Section 107
Navigation

June 2003

DRAFT
DETAILED PROJECT REPORT
WITH ENVIRONMENTAL ASSESSMENT
HERNANDO BEACH NAVIGATION STUDY
HERNANDO BEACH, HERNANDO COUNTY, FLORIDA

US Army Corps of Engineers®
Jacksonville District

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT CORPS OF ENGINEERS
P. O. BOX 4970
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REPLY TO
ATTENTION OF

DRAFT
DETAILED PROJECT REPORT
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SYLLABUS

Hernando Beach, Florida, is a small commercial fishing and residential community about 60 miles north of Tampa on the Gulf of Mexico coast. Constructed by local interests, the existing non-Federal navigation channel at Hernando Beach is narrow, shallow and winding. Commercial, as well as recreational, vessels incur damages as a result of the poor condition of the channel. Opportunities exist to improve the channel for the purposes of safety, commercial navigation and recreation.

Through Congresswoman Karen Thurman, Hernando County requested the United States Army Corps of Engineers conduct a study to assess Federal interest in a navigation project at Hernando Beach. The study resulting from this request is a Continuing Authorities Program Section 107 navigation study. This Detailed Project Report describes the study. The report presents the results of planning, engineering, geotechnical, environmental, economic and real estate investigations that address the identified problems and opportunities.

Commercial fishing benefits justify the recommended plan, which is for the project purpose of navigation, with incidental recreation benefits. The National Economic Development Plan is a channel having a project depth of six feet, mean lower low water, a bottom width of 80 feet, and a length of 20,500 feet, with wideners in the bends as appropriate. Placement of material removed during channel construction is to be near the Richardson Reef site. This placement will create hardbottom habitat.

Hernando Beach Project Pertinent Data	
Physical Data	
Channel length	20,500 feet
Channel width	80-foot bottom width
Channel depth	Six feet, mean lower low water (Constructed with one foot required and one foot allowable overdepth)
Estimated Volume and Placement	
Sand, rock, other materials	333,000 cubic yards, hardbottom habitat
Total	333,000 cubic yards
National Economic Development Benefits/Outputs	
Commercial fishing	$315,300 average annual equivalent (AAEQ), 5.875%
Recreation	$134,500 (AAEQ)
Total	**$449,800 (AAEQ)**
National Economic Development Costs	
Economic Investment	$324,500 (AAEQ)
Future Operations & Maintenance	$21,000 (AAEQ)
Total	**$345,500 (AAEQ)**
NED Benefit/NED Cost Ratio	**1.3**
Construction Costs	
Total	$4,934,000
Federal share	$4,110,000 up-front
Non-Federal share	$824,000 up-front, additional $487,000 over 30 years

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STUDY AUTHORITY

1. The study for Hernando Beach, Florida, is conducted under the Continuing Authorities Program, Section 107, River and Harbor Act of 1960, as amended. Funds for the study were included in House Report 104-679, the Energy And Water Development Appropriations Bill of 1997, as follows:

> *Small Navigation Projects (Section 107)*- The Committee has provided $5,000,000 for the section 107 program, the same as the budget request. Within the funds provided, the bill includes: $100,000 to initiate a study of navigation problems at Hernando Beach Channel in Florida...

STUDY PURPOSE AND SCOPE

2. The purpose of the Hernando Beach study is to identify, evaluate and recommend an appropriate, coordinated and implementable solution to the identified navigation problems and opportunities. This report is a final response to the study authority. It presents the results of both the reconnaissance-level effort and the feasibility-level effort for the study. While the Continuing Authorities Program does not specifically separate a study into a reconnaissance phase and a feasibility phase, the present investigation applies a two-phase approach as a result of early caution by the Corps of Engineers and Hernando County. The level of detail of the investigation and report is intended to be sufficient to proceed directly to the preparation of contract plans and specifications for the recommended plan. This report focuses on the Federal water resources project purposes of navigation and recreation and relies on the National Economic Development (NED) justification, as described in Corps of Engineers' guidance document Digest of Water Resources Policy and Procedures, EP 1165-2-1, 30 July 1999, and other Corps' guidance.

3. The intent of this report is to provide a complete presentation of study results and findings, including those developed during the reconnaissance-level effort, so readers can reach independent conclusions regarding the reasonableness of the recommendation contained herein; to comply with applicable statutes, executive orders and policies; and to provide a sound and documented basis upon which to judge the recommended plan. Further, this report is intended for project authorization and operations and maintenance dredging, including dredging by the non-Federal sponsor in the access channels.

4. The report documents the study process leading to the NED Plan. The selection of the recommended plan relies on both commercial fishing and recreation benefits. Navigation projects may produce both recreational navigation outputs including sport fishing and commercial navigation outputs. Civil Works funds may normally be used to support recreational development where the level of commercial navigation benefits is equal to or exceeds 50 percent of the average annual project cost.

5. Hernando Beach is located on Florida's Gulf Coast, about 60 miles north of Tampa. **Figure 1** shows the location of Hernando Beach in relation to the Gulf Coast of Florida. It is a small residential and commercial fishing (primarily live bait shrimp) community. The channel leading to the Gulf of Mexico from Hernando Beach is shallow, narrow and curving; it poses a threat to safe navigation and hampers reliability in the live bait shrimp industry.

CONCISE DISCUSSION OF PRIOR STUDIES, REPORTS AND EXISTING FEDERAL PROJECTS

Prior studies

6. There are no prior Federal studies at Hernando Beach, Florida.

7. Federal studies were conducted for both the neighboring Bayport Channel to the north of Hernando Beach and Hudson River Channel to the south of Hernando Beach. Bayport Channel was studied under Section 107 of the River and Harbor Act of 1960, culminating in a Reconnaissance Report in 1968 and a Detailed Project Report (DPR) [feasibility report] in 1970. The feasibility report for Bayport Channel revealed no Federal interest in a project at that location.

8. Hudson River Channel was authorized as a Federal project for the purpose of navigation in the River and Harbor Act of 17 May 1950. This project was not constructed. Later the project was classified as deferred due to doubts as to its economic justification. In 1973 an economic restudy of the project was conducted. Results of this study indicated that area development and prospective commercial and recreational usage were not adequate to justify project costs. The project was recommended for deauthorization in 1985. A reconnaissance study was funded in the Energy and Water Development Appropriation Act, Public Law 99-141, dated 1 November 1985, because there were significant increases in usage. The report resulting from this reconnaissance study was recommended for approval and it was also recommended that a feasibility study be initiated. The feasibility study was terminated in 1993.

9. Hernando Beach differs from Bayport and Hudson in several respects. The commercial vessels homeporting at Bayport and Hudson are generally smaller in size than those that homeport at Hernando Beach. The catch is different, with more minnows and crabs being brought in at Bayport and Hudson and more live bait shrimp at Hernando Beach. There are more boat ramps at Hernando Beach, which has two boat ramps while Bayport and Hudson each only have one. Thus, there is more commercial and recreational use of the channels at Hernando Beach than at Bayport or Hudson. For these reasons it seems more likely that a Federal project for the purpose of navigation could be justified at Hernando Beach than at Bayport or Hudson.

Prior reports

10. There are no prior Federal reports at Hernando Beach, Florida.

Existing projects

11. There is no existing Federal project at Hernando Beach, Florida. There is an existing navigation channel. This channel was constructed by local interests and is maintained by Hernando County. **Figures 2 and 2a** offer more detailed views of the Hernando Beach study area. **Figure 3** shows the location of the existing channel and contains some information on the construction of the channel. Reviews of permits issued for channel construction or maintenance at Hernando Beach channel reveal the following information. The channel was constructed at approximately the time of the development of the town of Hernando Beach around 1960 (**Figure 4**). Corps of Engineers permit SAKSP permit number 60-264 was issued 27 July 1960 for the channel construction. A copy of this permit is found in Appendix D-Supplemental Information. The permit was to dredge a channel 35 feet wide extending about 5,800 feet west of the westerly tip of Coon Key. The depth of the channel was to be about 5 feet below mean low water. **Figure 5** provides a visual description of mean low water and other tidal references. The dredged material was to be placed in a strip about 25 feet wide at its top along the northerly side of the proposed channel. This permit was revised on 9 February 1973 to extend this channel 1,800 feet, with placement of the material again along the northerly side of the channel. The width of this extension was to be 40 feet and the depth three feet below mean low water. A dragline was to be used for the construction (**Figure 6**). The material to be removed was estimated to be 20 percent sand and 80 percent rock. The sand was expected to be fine to medium and the rock to be soft limestone rock. No records indicate that this work was not completed.

12. On 5 December 1978 Corps of Engineers permit number 77E-1311/Department of Environmental Protection (DEP) permit number 27-20-4122 was issued to Hernando County Port Authority to extend the channel waterward by 1,800 feet and to enlarge the channel to have a bottom width of 60 feet and a depth of six feet below mean low water. This action was expected to remove about 18,000 cubic yards of material. Placement of the material was to be again on the islands north of the channel. The dredging work appears to have been completed in 1980.

13. On 12 March 1983 another permit was issued by the DEP to Hernando County Port Authority for the removal of approximately 255 cubic yards of maintenance material from the channel. Placement was again to be on the islands north of the channel. The permit number for this action is 270716593.

14. On 13 February 1984 DEP permit number 270613153 was issued to further extend the channel by 3,330 feet, at a bottom width of 60 feet and a depth of five

and one-half feet. The Corps of Engineers permit number is 82F-1310. This action was to remove approximately 10,000 cubic yards of material. Placement of the material was to be both north and south of the channel. The DEP letter dated 9 April 1984 and the Corps of Engineers letter dated 15 May 1984 later modified this permit for placement of material only on the north side of the channel. The length of the channel, once this work was complete, was to be about 12,700 feet. Copies of these permits are found in Appendix D-Supplemental Information.

15. The existing channel, therefore, was built with a length of 12,700 feet and a range in width between 35-60 feet. The landward 9,400 feet have a design depth of six feet, mean low water, and the remaining 3,300 feet have a design depth of five and one-half feet, mean low water. The channel has several blind or nearly blind curves and is heavily marked with private aids to navigation. **Figure 7** shows the channel markings. Large boulders reportedly migrate in the channel, particularly during storm events. **Figure 8** identifies rock high spots in the residential access channels. The channel has shoaled in places creating an effective water depth shallower than the design depth. At the landward end of the channel is the town of Hernando Beach. Access channels oriented east-west connect residences and public and commercial areas to the main channel leading to the Gulf of Mexico. These access channels vary in depth from about six to ten feet and are approximately 150 feet wide. They are lined with residential docks. Just beyond the waterward end of the channel is a private (non-United States Coast Guard) aid to navigation, known as Watts Tower, marking the channel entrance. The water depth at this end of the channel is shallower than that of the channel itself and the Gulf bottom in this area is marked with scars caused by boats scraping bottom.

Study history

Initial Appraisal

16. The Federal navigation study began in 1994 with a site visit on 13-14 September to assess Federal interest. This site visit was made at the request of the Hernando County Port Authority. To iterate, the Hernando Beach channel serves the community of Hernando Beach, a manmade development. The area has good-sized access channels to residential property as well as the main channel, serving public and commercial facilities near County Road 595. Commercial as well as recreational vessels use the channels for access to the Gulf of Mexico. The Hernando Beach area has public launching and parking facilities for handling trailed vessels. The residential community has a large number of waterfront homes with deep and wide channels for access. Commercial fishermen have waterfront property specifically for berthing their vessels, storing their equipment, and handling their catch. The catch consists primarily of live bait shrimp, and also of grouper and red snapper. Several

marinas are on the water to serve the public and provide wet and dry vessel storage, fuel, water and marine supplies. **Figure 9** shows the zoning of the area.

17. Problems identified with the existing channel at the time of the initial appraisal were insufficient width, with commercial and recreational vessels having to pass in the narrow channel, and narrow turns with insufficient visibility, particularly the channel section as it turns to enter the Gulf channel reach (mouth of Minnow Creek). Evidence of these problems was a high and increasing frequency of vessels grounding with damage. The channels inside the developed area of Hernando Beach appeared to be adequate in both depth and width.

18. At the time of the site visit, Hernando County, specifically Hernando County Port Authority, had a strong interest in pursuing improvement to the Hernando Beach channel. The vessel traffic in the area was growing and growth problems were emerging. The Port Authority expressed interest in continuing a study for a Federal project at Hernando Beach, a study that would consider widening and deepening the existing channel. The recommendation made after this initial site visit was to proceed with a reconnaissance study under Section 107. A copy of the memorandum for record documenting the initial site visit is found in Appendix D-Supplemental Information. In February 1995 Jacksonville District requested, by memorandum to South Atlantic Division, funding for the reconnaissance phase.

Reconnaissance-level Phase

19. The reconnaissance-level phase of the Hernando Beach navigation feasibility study began with Federal funding in fiscal year 1997. Work for this effort began in January 1997 and a Preliminary Analysis letter report was submitted to South Atlantic Division by Jacksonville District on 5 September 1997. A copy of the letter report is found in Appendix D-Supplemental Information. The recommendation made in the report is to continue the feasibility study with the rest of the study cost-shared. The District received comments from South Atlantic Division. These comments, with the District's responses, are found in Appendix D-Supplemental Information. Note that some of the comments/responses call for follow-up by the end of the feasibility study. This report contains the follow-up.

Feasibility Cost Sharing Agreement

20. The feasibility cost sharing agreement for the cost-shared portion of the feasibility study was signed on 2 June 1998. The scope of work for this portion includes significant data collection, as very little engineering information existed at that time about the channel and the surrounding area. This DPR is the culmination of the feasibility study, reporting on the information collected and the analysis of that information. Work on the cost-shared portion of the feasibility study tasks began with receipt of non-Federal funding in January 1999.

21. The non-Federal sponsor for the feasibility study is Hernando County Board of County Commissioners. At the time of the initial appraisal and reconnaissance-level phase the Hernando County Port Authority was a branch of the Hernando County Department of Public Works. The point of contact for those stages of the study was the Port Authority. The main point of contact for the cost-shared feasibility study is the Department of Parks and Recreation. The Hernando County Port Authority and the Department of Parks and Recreation are, however, both on the Executive Committee and the Study Management Team for the feasibility study. Both contributed extensively to the feasibility study.

Cost-Shared Feasibility Study

22. The cost-shared portion of the feasibility study documented in this DPR began with the receipt of funding in January 1999. Data collection included a hydrographic survey, aerial photography, geotechnical information (core borings and wash probes), commercial and recreational channel use information, a submerged aquatic vegetation survey, and real estate valuation. One important note is that previous data collected relating to channel depth was collected in mean low water. Federal harbor projects reference mean lower low water (mllw); all data collected for this study is reported in mllw. Hereinafter, all depths reference mllw unless otherwise stated. The difference between these two reference planes is shown in the Appendix B-Engineering Appendix and on **Figure 5**. A channel design was developed to meet channel users' needs. A placement area analysis was conducted. Environmental impacts were determined and minimized. Commercial fishing and recreational benefits were analyzed. The results of these feasibility study activities and others are included in this DPR.

PLAN FORMULATION

23. Formulation Concept. Plan formulation for this study set out to identify measures to address the problems and opportunities and then to combine these measures into alternative plans. The measures could be structural (involving construction) or non-structural. The initial list of measures would be evaluated, perhaps resulting in the elimination of some measures, and a refined list of measures developed. Once the measures were combined into plans, the plans would be scaled. Scaling might involve refining plans by size or location. Once a list of refined plans was set the refinements would be evaluated and compared. This evaluation and comparison could lead to reformulation during which the refined plans might be changed for any number of reasons. After comparison, evaluation and reformulation a final set of refined plans would be described by NED cost/benefit procedures. One refined plan would be selected for recommendation based on maximization of net benefits and provided the benefits were greater than the cost for that plan.

Assessment of water and related land resource problems and opportunities specific to the study area

Existing conditions

24. Hernando Beach. Hernando Beach is located on Florida's Gulf of Mexico coast about 60 miles north of Tampa. The town of Hernando Beach is in Hernando County. Hernando Beach is relatively isolated from other development. Construction of the residential area, residential channels and Gulf of Mexico channel at Hernando Beach began in the 1960s. Hernando Beach consists in three parts: Hernando Beach, Middle Hernando Beach and Hernando Beach South (**Figure 10**). Gulf of Mexico access from Middle Hernando Beach and Hernando Beach South is through a navigation lift and then via the access channels of Hernando Beach; there is no direct water access for boats to the Gulf from Middle Hernando Beach or Hernando Beach South. There are three main east-west access channels at Hernando Beach, other east-west channels and many north-south finger channels. The access channels are approximately 150 feet wide and vary in depth from about six to ten feet. In many locations in the access channels large, hard, rocks protrude above the channel bottom. Several of these are marked so vessels can avoid them. Residential docks line the access channels. At the eastern end of the northernmost east-west access channel (Tarpon Canal) is an area of docks for commercial fishing, as well as a public boat ramp. At the eastern end of the southernmost east-west channel is an area of service facilities. Commercial fishing vessels requiring service at these facilities must head west from their dock area down the northernmost east-west channel, then south down a narrow, twisting access channel and finally east down the southernmost east-west channel to the service facilities. This is a long, dangerous route, however, there is not direct access from the docking facilities/public boat ramp on the north of Hernando Beach to the service facilities on the south side of Hernando Beach.

25. Note that the commercial fishermen must use the access channels to get to the Gulf of Mexico channel, their docking facilities, and their service facilities. In the past there have been concerns raised by the residents of Hernando Beach about noise and about the use of residential facilities for the commercial purposes of docking and unloading catch. Hernando County has ordinances pertaining to these issues and zoning to specify commercial property uses. In August 2000 an effort was made to enforce the zoning and ordinances. Enforcement influenced a small number of vessels, perhaps three, in the commercial fishing fleet, which consists of approximately 60 vessels. Controversy between the residents and the fishermen is a local issue with possible intervention on the part of the County through zoning/ordinances. This matter is of importance to the study since it may impact the commercial fishing fleet. At this time, the impact on the fleet of the zoning enforcement is thought to

have occurred and the vessel fleet used for the economic analysis is the fleet as it exists after the 2000 enforcement.

26. To iterate, the existing Gulf of Mexico channel at Hernando Beach is locally constructed and maintained. It provides vessel access to the Gulf of Mexico from the town of Hernando Beach. Commercial fishermen, shrimpers, stone crabbers, charters, tow vessels and recreational boaters use the channel. The existing channel has design depths of five and one-half feet, mean low water, and six feet, mean low water, a bottom width varying from 35-60 feet and a length of 12,700 feet. Just beyond the Gulf of Mexico end of the channel is a marker known as Watts Tower. There is a depth difference between the channel and the Gulf bottom at the end of the channel, with the Gulf of Mexico bottom being shallower than the channel. Scar marks can be seen on aerial photographs of this area, showing where the vessels have hit and dug into the Gulf of Mexico bottom. Immediately to the north of the channel all along the length of the channel are the islands created during channel construction/maintenance. Although the design depths of the existing channel are five and one-half feet and six feet, mean low water, the channel depth varies along its length and the channel is very shallow in spots (Appendix B-Engineering contains a copy of the hydrographic survey conducted for this study). One reason for the inconsistency in the depth is thought to be the rock that underlies the channel. The dragline, or other mechanical equipment, used to construct the channel may not have been able to remove all of the rock, due to equipment limitations such as accuracy or rock hardness. Another reason for the inconsistency may be the presence of boulders that move in the channel as current conditions change, particularly during storm events. Channel users indicate heavy shoaling in distinct locations, although only one maintenance dredging event has been documented since the channel's initial construction about 1960. As stated previously, the channel has rock on the bottom, some of which juts above the channel bottom. The channel winds with curves in three places. These curves tend to be narrow and the view rounding the curves is obscured by landmasses (dredged material islands). The channel is narrow, causing a problem for vessel traffic that requires two-way movement in passing situations. Frequently one vessel will attempt to move outside of the channel limits in order to let another vessel pass. This can cause damage to the vessel trying to pull over since the area outside of the channel is very shallow and rocky. Both recreational and commercial vessels experience difficulty passing in the narrow channel. Local reports indicate that vessel traffic in the channel is beset by numerous marine incidents and groundings. Commercial users of the channel report significant damage and delays. There has been one death resulting from a marine incident in the channel. Each year at least one commercial fishing vessel sinks in the channel due to damages incurred by hitting the rocks or rock sideslope or by running aground just outside the channel limits.

27. Many recreators use the channel for access to the Gulf of Mexico, for access to the shallow water areas just south of the channel, and for access to the spoil

islands and shallow water areas just north of the spoil island. Recreational craft are frequently forced outside of the channel when passing other vessels since the channel width is sufficient enough only for one-way traffic. When forced out of the channel, or to the channel sideslopes, the craft sustain damages. Sailboats with deeper keels are especially vulnerable to the shallowness of the channel; shallower motorized craft are often able to gain speed and 'plane' on the water surface to avoid hitting bottom but fixed keel sailboats that cannot get up speed cannot avoid the bottom and thus often avoid the channel altogether. Recreational craft and sailboat operators unfamiliar with the channel are particularly vulnerable to its poor channel conditions.

28. Recreators frequent the spoil islands to the north of the channel, particularly on weekends and holidays. Residents report large numbers of boats gathered in the shallow water just north of the spoil islands and larger numbers of people on the boats, in the water, and on the islands. The residents and the County express the desire for more recreational area adjacent to and north of the spoil islands.

29. Weekiwachee Preserve. Much of the land surrounding Hernando Beach is in public ownership as the 7,000-acre Weekiwachee Preserve (Preserve). **Figure 2** shows the location of the Preserve in relation to Hernando Beach. The land that makes up the Preserve was acquired by the Southwest Florida Water Management District in a series of land purchases between 1993-1996. Hernando County contributed funds for the acquisition of land for the Preserve. The Preserve is an area of statewide significance in that it protects the last remaining expanse of significant natural lands remaining along the developed coastline of Hernando County. Within the Preserve are water-filled mine pits, ranging in depth from 35-60 feet, remnants of commercial limerock mining conducted prior to the formation of the Preserve. Partial reclamation of the pits, beginning in 1995, resulted in the creation of littoral shelves along some of the pits' shorelines, however, overall there is very little shallow water habitat in the artificially created lakes. Among the many ecosystem restoration opportunities within the Preserve are creation of shallow water habitat and littoral zone at the mining lakes.

30. The existing condition of the Weekiwachee Preserve is documented in the December 1997 Plan for the Use & Management of the Weekiwachee Preserve. While the Preserve consists of wetlands (mostly saltmarsh), on or near the coast, and uplands east of County Road 595, of particular interest for ecosystem restoration is the subarea of the Preserve that is a former limerock mine. This area, about 600 acres, consists of water-filled mine pits and adjoining disturbed lands. The disturbed lands surrounding the lakes support very little native vegetation. The substrate in these areas consists of exposed limerock or a thin veneer of depauperate soil overlying limerock. **Figure 11** is an aerial photograph of the water-filled mine pits.

31. Surrounding area. East of the Preserve much development has taken place, and continues to take place, along State Road 19, particularly in the region known as Spring Hill. Just south of the Preserve is a water treatment plant. In Middle Hernando Beach there is a water quality concern since the channels there are very deep. Light is unable to penetrate to the bottom and turnovers with fish kills occur because of the extreme water depth. West of the end of the main Hernando Beach channel, approximately 15 miles west, are several permitted artificial reef sites in varying stages of construction. These reef sites are maintained by the County through the Hernando County Port Authority.

32. It is important to note there was a regulatory enforcement action against non-permitted development in the Middle Hernando Beach area in the 1970s. As a result of this action, involving Federal, state and local agencies and the developer, a berm was constructed around Middle Hernando Beach and land was turned over to the state. These actions were taken to protect water quality so that the poor quality water in the canals would have little opportunity to mix with the high quality water of the surrounding marsh. A lift was installed between Middle Hernando Beach and Hernando Beach so that vessels could access the Gulf of Mexico.

Future without-project conditions

33. In the future it is expected that vessel traffic, both commercial and recreational, using the Hernando Beach channel will increase. The channel is expected to experience continued shoaling. Accidents with injuries, groundings, vessel damage and delays are all expected to increase. Maintenance dredging will continue as needed. Maintenance and replacement of the private channel markers will continue on a regular basis. The spoil islands and nearby shallow water areas will remain favorite and frequented recreational areas. There will be no beach. Environmental resources such as plants and animals are expected to be stable unless an extreme manmade or natural event causes disturbance. The implementation plan for the Weekiwachee Preserve will be put into action as time and funding permit. Additional lands in the area will be acquired for conservation. Population is expected to increase and development is expected to continue, especially east of State Road 19.

34. The following assumptions are part of the future without-project condition:

- All reasonably expected nonstructural practices within the discretion of Hernando County, the Hernando County Port Authority, Southwest Florida Water Management District, other public agencies and the transportation industry are implemented at the appropriate times,
- Normal operation and maintenance practices are assumed to be performed over the period of analysis (50 years),
- Sufficient capacity of the hinterland transportation and related facilities and the alternative modes is assumed, and

- Advances in technology affecting the transportation industry are considered, within reason.

Future with-project conditions

35. The future with-project condition is the most likely condition expected to exist in the future if a project is undertaken. The same assumptions underlie the future with-project condition and the future without-project condition. In the with-project condition the main Gulf of Mexico navigation channel will be improved. Maintenance dredging will address shoaling by removal of the shoaled material. Channel markers will be maintained and replaced as needed. Accidents with injuries, groundings, vessel damage and delays are expected to decrease. The spoil islands and nearby shallow water areas will be favorite and frequented recreational areas.

Concise statement of specific problems and opportunities

Problems

36. Problems identified during the course of the study for Hernando Beach channel are summarized in the following list:

- The main channel is too narrow for the vessels that use it,
- The main channel is too shallow for the vessels that use it,
- The main channel twists and has low to no visibility,
- There are rock outcrops in the main channel that impede safe navigation,
- There are moving boulders in the main channel that are a hazard to safe navigation,
- The length of main channel is not sufficient for its depth (the main channel does not go out far enough into Gulf of Mexico),
- The commercial docking and unloading facilities are separated from repair facilities,
- The commercial fishermen must travel through a residential neighborhood and may have docked or unloaded their catch at residential docks in the past,
- The shallow water areas and spoil islands are crowded with recreators at high use times,
- There is no beach,
- A lift is needed to move vessels between the southern residential area and the northern residential area,
- The channels at Middle Hernando Beach are very deep, causing water quality issues, including turnover,
- Storm surge during major events causes flooding,
- The water-filled mine pits have edges that steeply drop off,
- The surface around the water-filled mine pits is altered, as well as the subsurface soil layers,

- In the area of the former limerock mine there are large overburden mounds and erosion gullies,
- Nuisance and exotic plants are growing in the area of the former limerock mine, and
- The exposed limerock in the area of the former mine remains unvegetated.

Problem Statement

37. The main problem with the Hernando Beach channel is that it is unsafe for navigation. The channel is also inefficient. Other problems are difficulty in accessing service facilities and the Gulf of Mexico channel, disregard for zoning, and storm surge. The main problem with recreation on and around the spoil islands is there is no sandy area for recreational use. The main problem with the former limerock mine is that the pits are biologically sterile in comparison to a natural lake environment. The main problem with water quality in Middle Hernando Beach is that the channels are so deep that light cannot penetrate to the bottom, creating an unproductive bottom surface.

Opportunities

38. Opportunities associated with the Hernando Beach channel are summarized as follows:

- Safety can be improved,
- Efficiency can be improved,
- Vessel damages can be reduced,
- Catch or marine harvest can be increased,
- The opportunity cost of time can be decreased,
- Design and construction can widen, deepen, lengthen and straighten the channel and remove rock outcrops,
- Material can be placed along the shoreline to create a sandy recreational area,
- Issue resolution can be achieved between residents and fishermen,
- The environment, including water quality, can be restored, enhanced or improved at Weekiwachee Preserve and in Middle Hernando Beach, and
- Habitat can be created in the vicinity of the existing artificial reefs.

39. Improved navigation due to the deepening, widening, straightening and clearing of the channel is expected to increase safety (reduce the number of marine incidents) and reduce vessel damage costs. Local commercial and recreational boaters report prospects for increased and sustainable catches with an improved channel. An increase in catch and a sustainable catch will increase revenue in the local fishing industry. Lost opportunities due to the cost of time will be lessened with improved channel conditions. The opportunity exists to place material along the shoreline to create an area for recreational use. An opportunity exists to resolve issues between residents and fishermen.

Opportunities also exist, in keeping with the Weekiwachee Preserve's Management Plan, for mine pit reclamation, environmental restoration, and environmental enhancement in the Preserve. The opportunity exists to improve the environment, particularly water quality, in Middle Hernando Beach. In addition, the opportunity exists to create, enlarge, or enhance hardbottom habitat west of Hernando Beach in the Gulf of Mexico in the vicinity of the existing artificial reefs.

Opportunity statement

40. The main opportunity for the Hernando Beach channel is to improve safety. There is also an opportunity to increase economic efficiency. There is an opportunity to create a sandy area for recreational use. The main opportunity for the Weekiwachee Preserve is to improve biological productivity in the area of the former limerock mine. An opportunity exists to improve the biological productivity in the vicinity of the artificial reef sites. An opportunity also exists to improve water quality in Middle Hernando Beach. The opportunity exists to promote dialogue and reconciliation over zoning issues.

Goals

41. The goal of this Federal study is to determine whether NED can be enhanced through the construction of a water resources project at Hernando Beach, Florida. Specifically, the goal is to determine whether a water resources project at Hernando Beach, Florida, will contribute to NED consistent with protecting the Nation's environment, in accordance with national environmental statutes, applicable executive orders, and other Federal planning requirements.

Objectives

42. The objective of this study is to investigate and recommend a solution to the navigation problems of safety and inefficiency at Hernando Beach, with a focus on placement of dredged material as beneficial use for improvement of the environment. Specific objectives are the following:

- To minimize channel-related damages and disruptions to the commercial fishing industry and to recreational boaters in Hernando Beach due to insufficient channel depth,
- To minimize channel-related damages and traffic congestion to commercial fishermen and recreational boaters using the Hernando Beach channel due to insufficient channel width,
- To improve recreation on and near the channel with a focus on creation of a sandy area, and
- To improve the environment in the vicinity of Hernando Beach.

43. The role of the Corps of Engineers with respect to navigation is to provide safe, reliable and efficient waterborne transportation systems for the movement of commerce, national security and recreation. This is accomplished through capital improvement and operation and maintenance of existing projects. The Corps of Engineers classifies the Hernando Beach channel as a shallow draft waterway, supporting vessels with drafts equal to or less than 14 feet. The benefits evaluated for this shallow draft channel come from commercial fishing, charter fishing craft, head boats and recreational craft. The study to establish Federal interest in a project at Hernando Beach is conducted under the Continuing Authorities Program in keeping with the program's purpose of planning, designing, and constructing projects of limited scope and complexity.

Planning constraints

44. Constraints are restrictions that limit the extent of the planning process. For this study, the constraints fall into two categories, resource constraints and planning constraints. The resource constraints are knowledge, expertise, experience, ability, data, information, time and money. These constraints are common to all planning studies. This study, as set forth in the Feasibility Cost Sharing Agreement/Project Study Plan, requires a fixed amount of funding, in turn determined by the tasks deemed necessary for evaluation of alternative solutions to the identified problems, and approximately three years to complete. To minimize the impact of the constraints of knowledge, expertise, experience, ability, data and information, every effort has been made to coordinate the study with interested parties, such as Federal and State resource agencies and stakeholders. The planning constraints are legal and policy constraints. These constraints are those defined by law, and by Corps of Engineers policy and guidance. The authority for the study is the Continuing Authorities Program; this limits the cost-shared Federal expenditure to $4,000,000. When plans were formulated to provide solutions to the identified problems, adverse impacts to threatened or endangered species were avoided. Adverse impacts on cultural resources were also avoided. Plans were also formulated to meet State water quality standards. Other constraints came to light during the study, including the lack of upland for an upland placement area of size sufficient to contain the material to be removed during channel construction, due to the coastal surroundings; and the limit in the equipment available in the dredging industry to remove material from shallow waters such as those found in and around the channel area.

Public involvement

45. For this study, the public includes individuals, organizations or governmental entities that might be affected by or interested in the results of the study. Efforts were made to involve the public according to the public involvement strategy described in Appendix G-Public Involvement. Coordination efforts were also made with all governmental entities identified as having a possible interest in the

study and its outcome. Coordination efforts are different from public involvement efforts in that coordination efforts are formal exchanges of information by letter, report, meeting or other means between the Corps and other governmental entities. Collaboration occurred for this study as the Corps worked jointly with Hernando County, Florida DEP, U.S. Fish and Wildlife Service, National Marine Fisheries Service, Southwest Florida Water Management District and Audubon of Florida. Collaboration is distinguished from the less formal public involvement and the more formal coordination by the active involvement of parties in either conducting the study or implementing the recommended plan. Every effort was made to conduct this study in an open atmosphere to attain public understanding, trust and mutual cooperation. A concerted effort was also made to provide the public with opportunities to participate throughout the entire study. **Table 1** summarizes major events during the initial appraisal and feasibility study. These events were opportunities for public involvement, coordination and collaboration. Comments and questions were entertained throughout the duration of the study in person, in writing (traditional letters or e-mail) and over the telephone. Letters received during scoping, as part of the National Environmental Policy Act coordination, and the study mailing list are found with the Environmental Assessment. Pertinent documentation of the events listed in **Table 1** is also found in Appendix G-Public Involvement.

Table 1. Public involvement	
Date	**Action**
September 1994	Field trip by Corps to see project area
June 1997	Town hall meeting
July 1997	Meeting with Board of County Commissioners
August 1997	Town hall meeting and meeting with Board of County Commissioners
April 1998	Meeting to discuss FCSA/PSP
June 1998	Site visit with resource agencies
February 1999	Meeting with Board of County Commissioners
March 1999	Site visit by Corps study team
February 2000	Meeting with Board of County Commissioners
April 2000	Meeting with commercial fishermen
May 2000	Town hall meeting
June 2000	Stakeholders meeting
August 2000	Site visit with U.S. Fish and Wildlife Service
December 2000	Site visit with resource agencies
June 2001	Meeting with Board of County Commissioners
June 2001	Site visit with Corps' Waterways Experiment Station research personnel
October 2002	Town hall meeting
January 2003	Site visit with Florida Department of Environmental Protection

Alternative plans

Measures available to address identified problems and opportunities

46. The following measures are available to address the identified problems and opportunities, for the project purposes of navigation and recreation:

- widen the existing channel,
- straighten the existing channel,
- deepen the existing channel,
- lengthen the existing channel,
- clear the existing channel of shoaled material and boulders,

- discuss zoning and commercial practices in dialogue with residents and commercial interests,
- remove the lift connecting Hernando Beach South to Hernando Beach and dredge a channel from Hernando Beach South to the Gulf of Mexico in place of the lift,
- connect the service facilities and the commercial fishing facilities by water by constructing bridges.

47. All of these measures are structural except for the dialog on zoning and commercial practices, which is a nonstructural action.

Reasons for selecting and combining measures to formulate alternative plans that meet identified problems and opportunities

48. Measures were selected and combined on the basis of whether they met the objectives of the study and whether they avoided the constraints. A placement analysis was conducted for those measures specific to placement of dredged material. The following questions summarize the basis of whether a measure met the objectives and avoided the constraints of the study:

- Does the measure in question address the navigation problems of safety and inefficiency at Hernando Beach?
- Does it minimize channel-related disruptions to the commercial fishing industry in Hernando Beach?
- Does it minimize channel-related traffic congestion to commercial fishermen and recreational boaters using the Hernando Beach channel?
- Does it improve recreation?
- Does the measure avoid adverse impacts to threatened and endangered species?
- Does the measure avoid adverse impacts to cultural resources?
- Does the measure contribute to meeting State water quality standards?

Screening of alternative plans

49. The following measures were excluded from the alternative plan formulation and from the placement area analysis for the reasons given:

- The nonstructural measure of discussing zoning and commercial practices in dialogue with residents and commercial interests is also best addressed by local interests.
- Removing the lift connecting Hernando Beach South to Hernando Beach and dredging a channel from Hernando Beach South to the Gulf of Mexico in place of the lift would benefit only recreational vessels and would not lessen the problems the commercial fishermen have with the main Gulf channel, therefore it is outside the realm of Federal interest. In addition, dredging the channel would have

environmental impacts. This issue is best left to State and local interests to resolve.

- Connecting the service facilities and the commercial fishing facilities by water by constructing bridges is an access issue best dealt with by local interests.

50. Therefore, after an initial round of formulation, the following measures were eliminated:

- to discuss zoning and commercial practices in dialogue with residents and commercial interests,
- to remove the lift connecting Hernando Beach South to Hernando Beach and dredge a channel from Hernando Beach South to the Gulf of Mexico in place of the lift,
- to connect the service facilities and the commercial fishing facilities by water by constructing bridges.

51. The following remaining structural measures (refined list of measures) were combined in the various ways described below:

- widening the existing channel,
- straightening the existing channel,
- deepening the existing channel,
- lengthening the existing channel,
- clearing the existing channel of shoaled material and boulders.

52. Widening and straightening the existing channel were combined to promote safe navigation.

53. Deepening and lengthening were also combined since the length of the channel is a function of the depth (a design feature of Federal channels is generally that they end at the depth contour equivalent to the project depth). Clearing the existing channel is inherent in any construction improvement and thus it was assumed to be understood for all deepening projects. The following paragraphs present information used for the design and describe the design process and the final channel design.

54. Combined measures then, are the following: 1)Widen and straighten the existing channel and 2)Deepen and lengthen the existing channel. Alternative plans arising from these combined measures are the following: a)Widen and straighten the existing channel, b)Deepen and lengthen the existing channel and c)Widen, straighten, deepen and lengthen the existing channel. To scale these plans, a design vessel was chosen and Corps of Engineers channel design criteria were applied. Many channel alignments were considered and a channel design developed. **Table 2** presents a summary of the scaling of the alternative plans. The no action plan is always a consideration but does not include any of the measures or any scaling. The scales applied to the alternative plans are

described in the following paragraphs. Any channel improvement project that would involve removal of material would also involve placement of that material at some destination. The placement area analysis is also described below.

55. Photographs **Photograph 1** shows a vessel stranded in the channel. This photo exemplifies one of the difficulties faced by vessels traversing the channel. Damages occur if vessels stray outside of the deepest parts of the channel. Every year one commercial fishing vessel is lost to the fleet due to irreparable damage incurred as a result of the narrow, shallow, winding channel. **Photograph 2** shows some of the vessels in the commercial fishing fleet at dock. **Photograph 3** shows two vessels in the narrow channel. Note the channel markers denoting the sides of the channel.

56. Channel Design Corps of Engineers' guidance on channel design is Engineer Manual (EM) 1110-2-1613, Hydraulic Design Guidance for Deep-Draft Navigation Projects, 31 August 1995. Note the title specifies deep-draft navigation, not shallow-draft navigation as found at Hernando Beach channel. This guidance supercedes EM 1110-2-1613, Hydraulic Design of Deep-Draft Navigation Projects, 8 April 1983. A significant difference between these two versions of the guidance is that the 1983 guidance relies on vessel dimensions plus dimensions for safe navigation whereas the 1995 guidance relies on vessel dimensions times multipliers for safe navigation. It is often interesting to compare the channel dimensions resulting from each type of design process.

57. *Design vessel.* Channel design generally begins with a design vessel, or representative design vessels if the fleet consists in more than one vessel type. For the Hernando Beach navigation study there is one design vessel due to the continuity in vessel type of the commercial shrimpers. The design vessel for the Hernando Beach study is a commercial bait shrimper with a loaded draft (non-moving) of 4 ¼ feet, a breadth of 14 ¼ feet and a length of 45-46 feet. These dimensions are documented in **Figure 12**.

58. *Channel dimensions-depth.* The reference presently for Corps of Engineers navigation projects is mean lower low water (mllw). **Figure 5** is a schematic showing the relationships of the various terms used to describe water level. North American Vertical Datum 88 (for 1988) is a non-water based (land-based) reference plane.

Table 2. Scaling of alternative plans						
Plan	No action[1]	Plan a)Widen/straighten		Plan b)Deepen/lengthen		Plan c)Widen/straighten/deepen/lengthen
Measure		Widen	Straighten	Deepen	Lengthen	
Scale						
Width						
65 feet		X				X
80 feet		X				X
85 feet		X				X
95 feet		X				X
100 feet		X				X
Location						
1			X			X
2			X			X
3			X			X
4			X			X
5			X			X
6			X			X
7			X			X
Depth						
8/10				X	X	X
8				X	X	X
7				X	X	X
6				X	X	X
Overdepth						
2+2				X	X	X
1+1				X	X	X
Note: The no action plan is always a viable alternative plan. It includes no measures to address the problems/opportunities.						

59. Channel depth includes three descriptors: project depth, required overdepth and allowable overdepth. Channel depth is determined by economics in an incremental fashion and the economic depth includes a risk factor that vessel operators are willing to assume. The depth that maximizes net benefits becomes the project depth. Channel depth is costed by engineering principles using a zero-risk design depth. The following paragraphs focus on the zero-risk depth.

60. **Figure 13** is a visual description of the factors considered when determining the zero-risk depth. For the case of Hernando Beach channel, the design ship loaded draft is four and one-quarter feet. The effect of fresh water, ship motion from waves and squat underway are assumed to be zero due to the calm nature of the Gulf of Mexico. The safety clearance is generally two feet when the bottom of the channel is in soft material and three feet when the bottom of the channel is in rock. The project depth for the Hernando Beach channel is the sum of the draft and the safety clearance or, in keeping with the guidance and the fact that the channel is in rock, seven and one-quarter feet. This was the basis for the initial eight-foot project depth.

61. Also, initially, the channel was designed with an entrance channel component. Entrance channels are usually deeper than the more landward segments of a Federal channel to take into account wave action further from land. The Hernando Beach entrance channel was to have a project depth of ten feet, an additional two feet over the main channel project depth of eight feet. Since the wave climate in the vicinity of Hernando Beach channel is expected to be calm the entrance channel depth was eliminated and the entire channel given the same depth over its length.

62. Since the channel winds, with curves in several places, wideners were included in the channel width design to allow for safe navigation in the bends. Widener design is described in detail in EM 1110-2-1613. At the eastern end of the Federal channel design there are wideners both to the north and to the south, creating a 'flare'. The U.S. Coast Guard requested a turning basin with minimum diameter 175 feet for turning the vessel that places and maintains aids to navigation. This turning basin is included in the flare at the eastern end of the Federal channel.

63. Corps of Engineers' navigation channels are constructed with required overdepth and allowable overdepth. Engineer Regulation (ER) 1130-2-307, Operations Dredging Policies and Practices, 1 June 1991, states the following:

> New work dredging plans and specifications, where hard materials exist (e.g. dense clays, rock, or manmade materials), shall have a required depth, required overdepth, and allowable overdepth, in order to ensure future maintenance of the project to the authorized dimensions.

64. Engineer Regulation 1130-2-520, Navigation and Dredging Operations and Maintenance Policies, Chapter 8, provides the following information:

> Allowable overdepth dredging (depth and/or width) outside the required prism is permitted to allow for inaccuracies in the dredging process. District commanders may dredge a maximum of two feet of allowable overdepth in coastal regions (to include the Great lakes, Columbia & Lower Willamette Rivers, etc.), and in inland navigation channels. Allowable overdepth in excess of these allowances or the use of zero allowable overdepth requires the prior approval of the MSC commander.

65. Initially the project was designed with two feet of required overdepth and two feet of allowable overdepth. This was because the channel would be constructed in rock. In order for the channel to be cost effective and to minimize impacts to the environment the required and allowable overdepths were reduced for the final design to one foot each. This means, for example, that the channel with the eight-foot project depth would be costed to 12 feet (8+2 required+2 allowable feet). The final design is for a six-foot project depth with one foot of required overdepth and one foot of allowable overdepth. Thus, the final design is costed to eight feet (mllw).

66. Note that required and allowable overdepths are different from advance maintenance dredging which may be performed in critical or fast-shoaling areas to avoid frequent redredging and ensure the least overall cost of maintaining the project. No extensive advance maintenance analysis was conducted for the Hernando Beach channel as the channel is in rock with a maintenance interval of once every 23 years. Any rapidly shoaling areas of the channel cannot be identified at this time due to the lack of frequent maintenance dredging events. In the event they can be defined at a later time, and in the event it appears cost efficient to perform advance maintenance, an advance maintenance analysis can be conducted and submitted to higher authority for approval. Approvals on advance maintenance are made at the Division level.

67. *Channel dimensions-width.* Channel width is also designed using the design vessel as a basis. Other factors that are considered when determining channel width are channel type and whether there is to be one-way or two-way traffic. For the Hernando Beach channel the channel type is the trench type channel and the traffic is two-way traffic. The two-way traffic assumption is made to alleviate damages to passing vessels as are presently occurring with the existing channel. It is also assumed that the vessels passing will have the same breadth. Assuming a maximum current between 0 and 0.5 knots the width multiplier for a trench canal, best aids to navigation, constant channel width, is 4.5. Since the design vessel breadth is 14 ¼ feet, the resulting bottom width is 65 feet. Using the multiplier for currents in knots of 0.5-1.5, which is 5.5, yields a bottom width

of 80 feet (rounded up to the nearest five feet). Using the multiplier for currents in knots of 1.5-3.0, which is 6.5, yields a bottom width of 95 feet (rounded up to the nearest five feet). The original channel design had a bottom width of 100 feet. This was narrowed to 85 feet to bring down costs, and further to 80 feet again to minimize dredging costs and avoid impacts to seagrasses. The U.S. Coast Guard requested a minimum channel width of 80 feet, for the vessel that places and maintains aids to navigation (**Photograph 4**).

68. Trench-type channels are trapezoidal in shape, with a bottom and sideslopes. For the Hernando Beach channel the sideslopes are assumed to fall at 1:3. If the channel bottom is about four feet below the Gulf bottom the sideslopes account for about 12 feet horizontally. **Figure 14** shows these dimensions. Sideslopes are generally cut during construction by the box method. Since this channel is cut in rock the sideslopes may fall at or near vertical. The additional 15 feet of bottom width over the minimum 65-foot design width could be viewed as accounting for a nearly vertical sideslope.

69. *Channel length.* Generally, channels begin at the contour with the same depth as the project depth for that segment of the channel. For Hernando Beach channel, this contour is the six-foot contour.

70. Originally the channel design ended at Watts Tower. During a review of the channel, the U.S. Coast Guard pointed out that consideration should be given to whether the channel extended far enough out into the Gulf of Mexico, that is, to the six-foot contour. Since no survey data was collected for the study beyond Watts Tower, the Coast Chart was relied upon to determine the location of the six-foot contour.

71. *Channel alignment.* Many channel alignments were initially considered, **Figure 15.** Two channel alignments, as shown in **Figure 16**, were retained for further consideration during initial formulation. Channel alignments usually follow natural deep water, to maximize the influence of tides and currents and to minimize dredging requirements. **Figure 15** shows seven alignment components, as follows:

1. Existing channel
2. Channel extension
3. Elimination of two bends, plus turning basin
4. Elimination of two bends, southern
5. Elimination of one bend, middle section
6. Elimination of one bend, east section
7. Elimination of two bends, northern

72. During initial formulation, merit was seen in utilizing the existing channel as much as possible to reduce dredging requirements. The alignment that cut across the flats, component 3 above, was retained for further consideration

during initial formulation as well. This alignment was eventually eliminated upon realization that it cut across virgin flats and would require removal of a significant amount of material, thereby costing more. The final alignment is a combination of components 1, 2 and 6. This alignment makes maximum use of the existing channel, extends the channel to the necessary contour (consistent with the project depth) and eliminates or reduces the severity of bends for ease of navigation. Extending the channel straight out beyond Watts Tower to the six-foot contour will encourage vessels to stay out of the seagrass beds in the vicinity of the end of the existing channel since the depth in the improved channel will be adequate for navigation and boat operators will want to remain in the channel to avoid vessel damage.

73. In keeping with Corps of Engineers guidance, the U.S. Coast Guard was requested to provide safety information for the existing channel. In addition to information from the Coast Guard, safety information was also obtained from the Hernando County Marine Industry Council, U.S. Coast Guard Auxiliary Flotilla 15-8 and Florida Fish and Wildlife Conservation Commission, Division of Law Enforcement, Boating Safety & Waterway Management Section. Letters from these agencies regarding safety are included In Appendix E-Correspondence.

74. It was finally determined that based on the design vessel and based on U.S. Coast Guard requirements for placing and maintaining aids to navigation, a minimum project depth of six feet, mean lower low water, would be needed for safety and to realize project benefits. Recall, the design vessel has a draft of 4 ¼ feet, a breadth of 14 ¼ feet and a length of 45 ½ feet. Due to the consistency in the dimensions of the commercial fleet it is not necessary to optimize for depth. No additional benefits would be realized at depths deeper than six feet, although costs would increase at the deeper depths, due, in part, to the larger volumes of material needing removal. In addition, based on the design vessel (assuming two-way vessel traffic) and U.S. Coast Guard requirements, a minimum channel depth of six feet, bottom width of 80 feet and turning basin of 175-foot minimum diameter would be needed. A project constructed to a project depth of six feet, mean lower low water, would extend to the six-foot contour, lengthening the channel by approximately 8,000 feet. The final channel design extends the channel beyond the end of the present channel and beyond the existing aid to navigation known as 'Watts Tower' to the six-foot contour (as indicated on the U.S. Coast Guard's Coast Chart). Two alignments were considered for the extension, one that meets the six-foot contour by the shortest route and bends to the northeast and another that meets the six-foot contour by heading along the bearing of the existing channel. The latter alignment was chosen as the safest route for navigation since it requires no bend, widener or aid to navigation. Since boaters will not have to turn in order to meet deep water this alignment should lessen the amount of propeller scarring that is presently occurring near the end of the existing channel. **Figure 17** shows the final channel design.

75. Placement analysis. A placement analysis was conducted to determine possible placement sites. The greatest impediment to traditional upland placement is the lack of suitable acreage on which to locate a diked placement area since the land in the immediate vicinity of Hernando Beach is predominately marsh. Verbal communication with Southwest Florida Water Management District personnel revealed the Weekiwachee Preserve is not a candidate for placement in a traditional upland confined area. **Figure 18** shows the calculations for a traditional upland placement area. In order to hold just the fine material removed from the Hernando Beach channel, an area of approximately 15 acres would be needed. The largest area identified in Hernando Beach that might be developed as a placement area is about five acres in size. Since traditional upland placement appeared to be out of the question, creative options were sought for placement. The following options were considered for placement (**Figure 19**):

a) Adjacent to and north of the existing channel on the existing spoil islands,
b) North of the existing spoil islands as thin-layer placement,
c) North of the existing spoil islands for creation of a recreational area,
d) On the Gulf bottom adjacent to and south of the existing channel to create new spoil islands,
e) West of the town of Hernando Beach to create a breakwater,
f) At the mouth of Minnow Creek where the channel would be re-aligned to fill the existing channel,
g) On Coon Key Point in an upland placement area,
h) As road fill for highway improvements along C.R. 597,
i) To fill the borrow canals along C.R. 597,
j) Upland at either of two sites near the county boat ramp,
k) In the canal just west of the Weekiwachee Preserve, to retard/stop leakage,
l) In Weekiwachee Preserve for littoral zone habitat creation,
m) In Weekiwachee Preserve for shallow water habitat creation,
n) In Weekiwachee Preserve at site of future County park (upland placement with reuse for park construction)
o) In Weekiwachee Preserve to create an island for birds,
p) In Weekiwachee Preserve to plug underground conduits and retard water flow to the west,
q) At or near any of the County's existing, permitted, artificial reef sites for hardbottom habitat creation
r) In the canals of Middle Hernando Beach to shallow them and improve water quality.

76. **Photographs 5** and **6** show the existing spoil islands north of the channel. **Photograph 7** shows Little Lake. Note the absence of vegetation around the edges, indicative of the steepness of the slope. **Photograph 8** provides an example of exotic vegetation at the edge of one of the former mine pits in the Weekiwachee Preserve. The conceptual designs for littoral zone habitat creation and shallow water habitat creation involve removing exotic vegetation.

77. Explanations as to why some of these ideas were not carried further through plan formulation follow.

a)Even though during early dredging events material was placed north of the channel to create islands, in the present environmental climate this action is unacceptable. Habitat conversions, in this case from underwater to above water, are discouraged.
b)Seagrasses and marsh exist north of the spoil islands so thin-layer placement would potentially smother them. This option would be suitable for the finer material removed from the channel but not for the rock.
d)Same reasoning as placement option a).
e)The breakwater was deemed to be unlikely to serve the purpose of flood protection and eliminated from further consideration. Constructing a breakwater might have an effect on storm surge but would not alleviate channel problems. The effect on storm surge is uncertain due to the type and severity of storms that affect the area and due to the geographic layout of the area. The Hernando Beach area is so large with so much land/water interface that a breakwater would most likely be ineffective when the water level rose above a certain level. In all likelihood the benefit of a breakwater would not outweigh the costs.
f)Seagrasses exist in the channel in this location. Filling the channel segment with material would smother the seagrasses.
g)Coon Key point is primarily wetland. An upland area of sufficient size is not available there.
h)An upland placement area would be needed before using the material as road fill, in order to dry out the material. No site of adequate size could be located in the vicinity of Hernando Beach.
i)The canals on either side of C.R. 597 provide shallow water habitat and recreation areas.
j)Neither of the sites near the boat ramp are large enough for the amount of material to be removed.
k)The canal serves as a stormwater system for the area and also as waterfront for local restaurants and might lose these functions if filled.
n)The timing of the channel improvements and park construction do not allow enough overlap for this alternative to be feasible.
o) Creating an island for birds in one of the former mining pits would require a larger volume of material than would be available as a result of channel construction.
p) Plugging underwater conduits at the western edge of the former mining area would require larger-sized rocks than would be available as a result of channel construction.
r) Shallowing the canals in Middle Hernando Beach met opposition from some residents and was therefore removed from further consideration.

78. Placing material along the shoreline to create a recreational area was carried on for additional consideration. Although this option might appear to be a subset

of placing material on the existing spoil islands it was retained since the area of impact would be relatively smaller and since an area could probably be found that was already disturbed. A site visit was made with Florida Department of Environmental Protection in January 2003 to view possible locations for the recreational area. Initially the south side of the spoil island just west of Coon Key was the focus area for a recreational area, however, this location was not deemed most suitable since material placed there might slough into the channel. The area on the north side of this spoil island became the ultimate focus for creation of a recreational area. Beach design considerations include avoiding impacts to the environment and longterm stability. Finer material removed during channel improvement could be used for initial nourishment and maintenance material from the improved channel could be used for renourishment of the recreational area in the future. Although sea turtles have not been known to nest in the Hernando Beach area, a sandy stretch of shoreline might encourage nesting.

79. Creating littoral zone habitat in the former mine pits in the Weekiwachee Preserve was considered further. The northwesternmost mine pit and the smallest mine pit, known as Little Lake, were identified as candidates for creation of littoral zone habitat. Due to the depth of the northwesternmost mine pit and the lack of success in past attempts, during initial reclamation, to create littoral zones at the edges of the deeper mine pits, this area was eliminated from further consideration. Little Lake was retained for further consideration since it has a small area (four acres), is relatively shallow (38 feet deep) and has a shallow lobe (12 feet deep) at its eastern end.

80. Creating shallow water habitat in the former mine pits in the Weekiwachee Preserve was also given further consideration. The only mine pit deemed suitable for shallow water habitat creation is Little Lake, again due to its relatively small size and shallow depth. Other mine pits are too deep and too big, having volumes too large to successfully raise their bottom surfaces into the photic zone with material removed from the channel during construction. Little Lake, however, does not hold enough volume to handle all the material expected to be removed during channel construction. The fine material could be placed in Little Lake and the rock placed elsewhere.

81. Creating hardbottom habitat in the vicinity of the existing artificial reefs was also retained for further consideration. Both low profile and high profile hardbottom could be considered for creation to attract pelagic and demeral fish species, as well as to serve as substrate for benthic organisms, sponges and algae.

82. Creating littoral zone habitat and creating shallow water habitat were combined since both could be accomplished at Little Lake.

83. At this point in the plan formulation there is one channel design/alignment and three possible placement areas. The channel design/alignment is a 20,500-foot long channel with a project depth of six feet, mllw, and a bottom width of 80 feet. This design/alignment is the minimum design/alignment that will achieve project benefits and U.S. Coast Guard requirements. The channel extends from the mouth of Minnow Creek gulfward to the six-foot contour. It takes maximum advantage of the deep water in the existing channel, with most widening to the south to avoid cutting into the spoil islands. The channel is designed with one foot of required overdepth and one foot of allowable overdepth. It has wideners in the bends. The three possible placement areas are Little Lake in Weekiwachee Preserve, north of the spoil island adjacent to Coon Key Point (resulting in shoreline placement for recreation) and at one of the County's existing artificial reef sites (resulting in hardbottom habitat creation).

84. Material to be removed during channel construction consists of sand, peat, clay, and rock. These material types are presented by volume in **Table 3**. The sand lies on top of the rock in a fairly uniform one-foot thick layer. The rock is limestone and if removed by mechanical means might be in chunks ranging in diameter from several inches to two feet. This is the size distribution of the rock on the existing spoil islands to the north of the channel. The spoil islands were created by placement of material removed from the channel. They are very rocky since the finer materials have washed away over time. Photographs **5** and **6** show the rocky spoil islands. Geotechnical data was collected only to the Watts Tower, not beyond to the six-foot contour. Additional geotechnical work may need to be collected during plans and specifications phase.

Table 3. Volumes to be removed (cubic yards)

Rock	Sand	Clay, Peat and other materials	Total
206,000	124,000	3,000	333,000

85. Consideration of material type and equipment limitations further refines the placement analysis. Local knowledge revealed that construction of the existing channel was by dragline. Photographs of the dragline reportedly used for channel construction are shown as **Figure 6**. It appears this dragline is a modified version of the type used in the mining industry, fitted to 'walk' in the water. Were the rock at the bottom of the channel removed with this, or similar, mechanical equipment it might take the form of large chunks or boulders. Were it removed with a cutter suction dredge it might take the form of smaller rock fragments. When considering the plant that could be used for channel construction, it was realized that some dredging plant could not be used in this area due to the shallow water depth. Drilling and blasting are assumed to be unnecessary since the precedent is set, by previous channel construction, that the rock can be removed with a mechanical dredge.

86. Placement of all the material along the shoreline for a recreational area is not likely since the rock is not suitable as a sandy substrate. However, the sand could be placed at the shoreline placement site and the rock at a hardbottom habitat site.

87. Placement of all the material for littoral zone and shallow water habitat creation at Little Lake is not likely since Little Lake will not hold all the material. The sand could be placed at Little Lake and the rock placed at a reef site.

88. Hernando County has several existing artificial reef sites. The Richardson Reef site was selected over the other sites as the most viable for placement of the dredged material since it is the closest site to the channel and would therefore involve the least cost. The location of the Richardson Reef site is shown in **Appendix H.** The proposed location for the hardbottom habitat creation is shown on **Plate B-6** (Engineering Appendix). Photocopies of the permits for the Richardson reef site is found in Appendix D-Supplemental Information. Some concrete materials have been placed at the Richardson Reef but it is by no means a fully constructed project. The depth of the water at the Richardson Reef site is 15-20 feet. The material removed during channel construction would be placed near the site for hardbottom creation. Hardbottom habitat near the Richardson Reef should improve biodiversity in the area through the attraction of species that would not be found on the featureless Gulf bottom.

89. For the conceptual reef design (**Figure 20**), it was assumed that approximately 26,000 linear feet of hardbottom could be created using all the material to be removed from the channel during construction. This hardbottom is to be low-profile hardbottom to provide habitat for demersal species, algae, sponges and the like. The material is assumed to be placed in irregular rows about 80 feet wide and five feet high. The Richardson Reef is located in about 15-20 feet of water so there would still be about 10-15 feet of clearance between the tops of the hardbottom rows and the water surface. This should be enough clearance for any vessel moving in the waters where the reef is located.

90. The total surface area of hardbottom will be about 48 acres (30 acres if only the rock is placed at the reef site). About 127,000 cubic yards of sand and 206,000 cubic yards of limerock will make up the hardbottom. The rock is expected to be chunks four inches to two feet in diameter, with some possibly larger. Again, the sizes of the rocks making up the existing spoil islands on the north side of the present channel give an indication of the rock sizes to be placed for hardbottom. According to the Guidelines, quarry rock is the preferred material for constructing artificial reefs. In Florida, limerock has been used in reef construction in Palm Beach County, off Boca Raton and in Dade County. Limestone has the benefit of being comprised of calcium carbonate, the primary component of most natural reefs in the Gulf of Mexico and is compatible with the environment. In addition, rock is a very dense material so it is unlikely to move off the site except in the most extreme conditions. Rock is durable and the

hardbottom made of it should last a long time. Indications are that rock is a good fish attractant and provides a good surface for fouling benthos to attach.

91. The design for the shallow water habitat and littoral zone habitat at Little Lake (**Figure 21**) is dependent on the amount of material to be placed there. In order to raise the bottom surface of the entire main lake body, which is about four acres in size, into the photic zone (assumed to be at six feet below the water surface), approximately 205,000 cubic yards of material will be needed. This volume is less than the entire volume to be removed but more than the volume of the fines. Thus, the volume of the fine material removed during channel construction is not enough to raise the entire bottom surface into the photic zone and as a result, a sloping surface was chosen for the lake design. The slope will be very shallow, about one foot in the vertical direction for every ten feet in the horizontal direction. The natural repose of sand is at about one foot in the vertical direction for every three feet in the horizontal direction, so at 1V:10H a very stable slope should result. About 127,000 cubic yards of material would be used to shallow Little Lake.

92. The lobe at the eastern end of Little Lake is about one-third of an acre in size, with a depth of about 12 and one-half feet. In order to raise the bottom surface of the lobe to an elevation suitable for littoral zone or marsh creation, assumed to be about one and one-half feet below the water surface in the center of the lobe, approximately 6,000 cubic yards of material will be needed. Prior to filling with dredged material, exotic vegetation will be removed manually. For stability, native species will be planted after filling. A suitable candidate for planting is widgeongrass, since it tolerates saltier waters. Other candidates are listed in the Plan. It is anticipated that grasses will be planted on one-foot spacings in order to promote stability.

93. About three acres of shallower water habitat, one acre of shallow water habitat (in photic zone) and one-third acre of littoral zone will be created in Little Lake. An alternative plan might be to use the piles of rock material still found in the former mining area in addition to the material removed during the channel construction to bring the entire bottom surface of Little Lake into the photic zone. The shallow water created as a result would probably be of even more benefit to the environment.

94. Material could be placed adjacent to and north of the existing spoil islands and create a recreational area. **Figure 22** is a schematic of a recreational area. Material would be placed at about the same height as the top of the existing spoil island and grade downward to the existing bottom. About 20 acres of recreational area would be created.

95. Environmental Resources. A submerged aquatic vegetation (SAV) and oyster bed survey was conducted to document the presence or absence of seagrass and oyster beds in the Hernando Beach area. A cultural resources

survey was also conducted, as well as a hazardous, toxic and radioactive waste (HTRW) assessment. The presence of threatened or endangered species was determined. Audubon of Florida conducted a one-time detailed bird survey. Comprehensive information on these investigations is found in the Environmental Assessment.

96. Halodule wrightii, Thalassia testudinum and algae were present in the channel area. Oyster beds were found outside of the area that would be disturbed by a channel improvement project. The proposed channel area beyond Watts Tower was not surveyed. Seagrasses in this area are assumed to be similar in type and abundance to those at the western end of the main channel. Halodule wrightii and thalassia testudinum were found in the area between the end of the existing channel and Watts Tower.

97. As indicated in the biological survey conducted prior to the 1978 permit issuance and as demonstrated by the Bayport Channel baseline and monitoring seagrass surveys (Appendix D-Supplemental Information), impacts to seagrasses due to dredging are expected to be temporary. In fact, additional seagrass habitat may exist after channel construction, as some areas that are now too shallow for abundant seagrass growth will be made deeper by the construction. **Figure 30** shows the seagrass coverage.

98. A cultural resources remote sensing survey has identified a number of magnetometer anomalies along the channel that may be indicative of submerged cultural resources and warrant further investigations. These investigations will occur during Preconstruction Engineering and Design. No HTRW concerns were identified. The manatee and several species of sea turtle were identified as threatened or endangered species possible occurring in the area, however, no turtle nesting has been documented in Hernando County and there are no designated critical habitat areas.

Presentation and evaluation of a final array of alternative plans

99. The final array of alternative plans is the following:

a) Plan number one. No action.
b) Plan number two. This plan is to widen the channel to an 80-foot bottom width, deepen the channel to a six-foot, mean lower low water, depth, extend the channel to the six-foot contour; and to create shallow water and littoral zone habitat at Little Lake and to create hardbottom habitat near the Richardson Reef.
c) Plan number three. This plan is to widen the channel to an 80-foot bottom width, deepen the channel to a six-foot, mean lower low water, depth, extend the channel to the six-foot contour; to place material along the shoreline at the eastern end of the Gulf of Mexico channel and to create hardbottom habitat near the Richardson Reef.

d) Plan number four. This plan is to widen the channel to an 80-foot bottom width, deepen the channel to a six-foot, mean lower low water, depth, extend the channel to the six-foot contour, and to place all material near the Richardson Reef.

Plan evaluation

100. The forecasts of the without- and with-project condition for the four plans follow. The forecasts include statements of the resource conditions, project outputs and plan effects expected based on the objectives of the study.

101. Plan number one. For the no action plan, the forecast of with-project conditions is the without-project condition. That is, in the future it is expected that vessel traffic using the Hernando Beach channel will increase. Accidents with injuries, groundings, vessel damage and delays are all expected to increase. Environmental resources will remain stable. Additional lands in the area are expected to be acquired for conservation. The management plan for Weekiwachee Preserve is expected to be put into action, as funding is available, and according to the priorities set by the Southwest Florida Water Management District. Little Lake is expected to remain a deep-water lake due to lack of the necessary volume of material for shallowing. The Richardson Reef is expected to remain as it is a present, with no further placement of reef materials. There will be no beach at Hernando Beach. Population is expected to increase and development is expected to continue, especially east of State Road 19.

102. Plan number two. This plan is to widen the channel to an 80-foot bottom width, deepen the channel to a six-foot, mean lower low water, depth, extend the channel to the six-foot contour; and to create shallow water and littoral zone habitat at Little Lake by placement of the fine material and to create hardbottom habitat near the Richardson Reef. Construction of the channel would involve removal of approximately 333,000 cubic yards of material. About 206,000 cubic yards would be rock. The remainder would be sand (124,000 cubic yards), with small amounts of clay, peat and other materials such as silty sand (3,000 cubic yards total). Construction of the shallow water and littoral zone habitat will require approximately 127,000 cubic yards of material; construction of the hardbottom habitat will require approximately 206,000 cubic yards of material. Safety and economic efficiency of the channel will improve because of the deeper, wider channel and the environment will improve through restoration of Little Lake and creation of hardbottom habitat near the Richardson Reef. There will be temporary impacts to seagrasses.

103. Plan number three. This plan is to widen the channel to an 80-foot bottom width, deepen the channel to a six-foot, mean lower low water, depth, extend the channel to the six-foot contour; to place material along the shoreline at the eastern end of the Gulf of Mexico channel and to create hardbottom habitat near the Richardson Reef. Construction of the channel would involve removal of

approximately 333,000 cubic yards of material. About 206,000 cubic yards would be rock. The remainder would be sand (124,000 cubic yards), with small amounts of clay, peat and other materials such as silty sand (3,000 cubic yards total). Shoreline placement will require approximately 127,000 cubic yards of material; construction of the hardbottom habitat will require approximately 206,000 cubic yards of material. Safety and economic efficiency of the channel will improve because of the deeper, wider channel, recreation will improve by creation of the sandy area and the environment will improve through creation of hardbottom habitat. There will be temporary impacts to seagrasses.

104. Plan number four. This plan is to widen the channel to an 80-foot bottom width, deepen the channel to a six-foot, mean lower low water, depth, extend the channel to the six-foot contour; and place all dredged material near the Richardson Reef. Construction of the channel would involve removal of approximately 333,000 cubic yards of material. About 206,000 cubic yards would be rock. The remainder would be sand (124,000 cubic yards), with small amounts of clay, peat and other materials such as silty sand (3,000 cubic yards total). Construction of the hardbottom habitat will involve all 333,000 cubic yards of material. Safety and economic efficiency of the channel will improve because of the deeper, wider channel, and the environment will improve through creation of hardbottom habitat. There will be temporary impacts to seagrasses.

Compare with- and without-project conditions

105. **Table 4** provides a simple comparison of the without- and with-project conditions for the three plans. The comparison is qualitative and only indicates whether the identified plan is expected to achieve the desired effect. Plan number one is the no action plan and does not achieve any of the study's objectives. Plan number two involves widening, deepening and lengthening the existing channel, creating littoral zone and shallow water habitat at Little Lake, and creating hardbottom habitat near the Richardson Reef site. Plan number three involves widening, deepening and lengthening the existing channel, placing material along the shoreline, and creating hardbottom habitat near the Richardson Reef site. Plan number four involves widening, deepening and lengthening the existing channel and creating hardbottom habitat near the Richardson Reef site. Plan two achieves the objectives of minimizing channel-related disruptions to the commercial fishing industry in Hernando Beach, minimizing channel-related traffic congestion to commercial fishermen and recreational boaters using the Hernando Beach channel, improving safety, improving recreation (channel, hardbottom habitat, beach [maintenance material]) and improving the environment. Plan two temporarily impacts seagrasses. Plan three achieves the objectives of minimizing channel-related disruptions to the commercial fishing industry in Hernando Beach, minimizing channel-related traffic congestion to commercial fishermen and recreational boaters using the Hernando Beach channel, improving safety, improving recreation (channel, hardbottom habitat, recreational area, beach [maintenance

material]) and improving the environment. Plan three temporarily impacts seagrasses. Plan four achieves the objectives of minimizing channel-related disruptions to the commercial fishing industry in Hernando Beach, minimizing channel-related traffic congestion to commercial fishermen and recreational boaters using the Hernando Beach channel, improving safety, improving recreation (channel, hardbottom habitat, beach [maintenance material]) and improving the environment

Table 4. Comparison of project conditions				
Effect	**Plan one**	**Plan two**	**Plan three**	**Plan four**
Minimize channel-related disruptions	No	Yes	Yes	Yes
Minimize channel-related traffic congestion	No	Yes	Yes	Yes
Improve safety	No	Yes	Yes	Yes
Improve recreation	No	Yes	Yes	Yes
Improve the environment	No	Yes	Yes	Yes
Temporarily impact seagrasses	No	Yes	Yes	Yes
Impact threatened or endangered species	No	No	No	No
Impact cultural resources	No	No	No	No

Assessment of important differences between the without- and with-project conditions

106. Recall, the without-project condition is a channel 35-60 feet wide, less than six feet deep (mean low water) in some locations and about 12,700 feet long. **Table 5** describes differences between the without- and with-project conditions. Minimizing channel-related disruptions is quantified by channel depth. As the channel is made deeper there should be less damage to vessels traversing it as the likelihood the vessels will scrape bottom diminishes. Minimizing channel-related traffic congestion is quantified by channel bottom width. As the channel is made wider there should be less damage to vessels since they will be less likely to maneuver into the sideslopes and incur damage by doing so. Safety is either improved or not improved. Recreation is either improved or not improved. Improving the environment is qualified only for this formulation and not quantified in a format analysis, although acreages are given in situations where they could be calculated. Impacts to seagrasses are either none or temporary. Threatened or endangered species and cultural resources are either impacted or not.

107. Plan number one is the no action plan. Therefore, the without- and with-project conditions are the same and there is no difference between them. The existing channel has a bottom width of between 35-60 feet (as navigation channels are usually trapezoidal in shape there is a difference between the channel width at the bottom of the channel and at the top of the channel, at the water surface; this difference is due to the sideslopes on either side of the channel so the channel width at the bottom is the narrowest of the two widths and is therefore the general descriptor for channel width). The existing channel has a design depth of five and one-half or six feet, mlw, depending on the section of channel. While this is the design depth, the channel is shallower than this in many locations and deeper than that in some others. The channel remains unsafe. There is no placement of dredged material since this plan involves no construction so the environment is the same when comparing the without- and with-project conditions. The Richardson Reef site remains as it, with some concrete material. The littlest of the southern lakes in the Weekiwachee Preserve, known as 'Little Lake', is unchanged between the without- and with-project conditions. It is rectangular in shape, with a small, shallow lobe at the western end. The depth of the lake is approximately 38 feet.

108. Plan number two. For this plan the without-project condition is as described above. In the with-project condition the depth of the channel is six feet, mllw. This depth is at least one foot below the existing channel depth. The reason for the wording 'at least one foot' is that the conversion from the mlw reference plane to the mllw reference plane is approximately one-half foot or six inches. Therefore, even though by nomenclature the depth changes from 'five and one-half feet' to 'six feet', the actual depth changes at least one foot. In the with-project condition the width of the channel is 80 feet. This width is between 20 and 45 feet wider than in the without-project condition. If the existing channel is 35 feet wide, this is 45 feet wider, and if the existing channel is 60 feet wide, this is 20 feet wider. Because the channel is deeper, wider and straighter it is safer. In the with-project condition seagrasses are temporarily disturbed due to channel construction. As indicated in the biological survey conducted prior to the 1978 permit issuance and as demonstrated by the Bayport Channel baseline and monitoring seagrass surveys, impacts to seagrasses due to dredging are expected to be temporary. Details about seagrasses are found in Appendix D-Supplemental Information. In the with-project condition the Richardson Reef site is expanded with limerock hardbottom. **Figure 20** is a schematic of the reef with additional hardbottom habitat. Details about the existing Richardson Reef and the proposed hardbottom creation are found in Appendix H-Hardbottom Habitat Creation. Expanding the hardbottom in the vicinity of the reef by placing the limerock removed during channel construction at the reef site will increase the size of the reef by about 30 acres. The littlest of the southern lakes in the Weekiwachee Preserve, known as 'Little Lake', undergoes a habitat change between the without- and with-project conditions. Little Lake is rectangular in shape, with a small, shallow lobe at the western end. The size of the lake is about four acres. The existing depth of the lake is approximately 38 feet. In the

with-project condition material removed from the channel during construction is placed in the lake and the bottom surface of the lake is raised. By doing so, the bottom surface is raised into the photic, or light, zone and light penetrates the bottom, encouraging oxygenation and therefore improving conditions for plant and animal growth in the lake. The lobe will be shallow enough to support littoral zone vegetation. In all, about one and one-third acres of shallow water habitat/littoral zone will be created with another three acres of deepwater habitat made shallower. **Figure 21** is a schematic of the restoration at Little Lake. There may be some short-term, temporary, impacts that result from placement of the dredged material into Little Lake, including an impermanent change from freshwater to saltwater, which in turn may cause a one-time die-off of species currently residing in the lake. Threatened or endangered species and cultural resources are not impacted.

109. Plan number three. For this plan the without-project condition is as described above. In the with-project condition the depth of the channel is six feet, mllw. This depth is at least one foot below the existing channel depth. The reason for the wording 'at least one foot' is that the conversion from the mlw reference plane to the mllw reference plane is approximately one-half foot or six inches. Therefore, even though by nomenclature the depth changes from 'five and one-half feet' to 'six feet', the actual depth changes at least one foot. In the with-project condition the width of the channel is 80 feet. This width is between 20 and 45 feet wider than in the without-project condition. If the existing channel is 35 feet wide, this is 45 feet wider, and if the existing channel is 60 feet wide, this is 20 feet wider. Because the channel is deeper, wider and straighter it is safer. In the with-project condition seagrasses are temporarily disturbed due to channel construction. As indicated in the biological survey conducted prior to the 1978 permit issuance and as demonstrated by the Bayport Channel baseline and monitoring seagrass surveys, impacts to seagrasses due to dredging are expected to be temporary. Details about seagrasses are found in Appendix D-Supplemental Information. In the with-project condition the Richardson Reef site is expanded with limerock hardbottom. **Figure 20** is a schematic of the reef with additional hardbottom habitat. Details about the existing Richardson Reef and the proposed hardbottom creation are found in Appendix H-Hardbottom Habitat Creation. Expanding the hardbottom in the vicinity of the reef by placing the limerock removed during channel construction at the reef site will increase the size of the reef by about 30 acres. A recreational area is nourished near the western end of Coon Key Point, on the north side of the first spoil island. **Figure 22** is a schematic of the shoreline placement area. This area is about 20 acres in size. Threatened or endangered species and cultural resources are not impacted.

110. Plan number four. For this plan the without-project condition is as described above. In the with-project condition the depth of the channel is six feet, mllw. This depth is at least one foot below the existing channel depth. The reason for the wording 'at least one foot' is that the conversion from the mlw

reference plane to the mllw reference plane is approximately one-half foot or six inches. Therefore, even though by nomenclature the depth changes from 'five and one-half feet' to 'six feet', the actual depth changes at least one foot. In the with-project condition the width of the channel is 80 feet. This width is between 20 and 45 feet wider than in the without-project condition. If the existing channel is 35 feet wide, this is 45 feet wider, and if the existing channel is 60 feet wide, this is 20 feet wider. Because the channel is deeper, wider and straighter it is safer. In the with-project condition seagrasses are temporarily disturbed due to channel construction. As indicated in the biological survey conducted prior to the 1978 permit issuance and as demonstrated by the Bayport Channel baseline and monitoring seagrass surveys, impacts to seagrasses due to dredging are expected to be temporary. Details about seagrasses are found in Appendix D-Supplemental Information. In the with-project condition the Richardson Reef site is expanded with sand and limerock hardbottom. **Figure 20** is a schematic of the reef with additional hardbottom habitat. Details about the existing Richardson Reef, including the 1977 and 1988 Corps of Engineers permits for reef construction, and the proposed hardbottom creation are found in Appendix H-Hardbottom Habitat Creation. Expanding the hardbottom in the vicinity of the reef by placing the sand and limerock removed during channel construction at the reef site will increase the size of the reef by about 48 acres. Threatened or endangered species and cultural resources are not impacted.

Table 5. Assessment of plan effects							
	A	B	C	D	E	F	
Effect	***Without-project condition***	***Plan Two***	***Difference (B-A)***	***Plan Three***	***Difference (D-A)***	***Plan Four***	***Difference (F-A)***
Minimize channel-related disruptions	35-60 feet	80 feet	Increase of 20-45 feet	80 feet	Increase of 20-45 feet	80 feet	Increase of 20-45 feet
Minimize channel-related traffic congestion	5 ½-6 feet, mlw, deepest Many areas shallower	6 feet, mllw	Minimum increase of one foot	6 feet, mllw	Minimum increase of one foot	6 feet, mllw	Minimum increase of one foot
Improve safety	Unsafe	Safe	Safer	Safe	Safer	Safe	Safer
Improve recreation	Suitable for recreation/channel and nearby areas	30 acres hardbottom/artifical reef, beach nourishment (County Park)	Increase in 30 acres hardbottom habitat, addition of beach nourishment	Recreational area, 30 acres hardbottom habitat, beach nourishment (County Park)	Addition of recreational area, increase in 30 acres hardbottom habitat, addition of beach nourishment	48 acres hardbottom habitat, beach nourishment (County Park)	Increase in 48 acres hardbottom habitat, addition of beach nourishment
Improve the environment							
Hardbottom habitat	Sparse reef	30 acres	Increase of 30 acres	30 acres	30 acre increase	48 acres	48 acre increase
Little Lake habitat conversion	Deep water (38 feet)	4 acres shallow water, creation of littoral zone	Increase of three acres of shallower water habitat, one acre of shallow water habitat (in photic zone) and 1/3-acres of littoral zone. Temporary influx of saltwater to freshwater lake.	None	No difference	None	No difference
Impact seagrasses	Halodule wrightii, Thalassia testudinum	Temporary impact	Temporary impact	Temporary impact	Temporary impact	Temporary impact	Temporary impact
Impact oysters	Oyster beds outside of channel area	No impact	No impact	No impact	No impact	No impact	No impact
Impact threatened and endangered species	Manatees, sea turtles	No impact	No impact	No impact	No impact	No impact	No impact
Impact cultural resources	One site/Coon Key Point	Potential impact to historic properties	Potential impact to historic properties	Potential impact to historic properties	Potential impact to historic properties	Potential impact to historic properties	Potential impact to historic properties

Appraise the plans' effects

111. **Table 5** assesses each plan's effects based on a comparison between the plan and the without-project condition. Plan number one is the no action plan and there is no difference between the without-project condition and the no action plan. Plan number two widens the channel by 20-45 feet and deepens the channel by at least one foot. The beneficial effects of this widening and deepening are cost savings and a safer channel. Cost savings would be realized in the with-project condition due to reductions in the cost of repairs to commercial vessels that are necessary in the without-project condition as vessels often must maneuver outside of the channel during passing situations and hit the channel sides and also as vessels frequently hit the bottom as it is shallow. These beneficial effects would be realized upon construction and last indefinitely. The adverse effect of the channel widening and deepening may be the temporary impacts to seagrass in the existing channel, adjacent to the existing channel and in the area of the channel extension. This effect would occur at the time of construction and last until the seagrass had recolonized. Seagrass recolonization is recognized as a slow process and would be expected within five years after construction. This length of time is based on seagrass recolonization at the Bayport Channel, north of Hernando Beach. Information on the Bayport Channel seagrass baseline and monitoring events is provided in Appendix D-Supplemental Information. An additional beneficial effect of plan number two, with placement of material removed during channel construction near the Richardson artificial reef site for hardbottom habitat, is increase in hardbottom habitat of approximately 30 acres. This effect will be realized after placement of the material and should last indefinitely. Also, at Little Lake in the Weekiwachee Preserve, increases will be realized in shallower water habitat, of three acres, in shallow water (photic zone) habitat of one acre and in littoral zone habitat of one-third acre. These effects will be realized after placement of the material from the channel at the reef site and into the lake, and should last indefinitely. Plan number three has the same effects as plan number two except in lieu of shallow water/littoral zone habitat creation material is placed along the shoreline for creation of a recreational area. The improvements to the environment due to the rehabilitation of Little Lake are replaced with improvements to recreation. Plan number four also widens the channel by 20-45 feet and deepens the channel by at least one foot. The beneficial effects of this widening and deepening are cost savings and a safer channel. Cost savings would be realized in the with-project condition due to reductions in the cost of repairs to commercial vessels that are necessary in the without-project condition as vessels often must maneuver outside of the channel during passing situations and hit the channel sides and also as vessels frequently hit the bottom as it is shallow. These beneficial effects would be realized upon construction and last indefinitely. The adverse effect of the channel widening and deepening may be the temporary impacts to seagrass described above. An additional beneficial effect of plan number four, with placement of all material removed during channel construction near the

Richardson reef site for hardbottom habitat, is increase in hardbottom habitat of approximately 48 acres. This effect will be realized after placement of the material and should last indefinitely.

112. **Table 6** summarizes the costs of plans two, three and four. These costs are plan formulation costs for comparison purposes and are taken from initial plan formulation cost estimates.

Table 6. Plan Evaluation Costs/Factors

ITEM	Cost Per Cubic Yard	Cubic Yards	Plan Two	Plan Three	Plan Four
Mobilization					
Hydraulic Dredge			$593,000	$593,000	$0
Mechanical Dredge			$330,000	$330,000	$330,000
Shore Equipment			$0	$8,000	$0
Dredging					
Hydraulic Dredge/ Little Lake	$15.69	127,000	$1,993,000	$0	$0
Hydraulic Dredge/ Beach	$7.73	127,000	$0	$982,000	$0
Mechanical Dredge/ Richardson Reef	$12.39	206,000	$2,478,000	$2,478,000	$0
Mechanical Dredge/ Richardson Reef	$11.81	333,000	$0	$0	$3,933,000
Placement			$9,000	$176,000	$0
Total			$5,403,000	$4,567,000	$4,263,000
Time To Construct			150 days	120 days	160 days

Note: Contingencies of 15% are included on all costs. All costs (except per cubic yard costs) are rounded to the nearest thousand.

Plan screening: Completeness, effectiveness, efficiency and acceptability

113. The four alternative plans are screened and evaluated according to the four criteria completeness, effectiveness, efficiency and acceptability in **Table 7**. Complete plans are well thought out and consider all necessary implementation actions. Effective plans contribute to the attainment of the specified planning objectives and avoid specified planning constraints. Efficient plans are cost-effective and use resources wisely in plan implementation. Acceptable plans are implementable and satisfactory; they are feasible and wanted.

114. **Table 7** organizes the effects of the alternative plans according to four accounts: NED, regional economic development, environmental quality and other social effects. The purposes of this table are to show all effects important to decision-making, including to show NED and national ecosystem restoration effects, and to provide a rational, organized framework for the presentation of the results of the feasibility study.

115. The NED information provided in **Table 7** is for comparison purposes only. The costs do not reflect the entire economic or cost-shared cost of the recommended plan. The economic and cost-shared costs of the recommended plan are found in the following section. The project costs in **Table 7** are dredging and placement costs for alternative plans two, three and four only. Operations and maintenance costs are not shown in **Table 7**. The annual cost is the present worth of the project cost, based on a 50-year economic life and an interest rate of five and seven-eighths percent.

116. Recall, all project benefits are achieved once the project dimensions are constructed. There is no additional benefit for additional depth or width for this project, due to the consistency in the dimensions in the vessel fleet using the channel.

Table 7. Summary comparison of alternate plans for Hernando Beach, Florida				
	Plan One (No Action)	**Plan Two**	**Plan Three**	**Plan Four**
1. PLAN DESCRIPTION	No Action/Without-project Condition	Channel: 80-foot bottom width, 6-foot, mllw, project depth, 20,500-foot length Restoration/Habitat creation: Little Lake, Richardson Reef site	Channel: 80-foot bottom width, 6-foot, mllw, project depth, 20,500-foot length Habitat creation: Richardson Reef site, Shoreline placement.	Channel: 80-foot bottom width, 6-foot, mllw, project depth, 20,500-foot length Habitat creation: Richardson Reef site
2. IMPACT ASSESSMENT				
A. National Economic Development (NED) Benefits				
(1) Total Project Cost ($/Annual Cost) (2) Annual Net Commercial Benefits (3) Annual Net Recreational Benefits (4) Annual Total Net Benefits (5) Annual Benefits – Costs (6) Benefit/Cost Ratio Note: Preconstruction, engineering and design costs are assumed to be the same for plans two, three and four. Aids to navigation costs are the same.	$0 $0 $0 $0 $0 0 Ranks 4th.	$5,403,000/$337,000 $334,500 $33,750 $368,250 $31,250 1.09 Ranks 3rd. Note: Time to construct is 150 days. Real estate costs will most likely be higher than plans three and four since easements will be needed. Supervision and administration costs may be higher than plan three due to longer construction time but lower than plan four. Interest during construction will be higher than for plan three due to the greater project cost and the longer construction period. Operations and maintenance costs are greater than for plan three due to longer distance to site but equal to those for plan four.	$4,567,000/$285,000 $334,500 $33,750 $368,250 $83,250 1.3 Ranks 2nd. Note: Time to construct is 120 days. Real estate costs may be less than for plan two since easement requirements will be less. Supervision and administration costs may be least due to shortest construction time. Interest during construction may be slightly less than for plan two since it has the smaller project cost and a shorter construction period. Operations and maintenance costs will be less than for plans two and four due to shorter distance to placement site.	$4,263,000/$266,000 $334,500 $33,750 $368,250 $102,250 1.4 Ranks 1st. Note: Time to construct is 160 days. Real estate costs may be least since all construction operations will be water based. Supervision and administration costs may be most due to longest construction time. Interest during construction may be slightly less for plan four than other plans since it has the smallest project cost. Operations and maintenance costs will be same as for plan two.
B. Environmental Quality (EQ)				
(1) Air/Noise	Normal noise levels created by commercial and recreational activities. Ranks 1st.	Possible temporary increased noise levels during 150-day construction period. Ranks 3rd.	Possible temporary increased noise levels during 120-day construction period. Ranks 2nd.	Possible temporary increased noise levels during 160-day construction period. Ranks 4th.
(2) Water Quality	Existing water quality is very good in the	Temporary increased turbidity levels in channel vicinity during 150-day	Temporary increased turbidity levels in channel vicinity during 120-day	Temporary increased turbidity levels in channel vicinity during 160-day

	channel vicinity. Ranks 1st.	construction period. Temporary influx of saltwater to the freshwater Little Lake. Ranks 4th.	construction period. Ranks 2nd.	construction period. Ranks 3rd.
(3) Vegetation	Seagrasses exist in the channel vicinity, Ranks 1st.	Temporary impacts to seagrasses. Ties for 2nd.	Temporary impacts to seagrasses. Ties for 2nd.	Temporary impacts to seagrasses. Ties for 2nd.
(4) Threatened & Endangered Species	Loggerhead, green, leatherback, hawksbill and Kemp's ridley sea turtles, and manatees, frequent Gulf waters. They are not known to nest in the Hernando Beach channel area. Ranks 1st.	Standard manatee protection conditions to be followed during construction. Ties for 2nd.	Standard manatee protection conditions to be followed during construction. Ties for 2nd.	Standard manatee protection conditions to be followed during construction. Ties for 2nd.
(5) Aquatic Birds	The spoil islands north of the channel provide some nesting habitat for birds.	No impact. Jacksonville District's migratory bird protection plan to be followed during construction.	No impact. Jacksonville District's migratory bird protection plan to be followed during construction.	No impact. Jacksonville District's migratory bird protection plan to be followed during construction.
(6) Cultural Resources & Historic Properties	One cultural resources site of significance identified outside of project area.	Potential impact to historic properties.	Possible impact to historic properties.	Possible impact to historic properties.
C. Regional Economic Development (RED)	Commercial and recreation-related development: Some boaters are hampered by difficult access to the Gulf through Hernando Beach channel because of insufficient depth. Some boaters are discouraged by the low margin of safety provided by the channel due to insufficient width. Some boaters spend time accessing the Gulf through Tarpon Springs or Crystal River instead of Hernando Beach.	Commercial and recreation-related industries may boom. Some boaters will enjoy increased access to the Gulf through Hernando Beach channel due to the increased depth provided by the project. Some boaters will increase their enjoyment of a boating occasion through the channel because of the additional margin of safety provided by the project. Some boaters will save time by accessing the Gulf through Hernando Beach instead of using alternative access at or Tarpon Springs or Crystal River. Some boaters will be attracted to the additional hardbottom. Ties for 1st.	Commercial and recreation-related industries may boom. Some boaters will enjoy increased access to the Gulf through Hernando Beach channel due to the increased depth provided by the project. Some boaters will increase their enjoyment of a boating occasion through the channel because of the additional margin of safety provided by the project. Some boaters will save time by accessing the Gulf through Hernando Beach instead of using alternative access at or Tarpon Springs or Crystal River. Some boaters will be attracted to the additional hardbottom. Ties for 1st.	Commercial and recreation-related industries may boom. Some boaters will enjoy increased access to the Gulf through Hernando Beach channel due to the increased depth provided by the project. Some boaters will increase their enjoyment of a boating occasion through the channel because of the additional margin of safety provided by the project. Some boaters will save time by accessing the Gulf through Hernando Beach instead of using alternative access at or Tarpon Springs or Crystal River. Some boaters will be attracted to the additional hardbottom. Ties for 1st.

	Ranks 4th.			
D. Other Social Effects (OSE)				
(1) Life, Health and Safety	Channel is dangerous as it is shallow, narrow and winding. Ranks 4th.	Safety is improved by deeper, wider and straighter channel. Ties for 1st.	Safety is improved by deeper, wider and straighter channel. Ties for 1st.	Safety is improved by deeper, wider and straighter channel. Ties for 1st.
(2) Community Cohesion (displacement of people & businesses)	Issues have existed between residents and commercial fishermen. Ranks 4th.	No displacement of people or businesses expected. Issues best resolved on a local level. An improved channel serving the needs of the people should improve community cohesion. Ties for 1st.	No displacement of people or businesses expected. Issues best resolved on a local level. An improved channel serving the needs of the people should improve community cohesion. Ties for 1st.	No displacement of people or businesses expected. Issues best resolved on a local level. An improved channel serving the needs of the people should improve community cohesion. Ties for 1st.
(3) Recreation	The many recreation opportunities afforded by the channel are hampered by its insufficient depth and width. No beach. Ranks 4th.	Recreation experience is improved by increased depth and width. Additional hardbottom affords more recreation opportunities. Ranks 3rd.	Recreation experience is improved by increased depth and width. Sandy shoreline area affords more recreation opportunities. Additional hardbottom affords more recreation opportunities. Ranks 1st.	Recreation experience is improved by increased depth and width. Additional hardbottom affords more recreation opportunities. Ranks 2nd.
3. PLAN EVALUATION				
A. Contribution to Planning Objectives				
(1) Minimize channel-related damages and disruptions due to insufficient depth	Channel-related disruptions occur and damages are incurred. Does not meet objective.	Channel-related disruptions and damages are lessened. Meets objective.	Channel-related disruptions and damages are lessened. Meets objective.	Channel-related disruptions and damages are lessened. Meets objective.
(2) Minimize channel-related damages and traffic congestion due to insufficient width	Channel-related traffic congestion occurs and damages are incurred. Does not meet objective.	Channel-related congestion and damages are lessened. Total average annual reduction is $334,500. Meets objective.	Channel-related congestion and damages are lessened. Total average annual reduction is $334,500. Meets objective.	Channel-related congestion and damages are lessened. Total average annual reduction is $334,500. Meets objective.
(3) Improve recreation	There is no beach. Craft incur damages. Does not meet objective.	There is no beach. Damages are lessened. Total average annual reduction is $33,750. Partially meets objective.	There is a sandy area along the shoreline. Damages are lessened. Total average annual reduction is $33,750. Fully meets objective.	There is no beach. Damages are lessened. Total average annual reduction is $33,750. Partially meets objective.
(4) Improve the environment	Does not meet objective.	Increase in shallower water habitat, shallow water habitat and littoral zone habitat. Increase in hardbottom habitat. Meets objective.	Increase in hardbottom habitat-meets objective. May not be implementable due to concern about converting tidal habitat to beach.	Increase in hardbottom habitat. Meets objective.
B. Response to Planning Constraints				
(1) Meet Federal expenditure limit	Yes. Avoids constraint.	Continuing Authorities Program Federal expenditure limit is $4,000,000 for navigation. May avoid constraint.	Continuing Authorities Program Federal expenditure limit is $4,000,000 for navigation. May avoid constraint.	Continuing Authorities Program Federal expenditure limit is $4,000,000 for navigation. May avoid constraint.

(2) Avoid impacts to threatened or endangered species	Yes. Avoids constraint.	Construction may cause a temporary impact to these species. Avoids longterm impact.	Construction may cause a temporary impact to these species. Avoids longterm impact.	Construction may cause a temporary impact to these species. Avoids longterm impact.
(3) Avoid impacts to cultural resources	Yes. Avoids constraint.	Yes. Avoids constraint.	Yes. Avoids constraint.	Yes. Avoids constraint.
(4) Meet State water quality standards	Yes. Avoids constraint.	Construction will be conducted to meet State water quality standards. Avoids constraint.	Construction will be conducted to meet State water quality standards. Avoids constraint.	Construction will be conducted to meet State water quality standards. Avoids constraint.
C. Response to Evaluation Criteria				
(1) Completeness	Is not complete in that existing channel does not meet the needs of commercial fishermen and recreational boaters.	Complete. Well-thought out.	Complete. Well-thought out.	Complete. Well-thought out.
(2) Effectiveness	Is not effective. Does not meet specified objectives but does avoid specified constraints.	Effective plan. Fully meets three out of four objectives. Avoids most constraints.	Effective plan, meets all specified objectives. Avoids most constraints. May not be implementable.	Effective plan. Fully meets three out of four objectives. Avoids most constraints.
(3) Efficiency	Is not efficient because plan is not cost-effective since damages are incurred.	May not meet Federal expenditure limit, uses resources wisely as it creates habitat.	May not meet Federal expenditure limit, uses resources wisely as it creates habitat.	May not meet Federal expenditure limit, uses resources wisely as it creates habitat.
(4) Acceptability	Is not acceptable. Plan is implementable but not satisfactory since damages are incurred and channel is unsafe. Plan is not the most feasible and is not wanted over other plans.	Is acceptable. Plan is implementable. Plan is satisfactory since damages are reduced and safety is improved. Plan is feasible and is wanted over no action plan.	May not be acceptable due to concerns about intertidal habitat conversion. Plan may not be implementable. Plan is satisfactory since damages are reduced and safety is improved. Plan is wanted over no action plan.	Is acceptable. Plan is implementable. Plan is satisfactory since damages are reduced and safety is improved. Plan is feasible and is wanted over no action plan.

Trade-off analysis

Identification of plan differences

117. The differences between plans one, two, three and four are those between no action and construction of a project to improve navigation. Plan one is the no action plan. Plan two is reclamation of a former mine pit, creation of hardbottom habitat, and widening, deepening and lengthening the Hernando Beach channel. Plan three is creation of hardbottom habitat, shoreline placement and widening, deepening and lengthening the Hernando Beach channel. Plan four is creation of hardbottom habitat and widening, deepening and lengthening the Hernando Beach Channel. Plan one contains no features to benefit the environment while plan two creates shallow water habitat, littoral zone habitat and hardbottom habitat, plan three creates hardbottom habitat and plan four creates hardbottom habitat. Plan one realizes no cost savings while there are cost savings to be realized by vessels using the improved channel due to reductions in damages to be realized by plans two, three and four. Plan one realizes no increase in net revenue and time saved while plans two, three and four increase net commercial revenue and time savings. Plan one realizes no recreational benefit while plans two, three and four have recreational components; plan two in the wider, deeper, longer channel and hardbottom habitat for recreational fishing, plan three in the wider, deeper, longer channel and in the sandy shoreline area and plan four in the wider, deeper, longer channel and hardbottom habitat for recreational fishing. Plan one realizes no additional adverse environmental impact while plans two, three and four may realize the possible environmental adverse impact of temporary disturbance to seagrass beds due to widening, deepening and lengthening the channel. Plan two may have a temporary impact to the environment due to the influx of saltwater to a freshwater lake.

Weighting of the relative importances of the plan impacts

118. Impacts identified in **Table 7** include commercial and recreational benefits, costs, air and noise effects, water quality effects, effects on vegetation, effects to threatened and endangered species, effects on aquatic birds, effects to cultural resources and historic properties, regional economic development, life, health and safety effects, and community cohesion. In Federal analysis of a water resources development project the most significant of these are the commercial and recreational benefits, costs and environmental effects. Also of greater significance is safety. Public involvement revealed boater benefits (damage reduction), safety and recreation (desire for a beach) to be of most importance to the community.

119. NED criteria are least cost and environmentally acceptability. Plans recommended for Federal participation according to NED criteria must have benefits greater than costs. Commercial benefits are given utmost credibility. Recreational benefits are considered incidental. Environmental benefits may

also be considered incidental. Safety is a non-quantifiable benefit. Therefore, the most important impacts are commercial benefit, cost and environmental acceptability. Recreational benefit is less important. Safety is even less important to NED analysis.

120. Plans two, three and four have the same commercial benefits a defined by Corps of Engineers guidance. Plan four has the least cost. Plan two, three and four benefit to the environment. Plans two and four avoid longterm impacts to the environment. Plan three may have adverse impacts in the conversion of tidal habitat. Plan three has the most benefit to recreation. Plans two, three and four improve safety.

Discussion of the plans' contributions to the study's objectives

121. In all, there are four objectives for this study. These objectives are the following: 1)to minimize channel-related damages and disruptions due to insufficient depth, 2)to minimize channel-related damages and traffic congestion due to insufficient width, 3)to improve recreation and 4)to improve the environment. Plan one does not contribute to any of the objectives. Plans two, three and four contribute to all four objectives, however, plans two and four do not include provision for a recreational area along the shoreline.

122. In terms of stakeholder views and values, the objectives to minimize damages, disruptions and traffic congestion and improve recreation (particularly to provide a recreational area along the shoreline) are in all likelihood most significant.

Selection of the final plan

Rationale for selection

123. The final plan was selected based on the goal of the study, the objectives of the study, and the constraints of the study. The goal of this Federal study is to determine whether NED can be enhanced through the construction of a navigation channel at Hernando Beach, Florida. Specifically, the goal of the study is to determine whether a water resources project at Hernando Beach, Florida, will contribute to NED, consistent with protecting the Nation's environment, and to national ecosystem restoration. The objectives of this study are 1)to minimize channel-related damages and disruptions due to insufficient depth, 2)to minimize channel-related damages and traffic congestion due to insufficient width, 3)to improve recreation and 4)to improve the environment. The constraints of the study are to avoid impacts to threatened or endangered species, avoid impacts to cultural resources and meet State water quality standards. **Table 7** provides a thorough summary of the factors considered in the selection of the final plan.

124. **Table 8** provides an NED benefit/cost analysis for plans two, three and four. Plan one is eliminated from consideration since it does not achieve any of the study objectives. The NED analysis compares costs and benefits at a common point in time. The common point in time for comparison is at the end of the installation period and the beginning of the period of analysis. The time from the beginning of the preparation of plans and specifications for a construction job until turnover of the completed project to the non-Federal sponsor is known as the installation period. Navigation projects generally have a period of analysis of 50 years. Costs and benefits are compared in average annual equivalent (AAEQ) terms. A pre-established discount rate is used to determine AAEQ values. For this study the discount rate is 5.875%. If alternative plans have different installation periods a common point in time is chosen in order to compare plans on an equal time basis. This point is known as the base year.

125. Costs included in the analysis are project investment costs, associated costs and other direct costs. Project investment or installation costs include post-authorization planning and design costs; construction costs; construction contingency costs; administrative services costs; fish and wildlife habitat mitigation costs; relocation costs; historical and archaeological salvage costs; land, water and mineral rights costs; operation, maintenance, repair, rehabilitation and replacement costs; interest during construction. Associated costs are the costs of measures needed over and above project measures to achieve the benefits claimed during the period of analysis. For this project there are no associated costs. Other direct costs are the costs of resources directly required for a project but for which no implementation outlays are made. For this project there are no other direct costs.

126. Benefits included in the analysis include navigation benefits and recreation benefits.

Table 8. NED Analysis

COSTS					
ITEM	Cost Per Cubic Yard	Cubic Yards	Plan Two	Plan Three	Plan Four
Mobilization					
Hydraulic Dredge			$593,000	$593,000	$0
Mechanical Dredge			$330,000	$330,000	$330,000
Shore Equipment			$0	$8,000	$0
Dredging					
Hydraulic Dredge/Little Lake	$15.69	127,000	$1,993,000	$0	$0
Hydraulic Dredge/Beach	$7.73	127,000	$0	$982,000	$0
Mechanical Dredge/Richardson Reef	$12.39	206,000	$2,478,000	$2,478,000	$0
Mechanical Dredge/Richardson Reef	$11.81	333,000	$0	$0	$3,933,000
Placement			$9,000	$176,000	$0
Subtotal			$5,403,000	$4,567,000	$4,263,000
Preconstruction Engineering and Design (PED)			$150,000	$150,000	$150,000
Supervision and Administration (S&A)			$252,000	$181,000	$232,000
Real Estate			$64,000	$64,000	$64,000
Aids to Navigation (ATON)			$55,000	$55,000	$55,000
Interest During Construction			$77,000	$54,000	$75,000
Total economic investment			$6,001,000	$5,071,000	$4,764,000
AAEQ			$387,000	$327,000	$312,000
Time To Construct			150 days	120 days	160 days
Operations and Maintenance Costs			$931,000	$ 773,000	$931,000
O&M AAEQ			$19,800	$16,500	$19,800
Total AAEQ Costs			$406,800	$343,500	331,800
BENEFITS					
Navigation			$334,500	$334,500	$334,500
Recreation			$33,750	$33,750	$33,750
AAEQ Benefits			$368,250	$368,250	$368,250
Net AAEQ Benefits			($38,550)	$24,750	$36,450
Benefit/Cost Ratio			0.91	1.07	1.1

Note: Contingencies of 15% are included on all costs, except real estate (25%) and PED, S&A, ATON (actual estimates). All costs (except per cubic yard costs) are rounded to the nearest thousand. Interest rate used is 5.875%.

Sensitivity analysis

127. Three factors in the sensitivity of the with-project plans are likelihood of physical performance, expected economic successes and residual risks. The likelihood that the physical performance of the with-project plans will be satisfactory is good to great. Since so many problems are encountered with the existing depth and width, physical performance will be improved as long as the channel is deeper or wider. How much deeper is determined by the risk the vessel operators are willing to assume. The six-foot project depth is not the no-risk or design depth. That depth would be about 7 feet, based on the four and one-quarter foot design ship draft plus three feet of safety clearance as the channel is over rock. This depth allowance is based on the guidance set forth in Engineer Manual 1110-2-1613. The guidance is written for deep-draft vessels and the Hernando Beach channel is a shallow-draft channel transited by shallow-draft vessels so the guidance may not strictly apply. The six-foot project depth is the depth at which the benefits justifying the project are realized; it is also the minimum depth requested by the U.S. Coast Guard to place and maintain aids to navigation. The project depth is different from the design depth because vessel operators are willing to take on some risk when transiting the channel. The likelihood of the physical performance of the hardbottom habitat is also good to great. The hardbottom habitat is expected to reach full benefit with little uncertainty of not reaching full benefit. This is based on the reported great success of the existing County reef sites. The existing tank and culvert artificial reef at the Bendickson site receives accolades from those who use it for recreational diving. It is expected that the additional hardbottom near the Richardson Reef site will attract other benthic organisms, sponges, algae and fish. The likelihood of the physical performance of the shallow water and littoral zone habitat at Little Lake is good to very good. Exotic species may continue to be a problem in the littoral zone. In addition, some attempts to create littoral zone in the past in the Preserve resulted in the material placed along the edge of a mining lake simply sloughing off into the lake. In order to prevent sloughing a slope is included in the design of the littoral zone. Whether this slope will be achieved and whether conditions are right for this slope to maintain itself are two questions left unanswered. The shallow water habitat creation in Little Lake has some, but little, uncertainty of success. The design of this shallow water habitat includes a flat area of about one-third acre and a sloping area down to the existing water depth of approximately 38 feet. This design is necessary because there is not expected to be enough material to bring the entire lake bottom surface to the photic zone and because there is little if any environmental benefit to raising the bottom surface a few feet but not into the photic zone.

128. The expected economic success of plans two, three and four is great since all benefits are realized at the project depth.

129. Other risks, or residual risks, are the likelihoods of reaching full environmental benefit for the placements of dredged material. The recreation of

seagrass habitat, or regrowth of seagrasses, in the project channel is very likely since seagrasses are growing in the existing channel. The additional foot or two of depth provided by the project channel still allows for a depth at which seagrasses are known to grow in the area.

Risks and uncertainties in costs

130. There is some uncertainty associated with two significant cost features that warrants discussion. The first cost feature is the production rate assumed for the dredging operation. It is assumed that there will be 24-hour a day dredging as well as unrestricted access to the areas to be dredged and to the placement areas. If the production rate is less than assumed the cost of the dredging may increase. The commercial live bait shrimpers generally traverse the channel twice each day, for a total of about four hours per day, once in the early morning (returning to port) and once in the late afternoon (heading to sea). It is assumed that during these times the channel will remain open, with the dredgers performing maintenance or other normal downtime activities. This is a valid assumption since typical dredge production averages about 60% effective operating hours per day. Uncertainty in production rate is worth mentioning but is not expected to be great. The second cost feature is the use of mechanical equipment without blasting in the rock areas. If the rock present in the area to be dredged is harder than anticipated based on the geotechnical information gathered during the study the cost of the project may go up, again due to a decreased production rate. Again, however, the uncertainty in production rate due to changes in character of materials is not expected to be great. It is known that the existing channel was constructed using a dragline, a piece of mechanical equipment, without blasting. Since the rock present is not expected to be different from that previously removed the assumption that mechanical equipment can remove the rock without blasting is valid. Other cost features that warrant mentioning are those that cannot be predicted at present that would slow down production by hampering either the dredging or the placement. Frequently these are related to environmental constraints or public objection to some part of the dredging process.

DESCRIPTION OF THE SELECTED PLAN

Plan components

131. The selected plan is plan number four. Therefore, the selected plan is a 20,500-foot long channel, with a project depth of 6 feet, mean lower low water, constructed with one foot of required overdepth due to rock and one foot of allowable overdepth. The channel has a bottom width of 80 feet and sideslopes are expected to fall at 1:3. Construction is expected to involve removal of approximately 333,000 cubic yards of material. **Figure 23** shows the selected plan.

132. Placement of the rock will be in the vicinity of the County's Richardson Reef site. The artificial reef site is about 13 miles offshore. The material removed during channel construction will create hardbottom habitat. Appendix H contains information about the hardbottom habitat creation.

133. The final plan, the selected plan, is the recommended plan. This plan is supported by the non-Federal sponsor, Hernando County Board of County Commissioners, by the Hernando County Port Authority, by the Hernando County Marine Industry Council and by the Hernando Beach Coast Guard Auxiliary.

Design and construction considerations

Design considerations

134. The design of the recommended plan channel is based on the guidance set forth in Engineer Manual 1110-2-1613, dated 31 August 1995, entitled, "Hydraulic Design Guidance for Deep-Draft Navigation Projects". This design guidance applies primarily to the channel bottom width and to wideners in the channel bends. Economics is the key factor in determining the project depth, although the design guidance is helpful in determining the zero-risk depth for comparison purposes. When designing the channel it was desired to allow for two-way vessel traffic in order to meet the study's objective of minimizing channel related traffic disruptions.

135. Other design considerations are the length and depth of the Gulf of Mexico channel entrance and the need to maneuver U.S. Coast Guard vessels in the channel for placement and maintenance of aids to navigation. Presently the depth just west of the entrance is shallower than the channel itself. In order to maintain a consistent project depth and account for sufficient depth beyond the channel the channel was extended approximately 8,000 feet to the west. To ensure that U.S. Coast Guard vessels would be able to enter, transit and turn around in the design channel, the U.S. Coast Guard provided vessel dimensions, necessary channel depth and width information, and a desired turning basin diameter. The design channel is intended to meet the U.S. Coast Guard depth, width and basin dimensions. The flare at the east end of the channel, provided in the channel design for ease of navigation for vessels turning both south and north, also meets the U.S. Coast Guard recommendations for a turning basin for their vessels for placing and maintaining Federal aids to navigation.

Construction Considerations

136. Because the water depth outside of the existing channel is very shallow the type of equipment that can construct the project channel may be limited. In addition, it would be prohibitively expensive to place all the material at Little Lake, since double-handling might be required. Also, it may be environmentally

unacceptable to place the fine material along the shoreline due to the presence of seagrasses and the conversion of a tidal shoreline to more upland-type habitat.

137. Due to the shallow water and the equipment limitation brought thereby one type of dredge plant that might be used is a barge-mounted backhoe in conjunction with bottom-dump barges. Because of the stratification of the material, with the sand overlying the rock, it is likely that each barge placing material at the hardbottom habitat creation site will consist of one-third sand and two-thirds limerock. The limerock will be cobbles about four inches to two feet in diameter. These dimensions are based on the size of the rock seen on the existing spoil islands adjacent to the channel. In fact, it may be that the sand, smaller in size and lesser in weight than the rock, will flow out of the backhoe bucket and back into the channel during construction resulting in a higher percentage of rock and a lesser percentage of sand in each barge and therefore placed at the site.

138. Staging area. A staging area was identified for possible use during construction. **Figure 24** shows the location of the staging area and **Figures 25 and 26** show details about the area. The property is presently used by Hernando County Department of Public Works, Waterways Maintenance, and is large enough to accommodate both the waterways division and dredging machinery and dredging equipment stockpiles. As an alternative, a contractor might choose to use the public boat ramp and nearby public parking area for staging.

139. Real estate costs. Real estate costs include administrative costs and costs for easements (staging area). Real estate costs include the following:

Project Planning	$ 2,000
Acquisition/Administrative Costs	
Federal	$ 2,000
Non-Federal	$ 6,000
Appraisals	
Federal	$ 2,000
Non-Federal	$ 4,000
Lands	
Non-Federal	$12,000
Contingencies (25%)	$ 7,000
Total	$35,000

140. Preconstruction engineering and design costs. Preconstruction engineering and design costs are those costs necessary to complete the plans and specifications phase. These costs are cost-shared in the manner of the project purpose (90% Federal/10% non-Federal plus 10% non-Federal over 30 years). These costs include the following areas: design, specifications, cost estimating, contracting, hydrographic surveying, geotechnical, environmental,

project management and review. The environmental cost includes an estimated amount for the further cultural resources investigations mentioned previously. For the Hernando Beach navigation project the total Preconstruction engineering and design costs are estimated to be $347,000.

141. Since this is an actual cost estimate, not a percentage of the construction cost, no contingency is included (see cost estimate for the Recommended Plan, Appendix B-Engineering).

142. Construction supervision and administration costs. Construction supervision and administration costs are estimated based on the nature of the work and the anticipated duration of the construction job. This cost estimate is also an actual estimate, not strictly a percentage, and no contingency is included (see cost estimate for the Recommended Plan, Appendix B-Engineering). The estimate is $232,000. A breakdown of the estimate is found as **Figure 27**.

Operation and maintenance considerations

143. For Federal navigation projects, maintenance dredging, or periodic dredging to achieve the authorized project depth, is generally funded in total by the Government. In the case of Continuing Authorities Program projects, of which Hernando Beach channel is one, there is a limit to the Federal expenditure on maintenance dredging. This limit is described in the main report in table format, the project-specific limit being $5,000,000. There is also a time limit on Federal maintenance of Continuing Authorities Program projects of 50 years.

144. For the Hernando Beach channel, only one maintenance dredging event is documented in the permits. This event occurred 23 years after initial construction and removed 255 cubic yards of material. Local knowledge indicates that this general area of the Gulf Coast experiences very low rates of sediment movement.

145. To determine the economic investment of operations and maintenance, for inclusion in the project's overall economic investment, consideration is given to dredging and also to maintenance of channel markers. Only that maintenance dredging above and beyond that already being performed by the non-Federal sponsor is taken into consideration. The non-Federal sponsor is performing maintenance dredging of the existing channel, albeit on an infrequent basis. For the project it is assumed that maximum maintenance volumes in the widened area are 28,000 cubic yards. This figure is determined by assuming that shoaling will occur over a 12,700-foot length, a 30-foot width (widened area only), with a depth of two foot (assuming that during initial construction both the required and allowable overdepths are dredged and that the maintenance event occurs when the channel shoals to project depth). In addition, it is assumed that maximum shoaling will occur over a 7,800-foot length (extension to six-foot contour), at a width of 80 feet and a depth of two feet. Thus the maximum

maintenance volume in the extended area is 46,000 cubic yards. Adding together the resulting volumes yields 74,000 cubic yards. Note this is an overestimate since maintenance dredging does not occur over an entire project, rather just over the areas that shoal. Therefore, it is assumed that for every maintenance event one-third of this area will require dredging, for a dredging volume of about 25,000 cubic yards. The maintenance interval is once every 23 years.

146. Hernando County reports it spent over $13,000 in the fiscal year from 1 October 2001 to 30 September 2002 on labor, tools and equipment to maintain the channel, exclusive of the cost of signs and pilings. This amount does not include maintenance dredging. The County will still need to maintain the access channels and other water features not included in the Federal channel. However, since the U.S. Coast Guard estimate to maintain the aids to navigation is far smaller ($1,100) than the cost the County is presently incurring, no line item is added in the economic investment for increased spending on other operations and maintenance, that is, aids to navigation (channel markers).

Other considerations

147. Interest during construction. Interest during construction represents the opportunity cost of capital incurred during the construction period. The cost amortized is the investment incurred up to the beginning of the period of analysis. Cost incurred during the construction period is increased by adding compound interest at the project discount rate from the date the expenditures are incurred to the beginning of the period of analysis. Interest during construction ensures costs and benefits are evaluated on an equivalent time basis.

148. For the Hernando Beach project, interest during construction is calculated at a discount rate of 5.875%. Preconstruction engineering and design costs (see above) are spread out evenly over an assumed period of six months. Furthermore, the contracting process is assumed to last three months. Construction costs are spread out evenly over an assumed period of six months, or 160 days as indicated in the Recommended Plan cost estimate (see Appendix B-Engineering). The base year is assumed to be 2005 (the first full year after transfer and acceptance). The interest during construction is, therefore, $80,000. This value is included in the economic cost of the project. Interest during construction calculations are shown on **Figure 28**.

149. Recall, this document intends to include all work necessary for project construction and maintenance, including work undertaken by the non-Federal sponsor in the access channels. No resources were found in the access channels that would prohibit removal of high spots or maintenance material. Oyster beds and mangroves along the sides should be avoided. **Figure 29** highlights some of these areas.

Plan accomplishments

Purposes, scope, scale, and public acceptability

150. The purpose of the Hernando Beach Navigation Project is to enhance national economic development through the construction of a navigation channel at Hernando Beach, Florida. The scope of the project is such that it will contribute to national economic development while protecting the Nation's environment, in accordance with national environmental statutes, applicable executive orders, and other Federal planning requirements. The project meets the study objectives of minimizing channel-related damages and disruptions to the commercial fishing industry and other boaters in Hernando Beach due to insufficient channel depth, minimizing channel-related damages and traffic congestion to commercial fishermen and other boaters using the Hernando Beach channel due to insufficient channel width, improving recreation and improving the environment by strategically placing material dredged from the Hernando Beach channel.

151. The scale of the project is such that it meets the needs of commercial interests while minimizing impacts to the environment. The depth and width of the channel project, including required and allowable overdepth dredging, were carefully considered, reviewed and minimized so as to meet the needs of the non-Federal sponsor and commercial interests while not being excessive.

152. Public acceptability of the project is evidenced in the support from the non-Federal sponsor, Hernando County Board of County Commissioners, by the Hernando County Port Authority, by the Hernando County Marine Industry Council and by the Hernando Beach Coast Guard Auxiliary.

Summary of economic, environmental, and other social effects

Enhancing national economic development

153. **Table 9** itemizes the economic investment for the recommended plan. Both the costs and the economic benefits rely on the interest rate of 5.875%. The cost estimate for the recommended plan is found in Appendix B-Engineering. The costs for aids to navigation were provided by the U.S. Coast Guard. Real estate costs are those of an in-house estimate and include a contingency of 25%. Contingencies of 15% are applied to the dredging costs and are found in the recommended plan cost estimate in Appendix B. Interest during construction calculations are shown in **Figure 28**.

Table 9. Economic investment	
ITEM	COST
Construction Costs	
Channel Dredging (Including placement area preparation)	$4,272,000
Real Estate	$35,000
Preconstruction, Engineering and Design	$347,000
Construction Management	$232,000
Aids To Navigation	$55,000
Interest During Construction	$87,000
Economic Investment	$5,028,000
Note: Contingencies of 15% are included on dredging costs and 25% on real estate costs for a total contingency of $564,000. All numbers are rounded to the nearest thousand.	

154. **Table 10** summarizes the anticipated maintenance dredging costs per event for the recommended plan. It is assumed that 25,000 cubic yards of material will need to be removed from the channel per maintenance event. Maintenance dredging events are assumed to occur once every 23 years. This interval is based on the history of maintenance dredging in the existing channel. The maintenance material is assumed to be sand and the placement is assumed to be along the shoreline for creation of a recreational area.

Table 10. Maintenance dredging costs	
ITEM	COST
Channel Dredging	$884,000
Preconstruction, Engineering and Design	$38,000
Construction Management	$46,000
Total	$ 968,000
Note: Contingencies of 15% are included on dredging costs for a total contingency of $115,000. All numbers are rounded to the nearest thousand.	

155. **Table 11** provides the economic summary of the recommended plan. The average annual equivalent cost (AAEQ) of the navigation components of the economic investment is $324,600. The AAEQ cost of the maintenance dredging is $21,000. The total AAEQ cost of the project is $345,600. Project economic benefits are detailed in Appendix A-Economics. The benefits are determined using a 50-year economic period and an interest rate of 5.875%. Commercial fishing AAEQ benefits for the recommended plan are $315,800. Recreational AAEQ benefits for the recommended plan are $134,500. Total AAEQ benefits

are $449,800. The NED benefit/NED cost ratio is 1.3. **Table B-3** in Appendix B-Engineering presents the costs of the recommended plan. No benefits are foregone in the recommended plan and the recommended plan is the base plan.

Table 11. Economic summary of the recommended plan	
	AMOUNT
NED COSTS (Average annual equivalent) Interest Rate = 5.875%	
Economic Investment	$324,600
Future OMRR&R*	$21,000
TOTAL	$345,600
NED BENEFITS	
Commercial Fishing Benefits	$315,800
Recreational Benefits	$134,500
TOTAL	$449,800
NET BENEFITS	$104,200
NED BENEFIT/COST RATIO	
Commercial Fishing Benefit Percent of Total Benefits	70%
Recreation Benefit Percent of Total Benefits	30%
OVERALL	1.3
*Note: This is the increase in future maintenance costs expected with the new channel and considers both channel dredging and aids to navigation.	

156. **Table 11** demonstrates that national economic development can be enhanced through the construction of a water resources project, specifically a navigation channel, at Hernando Beach, Florida. The feasibility study leading to this report revealed that a water resources project at Hernando Beach, Florida, would contribute to national economic development consistent with protecting the Nation's environment, in accordance with national environmental statutes, applicable executive orders, and other Federal planning requirements. Improved navigation due to the deepening, widening, straightening and clearing of the channel is expected to increase safety (reduce the number of marine incidents) and reduce vessel damage costs. Local commercial and recreational boaters should realize increased and sustainable catches with an improved channel. An increase in catch and a sustainable catch will in turn increase revenue in the local fishing industry. Lost opportunities due to the cost of time will be lessened with improved channel conditions. Recreation will be enhanced by channel improvements and a larger hardbottom habitat. Hardbottom habitat will be created.

Protecting and restoring the quality of the total environment

157. The fish and wildlife resources feature included in the recommended plan is hardbottom habitat creation. The hardbottom habitat creation constitutes a component of the least cost placement method. The hardbottom is expected to attract fish and to serve as substrate for benthic organisms, sponges and algae.

158. Letters and reports furnished by U.S. Fish and Wildlife Service, National Marine Fisheries Service, Florida Fish and Wildlife Conservation Commission, Southwest Florida Water Management District, Audubon of Florida, Withlacoochee Regional Planning Council and other agencies as well as private citizens are contained in the appendices to this report.

The well-being of the people of the United States

159. Since the project meets the criteria for National Economic Development and is environmentally acceptable it protects the well-being of the people of the United States.

The prevention of loss of life

160. The wider, deeper, straighter, longer channel at Hernando Beach is expected to improve safety and therefore aid in the prevention of loss of life.

The preservation of cultural and historical values

161. NEPA implementation seeks to preserve cultural and historical values. The Environmental Assessment is the NEPA document for this feasibility study.

PLAN IMPLEMENTATION

Institutional requirements

162. The recommended plan is a navigation project with a 20,500-foot length, a bottom width of 80 feet and a project depth of 6 feet, mean lower low water. All submerged lands needed for the channel are within the navigable waters of the United States and are available to the Federal government directly by navigational servitude. The placement of material removed during channel construction will be near the Richardson Reef.

Cost allocation

163. For the Hernando Beach Channel the project purpose is commercial navigation. Design and construction costs for commercial navigation are assigned by project depth. Non-Federal sponsors must pay during the period of construction a portion of the costs associated with the general navigation features (GNF) of the project. General navigation features include navigation channels, anchorages, turning basins, jetties, breakwaters and land-based and aquatic dredged material disposal areas. The non-Federal share is based upon the project depth (including any overdepth dredging associated therewith): for the Hernando Beach Channel, with a project depth of six feet, mean lower low water, the non-Federal share is 10 percent. Non-Federal sponsors must pay an additional 10 percent of the total cost of construction of the GNF, in cash, over a

period not to exceed 30 years. The value of lands, easements, rights-of-way and relocations provided by the non-Federal sponsor for the construction, operation and maintenance of the GNF is credited toward this 10 percent payment, including credit for utility relocation costs except in the case of deep-draft harbors or harbors constructed by non-Federal interests. A non-Federal sponsor must also provide and maintain, without cost to the Federal government, all local service facilities other than those for GNF needed to achieve anticipated project benefits, including dredging in berthing areas and local access channels serving GNF. Cost allocation is summarized in **Table 12**.

Table 12. Cost allocation

Item	Federal	Non-Federal	Total
General Navigation Features	90%	10%	100%

Note: The Non-Federal sponsor contributes an additional 10% over a period of 30 years. This additional 10% of the General Navigation Features may be offset by creditable lands, easements, rights-of-way and relocations.

Cost apportionment

164. Cost apportionment for the recommended plan is shown in **Table 13**.

Table 13. Apportionment of first costs			
Item	**Total Cost**	Federal	Non-Federal
General Navigation Features (GNF) Costs (90% Federal, 10% non-Federal)			
Channel Dredging with Placement	$4,272,000	$3,845,000	$427,000
Real Estate (Administrative)	$16,000	$14,000	$2,000
Preconstruction Engineering and Design	$347,000	$312,000	$35,000
Construction Management	$232,000	$209,000	$23,000
Subtotal GNF Costs	$4,867,000	$4,380,000	$487,000
10% of GNF Costs Over 30 Years			
10% of GNF Costs		($487,000)	$487,000
Lands, Easements, Rights-of-way and Relocations (LERR) Costs (100% non-Federal)			
Real Estate	$12,000	$0	$12,000
Federal Costs (100% Federal)			
Navigation Aids	$55,000	$55,000	$0
TOTAL FIRST COSTS	$4,934,000	$3,948,000	$986,000

165. The Continuing Authorities Program's legislative authorities contain specific Federal funding limits. These limits are imposed on the Federal allocations on projects as well as on annual allocations or appropriations. For the Section 107 authority the per-project limit is $4,000,000. Expenditures of other Federal agencies under their own authorities are not included within these funding limitations. Note that this applies to the expenditure of the U.S. Coast Guard to place and maintain the aids to navigation for the Hernando Beach Channel project.

166. Projects implemented under Section 107 that result in a Federal share that exceeds the statutory per project Federal funding limit are discouraged. Such projects may proceed if the project sponsor agrees to pay all of what would have been Federal costs in excess of the statutory Federal funding limit. In no event shall Federal funds in excess of the statutory Federal project limits be allotted even if later reimbursed by the non-Federal sponsor. Since the Federal share of the general navigation features for the recommended plan exceeds the Federal funding limit the cost sharing is revised in **Table 14** to show the costs of the project considering the Federal limit. Federal costs are Corps of Engineers costs, unless otherwise noted, and non-Federal costs are sponsor costs.

Table 14. Apportionment of costs considering Federal funding limit			
Item	**Total Cost**	Federal	Non-Federal
General Navigation Features (GNF) Costs (90% Federal, 10% non-Federal)			
Channel Dredging with Placement	$4,272,000	$3,845,000	$427,000
Real Estate (Administrative)	$16,000	$14,000	$2,000
Preconstruction Engineering and Design	$347,000	$312,000	$35,000
Construction Management	$232,000	$209,000	$23,000
Subtotal GNF Costs	$4,867,000	$4,380,000	$487,000
10% of GNF Costs Over 30 Years			
10% of GNF Costs		($487,000)	$487,000
Lands, Easements, Rights-of-way and Relocations (LERR) Costs (100% non-Federal)			
Real Estate	$12,000	$0	$12,000
Federal Costs (100% Federal)			
Navigation Aids (U.S. Coast Guard)	$55,000	$55,000	$0
Study Costs			
Reconnaissance Study	$100,000	$100,000	$0
Feasibility Study	$664,000	$332,000	$332,000
Subtotal All Costs	$5,698,000	$4,380,000	$1,318,000
Corps of Engineers Funding Limit			
Subtotal all costs minus expenditures by other Federal agencies	$5,643,000	$4,325,000	$1,318,000
Federal funding limit-$4,000,000			
Amount in excess of limit		($325,000)	$325,000
TOTAL CORPS AND SPONSOR COSTS CONSIDERING FUNDING LIMIT		$4,000,000	$1,643,000
Summary			
Amount previously funded by Corps of Engineers and non-Federal sponsor		$432,000	$332,000
Amount remaining to be funded by Corps of Engineers and non-Federal sponsor		$3,568,000	$1,311,000
Amount to be funded over 30 years by non-Federal sponsor			$487,000
Amount to be funded by non-Federal sponsor at time of signing of Project Cooperation Agreement			$824,000
Amount to be funded by other Federal agencies		$55,000	

167. In addition to the per project limit, total Federal expenditures for construction and operation, maintenance, repair, rehabilitation and replacement (OMRR&R) are limited to the greater of $4,500,000 or 2.25 times the Federal costs of the project, including costs for through the construction phase. These expenditures are computed on a present worth basis starting with the date the non-Federal sponsor accepts the project. The discount rate to be used in determining the value of the future OMRR&R expenditures will be the rate applicable to the evaluation of Federal water resource projects in the Federal fiscal year of the first construction contract award. **Table 15** contains a sample calculation. When Federal participation ceases, the operation and maintenance of the project become the responsibility of the non-Federal sponsor. Regardless of the financial limit on future OMRR&R as exemplified in **Table 15**, the period of Federal participation in OMRR&R of Section 107 projects will not exceed 50 years.

Table 15. Total project limit and limit on Federal OMRR&R		
Federal Costs		
Studies, PED and Construction		$4,000,000
Estimated Average Annual Federal OMRR&R		$21,000
Total Project Limit		
	Total Federal Costs x 2.25	$9,000,000
Total Project Limit		$9,000,000
Federal Limit for Future OMRR&R		
	Total Project Limit – Total Federal Costs	$5,000,000

Implementation schedule

168. The schedule for construction of the Hernando Beach Project is as follows: complete plans and specifications, November 2003; contract award, February 2004; begin construction, March 2004; complete construction August 2004.

Federal responsibilities

169. The U.S. Army Corps of Engineers is responsible for budgeting for the Federal share of construction costs for all future work during the remaining economic life of the project. Federal funding is subject to budgetary constraints inherent in the formation of the national civil works budget for a given fiscal year. The Corps will perform the necessary planning, engineering and design needed

for the Federal project prior to construction. The Corps will obtain water quality certification.

Non-Federal responsibilities

Items of cooperation

170. Prior to implementation, the non-Federal sponsor shall be required to enter into a written Project Cooperation Agreement, as required by Section 221 (PL 91-611), as amended, to provide local cooperation satisfactory to the Secretary of the Army. By this vehicle the Hernando County Board of County Commissioners shall agree to perform the required items of cooperation prior to implementation. The required items of local cooperation are as follows:

a. Provide any additional funds needed to cover the non-Federal share of design costs;
b. Provide, during the period of construction of the project, up to an additional 10 percent of the total project costs allocated for construction of the general navigation features (which include the construction of land-based and aquatic dredged material disposal facilities that are necessary for the disposal of dredged material required for project construction, operation, or maintenance and for which a contract for the federal facility's construction or improvement was not awarded on or before October 12, 1996;);
c. Pay with interest, over a period not to exceed 30 years following completion of the period of construction of the project, up to an additional 10 percent of the total project costs allocated to commercial navigation for construction of the general navigation features. The value of lands, easements, rights-of-way, and relocations provided by the non-Federal sponsor for the general navigation features, described below, may be credited toward this required payment. If the amount of credit exceeds 10 percent of the total cost of construction of the general navigation features, the non-Federal sponsor shall not be required to make any contribution under this paragraph, nor shall it be entitled to any refund for the value of lands, easements, rights-of-way, and relocations in excess of 10 percent of the total cost of construction of the general navigation features;
d. Provide all lands, easements, and rights-of-way, and perform or ensure the performance of all relocations determined by the Federal Government to be necessary for the construction, operation, maintenance, repair, replacement, and rehabilitation of the project (including all lands, easements, and rights-of-way, and relocations necessary for dredged material disposal facilities);
e. For so long as the project remains authorized, provide, operate, maintain, replace, repair, and rehabilitate, at its own expense, the local service facilities (including all public berthing and landings with provisions for the sale of motor fuel, lubricants, and potable water) in a manner compatible with the project's authorized purposes and in accordance with applicable Federal and state laws and regulations and nay specific directions prescribed by the Federal Government.

f. Accomplish all removals determined necessary by the Federal Government other than those removals specifically assigned to the Federal Government;
g. Grant the Federal Government a right to enter, at reasonable times and in a reasonable manner, upon property that the non-Federal sponsor owns or controls for access to the general navigation features for the purpose of inspection, and, if necessary, for the purpose of operating, maintaining, repairing, replacing, and rehabilitating the project;
h. Hold and save the United States free from all damages arising from the construction, operation, maintenance, repair, replacement, and rehabilitation of the project, any betterments, and the local service facilities, except for damages due to the fault or negligence of the United States or its contractors;
i. Keep, and maintain books, records, documents, and other evidence pertaining to costs and expenses incurred pursuant to the project, for a minimum of three years after completion of the accounting for which such books, records, documents, and other evidence is required, to the extent and in such detail as will properly reflect total cost of construction of the project, and in accordance with the standards for financial management systems set forth in the Uniform Administrative Requirements for Grants and Cooperative Agreements to State and local governments at 32 CFR, Section 33.20;
j. Perform, or cause to be performed, any investigations for hazardous substances as are determined necessary to identify the existence and extent of any hazardous substances regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 U.S.C. 9601-9675, that may exist in, on, or under lands, easements, or rights-of-way that the Federal Government determines to be necessary for the construction, operation, maintenance, repair, replacement, or rehabilitation of the general navigation features. However, for lands that the Government determines to be subject to the navigation servitude, only the Government shall perform such investigation unless the Federal Government provides the non-Federal sponsor with prior specific written direction, in which case the non-Federal sponsor shall perform such investigations in accordance with such written direction;
k. Assume complete financial responsibility, as between the Federal Government and the non-Federal sponsor, for all necessary cleanup and response costs of any CERCLA regulated materials located in, on, or under lands, easements, or rights-of-way that the Federal Government determines to be necessary for the construction, operation, maintenance, repair, replacement, and rehabilitation of the project;
l. To the maximum extent practicable, perform its obligations in a manner that will not cause liability to arise under CERCLA;
m. Comply with the applicable provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, Public Law 91-646, as amended by Title IV of the Surface Transportation and Uniform Relocation Assistance Act of 1987, and the Uniform Regulations contained in 49 CFR Part 24, in acquiring lands, easements, and rights-of-way, required for construction, operation, maintenance, repair, replacement, and rehabilitation of the general

navigation features, and inform all affected persons of applicable benefits, policies, and procedures in connection with said act;
n. Comply with all applicable Federal and State laws and regulations, including, but not limited to, Section 601 of the Civil Rights Act of 1964, Public Law 88-352 (42 U.S.C. 2000d), and Department of Defense Directive 5500.11 issued pursuant thereto, as well as Army Regulation 600-7, entitled "Nondiscrimination on the Basis of Handicap in Programs and Activities Assisted or Conducted by the Department of the Army";
o. Provide the non-Federal share of that portion of the mitigation and data recovery activities associated with historic preservation, that are in excess of 1 percent of the total amount authorized to be appropriated for the project, in accordance with the cost sharing provisions of the agreement;
p. Do not use Federal funds to meet the non-Federal sponsor's share of total project costs unless the Federal granting agency verifies in writing that the expenditure of such funds is expressly authorized by statute;
q. Maintain a properly constituted and competent nonprofit public body empowered to cooperate financially and to provide and operate all local cooperation requirements, including essential local facilities for navigation at Hernando Beach open to all on equal terms.

171. The non-Federal sponsor furnishes the above assurances after the project has been authorized for construction by execution of a Project Cooperation Agreement (PCA) with the United States Government. As of 8 July 1994, there is no longer a requirement to include an initial draft PCA when submitting decision documents. The model PCA and possible deviations based on the recommended plan have been fully discussed with the non-Federal sponsor. The non-Federal sponsor is in basic agreement with the appropriate model PCA and understands the type of agreement that they will be expected to sign prior to the start of construction and that they must provide non-Federal items of cooperation. The terms of non-Federal cooperation are listed above as 'items of cooperation'. All parties involved have a complete understanding of the ultimate requirements for implementation of the plan.

Non-Federal Sponsor's Financial Statement and Financing Plan, and Financial Analysis

172. Financial analysis is required for any plan being considered for U.S. Army Corps of Engineers implementation that involves non-Federal cost sharing. The ultimate purpose of the financial analysis is to ensure that non-Federal sponsors understand the financial commitment involved and have reasonable plans for meeting that commitment. The financial analysis includes the non-Federal sponsor's statement of financial capability, the non-Federal sponsor's financing plan, and an assessment of the sponsor's financial capability. These plans and analyses are part of the draft PCA package submitted to higher authority for review and approval once the feasibility report is approved, the proposed project

modifications are authorized, and the Federal funds are budgeted for project construction.

Views of non-Federal sponsor

173. By letter dated 1 April 2002, the Board of County Commissioners, Hernando County, the non-Federal sponsor for the study, gave support for the project. A photocopy of this letter is found in Appendix D-Supplemental Information.

SUMMARY OF COORDINATION, PUBLIC VIEWS, AND COMMENTS

174. This draft feasibility report, with environmental assessment, will be coordinated with Federal, state and local interests. State-level coordination is through the Florida State Clearinghouse. During the coordination, public views and comments will be sought.

Flood Plain Development

175. Executive Order 11988 requires the Federal government to avoid, if possible, adverse impacts associated with the occupancy and modification of flood plains as well as direct or indirect support of development in those areas where there is a practical alternative. The existing channel system and community of Hernando Beach are already in the 100-year flood plain (National Flood Insurance Program). Federal improvement of the navigation channel will encourage continued use of existing facilities as well as those already planned for future growth in commerce. Development will occur with or without the proposed improvement.

CZM Consistency

176. The Coastal Zone Management (CZM) Act of 1972, as amended (P.L. 92-583) requires all Federal activities inside or outside a state's coastal zone to be consistent to the maximum extent practicable with the state's coastal zone management plan if the activities affect natural resources, land uses or water uses within the coastal zone. By issuance of a State Water Quality Certificate the State determines that the authorized project for which initial construction has been completed was consistent with the state CZM Act. The state will review the application and project plans and specifications in order to make a final consistency determination prior to any future project construction.

Coastal Barrier Resources Act

177. The proposed new Federal investment decision for the Hernando Beach Channel navigation project does not include any recommendations which would result in any new Federal expenditures or financial assistance prohibited by the

Coastal Barrier Resources Act (P.L. 97-348); nor were funds obligated in past years for this project for purposed prohibited by this Act.

RECOMMENDATION

178. I have given consideration to all significant aspects in the overall public interest. These aspects include environmental, social and economic effects; engineering feasibility and any other elements bearing on the decision.

179. I recommend for implementation the following Federal navigation project at Hernando Beach Channel, Florida: a channel having a project depth of six feet, mean lower low water, a bottom width of 80 feet, and a length of 20,500 feet, with wideners in the bends as appropriate. This plan is recommended with such modifications thereof as in the discretion of the Commander, HQUSACE, may be advisable.

180. The recommendations contained herein reflect the information available at this time and current Departmental policies governing formulation of individual projects. They do not reflect program and budgeting priorities inherent in the formulation of a national Civil Works construction program nor the perspective of higher review levels within the Executive Branch. Consequently, the recommendations may be modified before they are transmitted to the Congress as proposals for authorization and implementation funding. However, prior to transmittal to the Congress, the sponsor, the States, interested Federal agencies, and other parties will be advised of any modifications and will be afforded an opportunity to comment further.

JAMES G. MAY
Colonel, Corps of Engineers
Commanding

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