on the dumping area, it should be pointed out that most of the silt and fine materials of the harbor bottom are not retained by the hopper dredge and go back overboard on site. The effects of this material, especially if in areas where toxic sediments occur, could be significant. The fact that material in the upper Harbor, as pointed out, is of a finer nature than in the area now dredged, magnifies this problem rather than reduces

it as implied here. Our observations indicate that a significant percentage of the dredged materials are stirred up by the action of the dredge and rather than being retained in the hopper, are merely pumped back overboard causing turbid conditions. The resulting turbidity probably has as much effect on the marine biota as deposition of these materials on the dumping grounds. The fate of resulting turbid masses depends on prevailing winds and currents Thus, such turbid conditions could become problematical during seasonal runs of postlarval shrimp and fish.

Response: This part of the revised draft EIS has been revised to show that the biological productivity of the offshore area could be reduced if polluted sediments from the inner harbor are deposited there.

b. Citizens and citizen groups

South Carolina Electric and Gas Company

Comment: These remarks address the Draft Environmental Statement of the Charleston Harbor Deepening Project issued September 1974. Page 42, paragraph 2.10.4, the Ashley River Section. You have omitted our Plant Hagood.

Table 7, Page 129, under Berkeley County, and paragraph 2.10.5, Page 31, the 388,750,000 gallons per day should be 462,931,000 gallons per day of cooling and 2,000,000 gallons per day ash sluice water.

Table 9, Page 131, Charleston County, Plant Hagood (see our paragraph 1 above) should be 67.82 million gallons per day and the type treatment should be cooling water and plant process water.

Response: The suggested corrections have been made in this final EIS.

Others

A total of 50 letters (listed below) were received from interested individuals, and various Congressional, business, and shipping interests. All expressed support for the proposed project. Because of their similarity, individual responses were not prepared for these letters. All letters of comment received are attached as Appendix B to this EIS.

Honorable James R. Mann, U. S. House of Representatives
Honorable Clyde M. Dangerfield, State of South Carolina Representative
Honorable James B. Edwards, State of South Carolina Senator
Honorable Harris P. Smith, State of South Carolina Senator
Honorable L. Mendal Rivers, Jr., State of South Carolina Representative
Honorable John E. Bourne, Jr., Mayor, City of North Charleston

Mr. Frank R. Sadler, Airco Alloys and Carbide

Mr. S. Caruso, Amerlux Steel Products Corporation

Mr. Gerald L. Zulli, Amobelge Shipping Corporation

Mr. W. F. Wilson, Associated Container Corporation(USA)

Mr. L. N. Bagnal, Bagnal Lumber Company

Mr. Herman B. Little, Bowman Transportation, Inc.

Mr. E. S. Braswell, Braswell Shipyards, Inc.

Mr. E. M. Olson, Carolina Eastman Company

Mr. E. Randall Swan, Jr., Charleston Branch Pilots' Association

Mr. Thomas E. Thornhill, Charleston Oil Company

Mr. Neil McCaskill, Jr., Coastal Forwarders

Mr. W. W. Williams,Jr., Coastal Steel Forwarders

Mr. John H. Hardwick, Commercial Bonded Warehouse, Inc.

Mr. R. A. Miller, Cryovac

Mr. Currie B. Spivey, Jr., Daniel Construction Company

Mr. Michael A. Galasso, Del Monte Terminal

Mr. Richard P. Coon, E. I. Du Pont De Nemours & Company

Mr. A. A. Hancock, Exxon Company, U. S. A.

Mr. D. M. Russell, General Electric

Mr. Cleveland S. Harley, Harley Corporation

Mr. P. F. Forester, Hoest Fibers Incorporated

Mr. John A. McPherson, Jr., LBC&W Industrial

Mr. H. M. Long, Leigh Textile Company

Mr. E. S. Corbin, Lifetime Doors, Inc.

Mr. T. A. Fridy, Jr., Lockwood Greene Engineers, Inc.

Mr. S. Fox, The Maritime Association of the Port of Charleston

Mr. Jack McCarthy, Greenville, S. C.

Mr. Herbert J. Rocchi, Newton International Corporation

Mr. C. M. Anderson, Overnite Transportation Company

Mr. James P. Lamb, Palmetto Shipping and Stevedoring Co., Inc.

Mrs. Carlotta J. Byers, Pilot Club of Charleston, South Carolina, Inc.

Mr. Michael E. Delaney, Price Paper Corporation

Mr. W. H. Collister, Reeves Controller Division

Mr. L. S. Turner, Saco-Lowell Corporation

Mr. I. B. Hutcheson, Seaboard Coast Line Railroad Company

Mr. James W. Farrah, Seatrain Lines, Inc.

Mr. Charles J. Arocha, South Atlantic Terminals, Inc.
Mr. John H. Lumpkin, South Carolina National Bank
Mr. S. Fox, Southeastern Maritime Co.
Mr. Timothy S. Street, Street Brothers, Inc.
Mr. William Lowndes, III, Tindall Concrete Products, Inc.
Mr. Calvin H. Reed, Utica Tool Company, Inc.
Mr. Robert E. Whiteside, Wilbur Smith and Associates
Mr. E. W. Waring, White Stack Towing Corporation

9.05 Coordination of revised draft EIS.

U. S. Department of Commerce

Response: There are no planned activities which will disturb or destroy any of the tidal bench marks located in the project area.

U. S. Department of the Interior

No response is required.

U. S. Coast Guard, U. S. D. T.

No response is required.

Environmental Protection Agency

1. Response: The provision of disposal areas for the proposed project will be the responsibility of the project sponsor, the State of South Carolina. The project sponsor has indicated that it would be desirable from his position to locate the upland disposal areas on and northward of Daniel Island. Although the exact location of these disposal areas will not be known until the post-authorization stages of planning, a description of those areas used for cost estimates is presented in Section 2.13 of this EIS and the impacts are discussed in Section 4.03.

2. Response: The present diked disposal areas on Daniel and Morris Islands will not be expanded to include new marsh areas when they are filled to capacity. As discussed in several places in the EIS (Sections 1.04, 4.03), disposal areas to be utilized for the

deepening project will be located on uplands on and north of Daniel Island, on Morris Island, and in the open ocean. When existing diked disposal areas are used to capacity, new areas will be sought on uplands near the harbor or some alternative other than marsh disposal will be utilized. In any event, in view of the high premium now placed on estuarine marshes, it is considered unlikely that new disposal areas in the marsh zone will be acquired when existing areas are depleted. Also see response number 1 above.

3. Response: Sediments in Charleston Harbor have not been tested using the new EPA criteria to determine whether or not any of the sediments upstream from the harbor entrance on a line from Sullivans Island to Cummings Point are now suitable for ocean disposal. However, such studies will be conducted in the near future.

Department of Health, Education, and Welfare

No response is required.

Forest Service, USDA

No response is required.

Soil Conservation Service, USDA

No response is required.

S. C. Water Resources Commission

Response: Sedimentation rates with and without rediversion are presented in [illegible].

[illegible] Control,

[illegible]

Response: [illegible] diked disposal [illegible] Every [illegible] Mosquito Abatement [illegible].

[illegible] Environmental Control [illegible] Environmental Health and Safety

[illegible] the [illegible] will

2. Response: The production of mosquitoes in disposal areas is greatly influenced by the physical characteristics of soil within the disposal area. When disposal areas have been selected, the Department of Health and Environmental Control will be consulted about measures to reduce mosquito production.

S. C. Wildlife and Marine Resources Department

Response: Quantitative predictions on decreased sedimentation rates with and without the proposed deepening project have been added to Table 1 of this EIS.

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Cronin, L. E., Summary, conclusions, and recommendations. 15 p.
Biggs, R. B., Geology and Hydrology. Project A. Ref. No. 69-23. 36 p.
Flemer, D. A., Phytoplankton. Project B. Ref. No. 69-15. 15 p.
Pfitzenmeyer, H. T., Benthos. Project C. Ref. No. 69-130. 30 p.
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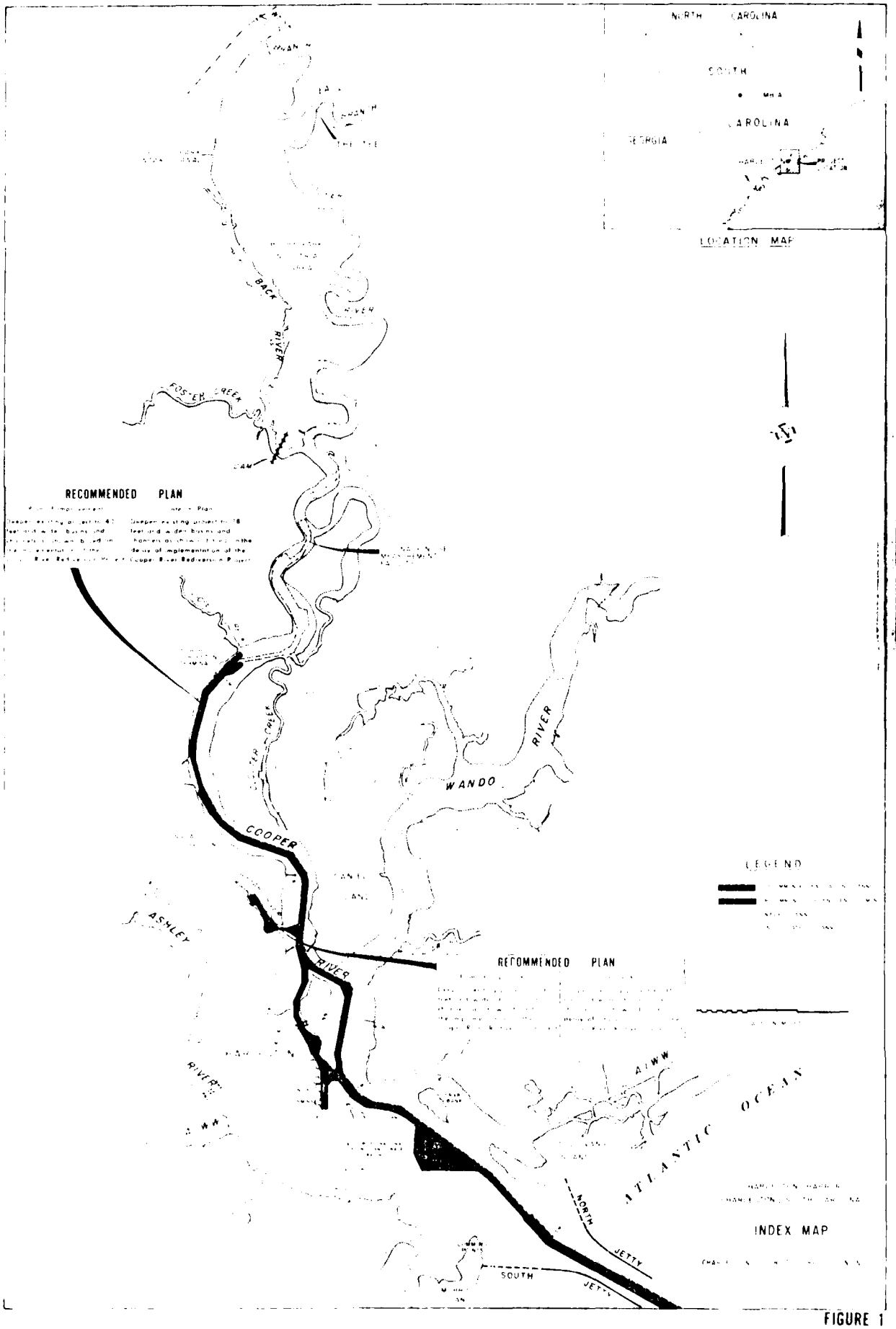
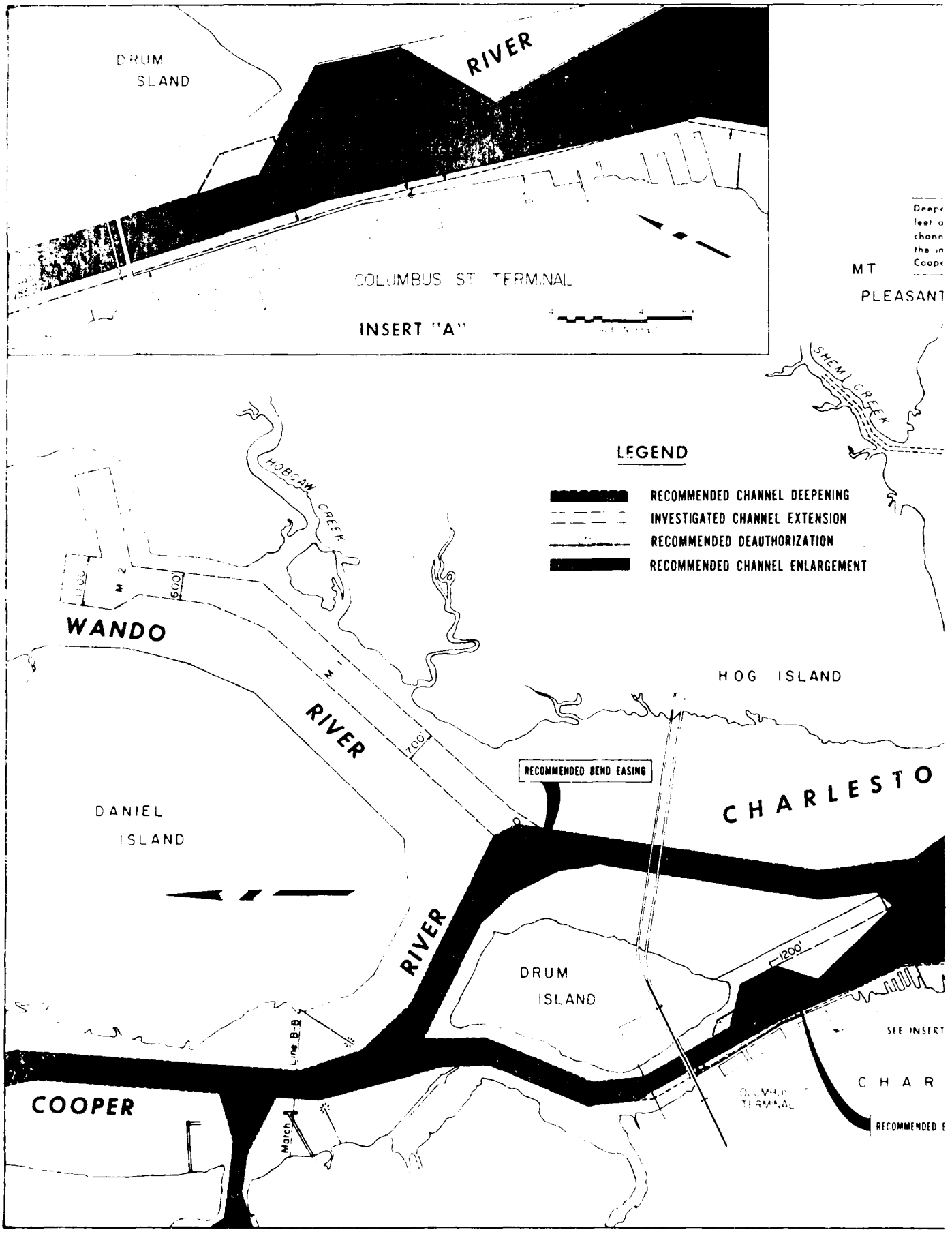
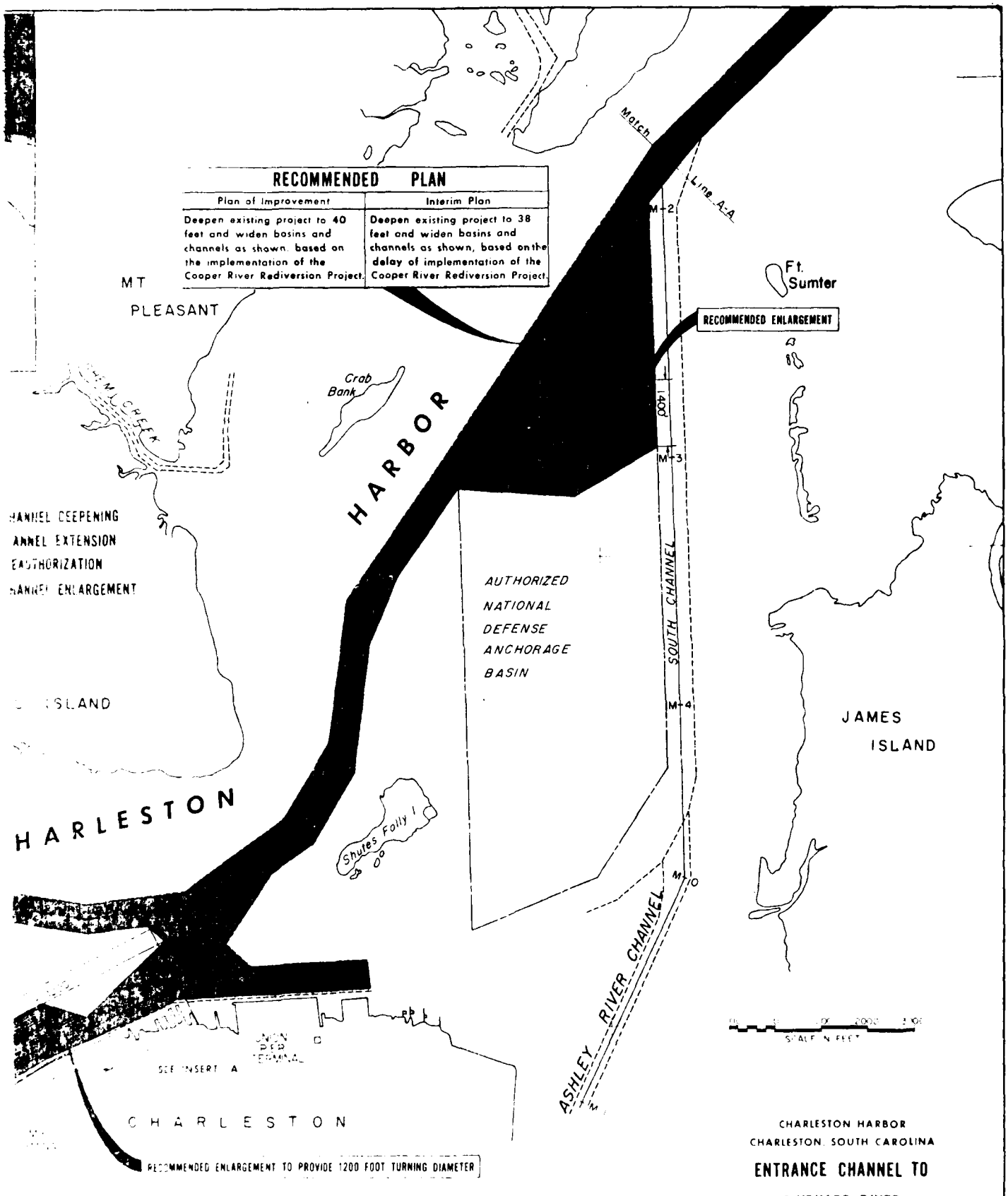

NORTH CAROLINA
SOUTH CAROLINA
GEORGIA
LOCATION MAP
BACK RIVER
FOSTER CREEK
RECOMMENDED PLAN
COOPER RIVER
WANDO RIVER
ASHLEY RIVER
LEGEND
RECOMMENDED PLAN
ATLANTIC OCEAN
NORTH JETTY
SOUTH JETTY
INDEX MAP

FIGURE 1





CHARLESTON HARBOR
CHARLESTON, SOUTH CAROLINA

ENTRANCE CHANNEL TO SHIPYARD RIVER

CHARLESTON DISTRICT, CORPS OF ENGINEERS

R 11 74 **FIGURE 2**

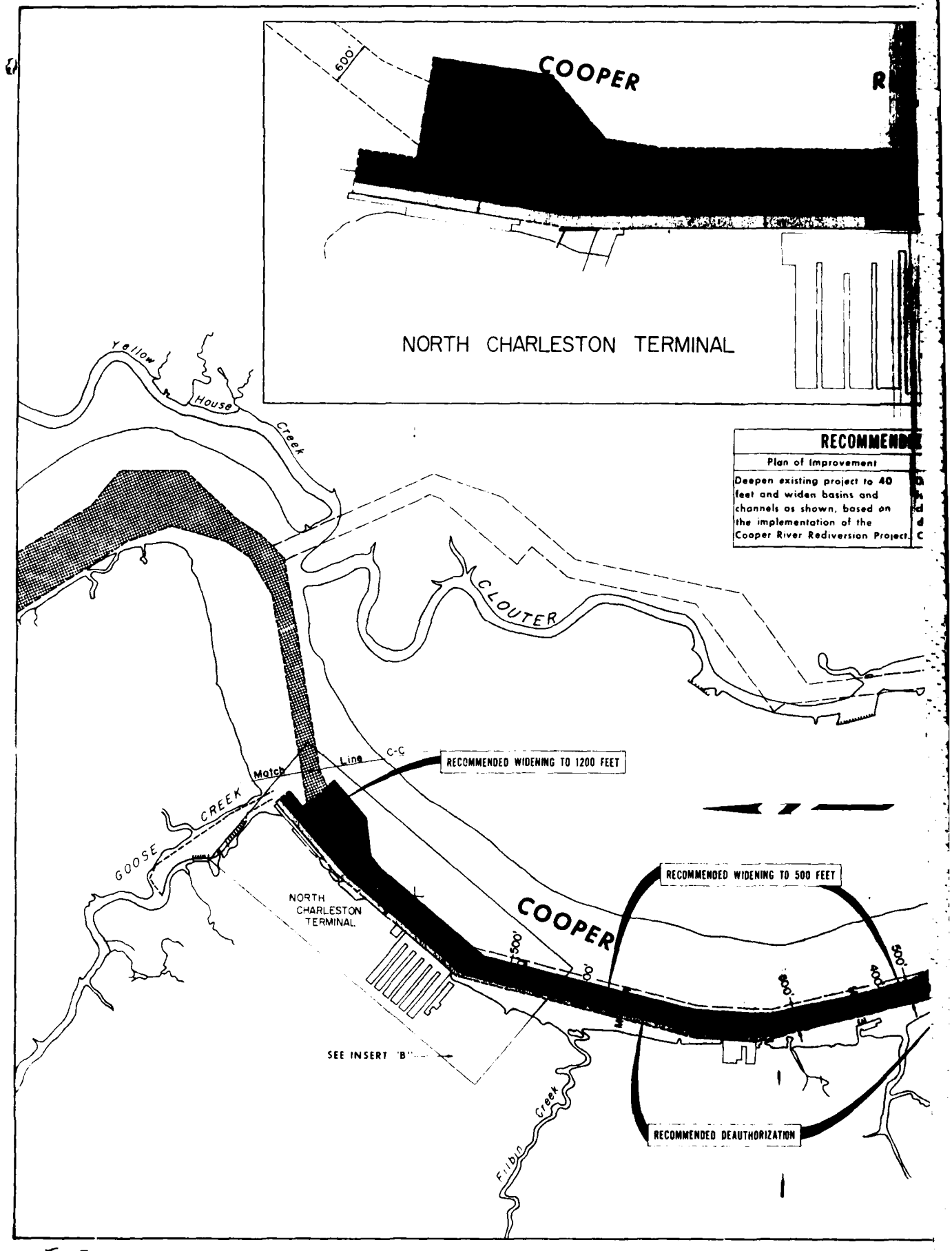
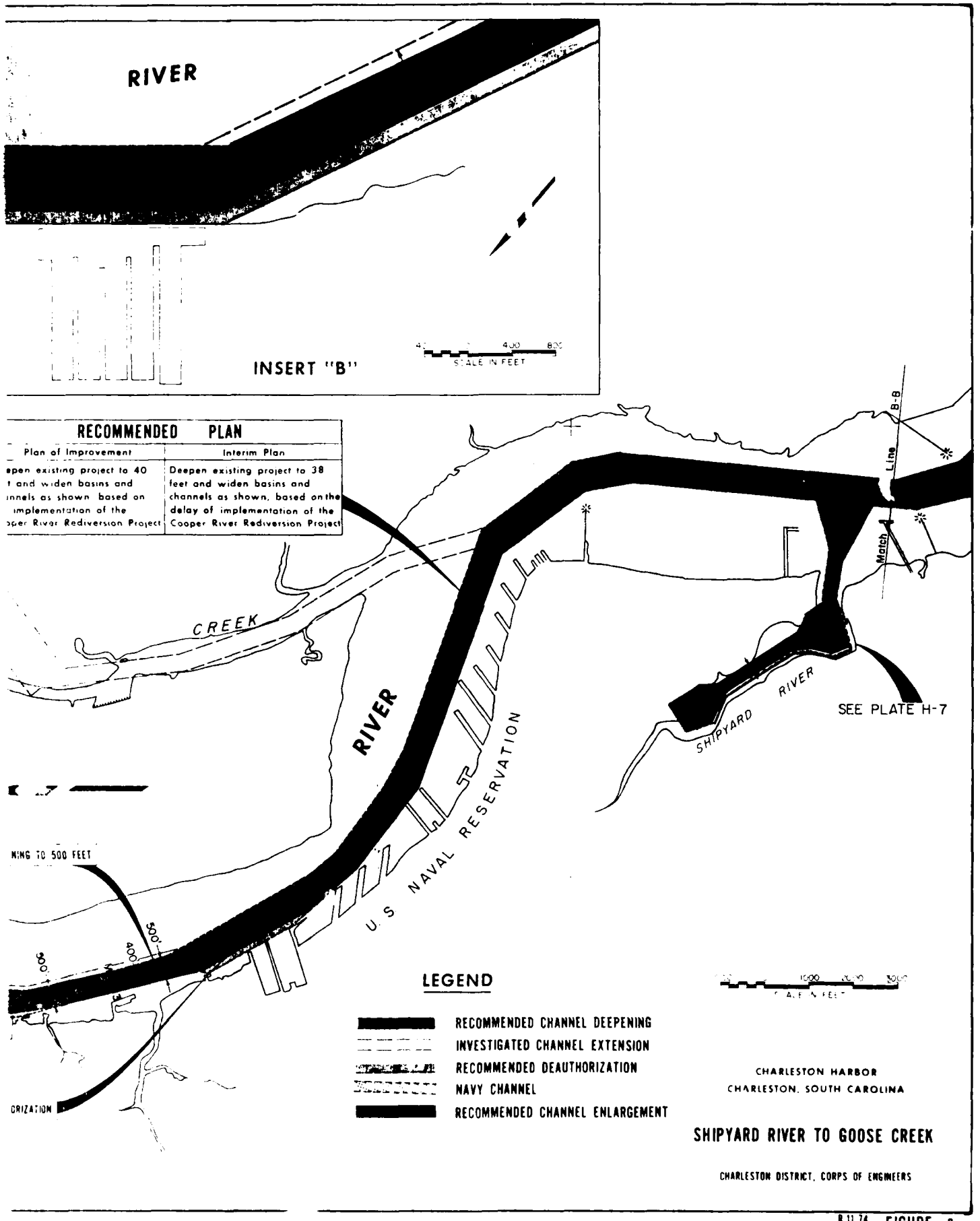
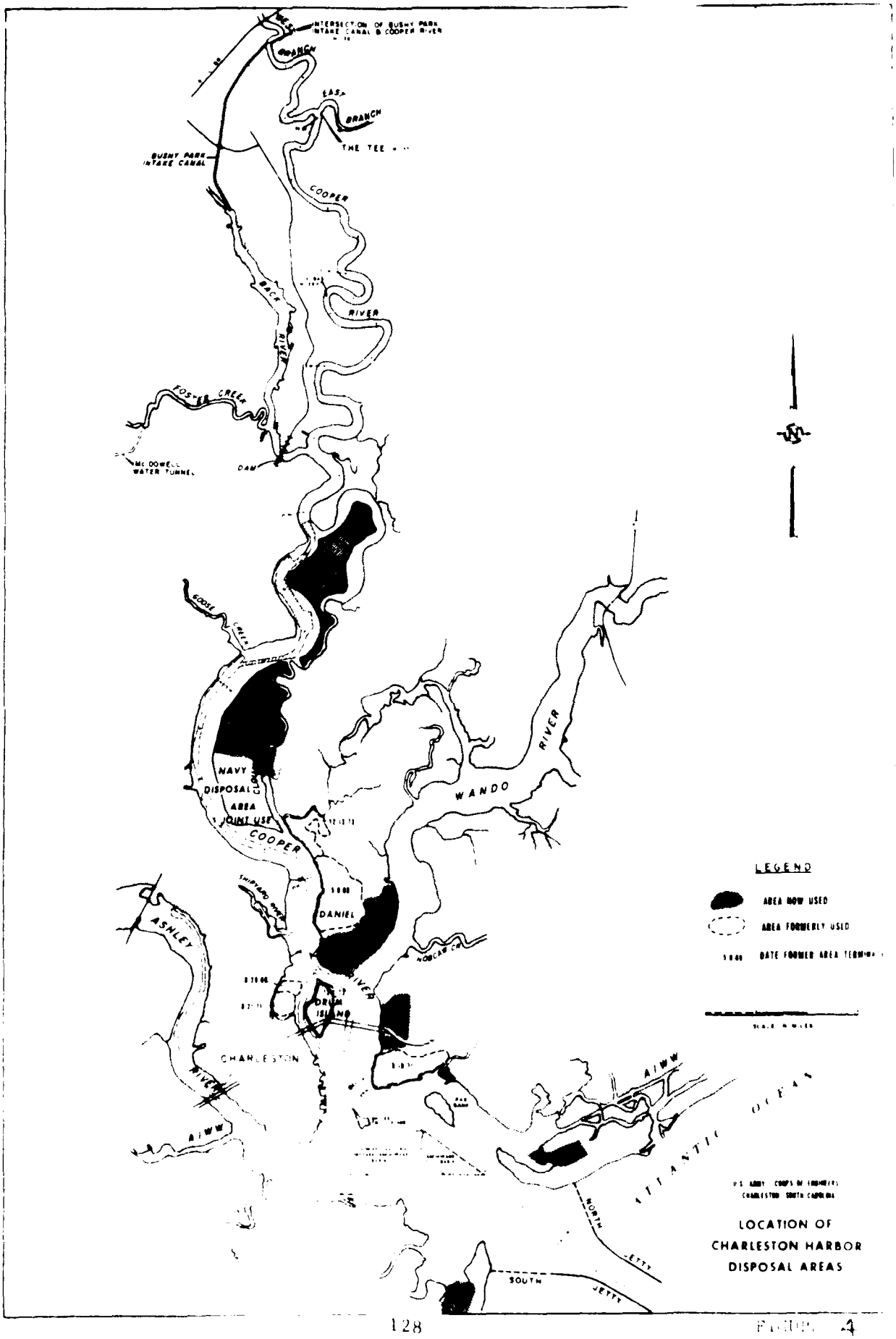


FIG 3



R 11 74 **FIGURE 3**


INTERSECTION OF BUSHY PARK INTAKE CANAL & COOPER RIVER
BRANCH
EAST BRANCH
THE TEE
BUSHY PARK INTAKE CANAL
COOPER
BACK RIVER
FOSTER CREEK
McDOWELL WATER TUNNEL
DAM
GOOSE CREEK
NAVY DISPOSAL AREA JOINT USE
WANDO RIVER
DANIEL
ASHLEY
CHARLESTON
RIVER
AIWW
ATLANTIC OCEAN
NORTH JETTY
SOUTH JETTY
LEGEND
AREA NOW USED
AREA FORMERLY USED
DATE FORMER AREA TERMINATED
U.S. ARMY CORPS OF ENGINEERS
CHARLESTON SOUTH CAROLINA
LOCATION OF
CHARLESTON HARBOR
DISPOSAL AREAS

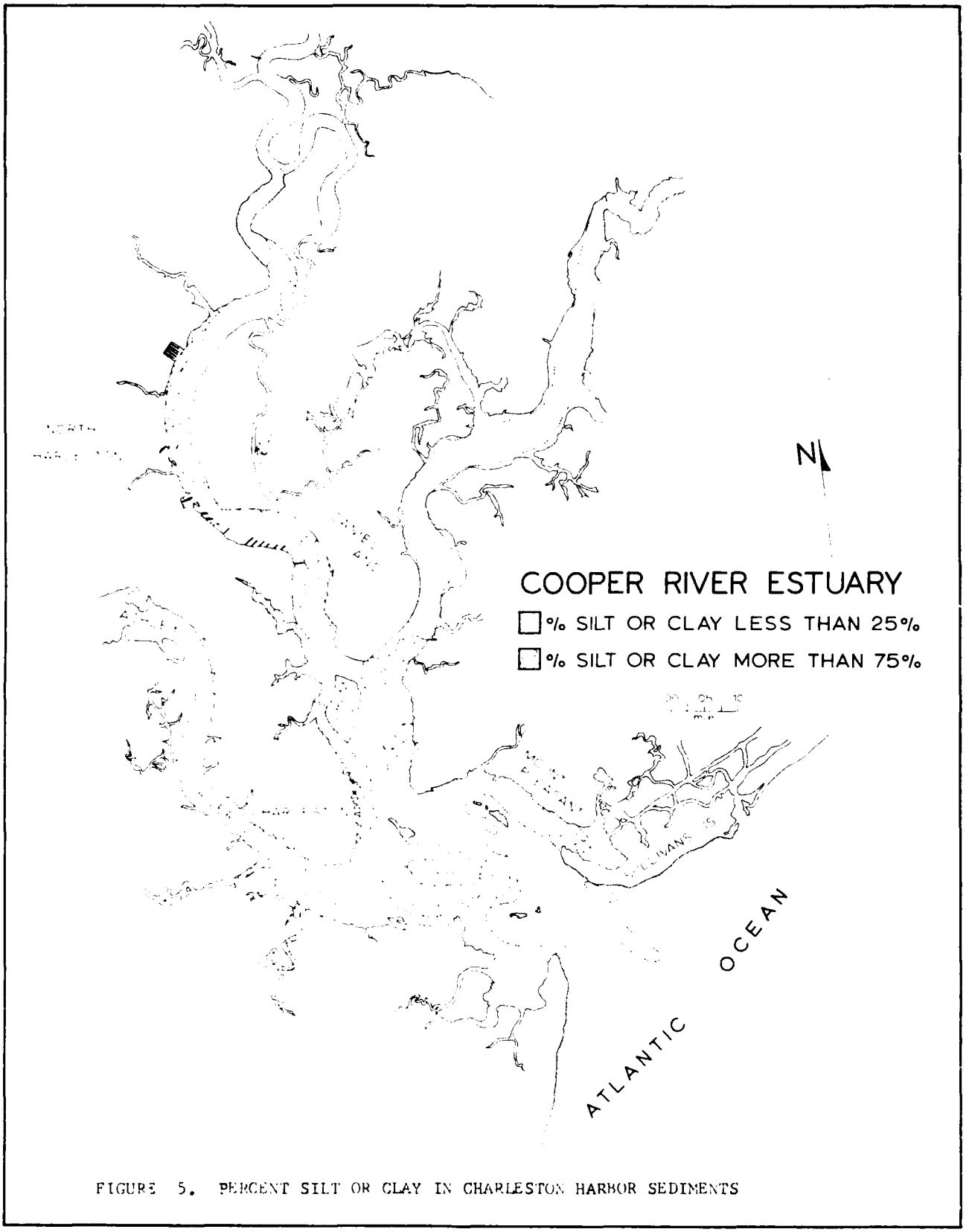


FIGURE 5. PERCENT SILT OR CLAY IN CHARLESTON HARBOR SEDIMENTS

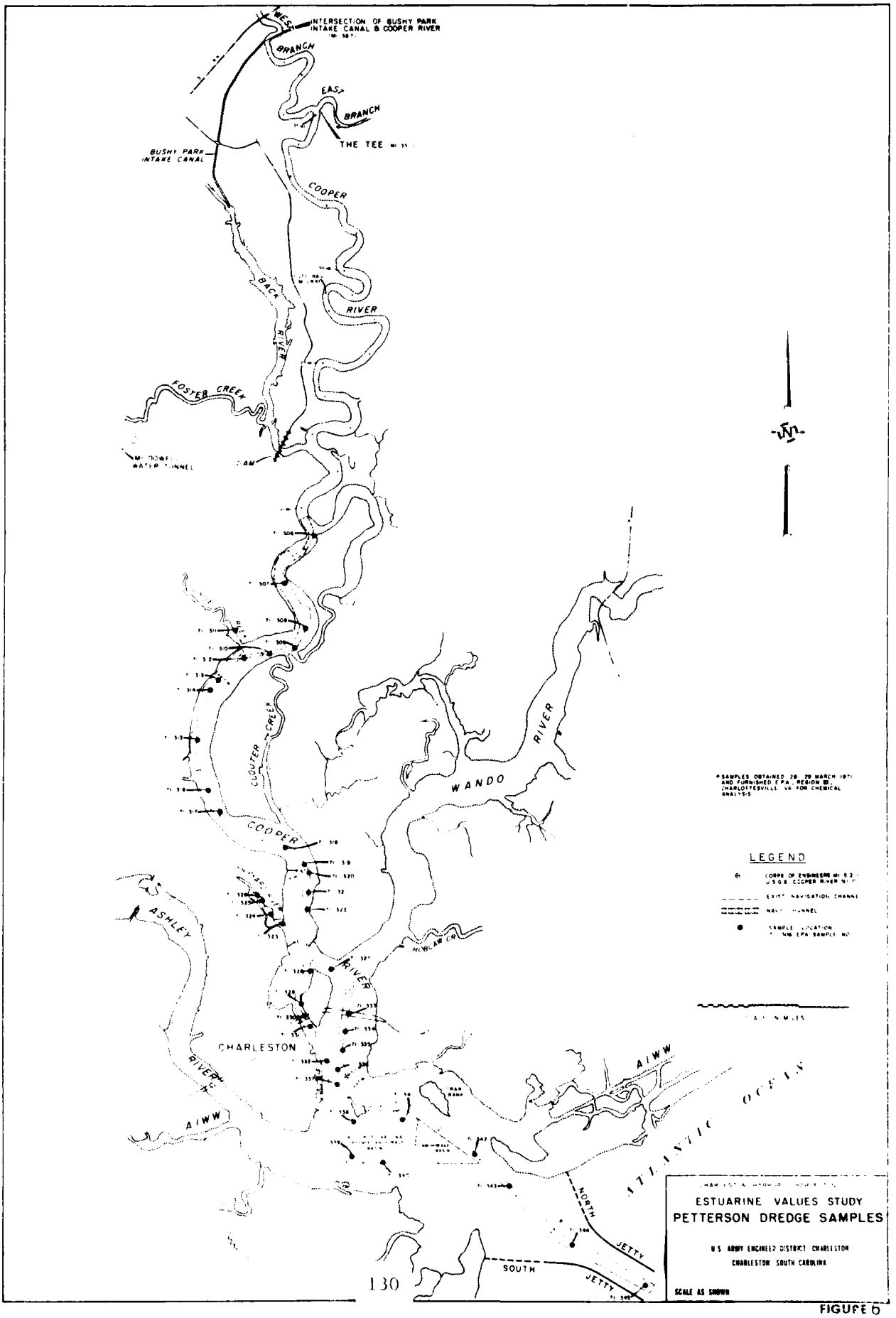

INTERSECTION OF BUSHY PARK INTAKE CANAL & COOPER RIVER
WEST BRANCH
EAST BRANCH
THE TEE
BUSHY PARK INTAKE CANAL
COOPER
BACK RIVER
FOSTER CREEK
RIVER
CLOUTER CREEK
WANDO RIVER
ASHLEY
CHARLESTON
AIWW
ATLANTIC OCEAN
NORTH JETTY
SOUTH JETTY
LEGEND
ESTUARINE VALUES STUDY
PETTERSON DREDGE SAMPLES
U.S. ARMY ENGINEER DISTRICT CHARLESTON
CHARLESTON SOUTH CAROLINA
SCALE AS SHOWN

FIGURE 6

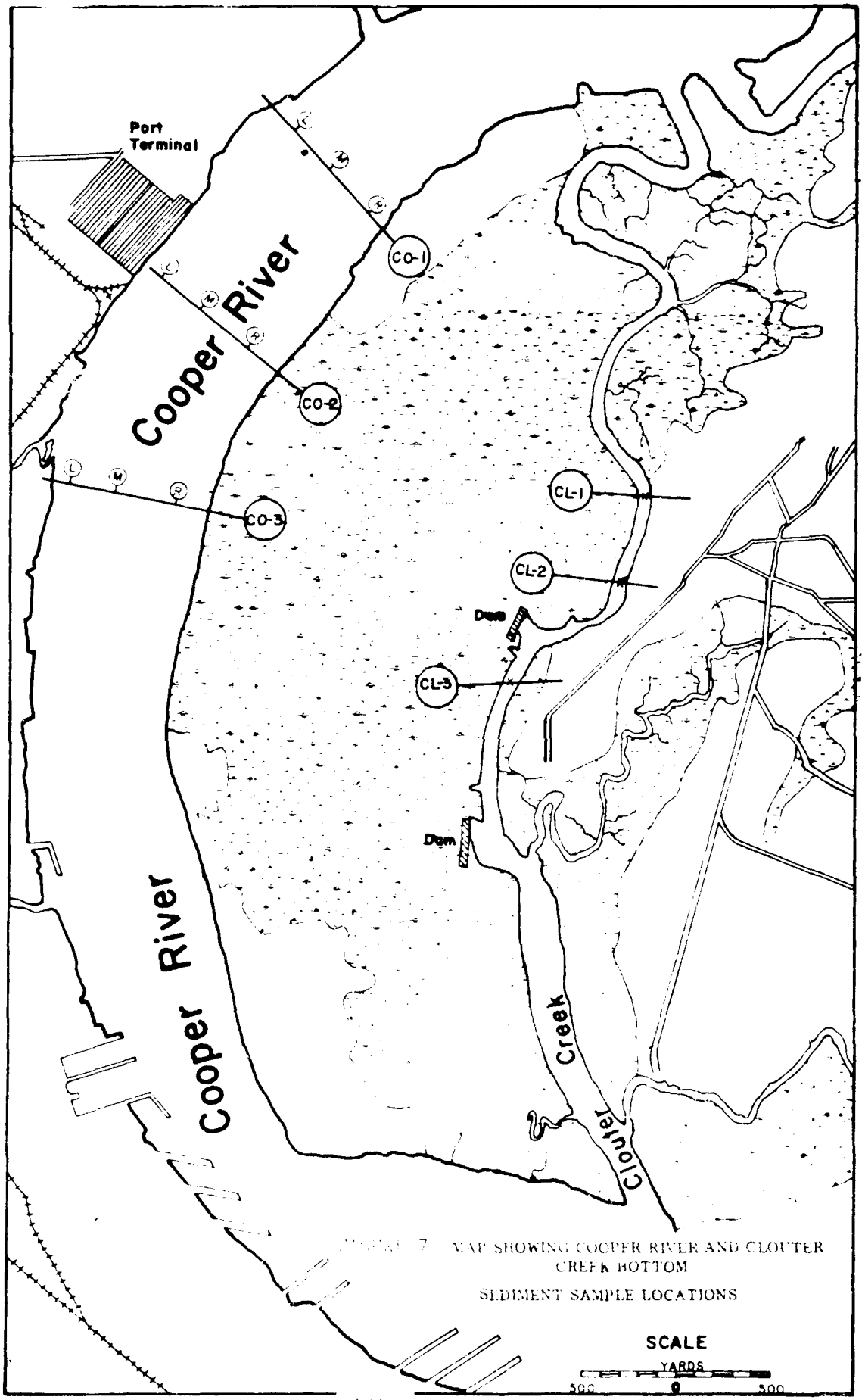


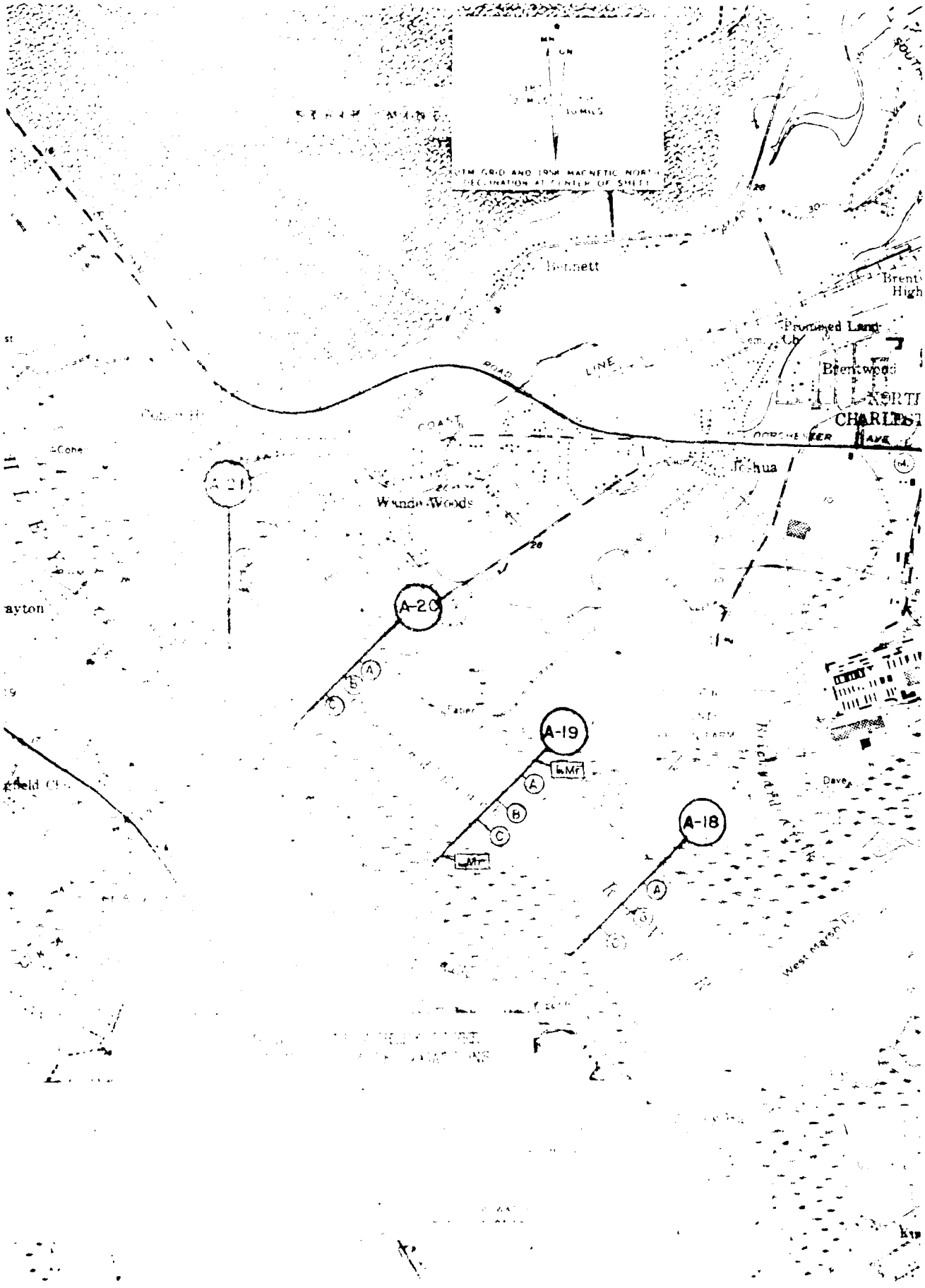
FIGURE 7 MAP SHOWING COOPER RIVER AND CLOUTER CREEK BOTTOM

SEDIMENT SAMPLE LOCATIONS

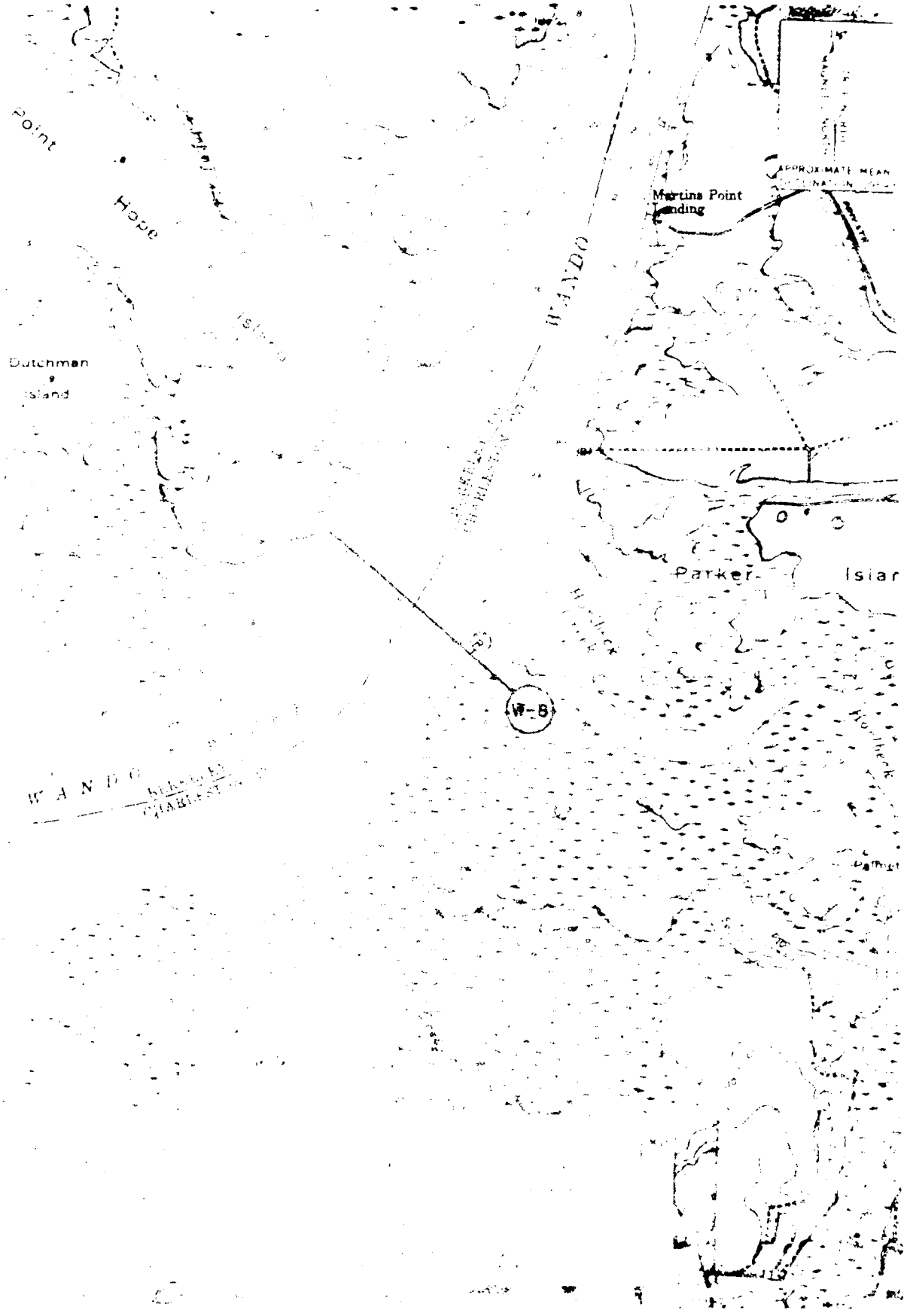
SCALE

YARDS

500 0 500


A-21
A-20
A-19
A-18
Brentwood
Wando Woods
Dave
West Marsh

W-7
W-6
W-5
W-4
W-3
W-2
Islands


Point
Hope
Dutchman
Island
WANDO
Martins Point
Landing
Parker
Island
W-8
WANDO

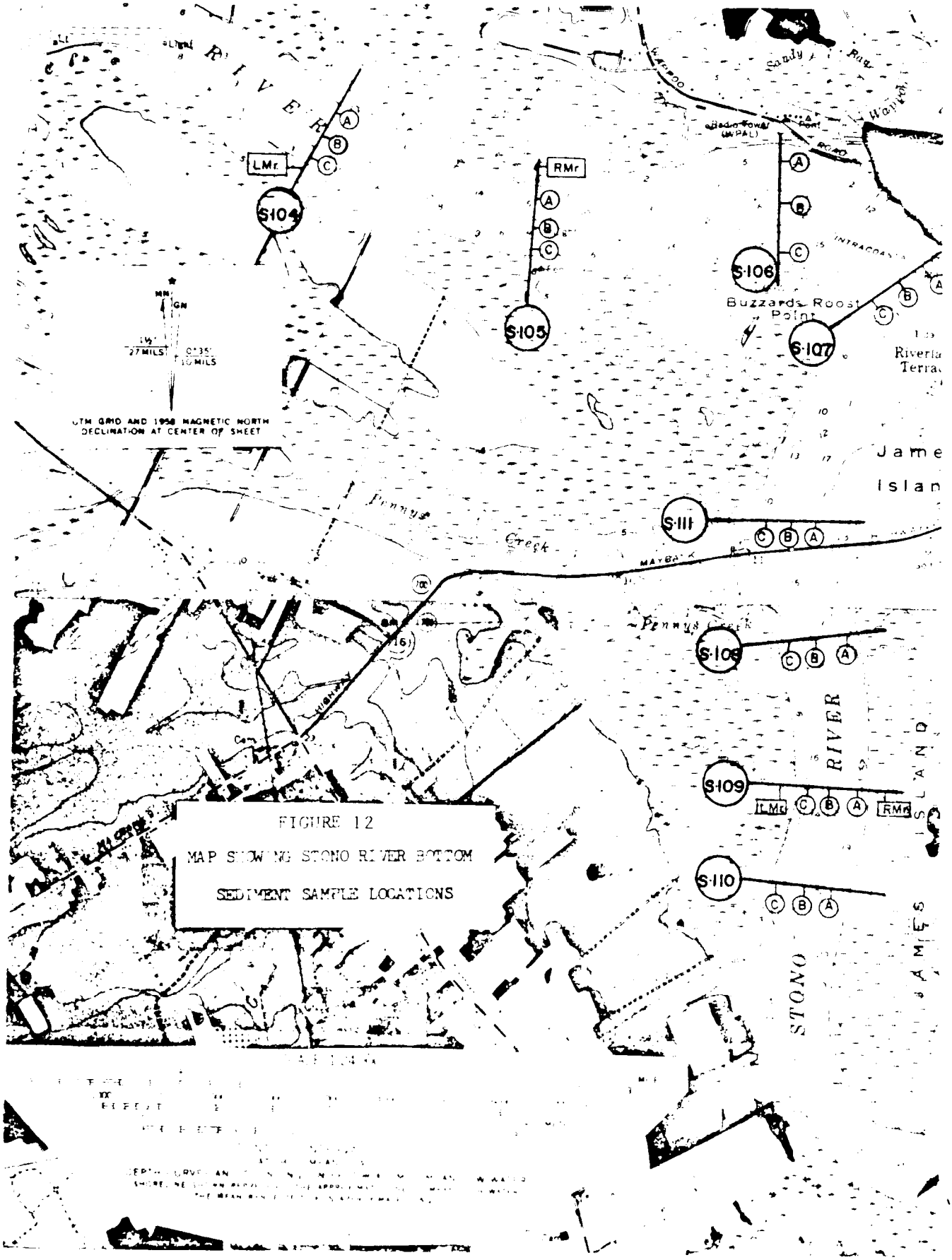


FIGURE 12

MAP SHOWING STONO RIVER BOTTOM SEDIMENT SAMPLE LOCATIONS

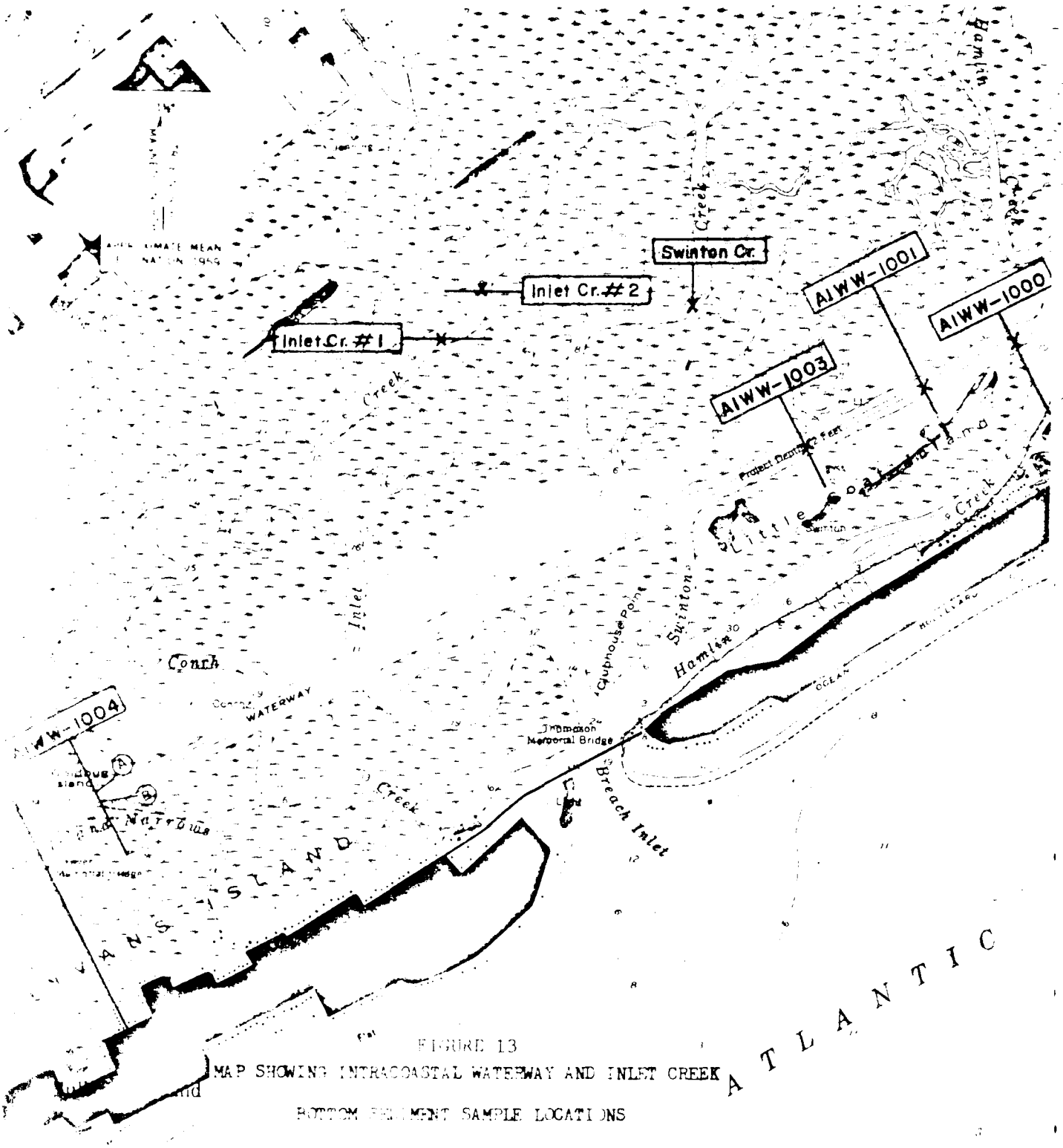


FIGURE 13

MAP SHOWING INTRACOASTAL WATERWAY AND INLET CREEK

BOTTOM SEDIMENT SAMPLE LOCATIONS

SCALE 1:24000

1 MILE

1 KILOMETER

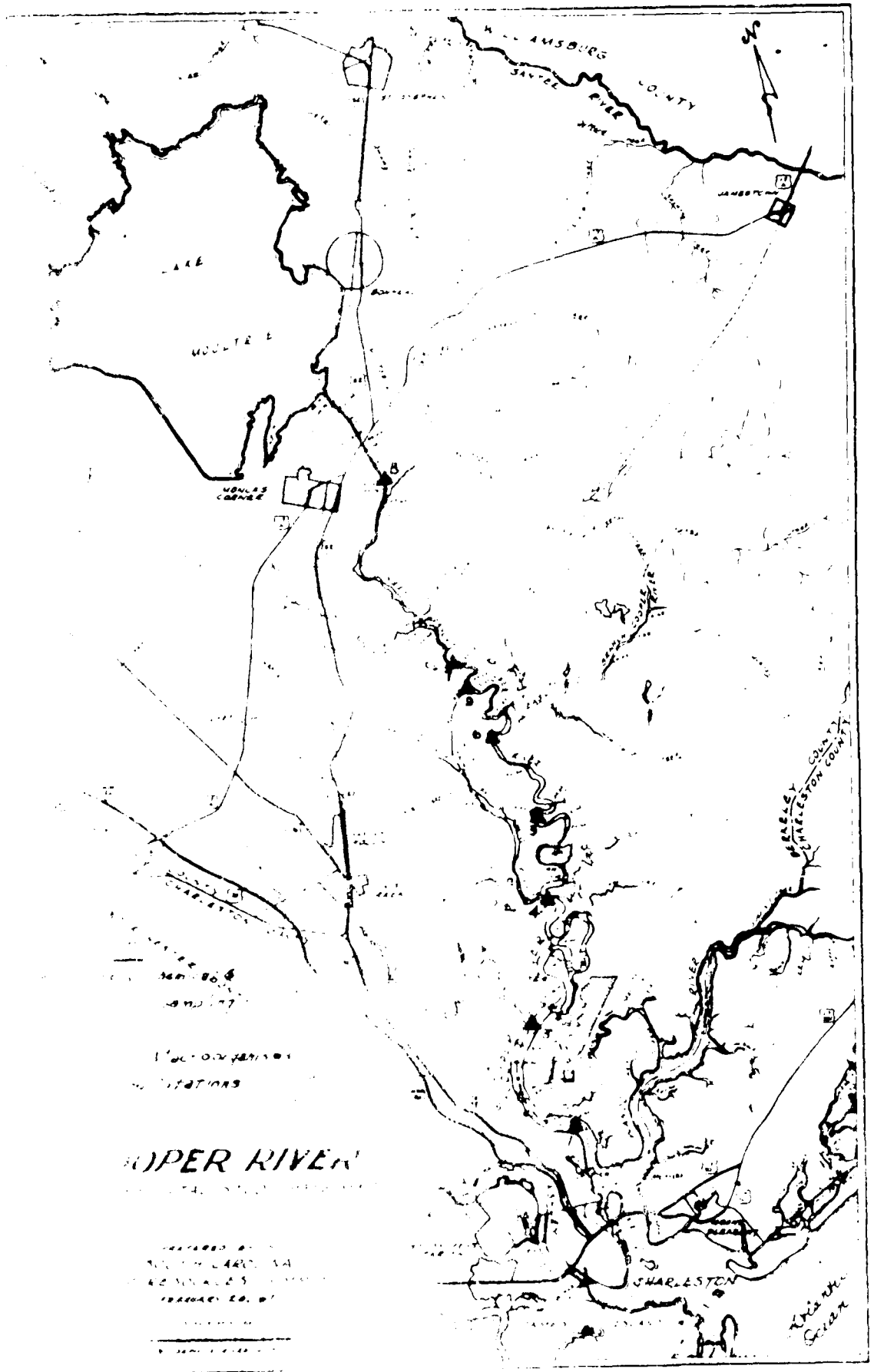
CONTOUR INTERVAL 5 FEET

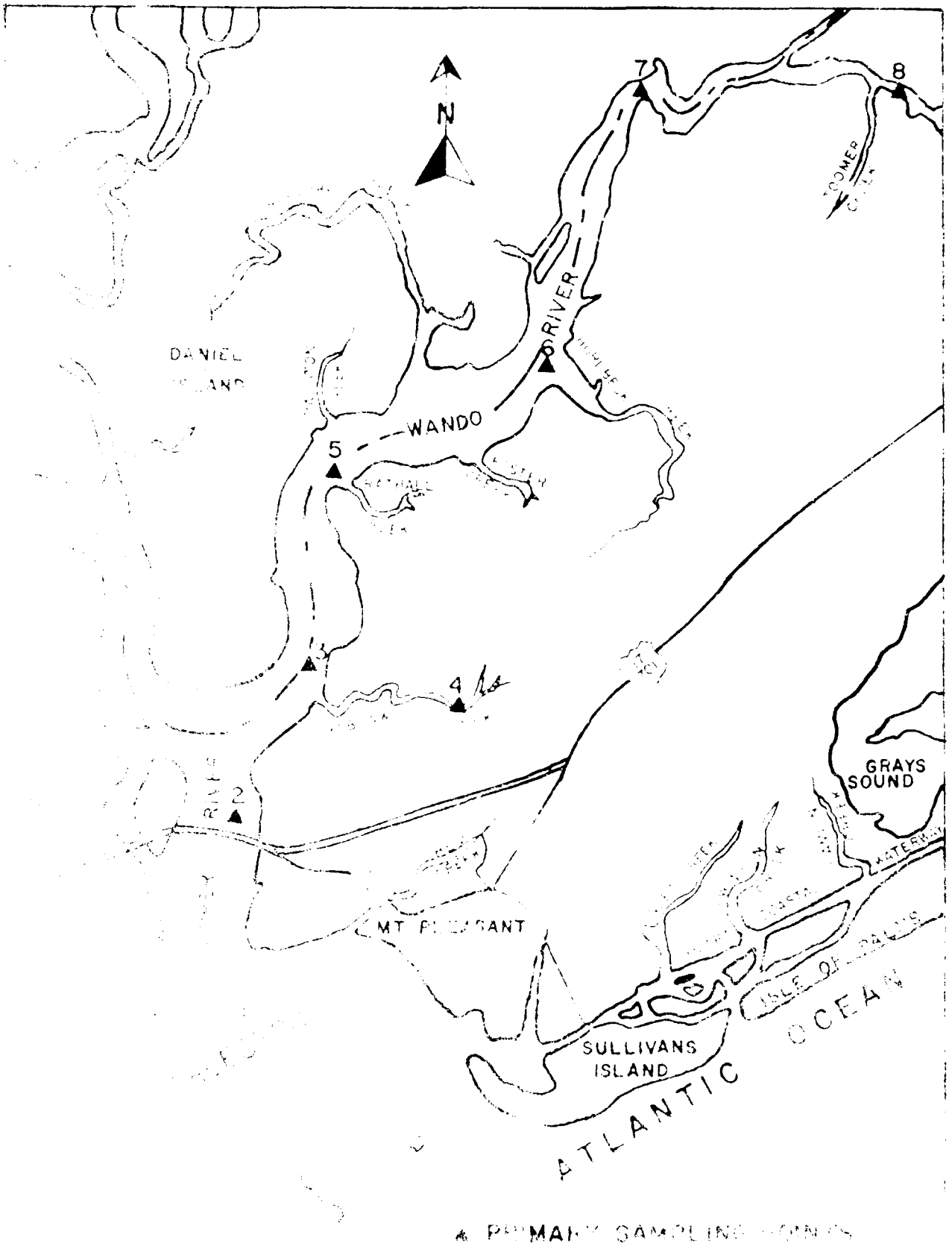
DATUM IS MEAN SEA LEVEL

DEPTHS SHOWN ARE REFERENCED TO AN APPROXIMATION OF MEAN LOW WATER

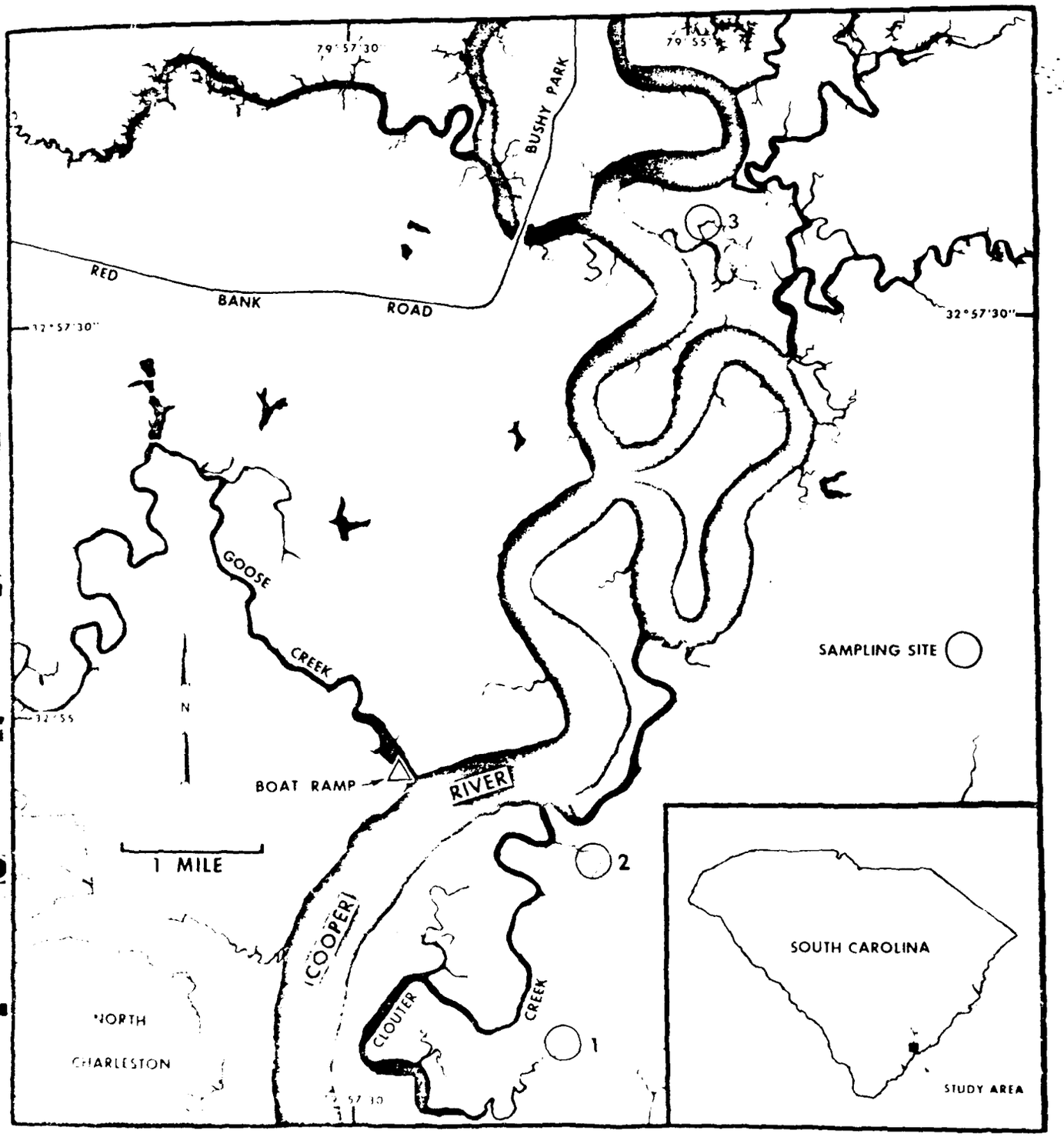
SHORELINE SHOWN REPRESENTS THE APPROXIMATE LINE OF MEAN HIGH WATER

THE MEAN RANGE OF TIDE IS APPROXIMATELY 6.2 FEET


SANTEE RIVER
COUNTY
LAKE
MOULTRIE
MONCKS CORNER
CHARLESTON COUNTY
CHARLESTON
OPER RIVER



* PRIMARY SAMPLING STATIONS
WATER QUALITY DETERMINATIONS



. SAMPLING STATIONS - COOPER RIVER STANDING CROP STUDIES

TABLE 1

ESTIMATES OF ANNUAL DREDGING RATES FOR AVERAGE FRESH-WATER INFLOWS OF 15,600 CFS and 3,000 CFS

Shoal Reach	Expected Dredging Rate Without Deepening		Expected Dredging Rate with Deepening			
			38-foot Project		40-foot Project	
	15,600 cfs	3,000 cfs	15,600 cfs	3,000 cfs	15,600 cfs	3,000 cfs
Noise Measurement Facility	120,000	37,000	120,000	37,000	120,000	37,000
Naval Ammunition Depot Channel	840,000	250,000	840,000	250,000	840,000	250,000
Goose Creek	36,000	17,000	36,000	17,000	36,000	17,000
Charleston Harbor:						
Shoals 1 & 2	414,020	39,370	480,200	46,000	527,000	50,700
Shoal 3	78,240	7,440	90,400	8,700	99,000	9,600
Shoal 4	221,680	21,080	256,200	24,600	280,600	27,200
Shoal 5	74,980	7,130	87,000	8,300	95,400	9,200
Shoal 5A	736,760	70,060	848,500	81,900	927,400	90,300
Shoal 6	117,360	11,160	131,100	13,000	149,400	14,400
Shoal 6A	638,960	60,760	735,900	71,000	804,300	78,300
Shoal 6B	71,720	6,820	82,600	8,000	90,300	8,800
Shoal 6C	534,640	50,840	615,800	59,400	673,000	65,500
Customhouse Reach	143,440	13,640	165,800	15,900	181,500	17,600
Tidewater Reach	228,200	21,700	262,800	25,400	287,300	28,000
Navy Slips and Docks	3,000,000	1,220,000	3,000,000	1,220,000	3,000,000	1,220,000
Shipyard River	790,000	370,000	1,157,600	578,125	1,260,500	637,400
Other Slips and Docks	130,000	53,000	149,000	61,900	166,200	68,300
Shem Creek	2,000	1,000	2,000	1,000	2,000	1,000
Anchorage Basin	720,000	210,000	1,065,000	328,100	1,161,800	361,800
Entrance Channel	1,250,000	500,000	1,388,800	584,400	1,534,900	644,300
TOTAL	10,148,000	2,968,000	11,514,700	3,439,725	12,236,600	3,636,400

[illegible] Collected by the Environmental Protection Agency

Station No.	Date Sampled	Radio-act. pCi/gm	% Tot. Vol. Solids	COD %	TKN %	NH_3.N %	Oil & Grease %	Total P %	Pb %	Zn %	Cu %	Cr %	Merphos %	DEF %	Hg %
SW-1	3-30-71		6.9	7.9	0.09	0.004	0.715	0.74	0.0042	0.0075	0.0087	0.0052			<0.00003
SW-1	3-30-71		4.2	2.0	0.02	0.001	0.903	0.08	0.0017	0.0059	0.0032	0.0029			
SW-2	3-30-71		17	18	0.35	0.020	0.542	0.24	0.0058	0.0135	0.0031	0.0096			
SW-3	3-30-71		9.8	10	0.19		0.698	0.25	0.0023	0.0153	0.0027	0.0055			
SW-4	3-30-71		8.5	3.6	0.01		0.442	0.93	0.0029	0.0061	0.0022	0.0052			
CH-1	3-30-71		5.4	7.2	0.09		0.737	0.15	0.0009	0.0069	0.0014	0.0019			
S1A-1	3-30-71		17	18	0.31		0.717	0.05	0.0033	0.0145	0.0048	0.0079			
S1B-2	3-30-71		12	8.1	0.16		0.283	0.18	0.0031	0.0091	0.0034	0.0048			
S1C-3	3-30-71		13	12	0.23		0.156	0.18	0.0054	0.0186	0.0038	0.0081			
S3-1	3-30-71	<0.2	13	13	0.20		0.598	0.28	0.0041	0.0125	0.0052	0.0060			
S4-1	3-30-71	<0.2	17	14	0.35		0.518	0.22	0.0044	0.0155	0.0060	0.0088			
S4-2	3-30-71	<0.2	3.9	3.6	0.04		0.124	0.42	0.0061	0.0230	0.0047	0.0084			
S5-1	3-30-71	<0.2	5.4	5.5	0.07		0.121	0.37	0.0036	0.0115	0.0022	0.0031			
S6A-1	3-30-71	<0.2	6.2	2.9	0.11		0.0695	2.2	0.0029	0.0059	0.0034	0.0034			
S6A-2	3-30-71	<0.2	11	4.3	0.07		0.0718	1.0	0.0033	0.0081	0.0050	0.0070			
S6A-3	3-30-71		16	12	0.23		0.260	0.28	0.0034	0.0126	0.0050	0.0097			
S6A-4	3-30-71		15	11	0.28	0.020	0.313	0.23	0.0033	0.0094	0.0042	0.0084			
SB-1	3-30-71	<0.2	18	12	0.34		0.234	0.12	0.0038	0.0114	0.0048	0.0092			
SB-2	3-30-71	<0.2	18	14	0.38		0.285	0.13	0.0055	0.0128	0.0042	0.0290			
SB-3	3-30-72		18	12	0.38		0.0422	0.15	0.0015	0.0150	0.0044	0.0071			
SB-4	3-30-71	<0.2	17	13	0.40		0.107	0.16	0.0074	0.0170	0.0043	0.0074			
SW-1	3-31-71	<0.2	7.4	5.4	0.10		0.0942	0.30	0.0026	0.0053	0.0018	0.0038			0.00033
S6B-1	3-30-71		4.6	1.4	0.03		0.0193	0.45	0.0010	0.0022	0.0016	0.0017			<0.00003
S6A-1	3-30-71	<0.2	8.4	11	0.23		0.0897	0.21	0.0041	0.0083	0.0015	0.0067			
S6A-2	3-30-71		7.8	3.4	0.08		0.0655	0.44	0.0028	0.0240	0.0042	0.0035			
S6A-3	3-30-71		8.1	4.2	0.12		0.0626	0.27	0.0016	0.0047	0.0012	0.0019			
S6A-4	3-30-71		18	12	0.38		0.136	0.08	0.0045	0.0170	0.0033	0.0056			
S6C-1	3-31-71		6.7	3.8	0.10		0.0746	0.37	0.0015	0.0048	0.0016	0.0034			
S6C-2	3-31-71		7.5	3.6	0.12		0.0540	0.18	0.0011	0.0071	0.0013	0.0037			
S6C-3	3-31-71		1.8	0.5	0.02		0.00739	0.37	0.0006	0.0013	0.0007	0.0011			
CHR-1	3-31-71	<0.2	11	8.9	0.08		0.0719	0.07	0.0048	0.0160	0.0023	0.0058			
TWR-1	3-31-71		7.6	4.2	0.12		0.226	0.04	0.0013	0.0051	0.0018	0.0023			<0.00003
AB-1	3-31-71		4.1	0.66	0.02		0.0117	0.38	0.0010	0.0018	0.0006	0.0010	<0.000001	<0.000001	
AB-2	3-31-71		18	0.94	0.29		0.0577	0.17	0.0037	0.0120	0.0028	0.0014	<0.000001	<0.000001	
AB-3	3-31-71		16	8.9	0.24		0.0754	0.09	0.0027	0.0080	0.0016	0.0054	<0.000001	<0.000001	
AB-4	3-31-71		13	5.3	0.16		0.0477	0.23	0.0023	0.0070	0.0023	0.0048	<0.000001	<0.000001	
EC-1	3-31-71		12	5.1	0.10		0.0297	3.30	0.0026	0.0160	0.0057	0.0057			
EC-2	3-31-71		10	1.7	0.04		0.0280	0.33	0.0020	0.0100	0.0015	0.0023			
EC-3	3-31-71		9.1	4.0	0.07		0.0260	1.40	0.0012	0.0096	0.0015	0.0063			
EC-4	3-31-71		3	1.1	0.03	0.005	0.0382	2.0	0.0020	0.0041	0.0009	0.0019			
EC-5	3-31-71		6.4	2.2	0.04		0.00828	0.35	0.0028	0.0065	0.0012	0.0029			
EPA Limits			6.0	5.0	0.1		0.15		0.005	0.005					0.0001

Harbor Sediments Analysis, Aug. 1972 (S.C. Pollution Control Authority

Station	Volatile Solid 600°	COD Dry	TKN Dry	GREASE Dry	PB Wet	ZN Wet	HG Dry	% Total Solids
Ashley River	**% Dry**		**Mg/Kg**					
A13C	7.2	73800	1360	3370	20.4	43.9	.48	60.0
A19A	12.2	86600	1720	1130	23.8	30.6	.39	57.1
A19B	7.1	44000	1370	1960	39.2	77.6	.35	52.8
A19L MAR.	13.4	108000	1790	3510	17.0	28.3	.33	48.4
A2OB	4.7	40200	730	830	47.6	11.8	.28	65.8
A21A	7.2	93000	1600	1990	44.6	74.0	—[2]	52.9
A21B	18.1	25500	700	590	ND[1]	27.6	.16	80.0
A3A	10.8	107900	1990	1580	28.7	2.9	.81	48.0
A3B	12.1	75500	1440	830	43.5	47.6	1.02	49.0
A5B	14.4	126900	4440	3900	39.6	43.5	.73	39.8
A7R MAR.	12.7	129200	1440	11019	46.8	63.1	1.08	37.0
A9A	13.5	103000	2048	1890	52.1	241.8	1.20	39.6
A9B	2.75	40200	730	450	50.7	69.9	.24	74.2
A9C	11.5	100000	2680	1220	31.9	56.1	.42	46.8
A11B	10.9	111000	4030	2160	42.8	62.4	.39	51.7
A11C	13.4	108900	2090	1120	46.4	75.9	.75	41.3
A13B	8.58	66100	1800	1220	31.6	38.9	.19	51.4
A18A	15.5	149400	1290	2840	42.3	46.3	.44	38.5
A18C	1.45	14000	1740	301	19.8	18.5	.93	76.3
A19 R MAR.	13.2	122000	1790	2120	25.2	6.0	13.2	42.0
A20C	1.61	23000	930	4240	21.5	22.3	.14	76.3
A13A	6.6	58300	1050	820	27.5	27.0	.15	76.0
A7C	7.3	32300	590	1140	13.6	17.5	.23	72.3
A19C	8.8	73300	2240	900	25.6	19.8	.23	50.7
101 B	17.1	140800	1070	670	31.7	25.0	.34	76.0
103 B	8.5	100000	1490	540	42.5	149	.68	50.6
102A	12.6	60200	2700	490	60.4	88.1	1.12	57.3
A21C	12.4	66000	590	690	18.8	17.8	.58	85.0
A18 B	10.4	37000	690	1010	23.2	46.0	.38	83.1
A20A	9.5	54600	1090	550	22.1	36.2	.09	69.7
102 C	12.2	92000	2080	2230	35.8	47.2	—[2]	61.5
101 A	10.2	70300	1970	3220	—[2]	53.8	.15	58.0
103 C	8.3	83600	1650	2990	24.3	41.0	.24	55.9
101 C	9.8	110300	2500	3690	91.1	59.4	.72	58.5
A 3C	2.8	46000	830	530	21.5	57.0	.35	72.9
A5A	5.3	49700	1330	2870	40.5	41.3	.33	65.5
A 5C	8.0	106000	1360	1930	24.3	13.6	.23	59.5
A 7A	11.6	115000	3100	11700	45.9	74.1	.50	44.3
A 7B	2.7	26800	609	1190	19.9	10.7	.10	77.4
A 7L MAR.	5.8	70700	1820	1250	17.0	28.3	.43	60.0
A11A	10.2	109000	2460	10000	43.0	72.3	.24	49.9
Average (Ashley)	9.32	79270	1682	2288	32.7	45.8	.45	59.0

TABLE 3 (Continued)

Station	Volatile Solid % Dry 600°	COD Mg/Kg Dry	TKN Mg/Kg Dry	GREASE Mg/Kg Dry	PB Mg/Kg Wet	ZN Mg/Kg Wet	HG Mg/Kg Dry	% Total Solids
Cooper River								
CLM2	20.7	27500	510	720	33.7	39.8	.54	87.9
CLM3	7.1	163600	1040	602	32.2	43.1	.34	37.4
CLM1	12.7	111100	1650	3470	28.6	32.1	.25	57.4
CO2R	8.5	37300	819	1010	20.9	7.5	.34	68.6
CO3L	15.7	43000	820	570	19.1	9.9	.15	65.0
CO2L	17.8	67400	875	660	33.7	32.7	.26	57.6	
CO3R	16.6	55000	840	390	27.0	10.4	.29	70.8
CO2L	32.2	79600	1580	1270	58.9	44.7	.17	49.9
CO3L2 Deep	4.9	43100	1070	360	32.7	42.6	.36	72.9
CO3M	8.9	15700	730	510	16.2	20.7	.40	73.2
CO2M	6.4	76400	1390	7760	19.8	11.5	.30	42.0
CO1M	5.1	54300	980	790	24.8	13.9	.18	60.3
Average Cooper	12.2	18880	1029	1514	28.9	25.7	.29	61.9
Intracoastal Waterway								
[illegible]	9.0	17600	510	870	ND[1]	18.1	.25	76.9
[illegible] Cr	8.0	85100	3310	1090	14.0	26.7	.24	45.2
[illegible]	13.0	78600	2910	2500	52.1	98.1	.41	59.7
[illegible]	20.2	67300	890	4270	4.8	5.3	.10	36.8
[illegible]	20.2	80-600	2470	4060	12.0	18.0	—[2]	46.9
[illegible]	[illegible]	54300	1560	3220	38.7	52.0	.33	45.1
[illegible]	12.2	83500	3220	600	30.0	27.0	.36	56.5
[illegible]	[illegible]	166600	2690	4330	15.3	17.3	.09	53.3
[illegible]	10.3	85550	2123	2070	20.8	31.5	.22	52.5
Wando River	% Dry		Mg/Kg					
[illegible]	8.6	31600	710	980	19.7	12.6	0.29	63.5
[illegible]	[illegible]	60000	1300	1350	33.1	32.9	0.97	58.0
[illegible]	[illegible]	30700	1040	1110	29.2	20.3	0.58	53.8
[illegible]	[illegible]	[illegible]	590	860	13.6	19.4	0.17	70.4
[illegible]	2.8	32600	660	1070	16.9	20.2	0.40	72.9
[illegible]	[illegible]	46500	440	1110	27.1	41.1	0.68	74.6
[illegible]	[illegible]	105000	2140	3980	35.6	47.9	0.33	43.6
[illegible]	[illegible]	32900	[illegible]	[illegible]	[illegible]	16.8	0.49	70.4
[illegible]	[illegible]	[illegible]	2800	3490	35.2	47.1	0.29	58.5
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	13.4	0.69	37.3
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	ND[1]	[illegible]	0.21	25.2
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	12.6	8.2	0.11	67.4
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	42.9	0.04	28.1
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.43	34.7
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	42.9	24.4	0.24	34.4
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	—[2]	36.8
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.43	62.3
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.51	33.3
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	12.4	[illegible]	36.3
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.26	22.5
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.83	64.0
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	49.9

[illegible] Sample not reported

[illegible] Sample lost during analysis

TABLE 3 (continued)

Station	Volatile Solid 600°	COD Dry	TKN Dry	GREASE Dry	PB Wet	ZN Wet	HG Dry	% Total Solids
	% Dry		Mg/Kg					
Stono River	% Dry		MG/KG					
S1096	7.7	60700	1530	980	13.4	13.9	.14	63.0
S 108B	7.4	28500	250	780	7.1	3.4	.12	76.5
S 104 A	17.8	75600	1480	410	24.6	10.5	.40	57.8
S 104 B	9.3	8250	360	210	19.3	14.1	.09	84.3
S 104 C	2.4	19900	540	300	23.6	7.7	.31	77.9
S 104 LM	26.6	89400	1740	780	31.8	25.8	.21	51.4
S 105 A	5.9	47100	900	240	14.3	25.5	.19	61.8
S 1056	12.2	142000	3310	620	15.9	20.2	.20	41.6
S 106 B	1.8	13000	570	65	.42	7.7	.23	75.7
S 106 C	6.0	66700	730	200	21.2	19.8	.20	57.5
S 107A	3.4	20600	940	110	ND[1]	19.7	.28	67.3
S108 A	4.6	38100	1240	260	23.4	13.1	.29	58.0
S 107C	15.9	182000	2640	5170	19.6	22.9	—[2]	34.1
108 C	6.5	54200	9.0	2620	30.3	26.1	0.20	53.2
106 A	104.4	113700	3400	1120	17.8	35.8	.66	50.4
109 A	4.4	31200	660	720	12.8	11.1	.14	61.4
109 B	3.5	38000	720	480	20.7	12.2	.25	64.6
109 L	15.9	166000	4500	870	11.6	20.1	.24	38.3
109 RM	14.6	115000	—[2]	1500	22.3	33.4	.96	34.5
110 A	2.8	26500	460	480	20.7	23.2	.33	67.9
111A	5.5	51400	1100	560	3.9	14.3	.18	60.3
111 B	2.0	10300	565	320	12.9	4.7	.43	75.2
111 C	1.2	64800	1660	460	4.8	18.6	.17	55.0
Average (Stono R.)	8.16	63606	1372	837	16.3	17.5	.27	59.2

TABLE 4

PESTICIDE ANALYSES

Bottom Sediments

(ug/kg)

U. S. G. S. [illegible]

Sampling Site	Date & Time	Aldrin	DDD	DDE	DDT	Dieldrin	Endrin	[illegible]
[illegible]	5-4-71 0900					1.7	0.0	
[illegible]	5-4-71 0930					1.1	0.0	
[illegible]	5-4-71 1020					0.9	0.0	
[illegible]	5-4-71 1035	0.0	0.0	0.0	0.0	0.0	0.0	0.0
[illegible]	5-4-71 1035					0.0	0.0	
[illegible]	5-4-71		0.0		0.0	0.0	0.0	
[illegible]	5-4-71 1152	0.0	0.3	0.1	0.0	0.0	0.0	0.0
[illegible]	5-4-71 1350	0.0	8.4	1.5	0.0	0.0	0.0	0.0
[illegible]	5-4-71 1255		0.0		0.0	0.0	0.0	
[illegible]	5-4-71 1[illegible]0	0.0	1.0	3.0	0.0	0.0	0.0	0
[illegible]	5-4-71 [illegible]	0.0	4.2	3.4	0.0	9.1	0.0	0.0
[illegible]	5-4-71 1[illegible]3	0.0	0.4	0.6	0.0	1.1	0.0	0.0

[illegible] cannot be con-

[illegible] be con

[illegible] cannot be con-

[illegible] present but

[illegible]

* PCB - 40 ug/kg
be confirmed
* PCB - 40 ug/kg
* PCB - 50 ug/kg
be confirmed
* Suspected

TABLE 6

Charleston Harbor Water Quality Data collected by the S. C. Department of Health and Environmental Control during the period February, 1973 to April, 1974.

	Sta MD-48*		Sta MD-43*		Sta MD-50*		Sta MD-47*		Sta MD-46*	
	Range	Mean	Range	Mean	Range	Mean	Range	Mean	Range	Mean
T-NO_3 mg/l-N	0.0-.24	0.10	0.0-.37	0.10	.01-.17	0.09	.00-1.22	0.03	.00-.26	0.09
O-PO_4 mg/l	0.0-.30	0.14	0.0-.63	0.13	.03-.90	0.23	0.0-.33	0.09	.02-.26	0.12
Fe ug/l	100-662	328.7	30-510	270	100-1059	493	100-1246	412.1	50-652	230.5
Pb ug/l	200	200	100	100	200	200	200	200	200	200
Hg ug/l	0.5-1.2	0.73	0.5-1.5	0.93	0.5-0.8	0.6	0.1-4.15	1.15	0.1-1.65	0.65
Temp C°	6-28	20.5	13-29	22.4	7-28	20.6	7-28	19.2	7-27	19.3
Final DO	5.6-7.2	6.38	5.5-7.3	6.4	5.4-7.0	6.25	5.4-7.6	6.6	4.45-7.3	6.23
BOD_5 mg/l	1.25-2.8	1.86	1.1-3.3	2.0	1.2-3.5	2.19	0.7-3.7	1.98	0.9-3.95	0.83
pH (lab.)	6.8-7.85	7.3	6.5-6.9	6.6	6.7-7.4	7.0	6.5-7.3	6.95	6.6-7.7	7.2
Total Alk.	16-120	64	21-34	24	10-180	57	26-67	45	36-90	60
Fecal Col:/100ml	10-1460	347	8-1320	199	75-880	284	10-4000	852	10-2760	385

*Station locations

MD-48 South Channel, Charleston Harbor off Ft. Johnson near bell buoy #28.
MD-43 Cooper River at channel marker #72 near U.S. Ammunition Depot.
MD-50 Ashley River at A.C.L.R.R. Bridge (Bee's Ferry).
MD-47 Town Creek (West Side of Drum Island) under Grace Memorial Bridge.
MD-46 Cooper River under Grace Memorial Bridge.

TABLE 7

CHARLESTON AREA INDUSTRIAL WASTES

Source	Approximate Discharge Rate (Gallons)	Type Treatment
Berkeley County		
Stanley's Trailer Park	60,000	Oxidation pond
I.B.C.-B.D.F.	25,000	Stabilization pond
Highland Trailer Park	25,000	Aeration pond & chlorination
Air Products and Carbide Co.	20,000	Clarifier & waste disposal system
North Chas. P.S.D.-Bacon Ave. Pond	3,000,000	Treatment plant
Joe Frost S.D.	120,000	Stabilization pond, chlorination
Paramount Trailer Park	50,000	Aerated pond & chlorination
Apts. on Cross Apartments	---	---
North Chas. A.F.B.-Radar Station	---	Oxidation
U.S. Steel Metal	5,000	Aerated lagoon, chlorinate
Swift Fertilizer	140,000	Oxidation pond
Westvaco	55,000,000	Activated sludge plant
Dorchester Village	---	Aerated pond & chlorination
Stinson Fertilizer	7,000	Aeration treatment plant & chlorinate
F.S. Royster Fertilizer Co.	---	Cooling pond
LARCO Div. - Hooper	---	Sand trap
BOB Automatic Car Wash	5,000	Grease and grit trap
Town of Mt. Pleasant - Sewerdaw	150,000	Treatment plant
Town of Mt. Pleasant - Isle of Seclaws	300,000	Aeration and chlorination
Town of Mt. Pleasant - Parrish Plaza	180,000	Stabilization ponds
Town of Mt. Pleasant	570,800	Treatment plant
Town of Sullivans Island	570,000	Oxidation ditch with chlorination
Westvaco Estates - Northwood Mall	375,000	Treatment lagoon
Berkeley - Whitney Industries	1,700	Aeration and chlorination
Baptist College at Charleston	350,000	Oxidation pond and chlorination
North Chas. Gen. P.S.D.- Trim St.	10,000,000	Treatment plant
Berkeley County		
Swamp Fox, Berkeley Square S.D.	-----	Ponds
Lowcountry Girl Scout Camp	12,000	Oxidation pond & chlorination
Berkeley Country Club S.D.	28,000	Treatment plant
Pinehaven S.D.	40,000	Treatment plant
Batteries Steam Plant	6,000	Treatment plant
Cross Navy - Short Stay	10,000	Activated sludge system
Central High School	---	Oxidation pond
U.S. Navy - Post A	1,000	Aeration system
U.S. Navy - Outside	500,000	Activated sludge system
Santee Cooper Station	3,000,000	Equalization, nutrient, aeration, stabilization & settling
U.S. Electric and Gas - Bushy Park Unit #2	200,000,000	Ash sluice pond, cooling tower
U.S. Navy - Naval Weapons Annex	600,000	Oxidation ponds
St. Thomas Estates S.D.	40,000	Activated sludge system
Grand Oaks	---	----
Sunrise Trailer Court	22,500	Oxidation pond
Hanahan S.D.	150,000	Treatment plant
U.S. Navy - Naval Base	7,000	Oxidation ponds
Berkeley Plaza S.D.	8,000	Stabilization pond
Cypress Cove S.D.	80,000	Stabilization pond
Oak Forest S.D.	---	Trees and spray irrigation system

TABLE 8

Summary of Physical ,Chemical and Microbiological Data Collected by the Environmental Protection Agency During October and November, 1971

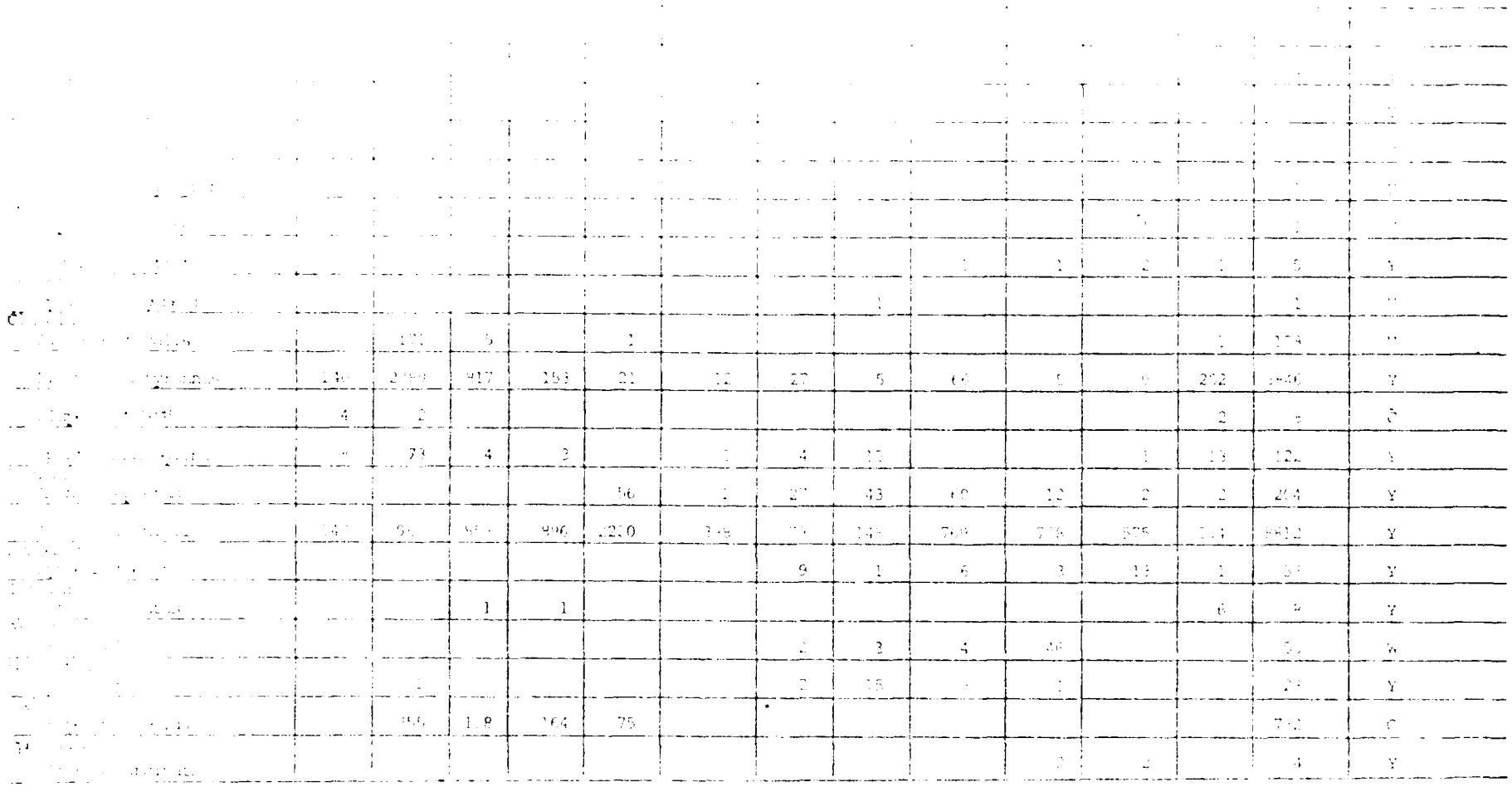
October, 1971

Sta		Temp °C	pH Units	Chloride mg/l	DO mg/l	BOD_5 mg/l	TOC mg/l	Nitrogenous Compounds mg/l TKN	NH_3-N	NO_2-NO_3	Phosphorus mg/l Total-P	Ortho-P	Nonfilterable Residue mg/l Total	Vol	Metals, ug/l Cu	Cr	Pb	Zn	Mn	Fe	Hg	Fecal Coliform 100 ml
1	Avg	21.9	7.7	7530	5.9	1.1	5.2	0.42	0.05	0.05	0.05	0.04	37	14	45	<20	170	46	65	1070	< 20	930
	Max	23.0	8.3	13400	6.7	1.4	6.0	0.54	0.10	0.10	0.08	0.07	63	21	60	<20	240	70	80	1580	< 20	1600
	Min	20.0	6.9	1640	5.1	0.6	4.0	0.35	0.04	0.02	0.02	0.02	12	6	30	<20	100	10	50	960	< 20	330
3	Avg	22.1	7.6	3265	6.4	1.1	4.7	0.47	0.05	0.04	0.03	0.02	16	6	-	-	-	-	-	-	-	70
	Max	23.5	8.3	10960	7.2	2.5	6.0	0.54	0.06	0.06	0.04	0.04	31	9	-	-	-	-	-	-	-	140
	Min	20.5	7.2	520	4.7	0.4	4.0	0.40	0.04	0.03	0.02	0.02	6	2	-	-	-	-	-	-	-	30
4	Avg	21.3	7.2	310	7.6	0.8	4.7	0.41	0.05	0.05	0.03	0.02	19	5	-	-	-	-	-	-	-	47
	Max	22.0	8.0	2670	7.8	1.1	5.0	0.58	0.07	0.10	0.04	0.03	25	8	-	-	-	-	-	-	-	70
	Min	20.0	6.5	10	3.4	0.4	4.0	0.23	0.01	0.03	0.02	0.01	9	2	-	-	-	-	-	-	-	30
5	Avg	21.6	7.5	9	7.2		5.0	0.45	0.05	0.05	0.04	0.02	17	5	-	-	-	-	-	-	-	70
	Max	23.0	7.8	16	8.0		6.0	0.59	0.06	0.05	0.05	0.04	24	6	-	-	-	-	-	-	-	170
	Min	20.5	7.1	7	7.4		4.0	0.28	0.04	0.03	0.03	0.01	9	4	-	-	-	-	-	-	-	30
6	Avg	21.6	7.4	8	7.6	0.8	4.7	0.49	0.04	0.04	0.04	0.01	12	3	35	<20	<80	45	25	855	< 20	240
	Max	22.0	7.7	9	8.0	1.0	6.0	0.46	0.06	0.05	0.05	0.02	17	4	40	<20	<80	60	30	920	< 20	2400
	Min	21.0	7.0	8	7.2	0.5	4.0	0.26	0.03	0.03	0.02	<0.01	7	1	30	<20	<80	30	20	790	< 20	130
7	Avg	21.7	7.3	8	7.6	0.9	4.2	0.42	0.07	0.05	0.04	0.03	16	4	45	<20	<80	35	30	945	< 20	170
	Max	22.5	7.7	10	8.2	1.0	5.0	0.53	0.12	0.09	0.07	0.07	24	4	50	<20	<80	40	40	1190	< 20	2300
	Min	20.5	6.5	7	7.1	0.4	4.0	0.36	0.04	0.03	0.03	0.01	9	3	40	<20	<80	30	20	700	< 20	30
8	Avg	21.8	7.4	8	7.8		5.2	0.44	0.04	0.01	0.04	0.02	9	3	-	-	-	-	-	-	-	45
	Max	22.5	7.8	9	8.4		6.0	0.50	0.08	0.01	0.06	0.03	14	5	-	-	-	-	-	-	-	170
	Min	21.0	7.0	7	7.3		5.0	0.38	0.03	<0.01	0.02	0.01	3	1	-	-	-	-	-	-	-	20
9	Avg	20.8	7.2	9	7.4	0.8	4.5	0.46	0.04	0.03	0.03	0.01	9	3	25	<20	<80	20	20	740	< 20	150
	Max	21.5	7.8	11	8.0	1.1	5.0	0.58	0.06	0.04	0.03	0.02	12	4	30	<20	<80	20	30	1100	< 20	330
	Min	20.0	6.4	7	7.0	0.8	4.0	0.33	0.03	0.02	0.02	0.01	8	2	20	<20	<80	20	10	380	< 20	70

November, 1971

Sta		Temp °C	pH Units	Chloride mg/l	DO mg/l	BOD_5 mg/l	TOC mg/l	Nitrogenous Compounds mg/l TKN	NH_3-N	NO_2-NO_3	Phosphorus mg/l Total-P	Ortho-P	Nonfilterable Residue mg/l Total	Vol	Metals, ug/l Cu	Cr	Pb	Zn	Mn	Fe	Hg	Fecal Coliform 100 ml
1	Avg	17.9	7.7	9030	6.4	0.9	5.9	0.31	0.02	0.05	0.05	0.04	44	12	67	<20	232	135	58	2212	30	460
	Max	22.0	8.1	14800	7.4	1.0	9.0	1.00	0.06	0.09	0.12	0.10	128	34	100	<20	480	380	100	6650	50	1700
	Min	15.0	7.2	3020	5.3	0.8	4.0	0.14	<0.01	0.01	0.02	0.02	13	2	40	<20	130	60	20	650	< 20	130
3	Avg	18.3	7.5	6115	6.1	0.8	6.0	0.26	0.03	0.06	0.06	0.05	45	11	-	-	-	-	-	-	-	200
	Max	22.5	8.0	13100	7.1	1.0	10.0	0.40	0.01	0.11	0.20	0.10	146	31	-	-	-	-	-	-	-	790
	Min	15.5	7.0	323	5.1	0.6	4.0	0.17	<0.01	0.02	0.02	0.02	13	3	-	-	-	-	-	-	-	20
4	Avg	18.2	7.5	2620	6.9	0.8	6.0	0.27	0.02	0.08	0.04	0.04	20	8	-	-	-	-	-	-	-	90
	Max	22.-	8.2	8900	7.7	0.8	8.0	0.48	0.07	0.15	0.09	0.07	44	16	-	-	-	-	-	-	-	330
	Min	15.1	6.7	9	5.9	0.4	5.0	0.13	<0.01	0.05	0.02	0.01	9	2	-	-	-	-	-	-	-	20
5	Avg	17.4	7.5	135	7.6		7.7	0.59	0.03	0.12	0.04	0.03	11	3	-	-	-	-	-	-	-	60
	Max	22.5	8.5	630	8.2		10.0	0.83	0.05	0.14	0.06	0.04	23	7	-	-	-	-	-	-	-	230
	Min	15.-	6.9	9	7.2		6.0	0.13	<0.01	0.09	0.02	0.02	3	1	-	-	-	-	-	-	-	20
6	Avg	17.6	7.3	14	7.7	0.6	6.7	0.38	0.02	0.12	0.04	0.03	11	4	23	<20	<80	45	50	1120	< 20	100
	Max	22.-	7.8	26	8.5	0.7	9.0	0.57	0.06	0.17	0.07	0.05	45	10	40	<20	<80	140	100	1320	< 20	490
	Min	15.-	7.1	11	6.8	0.3	5.0	0.15	<0.01	0.06	0.02	0.02	1	1	10	<20	<80	20	20	860	< 20	20
7	Avg	17.9	7.3	12	7.2	0.7	6.7	0.42	0.02	0.13	0.04	0.02	11	4	27	<20	115	28	28	907	< 20	380
	Max	22.-	8.5	26	8.5	1.0	9.0	0.96	0.06	0.17	0.09	0.03	46	11	60	<20	150	40	60	1250	< 20	240
	Min	15.-	6.9	8	5.7	0.4	4.0	0.12	<0.01	0.06	0.01	0.01	1	1	10	<20	<80	20	10	600	< 20	20
8	Avg	17.8	7.4	11	8.5		4.0	0.34	0.03	0.15	0.03	0.02	6	2	-	-	-	-	-	-	-	45
	Max	20.-	7.9	13	8.3		7.0	0.52	0.08	0.21	0.07	0.04	17	7	-	-	-	-	-	-	-	170
	Min	15.-	6.7	9	7.6		4.0	0.15	0.01	0.14	0.01	<0.01	1	1	-	-	-	-	-	-	-	20
9	Avg	17.2	7.3	12	7.3	0.6	6.9	0.41	0.02	0.11	0.04	0.03	7	3	32	<20	90	32	32	988	< 20	110
	Max	22.3	8.0	20	8.4	0.8	10.0	0.95	0.03	0.15	0.07	0.06	16	8	60	<20	100	40	50	1250	< 20	340
	Min	14.5	7.0	8	5.6	0.4	4.0	0.16	<0.01	0.07	0.02	0.02	2	1	20	<20	<80	20	10	630	< 20	20

...ometric mean



[illegible]								12	4				[illegible]	[illegible]
[illegible]							[illegible]				7		8	C
[illegible]							1						1	W
Larvae, [illegible] Sciaenidae							6	5	1				12	Y
Bairdiella chrysoura	1	[illegible]	16	4	6	1	2	155	278	126	210	189	1006	Y
Cynoscion [illegible]												1	1	Y
Cynoscion regalis		7		1	6	220	628	513	401	150	40	25	1991	Y
Larimus fasciatus											1		1	Y
Leiostomus xanthurus	11	133	168	128	3945	2410	1554	79[illegible]	279	47	94	58	9617	Y
Menticirrhus americanus								30	6	23		1	60	Y

TABLE 10 (continued)

SPECIES	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC	TOTAL	S.O.
Sciaenidae														
Trinectes maculatus			2	3	5	18	2	55	160	58	4	5	312	Y
Cynoglossidae														
Symphurus plagiusa		49	80	93	12	142	14	268	361	661	207	250	2137	Y
Balistidae														
Monacanthus hispidus							1			1	2		4	Y
Tetraodontidae														
Lagocephalus laevigatus														U
Sphoeroides maculatus									2				2	U
Diodontidae														
Chilomycterus schoepfi											1		1	U

Y = Occurs year long

C = Present only during colder months

W = Present only during winter months

U = Uncommon

Total No. 48,874

TABLE 11

Monthly Occurrence of Fish Species - Marsh Island Area 1973 - 1974 (Y, C, U = Seasonal Occurrence)

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC	TOTAL	S.O.
Clupeidae														
Dorosoma cepedianum														
Engraulidae														
Anchoa hepsetus				1									1	Y
Ariidae														
Arius felis					2								2	Y
Batrachoididae														
Opsanus tau					1								1	Y
Gadidae														
Urophycis regius					1								1	U
Ophidiidae														
Rissola marginata														
Belonidae														
Strongylura marina														
Cyprinodontidae														
Cyprinodon variegatus														
Gerreidae														
Eucinostomus argenteus												1	1	U
Haemulidae														
Brachydeuterus auritus	15	13	732	1	21	18					1	4	805	Y
Sciaenidae														
Cynoscion nebulosus		7											7	C
Cynoscion regalis														
Leiostomus xanthurus	2	34			3	29		1				25	94	Y
Mugilidae														
Mugil cephalus					227	21	6	19	57	39	23		392	Y
Menidia beryllina	81	337	196	111	406	391	35	23	156	350	218	107	2411	Y
Synodontidae														
Synodus foetens														
Ictaluridae														
Ictalurus catus														
Ariidae														
Arius felis														
Batrachoididae														
Opsanus tau														
Gadidae														
Urophycis regius	5	43	127	106	96	27							404	C
Ophidiidae														
Rissola marginata			1	3	8			9				7	28	Y

TABLE 11 (continued)

SPECIES	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC	TOTAL	S.O.
Atherinidae											4		6	Y
Menidia menidia		2								1		1	3	Y
Syngnathidae				1								1	1	Y
Syngnathus fuscus														
Serranidae														
Centropristis striata					2	1		1					4	Y
Percidae														
Etheostoma olmstedi														
Carangidae							17	1	1	5			24	W
Caranx hippos							3	4					7	W
Selene vomer							2		4	151			157	U
Vomer setapinnus														
Gerreidae														
Eucinostomus argenteus														
Percichthyidae														
Morone chrysops														
Sparidae														
Lagodon rhomboides						3		553			1	2	560	Y
Sciaenidae		1												
Bairdiella chrysura														
Cynoscion nebulosus		1			18	43	48	40	61	53	1	4	269	Y
Cynoscion regalis	2	6		19	3	2	1	59	17	8	1	15	133	Y
Larimus fasciatus					27	359	3	14	2		1	5	411	Y
Leiostomus xanthurus							3	59	8	7	4	41	118	Y
Menticirrhus americanus		2		3										
Menticirrhus littoralis														
Micropogon undulatus			1		5	300	20	20				3	349	Y

TABLE 11 (continued)

Species															
Ophidiidae															
Unidentified larvae							1						2736	4255	Y
Labridae														1	Y
Halichoeres bivittatus															
Gobiidae															
Astrogobius virgatus	3	2											1	6	U
Gobiidae															
Microgobius thalassinus					5	14								24	W
Gobiidae															
Scorpaenichthys marmoratus															
Hippocampus ingens								3	1					4	W
Syngnathidae															
Syngnathus auliscus							24	8	2					34	W
Syngnathus leptorhynchus					13	11	9							24	W
Syngnathidae															
Hippocampus ingens		1				21	1	1						24	Y
Syngnathus leptorhynchus							9	1					1	1	Y
Gobiidae															
Acanthogobius flavimanus															
Citharichthys stigmaeus								11		1			6	18	Y
Hypsopsetta guttulata		1		2									2	5	Y
Paralichthyidae															
Paralichthys californicus							1		1				1	3	Y
Paralichthys lethostigma		1												1	Y
Scophthalmus aquosus		10	1	4	5	1								21	Y
Pleuronectidae															
Pleuronichthys verticalis	2	6	4	2	1	1	26	3					2	47	Y
Cynoglossidae															
Symphurus plagiusa	1	61	19	8	1	7	14	2	3	1			32	149	Y

TABLE 11 (continued)

SPECIES	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC	TOTAL	S.O.
Belted Kingfisher														
Megaceryle alcyon										2		6	8	Y
Red-bellied Woodpecker														
Melanerpes carolinus					1								1	U
Yellow-bellied Sapsucker							5	1					6	C
Sphyrapicus varius														

Y = Occurs year long

C = Present only during colder months

W = Present only during winter months

U = Uncertain

Total No. 13,831

S. C.

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Total Shellfish Pounds	Total Shellfish Dollars	Total Fish Pounds	Total Fish Dollars	Grand Total Fish and Shellfish Pounds	Grand Total Fish and Shellfish Dollars
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible],285,959
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1,790,[illegible]	[illegible]	[illegible]	[illegible],093
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1,809,02[illegible]	[illegible],323	[illegible]	[illegible],585
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	153,[illegible]	[illegible],184	[illegible],991
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	3,1[illegible]	[illegible]	7,59[illegible]	[illegible],841
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible],277
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible],116	[illegible]	[illegible]	[illegible],094
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible],965	[illegible],281	[illegible],330,665
[illegible]	[illegible]	[illegible]	[illegible]	962,474	[illegible]	[illegible]	[illegible],181	[illegible]	27[illegible],774	10,068,876	2,2[illegible],955
[illegible]	[illegible]	[illegible]	[illegible]	966,27[illegible]	[illegible]	[illegible]	[illegible],611	[illegible],317,127	268,[illegible]	[illegible],401,318	1,233,177

Table 13 Average monthly catch per unit of effort for zooplankters in experimental plankton tows, Wando River, 1963 - 1964.

	CATCH PER UNIT OF EFFORT												
Zooplankter	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.
Coelenterata	2065.9	3859.9	4521.9	3730.0	1309.3	36.7	12.3	0.3	0.3	1.1	0.6	21.3	2375.0
Ctenophora			6.3	0.1								3.2	
Chaetognatha						0.3			0.1				
Polychaeta		0.3											
Misc. worms		0.1			0.2			0.3					
Copepoda	357.2	734.0	1533.3	16.3	9.6		0.3	32.3	157.5	666.9	177.0	246.0	73.5
Mysidacea	2.9	20.1	1.5	91.3	0.9	6.4	1.5	0.3		4.0	2.4	60.0	
Isopoda	0.8	0.5	0.3	0.3	0.3	0.4		0.1	0.1	0.5	1.3	0.8	0.8
Amplipoda	2.0	0.3		0.4	0.2	0.5	0.5	0.5	0.1	2.0			
Paleomonetes		3.0						0.1	0.4	0.1			0.8
Paleomonetes larvae	10.8	34.1	3.0	0.8	1.2	0.1					0.3	2.5	0.8
Penaeid larvae	1.5	1.3	0.6		0.1					1.0	0.9		1.0
Misc. shrimp larvae		0.1		0.1									
Sergestidae		0.1			0.4								
Callinectes larvae	649.2	831.5	389.4	21.6							398.3	2409.4	3163.8
Misc. crab larvae	14.5	1.3	16.0	12.4									
Micropogon						0.3	1.0	0.4	0.3	0.3			
Leiostomus							0.1	1.4	1.5	1.0			
Paralichthys										0.1			
Anchoa							0.1		0.3				0.2
Gobiosoma							0.1						
Stellifer	0.3	0.1		0.3									
Brevoortia								0.1	1.6	0.4	0.3		
Lagodon								0.1					
Misc. fish larvae	0.2	0.1	0.3				0.1						
Mollusca						0.1		0.9	0.1				
Callinectes juveniles						0.1				0.1			
Caprella	0.2							0.1					
Misc. shrimp			0.6										
Eggs		0.1		0.1									

Table 14 Monthly abundance of zooplankters in experimental plankton tows, Cooper River, 1963 - 1964.

	CATCH PER UNIT OF EFFORT												
Organisms	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June
Organic detritus, cc.	5.0	4.8	2.0	8.0	10.8	60.0	0.5	13.5	117.0	45.5	5.8	1.0	4.0
[illegible]ferata	2200.5	633.5	148.0	676.3	673.0	8.8	1.5	0.8	25.2	8.3	4.7	43.5	146.0
Ctenophora		1.8	2.3		3.0							1.3	2.5
Chaetognatha	25.0	54.5	2.5			0.5	1.3		0.8		0.5	0.5	
Polychaeta											0.5		
Misc. worms		1.5		23.3	0.2	0.1							
Copepoda	26.5	1578.0	1.5	81.3	5.5			2.5	81.3	47.5	192.5	92.0	225.0
Mysidacea	29.5	0.5		5.0	3.8	20.5	1.3	25.0	0.5	4.5	0.3	2.5	
Isopoda	3.5	1.0		2.3	0.2	0.8			0.3	0.3	0.5	1.3	
Amphipoda	1.5		1.3	1.0		1.2	0.3	1.0	0.3	0.8			
Palaemonetes							0.3	1.0	0.3	0.8	0.2	0.5	
Palaemonetes larvae	34.0	1.2		6.3	5.8	0.3					0.5	4.5	2.5
Penaeid larvae	11.0	3.8	0.3	4.3	3.0					2.5	0.8		
Misc. shrimp larvae			1.0	1.7		0.5						1.3	57.5
Sergestidae		0.2		2.3								0.5	
Callinectes larvae		6.3	189.5	13.8	0.5						20.8	12.5	47.5
Misc. crab larvae	3.0		0.8		2.0								
Stomatopoda			0.3		0.2						160.0		
Micropogon					0.8	1.8		0.5	0.3	1.0			
Leiostomus								0.5	0.3	1.8			
Anchoa						0.5		0.3		0.5			0.5
Gobiosoma								0.3	0.8				
Brevoortia									1.8		0.3		
Lagodon								0.3	0.3				
Misc. fish larvae	1.0	0.3		1.0	0.2			0.8	0.2	0.2			2.0
Mollusca	1.5		0.5							0.5			
Callinectes juveniles									0.3				
Eggs			0.5								7.5		

Table 15. Monthly abundance of zooplankters in experimental plankton tows, North Santee River, 1963-1964.

	CATCH PER UNIT OF EFFORT												
[illegible]	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June
[illegible]	109.0	82.2	83.0	43.7	104.5	18.7	20.3	11.0	36.3	53.3	127.5	62.2	24.2
[illegible]	545.0	459.6	838.3	531.2	947.5	17.5	0.8		0.2	4.2	0.8	0.8	311.7
[illegible]			4.0									8.3	5.2
[illegible]				1.5	4.2		2.8	0.2				5.8	61.7
[illegible]	0.3		0.3		0.2						0.8		
[illegible]	266.7	5.0	1791.7	3.0	33.5		2.3	17.2	13.7		4.2	29.2	115.8
[illegible]	22.7	10.2	4.5		212.7	35.7	2.5	1.2	1.3	3.0			
[illegible]	0.3	0.4		0.2	0.2			0.2	0.2	0.3		0.2	3.8
[illegible]	63.7	5.6	110.7	56.7	2.3	3.2	0.3	9.3	5.2	2.0	6.3		
Diptera	3.7	0.2			0.2	1.7		1.9	1.7	1.3	0.2	0.2	0.2
Fish eggs	22.7	15.2	5.2	3.0	2.7	0.7							179.7
Penaeid larvae		2.6	5.0	0.2						2.3			0.3
Mysis shrimp larvae	0.2		0.2	0.2	2.0								266.7
Sergestidae			150.3	0.3	1.0								33.3
Callinectes larvae	28.3	11.0	71.2	0.3	29.3							16.7	571.7
Mysis crab larvae	0.3		0.5	0.3	83.5		0.2						
Stomatopoda			0.7										
Mysidacea	1.3			0.3	5.5	3.7	0.8	4.3	3.2	1.3			
Leiostomus								10.2	42.2	10.7	0.2		
Paralichthys								0.2					
Anchoa								0.2	0.2				6.7
Gobiosoma			0.2					0.2					25.0
Strongylura			0.7										
[illegible]									0.2	27.0			
								0.5	0.2	0.2			
							2.3	0.3	1.0				
	[illegible]	0.3	2.0	0.3	0.2		0.2		0.5		0.3	0.7	13.0
									4.2				
												14.5	

Table 16 Monthly abundance of zooplankters in experimental plankton tows, Ashley River, 1963-1964

CATCH PER UNIT OF EFFORT

Species, etc.	June	July	Aug.	Sept	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June
Organic detritus	11.7	21.8	1.9	1.2	12.3	2.5	6.9	4.0	55.8	71.0	8.4	4.5	44.3
Coelenterata	536.7	542.4	3180.7	1019.5	318.7	32.2	13.5	0.5	12.3	53.3	26.0	349.8	356.6
Ctenophora		1.0	1.5	1.5	12.7						0.6	14.0	0.7
Chaetognatha	120.0	2.5	79.4	20.9					0.3				1.0
Polychaeta											0.9	2.0	
Misc. worms			0.5	0.4			0.2					5.0	
Copepoda	443.7	53549.2	1166.6	382.2	5.1	2.4	0.5	0.3	23.2	43.7	127.8	67.8	54.3
Mysidacea	125.0	41.2	12.5	166.9	6.0	5.5	0.2	10.7	11.7	11.7	3.0	4.4	
Isopoda				0.4	0.7			0.3			0.7	0.1	0.3
Amphipoda	1.3	0.4	0.5	0.2		2.4		0.3	0.5	0.2	0.3		
Paleomonetes	3.0	0.5	1.2					1.2	1.3		0.2		
Paleomonetes larvae	69.7	9.2	5.5	11.5	3.0							15.6	14.3
Penaeid larvae	14.3	3.4	1.2	1.0		0.4				0.3	1.0		
Misc. shrimp larvae		5.5	68.3	0.6									1.7
Sergestidae	1.7	2.7	2.0	46.6									
Callinectes larvae	37.3	198.4	259.4	33.4							0.2	219.1	1213.0
Misc. crab larvae				215.9	19.0	1.0							
Stomatopoda				0.2									
Micropogon							0.2	1.0	6.5	0.3	0.3	0.5	0.3
Leiostomus								1.0	17.9	3.7	0.4		
Paralichthys								0.2	1.3				
Anchoa		0.4	0.2				1.0		1.5	0.3			8.3
Stellifer		0.4		0.7			1.0						
Brevoortia									0.7	1.0	0.7		
Eel larvae									0.7				
Lagodon								0.2	0.2				
Misc. fish larvae				2.0			0.2	0.2					
Mollusca			1.3		0.2								
Eggs				5.4							0.7	0.2	
Renilla						0.2							

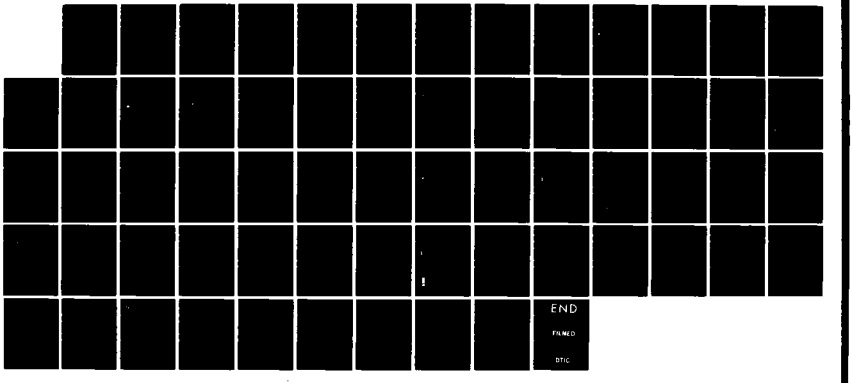
TABLE 17

Standing crops (catch per surface acre) of fishes and invertebrates in three Cooper River, South Carolina, tidal streams in April, July, and November 1971. Numbers of organisms are suffended by weights (pounds) in parentheses.

Organisms	Sampling Site											
	Clouter No. 1			Clouter No. 2			Bushy Park			Mean[1]		
	April	July	November	April	July	November	April	July	November	April	July	November
Fishes												
Lepisosteidae - gars												
Lepisosteus osseus, longnose gar		2 (5.6)			5 (13.5)				1 (0.1)		2 (6.4)	<1 (<0.1)
Amiidae - bowfins												
Amia calva, bowfin				1 (2.6)						<1 (0.9)		
Anguillidae - freshwater eels												
Anguilla rostrata, American eel	462 (10.3)	23 (2.0)	1 (0.3)	559 (6.5)	1,303 (108.0)	18 (1.5)	463 (14.5)	28 (2.5)	9 (1.0)	495 (10.4)	451 (37.5)	9 (0.9)
Clupeidae - herrings												
Alosa aestivalis, blueback herring			85 (0.4)			961 (5.1)			107 (0.2)			384 (1.9)
Alosa mediocris, hickory shad				1 (0.6)								
Brevoortia tyrannus, Atlantic menhaden	3,398 (3.1)	15,562 (33.8)	9 (<0.1)	22,464 (5.1)	21,421 (71.6)	5 (<0.1)	2 (<0.1)	7 (<0.1)		8,621 (2.7)	12,330 (35.1)	5 (<0.1)
Dorosoma cepedianum, gizzard shad	7 (0.4)		13 (1.3)	14 (0.2)	251 (1.1)	8 (2.3)	3 (0.2)	9 (0.5)	1 (0.7)	8 (0.3)	87 (0.5)	7 (1.4)
Dorosoma petenense, threadfin shad	2 (<0.1)			1 (<0.1)						1 (<0.1)		
Engraulidae - anchovies												
Anchoa mitchilli, bay anchovy			435 (0.1)	107 (0.3)		10,508 (22.3)			1,305 (0.3)	36 (0.1)		4,083 (7.6)
Esocidae - pikes												
Esox niger, chain pickerel								1 (<0.1)			<1 (<0.1)	
Cyprinidae - minnows and carps												
Cyprinus carpio, carp					2 (22.0)						<1 (7.3)	
Ictaluridae - freshwater catfishes												
Ictalurus catus, white catfish	379 (12.8)	521 (24.7)	1 (<0.1)	209 (4.0)	87 (6.5)	459 (30.4)		884 (5.0)	1 (0.3)	196 (5.6)	497 (12.1)	154 (10.2)
Belonidae - needlefishes												
Strongylura marina, Atlantic needlefish		9 (0.1)		2 (0.9)	1 (<0.1)	1 (0.4)		1 (<0.1)		<1 (0.3)	4 (<0.1)	<1 (0.1)
Cyprinodontidae - killifishes												
Fundulus heteroclitus, mummichog	869 (6.6)	21,476 (30.0)		4,580 (13.4)	3,964 (7.7)	806 (0.9)	850 (1.1)	3,805 (17.1)		2,100 (7.0)	9,748 (18.3)	269 (0.3)
Poeciliidae - livebearers												
Gambusia affinis, mosquitofish								2 (<0.1)			<1 (<0.1)	
Atherinidae - silversides												
Menidia beryllina, tidewater silverside		806 (1.8)	414 (0.1)	6 (<0.1)	806 (1.8)	1,636 (3.0)	1,235 (0.9)	12 (<0.1)	39 (<0.1)	414 (0.3)	541 (1.2)	696 (0.4)
Menidia menidia, Atlantic silverside	1 (<0.1)	1,936 (1.8)								<1 (<0.1)	645 (0.6)	
Sphyraenidae - barracudas and mackerels												
Sphyraena borealis, northern pelfish			1 (<0.1)									<1 (<0.1)
Scombridae - mackerels												
Scomberomorus maculatus, Spanish mackerel						1 (<0.1)						<1 (<0.1)
Pomatomidae - bluefishes												
Pomatomus saltatrix, bluefish			1 (<0.1)			1 (0.8)						1 (0.4)
Sparidae - porgies												
Archosargus probatocephalus, sheepshead			1 (<0.1)			15 (0.4)			1 (<0.1)			6 (0.1)
Sciaenidae - drums									4 (1.2)			1 (<0.1)
Micropogonias undulatus, Atlantic croaker							<3 (2.3)		3 (0.3)	8 (0.8)		1 (<0.1)

AD-A149 547 CHARLESTON HARBOR DEEPENING PROJECT CHARLESTON HARBOR AND SHIPYARD RIVER SOUTH CAROLINA(U) CORPS OF ENGINEERS CHARLESTON SC CHARLESTON DISTRICT APR 76 3/3

UNCLASSIFIED F/G 13/2 NL



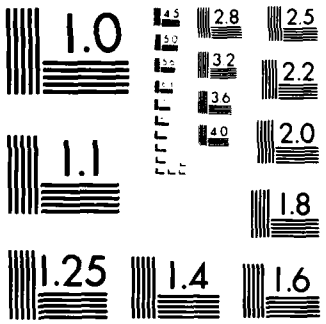


TABLE 17 (continued)

Organisms	Sampling site											
	Clouter No. 1			Clouter No. 2			Bushy Park			Mean		
	April	July	November	April	July	November	April	July	November	April	July	November
Fishes												
Lepomis macrochirus, bluegill						1 (<0.1)		2 (<0.1)			<1 (<0.1)	<1 (<0.1)
Lepomis microlophus, redear sunfish							1 (<0.1)	1 (<0.1)		<1 (<0.1)	<1 (<0.1)	
Lepomis punctatus, spotted sunfish	1 (<0.1)						1 (0.1)	16 (0.6)		<1 (<0.1)	<1 (0.2)	
Micropterus salmoides, largemouth bass			1 (0.1)	1 (0.1)	23 (3.2)	3 (0.8)	6 (1.3)	421 (3.1)	11 (3.3)	2 (0.5)	148 (2.1)	5 (1.4)
Pomoxis annularis, white crappie	3 (0.1)		18 (1.8)	24 (0.7)	47 (1.3)		14 (0.3)	5 (0.5)	9 (0.9)	14 (0.4)	10 (0.4)	9 (0.9)
Percidae - perches Perca flavescens, yellow perch				4 (0.2)	3 (0.3)	2 (1.0)	6 (0.2)	14 (0.5)	4 (0.4)	3 (0.1)	6 (0.3)	2 (0.5)
Pomatomidae - bluefishes Pomatomus saltatrix, bluefish					3 (0.1)						1 (<0.1)	
Carangidae - jacks and pompanos Caranx hippos, crevalle jack			6 (0.1)			20 (0.6)			1 (<0.1)			9 (0.2)
Gerreidae - mojarras Eucinostomus gula, silver jenny			3 (<0.1)			41 (0.1)			8 (<0.1)			17 (<0.1)
Sciaenidae - drums Bairdiella chrysoura, silver perch		158 (0.3)	3 (0.1)		4,944 (1.4)						1,701 (0.6)	1 (<0.1)
Cynoscion nebulosus, spotted seatrout			5 (0.3)									2 (0.1)
Leiostomus xanthurus, spot	7 (0.3)	2,783 (8.1)	2,826 (0.1)	29 (1.5)	1,341 (9.9)	3,058 (2.5)			76 (0.4)	12 (0.6)	1,375 (6.0)	1,987 (1.0)
Micropogon undulatus, Atlantic croaker	19,548 (29.3)		26 (<0.1)	75,425 (85.4)			2,447 (1.8)	10 (0.1)		32,473 (38.8)	3 (<0.1)	9 (<0.1)
Mugilidae - mullets Mugil cephalus, striped mullet	2,053 (36.3)	1,228 (9.8)	4 (1.4)	1,582 (36.8)	35 (4.4)	22 (4.2)	830 (22.7)	24 (2.2)	2 (0.3)	1,488 (31.9)	429 (5.5)	9 (2.0)
Gobiidae - gobies Evorthodus lyricus, lyre goby								2 (<0.1)			<1 (<0.1)	
Gobiomellus hastatus, sharptail goby								3 (<0.1)	1,218 (0.6)		1 (<0.1)	406 (0.2)
Gobiomellus shufeldti, freshwater goby	1 (<0.1)	37 (0.1)	1,212 (0.2)	2,121 (4.7)	889 (3.8)		2,035 (2.7)	3,282 (4.7)		1,386 (2.5)	1,403 (2.9)	406 (<0.1)
Gobiosoma bosci, naked goby				1,081 (2.4)	403 (0.1)	416 (0.2)	1 (<0.1)	397 (0.1)		361 (0.8)	267 (<0.1)	139 (<0.1)
Bothidae - lefteye flounders Etropus crossotus, fringed flounder		9 (0.1)						2 (0.1)			4 (<0.1)	
Paralichthys dentatus, summer flounder			1 (0.1)			1 (0.3)			1 (0.1)			1 (0.2)
Paralichthys lethostigma, southern flounder	7 (0.5)	1 (<0.1)		2,922 (1.5)	9 (0.2)		1,220 (0.9)	9 (0.2)		1,383 (1.0)	6 (0.2)	
Soleidae - soles Trinectes maculatus, hogchoker					1 (<0.1)		1 (<0.1)	1 (<0.1)	1 (<0.1)	<1 (<0.1)	<1 (<0.1)	<1 (<0.1)
Total fishes (45 species)	26,738 (99.9)	44,551 (118.3)	5,066 (7.3)	111,133 (167.0)	35,538 (257.1)	17,983 (74.9)	9,138 (49.1)	8,938 (37.7)	2,802 (10.4)	49,003 (102.0)	29,676 (137.7)	8,617 (30.9)
Invertebrates												
Palaemonidae - grass shrimps Palaemonetes pugio, grass shrimp	50,860 (24.7)	357,416 (247.7)	4,039 (0.4)	307,312 (122.0)	980,016 (663.3)	334,093 (104.8)	56,177 (13.1)	10,093 (2.0)	2 (<0.1)	138,116 (53.3)	449,175 (304.3)	112,711 (35.1)
Penaeidae - penaeid shrimps Litopenaeus setiferus, white shrimp		11,759 (13.5)	481 (2.1)		50,668 (61.5)						20,809 (25.0)	160 (0.7)
Portunidae - swimming crabs Callinectes sapidus, blue crab	1,635 (94.6)	15 (1.2)	1,216 (1.1)	2,761 (3.1)	8,151 (32.4)	809 (1.4)	1,638 (30.4)	425 (1.9)	2 (0.7)	2,011 (42.7)	2,864 (11.8)	676 (1.1)
Total invertebrates (3 species)	52,495 (119.3)	369,190 (262.4)	5,736 (3.6)	310,073 (125.1)	1,038,835 (757.2)	334,902 (106.2)	57,815 (43.5)	10,518 (3.9)	4 (0.7)	140,127 (96.0)	472,848 (341.2)	113,547 (36.8)
Total organisms (48 species)	79,233 (219.2)	413,741 (380.7)	10,802 (10.9)	421,206 (292.1)	1,074,371 (1,014.3)	352,885 (181.1)	66,953 (92.6)	19,456 (41.6)	2,806 (11.1)	189,131 (201.3)	502,523 (478.9)	122,164 (67.7)

[illegible] Discrepancies in totals due to rounding of mean values.

TABLE 18

Species Composition of Fish Captured in Charleston Harbor Dumping Area

Family & Species	No. of Specimens	Length Range (mm)
Carcharhinidae		
Mustelus canis	1	641
Rajidae		
Raja eglanteria	1	477
Engraulidae		
Anchoa hepsetus	12	100-119
Synodontidae		
Synodus foetens	144	140-339
Ogcocephalidae		
Ogcocephalus	1	59
Gadidae		
Urophycis regius	1	188
Syngnathidae		
Centropristis striata	12	71-182
Diplectrum formosum	1	91
Carangidae		
Caranx crysos	1	164
Decapterus macarellus	10	122-144
Decapterus punctatus	4	133-173
Lutjanidae		
Lutjanus analis	8	76-126
Gerreidae		
Eucinostomus argenteus	1	90
Eucinostomus gula	1	78
Pomadasyidae		
Orthopristis chrysoptera	1	122
Sparidae		
Stenotomus caprinus	18	75-120
Lagodon rhomboides	3	105-118
Scianidae		
Bairdiella chrysura	1	140
Leiostomus xanthurus	10	135-155
Trichiuridae		
Trichiurus lepturus	1	216
Stromateidae		
Peprilus triacanthus	50	105-144
Triglidae		
Prionotus evolans	3	103-118
Prionotus scitulus	9	101-121
Bothidae		
Ancyclopsetta quadrocellata	4	146-199
Citharichthys spilopterus	26	53-81
Scophthalmus aquosus	1	119
Balistidae		
Balistes capriscus	1	122
Monocanthus hispidus	1	54

Total No. 328

TABLE 19

SPECIES COMPOSITION OF BENTHIC AND FREE-SWIMMING INVERTEBRATES CAPTURED IN CHARLESTON HARBOR DUMPING AREA.

	UNCOMMON	COMMON	ABUNDANT
Portunidae			XXX
Cancridae	X		
Maiidae	X		
Paguridae		XX	
Xiphosura	X		
Squillidae		XX	
Loliginidae			XXX
Holothuroidea	X		
Echinoidea		XX	
Asteroidea		XX	
Ophiuroidea		XX	
Gastropoda		XX	
Pelecypoda	X		
Chaetopoda	X		
Entoprocta		XX	
Anthozoa		XX	
Amphineura	X		
Cirripedia	X		

APPENDIX A

ECONOMIC DATA, EXTRACTED FROM U. S. ARMY CORPS OF ENGINEERS SURVEY REPORT, CHARLESTON AND SHIPYARD RIVER, SOUTH CAROLINA. COMPLETE DOCUMENT IS AVAILABLE AT U. S. ARMY ENGINEER DISTRICT, CHARLESTON, SOUTH CAROLINA

Type of Benefit	Charleston Harbor	Shipyard River
Savings in Transportation Costs		
(1) Petroleum Products	$4,428,000	$716,000
(2) Containerized Cargo	1,100,000	-
(3) Dry Bulk Cargo		
a. Ore	-	648,000
b. Oil & Grains	369,000	-
Reduction in Hazards to Navigation	33,000	-
TOTALS	$5,930,000	$1,364,000

Estimated First Costs and Annual Charges

Item	Charleston Harbor	Shipyard River
Federal First Costs	$ 23,688,000	$1,979,000
Non-Federal First Costs	3,498,000	1,212,000
TOTAL FIRST COSTS	$ 27,186,000	$3,191,000
Annual Charges		
Federal	$ 2,766,000	$ 508,000
Non-Federal	329,000	436,000
TOTAL	$ 3,095,000	$ 944,000
Excess Annual Benefits	$ 2,835,000	$ 420,000
Benefit-Cost Ratio	1.92	1.44

APPENDIX B
LETTERS OF COMMENT ON DRAFT EIS

Table of Contents

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
901 Sumter Street, Columbia, South Carolina 29201

October 21, 1974

Colonel Harry S. Wilson, Jr.
District Engineer
Corps of Engineers
P. O. Box 919
Charleston, South Carolina 29402

Dear Colonel Wilson:

Appropriate members of my staff have reviewed the draft environmental impact statement for the Charleston Harbor Deepening Project and we have no comments to offer.

We appreciate the opportunity to review this statement.

Sincerely yours,

G. E. Huey
State Conservationist

B-1

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
ATLANTA, GEORGIA

November 8, 1974

Re: 456-9-74

Commanding Officer
U. S. Army Engineer District
Post Office Box 919
Charleston, South Carolina 29402

Dear Sir:

Subject: Charleston Harbor Deepening
Project
Charleston, South Carolina

We have reviewed the subject draft Environmental Impact Statement. Based upon the data contained in the draft, it is our opinion that this proposed action will have only a minor impact upon the human environment with respect to the concerns of this Department.

Sincerely yours,

James E. Yarbrough
Regional Environmental Officer

FEDERAL POWER COMMISSION
REGIONAL OFFICE
730 Peachtree Building
Atlanta, Georgia 30308
October 2, 1974

District Engineer
Corps of Engineers
Department of the Army
P. O. Box 919
Charleston, S. C. 29402

Dear Sir:

This is in response to your letter dated September 24, 1974, your file SANGC-R, requesting our review and comments on the draft environmental impact statement dated September 1974 for Charleston Harbor Deepening Project.

Our comments are made in accordance with the National Environmental Policy Act of 1969 and the August 1, 1973, Guidelines of the Council on Environmental Quality. Our principal concern with developments affecting land and water resources is the possible effect of such developments on bulk electric power facilities, including potential hydroelectric developments, and on natural gas pipeline facilities.

A review of the report indicates that the proposed plan would have no significant effect on such facilities. However, if there are any electrical power transmission facilities or natural gas facilities existing in the vicinity, these should be protected during construction.

Very truly yours,

C. L. Fishburne

C. L. Fishburne
Regional Engineer

2cc: Div. Engr.
Atlanta, Ga.

United States Department of the Interior

OFFICE OF THE SECRETARY

Southeast Region / 148 Cain St., N.E. / Atlanta, Ga. 30303

ER-74/1220 November 8, 1974

AIRMAIL

District Engineer
U.S. Army Corps of Engineers
Post Office Box 919
Charleston, South Carolina 29402

Dear Sir:

In response to your September 24, 1974, letter to the Assistant Secretary, Program Policy, we have reviewed the draft environmental statement for the proposed Charleston Harbor Deepening Project for its effects on national park areas, outdoor recreation, geology, hydrology, cultural, mineral, and fish and wildlife resources.

We offer the following comments for your consideration:

General

We are pleased to note that initial steps have been taken to comply with the requirements of the Advisory Council on Historic Preservation's "Procedures for the Protection of Historic and Cultural Properties" (Federal Register Section 800, January 25, 1974).

The National Register of Historic Places lists known cultural (historic, archeological, architectural) resources. It is the responsibility of the constructing or licensing agency to identify such resources in the area of project impact which may be eligible for nomination or in the process of nomination, as well as those already listed in the National Register.

Because cultural resources are nonrenewable, special care should be taken to preserve them and minimize project impacts upon them. The State Historic Preservation Officer should be consulted for information on cultural properties and his comments included in the final statement. If there are areas within the zone of project impact

[illegible] not been [illegible] evaluated, then it is the responsibility of the federal agency to see that such an evaluation is made. Results of the evaluation should also be presented in the final statement. Significant cultural resources, whether [illegible] subsurface or underwater, which are subject to [illegible] damage by the project should be salvaged.

[illegible]

we suggest that a clarification be made to differentiate "recommended channel deepening" and "recommended deauthorization" on figure 3.

1.0 Project Description:

The term "upland disposal" is defined on page 22 as "disposal above the highwater mark." Throughout the statement the term "upland" is used frequently, without further explanation. The term "upland" appears to have been used only as a means to differentiate areas that are above from areas that are below the mean high water line. We believe such a usage is misleading and suggest it be clarified.

1.04:

The last paragraph indicates that approximately 1,110 acres of new diked disposal areas would be needed, probably on Daniel Island proper. It is our understanding that these disposal areas have not been selected. The environmental impact statement should either provide a general description of the probable locality on Daniel Island or state why such a description has been omitted, e.g., that a disposal area has not been selected.

2.0 Environmental Setting Without the Project:

2.07.3:

No mineral production has been recorded in recent years in Charleston County. Sand, an abundant resource in the area, has been produced in the recent past in the county. The statement indicates that, "The Charleston area...was formerly the most productive area of phosphate in the state," (but) "...mining in the area has been insignificant since 1920 and ceased entirely in 1938..."

Investigations by the U.S. Geological Survey indicate the presence of heavy minerals on James Island and on nearby Isle of Palms and Folly Beach. However, the statement does not indicate the possible presence of heavy minerals in the project area. Section 2.07.3 should be expanded to reflect consideration of heavy minerals as potential resources. The impact of the project on these resources should be discussed in sections 4.0, 5.0 and 8.0.

2.16:

We suggest the statement contain maps of sufficient scale to clearly depict the location of all cultural resources in the Charleston area within the zone of project impact.

4.0 The Probably Impact of the Proposed Action on the Environment:

The entire perimeter of the Daniel Island site, as shown by a comparison of figures 4 and 10, is near sea level and must be marsh unless the former marsh has already been destroyed by spoil deposition. Such deposition on marshland has not been indicated on figure 10, nor has it been mentioned in the text. Figure 10 also shows that the former disposal area is diked and that the spoils were clearly deposited on marshland, as the perimeter of the spoil area is ringed by surviving marsh. The fact that all present spoil areas shown on figure 4 extend to the water's edge, or beyond, suggests that marsh bordering the shore will inevitably be destroyed, or already has been during recent disposal operations. We suggest these apparent discrepancies be clarified.

It is stated that "The Charleston Harbor estuary contains thousands of acres of productive salt marshes, none of which would be affected by the proposed project since dredged materials would be disposed of on upland sites or in approved offshore areas." We feel that this statement needs to be supported by map documentation, as maps now provided (e.g., figure 10) suggest that the disposal areas delineated on figure 4 include considerable marsh. That map is highly generalized with regard to disposal area limits, being at a scale of only 1:175,000 (about 2.7 miles equal 1 inch). Disposal areas should be delineated in sufficient detail to show the location of existing or proposed dikes with respect to shorelines, tidal inlets, and the limits of marshlands.

4.04:

The National Register lists only known cultural resources. The construction agency cannot take for granted that all such resources in the project area are known. Despite the fact that most of the material to be removed by dredging has been deposited in modern times, it is possible that historic shipwreck sites will be disturbed. Charleston Harbor and the mouth of the Cooper River were extensively utilized by naval vessels during the Revolutionary and Civil Wars, and many ships were sunk in this vicinity. Although modern debris would make a preproject underwater survey impractical, arrangements should be made to notify the Office of the State Archeologist in the event evidence of historic shipwreck is revealed during dredging so that artifactural material may be salvaged and preserved.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION IV

1421 PEACHTREE ST N E
ATLANTA GEORGIA 30309

Colonel Robert G. Gelsson
District Engineer
Charleston District, Corps of Engineers
P O Box
Charleston, SC 2402

Dear Colonel Gelsson

We have reviewed the Draft Environmental Impact Statement for [illegible] of Charleston Harbor and Shipyard River in South Carolina and find that exceptionally good coverage is given to the water environment. However, there are several areas that we feel that further consideration should be given, i.e. better description of each of the ocean disposal sites, (2) a detailed account of the biota of these sites, and (3) the effect of material on each biota at these sites.

Furthermore, although eight plans for the disposal of spoil are discussed, it does not appear that any decision has been made as to which plan will be used. It is noted, however, that in the [illegible] Reports on the Charleston Harbor, preferred [illegible] plan. [illegible] implementation of Plan [illegible] would be unacceptable unless [illegible] program [illegible] that dredged material will be properly transported and disposed of at sea.

It is stated [illegible] of existing sub-standard [illegible] species [illegible] is desirable. [illegible] in the plan, that the [illegible] Harbor.

We have environmental concerns [illegible] to the proposed [illegible] of the Federal project [illegible] Consequently, we have assigned a rating of EC-2 to the project as [illegible].

As mentioned, recreation of Plan 5 with regard to the possible effect on groundwater supplies and on inland vegetation, including trees, especially along drainageways leading from the proposed spoil sites.

We also recommend reevaluation of Plan 5 in light of the Final Regulations and Criteria for Ocean Dumping published in the Federal Register of October 15, 1973 (Volume 38, No. 198, Part III). Tests should be made of materials to be dredged (as outlined in Chapter 227.01) to determine whether spoil is polluted, in accordance with the new regulations. If such materials are found to be polluted, special attention should be given to Chapter 227.04 which states in part: Polluted dredged material may be disposed of in the ocean if it can be shown that the place, time, and conditions of dumping are such as not to produce an unacceptable adverse impact on the areas of the marine environment cited in 227.60 (c). The proposed pilot study should determine whether this is feasible.

In view of the foregoing, certain chapters of the Statement need clarification, as follows:

1. Chapter 4.03.1 should give a more complete description of vegetation on the upland sites and of the possible effect of saltwater on this vegetation.

2. Chapter 5.02 should include a description of the upland vegetation affected on the various sites. This should include an evaluation of whether areas other than the actual disposal site may be affected, such as drainageways leading from the site, with a resultant reduction in aesthetics and property values in the area.

3. Chapter 2.08 should reevaluate the data outlined. This is necessary because of the new ocean dumping regulations; however, EPA's conclusions that certain sediments are polluted is still valid for inland waters (our letter of November 2?, 1972).

We also find the Statement contains discrepancies and contradictions regarding benthic populations, the effect of the project on such populations, and recovery.

It is stated (paragraph 4. [illegible]) that [illegible] eliminated all benthic organisms from the harbor [illegible] paragraph 4.03.2.2 states that the smothering of benthos at the disposal site will be short term as the destroyed organisms are to be replaced by recruitment from surrounding areas. We suggest that if this material is toxic enough to eliminate benthic organisms in the harbor its toxicity should also preclude repopulation at the disposal site.

We further suggest that if the channel bottoms are devoid of benthic organisms, the discussion (paragraph 4.03.7.1) of resuspension of invertebrates into the water column at the dredged and disposal sites by ocean disposal operations is not relevant to this project. Paragraph 4.03.7.4 says studies show that fish will avoid turbid waters if possible. This, too, indicates that any feeding at the disposal site will be limited because of high turbidity. Further, it is indicated that the dredged material may increase the BOD, while paragraph 4.03.7.5 reveals that, although fish can tolerate high turbidities, they cannot do so when turbidity is accompanied with high BOD.

Finally, it is noted that the peninsula of Charleston has a particulate problem, often greatly exceeding national primary standards for ambient air quality. Because of this problem, we recommend that the final environmental impact statement give assurance that contributions of dust will not accrue from transportation, temporary storage or permanent land storage of dredged material.

In addition, in paragraph 4.06, the types of pollutants expected should be identified, and the word "temporary" should be clarified since continued maintenance and dredging will be required.

We would appreciate receiving five copies of the final environmental impact statement when it is available. If we can be of further assistance in any way, please let us know.

Sincerely,

Jack E. Ravan
Regional Administrator

UNITED STATES DEPARTMENT OF COMMERCE
The Assistant Secretary for Science and Technology
Washington, D.C. 20230

November 14, 1974

Colonel Harry S. Wilson, Jr.
Corps of Engineers
District Engineer, Charleston District
Department of the Army
P. O. Box 919
Charleston, South Carolina 29402

Dear Colonel Wilson:

The draft Environmental Impact Statement for "Charleston Harbor Deepening Project - Charleston Harbor and Shipyard River, South Carolina" which accompanied your letter of September 25, 1974, has been received by the Department of Commerce for review and comment.

The statement has been reviewed and the following comments are submitted for your consideration.

3.0 Project Description
3.04 Proposed Dredged Material Quantities and Placement Plan

Page 3, paragraph 3. This paragraph is not clear with respect to the location of the 1,110 acres required for initial inland disposal or the 49 acres needed annually for disposal of additional shoal material generated each year as a result of harbor deepening. The statement should describe and specify the location of these areas.

2.0 Environmental Setting Without the Project
2.13 Biological Resources
2.13.4 Commercial Fisheries

(2)

Page 57, paragraph 2.13.4.1. If the statement indicating that "...a total of 363,600 pounds or 8,054,000 herring were harvested..." were true, the average weight of these herring would be less than one ounce. We suggest these values be verified.

4.0 The Probable Impact of the Proposed Action on the Environment
4.09 Maintenance Dredging

Page 84. The location and description of the 49-acre upland disposal site must be given before the impacts of maintenance dredging can be predicted. We suggest that this section be readdressed after the disposal site has been selected.

4.10 Existing Projects

Page 85. Since the proposed project would have a favorable cost-benefit ratio at a lesser depth without the Cooper River Rediversion Project, we recommend that this section be expanded to consider the possibility and the consequences of not rediverting the Cooper River. For example, if the Cooper River were not rediverted, what depths would result in a favorable cost-benefit ratio for the Charleston Harbor project, and what would be the impact of the required dredging on the quantity of dredged material and the area needed for its disposal?

Thank you for giving us an opportunity to provide these comments, which we hope will be of assistance to you. We would appreciate receiving a copy of the final statement.

Sincerely,

Sidney R. Galler
Deputy Assistant Secretary
for Environmental Affairs

DEPARTMENT OF TRANSPORTATION
UNITED STATES COAST GUARD

Advisory Council
On Historic Preservation

3. We are particularly concerned about the effects of dredging and disposition of spoils on archeological resources.

To insure a comprehensive review of historical, cultural, archeological, and architectural resources, the Advisory Council suggests that the

environmental statement contain evidence of contact with the appropriate State Historic Preservation Officer and that a copy of his comments concerning the effects of the undertaking upon these resources be included in the environmental statement. The State Historic Preservation Officer for South Carolina is Mr. Charles Lee, Director, Archives Department, 1430 Senate Street, Columbia, South Carolina 29211.

Should you have any questions or require any additional assistance, please contact Stephen Cochran of the Advisory Council staff at 202-254-3974.

Sincerely yours,

John D. McDermott
Director, Office of Review and Compliance

South Carolina Wildlife & Marine Resources Department

November 27, 1974

Mr. Elmer C. Whitten, Jr.
State Clearinghouse
1205 Pendleton Street
Columbia, South Carolina 29201

Re: Draft Environmental Impact Statement -
Charleston Harbor Deepening Project,
Charleston Harbor and Shipyard River

Dear Mr. Whitten:

As you know, the above is focused on improvements of Charleston Harbor and existing ship channels to accommodate deep-draft vessels which are so prevalent today with the adoption of containerization. Modern trends clearly indicate that the present 35-foot channel depth is not adequate for a competitive port city. Although this project may be justified, the problem of dredged materials disposal in this case, 27 million cubic yards, is a major factor to consider in evaluating the EIS.

This Department conducted an estuarine values study under contract to the Corps of Engineers and our results and recommendations are adequately reflected in the EIS. In general, the EIS presents an accurate project description and the probable impact of the proposed work is well summarized. In our review, we found several details which should be commented on as a matter of suggested revision in the final draft; they are as follows:

(1) We do not necessarily agree with the recommendation on Page 6 concerning disposal alternatives. The disposal of materials at sea is not the most desirable alternative under all circumstances. In our opinion, upland disposal in selected diked areas would be far more desirable as well as safer than offshore disposal. We feel relatively confident that biological repercussions would occur if toxic sediments were dumped at sea.

(2) On Page 9, it is stated that approximately 1,110 acres of diked upland disposal area would be needed for the deepening project. We suggest that the impact of disposal in this area be described and the area be specified as to the selected nature of the site. We can only assume it is on Daniel Island, but there is no information on type of habitat displacement.

Mr. Elmer [illegible] Whitten, Jr. -2- November 27, 1974

[illegible] Page 45 [illegible] briefly mentioned [illegible] overall importance [illegible] should be expanded [illegible] should [illegible] appears that a statement is necessary [illegible] EIS [illegible]

[illegible] offshore disposal [illegible] effects [illegible] reefs [illegible] banks [illegible] These effects [illegible] general [illegible] offshore versus inland disposal.

[illegible] The invertebrates [illegible]

[illegible] shrimp [illegible] oysters [illegible]

[illegible] Page [illegible] material dumped in the [illegible] adverse effects on the [illegible] that [illegible] the silt and fine [illegible] by the hopper dredge and [illegible] The effects of this material, especially [illegible] could be significant. The fact that [illegible] Harbor, as pointed [illegible] of a finer nature [illegible] magnifies this problem rather than reduces it [illegible] observations [illegible] that a significant percentage of the dredged materials are stirred up by the action of the dredge and rather than being retained in the hopper, are merely pumped back over-board causing turbid conditions. The resulting turbidity probably has as much effect on the marine [illegible] deposition of these materials on the [illegible] The fate of resulting turbid masses depends on pre-vailing winds and currents. Thus, such turbid conditions could become problematical during seasonal runs of postlarval shrimp and fish.

Sincerely,

James A. Timmerman, Jr.
Executive Director

JAT:[illegible]

SC

SOUTH CAROLINA STATE PORTS AUTHORITY

[illegible]

October [illegible], 1973

Colonel Harry [illegible]
[illegible]
[illegible] South Carolina [illegible]

Dear [illegible]:

[illegible] Charleston, South Carolina [illegible] State Ports Authority that the [illegible] and enlargement [illegible] essential for the [illegible]

[illegible] shipping [illegible] technological revolution. Specialized [illegible] designed for [illegible] shipping are [illegible] anything seen before in the history of ocean navigation. They are faster, wider and deeper and they require wider and deeper channels in which to navigate. For this reason, the [illegible] recommendation for the Charleston Harbor Deepening Project is essential to maintaining the Port of Charleston's ability to accommodate the [illegible] level of commodity movement by increasing numbers of large fast ships. The need for harbor improvements is especially important for container ships which are becoming the preferred mode for the majority of the Port of Charleston's general cargo volume. In the near future as container ships become the predominant vessels in the harbor, the size will be the determining factor in channel requirements. It is anticipated that as new container ships come on stream the majority of the vessels will have operating drafts of more than 34 feet.

Limitations on the ability of the port to keep pace with shipping technology could threaten the port with stagnation and decline. This would endanger the contributions of the activities of South Carolina's ports to the economic health of the entire state.

A study recently completed by the Bureau of Business and Economic Research of the University of South Carolina cites the following 1973 economic impacts of the State Ports Authority on South Carolina's economy:

1. Transportation cost savings to South Carolina shippers of

12 [illegible] 1974

SOUTH CAROLINA ELECTRIC & GAS COMPANY
[illegible]
COLUMBIA, SOUTH CAROLINA 29202

November 11, 1974

[illegible]
[illegible] to Col Sims
Charleston District
Corps of Engineers
[illegible] Box 919
Charleston, South Carolina [illegible]

Dear Colonel Rogers:

These remarks address the Draft Environmental Statement of the Charleston Harbor Deepening Project and dated September 1974. Page 5, paragraph 10.4, the Ashley River Section. You have omitted our [illegible] load.

Table 2, Page 1 [illegible] under Terminal [illegible] [illegible] of 5, Table 3, the 399,750,000 gallons per day would be deducted, 5 million gallons per day of cooling water and 394,750,000 gallons per day of [illegible] water.

Table 4, Page 131, Charleston County, Plant Hagood [illegible] our percentage load level should be 67.55 million gallons per day and the type treatment should be cooling water and plant process water.

The changes recommended here have been submitted [illegible] your [illegible] Department.

Attached are copies of NPDES Permits reflecting the above changes.

Very truly yours,

E. H. Crews, Jr.

EHC:gj
Attachments

JAMES R. MANN
4TH DISTRICT, SOUTH CAROLINA

Room 1117
LONGWORTH BUILDING
TELEPHONE 202-225-5030

COUNTIES:
GREENVILLE
SPARTANBURG

Congress of the United States
House of Representatives
Washington, D.C. 20515

COMMITTEE ON JUDICIARY
COMMITTEE ON
DISTRICT OF COLUMBIA

DISTRICT OFFICES:
FEDERAL BUILDING
GREENVILLE

FEDERAL BUILDING
SPARTANBURG

Post Office Box 1911
Greenville, South Carolina

November 7, 1974

Colonel Harry S. Wilson, Jr.
U. S. Army Corps of Engineers
Post Office Box 919
Charleston, South Carolina 29402

Dear Colonel Wilson:

I appreciate the opportunity of commenting on the draft environmental statement on the Charleston Harbor Deepening Project. I consider it absolutely essential that this project proceed as rapidly as possible, since changing technology may rapidly reduce the utility of the Port of Charleston.

I am confident that the disposal recommendation made by the Corps of Engineers is a sound one, and I am prepared to support your position in the matter.

Thanks for your cooperation in expediting this project.

Sincerely,

James R. Mann
Member of Congress

JRM/r

G1-8

SENATORS

Seat No. 1
JAMES B. EDWARDS

Seat No. 2
THOMAS P. HARTNETT

Seat No. 3
THOMAS DEWEY WISE

Seat No. 4
ALLEN R. CARTER
Chairman Joint Delegation
Chairman Senate Delegation

Seat No. 5
WILLIAM W. DOAR, JR.

FRANCES K. SULLIVAN
Executive Secretary

State of South Carolina

OFFICE OF
CHARLESTON COUNTY LEGISLATIVE
DELEGATION
P. O. BOX 487
CHARLESTON, S. C.

County of Charleston

October 29,1974

Members of the House of Representatives

JAMES M. CONDON
Chairman House Delegation

JOHN L. HENSON
Vice Chairman House Delegation

CLYDE M. DANGERFIELD
ARNOLD S. GOODSTEIN
THOMAS A. RUTTO
JAMES C. JOSEPH, SR.
P. JULIAN LeMOND
J. SIDI LIMEHOUSE, III
JOSEPH P. RILEY, JR.
L. MENDEL RIVERS, JR.
WHEELER M. TILLMAN
ROBERT R. WOODS

Colonel Harry S. Wilson, Jr.
U. S. Army Corps of Engineers
Post Office Box 919
Charleston, South Carolina 29402

Dear Colonel Wilson:

It is my understanding that the Corp will be accepting comments on the draft environmental statement on the Charleston Harbor Deepening Project through November 11th.

Accordingly, I would like included for the record that I strongly endorse the Port's position on this matter and urge every consideration by the Corps on this most important project for South Carolina.

Very truly yours,

Clyde M. Dangerfield, Chairman
Roads Committee

CMD:etk

DR. JAMES B. EDWARDS
SENATOR, CHARLESTON AND
CHARLESTOWN COUNTIES
SENATORIAL DISTRICT NO. 4
SENATE OFFICE NO.

HOME ADDRESS
GARDEN ST.
CHARLESTON, S. C. 29401

THE SENATE OF SOUTH CAROLINA

COMMITTEES
ATOMIC AND NUCLEAR ENERGY
FEDERAL RELATIONS
LEGISLATIVE LIBRARY
PENAL AND CHARITABLE INSTITUTIONS
PRIVILEGES AND ELECTIONS
SOCIAL SECURITY

October 31, 1974

Colonel Harry S. Wilson, Jr.
U. S. Army Corps of Engineers
Post Office Box 919
Charleston, South Carolina 29402

Dear Colonel Wilson:

Because of my deep concern in reference to keeping Charleston Harbor in competition with international ports, I want to encourage the Corps of Engineers to do what it can to implement the recommendations in the Charleston Harbor deepening project. I am aware that the dredging necessary to improve anchorages, turning basins and channels will create problems of disposal. I hope that you will be able to implement the ocean disposal method if at all possible.

As you know, this is a most important project, and it has my enthusiastic support.

Sincerely yours,

James B. Edwards

JBE/lwj

HARRIS P. SMITH
SENATOR, PICKENS, ABBEVILLE, ANDERSON AND OCONEE COUNTIES
SENATORIAL DISTRICT NO. 1
SENATE OFFICE NO. 4

HOME ADDRESS:
BOX 68
EASLEY, S. C. 29640

THE SENATE OF SOUTH CAROLINA

COMMITTEES
AVIATION
COMMERCE AND MANUFACTURES
CORRECTIONS AND PENOLOGY
FEDERAL RELATIONS
JUDICIARY
MILITARY
NATURAL RESOURCES
VETERANS AFFAIRS

October 31, 1974

Colonel Harry S. Wilson, Jr.
US Army Corps of Engineers
Post Office Box 919
Charleston, South Carolina 29402

Dear Colonel Wilson:

Thank you for sending me a copy of your Draft Environmental Statement relating to the Charleston Harbor Deepening Project and the opportunity to comment thereon.

The Port of Charleston is of vital importance to the economy of my district and to the entire state. Operation of shipping facilities under the South Carolina State Ports Authority is playing an increasingly important role for the entire state and neighboring states. These facilities and the port must stay abreast of developments that require deeper channels and improved cargo handling facilities.

In my opinion, the Environmental Impact Statement in general gives an accurate analysis of results of alternative methods of deepening the channel. I recommend the ocean disposal method be utilized if at all possible, but that the project proceed at the earliest possible date.

Very truly yours,

Harris P. Smith

HPS:cg

AIRCO Alloys and Carbide

November 9, 1971

[illegible]

[illegible] Alloys, a division of Airco, Inc., [illegible] Avenue in North Charleston, I am [illegible] comment on the draft environmental statement [illegible] Charleston Harbor Deepening Project pre- [illegible] by the U. S. Army District Engineer, Charleston, South Carolina.

As stated previously, Airco Alloys is vitally interested [illegible] in efforts to secure improved navigation [illegible] for the Port of Charleston. We are especially [illegible] of widening and deepening Shipyard Creek and the turning basin at the Airco Dock.

Our plans for the future certainly indicate the need for wider and deeper channels and turning basins to accommodate larger ships.

Sincerely,

AIRCO ALLOYS COMPANY
A DIVISION OF AIRCO, INC.

Frank P. Sadler
General Manager

FPSimm

AMERLUX
STEEL PRODUCTS CORPORATION

[illegible]

November [illegible] th [illegible]

Colonel Harry [illegible], Jr.
U.S. Army Corps of Engineers
P. O. Box [illegible]
Charleston, S. C. [illegible]

Dear Colonel [illegible]:

We refer to the draft Environmental Statement which concerns the Charleston Harbor Deepening Project, as prepared by the U.S. Army District Engineer, Charleston, S.C., and wish to comment as follows:-

As steel importers into the United States, we are concerned with the limitation of the Charleston Harbor dimensions which create problems for the new specialized vessels that will be prevalent in the near future. Recently, the Dept. of Commerce Maritime Administration had completed an expenditure survey of North American Port Developments from the year 1966 thru 19[illegible] with projections to 19[illegible]. The survey emphasizes the need for Port Expansions and specifically the need for acceleration of channel-deepening projects in order to accommodate the new specialized general cargo type of containerized shipments.

A port exists and expands to serve its natural trade territory, but principally to provide economic stimulus to its community and area. Limitations on the ability of a port to keep pace with shipping technology could threaten the port with stagnation and decline. This of course, tends to threaten the economic health of the entire State.

The Maritime Administration recognizes the need for Port Expansions in all phases to meet the ever-increasing specialized type of shipping and, in fact, currently has under way a number

of important efforts to assist the Ports in reducing and meeting capital needs in the years ahead. For example, they are currently developing a computerized Port Information System, designed to provide Port-Decision Makers with vital data on trade trends and available facilities in order to forecast the demand for new facilities accurately.

We understand that an in-depth study was conducted by the University of South Carolina (Bureau of Business & Economic Research) at the South Carolina Ports Authority's request. This project represented almost a year of research analysis by several University economists to determine port defects on business activity and on the State of South Carolina's citizens' welfare. An interesting result of this study is the volume of State taxes which the ports generate and the $9 million annual savings in transportation costs attributable to the existence of South Carolina ports.

We wish to applaud the South Carolina Ports Authority for their foresight and determination to maintain the port of Charleston's pre-eminence among South Atlantic and Gulf ports; keeping the advantages of Charleston's large natural harbor so near the open sea and so accesible to the United States and global markets.

We feel that ocean disposal of the shoal material is the preferred method, both environmentally and economically, as reported by the Corps.

The "no growth" alternative would, of course, result in port stagnation and general economic decline in the State of South Carolina.

We wish to thank you for the opportunity to comment on this project, and remain

Very truly yours,

AMERLUX STEEL PRODUCTS CORPORATION

S. Caruso

SC/bc

AMOBELGE SHIPPING CORP.

920 BERGEN AVENUE (P. O. BOX 6867)
JERSEY CITY, NEW JERSEY 07306
TELEPHONE N. J. (201) 653-4190
N. Y. (212) 344-0855
CABLE ADDRESS: AMOBELGE, JERSEY CITY
TELEX NO. 126069

November 4, 1974

Colonel Harry S. Wilson, Jr.
U.S. Army Corps of Engineers
P. O. Box 919
Charleston, South Carolina 29402

Dear Colonel Wilson,

We have been informed by the South Carolina State Ports Authority that the Corps of Engineers will be accepting comments on the draft environmental statement on the Charleston Harbor Deepening Project until November 11th.

In this regard, we can but reiterate that the present channel and anchorage areas in Port Charleston are not adequate to handle the new container vessels in which most general cargoes now move from our country to foreign ports.

Although we are located in Jersey City, New Jersey, we ship on behalf of our clients in the South, many tons of general cargo every month from Charleston to most of the major world ports.

As you can imagine, these tonnages will increase in the years ahead, and it is imperative, therefore, that Charleston's port channel be made wider and deeper.

Trusting you will give our comments your serious consideration, we remain,

Very truly yours,

Gerald L. Zulli
Vice President-Secretary

GLZ:ck
cc: Mr. W. Don Welch
South Carolina State Ports Authority
P. O. Box 817
Charleston, South Carolina 29402

Mr. Charles Moore
Deering-Milliken, Inc.
Box 340
Union, South Carolina 29379

Associated Container Transportation (USA)

... improvement and are sure that you ... when the time comes.

Very truly yours,

W. F. Wilson
Vice President
Marine Operations

cc: Mr. W. D. Welch
Executive Director
South Carolina States Port Authority

LUMBER PRODUCTS

WINSTON SALEM, N. C. 27105

Charleston, South Carolina

... wrote you ... with reference to deepening the channel at Charleston, South Carolina in one or two different places. We are very much interested in getting these channels deepened because of the amount of material that we bring into Charleston. We have been importing into Charleston for a good many years now and ... like it better than any other port that we bring material into.

We certainly hope that you will approve and deepen these channels.

With best wishes,

Cordially,

BOWMAN TRANSPORTATION, INC.

ATLANTA GEORGIA 30316

[illegible] 4, [illegible]

[illegible]

Dear Colonel Wilson:

[illegible] letter is being written in further support of the [illegible] and modernization of the Charleston Port to accommodate [illegible] larger and more specialized ships. To keep the Port of Charleston on a competitive footing we feel that the implementation of the Corps of Engineers' recommendations for the Charleston Harbor should be approved.

Further, we feel that this project would be highly beneficial for the State of South Carolina and all companies that are involved in shipping or receiving traffic moving in export and import. Bowman Transportation, Inc. has extensive investments within the State of South Carolina and our research and marketing analysis indicates to us that South Carolina will continue to be very important to us in the future. The final disposition made regarding this port improvement will certainly have great impact on many people. A favorable disposition would be highly beneficial to Bowman Transportation and the motor carrier industry throughout South Carolina and the Southeast.

Thank you very much for allowing us to comment and state our position regarding this most important development. We offer you our sincere and enthusiastic support.

Yours very truly,

BOWMAN TRANSPORTATION, INC.

Herman B. Little
Vice President - Sales

HBL/pmq

BONDED INSURED REGULAR AND IRREGULAR ROUTE CARRIERS

BRASWELL SHIPYARDS, INC.

[illegible]

803 884 2[illegible]

[illegible]

[illegible]

Sincerely,

[illegible] Braswell,
[illegible]
President

cc: South Carolina State
Port Authority

CAROLINA EASTMAN COMPANY

July 17, 1974

Colonel Robert C. Nelson
District Engineer
U. S. Army Corps of Engineers
P. O. Box 919
Charleston, South Carolina 29402

Dear Colonel Nelson:

We are familiar with the Charleston Harbor Navigation Study and would like to voice our support of the proposed U. S. Army Corps of Engineer's project for Charleston Harbor improvements. Although we do not currently have a great deal of exports or imports at Columbia, South Carolina, our plant in Kingsport, Tennessee, does export a substantial quantity through the port of Charleston. In 1973, approximately 10,000 tons were shipped through Charleston primarily on container ships. It is our expectation that our exports will continue to grow and the need for a modern port will become even more essential.

Export shipping has made a very fast transition from break bulk cargo to containerization. It is apparent that container and LASH vessels will handle the major portion of freight in the future years. For this reason, it is essential that a modern port with facilities adequate for the handling of these large vessels be maintained.

Yours very truly,

E. M. Olson
Manager

kps

bcc: Mr. R. C. Petrey
Mr. Ralph Disler

CHARLESTON BRANCH PILOTS' ASSOCIATION

[illegible] SOUTH CAROLINA 29401

[illegible], 1979

[illegible]

[illegible],

On behalf of the [illegible] Pilots' Association I would like to support in the draft, environmental statement, subsequently the [illegible] Harbor Deepening Project.

We are in complete agreement with the plans to deepen the entrance channel to 45 feet and the existing harbor channels to 40 feet. We fully support the improvement of Rebellion Roads anchorage, enlargement of Drum Island turn at Buoy #45, widening of North Charleston Reach and Daniel Island Reach, and enlarged turning basins for Columbus St. Dock, North Charleston Port terminal and Shipyard River docks.

A 45 foot deep entrance channel is necessary, since a ships' draft increases in the rolling of a swell, and the greater speed generally made by ships on the bar and entrance channel results in more "squat" than in inner channels.

At least a 40 foot depth is needed in the inner channels to satisfy the demands of today's shipping, and to ensure some margin of safety in piloting large deep-draft ships.

Rebellion Roads Anchorage must be improved to accomodate ships nearly 900 feet long. These ships have outgrown the anchorage and need more "swinging room" as well as more depth of water.

The turning basins off Columbus St. Dock and Port terminal need to be enlarged and deepened to accomodate ships up to 870 feet long with drafts up to 38 feet.

The widening of Drum Island Turn would be extremely helpful. On ebb tide a tide rip forms at the confluence of the Cooper and Wando rivers, and under some conditions it is extremely difficult and potentially hazardous for large deep-draft ships to make this turn.

[illegible] Col. [illegible]
[illegible]
October 22, 1979

Widening of the Hobcaw Creek [illegible] North Charleston reach channel is also necessary. Often with a large inbound vessel in reach, there is not room for two ships to pass in the channel with safety. The risk to widen the channel at these points would remove this hazard.

Thank you for allowing us to express our opinions concerning the Charleston Harbor Deepening Project. The Charleston Pilots are deeply interested in the growth and safety of shipping in Charleston Harbor, and fully support the plans of the U.S. Army Corps of Engineers to deepen and improve Charleston Harbor.

Sincerely,

[illegible]

E. RANDALL SWAN, JR.
PRESIDENT

ERS,jr:jaj

CHARLESTON OIL COMPANY

CHASONOIL

Charleston, S.C.

[illegible], 1974

[illegible] years

[illegible]
[illegible]
[illegible], S.C. 29[illegible]

Dear [illegible]:

[illegible] at the recent public hearings at your studies on the [illegible]Harbor and Tributaries Inner Harbor Navigation Study, [illegible] the Charleston Harbor Deepening Project, my comments and my personal [illegible] relations to make them.

It has come to my attention that you are accepting comments on the draft Environmental Impact Statement until November 15th. Just to be sure that you have my comments, I am enclosing a copy of my statement of 20 June 1974 before the Corps of Engineers public meeting held in Charleston.

I reiterate the concern of many of our citizens that we do need deeper and wider harbor channels for the economic development of our state and this part of our nation but we also must protect our immediate environment. It was a poor choice to place the disposal products on our shores near our water courses. That mistake becomes more obvious everyday and we cannot allow it to continue. We urge the Corps of Engineers and all other agencies in Federal government to dispose of this silt either at sea or in upland areas where damage will be less costly and less permanent, regardless what the short run cost benefits might show in favor of marsh disposals.

Yours for SOUTH CAROLINA,

Thomas E. Thornhill,

TET/dw
Encl.

WATER

[illegible] for [illegible] years, however, some of the cost of [illegible] should be charged to the project. The annual reports of the Corps of Engineers [illegible] a maintenance dredgement [illegible] water [illegible] of the [illegible] have been as the facts [illegible]. [illegible] at 45 feet with across the bar at [illegible] and 35 feet on the [illegible]. [illegible] the [illegible] to the ocean to age terminals and the [illegible] by [illegible] that [illegible] to the [illegible] ports [illegible] the [illegible] figures for the year [illegible].

[illegible] for [illegible] (000's of tons)

	[illegible]	[illegible]	1972
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]

A [illegible] comparison of [illegible] and Charleston shows that for the past ten years, for which [illegible] reports are available, the maintenance [illegible] on Savannah Harbor projects that exceeded by the [illegible] maintenance on Charleston Harbor. The figures are Savannah $4,[illegible],173 and Charleston $1,[illegible]. The five year total for the fiscal years 69, 70, 71, and 72 shows that Charleston has $[illegible] spent by the Corps of Engineers on maintenance while Savannah has $[illegible] expended. This 4% more dollars spent in Charleston Harbor than in Savannah over a period of five years approximates the difference in the value of commerce in ports. It certainly falls far short of supporting the [illegible] naval installations in Charleston Harbor which are not present in Savannah or

- Thomas E. Thompson

[illegible] Forwarders

21 Vendue Range [illegible]

FOREIGN [illegible] FORWARDERS

[illegible]

November 4, 1974

Colonel Harry S. Wilson, Jr.
U. S. Army Corps of Engineers
P. O. Box 919
Charleston, South Carolina 29402

Dear Colonel Wilson:

We are writing to you as a member of the family of the Port of Charleston in connection with harbor improvements as proposed.

As we have stated before, we consider the Port of Charleston to be of most vital importance not only to the Charleston community but to every community in the state of South Carolina. We are also told frequently by sources in adjoining states, particularly North Carolina, that the Port of Charleston is most important to their operations in view of its location and continued growth in steamship services.

If these interests are to continue to be served, we must prepare our harbor to accept the larger and more complex ships which are constantly being put into service. This must include not only the deepening of our harbor but improvements in the depths and sizes of our turning basins which are so essential to Lash ships in particular.

May we respectfully urge that these actions be taken just as soon as possible as each month of delay, we feel, will further worsen the situation.

Yours very truly,

COASTAL FORWARDERS

Neil McCaskill, Jr.

NMJ/dc

COASTAL STEEL COMPANY

[illegible]

Columbia, S. C. 29[illegible]

[illegible]

[illegible]

[illegible] port to grow.

[illegible]

Now we [illegible] tainer [illegible] quirements of the [illegible] port fall behind [illegible]

We are not [illegible] but we do know something must be done [illegible]

With best wishes,

Very truly yours,

COASTAL STEEL COMPANY

W. W. Williams, Jr., President

WWWjr/dac

Commercial Bonded Warehouse, inc.

P. O. Box 5322 • Charleston, South Carolina 29406 • 803 554-7529

JOHN H. HARDWICK
PRESIDENT

FRED A. YOHE
VICE PRESIDENT AND
GENERAL MANAGER

CHARLESTON'S
LARGEST PRIVATELY
OPERATED WAREHOUSE

SERVICED
BY ALL
RAILROADS

EXPORT
PACKING-CRATING

STORAGE AND
DISTRIBUTION
FOR ALL TYPES
OF PRODUCTS

October 25, 1974

Colonel Harry S. Wilson, Jr.
U. S. Army Corps of Engineers
Post Office Box 919
Charleston, South Carolina 29402

Dear Colonel Wilson:

On behalf of Commercial Bonded Warehouse, Inc., I am writing to comment on the draft environmental statement concerning the Charleston Harbor Deepening Project prepared by the U. S. Army District Engineer, Charleston, South Carolina.

As you know, it is the position of most waterfront businesses that the deepening of Charleston harbor is essential to the continuing prosperity of this great port. With the newer ships requiring deeper and wider channels, it is imperative that we work our channels to accommodate modern-day shipping.

Very truly yours,

John H. Hardwick
President

JHH/vgs

B-22

CRYOVAC

ROBERT A. V. [illegible] PRESIDENT

October 31, 1974

Dear Colonel Wilson:

As president of a company whose success is greatly dependent upon the continued operation of the Charleston Harbor, I urge you to support the improved extension and enlargement of the Harbor's anchorages and turning basins. We support the ocean disposal method as being the most economical and environmentally sound approach for providing the desired results.

Thank you for the opportunity to comment on this project which is essential to the continued growth of South Carolina industries.

Yours truly,

[signature]

Colonel Harry S. Wilson, Jr.
U. S. Army Corps of Engineers
P. O. Box 919
Charleston, South Carolina 29402

CRYOVAC DIVISION W. R. GRACE & CO. DUNCAN SOUTH CAROLINA 29334 (803) 439-4121

OFFICES IN
BIRMINGHAM ALA
GREENSBORO N C
JACKSONVILLE FLA
LEXINGTON KY
LITTLE ROCK ARK
RICHMOND VA

DANIEL CONSTRUCTION COMPANY
DIVISION OF DANIEL INTERNATIONAL CORPORATION
GENERAL CONTRACTORS
DANIEL BUILDING
TELEPHONE 803 242 2500
GREENVILLE SOUTH CAROLINA 29602

SALES OFFICES
NEW YORK N Y
CHICAGO ILL
SAN JUAN P R

November 4, 1974

Colonel Harry S. Wilson, Jr.
U. S. Army Corps of Engineers
Post Office Box 919
Charleston, South Carolina 29402

Dear Colonel Wilson:

As a South Carolina corporation involved in the location, engineering and construction of new and expanded industrial facilities, we strongly support the position that the improved extension and enlargement of Charleston Harbor's anchorages and turning basins are essential for the continued function and growth of the Port of Charleston.

Many of our clients both within South Carolina and bordering states are heavily dependent on the Port of Charleston. In our location of new facilities and the expansion to existing facilities, we have found the Port to be a very meaningful economic consideration.

The continued limitations of the Port coupled with the increasing demands of the latest in shipping technology could easily threaten the economic status of the Port and the State.

We also urge the implementation at the earliest possible date of ocean disposal which the Corps recommends as the best method environmentally and economically.

Thank you very much for any assistance which you might be able to give on a problem which is foremost on all our minds.

Very truly yours,

Currie B. Spivey, Jr.
Group Vice President
Marketing - Sales

cc: Mr. W. Don Welch

October 29, 1974

Colonel Harry S. Wilson, Jr.
U. S. Army Corps of Engineers
Post Office Box 919
Charleston, South Carolina 29402

Dear Colonel Wilson:

I am writing to comment on the draft environmental statement concerning the Charleston Harbor Deepening Project now being made by the U. S. Army District Engineer, Charleston, South Carolina.

From my almost twenty years working on the Charleston waterfront and watching the growth and expansion of the Port, I can appreciate the value of our shipping industry not only now but for future generations.

With the coming of larger and more specialized ships it is important that Charleston be able to accommodate these ships. According to a recent report the Port of Charleston is now ranked thirteenth in the nation, but we can't stand still and in order to grow, there must be improvements made, not only to keep pace but to move ahead.

The Port of Charleston is important to the entire state so, I urge that the proposed project be carried out as early as possible.

Sincerely,

Michael A. Galasso, Manager
Del Monte Terminal

DU PONT

E. I. du Pont de Nemours & Company

Cooper River Plant
P. O. Box 10228
Charleston, South Carolina 2941

Textile Fibers Department

November 11, 1974

Colonel Harry S. Wilson, Jr.
District Engineer
U. S. Army Corps of Engineers
Post Office Box 919
Charleston, SC 29402

Ref: DRAFT ENVIRONMENTAL STATEMENT, SEPTEMBER 1974,
CHARLESTON HARBOR DEEPENING PROJECT

Dear Colonel Wilson:

We have studied the draft environmental impact statement for the Charleston Harbor Deepening Project and conclude that the objectives of this project will maintain the existing satisfactory water quality in the upper Cooper River and in the Back River Reservoir. Therefore, we have no objection to this statement.

Very truly yours,

R. P. Coon

Richard P. Coon
Environmental Control
Supervisor

RPC:jdn

BETTER THINGS FOR BETTER LIVING THROUGH CHEMISTRY

EXXON

October 7, 1974

Draft Environmental
Impact Statement

Colonel Harry S. Wilson, Jr.,
District Engineer,
Charleston District,
P. O. Box 919,
Charleston, S. C. 29402

Dear Colonel Wilson,

We have reviewed a copy of the draft of the Environmental Impact Statement for the Charleston Harbor Deepening Project.

As we have stated in previous correspondence, we are totally in favor of the harbor deepening project, and find nothing in the Environmental Impact Statement to change our opinion.

We urge continued full efforts to complete this project at an early date.

Very truly yours,

A. A. Mancock

A. A. Mancock,
Superintendent

AA:sef:m

GENERAL ELECTRIC

TURBINE DEPARTMENT

GENERAL ELECTRIC COMPANY · P. O. BOX 1016 · CHARLESTON, SOUTH CAROLINA 29402 · TELEPHONE 803 554-6500

CHARLESTON PLANT

October 24, 1974

Colonel Harry S. Wilson, Jr.
U. S. Army Corps of Engineers
P. O. Box 919
Charleston, South Carolina 29402

Dear Colonel Wilson:

Further to our letter of June 6, 1974 whereby we submitted a statement in support of the Charleston Harbor Navigational Study Improvement to the port of Charleston, we wish to further comment on the draft, environmental statement concerning the Charleston Harbor Deepening Project prepared by the U. S. Army District Engineer and make it known that we are very much interested in having the Charleston Harbor deepened to necessitate the visiting of ships that can transport our products.

For your information, we are attaching a statement prepared by us on June 6 for your ready reference.

We hope that the project of harbor deepening will be implemented soon and we believe that this is an essential project to maintain the port of Charleston's capability of handling increased movement of larger vessels.

Very truly yours,

D. M. Russell
Specialist-Traffic

Attachment

ri

STATEMENT

OF

GENERAL ELECTRIC COMPANY

My name is Dennis M. Russell. I am employed by the General Electric Company as Specialist - Traffic, Turbine Department, with offices and plant on U. S. Highway 78, Ladson, South Carolina 29411. I am making this statement for the General Electric Company in support of improvements to the Charleston Harbor Navigation Project.

Our plant is on 300 acres of land, in Charleston County, of which only 59% is currently used, and our total employment is approximately 1100 persons. The product we are producing at this facility is steam and nuclear turbine parts. These efficient machines, when assembled, are the principal means of converting the heat energy released by fossil and nuclear fuels into the kinetic energy needed to drive large power generators.

The General Electric plant was founded here in Ladson by considering a number of very important factors, one being the accessibility of the South Carolina State Ports Authority at Charleston. Without adequate port facilities, we would lose part of the economic value of establishing our plant here. Utilization of neighboring ports would burden us with excessive transportation costs.

We are manufacturing a number of units for export to Japan, these being the largest turbines ever produced. Each order consists of over 1000 tons with one single piece over 5800 cubic feet. In the future, we will be expanding our shipments to other parts of the world through the Port of Charleston.

Our engineers are now looking into the possibility of building larger machines. These new machines will undoubtedly require even heavier, and deeper draft vessels not only for our export orders but for domestic shipments as well.

Other General Electric plants throughout the Southeast are taking a hard look at the possibility of utilizing the Port of Charleston. For example, our Greenville plant was just recently to begin utilizing the port due to recent improvements such as the 40' ten "Shearlegs" crane, which has become a valuable asset to General Electric Company. In order to continue our export trade through the Port of Charleston, we feel the need for the improvement, extension, and enlargement of Charleston Harbor's channels, anchorages, and turning basins are imperative for our future shipments.

We hope that this statement contains information which will enable the Department of the Army, Corps of Engineers to understand that without these improvements, the ability of Charleston Harbor to accomodate the increasing number of large, modern ships will be severely limited.

Dated: June 7, 1974
Ladson, South Carolina

Dennis M. Russell
Specialist - Traffic
Turbine Department

HARLEY CORPORATION

October 28, 1974

Colonel Harry S. Wilson, Jr.
U. S. Army Corps of Engineers
Post Office Box 919
Charleston, South Carolina 29402

Dear Colonel Wilson:

On behalf of Harley Corporation, I am writing in support of the draft environmental statement covering the Charleston Harbor Deepening Project, Charleston Harbor and Shipyard River, South Carolina.

In the past, Harley Corporation has purchased foreign equipment from time to time and have made bids on commodities which were shipped out of this country. At times we have not been competitive due to shipping charges being excessive and freight charge excesses tacked on due to us having to ship to increase mileage away from our manufacturing plant to the ocean going embarcation.

We need very badly to compete with other States in giving our industries a competitive edge when possible. To me, the Charleston Harbor Deepening Project is essential to maintain the port of Charleston's ability to accommodate the rising level of commodity movements to keep our industries competitive.

It is my understanding that the increased port related employment would improve the economic conditions around the Charleston area and also aid in employment of approximately 15,000 jobs.

In addition, the revenues from the imports and exports would be approximately 250 million dollars and the total ports improvement impact would amount to well over 500 million dollars.

This would also benefit our State taxes considerably.

The people of South Carolina deserve this Charleston Harbor Deepening Project. I hope you will use your influence to aid in seeing this project through to the end.

Thanking you, I remain

Very truly yours,

HARLEY CORPORATION

Cleveland S. Harley
President

CSH/kc

Hoechst Fibers Incorporated

November 6, 1974

U. S. Army Corps of Engineers
Post Office Box 919
Charleston, South Carolina 29402

Attention: Colonel Harry S. Wilson, Jr.

Dear Colonel Wilson:

On behalf of Hoechst Fibers Incorporated and the S. C. State Ports Authority, I am writing to comment on the draft environmental statement concerning the Charleston Harbor Deepening Project prepared by the U. S. Army District Engineer, Charleston, South Carolina.

It is our position that the improved extension and enlargement of the Charleston Harbor's anchorages and turning basins are essential for the continued viability of the Port of Charleston.

As one large industrial concern which utilizes the Port of Charleston, we support your report and thank you for the opportunity to participate and to comment on this project.

Sincerely,

HOECHST FIBERS INCORPORATED

P. F. Foerster
Vice President, Operations

PFF/bbs

November 6, 1974

Colonel Harry S. Wilson, Jr.
U.S. Army Corps of Engineers
Post Office Box 919
Charleston, South Carolina 29402

Re: Charleston Harbor Deepening Project,
Draft Environmental Statement

Dear Colonel Wilson:

On behalf of LBC&W we are writing to comment of environmental draft of the above project. As previously expressed, it is LBC&W's position that the improved extension and enlargement of Charleston Harbor's anchorages and turning basins are essential for the continued viability of the Port of Charleston and the industries it serves.

Without implementation of the project, a limitation would be placed on the ability of the Port of Charleston to keep pace with shipping technology could threaten the port with stagnation and decline. This would endanger the contributions of the activity of South Carolina's ports to the economic health of the entire state.

The action recommended in the Charleston Harbor Deepening Project would require 1,110 acres of upland disposal area. While we strongly urge that the project proceed on that basis, we are cognizant that ocean disposal is the preferred method, both environmentally and economically, as reported by the Corps. LBC&W, therefore, strongly recommends that the ocean disposal method be implemented as soon as possible.

Please accept my thanks for this opportunity to participate and to comment on this project--a most important one for South Carolina and one which certainly deserves our enthusiastic support.

Sincerely,

JOHN A. MCPHERSON, JR. P.E.
EXECUTIVE DIRECTOR

JAMc:gst:w

GERVAIS AT SUMTER ■ COLUMBIA SOUTH CAROLINA 29202 ■ 803-779-3000

8-28

Leigh

LEIGH TEXTILE COMPANY · FIBERS MARKETING AND PROCESSING
P.O. Box 1132 Spartanburg South Carolina 29301 · Telephone (803) 439-4111
Telex 809-446

October 29, 1974

Colonel Harry S. Wilson, Jr.
U. S. Army Corps of Engineers
Post Office Box 919
Charleston, South Carolina 29402

Dear Colonel Wilson:

I have received and reviewed the environmental statement on the deepening of Charleston Harbor and I was amazed at the vast scope of this report. It was my conclusion that the environment in the Charleston area will not be adversely affected, provided the material dredged up is dumped at sea. Nowhere in this study did I find any significant figures on the cost or cost estimates of this project but I assume they're in reason, considering what is at stake for the State and its existing industry for the future.

It is our conclusion that this project should be commenced and handled to a conclusion at the earliest possible date.

Yours very truly,

LEIGH TEXTILE COMPANY

H
Controller

HML/nm

cc: Mr. W. Don Welch
Executive Director
South Carolina State Ports Authority
P. O. Box 817
Charleston, South Carolina 29402

LIFETIME LP DOORS inc

October 31, 1974

Colonel Harry S. Wilson, Jr.
U.S. Army Corps of Engineers
P.O. Box 919
Charleston, S.C. 29402

Dear Colonel Wilson:

We are one of the importers in this area having imported approximately 1,578 tons of manufacturing material in the past 3 months, all of which were originally scheduled for the port of Charleston.

Recently, of the above tonnage, 1121 tons were diverted to the ports of Savannah, Ga., and Jacksonville, Fla. We assume this diversion was due to the inability of the Charleston port to handle the vessels. This has resulted in excessive overland transportation costs to us.

Therefore you can appreciate our endorsement regarding the Charleston Harbor Deepening Project. We feel that this is essential to our continued profitable operation in this area.

Yours truly,

E. S. Corbin
Plant Manager

ESC/cs

MANUFACTURING PLANTS & SALES OFFICES

LOCKWOOD GREENE

December [illegible], 1974

[illegible] - Charleston Harbor

Colonel Harry S. Wilson, Jr.
U.S. Army Corps of Engineers
Post Office Box 919
Charleston, South Carolina 29402

Dear Colonel Wilson:

On behalf of Lockwood Greene Engineers, Inc., I am writing in support of the draft environmental statement concerning the Charleston Harbor deepening project prepared by the U.S. Army District Engineer, Charleston, South Carolina dated September [illegible]. As you can see, Lockwood Greene is a diversified Architectural-Engineering firm and has a major design office in Spartanburg, South Carolina. Our corporate population in the state of South Carolina is in excess of [illegible] people dedicated to A-E effort. We have a very active professional and personal interest in both the welfare of the South Carolina industry and its marine capability. We have been involved with a number of the industries within the state as well as within the country. We have been directly responsible for the design of many of the marine facilities (military and civilian) now in use in the Charleston Harbor.

We are certain that the economy of this area hinges very directly on the capability of Charleston Harbor to keep abreast of the advances in technology in the shipping industry. This has been evidenced by the progress made since the end of World War II in the Charleston Harbor. It is an absolute necessity to have a deepened channel to accommodate the present and expected generation of shipping both in the container area as well as in bulk handling. Limitations of draft placed on any port are without a doubt going to relegate it to "second class citizenship" and eventually contribute to its demise.

THE MARITIME ASSOCIATION OF THE PORT OF CHARLESTON

POST OFFICE BOX 494
CHARLESTON, SOUTH CAROLINA
U. S. A.

October 29, 1974

Colonel Harry S. Wilson, Jr.
U. S. Army Corps of Engineers
P. O. Box 919
Charleston, South Carolina [illegible]

Dear Colonel Wilson:

The members of the Maritime Association of the Port of Charleston have [illegible] you to proceed as [illegible] with the [illegible] plan of improvements as contained in the Draft Environmental Statement for the Charleston Harbor Deepening Project.

The urgent need for a Deeper Harbor and Approaches is detailed in the Association's letter to the District Engineer, dated June 19th, 1974.

We strongly recommend that the Corps dispose of the dredged material in the manner recommended in the Draft Environmental Statement.

Sincerely,

THE MARITIME ASSOCIATION OF THE PORT OF CHARLESTON

[illegible]

[illegible] Fox,
President

SF/kas

[illegible]

Thomas A. [illegible] Jr.

Newton International Corporation

October 30th, 1974

Colonel Harry S. Wilson, Jr.
U.S. Army Corp. of Engineers
Post Office Box 919
Charleston, S.C. 29402

Dear Colonel Wilson:

We have read the draft environmental statement concerning the Charleston Harbor Deepening Project.

We feel that the various changes put forward would certainly enhance the usefulness of the harbor, both now and in the future when larger vessels with deeper drafts will be calling there.

We thank you for the information forwarded to us on this project.

Yours very truly,

NEWTON INTERNATIONAL CORPORATION

Herbert J. Kocchi
TRAFFIC MANAGER

HJR:bdo

[illegible] TRANSPORTATION COMPANY

[illegible]

[illegible]

Please permit me to comment briefly on the draft environmental statement [illegible] the Charleston Harbor Deepening Project which was prepared by the U. S. Army District Engineer, Charleston, S. C.

I realize that the improved extension and enlargement of Charleston Harbor's anchorages and turning basin can be very important, not only to the future growth of the motor carrier industry in that area, but to all other modes of transportation as well. What a drawing card this will be to the now and future generation of ships desiring to make port calls at Charleston.

Much has been done in the way of port facilities to enable Charleston to continue to enjoy a sizable bulk of import - export commerce. It is good to have the feeling that this will continue to be the case. South Carolina is a prosperous state, and import - export commerce helped to make it so. This is one of the reasons we invested so heavily in terminal facilities at Charleston.

Hopefully we shall see an early implementation of the Charleston Harbor deepening project.

Yours very truly,

C. M. Anderson

n

Palmetto Shipping and Stevedoring Co., Inc.

P. O. BOX 974 CHARLESTON [illegible] TELEPHONE 803 [illegible]

Cable Address PALMETTO [illegible] TWX 810 882 [illegible] FMC License No. 241 B

November 7, 1974

Colonel Harry S. Wilson, Jr
U. S Army Corps of Engineers
Post Office Box 919
Charleston, South Carolina 29402

Dear Colonel Wilson:

On behalf of Palmetto Shipping and Stevedoring Company, Inc., I would like to express my views on the draft environmental statement prepared by the U S Army District Engineer, Charleston, South Carolina, that concerns the Charleston Harbor Deepening *Project*.

It is our position that in order for the Port of Charleston to continue to grow and prosper, an improved extension and enlarge*ment of Charleston Harbor's anchorages and turning basin are* absolutely essential Without these necessary improvements the shipping industry and the Port of Charleston would eventually stagnate and die.

Innovations in the shipping industry have brought about whole new needs. Specialization has led to revolutionary ideas in vessel design and activity Because the ships of today are wider and deeper, they need larger, deeper channels for navigation. The newest containerships are expected to draw a draft of over 35 feet and cargo vessels of the future will have drafts of up to 40 feet. If these vessels cannot be accommodated in Charleston, they will quickly turn to other ports that are able to serve them.

If Charleston Harbor's present limitations remain unchanged, the port will not be able to serve the needs of the fast-growing shipping industry. The effect this would have on Charleston and the State of South Carolina in both port-related and other industries would be disastrous. We are speaking of a $9 million savings yearly in transportation costs for shippers, a total state employment effect of 30,000 jobs, a total port impact revenue of $507 million and total port induced state taxes of $11.6 million, as stated in a recent study by the University of South Carolina's Bureau of Business and Economic Research

Faced with such statistics, we strongly urge immediate action on the Charleston Harbor Deepening Project. We understand

Palmetto Shipping and Stevedoring Co., Inc.

Colonel Harry S. Wilson, Jr.
U. S. Army Corps of Engineers
Charleston, S. C.
November 7, 1974 - continued -

that action recommended requires 1,110 acres of upland disposal area and that ocean disposal is the preferred method by the Corps for both environmental and economical reasons. It is therefore recommended by Palmetto Shipping and Stevedoring Company that the ocean disposal method be implemented as soon as possible.

Thank you for the opportunity to comment on and wholeheartedly support this most important project.

Sincerely,

James P. Lamb
President

JPL/ar

B-33

Pilot Club of Charleston, South Carolina, Inc.

[illegible]

[illegible], Jr.
U. S. Army Corps of Engineers
[illegible]
Charleston, S. C. [illegible]

Dear Colonel [illegible]:

[illegible] interest expressed by Mr. Lamb in the [illegible] Harbor Deepening project, Mr. A. Ben Welch of the [illegible] State Ports Authority gave me a copy of his letter to you [illegible].

We are still interested in the economical situation in our community and agree with Mr. Welch that the early implementation of the Corps of Engineers' recommendation for the project is essential if it is to remain competitive with the ever increasing number of large fast ships - and the competitive ports.

If we are affected by the environment as much as we fear, then for goodness sake let us have the ocean disposal method -- in fact.

Sincerely,

(Mrs) Carlotta A. Myers
President.

"True Course Ever"

PRICE PAPER CORPORATION
50 ROCKEFELLER PLAZA
NEW YORK, N.Y. 10020

November [illegible], 1974

Colonel Harry S. Wilson, Jr.
U.S. Army Corps of Engineers
P.O. Office Box 919
Charleston, South Carolina 29402

Dear Colonel Wilson:

I have seen a letter written by Mr. D. Welch, Executive Director of the South Carolina State Ports Authority and I would like to go on record that I whole-heartedly agree with everything that he has stated. It would only be repetitious of me to write the same letter.

Price Paper has its own fleet of ships and we are finding, from day to day, that the increased costs are slowly driving small ships out of business. We, in the United States, must start thinking big or become a secondary power.

The first step towards this would be the widening of the channels and the depths of the waterways and I could think of no better place to start than Charleston.

Yours very truly,

PRICE PAPER CORPORATION

Michael E. Delaney
Transportation & Distribution Dept.

MED:cj

REEVES
CONTROLLERS DIVISION

REEVES BROS INC.

[illegible]

October 28, 1974

Colonel Harry S. Wilson, Jr.
U. S. Army Engineers
P. O. Box 919
Charleston, South Carolina 29402

Dear Colonel Wilson:

This will acknowledge receipt of the draft environmental statement concerning the Charleston Habor Deepening Project prepared by the U. S. Army District Engineer, Charleston, South Carolina.

We strongly support the position of the South Carolina Ports Authority that the improved extension and enlargement of Charleston's anchorages and turning basins are essential for the Port of Charleston and industries operating in the Southeast. Technically we are not capable of making an opinion of the best approach to this problem but in the interests of the environmental factors involved and the need, especially today, for economy, we trust you will proceed with the ocean disposal method as soon as possible.

We have some eighteen manufacturing plants within a couple of hundred miles of Charleston that are dependent on the Port to a greater degree every year now that foreign trade is becoming a necessity for economic survival.

We wish to thank you for an opportunity to comment on this project.

Very truly yours,

REEVES BROS., INC.

W. H. Collister,
Corp. Transportation Mgr.

WHC:rj

SACO-LOWELL CORPORATION

October 29, 1974

Colonel Harry S. Wilson, Jr.
U. S. Army Corps of Engineers
Post Office Box 919
Charleston, South Carolina 29402

Dear Colonel Wilson:

Re: Charleston Harbor Deepening Project

Saco-Lowell Corporation is vitally interested in the future of the Port of Charleston. We are an internationally-known manufacturer of preparatory textile machinery with plants in Easley, South Carolina and Sanford, North Carolina with a total of 1700 employees. Two years ago we became the second South Carolina firm to receive an "E" star flag for outstanding achievements in developing overseas markets.

The Port of Charleston, with its continually improving facilities for regular and containerized cargoes, has handled an increasing amount of our shipments. In 1974 we expect our export shipments through Charleston to be in the neighborhood of 2500 to 3000 tons - double that of two years ago - with excellent prospects for continued growth. The recent acquisition of Saco-Lowell Corporation by Stone-Platt Industries of the United Kingdom has resulted in most of the imports from the U.K. coming through Charleston, which together with imports from our Spanish plant, will total approximately 6500 tons this year. Approximately [illegible] of the total of 9500 tons, export and import, will be containerized.

It is vitally important to us that the Port of Charleston be in a position to handle these shipments. For this reason, we wholeheartedly support the Charleston Harbor Deepening Project.

Very truly yours,

L. W. Turner
Vice President - Manufacturing

cc: W. Don Welch

SEABOARD COAST LINE RAILROAD COMPANY

Engineering Department
Jacksonville, Florida 32202

T. B. HUTCHESON
ASSISTANT VICE PRESIDENT

October 30, 1974

TELEPHONE 353-3011
AREA CODE 904

4.1-C-Gen. - D

Colonel Harry S. Wilson, Jr.
Department of the Army
Charleston District, Corps of Engineers
P. O. Box 919
Charleston, South Carolina 29402

Dear Colonel Wilson:

This is in reference to the proposed Charleston Harbor Deepening Project and particularly the draft environmental impact statement which has been issued with respect to this work.

The Seaboard Coast Line Railroad Company continues to support the Charleston Harbor Deepening Project. We are also involved in harbor deepening proceedings at other ports in the Southeast, and we are quite aware of both the advantages and disadvantages to the several methods of spoil disposal which have been suggested. We believe, however, that the Charleston Harbor Deepening Project is one that should proceed at the earliest possible date, and the matter of spoil disposal should present a balance of cost, environmental considerations and the economic well being of the Port of Charleston and surrounding vicinity.

[illegible] your office [illegible] with the [illegible] of the final environmental impact [illegible] about November 11.

[illegible]

[illegible]

Seatrain Lines, Inc.
Container Division

P.O. Box 10206
Charleston Heights, South Carolina 29411

[illegible]

[illegible] 1, 1974

[illegible] W[illegible]
[illegible] Army Corps of Engineers
[illegible] Box [illegible]
Charleston, South Carolina [illegible]

Dear [illegible]:

I would like to reiterate my company's support of the Charleston Harbor deepening project.

[illegible] of the largest vessels to call at North Charleston, we are now and have been for some time handicapped by the draft limitations of the [illegible] River.

Charleston [illegible] the final port on this coast for our "Euroclass" [illegible] and as such, we are required to limit our export tonnage due to the draft limits of the channel. These vessels are designed to operate at a mean draft of 36 feet. It is only through [illegible] preparation and considerable expense in rehandling cargo that we are able to attain maximum tonnage with the minimum draft required to transit the river.

We again urge you to take the necessary action to complete the project. It is not only a future requirement of the port, it is a "now" requirement.

Sincerely,

James W. Farrah

[illegible]

South Atlantic Terminals Inc.

[illegible]

South Carolina National Bank

November [illegible], 1974

Colonel Harry S. Wilson, Jr.
U. S. Army Corps of Engineers
Post Office Box 919
Charleston, South Carolina 29402

Dear Colonel Wilson:

I have been favored with a copy of your draft environmental statement as submitted to Mr. W. Don Welch, Executive Director of the South Carolina State Ports Authority. Mr. Welch also forwarded me a copy of his letter to you of October 22, 1974. The record will reveal that I have taken a strong position in this matter as a citizen of this State, and I guess you might describe my status as amicus curiae to the petition of Charleston for such remedial steps as may be necessary to protect its position as a major port on the Eastern Seaboard.

Since I last submitted a letter in support of the Ports Authority, I have also received a copy of the study recently completed by the Business and Economic Research Department of the University which I admit to not reading in depth but having scanned with interest.

It is so very apparent that in a great many critical ways the viability of the Charleston Port will determine the future economic health of our State. As noted by Mr. Welch in his recent letter to you, we are beginning to witness, for that matter this Bank has participated in the financing of, major changes in the technology of shipping. As a Director of Seaboard Industries, it has been a highly enlightening process for me to learn how the rail carriers are now developing their cars on a highly specialized basis so as to tie in with the containerization of ocean and inland waterway shipping.

I can add little to what Mr. Welch has said other than to reiterate with all the enthusiasm and force I can muster the absolute need to adopt an approach which will allow Charleston and its environs to continue to grow into one of the key shipping outlets of our country. I cannot help but be continually impressed by the first item noted from the Business School report as to the tremendous savings to South Carolina shippers through the use of Charleston as an international port.

Let me conclude by noting that in my experience, seldom have I seen a more complete and professional presentation than your draft of the environmental statement.

With my thanks and best wishes,

Yours sincerely,

John H. Tumpkin
Chairman

JHL:c

SOUTHEASTERN MARITIME CO.
STEAMSHIP AGENTS AND BROKERS — STEVEDORES
TERMINAL OPERATORS AND WAREHOUSEMEN
6 Gillon Street
P. O DRAWER 978
CHARLESTON, SOUTH CAROLINA 29402
TELEPHONE (803) 722-8451
CABLE ADDRESS SEMCO

October 29, 1974

Colonel Harry S. Wilson, Jr.
U. S. Army Corps of Engineers
P. O. Box 919
Charleston, S. C. 29402

Dear Colonel Wilson:

We have reviewed the draft environmental impact statement for the Charleston Harbor Deepening Project prepared by the Charleston District, Corps of Engineers.

The position taken by Southeastern Maritime Company in our letter of June 14th to the District Engineer remains unaltered. Copy of this letter is attached for your ready reference.

We, therefore, strongly recommend that the proposed plan of improvement be implemented with all haste and that the dredged material be disposed of in the manner recommended in the Draft Environmental Statement.

Sincerely,

SOUTHEASTERN MARITIME CO.

S. Fox,
Vice President

SF/kas

8-38

SOUTHEASTERN MARITIME CO.
STEAMSHIP AGENTS AND BROKERS — STEVEDORES
TERMINAL OPERATORS AND WAREHOUSEMEN
6 Gillon Street
P. O DRAWER 978
CHARLESTON, SOUTH CAROLINA 29402
TELEPHONE (803) 722-8451
CABLE ADDRESS SEMCO

June 14, 1974

Colonel Robert C. Nelson,
Charleston District, Corps of Engineers
P. O. Box 919
Charleston, S. C. 29402

RE: CHARLESTON HARBOR NAVIGATION STUDY

Gentlemen:

Southeastern Maritime Company is engaged in the Stevedoring and Steamship Agency business. In this latter capacity we represent a number of American and Foreign Flag steamship companies operating to and from the Port of Charleston. We therefore have a vital interest in Charleston Harbor, as our business future is entirely dependant on Charleston being able to provide a suitable harbor to meet the requirements of our principals.

Already we have lost ships to neighboring ports because there was insufficient water in the harbor for them to enter safely. T is means that the Port of Charleston is presently unable to attract any of the larger ships now in service and, as everyone knows, ships are getting larger with every launching.

Not only is it imperative that the approaches, channels and anchorages be deepened, but it is also imperative that the anchorages be increased in area. One of our Principals, Combi Line, had to discontinue their lash service to Charleston because the

anchorage at Rebellion Roads was both too shallow and too small.

The whole principle of the lash-type vessel is based on the premise that the barges will be loaded and discharged at anchor.

Clearly, for Charleston to retain its right to be referred to as a port of any consequence in modern shipping circles, it is of the utmost importance that adequate channels and anchorage areas be provided for modern ships.

It is therefore imperative that the channel depths in Charleston Harbor be increased to at least forty (40) feet as soon as possible. Of equal importance is the necessity to provide one or more anchorage areas where two 850 foot ships can ride at anchor in forty feet of water at low tide.

We are attaching the specification sheet for Combi Line's lash vessels to help bear out the foregoing statements.

Cordially yours,

SOUTHEASTERN MARITIME CO.

S. Fox,
Vice President

SF/kas

STREET BROTHERS

ESTABLISHED 1930

STEAMSHIP AGENTS

POST OFFICE BOX 817 235 EAST BAY STREET

CHARLESTON, SOUTH CAROLINA 29402

November 1, 1974

Colonel Harry S. Wilson, Jr.
U. S. Army Corps of Engineers
Post Office Box 919
Charleston, South Carolina 29402

Dear Colonel Wilson:

Thank you for this opportunity to comment further on the Charleston Harbor Deepening Project. Having been actively engaged in the Shipping Business in Charleston over an extended period of time, it is our considered opinion that Charleston Harbor improvements are urgent and immediate. We particularly stress the need for deeper anchorages and turning basins and for deeper and wider channels.

With new and specialized ships these needs must be met or South Carolina is certain to lose important Maritime Commerce as well as suffering general economic losses.

We are fortunate to be in the forefront of some of the technological advances in shipping as agents for Lighter Aboard Ship LASH Vessels for both Prudential Lines and Waterman Steamship Corporation. These vessels are 820 feet long and 100 feet wide (Prudential) and 893 feet long and 100 feet wide (Waterman) and the gross tonnages are 26406 and 32269 respectively. Drafts of thirty-five feet are commonplace. With the necessary improvements in Charleston Harbor these operators will continue to serve South Carolina and others will follow.

We appreciate the time and effort that you and your organization are giving this important matter and we sincerely hope that the necessary goals are achieved at the earliest possible time.

Yours truly,

STREET BROTHERS, INC.

Timothy S. Street
President

TSS/w

CONCRETE PRODUCTS, INC.

P. O. Box 1778 • SPARTANBURG, SOUTH CAROLINA 29304

October 28, 1975

Colonel Harry S. Wilson, Jr.
U. S. Army Corps of Engineers
P. O. Box 919
Charleston, South Carolina 29402

Dear Colonel Wilson:

I am writing to comment on the draft environmental statement [illegible] project to deepen and improve the harbor at Charleston, South Carolina.

I believe that the continued growth of the port of Charleston is essential for the economic well being of the entire state, and therefore urge you to proceed with deepening the harbor as recommended in the report.

I greatly appreciate being sent the environmental statement and also the opportunity to comment.

Sincerely,

William Lowndes, III
President

WL/ig

cc: Mr. W. Don Welch, Executive Director
South Carolina State Ports Authority

UTICA TOOL COMPANY, INC.
Subsidiary of THE TRIANGLE CORPORATION

CABLE ADDRESS "UTICA" ORANGEBURG, S. C., USA

ORANGEBURG, SOUTH CAROLINA 29115 TELEPHONE (803) 534-7010
TELEX 57-3498

November 6, 1975

Colonel Harry S. Wilson, Jr.
U. S. Army Corps of Engineers
Post Office Box 919
Charleston, South Carolina 29402

Dear Colonel Wilson:

As a client of the Port of Charleston, South Carolina the Utica Tool Company has followed with interest the planned development and improvement of this port facility. We have recently received and reviewed the draft environmental statement concerning the Charleston Harbor Deepening Project prepared by the U. S. Army District Engineer and would like to offer our comments.

The Utica Tool Company is located in Orangeburg, South Carolina and uses the Port of Charleston to import materials and export mechanics hand tools. Containerized shipping is important to the economics of our business and we are therefore concerned with the modernization and improvement of the Port of Charleston. If the port facilities were allowed to decline industry in South Carolina that use of ocean shipping would be at an economic disadvantage.

It is our feeling that the proposed improvement can be accomplished without doing any significant harm to the environment and we therefore would like to throw our support behind this important project.

Sincerely yours,

Calvin H. Reed
Vice President & General Manager

CHR:gc

Wilbur Smith and Associates

BANKERS TRUST TOWER
Columbia, S C 29202
PHONE (803) 779-5000

November 4, 1974

Colonel Earl [illegible], Jr.
Page 2
November 4, 1974

[illegible] Highway [illegible] Florence [illegible]

[illegible] Highway [illegible] Atlanta, and now [illegible]

[illegible] Highway [illegible] Florence [illegible] Atlanta, and now [illegible]

[illegible] Highway [illegible] Florence [illegible] Atlanta, and now [illegible]

Very truly yours,

WILBUR SMITH AND ASSOCIATES

Robert E. Wilson, Jr.

REW:lhl
cc: W. Don Welch

ALLIANCE · ATLANTA · BRISBANE · [illegible]

WHITE STACK TOWING CORPORATION

PHONE 577-6556 P. O. BOX 827

CHARLESTON, S. C. 29402

November 1, 1974

Colonel Harry S. Wilson, Jr.
U. S. Army Corps of Engineers
Post Office Box 919
Charleston, South Carolina 29402

Dear Colonel Wilson:

I am writing to express the opinion of White Stack Towing Corporation regarding the draft environmental statement of the Charleston Harbor Deepening Project.

The provision of safe navigation for existing and particularly prospective large vessel traffic by deepening channels, enlarging turning basins, realigning and easing bends is essential to the continued economic development of both the Port of Charleston and the State of South Carolina.

Tankers, sophisticated Navy ship types and the anticipated size of Container Ships all requiring harbor ingress and egress, in many instances currently, and in the future projections particulary are anticipated to require operating drafts in excess of 34'. A channel depth of 42' is presently considered minimal.

Though we concur in the Corp's opinion that ocean disposal of dredged material is preferable to upland disposal from both environmental and economic viewpoints, we consider the project of such vital importance to the economy as to warrant its early emplementation by utilization of whichever means prove more expedient.

We sincerely appreciate the opportunity to comment on this major project.

Very truly yours,

WHITE STACK TOWING CORPORATION

E. W. Waring
Executive Vice President

EWW:vjw

APPENDIX C
LETTERS OF COMMENT
ON REVISED DRAFT EIS

United States Department of the Interior

OFFICE OF THE SECRETARY
WASHINGTON, D.C. 20240

July 2, 1975

Dear [illegible]:

[illegible] March [illegible], 1975, [illegible] project [illegible] Chesapeake [illegible] was reviewed [illegible] carefully considered [illegible] and expertise.

Sincerely yours,

[illegible]

Secretary of the Interior

DEPARTMENT OF TRANSPORTATION
UNITED STATES COAST GUARD

[illegible]
Phone [illegible]

16 June 1975

Major General O. A. Raymond
Acting Chief of Engineers
Department of the Army
Washington, D. C.

Dear General Raymond:

This is in response to your letter of 25 March 1975 addressed to the Secretary of Transportation concerning a revised draft environmental statement on Charleston Harbor Deepening Project, Charleston County, South Carolina.

The concerned operating administrations and staff of the Department of Transportation have reviewed the material submitted. We have no comments to offer nor do we have any objection to this project.

C-2

The opportunity to review this draft statement is appreciated.

Sincerely,

R. L. [illegible]
Rear Admiral, U. S. Coast Guard
Chief, Office of [illegible] Environment
and Systems

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IV
1421 PEACHTREE ST. N.E.
ATLANTA, GEORGIA 30309

June 9, 1975

Colonel Marvin W. Rees
Executive Director of Civil Works
Department of the Army
Office of the Chief of Engineers
Washington, D. C. 20314

Dear Colonel Rees:

1. We have reviewed the Revised Draft Environmental Impact Statement for the Charleston Harbor Deepening Project at Charleston, South Carolina, and find exceptionally good coverage of the water quality aspects of the project. However, to make complete evaluation of the effects of the project on the environment we must know the exact location of the spoil sites, and have a detailed account of the biota present in the spoil areas and the effect of spoil disposal on the sites.

2. It is stated that the State of Carolina desires that disposal areas be located on Daniel and Morris Islands. Since the capacities of the existing sites are limited and are presently being used for maintenance purposes, the question arises as to whether present diked areas will be expanded to include new marsh areas on Daniel and Morris Islands. The only additional area available on Morris Island is at the northeast end, an area containing valuable salt marsh. Daniel Island still contains large areas of productive marsh, and enlargement of the spoil site could destroy considerable productive marsh. In order to properly evaluate the proposed project, it is essential that the proposed spoil areas be selected and that they be fully described in the final impact statement.

3. Since pressure is being placed on marsh areas by disposal, it may be desirable to consider the disposal of additional amounts of spoil at sea. The change in criteria for ocean disposal of dredged material may make this possible. Whether the dredged materials come from the interior harbor or the outer bar channel, their suitability for ocean disposal is now determined by the Final Regulations and Criteria, Federal Register (October 15, 1973) Volume 38, No. 198, Part II, Environmental Protection Agency, Ocean Dumping. Whether or not a dredged material is polluted is determined by guidelines outlined in Section 227.61 of these regulations.

However, the dredged material may still be deposited in the ocean provided it can be demonstrated by pilot test that it will not have an unacceptable adverse impact on shellfish beds, wildlife, fisheries (including spawning and breeding areas) or recreational areas. The Revised Draft Statement does not indicate that tests, using the new criteria, have been made to determine whether or not the sediment to be dredged is suitable for ocean disposal. We believe that such tests are necessary to properly evaluate the project in accordance with present laws, rules, and regulations.

Using the new criteria, a determination also should be made whether the assumption on page 109 that "all sediment upstream from the harbor entrance on a line from Sullivans Island to Cummings Point should be disposed of on upland areas" is still applicable.

If the material is found to be suitable for ocean dumping in accordance with the new criteria, we believe that the best long-term plan from environmental standpoint is to deposit the material in the ocean at an approved designated site in accordance with Plan 8 (briefly outlined on page 6 and further discussed on page 96). This plan, however, is contingent upon the availability of equipment. If the special dredge and barges are not available, some additional sediment in the lower harbor area could be removed by hopper dredge and deposited in the ocean, and more of the existing upland capacity could be retained for maintenance dredging, thereby taking some of the pressure off of additional marsh fill.

In light of our review and in accordance with procedures, we have assigned a rating of ER- (environmental reservations) to the project and 2 (insufficient information) to the Impact Statement.

We would like to have five copies of the final environmental impact statement when it is available, and if we can be of further assistance in any way please let us know.

Sincerely,

Jack E. Revan
Regional Administrator

DEPARTMENT OF HEALTH, EDUCATION AND WELFARE
REGION IV
50 7TH STREET N.E.
ATLANTA, GEORGIA 30323

OFFICE OF THE
REGIONAL DIRECTOR

June 2, 1975

RE: HEW 523-5-75
and 456-9-74

Mr. Harry S. Wilson, Jr.
District Engineer
Charleston District Corp of Engineers
Post Office Box 919
Charleston, South Carolina 29402

Subject: Charleston Harbor Deepening Project
Charleston, South Carolina

Dear Colonel Nelson:

We have reviewed the revised subject draft Environmental Impact Statement. Based on the data contained in the draft, it is our opinion that this proposed action will have only a minor impact upon the human environment within the scope of this Department's review. The revised impact statements have been adequately addressed for our comments.

Sincerely yours,

Philip T. Sayre
Regional Environmental Officer
DHEW-Region IV

cc:
Charles Custard
Warren Muir (2)

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
240 Stoneridge Drive, Columbia, South Carolina 29210

May 13, 1975

Colonel Harry S. Wilson, Jr.
District Engineer
Corps of Engineers
P. O. Box 919
Charleston, South Carolina 29402

Dear Colonel Wilson:

My staff has reviewed the revised draft environmental impact statement for the Charleston Harbor Deepening Project, Charleston County, and have no additional comments.

We appreciate the opportunity to review this statement.

Sincerely,

G. E. Huey
State Conservationist

C-4

UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE
Southeastern Area, State and Private Forestry
1720 Peachtree Road, N.W.
Atlanta, Georgia 30309

June 13, 1975

Col. Harry S. Wilson, Jr.
District Engineer
Charleston District, Corps of Engineers
Charleston, S. C. 29402

Dear Col. Wilson:

The U. S. Forest Service, State and Private Forestry has complete review of the revised draft environmental statement covering the Charleston Harbor Deepening Project, Charleston Harbor and Shipyard River, South Carolina.

Only insignificant impacts are anticipated on forest lands and resources. Therefore, we have no comments on this project proposal.

Thank you for the opportunity to review and comment on this revised draft statement.

Sincerely,

PAUL E. BUFFAM
Area Environmental Coordinator

6200-11b (4-74)

State of South Carolina

JAMES B. EDWARDS
GOVERNOR

OFFICE OF THE GOVERNOR
POST OFFICE BOX 11450
COLUMBIA 29211

May 28, 1975

General D. A. Raymond
Acting Chief of Engineers
Department of the Army
Office of the Chief of Engineers
Washington, D. C. 20314

Dear General Raymond:

This office appreciates the opportunity to comment on the proposal by the United States Corps of Engineers to deepen Charleston Harbor Channels and to maintain them at the recommended depths. Such actions will enable South Carolina to maintain its position of prominence in ocean trade and commerce.

I want to offer my support and endorsement of the proposed improvement. At the same time, I would like to express concern that every precaution must be taken to insure against unnecessary degradation of the local environment both during and after construction.

Under separate cover, you will receive communications regarding this project from the S. C. Water Resources Commission and the S. C. Wildlife and Marine Resources Commission. I will appreciate your consideration of their suggestions and comments.

Very truly yours,

James B. Edwards

JBE:EAF

State of South Carolina
Water Resources Commission

Clair P. Guess, Jr.
Executive Director

May 30, 1975

General D. A. Raymond
Acting Chief of Engineers
Department of the Army
Office of the Chief of Engineers
Washington, D. C. 20314

Dear General Raymond:

Having reviewed the feasibility report Charleston Harbor, Deepening and Extending Channels For Navigation (9 October 1974) together with the Revised Draft Environmental Statement (December 1974) relating to Charleston Harbor deepening, this agency concurs in the findings and recommends continuance of efforts toward implementation of the structural improvements described.

It is felt that proper environmental safeguards have been taken into consideration, and the ultimate results of the project will be a net benefit to the State.

It is understood that earlier questions by the South Carolina Wildlife and Marine Resources Department have been generally resolved except for a clarification of post-rediversion sedimentation rates. Even though rediversion and deepening are two separate projects they are inseparable in final effect and the sedimentation rate modification should be properly addressed.

The Division of Vector Control, Department of Health and Environmental Control, notes a lack of attention to the question of mosquito control in diked spoil areas. Their recommendations concerning this matter will emerge in the A-95 review process along with any other agency inputs.

Very truly yours,

Clair P. Guess, Jr.
Executive Director

CPG,Jr:tw

Water Resources Commission

Clair P. Gross, Jr.
Executive Director

June 4, 1975

General O.A. Raymond
Acting Chief of Engineers
Department of the Army
Office of the Chief of Engineers
Washington, D.C. 20314

Dear General Raymond:

In further response and earlier comments regarding proposed Deepening Charleston Harbor, we submit statements from other interested state agencies. For the most part these reactions are not seriously detrimental to orderly progress in moving forward with the project. The suggestions contained in these statements, however, merit consideration in the design and implementation of the overall structural features. The matter of sediment dating, involved with reclamation, should be expressed in more definitive terms.

Very truly yours,

Clair P. Gross, Jr.
Executive Director

CPG/jrmw
Enclosures

BOARD MEMBERS
[illegible]

SOUTH CAROLINA DEPARTMENT OF HEALTH AND ENVIRONMENTAL CONTROL

E. KENNETH AYCOCK, M.D., M.P.H., COMMISSIONER
J. MARION SIMS BUILDING — 2600 BULL STREET
COLUMBIA, SOUTH CAROLINA 29201

May 22, 1975

Mr. Elmer Whitten
S. C. Division of Administration
Room 466 - Edgar A. Brown Office Bldg.
Columbia, S. C. 29201

JUN 2 1975

Dear Mr. Whitten:

Thank you for the opportunity to review the revised draft of the EIS for the Charleston Harbor Deepening Project; Charleston Harbor and Shipyard River, South Carolina.

In reviewing this statement, we find no mention of the mosquito problem which usually accompanies dredging operations in the Charleston area.

As you are now aware, the production of Aedes sollicitans requires in confined disposal areas constitutes a significant problem both in terms of nuisance and health hazard to the citizens of that area as well as to the capacity of the Charleston County Mosquito Abatement Project to provide adequate control.

For these reasons, we recommend that the use of diked disposal areas be given close scrutiny and that if it is decided to use this disposal method, the Charleston County Mosquito Abatement Project be kept informed of disposal activities in order to intensify their control efforts.

We recognize the need for keeping Charleston Harbor open and modifying it to handle the increasing size of vessels, but we also feel that such an operation can be done in such a way as to minimize the mosquito problem associated with it.

Yours truly,

S. Michael Loving
Entomologist II
Division of Vector Control

SML/s

cc - Frank Nelson

SOUTH CAROLINA DEPARTMENT OF HEALTH AND ENVIRONMENTAL CONTROL

J. MARION SIMS BUILDING • 2600 BULL STREET
COLUMBIA, SOUTH CAROLINA 29201

May 7, 1975

MAY 9 1975
DIVISION OF
ADMINISTRATION

Mr. [illegible]
Assistant Director, S.C. State Clearinghouse
Division of Administration
Pendleton Street
Columbia, SC 29201

Dear [illegible]:

(1) I have reviewed the [illegible] for Charleston Harbor [illegible] Engineers [illegible] of the [illegible] not all [illegible] Corps, [illegible] from [illegible] of the [illegible]

(2) If [illegible] that the [illegible] the [illegible] agencies [illegible] be [illegible] and [illegible]

Sincerely,

[illegible]

Project Notification & Review System

Public Authority
P. O. Box 817
Charleston, SC 29402

Clearinghouse Use Only
CONTROL NUMBER
DIST. MO. FY
09

SUSPENSE DATE
5/23

attached project notification is being referred to your agency in rdance with Office of Management and Budget Circular A-95. This em coordinates the review of proposed federal or federally assisted development programs projects. Please provide comments below, relating the proposed project to the plans, cies, and programs of your agency. All comments will be reviewed and compiled by the e Clearinghouse. Any questions may be directed to this office by phone at 758-2946. se return this form prior to the above suspense date to:

e Clearinghouse
sion of Administration
Pendleton Street
mbia, South Carolina 29201

Signature Elmer C. Whitten, Jr.

Name Elmer C. Whitten, Jr.

RESULTS OF AGENCY REVIEW

- [X] PROJECT CONSISTENT WITH AGENCY PLANS AND POLICIES
- [ ] AGENCY REQUESTS CONFERENCE TO DISCUSS COMMENTS
- [ ] AGENCY COMMENTS ON CONTEMPLATED APPLICATION AS FOLLOWS:

MAY 12 1975

(Use separate sheet if additional space is necessary)

FOR THE REVIEWING AGENCY:
SIGNATURE [illegible]

DATE: MAY 1975

TITLE [illegible]

South Carolina
Project Notification & Review System

Clearinghouse (If Any)
Control Number
Date
SUSPENSE DATE
5/23

S.C. Coastal Zone Management Council

S.C. Wildlife & Marine Resources Department

...project notification is being circulated to your agency in accordance with Executive Order 12372, Circular A-95. This ... proposed federal or federally assisted development ... Please review the proposed project to the ... and purposes of your agency. All comments will be reviewed and compiled by the ... Clearinghouse. Any questions may be directed to this office by phone at 758-2470. ... return this form prior to the above suspense date to:

Clearinghouse
Office of Coordination
S.C. Wildlife & Marine Resources Department
Columbia, South Carolina 29201

Signature Elmer C. Whitten, Jr.

Name Elmer C. Whitten, Jr.

RESULTS OF AGENCY REVIEW

- [ ] PROJECT CONSISTENT WITH AGENCY PLANS AND POLICIES
- [ ] AGENCY REQUESTS CONFERENCE TO DISCUSS COMMENTS
- [x] AGENCY COMMENTS ON CONTEMPLATED APPLICATION AS FOLLOWS:

Personnel of the S. C. Wildlife & Marine Resources Department have reviewed the Revised Draft Environmental Statement for the deepening of Charleston Harbor and Shipyard River and most of our previous concerns have been satisfied.

Generally, the Environmental Statement provides a good review of the environmental impact of the deepening project. Although Section 4.[illegible] has been revised in part, there remains an apparent lack of information regarding the impact of the Cooper River Rediversion on the Harbor maintenance project in the future. ...antitative predictions on decreased sediment rates with rediversion should be indicated.

(Use separate continuation sheets if necessary)

FOR THE REVIEWING AGENCY:
SIGNATURE [signature] DATE: May 22, 1980
TITLE [illegible] PHONE: [illegible]

South Carolina
Project Notification & Review System

TO: Joe W[illegible]
St. Clearinghouse

Clearinghouse Use Only
CONTROL NO.

SUSPENSE DATE
5/23

The attached project notification is being referred to your agency in accordance with Office of Management and Budget Circular A-95. This System coordinates the review of proposed federal or federally assisted development pro and projects. Please provide comments below, relating the proposed project to the plan policies, and programs of your agency. All comments will be reviewed and compiled by t State Clearinghouse. Any questions may be directed to this office by phone at 758-294[illegible] Please return this form prior to the above suspense date to:

State Clearinghouse
Division of Administration
1205 Pendleton Street
Columbia, South Carolina 29201

Signature Elmer C. Whitten

Name Elmer C. Whitten, Jr.

RESULTS OF AGENCY REVIEW

- [x] PROJECT CONSISTENT WITH AGENCY PLANS AND POLICIES
- [ ] AGENCY REQUESTS CONFERENCE TO DISCUSS COMMENTS
- [ ] AGENCY COMMENTS ON CONTEMPLATED APPLICATION AS FOLLOWS:

(Attach additional sheets if necessary)

SIGNATURE DATE

TITLE

South Carolina
Project Notification & Review System

TO

SUSPENSE DATE
5/23

This attached project notification is being referred to your agency in accordance with Office of Management and Budget Circular A-95. This System coordinates the review of proposed federal or federally assisted development and projects. Please provide comments below, relating the proposed project to the plans, policies, and programs of your agency. All comments will be reviewed and compiled by the State Clearinghouse. Any questions may be directed to this office by phone at 758-2941. Please return this form prior to the above suspense date to:

State Clearinghouse
Division of Administration
1205 Pendleton Street
Columbia, South Carolina 29201

Signature Elmer C. Hatten, Jr.

Name Elmer C. Hatten, Jr.

RESULTS OF AGENCY REVIEW

- [x] PROJECT CONSISTENT WITH AGENCY PLANS AND POLICIES
- [ ] AGENCY REQUESTS CONFERENCE TO DISCUSS COMMENTS
- [ ] AGENCY COMMENTS ON CONTEMPLATED APPLICATION AS FOLLOWS:

(Please attach additional sheets if necessary)

FOR THE STATE

SIGNATURE

TITLE

DATE

END

FILMED

2-85

DTIC