ENVIRONMENTAL IMPACT STATEMENT
APPENDIX H: Section 404(b)(1) Evaluation

SAVANNAH HARBOR EXPANSION PROJECT

Chatham County, Georgia and Jasper County, South Carolina

January 2012

Revised July 2012

US Army Corps
of Engineers
Savannah District
South Atlantic Division

This page intentionally blank

SECTION 404(b)(1) EVALUATION

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ATTACHMENT

SECTION 404 (b)(1) EVALUATION
SAVANNAH HARBOR EXPANSION PROJECT

1.0 <u>INTRODUCTION</u>.

Section 404 (b)(1) of the Clean Water Act of 1972 requires that any proposed discharge of dredged or fill material into waters of the United States must be evaluated using the guidelines developed by the Administrator of the U.S. Environmental Protection Agency (EPA) in conjunction with the Secretary of the Army. These guidelines are located in Title 40, Part 230 of the Code of Federal Regulations. The following Section 404 (b)(1) evaluation is prepared in accordance with those guidelines. This Section 404 (b)(1) evaluation analyzes all activities associated with the Savannah Harbor Expansion Project that involve the discharge of dredged or fill material into waters of the United States, including both construction and mitigation features and long-term maintenance requirements.

This Section 404 (b)(1) Evaluation focuses on aspects of the Savannah Harbor Expansion Project that would involve the discharge of dredged or fill material into waters of the United States An Environmental Impact Statement has been prepared which provides a comprehensive analysis of the other environmental issues associated with the project.

2.0 <u>PROJECT DESCRIPTION.</u>

2.1 <u>Project Location.</u> Savannah Harbor is a deep draft harbor on the South Atlantic coast 75 statute miles south of Charleston, South Carolina and 120 miles north of Jacksonville, Florida. Savannah Harbor includes an inner harbor that comprises the last 21.3 miles of the Savannah River and an entrance channel that presently extends about 11.4 miles into the Atlantic Ocean.

2.2 <u>General Description-Existing Project.</u> The Savannah Harbor Navigation Project has an authorized project depth of 30-feet MLW in the inner harbor from Stations 112+000 to 105+000, 36-feet MLW from Stations 105+000 to 103+000 and 42-feet MLW from Stations 103+000 to 000+000. The width of the inner harbor channel is 200 feet from the upstream end of the project to the Argyle Island Turning Basin, 400 feet to the Kings Island Turning Basin and 500 wide (except 400-feet wide from Stations 59+000 to 58+000) from the Kings island Turning Basin to the harbor entrance. The entrance channel is 600-feet wide and 42-feet deep from Stations 000+000 to -14+000B and 44-feet deep from Station -14+000B to the present end of the entrance channel (Station -60+000B).

2.3 <u>General Description-Proposed Project.</u> The Savannah Harbor Expansion Project would involve various construction efforts that would require the discharge of dredged or fill material into waters of the United States. The project would include extending the entrance channel, deepening the existing entrance channel, deepening of the inner harbor to the Garden City Terminal of the Georgia Ports Authority, annual maintenance dredging of the entrance and inner harbor channels to maintain authorized project depths (including advance maintenance), expanding the Kings Island Turning Basin across from the Garden City Terminal, deepening eight container vessel berths at the Garden City Terminal, construction of three bend wideners, two meeting areas, and construction of six mitigation features.

The District developed and evaluated five channel deepening alternatives, in addition to the No Action Alternative. Each channel deepening alternative contains mitigation features to address adverse environmental impacts that they would otherwise produce. With inclusion of the mitigation features, each depth alternative is environmentally acceptable. The 47-foot depth alternative is the National Economic Development (NED) Plan, the plan that maximizes net economic benefits to the Nation (See GRR). Under current Federal planning policy, the NED plan would be recommended for implementation unless there are overriding considerations that favor recommendation of another plan. Benefits that would accrue from the deepening of Savannah Harbor include reductions in light loading of vessels and vessel delays. Shippers will also be able to use larger, more efficient vessels. The economic benefits increase with each additional increment of channel deepening. Environmental impacts associated with a shallower depth would be less than those associated with the NED plan, but the lesser impacts of the 44-foot depth, 45-foot depth, and 46-foot depth alternatives are not considered sufficient to justify recommendation of these alternatives instead of the NED Plan. The 47-foot depth alternative is the selected plan.

The State of Georgia has asked the Corps to consider the 48-foot depth alternative as the Locally Preferred Plan. After review of the comments received on the Draft GRR and DEIS, and discussions with the non-Federal sponsor, the Corps has elected to select the NED 47-foot depth alternative for implementation.

The details of the proposed action are as follows:

A) The existing entrance channel would be extended 37,680 feet from its current end at Station -60+000B to Station -97+680B. When completed, the entrance channel would be -49 feet MLW deep and 600-feet wide from Station -97+680B to the jetties (Station -14+000B) and then -47 feet MLW deep and 500-foot wide from the jetties to the harbor entrance (Station 0+000). Construction of the extension to the entrance channel also includes a bend widener located between Stations -14+000B and -23+000B. The entrance channel would be dredged annually to maintain project depths.

B) The inner harbor would be deepened to -47 feet MLW from the harbor entrance (Station 0+000) to the Garden City Terminal of the Georgia Ports Authority (Station 103+000). Deepening the channel to -487feet MLW includes the construction of two bend wideners located between Stations 27+500 and 31+500 and Stations 52+250 and 55+000 Inner harbor improvements also include the construction of two meeting areas between Stations 14+000 and 22+000 and Stations 55+000 and 59+000, respectively. The Kings Island Turning Basin, located between Stations 98+000 and 101+000, would also be deepened and expanded. The inner harbor would be dredged annually to maintain project depths, and authorized advanced maintenance.

C) Container Vessel Berths 2,3,4,5,6,7,8 and 9 at the Garden City Terminal of the Georgia Ports Authority would be deepened to -47 feet MLW. Maintenance of these berths after initial project construction would be the responsibility of the project sponsor.

D) Some components of the Mitigation Plan would be constructed to minimize an increase in upstream salinity levels caused by harbor deepening. These aspects of the mitigation were developed to minimize the anticipated increase in upstream salinity levels in the area of the Savannah National Wildlife Refuge. The plan includes a diversion structure at the entrance to McCoys Cut, closing the western arm of McCoys Cut, deepening a portion of McCoys Cut to -12 feet MLW, deepening a portion of Little Back River to -10 feet MLW, deepening a portion of Middle River to -10 feet MLW, and closing Rifle Cut. The plan also includes constructing a rock sill where Back River joins Front River downstream of the Tidegate structure, placing earthen fill upstream of the rock sill to construct a broad berm that would result in subsequent natural filling of the entire Sediment Basin, and removing the Tidegate structure. While removing the Tidegate structure does not directly constitute a discharge of fill material into waters of the United States, some concrete will be temporarily discharged into Back River as a result of the demolition. Concrete from the Tidegate structure will be recycled and beneficially used by either placing it in tidal waters within the estuary to create fish habitat or in the lower portion of the Sediment Basin as fill.

E) The Mitigation Plan also includes constructing a boat ramp in Back River near the Tidegate structure. The boat ramp would be constructed to replace access lost as a result of blocking Rifle Cut. Constructing this facility would also require placing riprap along the embankment of the river.

F) Studies indicate that construction of the SHEP would result in an increase in chloride levels at the intake of the City of Savannah's Municipal and Industrial Water Treatment Facility on Abercorn Creek. These conditions would occur during very low river flow and high tides. Consequently, a storage impoundment would be constructed that would be used to store raw water for use during chloride spike events predicted to occur during these events. The storage impoundment would be approximately 28 acres. The storage pond would be located on high ground in an existing industrial park. However, in view of its size and the need to construct a pumping station, inflow and outflow pipes, etc., adverse effects to a small amount of wetlands (non-tidal) could occur. The Corps will conduct detailed surveys during final design to identify and quantify any wetland areas that would be affected. If wetlands must be impacted to construct the storage impoundment, the Corps would follow the interagency-approved Savannah District Regulatory SOP to quantify the extent of mitigation that would be needed. The

Corps would coordinate the results of the SOP calculations with the Federal and Georgia natural resource agencies.

G) Site preparation would be required in Disposal Area 1S to allow restoration of estuarine emergent wetlands. Approximately 4.2 acres of brackish marsh would be lost as a result of excavation requirements for the project, and approximately 30 acres of brackish marsh would be lost as a result of the Kings Island Turning Basin expansion. In addition, removal of the Tidegate structure would result in a loss of approximately 8.48 acres of brackish marsh. To provide in-kind mitigation, about 40.3 acres of uplands in Disposal Area 1S (formerly wetlands) would be excavated down to the adjacent marsh elevation to allow the re-establishment of estuarine emergent wetlands. Approximately 28.8 acres of the restored site would serve as the required wetland mitigation for the excavation requirements of the SHEP. The remaining 11.5 acres of marsh restoration could be used to satisfy any additional wetland mitigation requirements of the SHEP or for approved Operation and Maintenance projects associated with Savannah Harbor. Although excavation of uplands in Disposal Area 1S does not constitute a discharge of dredged material into waters of the United States, some of the soil would inadvertently be discharged into the adjacent waterways during the construction process.

H) A fish passage structure would be constructed at New Savannah Bluff Lock and Dam. Deepening of the harbor would adversely affect Shortnose sturgeon habitat in Savannah Harbor. As part of the mitigation plan for the loss of Shortnose sturgeon habitat, an off-channel rock ramp fish passage structure would be constructed at the New Savannah Bluff Lock and Dam. The New Bluff Lock and Dam is located at Mile 188 of the Savannah River. It is the first structure on the Savannah River that blocks passage of Shortnose sturgeon (and other anadromous species of fish) from traditional upstream spawning grounds. Construction of this facility would provide access for spawning fish to about 20 miles of traditional spawning habitat in the Savannah River located between the New Savannah Bluff Lock and Dam and the Augusta Diversion Dam.

I) Without mitigation, construction of the SHEP would lower dissolved oxygen levels in Savannah Harbor. The project’s mitigation plan includes installation of oxygen injection systems which would be operated during the summer months to remove the incremental effects of the project on dissolved oxygen. Construction the inflow and discharge pipes for the oxygen injection systems would require excavation of material along the banks at two locations on Hutchinson Island and another site upriver near Georgia Power’s Plant McIntosh. Clean fill material (sand, concrete) would be discharged into these areas to provide the necessary support structures for the oxygen injection systems.

J) The maintenance requirements of the completed project are not expected to substantially differ from the existing 42-foot project. Approximately 6 million cubic yards of dredged material would be removed from the inner harbor on an annual basis. The Base Plan (least cost and environmentally acceptable plan) for maintenance of the harbor would remain the same. Maintenance material dredged from the inner harbor would be placed in the existing seven CDFs while material removed from the entrance channel would be place into the ODMDS or at Site 2 and Site 3 which are located just south of the entrance channel. The LTMS study completed in 1996 also authorized placement of suitable maintenance material from the first part of the inner harbor and suitable material from the entrance channel to be placed into the nearshore area off Tybee Island to create a feeder berm system as well as directly on Tybee Beach. An EIS, including a Section 404 (b)(1) Evaluation, was prepared for the LTMS study. This EIS and accompanying Section 404 (b)(1) evaluation assessed the impacts of placing maintenance material from the Savannah Harbor Navigation Project into the existing CDFs, the ODMDS, Sites 2 and 3 adjacent to the entrance channel, the nearshore sites off Tybee Island, and on the beach at Tybee Island. Construction of the 47-foot project is not expected to result in a substantial change to the quantity or the quality of maintenance sediments that would have to be removed from the completed project. Consequently, this Section 404 (b)(1) Evaluation focuses on the impacts associated with the discharge of dredged or fill material that would occur during construction of the 47-foot project.

2.4 Authority and Purpose. The Savannah Harbor Expansion Project was authorized in the Water Resources Development Act of 1999 (Public Law 106-53, Section 102 (b)(9)). The legislation required the US Army Corps of Engineers to evaluate project depth alternatives ranging from 42 feet to 48 feet and develop acceptable mitigation plans.

3.0 GENERAL DESCRIPTION OF DREDGED OR FILL MATERIAL

3.1 General Characteristics of Sediments (Grain size, soil type). Dredged sediments from Savannah Harbor are a mixture of sands, silts, and clays. Sand is defined as grain size between 0.07 and 5.0 mm while silt and clay measures less than 0.07 mm in diameter. Fill material that would be used to construct the various mitigation features of the project would include clean sand, rock and riprap. The following is a description of the dredged and fill material that would be discharged into waters of the United States as a result of construction of the Savannah Harbor Expansion Project:

A) Savannah Harbor Entrance Channel (New Work Sediments). In the entrance channel, the reach from 0+000 to -30+750 averages about 79 percent sand. Very sandy sediments (at least 90 percent sand) occur from Stations -30+750 to -37+000, -41+250 to -47+500, and in the upper layer (down to -50 ft MLLW) from Station -47+500 to -60+000. The outermost reach for which data exists is from -60+000 to -63+000 which averages 88.4 percent sand.

B) Inner Harbor (New Work Sediments). Sandy sediments (at least 82 percent sand) occur in the upper harbor from Stations +47+000 to +45+000, +33+000 to 31+000, and 17+600 to 0+000. Reaches with the least amount of sand (no more than 37 percent sand) occur from Stations +103+000 to +76+500 and +45+000 to +33+000.

C) Sediments removed from Container Berths 2, 3, 4, 5, 6, 7, 8, and 9 would contain a high percentage of silts and clays.

D) Construction of the various features associated with the Mitigation Plan would involve placing structures in McCoys Cut, Rifle Cut, and Back River to divert, impede or stop the flow of water. Materials required to construct these structures include stone, armor stone, riprap, sheet pile and sand. Sediment dredged to deepen the channels in McCoys Cut, Little Back and Middle Rivers would be mostly sand. Sediment used to construct the broad berm in the Sediment Basin would come from the navigation channel during deepening construction or from the CDFs along Savannah Harbor and would consist of predominantly sand (> 75%).

E) Demolition of the Tidegate structure would result in the discharge of concrete into Back River and placement of the rubble at other estuarine sites. Construction of the boat ramp facility in Back River would require the placement of concrete for the boat ramp, as well as riprap for bank protection.

F) A storage impoundment would be constructed to serve the City Of Savannah's Municipal and Industrial water treatment plant on Abercorn Creek. This impoundment would provide a source of acceptable raw water during times (very low flows and high tides) when chloride levels increase at their intake on Abercorn Creek. Although the impoundment would be constructed on high ground, some fill might have to be placed in wetlands or construction could occur in wetlands to build the facility. The discharge of fill material to support this action would include concrete, stone and clean sand.

G) Establishment of a marsh restoration area in Disposal Area 1S would involve grading down about forty acres of high ground (former wetlands) to marsh elevation and constructing finger streams to allow tidal interchange. This high ground is mostly sand.

H) Material required to construct the fish passage facility at New Savannah Bluff Lock and Dam would be concrete and stone.

I) Fill Material-Oxygen Injection Systems. Some excavation along the river shoreline would likely be required. A discharge of clean sand and concrete would be required to provide support structures for the oxygen injection systems.

J) Entrance Channel Maintenance Sediments. Entrance channel maintenance sediments are primarily sand, except for sediments between the jetties (Station -5+000B) and at Station -45+000B which have high silt and clay components. Table 1 shows the characteristics of maintenance sediments in the entrance channel.

Table 1. Composition of Maintenance Sediments in Entrance Channel

Stations	Percent Sand	Percent Silt
0+000 to -10+000B	86	14
-10+000B to -20+000B	81	19
-20+000B to -30+000B	79	21
-30+000B to -40+000B	77	23
-40+000B to -50+000B	74	26
-50+000B to -60+000B	93	7

K) Inner Harbor Maintenance Sediments. The upper harbor from Stations 100+000 to 110+000 (including the Kings Island Turning Basin) has areas of high sand content (up to 88.7 percent sand) and areas with low sand content (3 percent sand). The ENSR toxicity test sample composite (KI, T110, T100) contained 66.9 percent sand. From Station 50+000 to 100+000 and the sediment basin, sand measurements range from 8 to 78 percent sand, with the area generally characterized by low sand content. The ENSR toxicity test sample for the channel composite (T60, T70, T80, T90) was 20.5 percent sand. The ENSR toxicity test sample for the sediment basin composite contained 8.6 percent sand. The area from Stations 27+500 to 50+000 is mostly sand, with sample measurements ranging from 0 (one sample) and 65 to 85 percent sand. The ENSR toxicity test sample composite (T30, T40, T50) contained 70.6 percent sand. The area from Stations 27+500 (Field's Cut) to 0+000 (at harbor entrance) is mostly sand with area samples ranging from 17 to 100 percent sand, with the average for all samples showing > 86 percent sand. The inner harbor maintenance sediments are primarily silts and clays from the upper end of the proposed project (Station 103+000) to Station 56+000. The reach from Station 56+000 to 25+000 has a higher percentage of sand in the sediments with the exception of the area in the vicinity of Station 36+000, which contains almost no sand. Sediments found between Station 25+000 and the mouth of the harbor are primarily sand. Sediments found in the Sediment Basin are almost totally silt.

Table 2 shows the maintenance sediment characterization by reach.

Table 2. Inner Harbor Sediments Composition

STATIONS	SAND (%)		FINES (%)
112+500 to 105+000	80		20
105+000 to 79+000	68		32
79+000 to 63+000	10		90
63+000 to 40+000	20		80
40+000 to 0+000	60		40
Sediment Basin	10		90

3.2 <u>Quantity of Sediments (Cubic Yards)</u>. The following estimates indicate the amount of dredged or fill sediments that would be discharged for each action described above:

A. Project design estimates indicate that about 10.6 MCY of sediments will have to be removed to deepen the existing entrance channel to -49 feet MLLW, construct a bend widener, and extend the bar channel from Station -60+000B to -97+680B. Annual maintenance dredging requirements would increase only slightly for the improved entrance channel to about 1.12 MCY per year.

B. Deepening of the inner harbor from Stations 4+000 to 103+000 to -47 feet MLLW, construction of two bend wideners and two meeting areas, and deepening and expanding the Kings Island Turning Basin would require dredging approximately 13.0 MCY of sediments. Annual maintenance dredging requirements would change only slightly for the deepened channel versus the existing 42-foot channel. Estimates indicate that the annual maintenance dredging requirements for the 47-foot channel would be approximately 7.0 MCY per year.

C. Deepening the eight container berths at the Garden City Terminal of the Georgia Ports Authority would require the removal of about 170,000 cubic yards of sediments.

D. Constructing various features of the Mitigation Plan would require the discharge of both fill and dredged sediments. The present design to construct the diversion structure at McCoys Cut would require placing 8,400 tons of stone, 168 tons of sheetpile, and 266 tons of riprap. Closing the western end of McCoys Cut would require placing 5,100 tons of armor stone and 266 tons of riprap. Closing Rifle Cut would require discharging 3,300 cubic yards of sand and placing 2,500 tons of stone and 160 tons of riprap. Dredging to deepen the channel in McCoys Cut would involve removing about 208,000 cubic yards of sediments along 1.5 miles of the waterway. Dredging to deepen a portion of Little Back River would involve removing approximately 161,000 cubic yards of sediments in 1.7 miles of the stream. Dredging to improve the channel along 1.5 miles of Middle River would require removing about 74,000 cubic yards of sediments. Constructing the sill across Back River in the Sediment Basin would require placing 158,200 tons of stone. Approximately 2,100,000 cubic yards of sediment would be discharged behind the sill to create a broad berm to effectively reduce the upstream movement of saline tidal waters. Maintenance dredging of McCoys Cut, Little Back River, and Middle River is expected to occur approximately every 10 years for the duration of the project.

E. Detailed plans for construction of the boat ramp in Back River have not been developed. However, construction of a two-lane boat ramp would only involve placing a small amount of concrete into Back River and placing some riprap along the bank for stabilization.

F. Plans for the storage impoundment that would be constructed at the City of Savannah's water treatment facility on Abercorn Creek provide for it to be constructed on high ground in an existing industrial park. However, there is a possibility that some fringe non-tidal wetlands could be impacted by this construction. Fill material that would be used to construct this impoundment would consist of clean fill material as well as rock and stone.

G. The marsh restoration site in Disposal Area 1S would require the removal of approximately 437,000 cubic yards of sediment to grade the site to marsh elevation and to construct the necessary finger streams to insure the area receives sufficient tidal flow. Every effort would be made to prevent any of this material from entering adjacent water bodies. However, a small amount of this material may inadvertently enter adjacent streams during the grading and excavation processes.

H. Conceptual plans have been developed for the fish passage structure at New Savannah Bluff Lock and Dam. An off channel rock ramp design around the South Carolina end of the dam would be used. Consequently, concrete and rock would have to be placed in the Savannah River to build the structure.

I. As discussed previously, approximately 6 million cubic yards of maintenance material would be removed from the inner harbor on an annual basis.

3.3 <u>Source of Material.</u> Most of the dredged material that would be discharged into waters of the United States will emanate from the bottom of the Savannah River. The exceptions are the sediments that would be removed during deepening of the channels in McCoys Cut, Little Back River and Middle River. Most of the fill material (armor stone, riprap, concrete) that would be discharged into waters of the United States would be purchased from a commercial source. Sediments removed from the channel improvement dredging in McCoys Cut, Little Back River and Middle Rivers may be used to construct the broad berm in Back River. Sediments used to construct that broad berm may also be taken from Confined Disposal Facilities 12A, 13A, 13B, 14A, 14B, and Jones/ Oysterbed Island, or the material from the removal of the Tidegate structure earthen embankments.

4.0 DESCRIPTION OF THE PROPOSED DREDGED MATERIAL DISPOSAL SITES

4.1 <u>Sites for Placement of Dredged Sediments from the Entrance Channel.</u> Material dredged to deepen the existing entrance, extend the entrance channel from Stations -60+000B to -97+680B, and to construct the entrance channel bend widener would be discharged into the Savannah Harbor Offshore Dredged Material Disposal Site (ODMDS). Material removed from the first portion of the inner harbor (Stations 0+000 to 4+000) may also be placed in the ODMDS or an existing CDF. This work would normally be performed by a hopper dredge which would remove the material from the channel and carry it to the ODMDS. The environmental considerations and requirements for use of the ODMDS during the SHEP are addressed in Appendix R (ODMDS

Placement Evaluation). Maintenance sediments could also be deposited in Sites 2 and 3 or other approved nearshore placement areas.

Although material removed by a hopper dredge would be discharged into the ODMDS, pumping to overflow is a common practice when the sediments to be dredged are mostly sand and free of contaminants. Pumping to overflow allows the hopper dredge to take on the maximum load of material before it takes the material to the ODMDS. When the hopper dredge is inside of the 3-mile line, this overflow of dredged material from the hopper is considered a discharge of dredged material into waters of the United States. Consequently, the discharge of dredged material associated with hopper dredge overflow must be addressed using the Section 404 (b)(1) Guidelines.

On occasion, a hydraulic pipeline dredge may be used to remove material from the entrance channel. On those occasions, the new work dredged material is discharged into an existing CDF or the ODMDS. Maintenance sediments could also be deposited in Sites 2 and 3 or other approved nearshore placement areas.

The Savannah Harbor Ocean Dredged Material Disposal Site (ODMDS) is a 4.26 (2,726 acres) square mile site located south of the entrance channel. The site has been designated (December 1993) by the U.S. Environmental Protection Agency as an approved disposal site for sediments removed from the entrance channel during annual maintenance dredging operations. While this site has been cleared to receive maintenance sediments from the entrance channel, it has not been designated to receive new work sediments from the Savannah Harbor Expansion Project. Previous testing of sediments from the entrance channel revealed that maintenance sediments met the criteria of the EPA Ocean Dumping Regulations and are therefore acceptable for transportation for ocean disposal. The EIS contains an evaluation (Appendix R) of the excavation of new work entrance channel sediments, transportation to the ODMDS, and deposition into the ODMDS. At the request of EPA Region 4, the District is conducting biological testing of the new work sediments. When the results or those confirmatory tests are available, the District will prepare a Section 103 Evaluation and provide it to EPA for review and approval, before the ODMDS could be used.

4.2 <u>Disposal Sites for Dredged Sediments from the Inner Harbor.</u> New work sediments dredged from the inner harbor (Station 0+000 to Station 103+000), the two bend wideners, the two meeting areas, and the Kings Island Turning Basin would be deposited into the existing confined disposal facilities (CDFs) along Savannah Harbor. Figure 1 shows these CDFs. CDFs that would be used for the Savannah Harbor Expansion Project include 2A, 12A, 13A, 13B, 14A, 14B and Jones/Oysterbed Island. These same disposal sites would be used to maintain the completed project (Station 0+000 to Station 112+500).

Figure 1. Savannah Harbor confined disposal facilities.

4.3 Disposal Site for Sediments Dredged from the Container Berths. Sediments dredged from the 8 container vessel berths at the Georgia Ports Authority Garden City Terminal would be discharged into existing CDFs for the Savannah Harbor Navigation Project, which include 2A, 12A, 13A, 13B, 14A, 14B and Jones/Oysterbed Island.

4.4 Sites for Dredged and Fill Material Associated with the Mitigation Plan. Figure 2 shows the major features of the Mitigation Plan, including the locations of the diversion structure at McCoys Cut, the structure that would close the western end of McCoys Cut, the one plug that would close Rifle Cut, and the location of the berm in Back River below the Tidegate. Concrete debris resulting from demolition of the Tidegate structure would be removed and placed along the banks in various locations in Back River and other portions of the estuary for fish habitat, or used to construct the berm in Back River. The boat ramp site is located in Back River at the present location of the Tidegate.

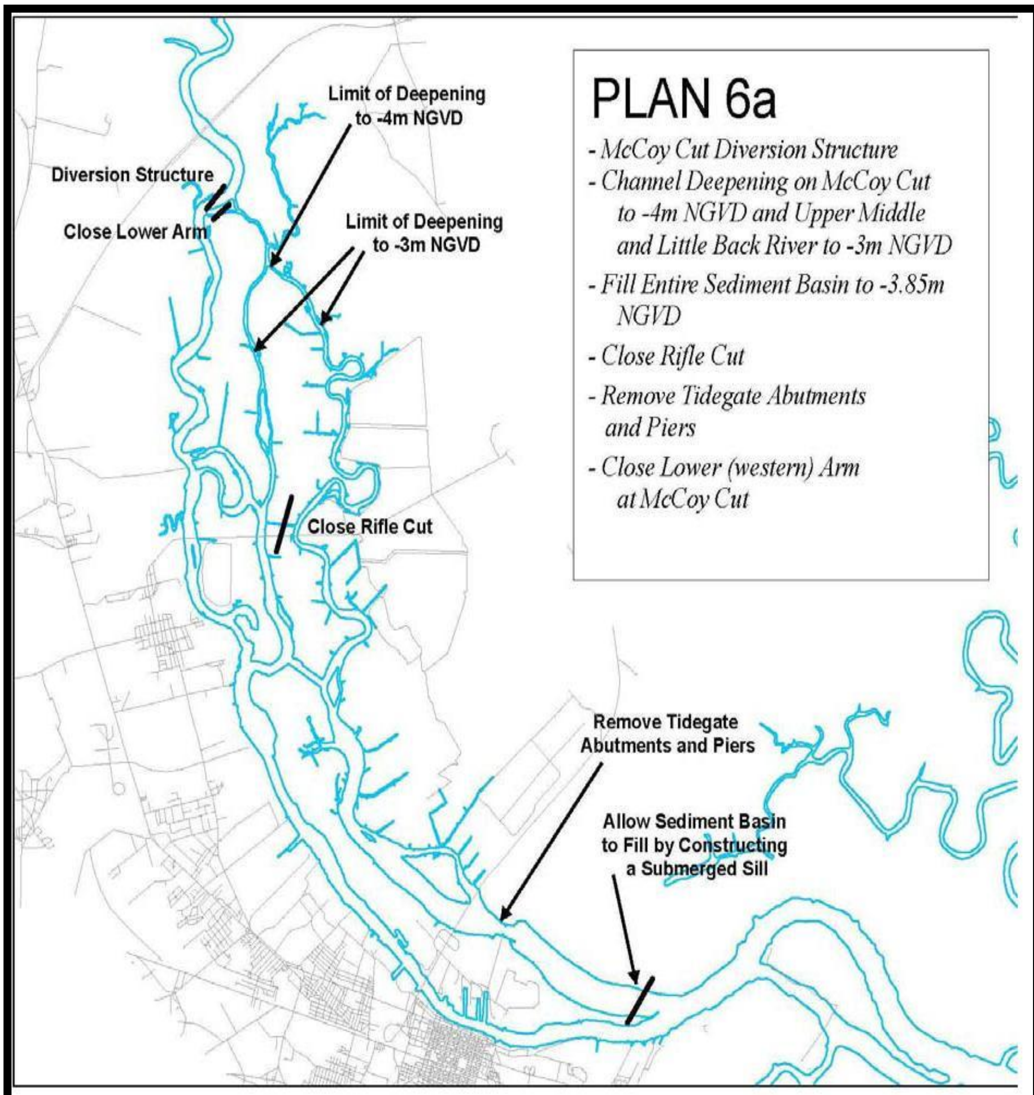


Figure 2. Mitigation flow re-routing plan.

4.5 Storage Impoundment for City of Savannah Water Treatment Plant. The discharge site for the storage impoundment at the City of Savannah's water treatment plant on Abercorn Creek would be in non-tidal wetlands (if required). The storage impoundment would be located in close proximity to the city's water treatment plant in Chatham County, Georgia. The site presently identified for this impoundment is in Parcel 3 in the Savannah River International Trade Park.

4.6 Re-establishing Wetlands at Disposal Area 1S. Some of the sediment excavated from Disposal Area 1S to permit re-establishment of estuarine emergent wetlands would be discharged into the Back River to construct the broad berm at the lower end of the basin, or into CDFs 2A or 12A. Some of the material may inadvertently be discharged into Middle River during the grading down of the dredged material deposits in Disposal Area 1S.

4.7 The New Savannah Bluff Lock and Dam. Located at about Mile 194 of the Savannah River, the discharge site for the fish passage facility would be located in the Savannah River around the South Carolina abutment of the dam.

4.8 Construction of the Pipes and Support Structures for the Oxygen Injection Systems. Fill material would be placed to facilitate construction of the inflow and discharge pipes and support structures for the three oxygen injection systems. Two systems would be located on Hutchinson Island (one in Back River and one in Front River) and one would be located near Georgia Power's Plant McIntosh upriver on the Savannah River (upstream of I-95).

4.9 Timing and Duration of Discharge. The estimated time to complete the entire Savannah Harbor Expansion Project is three to six years. The current schedule provides for a 4-year construction period. The individual construction components of the project will be of much shorter duration. Discharges of dredged sediments or fill material will be subject to restrictions which will limit when this type of work can be performed.

Use of hopper dredges in the entrance channel and subsequent disposal of the dredged sediments into the ODMDS would be restricted to the period December 15-March 31 to avoid the nesting season for endangered sea turtles, consistent with the Section 401 water quality certifications. Hydraulic pipeline dredges can be used in the entrance channel during the sea turtle nesting season since it has been demonstrated that they do not adversely affect sea turtles.

Hydraulic dredging in Savannah Harbor is not conducted above Station 63+000 during the spawning season for the Striped bass which is April 1-May 15. This restriction would also be applicable to the channel improvements proposed at McCoys Cut, Little Back River and Middle River. To minimize project impacts to sturgeon, the NMFS has stipulated in the BO that construction of the diversion structure at McCoys Cut be restricted to the period May 15-November 1 while most sturgeon are not expected to be in that portion of the estuary.

To protect spawning sturgeon and their offspring, no in-water fish passage construction downstream of the New Savannah Bluff Lock and Dam will occur during the late winter/spring spawning period and early summer larval period between February 1 and May 31.

Dissolved oxygen concentrations in Savannah Harbor generally deteriorate in the summer months to where concentrations are at or below State standards. The Corps monitors dissolved oxygen levels in the vicinity of its operating dredges during the summer months. Dredging and disposal operations are stopped during these periods of low dissolved oxygen, if required. The oxygen injection systems may facilitate dredging conducted during the summer once they become operational.

4.10 Description of Proposed Dredging Methods. Hopper dredges would be used to remove sediments from Station 4+000 to -97+680B at the end of the extended entrance channel. Hydraulic pipeline dredges may also be used to remove and place dredged sediments removed from Stations 4+000 to -97+680.

The vast majority of the work in the inner harbor will be performed by hydraulic pipeline dredge. However, other types of equipment will be used as required such as barge mounted cranes, clamshells, and other mechanical dredges.

5.0 SUBPART B - COMPLIANCE WITH THE GUIDELINES

The following objectives should be considered in making a determination of any proposed discharge of dredged or fill material into waters of the United States.

5.1 Restrictions on Discharge (Section 230.10)

5.1.1 Practicable Alternatives.

"(a) . . . [N]o discharge of dredged or fill material shall be permitted if there is a practicable alternative to the proposed discharge which would have less adverse impact on the aquatic ecosystem, so long as the alternative does not have other significant adverse environmental consequences. (1) For the purpose of this requirement, practicable alternatives include, but are not limited to: (i) Activities which do not involve a discharge of dredged or fill material into the waters of the United States or ocean waters; (ii) Discharges of dredged or fill material at other locations in waters of the United States or ocean waters."

Introduction. The NEPA alternatives analysis will typically provide the information for evaluation of practicable alternatives under 40 CFR Part 230, known as the Section 404(b)(1) guidelines. 40 CFR 230.10(a)(4). The following summary describes and consolidates the comprehensive and iterative NEPA alternatives analysis for the project, and provides supplemental discussion regarding practicable alternatives.

Summary of SHEP NEPA Alternatives Analysis. The SHEP NEPA alternatives analysis ranged from considering other potential options or sites for the project, including other South Atlantic ports, to evaluating potential specific locations for disposal of dredged or fill material along Savannah Harbor and in the Atlantic Ocean along the entrance channel. The SHEP NEPA alternatives analysis is found in various places in the Environmental Impact Statement (EIS) and General Re-Evaluation Report (GRR) including EIS Section 2.0, Purpose and Need for Action; EIS Section 3.0, Alternatives; EIS Appendix O, Formulation of Alternatives; GRR Section 6, Formulation of Alternatives; various other sections in the GRR; GRR Appendix A, Economics; GRR Appendix A, Attachment 6 (Regional Port Analysis); GRR Appendix A, Attachment 4 (Multiport Analysis); and GRR Appendix D, Plan Formulation Appendix.

The SHEP NEPA alternatives analysis includes the following key elements: (1) the statement of project purpose and need (EIS Section 2.0); (2) a Regional Port Analysis (GRR, Appendix A, Attachment 6); (3) a Multiport Analysis (GRR, Appendix A, Attachment 4); (4) analysis of various structural and non-structural alternatives (EIS, Section 3.0; GRR, Appendix D); (5) analysis of eight alternative locations or sites for a port/terminal along the Savannah River (EIS, Section 3.0 and Appendix O; GRR Section 6 and Appendix D) (6) analysis of six different depths of harbor deepening along the Savannah River (EIS, Section 3.0 and Appendix O; GRR, various sections); (7) analysis of alternative disposal sites, methods, or beneficial use of dredged sediments (EIS, Section 3.01.1 and 3.07); (8) analysis of related maintenance dredging requirements (EIS, Section 3.08-3.10); and (9) analysis of the no-action alternative (EIS, Section 3.01.1 and Appendix O; GRR Section 6.12.1). For purposes of this Section 404(b)(1) guidelines discussion, these documents are incorporated herein by reference to avoid duplication.

Regional Port Analysis. The Regional Port Analysis specifically evaluated current and projected port capacity, demand, and growth, and environmental impacts and constraints for other South Atlantic ports (Norfolk, VA; Wilmington, NC; Charleston, SC; Savannah, GA; and Jacksonville, FL) and a proposed Jasper County Marine Terminal. GRR, Appendix A, Attachment 3, Final Report, pp. 1-20, and Interim Reports. In addition, the information regarding a Jasper County Marine Terminal from the Regional Port Analysis was further analyzed in a study of the potential costs and environmental impacts of locating the project at one of eight different sites along the Savannah River (four on the South Carolina side, four on the Georgia side). EIS Sec. 3.0 and Appendix O; GRR Section 6.8 and Appendix D.

Conclusions Regarding Alternative Project Sites. Among the conclusions reached as a result of the Regional Port Analysis, the Multiport Analysis, and the analysis of eight alternative sites for the project along the Savannah River were the following: (1) no one port could accommodate all the growth in container volume expected in the region, (2) there is no feasible alternative to improving Savannah Harbor because the major South Atlantic ports will experience so much cargo growth from 2005 to 2050 they will all need deepening or improvement, (3) the proposed deepening of Savannah Harbor would not take business from another port because the shipping cost efficiencies would not outweigh the additional landside transportation costs (largely due to the longer distances from each port to and from population centers that are outside its primary service area), and (4) a Jasper County Marine Terminal would not be cost effective when compared to improving Savannah Harbor based on the high cost involved (now estimated by the Jasper Ocean Terminal Joint Project Office at more than $4 billion including the cost of constructing the new transportation infrastructure that would have to be built), and the timing (Jasper does not exist at present and cannot be constructed in time to meet the growth in demand occurring through Savannah Harbor).

Water Dependency. One of the issues to be considered during evaluation of practicable alternatives is whether a particular project is water dependent. In general, if a project is not water dependent, practicable alternatives are presumed to be available unless clearly demonstrated otherwise. A project is water dependent if the activity associated with a discharge which is proposed for a special aquatic site requires access or proximity to or siting within a special aquatic site to fulfill its basic purpose. 40 CFR 230.10(a)(3).

The special aquatic sites with regard to the SHEP are the Savannah National Wildlife Refuge and the various types of wetlands in the project area as described in EIS Section 5.1. The project generally will not involve any discharge of dredged or fill material in the Savannah National Wildlife Refuge nor into wetlands. (In a few locations, some fill material will be placed to mitigate other environmental impacts through constructing flow modifications to restore and protect freshwater and brackish marshes). The primary direct impacts to wetlands will occur as the result of excavating 15.68 acres but the excavated material would be disposed in a confined disposal facility (CDF). Although there would be no disposal of dredged or fill material in a special aquatic site (except as noted above), SHEP would clearly be considered a water dependent project, because the deepening of a harbor to allow ships to reach an upriver terminal obviously requires work to be performed in the water. Consequently, there is no presumption that practicable alternatives are available and no requirement to clearly demonstrate otherwise. Nevertheless, the following analysis clearly demonstrates no practicable alternatives are available.

Practicable Alternatives – Other Project Sites. "An alternative is practicable if it is available and capable of being done after taking into consideration cost, existing technology, and logistics in light of overall project purposes." 40 CFR 230.10(a)(2). As discussed above, the GRR/EIS contains a comprehensive analysis of alternatives to meet the project purpose of improving navigation efficiency to accommodate deeper draft container vessels. Due to the iterative nature of the analysis, several different parts of the GRR/EIS address alternatives. When read together they provide a thorough examination of environmental and economic issues for the full range of alternative projects. Importantly, the GRR/EIS carefully analyzed the feasibility of the No Action alternative, which would result in large deep-draft ships calling at alternative ports in the South Atlantic region and increasing the land transportation costs of their goods, and would not meet the project purpose and need.

Alternative management and structural measures were considered for reducing transportation costs by accommodating more efficient, deep-draft vessels. At least 10 structural measures other than deepening the channel to the Garden City Terminal were considered, including (a) other South Atlantic ports, (b), terminal development or improvements along the Savannah River at four sites in Georgia, four sites in South Carolina, (c) an Offshore Transshipment Terminal, (d) a Southeast Regional Port operating as a hub for other container ports and (e) navigation improvements. The implications of shifting traffic to other existing ports were considered in the Regional Port Analysis.

After initial evaluation, several alternatives were not carried forward for more detailed study. For example, the regional hub-and-spoke port concept was not carried forward for further review. There are several reasons supporting that decision, including the practical impossibility of meeting the need for new container capacity by concentrating traffic at a single load center. The forecasts of growth for the region are too large for any one port to handle current and projected traffic. GRR, pp. 118-19. Also, there is no precedent for construction of a US port of the size required to address southeastern US shipping traffic, or on the accelerated schedule required to have port capacity in place as container traffic grows. Moreover, double handling of containers from larger vessels to smaller ships costs time and money and increased distances to and from population centers would increase land transportation costs.

The Regional Port Analysis also includes a survey of environmental constraints facing port improvement plans on the South Atlantic coast. The survey demonstrates that development of a super-sized regional port at any of the locations considered would cause substantial environmental impacts to develop the channel improvements and land side infrastructure.

Evaluation of the feasibility of alternatives requires consideration of economic information developed for the National Economic Development study. As discussed in the main text, SHEP benefits exceed costs by a ratio of over 5 to 1. Information developed as part of the analysis confirms that shipping fleets are responding to expansion in world trade by shifting to lager more efficient deep-draft vessels, and that cargo volumes predicted for container traffic through South Atlantic ports will increase steadily from the current collective volume of less than 10 million TEUs to more than 23 million TEUs within 25 years of expansion of the Panama Canal in 2014, and reach 33 million TEUs by 2050. GRR, Regional Port Analysis, Tables 4 and 5. Handling cargo volumes of 33 million TEUs through southeastern ports will require all of the current and all of the planned capacity of ports in Norfolk, Wilmington, Charleston, Savannah and Jacksonville. GRR, Regional Port Analysis, Table 5.

If the region and nation are to enjoy the full cost savings that can be provided by accommodating deep-draft vessels, there are no feasible alternatives to SHEP for handling Savannah's 6.5 million TEU share (year 2030 projection based on demand and GPA's capital improvement program) of the total 33 million TEU demand. Expansion of Savannah and Charleston Harbors will be needed to meet projected trade demand and to accommodate the shift in the composition of shipping fleets to larger vessels. Further, expansion at other southeastern ports and development of new container terminals such as a Jasper County Marine Terminal will also be needed to meet trade demand over the 50-year period of analysis. Expansion of Savannah Harbor will not divert traffic from other ports because each enjoys surface transportation advantages in its service area, and projected traffic volumes require the total planned capacity in the region. Therefore, there is no practicable alternative to deepening Savannah Harbor taking into account cost, existing technology, and logistics.

Practicable Alternatives – Other Locations for Disposal of Dredged or Fill Material. There are three basic issues regarding specific alternatives for disposal sites: (1) where to dispose of sediment dredged during construction and maintenance of the inner harbor, (2) where to dispose of sediment dredged during construction and maintenance of the harbor entrance channel, and (3) where to dispose of dredged or fill material during construction and maintenance of certain mitigation features. In addition to the discussion in EIS Sections 3.07, Alternative Disposal Methods or Beneficial Use of Dredged Sediments, 3.08 – 3.10, and elsewhere in this Appendix H, the following comments are provided.

Disposal of Harbor Material. Sediments dredged to deepen the inner harbor channel and construct the various improvements, as well as sediments dredged to deepen container vessel berths would be discharged into the existing CDFs along Savannah Harbor. All sediments dredged to deepen Savannah Harbor would be discharged into existing disposal areas.

Placement of sediment into existing CDFs would not constitute a discharge of dredged or fill material into waters of the United States because the CDFs are diked upland features. However, the extensive deposition will result in discharge of effluent from the CDFs, so evaluation as a Section 404 discharge is appropriate. Sediments suspended in the effluent would be of small volumes as a result of the settling that occurs within the CDF and the suspended solids limitation the Corps uses for the CDF discharges. Any naturally-occurring cadmium-laden sediment would be placed in CDFs 14A and/or 14B. Management of discharges from CDFs 14A and 14B is addressed in EIS Sec. 5.04, Appendix M, and elsewhere in this Appendix. Monitoring of the effluent from CDFs 14A and 14B would continue as long as a discharge is present and until all sediments had been covered and dewatered. Following deposition of the covering sediments, cadmium would be monitored in the effluent on a monthly basis for one year.

The practicable alternatives analysis regarding use of existing CDFs along Savannah Harbor is very simple: First, using existing CDFs along Savannah Harbor avoids the environmental impacts that would be associated with developing one or more new CDFs, if any sites were available. Second, using existing CDFs along the harbor and allows the most cost-efficient transportation of dredged material (pumping to CDFs located along the river close to the dredging location). Third, there is only one other existing CDF available along Savannah River – the one owned by Southern LNG on Elba Island, and that one does not have any present or future storage capacity available for use for this project. Therefore, taking into account cost, existing technology, and logistics, there is no practicable alternative to using the existing CDFs of the Savannah Harbor Navigation Project.

Disposal of Harbor Entrance Material. The plan for disposal of sediment dredged from the harbor entrance (and possibly the first portion of the inner harbor) is to place it in the Savannah ODMDS, as described in EIS Section 3.07. An earlier plan to place some of the harbor entrance sediments in nearshore sites that would nourish Tybee Island was eliminated because of objections from Georgia DNR-CRD and the City of Tybee Island (EIS Section 3.07). Because these nearshore sites are no longer considered acceptable for deposition of sediments from this project, they are not practicable alternatives. An earlier plan (See Figure 3-2 in the EIS) also provided for some of the material to be placed in five sites (Sites 2-6) south of the entrance channel to construct submerged feeder berms and in two sites (Sites 11 and Site 12) south of the entrance channel to provide additional fish habitat. These sites were also eliminated based on objections from Georgia DNR-CRD and the City of Tybee Island. Consequently, these seven sites are not practicable alternatives. No other approved ocean disposal sites than the Savannah ODMDS exist in reasonable proximity to where the harbor entrance channel dredging work would occur, and therefore no other practicable alternatives have been identified. Furthermore, use of the existing Savannah ODMDS would have minor environmental impacts as described in the EIS and this Appendix.

Disposal of Mitigation Feature-Related Dredged or Fill Material. The remaining discharges of dredged and fill material included in the Savannah Harbor Expansion Project are associated with the various mitigation features of the project. Most of these discharges are associated with the implementation of the Mitigation Plan, which is designed to minimize the effects of increasing upstream salinity levels by increasing freshwater flow into the Back River, while shifting salinity increases largely to the Front River The discharge of dredged sediments associated with the Mitigation Plan includes sediments from the channel improvements in McCoys Cut, Middle River and Back River which would be discharged into existing CDFs, the sediments used to construct the plug in Rifle Cut, and the sediments used to construct the broad berm in the Sediment Basin. Discharges of fill material associated with the Mitigation Plan include construction of the diversion structure at McCoys Cut, construction of the submerged berm in Back River, and construction of the boat ramp with riprap in Back River. Other discharges of fill material associated with the mitigation features of the project include the construction of a fish passage structure on the Savannah River at the New Savannah Bluff Lock and Dam, the placement of concrete rubble from the Tidegate structure along the river shores to create fish habitat, the construction of support structures for the oxygen injection systems, and possibly some placement of fill in non-tidal wetlands to construct the storage impoundment near the City of Savannah's water treatment plant on Abercorn Creek.

Consequently, all discharges of dredged and fill material associated with the mitigation aspects of the Savannah Harbor Expansion Project would be into existing disposal areas or into sites specified in the project's Mitigation Plan. The discharges of dredged and fill material to construct the plug in Rifle Cut, the berm in the Sediment Basin, the diversion structure at McCoys Cut, the boat ramp in Back River, and the fishway at New Savannah Bluff Lock and Dam would occur in open water on unconsolidated water bottoms. There would be no discharge of dredged material into emergent wetlands associated with the construction of these mitigation features. Construction of the support structures for the oxygen injection systems would require excavation of areas along the bank of the Savannah River and Back River. Fill material in the form of clean sand or concrete may be required to construct the support structures. The sites for these support structures would be selected to avoid emergent wetlands if at all possible. If the construction of these sites requires the excavation or filling of emergent wetlands, mitigation would be required.

The activity described above must be performed to implement the project's Mitigation Plan, which in general terms is designed to avoid, minimize, and compensate for increased salinity upriver. During development of the project mitigation plan, a series of flow re-routing options and plans (alternatives) was developed and analyzed based on effectiveness of these measures in reducing project impacts and their cost. EIS Section 5.1.2.3 and Appendix C, Mitigation Planning, pp. 15-37. Taking into account cost, existing technology, and logistics in light of overall project purposes, there is no practicable alternative to the selected Mitigation Plan. Further, as noted, the discharge of dredged material during this activity would be to existing CDFs, with relatively minimal discharges from these CDFs into waters of the United States. The discharge of fill material during this activity would be of clean fill required to accomplish the goals of the Mitigation Plan, and therefore could not take place at any other location (*i.e*., there is no practicable alternative to the discharge of fill material involved).

Conclusion. The alternatives analysis contained in the GRR and EIS, as supplemented by the above discussion of practicable alternatives, fully satisfies NEPA and the Section 404 (b)(1) Guidelines. The proposed discharges of dredged and fill material associated with the Savannah Harbor Expansion Project have been evaluated and there are no known practicable alternatives with less adverse impacts on the aquatic ecosystem.

5.1.2 State Water Quality Standard or Toxic Effluent Standards.

"(b) Discharged of dredged material shall not be permitted if it;"

"(Causes or contributes, after consideration of disposal dilution and dispersions, to violations of any applicable state water quality standard;"

"(2) Violates any applicable toxic effluent standard or prohibition under Section 370 of the Clean Water Act."

Samples were taken in 1997 and 2005 from the entire Savannah Harbor Expansion Project area from the entrance channel to the upstream limit (Station 103+000) of the project. Analysis of the samples included investigations for metals, PCBs, PAHs, petroleum hydrocarbons, phenols, pesticides, dioxin congeners, cyanide, organotins, and nutrients. Sample analysis results indicated there was only one main concern relating to the dredging and subsequent disposal of the sediments from the Savannah Harbor Expansion Project. Some of the sediments in the Miocene clay that would be encountered during construction contain elevated levels (naturally occurring) of cadmium. All cadmium-laden sediments would be placed in CDFs 14A and/or 14B and capped/covered with cleaner new work sediments. Those sites would subsequently receive placement of Operation and Maintenance sediments to further cover the cadmium-laden sediments deposited in the disposal area. The effluent from CDFs 14A and 14B would be carefully monitored to ensure water quality standards are met. See Section 6.4 below for a complete discussion concerning the proposed dredging and disposal of cadmium-laden sediments.

The effluent from all CDFs is monitored for physical parameters (dissolved oxygen, suspended solids, pH, etc.) to ensure the CDFs are operating as designed. As a requirement of the Section 401 Water Quality Certification for the SHEP, weekly monitoring of the effluent from the CDFs would be conducted. Parameters to be monitored include total suspended solids, dissolved oxygen, pH, temperature, salinity, turbidity and conductivity. Corrective measures are taken when sample results indicate that discharges are not meeting state standards.

Hopper dredge overflow would also result in the discharge of dredged material into waters of the United States. However, no significant water quality degradation would be expected from allowing the practice of dredging to overflow when dredging in the open ocean. The material would be mostly silts with some clays. The increase in suspended solids and turbidity would be temporary in nature and occur in the open ocean. Based on previous sediment sampling, there are no contaminants of concern in the sediments where the hopper dredges would be working.

Based on the above determinations, there is no indication that the dredging and subsequent disposal of the inner harbor sediments from the Savannah Harbor Expansion Project will violate any state water quality standard or any applicable toxic effluent standard established under Section 370 of the Clean Water Act.

5.1.3 Threatened and Endangered Species.

"(3) Jeopardizes the continued existence of species listed as endangered and threatened under the Endangered Species Act of 1973, as amended."

A Biological Assessment of Threatened and Endangered Species (BATES) was prepared for the SHEP (See Appendix B). The BATES concluded that the SHEP may affect but is not likely to adversely affect North American right whale, humpback whale, sperm whale, leatherback turtle, loggerhead turtle, kemp's ridley turtle, hawksbill turtle, green sea turtles, Piping plover, Shortnose sturgeon and Atlantic sturgeon or their critical habitat. The BATES was submitted to the USFWS and the NMFS for their review and Biological Opinion. The report of the USFWS and the BO submitted by the NMFS are included in Appendix Z of this document.

The majority of the dredged material that would emanate from the SHEP would be discharged into existing CDFs. Some of the dredged material as well as clean fill material would be used to construct the various mitigation features of the project. Material used to construct these mitigation features would be discharged into unconsolidated river bottoms. These discharges of dredged or fill material would not adversely affect any critical endangered species habitat in the Savannah Harbor estuary.

Deepening Savannah Harbor would adversely affect Shortnose sturgeon habitat by increasing upstream salinity levels and causing a decrease in dissolved oxygen levels. The discharge of dredged and fill sediments associated with the Savannah Harbor Expansion Project will actually be an integral part of minimizing these impacts. The diversion structure at McCoys Cut, the structures to close the western end of McCoys Cut and Rifle Cut, the submerged sill in the Sediment Basin and the fill behind it, and the submerged sill in Middle River are all designed to minimize the anticipated increase in upstream salinity levels that would be caused by harbor deepening. Also, the fish passage structure at New Savannah Bluff Lock and Dam would allow Shortnose sturgeon access to about 20 miles of traditional spawning habitat between New Savannah Bluff Lock and Dam and the Augusta Diversion Dam. The discharge of fill material to facilitate construction of the support structures for the oxygen injection systems would allow these systems to be constructed and operated. The oxygen injection systems are designed to remove the incremental effects of the SHEP on the dissolved oxygen regime in Savannah Harbor. Consequently, construction and operation of the oxygen injection systems would minimize the adverse effects of the project on dissolved oxygen and thus minimize impacts on Shortnose sturgeon habitat.

The NMFS' BO included stipulations relating to the discharge of dredge and fill material to protect sturgeon.

1. To protect spawning sturgeon and their offspring, no-inwater fish passage construction downstream of the New Savannah Bluff Lock and Dam shall occur during the late winter/spring spawning period and early summer larval period between February 1 and May 31 of any year. In-water construction of the fish passage may be performed upstream of the dam throughout the year.
2. The construction of the diversion structure associated with the flow re-routing modifications has the potential to cause injury to sturgeon. The impact to sturgeon shall be minimized by constructing the diversion structure while most sturgeon are congregated upstream of the construction area between May 15 and November 1.
3. Appropriate erosion and turbidity controls shall be utilized wherever necessary to limit sediments from entering the water.

Project plans would include these stipulations.

5.1.4 Marine Sanctuaries.

"Violates any requirements imposed by the Secretary of Commerce to protect any marine sanctuary designated under Title III of the Marine Protection Research and Sanctuaries Act of 1972."

The discharge of dredged or fill material associated with the Savannah Harbor Expansion Project will not affect any marine sanctuary or other items addressed under the Act.

5.1.5 Human Health or Welfare.

"(c) Except as provided under Section 404(b)(2), no discharge of dredged or fill material which will cause or contribute to significant degradation of the waters of the United States. Findings of significant degradation related to the proposed discharge shall be based upon appropriate factual determinations, evaluations, and tests required by Subparts B and G of the consideration of Subparts C-F with special emphasis on the persistence and permanence of the effects contributing to significant degradation considered individually or collectively include:"

"(1) Significant adverse effects of the discharge of pollutants on human health, or welfare including, but not limited to effects on municipal water supplies, plankton, fish, shellfish, wildlife, and special aquatic sites."

The discharge of dredged or fill material associated with the SHEP would not result in the discharge of pollutants that would have adverse effects on municipal water supplies, plankton, fish, shellfish, wildlife or special aquatic sites. There would be no discharge of dredged or fill material in the vicinity of a municipal water supply intake, designated shellfish harvesting area or special aquatic site.

Sediment testing has been conducted along the entire stretch of inner channel that would be deepened. The only contaminant of concern detected at elevated levels was cadmium which was detected in sediments along some portions of the inner harbor channel. Dredged sediments with elevated levels of cadmium would be discharged into CDFs 14A and/or 14B and kept in a wet environment until they could be covered with other sediments from the harbor until concentrations of cadmium in surficial sediments are at an acceptable level (<4 mg/kg). The effluent from CDFs would be monitored to ensure that no applicable water quality standards were violated.

5.1.6 Aquatic Life and Wildlife Dependent on Aquatic Ecosystems.

"(2) Significant adverse effects of the discharge of pollutants on life stages of aquatic life and other wildlife dependent upon aquatic ecosystems, including the transfer, concentration, and spread of pollutants or their by-products outside the disposal site through biological, physical, and chemical processes."

The dredged material containing naturally-occurring cadmium at elevated levels would be placed in CDFs 14A and/or 14B. Studies indicate that this material can be dredged and placed in the CDFs without a significant release of cadmium to the environment. Fill material (i.e., sand and rock) would be good, clean material. Therefore, provisions of the above paragraph would not be violated.

5.1.7 Aquatic Ecosystem Diversity, Productivity and Stability.

"(3) Significant adverse effects of the discharge of pollutants on aquatic ecosystems diversity, productivity, and stability. Such effects may include, but are not limited to, loss of fish and wildlife habitat or loss of the capacity of a wetland to assimilate nutrients, purify water, or reduce wave energy; or

(4) Significant adverse effects of the discharge of pollutants on recreational, aesthetic, and economic values."

The discharge of dredged material associated with the Savannah Harbor Expansion Project would not adversely affect any emergent wetlands or wildlife habitat. Some of the dredged material as well as fill material would be discharged into unconsolidated water bottoms to construct the various mitigation features of the project. The dredged material to be used to construct the mitigation features does not contain any contaminants at levels of concern that would prohibit it from being used for this purpose. The fill material would be clean sand and rock,

Essential Fish Habitat (See Appendix S) in the project area includes estuarine emergent wetlands (includes palustrine, emergent, and forested wetlands), submerged aquatic vegetation, oyster reefs and shellbanks, intertidal flats, aquatic beds, estuarine water column (during construction) and estuarine water column (dissolved oxygen). Most of the dredged material emanating from the SHEP would be discharged into existing CDFs. Some dredged material would be discharged into open water areas to construct the mitigation features of the project. This dredged material does not contain contaminants at levels of concern. The dredged material to be discharged into open water sites to construct some of the mitigation features would not be discharged into any estuarine emergent wetlands. Adverse effects to other essential fish habitat (water column, etc.) would be avoided by not discharging any dredged material into open water areas above Station 63 during the Striped bass spawning season (April 1-May 15). As directed by the NMFS in the BO, construction of the diversion structure at McCoys Cut would only be conducted during the period May-15-November 1 to avoid possible impacts to surgeon that use the area.

The BO also contains a provision to protect fish habitat in the vicinity of the New Savannah Bluff Lock and Dam during construction of the fish passage facility. To protect spawning sturgeon and their offspring, no in- water construction downstream of the New Savannah Bluff Lock and Dam would occur between February 1 and May 31.

Some of the fill material that would be used to construct some of the mitigation features could impact estuarine emergent wetlands. Construction of the inflow and discharge pipes and support structures for the oxygen injection systems would require excavation of bank areas in Front River and Back River. Every effort would be made to avoid any areas with estuarine emergent wetlands. If estuarine emergent wetlands cannot be avoided, mitigation would be required. Restoration of wetlands in Disposal Area 1S would provide 11.5 acres of wetland restoration beyond what is currently needed to offset wetland losses associated with SHEP. The 11.5 acres of excess wetland restoration would provide more than enough wetland mitigation credits to offset any wetland losses associated with constructing the oxygen injection system support facilities.

The closure of the western end of McCoys Cut (connects Front River to Middle River) and Rifle Cut (connects Middle River to Little Back River) will have a minor impact on recreational boating. Boaters will still have access to all waterways in the project area. A boat ramp would be constructed at the Tidegate location to provide easier access to the lower ends of Middle River and Little Back River as mitigation for the closure of Rifle Cut.

5.1.8 Steps Taken to Minimize Adverse Effects.

"(d) Except as provided under Section 404(b)(2), no discharge or dredged or fill material shall be permitted unless appropriate and practical steps have been taken which will minimize the potential adverse effects of the discharge on the aquatic ecosystem."

Most of the dredged material emanating from the SHEP would be discharged into existing CDFs, which would greatly minimize adverse impacts to the aquatic environment.

As previously discussed, sediments dredged from the inner harbor that have elevated cadmium levels will be discharged into CDFs 14A and/or 14B and capped/covered with clean sediments. The effluent that is discharged from these CDFs will be monitored for various parameters including cadmium to ensure that no applicable water quality standards are violated.

The dredged sediments discharged into Back River to partially fill in the Sediment Basin would be placed behind a submerged broad berm to prevent the sediments from moving into other areas of Back River. Hydraulic dredging in the inner harbor channel and the subsequent disposal of the dredged sediments would not be permitted above Station 63+000 from April 1 through May 15 to avoid the striped bass spawning season. The construction restrictions of the NMFS in the BO with respect to surgeon both in the Savannah Harbor estuary and in the vicinity of the New Savannah Bluff Lock and Dam would be adhered to.

6.0 <u>FACTUAL DETERMINATION (SECTION 230.11)</u>

6.1 Physical Substrate Determination.

Consideration shall be given to the similarity in particle size, shape, and degree of compaction of the material proposed for discharge and the material constituting the substrate at the disposal site and any potential changes in substrate elevation and bottom contours.

The discharge of dredged sediments associated with the Savannah Harbor Expansion Project would mostly involve deposition of sediments into areas with similar substrate. Sediments dredged from the inner harbor would be discharged into existing CDFs along Savannah Harbor which routinely receive maintenance sediments.

Sediments dredged from the eight container vessel berths would be discharged into CDFs 2A, 12A, 12B, 13A, 13B, 14A, 14B, or Jones/Oysterbed Island, which are used regularly for deposition of maintenance material.

The discharge of dredged sediments to partially fill in the Sediment Basin would involve the use of sediments dredged from the inner harbor or from within the existing CDFs. Discharge of these sandy sediments into the Sediment Basin would change the bottom substrate in the basin, which is presently about 100 percent silt.

Sediments used to construct the various features of the Mitigation Plan, the boat ramp, the supplemental water supply line for the City of Savannah Water Treatment Plant, and the fish passage structure at New Savannah Bluff Lock and Dam would be clean, commercial-grade sand, stone, riprap, etc. These types of materials are not uncommon along the Savannah River.

Sediments dredged from the inner harbor channel and the eight container vessel berths would be discharged into existing CDFs so there would be no change to aquatic substrate elevation. Changes to the aquatic substrate elevation would be realized in the Sediment Basin. A submerged broad berm and sill would be constructed in the Sediment Basin downstream of the Tidegate, and approximately 2,100,000 cubic yards of dredged sediments would be discharged upstream of the sill. The sill and dredged sediments placed behind the berm would serve as a barrier to impede the movement of saltwater up Back River to valuable marsh areas.

There would be some change in aquatic substrate elevations where the various mitigation features are constructed including the channels in Middle and Back River and McCoy's Cut, Rifle Cut, western arm of McCoy's Cut, the new boat ramp in Back River, the new water intake structure and supplemental supply line for the City of Savannah Water Treatment Plant, and the fish passage structure at New Savannah Bluff Lock and Dam.

Possible loss of environmental values

Net loss of environmental value is expected to be minimal. Most of the dredged material from the SHEP would be placed into existing CDFs. The discharge of dredged and fill material into open water areas to construct the mitigation features of the project would be conducted in a manner to minimize impacts to the aquatic environment as previously described.

Actions to Minimize Impacts

Dredged sediments discharged to construct the broad berm in the Sediment Basin would be placed behind a rock sill to prevent the sediments from migrating downstream into Front River.

Sediments dredged from the inner harbor channel deepening and construction of the various other improvements, as well as the sediments removed from the eight container vessel berths at the Garden City terminal would be discharged into existing CDFs. Effluent from these CDFs would be monitored for physical parameters such as dissolved oxygen and suspended solids as well as other parameters of concern to ensure that these facilities are managed and functioning properly.

6.2 Water Circulation, Fluctuations, and Salinity Determinations.

Consideration shall be given to water chemistry, salinity, clarity, color, odor, taste, dissolved gas levels, temperature, nutrients, and eutrophication plus other appropriate characteristics. Also to be considered are the potential diversion or obstruction of flow, alterations of bottom contours, or other significant changes in the hydrologic regime. Changing the velocity of water flow can result in adverse changes in location, structure, and dynamics of aquatic communities, shoreline erosion and deposition, mixing rates and stratification, and normal water-level fluctuation patterns. These affects can alter or destroy aquatic communities.

Many of the components of the Mitigation Plan are designed to change water circulation patterns and salinity gradients. The discharge of dredged and/or fill material required to construct the diversion structure at McCoys Cut and the closure structures at the western end of McCoys Cut are designed to increase the flow of fresh water from the Savannah River into Little Back River and Middle River. The closure of Rifle Cut is designed to reduce the flow of water from Front River (which has a higher salt concentration) into Little Back River and Middle River. The submerged broad berm in Back River below the Tidegate and the dredged sediments placed behind it are designed to impede the flow of water from Front River (which has a higher salt content) into Back River. These changes in flows are primarily designed to help maintain a freshwater environment which is required to provide a dependable source of freshwater at the SNWR intake, maintain freshwater tidal marsh in the area, as well as protect several important fisheries including Striped bass and Shortnose sturgeon.

Loss of Environmental Value

No net loss of environmental value from a change in water circulation patterns or a change in substrate elevation is envisioned based on the above determinations.

Actions to Minimize Impacts

The discharge of dredged and fill material required to construct the mitigation features of the SHEP in McCoys Cut, Middle River, Back River and Rifle Cut would be conducted in a manner to minimize impacts to the aquatic environment. Measures to reduce impacts to the aquatic environment include confining the material that is discharged into open water and avoiding discharges of dredged material into these open water areas during the Striped bass spawning season (April 1-May 15). Construction activities required to construct the diversion structure at McCoys Cut would be restricted to the period May 15-November 1 to minimize potential impacts to sturgeon. The construction of these various flow diversion structures would actually help maintain freshwater conditions in the upper reaches of Little Back River and Middle River that would be impacted by deepening of the Savannah Harbor Navigation Channel.

6.3 Suspended Particulate/Turbidity Determinations.

Effects due to potential changes in the kinds and concentrations of suspended particulate/turbidity in the vicinity of the disposal site. Factors to be considered include grain size, shape and size of any plume generated, duration of the discharge and resulting plume, and whether or not the potential changes will cause violations of applicable water quality standards. Consideration shall include the proposed method, volume, location, and rate of discharge, as well as the individual and combined effects of current patterns, water circulation and fluctuations, wind and wave action, and other physical factors on the movement of suspended particulates.

Sediments dredged from the inner harbor channel and the eight container vessel berths would be discharged into the existing CDFs. The CDFs allow most of the suspended particulates to settle out in the disposal area before the effluent is discharged from the CDF via a weir. Normal effluent turbidity is expected to be less than river turbidity during rain events. A test of one Savannah CDF found a solids retention rate of over 99.93 percent (Palermo, 1988). According to data collected from 1988 to March 1994, the average suspended solid level in the effluent from Disposal Area 2A was about 200 mg/L. In the remainder of the O&M CDFs, the average suspended solid level was about 100 mg/l. Background levels within the vastly larger Savannah River range from 20 to 50 mg/l during non-rain events. Discharges from the CDFs are expected to meet water quality standards or meet them with a minimal mixing zone. The discharge of effluent from the CDFs is routinely monitored for suspended solids, dissolved oxygen, pH, etc.

Sediments discharged into Back River to construct the broad berm in the Sediment Basin would be placed behind a submerged rock sill. Placing the dredged sediments behind the sill should localize areas that would experience an increase in suspended solids and turbidity. Material used to construct the various mitigation features of the project would consist of clean sand and rock, which would cause only minor increases in suspended particulates when discharged into the affected waterway.

Allowing the hopper dredges to dredge to overflow would result in increases in suspended solids and turbidity in the area of the dredging. These impacts would be expected to be temporary and localized.

Loss of Environmental Values

Due to reduction in light transmission, reduction in photosynthesis, reduced feeding and growth of sight dependent species, direct destructive effects to nektonic and planktonic species, reduced DO, increased levels of dissolved contaminants, aesthetics.

There would be no loss of environmental values associated with the discharge of dredged or fill material for the SHEP. Most of the material from inner harbor improvements would be discharged into existing CDFs. Open water disposal of dredged or fill material would be required to construct the various mitigation features of the project including the flow diversion structure at McCoys Cut, the closure plugs in the western end of McCoys Cut and Rifle Cut and the submerged berm in the Sediment Basin. The dredged and fill material used to construct these project features would consist of rock, and material with a high sand content. Consequently, discharge of this type of material into the open water environment would be expected to have only minor impacts on light transmission and nektonic and planktonic species of aquatic life.

Actions to Minimize Impacts

The effluent discharged from the confined disposal areas is tested for suspended solids content on a routine basis. Material discharged for the mitigation structures would be carried out in a manner to minimize effects to aquatic life. This work would be scheduled to avoid the Striped bass spawning season (April 1-May 15)

Dissolved oxygen concentrations are routinely monitored in the effluent from the CDFs and in the vicinity of the dredges during the summer months when dissolved oxygen concentrations in Savannah Harbor are low. The Georgia DNR-EPD has provided guidelines for maintenance dredging activities in the Section 401 Water Certification for the SHEP which state:

> "Dredging operations must maintain a daily average of 5.0 mg/l and an instantaneous average of 4.0 mg/l throughout the water column during those times of year when the natural condition in the waterbody has a dissolved oxygen concentration level above these values. If it is determined that the natural condition in the waterbody is less than these values, the criteria will revert to the "natural condition" and the water quality standard will allow for a 0.1 mg/l deficit from the "natural" dissolved oxygen value. Up to a 10% deficit will be allowed if

it is demonstrated that resident aquatic species shall not be adversely affected. Since the available dissolved oxygen deficit has already been allocated, the USACE will only be able to conduct maintenance dredging when the dissolved oxygen, one meter from the bottom, is 3.0 mg/l or greater and the maintenance dredging does not affect the dissolved oxygen levels in the Savannah River Harbor. Variances for maintenance dredging when dissolved oxygen levels are less than 3.0 mg/l may be granted if the additional oxygen is effectively injected into the Savannah River Harbor as appropriate".

6.4 Contamination Determination.

Consider the degree to which the proposed discharge will introduce, relocate, or increase contaminants. This determination shall consider the material to be discharged, the aquatic environment at the proposed disposal site, and the availability of contaminants. Consideration of Evaluation and Testing (parts 230.60 and 230.61).

Three rounds of sediment sampling and analysis were performed for the Savannah Harbor Expansion Project. Each round built upon the results of the previous work. Detailed information on the sampling and analysis can be found in Appendix M of the Draft EIS. In 1997, sediment core samples were collected and examined for sediment physical and chemical properties. The sampling area covered the entire area proposed for harbor deepening, extending from deep water in the ocean to the Kings Island Turning Basin (Station 103+000). Parameters investigated included metals, PCBs, PAHs, petroleum hydrocarbons, phenols, pesticides, dioxin congeners, cyanide, organotins, and nutrients. The evaluation found that most of the sediments provided no reason for concern over potential contaminant-related impacts associated with the proposed dredging and dredged sediment placement. One potential issue identified involved sediments near the old RACON Tower site. The second round of sampling was performed in 2005 and the analysis was completed in 2006. The conclusions from that evaluation were that the only sediment contaminant of concern for this project is naturally-occurring cadmium found in Miocene clays that would be dredged and/or exposed in the inner harbor during construction. The highest concentrations of cadmium (average 21.45 mg/kg) are found between Stations 16+000 and 45+000 (River Mile 3.0 to 8.5) and medium concentrations (average 6.67 mg/kg) are found between Stations 45+000 and 94+000 (River Mile 8.5 to 17.8).

Additional studies were conducted in 2007 to assess the potential pathways by which cadmium could enter the environment during the dredging and disposal process. The additional studies included the following activities:

- Sediment Profile Imaging to locate/verify exposed Miocene clays and assess the potential existence of benthic communities in the clay;
- Side scan sonar survey to identify and map bottom characteristics in the channel;
- Benthic community assessment;

- Sediment sample collection (vibracoring 6 ft into Miocene clay at four locations in the navigation channel, reference sediment sampling, and upland reference soil sampling);
- Collecting dredging water from one location in the Federal navigation channel and one receiving water location in Fields Cut;
- Compositing and processing sediment cores to create "high cadmium" and "low cadmium" composite samples for further testing;
- Analytical testing of bulk sediment, standard elutriates, effluent elutriates, dredging water, and receiving water samples;
- Analytical testing of porewater and SLRP samples at the high cadmium locations only;
- Aquatic bioaccumulation studies and plant uptake studies using high and low cadmium composites; and
- Risk evaluation and report preparation.

Benthic community sampling was conducted in each of the four prevalent bottom types (coarse-grained sands, medium-to–fine-grained sands, silty sands, and clay substrates) both inside and outside of the navigation channel. Results of this sampling and subsequent sample analysis indicate a substantial benthic population both within and outside of the navigation channel. Polychaetes and oligochates were the numerically dominant taxonomic groups in the coarse sand, medium sand, and silt –sand substrates. The benthic community in the clay/sand veneer (the exposed Miocene clays with the high cadmium concentrations) was the most diverse community of the four sampled substrates and included annelids, bivalves, and crustaceans as dominant taxic groups. Based on these results, the existing bottom habitat types within the Savannah Harbor navigation channel support benthic communities that are diverse and provide an available food resource. Of the area sampled, the clay/sand veneer substrates comprised approximately 28.4% of the channel bottom.

Although substantial benthic communities reside in the clay/sand veneer substrates which have naturally-occurring elevated levels of cadmium, studies indicate that the cadmium is not freely soluble or readily bioavailable to aquatic organisms. Sediment sampling was conducted in the navigation channel to determine the physical and chemical properties of the sediments proposed for dredging, to verify cadmium concentrations in the Miocene clays, and to create a high cadmium composite sample (average concentration of 30 mg/kg) and a low cadmium composite sample (average concentration of 15 mg/kg). These samples were used for physical and chemical analyses, standard and effluent elutriate creation, simplified laboratory runoff procedure (SLRP), aquatic bioaccumulation testing, and plant uptake studies.

Sediments from the navigation channel were analyzed for aluminum, arsenic, cadmium, chromium, copper, manganese, nickel, and zinc concentrations, and detected concentrations were compared to Sediment Quality Guidelines [Effects Range-Low (ERL) and Effects Range-Medium (ERM) for marine sediments to assess the quality of sediments that would be dredged. A total of five metals -- cadmium, arsenic, chromium, nickel, and zinc -- each had concentrations that exceeded ERL values, but cadmium was the only metal that had concentrations that exceeded the ERM value. The cadmium concentration in both the high cadmium composite and the low cadmium composite exceeded the ERM value of 9.6 mg/kg.

To evaluate the bioavailability of cadmium in both the high cadmium and low cadmium composites, sequential extraction procedures (SEP) were used. SEP uses a series of progressively more aggressive chemical extractions to determine the amount of metal bound in different fractions of the sediment or soil. SEP results can be used to predict the metal concentrations that would most likely be available to aquatic organisms, plants, and wildlife. Results of the SEP for the high cadmium composite and the low cadmium composites indicated that no cadmium was detected in the exchangeable fraction, and that about 98 percent of the cadmium in the Miocene sediments was bound in relatively insoluble forms. Therefore, these results suggest that the majority of the cadmium is not freely soluble or readily bioavailable.

Water quality sampling was conducted to determine background concentrations in the receiving water in proximity to the CDF and to collect site water (dredging water) for standard and effluent elutriate creation. Chemical analysis of site water, receiving water, standard elutriates, effluent elutriates, and porewater were each evaluated to assess the potential for chemical constituents, mainly cadmium, to be mobilized through water pathways during the dredging process and after placement in the CDF. Also, the SLRP was conducted for the dry, oxidized high cadmium composite sample to evaluate the water quality of precipitation runoff in the CDF.

Analysis of the site water, receiving water, standard elutriate, and effluent elutriate results included both the total and dissolved fractions and comparisons of detected chemical constituents to Federal and state (South Carolina) saltwater acute and chronic water criteria for the protection of aquatic life. In the dredging water and the receiving water, nutrient and metal concentrations in both the total and dissolved fractions were low, and generally below the USEPA/South Carolina saltwater quality criteria for the protection of aquatic life. Cadmium was not detected in either the total or dissolved fraction of the dredging water sample or the receiving water sample.

Porewater analysis of two core samples collected from the high cadmium locations indicated that concentrations of dissolved cadmium in the porewater were low and below the laboratory reporting limit and applicable water quality criteria.

For both the standard and the effluent elutriates, there was a substantial difference in the concentrations of detected constituents in the total and dissolved fractions which can be attributed to high Total Suspended Solids concentrations. Since the high cadmium and low cadmium composite samples were comprised of consolidated, fine-grained silts and clays, a significant portion of solids remained in suspension in solution after the elutriates were created. Consequently, concentrations of metals detected in the total fraction of the standard elutriates created using the high cadmium composite and the low cadmium composite were high, exceeding State of South Carolina water quality criteria for the protection of aquatic life. However, in the dissolved fraction of both the standard and the effluent elutriate samples, cadmium concentrations did not exceed USEPA chronic saltwater quality criteria. Therefore, the cadmium detected in the total fraction is most likely bound to the fine-grained particulates that were present in the water column.

Aquatic bioaccumulation tests were designed to evaluate the potential of benthic organisms to bioaccumulate contaminants of concern from the dredged sediments. Aquatic bioaccumulation studies were conducted using the high cadmium and low cadmium composite created from samples collected in the navigation channel. Reference sediment samples were taken from New River. Sediments were evaluated in 28-day bioaccumulation studies using *Nereis virens* (sand worm) and *Macoma nasuta* (blunt-nose clam). Survival results from the bioaccumulation tests indicated that after 28 days of exposure, none of the test sediments had significantly lower survival than the reference sediment.

After completion of the bioaccumulation testing, the organism tissues were submitted for selected chemical analyses of cadmium, copper, lead, mercury, nickel, lipids, and moisture content. In the worm tissue, cadmium and nickel concentrations statistically exceeded the reference site tissue concentrations for tissue exposed to sediment from both the high and low cadmium composite samples. In the clam tissue, cadmium and other metal tissue concentrations from the high and low cadmium composites were not statistically different from the reference.

Plant uptake testing was conducted because plants may uptake metals from sediments/soils in the aquatic and terrestrial environments at the CDF, creating a pathway of exposure form organisms that feed on the plants. Plant uptake studies (45-day) using *Cyperus esculentus* (yellow nutsedge) were conducted using the high cadmium composite and low cadmium composite soils. Reference soil for the plant uptake study was collected from a location on the dikes in the CDF.

Plant tissues exposed to the prepared soils from the navigation channel were analyzed for cadmium, copper, lead, nickel, zinc, and moisture content. Concentrations of metals in plant tissues were compared to plant tissue metal concentrations exposed to soil taken from the reference site. The mean concentrations of cadmium, nickel, and zinc in plant tissue exposed to the samples taken from the navigation channel statistically exceeded concentrations in reference tissue for both the high and low cadmium composite samples, indicating that uptake from the soil to the plants occurred for each of these concentrations.

A risk assessment was conducted to identify the potential for impacts on human health or the environment from elevated cadmium concentrations in new work sediments that would be dredged. The risk assessment evaluated potential exposures and impacts of cadmium on aquatic and benthic organisms, wildlife, and fishermen in the Savannah River and on plants, aquatic and benthic organisms, and wildlife in the CDF. A conceptual model was developed to identify potential pathways for ecological and human receptors to cadmium in new work sediments during and after dredging. The conceptual model identified exposure pathways for two environments, which are the Savannah River where sediments would be mixed with surface water and where new sediment surfaces would be exposed, and wetland and upland habitats in the CDF where dredged sediments are discharged, forming upland soil, wetland sediments, and effluent and runoff that could enter adjacent waterways.

To evaluate the potential for adverse impacts to aquatic and benthic organisms, multiple lines of evidence (measurement endpoints) were considered. Results of the testing and analysis were compared to various benchmarks, which are standards of comparison that correspond to a known level of ecological effect (usually no effect or low effect). For sediments, total cadmium concentrations in the composite samples were compared to sediment benchmarks protective of benthic organisms. The estimated bioavailable cadmium concentrations in sediment, determined from the SEP analysis, were compared to sediment benchmarks protective of benthic organisms. For surface water, cadmium concentrations in overlying water from the bioassays, in sediment porewater, and in elutriates prepared to mimic worse-case surface water conditions during dredging were compared to surface water benchmarks protective of aquatic and benthic organisms. For aquatic organism tissue, worm tissue concentrations from laboratory bioaccumulation exposures using sediment composite samples were compared to tissue benchmarks protective of benthic organisms. Worm tissue concentrations were used to estimate fish tissue concentrations which were also compared to benchmarks.
Based on risk assessment analyses, the following conclusions were reached:

Cadmium in new work sediments is not likely to cause adverse impacts to aquatic and benthic organisms in the Savannah River. While total concentrations of cadmium and in sediment and water are elevated above benchmarks, the bioavailability of cadmium is limited. Dissolved concentrations of cadmium in porewater, standard elutriates and overlying water from bioaccumulation tests were lower than benchmark concentrations protective of aquatic and benthic organisms. SEP data indicated that more than 98 percent of the cadmium in the sediment is not likely to be available to aquatic and benthic organisms. This is also reflected in bioaccumulation test results, which demonstrated that tissue concentrations of cadmium were either similar to reference concentrations or below no-effects tissue residue benchmarks.

While cadmium concentrations are likely to be elevated in sediment and water during and after dredging in Savannah Harbor, the limited bioavailability and bioaccumulation potential of cadmium results in relatively low doses to wildlife and no potential for adverse effects. Food web ingestion models were used to quantify exposures to evaluate potential adverse impacts to wildlife from cadmium in new work sediments. The assessment evaluated exposures for birds and mammals that consume fish and benthos that included blue heron, spotted sandpiper, osprey, and river otter. When considered in conjunction with life history and feeding habitat information, the modeled doses of cadmium were below benchmarks for each species. Risks to wildlife were further evaluated using limited dose benchmarks, which were developed based on the wildlife food web models as a protective standard of comparison for cadmium concentrations expected after dredging. The average cadmium concentrations expected for channel bottom sediments after dredging were below sediment limiting dose benchmarks, indicating that wildlife are not likely to be at risk from cadmium in sediments expose by the dredging process.

The predicted concentration in game fish tissue was below the thresholds protective of human health, indicating there are no adverse impacts to humans. The projected concentration in a representative game fish species (flounder) was compared to fish tissue benchmarks protective for human consumption and found to be within acceptable limits.

Cadmium in dredged material and held at the CDF in a wet condition and in effluent, runoff, sediment discharged from the CDF are not likely to cause adverse impacts to plants in drainage areas and wetlands. The measurement endpoints evaluated for plants in upland CDF drainage areas and wetlands indicated that while total concentrations of cadmium in sediment and water were elevated, the bioavailable concentrations in sediment and the dissolved concentrations of cadmium in effluent elutriates and simulated runoff were below benchmarks protective of plants. Cadmium concentrations in the overlying water from the bioaccumulation tests were also below benchmarks.

Cadmium in sediments placed in the CDF is not likely to cause adverse impacts to aquatic and benthic organisms in drainage areas, impoundments, and wetland areas of the CDF. While total concentrations of cadmium in sediment and water were elevated above benchmarks, the bioavailability of cadmium is limited and unlikely to cause adverse impacts. Dissolved concentrations of cadmium in porewater, effluent elutriates, and overlying water from bioaccumulation tests were lower than benchmark concentrations protective of aquatic and benthic organisms. SEP analysis of the sediments demonstrated that more than 98 percent of the cadmium in sediments is not likely to be bioavailable to aquatic and benthic organisms. Bioaccumulation tests indicate that test tissue concentrations of cadmium were either similar to reference concentrations or below no-effects residue benchmarks or estimated tissue concentrations for higher trophic level fish were also below on-effects residue benchmarks.

There is a strong indication that cadmium is not likely to cause adverse effects to wildlife using drainage areas, impoundments, and wetlands at the CDF. Risks to wildlife from cadmium in wetland environments at the CDF were evaluated using food web ingestion models to quantify exposures. The assessment evaluated exposures for birds and mammals that consume plants, fish, and benthic organisms, and modeled doses were compared to no-effects and lowest observable effects benchmarks. Great blue heron, spotted sandpiper, osprey, Canada goose, muskrat, and river otter were used as representative or surrogate receptor species. Food web ingestion models based on concentrations in sediment composites and effluent or runoff indicated that for all species, except sandpiper, the doses of cadmium were below benchmarks. For sandpiper, the cadmium concentration in the high cadmium composite exceeded the no-effect benchmark, but did not exceed the lowest observable effects benchmark. Limiting dose benchmarks were developed based on the wildlife food web models as a protective standard of comparison for concentrations expected at the CDF. The concentrations of cadmium expected in sediment and water at the CDF were all below limiting dose benchmarks.

Evidence from measurement endpoints indicates that there may be a limited potential for adverse impacts to plant growth from cadmium in new work sediments placed in the CDF.

Risks were evaluated for exposures in the CDF to upland soils composed of dredged sediments, to effluent discharged from the CDF, and to runoff discharged from the CDF. Dredged sediments placed in uplands is expected to undergo changes in soil chemistry that may make cadmium more bioavailable. The SEP indicates that a small but significant fraction of the total cadmium becomes more bioavailable as sediments dry. Plants may be exposed to cadmium through direct contact with soil. To evaluate the potential for adverse impacts to plants, multiple measurement endpoints were considered. Total cadmium concentrations from sediment composite samples were compared to soil benchmarks protective of plants. Estimated bioavailable cadmium concentrations based on SEP analysis of sediment composite samples were compared to soil benchmarks protective of plants. Plant biomass generated in bioassays was considered as a measure of growth and was compared to reference and control sample biomass. The total concentrations of cadmium in sediment exceeded benchmarks. However, SEP data indicated that more than 80 percent of cadmium is bound in the soils in forms not available to plants, and bioavailable concentrations in sediment did not exceed benchmarks. Bioaccumulation test results indicated that plant tissue concentrations for high and low cadmium composites were higher than reference concentration, but the plant tissue concentrations were below tissue residue benchmarks. Plant growth in the bioassays was statistically significantly lower for plants grown in high and low cadmium composites than for control and reference treatments. This reduced plant growth may be related to cadmium concentrations and/or the fine-grained size of the dredged sediments.

Cadmium concentrations in dredged sediments to be discharged into CDFs 14A and 14B could cause adverse effects to wildlife using uplands if not managed properly. Some of the dredged sediments that would be removed from the inner harbor are cadmium-laden. Project plans call for these sediments to be placed in CDFs 14A and/or 14B and held in a wet state until they can be covered with new material that is expected to have cadmium concentrations of 4 mg/kg or less. If necessary, an additional cap of sediment from operation and maintenance dredging would also be placed on the cadmium- laden sediments. Capping/covering material would be expected to produce tissue levels in target vertebrates below lowest observable effects limiting dose benchmarks. Risks to wildlife from cadmium in upland habitats were evaluated using food web ingestion models to quantify exposures. Models included site-specific bioavailability factors developed based on SEP analyses of the sediments and site-specific bioaccumulation factors developed based on sediment bioassays using plants. Modeled doses were compared to no-effects and lowest observable effects benchmarks. The assessment evaluated impacts for birds and mammals that consume plants, invertebrates, and small mammals which included the song sparrow, marsh wren, red-tailed hawk, meadow vole short-tailed shrew and red fox. Using concentrations in sediment composites and effluent or runoff, modeled doses for song sparrow, marsh wren, and shrew for both low and high cadmium scenarios exceeded both no-effects and low-effects benchmarks. This indicates a definite for potential adverse effects to these receptors.

SHEP Cadmium Placement and Monitoring Plan. Based on the findings of the various studies relating to the dredging and disposal of cadmium contaminated sediments, a disposal and monitoring plan was developed for the Savannah Harbor Expansion Project. All of the cadmium- laden sediments that would be dredged from the inner harbor would be deposited into existing CDFs 14A and 14B. These sediments would be kept in a wet environment until a covering layer could placed on the material and sediment samples taken from that cover indicate that cadmium concentrations in the surface sediments are less than 4 mg/kg. Studies indicate that allowing the sediments in the CDF to dry changed the behavior of the cadmium in the sediments. Sequential extraction procedures on washed and dried sediment showed that cadmium becomes more available in the dried sediment. Plant uptake studies showed that plants can accumulate cadmium from dried sediments. An exposure model found that both birds and mammals exposed to the dried cadmium sediments are likely to accumulate cadmium at levels shown to have impacts. Following placement of cadmium-laden sediments, eighty-six (86) grab samples would be collected from a depth of 15 cm to characterize the cadmium levels of surface sediments. The sediments would then be covered with at least two feet of material consisting of sediments that are expected to have cadmium concentrations of 4 mg/kg or less. After this cover has been applied, sediment samples from the cover would be obtained and analyzed. Eighty-six (86) grab samples would be taken from a depth of 30 cm and analyzed for cadmium. If cadmium levels in the cover are less than 4 mg/kg, the sampling would be considered complete. If cadmium levels in the cover are equal to or exceed 4 mg/kg in a cumulative area of 25 acres or greater, an additional cover of material from operation and maintenance dredging would be applied a soon as possible. Sediment sampling would then be conducted as previously performed. This process would be repeated until the concentration of cadmium in the samples was less than 4 mg/kg. The cadmium-laden sediments would remain in CDFs 14A and 14B and not used for other purposes (dike construction, etc.).

Monitoring would also include evaluation of the inflow and the effluent discharged from the disposal areas. Samples would be taken from the head section of the discharge pipe from the dredge and analyzed for cadmium. Samples of the effluent leaving the disposal area would be taken and analyzed to ensure that state water quality standards are being met. The Section 401 Water Quality Certification issued by the Georgia DNR-EPD requires cadmium concentrations be monitored on a weekly basis at the point of discharge from the CDFs where cadmium-laden sediments are placed. Monitoring shall continue at these CDFs for as long as the discharge of effluent is present, and until all dredged sediments have been dewatered, stabilized and capped. Following the installation of a stable, clean cover, cadmium must be monitored for one year.

If analytical results indicate standards are not being met, corrective actions include reducing the pumping rate of the dredge and/or boarding up the weir to decrease the amount of effluent being discharged from the CDF.

Other monitoring efforts associated with cadmium-laden sediments include wildlife use surveys in CDFs 14A and 14B, vegetation sampling and removal (if required), and biological monitoring.

The Corps would perform monthly wildlife surveys of the CDFs. These one-day surveys would record all birds and other major vertebrates seen within CDFs 14A and 14B. Monitoring would be performed during placement of sediment (including any placement of required cover) and for 3 years after placement is completed. If there is a concern about the number of birds or other animals or a particular species using the CDFs, some type of hazing may be appropriate (with concurrence of the USFWS).

If analyses of the sediment samples from the cover show that concentrations of cadmium equal or exceed 4 mg/kg, vegetation sampling would be required. This sampling would be conducted on a quarterly basis in “hot spots” to determine cadmium uptake by plants. Samples collected from the CDFs would be compared to control samples taken from other, cadmium-free environments in adjacent CDFs. If vegetation samples have significantly elevated cadmium concentrations, then efforts would be initiated to eradicate vegetation and/or place additional, low-cadmium sediments over the capping layer. These contingency measures would eliminate wildlife exposure should vectors for cadmium uptake be identified. Vegetation sampling would be considered complete once sustained cadmium concentrations in the surface sediments of the cover are less than 4 mg/kg.

Blood sample monitoring of birds would be conducted prior to construction (baseline) and during placement of cadmium-laden sediments and its cover, and for 3 years after placement. The sampling protocols take into account the hydrologic conditions of the CDF (wet/ dry) and the season since these factors greatly influence which birds are using the CDFs at a given time. Tissue analysis would also be required if cadmium concentrations in the blood samples obtained during and after construction show a significant increase in levels observed in the pre-construction samples.

At the end of construction, sediment samples would be taken from the exposed channel bottom sediment surface and analyzed for grain size and metals (aluminum, iron, arsenic, beryllium, cadmium, copper, lead, manganese, mercury, nickel, selenium, silver and zinc). Analysis of the river bottom would provide an assessment of anticipated cadmium concentrations in sediments at the sediment/water interface.

The Section 401 Water Quality Certification also requires monitoring of maintenance dredging activities that would occur in areas of the channel with known high cadmium concentrations. Sediments to be dredged would require testing for cadmium from two locations that are representative of average sediment accumulation in that reach. This protocol would remain in effect for at least two maintenance dredging cycles and would continue if the sampling indicates cadmium levels of concern.

Details of cadmium monitoring are fully discussed in Appendix M.

Disposal Areas 12A, 12B and 13 A contain underdrains. Underdrains are used to help dewater the dredged sediments. A 1994 NMFS study found that effluent released to the Wright River through those underdrains contained arsenic at levels that violated water quality criteria. Arsenic levels in the Disposal Area 12B weir 1 underdrain effluent ranged from 117 to 147 micrograms/liter and in the Disposal Area 13A weir 2 effluent (which included both underdrain and overflow effluent) ranged from 14.9 to 298 micrograms/liter. The underdrain effluent was found to be toxic to test organisms. This toxicity was attributed primarily to arsenic, although other factors were also implicated (elevated manganese, low salinity, low dissolved oxygen and high turbidity). In agreement with the South Carolina Office of Ocean and Coastal Resource Management, the District has closed the underdrains to the Wright River. As of October 1994, the underdrains in Disposal Area 12B were sealed. The other underdrains were closed later in 1994.

New underdrains were subsequently constructed and drained to Savannah River or Back River. The district has temporarily closed those underdrains and is conducting a study to ensure they can be operated in a manner that allows the effluent to meet water quality standards. A 100-foot mixing zone would be allowed to bring the effluent levels within water quality criteria.

Loss of Environmental Value. Based on the results of the analysis discussed above, the sediments in the inner harbor that have elevated natural cadmium concentrations can be dredged and discharged into the CDFs without any loss of environmental values.

Actions to Minimize Impacts. Cadmium-laden sediments would be managed in Disposal Areas 14A and 14B to minimize their exposure to the environment. Sediments with elevated concentrations of cadmium would be capped/covered by cleaner sediments. These sediments would be covered with sediments removed during maintenance dredging, if required.

The project would include monitoring of cadmium both during construction and after placement of the sediments into CDFs 14A and 14B. Monitoring during construction would include monitoring of cadmium concentrations in the sediment slurry leaving the dredge discharge pipe as it enters the CDF. The monitoring would also include sampling and analysis of the weir effluent to ensure it meets water quality standards.

The project would also include monitoring sediments in the CDFs after placement and drying. Actions for elevated cadmium concentrations, if required, include placing a maintenance material sediment cover on the cadmium-laden sediments, sampling of vegetation and removal of vegetation if required, wildlife use studies in CDFs 14A and 14B, and analysis of blood samples from birds for cadmium.

6.5 Aquatic Ecosystem and Organism Determinations.

Effect on the structure and function of the aquatic ecosystem and organisms and effect on the re-colonization and existence of indigenous aquatic organisms or communities.

Most of the dredged material emanating from the SHEP would be discharged into existing CDFs and thus would not adversely affect any aquatic organisms or communities. There would be some loss of bottom habitat where dredged material and fill material are placed to construct various mitigation features of the project. While there would be some loss of bottom habitat to certain aquatic organisms, the mitigation structures would provide potential habitat for other species.

Threatened and Endangered Species. Listed species most likely to be affected by the discharge of dredged or fill sediments include the Shortnose sturgeon. All discharges of dredged sediments associated with construction of the project would occur well below Shortnose sturgeon spawning habitat. Placement of fill sediments associated with the Mitigation Plan is designed to benefit Shortnose sturgeon by reducing salinity levels in Middle, Back and Little Back Rivers that would result from deepening the channel. The discharge of fill material into the Savannah River at the New Savannah Bluff Lock and Dam to construct a fish passage facility would benefit Shortnose sturgeon by allowing them to access additional spawning grounds between New Savannah Bluff Lock and Dam and the Augusta Diversion Dam.

A Biological Assessment of Threatened and Endangered Species (BATES) was prepared and can be found in Appendix B of the EIS. The BATES determined that the Project as currently proposed "may affect but is not likely to adversely affect" piping plover, wood stork, West Indian manatee, right whale and humpback whales, sea turtles, and Shortnose sturgeon. This determination is contingent upon the conditions outlined in the BATES and the Mitigation and Monitoring Plan (found in Appendices B and D in the EIS). The NMFS submitted their Biological Opinion (Appendix Z) which provides further guidance and construction restrictions to minimize the effects of the project on protected species. The NMFS included three stipulations in the BO relating to the discharge of dredged and fill material.

1. Construction of the flow diversion structure at McCoys Cut should be restricted to the period May 15-Novmeber 1 to avoid adverse impacts to sturgeon.

2. To protect spawning sturgeon and their offspring, no in-water fish passage construction downstream of the New Savannah Bluff Lock and Dam should occur during the late winter/spring spawning period and early summer larval period between February 1 and May 31.

3. Appropriate erosion and turbidity controls shall be utilized wherever necessary to limit sediments from entering the water.

Fish, Crustaceans, Mollusks and Other Aquatic Organisms in Food Web

As indicated within Section 3.06 of the EIS, about 10.6 MCY of sediment excavated to deepen the ocean bar channel would be placed within the Savannah Harbor ODMDS. This would not interfere with recreational or commercial fishing operations.

A boat ramp would be constructed on Hutchinson Island to mitigate for the closing at Rifle Cut. Concrete rubble from the Tidegate would be deposited in intertidal areas along the estuarine riverbanks to produce fish habitat.

No significant adverse impacts to either recreational or commercial fishing are anticipated by the proposed action.

The project would not involve any discharge of dredged or fill material into areas with high concentrations of shellfish. Most impacts to benthos resulting from the discharge of dredged or fill material would be realized for those aspects of the project involving open water discharge. The ODMDS is used on a routine basis for the maintenance of the Savannah Harbor entrance channel. The environmental impacts from that placement are described in the ODMDS Placement Evaluation (Appendix R).

Other Wildlife

The discharges of dredged and fill material associated with the Savannah Harbor Expansion Project would not have any significant adverse effect on wildlife. Numerous species of wildlife including various mammals and birds use the CDFs. As part of the Long Term Management Strategy for the operation and maintenance of Savannah Harbor, some of the disposal areas are managed for wading and shorebird habitat. This practice would continue.

Special Aquatic Sites

The discharge of dredged and fill material associated with the Savannah Harbor Expansion Project would not directly affect any estuarine emergent wetlands. Dike raising would be required in the existing CDFs to accommodate the dredged sediments from the project. Dike raising would require footprint expansion to provide a suitable base for the dike. Footprint expansion is accomplished on the inside of the dike to prevent filling of adjacent wetlands. Sediments used to raise the dikes are usually obtained from within the CDF or from another CDF. Erosion control plans would be implemented during these construction events to ensure maintenance of water quality. "Best Management Practices," as defined in the Manual for Erosion and Sediment Control in Georgia or the South Carolina Stormwater Management and Sediment Control Handbook for Land Disturbance Activities, are used to determine the appropriate erosion control measures to implement during the dike raising process.

The discharge of dredged and fill material required to conduct the SHEP would not adversely impact any special aquatic sites. Special aquatic sites include sanctuaries and refuges, wetlands, mud flats, vegetated shallows, coral reefs, and riffle and pool complexes. The flow diversion structures at McCoys Cut and Rifle Cut and the submerged berm in Middle River are within the boundaries of the SNWR. Material used to construct these flow diversion structures would consist of dredged material (sand) and rock. The purpose of these structures is to help maintain freshwater conditions in the vicinity of the SNWR by reducing the increase in upstream salinity levels that would result from the SHEP. Minimizing the increase in upstream salinity levels that would result from channel deepening is essential to maintain a reliable source of freshwater at the SNWR intake located off Little Back River and to reduce impacts to Striped bass and Shortnose sturgeon habitat in these streams.

The discharge of dredged and fill material associated with the Savannah Harbor Expansion Project would impact various types of estuarine, and riverine bottom habitat as previously described. Estuarine habitat would be affected by implementation of the Mitigation Plan, which includes diversion/closure structures in McCoys Cut and Rifle Cut, construction of a submerged sill and broad berm in Back River below the Tidegate. The Mitigation Plan was designed to minimize the predicted increase in upstream salinity levels in Middle River and Little Back River that would result from deepening the navigation channel, and thus reduce adverse impacts to tidal freshwater marsh. Implementation of the Mitigation Plan would also affect some bottom habitat in Back River where the boat ramp would be constructed to provide access for local fishermen.

Most of the impacts to riverine habitat would result from construction of the fish passage structure at New Savannah Bluff Lock and Dam. A small area of the Savannah River would be impacted by the construction of the fish passage structure at the New Savannah Bluff Lock and Dam.

Potential Effects on Human Use Characteristics

The discharge of dredged and fill material associated with the SHEP would affect human use of the affected waterways where the western end of McCoys Cut and Rifle Cut are closed since it would remove “short cuts” between Front River and Middle River and Middle River and Little Back River. Access to these streams would still be available to recreational boaters.

7.0 <u>PROPOSED DISPOSAL SITE DETERMINATIONS</u>

Each disposal site shall be specified through application of the guidelines. The mixing zone shall be confined to the smallest practicable zone within each specified disposal site that is consistent with the type of dispersion determined to be appropriate by the application of the guidelines.

The various disposal sites that would be used for the Savannah Harbor Expansion Project are in agreement with the intent of the guidelines. The placement of dredged and fill sediments involves using existing disposal areas or sites required to implement mitigation features of the project.

8.0 <u>DETERMINATION OF CUMULATIVE EFFECTS ON THE AQUATIC ECOSYSTEM</u>

Cumulative Effects attributable to the discharge of dredged or fill material in Waters of the United States should be predicted to the extent reasonable and practical.

A cumulative impact analysis has been prepared for the Savannah Harbor Expansion Project and can be found in Appendix L. This analysis focused on the potential cumulative impacts to various resources in the estuary including wetlands, fisheries, groundwater, Shortnose sturgeon, the dissolved oxygen regime in Savannah Harbor, and the Tybee Island Beach and nearshore area. There are no known adverse cumulative impacts associated with any of the placement sites designated to be used for dredged or fill material.

9.0 <u>DETERMINATION OF SECONDARY IMPACTS ON THE AQUATIC ECOSYSTEM</u>

Most of the secondary impacts associated with the dredged and fill material placement sites for the Savannah Harbor Expansion Project are positive, since they are part of the project's mitigation plan.

10.0 <u>FINDINGS OF COMPLIANCE OR NON-COMPLIANCE WITH RESTRICTIONS ON DISCHARGE (SECTION 230.12)</u>

10.1 <u>Determinations.</u>

a. An ecological evaluation of the discharge of dredged and fill material associated with the construction and operation of the proposed Savannah Harbor Expansion Project has been made following the evaluation guidance in 40 CFR 230.6, in conjunction with the evaluation considerations in 40 CFR 230.5 .

b. Potential short-term and long-term effects of the proposed work on the physical, chemical, and biological components of the aquatic ecosystem have been evaluated and it has been found that the proposed discharge will not result in significant degradation of the environmental values of the aquatic ecosystem.

c. There are no less environmentally damaging practicable alternatives to the proposed work that would accomplish the project goals and objectives.

(1) The proposed work will not cause or contribute to violations of any applicable State water quality standards, will not violate any applicable toxic effluent standard or prohibition under Section 307 of the Clean Water Act, will not jeopardize the continued existence of species listed as endangered or threatened under the Endangered Species Act of 1973, and will not violate any requirement imposed by the Secretary of Commerce to protect any marine sanctuary designated under Title III of the Marine Protection, Research, and Sanctuaries Act of 1972.

(2) The proposed work will not cause or contribute to significant degradation of the waters of the United States.

(3) The discharge includes all practicable and appropriate measures to minimize potential harm to the aquatic ecosystem.

10.2 <u>Findings.</u>

On the basis of the guidelines, the proposed disposal sites for the discharge of dredged or fill material are specified as complying with the requirements of these guidelines, with the inclusion of appropriate and practical conditions to minimize pollution or adverse effects on the aquatic ecosystem.

ATTACHMENT

WATER QUALITY MONITORING PLAN

Savannah Harbor Navigation Project
Water Quality Monitoring
U. S. Army Corps of Engineers, Savannah District

1. Purpose:

To establish the duties of the Savannah District in performing water quality monitoring services for the activities associated with maintenance of Savannah Harbor. These activities include weir and potential underdrain discharges from project Dredged Material Containment Areas (DMCA's), and monitoring the performance of the oxygen injection systems which would be installed as part of the SHEP.

2. Responsibilities:

The Project Manager for the Savannah Harbor Navigation Project resides in Operations Division. Therefore, Operations Division is responsible for funding the monitoring that the District performs. Planning Division is responsible for the environmental compliance of the Savannah Harbor Navigation Project. Therefore, Planning Division is responsible for ensuring that the District conducts and coordinates the water quality monitoring that is required. Additional monitoring may be requested to obtain data to better document the effects of the District's operations on the environment. Engineering Division is responsible for the field performance of the monitoring and the quality of the data that are obtained.

3. Sampling Plan:

The District will perform water quality monitoring at the following locations, according to the following schedules or on an as needed basis as appropriate. Any alteration in schedules would need prior approval by Planning Division to ensure the Project continues to meet its environmental commitments. All field collection of samples will be taken in a manner such that the water in the sample bottle is truly representative of the water at the monitoring location.

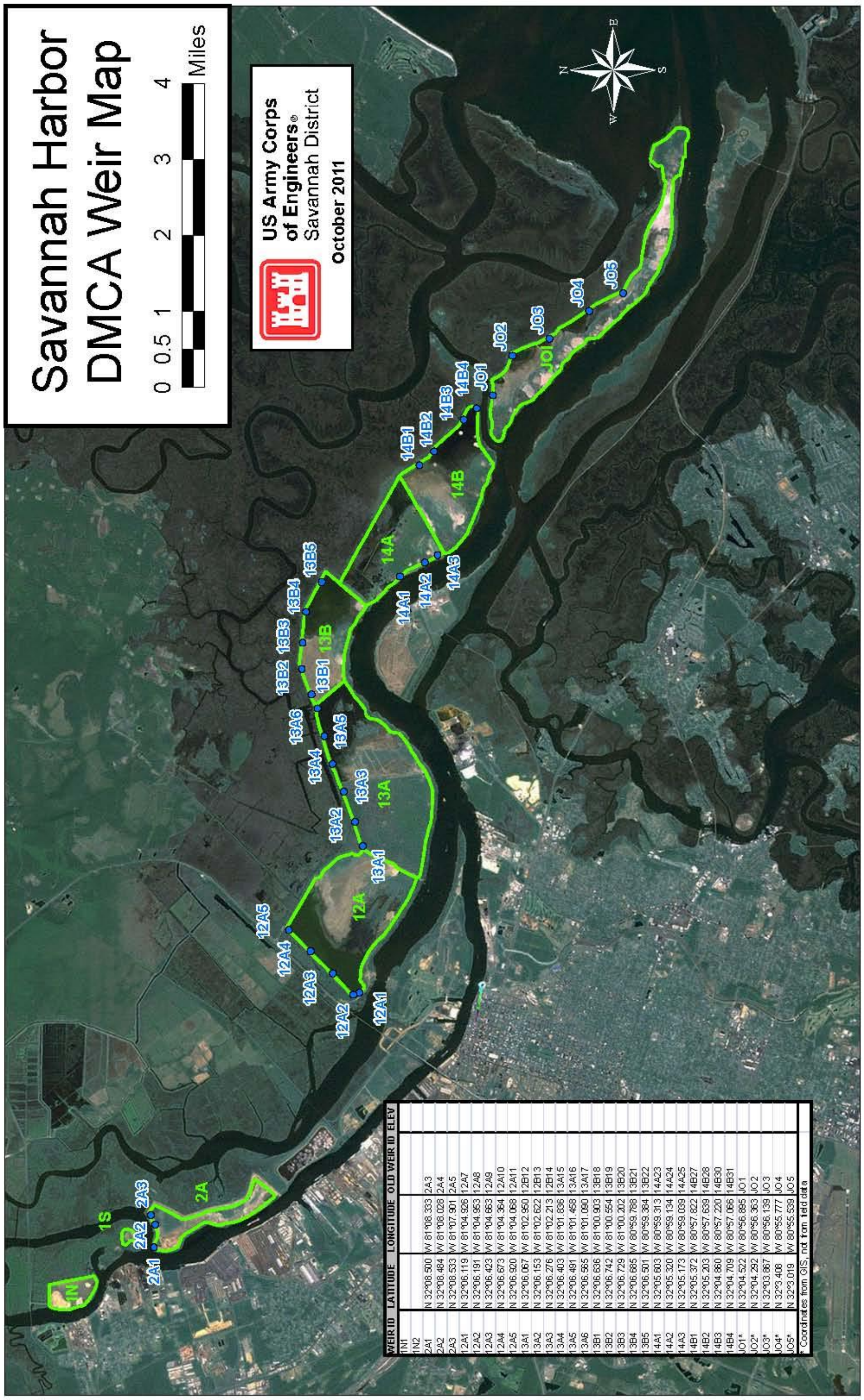
A. Savannah Harbor Dredged Material Containment Areas (DMCA's) Overflow Weirs: Monitoring of all overflow weirs at the listed DMCA's will occur on a monthly basis as close to the beginning of the month as practicable. Total discharge from each weir outfall pipe will be determined, to include seepage through and flow over the weir boards. Where water is ponded at the weir but there is no discharge occurring, the water quality of the impounded water will be measured.

Each weir that is discharging greater than 0.1 cubic feet per second (cfs) through seepage and/or weir overflow (at least 1/2 inch of flow over 3 feet of weir board) will be checked weekly during the month for overboard weir flow and water quality parameters.

Seepage estimates will be updated on a monthly basis. Weekly measurements will be made at all DMCA weirs discharging greater than 0.1 cfs at the beginning of the month, at any additional weirs for which EN has been notified that boards have been pulled, and at the weirs of any DMCA that, during the month, begins to receive sediment deposition from a dredging operation. Where water is ponded at a weir in an area where deposition has just begun but there is no discharge occurring, the water quality of the impounded water will be measured. If the discharge is less than 0.1 cfs from a weir with ponded water, no additional sampling will occur until the following monthly check of all DMCA weirs. Where it is practicable, water quality parameters from weirs discharging greater than 0.1 cfs should be obtained at the weir from overflow or seepage water. Where that is not possible, measurement of ponded water is acceptable.

If the measured water is not compliant with standards and the discharge (weir flow and/or seepage) is greater than 0.1 cfs, water quality will be measured additionally at the outfall pipe. If non-compliant values are measured at the outfall pipe, monitoring will then occur at the receiving water or a representative intermediate point (see Section 6, below) at the earliest opportunity. The intention is to sample the receiving water within 24-hours of discovering the outfall discharge may be non-compliant. If the receiving water cannot be sampled within 48-hours of discovering the outfall discharge is non-compliant, PD and the OP Project Manager must be notified before that time has elapsed Receiving waters include the river or natural creeks. Intermediate points include the pool of water at the outfall pipe (where the pool is separated from the river), and ditches flowing through the marsh to the river. Monitoring should be performed near the beginning of each week so that any required retesting or sample collection may be performed the same day or the following day.

DMCAs 2A, 12A, 13A, 13B, 14A and 14B are located along Savannah Harbor near Port Wentworth, GA to the Atlantic Intracoastal Waterway (AIWW). All areas are accessible by road in a four-wheel-drive vehicle. The Jones-Oysterbed Island Disposal Area is located between the AIWW and the mouth of the Savannah River and is only accessible by boat. The locations of the weirs and disposal areas are shown in Figure 1.



WEIR ID	LATITUDE	LONGITUDE	OLD WEIR ID	ELEV
1N1				
1N2				
2A1	N 32°08.500	W 81°08.333	2A3	
2A2	N 32°08.484	W 81°08.028	2A4	
2A3	N 32°08.533	W 81°07.901	2A5	
12A1	N 32°06.119	W 81°04.926	12A7	
12A2	N 32°06.191	W 81°04.953	12A8	
12A3	N 32°06.423	W 81°04.663	12A9	
12A4	N 32°06.673	W 81°04.364	12A10	
12A5	N 32°06.920	W 81°04.068	12A11	
13A1	N 32°06.067	W 81°02.950	12B12	
13A2	N 32°06.153	W 81°02.622	12B13	
13A3	N 32°06.276	W 81°02.213	12B14	
13A4	N 32°06.403	W 81°01.836	13A15	
13A5	N 32°06.491	W 81°01.458	13A16	
13A6	N 32°06.565	W 81°01.090	13A17	
13B1	N 32°06.636	W 81°00.903	13B18	
13B2	N 32°06.742	W 81°00.554	13B19	
13B3	N 32°06.729	W 81°00.202	13B20	
13B4	N 32°06.685	W 80°59.788	13B21	
13B5	N 32°06.501	W 80°59.384	13B22	
14A1	N 32°05.603	W 80°59.313	14A23	
14A2	N 32°05.320	W 80°59.134	14A24	
14A3	N 32°05.173	W 80°59.039	14A25	
14B1	N 32°05.372	W 80°57.822	14B27	
14B2	N 32°05.203	W 80°57.639	14B28	
14B3	N 32°04.860	W 80°57.220	14B30	
14B4	N 32°04.709	W 80°57.066	14B31	
JO1*	N 32°04.522	W 80°56.895	JO1	
JO2*	N 32°04.292	W 80°56.363	JO2	
JO3*	N 32°03.867	W 80°56.139	JO3	
JO4*	N 32°3.408	W 80°55.777	JO4	
JO5*	N 32°3.019	W 80°55.539	JO5	
* Coordinates from GIS, not from field data				

Figure 1. Locations of DMCAs and Weirs-Savannah Harbor

B. Savannah Harbor DMCA Underdrains: Underdrains exist at DMCAs 12A, 12B, 13A, and 13B. The underdrain in DMCA 12A discharges into Back River. One of the underdrains in DMCA 12B discharges into Back River while the other two discharge into the Savannah River. Disposal Areas 13A and 13B both contain three underdrains all of which discharge into the Savannah River. The underdrains are presently closed for an indeterminate period of time (no discharge is occurring) and are not being monitored.

If underdrains are used again, the following monitoring plan will be implemented. Monitoring of underdrain discharge pipes at the listed disposal areas will generally be performed every six months, where discharges are occurring. Monitoring should be performed at the beginning of a week so that any required retesting or sample collection may be performed the same day or the following day. Since the underdrains are allowed to discharge only on a moving tide, sampling will be performed at roughly mid-tide down-current from the discharge station. If the District determines metal analysis is appropriate, two samples should be collected for metals analysis at each discharge location. The first sample would be collected either within the pipe before the discharge occurs or outside the pipe before the discharge mixes with the receiving water. The second sample would be taken within the receiving body at the down-current edge of a 100-foot mixing zone from the discharge point (see Section 3, below). Water quality probe measurements should also be taken at the down-current sampling point to determine compliance with State Standards.

C. Savannah Harbor Oxygen Injection Systems: Monitoring will be performed on a daily basis to ensure the dissolved oxygen systems are performing satisfactorily. Monitoring will occur of the water entering and discharged from the Oxygen Injection Systems, as well as at specific fixed locations in the estuary. This monitoring will be performed remotely, by reviewing the values being recorded on continuous monitors that measure dissolved oxygen levels and report that information on a real time basis. If the monitoring indicates that the dissolved oxygen systems are not performing satisfactorily (adding the agreed upon amount of oxygen), the District will adjust the systems so that they do add the required amount of oxygen at that location.

After the Oxygen Injection Systems are found to be performing satisfactorily (expected to be the end of the 10-year post-construction monitoring program), the Corps would fund USGS to operate and maintain continuous recorders for hydrologic and hydraulic data at the following four locations:

- 02198920 Savannah River at GA25, at Port Wentworth, GA
- 021989773 Savannah River at USACE Dock at Savannah, GA
- Back River at US 17 at Savannah, GA
- Savannah River at I-95

USGS would service the dissolved oxygen monitors (and other needed parameters) on at least a monthly basis to ensure the monitors are making accurate measurements and reporting the data properly.

The District would fund USGS operation of continuous recorders for hydrologic and hydraulic data at four additional sites during the pre-construction and during-construction periods. The Corps would use that more detailed information to observe water quality in the estuary during the construction and ensure the Oxygen Injection Systems perform as designed.

4. Field Water Quality Parameters:

The District will record the following data at each weir and channel monitoring location:

- Location (identify DMCA, discharge pipe, receiving water for weirs, channel station number and location in channel -- middle, left side facing upstream, right side). When monitoring near a dredge, record sampling depth. For weir sampling, indicate if sampling is from ponded water, weir overflow, seepage at the boards, outfall pipe, outfall ditch, or receiving water.
- Date
- Time
- Tide (estimate of high slack, near high falling, mid-tide falling, near low falling, low slack,
  near low rising, mid-tide rising, near high rising)
- Depth of water flowing over the weir boards (also width of flow if it is less than the full width of the weir boards)
- Total discharge at weir outfall pipe on a monthly basis (to include seepage and weir overflow)
- Air Temperature (degrees Centigrade, °C)
- Water Temperature (degrees Centigrade, °C)
- Dissolved Oxygen (DO, in milligrams per liter, mg/l). Winkler analyses will be conducted as needed.
- pH
- Conductivity (in micromhos/centimeter, umho/cm)
- Salinity (in parts per thousand, ppt)
- Turbidity (in nephalometric turbidity units, NTU)
- Total Suspended Solids (reported as milligrams per liter (mg/l), developed through conversion of turbidity measurements). Actual TSS measurements would be taken only on an as needed basis.
- Comments (color of discharge waters, etc)

The District will record the following data at each underdrain monitoring location:

- Location (identify DMCA, discharge pipe number, discharge point (DP) vs. receiving waters (DS))
- Diameter of discharge pipe
- Amount of flow in pipe (full, three-quarters full, half-full, one-quarter full, trickle, and approximate discharge rate in cfs)

- Date
- Time
- Tidal stage
- Current direction

At each discharging underdrain location, the District will collect sufficient sample volume to allow subsequent laboratory testing. A second sample will be taken at the down-current edge of the 100-foot mixing zone in the receiving water.

If metal testing is conducted, each underdrain sample will be analyzed as total recoverable for the following parameters:

Arsenic
Beryllium
Cadmium
Chromium
Copper
Cyanide
Lead
Manganese
Mercury
Nickel
Selenium
Silver
Total Suspended Solids (TSS)
Zinc

A duplicate sample will be taken from one underdrain outfall pipe and the results will be compared by the District to those of the matching sampling location.

The District will complete a chain of custody form that includes a listing of all analytes and the collection time for each sample. When laboratory analysis has been completed, the District will provide a reproducible data sheet with the results of each sampling event to the natural resource agencies.

Engineering Division will maintain a database of the reported data for DMCA and channel water quality. Planning Division will coordinate the results and any District analysis with the natural resource agencies, as required by their project approval documents.

5. Instrumentation and Calibration:

A Hydrolab Datasonde, similar YSI sonde, or other comparable equipment will be used to measure water temperature, DO, pH, conductivity/salinity and turbidity.

Air temperature should be determined using a calibrated mercury-filled centigrade thermometer or the nearest available weather station data.

The District (Engineering Division) will be responsible for calibration of all water quality monitoring instruments to ensure accuracy of the field data.

- Dissolved Oxygen (DO, in milligrams per liter, mg/l) sensors will be calibrated to air saturation or by collecting and “fixing” a sample in the field, followed by laboratory calibration of the results using the Azide/“Winkler” Method.
- pH sensors will be calibrated using buffered standards of pH 4.0, pH 7.0 and pH 10.0 as appropriate.
- Turbidity sensors will be calibrated using tap water and formazine standards.
- Conductivity sensor will be calibrated to air and standards.

Water quality instruments will be calibrated at the beginning of each sampling day. Daily data sheets will show the instrument results from calibration and will be archived by Engineering. During DMCA water quality sampling, weekly calibration will be sufficient to ensure accurate sampling results.

All laboratory procedures will be performed in accordance with the most recent edition of *Standard Methods for the Examination of Water and Wastewater*.

6. Water Quality Discharge Requirements:

Dissolved Oxygen requirement

State	Standard	Months
South Carolina	daily average of 5.0 mg/L	All Year
	daily minimum of 4.0 mg/L	All Year
Georgia	daily average of 5.0 mg/L	All Year
	daily minimum of 4.0 mg/L*	All Year
	minimum instantaneous throughout the water column	

pH requirement

State	Standard	Months
South Carolina	6.0 - 8.5	All year
Georgia	6.0 - 8.5	All year

Metals requirement

Parameter	Standard for Saltwater Chronic Criterion*		Months
Arsenic	36 ug/L		All Year
Cadmium	9.3 ug/L		All Year
Copper	3.7 ug/L		All Year
Cyanide	1.0 ug/L		All Year
Lead	8.5 ug/L		All Year
Mercury	1.1 ug/L		All Year
Nickel	8.3 ug/L		All Year
Selenium	71 ug/L		All Year
Silver	2.3 ug/L	***	All Year
Zinc	86 ug/L		All Year

*Standards are based on SCDHEC R.61-68, *Water Classifications and Standards*, April 25, 2008 and expressed in terms of total recoverable metals
*** Only Acute Criteria available

Turbidity requirement

State	Standard	Months
South Carolina	Does not change the receiving waters to such a degree as to create a nuisance, or interfere with classified or existing water uses.	All Year
Georgia	Does not interfere with legitimate water uses. Does not result in a substantial visual contrast in the receiving water body.	All year
Savannah District	500mg/L or 250 NTU's	All Year

7. Retesting Procedures and Immediate Reporting:

A. Weekly DMCA Overflow Weir Monitoring: A confirmed violation of a discharge requirement at a weir and discharge pipe will require monitoring to be conducted where the discharge enters the receiving water body if the discharge is not reduced below 0.1 cfs. Retesting the same or following day at the weir, discharge pipe, and/or in the receiving water body will be necessary.

The District will determine the required location(s) for sampling in the receiving water body. A boat will be required for that sampling. Ready access will likely not be available to the receiving water body sampling location(s). Depending on which weir does not meet the discharge requirements, transit by boat for several miles may be necessary to reach the sampling location(s) specified in the receiving water body.

Sampling of the receiving water will be performed on the last half of an ebb tide where practicable. Samples will be taken at the surface, mid-depth, and one meter above the bottom. The samples shall be at least one meter apart in depth. Where shallow depths preclude three separate measurements, a mid-depth reading will be taken.

In general, sampling will occur in the receiving water near the discharge pipe, at the confluence point of an effluent ditch/canal and the receiving water, and 100 feet down-current in the receiving water. For discharges from Disposal Area 12A, monitoring will occur in the Back River approximately 100 feet down-current from the mouth of the ditch that carries effluent from the weirs. If the readings 100feet down-current in the receiving water indicates non-compliance, an additional set of readings will be taken 100 feet up-current. If those readings show the effluent discharge has no effect on the receiving water, then discharges from that weir/DMCA may continue. For DMCAs discharging to the Wright River (Disposal Areas 12B, 13A, 13B and 14A), monitoring will occur at the following locations: (a) the mouth of the ditch leading from the discharge pipe to the Wright River, and (b) in the Wright River 100 feet down-current from the mouth of the ditch that carries effluent from the weirs. If the readings 100-feet down-current in the receiving water indicates non-compliance, an additional set of readings will be taken 100 feet up-current. If that reading shows effluent discharge has no effect on the receiving water, then discharges from that weir/DMCA may continue.

If 100 foot up-current reading shows the discharge is non-compliant and has a measurable effect on the receiving water, then an additional set of readings will be taken at 50-foot intervals (up to 400 feet down-current from the edge of the 100-foot mixing zone) to determine where the discharge has no measurable effect on the receiving waters. If this second set of readings shows that the discharge continues to fail water quality requirements, (1) Planning Division will coordinate with the appropriate natural resource agencies and reach agreement on a resolution to the situation, or (2) Operations Division will stop the release of effluent from that discharge pipe.

B. <u>CDF Underdrain Monitoring</u>: If the readings do not meet the discharge requirements, the District will verify the results by taking a second reading, and, if necessary, taking a sample for laboratory analysis. If consistent measurements confirm potential violation of a standard, the investigator will immediately perform additional testing to (1) determine the ambient conditions in the receiving water near the discharge point, and (2) determine the distance of the mixing zone at which the discharge requirement is met.

The monitoring would be repeated the next day. If the discharge meets the water quality requirements no further action will be taken. If the discharge fails to meet water quality requirements, (1) Planning Division will coordinate with the appropriate resource agencies and reach agreement on a resolution to the situation, or (2) Operations Division will stop the release of effluent from that discharge pipe. Ready access will likely not be available to the receiving water body sampling location. A boat will be required for sampling the receiving water body at the edge of the mixing zone. Depending on which underdrain pipe does not meet the discharge requirements, transit by boat for several miles may be necessary to reach the required sampling location.

8. Equipment and Supplies:

The following equipment and supplies would generally be needed to perform the monitoring in the Plan:

- Four-wheel drive vehicle
- Boat and motor (with safety equipment)
- Multi-probe water quality monitoring instrument
- Cellular telephone
- Field equipment for collection of samples
- Laboratory equipment and supplies for calibration of the instrument
- Laboratory equipment and supplies for DO titrations and measuring total suspended solids
- Forms to ensure chain of custody on samples to be sent to commercial laboratories for analysis

9. Annual Reports:

Planning Division will be responsible for developing a written report of the water quality data that the District collects during a given fiscal year. Since Engineering Division will be storing the data, it will format the data in a useable manner and provide the data and any analysis it deems appropriate data to Planning. Environmental staff within Planning will then conduct its own analysis and highlight any significant items as it completes the report. After review by the Project Manager and Engineering staff, Planning will provide the report to the South Carolina and Georgia natural resource agencies. The intent is to provide this report of data collected over a fiscal year by the end of that calendar year.