ENVIRONMENTAL IMPACT STATEMENT
APPENDIX O: Formulation of Alternatives

SAVANNAH HARBOR EXPANSION PROJECT

Chatham County, Georgia and Jasper County, South Carolina

January 2012

US Army Corps of Engineers
Savannah District
South Atlantic Division

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EDITOR'S NOTE: Savannah District prepared this document in 2004/2005 to describe the plan formulation work that had been performed at that time. A public review of the report was conducted in May/June 2005. Because of the age of the document, some of the information it contains is now out of date -- descriptions of ongoing construction projects, for example – but the report has been included to inform the reader of the analyses that were performed and conclusions reached at that time. Those decisions are important in the overall study process. The District has reviewed the decisions described herein and believes they are still valid. In addition, Label "G" on Figure 1 should read "Disposal Sites 14A/B" to correspond with the discussion later in the document (pp. 72-76).

The table on the following page summarizes the measures that were considered, the conclusions reached in 2005 on those measures, and reviews those decisions to ensure they are still valid.

MEASURE	CONCLUSION IN 2005 REPORT	SUMMARY REASON IN 2005 REPORT	2012 ASSESSMENT
Non-Structural			
Reduce Underkeel Clearance Requirement	No improvement is possible	Savannah Underkeel Guidelines are consistent with other deep-water ports. Harbor Pilots do not believe they could operate safely with less clearance.	Concur. Detailed analysis includes present underkeel clearances.
Increase Efficiency of Landside Operations	No further action needed beyond W/O Project Condition	Would only consist of advancing already planned capital improvements to the Garden City Terminal	Concur. GPA continues to make capital investments to increase the terminal's throughput capacity.
Specialization / Optimization of Facilities	Not needed beyond W/O Project Condition	GPA has specialized the Garden City Terminal and is increasing the efficiencies in landside handling and storage. New berths and facilities are being developed to handle Post-Panamax container ships.	Concur. GPA continues to make capital investments to increase the terminal's throughput capacity.
Improve Traffic Management Practices	No additional measure would be helpful	Further coordination or a system to facilitate coordination would not be helpful	Concur. Pilots have not identified a system that would improve their operations.
Structural			
Minor Modifications			
Passing/ Meeting Areas	Include	Required with a larger design vessel to maintain the present level of service	Concur. Ship simulation studies confirmed the need for these measures.
Bend Wideners	Include	Ship Simulation Report identified areas where bend wideners would be needed to allow safe transit of the design vessel	Concur. Ship simulation studies confirmed the need for these measures.
Aids To Navigation	Include	Additional aids would not be helpful in the inner harbor; New aids would be required on an extension to the entrance channel	Concur. New aids would be placed to mark the extended entrance channel.
Vessel Traffic Coordination	Not include	Further coordination or a system to facilitate coordination would not be helpful	Concur. Pilots have not identified a system that would improve their operations.
Alternate Terminal Locations			
Garden City Terminal	Most cost effective site when harbor deepening and landside facility costs are considered	Presently a large functioning container terminal (infrastructure already in place); Planned expansions in terminal capacity would be part of Without Project Condition	Concur. GPA continues to increase the terminal's throughput capacity. Project costs are higher than previously predicted, but the dredging costs to this site are still much less than the costs of developing a new container terminal.
East Coast Terminal	Low Potential - Eliminated	Inadequate size; East-West landside transportation through City; Relocate existing operation	Concur. Site limitations still exist

Structural (Continued)			
Alternate Terminal Locations (Continued)			
Ocean Terminal	Low Potential - Eliminated	Inadequate size; High cost of renovation; Lack of dredging savings	Concur. Site limitations still exist.
Elba Island	Low Potential – Eliminated	Adjacent to LNG facility; Inadequate size; East-West landside transportation through City; Navigation safety issues	Concur. Site limitations still exist.
Blue Circle	Low Potential – Eliminated	Inadequate size; Lack of dredging savings; Difficult rail connection; Relocate existing operation	Concur. Site limitations still exist.
Brunswick	Low Potential – Eliminated	Distance from inland markets; High dredging costs	Concur. Site limitations still exist.
Disposal Area 12A	Medium Potential – Not Cost Effective	Need to develop rail connection; Loss of sediment storage capacity; Adverse environmental effects from access & replacement sediment storage capacity	Concur. Landside development costs are now expected to be $4-5B, greatly exceeding the costs to deepen to GCT.
Disposal Areas 14A/14B	Medium Potential – Not Cost Effective	Need to develop rail connection; Loss of sediment storage capacity; Adverse environmental effects from access & replacement sediment storage capacity	Concur. Landside development costs are now expected to be $4-5B, greatly exceeding the costs to deepen to GCT
Tybee Island National Wildlife Refuge	Medium Potential – Not Cost Effective	Need to develop rail/road connection; Adverse environmental effects from access and replacement sediment storage capacity; Potential Intracoastal waterway impacts	Concur. Landside development costs would be high, coupled with the costs for a bridge over the AIWW.
Alternate Facility Types			
Offshore Transshipment Facility	Low Potential – Eliminated	High development costs; Adverse environmental effects; High costs of double handling; Delays due to weather.	Concur. Development costs still expected to be high. Double handling still required.
Major Modifications			
River Straightening	Not include	Would not markedly increase the efficiency of vessel transits	Concur.
Harbor Deepening	Include	Deepen existing navigation project to reduce light loading and tidal delays	Concur. Vessels calling at the port continue to grow in size. Cargo levels have increased and are expected to continue to grow in the future.

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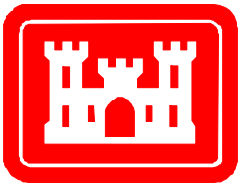
Savannah Harbor Expansion Project

Formulation of Alternatives

General Re-evaluation Report

&

Environmental Impact Statement



US Army Corps
Of Engineers
Savannah District

March 2004
(Revised April 05)

SAVANNAH HARBOR EXPANSION PROJECT
FORMULATION OF ALTERNATIVES

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FEDERAL WATER RESOURCE OBJECTIVE

The objective of water and related land resources planning is to contribute to national economic development consistent with protecting the Nation's environment, pursuant to national environmental statutes, applicable executive orders, and other Federal planning requirements.

COOPERATING AGENCY GOALS

1. Process related:
    - Determine the specific and differential incremental effects of each channel improvement alternative.
    - Identify and evaluate impacts on the human environment, including impacts on natural resources, economics, and societal considerations (jobs).
    - Contain studies that are conducted in a manner that leads to their technical acceptance by the scientific community.
    - Clearly identify all benefits and costs for the decision-makers.
    - Recognize that mitigation may be necessary for any or all of the identified impacts.
    - If needed, recommend specific actions that should be taken outside the context of the Expansion Project to improve the local environment and/or compensate for past harbor improvement projects. The report would identify the process and participants to accomplish those specific needed actions.
    - Be documented by a report that leads decision-makers to clear decisions on the project.
2. Outcome related:
    - Produce positive economic benefits for the port community and have beneficial environmental effects.
    - Include a mitigation plan that addresses unavoidable impacts to critical natural resources.
    - Include post-project monitoring to ensure that the expected levels of adverse impacts are not exceeded.
    - Be supported by most stakeholders.

IDENTIFYING PROBLEMS AND OPPORTUNITIES

Problems and opportunities statements will be framed in terms of the Federal objective and the specific study planning objectives. Problems and opportunities should be defined in a manner that does not preclude the consideration of all potential alternatives to solve the problems and achieve the opportunities.[1]

PROBLEM STATEMENTS:

1. Existing shippers are experiencing increased/ inflated operations costs due to light loading and tidal delays
2. Light loading and tidal delays will increase as present harbor users increase their annual tonnage and as larger, more efficient ships replace older, smaller ones.
3. Existing ships are experiencing problems associated with turning capabilities and overall maneuverability in certain reaches of the inner harbor.
4. The severity of problems associated with turning capabilities and overall maneuverability in certain reaches of the inner harbor will increase as vessel size increases.

OPPORTUNITIES

1. Beneficial placement of new work sediments (Tybee Island and other locations)
2. Development of new upper harbor disposal area with new work material
3. Reduce O&M annual dredging costs
4. Enhance the natural resources in the project area
5. Advance the understanding of the natural resources in the project area
6. Contribute to the preservation of historically significant resources in the project area
7. Contribute to other agencies environmental decision making resources through development of state of the art modeling tools
8. Reduce constraints of harbor pilot operating practices
9. Identify the accumulated environmental impacts from past harbor development and operation. When consistent with the USACE authorities and policies, include appropriate actions in the plan alternatives.

OBJECTIVES

Definition: Statements that describe the desired results of the planning process by solving the problems and taking advantage of the opportunities identified.[2]

1. Contribute to national economic development by minimizing costs of moving cargo through Savannah Harbor by reducing current and future tidal delays in an environmentally acceptable and sustainable manner.

[1] [1] Planning Guidance Notebook, Para. 2-3.a.
[2] Planning Guidance Notebook, Para. 2-3.a. (4)

2. Include post-project monitoring and adaptive management to ensure that the expected levels of adverse impacts are not exceeded.
3. Reduce current and expected future tidal delays
4. Reduce the need to light load caused by channel depth constraints
5. Reduce the need to light load caused by operational constraints
6. Reduce the current and future impacts and problems associated with turning capabilities and overall maneuverability in certain reaches of the inner harbor.

NOTE: In the plan formulation and evaluation process, incorporate consideration of all identified opportunities while achieving the objectives listed above.

PROJECT CONSTRAINTS

Definition: Constraints are restrictions that limit the planning process. Plans should be formulated to meet the study objectives and to avoid violating the constraints.

1. Underkeel clearance requirements
   - Pilots current and anticipated future operating practices requires 4-feet underkeel clearance
2. Meeting and passing limitations
   - Pilots current and anticipated future operating practices limit meeting and passing in the navigation channel
3. Environmental restrictions on dredging
   - Bar – Sea Turtles, Whales
   - Inner Harbor – Striped Bass, Manatee
4. Proximity of navigation channel to the Savannah National Wildlife Refuge
5. Aquifer
6. Location of cultural resources (Ft. Jackson, Ft Pulaski)
7. Proximity of landside development
8. Coast Guard restrictions on vessel movements
   - LNG Tanker movement limitations on other vessel traffic
   - Transit speed and or wake limitations
9. Tier I Commitments
   - Commitment to GADNR that deepening will not adversely impact recovery of striped bass
   - Shortnose Sturgeon
   - Additional field studies
   - No net effect on Dissolved Oxygen (DO)
   - Refine Hydrodynamic and Salinity Model

INVENTORY & FORECASTING CONDITIONS

An inventory and forecast of critical resources (physical, demographic, economic, social, etc.) relevant to the problems and opportunities under consideration in the planning area. This information is used to further define and characterize the problems and opportunities. A quantitative and qualitative description of these resources is made, for both current and future conditions, and is used to define existing and future without-project conditions.

ITEMS TO INVENTORY AND FORECAST

1. Fleet
2. Commodities
3. Operation procedures
4. Landside capacities
    - Berth characteristics
    - Throughput capacity
    - Acreage
    - Crane capacity
5. Fishery resources in the harbor
    - Shortnose Sturgeon
    - Temporal and spatial distribution of estuarine dependent species
    - Striped Bass
    - Scaienid species
6. Wetlands vegetation in the upper harbor
7. Cultural resources
    - Ft Jackson
    - CSS Georgia
    - Ft Pulaski
    - Others
8. Socioeconomic Considerations
9. Features of existing navigation project
    - Channel
    - Continued use of the existing harbor, at authorized channel dimensions, with no improvements for navigation. Periodic O&M would continue as required.
    - Disposal areas
    - Turning basins
    - Sediment Control Works
10. Adjacent Properties and Structures (to include)
    - Roussakis Plaza
    - East Coast Terminal
    - Blue Circle Cement
    - International Paper
    - Fife and Clydesdale Plantation
11. Water Quality Conditions

- Salinity Distributions
- Chloride Distributions
- Dissolved Oxygen Distributions

12. Sediment Quality
    - Physical
    - Chemical
13. Freshwater Marsh Succession
14. Wetland Resource Utilization
15. Ocean shoreline and riverbank conditions
16. Floridan Aquifer

WITHOUT PROJECT CONDITIONS

Existing conditions are those at the time the study is conducted. The forecast of the future-without project conditions reflects the conditions expected during the period of analysis. The future without-project condition provides the basis from which alternative plans are formulated and impacts assessed.

1. Initial assumptions
2. Detailed description
    - Fleet
    - Commodities
    - Operation procedures
    - Landside capacities
    - Fishery resources
    - Wetlands vegetation in upper harbor
    - Cultural resources
    - Socioeconomic considerations

FORMULATION OF ALTERNATIVE PLANS

Alternative plans shall be formulated to identify specific ways to achieve planning objectives within constraints, so as to solve the problems and realize the opportunities that were identified in Step 1. An alternative plan consists of a system of structural and/or nonstructural measures, strategies, or programs formulated to meet, fully or partially, the identified study planning objectives subject to the planning constraints. An alternative plan is a set of one or more management measures functioning together to address one or more objectives.

POTENTIAL MANAGEMENT MEASURES

Management measures are the building blocks of alternative plans and are categorized as structural and nonstructural. Equal consideration must be given to these two categories of measures during the planning process.

1. Reduce current and future tidal delays
    (a) Non-Structural
        1. Timing/schedule (dealing with a single vessel only)
        2. Reduce under keel clearance requirement
        3. Increase efficiency of landside operations to decrease turn-around time
        4. Specialization/optimization of facilities
            - Modification of Garden City Terminal
            - Increase efficiency of landside operations to decrease turn-around time
        5. Improved traffic management practices (dealing with coordination of multiple vessel movements)
        6. Regional port (feeder hub as well)
    (b) Structural
        1. Deeper channel
        2. Alternate terminal locations
            - Offshore transshipment facility
            - Onshore terminal
        3. Straighter channel alignment
        4. Passing lanes
        5. Increased/Improved landside infrastructure

2. Maneuverability of existing vessels
    (a) Non-Structural
        1. Improved equipment
        2. Vessel design modifications
            - Thrusters
            - Power
        3. Tug assistance
        4. Pilot training

5. Aids to navigation
    - Portable GPS navigation system
    - Harbor based vessel control system
    - Range lights/radar reflectors
    - Fixed radar reflectors along channel
6. Real time environmental data
    - Real time tide data vs. predicted tide
    - Wind speed and direction
    - Current speed and direction
7. Other

(b) Structural

1. Bend wideners
2. Turning basins
3. Passing lanes
4. Straighten river/longer ranges

3. Reduce the need to light load caused by channel depth constraints

(a) Non-Structural

1. Timing/schedule (dealing with a single vessel only)
    - Reduce underkeel clearance requirement
    - Increase efficiency of landside operations to decrease turn-around time
2. Specialization / optimization of facilities
    - Modification of Garden City Terminal
        a. Increase efficiency of landside operations to decrease turn-around time
        b. Specialization / optimization of facilities
3. Improved traffic management practices (dealing with coordination of multiple vessel movements)
4. Regional port (feeder hub as well)

(b) Structural

1. Deeper channel
2. Alternate terminal locations

(a) Georgia

- East Coast Terminal
- Ocean Terminal
- Elba Island
- Brunswick
- Other

(b) South Carolina

- Disposal Area 12A proposed terminal
- Disposal Areas 14A/14B proposed terminal location
- Tybee Island National Wildlife Refuge
- Other locations

3. Offshore transshipment facility

4. Onshore terminal
5. Straighter channel alignment
6. Passing lanes
7. Increased/Improved landside infrastructure

4 Reduce the need to light load caused by operational constraints
   (a) Non-Structural
      1. Timing/schedule (dealing with a single vessel only)
      2. Reduce under keel clearance requirement
      3. Increase efficiency of landside operations to decrease turn-around time
      4. Specialization / optimization of facilities
      5. Improved traffic management practices (dealing with coordination of multiple vessel movements)
      6. Regional port (feeder hub as well)
   (b) Structural
      1. Deeper channel
      2. Alternate terminal locations
         - Offshore transshipment facility
         - Onshore terminal
      3. Straighter channel alignment
      4. Passing lanes
      5. Increased/Improved landside infrastructure
         - Create breakwaters

5. Reduce underkeel clearance requirement

PRELIMINARY ALTERNATIVES

1. Reduce underkeel clearance requirement
   - Real time environmental data

2. Modification of Garden City Terminal
   - Increase efficiency of landside operations to decrease turn-around time
   - Specialization / optimization of facilities

3. Alternative terminal locations
   a. Georgia
      - East Coast Terminal
      - Ocean Terminal
      - Elba Island
      - Brunswick
      - Other
   b. South Carolina
      - Other than Disposal Areas 14A/14B proposed terminal

- Disposal Areas 14A/14B proposed terminal location
- Tybee Island National Wildlife Refuge
- Other locations

4. Regional port

5. Offshore transshipment facility

6. Deepening existing 42 MLW navigation channel (to Station 103)
   - Alternative 44 (44’ Deepening)
   - Alternative 46 (46’ Deepening)
   - Alternative 48 (48’ Deepening)

7. Improve existing 42 MLW navigation channel
   - Passing Lanes
   - Bend Wideners
   - Aids to navigation
   - Coordination of multiple vessel movements
   - Straighten river / Longer ranges

EVALUATION OF PRELIMINARY ALTERNATIVES

Savannah District conducted a conceptual-level evaluation of the preliminary alternatives identified in the previous section to determine whether they were likely to meet the problems and needs that this project is intending to address. We first examined the non-structural measures (underkeel clearance and modifications to the Garden City Terminal), then the alternative terminal locations, followed by the minor modifications passing areas, bend wideners, aids to navigation, vessel traffic coordination, and straightening of the river).

NON-STRUCTURAL ALTERNATIVES

Tier II plan formulation has considered a wide variety of nonstructural measures to address navigation problems and opportunities in Savannah Harbor. Most of these measures were screened out due to technical or economic considerations. However, two nonstructural measures were carried forward for more detailed evaluation in this investigation: (1) reduce underkeel clearance requirements and (2) increase efficiency of landside operations to decrease turn-around time. Both of these measures could potentially reduce lightloading and/or tidal delay costs to vessels that are constrained by existing channel dimensions in Savannah Harbor.

1. Reduce underkeel clearance requirement.

Existing Conditions: Underkeel Clearance

Reducing underkeel requirements could potentially reduce lightloading and tidal delays experienced by commercial vessels calling at Savannah Harbor. If, as expected, design drafts of container ships continue to increase, lightloading and tidal delays could become increasingly prevalent during the 50-year period of analysis. Reductions of these problems would reduce transportation costs for commercial navigation through Savannah Harbor with consequent National Economic Development (NED) benefits.

Underkeel Guidelines of Port User's Workgroup

In 1996, a Port Users Workgroup was assembled to coordinate commercial navigation operations in Savannah Harbor. The Port Users Workgroup consisted of representatives of the SPA, GPA, shippers, terminal operators, towing companies, and other maritime industry professionals. Also included were the Corps, USCG, and other Federal agencies responsible for safe and efficient navigation on these waterways. The Workgroup discussed current underkeel and safe transit guidelines for the ports of Savannah and Brunswick. The intent of this cooperative partnership was to proactively implement proven guidelines and operating controls to promote marine safety and to prevent economic and environmental loss by not imposing overly restrictive government regulation and controls. As a result of this coordination, the Workgroup developed *Port of Savannah Minimal Underkeel Clearance Guidelines for Minimum Underkeel*

Clearances. The guidelines were adopted by parties to the Workgroup as minimum operational standards for vessels transiting Savannah Harbor. These guidelines may be modified in the future by a similar representative body of Savannah's port users. The purpose of the guidelines is to proactively prevent maritime accidents and casualties. They were also intended to remove ambiguity and inconsistency in the procedures necessary to ensure that commercial vessels do not ground during transit or while berthed at a Savannah facility.

The underkeel guidelines for commercial vessels are as follows. They are applicable to all vessels in excess of 1600 gross tons.

"The following minimum underkeel guidelines apply in all conditions of tide and weather.

1. *4 feet for transits in the navigation channel between the sea buoy, across the Savannah Bar, through Jones Island range, ACOE station –14, where the project depth of the channel increases 2 feet.*
2. *2 feet for transits between Jones Island range and the point in the navigation channel which is adjacent to the facility of destination.*
3. *When operating on waters outside the established navigation channel, and while moored at a facility pier, 1 foot for single-skin tank vessels greater than 5,000 gross tons and 6 inches for all other deep draft vessels. These guidelines are also applicable for vessels maneuvering outside the boundaries of the navigation channel."*

The underkeel clearance specified by the guidelines includes squat. Squat is the phenomenon whereby the ship's draft is increased in shallow water due to the hydrodynamic effects between the ship and the channel bottom causing an increase in draft. It effectively reduces the underkeel clearance in areas where clearance may be critical. It can also impair maneuverability. Squat is approximately proportional to the speed of the ship. Halving the speed reduces the squat effect by a factor of four. In general, squat effects typically commence in waters where the depth/draft ratio is less than four-to-one.

In addition to underkeel clearance, the guidelines identified the following operational responsibilities and controls necessary to meet these objectives.

- The guidelines request that the Corps conduct regular surveys of the navigation channel and provide reports of the channel condition to the pilots and all concerned parties. At a minimum interval of every 90 days, or within 30 days prior to the arrival of a deep draft vessel, terminal operators are asked to conduct soundings in their berths.
- A conference between a vessel's master and the appropriate pilot should occur prior to the vessel's inbound or outbound transit. This pre-transit conference allows pilots to discuss with vessel masters the transit route and any special risks that the transit may incur.

- If a vessel in transit, using "tidal lift" to assure its underkeel clearance should experience a steering failure or loss of power that requires the vessel to be anchored, it shall be assisted by tugs to a safe anchorage. This anchorage shall be either offshore or in the vicinity of a Savannah River range or facility that has depth sufficient to accommodate the vessel's draft. It is the responsibility of the vessel's agent and master to identify, in advance, the towing requirements necessary to ensure the aforementioned actions may take place in a timely manner.
- The SPA's Pilotage Regulations are the recognized standard for maximum deep draft of vessels crossing the Savannah Bar under normal weather and navigation channel conditions.
- If a vessel is using "tidal lift" to assure minimum underkeel clearance while moored at a facility, that vessel must have a contingency plan in place which provides the personnel necessary to move the vessel away from the facility prior to exceeding the clearance. Additional discussion on this subject is provided below.
- A waiver for any of the underkeel clearance guidelines may be applied for by sending a written request, with supporting documentation, to the Port User's Workgroup. In certain cases, a request for waiver may necessitate the specific approval of the USCG.

Discretion of Pilots

According to the Savannah Pilots Association, it is the pilot's decision whether conditions are adequate for a vessel to transit the river at a given time. The Savannah underkeel guidelines are minimum standards and are not intended to be limiting for pilots, operators, or owners that choose to require a higher degree of safety for their operations. It is also the owners/operators discretion to require that their vessels transit with underkeel clearance in excess of the minimum requirements established by the guidelines. For example, a major containership carrier line, P&O Nedlloyd, has a policy that underkeel clearance requirements for their vessels should equal 10% of the vessels' design drafts, which is more than four feet for the largest containerships calling at Savannah.

By riding the high tide up or down the river vessels that are depth-constrained by channel dimensions of Savannah Harbor can achieve additional underkeel clearance, allowing deeper loading of a given vessel or use of a larger vessel. The tradeoff is the additional time required to wait for a favorable tide (i.e., tidal delay), and any additional steaming time required to reach the dock when "drifting" the tide. As indicated above, the Pilotage Regulations of the SPA are the recognized standard for inbound and outbound transits for vessel that are depth-constrained. These regulations specify time windows in the tidal cycle when vessels of specific draft can initiate inbound/outbound transits (see Table 1). Vessels with operating drafts of 38 feet or less can transit the channel at any time, weather permitting. Vessels drawing up to 42 feet can transit the channel using tidal advantage consistent with the Pilotage Regulations.

Table 1
Pilotage Regulations of the
Savannah Pilots Association
(12/15/94)

Start		Deadlines
	Inbound	
LW + 3.0 hours	42’00"	HW – 1.0 hours
LW + 2.5 hours	41’00"	HW – .5 hours
LW + 1.5 hours	40"00"	HW
LW + 1.0 hours	39’00"	HW
LW---anytime	**38’00"**	**LW---anytime**
LW + 2.0 hours	39’00"	HW – 2.5 hours
LW + 2.5 hours	40’00"	HW – 2.0 hours
LW + 3.0 hours	41’00"	HW – 1.0 hours
LW + 3.0 hours	42’00"	HW – .5 hours
	Outbound	

LW = Low Water; HW=High Water

All Vessels GCT (General License)

Tides – Savannah River Entrance

Wind Factor – 0

Time Limits Subject To Change Due To Weather Conditions Or Low Powered Vessels Or Emergencies

FROM SAVANNAH RIVER TO TOWN
+ 1 hour - high water
+ 1-1/2 hours – low water

The pilots use every available means to safely transit the harbor. In pre-transit coordination, vessel masters provide the pilot with the characteristics and condition of their vessels, including: mean draft, trim and list, and speed/squat. In turn, pilots provide vessel masters with information about physical conditions in the harbor, including: tide, seas, wind conditions, facility depth, and transit depth. The pilots currently have real-time information about channel depths from National Oceanic and Atmospheric Administration (NOAA) tide gauges, which can be accessed by cell phone. The Corps and port facilities provide the pilots and vessel masters with up-to-date information on channel depths and berth depths, respectively. The pilots are also aware of areas subject to shoaling and the type of material accreted. Much of the substrate of the Savannah Harbor Federal channel is either hard sand or soft mud.

Commercial ships must keep up their speed to maintain steerage in the tidal currents, and squat can be significant at speeds typically maintained by vessels in the harbor. The underkeel guidelines assume the vessel has good maneuverability. At low water (LW), vessels with good maneuverability would have a 38-foot operating draft in the 42-foot channel. If the vessels have poor maneuverability, the pilots may require as much as five or six feet of clearance underkeel.

Without-Project Future Conditions: Underkeel Clearance

As expressed by Capt. Browne the Savannah pilots consider the Savannah underkeel guidelines to be the minimal underkeel clearance necessary to safely navigate Savannah Harbor and fully expect that the current underkeel clearance guidelines will prevail throughout the period of analysis. The Panamax container ships which call at Savannah can have lengths overall (LOA) of up to 950 feet. Post-Panamax ships are longer. The pilots consider the underkeel guidelines to be the absolute minimum for commercial vessels, given potential pitch and roll. As indicated above, it is the pilot's discretion at all times to delay in order to ensure additional clearance.

The Savannah underkeel guidelines are consistent with other deep-water ports in the United States. Specifically, the ports of New York – New Jersey, Delaware River, Norfolk – Hampton, and Los Angeles – Long Beach require a minimum of three feet underkeel in their harbors.

With-Project Conditions: Reduced Underkeel Clearance

The SPA is resolute in its defense of the Savannah Underkeel Guidelines. Although the guidelines indicate that modification is possible by the Port User's Workgroup or a similar body representative of the Savannah port community, the SPA cannot envision any circumstances under which those guidelines would be reduced.

Conclusion: Underkeel Clearance

At this time there is no potential for reduced underkeel clearance to address navigation problems and opportunities in Savannah Harbor. The underkeel clearance currently

stipulated by the guidelines does not offer any opportunity for reduction when vessel squat is included in the clearance calculation. In addition, the resolute opposition by the SPA on the basis of navigational safety indicates a lack of institutional support for this nonstructural measure. Based on coordination with GPA and USCG, the position of the Savannah Pilots Association is the most critical determinant of underkeel clearance in port operations in Savannah Harbor.

2. Modifications of Garden City Terminal (GCT).

As a nonstructural measure, modifications to Garden City Terminal would entail improvements to the container throughput capacity of the terminal, and would also be considered under the without-project conditions. The rationale for this particular nonstructural alternative is that increasing the efficiency of the terminal could potentially decrease the turn-around time for vessels calling at the terminal. Given the growth forecasts for containers moving through Savannah Harbor during the period of analysis, the decreased turn-around time could potentially reduce congestion and increase throughput in the port relative to the without-project conditions.

Specifically, it must be determined to what extent this nonstructural measure could address problems associated with channel dimensions which are insufficient to efficiently accommodate the fleet of container ships expected to call on Savannah during the period of analysis.

Existing Conditions: Facilities and Throughput Capacity

Garden City Terminal, which is a public terminal operated by GPA, is profiled in Table 1. At this terminal there are currently an average of approximately 16,000 picks (i.e., containers to/from a vessel) per week. During peak periods, there can be as many as 17,500 picks/week. This translates into approximately 830,000 picks/year (assuming a 365-day per year operation) and 1.5 million 20-foot equivalent units (TEUs) per year (assuming a 1.8 factor to account for the predominance of 40-foot boxes). In FY 2002, Garden City Terminal had 1,136,616 TEUs pass through this terminal. Garden City Terminal encompasses approximately 1,200 acres with 500 acres dedicated to container operations and storage. The remaining acreage is occupied by rail facilities, warehouses, tank farms, and buildings. At this time, all of the Garden City berths are maintained at 42 feet deep, consistent with the depth of the Savannah Harbor Federal channel

Table 2: Garden City Terminal Facilities
Cargo Handled: Containers, General Cargo, Ro/Ro, Project Cargo, and Liquid Bulk
Terminal Area: 1,120 acres
Container, RO/RO Berths Linear Feet: 7,726 Depth Alongside 42 ft. at mean low water Dock Height 15 ft. above mean low water Apron Width Up to 196 ft.
Liquid Bulk Berths Linear Feet: 682 Depth Alongside 36 ft. (10.9 m.) at mean low water Dock Height 15 ft. (4.5 m.) above mean low water Liquid Tank Farm 2.2 million barrel capacity
Container Cranes Total: 13 (2 super post-Panamax and 11 post-Panamax)
Equipment Rubber-Tired Gantries: (22) 45-st capacity Four-high loaded toplifts: (25) 67,400 lb. under spreader capacity; (7) 87,000 lb. under spreader capacity Three-high loaded toplifts (3) 87,000 lb. under spreader capacity Five-high empty stackers (6) 15,000 lb. capacity under spreader capacity Forklifts (43) 11,000 lb. - 52,000 lb. capacity with accessory attachments Over-height crane attachment (1) 45-st capacity spreader loader; (2) 56-st (50 lt) capacity spreader loader
Warehousing: Total 1,417,808 sq. ft., equipped with alongside rail/truck capabilities, includes 68,150 sq. ft. cold storage
Container Field Paved Area (acres) 405 Paved Area (hectares) 164 Parking Slots 12,345 TEU Stacking Slots 33,598
Rail Services: Norfolk Southern Railroad provides switching services; interchange and line haul services provided by Norfolk Southern Railroad and CSX Transportation. Newly-completed Mason Intermodal Container Transfer Facility (ICTF) is located adjacent to Garden City Terminal. ICTF spans over 150 acres. At final build-out, the ICTF will include 40,000 feet of lead track and 80 acres for container storage and marshaling. This facility now daily handles unit trains.

With its current facilities, Garden City Terminal currently has an annual throughput capacity of approximately 1.75 million TEUs. This capacity estimate is based on current container storage capacity at Garden City Terminal (500 acres of container storage with storage capacity of approximately 3,512 TEU's per acre per year).

Permits for construction of Container Berth 8 (CB-8) were received in November 2003. CB-8 will include approximately 2,100 linear feet of berthing space, and four high-speed super post-Panamax container cranes, and 80 acres of landside storage. As part of GPA's plans for development of CB-8, yard capacity will be augmented by an additional 75 acres of GPA-owned land south of Berths 7 and 8. It is anticipated that, of this area, 42 acres will be used for container storage; the remainder will be used for relocated gate operations and vehicle/trailer depots. Relocation of these activities will provide additional container storage near the terminal berths.

There are currently 2,500 to 3,000 TEU moves by rail per week through the Mason Intermodal Container Transfer Facility (ICTF). At this time, Norfolk Southern is the only railroad that operates from the ICTF. However, CSX is currently developing rail connection to this facility with completion expected in 2005-2006. Norfolk Southern provides service to Atlanta five days per week, effectively competing with truck transport. Norfolk Southern's access to ICTF is via the Foundation Lead track. Norfolk Southern currently loops eastward to its yard in Savannah and comes in the east side of ICTF. CSX and Norfolk Southern intend to construct connector rails from their tracks south of ICTF for more direct access to ICTF from the west side. Norfolk Southern owns Foundation Lead but is expected to reach agreement with CSX regarding their use of this track.

The ICTF can accommodate 8,000-foot unit trains. Through this facility, Norfolk Southern provides expedited, overnight rail service to Atlanta and offers users seamless 3-day delivery, or less, by rail to major American hubs in Chicago, Detroit, Dallas/Fort Worth, Memphis, Kansas City, St. Louis, Louisville, Houston, New Orleans, Mobile, as well as other key destinations throughout the United States. The Mason ICTF now handles daily unit trains.

Without-Project Conditions

GPA is making significant investments to maintain state-of-the-art container handling facilities at Garden City Terminal, and GPA is committed to providing the terminal facilities and landside infrastructure necessary to accommodate its future customer.

Facilities and Throughput Capacity

GPA's capital planning process will expand the throughput capacity of the terminal consistent with anticipated sizes and frequencies of container vessels calling at the terminal and with the expected volumes of containers to pass through the facility. GPA's capital planning horizon is 10 years. At this time, GPA anticipates that the volume of containers moving through Garden City Terminal will increase five to seven percent per year over the period of analysis. The capital planning process is designed to anticipate future commodity volumes with sufficient time to implement needed improvements to ensure that facility capacities always meet or exceed the total throughput needs of shippers utilizing this terminal.

Recent, ongoing, and planned improvements at Garden City Terminal include the installation in 2003 of two super post-Panamax cranes to augment the capacity of 11 post-Panamax cranes already in place. The development of the Mason ICTF, the ongoing realignment of container stacks to facilitate the faster movement of containers to/from ships and storage, and the pursuit of navigation improvements in Savannah Harbor.

At this time, GPA is pursuing increased efficiencies in landside handling and storage and new berths and facilities capable of handling post-Panamax container ships. In pursuit of increased efficiencies in container handling and storage, GPA intends to increase storage densities and thereby augment throughput capacity. GPA's goal is to increase storage utilization from the current level of 3,512 TEUs per acre per year to 5,500 TEUs per acre

per year. Achieving this level of storage utilization in the entire container operations would increase terminal capacity to 2,750,000 TEUs, not including additional capacity expected with CB-8. U.S. container ports typically handle 2,000 to 5,000 TEUs per acre per year. Consequently, the 5,500 per acre per year target is realistic with current technology.

Permits for construction of CB-8 have been obtained and development of these facilities has been initiated. CB-8 will add 2,100 linear feet of berth with 75 acres of yard, or approximately 0.04 acres (1,556 square feet) per linear foot of berth. The anticipated CB-8 yard area would be consistent with yard areas supporting existing container berths at Garden City Terminal. Currently, the container berths at Garden City are approximately 7,726 feet long with 405 acres of container yard, or approximately 0.05 acres (2,283 square feet) per linear foot of berth. If the 5,500 per acre per year storage utilization is applied to the CB-8 back area, implementation of CB-8 would augment terminal throughput by approximately 440,000 TEUs.

At this time, GPA does not have a precise date for achieving their target storage capacity 5,500 TEUs per acre per year. However, GPA is making ongoing improvements to storage capacity toward this goal. These improvements include: (1) continuing ongoing realignment of the container stacks to facilitate vessel loading/unloading, and (2) pavement work to increase the load-bearing capacity of container storage areas, allowing increased storage densities. The container stacks have been undergoing realignment from an orientation that was perpendicular to the dock, to an orientation that is parallel to the docks. Realignment and pavement work are taking place at Berths 1-5. Work on CB-1, CB-2 and CB-3 is complete. CB-4 and CB-5 are scheduled to occur in FY06 through FY10. Realignment has been completed on CB-6 and CB-7. These storage-related improvements could increase the terminal's throughput capacity to 2.0 million TEUs in the near future. No new equipment would be required to achieve this throughput capacity increase.

Toward the goal of 5,500 TEUs per acre per year, GPA is also increasing density and stacking heights for loaded and empty containers. This will open up more area for realignment. Currently containers at Garden City Terminal are stacked 4-high (loaded) and 5-high (empties). All of the handling equipment GPA has been purchasing can handle 5-high loaded and 7-high empties. However, GPA is not consistently stacking at these heights. The goal is to consistently stack 5-high (loaded) and 7-high (empties). GPA continues to budget for new equipment purchases through the end of their budgeting cycle – 2010.

Other actions to increase terminal capacity would entail incorporation of adjacent GPA properties into container operations. Additional storage capacity and terminal throughput capacity could be achieved by incorporating GPA-owned properties south and west of the terminal into terminal operations. The property associated with the anhydrous ammonia facilities south of Berth 7 should become available to GPA when the lease for this 16-acre property expires in December 2008. Incorporation of this acreage into terminal operations could occur in 2009. In a 2002 capacity analysis Moffett & Nichol estimated

incorporation of this property into terminal operations could increase annual throughput capacity by 75,000 TEUs. This addition to terminal throughput capacity would be consistent with the target storage utilization rate of 5,500 TEUs per acre per year.

The potential expansions of Garden City Terminal throughput capacity discussed above are summarized in Table 3. This table suggests the above measures, if implemented, could increase Garden City Terminal's capacity to 3.85 million TEUs per year.

TABLE 3
PLANNED AND EXPECTED MEASURES TO AUGMENT CAPACITY
GARDEN CITY TERMINAL

Improvements	Capacity Augmentation (TEUs)	Year
Current Throughput Capacity	1,750,000	2003
Increase Storage Utilization to 5,500 TEU per acre per year, Including: realigning stacks, improved pavement, increasing stack heights and densities	+ 1,000,000	Ongoing
Bring new berth (CB-8) on line	+ 440,000	2007
Incorporation of Anhydrous Ammonia Property at CB-7	+ 75,000	2008
Off-Site Storage of Long-Dwell Empties	+ 200,000	2015/2019
Incorporation of Garden City Triangle Property	+ 385,000	2015/2019
Total	3,850,000	

Table 4 presents container volumes in TEUs shipped annually through Garden City Terminal from Fiscal Year (FY) 1999 to 2003 (July to February). As indicated in this table, 1.5 million TEUs were shipped through this terminal in FY 2003. This suggests that Garden City Terminal is approaching its current throughput capacity of 1.75 million TEUs. It also explains why GPA is expanding capacity via development of CB-8 and increased storage efficiency.

TABLE 4
TEUs SHIPPED THROUGH
GARDEN CITY TERMINAL
1999-2003

Fiscal Year	TEUs Shipped Through Garden City Terminal	Annual Growth Rate (%)
1999	761,000	
2000	845,400	11%
2001	1,021,200	21%
2002	1,137,100	11%
2003	1,505,300	32%
	Average	19%

If a 5-percent growth rate is experienced for containers moving through the terminal, the 3.85 million TEU capacity in Table 3 could accommodate growth through 2023. If a 7-percent growth rate occurs, this capacity would be sufficient through 2017. As indicated in Table 3, there is some uncertainty about the timing of capacity expansion at Garden City Terminal. The most immediate capacity expansions will be achieved before the project's base year of 2010 through the ongoing realignment of container stacks and pavement work to allow higher stacking of loaded and empty boxes.

GPA has the last two measures shown in Table 3 in their Strategic Plan for the Garden City Terminal, but will not need to implement them until beyond the scope of their 5-year budgeting cycle, which presently extends to 2010. Based on a 5-percent growth rate, GPA would not need those two measures until 2019. With a 7-percent growth rate, GPA would need them in 2015. GPA presently owns the lands on which both measures would occur, so funding is the only factor that limits when these measures could be in place. GPA continuously monitors the throughput capacity of the terminal and actively manages the facilities to stay ahead of the volumes of TEUs expected to employ that capacity. Improvements are typically made so that the needed capacity is in place one-year prior to when it is actually needed. A one-year construction period would be adequate to implement these measures. Therefore, if implemented the same year, these measures would need to be included in GPA's 2017 budget, if a 5-percent growth rate occurs, or the 2013 budget if a 7-percent growth rate occurs. With GPA's 5-year budgeting cycle, these measures would be include in their budgets prepared in 2012 if a 5-percent growth rate occurs, or 2008 if a 7-percent growth rate occurs.

The last two measures shown in Table 3 would provide slightly more capacity than that required to accommodate the containers expected to be handled by the larger vessels that would use a deeper channel. Since GPA has already identified what measures it would take to provide that capacity, has acquired the land necessary to implement those measures, has identified when it would need to take further steps on those measures (beginning to budget for them), and has demonstrated a willingness and ability to make sufficient capacity improvements to stay ahead of the terminal throughput volume, Savannah District believes that GPA will implement these two measures even if harbor deepening does not occur.

Berth Utilization and Port Congestion

The viability of modifications to Garden City Terminal as a nonstructural measure depends in part on the level of current and future berth congestion. The premise of this measure is that if turn-around time for vessels could be decreased, there might be less berth congestion, allowing depth-constrained vessels greater opportunities to take advantage of the tides and transit the system more rapidly.

Garden City Terminal currently has a berth utilization of approximately 42 percent (based on a 24-hour operation, 365 days/year). Based on industry standards that typically describe 50 percent as full practical berth utilization, this level of berth utilization is approaching full utilization. A 2002 capacity analysis by Moffat & Nichol identified 30 percent capacity utilization as full utilization. However, according to GPA managers,

this relatively-low utilization rate was intended as a trigger point for development of additional berth capacity. Some berths are occupied more often than other berths depending on their locations relative to container stacks, as well as other considerations. Some shippers prefer to use specific berths because of the more direct access they provide to boxes slated for their ships. Garden City Terminal managers make every effort to accommodate the berth preferences of shippers. The need for additional berth space, as well as the increasing use of post-Panamax container ships, was the impetus for development of CB-8.

Berth utilization is typically calculated using the following formula:

Berth Utilization = [Time at Berth / Time Berth Available] x [(LOA + tie down) / Berth Length]

Container vessels calling at Garden City typically spend 8-12 hours at berth. The average container vessel arriving at Garden City is 965 feet in length overall (LOA). Container vessels arrive/depart Garden City Terminal at an average frequency of approximately 24 vessels per week.

GPA estimates that the addition of Container Berth 8 will reduce overall facility berth utilization by 6 percent to 37 percent. Depending on the vessels at dock, Berths 7 and 8 could accommodate up to three ships. The berth utilization at Garden City Terminal with the addition of CB-8 will still be relatively high. Berth congestion may require other measures during the period of analysis to increase berth capacity.

With-Project Conditions: Modification of Garden City Terminal

Based on discussions with GPA managers, modifications to Garden City Terminal as a non-structural measure would likely involve an acceleration of GPA's capital planning to create additional capacity to reduce turn-around time relative to without-project conditions. However, for several reasons the risks and rewards of accelerating the capital program would likely not be advantageous for GPA to pursue.

First, accelerating the capital program would be expensive. The goal of capital planning is to provide needed facilities when they are needed, not before or after. The financial investments required to significantly increase terminal throughput capacity are typically very large. If that equipment, which immediately begins to depreciate, is unutilized or underutilized, the costs would not be justifiable financially.

Second, even if such investments were made and berth utilization declined significantly, the rewards would be small. As discussed in the Tier I Economics Appendix, most of the draft-constrained container ships that enter/leave Savannah Harbor do so light-loaded. There is some riding of the tide by container ships for depth advantage, but in general liner services prefer to light-load rather than ride the tide due to their tight, multi-port schedules. The marginal benefit of deeper loading is not offset by the cost to customers of potentially slipping their service schedules. In addition, the increased availability of berths at Garden City would only affect a subset of depth-constrained vessels by marginally increasing their tidal window to transit the channel. It is also questionable

whether a minor reduction in time spent transiting the system would result in transportation time and cost savings for vessels calling at multiple ports, since they must maintain precise arrival / departure schedules at the prior and next ports of call.

The benefits of reduced turn-around time associated with facility improvements would likely not be offset by the financial cost of those improvements, particularly when they would be underutilized for a longer period of time than under without-project conditions.

Conclusion: Modification of the Garden City Terminal

Based on this investigation, the following conclusions can be drawn about modifications to Garden City Terminal as a non-structural measure. First, GPA is presently upgrading the facilities serving this terminal to increase its throughput capacity. Second, GPA has identified additional improvements that it would implement when needed. These improvements are expected to occur after the 2010 base year of the project. Third, there are likely to be some minor benefits associated with accelerating the capital planning process for the terminal. Fourth, these benefits will be difficult to measure in terms of time and expense. Fifth, the benefits are likely to be exceeded by the costs of implementing those improvements, since they would be underutilized for some period of time after they are in place. It should also be noted that, if there were any clear economic advantage to reduce turn-around time to increase tidal windows via measures to improve terminal capacity or efficiency, GPA would already be pursuing these actions, as they are already doing under without project conditions.

EVALUATION OF ALTERNATIVE TERMINAL LOCATIONS

The purpose of this investigation was to evaluate the potential for alternative terminal locations to address navigation problems and opportunities in Savannah Harbor. The evaluation of the alternative terminal locations is consistent with criteria established by Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies (U.S. Water Resources Council, 1983) and the policies and procedures established by ER 1105-2-100, Planning Guidance Notebook, 22 Apr 2000. The evaluation of alternative terminal locations includes technical, economic, and environmental considerations.

Earlier Tier II plan formulation activities identified alternative terminal locations as having the potential to address navigation problems and opportunities in Savannah Harbor. The following alternative terminal locations were carried forward for more detailed evaluation in this phase of the investigation.

- Georgia
    - Garden City Terminal,
    - East Coast Terminal,
    - Ocean Terminal,
    - Elba Island,
    - Brunswick, and

    - Other locations.
- South Carolina
    - Disposal Area 12A,
    - Disposal Areas 14A/B,
    - Tybee Island National Wildlife Refuge (NWR), and
    - Other locations.

The earlier plan formulation activities also recognized the potential for an offshore trans-shipment facility to serve depth-constrained container ships calling at Savannah Harbor and potentially other South Atlantic ports, such as Jacksonville or Charleston. An examination of the feasibility of offshore transshipment facility is included in the array of alternative terminals considered in this section.

SCOPE OF THIS INVESTIGATION

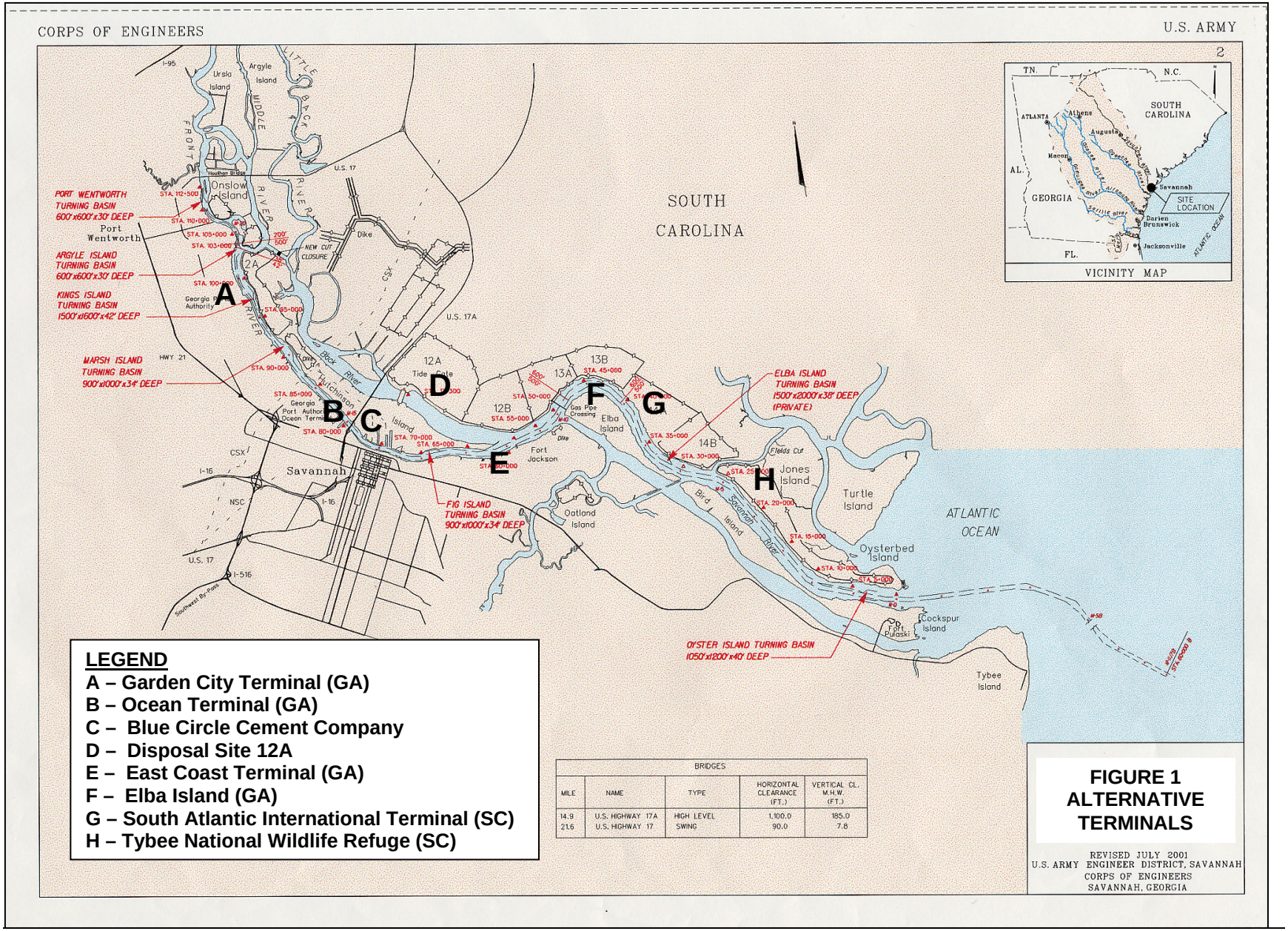
The Tier I Selected Plan consisted of deepening Savannah Harbor to 48-feet mean low water (MLW) from the Garden City Terminal to the sea. The premise for the alternative terminal locations is that they could be located downstream from the Georgia Port Authority's (GPA's) Garden City Terminal to reduce dredging costs and possible environmental impacts associated with saltwater intrusion. To address navigation problems and opportunities in Savannah Harbor, channel deepening would be implemented only as far as the single terminal that would serve the deeper vessels, but not beyond. If that terminal could be located closer to the ocean than the Garden City Terminal, perhaps the total economic and environmental costs would be less.

The concept is that no matter where the terminal serving the deeper-draft vessels is located, Savannah Harbor would have: (1) channel dimensions sufficient to accommodate fully loaded Post-Panamax (those with a beam greater than 106-feet) container ships, and (2) throughput capacity sufficient to accommodate the anticipated growth in the volume of containers expected over the period of analysis.

ALTERNATIVE CONTAINER TERMINALS

The alternative terminal locations considered in this investigation are illustrated in Figure 1, with the exception of the Colonel's Island terminal in Brunswick, Georgia. The locations considered include those identified early in Tier II plan formulation, as well as several others subsequently identified through coordination between Savannah District and GPA. As indicated in this figure, the terminals include: Garden City Terminal, Ocean Terminal, East Coast Terminal Company site, Elba Island, and Blue Circle Cement Company on the Georgia side of the Savannah River, and Disposal Area 12A, Disposal Sites 14A/B, and Tybee National Wildlife Refuge on the South Carolina side of the river.

Initial coordination between Savannah District and GPA identified Port Royal, South Carolina as an alternative terminal location. Port Royal is located approximately 10 miles north of Hilton Head Island along the Beaufort River. This site was eliminated from detailed investigation in this analysis due to geotechnical considerations. Savannah District's Engineering Division discovered that a freshwater aquifer lies close to the surface at Port Royal. This site was not carried forward for detailed investigation due to concerns that deepening the Beaufort River could result in saltwater intrusion into this important source of water supply.


CORPS OF ENGINEERS
U.S. ARMY
SOUTH CAROLINA
PORT WENTWORTH TURNING BASIN 600'x600'x30' DEEP
ARGYLE ISLAND TURNING BASIN 600'x600'x30' DEEP
KINGS ISLAND TURNING BASIN 1500'x1600'x42' DEEP
MARSH ISLAND TURNING BASIN 900'x1000'x34' DEEP
FIG ISLAND TURNING BASIN 900'x1000'x34' DEEP
ELBA ISLAND TURNING BASIN 1500'x2000'x38' DEEP (PRIVATE)
OYSTER ISLAND TURNING BASIN 1050'x1200'x40' DEEP
A
B
C
D
E
F
G
H
Savannah
Port Wentworth
Onslow Island
Argyle Island
Ursla Island
Elba Island
Fort Jackson
Oatland Island
Jones Island
Turtle Island
Oysterbed Island
Cockspur Island
Fort Pulaski
Tybee Island
ATLANTIC OCEAN
Savannah River
Back River
Middle River
Front River
Little Back River
Bird Island
Fields Cut
Houlihan Bridge
U.S. 17
U.S. 17A
I-95
I-16
I-516
HWY 21
CSX
NSC
Dike
NEW CUT CLOSURE
Tide Gate
Gas Pipe Crossing
Georgia Ports Authority
Georgia Port Authority Ocean Terminal
Southwest By-Pass
VICINITY MAP
TN.
N.C.
SOUTH CAROLINA
GEORGIA
AL.
FL.
ATLANTA
Athens
Augusta
Macon
Savannah
SITE LOCATION
Darien Brunswick
Jacksonville
ATLANTIC OCEAN
LEGEND
A – Garden City Terminal (GA)
B – Ocean Terminal (GA)
C – Blue Circle Cement Company
D – Disposal Site 12A
E – East Coast Terminal (GA)
F – Elba Island (GA)
G – South Atlantic International Terminal (SC)
H – Tybee National Wildlife Refuge (SC)
BRIDGES
MILE
NAME
TYPE
HORIZONTAL CLEARANCE (FT.)
VERTICAL CL. M.H.W. (FT.)
14.9
U.S. HIGHWAY 17A
HIGH LEVEL
1,100.0
185.0
21.6
U.S. HIGHWAY 17
SWING
90.0
7.8
FIGURE 1
ALTERNATIVE TERMINALS
REVISED JULY 2001
U.S. ARMY ENGINEER DISTRICT, SAVANNAH
CORPS OF ENGINEERS
SAVANNAH, GEORGIA

ENVIRONMENTAL CONSIDERATIONS:

During the initial phases of Tier II, the Stakeholders Evaluation Group assisted the project in identifying other environmental issues that could be considered during Tier II. As a result of that and other input, the following issues are being considered during development of the GRR and Tier II EIS:

- Issues identified in Tier I as requiring further study:
  - Impacts to the wetlands from changes in salinity, particularly wetlands located in the Savannah National Wildlife Refuge
  - Impacts to the endangered shortnose sturgeon from changes in salinity and dissolved oxygen
  - Impacts to striped bass spawning and nursery habitat from changes in salinity and other factors
  - Impacts to the City of Savannah's water intake from changes in chloride levels
  - Impacts to dissolved oxygen levels
- Verification of the 3-Dimensional Hydrodynamic Model
- Salinity changes
- Dissolved oxygen
- Chloride levels
- Striped Bass
- Shortnose Sturgeon
- Freshwater Wetlands
- Salt Water Wetlands
- Tide Gate Restoration
- Cumulative Impacts from Previous Dredging
- Closing Middle River
- Fishery management Plans
- Anadromous Fish Populations
- Other Fish Species: Red Drum, American Shad, River Herring
- Essential Fish Habitat
- Endangered Species Act Compliance
- Management of Contaminated Sediments
- Beach Erosion
- Channel Slope Erosion
- Fort Pulaski Erosion
- Dissolved Oxygen/Fecal Coliform on Beaches
- Agitation Dredging
- Sand as a Resource
- Upstream Water Releases
- Project Economics
- US Army Corps of Engineers Section 1135 Restoration Study
- US Army Corps of Engineers Savannah River Comprehensive Study

- Bend Widener Impacts
- Fort Pulaski Impacts
- Dredged Material Disposal Capacity and Impacts
- Impacts on Adjacent South Carolina Properties
- Integration with COE Savannah River Basin Comprehensive Water Resource Management Study
- Tidal Amplitude
- Drinking Water Aquifer
- Ballast Water
- Cultural and Historic Resources
- CSS Georgia Impacts
- Old Fort Jackson Impacts
- Impacts on Adjacent Georgia Properties
- Environmental Justice
- Multiport Analysis
- Landside Infrastructure
- Alternate Methods to Improve Transportation Efficiencies
- Alternate Sites for Terminal Operations
- Consistency with Coastal Zone Management Plans

At this point in the process the study team believes that the following potential impacts have the potential to result in substantial mitigation costs to the proposed project:

- Direct impacts to wetlands along the river from construction activities.
- Secondary impacts to wetlands resulting from changes in salinity, particularly wetlands located near the Savannah National Wildlife Refuge.
- Impacts to the endangered shortnose sturgeon from changes in salinity and dissolved oxygen.
- Impacts to striped bass spawning and nursery habitat from changes in salinity and other factors.
- Impacts to the City of Savannah's industrial water intake from changes in chloride levels.
- Impacts to dissolved oxygen levels.
- Effects of increasing traffic volumes through the city.

Therefore to the extent possible, the scope of impacts expected to occur on these resources should be included while considering the likely feasibility of preliminary alternatives. Since the detailed studies that will identify the extent of the impacts to these resources are still underway, the study team decided to use the level of impacts identified during Tier I, since that would constitute the best information available at the time decisions need to be made.

Tier I estimated the extent of impacts expected if the navigation channel were deepened to the Garden City Terminal. Several resource agencies and members of the public have expressed a belief that impacts to natural resources would be less if the channel were not

deepened as far upstream. That is true to some extent. Based on the technical experience within the Savannah District, the following table was developed that displays the extent of impacts expected to the critical resources identified previously, when compared to the impacts identified if the channel were deepened to Garden City Terminal. As can be seen, fewer direct and secondary impacts are expected as the extent of construction is reduced to lower portions of the harbor.

TABLE 5
EXPECTED PERCENTAGE OF MITIGATION NECESSARY FOR ALTERNATIVE TERMINAL SITES WHEN COMPARED TO GARDEN CITY TERMINAL

Impact Category	Garden City Terminal	Ocean Terminal	Blue Circle Site	Disposal Area 12A	East Coast Terminal	Elba Island	Disposal Site 14A/14B	Tybee NWR
Chlorides at City's Industrial Water Intake	100	75	70	0	0	0	0	0
Dissolved Oxygen	100	75	70	20	20	0	0	0
Cultural/Historic	100	100	100	100	100	0	0	0
Direct Construction Impacts	100	75	70	65	55	30	25	10
Secondary Wetland Impacts	100	75	70	25	0	0	0	0
Shortnose Sturgeon Habitat	100	75	70	20	20	0	0	0
Striped Bass Habitat	100	100	100	0	0	0	0	0

However, those impacts do not include some impacts that would occur with specific alternative terminal site locations. Three sites that are considered are located within existing confined dredged material disposal facilities on the South Carolina Side of the river. That storage capacity would need to be restored to keep the government whole if those sites were no longer available for deposition of sediments excavated from the river. Both the tract size and its location are important when considering costs for sediment deposition. A standard terminal size was used to estimate development costs for such a facility, so the amount of land needed to replace lost sediment storage capacity is fairly straight forward. Loss of 375 acres from a disposal facility requires development of the same sized facility, at roughly the same location along the river, and at roughly the same distance from the navigation channel. Based on the extent of existing development along the river, no large tracts of undeveloped land appear to meet these requirements on the Georgia side. Therefore, this analysis assumed that land to replace the lost sediment storage capacity would be made available to extend the existing CDFs out into the marshes that lie along the northern side of those CDFs. This would result in impacts to an additional 375 acres of saltmarsh. The costs to mitigate for those losses are included in the evaluation of the alternate terminal locations at the same rate as for similar losses resulting from other projects.

One of the proposed alternate terminal locations is the Tybee National Wildlife Refuge. A higher level of mitigation could be necessary to compensate for the land lost from that refuge, but those costs are not included in this analysis.

The costs to mitigate for environmental impacts are described in the assessment of each separate alternate terminal location. The costs of increasing traffic volumes through the City have not been quantified. The effects of such impacts are discussed in a qualitative manner, but the District concluded that quantification of those impacts was not necessary to reach a decision of the feasibility of the sites that would produce those effects.

ANALYTICAL ASSUMPTIONS

The assumptions that underlie this analysis are discussed below. They encompass: features and facilities of alternative terminals, port maneuvering costs, joint terminal operations, distribution effects of benefits associated with alternative terminals, benefits of channel deepening, construction and operating costs, and maintenance dredging.

Features and Facilities at Alternative Terminals

To address the navigation problems and opportunities in Savannah Harbor, an alternative terminal would need sufficient capacity to handle the volume of containers anticipated to be carried on depth-constrained container ships (i.e., those container ships that would require more depth than currently provided by the 42-foot Savannah Harbor channel). These ships are typically post-Panamax-class vessels that are consistent with the Design Vessel used in the Tier II EIS and GRR: the *Susan Maersk*, a 6,600 TEU post-Panamax class container ship launched in 1997 (beam: 140 feet, length overall 1,138 feet; design draft: 47.6 feet).

The volume of containers anticipated to be carried on depth-constrained vessels during the period of analysis is approximately 500,000 TEUs. However, based on coordination between Engineering Division of the Savannah District and GPA it was concluded that a new container terminal would need to be significantly larger to achieve economies of scale in facility development, equipment purchase, and terminal operations. To achieve economies of scale, the following mix of facilities and equipment would represent the minimum features for a new state-of-the-art container facility to be an effective and efficient terminal. This mix of facilities and equipment, which are consistent with industry standards, would provide approximately 1.5 million TEU throughput capacity.

- Two berths with an assumed length of 1,250 feet per berth,
- Each will need a minimum of three Super Post-Panamax cranes (with a 72-95 long ton rated capacity),
- Other handling equipment to include: seven Rubber Tired gantries, 10 Five-high loaded Top lifts (87,000 lbs.), and two Seven-high empty stackers (15,000 lbs.),
- 150 acres of container parking needed per berth, or 300 acres total, including: 90 acres for container storage, 15 acres of parking space for vehicle storage, 10 acres for service drives and buffer, and 35 acres for container handling marshalling yard for rail loading,

- Annual throughput capacity commensurate with these facilities would be approximately 1.5 million TEUs,
- Dedicated rail access with intermodal rail connection within 10 miles,
- Sufficient landside area for potential future expansion, and
- For existing terminals that would be modified to handle containers or more containers (e.g., Garden City Terminal, Ocean Terminal, East Coast Terminal, Brunswick's Colonel Island Terminal), 90 acres of container parking would be needed per berth. For these terminals, no additional area would be needed for vehicle storage, service drives, or rail container marshalling.
- For Greenfield sites additional requirements include: heavy duty access road(s), water and electrical service, railroad ties and foundation, water storage tank (100,000 gallons), an intermodal transfer station, and a wastewater treatment facility.

Joint Terminal Operations

It is assumed in this analysis that a new terminal would not eliminate the need for the continued operation of the Garden City Terminal. Instead, the new facility would supplement container handling capacity to help meet the growth in future demand. For this analysis, it was assumed that the new terminal(s) would handle depth-constrained container vessels, and Garden City Terminal would handle container ships that are not depth-constrained. It is also assumed that the new terminal would not result in underutilization of Garden City facilities and that costs of such inefficiencies would not be incurred.

Benefits of Channel Deepening

This investigation assumes that channel deepening to either a new container facility or to Garden City Terminal would result in equivalent NED marine transportation benefits by reducing or eliminating transportation costs associated with tidal delays and lightloading of vessels constrained by current channel depths. As noted above, the differences between the alternatives will primarily consist of site development costs, dredging costs, and environmental mitigation costs as shown in Table 6 on the next page.

Construction Costs vs. Operating Costs

For this screening of alternative plans, the emphasis of this investigation is on construction costs. It is assumed that the operations and maintenance costs for a new terminal and for Garden City Terminal would be commensurate in dollars per TEU moving through the terminals, since the facilities would have similar facilities and equipment.

Maintenance Dredging

In addition, according to the Tier I analysis, channel deepening in Savannah Harbor should not generate significant additional maintenance dredging requirements relative to Without Project conditions. Differences in landside transportation costs between the alternative terminals will be discussed.

TABLE 6 FACILITY COSTS, MITIGATION COSTS, DREDGING COSTS, AND TOTAL COSTS ALTERNATIVE TERMINALS				
Alternative Terminals	**Facility Costs**	**Mitigation Costs**	**Dredging Costs**	**Total Costs**
Garden City Terminal	$0	$113,100,000	$213,600,000	$326,700,000
Ocean Terminal	$249,900,000	$89,200,000	$211,600,000	$550,700,000
Blue Circle Site	$361,100,000	$83,000,000	$207,000,000	$651,100,000
Disposal Site 12A	$334,400,000	$25,800,000	$162,700,000	$522,900,000
East Coast Terminal	$370,400,000	$23,600,000	$178,900,000	$572,900,000
Elba Island	$285,400,000	$1,400,000	$136,500,000	$423,300,000
Disposal Site 14A/14B	$357,400,000	$1,400,000	$125,600,000	$484,400,000
Tybee NWR	$384,900,000	$1,600,000	$79,100,000	$465,600,000
Colonel's Island, Brunswick	$292,600,000	Not Calculated	$137,500,000	$430,100,000

GARDEN CITY TERMINAL

The largest container facility in Savannah Harbor is Containerport, located within GPA's Garden City Terminal. Due to its existing container operations and its role in the Tier I Selected Plan, Garden City Terminal in this analysis serves as the benchmark terminal to which the alternative terminals are compared. A profile of Garden City Terminal is contained in Table 2, above. An assessment of its potential to address the problems and opportunities of a depth-constrained Federal channel in Savannah Harbor begins below.

Garden City Terminal Site Profile and Initial Assessment

Garden City Terminal, is a public terminal operated by GPA. For an extensive site profile and initial assessment of this terminal please refer to the evaluation of non-structural alternatives; Modifications of Garden City Terminal, discussed earlier in this report. An aerial photo of Garden City Terminal is provided in Figure 2.

FIGURE 2
GARDEN CITY TERMINAL – AERIAL PHOTO

Cost of Modifying Garden City Terminal

The costs of modifying Garden City Terminal to achieve the additional throughput capacity of the 1.5 million TEUs assumed in this analysis are presented in Table 7. These costs were coordinated between Savannah District and GPA. The costs reflect existing container facilities at Garden City Terminal, such as the two super Post-Panamax container cranes currently in service. As indicated in this table, cost estimates include demolition of the building and storage tanks associated with the anhydrous ammonia facilities behind CB-7. The costs identified in Table 3 are ones that GPA plans to incur to increase the throughput capacity of Garden City Terminal over the near future. As presently-planned actions and expenditures, these would be part of the Without Project Condition and not a component of the cost of deepening to Garden City Terminal.

TABLE 7
ESTIMATED COSTS OF MODIFICATIONS
GARDEN CITY TERMINAL

Site Demolition				
Asphalt pavement	10,000	sy	$3.48	$34,820
Storage tanks	1,288,872	cf	$0.21	$266,842
Building Demolition	242,500	cf	$0.21	$50,206
Building Foundation Demo	629	cy	$64.93	$40,817
Site Improvement				
Container Parking area	83	ac		
Dock Includes: Concrete Deck & Beam, concrete steel reinforcement, pilings, handrail	1,700	lf	$14,300	$24,310,000
Fender system				
Crane Tracks on concrete ties (assume length = 1.25 x dock length)	2,125	lf	$181.63	$385,956
Heavy Duty Pavement for container traffic	83	ac	$300,000	$24,900,000
Equipment				
72-95 Ton Cranes	4	ea	$6,500,000	$26,000,000
Rubber tire gantries	6	ea	$1,300,000	$7,800,000
Five High loaded top lifts (87,000 lbs)	8		$350,000	$2,800,000
Jockey Trucks	5	ea	$39,120	$195,600
Flatbed Trucks	2	ea	$28,980	$57,960
Contingency	25%			$21,710,550
			Subtotal	$108,552,750
E&D / S&A	20%			$21,710,550
			TOTAL=	$130,263,299

Dredging Costs: Garden City Terminal

Costs to deepen Savannah Harbor to 48 feet MLW from the sea to Garden City Terminal are presented in Table 8. Quantities to be dredged and unit costs of dredging and disposal were estimated based on the Tier I analysis and dredged material management plans (DMMP) prepared by the Savannah District for maintenance of the Savannah Harbor Federal channel. Cost estimates for disposal area site work and erosion control for Garden City Terminal (and all of the alternative sites) were also developed using a combination of the Tier I cost estimates and cost sheets prepared for the Savannah Harbor DMMP. Also included are costs to deepen Kings Island Turning Basin.

Other dredging-related costs are included in Table 8. These costs are based on the Tier I Feasibility Report, escalated to 2003 dollars. Lands, easements, relocations, rights-of-way (LERRRD) are self-explanatory; other costs are explained below.

- Debris removal: along river bottom and river banks,
- Aids to navigation: consistent with U.S. Coast Guard coordination,
- Chloride mitigation: refers to the potential relocation of the City of Savannah water intake in the Savannah River, if chloride impacts from channel deepening exceed the City's contracted standards for chloride levels.
- Dissolved oxygen mitigation: refers to mitigation required if channel deepening reduces average summer dissolved oxygen levels in the Savannah River.
- Cultural/historic mitigation: refers to mitigation required to protect Old Fort Jackson and the *CSS Georgia*. Both resources are located at the junction of Back River and the Savannah River.
- Channel modification mitigation: refers to mitigation required for direct wetland impacts of channel deepening on the river banks. Ten acres would be affected by deepening to Garden City Terminal. Wetland mitigation costs are estimated at $26,000 per acre, including $6,000 for real estate costs and $20,000 for mitigation activities ($10,000/acre plus a 2:1 replacement ratio).
- Secondary wetland mitigation: refers to secondary impacts to wetlands resulting from saltwater intrusion into the Savannah National Wildlife Refuge upstream of Garden City Terminal. Adverse secondary effects of saltwater intrusion could degrade up to 722 acres of wetlands, potentially requiring mitigation at $26,000 per acre as above.
- Shortnose sturgeon mitigation: refers to actions taken to compensate for impacts to habitat of shortnose sturgeon.
- Striped bass impact avoidance: refers to actions taken to avoid adverse effects to habitat of striped bass.

TABLE 8
ESTIMATED COSTS OF CHANNEL DEEPENING (48 FEET MLW)
TO GARDEN CITY TERMINAL

Mobilization				$2,683,845
Dredging				
-85+000 to -60+000	2,616,000	cy	$3.87	$10,123,920
-60+000 to -38+500	4,163,000	cy	$2.69	$11,188,063
-38+500 to -14+000	5,155,000	cy	$2.04	$10,529,088
-14+000 to 0+000	2,071,000	cy	$2.26	$4,675,283
0+000 to 24+000	3,506,000	cy	$2.37	$8,291,690
24+000 to 40+000	3,824,000	cy	$4.89	$18,704,140
40+000 to 50+000	2,963,000	cy	$2.96	$8,759,369
50+000 to 70+000	3,874,000	cy	$2.63	$10,203,148
70+000 to 79+000	1,817,000	cy	$4.03	$7,324,781
79+000 to 97+750	2,962,000	cy	$5.27	$15,602,335
97+750 to 102+000	2,220,000	cy	$4.57	$10,142,625
102+000 to 103+000	303,000	cy	$4.84	$1,465,763
Dredging for turning basin	600,000	cy	$4.84	$2,902,500
Berth Dredging	150,000	cy	$4.84	$725,625
Disposal Area Site Work and Erosion Control				$19,075,000
Contingency	25%			$35,599,293
E&D / S&A	20%			$35,559,293
Subtotal				$213,595,764
Debris Removal	100%		$2,449,764	$2,449,764
Aids to Navigation	100%		$871,691	$871,691
Chloride Mitigation - relocate City of Sav. Water intake	100%		$49,450,000	$49,450,000
DO Mitigation	100%		$25,800,000	$25,800,000
Cult/Historic Mitigation	100%		$15,424,449	$15,424,449
Lands, Easements, Relocations, Rights-of-Way	100%		$2,349,198	$2,349,198
Channel Mod Mitigation	100%		$260,000	$260,000
Salinity Intrusion on Wetlands (722 acres)	100%		$18,772,000	$18,772,000
Shortnose Sturgeon Mitigation	100%		$1,375,500	$1,375,500
Striped Bass Impact Avoidance	100%		$2,000,000	$2,000,000
			TOTAL	$326,677,713

Other Considerations: Garden City Terminal

There are some environmental concerns associated with channel deepening to Garden City Terminal. These concerns were identified in the Tier 1 process and are being evaluated in more detail during Tier II. The major environmental issues identified in Tier 1 consist of the following:

- Chloride impacts on the City of Savannah water intake,

- Seasonal reduction in dissolved oxygen levels in the Savannah River
- Cultural and Historic impacts on Old Fort Jackson and the *CSS Georgia*,
- Direct loss or riverbank wetlands as a result of the channel construction activities,
- Salinity intrusion on wetlands in the Savannah Wildlife Refuge,
- Impacts on Shortnose Sturgeon habitat, and
- Impacts to striped bass habitat.

Overall Assessment: Garden City Terminal

Garden City Terminal is viable as an alternative terminal due to the existing container operations at this location. Costs to develop additional terminal capacity would be minimized by usage of terminal facilities and landside infrastructure already in place. Shortcomings of Garden City Terminal as an alternative terminal are the high costs of dredging to this upstream location and potential adverse environmental effects associated with dredging.

OCEAN TERMINAL

The potential for modifying Ocean Terminal to serve as a dedicated container facility is assessed below. It includes a profile of the site, estimation of the costs to modify the facility, a discussion of required landside transportation, an evaluation of benefits of modifying this facility, discussion of other factors involved in conversion of this facility, and an overall assessment of its ability to address navigation problems and opportunities in Savannah Harbor.

Ocean Terminal Site Profile and Initial Assessment

As indicated in Figure 1, Ocean Terminal is located on Bay Street in the City of Savannah, immediately west of the Talmadge Memorial Bridge. A profile of Ocean Terminal is provided in Table 9, and an aerial view is provided in Figure 3. This 208-acre terminal primarily handles break-bulk, roll-on/roll-off (RoRo), and project cargo. As part of its RoRo operations, this facility handles an incidental amount of containers, approximately 150 TEUs per week. However, container movements through Ocean terminal are declining due to reductions in container cargo handled by a major RoRo carrier.

As an initial assessment, Ocean Terminal, which is only 2.5 miles downstream of Garden City Terminal, would not likely generate large benefits in terms of dredging costs avoided. However, the proximity to Garden City Terminal might allow complementary development and operation of these terminals. The 208 acres of this terminal is significantly smaller than the 300 acres that is assumed necessary for a container terminal with two berths. However, Ocean Terminal has over 6,000 feet of berth space, existing rail facilities, and seemingly good road connections to highways for truck transport of containers.

Cost of Modifying Ocean Terminal

Savannah District coordinated with GPA to identify improvements that would be required to convert Ocean Terminal to a dedicated container facility. To ensure a fair comparison, the analysis of Ocean Terminal is equivalent in level of detail to that used to evaluate development of a new terminal downstream along the Savannah River. Based on this coordination, the following assumptions were made about requisite modifications to this terminal:

- The location of the existing docks is too close to the Federal channel to allow sufficient beam for post-Panamax container ships to berth at this terminal. Consequently, it was assumed that existing docks would be demolished and rebuilt, thereby avoiding realignment of the Federal channel.
- Maintain the current function of this facility. If possible, RoRo operations at Ocean Terminal would be continued. RoRo parking located adjacent to the dock would be demolished and rebuilt outside of the container storage area to prevent any accidental damage from container traffic. This would leave 140 acres available as a container yard.
- The load-bearing capacity of existing storage areas at this terminal would not be sufficient to support container operations. Consequently, the 140 acres of open storage would need to be demolished, strengthened, and repaved (at an approximate cost of $300,000 per acre).
- Buildings located adjacent to the dock to store materials will be demolished and rebuilt farther away from dock and outside of the container storage area.
- Although Ocean Terminal currently has rail service, it is assumed that a significant upgrade would be needed to serve a large container facility.

Container handling equipment is consistent with the assumptions listed above. These assumptions are incorporated into the costs estimates for converting Ocean Terminal into a dedicated container facility contained in Table 10. Estimation of the cost estimates for Ocean Terminal and for the other terminals considered in this investigation was initiated by Engineering Division of Savannah District.

As indicated in Table 10, it is estimated that conversion of Ocean Terminal to a container facility would cost approximately $250 million. Demolition costs, construction costs, and container handling equipment costs are included in this estimate.

In 2002, GPA contracted with Lockwood Greene to assess the feasibility of converting Ocean Terminal into a container facility. The study estimated the cost of conversion of Ocean Terminal to be $284 million. This estimate included the assumption that the docks would be demolished and set back (landward) to provide for additional berth width, thereby avoiding encroaching into the Federal channel or realigning the Federal channel.

TABLE 9
OCEAN TERMINAL FACILITIES

Cargo Handled: General Cargo, Containers, RoRo, and Project Cargo

Terminal Area: 208 acres

Berths

Berths Linear Feet: 6,674 total. [This total includes Slip 2, which is not practical for container vessels. The total usable berth length is 4,503 feet, with approximately 300 feet of additional distance across Slip 2 that could be closed off for wharf area.]
Depth Alongside Berths 1,2,12,13,18,19: 42 ft.; Berth 20 38 ft.
Dock Height 15 ft. at mean low water
Apron Width From 53 ft. to 200 ft.

Cranes

Gantry Cranes:
Kocks (Berths 12-20) 100-st capacity under main hook at a 65 ft. radius
Diamond (Berths 12-20) 50-st capacity under main hook at a 40 ft. radius
Diamond (Berths 1-2) 35-st capacity under main hook at a 40 ft. radius
Clyde (Berth 13) 175-st capacity under main hook at a 45 ft. radius
Container Cranes:
Kone (Berths 13-20) (1) 45-st capacity under spreader/56-st capacity
Link Belt Mobile Crane 45-st capacity with 100' boom

Equipment

Three-high loaded toplifts (3) 67,400 lb. capacity under spreader
Forklifts (51) 11,000-50,000 lb. capacity with accessory attachments
Clay Bagging Facility -Capacity: 25 tons per hour
Reefer Outlets Warehouse 2

Rail Services: Norfolk Southern Railroad provides switching services; interchange and line haul services provided by Norfolk Southern Railroad and CSX Transportation.

Warehousing: total 1,621,868 sq. ft.

Open Storage: 83 acres

Container Field Paved Area: 47 acres

FIGURE 3
OCEAN TERMINAL

Based on the findings of the Lockwood Greene study, GPA concluded that conversion of Ocean Terminal to a container facility would not be feasible at this time. The high costs of demolishing and reconstructing the docks, warehouses, and paved areas and the limited container storage area (140 acres) made modification of this terminal prohibitively expensive under current circumstances.

TABLE 10
ESTIMATED COSTS OF MODIFICATIONS
OCEAN TERMINAL

Site Demolition				
Asphalt pavement	822,800	sy	$3	$2,864,951
Building Demo (assume 18' high buildings)	42,168,568	cf	$0.21	$8,730,371
Building foundation removal	60,069	cy	$65	$3,900,515
Railroad track removal, ties and track	15,000	lf	$8.0	$120,692
Site Improvement				
Container Parking area	140	ac		
Heavy Duty Pavement for container traffic	140	ac	$300,000	$42,000,000
Dock Includes: Concrete Deck & Beam, concrete steel reinforcement, pilings, handrail, Fender system	2,500	lf	$21,300	$53,250,000
110 lb Railroad track w/ wooden ties and ballast		lf	$78	$0
110 lb Railroad track w/ concrete ties in container yard	5,000	lf	$182	$908,131
Administration Building	10,000	sf	$168	$1,675,102
storage building	20,000	sf	$10	$198,565
Equipment				
72-95 Ton Cranes	6	ea	$6,500,000	$39,000,000
Rubber tire gantries	7	ea	$1,300,000	$9,100,000
Five High loaded top lifts (87,000 lbs)	10	ea	$350,000	$3,500,000
Seven High empty stackers ((15,000 lbs)	2	ea	$200,000	$400,000
Jockey Trucks	20	ea	$39,120	$782,400
Flatbed Trucks	6	ea	$28,980	$173,880
Contingency	25%			$41,651,152
			Subtotal	$208,255,758
E&D / S&A	20%			$41,651,152
			TOTAL=	$249,906,910

Landside Transportation: Ocean Terminal

Ocean Terminal has good transportation access. However, Bay Street in Savannah is very congested, since it serves as an important east-west corridor through the city and the principal access of visitors to the Historic District. The additional truck traffic associated with a container facility of the size under consideration here would significantly exacerbate this congestion.

Regarding rail access to/from the site, currently only Norfolk Southern has access to Ocean Terminal. Development of a container port at Ocean Terminal that is served by only one railroad could be a competitive (cost) disadvantage for a container port. It is likely that some arrangements would need to be made to allow CSX to serve Ocean Terminal as well. It might be feasible to truck containers to/from the Mason Intermodal Container Transfer Facility (ICTF) at Garden City Terminal, since it is within the 10-mile drayage limit assumed as part of this analysis. However, if rail facilities at Ocean Terminal were not upgraded and used by the container operations, this would result in even more trucks using Bay Street.

Dredging Costs: Ocean Terminal

Dredging-related costs associated with Ocean Terminal are presented in Table 11. Since Ocean Terminal is 2.5 nautical miles downstream of Garden City Terminal, dredging costs would be less than those of Garden City Terminal. Other dredging-related costs shown in the last nine rows of Table 10 (from Debris Removal through Striped Bass Impact Avoidance) would also be expected to be less than for Garden City Terminal. Based on the distance downstream, it was assumed that most of these costs would be 75 percent of costs developed for Garden City Terminal in the Tier I analysis. Mitigation costs for cultural/historic impacts and channel modification would be expected to consistent with Garden City costs. Regarding cultural/historic costs, sites upstream of Old Fort Jackson and the *CSS Georgia* would require the full cost of mitigation.

A turning basin for Ocean Terminal required detailed investigation. The Savannah River is relatively narrow in this reach of the river. Construction of a turning basin consistent with the Tier I analysis (1,600 feet wide, 1,675 feet long, and 48 feet deep MLW) would require excavation of a portion of Hutchinson Island at very high cost. A preliminary cost analysis was conducted to compare these costs against deepening of the channel further upriver to existing turning basins, which would need to be modified to be consistent with the above Tier I specifications.

The nearest existing turning basin is Marsh Island Turning Basin, which has dimensions of: 900 feet wide, 1,000 feet long, and 34 feet deep. Marsh Island Turning Basin is approximately 1.9 miles upstream from Ocean Terminal on the north side of the channel. This turning basin is located adjacent to Hutchinson Island at the location of the International Paper aeration lagoon. The landward edge of the turning basin is approximately 150 feet from the shore, and the containment dike for the lagoon is approximately 125 feet beyond. According to the Tier I Feasibility Report, the width of the Kings Island Turning Basin, which is 1,600 feet long, would be expanded from 1,500 feet wide to 1,675 feet wide to accommodate the post-Panamax container ship that serves as the Design Vessel. There is insufficient room to expand the Marsh Island Turning Basin to dimensions sufficient to accommodate the Design Vessel without encroaching on the aeration lagoon and triggering the economic and environmental consequences of disturbing an active industrial waste treatment lagoon.

TABLE 11
ESTIMATED COSTS OF CHANNEL DEEPENING (48 FEET MLW)
TO OCEAN TERMINAL

Mobilization				$2,683,845
Dredging				
-85+000 to -60+000	2,616,000	cy	$3.87	$10,123,920
-60+000 to -38+500	4,163,000	cy	$2.69	$11,188,063
-38+500 to -14+000	5,155,000	cy	$2.04	$10,529,088
-14+000 to 0+000	2,071,000	cy	$2.26	$4,675,283
0+000 to 24+000	3,506,000	cy	$2.37	$8,291,690
24+000 to 40+000	3,824,000	cy	$4.89	$18,704,140
40+000 to 50+000	2,963,000	cy	$2.96	$8,759,369
50+000 to 70+000	3,874,000	cy	$2.63	$10,203,148
70+000 to 79+000	1,817,000	cy	$4.03	$7,324,781
79+000 to 97+750	473,920	cy	$5.27	$2,496,374
Dredging/Excavation of turning basin				$26,275,430
Berth Dredging	150,000	cy	$4.84	$725,625
Disposal Area Site Work and Erosion Control				$19,075,000
Contingency	25%			$35,263,938
E&D / S&A	20%			$35,263,938
Subtotal				$211,583,630
Debris Removal	75%		$2,449,764	$1,837,323
Aids to Navigation	75%		$871,691	$653,768
Chloride Mitigation - relocate water intake	75%		$49,450,000	$37,087,500
Dissolved Oxygen Mitigation	75%		$25,800,000	$19,350,000
Cultural/Historic Mitigation	100%		$15,424,449	$15,424,449
Lands, Easements, Relocations, Rights-of-Way	75%		$2,349,198	$1,761,898
Channel Modification Mitigation	75%		$260,000	$195,000
Salinity Intrusion on Wetlands (722 ac)	75%		$18,772,000	$14,079,000
Shortnose Sturgeon Mitigation	75%		$1,375,500	$1,031,625
Striped Bass Impact Avoidance	100%		$2,000,000	$2,000,000
			TOTAL	$305,004,194

The next turning basin upriver is Kings Island, located above Garden City Terminal approximately 2.8 nautical miles above Ocean Terminal. Deepening to Kings Island Turning Basin would result in dredging and related costs consistent with deepening to Garden City Terminal.

The costs of constructing a turning basin adjacent to Ocean Terminal were found to be cost-effective compared to deepening to Kings Island Turning Basin. The turning basin costs in Table 11 are associated with this location.

Overall Assessment: Ocean Terminal

Based on the high costs of renovating Ocean Terminal and the lack of any significant dredging savings relative to deepening to Garden City Terminal, it is concluded that conversion of Ocean Terminal to a container facility is not feasible at this time. The desirable aspects of such a conversion in terms of minimal environmental impacts and efficient access to landside transportation would be insufficient to outweigh the costs of facility renovation and channel dredging and the congestion related impacts on local area roadways.

BLUE CIRCLE CEMENT COMPANY

The potential for modifying Blue Circle Cement Company's site on Hutchinson Island to serve as a dedicated container facility is assessed below. As for the discussion of all the alternative facilities, the analysis includes a profile of the site, estimation of the costs to modify the facility, a discussion of required landside transportation infrastructure, an evaluation of benefits of modifying this facility, discussion of other factors involved in conversion of this facility, and an overall assessment of its ability to address navigation problems and opportunities in Savannah Harbor.

Blue Circle Cement Site Profile and Initial Assessment

As indicated in Figure 1, the Blue Circle Cement site is located on Hutchinson Island, immediately east of the Talmadge Memorial Bridge. Figure 5 provides a more detailed aerial view. Blue Circle Cement Company uses this facility for receipt of bulk cement. This facility has approximately 400 feet of berthing space and 36-foot depth MLW at berth. Landside facilities include four 12-inch, pneumatic pipelines extending from wharf via trestle (over approach from shore) to 16 concrete storage silos located in the rear of the site (north).

The polygon in Figure 5 provides visual scale for the aerial photo. This box represents the 300 acres that are would be necessary for development of a new container facility.

As an initial assessment of the viability of developing a container facility at this location, two characteristics of this site are evident. First, there may not be sufficient area for the purposes considered between the bridge (to the west), the Marine Trade Center (to the east), and the golf course (to the north). This issue alone might be sufficient to eliminate this site from further consideration. Second, landside transportation could be problematic, given the site's location on Hutchinson Island.

Costs Of Modifying Blue Circle Terminal

The costs required to construct a container terminal at the Blue Circle site are contained in Table 12. As indicated in this table, it is estimated that $361 million would be required to develop a container terminal at this site. It is anticipated that the facilities currently on this site would need to be demolished prior to construction of the container terminal. The terminal would require installation of the full set of facilities assumed above, and new docks would be needed. Other assumptions about this site include: a water storage tank

for fire protection, a package wastewater treatment facility, and approximately 50 acres (of 300) would require wetland mitigation.

To achieve the area required for development of a new container facility at the Blue Circle site, some or all of the adjacent property owned by Powell Dufferin Terminals, Inc. may be required. This adjacent site previously contained a liquid bulk terminal and tank farm, which was operated by Powell-Dufferin Oil. The site is currently used by TIC Construction Company. It is anticipated that properties to the north around the golf course and along the Back River will be converted to upscale residential developments. A new container terminal in this area may not be compatible with these uses, and nearby residential developments could raise acquisition costs.

The cost estimates in Table 12 do not include the replacement costs of Blue Circle Cement operations at another location. If a detailed evaluation of this site is to be conducted, these associated costs would need to be included.

FIGURE 5
BLUE CIRCLE CEMENT SITE

TABLE 12
ESTIMATED COSTS OF BLUE CIRCLE TERMINAL

Site Demolition				
Asphalt pavement	48,400	sy	$3	$148,636
Building Demo	745,342	cf	$0	$136,099
Building foundation removal	28,667	cy	$57	$1,641,759
Site Improvement				
Land purchase	375	ac	$100,000	$37,500,000
Heavy Duty Pavement for container traffic	300	ac	$300,000	$90,000,000
Administration Building	10,000	sf	$168	$1,675,102
storage building	20,000	sf	$10	$198,565
Building foundation	3,333	sy	$22	$73,717
110 lb Railroad track w/ wooden ties and ballast	8,000	lf	$78	$621,105
RR foundation	19,200	sy	$13	$257,664
110 lb Railroad track w/ concrete ties in container yard	20,000	lf	$182	$3,632,524
Electrical service to terminal	21,000	lf	$60	$1,260,000
Dock (includes: concrete deck & beam, concrete steel reinforcement, 18" square precast concrete piling, expn joint & misc const items, handrail, fender system)	2,500	lf	$14,300	$35,750,000
Crane Tracks on concrete ties(assume length = 1.25 x dock length)	3,125	lf	$182	$567,582
100,000 Gallon Water Storage Tank for fire protection	1	ea	$250,000	$250,000
Intermodal Transfer Station	1	ea	$5,304,817	$5,304,817
Wetlands Mitigation	60	ac	$26,000	$1,560,000
Wastewater Treatment Facility	1		$10,000,000	$10,000,000
Equipment				
72-95 Ton Cranes	6	ea	$6,500,000	$39,000,000
Rubber tire gantries	7	ea	$1,300,000	$9,100,000
Five High loaded top lifts (87,000 lbs)	10		$350,000	$3,500,000
Seven High empty stackers ((15,000 lbs)	2		$200,000	$400,000
Jockey Trucks	20	ea	$39,120	$782,400
Flatbed Trucks	6	ea	$28,980	$173,880
Contingency	25%			$60,178,462
			Subtotal	$300,892,313
E&D / S&A	20%			$60,178,462
			TOTAL	$361,070,775

It is assumed for all of the alternative sites that are located in industrial areas along the Savannah River (i.e., Blue Circle, East Coast, and Elba Island) that $100,000 is representative of real estate purchase costs per acre. This cost per acre is based on a sample of such properties using real estate property assessments of Chatham County. However, in areas that are undergoing upscale residential waterfront development, real estate could be significantly more expensive, approximately $150,000 to $200,000 per acre. The real estate acquisition costs for a new container facility could significantly increase over time as upscale residential development occupies more of the riverfront.

It is also assumed for those alternative sites that would require a new intermodal container transfer facility that 75 acres would be required. Consequently, land purchases in Table 12 contain 375 acres (i.e., 300 for the container terminal and 75 acres for the intermodal facility).

Based on aerial photos, U.S.G.S. quadrangle maps, and preliminary site reconnaissance, it is assumed that 50 acres of this site (i.e., 25 percent of the 300 acres) would be wetlands. As noted above, it is assumed that wetland mitigation activities (in addition to land purchases) would be approximately $20,000 per acre ($10,000/acre plus a 2:1 replacement ratio).

Landside Transportation: Blue Circle Terminal

Relative to Garden City Terminal, trucks coming to/from the Blue Circle site may have marginally better access to major highway routes to the northwest toward Macon and Atlanta and the rest of Savannah's economic hinterland. Truck traffic to/from a terminal at the Blue Circle site would have convenient access to Route 17 and Interstate 16. However, it is not expected that this would translate into significant savings in trucking costs.

In contrast, rail movements to/from the Blue Circle site would likely be at a significant disadvantage relative to Garden City Terminal's Mason ICTF. A Seaboard Coast Line (SCL, now CSX) rail line is located on Hutchinson Island and runs east-west along the northern edge of the red square in Figure 5. In 1899, a rail bridge across the Savannah River was constructed approximately 1.8 miles upstream of the Talmadge Bridge. The Blue Circle tracks tied into this bridge, which connected SCL's Savannah rail yard across the Savannah River with the main CSX tracks north of Ridgeland, a distance of approximately 27 miles (from Savannah to Ridgeland.

The Savannah River rail bridge no longer exists. The bridge suffered ship collisions in 1952, 1966, 1967, and 1971. In the 1971 collision, the south tower was struck and collapsed causing the main span to fall. Subsequently, the bridge was removed, and the existing railroad bridge across the Back River to Hutchinson Island was upgraded. As part of this work, the railroad installed 7.5 miles of new line to connect the former SCL line to the main CSX line approximately 2.5 miles northeast of Interstate 95's crossing of the Savannah River, near Hardeeville, South Carolina. This rail connection, was known as the Hardeeville Spur.

The result is that train access/egress from the Blue Circle site would be via the rail bridge from the island north across Back River. It is assumed that an intermodal rail facility would need to be located on the island, likely west of the bridge. The acreage needed for the facility would be in addition to the 300 acres needed for the terminal.

The former SCL rail route through Jasper County and the Hardeeville Spur were formally abandoned by CSX in 1997. In the late 1990s, the County considered purchasing the SCL corridor from CSX for a rails-to-trails project, and conducted preliminary negotiations toward this purchase. The County subsequently decided not to pursue the rails-to-trails project, apparently having concluded that the rail line could be an important resource for economic development. Although the line is not operational at this time, it could be re-activated if a container terminal was developed on the north side of the Savannah River, either on Hutchinson Island or in Jasper County. CSX continues to own this SCL corridor through Jasper County.

For Norfolk Southern, which sends unit trains from the Mason ICTF, a track-sharing arrangement with CSX would need to be reached. The potential for such an agreement is uncertain at this time. It is also conceivable that a rail connection would need to be made near Interstate 95 northwest of the City of Savannah to allow Norfolk Southern trains to turn to the west and northwest without going into the City of Savannah.

The Blue Circle site is approximately 8 miles from Garden City's Mason intermodal facility. Containers could conceivably be trucked to this facility, eliminating the need for rail access to the Blue Circle site. However, drayage costs would be very significant. Although drayage contracts are usually confidential, it is assumed that drayage rates for a 5 to 10 mile haul could be in the range of $100-125/dray for a one-way trip. Use of the Mason ICTF would create another set of problems by forcing large amounts of trucks onto local Savannah roadways, many of which are already congested.

Whatever the origin/destination, it is likely that rail service from the Blue Circle site would be somewhat less efficient than service to Garden City Terminal, assuming that the existing rail line to Hutchinson Island could be reactivated. However, these inefficiencies, manifested as time delays and increased costs, would be incurred for medium and long hauls, for which rail transport is the preferred mode of transport.

Dredging Costs: Blue Circle Terminal

Dredging-related costs associated with the Blue Circle site are presented in Table 13. The costs are similar to those of Ocean Terminal, which is located on the other side of the Talmadge Bridge on the south side of the Savannah River. As for Ocean Terminal, the costs of constructing a new turning basin are high due to required excavation of Hutchinson Island but less than dredging to King Island Turning Basin. As a result, it is assumed that a turning basin for Blue Circle Terminal would be the same as for Ocean Terminal, on the western side of the Talmadge Bridge adjacent to Ocean Terminal. Consequently, the costs of a turning basin in Table 13 are the same as in Table 11.

TABLE 13
ESTIMATED COSTS OF CHANNEL DEEPENING (48 FEET MLW)
TO BLUE CIRCLE TERMINAL

Mobilization				$2,683,845
Dredging				
-85+000 to -60+000	2,616,000	cy	$3.87	$10,123,920
-60+000 to -38+500	4,163,000	cy	$2.69	$11,188,063
-38+500 to -14+000	5,155,000	cy	$2.04	$10,529,088
-14+000 to 0+000	2,071,000	cy	$2.26	$4,675,283
0+000 to 24+000	3,506,000	cy	$2.37	$8,291,690
24+000 to 40+000	3,824,000	cy	$4.89	$18,704,140
40+000 to 50+000	2,963,000	cy	$2.96	$8,759,369
50+000 to 70+000	3,874,000	cy	$2.63	$10,203,148
70+000 to 79+000	1,817,000	cy	$4.03	$7,324,781
79+000 to 97+750 (Assume end of port located at station 79+000)	473920	cy	$5.27	$2,496,374
Dredging for turning basin				$26,275,430
Berth Dredging	600,000	cy	$4.03	$2,418,750
Disposal Area Site Work and Erosion Control				$14,310,309
Contingency	25%			$34,496,047
E&D / S&A	20%			$34,496,047
			Subtotal	$206,976,281
Debris Removal	70%		$2,449,764	$1,714,835
Aids to Navigation	70%		$823,038	$576,127
Chloride Mitigation - relocate water intake	70%		$46,690,000	$32,683,000
Dissolved Oxygen Mitigation	70%		$24,360,000	$17,052,000
Cultural/Historic Mitigation	100%		$14,563,550	$14,563,550
Lands, Easements, Relocations, Rights-of-Way	70%		$2,349,198	$1,644,438
Channel Modification Mitigation	70%		$260,000	$182,000
Salinity Intrusion on Wetlands (722 ac)	70%		$18,772,000	$13,140,400
Shortnose Sturgeon Mitigation	70%		$1,375,500	$962,850
Striped Bass Impact Avoidance	100%		$2,000,000	$2,000,000
			TOTAL	$291,495,480

Based on the distance downstream, it was assumed that most of the dredging-related costs in the bottom rows of Table 13 (Debris Removal to Striped Bass Impact Avoidance) would be 70 percent of costs developed for Garden City Terminal in the Tier I analysis. Mitigation costs for cultural/historic impacts and channel modification would be expected to consistent (i.e., 100 percent) with Garden City costs. Regarding cultural/historic costs, sites upstream of Old Fort Jackson and the *CSS Georgia* would require the full cost of mitigation.

Other Considerations: Blue Circle Terminal

Development of a container terminal at the Blue Circle site would appear to encroach on 60 acres of wetlands, for which mitigation would be required. The costs for such mitigation are included in Table 12. No other natural areas would be impacted by this

development. Since the site is presently an industrial facility, there is the potential for problems associated with hazardous, toxic, and radioactive wastes (HTRW).

A portion of the traffic from a container facility is generated by deliveries to and from distribution centers (DCs). Currently there are 12 DCs located in proximity to the GCT. Rates for draying containers to and from the DC's are based on an individual basis. Anything that would generate longer delivery times, such as longer dray distances, will affect the number of deliveries that can be made. As the number of deliveries per driver decreases, the cost per dray will increase. If the number of containers stays constant, more trucks will be required to handle the same number of containers, generating more traffic on the road. There is a potential to relocate the DC's to alleviate this cost, but it won't happen in the short term. Also, the DC's would be reluctant to pick up any additional cost, as would the shipping lines.

Overall Assessment: Blue Circle Terminal

The Blue Circle site has very limited potential as a container facility. It is unlikely there is sufficient space for facility operations and potential expansion. In addition, dredging savings relative to deepening to Garden City Terminal are limited by its upstream location.

DISPOSAL SITE 12A

The potential for developing a new container facility at Disposal Site 12A is assessed below. As for the discussion of all the alternative facilities, the analysis includes a profile of the site, estimation of the costs to modify the facility, a discussion of required landside transportation infrastructure, an evaluation of benefits of modifying this facility, discussion of other factors involved in conversion of this facility, and an overall assessment of its ability to address navigation problems and opportunities in Savannah Harbor.

Disposal Site 12A Profile and Initial Assessment

As indicated in Figure 1, Disposal Site 12A is located on the northern bank of the Back River, east of the tidal gate, in Jasper County, South Carolina. Figure 6 provides a more detailed aerial view of Disposal Site 12A. As for the Blue Circle site, the polygon in Figure 6 provides visual scale for the aerial photo, representing the 300 acres that are

FIGURE 6
DISPOSAL SITE 12A

assumed to be necessary for development of a new container facility.

As an initial assessment, Disposal Site 12A would have the following assets and liabilities. First, the site appears to have sufficient room for the necessary port and landside facilities required for a container terminal. Second, all of the infrastructure would need to be brought to the site, including rail and road connections. Third, the Back River east of the tidal gate is not part of the Federal channel. This backwater area is intended to capture sediment. Consequently, project construction could be expensive. In addition, this backwater area could be subject to significant sediment accretion, resulting in significant increases in maintenance dredging costs.

Construction Costs: Disposal Site 12A

The cost estimated to construct a container terminal at Disposal Site 12A are contained in Table 14. As indicated in this table, it is estimated that $334 million would be required to develop a container terminal at this site. Since the site is undeveloped, a new container terminal would require new construction of all of the facilities assumed to be necessary for such a facility. It is assumed that an intermodal rail facility would need to be located onsite, since Garden City's intermodal terminal is beyond the 10-mile practical limit assumed in this analysis. As previously mentioned, 75 acres would be required for this facility. Consequently, land purchases in Table 14 contain 375 acres (i.e., 300 for the container terminal and 75 acres for the intermodal facility). Other assumptions about this site include: a water storage tank for fire protection and a package wastewater treatment facility.

It is also assumed for all of the alternative sites that are located in undeveloped areas along the Savannah River (i.e., Disposal Area 12A, Disposal Sites 14A/B, and Tybee National Wildlife Refuge) that $6,000 is representative of real estate purchase costs per acre. This cost per acre is based on a sample of such properties using real estate property assessments of Chatham County.

As indicated in Table 14, the Federal Government would need to be compensated for disposal capacity lost when this site is developed. It is assumed that this compensation would be in the form of replacement disposal capacity elsewhere (preferably nearby) along the river. The Compensation for Lost Disposal Capacity cost category includes 375 acres of replacement disposal capacity to compensate for capacity lost with development of the terminal and the intermodal facility. It is assumed that one-half of the new disposal capacity would be located in wetlands, which would require mitigation. Consequently, the $7.1 million cost estimate is based on: [(375 acres x $6,000 per acre) + (187.5 acres * $26,000 per acre for land/mitigation costs)].

Based on aerial photos, U.S.G.S. quadrangle maps, and preliminary site reconnaissance, it is assumed that two acres of wetland would be impacted by the transportation corridor (rail and road), assuming one-half of the corridor passes through wetlands. As noted above, it is assumed that wetland mitigation activities (in addition to land purchases) would be approximately $20,000 per acre ($10,000/acre plus a 2:1 replacement ratio).

TABLE 14
ESTIMATED COSTS OF DISPOSAL SITE 12A TERMINAL

Site Improvement				
Land purchase	375	ac	$6,000	$2,250,000
Heavy Duty Pavement for container traffic	300	ac	$300,000	$90,000,000
Heavy Duty Access Drive Pavement for container traffic	2.5	mi	$2,000,000	$5,000,000
8" PVC Water service from Hardeeville (10 miles)	52,800	lf	$13	$663,340
Administration Building	10,000	sf	$168	$1,675,102
storage building	20,000	sf	$10	$198,565
Building foundation	3,333	sy	$22	$73,717
110 lb Railroad track w/ wooden ties and ballast	26,000	lf	$78	$2,018,592
RR foundation	62,400	sy	$13	$837,408
110 lb Railroad track w/ concrete ties in container yard	20,000	lf	$182	$3,632,524
Railroad track bridge crossing	300	lf	$1,132	$339,488
Electrical service from Hardeeville, SC	71,280	lf	$60	$4,276,800
Dock (includes: concrete deck & beam, concrete steel reinforcement, 18" square precast concrete piling, expn joint & misc const items, handrail, fender system)	2,500	lf	$14,300	$35,750,000
Crane Tracks on concrete ties(assume length = 1.25 x dock length)	3,125	lf	$182	$567,582
Hwy 17 railroad & semi flyover				$3,299,524
100,000 Gallon Water Storage Tank for fire protection	1	ea	$250,000	$250,000
Intermodal Transfer Station	1	ea	$5,304,817	$5,304,817
Compensation for Lost Disposal Capacity				$7,125,000
Wetlands Mitigation	2	ac	$26,000	$63,030
Wastewater Treatment Facility	1		$10,000,000	$10,000,000
Equipment				
72-95 Ton Cranes	6	ea	$6,500,000	$39,000,000
Rubber tire gantries	7	ea	$1,300,000	$9,100,000
Five High loaded top lifts (87,000 lbs)	10		$350,000	$3,500,000
Seven High empty stackers ((15,000 lbs)	2		$200,000	$400,000
Jockey Trucks	20	ea	$39,120	$782,400
Flatbed Trucks	6	ea	$28,980	$173,880
Contingency	25%			$55,729,804
			Subtotal	$278,649,018
E&D / S&A	20%			$55,729,804
			TOTAL	$334,378,823

Landside Transportation: Disposal Site 12A

Truck traffic to/from this site would have access to Route 17 along an existing access road that connects with Route 17 approximately 1.25 miles north of Back River. Access to Interstate 16 would be approximately equivalent to Garden City Terminal. A heavy-duty access road would need to be built to accommodate truck traffic to/from the site. Approximately one-half of this access road would pass through wetlands, requiring significant foundation work and mitigation.

This facility would need to utilize the Hardeeville Spur to access the CSX system north of its intersection with Route 17. This would require approximately five miles of new track, much of it through wetlands. A rail bridge would be needed to cross Salt Water Creek approximately two miles north of Disposal Site 12A.

The rail issues would be the same as for the other sites north of Savannah River, as discussed above for the Blue Circle site, exacerbated by the additional travel time to reach the former SCL line and the Hardeeville Spur. Use of the Garden City intermodal terminal would not be practical, since it is more than 10 miles away.

Dredging Costs: Disposal Site 12A

Dredging-related costs associated with Disposal Site 12A are presented in Table 15. Dredging costs would include deepening Back River to access the terminal and construction of a turning basin in Back River near the site. As indicated in this table, dredging to 48 feet MLW from the sea to Disposal Site 12A would cost approximately $192 million.

Based on the distance downstream, it was assumed that most of the dredging-related costs in the bottom rows of Table 15 (Debris Removal to Striped Bass Impact Avoidance) would be 65 percent of costs developed for Garden City Terminal in the Tier I analysis. Mitigation costs for cultural/historic impacts and channel modification would be expected to consistent (i.e., 100 percent) with Garden City costs. Secondary effects of salinity intrusion on wetlands would be expected to be significantly less (25 percent).

TABLE 15
ESTIMATED COSTS OF CHANNEL DEEPENING (48 FEET MLW)
TO DISPOSAL SITE 12A TERMINAL

Mobilization				$2,683,845
Dredging				
-85+000 to -60+000	2,616,000	cy	$3.87	$10,123,920
-60+000 to -38+500	4,163,000	cy	$2.69	$11,188,063
-38+500 to -14+000	5,155,000	cy	$2.04	$10,529,088
-14+000 to 0+000	2,071,000	cy	$2.26	$4,675,283
0+000 to 24+000	3,506,000	cy	$2.37	$8,291,690
24+000 to 40+000	3,824,000	cy	$4.89	$18,704,140
40+000 to 50+000	2,963,000	cy	$2.96	$8,759,369
50+000 to 70+000 (Assume end of port located at station 60+000)	1,937,000	cy	$2.63	$5,101,574
Back River Dredging	3,000,000	cy	$2.37	$7,095,000
Dredging for turning basin	2,382,222	cy	$2.63	$6,274,178
Berth Dredging	600,000	cy	$4.03	$2,418,750
Disposal Area Site Work and Erosion Control				$12,652,407
Contingency	25%			$27,124,326
E&D / S&A	20%			$27,124,326
			Subtotal	$162,745,957
Debris Removal	65%		$2,449,764	$1,592,346
Aids to Navigation	75%		$871,691	$653,768
Chloride Mitigation - relocate water intake	0%		$49,450,000	$0
Dissolved Oxygen Mitigation	20%		$25,800,000	$5,160,000
Cultural/Historic Mitigation	100%		$15,424,449	$15,424,449
Lands, Easements, Relocations, Rights-of-Way	65%		$2,349,198	$1,526,978
Channel Modification Mitigation	65%		$260,000	$169,000
Salinity Intrusion on Wetlands (722 ac)	25%		$18,772,000	$4,693,000
Shortnose Sturgeon Mitigation	20%		$1,375,500	$275,100
Striped Bass Impact Avoidance	0%		$2,000,000	$0
			TOTAL	$192,240,599

Other Considerations: Disposal Site 12A

Development of a container terminal at Disposal Site 12A would not have significant environmental effects associated with the facility footprint, given its current use for disposal of dredged material. However, as discussed above, installation of a new marine terminal at this site would entail development of equivalent disposal capacity at another location. It is likely that this disposal capacity would be located in saltmarsh wetlands that lie along the north shore of the Savannah River. In addition, rail and road access to the site would likely traverse wetlands. This could require significant efforts in planning the rail route to avoid, minimize, and mitigate adverse environmental effects. Wetland mitigation costs for landside transportation corridors are included in Table 14.

Vessel traffic associated with a new terminal may increase tidal velocities in Back River, thereby reducing the effectiveness of the area as a sediment trap. The reduced effectiveness would increase the cost of removing that sediment from other portions of the harbor. In addition, deepening of Back River could increase salinity intrusion up Back River, resulting in adverse impacts to wetlands and fishery habitats. Costs of such secondary impacts have not been included in this analysis.

As discussed above, a portion of the traffic from a container facility is generated by deliveries to and from distribution centers. Anything that would generate longer delivery times, such as longer dray distances, will affect the number of deliveries that can be made. As the number of deliveries per driver decreases, the cost per dray could increase. If the number of containers stays constant, more trucks will be required to handle the same number of containers, generating more traffic on the road. Since Disposal Site 12A is approximately six miles downstream of Garden City Terminal, the drayage distance from this site would be at least that much more than the distance from Garden City Terminal.

Overall Assessment: Disposal Site 12A

Disposal Site 12A has potential as a site for a new container terminal. There is sufficient space for a terminal and highway access is relatively efficient. However, the costs of developing this facility would be more than twice the expected benefits, in terms of dredging costs avoided. In addition, environmental impacts associated with rail and road access to the site could be significant.

EAST COAST TERMINAL

The potential for modifying East Coast Terminal to serve as a dedicated container facility is assessed below. The analysis includes a profile of the site, estimation of the costs to modify the facility, a discussion of required landside transportation infrastructure, an evaluation of benefits of modifying this facility, discussion of other factors involved in conversion of this facility, and an overall assessment of its ability to address navigation problems and opportunities in Savannah Harbor.

East Coast Site Profile and Initial Assessment

As indicated in Figure 1, the East Coast Terminal site is located on the south bank of the Savannah River east of downtown Savannah, approximately 1.2 miles below the foot of Bull Street.

This site is operated by the East Coast Terminal Company. This marine terminal handles conventional and containerized general cargo, steel products, linerboard, and woodpulp; receipt of cement clinker, bauxite, gypsum, and liquid sulfur. Rail service to this terminal is provided by CSX. This marine terminal currently has 1,800 feet of berth space with berths that are 34 - 36 feet MLW. Approximately 28 acres of open storage area are located in the rear of the site.

Figure 7 provides a more detailed aerial view. The polygon in Figure 7, which illustrates the 300 acres assumed necessary for a new container terminal, provides visual scale for the aerial photo. As evident in this figure, to achieve 300 acres, the new terminal would need to incorporate adjacent properties, as well as the East Coast Terminal site.

As an initial assessment, East Coast Terminal would be more downstream than other terminals considered thus far. Consequently, its benefits in terms of dredging costs avoided would be larger. However, East Coast might be too small to serve as a container facility. In addition, landside transportation appears to present a problem for truck and rail movement of containers. The site is on the east side of the City of Savannah and the transportation connections are on the west side. Moving the containers through the city could be problematic.

Costs of Modifying East Coast Terminal

The costs estimated to construct a container terminal at the East Coast site are contained in Table 16. As indicated in this table, it is estimated that $370 million would be required to develop a 300-acre container terminal at this site. It is anticipated that much of this site would need to be demolished prior to construction of the container terminal. As in the case of the Blue Circle site, the associated costs of relocating current East Coast Terminal operations to another facility would need to be included in a detailed analysis of this site. The terminal would require the full array of container handling facilities described above, and it is assumed that the existing docks would be inadequate for the container facility under consideration in this investigation.

Based on aerial photos, U.S.G.S. quadrangle maps, and preliminary site reconnaissance, it is assumed that 100 acres of this site (i.e., one-third of the 300 acres) would be wetlands. As noted above, it is assumed that wetland mitigation activities would be approximately $26,000 per acre, including land purchased for mitigation at $6,000 per acre.

FIGURE 7
EAST COAST TERMINAL

TABLE 16
ESTIMATED COSTS OF EAST COAST TERMINAL

Site Demolition				
Asphalt pavement	121,000	sy	$3	$421,316
Building Demo	10,707,122	cf	$0	$2,216,749
Building foundation removal	22,409	cy	$65	$1,455,083
Railroad track removal, ties and track	8,000	lf	$8	$64,369
Site Improvement				
Land purchase	375	ac	$100,000	$37,500,000
Heavy Duty Pavement for container traffic	300	ac	$300,000	$90,000,000
Administration Building	10,000	sf	$168	$1,675,102
storage building	20,000	sf	$10	$198,565
Building foundation	3,333	sy	$22	$73,717
110 lb Railroad track w/ wooden ties and ballast	-	lf	$78	$0
110 lb Railroad track w/ concrete ties in container yard	20,000	lf	$182	$3,632,524
Dock (includes: concrete deck & beam, concrete steel reinforcement, 18" square precast concrete piling, expn joint & misc const items, handrail, fender system)	2,500	lf	$21,300	$53,250,000
Crane Tracks on concrete ties(assume length = 1.25 x dock length)	3,125	lf	$182	$567,582
100,000 Gallon Water Storage Tank for fire protection	1	ea	$250,000	$250,000
Upgrade of Intermodal Facilities				$2,652,409
Wetlands Mitigation	100		$26,000	$2,600,000
Equipment				
72-95 Ton Cranes	6	ea	$6,500,000	$39,000,000
Rubber tire gantries	7	ea	$1,300,000	$9,100,000
Five High loaded top lifts (87,000 lbs)	10		$350,000	$3,500,000
Seven High empty stackers ((15,000 lbs)	2		$200,000	$400,000
Jockey Trucks	20	ea	$39,120	$782,400
Flatbed Trucks	6	ea	$28,980	$173,880
Contingency	25%			$61,728,424
			Subtotal	$311,892,119
E&D / S&A	20%			$61,728,424
			TOTAL	$370,370,544

Landside Transportation: East Coast Terminal

Detailed examination of transportation issues in the City of Savannah suggest that development of a large container facility at East Coast Terminal would be problematic with respect to landside transportation of containers. Coordination with Metropolitan Planning Commission (MPC) identified several pertinent studies. In addition, MPC staff characterized east-west freight transportation issues in the City of Savannah. Among the studies identified by MPC staff was the *East-West Corridor Feasibility Study*, prepared by HNTB Corporation for MPC. This study was initiated in 1997 in order to assess and address capacity deficiencies in east-west travel through the City of Savannah. In particular, the study focused on Bay Street and on DeRenne Avenue as the principal east-west corridors through the city. Traffic counts by MPC along these corridors support the findings of this study that they are already operating well beyond their efficient carrying capacity. In 2002, some portions of DeRenne Avenue had average daily volumes in excess of 50,000 vehicles, and average daily volumes for Bay Street through the Historic District of downtown Savannah exceeded 25,000 vehicles.

As established by the *East-West Corridor Feasibility Study*, these volumes clog the major east-west corridors through Savannah. This congestion has adverse implications for residents in neighborhoods along these corridors, city residents, and residents in communities east of the city, including Tybee Island. Increased commuting times, reduced air quality, impeded hurricane evacuation (of areas east of the city), and impeded movement of commercial vehicles are among the adverse effects of this east-west congestion.

Trucks moving to/from East Coast Terminal (or other potential container terminals east of the City) would likely use DeRenne Avenue and the Truman Parkway, the north-south corridor on the eastern side of the city. Under existing conditions, terminal-related trucks would experience significant delays and would increase congestion significantly. Assuming that 15 percent of the containers are moved by rail with the remainder by truck (generally consistent with Garden City Terminal), a container facility with the capacity under consideration in this analysis (500,000 TEUs annually) would generate approximately 600 trucks per day.

The *East-West Corridor Feasibility Study* recommended that the following actions as important near-term relief measures: (1) construction of a new, limited-access, six-lane freeway along DeRenne Avenue and (2) reduction of Bay Street through the Historic District from four to two lanes. According to MPC staff, the proposed DeRenne Avenue freeway is a source of great controversy in the neighborhoods along its route. Local residents resent the noise implications, loss of neighborhood properties from road widening, and the physical division of the neighborhoods. It is doubtful whether such a project could be implemented at this time due to neighborhood opposition. The unrelieved congestion on DeRenne Avenue could make it impractical to reduce the width of Bay Street, as recommended. The result is that the east-west congestion problems in

Savannah are likely to continue, and according to MPC planners, they will be exacerbated by new development (planned or pending) east of the city.

As long-term measures, the *East-West Corridor Feasibility Study* identified two additional options to relieve east-west congestion in Savannah: (1) a Gwinnett Street tunnel or (2) a Bay Street bypass route consisting of a bridge to Hutchinson Island from the south bank of the Savannah River near the East Coast Terminal and a freeway along the island connecting with the Houlihan Bridge upstream of Garden City Terminal. These congestion relief measures are too uncertain for consideration in this analysis.

Dredging Costs: East Coast Terminal

Dredging-related costs associated with the East Coast Terminal are presented in Table 17. Costs in this table include deepening Fig Island Turning Basin, which has the following dimensions: 900 feet wide, 1,000 feet long, and 34 feet deep. This turning basin would need to be enlarged as well as deepened to be consistent with Kings Island Turning Basin, which would be 1,600 feet by 1,675 feet under the Tier I Selected Plan. As indicated in this table, dredging to 48 feet MLW from the sea to the East Coast Terminal site would cost approximately $203 million.

Based on the distance downstream, it was assumed that most of the dredging-related costs in the bottom rows of Table 17 (Debris Removal to Striped Bass Impact Avoidance) would be 55 percent of costs developed for Garden City Terminal in the Tier I analysis. Mitigation costs for cultural/historic impacts and channel modification would be expected to consistent (i.e., 100 percent) with Garden City costs. Secondary effects of salinity intrusion on wetlands would be expected to be drop to insignificance, and dissolved oxygen mitigation costs for East Coast Terminal would be expected to 20 percent of the costs of Garden City Terminal.

Other Considerations: East Coast Terminal

The East Coast Terminal site could be affected by the development of a Hutchinson Island bridge, as discussed in the preceding section. This bridge could significantly affect this site and/or landside transportation in this part of the City of Savannah. The outcome for this site could be positive in terms of transportation access, negative if some portion of the site is lost to the bridge or its approaches, or some combination.

As discussed above, a portion of the traffic from a container facility is generated by deliveries to and from distribution centers. Anything that would generate longer delivery times, such as longer dray distances, will affect the number of deliveries that can be made. As the number of deliveries per driver decreases, the cost per dray could increase. If the number of containers stays constant, more trucks will be required to handle the same number of containers, generating more traffic on the road. Since East Coast Terminal is approximately seven miles downstream of Garden City Terminal, the drayage distance from this site would be at least that much more than the distance from Garden City Terminal.

TABLE 17
ESTIMATED COSTS OF CHANNEL DEEPENING (48 FEET MLW)
TO EAST COAST TERMINAL

Mobilization				$2,683,845
-85+000 to -60+000	2,616,000	cy	$3.87	$10,123,920
-60+000 to -38+500	4,163,000	cy	$2.69	$11,188,063
-38+500 to -14+000	5,155,000	cy	$2.04	$10,529,088
-14+000 to 0+000	2,071,000	cy	$2.26	$4,675,283
0+000 to 24+000	3,506,000	cy	$2.37	$8,291,690
24+000 to 40+000	3,824,000	cy	$4.89	$18,704,140
40+000 to 50+000	2,963,000	cy	$2.96	$8,759,369
50+000 to 70+000	3,874,000	cy	$2.63	$10,203,148
Deepening Fig Island Turning Basin		cy	$2.63	$18,995,817
Berth Dredging	600,000	cy	$2.63	$1,580,250
Disposal Area Site Work and Erosion Control				$13,524,987
Dredging Contingency	25%			$29,814,899
E&D / S&A	20%			$29,814,899
Subtotal				$178,889,396
Debris Removal	55%		$2,449,764	$1,347,370
Aids to Navigation	55%		$871,691	$479,430
Chloride Mitigation - relocate water intake	0%		$49,450,000	$0
Dissolved Oxygen Mitigation	20%		$25,800,000	$5,160,000
Cultural/Historic Mitigation	100%		$15,424,449	$15,424,449
Lands, Easements, Relocations, Rights-of-Way	55%		$2,349,198	$1,292,059
Channel Modification Mitigation	55%		$260,000	$143,000
Salinity Intrusion on Wetlands (722 ac)	0%		$18,772,000	$0
Shortnose Sturgeon Mitigation	20%		$1,375,500	$275,100
Striped Bass Impact Avoidance	0%		$2,000,000	$0
			TOTAL	$203,010,803

Overall Assessment: East Coast Terminal

The East Coast Terminal site has little potential as a container terminal. The benefits from dredging costs avoided are significantly outweighed by the costs of developing this facility. In addition, the site is likely too small for long-term use as an efficient container terminal. Even if these issues were not of concern, difficulties in east-west landside transportation of containers through the city by truck or by rail would likely be sufficient to eliminate this site from further consideration.

The conclusion is that landside transportation would be problematic for a new container terminal east of the City, including East Coast Terminal and Elba Island (the next alternative location discussed). The assumed 1.5 million TEUs per year would generate tremendous volumes of truck traffic to/from these terminals. According to MPC staff, rail movement of a significant portion of these containers would likely generate significant neighborhood opposition. The CSX rail line to areas east of the city, including the East Coast Terminal passes through residential neighborhoods in Savannah. This line is active, but according to MPC staff a dramatic increase in traffic could stimulate opposition from trackside neighborhoods.

ELBA ISLAND TERMINAL

The feasibility of developing a new container facility on Elba Island is assessed below. As for the discussion of all the alternative facilities, the analysis includes a profile of the site, estimation of the costs to modify the facility, a discussion of required landside transportation infrastructure, an evaluation of benefits of modifying this facility, discussion of other factors involved in conversion of this facility, and an overall assessment of its ability to address navigation problems and opportunities in Savannah Harbor.

Elba Island Site Profile and Initial Assessment

As indicated in Figure 1, Elba Island is located approximately half way between Garden City Terminal and the sea. Figure 8 provides a more detailed aerial view. The polygon in Figure 8 provides visual scale for the aerial photo, representing the 300 acres that are assumed to be necessary for development of a new container facility.

Elba Island is owned by Southern Gas which operates a liquefied natural gas (LNG) facility on the northeastern portion of the island. The facility has a marine terminal for receipt of LNG tankers. There is approximately 1,255 feet of berth space, maintained at a depth of 39 feet MLW. Adjacent to the terminal is a privately-maintained turning basin constructed by Southern Gas for its LNG ships. The remainder of the island, shown in Figure 8, serves as an active dredged material disposal site that Southern Gas uses for its maintenance dredging of the LNG berths and of the turning basin. Elba Island is accessed by a service road which includes a bridge over South Channel. There is currently no rail service to the island.

FIGURE 8
ELBA ISLAND

The LNG facility on Elba Island was re-activated in 2001, after being mothballed since 1982. As part of its re-activation, Southern Gas re-dredged the facility berths and the turning basin. Based on the re-activation of the facility, the planned expansion of the facility in 2005, and the rising importation of LNG, Southern Gas is likely to be operating the Elba Island facility for the foreseeable future.

As an initial assessment, Elba Island is far enough downstream of Garden City Terminal to generate significant savings in dredging costs avoided. In addition, there appears to be sufficient space on the island for a container facility consistent with the above assumptions. However, there does not appear to be much opportunity for future expansion. Although there is no rail service to the island, it is conceivable that a rail terminal could be developed on the south side of South Channel with convenient drayage. The previously mentioned difficulties of moving containers east-west through the City of Savannah would apply to an Elba Island container terminal.

Construction Costs: Elba Island Terminal

The costs required to construct a container terminal on Elba Island are contained in Table 18. As indicated in this table, it is estimated that $285 million would be required to develop a container terminal at this site. It is assumed that the container terminal site would not adversely affect the LNG terminal. It is assumed that an intermodal rail facility would need to be located on the south shore of South Channel. Trucks would access the site via the existing service road and bridge. However, significant improvements to this road and bridge would likely be necessary to accommodate the volume of truck traffic associated with a new container terminal; these costs are uncertain at this time and are not included in Table 18. Other assumptions about this site include: a water storage tank for fire protection and approximately 50 acres (of 300) would require wetland mitigation. It is assumed that City of Savannah's President Street Municipal Wastewater Treatment Plant would service a new terminal at Elba Island.

Based on aerial photos, U.S.G.S. quadrangle maps, and preliminary site reconnaissance, it is assumed that 50 acres of this site (i.e., one-sixth of the 300 acres) would be wetlands. As noted above, it is assumed that wetland mitigation activities (in addition to land purchases) would be approximately $20,000 per acre ($10,000/acre plus a 2:1 replacement ratio).

Landside Transportation: Elba Island Terminal

A container terminal on Elba Island would face the same landside transportation difficulties that face East Coast Terminal. Congestion on the east-west corridors through Savannah are severe and likely to worsen. Truck and rail transport of large volumes of containers to/from an Elba Island terminal could encounter significant community opposition in neighborhoods along those routes. The landside transportation problems associated with developing this site would likely greatly diminish if, separate from this project, a tunnel under downtown or a new bridge and bypass were constructed across the Savannah River, as discussed in the *East-West Corridor Feasibility Study*. Measures to reduce the rail problems are not readily foreseeable for this area and that - if true, operation of a terminal based solely on truck transit of the containers would greatly limit its potential efficiency and cost effectiveness.

As discussed above, a portion of the traffic from a container facility is generated by deliveries to and from distribution centers. Anything that would generate longer delivery times, such as longer dray distances, will affect the number of deliveries that can be made. As the number of deliveries per driver decreases, the cost per dray could increase. If the number of containers stays constant, more trucks will be required to handle the same number of containers, generating more traffic on the road. Since Elba Island is approximately 11 miles downstream of Garden City Terminal, the drayage distance from this site would be at least that much more than the distance from Garden City Terminal.

TABLE 18
ESTIMATED COSTS OF ELBA ISLAND TERMINAL

Site Improvement				
Land purchase	375		$6,000	$2,250,000
Heavy Duty Pavement for container traffic	300	ac	$300,000	$90,000,000
Administration Building	10,000	sf	$168	$1,675,102
storage building	20,000	sf	$10	$198,565
Building foundation	3,333	sy	$22	$73,717
110 lb Railroad track w/ wooden ties and ballast	-	lf	$78	$0
RR bed prep	-	lf		$0
110 lb Railroad track w/ concrete ties in container yard	-	lf	$182	$0
Electrical service to terminal	21,000	lf	$60	$1,260,000
Dock (includes: concrete deck & beam, concrete steel reinforcement, 18" square precast concrete piling, expn joint & misc const items, handrail, fender system)	2,500	lf	$14,300	$35,750,000
Crane Tracks on concrete ties(assume length = 1.25 x dock length)	3,125	lf	$182	$567,582
100,000 Gallon Water Storage Tank for fire protection	1	ea	$250,000	$250,000
Intermodal Transfer Station	1	ea	$5,304,817	$5,304,817
Wetlands Mitigation	50	ac	$26,000	$1,300,000
Equipment				
72-95 Ton Cranes	6	ea	$6,500,000	$39,000,000
Rubber tire gantries	7	ea	$1,300,000	$9,100,000
Five High loaded top lifts (87,000 lbs)	10		$350,000	$3,500,000
Seven High empty stackers ((15,000 lbs)	2		$200,000	$400,000
Jockey Trucks	20	ea	$39,120	$782,400
Flatbed Trucks	6	ea	$28,980	$173,880
Contingency	25%			$47,571,516
			Subtotal	$237,857,579
E&D / S&A	20%			$47,571,516
			TOTAL	$285,479,094

Dredging Costs: Elba Island Terminal

Dredging-related costs associated with the Elba Island site are presented in Table 19. As indicated in this table, dredging to 48 feet MLW from the sea to Elba Island would cost approximately $138 million.

TABLE 19
ESTIMATED COSTS OF CHANNEL DEEPENING (48 FEET MLW)
TO ELBA ISLAND TERMINAL

Mobilization				$2,683,845
-85+000 to -60+000	2,616,000	cy	$3.87	$10,123,920
-60+000 to -38+500	4,163,000	cy	$2.69	$11,188,063
-38+500 to -14+000	5,155,000	cy	$2.04	$10,529,088
-14+000 to 0+000	2,071,000	cy	$2.26	$4,675,283
0+000 to 24+000	3,506,000	cy	$2.37	$8,291,690
24+000 to 40+000	3,824,000	cy	$4.89	$18,704,140
40+000 to 50+000 (Assume end of port located at station 45+000)	2,963,000	cy	$2.96	$8,759,369
Dredging for turning basin	992,593	cy	$2.96	$2,934,352
Berth Dredging	600,000	cy	$2.96	$1,773,750
Disposal Area Site Work and Erosion Control				$11,343,537
Contingency	25%			$22,751,759
E&D / S&A	20%			$22,751,759
Subtotal				$136,510,553
Debris Removal	30%		$2,449,764	$734,929
Aids to Navigation	30%		$871,691	$261,507
Chloride Mitigation - relocate water intake	0%		$49,450,000	$0
Dissolved Oxygen Mitigation	0%		$25,800,000	$0
Cultural/Historic Mitigation	0%		$15,424,449	$0
Lands, Easements, Relocations, Rights-of-Way	30%		$2,349,198	$704,759
Channel Modification Mitigation	30%		$260,000	$78,000
Salinity Intrusion on Wetlands (722 ac)	0%		$18,772,000	$0
Shortnose Sturgeon Mitigation	0%		$1,375,500	$0
Striped Bass Impact Avoidance	0%		$2,000,000	$0
			TOTAL	$138,289,749

Based on the distance downstream, it was assumed that most of the dredging-related costs in the bottom rows of Table 19 (Debris Removal to Striped Bass Impact Avoidance) would be 30 percent of costs developed for Garden City Terminal in the Tier I analysis. Mitigation costs for cultural/historic impacts would be insignificant, since the Elba Island site is downstream of Old Fort Jackson and the *CSS Georgia.* Dissolved oxygen mitigation , shortnose sturgeon mitigation, and striped bass impact avoidance would not be necessary for this site.

Other Considerations: Elba Island Terminal

At Elba Island the Federal channel makes a sharp turn. This bend constitutes a challenge for commercial navigation. According to the Savannah Pilots, the pilots actively avoid passing commercial ships at this location. Consequently, a container facility on the undeveloped portion of the island might not be a safe location for a marine terminal if berthing areas would be located on or near the bend. This assumes that the LNG terminal would not be involved in development of a container facility. As stated above, it is likely that the LNG period would operate through the 50-year period of analysis.

A new terminal at Elba Island would fall into the current "blast zone" for the LNG facility. This raises the issue of whether Elba Island is a practical or safe location for a container terminal given the activities on the adjoining LNG facility. In addition, the Coast Guard regulates movements of LNG vessels in the harbor and movements of other vessels when LNG vessels are in transit. Specifically, movements of LNG tankers require a regulated navigation area (RNA) that extends from Fort Jackson (upriver from the LNG terminal) downstream to the channel entrance offshore (i.e., the Savannah River Channel Entrance Sea Buoy). Currently, when LNG ships are transiting the channel, vessels greater than 1,600 gross tons are prohibited from operating in the RNA without express permission of the USCG Captain of the Port. A revision to this RNA has been proposed by USCG. The proposed rulemaking [33 CFR Part 165] would allow vessels greater than 1,600 gross tons to operate in the RNA when LNG tankers are transiting Savannah Harbor, provided that a separation distance of two nautical miles is maintained. Under both current and proposed navigational rules, movements of LNG vessels could significantly constrain marine operations at an Elba Island container terminal.

The loss of sediment placement capacity that would result from use of the Elba Island disposal site would necessitate procurement of disposal capacity elsewhere along the river. It is assumed that the Georgia Department of Transportation and the Corps would allow Southern Energy to place their dredged material into contained disposal facilities (CDFs) on the north side of the river. The additional pumping costs and/or costs of constructing additional storage capacity have not been included in this analysis.

Overall Assessment: Elba Island Terminal

Elba Island has little potential as a container facility. The costs significantly exceed the benefits from avoided dredging costs. In addition, landside transportation would pose a significant challenge to the viability of this terminal, as for East Coast Terminal. Lastly, safe navigation practices may not allow location of a marine terminal at this sharp bend in the Savannah River.

DISPOSAL SITES 14A/B

The feasibility of developing a new container facility at Disposal Sites 14A/B in Jasper County, South Carolina is assessed on the next page. As for the discussion of all the alternative facilities, the analysis includes a profile of the site, estimation of the costs to modify the facility, a discussion of required landside transportation infrastructure, an evaluation of benefits of modifying this facility, discussion of other factors involved in

conversion of this facility, and an overall assessment of its ability to address navigation problems and opportunities in Savannah Harbor.

Disposal Sites 14A/B Profile and Initial Assessment

As indicated in Figure 1, the Disposal Sites 14A/B is located in Jasper County, South Carolina downstream of Elba Island. Figure 9 provides a more detailed aerial view. As with the other sites, the polygon in Figure 9 provides visual scale for the aerial photo. This box represents the 300 acres that are assumed to be necessary for development of a new container facility. This site is currently a dredged material disposal site operated by the Corps.

The consideration of the Disposal Sites 14A/B in this investigation is distinct from the South Atlantic International Terminal proposal being forwarded by Stevedoring Services of America (SSA). The SSA proposal, which would include some portions of Disposal Sites 14A/B, would occupy 500 acres and is expected to cost more than $400 million. This proposal is currently embroiled in a legal and political controversy. Legal issues concern the attempted condemnation of the site by Jasper County and lease to SSA for terminal development. Political issues include a lack of support by the State of Georgia or shipping interests in Charleston. This analysis is not evaluating the SSA proposal. Instead, it is evaluating Disposal Sites 14A/B for potential placement of a container facility that is commensurate with the other facilities being considered in this investigation.

As an initial assessment, Disposal Sites 14A/B are located toward the mouth of the Savannah River and would therefore generate significant benefits in terms of avoided dredging costs. There is also ample room for the terminal and its potential expansion.

Construction Costs: Disposal Sites 14A/B

The costs required to construct a container terminal at Disposal Sites 14A/B are contained in Table 20. As indicated in this table, it is estimated that $357 million would be required to develop a container terminal at this location.

As with Disposal Site 12A, the Compensation for Lost Disposal Capacity cost category includes 375 acres of replacement disposal capacity to compensate for capacity lost with development of the terminal and the intermodal facility. As for Disposal Site 12A it is assumed that one-half of the new disposal capacity would be located in wetlands, which would require mitigation.

Based on aerial photos, U.S.G.S. quadrangle maps, and preliminary site reconnaissance, it is assumed that 61 acres of this site (i.e., 50 percent of the landside transportation corridor and the intermodal facility) would be wetlands. As previously mentioned, it is assumed that a new intermodal container transfer facility that 75 acres would be required for this terminal. Consequently, land purchases in Table 20 contain 375 acres (i.e., 300 for the container terminal and 75 acres for the intermodal facility). As noted above, it is also assumed that wetland mitigation activities (in addition to land purchases) would be approximately $20,000 per acre ($10,000/acre plus a 2:1 replacement ratio).

FIGURE 9
DISPOSAL SITES 14A/B

TABLE 20
ESTIMATED COSTS OF TERMINAL AT DISPOSAL SITES 14A/B

Site Improvement				
Land purchase	375	ac	$6,000	$2,250,000
Access drive Heavy Duty Pavement for container traffic	47	ac	$300,000	$14,100,000
Heavy Duty Pavement for container traffic	300	ac	$300,000	$90,000,000
8" PVC Water service from Hardeeville (10 miles)	52,800	lf	$13	$663,340
Administration Building	10,000	sf	$168	$1,675,102
storage building	20,000	sf	$10	$198,565
Building foundation	3,333	sy	$22	$73,717
110 lb Railroad track w/ wooden ties and ballast	48,000	lf	$78	$3,726,630
RR bed foundation	117,333	sy	$13	$1,574,609
110 lb Railroad track w/ concrete ties in container yard	20,000	lf	$182	$3,632,524
Railroad track bridge crossing	300	lf	$1,132	$339,488
Electrical service from Hardeeville, SC	79,200	lf	$60	$4,752,000
Dock (includes: concrete deck & beam, concrete steel reinforcement, 18" square precast concrete piling, expn joint & misc const items, handrail, fender system)	2,500	lf	$14,300	$35,750,000
Crane Tracks on concrete ties(assume length = 1.25 x dock length)	3,125	lf	$182	$567,582
Hwy 17 railroad & semi flyover				$3,299,524
100,000 Gallon Water Storage Tank for fire protection	1	ea	$250,000	$250,000
Intermodal Transfer Station	1	ea	$5,304,817	$5,304,817
Compensation for Lost Disposal Capacity				$7,125,000
Wetlands Mitigation	24	ac	$26,000	$611,000
Wastewater Treatment Facility	1		$10,000,000	$10,000,000
Equipment				
72-95 Ton Cranes	6	ea	$6,500,000	$39,000,000
Rubber tire gantries	7	ea	$1,300,000	$9,100,000
Five High loaded top lifts (87,000 lbs)	10		$350,000	$3,500,000
Seven High empty stackers (15,000 lbs)	2		$200,000	$400,000
Jockey Trucks	20	ea	$39,120	$782,400
Flatbed Trucks	6	ea	$28,980	$173,880
Contingency	25%			$59,559,795
			Subtotal	$297,798,793
E&D / S&A	20%			$59,559,795
			TOTAL	$357,358,767

As for Disposal Site 12A, the Federal Government would need to be compensated for disposal capacity lost when this site is developed. It is assumed that this compensation would be in the form of replacement disposal capacity elsewhere along the river. The Compensation for Lost Disposal Capacity cost category includes 375 acres of replacement disposal capacity. It also includes wetland mitigation for one-half of that area that is assumed to be wetlands.

Landside Transportation: Disposal Sites 14A/B

A container facility at Disposal Sites 14A/B would have similar landside issues as the other terminals considered that are on the north side of the Savannah River. In particular, there could be significant environmental impacts and consequent mitigation costs associated with road and rail access to the terminal.

Dredging Costs: Disposal Sites 14A/B

Dredging-related costs associated with Disposal Sites 14A/B are presented in Table 21. As indicated in this table, dredging to 48 feet MLW from the sea to Disposal Sites 14A/B would cost approximately $127 million. It is assumed that ships calling at the Disposal Sites 14A/B container facility would use the Elba Island turning basin constructed by Southern Gas to serve the LNG marine terminal.

Based on the distance downstream, it was assumed that most of the dredging-related costs in the bottom rows of Table 21 (Debris Removal to Striped Bass Impact Avoidance) would be 25 percent of costs developed for Garden City Terminal in the Tier I analysis. Chloride mitigation, dissolved oxygen mitigation, cultural/historic mitigation, lands, easements, relocations, rights-of-way, channel modification mitigation, and salinity intrusion on wetlands would not be necessary.

Other Considerations: Disposal Sites 14A/B

Environmental considerations associated with Disposal Sites 14A/B include potential wetlands disturbances associated with rail and road access routes. The use of the site as a dredged material disposal site minimizes direct wetlands impacts. However, the lost dredged material disposal capacity would need to be replaced elsewhere along the river, preferably in the lower reaches of the river, which are currently served by the impacted disposal areas. Replacement of that capacity through expansion of the CDFs to the north into existing saltmarsh would result in extensive secondary wetland impacts which would need to be mitigated.

As discussed above, a portion of the traffic from a container facility is generated by deliveries to and from distribution centers. Anything that would generate longer delivery times, such as longer dray distances, will affect the number of deliveries that can be made. As the number of deliveries per driver decreases, the cost per dray could increase. If the number of containers stays constant, more trucks will be required to handle the same number of containers, generating more traffic on the road. Since Disposal Sites 14A/B are approximately 11 miles downstream of Garden City Terminal, the drayage distance from this site would be at least that much more than the distance from Garden City Terminal.

TABLE 21
ESTIMATED COSTS OF CHANNEL DEEPENING (48 FEET MLW)
TO TERMINAL AT DISPOSAL SITES 14A/B

Mobilization			$2,683,845
-85+000 to -60+000	2,616,000 cy	$3.87	$10,123,920
-60+000 to -38+500	4,163,000 cy	$2.69	$11,188,063
-38+500 to -14+000	5,155,000 cy	$2.04	$10,529,088
-14+000 to 0+000	2,071,000 cy	$2.26	$4,675,283
0+000 to 24+000	3,506,000 cy	$2.37	$8,291,690
24+000 to 40+000	3,824,000 cy	$4.89	$18,704,140
40+000 to 50+000 (Assume end of port located at station 42+000)	592,600 cy	$2.96	$1,751,874
Dredging for turning basin	992,593 cy	$2.96	$2,934,352
Berth Dredging	600,000 cy	$2.96	$1,773,750
Disposal Area Site Work and Erosion Control			$11,081,763
Contingency	25%		$20,934,442
E&D / S&A	20%		$20,934,442
Subtotal			$125,606,650
Debris Removal	25%	$2,449,764	$612,441
Aids to Navigation	25%	$871,691	$217,923
Chloride Mitigation - relocate water intake	0%	$49,450,000	$0
Dissolved Oxygen Mitigation	0%	$25,800,000	$0
Cultural/Historic Mitigation	0%	$15,424,449	$0
Lands, Easements, Relocations, Rights-of-Way	25%	$2,349,198	$587,299
Channel Modification Mitigation	25%	$260,000	$65,000
Salinity Intrusion on Wetlands (722 ac)	0%	$18,772,000	$0
Shortnose Sturgeon Mitigation	0%	$1,375,500	$0
Striped Bass Impact Avoidance	0%	$2,000,000	$0
		TOTAL	$127,089,313

Overall Assessment: Disposal Sites 14A/B

Disposal Sites 14A/B have potential as a container facility. Although the location of this facility would be sufficiently downstream to generate significant benefits in terms of avoided dredging costs, the costs of facility development are substantially in excess of dredging costs avoided. However, the potential for extensive secondary wetland impacts could be a significant factor in the ultimate feasibility of this site.

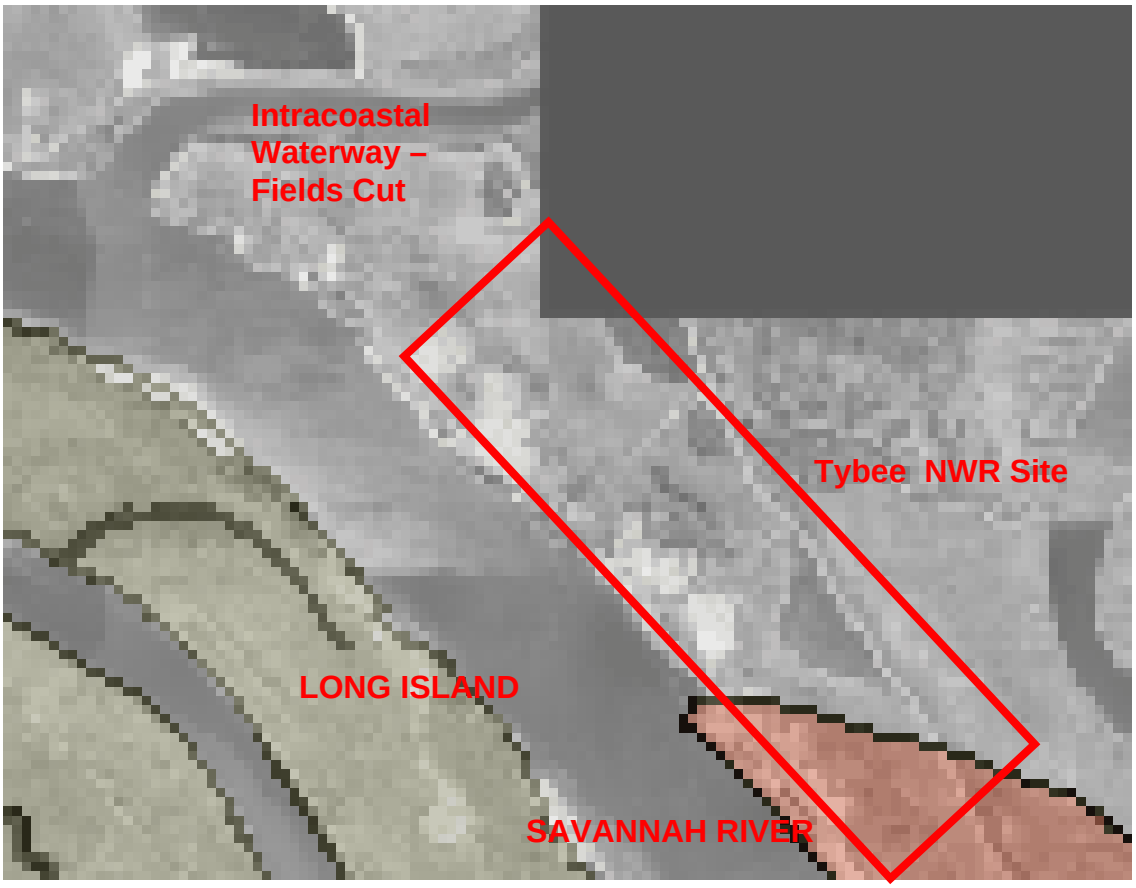
TYBEE NATIONAL WILDLIFE REFUGE

The feasibility of developing a new container facility in Tybee National Wildlife Refuge in Jasper County, South Carolina is assessed below. As for the discussion of all the alternative facilities, the analysis includes a profile of the site, estimation of the costs to modify the facility, a discussion of required landside transportation infrastructure, an evaluation of benefits of modifying this facility, discussion of other factors involved in conversion of this facility, and an overall assessment of its ability to address navigation problems and opportunities in Savannah Harbor.

Tybee National Wildlife Refuge Site Profile and Initial Assessment

As indicated in Figure 1, the Tybee NWR site is located in Jasper County, South Carolina approximately four miles upstream of mouth of the Savannah River. Figure 10 provides a more detailed aerial view. As for the other sites discussed above, the polygon in Figure 10 provides visual scale for the aerial photo. This box represents the 300 acres that are assumed to be necessary for development of a new container facility. It is assumed for this investigation that the Tybee NWR container facility would straddle the border between the wildlife refuge and the Corps' dredged material disposal facility (Jones/Oysterbed Island Disposal Area), with 50 percent of the facility footprint in each of these areas.

FIGURE 10
TYBEE NWR SITE



As an initial assessment, the Tybee NWR would have similar assets and liabilities as Disposal Sites 14A/B discussed above. There would be ample room for the terminal and its potential expansion. There would be significant benefits from avoided dredging costs by its location close to the mouth of the river. One challenge for the Tybee NWR site would be the need to cross the Fields Cut portion of the Intracoastal Waterway.

Construction Costs: Tybee NWR Terminal

The costs required to construct a container terminal at the Tybee NWR site are contained in Table 22. As indicated in this table, it is estimated that $385 million would be required to develop a container terminal at this site. Train access/egress from the Tybee NWR site would be via the Hardeeville Spur; road access would be via Route 17. It is assumed that an intermodal rail facility would need to be located near the site west of Fields Cut to avoid the expense of a rail bridge over the Intracoastal Waterway. As previously mentioned, it is assumed that a new intermodal container transfer facility that 75 acres would be required for this terminal. Consequently, land purchases in Table 20 contain 375 acres (i.e., 300 for the container terminal and 75 acres for the intermodal facility). Other assumptions about this site include: a water storage tank for fire protection and a package wastewater treatment facility.

As for Disposal Site 12A and Disposal Sites 14A/B, the Federal Government would need to be compensated for disposal capacity lost when this site is developed. It is assumed that this compensation would be in the form of replacement disposal capacity elsewhere along the river. As mentioned previously, it is assumed in the Compensation for Lost Disposal Capacity cost category that one-half of the site would be located in the Jones/Oysterbed Island Disposal Area. Since the compensatory disposal capacity would likely be located somewhere in the Tybee NWR, a 2:1 ratio of mitigation to loss was used for this site. Consequently, the $6.0 million cost estimate is based on: [(187.5 acres x $6,000 per acre) + (93.75 acres x 2:1 ratio x $26,000 per acre for land/mitigation costs)]. Based on aerial photos, U.S.G.S. quadrangle maps, and preliminary site reconnaissance, it is assumed that 51 acres of wetland would be impacted by the transportation corridor (rail and road), assuming one-half of the corridor passes through wetlands. As noted above, it is assumed that wetland mitigation activities (in addition to land purchases) would be approximately $20,000 per acre ($10,000/acre plus a 2:1 replacement ratio).

Landside Transportation: Tybee NWR Terminal

The need to cross Fields Cut could be a significant issue for this site. For the Norfolk to Miami section of this waterway, the U.S. Coast Guard (USCG) requires that all bridges provide 65 feet of vertical clearance. This would make the bridge expensive.

TABLE 22
ESTIMATED COSTS OF TYBEE NWR TERMINAL

Site Improvement				
Land purchase	375		$6,000	$2,250,000
Heavy Duty Pavement for container traffic	300	ac	$300,000	$90,000,000
Heavy Duty Access Drive Pavement for container traffic	101	ac	$300,000	$30,440,771
8" PVC Water service from Hardeeville (10 miles)	52,800	lf	$13	$663,340
Administration Building	10,000	sf	$168	$1,675,102
storage building	20,000	sf	$10	$198,565
Building foundation	3,333	sy	$22	$73,717
110 lb Railroad track w/ wooden ties and ballast	48,000	lf	$78	$3,726,630
RR foundation	117,333	sy	$13	$1,574,609
110 lb Railroad track w/ concrete ties in container yard	20,000	lf	$182	$3,632,524
Railroad track bridge crossing	300	lf	$1,132	$339,488
Electrical service from Hardeeville, SC	131,700	lf	$60	$7,902,000
Dock (includes: concrete deck & beam, concrete steel reinforcement, 18" square precast concrete piling, expn joint & misc const items, handrail, fender system)	2,500	lf	$14,300	$35,750,000
Crane Tracks on concrete ties(assume length = 1.25 x dock length)	3,125	lf	$182	$567,582
Hwy 17 railroad & semi flyover				$3,299,524
Bridge over Fields Cut				$3,299,524
100,000 Gallon Water Storage Tank for fire protection	1	ea	$250,000	$250,000
Intermodal Transfer Station	1	ea	$5,304,817	$5,304,817
Compensation for Lost Disposal Capacity				$6,000,000
Wetlands Mitigation	51	ac	$26,000	$1,319,100
Wastewater Treatment Facility	1		$10,000,000	$10,000,000
Equipment				
72-95 Ton Cranes	6	ea	$6,500,000	$39,000,000
Rubber tire gantries	7	ea	$1,300,000	$9,100,000
Five High loaded top lifts (87,000 lbs)	10		$350,000	$3,500,000
Seven High empty stackers ((15,000 lbs)	2		$200,000	$400,000
Jockey Trucks	20	ea	$39,120	$782,400
Flatbed Trucks	6	ea	$28,980	$173,880
Contingency	25%			$64,151,237
			Subtotal	$320,756,186
E&D / S&A	20%			$64,151,237
			TOTAL	$384,907,423

Dredging Costs: Tybee NWR Terminal

Dredging-related costs associated with the Tybee NWR site are presented in Table 23. As indicated in this table, dredging to 48 feet MLW from the sea to the Tybee NWR Terminal site would cost approximately $80 million.

Based on the distance downstream, it was assumed that most of the dredging-related costs in the bottom rows of Table 23 (Debris Removal to Striped Bass Impact Avoidance) would be 10 percent of costs developed for Garden City Terminal in the Tier I analysis. Channel modification mitigation costs for the Tybee NWR site would also be expected to 10 percent of Garden City costs. Chloride mitigation, dissolved oxygen mitigation, cultural/historic mitigation, lands, easements, relocations, rights-of-way, channel modification mitigation, and salinity intrusion on wetlands would not be necessary.

Other Considerations: Tybee NWR Terminal

A Tybee NWR container terminal would have adverse impacts on the wildlife refuge, assuming that one-half of the facility would located within the refuge. In addition, truck and rail access routes would likely impact wetlands. These impacts would need to be carefully designed to avoid, minimize, and mitigate wetland impacts.

As discussed above, a portion of the traffic from a container facility is generated by deliveries to and from distribution centers. Anything that would generate longer delivery times, such as longer dray distances, will affect the number of deliveries that can be made. As the number of deliveries per driver decreases, the cost per dray could increase. If the number of containers stays constant, more trucks will be required to handle the same number of containers, generating more traffic on the road. Since the Tybee NWR site is approximately 15 miles downstream of Garden City Terminal, the drayage distance from this site would be at least that much more than the distance from Garden City Terminal.

These adverse environmental effects on the refuge would under most circumstances be sufficient to preclude this site from further investigation. However, U.S. Fish and Wildlife Service has concerns about the effects of the Tier I Selected Plan (i.e., 48-foot MLW channel deepening to Garden City Terminal) on the Savannah National Wildlife Refuge and offered the Tybee NWR site for consideration in order to limit environmental impacts in the upper harbor.

As with Disposal Site 12A and Disposal Sites 14A/B, the loss of dredged material disposal capacity would need to be compensated elsewhere along the river, preferably in the same reach as this site. A plan for such compensation and the costs for such an action, have been included in this evaluation.

TABLE 23
ESTIMATED COSTS OF CHANNEL DEEPENING (48 FEET MLW)
TO TYBEE NWR TERMINAL

Mobilization			$2,683,845
-85+000 to -60+000	2,616,000 cy	$3.87	$10,123,920
-60+000 to -38+500	4,163,000 cy	$2.69	$11,188,063
-38+500 to -14+000	5,155,000 cy	$2.04	$10,529,088
-14+000 to 0+000	2,071,000 cy	$2.26	$4,675,283
0+000 to 24+000 (Assume end of port located at station 4+000)	584,333 cy	$2.37	$1,381,948
Dredging for turning basin	1,250,000 cy	$2.37	$2,956,250
Berth Dredging	600,000 cy	$2.37	$1,419,000
Disposal Area Site Work and Erosion Control			$7,765,960
Contingency	25%		$13,180,839
E&D / S&A	20%		$13,180,839
Subtotal			$79,085,034
Debris Removal	10%	$2,449,764	$244,976
Aids to Navigation	10%	$871,691	$87,169
Chloride Mitigation - relocate water intake	0%	$49,450,000	$0
Dissolved Oxygen Mitigation	0%	$25,800,000	$0
Cultural/Historic Mitigation	0%	$15,424,449	$0
Lands, Easements, Relocations, Rights-of-Way	10%	$2,349,198	$234,920
Channel Modification Mitigation	10%	$260,000	$26,000
Salinity Intrusion on Wetlands (722 ac)	0%	$18,772,000	$0
Shortnose Sturgeon Mitigation	0%	$1,375,500	$0
Striped Bass Impact Avoidance	0%	$2,000,000	$0
		TOTAL	$79,678,099

Other potential impacts would be lights from the facility adversely affecting sea turtles. This site is near the Atlantic beaches which are nesting grounds for sea turtles. The turtles can be disoriented by lights from shore. A large container terminal approximately two and one-half miles away could have adverse effects in this regard.

Overall Assessment: Tybee NWR Terminal

The Tybee NWR has limited potential as a container facility. Although the location of this facility would be sufficiently downstream to generate significant benefits in terms of avoided dredging costs, the costs of facility development are substantially in excess of dredging costs avoided. Finally, the environmental effects of a Tybee NWR container terminal would severely diminish the feasibility of this site.

COLONEL'S ISLAND, BRUNSWICK

Based on coordination between Savannah District and GPA, Colonel's Island was identified as having the greatest potential among the Brunswick marine terminals for development of a container terminal commensurate in channel depth and throughput capacity with the alternative Savannah River terminals discussed above. The feasibility of developing a new container facility at Colonel's Island in Brunswick is assessed below. The analysis of Colonel's Island includes a profile of the site, estimation of the costs to modify the facility, an evaluation of benefits of modifying this facility, discussion of other factors involved in conversion of this facility, and an overall assessment of its ability to address navigation problems and opportunities in Savannah Harbor.

Colonel's Island Site Profile and Initial Assessment

Figure 11 provides an aerial view of the Colonel's Island facility. As for the other sites discussed above, the polygon in Figure 11 provides visual scale for the aerial photo. This box represents the 300 acres that are assumed to be necessary for development of a new container facility consistent with the above facility parameters.

The existing Colonel's Island marine terminal is approximately 1,700 acres. It is served by a Federal navigation channel that is 400 feet wide with a depth of 30 feet MLW. Deepening of the Federal channel to 36 feet MLW has been authorized and is presently under construction. This marine terminal primarily handles bulk agricultural commodities and RoRo cargo. The existing Colonel's Island facility has three berths with lengths of 550, 750, and 550 feet. The terminal is located three miles from Interstate 95, and rail service is provided by CSX and Norfolk Southern Railroad.

As an initial assessment, a new container facility at Brunswick, which is approximately 80 miles from Savannah, may be of little help in addressing navigation problems and opportunities in Savannah Harbor. As evident in Figure 11, there appears to be sufficient space for a container terminal at Colonel's Island, but much of the site consists of wetlands. In the past, the Georgia Department of Natural Resources has strongly discouraged GPA from developing that site because of those wetlands. Mitigation costs would need to be included if this site were developed. Such costs are not included in this analysis. In addition, the existence of only a 36-foot channel (yet to be constructed) would likely result in significant cost disadvantages relative to alternative Savannah terminals given the assumed need to deepen to 48 feet MLW.

FIGURE 11
COLONEL'S ISLAND

Cost Of Modifying Colonel's Island Terminal

The estimated costs to construct a container terminal at Colonel's Island is contained in Table 24. As indicated in this table, it is estimated that $304 million would be required to develop a container terminal at this site. It is assumed that a new intermodal facility would be required. As previously mentioned, 75 acres would be required for this facility. Consequently, land purchases in Table 24 contain 375 acres (i.e., 300 for the container terminal and 75 acres for the intermodal facility). It is also assumed that all of this acreage would be wetlands (based on aerial photo interpretation) and that wetlands impacts would require mitigation at $20,000 per acre ($10,000/acre plus a 2:1 replacement ratio).

TABLE 24
ESTIMATED COSTS OF COLONEL'S ISLAND TERMINAL
BRUNSWICK, GA

Site Improvement				
Land purchase	375		$6,000	$2,250,000
Heavy Duty Pavement for container traffic	300	ac	$300,000	$90,000,000
Administration Building	20,000	sf	$168	$3,350,203
storage building	50,000	sf	$10	$496,414
110 lb Railroad track w/ wooden ties and ballast	10,000	lf	$78	$776,381
110 lb Railroad track w/ concrete ties in container yard	20,000	lf	$182	$3,632,524
Dock Includes items listed below:	2,500	lf	$14,300	$35,750,000
Crane Tracks on concrete ties(assume length = 1.25 x dock length)	3,125	lf	$182	$567,582
Intermodal Transfer Station	1	ea	$5,304,817	$5,304,817
Disposal Area Site Work and Erosion Control	0			
Wetlands Mitigation	375		$20,000	$7,500,000
Equipment				
72-95 Ton Cranes	6	ea	$6,500,000	$39,000,000
Rubber tire gantries	7	ea	$1,300,000	$9,100,000
Five High loaded top lifts (87,000 lbs)	10		$350,000	$3,500,000
Seven High empty stackers ((15,000 lbs)	2		$200,000	$400,000
Jockey Trucks	20	ea	$39,120	$782,400
Flatbed Trucks	6	ea	$28,980	$173,880
Contingency	25%			$50,646,050
			Subtotal	$253,230,251
E&D / S&A	20%			$50,646,050
			TOTAL	$303,876,301

Dredging Costs: Colonel's Island Terminal

Dredging-related costs associated with the Colonel's Island site are presented in Table 25. As indicated in this table, dredging to 48 feet MLW from the sea to Colonel's Island would cost approximately $138 million. According to recent discussions with Hydraulics Branch of Savannah District, the ongoing deepening of the Brunswick channel to 36 feet MLW is proving to be significantly more expensive than expected, due to the amount of rock encountered in the channel substrate. Consequently, the dredging estimates in Table 25 are likely to be unrealistically low for the same reason. As more geotechnical information about the Brunswick channel substrate becomes available, dredging costs in Table 25 will require adjustment.

TABLE 25
ESTIMATED COSTS OF CHANNEL DEEPENING (48 FEET MLW)
TO COLONEL'S ISLAND TERMINAL
BRUNSWICK, GA

Mobilization			$2,496,600
Dredging by Reach			
-6+250 to 19+000	**9,912,963** cy	$3.47	$34,410,868
19+000 to 32+500	5,300,000 cy	$3.50	$18,559,275
32+500 to 34+000	588,889 cy	$3.77	$2,217,549
34+000 to 46+350	4,848,519 cy	$5.11	$24,753,869
Dredge South Brunswick River	2,748,148 cy	$3.14	$8,619,154
Berth Dredging	200,000 cy	$3.14	$627,270
Contingency	25%		$22,921,147
		Subtotal	$114,605,733
E&D / S&A (dredging only)	20%		$22,921,147
		TOTAL	$137,526,879

Other Considerations: Colonel's Island Terminal

In 2002, GPA commissioned Booz, Allen, and Hamilton to prepare a strategic plan for the Port of Brunswick. This plan noted that cargo volumes of forest products shipped through Brunswick have been declining. These commodities, which were previously shipped primarily as break-bulk cargo, are increasingly being shipped in containers through Savannah, rather than Brunswick. Booz, Allen, and Hamilton estimated that the container hinterland of Brunswick would generate approximately 70,000-75,000 TEUs per year. Brunswick was expected to capture only a small portion of this volume (20-30 percent). The analysis indicated that Brunswick could develop a small, specialized niche in container services but could not be competitive in liner service with the major South Atlantic ports, including Savannah, Charleston, and Jacksonville. The reason cited was channel depth constraints resulting from rock in the channel substrate. The strategic plan did not consider Brunswick to be viable even for container barge feeder service to the major South Atlantic ports, noting that trucking would be more cost-effective for the distances involved.

The Booz, Allen, Hamilton study concluded that the container hinterland for Brunswick is too small to support a major container facility. This analysis studied the potential of Brunswick as an adjunct to Savannah, rather than a replacement. However, Savannah is approximately 60 miles closer to Atlanta and other more-distant inland origin/destinations.

Overall Assessment: Colonel's Island Terminal

Colonel's Island and the Port of Brunswick have little potential for development of a major container facility such as considered in this investigation. The port is not well situated to serve customers currently served by Savannah. In addition, the cost of deepening the channel appears to be prohibitive.

OFFSHORE TRANSSHIPMENT FACILITY

The investigation also evaluated an offshore container transshipment terminal. The premise of such a facility is that depth-constrained container ships would utilize the offshore terminal to load/unload either to: (1) the extent necessary to transit the channel upstream (i.e., lightering the vessel offshore) or (2) fully pick up and discharge cargo destined for the inland port thereby avoiding the transit altogether. As part of the operation of an offshore terminal, it is assumed that barges or non-depth-constrained ships would provide feeder service from the terminal to local or regional ports.

Development of an offshore terminal would allow Savannah to serve the largest container ships and avoid the full costs of channel deepening to Garden City Terminal. The feasibility for an offshore transshipment facility is assessed below. The discussion differs from those of the alternative landside terminals, since the design and operation of such a facility is very speculative at this time. The analysis includes discussions of: conceptual design and profile of the facility, costs and benefits, other considerations, and an overall assessment of its ability to address navigation problems and opportunities in Savannah Harbor.

As part of this investigation extensive coordination was conducted with proponents of Seahub, a conceptual offshore terminal that has evolved from Department of Defense (DOD) research into floating offshore military bases. As discussed below, some engineering feasibility investigations were conducted as part of this research. However, the research focused on military applications of offshore platforms. Costs were not developed. The costs or viability for a commercial container transshipment operation are unknown at this time.

As discussed below, research into an offshore transshipment terminal raises more questions than answers. However, based on work done to date on Seahub and current operations of landside transshipment terminals, an assessment of an offshore facility can be made.

Larger Ships and Increasing Interest in Transshipment

As larger container ships have been adopted for liner services, the larger loads and deeper drafts of these vessels has stimulated interest in and development of transshipment terminals. The concept of transshipment facility is a hub-and-spokes system, where transshipment facilities serve as regional hubs with feeder services by ship, barge, and landside transport to regional ports.

Transshipment activity is on the rise. In 1980 approximately 12 percent of worldwide container movements underwent transshipment. In 2002, 23 percent were transshipped. This trend is expected to continue as increasingly large container ships continue to be of interest to liner services, as evidenced by anticipation in the container industry that 10,000 to 15,000-TEU Malaccamax vessels may be in world service in the foreseeable future.

The adoption of larger container ships has been driven by pursuit of economies of scale, particularly over long trade routes. However, there is a trade-off with transshipment in the additional cost required to handle and store the transshipped containers, the time required for transshipment, and the potential for delays in making connections with feeder services.

Conceptual Design and Operations: Offshore Transshipment Facility

As part of this investigation, a literature search was conducted into container transshipment terminals. Several transshipment terminals are in operation around the world including Freeport, Bahamas; Kaohsiung, Taiwan; Aden, Yemen; Salalah, Oman, Singapore, and Manzanillo, Panama. To some extent, Garden City Terminal currently serves as a transshipment facility, with container barge fed services to regional (South Atlantic) ports moving containers to/from this central collection point served by the major container lines. In the Booz, Allen, Hamilton strategic plan for the Port of Brunswick discussed above, coastwise container barge service was considered more efficient than trucking for distances in excess of 300 miles.

At this time, all transshipment terminals are land-based. There are no offshore container transshipment terminals such as considered in this investigation for Savannah. Consequently, there is not a template upon which to base the design for an offshore container transshipment terminal at Savannah or to estimate the costs, benefits, and other effects. Following are discussions of the parameters for design and operation of an offshore container transshipment terminal at Savannah.

Regional or Local Scale?

Based on the limited experience with container transshipment terminals around the world, the geographic location of a transshipment terminal is a critical determinant of its success. Whether a Savannah facility would serve just the Port of Savannah or other South Atlantic ports would shape its design in terms of physical size and throughput capacity and its operation. The development of a regional offshore terminal would require cooperative planning between the South Atlantic ports, which are typically locked into a competitive struggle to serve overlapping economic hinterlands. For an offshore transshipment facility to address navigation problems and opportunities in Savannah Harbor, it is assumed that it would serve depth-constrained container ships with an annual throughput capacity of approximately 1.5 million TEUs.

Another issue of scale is the amount of container storage required on the offshore facility. Even if most containers were moved to/from ships to barges, some facility storage would

be required as part of repositioning operations. The load bearing capacity of an offshore facility and the surface area would be critical cost parameters.

Floating or Fixed?

As part of this investigation, several coastal/offshore engineering experts were consulted about the feasibility of an offshore container transshipment facility. The engineering challenges of an offshore terminal are significant. The most immediate challenge would be how to load/unload container ships in an offshore environment. In an unprotected berth, the movement of a ship in this wave environment would be problematic in terms of loading/unloading. Container transfers to/from vessels would be inefficient, potentially dangerous, and under certain wave conditions, impossible (see discussion below). If the transshipment platform was also moving (as for a floating platform), these difficulties become much more challenging, suggesting a fixed platform or artificial island would be required.

According to one offshore engineering expert, the wave uplift on a fixed crane platform would exceed engineering capabilities, and a platform would need to be at least 100 feet above sea level. A floating "tension leg" platform, which remains at a constant elevation due to the tension, might be suitable. Another option would be an artificial island. Feasibility studies are being conducted on an offshore container platform in Apra Harbor, Guam. The platform being studied is a tension leg design. This platform would be protected from wave action by a breakwater.

Whether the terminal is floating or fixed, the technical feasibility of offshore transshipment of containers is uncertain at this time. As part of this DOD research into Seahub, some simulation studies were conducted into the challenges of cargo transfer to/from a floating transshipment facility. Results were not conclusive.

The U.S. Navy performs Logistics Over-the-Shore (LOTS) operations where transport ships are offloaded at anchor in deep water. LOTS operations are part of amphibious capabilities, allowing for cargo movement in areas where ports are not available. LOTS operations handle containers, RoRo, and break-bulk cargo. Navy safety guidelines prohibit LOTS operations during strong winds and high seas, as defined by the Beaufort Scale for sea state. Adverse weather conditions during cargo handling greatly increase the danger to personnel and equipment through loss of control of the cranes and excessive relative movement between the container ship and lightering vessels. Operations are prohibited at Beaufort Scale Sea State of three (3) which describes wind speeds between 7 and 10 knots and "large wavelets with some breaking crests."

Safety limitations to offshore military cargo handling will also be inherent to commercial offshore cargo handling. Although the types of ships and lightering vessels may differ in size and capability between military and commercial operations, the limiting factor for safe cargo handling operations will always depend on the condition of the sea and prevailing weather. Landside commercial operations are also not immune from weather conditions. For example, Super Post-Panamax container cranes must be shut down when winds exceed 40 miles per hour.

The National Oceanographic and Atmospheric Administration (NOAA) maintains a network of weather sea buoys along the eastern seaboard of the continental U.S. The sea buoy that is located near to the mouth of the Savannah River is buoy number 41008. This buoy measures and records ocean currents, atmospheric pressure, water temperature, wind speed, wave height and wave period. Buoy 41008 is located 40 nautical miles Southeast from Savannah, Georgia at a mean water depth of 60 feet. Historic data trends recorded by buoy 41008 shows the average sea swell and wind speed that can be expected off the coast of Georgia.

- The average monthly wind speed is approximately 10 knots with a 5 knot mean deviation from standard; the wind speed measured range is from light and variable (zero knots) to over 45 knots of average speed during the peak hurricane month of September.
- The average monthly significant wave height is approximately 3 feet with a one-and-a-half foot mean deviation from standard; the significant wave height measured range is from less than one-foot to approximately 19 feet during the peak hurricane month of September.
- The average monthly wave period at buoy 41008 is approximately 5 seconds with a one-second mean deviation from standard; the wave period measured range is from 3 seconds to approximately 13 seconds during the month of December.

As evident in the buoy data, the average monthly conditions of the sea and wind are at the upper limit or exceed the maximum conditions for safe offshore cargo handling operations as defined by the Navy for its LOTS operations. If average conditions are at the upper limit of operation tolerances, the facility would be inoperable under many weather conditions. This would be a significant shortcoming from the perspective of container liner services which are schedule-driven and have little tolerance for significant delays at any port along their rotation.

Storage Requirements

If container transshipment was directly from ship to ship or ship to barge, a platform could be constructed similar to an offshore oil drilling facility. However, it is unlikely that the need for some storage capacity could be entirely avoided. Repositioning requirements would dictate that some storage capacity would be required.

Costs and Benefits: Offshore Transshipment Facility

Based on the above considerations, it is likely that an offshore transshipment facility would require an artificial island and some sort of breakwater. It is also likely that a regional facility would be most economical, allowing several different ports to share the capital costs of constructing this facility. Constructing an artificial island in 50 to 60 feet of water would be technically feasible, but the costs would be enormous. It is unlikely that use of dredged material would be permitted, which raises the question of where the material would come from at any kind of affordable cost.

In addition, the environmental effects of such a facility constructed in the coastal zone could be prohibitive. Offshore islands would require mitigation, as they would cover the sea bottom. A floating facility may also require mitigation, as its large size would likely

shade a substantial acreage of ocean bottom. If the permitting requirements for an offshore dredged material disposal site are an indication, the requirements for construction of an offshore transshipment facility are likely to be lengthy, difficult, and uncertain in their final result. National Marine Fisheries Service and Environmental Protection Agency policies militate heavily against any covering of the sea bottom, which typically cannot be mitigated.

Coastal/offshore engineering experts were consulted about the potential costs of an offshore transshipment facility, either platform or artificial island. As noted above, there was no template for which to estimate costs, and no conclusions about costs could be made. The Seahub proponents did not have cost estimates for a floating or fixed facility. At this point in their undertaking, they are trying to develop sufficient interest in an offshore container transshipment facility to undertake the feasibility studies that would generate cost estimates.

Conclusions about costs and benefits can be made by considering the costs of double handling during transshipment. Currently, GPA's rate structure for Garden City Terminal operations includes charges to re-stow containers, such as would be required at minimum for an offshore platform to transfer containers between mother ships and feeder vessels. Cell-to-cell transfers are $15 per container, and cell-to-dock-to-cell transfers are $30.00 per container. Although rates and costs are not equivalent, it can be assumed that the rates are representative of handling costs (crane and labor) associated with transfers of containers. If 1.5 million TEUs were transferred at the cell-to-dock-to-cell rate ($30.00/container), this would translate into $22.5 million in additional handling costs per year, with a present value of $375 million (50 years at prevailing Federal discount rate 5 5/8 percent). The additional handling costs alone exceed deepening costs to Garden City Terminal. Consequently, the economic feasibility of an offshore transshipment terminal are in doubt even before the costs of the facility are included.

It is unlikely that a deep-water facility would result in larger vessels calling at Savannah, since the other ports on the U.S. east coast rotations are depth-constrained. There are currently no predictions that Malaccamax-class container ships would call at U.S. east coast ports. In fact, the 8,000-TEU vessels currently under construction are not expected to call at east coast ports in the foreseeable future.

Other Considerations: Offshore Transshipment Facility

A variety of uncertainties surround the concept of an offshore terminal besides the issues of cost, down time due to weather and sea conditions, and environmental effects discussed above. In particular, the hazards posed by hurricanes could be particularly challenging in terms of design and operations. One asset of an offshore terminal that warrants attention is that this terminal could promote homeland security by allowing offshore inspection of containers before entering the country. For these reasons, it does not appear that an offshore transshipment facility meets the test of engineering feasibility and is not, at this stage of its development, a proven technology that could form the basis of a reliable plan.

Overall Assessment: Offshore Transshipment Facility

Based on interviews conducted around the port as part of this investigation, the prevailing view by members of the port community to the concept of an offshore transshipment facility is that it is a concept whose time has not yet arrived. The major problem of transshipment is that it introduces added transfer, storage, and transaction costs and times which often exceed the cost and time saving introduced by faster, larger container and feeder vessels. The major problem with an offshore facility would be the enormous development cost and potential delays associated with weather. Liner services have shown repeatedly that they would rather travel lightloaded than incur significant scheduling delays waiting for tides or fair weather.

EVALUATION OF PROPOSED ALTERNATIVE TERMINAL SITES.

GENERAL DISCUSSION:

Tier II plan formulation activities identified alternative terminal locations as having the potential to address navigation problems and opportunities in Savannah Harbor. The following alternative terminal locations were carried forward for more detailed evaluation in this phase of investigation.

Garden City Terminal
Ocean Terminal
Blue Circle Site
Disposal Area 12A
East Coast Terminal
Elba Island Site
Disposal Area 14A/14B
Tybee NWR
Colonel's Island

The main goal for an alternative terminal location is that it be located closer to the ocean than the Georgia Port Authority's (GPA's) Garden City Terminal to reduce dredging costs and possible environmental impacts associated with saltwater intrusion. To address navigation problems and opportunities in Savannah Harbor, channel deepening would be implemented only as far as a single terminal that would serve the deeper vessels, but not beyond. If that terminal could be located closer to the ocean than Garden City Terminal, perhaps the total economic and environmental costs could be less.

Once the list of alternative terminal sites was completed; costs for facilities, environmental mitigation, and dredging were developed for each of the sites. The costs were developed in order to put all of the sites on an equal basis. At the same time the costs were being developed, the team established a methodology by which the sites would be screened. Four categories were established. These were: (1) safety/social problems, (2) transportation problems, (3) environmental problems, and (4) economic cost of infrastructure. Of these categories, the first two were considered major problems. The definitions for these categories are:

Safety/social problems: Location of a terminal at this site would expose it to dangers above those encountered in the daily operation of a terminal. The development of a terminal at this location would cause major problems due to land use conflicts.

Transportation problems: Location of a terminal is at this site would negatively affect traffic patterns within the City of Savannah according to the Savannah East-West Corridor Feasibility Study.

Environmental problems: Location of a terminal at this site would cause secondary environmental impacts above and beyond those already being considered as part of the environmental mitigation problems. This raises a question of efficiency versus environmental acceptability.

Economic cost of infrastructure: The location of a terminal at a greenfield site, as opposed to one that already pre-exists, requires that the site be developed from scratch. This increases the cost of this alternative due to the need to develop basic infrastructure (roads, electricity, water and sewage, etc.).

The screening process involved running two screens based on the major problem areas. The first screen was run to weed out sites with safety and/or social problems. The second screen was to weed out the remaining sites with transportation problems. The results of this screening are shown in Table 26 and summarized as follows:

- The Elba Island and Blue Circle sites were eliminated in the first screening due to major safety/social problems.
- The Ocean Terminal, the East Coast terminal and the Colonel's Island sites were screened out in the second round due to transportation problems. The selection of sites located east of the City of Savannah - East Coast Terminal and Elba Island Site, would require that rail and truck traffic pass through the center of the City on its way to the inland sites served by the Port. As stated in the Savannah East-West Corridor Feasibility Study, completed in 2002, none of the major roads in their present condition could support this amount of traffic.
- Of the remaining sites, Disposal Site 12A and Disposal Site 14A/14B are located entirely on dredged sediment placement sites, while the Tybee NWR site is located half on a sediment placement site and half in a National Wildlife Refuge. These sites were carried forward for further investigation since there wasn't a major safety hazard at any of these sites, nor was there a major impact to transportation in the City of Savannah. While these sites made it to the next level, there are still several questions that need to be answered such as whether the soils at these sites could support a container terminal and the environmental impacts brought about by the requirement for replacement of lost sediment storage capacity.

Sensitivity of assumptions:

When developing the requirements for alternative terminal sites it was important to achieve economies of scale in facility development, equipment purchase, and terminal

operations. This included a 300-acre size requirement for the terminals and the ability to have throughput of 1.5M TEUs, rather than the minimum capacity of 500,000 TEUs required to obtain the economic benefits of a deeper channel. At some of the Alternative Terminal Sites, the 300-acre minimal size was unable to be met, but they would still be able to handle a minimum of 500,000 TEUs, so under the completeness category they were given a "Yes" designation. Recent real estate sales ($400,000 to $450,000/acre) in areas where the purchase of land would be required to bring the terminal up to adequate size indicate that land costs may be considerably higher than those used in calculating construction costs. However, for the purpose of this evaluation we left the land costs at the lower value ($6 - $100,000/acre). Construction costs also did not include the costs of buying out an existing business, they only included the costs of developing the site into a container port.

TABLE 26 SUMMARY OF SCREENING OF ALTERNATIVE SITES				
Site	**Major Safety/Social Problem**	**Transportation Problems**	**Environmental Problems**	**Economic costs of Infrastructure**
Garden City Terminal			Mitigation Req't = 100%	Infrastructure already in place.
Ocean Terminal		Additional truck traffic on Bay St., already a congested area.	Mitigation Req't = 75%	Demolition of facilities already on-site in order to make it acceptable for a container port. Available area too small to meet minimal footprint.
Blue Circle Site	New terminal in area would be incompatible with Chatham County land use plan.		Mitigation Req't = 70%	Demolition of facilities already on-site in order to make it acceptable for a container port. Cost of obtaining land required for minimal facility.
Disposal Area 12A			Mitigation Req't = 65% Replacement for 375 acres of disposal area lost for terminal development.	All infrastructure would have to be brought on site including rail and road connections, water and electricity.
East Cost Terminal		Location East of the City, creates major east-west transportation problem.	Mitigation Req't = 55%	Demolition of facilities already on-site in order to make it acceptable for a container port. Cost of obtaining land required for minimal facility.
Elba Island	Terminal would fall under "Blast Zone" for LNG Terminal.	Location East of the City, creates major east-west transportation problem.	Mitigation Req't = 30%	
Disposal Areas 14 A/B			Mitigation Req't = 25% Replacement for 375 acres of disposal area lost for terminal development.	All infrastructure would have to be brought on site including rail and road connections, water and electricity.
Tybee NWR	.		Mitigation Req't = 10% Replacement for 375 acres of disposal area lost for terminal development. A National Wildlife Refuge.	All infrastructure would have to be brought on site including rail and road connections, water and electricity.
Colonel's Island		Container services could not be made competitive in liner service with other South Atlantic ports.	Georgia DNR has strongly discouraged GPA from further developing this site due to the predominance of wetlands.	

Environmental Mitigation Costs:

Mitigation costs were developed for each proposed terminal location, as described previously. In general, the level of impact is expected to be less if the channel improvement does not occur as far upstream.

The mitigation costs were described for each alternate terminal location, but are summarized in this section. The mitigation costs were put into the following categories and are shown by site in Table 27:

- Chloride mitigation: Refers to the potential relocation of the City of Savannah water intake in the Savannah River if chloride impacts from channel deepening exceed the City's contracted standards for chlorine levels. The cost for this measure was the same as that used in the Tier I report for this feature.

- Dissolved oxygen mitigation: Refers to mitigation if channel deepening reduces average summer dissolved oxygen levels in the Savannah River. The cost for this measure was the same as that used in the Tier I report for this feature.

- Cultural/Historic mitigation: Refers to mitigation to protect Old Fort Jackson and the *CSS Georgia*. Both resources are located at the junction of Back River and the Savannah River. The cost for this measure was the same as that used in the Tier I report for this feature.

- Channel modification mitigation: Refers to mitigation for direct wetland impacts of channel deepening on the river banks. Ten acres would be affected by deepening to Garden City Terminal. Wetland mitigation costs are estimated at $32,000 per acre, including $6,000 for real estate costs and $20,000 for mitigation activities ($10,000/acres plus a 2:1 replacement ratio),

- Secondary wetland mitigation: Refers to secondary impacts to wetlands resulting from saltwater intrusion into brackish or freshwater marshes located upstream of Garden City Terminal. Adverse secondary effects of saltwater intrusion could degrade up to 722 acres of wetlands, potentially requiring mitigation at $32,000 per acre as above.

- Shortnose sturgeon mitigation: Refers to actions taken to avoid adverse effects to habitat of the shortnose sturgeon. The cost for this measure was the same as that used in the Tier I report for this feature.

- Striped bass impact avoidance: Refers to actions taken to avoid adverse effects to habitat of the striped bass. The cost for this measure was the same as that used in the Tier I report for this feature.

- Site Development: Wetlands Mitigation: The number of acres of wetlands affected on the 375-acre site designated for the alternative terminal.

Using the information just described, the team then evaluated the extent to which each of the alternative terminal locations met the four criteria contained in the Principles and Guidelines for alternative plans. Those criteria are described below using the definitions contained in P&G:

- **Completeness** – The extent to which a given alternative plan provides and accounts for all necessary investments or other actions to ensure the realization of the planned effects. This may require relating the plans to other types of public and private plans if the other plans are crucial to realization of the contributions to the objective.

- **Effectiveness** – The extent to which an alternative plan alleviates the specific problems and achieves the specified opportunities.

- **Efficiency** – The extent to which an alternative plan is the most cost effective means of alleviating the specified problems and realizing the specified opportunities, consistent with protecting the Nation's environment.

- **Acceptability** – The workability and viability of the alternative plan with respect to acceptance by State and local entities and the public and compatibility with existing laws, regulations, and public policies.

The alternative terminal locations met the Principles and Guidelines criteria as follows:

Garden City Terminal:

Completeness – Yes.
Effectiveness – Yes.
Efficiency – Yes. Although there may be some questions with regard to environmental effects.
Acceptability – Yes. GPA is already in the process of doing things that will allow the port to meet the requirements for future traffic without having to deepen.

Ocean Terminal:

Completeness – Yes.
Effectiveness – Yes. While it is not 300 aces, it can still handle the 500,000 TEUs as required.
Efficiency – No, because of the increased traffic and the cost of additional land to make the site adequate. Renovation costs for this site are rather high.
Acceptability – Marginal. It is questionable whether the public will accept the additional traffic created by the movement of additional trucks through that are of the City.

TABLE 27
Mitigation Costs by Category

Mitgation Category	Garden City Terminal	Ocean Terminal	Blue Circle Site	Disposal Area 12A	East Coast Terminal	Elba Island Site	Disposal Area 14A/14B	Tybee NWR
Chloride Mitigation	$49,450,000.00	$37,087,500.00	$32,683,000.00	$0.00	$0.00	$0.00	$0.00	$0.00
DO Mitigation	$25,800,000.00	$19,350,000.00	$17,052,000.00	$5,160,000.00	$5,160,000.00	$0.00	$0.00	$0.00
Cult/Historic Mitigation	$15,424,449.00	$15,424,449.00	$15,424,449.00	$15,424,449.00	$15,424,449.00	$0.00	$0.00	$0.00
Channel Modification Mitigation	$260,000.00	$195,000.00	$182,000.00	$169,000.00	$143,000.00	$78,000.00	$65,000.00	$26,000.00
Secondary Wetland Mitigation (722 Ac)	$18,772,000.00	$14,079,000.00	$13,140,400.00	$4,693,000.00	$0.00	$0.00	$0.00	$0.00
Shortnose Sturgeon Mitigation	$1,375,500.00	$1,031,625.00	$962,850.00	$275,100.00	$275,100.00	$0.00	$0.00	$0.00
Striped Base Impact Avoidance	$2,000,000.00	$2,000,000.00	$2,000,000.00	$0.00	$0.00	$0.00	$0.00	$0.00
Site Develoment: Wetlands Mitigation	$0.00	$0.00	$1,560,000.00	$52,000.00	$2,600,000.00	$1,300,000.00	$624,000.00	$1,326,000.00
Total Cost for Mitigation	$113,081,949.00	$89,167,574.00	$83,004,699.00	$25,773,549.00	$23,602,549.00	$1,378,000.00	$1,391,000.00	$1,612,000.00

Blue Circle:

Completeness – Marginal, because of the size of the site and the surrounding land use. You would need to purchase land for the terminal from the Golf Club.

Effectiveness – Yes, because you could establish a terminal with a capacity of 500,000 TEUs at the site.

Efficiency – No, because of the high cost of renovating the site (tear down old facilities) in order to establish a container facility.

Acceptability – No, because of land issues, the acceptability of having a container terminal on a golf course or in the area of an exclusive development.

Disposal Site 12A:

Completeness – Yes. However, there is a question as to whether a dredged sediment placement site will have the necessary soil strength to support the needed infrastructure for a terminal. This would also apply to the Disposal Site 14A/14B, and the Tybee NWR Site.

Effectiveness – Yes, a new terminal could be constructed at the site to move the required number of TEUs.

Efficiency – No, because of the cost to build a terminal at the site and to bring in the necessary transportation requirements. The increased impact to the environment with the requirement to provide replacement sediment storage capacity when the surrounding area is marsh.

Acceptability – No. Not acceptable from the point of view of the environment and the transportation costs (road and rail access to the site). Easement held by the Corps of Engineers/GADOT.

East Coast:

Completeness – Marginal based the acreage available to the terminal.

Effectiveness – Marginal because the area is too small to handle the required container traffic.

Efficiency – No, because of the additional land costs to bring up the area to the minimally-acceptable size and the cost of turning the facility into a container port.

Acceptability – No, because traffic to and from the terminal, both rail and truck would, would have to pass through the city to access inland areas served by the port.

Elba Island:

Completeness – No, the terminal berths would be on a dangerous bend in the River which would affect navigation. The lack of affordable road and rail access.

Effectiveness – No, because of its location with respect to the channel and safety questions with regard to its co-location with the LNG Terminal.

Efficiency – No, because of transportation costs.

Acceptability – No, because of the increased transportation costs, the location of the berths with respect to the channel, and the fact that the terminal would be in the blast zone for the LNG Terminal, a navigation safety problem.

Disposal Area 14A/14B:

Completeness – Yes, same as Disposal Area 12A.
Effectiveness – Yes, same as Disposal Area 12A.
Efficiency – No, same as Disposal Area 12A.
Acceptability – No, same as Disposal Area 12A.

Tybee NWR:

Completeness – Yes, same as Disposal Area 12A.
Effectiveness – Yes, same as Disposal Area 12A.
Efficiency – No, because of the cost to build a terminal at the site and to bring in the necessary transportation requirements. Environmental effects because of the requirement to obtain a replacement disposal area when all of the surrounding area is marsh. Also is a National Wildlife Refuge.
Acceptability – No, not acceptable from the point of view of the environment and the transportation costs. Development of a National Wildlife Refuge includes consideration of an the apparent tradeoff between the Savannah NWR and the Tybee NWR.

Colonel's Island:

Completeness – Yes.
Effectiveness – Marginal, because of the distances involved with respect to the port and the inland customers it serves.
Efficiency – No, because the entire property is wetland: the cost of dredging - unknown at this time - may be prohibitive; and transportation costs.
Acceptability – No, it is unacceptable to Ga. DNR because of the wetlands involved.

Offshore Transport Facility:

Completeness – No, because of the size of the structure required to handle the proposed 500,000 TEUs, and its establishment in an open ocean environment. While there is one such facility in a closed harbor (Hong Kong), and oil rigs exist in the Gulf of Mexico (too small), this is too experimental for this project.
Effectiveness – No, while it would alleviate some problems it would cause more than it would solve. The environmental variables, i.e., the minimal wave environment, under which such a facility could operate is on the low end; therefore most of the time the facility would be unable to operate.
Efficiency – No, the costs for a facility to handle the required TEU's would be exorbitant, and the facility would only be able to operate less than 24% of the time.
Acceptability – No, because the cost to build and the operating conditions under which the facility could operate would make it unacceptable.

Summary:

Table 28 contains a summary of the extent to which the alternative terminal sites meet the Principle and Guidelines criteria for alternative plans.

TABLE 28
Evaluation of Alternative Terminal Sites

Site	Completeness	Effectiveness	Efficiency	Acceptability
Garden City	Yes	Yes	Yes	Yes
Ocean Terminal	Yes	Yes	No	Marginal
Blue Circle	Marginal	Yes	No	No
DA 12A	Yes	Yes	No	No
East Coast	Marginal	Marginal	No	No
Elba Island	No	No	No	No
DA 14A/14B	Yes	Yes	No	No
Tybee NWR	Yes	Yes	No	No
Colonel's Island	Yes	Marginal	No	No
Offshore	No	No	No	No

Conclusion:

Table 29 on the next page contains a summary of the assessment of the alternative terminal sites. Based on the factors described in the analysis and highlighted in the table, the team rated the overall rating of the sites as a potential deep-draft container terminal. The Garden City Terminal was the only one that received a ranking of HIGH. The team gave three sites a MEDIUM ranking, while six sites - which had been screened out because of major problems - were judged as having a LOW potential. The extent to which the sites could meet the criteria for an alternative plan was heavily considered in this assessment.

The four sites that were judged as having either a MEDIUM or HIGH potential as a terminal were then compared just on their economics. Table 30 shows that comparison. The cost of the next most economically efficient alternative was 45 percent more than the lowest cost site. Therefore, only the lowest cost site (Garden City Terminal) will be considered in the detailed evaluations.

TABLE 29 SUMMARY ASSESSMENT OF ALTERNATIVE TERMINALS

	Screening Result	Positive Features	Negative Features	Overall Potential
Garden City Terminal	In	- Ongoing Container Operation - Access to Rail and Highway - Sufficient area	- Distance upstream - Associated dredging costs and potential environmental impacts	High
Ocean Terminal	Out	- Close to Garden City - Access to Rail and Highway	- Inadequate size - High cost of renovation - Lack of dredging savings	Low
Blue Circle Site	Out	- Highway access	- Inadequate size - Lack of dredging savings - Difficult rail connection - Relocate existing operation	Low
Disposal Area 12A	In	- Sufficient area - Highway access	- Need to develop rail connection - Loss of sediment storage capacity - Environmental effects: access & replacement sediment storage capacity	Medium
East Coast Terminal	Out	- Rail access	- Inadequate size - East-west landside transport - Relocate existing operation	Low
Elba Island	Out	- Sufficient area - Downstream location	- Adjacent to LNG facility - Inadequate size - East-west landside transport - Navigation safety issues	Low
Disposal Areas 14A/14B	In	- Sufficient area - Downstream location	- Need to develop rail/road connection - Loss of sediment storage capacity - Environmental effects: access & replacement sediment storage capacity	Medium
Tybee NWR	In	- Sufficient area - Downstream location	- Need to develop rail/road connection - Environmental effects: site, access, replacement sediment storage capacity - Potential Intracoastal waterway impacts	Medium
Colonel Island, Brunswick	Out	- Sufficient area	- Distance from inland markets - High dredging costs	Low
Offshore Terminal	Out	- Potential for regional service - No channel deepening	- High costs of facility - Environmental effects - High costs of double handling - Delays due to weather	Low

TABLE 30 Evaluation of Higher Ranked Alternative Terminal Sites ($20K/acre Mitigation)				
Site	**Initial Construction Costs**	**Mitigation Cost**	**Total Cost**	**Incremental Cost (Percentage)**
Garden City Terminal	$213,600,000	$113,100,000	$326,700,000	
Tybee NWR	$464,000,000	$1,600,000	$465,600,000	43
DA 14A/14B	$483,000,000	$1,400,000	$484,400,000	48
DA 12A	$497,100,000	$25,800,000	$522,900,000	53

Sensitivity Tests:

A. To examine the sensitivity of the plan formulation conclusions to wetland mitigation costs, we evaluated the effects of raising the wetland mitigation from $20,000 per acre to $100,000 per acre. The results of this increase can be seen in Table 31. The increase did not alter the rankings of the top sites, but it did narrow the cost difference between the alternate sites. However, since the cost difference would still be 23-percent, the team felt that detailed studies were not likely to eliminate that large a differential, so the likelihood of the next best site becoming less expensive than the presently identified lowest cost site was remote. Therefore, the team again agreed that deepening only to the lowest cost site – the Garden City Terminal – be evaluated in detail.

TABLE 31 Evaluation of Higher Ranked Alternative Terminal Sites ($100K/acre Mitigation)				
Site	**Initial Construction Costs**	**Mitigation Cost**	**Total Cost**	**Incremental Cost (Percentage)**
Garden City Terminal	$213,600,000	$167,200,000	$380,800,000	
Tybee NWR	$464,000,000	$5,200,000	$469,200,000	23
DA 14A/14B	$483,000,000	$2,650,000	$485,650,000	28
DA 12A	$497,100,000	$68,600,000	$565,700,000	46

B. All three MEDIUM rated alternative terminal sites (Tybee NWR, DA 12A, and DA 14A/14B) are CDFs or -- in the case of the Tybee NWR -- contain a major part of a CDF. This being the case, the sediment storage capacity that would be lost if those sites were used as terminals would need to be replaced elsewhere along the river. Replacement in the lower reaches of the river very close to the existing site is preferred to keep pumping costs the same. Replacement of that capacity through expansion of the CDFs to the north into existing saltmarsh may be the easiest to construct, but would result in extensive secondary wetland impacts which would need to be mitigated. To avoid these extensive secondary impacts, the U.S. Fish and Wildlife Service requested that we consider taking the O&M sediments to the ODMDS, instead of putting them in the CDF. Two previous studies in Savannah Harbor compared the cost of normal dredging and deposition operations to that of ocean disposal for the same reach and sediments. Based on that information and using our most recent costs for O&M dredging, we developed the cost estimates shown in Table 32. These costs are planning-level estimates useful for sensitivity analyses and screening of scenarios.

TABLE 32
Dredging Costs: CDF vs. Ocean Disposal

Confined Disposal Facility	Annual Dredge Volume (CY)	Cost/CY	Annual Cost	Difference CDF vs. Ocean	Capitalized Cost
DA 12A					
To CDF	1,510,000	$3.87	$ 5,843,700		
To Ocean	1,510,000	$8.82	$13,318,200	$ 7,474,500	$124,263,563
DA 14A/14B					
To CDF	2,228,500	$3.87	$ 8,624,295		
To Ocean	2,228,500	$8.82	$19,655,370	$11,031,075	$183,391,622
Tybee NWR					
To CDF	619,500	$3.87	$ 2,397,465		
To Ocean	619,500	$8.82	$ 5,463,990	$ 3,066,525	$ 50,980,978

To best evaluate the information in this table, one should compare the capitalized costs for ocean placement shown in the last column with the mitigation costs (shown below from Table 30) that are expected from re-establishing sediment storage capacity near the existing CDF.

Confined Disposal Facility	Total Mitigation Costs
DA 12A	$32,900,000
DA 14A/14B	$ 7,800,000
Tybee NWR	$ 7,300,000

Conclusion: The capitalized costs of transporting O&M sediments to the ocean far exceed the costs of keeping the existing CDF functioning and replacing sediment storage capacity that would be lost if portions of those sites were taken and used for a new terminal. Therefore, the total costs for developing a new terminal at an existing CDF would be even higher if the CDF were unavailable for use and the O&M sediments were transported offshore.

MINOR MODIFICATIONS

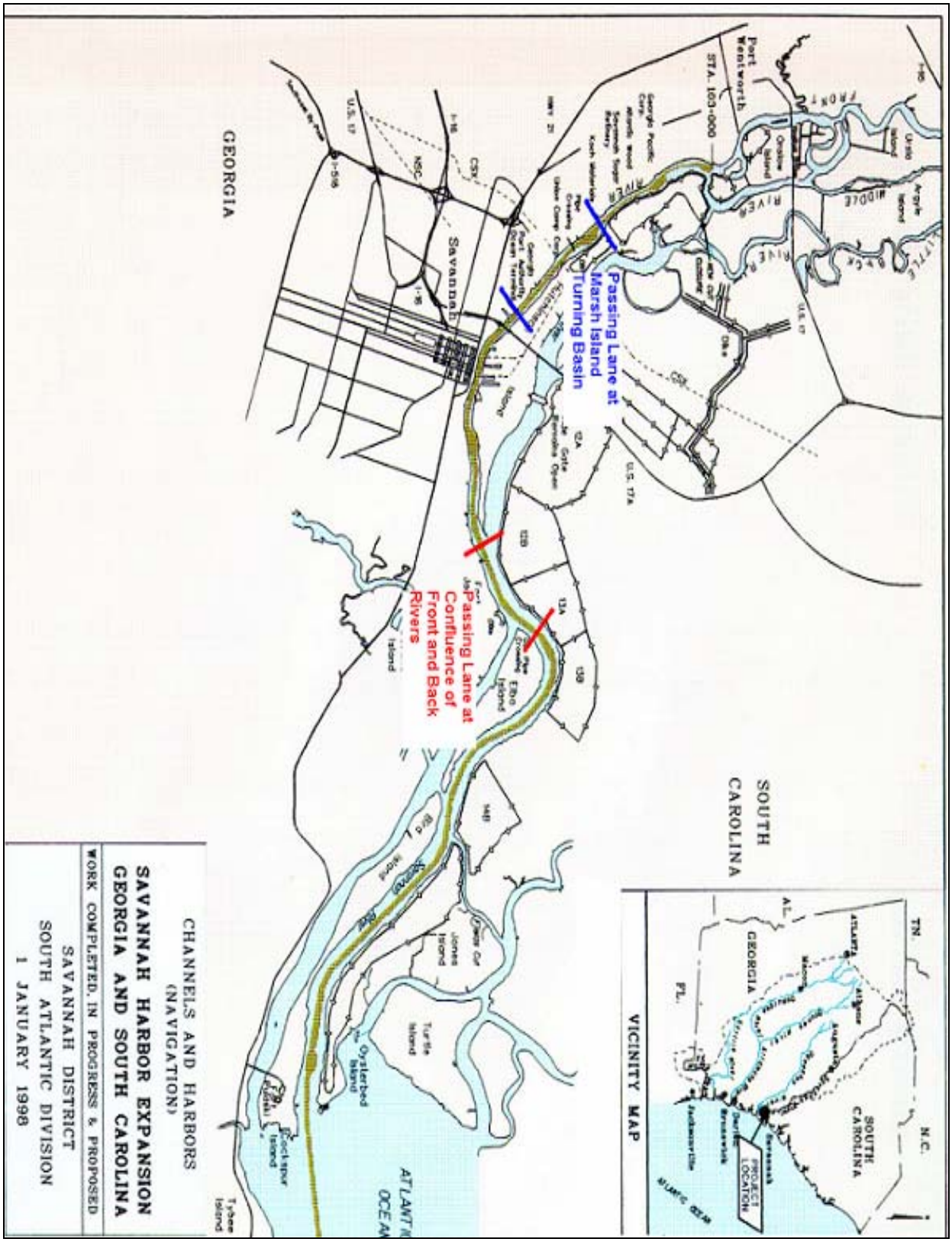
PASSING AREAS

The current design of the Savannah Harbor navigation channel (500-foot minimum width) does not provide sufficient width to accommodate two-way traffic of post-Panamax vessels at any time in the tidal cycle. With the channel design being considered in this Expansion Project, the width of the deeper channel would only be 450-feet, so the situation would become more of a problem. According to the Harbor Pilots, it is necessary to have fifty feet of clearance between the edge of the navigation channel and the container vessel and one hundred and fifty feet of clearance (the width of another post Panamax vessel) between passing vessels. Adding the width of the vessels and the required clearance shows a minimum required channel width of 514 feet (50+132+150+132+50). The addition of an appropriately sized passing area (a widening of the navigation channel to 600 feet for approximately 6,000 feet) would allow two post-Panamax vessels to pass, as well as the passing of a post-Panamax and Panamax vessel. The addition of a smaller passing area could allow passing of a post-Panamax and Panamax vessel, but would not facilitate the passing of two post-Panamax vessels in the harbor.

Design trends for the World fleet show a continued growth in the size of individual container vessels over time. The increase in the proportion of these larger vessels in the world fleet and the probability of some of these larger vessels calling on the harbor in the future suggests the need to examine a mid-harbor passing area. Future design of the harbor needs to support the fleet that is expected to call at the harbor. If it doesn't, when large ships start calling at the port on a regular basis there could be safety concerns or traffic delays.

The two potential sites suggested for placement of the proposed passing area are the Marsh Island Range which is above the Talmadge Bridge and near the Marsh Island turning basin and the Old Fort Jackson Range at the confluence of the Front and Back Rivers over the current site of the CSS Georgia. Proposed passing area sites are indicated in Figure 12. It should be noted that those markings exhibited in Figure 12; indicating proposed passing areas are not intended to suggest the width or length of the passing area, but are presented only as a general reference for potential location.

Figure 12 - Proposed Site Locations for Harbor Passing Lanes



After reviewing trends in the World Fleet and harbor requirements for maintaining the level of service, the study team decided to locate the passing area in the Old Fort Jackson Range, over the current site of the CSS Georgia. That site was selected, because siting one in the Marsh Island Range could result in impacts to the north bank of the river and require real estate acquisition.

BEND WIDENERS:

Ship Simulation studies were performed using the Design Vessel, *Susan Maersk*. This vessel is a 6,600 TEU, post-Panamax class container ship launched in 1997. It has a beam of 140 feet, a length overall 1,138 feet, and a design draft: 47.6 feet. Several bend wideners necessary to the transit of the Design Vessel were included in the design of the 48-foot channel. The Ship Simulation Report identified nine areas where bend wideners will be needed to allow safe transit of that sized vessel. Therefore, bend wideners will be included in the final channel designs that undergo detailed analyses.

AIDS TO NAVIGATION:

According to the Harbor Pilots, additional navigation aid improvements such as buoys and/or navigation markers would not be helpful given the present condition of the harbor and the current configuration of existing navigation aids. They mark the channel and where you are in it, but would not improve the efficiency of cargo movement through the harbor. Therefore this minor modification will not be included as a component of the final channel designs.

VESSEL TRAFFIC COORDINATION:

It was stated that the movement of vessels within the harbor system are coordinated by the Harbor Pilots (achieved mostly thru hand held communication and a queuing system) and as such, no further coordination or system to facilitate coordination would be helpful given current or expected conditions in the harbor. Therefore, this minor modification will not be included as a component of the final channel designs.

STRAIGHTENING OF THE RIVER:

The Harbor Pilots did not identify any portion of the channel where straightening would markedly increase the efficiency of transit. Additionally, Savannah District design staff did not identify a specific area that imposes an undue degree of difficulty in vessel handling necessitating a major straightening of the river. Therefore, this minor modification will not be included as a component of the final channel designs.

DEVELOPMENT OF DETAILED PLANS

The study team reviewed the information developed on non-structural measures (underkeel clearance and modifications to the Garden City Terminal), alternative terminal locations, offshore transshipment facility, and minor modifications passing areas, bend wideners, aids to navigation, vessel traffic coordination, and straightening of the river). Although the conclusions for those evaluations were included at the end of each separate section, they are summarized here to aid the reader in understanding the rationale for the decisions that the team reached.

Modifications to the underkeel clearances used in the harbor will not be pursued as a means of increasing vessel transit efficiency because the Harbor Pilots do not believe they could operate safely with less clearance. The guidelines used by the Pilots comply with channel design and safety criteria, so there is no need to pursue this feature further.

GPA regularly improves the facilities at the Garden City Terminal, increasing its container throughput capacity. The Ports Authority has several improvements in various stages of planning and indicates it will continue to add to the capacity of that facility as the traffic levels increase. Based on the schedule of improvements already identified and actions the Ports Authority has taken to allow it to expand the capacity of the site even further in the future, Savannah District believes that additional improvements at Garden City Terminal are not warranted as part of this project.

Based on the assessment of the alternate terminal locations, the Garden City Terminal is the most economically feasible location to which a channel deepening should be considered. Although dredging costs would be lower to most of the other sites considered, the total costs including both dredging and site development costs would be higher. All the other locations would be more costly methods of serving the expected growth in container volumes. In addition, the expected reduction in environmental impacts with the alternate locations is less than some probably envisioned, when all the effects of developing the alternate site are included.

A passing area should be included in the final plans. This feature is needed to address the effects that ships the size of the design vessel will have on traffic movements in the interior portion of Savannah Harbor. The entrance channel is wide enough to accommodate the larger vessels. When Post-panamax vessels call on Savannah regularly, they will likely have an adverse effect on the movement of other vessels transiting the harbor. That effect will be more pronounced with the effective narrowing of the proposed deeper channel. The Harbor Pilots identified the locations of two passing areas that they would like to see in place in the interior portion of the harbor. However, one of those sites is in a constructed reach of the river. Adding a passing area in that reach would result in the taking of developed land on the northern side of the river, so the team deleted further consideration of that location due to the expected high implementation costs. However, a passing area in the other location – near the junction of Front and Back Rivers – will be included as a component of the final channel designs.

Channel design criteria indicate the need to include bend wideners to accommodate the larger design vessel. This need was supported by the Ship Simulation Study. Therefore, the nine bend wideners identified as being needed for safe transit of that sized vessel in that study will be included as features of the final channel designs.

No new navigation aids were deemed to be needed to enhance the efficiency of vessel transits through the harbor. However, the detailed deign of the deeper channel will include an analysis of whether additional buoys or range makers will be needed to make the deeper channel, and whether the existing aids need to be moved to accommodate the new channel.

Neither vessel traffic coordination nor major straightening of the river were found to be needed, so they will not be included in the final channel design.

No channel modifications features were identified as being needed at this time to enhance Homeland Security. Inbound vessels are presently required to provide 96-hour advance notice, including a manifest of the cargo and crew. The Harbor Pilots already board the vessels offshore, before the vessels reach the coastline. So a separate boarding area is not considered needed. Therefore, the final channel design will not contain any features to enhance Homeland Security.

An important factor in the Tier I channel design was the concept of leaving the existing side slopes untouched as the channel is deepened. In this approach, the side slopes are continued further down toward the center of the river. The deeper channel is then narrower than the existing 500-foot navigation channel at low water. This approach was used before to minimize the taking of additional (valuable) land along the riverbank. The team agreed that this approach was valid and should be followed in the Tier II channel design. Therefore, the final Tier II channel design will include continuation of the side slopes toward the center of the river, resulting in a 16-foot narrowing of the channel with each 2-foot of depth added.

All vessels presently calling at the Garden City Terminal presently use the Kings Island Turning Basin. It is the largest turning basin in the harbor and is located at the upstream end of the Garden City Terminal. That turning basin would need to be deepened to accommodate the larger vessels using the deeper navigation channel. To safely serve vessels the size of the Design Vessel, the turning basin would also have to be expanded to 1,600 feet long by 1,600 feet wide. This expansion and deepening will be included in the final channel design.

The team agreed to continue the Project's existing advance maintenance features. An analysis would be conducted during the detailed studies to determine the effects of a deeper channel on the sedimentation in the river, but the starting point would be a continuation of the existing advance maintenance features, but at a lower elevation.

The Sediment Basin is a component of the Sediment Control Works of Savannah Harbor. The Basin is a quiescent area that collects sediments at a relatively high rate. The location of the Basin adjacent to large confined dredged sediment placement facilities allows for sediments to be removed from that location at a lower cost than elsewhere in the harbor. Although originally designed to be at a depth equal to the navigation channel, the Basin was not deepened as part of the 1993/1994 harbor deepening and it is now 4-feet shallower than the authorized navigation channel. That perched condition – being above the floor of the main river, along which many of the sediments are moved – is believed to have reduced the sediment trapping efficiency of that structure. After conducting a conceptual level assessment of the effects of further channel deepening, the team agreed to leave the Sediment Basin at its present depth and not deepen that facility as part of this project. The detailed studies will include a more in-depth analysis of the effects of a higher perched basin. Any expected increases in yearly channel maintenance costs will be included in the economic analysis of the proposed alternatives.

The Tier I design included one berth at the Garden City Terminal that would accommodate the larger vessels needing the deeper channel. For the Tier II design, the team agreed that two berths should be deepened to serve ships using the deeper channel. Those berths would be Container Berth 7 and Container Berth 8. Both are constructed (or being constructed) to accommodate a channel of greater than 48 feet of depth, so no modifications to those berths would be required for this project.

DESCRIPTION OF DETAILED PLANS

As a summary, the following alternative plans will be examined in detail.

PLAN A - NO ACTION.

In this plan, no improvements would be made to the existing Savannah Harbor Federal Navigation Project. The navigation channel would remain at its presently authorized 42-foot depth in the inner harbor and 44-foot depth in the entrance channel. This plan will serve as the basis for comparison of the expected project impacts. It will comprise the environmental and economic conditions that are expected to occur over the 50-year period of analysis. The analysis will include an identification of the type and volume of commodities that are expected to pass through Savannah Harbor if no harbor improvements are implemented. The size and number of vessels that will transport those commodities through the harbor will be identified. Expected changes in the environmental setting will also be identified.

PLAN B – CHANNEL DEEPENING

This plan will include several levels of harbor deepening so that an incremental analysis can be performed, as well as an overall determination of the justification of this proposed action. The plan will include several scales, ranging from a 44-foot to a 48-foot channel depth. The analyses will first be conducted on the following plans:

Plan B-44 A 2-foot channel deepening
Plan B-46 A 4-foot channel deepening
Plan B-48 A 6-foot channel deepening

A final interim depth will then be analyzed to allow identification of the NED plan, assuming the benefits peak before reaching the 48-foot depth. That plan will tentatively be identified as Plan B-4X.

The final channel deepening plans will have the following components:

- **Channel Length:** From the ocean to Station 103+500, plus an upstream transition.
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- **Channel Width:** Maintain existing side slopes. The bottom width for a 48-foot channel would be 450-feet.

- **Channel Depth**: Channel depth will be looked at in 2-foot increments to 48-feet.
  Plan B-44
  Plan B-46
  Plan B-48

  Plan B-4X – One interim depth

- **Berth(s):** Container Berth 7 and Container Berth 8.

- **Turning Basins:** Deepen and enlarge Kings Island Turning Basin to 1,600-feet x 1,600-feet.

- **Bend Wideners:** Use the nine bend wideners identified in the Ship Simulation Study. Two locations have wideners on both sides of the river.

- **Advance Maintenance:** Continue the existing advance maintenance features.