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.

3.2 Opportunities

A number of opportunities were identified in the initial and subsequent steps and iterations of the planning process. Opportunities identified in terms of the Federal interest include:

- Reduce the transportation cost of import and export trade through Savannah Harbor and contribute to increases in national net income (NED); and
- Reduce operations and maintenance costs for the Federal channel.

Opportunities were also developed that reflect priorities and preferences of the Federal Government, the non-Federal sponsors and other groups participating in the study process. These opportunities include:

- Beneficial placement of new work sediments (Tybee Island and other locations);
- Development of new upper harbor disposal area with new work material;
- Enhance the natural resources in the project area;
- Advance the understanding of the natural resources in the project area;
- Contribute to the preservation of historically significant resources in the project area;
- Contribute to other agencies environmental decision making resources through development of state of the art modeling tools;
- Reduce constraints of harbor pilot operating practices;
- Identify the cumulative environmental impacts from past harbor development and operation; and
- When consistent with the USACE authorities and policies, include appropriate actions in the plan alternatives.

4 Inventory of Existing Conditions

This chapter provides an inventory of critical resources (physical, demographic, economic, social etc.) relevant to the problems and opportunities under consideration in the planning area. The inventory of critical resources is a component of the second step of the planning process.

4.1 Overview of Existing Navigation Resources

Garden City Terminal at Savannah Harbor is currently the second largest container port on the US east coast (by TEU volume) and the fourth largest in the Nation. Garden City Terminal is a port of call for more than 40 container ship services, which call weekly on a fixed day schedule (liner services). However, Savannah Harbor also currently has the shallowest controlling depth for a major port. Although the 42-foot controlling depth and 38-foot unrestricted access depth at Savannah are similar to current constraints at the Panama Canal (39 feet), the Panama Canal Expansion Project will be fully operational by 2014, which will allow passage for vessels with up to 50 feet of draft. The Georgia Ports Authority has planned and funded improvements at Garden City Terminal to coincide with the Panama Canal Expansion Project. With these improvements in place, this terminal will be the largest single container handling facility in the Nation with more than 1,200 acres, 9,000 feet of berth, 33 Post-Panamax size cranes, and two on-site intermodal transfer facilities serviced by two major rail lines. The facility, at full build out, will have a throughput capacity of 6.5 million TEUs.

The existing Federal channel was designed for a 4,000 TEU vessel with a 106-foot beam, but vessels in the 6,600 to 8,000 TEU range with beams greater than 130 feet are currently using the channel. These large vessels operate in Savannah Harbor's Federal channel in a constrained manner. Inadequate channel dimensions cause inefficiencies in import and export trade, which increase the cost of the Nation's international trade. The cost impacts of inadequate channel dimensions are projected to increase in the future as the size of container vessels that call at the port becomes increasingly larger and more depth constrained.

Navigation of these large vessels is more restricted during wind conditions than navigation of smaller vessels because of the additional leeway the larger vessels require when navigating channel bends. Ship simulation studies were conducted using the design vessel *Susan Maersk*, which is an 8,200 TEU vessel with a beam of 140 feet, overall length of 1,138 feet. Widening of three channel bends was required for safe transit of the design vessel during the simulations. Under future without-project conditions, many more of the container ships using the channel are projected to be large Post-Panamax vessels with dimensions similar to those of the *Susan Maersk*. Panamax vessels are generally defined as being able to pass through the Panama Canal, with its 1,050-feet length, 110-feet width, and 38-foot depth limits. Post-Panamax vessels are generally defined as being too large to pass through the Panama Canal.

Carriers have adapted to Savannah Harbor's existing Federal channel constraint by modifying liner service operations. Alternative actions taken by the carriers include:

- By-pass Savannah Harbor;
- Service Savannah Harbor with smaller vessels;
- Light load to reduce vessel operating draft; or
- Use tidal advantage.

Carriers calling at Savannah Harbor have recently exercised one or more of these alternative actions and are projected to continue to do so over the 50-year planning horizon. For example, Mediterranean Shipping Company's (MSC) Golden Gate Service was calling at Garden City terminal with vessels in the 6,700 TEU range but left Savannah for Charleston after having incurred regular delays and light loads. The service returned to Savannah after less than a year in Charleston, but due to recurring delays and light loading has again returned to Charleston. This service is now deploying 8,500 TEU vessels and calls at Charleston but not at Savannah.

Landside operators, such as importers and exporters, also adjust to constraints at Savannah Harbor. One of the larger local Georgia exporters has been unable to find adequate space on vessels calling at Garden City Terminal. As a means of dealing with vessel capacity constraints at Garden City terminal, the shipper is trucking export containers to Charleston, where deeper drafts and more vessel space is available.

4.2 Existing Container Ship Industry Operations

The economic analysis of potential navigation improvements at Savannah Harbor mostly focuses on containerized trade and container ship operations. Container shipping is very competitive and adaptable to changing market conditions. Recent trends in the container shipping industry include:

- Increases in the amount of containerized cargo in world trade;
- Increases in vessel size, and capacity;
- Consolidation of carriers; and
- Slot sharing, which allows a carrier to use space on another carrier's vessel.

The impetus for these trends is increased economic efficiency, which typically results from using large vessels at high levels of utilization. The major trade lanes and major ports are all serviced by multiple carriers on multiple services, so competition on these trade lanes is strong. In this competitive environment, carriers often collaborate through alliances, conferences, and slot sharing agreements to maintain high vessel utilization rates.

In 2007, more than 50 liner services included regularly scheduled calls at Garden City Terminal. Some services handled more than 100,000 TEUs at Garden City, others only a few hundred. Savannah Harbor is typically one of multiple US east coast ports called on by a liner service. Vessels on a liner service are typically of similar size in order to provide a consistent port service. A typical liner service to the US east coast loads goods bound for the US east coast at a number of foreign ports (as few as two or as many as six) then calls at two, three, or more US east coast ports to discharge imports and pick-up exports. The vessel then returns to the same foreign ports-of-call serviced on the in-bound leg.

Liner services may also have more complicated itineraries. Liner services from Asia may stop at US west coast ports before calling at the US east coast. Liner services

from the Mediterranean and Europe may call at many ports before arriving at the US east coast, and may also include US Gulf ports in the rotation. Some services from Asia call at the US east coast then continue on to Europe before coming back to the US east coast on the return trip to Asia, thereby connecting Asia, the US east coast, and Europe in a single liner service. Another feature of liner service operations is transshipment, which occurs when a container terminal is used as a transfer point from one liner service to another. For example, MSC uses Freeport, BS (port depth -51 feet) as a transshipment terminal. MSC liner services from Asia to the US east coast and MSC liner services from Europe to the US east coast include a stop at Freeport where European goods bound for Asia and Asian goods bound for Europe can switch liner services. Transshipment terminals are also used for transfer of cargo from larger long haul vessels to smaller feeder vessels.

The container shipping industry has been evolving towards greater efficiency ever since the inception of containerized cargo in the 1950's. Greater efficiency involves moving more loaded boxes per voyage, which in turn has led to larger vessels. However, there are a number of constraints on vessel size, which include most importantly the physical dimensions of the Panama Canal and the physical dimensions of the major container ports. Over the years, the industry has addressed the physical limitations of the Panama Canal by increasing the number of TEUs that can be loaded on a Panamax size vessel. In 1991, the Panamax vessel used as the design vessel for the most recent Savannah Harbor deepening was a 4,000 TEU vessel, which was still under construction at the time. The most recently built Panamax vessels are rated at just over 5,000 TEUs with design drafts of 42 feet or more. The largest vessels being built are rated for more than 14,000 TEUs and design drafts of 48 feet.

At the major container ports, the limiting factor on container ship size is typically channel depth. Figure 4-2 presents the existing depths of the major international trading partner ports with service to Garden City Terminal. Savannah Harbor's controlling depth of -42 feet MLLW and unrestricted access operating draft no deeper than -38 feet are less than most other US east coast ports and less than all of Savannah's major foreign trading partner ports. Savannah's depth is on par with the existing Panama Canal constraint but will be a shallow depth outlier once the Panama Canal expansion is completed in 2014.

Continued competition among carriers requires transportation cost efficiency, which includes greater use of larger, more efficient vessels. The container ships calling at Garden City Terminal have been increasing in size, such as Post-Panamax vessels arriving via the Suez Canal. The container ship fleet calling on the major US east coast ports is currently shifting from being predominantly Panamax size vessels to include substantially more Post-Panamax size vessels. The industry-wide expectation is that this trend will increase and accelerate after completion of the Panama Canal Expansion Project. The Panama Canal and most major ports on the US east coast, in Europe, and in Asia are either currently able or will be able by 2014 to accommodate vessels with operating drafts in excess of 46 feet without requiring the use of tidal advantage (Table 4-1; Figure 4-1).

Table 4-1: Controlling Depths at Major US East Coast Ports, the Panama Canal, and Major Foreign Trading Partner Ports

Port	Existing (Feet below MLLW)	Planned Depth - Date (Feet below MLLW)
Savannah Harbor	42	42 (Without Project)
Port of New York & New Jersey	45	50 (2014)
Baltimore	50	50
Norfolk	50	50
Charleston	45	Study Underway
Miami	42	50 (2012)
Jacksonville	40	Study Underway
Port Everglades	44	49 (2012 Pending)
Panama Canal	39	50 (2014)
Freeport, BS	51	51
Antwerp, BG	49	49
Felixstowe, UK	49	49
Hamburg, GR	54	54
Bremerhaven, GR	48	48
Le Havre, FR	48	48
Busan, KO	52.5	52.5
Shanghai, CH	52.5	52.5
Hong Kong, CH	51	51
Yantian, CH	52.5	52.5

Source: Containerization International On Line (www.ci-online.uk)

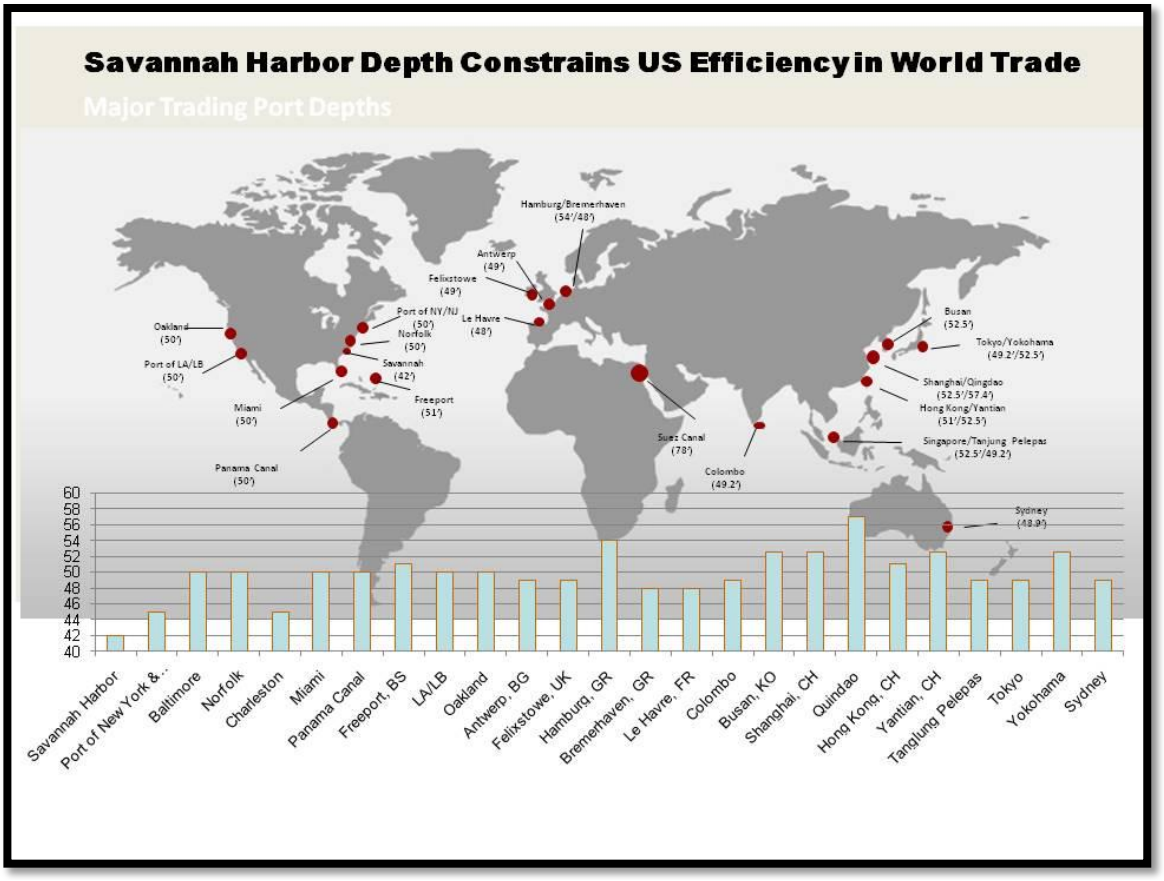

Figure 4-1: Selected World Harbor Depths Comparison

4.3 Existing World Container Ship Fleet

The world fleet currently (July 2010) consists of 4,805 container ships of various sizes and ages. Approximately one-third of the world's container ship fleet is Panamax size or larger. Panamax vessels are those which are sized to the dimensions of the Panama Canal. Historically, the defining constraint of the Panama Canal has been the 106 feet maximum vessel beam. Many Panamax vessels built since the 1990's, typically with TEU capacities greater than 4,500 TEUs, have been built with an operating draft capacity which exceeds the Panama Canal draft constraint (approximately 39 feet).

Seven hundred forty-one vessels in the current world fleet are Post-Panamax size, which in terms of vessel TEU capacity is typically greater than 5,100 TEUs. Table 4-2 categorizes current world fleet by TEU capacity. The minimum TEU capacity for a Panamax vessel is approximately 2,500 based on the dimensions and TEU capacities of vessels in the current fleet. These low volume Panamax vessels are typically among the oldest Panamax vessels.

Table 4-2: Current World Containership Fleet (July 13, 2010)

	Total	Percentage
Post-Panamax	741	15%
Panamax	1,334	28%
Smaller than Panamax	2,720	57%
All ships	4,795	100%
Panamax or larger	2,075	43%
Greater than Panamax Draft*	988	21%

* Includes Post-Panamax vessels and Panamax vessels with TEU capacity greater than 4,500
Source: Containerisation International On-line (www.ci-online.co.uk)

The first Post-Panamax vessels were built in 1995. Since that time, 20% of all container ships built have been Post-Panamax size and 29% built since then are Panamax size. Overall, for vessels built since 1995, 49% are Panamax size, or larger. More importantly for the Savannah Harbor deepening project, at least 25% of all container ships built since 1995 have sailing draft capabilities greater than the 39 feet Panama Canal constraint. Note that some Panamax size vessels have draft capabilities of 44 feet or more. Overall, 78% of active container ships and 88% of current TEU capacity have been built since 1995. Less than 12% of the current world container ship fleet is more than 20 years old, and just 7% are more than 25 years old.

As of July 10, 2010, there are 670 new container ships scheduled to enter the world fleet between the remainder of 2010 and 2014. It is important to note that orders under consideration but not contractually confirmed are not presented in the table, indicating that additional vessels may be delivered, especially in the out-years (2013 – 2014) Table 4-3 presents the current delivery schedule.

Table 4-3: World Container Ship Orderbook by Scheduled Delivery Date

	2010	2011	2012	2013	2014	Total
Post-Panamax	94	118	76	13	4	305
Panamax	82	78	40	7	0	207
Smaller than Panamax	120	32	4	2	0	158
All ships	296	228	120	22	4	670
Panamax or larger	176	196	116	20	4	512
Greater than Panamax Draft*	109	154	82	17	4	366

* Includes Post-Panamax vessels and Panamax vessels with TEU capacity greater than 4,500
Note: 2010 includes deliveries scheduled after Jun10
Source: Containerisation International On-line (www.ci-online.co.uk)

Table 4-4 presents the projected 2013 fleet based on the assumption that all scheduled deliveries are completed. Although many small container ships are scheduled to be added to the world fleet, nearly twice as many Panamax or larger vessels will enter the fleet over the next five years.

Table 4-4: 2013 World Container Ship Fleet (July 13, 2010)

	Total	Percentage
Post-Panamax	1,046	19%
Panamax	1,551	28%
Smaller than Panamax	2,878	53%
All ships	5,475	100%
Panamax or larger	2,597	47%
Greater than Panamax Draft*	1,354	25%

* Includes Post-Panamax vessels and Panamax vessels with TEU capacity greater than 4,500
Source: Containerisation International On-line (www.ci-online.co.uk)

Another perspective on the ongoing changes to the world container ship fleet is the increasing size of the Post-Panamax fleet. Table 4-5 presents the existing world Post-Panamax fleet and the current order book for Post-Panamax vessels. The table reveals that the existing Post-Panamax fleet mostly falls within size categories from 5,100 TEUs to 8,999 TEUs. Less than 10% of the existing Post-Panamax fleet is larger than 9,000 TEUs. The current order book for Post-Panamax vessels consists largely of vessels greater than 8,000 TEUs. The current order book adds nearly 200 vessels larger than 9,000 TEUs, which is equivalent to 45% of all new Post-Panamax vessels ordered. It is especially important to notice that by 2013, the world fleet will have more than 300 vessels ranging in size from 8,000 to 9,999 TEUs. Vessels in this size range have been identified by carriers and the Panama Canal Authority as the new standard for post-expansion Panama Canal traffic. Vessels as large as the 12,000 TEU range, and perhaps some 13,000 TEU vessels, will be able to transit the expanded Panama Canal.

The importance of these Super Post-Panamax vessels (greater than 10,000 TEUs) for containerized trade at the US east coast and for Savannah Harbor is that as these vessels are moved into the largest volume trade lanes (Asia – Asia and Asia - Europe), they will displace the existing Post-Panamax fleet. The displaced fleet of Post-Panamax vessels (6,000 TEUs to 9,999 TEUs) will shift to the next tier of trade lanes which includes the Asia to North America trade.

Table 4-5: World Fleet Existing and Ordered Post-Panamax Vessels (number of vessels)

TEU Capacity	Existing	Order Book	Total
5,100 – 5,999	246	20	266
6,000 – 6,999	177	43	220
7,000 – 7,999	31	22	53
8,000 – 8,999	191	53	244
9,000 – 9,999	54	9	63
10,000 – 10,999	13	21	34
11,000 – 11,999	10	7	17
12,000 – 12,999	0	44	44
13,000 – 13,999	9	75	84
14,000+	10	11	21
Totals	741	305	1,046

Source: Containerisation International On-line (www.ci-online.co.uk)

4.4 Existing Savannah Harbor Operations

The Georgia Ports Authority operates two terminals at Savannah Harbor: Ocean Terminal and Garden City Terminal (see Chapter 4.4.1 Garden City Terminal Operations and Infrastructure for a detailed discussion of Garden City Terminal). Ocean Terminal is a break-bulk and Roll-on/Roll-off facility owned and operated by the GPA. A range of shipments, including forest and solid wood products, steel, industrial and farm equipment, automobiles, project shipments, and heavy-lift cargoes move through this 208-acre, 10-berth facility every day. The facility features 6,674 linear feet of deepwater berthing, 1.5 million square feet of covered storage, and 83 acres of open storage. Ocean Terminal is located 10 miles from Interstate 95 and 1.2 miles from Interstate 16. Norfolk Southern Railroad provides switching services on-terminal. Line-haul services are provided by Norfolk Southern Railroad and CSX Transportation. Additional land is available for future expansion of this facility.

Other Savannah Harbor operations include Willamette Industries, Savannah Electric Power Generating Station – Southern Company, Atlantic Wood Industries, Savannah Food and Industries, Vopak, National Gypsum Company, SIT, Citgo Asphalt Refinery, Georgia Kaolin International, Savannah Steel Corporation, Colonial Oil Industries, Savannah Marine Services, Crescent Towing Services, Moran Towing, Liberty Terminal, East Coast Terminals/Woodchip Exporting Corporation, Georgia Pacific Gypsum, Nustar, Conoco Phillips, Tronox, and Southern LNG.

Waterborne Commerce of the United States, Calendar Year 2008 (USACE, 2010) reports that freight traffic tonnage at Savannah Harbor nearly doubled between 1999 and 2008 to 35.394 million short tons (Table 4-6 and Figure 4-2). The largest volume of commodities (by weight) in 2008 were exported clay (2.423 million short tons), imported liquefied gas (2.955 million short tons), and unclassified imported

manufactured products (2.002 million short tons). Clay is exported from Savannah Harbor's Ocean Terminal and Garden City Terminal. Imported manufactured products are largely landed at Garden City Terminal.

Table 4-6: Savannah Harbor Waterborne Freight Traffic: 1995 – 2009 (thousands of short tons)

Year	Total	Year	Total
1995	17,380	2003	23,369
1996	17,598	2004	28,177
1997	17,929	2005	30,114
1998	17,711	2006	33,971
1999	18,156	2007	36,486
2000	19,517	2008	35,394
2001	19,392	2009	32,339
2002	20,664		

Source :Waterborne Commerce of the United States, Calendar Years 2005 - 2009, USACE, 2010

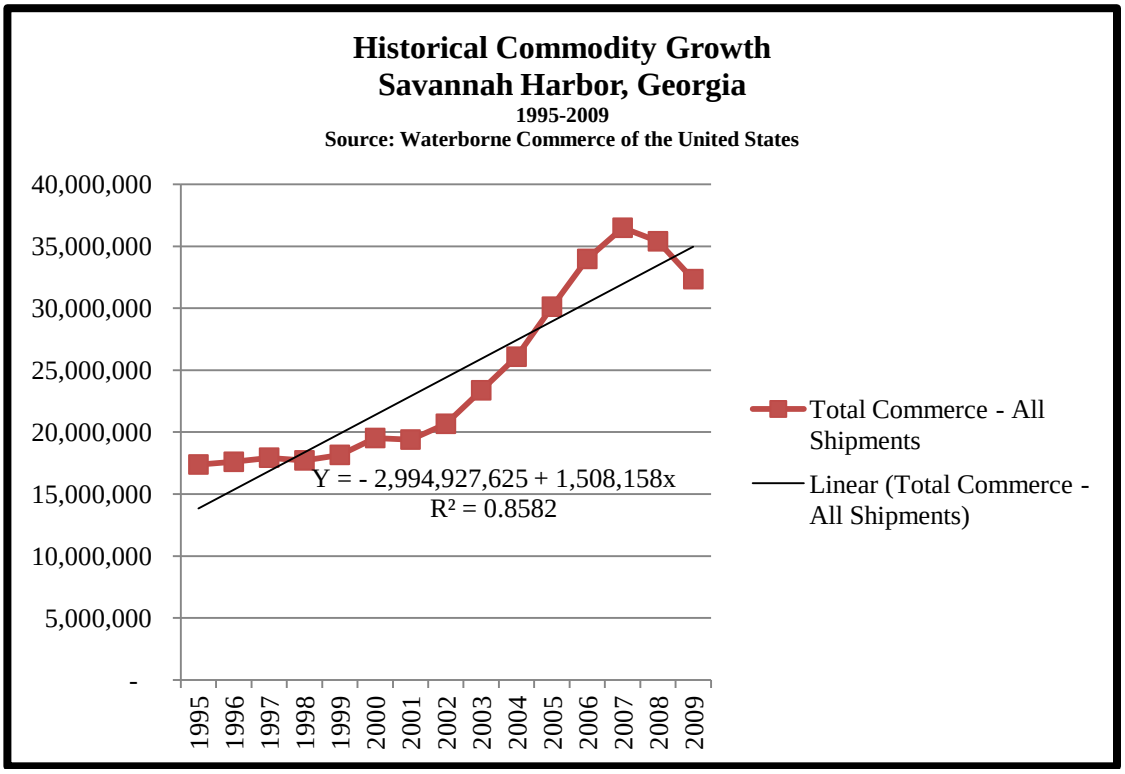

Figure 4-2: Savannah Harbor Historical Commodity Growth with Trendline

Imported liquefied natural gas (LNG) is handled at the Elba Island LNG import terminal located in Chatham County, Georgia approximately five miles south of the City of Savannah. Elba Island is operated by Southern LNG, which is a wholly owned

subsidiary of El Paso Energy Company. The facility includes two buried 30-inch pipes, which cross under the Savannah River. Consultation with Southern LNG concluded that a -48-foot channel could be constructed without requiring relocation of the existing pipes. In 2003, the Federal Energy Regulatory Commission issued an order authorizing the expansion of the Elba Island facility, which included adding a second and third docking berth, a fourth cryogenic storage tank, and associated facilities. The proposed expansion will increase the Elba Island facilities' working gas capacity from 4.0 billion cubic feet of gas equivalent (Bcfe) to 7.7 Bcfe.

The recent completion of a new double berth slip will allow LNG vessel calls at Savannah Harbor to increase from 60 to 120 projected for 2015. A third phase of expansion at Elba Island is currently being constructed. The third phase expansion is projected to increase the number of Elba Island LNG vessel calls to as many as 167 LNG vessel calls per year (2030). LNG vessels arrive loaded to an operating draft of 35 to 37 feet, with 36 feet being the typical operating draft. These vessels are 940 to 960 feet long with a beam ranging from 135 to 145 feet.

The US Coast Guard enforces a one mile "regulated navigation area" around inbound LNG vessel traffic in the harbor. As a part of Savannah Harbor's standard operating procedures, LNG vessels enter the harbor at high tide so as to arrive at the berth at high water slack tide. Despite coordination between harbor users, pilots, and the US Coast Guard, container ships and LNG vessels have been delayed due to the combined constraints of limited controlling depth (38 feet unrestricted) and LNG security and safety related operations.

4.4.1 Garden City Terminal Infrastructure and Operations

The Garden City Terminal is a secured, dedicated container terminal owned and operated by the Georgia Ports Authority. The terminal is the fourth-largest container port in the United States and the largest single-terminal operation in North America. The facility's single-terminal design supports flexible and efficient operation, as well as increased security, due to the concentration of all manpower, technology, and equipment in one massive container operation.

The terminal covers 1,200 acres with 9,693 continuous linear feet of waterfront. Garden City Terminal is equipped with 23 ship-to-shore container cranes with capabilities ranging from 128 feet of outreach (Post-Panamax vessels) to 192 feet of outreach (Super Post-Panamax vessels). The facility currently operates with 96 rubber-tired gantry (RTG) cranes, each with a lifting capacity of 50 tons.

Garden City terminal berths run in a line that follows the Savannah River navigational channel. The linear berth space is divided into four segments as follows:

- Container Berth 1: 1,600 feet;
- Container Berths 2-3: 2,300 feet;
- Container Berths 4-5-6: 2,300 feet; and

- Container Berths 7-9: 3,276 feet.

In 2011, Garden City Terminal operated at a volume of just over 2.95 million vessel lifts, or about 2.3 million TEU's per year. This is being accomplished with 8,300 feet of berth and approximately 407 acres of net container storage area, resulting in facility productivities of:

- 278 TEU's per foot of berth per year, and
- 5,650 TEU's per net container storage acre per year

Terminal facilities include the James D. Mason Intermodal Container Transfer Facility (Norfolk Southern Railway), which includes 12,500 feet of working track, 7,500 feet of storage track, and a 25 acre facility area. The Mason ICTF moves an average of 17 double stack trains to Atlanta each week. A second on-terminal ICTF facility, Chatham Yards (CSX), commenced operations in 2009. Chatham Yards includes 6,435 feet of working track, and 12,406 feet of storage track. Approximately 20% of Garden City Terminal's throughput moves by rail.

Truck traffic is serviced by 37 lanes through three separate gates. Recent improvements to gate and yard automation include development of an Automated Terminal Asset Management System, which became fully operational in 2008. The terminal also includes 1.3 million square feet of warehouse area and more than one mile of rail siding.

The Georgia Ports Authority has developed a 10-year, $1 billion capital improvement plan, which includes equipment purchases and upgrades, transportation infrastructure improvements, and container storage area expansion. A $56.5 million bond resolution was passed in 2007 in support of the capital improvement plan.

4.4.2 Regional Landside Transportation Infrastructure

Garden City Terminal is a strategic gateway to rail and road distribution networks providing access to markets across the U.S. Southeast and Midwest. The on-terminal Mason Intermodal Container Transfer Facility (Mason ICTF) is served by Norfolk Southern Railroad, providing overnight service to Atlanta, with two to four day delivery to inland destinations of Charlotte, North Carolina; Chicago, Illinois; Dallas, Texas; and Memphis, Tennessee. The new Chatham Yard ICTF, operated by CSX, services Florida and other destinations. Additionally, immediate interstate access is available via Interstates 95 (North/ South) within 5.6 miles and 16 (East/ West) within 6.3 miles. In 2011, state financing ($140 million) was approved for a 3.1 mile, four-lane highway extension from I-95 to the Bourne Street approach to the container terminal gates. Construction is planned to begin in 2013 and the roadway will be completed and opened in 2015. Garden City Terminal's regional landside transportation infrastructure has been instrumental in attracting international trade and is an important consideration for distribution center placement decision making.

4.5 Existing Garden City Terminal Cargo

Savannah Harbor has been the fastest growing US container port since 1995, with an average annual growth rate (1995 – 2006) of 12.5% (MARAD, 2007). This growth in TEU volume at the port has occurred even though average annual population growth in the Savannah MSA was approximately 1% during that time and growth in the 40-mile "trade radius" around Savannah grew at only slightly more than 2% per year. Savannah's share of TEUs among the four largest USEC ports (PONYNJ, Norfolk, Charleston, and Savannah) has grown from 13.1% in 1995 to 19.1% in 2005 (MARAD, 2007). The large volume of trade growth at Savannah Harbor is attributable to the port's favorable infrastructure configuration, transportation network, and local development of new distribution centers.

Annual total TEU volumes have grown continuously since 1987 at Garden City Terminal. Between 1987 and 2007, Garden City Terminal experienced an average annual TEU volume growth rate of 10%. During that 20-year time span, total TEU volume has increased more than seven-fold. Loaded import TEU volume has increased by more than 830%. Loaded export TEU volume has increased by more than 580%. Garden City Terminal currently operates at a balance between import and export TEUs: 53% exports and 47% imports in 2009. Imported TEUs typically contain retail goods, and exports are largely paper and paperboard, wood pulp, food, fabric, and clay. These export commodities are loaded heavily into boxes, which causes outbound drafts to often be deeper than inbound drafts. Table 4-7 presents Garden City Terminal TEU volumes for recent years and the interim average annual growth rates. Figure 4-3 graphically presents the historic growth in annual Garden City Terminal loaded TEU traffic.

Table 4-7: Garden City Terminal TEU Volumes (1995 – 2010)

	Imports	Exports	Total
1995	196,136	227,918	424,054
1996	195,182	245,101	440,283
1997	241,209	283,571	524,780
1998	294,821	240,169	534,990
1999	349,940	251,100	601,040
2000	396,563	260,437	657,000
2001	413,445	284,451	697,896
2002	536,510	339,013	875,523
2003	602,107	388,361	990,468
2004	679,215	649,516	1,328,731
2005	803,693	701,857	1,505,550
2006	862,763	774,056	1,636,819
2007	1,070,018	998,516	2,068,534
2008	1,072,075	1,079,421	2,151,496
2009	883,013	1,024,279	1,097,292
2010	1,050,466	1,144,554	2,195,020

Source: GPA

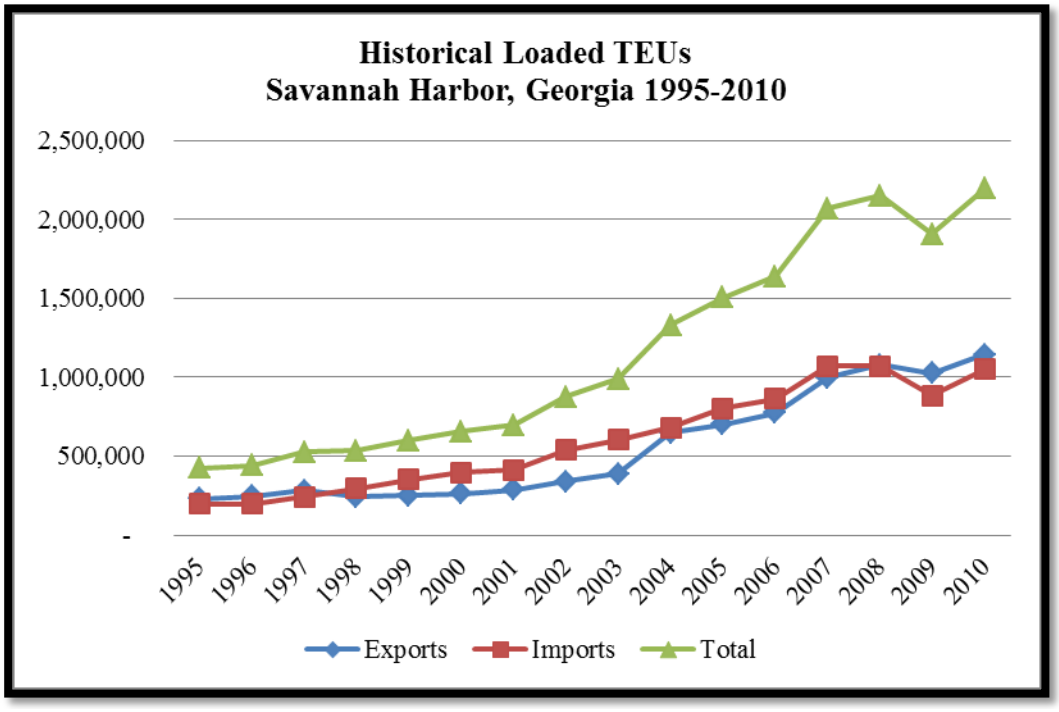

Figure 4-3: Garden City Terminal Historical Loaded TEUs

4.5.1 Hinterland and Regional Distribution Centers

Savannah Harbor's domestic hinterland (area served by the port; both imports and exports) generally consists of the area from Norfolk, VA, southward along the coast through Florida, west to Texas, and northward through all the mid-western states. The Georgia Ports Authority marketing department considers this area as Garden City Terminal's "Port Range". Within this Port Range, and generally in close proximity to Garden City Terminal, retail chain distribution centers have been developed on former farmland in Chatham and surrounding counties. Large scale distribution centers have developed at Savannah Harbor because of the availability of large tracts of undeveloped land and the proximity to road, rail, and waterborne transportation infrastructure.

Distribution centers are typically located within a one-day's drive of the local retail stores. One distribution center may hold inventory for a dozen, or more, local retail stores. The very large distribution centers located near Garden City Terminal may also supply regional distribution centers located in the hinterland, which in turn supply local retail stores. Large scale distribution centers reduce the amount of inventory that needs to be kept at the local retail stores. The use of large scale distribution centers also reduces the risk that an inappropriate volume of inventory would be sent to a local retail store. The economic efficiency of large scale distribution centers, and hence their recent expansion at all major US ports, is due to smaller inventories at local stores and the flexibility to provide the right inventory at the right time.

The 24 largest distribution centers using Garden City terminal have a combined warehouse area of 19.7 million square feet (GPA, 2007). The Savannah/Chatham County industrial real estate inventory for warehouse/distribution facilities, light manufacturing buildings, and flex/business service space has more than doubled from 1998 to 2007, increasing from 11.0 million square feet in 1998 to 28.3 million square feet in 2007. Additions to the industrial real estate inventory are currently expanding beyond Chatham County into nearby Bryan, Effingham, and Liberty Counties. Build-out of sites acquired and in the planning stage would add an additional 25 million square feet to the inventory (Neely/Dales, 2007).

4.6 Existing Garden City Terminal Vessel Operations

Operating draft data for 3,372 inbound and outbound container ship transits of Savannah Harbor, in 2007, confirms that carriers are typically averse to waiting for tidal advantage. Less than 12% of all container ship transits were at drafts greater than -38.00 feet. Container ship operating drafts cluster at the threshold of unrestricted access. Nearly 42% of all container ship transits (41.9%) were at drafts ranging from -35.00 to -37.99 feet. It is also important to note that the drafts of outbound vessels exhibit this trend even more strongly than inbound vessels. This is due in part to the fact that export boxes typically weigh more than import boxes and because of the importance of unrestricted channel access for vessels scheduled for a Panama Canal crossing. Table 4-8 presents 2007 container ship operating drafts at Savannah Harbor. Figure 4-4 presents the same information graphically. The information presented

below is based on vessel drafts reported by the shipping agent, which closely track but are not identical to pilot's data.

Table 4-8: 2007 Savannah Harbor Container Ship Arrival and Departure Drafts (number of calls)

Draft (feet)	Arrival	Departure	Total	Percentage
<30.00	224	150	374	11.1%
30.00 to 30.99	60	41	101	3.0%
31.00 to 31.99	98	53	151	4.5%
32.00 to 32.99	169	106	275	8.2%
33.00 to 33.99	146	122	268	7.9%
34.00 to 34.99	206	181	387	11.5%
35.00 to 35.99	209	198	407	12.1%
36.00 to 36.99	215	294	509	15.1%
37.00 to 37.99	198	300	498	14.8%
38.00 to 38.99	57	45	102	3.0%
39.00 to 39.99	39	51	90	2.7%
40.00 to 40.99	31	55	86	2.6%
41.00 to 41.99	29	32	61	1.8%
42.00 to 42.99	21	42	63	1.9%

Source: Georgia Ports Authority

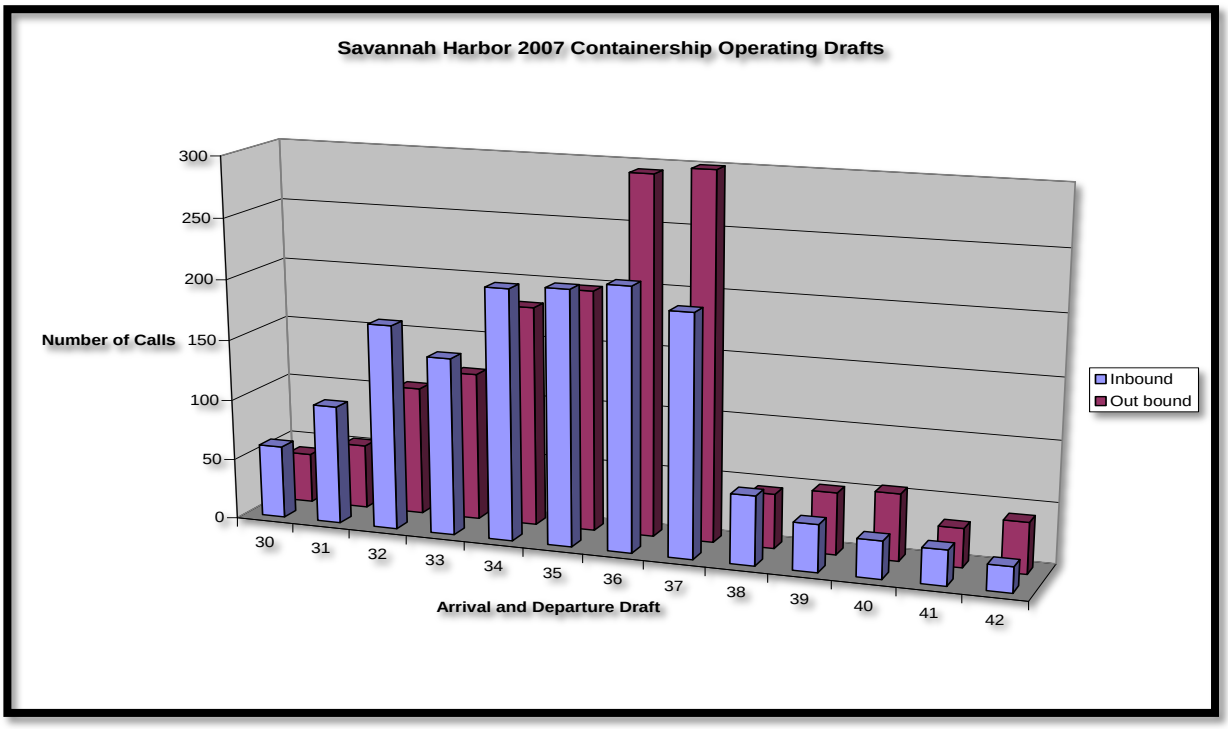

Figure 4-4: Garden City Terminal 2007 Arrival and Departure Drafts

Operating restrictions for container traffic transiting the Savannah Harbor are based on existing channel depth and width. With the exception of two Post-Panamax vessels, it is the usual practice to meet container ships in the straight channel segments. Container vessels can also pass empty LNG vessels. When a loaded LNG vessel is entering the channel, the channel must be clear within a 1 mile radius of the vessel. Pilots typically require container ships to operate with a minimum of 4 feet of underkeel clearance. Any vessel with a reported sailing draft of more than 38.0 feet is effectively using the tide to gain sufficient underkeel clearance. The tidal range at Savannah is approximately 6.9 feet.

The presentations in Figure 4-4 and Table 4-8 indicate that carriers are responding to existing operating draft restrictions by loading vessels so as to maintain unrestricted access to the channel (operating drafts no deeper than -38 feet). The constrained condition identified in the recent historical data continues through the present. In the first half of 2010, 80% of vessels that called at Garden City Terminal were considered depth constrained, and 20% of transits relied on tidal assistance.

Waiting for the tide is a costly operational inefficiency for schedule-driven liner service carriers for two reasons. The first reason is that, for inbound vessels, waiting adds to the operational cost of the voyage by increasing the vessel's time at sea. Outbound vessels waiting for the tide must spend more time at the dock and may delay the arrival of a vessel scheduled to use the same berth. Vessels may increase speed between ports to make up time lost waiting for the tide, which also adds to the cost of the voyage. The second reason that carriers are averse to waiting for the tide is that the additional time spent getting into or out of Savannah Harbor disrupts the vessel's scheduled arrival time at the next and following ports. Vessels may be subject to penalty fees for missing their scheduled time slot at the Panama Canal or may need to pay overtime fees due to a late port arrival. In addition, the deeper the vessel draft, beyond -38.00 feet, the narrower the tidal window required for transit. A vessel loaded to the channel's maximum operating draft of 42 feet has only a one hour window before and after each high tide. This narrow window increases the risk that the vessel may miss the opportunity for transit due to LNG vessel operations or cargo related delays.

The largest container ships to have recently called at Savannah Harbor are Post-Panamax vessels on two of MSC's trans-Atlantic services, which have a TEU capacity of more than 6,700 TEUs and maximum operating drafts of nearly 48 feet. MSC began bringing these vessels to Savannah Harbor in 2006 in typically light loaded condition, at or slightly greater than the unrestricted 38-foot constraint. In mid-2006 and early 2007, MSC began bringing these vessels in at drafts greater than 40 feet and often at the maximum draft of 42 feet. However, the reduced access window due to the depth constraint caused significant disruptions to MSC's schedule.

MSC's recent experience illustrates another response to Savannah Harbor's channel constraint. Instead of continually arriving light loaded, MSC began skipping Savannah as a port of call on these services in late 2007 and continued to call at

Savannah with these vessels only intermittently in 2008. Discussions with MSC indicate that MSC has decided to continue loading those vessels to 42 feet but will not bring them to Savannah Harbor at that draft. Cargo which would have been delivered directly to Savannah is being offloaded at Charleston and trucked to Savannah or is being transshipped at Freeport, BS onto smaller MSC vessels calling at Savannah Harbor. Exports out of Savannah are being delayed by the lack of vessel space, due to the large MSC vessels dropping Savannah as a port-of-call.

4.7 Existing Socio-Economic Profile

Savannah Harbor is included within the US Census Bureau's delineation for the Savannah, GA Metropolitan Statistical Area (MSA, 42340). Savannah is the principal city within this MSA, which also includes Bryan, Chatham, and Effingham counties. The 2010 American Community Survey Profile (www.census.gov) for Savannah, GA indicates that the MSA household population is 348,689. The median age is 34.4 years with 29% of adults having graduated high school, 23% having some college, 7% having achieved an Associates degree, 19% a Bachelors degree, and 10% having a Graduate or Professional degree. The median income is $46,755.

The largest industries by employment in the MSA are Education, Health, and Social Services (23%), Retail Trade (13%), and Public Administration (10%). The following lists employment distribution by industry category:

- Agriculture, forestry, fishing, hunting, and mining – 0%;
- Construction – 6%;
- Manufacturing – 10%;
- Wholesale trade – 3%;
- Retail trade – 13%;
- Transportation, warehousing, and utilities – 6%;
- Information – 1%;
- Finance, insurance, and real estate – 5%;
- Professional and business services – 10%;
- Education, health, and social services – 23%;
- Leisure and hospitality – 10%;
- Public administration – 6%; and
- Other services – 5%.

In 2010, the University of Georgia, Terry College of Business conducted an economic impact analysis of Georgia's deepwater ports on the state's economy for fiscal year 2009. The analysis found that Savannah cargo-based activity was responsible for 76% of the economic impact generated by the state's deepwater port industry. Table 4-9 presents a synopsis of the Savannah cargo-based economic impact. Activity related to containerized cargo at Garden City Terminal generated more than 85% of Savannah Harbor's cargo-related impact.

Table 4-9: Savannah Harbor Economic Impact – 2009 (millions of 2009 dollars)

	Direct	Indirect & Induced	Total
Revenue/Output	$1,575	$842	$2,417
Income	$561	$276	$873
Gross State Product	$775	$412	$1,186
Employment*	14,131	7,499	21,628

Source: The Economic Impact of Georgia's Deepwater Ports on Georgia's Economy in FY 2009, J.M Humphreys, April 2010. Note that totals may be affected by rounding. *Employment is shown in full- and part-time jobs.

4.8 Existing Environmental Resources

The Savannah River and its tributaries form the border between the states of Georgia and South Carolina. At 313 miles in length, the Savannah River has a drainage area of approximately 9,850 square miles. Its width varies between 2,000 feet near its mouth to about 1,000 feet at the Kings Island Turning Basin (near Station 100+000). Savannah Harbor and the deep-draft navigation channel are located along the lower 21.3 miles of the River and out 11.4 miles into the Atlantic Ocean. The inner Harbor is from just below the Georgia Highway 25 Crossing to about Fort Pulaski (Stations 112+500 to 0+000) and the outer Harbor is from Fort Pulaski into the Atlantic Ocean Station 0+000 to -60+000B.

Three Federal reservoirs, Hartwell, Richard B. Russell, and J. Strom Thurmond, and the New Savannah Bluff Lock and Dam at Augusta, are operated by the Savannah District Corps. This system of reservoirs and dams controls much of the freshwater flow within the River. Tidal fluctuations average 6.8 feet at the mouth of the harbor with the upper limit at approximately 7.9 feet. Salinity levels range from 0 ppt above the Garden City terminal to 35 ppt (sea strength) in the ocean bar channel.

4.8.1 Geology and Sediments

Eastern Chatham County is underlain by approximately 2,000 feet of sedimentary Coastal Plain sediments ranging in age from Holocene to Cretaceous. From land surface to a depth of about 500 feet, these sediments consist of unconsolidated to somewhat indurated beds of sand and clay of recent (Holocene) and Miocene age to indurated limestones of Oligocene and Eocene age. The Oligocene and Eocene limestones comprise what is commonly referred to as the Upper Floridan aquifer. In the Savannah Harbor area, the geologic formations can be grouped into three broadly defined hydrogeologic units: the Upper Floridan aquifer, the Miocene confining unit, and the surficial aquifer.

Within the study area, the elevation of the top of the Oligocene unit, the uppermost unit of the Upper Floridan aquifer, ranges from roughly –95 feet MLLW near Tybee Island to approximately –200 feet MLLW near downtown Savannah. The top of the Miocene unit occurs at an average of –45 feet MLLW and is generally level within the

study area, and unit thickness ranges from less than 30 feet near Tybee Island to 160 feet near downtown Savannah.

The uppermost recent sediments consist of varying mixtures of sands, silts, and clays of varying density and consolidation. Generally, soils at the river bottom exhibit lower consistency than the deeper recent soils. The bottom soils are often very loose and semi-liquid and can extend from the bottom of the river channel to only a few inches to several feet deep. The underlying Miocene-aged soils comprise a significant portion of the proposed new work material and consist of consolidated silty sands, clayey sands, high liquid-limit silts, and low liquid-limit and high liquid-limit clays. In general, relative to recent sediments, the Miocene soils are characterized by a significant density increase, uniform consistency, and cohesiveness.

Sediment testing conducted in 2006 revealed the presence of naturally-occurring cadmium in Miocene sediments within elevation ranges that include potential new work sediments. The highest concentrations of cadmium (average 21.45 mg/kg) were found in the sediments between Stations 24+000 and 45+000. None of the other ranges had an average cadmium concentration of greater than 6.89 mg/kg, which was above the Effects Range Low (ERL) of 1.2 mg/kg and well below the Effects Range Median (ERM) of 9.6 mg/kg. For concentrations less than the ERM but greater than the ERL, contaminant concerns for environmental impact potential should be low, but not zero.

4.8.2 Water Resources

The Upper Floridan aquifer is the primary source of groundwater and supplies Chatham County and the study area. It provides about 30 percent of the total water supply for the County. The Floridan aquifer, which underlies parts of Alabama, Georgia, South Carolina, and Florida, supplies approximately 50 percent of the groundwater in the State of Georgia. Groundwater can be found at various depths in the project vicinity, while subsurface drinking water is taken only from depths more than 100 feet below the surface. Clay lenses of 40 to 70 feet in thickness separate the various groundwater bearing strata.

The long-term withdrawal of water from the Upper Floridan aquifer has resulted in radial flow directed toward the center of pumping and a cone of depression beneath Savannah. Vertical leakage of water through the Miocene confining unit contributes nearly half the aquifer water budget for the Savannah area, or 40 million gallons per day (MGD). The *Aquifer Effects Evaluation Supplemental Study* (see Engineering Appendix, Supplemental Studies DVD) examines the impact of the proposed dredging on the rate of vertical intrusion, which consists of both fresh and salt water, and the resulting groundwater impacts in the Upper Floridan aquifer. Input from various agencies including the United States Geological Survey (USGS), Georgia Department of Natural Resources, Environmental Protection Division (GA DNR-EPD), South Carolina Department of Health and Environmental Control (SC DHEC), the SEG, and GPA was used to develop scopes for work for the investigations included in the Supplemental Study. Investigations included additional sub-bottom seismic surveys,

marine and land drilling, geographic information system (GIS) analysis, and 3-D numerical groundwater modeling.

The additional investigations provided increased understanding of the geologic and hydro-geologic framework underlying the navigation channel. The overall results of the investigations indicate that Savannah area withdrawals from the Floridan aquifer are the dominant force contributing to the downward movement of salt water through the Miocene protective layer to the aquifer. If the pumping rate remains at present levels, breakthrough of seawater will occur at some downstream locations in approximately 100 to 300 years regardless of the proposed harbor deepening. The proposed deepening would contribute only about 3 to 4 percent increase in total downward flow through the confining layer into the Upper Floridan aquifer and with the much larger lateral flow of freshwater, would have negligible impact on water quality in production wells in the Savannah area.

The City of Savannah operates an Municipal and Industrial Water Supply (M&I) raw water intake on Abercorn Creek. The City's M&I raw water intake is located along Abercorn Creek approximately 1 mile upstream of the confluence of the creek with the Savannah River, which is located at River Mile 29 or about 9.8 miles above the limits of the proposed Expansion Project. Presently, the City withdraws water from Abercorn Creek for both industrial and municipal uses. In the past, the City's contracts with its industrial customers included a provision that the water provided must possess a chloride concentration not greater than 12 mg/l. That provision is not in the City's present contracts, but industries experience higher maintenance costs associated with pipe scaling and boiler corrosion when the City delivers water with higher chloride levels. Chlorides in municipal water supplies must be under the 250 mg/l drinking-water standard established by the Georgia Department of Natural Resources. Seawater has a chloride concentration of about 19,400 mg/l.

South Carolina Department of Health and Environmental Control, has specified the following water quality classification for the Savannah River:

- From the headwaters of Lake Russell to the Seaboard Coastline Railroad (RM 27.4);
    - Class FW (suitable for primary and secondary contact recreation and as a source for drinking water supply after conventional treatment in accordance with the requirements of the Department. These freshwaters are suitable for fishing and the survival and propagation of a balanced indigenous aquatic community of fauna and flora. They are suitable also for industrial and agricultural uses),
- From the Seaboard Coastline RR to Fort Pulaski (RM 0.0);
    - Class SB (tidal saltwater suitable for primary and secondary contract recreation, crabbing, and fishing, except harvesting of clams, mussels, or oysters for market purposes or human consumption), and
- From Fort Pulaski to the Atlantic Ocean;

- Class SA waters (tidal saltwater suitable for primary and secondary contact recreation. Suitable also for uses listed in Class SB, with the same exception).

In addition, a fish consumption advisory due to mercury concentrations has been issued by the South Carolina Department of Health and Environmental Control.

The GA DNR classifies the Savannah River from Station 0+000 (mile 0) at Fort Pulaski to the open sea (including the littoral waters of Tybee Island) as Recreation waters. From Fort Pulaski (Station 0+000) to the Seaboard Coastline RR Bridge (about Station 144+672 or Mile 27.4), the river is classified as Coastal Fishing. The harbor from Highway 17 to South Channel is listed as not fully supporting the designated use of coastal fishing due to the violation of fecal coliform, copper, and dissolved oxygen criteria. In 2002, the GA DNR, Environmental Protection Division included a portion of the Savannah River on the State's Section 303(d) list from State Road 25 (Old US Highway 17) to the Elba Island Cut.

In 2009, following EPA disapproval of state dissolved oxygen (DO) standards for Savannah Harbor, the State of Georgia revised its DO standard. These criteria are applicable to protecting estuarine resources within the harbor and for permitting and Clean Water Act compliance purposes. The new standard calls for a daily average in the dissolved oxygen to be no less than 5.0 mg/l throughout the year, with an instantaneous minimum of 4.0 mg/l. These new standards apply throughout the water column, and they match the South Carolina standard for waters of the same use classification.

4.8.3 Air Quality

The ambient air quality for Chatham County, Georgia and Jasper County, South Carolina is in compliance with the National Ambient Air Quality Standards, and both counties have been designated as attainment areas.

4.8.4 Marine and Estuarine Resources

Savannah Harbor is in a moderately stratified estuary in which tidal action forces mixing of fresh and salt waters. Each spring and fall, the main Savannah River, Back River, Middle River, and the numerous interconnecting tidal streams are hosts for the migration of three members of the herring family: American shad (Alosa sapidissima), Hickory shad (Alosa mediocris), and Blueback herring (Alosa aestivals), and the Striped bass (Morone saxatilis), which are very important game fish. The American shad is the most valuable commercial anadromous fish in the southeast. The Shortnose sturgeon (Acipenser brevirostrum), which has been listed as endangered since 1967, is also present in the harbor. Other commercial and recreational species found in the river include blue crabs, oysters, and brown and white shrimp. Twenty-eight Essential Fish Habitat species have been identified for the riverine and estuarine areas of South Carolina and Georgia.

As part of the Savannah Harbor Expansion Project, the USGS Georgia Cooperative Fish and Wildlife Research Unit conducted a two year study from 2000-2001 to analyze the current condition of fishery resources within the Savannah River estuary. The study is documented in a report titled "Temporal and Spatial Distribution of Estuarine-Dependent Species in the Savannah River Estuary" by Jennings and Weyers in 2003. Over the course of the study, 91 different fish species and 67,826 individuals were collected. This study reported that Bay anchovy, Atlantic menhaden, Atlantic croaker, and spot were the most abundant species in the SRE and comprised 81% of the catch. The report noted that fish density and species richness to be low in the fall and higher in late winter and summer. The report documented that commercial and recreational species in the SRE "included marine/estuary species such as gray snapper, red drum, spotted seatrout, striped bass, weakfish, ladyfish, tarpon, Spanish mackerel, jack crevalle, and striped mullet and freshwater species such as largemouth bass, catfishes, black crappie, sunfishes, and carp." The authors indicated that the majority of the fish communities were able to tolerate a wide range of salinities (5.0 to 15 ppt). The recreational fishery for Striped bass was recently reopened in the harbor, as a response to restored population levels. Recent studies have indicated that historically the Savannah River was the location of Georgia's most important Striped bass fishery.

In 2006, the University of Georgia, Marine Extension Service received a grant from the National Aquatic Invasive Species Council to monitor for aquatic invasive species in the Port of Savannah. Invasive species can be spread through several pathways including ballast water and boat hulls. Three invasive species have been documented to occur on Tybee Island, the green porcelain crab (*Petrolisthes armatus),* the green mussel (*Perna viridis),* and the titan acorn barnacle (*Megabalanus coccopoma).*

4.8.5 Terrestrial Resources

Three wildlife resource areas have been designated within the study area:

- Savannah National Wildlife Refuge;
- Tybee National Wildlife Refuge; and
- Turtle Island Wildlife Management Area.

The Savannah National Wildlife Refuge is located in the upper portion of the harbor and consists of 25,600 acres of freshwater marshes, tidal rivers and creeks, and bottomland hardwoods. Its location across the river from highly developed port facilities and its original purpose as a freshwater refuge present significant challenges to harmonious operation of the harbor with adjacent landowners. The Refuge's extensive un-impounded wetlands along the Savannah, Middle and Back Rivers have been impacted by previous channel deepening projects. Channel deepening allows saline water to travel further upriver, which has caused a decline in freshwater vegetation. The Corps constructed a Freshwater Control System on the Refuge in 1977 to mitigate for the salinity increase expected from the harbor deepening and from sediment control features authorized in 1965. The Tidegate was removed from

operation in March 1991 and New Cut was closed in 1992 to alleviate impacts caused by sediment control structures, which were constructed in the late 1970's.

The Savannah National Wildlife Refuge includes 5,700 acres of diked impoundments for waterfowl habitat. Those impoundments include 3,000 acres of freshwater pools. Two management schemes are primarily used for the impoundments; draw-down pools and permanently flooded pools. The draw-down pools are drained annually between March 15 and May 15 and manipulated to promote growth of emergent waterfowl food plants. These areas are flooded in the fall of each year. Permanent pools remain flooded all year to promote growth of submerged aquatic plants and to provide wood duck brood-rearing and alligator habitat. Permanently flooded pools are drained, dried, burned, and mowed when undesirable vegetation becomes a problem or productivity of desirable plants decreases. These pools may require additional water at any time to make up for transpiration and evaporation. An adequate supply of freshwater was available under normal river flow conditions for management of the impoundments. Removal of the gates on the Tidegate structure in 1990 decreased salinity in Back River so that freshwater is available for flooding of the impoundments under all expected flow conditions.

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

Turtle Island Wildlife Management Area (WMA) is located on the northern side of the Tybee Refuge along the ocean coast and is operated by the SC Department of Natural Resources. The 1,700-acre island was donated to the State in 1976 for waterfowl management purposes. The site is within Unit SC10P of the Coastal Barrier Resources System, so it receives protection from development specified in the Coastal Barrier Resources Act. The WMA contains 1,170 acres of low salt marsh, 90 acres of palm/palmetto forest with a wax myrtle and yaupon understory, and 50 acres of beach and dunes. High ground is situated in roughly parallel strips which encircle 420 acres of high salt marsh. The high salt marsh provides the best habitat for waterfowl management and hunting. Public use includes waterfowl hunting, marsh hen hunting, beachcombing, fishing, bird watching, picnicking and camping (designated areas only). Public use is generally low because access is available only by boat.

In addition, the majority of the undeveloped uplands found in the project area consist of DMCAs used for harbor operations. The DMCAs are generally located on the north side of the Savannah River and are inhabited by numerous species of wildlife similar to those found at the Savannah NWR and surrounding areas. Nesting terns and

plovers can be found on the more sandy areas during spring and summer. Nesting islands have been created within each DMCA in South Carolina (except DMCA 13B where they are scheduled but not yet constructed). These 1-acre islands provide rare isolated bare ground habitat for colonial nesting birds. Along the edges of flooded areas and along canals and inner ditches, wading birds and shorebirds congregate and feed. Depending on the amount of water available and time of year, large numbers of waterfowl can be found in these impoundments. A portion of the Jones-Oysterbed Island DMCA is located on the Tybee Island National Wildlife Refuge. The 400-acre site serves as a resting spot for pelicans, seagulls, egrets, herons, and other birds. DMCA 1N and a portion of DMCA 2A are located within the Savannah National Wildlife Refuge. Feral hogs, deer, raccoons, opossums, otters, rodents, and other mammals are also found on the DMCAs.

4.8.6 Wetlands

The 2008 Draft Fish and Wildlife Coordination Report for the Savannah Harbor Comprehensive Study dated November 2008 identified 22,719 acres of emergent wetlands consisting of a mixture of freshwater and salt-tolerant species. The Report also identified 8,577 acres of forested wetlands consisting largely of Cypress-Gum and Scrub-Shrub species.

The USFWS has identified tidal freshwater marshes as being a critical resource in its consideration of the acceptability of the proposed harbor deepening. The extent of those marshes has decreased substantially over time as the harbor has been deepened and salinity has moved further upriver. Other development activities such as diking, filling, and agriculture have further reduced the acreages of tidal freshwater marshes within this estuary.

4.8.7 Special Status Species and Resource Areas

There are currently 23 Federally Threatened and Endangered Species potentially present in Chatham County, Georgia and Jasper County, South Carolina. These species include five Threatened and fifteen Endangered vertebrates, and three Endangered vascular plants.

The Georgia Department of Natural Resources has identified 24 Special Concern Animals, seven Special Concern Plants, and nine Conservation Areas in Chatham County, Georgia. The South Carolina Department of Natural Resources has listed 105 Rare, Threatened, and Endangered Species in Jasper County, which include 37 animal species and 68 plant species. The three separate listings (Federal, Georgia, and South Carolina) are not mutually exclusive, so some species may occur on multiple listings.

4.8.8 Recreational Resources

The Georgia DNR Coastal Resources Division indicates the area of the navigation channel commonly known as Tybee Roads and eastward (ocean-ward of Station

-18+000) is a popular location for recreational fishing for King and Spanish mackerel during the late spring and summer. One ocean fishing pier is located on Tybee Island (Tybee Pavilion Ocean Pier off 16th Street) and is considered an important recreational facility. This ocean pier, private recreational vessels, charter boats, and head boats that use the nearshore waters also contribute to the local economy. Recreational surf fishing is not extensive on Tybee Island since the natural water depth is shallow near the beach strand and very gradually deepens offshore.

The Savannah Harbor estuary supports several sport fisheries. Sport fishing within the navigation channel is low due to heavy vessel traffic and recurring maintenance dredging which removes bottom habitat and limits benthic communities. Several marine finfish taken around the mouth of the harbor include spotted sea trout, spot, croaker, and other bottom species. Cobia and tripletail provide sport fishing in the outer channel.

The ocean shoreline of Tybee Island is used extensively for recreational purposes. The beach receives high visitation numbers during the summer months of May through August. Tourism is a growth industry in the coastal area. The City of Savannah receives a large number of tourists, who visit the historic aspects of the City and its riverfront.

4.9 Existing Conditions: Cultural Resources

Significant Cultural resources within the study area include:

- The wreck of CSS *Georgia*;
- Fort Pulaski National Monument;
- Old Fort Jackson;
- Savannah National Historic District; and
- Savannah River Civil War Cribs

Also within the study are two National Register of Historic Places sites. The river lock and northern terminus of the Savannah and Ogeechee Canal (Station 79+000) is located on the south shore adjacent to the Highway 17 Bridge. The canal was constructed during the 1830s. It is listed in the National Register of Historic Places at the state level for architecture and archaeological research potential.

The Fig Island Channel Site (Station 72+000 to 73+500) is located on the north side slope and shore of the existing navigation channel. The site has been determined eligible for inclusion in the National Register of Historic Places at the state level for its archaeological research potential. The site area was once a channel between Fig and Hutchinson Islands. The channel was used for disposal of wrecked and derelict vessels during the eighteenth and nineteenth centuries.

4.9.1 The Wreck of the CSS Georgia

CSS *Georgia* is a Confederate ironclad constructed in Savannah in 1862. The vessel was scuttled in the Savannah River in 1864, approximately three miles below Savannah and 11 miles above the mouth of the river adjacent to the main navigation channel. The wreck of CSS *Georgia* was discovered in its current location (between Stations 59+000 and 58+000) during dredging operations in 1968. The wreck is un-protected from river currents and erosion in its location adjacent to the navigation channel. The wreck of CSS *Georgia* impedes full maintenance of the navigation channel, causing a pinch-point at its location.

The wreck of CSS *Georgia* is included in the National Register of Historic Places at the National level of significance for architecture, association with significant events, association with significant people, and archaeological research potential. The National Register boundary includes the channel side slope, the top of slope, and an area extending 50 feet into the authorized navigation channel. The boundary between South Carolina and Georgia runs through the wreck site. Since 1984, Savannah District has had an agreement with both states to avoid the site area during dredging by working no closer than 50 horizontal feet from the vessel for a distance of 1,000 feet along the channel. This stand-off became codified as the normal operating practice through its inclusion in the 1995 DMMP, and the subsequent environmental approvals for O&M of the harbor. Nonetheless, studies have demonstrated that past, present, and future operation and maintenance activities have, and will continue to have, an adverse effect upon the wreck site.

The navigation channel could not be substantially deepened without crossing a major portion of the wreck site. As a result, evaluation of the deepening alternatives included an *in-situ* archeological assessment of the present condition of the CSS *Georgia*. An extensive analysis of the wreck site was performed.

Using the new information, Savannah District reviewed the status of CSS *Georgia* in 2006 and concluded that past operation and maintenance dredging had severely impacted the wreck site. The wreck had become exposed and largely destroyed by a combination of factors including different river flow patterns, new work (primarily construction of the 4-foot advance maintenance section in 1983), maintenance dredging practices, and marine organisms. The data indicated that action should be taken to ensure the remaining archaeological information possessed by the remains of the wreck is obtained before the site degrades further.

The 2007 report documenting the *in-situ* archeological evaluation included recommendations for future actions. The evaluation recommended a systematic archeological salvage operation, which would include partial and full excavation conducted by divers working from a fixed platform. In light of the condition of the wreck at that time, the best plan consists of removing the remaining wreck and conducting archeological data recovery, which includes excavating, conserving, and curating. As a result of the likely impacts of the deepening alternatives on the site, the project includes performance of an archeological salvage operation as mitigation.

4.9.2 Fort Pulaski National Monument (GA)

Fort Pulaski National Monument (Station -2+000 to 8+000; GA) is a 5,623 acre park under the jurisdiction of the National Park Service. The park contains marsh, uplands, barrier islands, and the remains of the Civil War era fort constructed during the 1830s and 1840s. It is included in the National Register of Historic Places at the National level of significance for its architecture, association with significant events, association with significant people, and archaeological research potential. The park shoreline is well outside the channel side slope, and the fort itself is not near the shoreline. The park shoreline experiences erosion that is unassociated with channel maintenance dredging.

The Wilmington District of the Corps of Engineers conducted a Savannah Harbor Expansion Bank Erosion Study (Nov 2006) to assess the effects of wakes from vessel traffic on erosion at Fort Pulaski National Monument and Tybee Island, GA. The analysis concluded that shoreline erosion at Fort Pulaski National Monument averages 3.1 feet per year, of which 3.0 feet is attributable to flows, tides, and normal wave activity. The remaining 0.1 feet per year of erosion results from a combination of vessel traffic, rain events, and surface drainage events from existing drainage structures. In total, the analysis estimates that erosion due to vessel traffic amounts to 0.36 inch per year.

4.9.3 Fort James Jackson National Historic Landmark (GA)

Old Fort Jackson (Stations 59+000 to 58+000) is the oldest standing fort in the State of Georgia. Construction began in 1808 and the fort was in service during the War of 1812. The fort is located across the river from the current site of CSS Georgia. Old Fort Jackson is a national Historic Landmark and is listed on the National Register of Historic places at the national level of significance for its architecture and association with significant events and historic figures. It is owned by the State of Georgia and is operated and maintained as a historic site by the Coastal Heritage Society. In 2003, in accordance with a Memorandum of Agreement between Savannah District and the Georgia State Historic Preservation Office, the District completed a bank stabilization project to protect this property from harbor operation and maintenance activities.

4.9.4 Savannah National Historic Landmark District (GA)

The south shore of the navigation channel comprises the north border of the Savannah National Historic Landmark District (Stations 72+000 to 79+000). The district is listed in the National Register of Historic Places at the National level for its architecture. It is significant for its distinctive grid plan as well as its 18th and 19th century architecture. The district encompasses the original town plan laid out in 1733 by Gen. James E. Oglethorpe, founder of the British colony of Georgia. Today, Savannah retains much of this plan based on divisions also called wards, squares, and

"trustee lots." Most of the original squares remain and are surrounded by fine examples of buildings in the Georgian, Greek Revival, and Gothic styles.

All but one small shoreline area is protected by modern bulkheads, wharves, or rip rap. The exception is located near Station 75+500 where a brick-faced wharf constructed during the last quarter of the nineteenth century forms an alcove in the modern engineered shoreline. This area is used for small boat mooring.

4.9.5 Savannah River Civil War Cribs

Savannah Harbor and vicinity was the site of many war-time activities during the Civil War. Fortifications were built along the river, some of which remain today. Wooden cribs and pile dams were constructed in shallow areas to concentrate the flow of water. The remains of a few of those structures still exist. Impacts to these structures are not anticipated since the channel would be being deepened within the existing side slopes, with excavation of the side slopes occurring in only a few locations.

5 Forecast of Without-Project Conditions

This chapter presents future conditions concerning Savannah Harbor and related resources as they are projected to exist without Federal involvement in addressing the problems and opportunities identified in Chapter 3. Under future without-project conditions, the Federal channel at Savannah Harbor would remain at a depth of -42 feet MLLW. Planned improvements to major port facilities would become operational, which includes the expansion of the Panama Canal. In addition, new US east and Gulf coast container terminals will be constructed. Larger vessels will continue to enter the container ship fleet calling at the US east coast.

5.1 Panama Canal: Deepening Existing Locks (2010) and Expansion (2014)

Currently, the 39.4 foot controlling depth at the Panama Canal is the major constraint on the all-water route from Asia to the US East Coast. On October 22, 2006, Panamanian citizens overwhelmingly approved the proposed Panama Canal expansion plan through a national referendum. The Panama Canal expansion will provide for a maximum sailing draft of 50' (tropical freshwater) within a new set of locks. The width of the new locks will be 180 feet and the length 1,400 feet[3]. These dimensions were selected to accommodate 8,000 TEU vessels (approximately 48 ft sailing draft), which are considered the "right size" for the industry by the Panama Canal Administrator Mr. Alberto Aleman Zubieta [4]. The Panama Canal expansion project will be operational by 2014. Table 5-1 presents the maximum vessel dimensions for the existing and expanded Panama Canal.

[3] See www.pan-canal.com for detailed information on the planned expansion.
[4] "Panama Canal Expansion will make Waterway a Shipping Hub" Nick Savvides, 23Oct06. Containerization International News Service. See www.ci-online.co.uk