US Army Corps of Engineers ®
Mobile District

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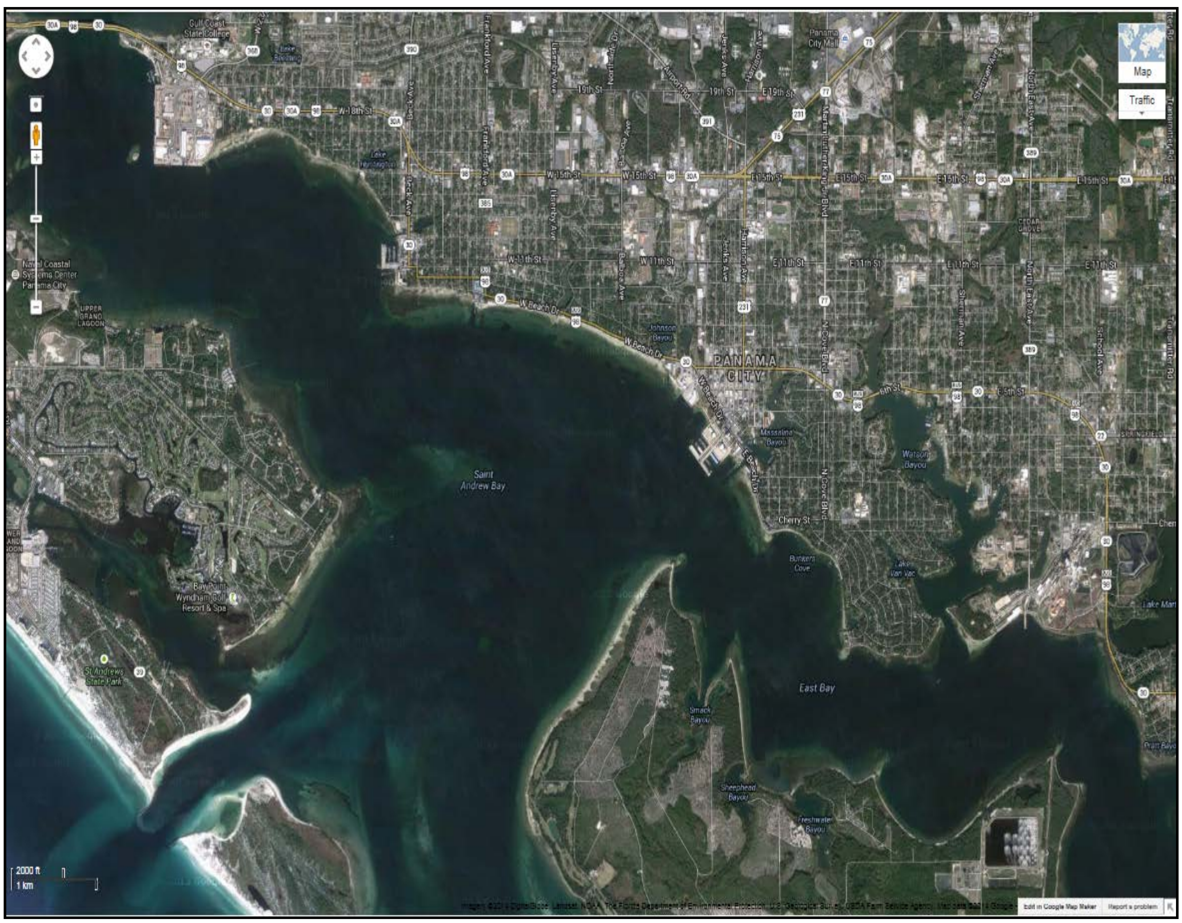
Panama City Harbor Improvements to Bay Harbor Channel Limited Reevaluation Report (LRR) with Integrated Environmental Assessment Panama City, Florida



JANUARY 2016

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FINDINGS OF NO SIGNIFICANT IMPACT

PANAMA CITY HARBOR IMPROVEMENTS TO BAY HARBOR CHANNEL LIMITED REEVALUATION REPORT (LRR) WITH INTEGRATED ENVIRONMENTAL ASSESSMENT PANAMA CITY, FLORIDA

Waterway and Location: Panama City Harbor is located on St. Andrew Bay, an arm of the Gulf of Mexico, about 105 miles east of Pensacola, Florida and 230 miles northwest of Tampa, Florida. The existing navigation project at Panama City Harbor, Florida was authorized by the River and Harbor Act of 1948 (House Document 559, 80th Congress). Project improvements to Bay Harbor Channel were authorized by Section 201 of the Flood Control Act of 1965 (House Document 196, 92nd Congress, 2nd Session) and by resolutions of the House Public Works Committee on 14 June 1972, and the Senate Public Works Committee on 21 June 1972.

The authorized project provides for a channel approximately 3.7 miles long extending from deep water in St. Andrew Bay across Lands End to the Gulf of Mexico, 300 feet wide and 40 feet deep; in the bay and across Lands End, and 450 feet wide, 42 feet deep and about 1.1 miles long in the approach channel in the Gulf, and is protected by two rubble jetties; branch channels 38 feet deep and 300 feet wide, leading from the inner end of the main entrance channel westward to the Panama City Port Authority (PCPA) terminal at Dyers Point and eastward to the Bay Harbor Terminal, about 3.4 and 3.6 miles in length, respectively; turning and maneuvering areas comprising about 55 acres opposite Dyers Point, and 42 acres opposite Bay Harbor, both at a depth of 38 feet; and an anchoring and loading basin for LASH type intermodal carriers, 40 feet deep and containing about 177 acres in St. Andrew Bay near the inner end of the main entrance channel; a channel in Watson Bayou, 100 feet wide and 10 feet deep from that depth in St. Andrew Bay to the highway bridge, about 1.75 miles; a channel 100 feet wide and 8 feet deep in Grand Lagoon to a point about 2,400 feet east.

As District Commander, U.S. Army Corps of Engineers, Mobile District, it is my duty in the role and responsible Federal Officer to review and evaluate, in light of public interest, the stated views of other interested agencies and concerned public, the environmental effects of this proposed action.

My evaluation and findings are as follows:

1. <u>Description of the Proposed Action for Which These Findings are Made</u>. The proposed action for the improved Federal navigation channel at Bay Harbor will deepen the channel from the existing depth of -32 feet mean lower low water (MLLW) to -36 feet MLLW, which will allow the current vessel fleet calling at the Port of Panama City (Port) to enter and exit at a deeper draft. The final Bay Harbor Channel will be approximately 3.5 miles long with a depth of 36 feet, a width of 300 feet, and a turning basin with a length of 1,700 feet and a width of 1,100 feet. Excavation includes an additional 2 feet for allowable overdepth and will require the removal of approximately 372,000 cubic yards of material. Shoaling of the improvement navigation channel would be minimal; however, to ensure channel depths it is anticipated future Operation and Maintenance (O&M) of the navigation channel would require the removal of approximately 40,000 cubic yards on a 4-year dredging cycle.

2. Coordination. Mobile District is coordinating the recommended proposed action with Federal, state, and local agencies and will issue a Public Notice to solicit comments. The U.S. Fish and Wildlife Service provided its Planning Aid Letter, in accordance with the Fish and Wildlife Coordination Act of 1958, as amended (48 Stat. 401; 16 U.S.C. 1531 et seq.), on September 18, 2015.

3. Environmental Effects and Impacts. This proposed action will be in compliance with all environmental laws. A “No Action” alternative was not considered as it would not provide sufficient channel depth for the Bay Harbor to sustain its navigation functions. Dredging and placement of material in this manner meets established regional sediment management principles, environmental operating principles, and minimizes environmental impacts to those protected resources.

4. Determination. Based on the Environmental Assessment (EA) prepared for this project, I have determined that this action does not constitute a major Federal action significantly affecting the quality of the human environment. Therefore, the action does not require the preparation of a detailed statement under Section 102 (2) (c) of the National Environmental Policy Act of 1969 (42 U.S.C. 4321 et seq.). My determination was made considering the following factors discussed in the EA to which this document is attached:

a. The proposed action would not adversely impact or threaten the continued existence of any threatened or endangered species potentially occurring in the project area.

b. No unacceptable adverse cumulative or secondary impacts would result from implementation of this action.

c. The proposed action would not impact cultural resources.

d. The proposed action would result in no significant impacts to air or water quality.

e. The proposed action would result in no significant adverse impact to fish and wildlife resources.

f. The proposed action complies with Executive Order 13045, “Protection of Children from Environmental Health Risks and Safety Risks.”

g. The proposed action complies with Executive Order 12898, “Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations.”

h. Testing of the sediment in the navigation channel has been conducted. Testing results show no evidence of oil detected within the navigation channel.

5. Findings and Conclusions. The proposed action would result in no significant environmental impacts and is the alternative that represents sound natural resource management practices and environmental standards.

Date:__________________ ____________________________

Jon J. Chytka
Colonel, U.S. Army
District Commander

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ACRONYMS AND ABBREVIATIONS

AAE	Average Annual Equivalent
AFB	Air Force Base
AIS	Acoustic Impedance Survey
AM	Adaptive Management
APEs	Areas of Potential Effect
ARA	Abbreviated Risk Analysis
ATON	Aids To Navigation
CEDAS-ACES	Veri-Tech Inc.
CEDEP	Cost Engineering Dredge Estimating Program
CEI	Coastal Environments, Inc.
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
DA	Disposal Area
DU	Dredging Unit
DWT	Deadweight Tons
EA	Environmental Assessment
EIS	Environmental Impact Statement
EFDC	Environmental Fluid Dynamics Code
EFH	Essential Fish Habitat
ERDC	Engineering Research and Development Center
F	Fahrenheit
FDEP	Florida Department of Environmental Protection
FDOT	Florida Department of Transportation
FONSI	Finding of No Significant Impact
FWC	Florida Wildlife Commission
GIWW	Gulf Intracoastal Waterway
GNF	General Navigation Features
GRR	General Reevaluation Report
HTRW	Hazardous, Toxic, and Radioactive Waste
LERR	Lands, Easements, Rights-Of-Way, and Relocations
LOA	Length Overall
LRR	Limited Reevaluation Report
MCACES/MII	Microcomputer Aided Cost Estimating System version 4.2
MLLW	Mean Lower Low Water
MPH	Miles Per Hour
MSL	Mean Sea Level
NAAQS	National Ambient Air Quality Standard

ACRONYMS AND ABBREVIATIONS (cont'd)

NAVD88	North American Vertical Datum 1988
NED	National Economic Development
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NPL	National Priority List
NRHP	National Register of Historic Places
O&M	Operations and Maintenance
OFW	Outstanding Florida Water
OMRR&R	Operation, Maintenance, Repair, Replacement and Rehabilitation
PAHs	Polycyclic Aromatic Hydrocarbons
PPA	Project Partnership Agreement
PCB	Polychlorinated Biphenyl
PCPA	Panama City Port Authority
PDT	Project Delivery Team
PORT	Port of Panama City
PPT	Parts Per Thousand
SAV	Submerged Aquatic Vegetation
SHPO	Florida State Historic Preservation Office
SAD	South Atlantic Division
SVOCs	Semivolative Organic Compounds
SWIM	Surface Water Improvement Management
TCLP	Toxicity characteristic leaching procedure
TPCS	Total Project Cost Summary
TSP	Tentatively Selected Plan
µg/L	Micrograms Per Liter
USACE	U.S. Army Corps of Engineers
USCS	Unified Soil Classification System
USFWS	U.S. Fish and Wildlife Service
USGS	United States Geological Survey
WCSC	Waterborne Commerce Statistics Center
WRDA	Water Resources Development Act

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Panama City Harbor Improvements
to Bay Harbor Channel
Limited Reevaluation Report (LRR) with
Integrated Environmental Assessment
Panama City, Florida

1.0 INTRODUCTION*

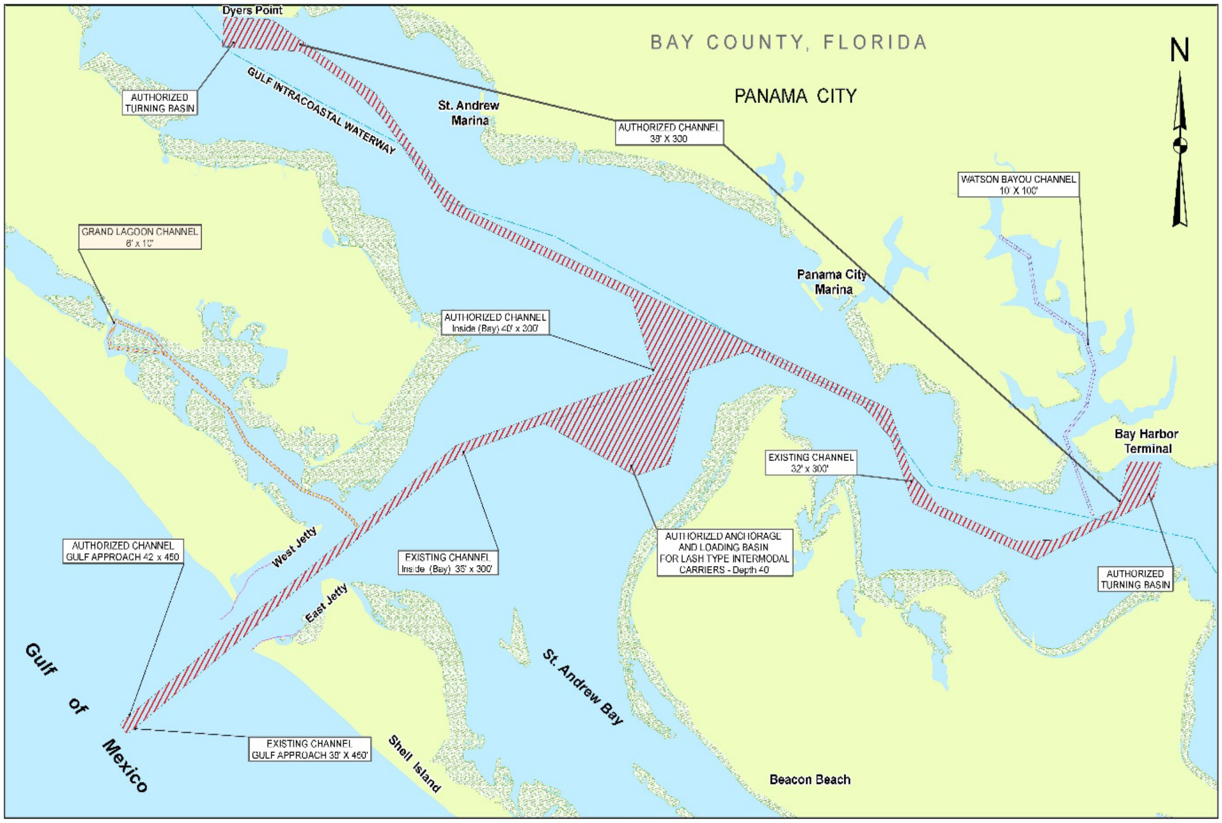
The U.S. Army Corps of Engineers (USACE), Mobile District proposes to deepen the Bay Harbor Channel to a depth of 36 feet at the Panama City Harbor Federal Navigation Project, Panama City, Bay County, Florida. The subsequent dredged material will be placed within an approved in-bay disposal area located adjacent and east of the project area.

The USACE has integrated an Environmental Assessment (EA) within this Limited Reevaluation Report (LRR) to assess the potential impacts associated with deepening the Bay Harbor Channel, the eastern leg of the Federally authorized Panama City Harbor Navigation Project and associated future Operations and Maintenance (O&M) activities. Sections of this LRR marked with an asterisk (*) identify the specific portions that satisfy the requirements of the National Environmental Policy Act (NEPA) to evaluate the potential effects to the human and natural environment.

1.1 Authority

The existing navigation project at Panama City Harbor, Florida was authorized by the River and Harbor Act of 1948 (House Document 559, 80th Congress). Project improvements to Bay Harbor Channel were authorized by Section 201 of the Flood Control Act of 1965 (House Document 196, 92nd Congress, 2nd Session) and by resolutions of the House Public Works Committee on 14 June 1972, and the Senate Public Works Committee on 21 June 1972.

The authorized project, shown in Figure 1-1 provides for a channel approximately 3.7 miles long extending from deep water in St. Andrew Bay across Lands End to the Gulf of Mexico, 300 feet wide and 40 feet deep; in the bay and across Lands End, and 450 feet wide, 42 feet deep and about 1.1 miles long in the approach channel in the Gulf, and is protected by two rubble jetties; branch channels 38 feet deep and 300 feet wide, leading from the inner end of the main entrance channel westward to the Panama City Port Authority (PCPA) terminal at Dyers Point and eastward to the Bay Harbor Terminal, about 3.4 and 3.6 miles in length, respectively; turning and maneuvering areas comprising about 55 acres opposite Dyers Point, and 42 acres opposite Bay Harbor, both at a depth of 38 feet; and an anchoring and loading basin for LASH type intermodal carriers, 40 feet deep and containing about 177 acres in St. Andrew Bay near the inner end of the main entrance channel; a channel in Watson Bayou, 100 feet wide and 10 feet deep from that depth in St. Andrew Bay to the highway bridge, about 1.75 miles; a channel 100 feet wide and 8 feet deep in Grand Lagoon to a point about 2,400 feet east



Panama City Harbor
Channel Locations

Figure 1-1. Authorized Project Map Panama City Harbor, Florida

of State Highway 392 Bridge with branches to serve terminal facilities on the north and south shores, both channels terminating at the bridge where they are connected by a channel running parallel to the highway; the connecting channel and the reaches opposite the terminal facilities are 8 feet deep by 150 feet wide.

1.2 Existing Project

The Panama City Harbor Federal Navigation Project currently consists of the following: A 450-foot wide Gulf approach channel from a point in the Gulf of Mexico extending into the mouth of the inlet cut to -38 feet mean lower low water (MLLW) with 2 feet advance maintenance and 2 feet allowable over depth for approximately 4.9 miles in length; in the mouth of the inlet, alongside the channel for a distance of 600 feet, a 300-foot wide sedimentation basin of equal depth to the channel; gradually narrow the channel to a width of 300 feet over a distance of 1,600 feet with a sedimentation basin tapering to a maximum of 75 feet wide alongside the narrowing channel for a distance of 3,200 feet; continue the 300-foot wide channel into the bay for a distance of 6,200 feet, to the inner end of the main entrance channel, with a depth of -36 feet at MLLW plus 2 feet of advance maintenance and 2 feet of allowable over depth. The entrance channel is protected by two stone jetties about 1,500 feet apart, the lengths of which are approximately 2,100 feet for the east jetty and 2,800 feet for the west jetty. A 300-foot wide channel westward, approximately 3.4 miles long to Dyer's Point with a depth of -36 feet MLLW plus 2 feet of allowable over depth with a 55-acre turning basin at the westward turn of the channel with a depth of -36 feet at MLLW 2 feet of allowable overdepth; and an approximately 17 acres at Dyer's Point to a depth of -36 feet at MLLW plus 2 feet allowable overdepth.

The 3.5 mile long Bay Harbor Channel has never been dredged, however the natural depth of St. Andrew Bay has allowed for a 300 feet wide and 32 feet deep channel. Recent shoaling in a few areas of this channel has restricted the allowable draft of transiting ships to under 30 feet.

1.3 Purpose and Scope

At the request of the PCPA, the USACE is evaluating the engineering, economics, and environmental acceptability of deepening the Bay Harbor Channel of the Port of Panama City (Port). The PCPA requested the USACE to study deepening the channel within its authorization to 36 feet in order to provide access for larger vessels entering the Bay Harbor Terminal. The PCPA has maximized their port operations at their current location, Dyer’s Point, and has developed a Port Master Plan which describes their future vision. In accordance with this master plan, the Port has begun the process of acquiring the necessary real estate interest from WestRock Paper Mill in order to gain deep water access and expand PCPA facilities at Bay Harbor Terminal.

Currently, the existing vessels calling on Bay Harbor Terminal are required to change the natural port rotation due to depth restrictions which result in inefficient port-rotations and in some cases cause double-rotation between other nearby ports located in Mobile and Pascagoula. Under future conditions and without further improvements, it is highly anticipated that one carrier that utilizes these larger vessels will stop calling on Bay Harbor completely due to loading deeper in prior ports on their rotation schedule.

The purpose of the proposed channel deepening is to ensure continued navigation to Bay Harbor Terminal. This will allow PCPA to expand the terminal through a real estate transfer between PCPA, a public port entity, and the private port facility currently operating at the terminal. Bay Harbor Channel improvements will ensure future port growth and more efficient operations by eliminating the need to double rotate. The Bay Harbor Channel improvements will provide the following:

- Retaining and accommodating recent and anticipated growth in cargo and vessel traffic;
- Improving the efficiency of vessel operations.

Globalization and large increases in commodity trade are significantly increasing shipping demands around the world. Technological advances have accelerated trends towards producing larger ships to meet these economic pressures. The proposed project will improve operating conditions and efficiency in the channel and harbor by providing adequate depth for the current fleet to access the Bay Harbor Terminal. This will also allow for expansion of existing and new products for import and export.

The PCPA is the non-Federal Sponsor for this LRR and has requested the USACE study a depth of 36 feet. This LRR will update the engineering, economics, and environmental conditions as related to selected alternatives considered in the project's feasibility study.

1.4 Study Area

Bay Harbor Terminal is located on St. Andrew Bay, an arm of the Gulf of Mexico, about 105 miles east of Pensacola, Florida and 230 miles northwest of Tampa, Florida as shown on Figure 1-2, Location Map.

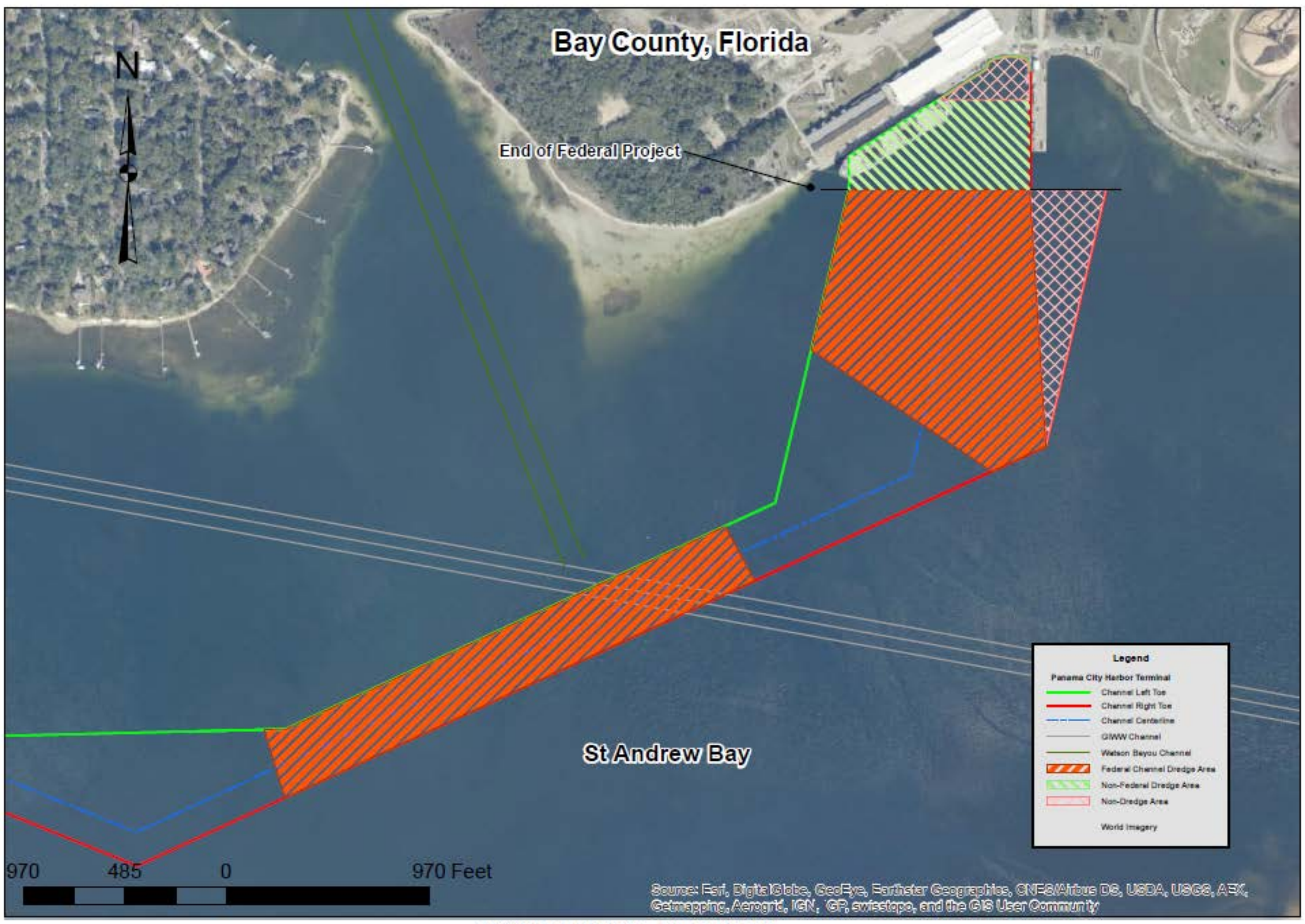
Figure 1-2. Location Map

St. Andrew Bay is a body of water about 20 miles long that runs parallel to the northwest Florida coast. Natural depths within the bay range up to about 50 feet with about seven square miles having a depth of 30 feet or more. A barrier beach formerly known as Lands End Peninsula separates St. Andrew Bay from the Gulf of Mexico. The Federal navigation project that currently exists created a channel through the peninsula and the portion of the peninsula east of the channel is now known locally as "Shell Island." The bay had two outlets to the Gulf, one a natural inlet at the eastern end of Lands End Peninsula that has now naturally closed off and the other, a dredged channel which runs through the barrier peninsula about four miles west of the natural opening. The dredged cut has been stabilized by two rubble-mound jetties and serves as the Panama City Harbor Federal Navigation Project entrance from the Gulf.

St. Andrew Bay is extended to the east by East Bay and to the northwest by West Bay and North Bay, each about 10 miles long. The City of Panama City is located on the north shore of St. Andrew Bay about 3.5 miles from the Gulf entrance. Facilities to accommodate ocean shipping, barge traffic, commercial fishing vessels and recreational craft extend along the city's waterfront. The PCPA terminal is located at Dyers Point, at the western limits of the city and the western end of St. Andrew Bay. Bay Harbor Terminal is located to the east at the mouth of Watson Bayou. The Gulf Intracoastal Waterway (GIWW) traverses West Bay, St. Andrew Bay, and East Bay enroute between Pensacola and Carrabelle, Florida.

St. Andrews State Park, adjacent and to the western side of the Panama City Harbor entrance channel, is the major park within the project limits. The park encompasses an area of 1,022 acres with 6,000 feet of beachfront on the Gulf of Mexico. It offers picnicking, swimming, fishing, nature trails, boating and camping. In addition, sea turtles use the beach for nesting and the park contains a coastal freshwater lake known as Gator Lake.

The non-Federal portion of the Bay Harbor Terminal, the eastern leg of the Panama City Harbor Federal Navigation project, consists of a berthing area adjacent to the WestRock Paper Mill dock and facilities. Responsibility for maintenance dredging the berthing area falls upon the non-Federal sponsor; however, since it is an integral part of the overall Federal project, the LRR also evaluates improvements to this portion along with the deepening of the Bay Harbor Channel. The berthing area is shown on Figure 1-3.



BAY COUNTY, FLORIDA
PANAMA CITY HARBOR TERMINAL CHANNEL PROPOSED DREDGING

Figure 1-3. Federal Project Limits

1.5 Non-Federal Sponsor

The non-Federal Sponsor, PCPA, handles a wide variety of cargo. In recent years the PCPA has invested over $50 million in new facilities and equipment, and has committed to another $35 million in improvements over the next five years. The PCPA provides complete terminal services. The PCPA has consistently supported the deepening of the Bay Harbor Channel in order to preserve and enhance the cargo operations at Bay Harbor Terminal.

The PCPA Board authorized the Port Director to enter into a Design Agreement with the USACE for the deepening of the Bay Harbor Terminal in January 2013. The Design Agreement for the Panama City Harbor LRR was signed by the Port Director in May 2013 (see Appendix A - Correspondence). The non-Federal sponsor is totally engaged with the LRR process and considers the Bay Harbor Terminal deepening and the development of new modern cargo facilities on the WestRock site as its number one priority. Copies of these letters are included in Appendix A – Correspondence.

Based on current real property ownership at the Bay Harbor Terminal port facilities located at the terminus of the Panama City Terminal Channel, SWF Gulf Coast, Inc., which is now known as WestRock Company, due to mergers of MeadWestvaco and RockTenn, holds fee interest into the said lands adjoining channel and those pier operations located at One Everitt Avenue, Panama City, FL. The non-Federal sponsor and RockTenn, LLC (now WestRock), entered into a Letter of Intent (LOI), dated May 27, 2014 for conveying a fee interest to the non-Federal sponsor into certain lands in order to satisfy multiple user requirements as required by Engineering Regulation (ER) 1165-2-123 Water Resources Policies and Authorities, Single-Owner Situations, October 1992. The LOI was further confirmed in a follow-up agreement letter between the non-Federal sponsor and WestRock dated November 17, 2015 (see Real Estate, Appendix F). The PPA will document the requirement that the non-Federal sponsor shall retain fee ownership of those lands for the economic life of the project. No credit will be afforded the non-Federal sponsor for this land conveyance since the purpose of said conveyance is to meet project eligibility.

1.6 Prior Studies

Survey Report on Panama City Harbor, Florida (1970). This report was a feasibility analysis and recommended a 42-foot by 450-foot Gulf Approach Channel with 38-foot channels to Dyers Point and Bay Harbor Terminals, turning and maneuvering areas opposite the terminals, and a 40-foot anchoring and loading basin for LASH type intermodal carriers. This report was the basis for project authorization.

A Final Environmental Impact Statement (EIS) entitled, *Final Environmental Impact Statement, Panama City Harbor, Navigation Project* was prepared in October 1971, to address the continued O&M of the Federally authorized navigation project.

Initial Appraisal (1988). The objective of this investigation was to establish existence of a feasible project as justification for recommending a new start under the General

Investigation Program. The report recommended resumption of Planning, Engineering and Design (PED).

Panama City Harbor, Florida General Reevaluation Report (GRR) (1995). The GRR completed a reformulation of the Panama City Harbor Federal Navigation Project. The locally preferred plan, which was smaller than the National Economic Development (NED) Plan, was recommended. This plan consisted of a 38-foot by 450-foot Gulf Approach Channel, a 36-foot by 300-foot Inner Harbor Channel to Dyers Point and a turning basin adjacent to the Dyers Point Terminal. An EA and Finding of No Significant Impact (FONSI) and Section 404(b)(1) Evaluation Report were prepared to address potential impacts that could result from channel improvements in accordance with NEPA.

Panama City Harbor, Florida Limited Reevaluation Report (2001). This LRR analysis was limited to confirmation of the plan recommended in the previous GRR. A plan smaller than the recommended plan was evaluated to confirm that the net economic benefits were increasing over the relevant range. Evaluation of this smaller plan was also necessary to insure that all cost sharing implications were considered.

Water Quality Certifications have been obtained for continued O&M activities for Panama City Harbor that provide NEPA coverage for maintenance dredging of the main channel, sedimentation basins, Dyer's Point, and rehabilitation of the project jetties.

The Bay Harbor Channel is a naturally occurring deep channel and no improvements or maintenance activities have occurred within this segment of the Panama City Harbor Federal Navigation Project.

2.0 PROBLEMS, OPPORTUNITIES, OBJECTIVES, AND CONSTRAINTS*

2.1 Problems and Opportunities

The Bay Harbor Terminal is a deep-water harbor offering access to the Gulf of Mexico and the Gulf Intracoastal Waterway. The existing 32-foot navigation channel has produced depth-related operational inefficiencies for the fleet servicing the Port.

New cargo opportunities for export and import at Bay Harbor are expected in the with project condition. Agreements have been made that with a deeper channel and vessels continuing to call, wood pulp and linerboard from other mills in the southeast will be exported over the Bay Harbor Terminal. The tonnage is currently moving through the Port of Pascagoula, however, it would be more efficient for landside transportation to be exported from Panama City. Other cargo opportunities with expansion of the landside facilities at Bay Harbor include steel, cement and lumber. The hinterland for the new cargo is the southeast, specifically Florida, Alabama and Georgia.

The Bay Harbor Channel deepening project and related terminal improvement plans are important to the future of the facilities on both the east and west channels. Over the last 15 years the PCPA has achieved an average year over year growth rate of 15 percent. Currently, PCPA is on track to handle over two million tons of cargo for the first time. While PCPA has increased its tonnage, it has also diversified its cargo base to include copper cathodes, kraft linerboard, steel coils, steel plate, containerized cargo, project cargoes, wood pellets, aggregates, and molasses.

Without the Bay Harbor Channel improvements project, the local sponsor will continue to experience transportation inefficiencies. The proposed channel improvements included within this report present the best opportunity to improve channel efficiency.

2.2 Goals and Objectives

The study goal and Federal objective is to contribute to the NED account consistent with protecting the Nation's environment. Both of these objectives must be consistent with national legal statutes, applicable executive orders, and other Federal planning requirements. The objective of this study is to maximize the transportation efficiency of the Bay Harbor Navigation Channel. The period of analysis is 2020-2069.

2.3 Environmental Operating Principles

The Mobile District is committed to implementing the USACE Environmental Operating Principles in the Panama City Harbor, Bay Harbor Terminal Channel Improvement Project consistent with the Federal Standard as defined at 33 CFR 335.7 and identified by the USACE which represents the least costly alternative consistent with sound engineering practices and meeting the environmental standards established by the 404 (b)(1) evaluation process.

- Foster sustainability as a way of life throughout the organization.
  - *The project considered the sustainability of both the existing deep-water navigation project at Panama City and the natural resources within the area. The proposed channel deepening would allow the "at-capacity" port to expand its current operations and continue to serve its customers in a more effective manner by ensuring continued vessel calls at the Port while assuring the sustainability of area natural resources.*
- Proactively consider environmental consequences of all USACE activities and act accordingly.
  - *The PDT worked closely with environmental agencies, both State and Federal, to review proposed project requirements and how those requirements will impact the environment and what can be done to minimize impacts.*
- Create mutually supporting economic and environmentally sustainable solutions.
  - *The project has been designed to allow sustainability for both mankind and the natural environments. Mitigation is not required as a result of implementation.*
- Continue to meet our corporate responsibility and accountability under the law for activities undertaken by the USACE which may impact human and natural environments.
  - *The project will not impact human health and welfare in the project vicinity.*
- Consider the environment in employing a risk management and systems approach throughout life cycles of projects and programs.

- *The USACE considered cumulative impacts in its assessment of the ecological and social value of resources that the project would impact. The project features were designed recognizing the present and expected future status of environmental resources, how those resources function in the project area, and how those resources are influenced by man's activities.*

- Leverage scientific, economic, and social knowledge to understand the environmental context and effects of USACE actions in a collaborative manner.
  - *The adoption of stakeholder input will be sought through various meetings to assure that possible impacts from project deepening will be identified and evaluated.*

- Employ an open, transparent process that respects views of individuals and groups interested in USACE activities.
  - *Future inclusion of the general public, stakeholders, and others in the study process will insure the identification of valuable concerns and suggestions that will be considered during the planning process.*

2.4 Sea Level Change

USACE guidance requires consideration of projected future sea-level changes and impacts in project planning, design, and O&M. Because future sea level rise rates are uncertain, planning and design should consider project performance for a range of sea level change rates.

Project area of interest generally includes the area surrounding the jetties at the entrance to St. Andrew Bay, the Panama City Harbor navigation channels, the Port of Panama City, Dyers Point, the Bay Harbor navigation channel, and the proposed expansion location at Bay Harbor Terminal. Several readily available analytical tools were used for the purpose of determining the range of potential sea level change around the project area of interest including:

- NOAA Tides and Currents *Sea Level Trends* product http://tidesandcurrents.noaa.gov/sltrends/sltrends.html
- NOAA *Sea Level Rise and Coastal Flooding* Impacts map http://coast.noaa.gov/slr/
- USACE *Sea Level Change Curve Calculator* http://www.corpsclimate.us/ccaceslcurves.cfm
- USACE *Wave Information Studies* http://wis.usace.army.mil/

Figure 2-1 shows a graph of projected sea level changes for the next 100 years under the low, intermediate, and high USACE scenarios. Not shown on the graph is the National Oceanic and Atmospheric Administration (NOAA) projected relative sea level rise for Station #8729108 within the St. Andrew Bay.

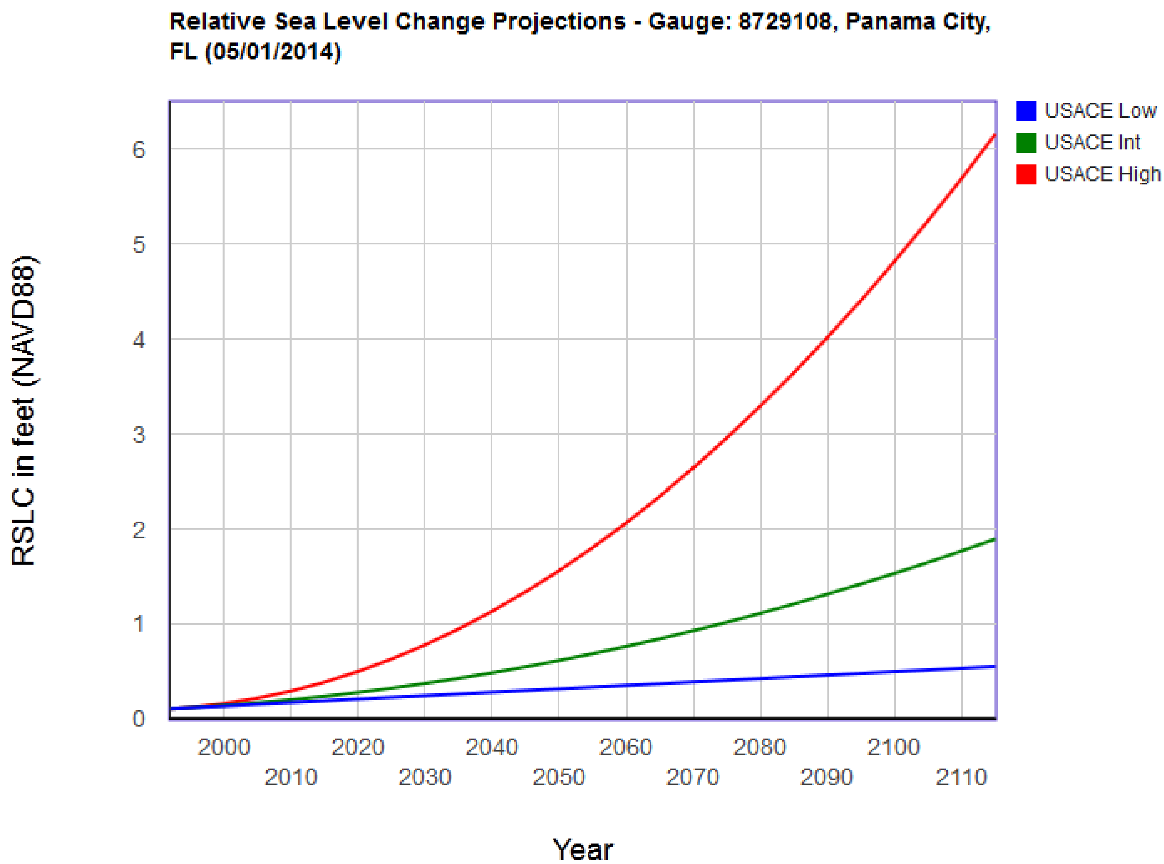


Figure 2-1. Sea Level Rise Projections under USACE Low, Intermediate, and High Rates

System impacts related to the project area under the influence of sea level changes include habitat reduction, threats to critical infrastructure, and an increase in the magnitude and frequency of flooding. Changes in coastal processes and water depths due to sea level changes also have the potential to increase destructive forces on the jetty structures at the mouth of the St. Andrew Bay.

2.5 Constraints

Planning constraints are technical, environmental, economic, regional, social and institutional considerations that act as impediments to successful response to the planning objectives or reduce the threat of possible solutions.

Technical Constraints

- Plans must represent sound, safe, acceptable engineering solutions.
- Plans must be in compliance with Corps regulations.
- Plans must be realistic and state-of-the-art.

Economic Constraints

- Plans must be efficient. They must represent optimal use of resources in an overall sense.
- The economic justification of the proposed project must be determined by comparing the average annual tangible economic benefits, which would be

realized over the project life with the average annual costs. The average annualized economic benefits must equal or exceed the annualized economic costs.

Environmental Constraints

- National Environmental Policy Act documentation must be fully coordinated.
- Water-quality standards must be maintained during construction activities and future O&M activities in accordance with water quality certification requirements, short-term and long-term.

Regional and Social Constraints

- No favoritism can be shown; all reasonable opportunities for development within the study scope must be considered and the views of state and local public interests must be solicited.
- The needs of other regions must be considered and one area cannot be favored to the unacceptable detriment of another.

Institutional Constraints

- Plans must be consistent with existing Federal, State and local laws.
- Plans must be locally supported to the extent that local interest must, in the form of a signed project partnership agreement, guarantee for all items of local participation including possible cost sharing.
- The plan must be fair and find overall support in the region and State.

3.0 EXISTING AND FUTURE WITHOUT PROJECT CONDITIONS*

3.1 Physical Setting

The following sections give physical setting of St. Andrew Bay for the existing and future without project conditions.

3.1.1 Geology

St. Andrew Bay is within the regional “Coastal Plain physiographic province” (Brim and Handley) and the regional geologic structure is a simple monocline dipping to the southwest at 30 to 40 feet per mile (USACE, 2001).” The physiography surrounding the bay is further subdivided into the Flat-Woods Forest Physiographic Subdivision to the north, southeast, and southwest, and the Beach Dune and Wave Cut Bluffs Subdivision to the south along the coast (Schmidt and Clark, 1980). The Flat-Woods Forest Division is slightly rolling to flat land lying on marine terraces below an elevation of 70 feet. Further inland, approximately 4,000 feet north of St. Andrew Bay, elevations rarely exceed more than 35 feet above mean sea level (MSL). Southeast and southwest of St. Andrew Bay there are low lying forested wetlands averaging elevations of 10-14 feet above MSL. The Beach Dune and Wave Cut Bluffs Subdivision on the south side of the bay contain “barrier island beaches, coastal ridges, estuaries, lagoons, relict spits and bars, and sand dune ridges. All of these features are generally parallel to the present coast, indicating an origin shaped by coastal environments (Schmidt and Clark, 1980).” At the shore, the beach elevation is generally less than 10 feet above MSL.

"Near-surface sands cover the majority of Bay County and consist of unconsolidated white to light gray quartz sand. Grain sizes range from very fine to gravel, and are subangular with medium sphericity. Heavy minerals are present (up to 19 percent), with phosphorite beginning to appear near the base of the unit (Schmidt and Clark, 1980)." Pliocene sediments in the region "belong to the Citronelle Formation and are mostly sands and gravel with lenses of clay. Late Pleistocene to recent marine estuarine deposits of silty sand and sandy clays are found at or near the surfaces close to the coast (USACE 2001)." The "surface stratigraphy [is] composed largely of post-Pleistocene sands, and is classified as coastal integrated drainage" due to the local streams draining the region (Brim and Handley). St. Andrew Bay is not considered a "true" estuary as it does not receive significant river flow. Since there is not a large river emptying into the St. Andrew Bay, there "is little sedimentation and associated turbidity in this bay" (Brim and Handley, 2006). The composition of the sediment within St. Andrew Bay is variable but, according to the United States Geological Survey (USGS), studies have indicated that there is a "positive correlation of increased silt and clay content as distance from the inlet increases (Brim and Handley, 2006)." Most of the recent shoreline changes in the project area have been due to modifications to the St. Andrew Bay entrance channel and GIWW, which were constructed in 1938 and ~1960, respectively.

3.1.2 Climate

The climate in Panama City is classified as semi-tropical with January being the coldest month and August the hottest. The first and last killing frost normally occurs during the latter part of November and February, respectively. January has a mean minimum temperature of 47°Fahrenheit (F) and a mean maximum temperature of 63°F. Although August temperatures sometimes go over 100°F, the mean maximum and minimum temperatures for this month are 89°F and 75°F. The average annual maximum and minimum temperatures are 79°F and 62°F. Average rainfall for Panama City is 59.12 inches per year with July being the wettest month. These conditions contribute to a long growing season that averages 285 days a year. However, Panama City is also located at latitudes prone to severe tropical storms, subjecting the area to extreme climatic changes associated with passing hurricanes and tornadoes.

3.1.3 Bathymetry

The significance of bathymetry would be a permanent change in depth that would affect currents, tides, and or natural water movement in St. Andrew Bay. St. Andrew Bay is naturally deep, and with no large rivers emptying into it, there is very little shoaling. Because of this it is unlikely that there will be any significant change in the bay bathymetry during normal tidal cycles. However, large changes in the bay bathymetry could be caused by hurricane storm tides which can potentially move large volumes of sediment within the bay.

3.1.4 Sediment Quality

The USACE, Mobile District, by contract, collected and analyzed sediment samples to conduct physical, chemical Tier II testing including elutriates from the proposed improvements dredge areas within the Federal Navigation Project at Bay Harbor Terminal. Efforts consisted of collecting sediment samples and sufficient site water within four separate dredge areas, Outer Channel, Inner Channel, Outer Turning Basin, and Inner Turning Basin. The purpose of the evaluation was to collect samples representative of the material proposed for dredging and perform physical and chemical evaluations to facilitate determination of appropriate placement options.

Physical testing included grain size, specific gravity, and total solids for each individual location as well as grain size for subsamples from each core as shown on Figure 3-1. Chemical concentrations of semivolative organic compounds (SVOCs), metals (including mercury), chlorinated pesticides, polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyl (PCBs) congeners, dioxin/furan congeners, and numerous others listed in the sediment evaluation report in Appendix E - Environmental Correspondence. Toxicity characteristic leaching procedures (TCLP) were identified in whole-core composites from individual locations. Lithologic core logs were prepared for one core from each location and each core was sub-sampled for grain size analysis at intervals determined by lithologic changes.

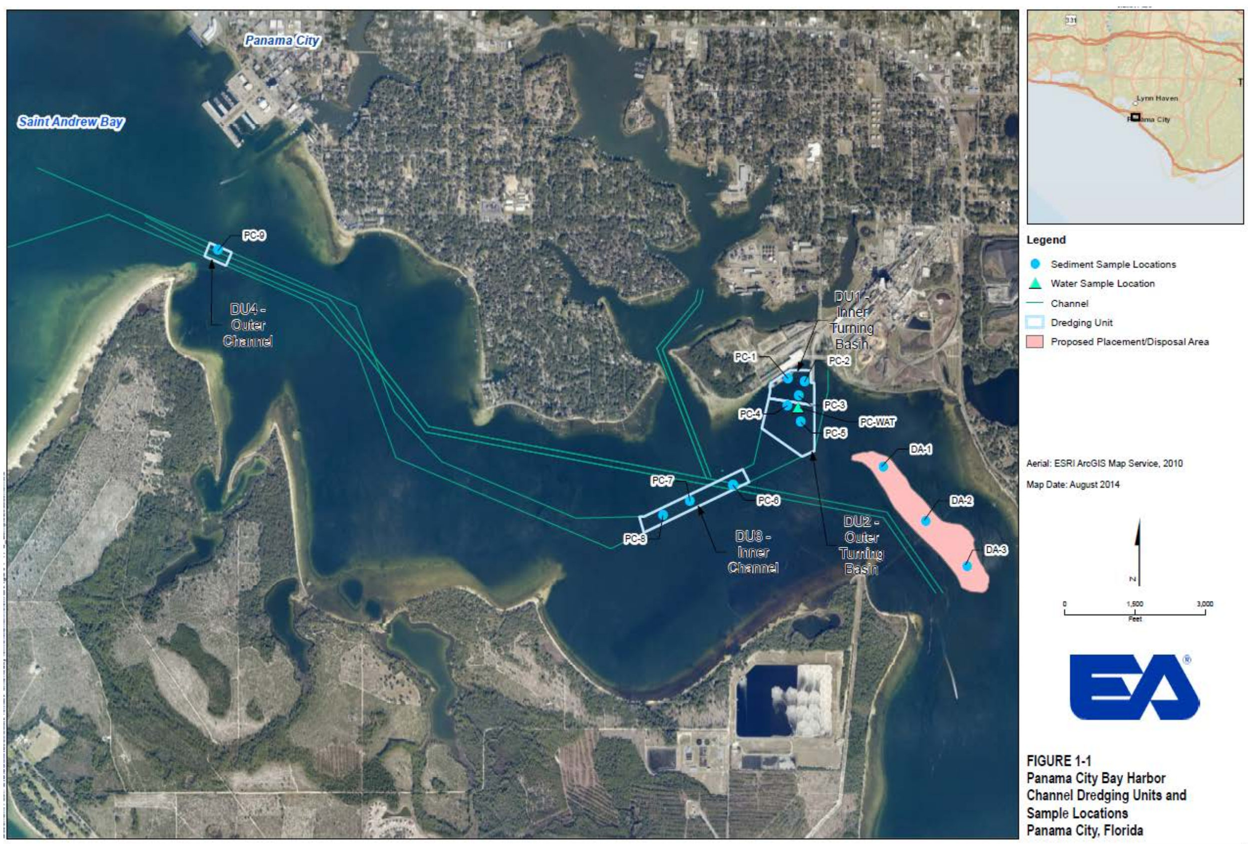


Figure 3-1. Bay Harbor Channel Sediment Testing Locations

The sampling and testing design was intended to provide a first-step, screening-level assessment to determine if any contaminants were present at concentrations that would require special handling, treatment or management to help determine disposal options. Based on the results of the screening-level assessment and through further coordination with Florida's Department of Environmental Protection (FDEP), it was determined additional sampling/testing was necessary to further delineate contaminants, assess water quality impacts during dredging to help formulate disposal alternatives. The results of sediment evaluation are found in Appendix E - Environmental Correspondence.

The second round of sampling and testing was based on the earlier results and through further coordination with FDEP, it was determined that elutriate tests were needed for PCB and dioxin/furan congener concentrations to assess possible water quality impacts during dredging and subsequent placement activities within an in-bay disposal area. The dredging prism of each dredging unit (DU) were targeted in and standard elutriates, which simulate release of metals and organic constituents in the water column during in-bay placement of dredged material were prepared for each of the DU composite samples and one grand composite sample, comprised of representative volumes from each DU. Surficial sediment was collected with a grab sampler at the disposal/placement site and compared to bulk sediment samples from each DU and the grand composite sample to determine if project samples were of similar physical and chemical quality. The testing locations are shown on Figure 3-1. The testing protocols developed and summary reports are found in Appendix E - Environmental Correspondence.

Lab gradation testing of each DU composite sample and the disposal area (DA) sample indicate that the project area is composed predominantly of sand and gravel, with lesser amounts of silts and clays. Shell hash is also present in some of the samples, but was not specifically quantified. The DU samples had sand content ranging from 63.9 to 78.4 percent, with a volumetrically-weighted composite content of 66.1 percent for the Grand sample. The gravel content ranged from 1.1 to 15.6 percent within the DU samples, and 14.9 percent within the volumetrically-weighted composite content for the Grand sample. Silts and clays ranged from 13.9 to 27.3 percent, with a volumetrically-weighted composite content of 19 percent for the Grand sample. The disposal area composited sample contained 76.5 percent sand and 0 percent gravel, while silts and clays tested at 23.5 percent. Four of the sediment samples were classified as clayey sand, SC (DA, DU1, DU3, and GRAND), one was classified as silty sand, SM (DU2), and one was classified as silty sand with gravel, SM (DU4). The DA was classified as Clayey Sand (SC).

Five standard elutriate samples were created using each of the four DU sediment samples and grand composite sediment sample and the site water collected in June 2015. Results of the PCB aroclor analyses for site water and standard elutriates from the Bay Harbor Channel project are presented in Table 3-1. None of the seven tested individual PCB aroclors were detected in the site water or in the DU2, DU3, DU4, or grand composite standard elutriates. PCBs 1254 and 1260 were detected in the DU1 standard elutriate at concentrations of 0.02 and 0.011 micrograms per liter (µg/L), respectively. The total PCB aroclor (ND=0) concentration was 0.03 µg/L in the standard elutriate for DU1, which is equivalent to the surface water quality standard.

The results of the PCB aroclor analyses for site water and standard elutriates from the Bay Harbor Channel are presented in the Sediment Evaluation Report in Appendix E - Environmental Correspondence.

The results of the dioxin and furan congener analyses for site water and standard elutriates from the Bay Harbor Channel project are provided in the Sediment Evaluation Report in Appendix E - Environmental Correspondence. The most toxic congeners, 2, 3, 7, 8-TCDD and 1, 2, 3, 7, 8-PECDD, were not detected in the elutriates. Each of the detected dioxin/furan congeners was estimated below the laboratory reporting limit. The dioxin TEQ (ND=0) was 0.026 pg/L in the elutriate from DU1 and exceeded the contaminant target clean-up level (0.005 pg/L).

Table 3-1
PCB Aroclor Concentrations (µg/L)
in Site Water and Standard Elutriates
Panama City Harbor, Bay Harbor Channel

				PC-WAT	DU1-SET	DU2-SET	DU3-SET	DU4-SET	GRAND-SET
ANALYTE	UNITS	Average RL	Surface Water Quality Standards*	Site Water	Panama City Inner Turning Basin	Panama City Outer Turning Basin	Panama City Inner Channel	Panama City Outer Channel	Volume-Weighted by DU
PCB-1016	UG/L	3.13	--	0.0095 U	0.01 U	0.01 U	0.01 U	0.01 U	0.0094 U
PCB-1221	UG/L	3.13	--	0.0095 U	0.01 U	0.01 U	0.01 U	0.01 U	0.0094 U
PCB-1232	UG/L	3.13	--	0.0095 U	0.01 U	0.01 U	0.01 U	0.01 U	0.0094 U
PCB-1242	UG/L	3.13	--	0.0095 U	0.01 U	0.01 U	0.01 U	0.01 U	0.0094 U
PCB-1248	UG/L	3.13	--	0.0095 U	0.01 U	0.01 U	0.01 U	0.01 U	0.0094 U
PCB-1254	UG/L	3.13	--	0.0095 U	**0.02**	0.01 U	0.01 U	0.01 U	0.0094 U
PCB-1260	UG/L	3.13	--	0.0095 U	**0.011**	0.01 U	0.01 U	0.01 U	0.0094 U
Total PCBs (ND=0)	UG/L	--	0.03	**0.00**	**0.03****	**0.00**	**0.00**	**0.00**	**0.00**

**Source*: F.A.C. 62-302.530
** equivalent to the surface water quality standards
NOTES: Bold values represent detected concentrations.
RL is reported for non-detected constituents.
RL = average reporting limit U = compound was analyzed, but not detected

3.1.5 Tides and Waves

The mean astronomical tide range at Panama City Beach, Florida is 1.25 feet. Hurricanes and storms that affect the area yield much higher water level variations; for example, Hurricane Opal produced a storm tide elevation of 15.6 feet North American Vertical Datum 1988 (NAVD88) in 1995 along the Panama City open coast. The height of breaking waves during Hurricane Opal added up to 10 feet to the reported storm surge in some areas along the northwest Florida coastline in the vicinity of the project area. (Federal Emergency Management Agency)

The CEDAS-ACES (Veri-Tech, Inc.) Program was utilized to evaluate the fetch-limited wave height that the Bay Harbor Terminal port facilities might be subjected to. The parameters and results of the wave-height analysis are presented in Figure 3-2. The

ASCE 7-10 3-second peak gust for a 25-year return period as 90 miles per hour (mph), which is approximately equivalent to a 60 mph, one hour duration wind speed was used for the fetch-limited wave analysis.

Case: PCH LRR Fetch-Limited Wave Height

Windspeed Adjustment and Wave Growth

Breaking criteria 0.780

Item	Value	Units
El of Observed Wind (Zobs)	25.00	feet
Observed Wind Speed (Uobs)	90.00	mph
Air Sea Temp. Diff. (dT)	0.00	deg F
Dur of Observed Wind (DurO)	3.00	sec
Dur of Final Wind (DurF)	1.00	hours
Lat. of Observation (LAT)	30.00	deg
Results		
Wind Fetch Length (F)	2.21	MILES
Wind Direction (WDIR)	150.00	deg
Eq Neutral Wind Speed (Ue)	55.90	mph
Adjusted Wind Speed (Ua)	87.04	mph
Mean Wave Direction (THETA)	146.00	deg
Wave Height (Hmo)	3.64	feet
Wave Period (Tp)	3.53	sec

Wind Obs Type	Wind Fetch Options
Overwater	Deep restricted

Restricted Fetch Geometry

#	Fetch Angle (deg)	Fetch Length (miles)
1	130.00	1.15
2	140.00	2.10
3	150.00	2.40
4	160.00	1.10
5	170.00	0.92
6	180.00	0.96
7	190.00	1.10
8	200.00	1.37
9	210.00	1.55
10	220.00	1.54
11	230.00	1.51

Wave Growth: Deep

Figure 3-2. Fetch-Limited Wave Height Analysis for Port Facilities adjacent to Watson Bayou

3.1.6 Sea Level Change

The 100- year high rate of sea level change will expand the potentially impacted project area into locations that will require protection or upgrades to existing project features.

- The jetty structures will experience increased wave forcing and the open coast shoreline is anticipated to experience increased long-term erosion.
- Bay side infrastructure and facilities may require additional engineering measures be taken to maintain their current level of protection against storm tides.

Based on the 100-year high rate curve horizontal and vertical project extents, the function or operation of the port facilities and infrastructure serving the Port may change if the shore protection adjacent to the docks or rails lines/roads is compromised under increased sea level rise or storm attack.

Wave overtopping during storm tide expected from the high rate of projected sea-level rise will increase at the Bay Harbor bulkhead and docks. It may be recommended to modify the existing infrastructure at this location if the high rate of sea-level change is realized.

The jetty structures at the St. Andrew Bay inlet have undergone several rehabilitations and modification and it may be necessary to increase maintenance along this open coast area if the sea level rise, erosion rates, storm tides, and flood frequency all increase over the project horizon.

As discussed in Appendix B - Engineering, it is assumed that the magnitude and frequency of flooding that result from sea level changes under the relative sea level rise scenario will happen at a rate which can be adapted to over time. If sea level changes accelerate under the intermediate or high rates of change, adaptation may be difficult without changes to infrastructure or flood defense mechanisms.

Coastal Processes

The St. Andrew Bay is considered a deep bay and alterations to the channel depth are relatively small in comparison to the existing water depths. These modifications are not currently anticipated to significantly exaggerate the effects of sea-level change on coastal processes at this project.

Coastal processes known to be effected by a change in sea level or precipitation which may be influenced by navigation channel modifications are as follows:

- Waves
    - Waves within the St. Andrew Bay are fetch-limited; therefore, the effects of sea level change within the next 100-years are not likely to yield a significant effect on the wave climate in this Bay.

- Shoaling and siltation
    - In the absence of a large river system, there "….is little sedimentation and associated turbidity in this bay". (Brim & Handley, 2006) Shoaling and siltation rates adjacent to the channel have the potential to rise if precipitation in the region is increased due to climate change; however, the magnitude of these impacts cannot be characterized at this time.

- Tidal currents
    - Modeling work performed for this study did not indicate that there was appreciable circulation within the St. Andrew Bay due to tidal currents. Based on existing knowledge of this system, the channel modifications proposed in this study are not likely to exacerbate potentially adverse effects of sea-level change to tidal currents in the project area.

- Saltwater intrusion
    - Channel modifications in the project area are not expected to contribute to saltwater intrusion. The alterations to the natural bay bottom from the proposed action are relatively small and hydrodynamic modeling did not indicate appreciable changes in circulation within the St. Andrew Bay. Potentially adverse effects of saltwater intrusion to the Panama City potable drinking water supply due to sea level rise is addressed in the Engineering Appendix, Tier 2: Project Area Vulnerability, Systems Extending Outside Project Area Boundary.

Coastal processes are dynamic and can be sensitive to large-scale changes. There is an inherent level of uncertainty that is assumed when making predictions based on a temporal projection of future events. Because of this uncertainty, it is highly recommended that changes to the project area be monitored over time and adaptive or reactive strategies be formulated as part of the normal O&M cycle.

3.2 Biological Resources

3.2.1 Plankton

Although there has been only one examination of phytoplankton assemblages in St. Andrew Bay (Hopkins 1964), the oceanic nature of the bay and the lack of endemic phytoplankton species in the Gulf of Mexico (Lackey, 1967; Wood, 1965; Steidinger, 1973) allows the use of previous characterizations of phytoplankton communities in the eastern Gulf of Mexico as a background for St. Andrew Bay. Over 900 species of diatoms and 400 species of dinoflagellates have been reported from the Gulf of Mexico (Simmons and Thomas, 1962). Seasonally, phytoplankton biomass and production are highest during warmer months in estuarine and nearshore waters (Dardeau et al., 1992). Recent data indicate that chlorophyll biomass in St. Andrew Bay is low (i.e., 1-5 ug/L) and is typical of other coastal embayments and their associated nearshore waters along the west coast of Florida that experience slow freshwater input (Wilber and Clarke, 2001). Copepods are normally the dominant component of the zooplankton community, but other organisms, particularly the meroplanktonic larvae of benthic organisms, can be seasonally abundant (Dardeau et al., 1992). Hopkins (1966) found that the plankton community of St. Andrew Bay was dominated by the copepods Oithona colcarva, Acartia tonsa, and Paracalanus crassirostris, and the appendicularian Oilopleura dioica. Zooplankton densities in the water column are low, not exceeding 500 individuals/m cubed. Typically, zooplankton abundance and biomass are highest during summer months (Dardeau et al., 1992). Copepods, crab zoea and chaetognaths were the abundant zooplankton forms in June 1994 (Wilber and Clarke, 2001).

3.2.2 Nekton/Epifauna

It has been estimated that over 90 percent of the fish caught shoreward of the 22 miles contour utilize coastal estuaries and bays like St. Andrew Bay during some part of their life cycle (Chittenden and McEachran, 1977; Dardeau et al., 1992). Coastal estuaries provide productive nursery areas for these species, and tidal passes and adjacent nearshore areas are pathways for migrating nekton.

Usually, a few species will dominate the abundance and biomass of estuarine fish communities. This is also the case in St. Andrew Bay (Brusher and Ogren 1976; Dardeau et al., 1992). Seasonal variation in nekton abundance in St. Andrew Bay coincides with the migration patterns of the dominant coastal species. In general, movement of nekton into the estuaries occurs mainly from January to June, while migration back into the Gulf typically occurs from August to December.

The St. Andrew Bay estuarine complex is regarded as a valuable nursery ground for fish of importance to both sport and commercial fisheries (Brusher and Ogren 1976; Sutherland 1978). Fishes near the estuary have been inventoried by Ogren and Brusher (1977), Pristis and Trent (1978), Nakamura (1976), Naughton and Saloman (1978). These authors found the most abundant inshore fishes to be the bay anchovy (Anchoa mitchilli) and the pinfish (Lagodon rhomboids). The next most abundant fish species are silver perch (Bairdiella chrysura), pigfish (Orthopristis chrysopterus), silver jenny (Eucinostomus qula), and sand seatrout (Cynoscion arenarius). Other abundant fish in the St. Andrew Bay estuary include the striped mullet (Mugil cephalus), tidewater silverside (Menidia beryllina), spot (Leiostomus xanthurus), sea catfish (Arius felis), hogchoker (Trinectes maculates), mosquitofish (Gambusia affinis), and scaled sardine (Harengula jaguana). This assemblage is similar to fish communities described from other bays and nearshore areas along the western coast of Florida which are dominated by submerged aquatic vegetation (SAV) (Livingston 1984; Zieman and Zieman 1989).

A variety of commercially important species are harvested from St. Andrew Bay (Sutherland 1978). Finfish of commercial significance include striped mullet, spotted seatrout, pompano (Trachinotus carolinus), and red drum (Sciaenops ocellata). Other important fisheries species include pink shrimp (Panaeus duorarum), blue crabs (Callinectes sapidus), stone crabs (Menippe mercenaria), and scallops (Aequipecten irradians). Historically, some oyster fishing has been recorded from North Bay, West Bay and East Bay (Sutherland 1978). However, the high salinity waters of St. Andrew Bay are unlikely to allow the persistence of oyster reefs as this is where their most successful predators, Thais haemastoma, are most likely to be abundant (Burkenroad 1931; Gunter 1979).

The area’s crab fishery is located primarily in the shallow waters of St. Andrew Bay. Blue Crabs are trapped along channel banks while Stone Crabs are taken from grass beds. Scallops are most abundant in vegetated habitats. Pink Shrimp are harvested for both food and bait form inshore and nearshore waters of the study area. Some shrimping activity may take place in the proposed project vicinity (Ogren and Brusher 1977). However, the principal offshore shrimping grounds are located in deeper waters to the south of the St. Andrew Bay. Pink Shrimp catches are highest from November to March.

3.2.3 Benthos

Polychaetes are the most abundant and diverse phylogenetic group within benthos. The polychaetes are dominated by the spionids Paraprionospia pinnata, Spio filiformis, and Prionospia spp., the capitellids Capitella and Capitata and Heteromastus filiformis, and the nereids Neanthes spp. and Nereis spp. Molluscs were second most abundant and dominated by tellinid bivalves including Macoma spp. and Tellina spp. Crustaceans dominated by amphipods, Ampellisca spp. and tanaids rank third in terms of diversity and abundance. Trawls conducted within the alignment of the channel found portunid crabs (Portunis spp.), squid (Loliguncula brevis), stomatopods (Squilla empusa), and penaeid shrimps to be most abundant (Wilber and Clarke, 2001).

No hard substrates or reefal areas with their associated fauna are known to exist within St. Andrew Bay or the shallow nearshore of the project area.

3.2.4 Marine Mammals

Several species of marine mammals may occur in area waters. The most abundant and widespread inshore mammal is the Bottlenose Dolphin (Tursiops truncates) while the

Spotted Dolphin (Stenella plagiodon) is probably the most common mammal species offshore.

3.2.5 Submerged Aquatic Vegetation (SAV)

Communities of Submerged Aquatic Vegetation (SAV) within the Florida Panhandle occur within shallow protected waters where bottom conditions and light penetration provide suitable habitat. The St. Andrew Bay Watershed covers about 750,000 acres in Walton, Washington, Jackson, Calhoun, Gulf and Bay Counties. The average depth of the bay is 27 feet. Studies indicate that extensive and diverse SAV beds exist in St. Andrew Bay which are dominated mostly by turtle grass (*Thalassia testudinu*m) and shoal grass (*Halodule wrightii*). Other seagrass communities that exist in these estuarine systems and within North, East and West Bay include manatee grass *(Syringodium filiform*e), star grass (*Halophilaengelmannii*), and widgeon grass *(Ruppia maritim*a).

3.2.6 Wetlands

Coastal wetlands include swamps and tidal flats, coastal marshes, and bayous. They form in sheltered coastal environments often in conjunction with river deltas, barrier islands, and estuaries. They are rich in wildlife resources and provide nesting grounds and important stopovers for waterfowl and migratory birds, as well as spawning areas and valuable habitats for commercial and recreational fish. Bay Harbor Channel contains pockets of saltwater marshes located along the shoreline adjacent to SAV beds. These marshes along with SAVs within this estuary serve as nursery grounds for the entire marine food chain within the Gulf of Mexico. Numerous species of marine flora and fauna begin their life cycles in marshes and wetlands.

3.2.7 Birds

Numerous species of birds including migratory and permanent residents can be found throughout the project area, several of which breed here as well. Shorebirds include osprey, great blue heron, great egret, piping plover, sandpiper, gulls, brown and white pelicans, American oystercatcher, and terns. Birds of the area eat a great variety of foods, are food to many predators, and exhibit a diversity of nesting behavior. The most commonly found species are listed in Table 3-2 below.

Table 3-2. Common Shorebird Species in Project Area

Common Name	Scientific Name
Spotted Sandpiper	*Actitis macularia*
Ruddy Turnstone	*Arenaria interpres*
Sanderling	*Calidris alba*
Dunlin	*Calidris alpina*
Red Knot	*Calidris cantutus*
Western Sandpiper	*Calidris mauri*
Least Sandpiper	*Calidris minutilla*
Willet	*Catoptrophorus semipalmatus*
Snowy Plover	*Charadrius alexandrinus*
Piping Plover	*Charadrius melodus*
Semipalmated Plover	*Charadrius semipalmatus*
Wilson's Plover	*Charadrius wilsonia*
Common Snipe	*Gallinago*
American Oystercatcher	*Haematopus palliates*
Black-necked Stilt	*Himantopus mexicanus*
Short-billed Dowitcher	*Limnodromus griseus*
Whimbrel	*Numenius phaeopus*
Black-bellied Plover	*Pluvialis squatarola*
American Woodcock	*Scolopax minor*
Lesser Yellowlegs	*Tringa flavipes*
Greater Yellowlegs	*Tringa melanolevea*

3.3 Essential Fish Habitat

Essential Fish Habitat (EFH) is defined in the Magnuson-Stevens Fishery Conservation and Management Act as "those waters and substrates necessary to fish for spawning, breeding, feeding or growth to maturity". The designation and conservation of EFH seeks to minimize adverse effects on habitat caused by fishing and non-fishing activities. The National Marine Fisheries Service (NMFS) has identified EFH habitats for the Gulf of Mexico in its Fishery Management Plan Amendments. These habitats include estuarine areas, such as estuarine emergent wetlands, mangrove wetlands, seagrass beds, algal flats, mud, sand, shell, and rock substrates, and the estuarine water column. Table 3-3 lists the managed species for the Gulf of Mexico. The habitat in the project area consists of estuarine waters and unvegetated bottoms with sand substrates. Of the species managed, the following would be expected to utilize the project area: brown shrimp (*Penaeus axtecus)*, pink shrimp (*P. duorarum)*, white shrimp (*P. setiferus)*, king mackerel (*Scomberomorus cavalla)*, Spanish mackerel (*S. maculate)*, gray snapper *(Lutjanus griseus)*, and lane snapper (*L. synagris).*

The habitats which occur within or in the vicinity of the project area include: estuarine emergent wetlands, seagrass beds, algal flats, mud, sand, shell, and rock substrates, and the estuarine water column.

Table 3-3. Fishery Management Plans and Managed Species for the Gulf of Mexico (NMFS 2012)

Shrimp Fishery Management Plan
- brown shrimp – *Farfantepenaeu ztecus*
- pink shrimp - *F. duorarum*
- royal red shrimp - *Pleoticus robustus*
- white shrimp - *Litopenaeus setiferus*

Reef Fish Fishery Management Plan
- almaco jack – *Seriola rivoliana*
- anchor tilefish - *Caulolatilus ntermedius*
- banded rudderfish – *S. zonata*
- blackfin snapper - *Lutjanus buccanella*
- blackline tilefish - *Caulolatilus cyanops*
- black grouper- *Mycteroperca bonaci*
- blueline tilefish – *C. microps*
- cubera snapper – *L. cyanopterus*
- dog snapper – *L. jocu*
- dwarf sand perch - *Diplectrum ivittatum*
- gag grouper - *M. microlepis*
- goldface tilefish – *C. chrysops*
- goliath grouper - *Epinephelus itajara*
- gray snapper – *L. griseus*
- gray triggerfish - *Balistes capriscus*
- greater amberjack – *S. dumerili*
- hogfish - *Lachnolaimus maximus*
- lane snapper - *Lutjanus synagris*
- lesser amberjack - *S. fasciata*
- mahogany snapper – *L. mahogoni*
- marbled grouper – *E. inermis*
- misty grouper – *E. mystacinus*
- mutton snapper – *L. analis*
- Nassau grouper – *E. striatus*
- queen snapper - *Etelis oculatus*
- red hind - *Epinephelus guttatus*
- red grouper – *E. morio*
- red snapper - *L. campechanus*
- rock hind – *E. adscensionis*
- sand perch - *Diplectrum formosum*
- scamp grouper - *M. phenax*
- schoolmaster – *L. apodus*
- silk snapper – *L. vivanus*
- snowy grouper – *E. niveatus*
- speckled hind - *E. drummondhayi*
- tilefish - *Lopholatilus chamaeleonticeps*
- vermilion snapper - *Rhomboplites aurorubens*
- Warsaw grouper – *E. nigritus*
- wenchman - *Pristipomoides aquilonaris*
- yellowedge grouper *E .lavolimbatus*
- yellowfin grouper – *M. venenosa*
- yellowmouth grouper – *M. interstitialis*
- yellowtail snapper - *Ocyurus chrysurus*

Stone Crab Fishery Management Plan FL
- stone crab - *Menippe mercenaria*
- gulf stone crab – *M. adina*

Spiny Lobster Fishery Management Plan
- spiny lobster - *Panulirus argus*
- slipper lobster - *Scyllarides nodife*

Coral and Coral Reef Fishery Management Plan
- varied coral species and coral reef communities comprised of several hundred species

Coastal Migratory Pelagic Fishery Management Plan
- cobia - *Rachycentron canadum*
- king mackerel – *Scomberomorus cavalla*
- Spanish mackerel - *S. maculatus*

Red Drum Fishery Management Plan
- red drum - *Sciaenops ocellatus*

3.4 Water Quality

Water quality within the project area is influenced by point and non-point source pollution. The Surface Water Improvement Management (SWIM) Plan for St. Andrew Bay Watersheds, indicated a number of sources of water quality degradation within the watersheds. The most notable throughout the region was urban and agricultural runoff. In spite of these notable pollution sources the 2010 305(b) Water Quality Assessment found the State of Florida's surface and groundwater resources to be predominantly in good condition based on the indicators assessed. In addition, water quality in the northwest sections of the State were found to be generally better than in other areas of the State.

The FDEP classifies the coastal water in the project area as Class III, defined as waters suitable for recreation and propagation of fish and wildlife. The waters within the St. Andrew State Park Aquatic Preserve and Lake Powell are classified as an "Outstanding Florida Water" (OFW), which is assigned additional protection through the FDEP Regulation. The FDEP sets water quality standards and requires monitoring of water quality during dredging and beach placement operations.

The St. Andrew Bay receives minimal freshwater inflow because of its relatively small drainage basin. Throughout the estuary, salinities are generally highest in February and lowest in April. Bottom and mid-water salinities typically exceed 30 parts per thousand (ppt). Temporal dissolved oxygen trends are similar to those reported from other estuaries located in the northeastern Gulf of Mexico in that values are lower in summer than in fall and winter.

3.5 Cultural Resources

Prior to this undertaking, no cultural resource survey of the project area had been conducted. Consequently, there was no way to know whether or not cultural resources lie within the project area and whether or not any cultural resources which may be in the project area are potentially eligible for the National Register of Historic Places (NRHP). However, a number of Federally initiated scientific studies have occurred along the northern Gulf of Mexico in an attempt to determine the likelihood of encountering prehistoric inundated sites as well as historic cultural resources, namely shipwrecks (Chaunu and Chaunu 1955-1957; Coastal Environments, Inc. [CEI] 1977; Garrison et al. 1989; Pearson et al. 2003). The main purpose of these studies involved having baseline information from which Federal agencies could ascertain whether maritime survey is needed in those areas. The general consensus of these studies is that the majority of shipwrecks in the Gulf of Mexico are in water 60 feet deep or shallower and that the density of shipwrecks increases the closer to a port one looks. Consequently, this project area is considered sensitive for cultural resources.

Future Without Project Conditions

If the project did not move forward, conditions within the project area for cultural resources would remain unchanged.

Proposed Survey Strategy

The effort called for in this scope of work involved marine archaeological survey to identify possible historic properties within the identified Areas of Potential Effect (APEs) associated with the dredging of Panama City Harbor to maintain a navigable waterway and the disposal of the dredged material. The Mobile District intends to dredge two locations in Panama City Harbor and dispose of the dredged material in an in-bay disposal area within the harbor.

As per requirements outlined in Section 106 of the National Historic Preservation Act, the lead Federal agency must consider the effects of the proposed action on historic properties. Based on the proposed action, the Mobile District has identified the dredge areas and placement area as the APEs for this project. Based on those APEs, the archaeologist proposed a survey strategy that includes marine remote sensing of the dredge and disposal areas that have not been previously disturbed or previously surveyed for cultural resources.

Marine remote sensing survey was conducted of those dredge and disposal areas identified as having not been previously impacted or previously surveyed. Phase I maritime survey standards conformed to the State of Florida standards. Specifically, the survey involved surveying submerged bottomlands using magnetometer, sidescan sonar, and sub-bottom profiler survey of the area, global positioning system, and depth finder technologies. This survey was conducted at not more than 15 meter line spacing by a qualified individual.

The fieldwork for this survey was completed in September 2015. This survey did not locate any submerged cultural resources in the project area. Based on data in the Management Summary prepared by the contractor outlining the results of this survey, the USACE maritime archaeologist determined that there will be No Effect to cultural resources as a result of this undertaking.

Coordination

This No Effects determination will be coordinated with the Florida State Historic Preservation Office (SHPO) and Federally-recognized tribes that may have an interest in the area. Specifically, the results will be coordinated with the Seminole Tribe of Florida, the Seminole Nation of Oklahoma, the Thlopthlocco Tribal Town of Oklahoma, and the Muscogee (Creek) Nation of Oklahoma.

Inadvertent Discoveries Plan

Although a project area may receive a complete cultural resource assessment survey, it is impossible to ensure that all cultural resources will be discovered. Therefore, a procedure has been developed for the treatment of any unexpected discoveries that may occur during dredging and placement operations.

If any cultural material is encountered that appears to be 50 years or older during dredging or placement operations, work must immediately cease and the Mobile District Archaeologist and the Florida SHPO must be contacted and investigate the material before dredging or placement can resume.

3.6 Aesthetics

The project area consists of a developed industrial port and has been in operations for over 50 years. Watson Bayou is located adjacent to the Bay Harbor Terminal and consists of ship building industries, etc. The majority of the surrounding land has been either developed that consists of industrial type operations, various commercial businesses, and some residential areas. There are surrounding areas that include developed residential areas with some remaining natural communities which are wooded and are likely to remain in their natural state.

3.7 Noise

Noise, generally, can be defined as unwanted sound and, therefore, is considered a relative environmental parameter. Noise levels in the area are primarily from industrial development, commercial and recreational vessels, and vehicles including industrial trucking, railways, and various commercial vehicles.

3.8 Air Quality

Non-point sources such as vehicular and boat traffic exists within the area; however, air quality within Panama City is good due to the presence of either on or offshore breezes that readily disperse airborne pollutants. Bay County is classified as an attainment area for all Federal Air Quality Standards.

3.9 Threatened and Endangered Species

Table 3-4 provides the Federally listed threatened and endangered species potentially found in Bay County:

Table 3-4 Threatened and Endangered Species in Project Area

	U.S. Fish and Wildlife	**National Marine Fisheries Service**	
E	*West Indian Manatee Trichechus manatus latirostris*	E	Blue whale, *Balaenoptera musculus*
T, CH	*Piping plover Charadrius melodus*	E	Finback whale, *Balaenottera physalus*
E	*Red-cockaded woodpecker Picoides borealis*	E	Humpback whale, *Megaptera novaeangliae*
T	*Wood stork Mycteria Americana*	E	Sei whale, *Balaenoptera borealis*
T	*Eastern indigo snake Drymarchon corais couperi*	E	Sperm whale, *Physeter macrocephalus*
C	*Gopher tortoise Gopherus polyphemus*	T	Green sea turtle, *Chelonia mydas*
T, CH	*Loggerhead sea turtle Caretta caretta*	E	Hawksbill sea turtle, *Eretmochelys imbricata*
E	*Kemp's ridley sea turtle Lepidochelys kempii*	E	Kemp's ridley sea turtle, *Lepidochelys kempii*
E	*Green sea turtle Chelonia mydas*	E	Leatherback sea turtle, *Dermochelys coriacea*
E	*Leatherback sea turtle Dermochelys coriacea*	T	Loggerhead sea turtle, *Caretta*
E	*Hawksbill sea turtle Eretmochelys imbricate*	T	Gulf sturgeon, *Acipenses oxyrinchus desotoi*
T, CH	*Gulf sturgeon Acipenses oxyrinchus desotoi*		
E	*Reticulated flatwoods salamander Ambystoma bishop*		
T	*Red knot Calidris canutus rufa*		
E	*Choctawhatchee beach mouse Peromyscus polionotus allophrys*		
E	*St. Andrew beach mouse Peromscus polionotus peninsularis*		
BGEPA	*Bald eagle Haliaeetus leucocephalus*		

*E=endangered, T=threatened, C=candidate, CH=Critical Habitat, BGEPA=Bald and Golden eagle protection act

Federally protected species such as the red-cockaded woodpecker, gopher tortoise, Eastern indigo snake, hawksbill sea turtle, Choctawhatchee beach mouse, and St. Andrew beach mouse would not be affected because these species are not likely to be found in or near the project area. The leatherback sea turtle, red knot, and piping plover are anticipated to avoid the area during construction activities as they are mobile. The blue whale, finback whale, humpback whale, sei whale, and sperm whale would not be affected because they are not likely to be found in or near the project area due to the shallow conditions of the area.

Of the listed species, the species that could be found in the project area include the West Indian manatee, Gulf sturgeon, and the Kemp's ridley, green and loggerhead sea turtles.

The Florida Manatee is a subspecies of the West Indian Manatee. The Florida Manatee occur in both fresh and salt water habitats within tropical and subtropical regions and show preferences to waters with salinity levels of less than 25 ppt (Hartman, 1979). Several factors contribute to the distribution of Manatees in Florida. These factors are habitat-related and include proximity to warm water during cold weather, aquatic vegetation availability, proximity to channels of at least 6.5 feet in depth, and location of fresh water sources (Hartman, 1979). Manatees often seek out quiet areas in canals, creeks, lagoons or rivers. Deeper channels are often used as migratory routes. The U.S. Manatee population generally confines itself to the coastal waters of the southern half of peninsular Florida and to springs and warm water industrial outfalls as far north as southeast Georgia.

The Gulf sturgeon is a subspecies of the Atlantic sturgeon. In early spring, sub-adult and adult fish migrate into rivers from the Gulf of Mexico and continue until early May. In late September or October, sub-adult and adult sturgeons begin downstream migrations. Adult fish spend eight to nine months each year in rivers and three to four of the coolest months in estuarine or Gulf waters. Research indicates that in the estuary/marine environment both sub-adult and adult Gulf sturgeon show preference for sand shoreline habitats with water depths less than 3.5 meters and salinity less the 6.3 ppt. The majority of tagged fish have been located in areas lacking seagrass, in shallow shoals 1.5 to 2.1 meters and deep holes near passes, and in unvegetated, fine to medium-grained habitats, such as sandbars, and intertidal and subtidal energy zones. These shifting predominately sandy, areas support a variety of potential prey items including estuarine crustaceans, small bivalve mollusks, ghost shrimp, small crabs and various polychaete worms and lancelets. The Gulf sturgeon is a bottom-feeder which apparently only feeds during its stay in marine waters; food items are rarely found in the stomachs of specimens sampled from rivers. However, although the Gulf sturgeon could be found in the vicinity, the project area is not listed as critical habitat for the Gulf sturgeon. Data collected from several years of research suggest that the fish near the project area are usually found at known over wintering areas to the east of the St. Andrews inlet along Tyndall and Mexico Beaches (Frank Parauka, personal communication 2006). Gulf sturgeon from the Brothers, Yellow, Apalachicola and Choctawhatchee Rivers have been located off Tyndall and/or Mexico Beaches in water depths typically of 12-20 feet (F. Parauka, personal communication 2006).

Piping plover winter in coastal areas of the United States from North Carolina to Texas. Their wintering season generally extends from August through May. The species can be found feeding on exposed wet sand in swash zones; intertidal ocean beach; wrack lines; washover passes; mud, sand, and algal flats; and shorelines of streams, ephemeral ponds, lagoons, and salt marshes (Coutu *et al*., 1990). They also use beaches adjacent to foraging areas for roosting and preening and small sand dunes, debris, and sparse vegetation within adjacent beaches for shelter from wind and extreme temperatures. Shell Island located east of the St. Andrews Inlet is designated as piping plover critical habitat. Although the species is known to utilize the surrounding state parks they are less likely to utilize the project area due to the high level of human disturbance.

The Kemp's ridley sea turtles are usually found in water with low salinity, high turbidity, high organic content, and where shrimp are abundant. The continual influx of freshwater and high organic content associated with the northern Gulf of Mexico provides ideal foraging habitat for this species. Loggerhead sea turtles inhabit continental shelves, bays, estuaries, and lagoons in temperate, subtropical, and tropical waters. In the Atlantic, loggerhead sea turtles' range extends from Newfoundland to as far south as Argentina. During summer, sea turtles nest in the lower latitudes. Primary Atlantic nesting sites are along the east coast of Florida, with additional sites in Georgia, the Carolinas, and along the Gulf Coast. In the Gulf of Mexico, principal foraging areas for the green sea turtle are located in the upper west coast of Florida. Nocturnal resting sites may be a considerable distance from feeding areas, and distribution of the species is generally correlated with grassbed distribution, location of resting beaches, and possibly ocean currents. Major nesting areas for green sea turtles in the Atlantic include Surinam, Guyana, French Guyana, Costa Rica, the Leeward Islands, and Ascension Island in the mid-Atlantic.

3.10 Hazardous, Toxic, and Radioactive Waste (HTRW)

No known hazardous, toxic or radioactive waste concerns are known to exist within the confines of the project area. Nor would any be added as a result of the proposed activities.

4.0 PLAN FORMULATION*

The plan formulation approach for this study follows the USACE guidance from ER 1105-2-100. It provides an evaluation of economic benefits and environmental impacts of a specific portion of the last approved plan with very limited formulation to confirm the recommended plan in the Chiefs Report in 1971. The following objective statement was developed from Section 2.0 Problems and Opportunities: Maximize the Transportation Efficiency of the Bay Harbor Navigation Channel.

4.1 Alternative Plans

Four alternative plans were developed to meet the planning objective. They included a no action plan, and three channel improvement plans. The three plans of improvement differed only with respect to project depth. All three plans of improvement include deepening the east leg inner channel to serve the port facility at Bay Harbor Terminal.

Alternative 1 is the No Action alternative for the without project condition. In the without project condition, the channel will remain at the existing depth. One of the carriers calling the Port will continue the double rotating operation and the other will cease to call on the Bay Harbor Terminal in the next three to five years.

Alternative 2, consists of deepening the Bay Harbor Terminal Channel to 34 feet. Existing channel widths of 300 feet for the Bay Harbor Terminal Channel will remain the same under Alternative 2. The Bay Harbor Terminal Channel will be extended at the 34-foot depth and 300-foot width to the Bay Harbor Terminal and include a turning basin area of approximately 42 acres. The total length of Alternative 2 is 3.6 miles. Alternative 2 requires the removal of 209,000 cubic yards of material from the Bay Harbor Terminal. The placement plan for Alternative 2 includes placing material in a deep area within St. Andrew Bay.

Alternative 3, consists of deepening the Bay Harbor Terminal Channel to 35 feet. The 35-foot alternative was considered, but since the existing warehouse still has limited capacity, the quantity of cargo cannot be exported over the mill dock as with the 36-foot channel. Therefore, this alternative was screened from further analysis as it has higher cost associated with additional cubic yards dredged, but does not return the benefits of the 36-foot alternative.

Alternative 4, consists of deepening the Bay Harbor Terminal Channel to 36 feet. Existing channel widths of 300 feet for the Bay Harbor Terminal Channel will remain the same under Alternative 4. The Bay Harbor Terminal will be extended at the 36-foot depth and 300-foot width to the Bay Harbor Terminal and include a turning basin area of approximately 42 acres. The total length of Alternative 4 is also 3.6 miles. Alternative 4 requires the removal of 372,000 cubic yards of material from the Bay Harbor Terminal Channel. The placement plan for Alternative 4 includes placing material in a deep area within St. Andrew Bay.

Improvements under each plan also include provision for a turning basin near the terminal. Dredging quantities were estimated for project depths of 34 and 36 feet. Dredging quantities for 35 feet were not estimated; this is explained in Section 4.4 Alternative Plan Evaluation. The 34 and 36 feet plans are shown in the cost estimates contained in this report, and include 2 feet of allowable overdepth dredging. Overdepth dredging is allowed due to inaccuracies in the dredging process caused by wave action and tidal fluctuations in the bay environments. Typical sections of 36 feet in the Inner Harbor Channel to Bay Harbor Terminal (including the turning basin) are shown in Appendix B - Engineering.

Five basic placement options were investigated during the reformulation of the Panama City Harbor deepening project, i.e. on Tyndall AFB, on WestRock, upland landfill placement, within-bay near shore placement, and designated in-bay placement area.

Alternatives would be constructed in conjunction with a normal maintenance cycle at Panama City Harbor if construction funding coincides with the normal maintenance cycle at Panama City Harbor.

4.2 Alternative Plan Evaluation

Initial discussions with the PDT and non-Federal sponsor identified that the material to be dredged for Alternatives 2, 3 and 4 was not suitable for placement on the beach due to its fine-grained nature and composition. Tyndall AFB and WestRock did not want the dredge material placed on their property due to the composition and quantity of the material. Upland disposal was not a viable disposal alternative because there was no adequately sized property available for upland placement, and the cost to dewater, transport and place the material at the nearest landfill was prohibitive. Within-bay near shore was ruled out due to the inability to hold the capacity of the dredge material. The USACE, during the planning process, considered regional sediment management during development of disposal alternatives. The USACE strives to achieve balanced, sustainable solutions to sediment-related issues and seeks opportunities to implement Regional Sediment Model plans, practices and procedures to improve sediment management and solve sediment issues. In the case of this particular project, USACE determined a dredging sequence was appropriate due to the amount of fines in the material located in the dredging area within the turning basin. The USACE will dredge this area first for placement within the deeper areas of the in-bay disposal area. The remaining areas contain more sandy material and will be dredged last and used as a cap over the disposal area. Engineering analysis to determine sediment movement during placement and over the long-term will be completed to ensure that there are no negative impacts to the surrounding area. This modeling will be completed in support of the FDEP permit application and the results will be available during the design phase of the project. The areas to be dredged and the area the dredge material will be placed are shown in the dredge plan Figure 4-1.

Coordination with FDEP is ongoing to finalize the placement plan and secure the required environmental clearances to place the dredge material in a deep area of the bay. This is also the most cost effective alternative and has been coordinated with State of Florida interests. The State has concurred that this placement alternative could be certified through the State water quality certification process.

For this analysis, four alternatives were considered; without project, 34-foot deepening, 35-foot deepening and 36-foot deepening. The 34-foot and 36-foot depths were carried forward for detailed analysis and comparison. The 34-foot alternative was analyzed to see if benefits would accrue with the channel improvement of an additional two feet. The 35-foot alternative was considered, but since the existing warehouse still has limited capacity, the quantity of cargo cannot be exported over the mill dock as with the 36-foot channel. Therefore, this alternative was screened from further analysis as it has higher cost associated with additional cubic yards dredged, but does not return the benefits of the 36-foot alternative.

The 34-foot alternative involved dredging approximately 300,900 cubic yards with a rough order magnitude total investment cost of $5,272,000, total AAE transportation cost savings benefits of $2,328,000 and Net Benefits of $1,994,000. The 36-foot alternative involved dredging approximately 372,000 cubic yards with a total investment cost of $7,052,000, total AAE transportation cost savings benefits of $8,815,000 and Net Benefits of $7,690,000. Table 5-1 summarizes the average annual benefits and costs for the 34- and 36-foot project alternative.

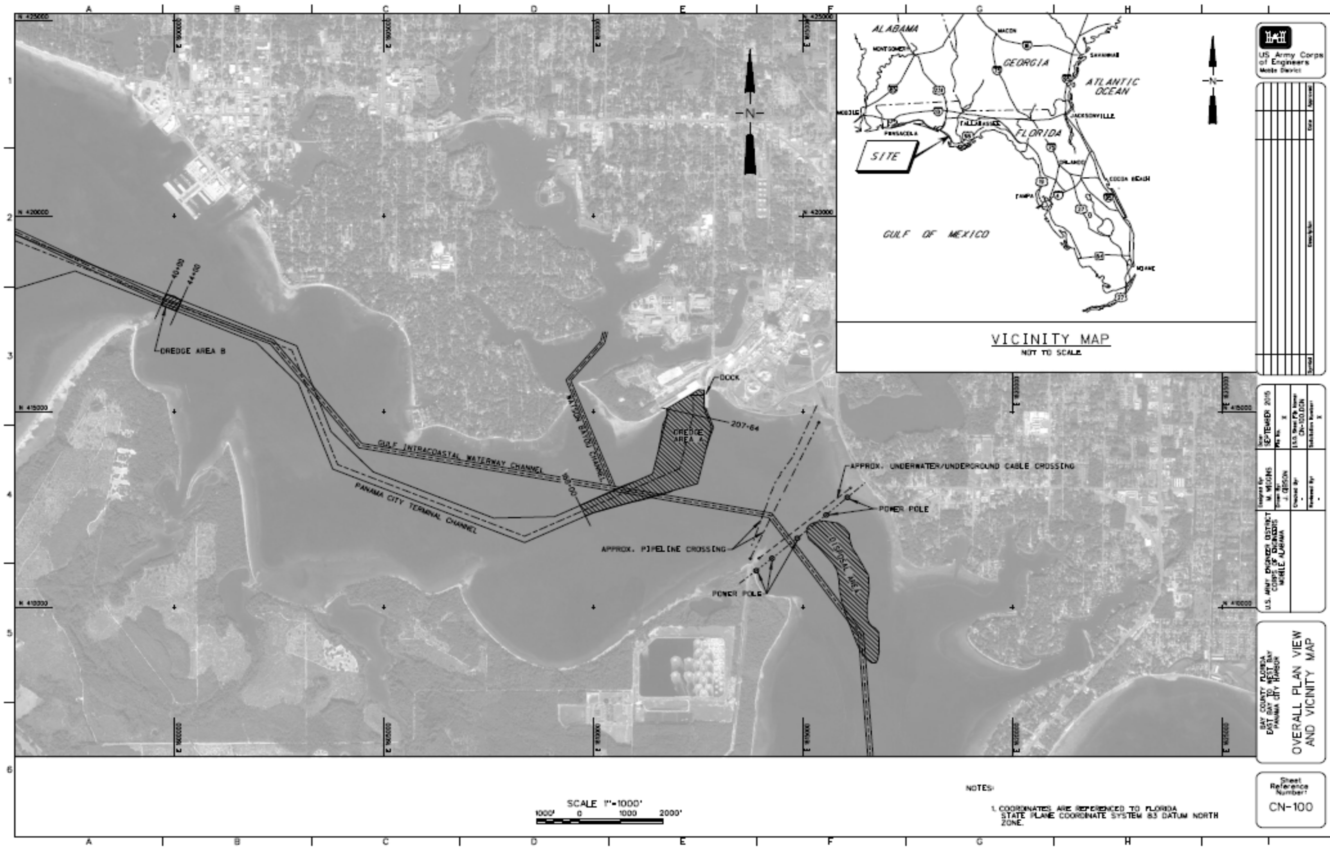


Figure 4-1. Dredge Plan

4.2.1 Geotechnical Investigation

Subsurface investigations have been conducted within the proposed project area. In 2014, geotechnical sampling (vibracores) and environmental sampling was conducted in the project area to determine sediment textural characteristics and contaminant concentrations (EA Engineering, 2014). In 2015, geotechnical sampling (standard penetration testing) was conducted in the vicinity of the 2014 vibracores to better refine the geology of the project areas. The results of the two subsurface investigations can be found in Appendix B - Engineering.

Outside of the project area, but within St. Andrew Bay, vibracore borings were obtained in 1974, from the inlet north into the bay and then to Dyers Point in the west. This study did not sample within the current project area. Physical and chemical testing were performed on samples from select cores. An acoustic impedance survey (AIS) was conducted in 1992, which covered the western portion of the bay, but did not cover the segment east to the Bay Harbor Terminal (USACE 2001). Continuous profiles of bottom and subsurface sediments were developed for 10 survey lines from the entrance to the bay and west to Dyers Point. Representative sediment samples were obtained for survey calibration purposes. Additional drilling was performed in 1994, for verification of the AIS profiles and acquisition of data in the areas proposed for sediment traps. Results of the pre-2014 subsurface investigations are contained in the GRR dated August 1995.

4.2.2 Channel Design

Ships calling at the harbor include general cargo vessels and dry bulk carriers. These ships typically have loaded static drafts up to 32 feet, overall lengths up to 815 feet, and beam widths up to 106 feet. A minimum tolerance of 2 feet between the keel and channel bottom is required for the Inner Channel based on the previous survey report, criteria contained in EM 1110-2-1613 (USACE, 1994), and operations information from local pilots. Based off of the economic analysis and the factors listed above, a project design depth of 36 feet was chosen for the Bay Harbor Terminal Channel.

Design Vessel. The critical ship for controlling the width of the channel to the Bay Harbor Terminal was first thought to be the design vessel from the 2001 LRR, which was a cargo vessel 600 feet long with a beam width of 90 feet. However, after examining the vessel fleet calling at the Bay Harbor Terminal, it was discovered that the 2001 design vessel was smaller than the majority of the fleet. Guidance contained in EM 1110-2-1613 requires that the design vessel be representative of the largest frequently calling vessels. An analysis of the vessel fleet currently calling at the Bay Harbor Terminal produced the *Star Lendesnes* as the design vessel. The Star Lendesnes has a length of 670.5 feet and a beam width of 106 feet and was in the fourth quartile of largest vessels calling at the Port, by length and beam.

Channel Width. According to EM 1110-2-1613 the required channel width for a shallow water channel is 3.0 times the beam width, or 318 feet, however this value exceeds the authorized channel width of 300 feet. Ship simulation is required to use channel dimensions that do not meet guidance, however, after discussions with the Engineering Research and Development Center's (ERDC's) Ship Simulation Team, the Deep Draft Navigation Planning Center of Expertise, and engineering from the South Atlantic Division (SAD) office, it was determined that a variance from the guidance would be requested in this case. The variance is based on several factors, which include: The design vessel is currently calling at the Port at a shallower draft, similar vessels are calling at Dyers Point with a draft of 34 feet, there have been no recorded safety issues associated with the channel, and that the entire length of channel has access to more than a 318 feet width with adequate water depth due to the naturally deep bay, bend easing, or being located within the turning basin. The variance request will be included with the ship simulation waiver request as they are similar in nature, and both need Headquarters' approval.

Turning Basin. The turning basin was designed based on pilot input and guidance found in EM 1110-2-1613. The width of the turning basin should be 1.5 times the length of the ship, or 1,005 feet, again based on EM 1110-2-1613 criteria. A trapezoidal-shaped basin 1,100 feet wide extending 1,700 feet along the channel approaching the Bay Harbor Terminal provides approximately 42 acres for ship turning and maneuvering operations. The general location and maximum size of the turning basin was given in the authorization, while the actual dimensions were not specified. The basin dimensions were designed to meet engineering guidance, incorporate local pilot experience and preferences, and to maximize use of the bay's natural depth.

Channel Alignment. The centerline alignment of the Bay Harbor Terminal Channel will remain the same as that shown in the authorization, only the alignment of the turning basin will change based on the design. Extension of the channel through St. Andrew Bay to the Bay Harbor Terminal follows the thalweg of deep water in the bay. Additional channel widths in the bends were based on the cutoff method described in EM 1110-2-1613, however it appears that the deflection angle of the bends in the channel are larger than the recommended values for using the cutoff method. After talking to the pilots and discussing the issue with the ERDC Ship Simulation Team, it was determined that since all of the bends are located in areas of natural depth, the pilots are satisfied and comfortable with the current design, and the recommended Apex Channel bend has not been widely used, the channel bend alignment would not be redesigned as a part of the current LRR.

Navigation Conditions. The primary navigation problems identified by the local pilots was their inability to remain on the channel centerline near station 42+00 because of shoaling on the northern side of the existing channel and their difficulty with the channel bend into and out of the turning basin. The first concern will be addressed by dredging the shoal within the channel, while the second concern will be addressed by adding a bend easing to the channel as it turns into the turning basin. In order to reduce dredging quantities and to achieve a smoother transition into the turning basin, the bend easing was applied to the outside of the bend. Upon the recommendation of ERDC Ship Simulation Team, Mobile District is pursuing a ship simulation study waiver, which will be obtained before the completion of the LRR.

Quantities. Construction of the recommended improvements to the deep draft navigation channel requires the removal of approximately 372,000 cubic yards of material. The Bay Harbor Terminal Channel will experience up to 10,000 cubic yards per year in shoaling. Due to the low shoaling rates occurring in St. Andrews Bay, it was determined that no advanced maintenance would be needed or allowed. Advance maintenance is dredging to a specified depth and/or width beyond the authorized channel dimensions in critical and fast shoaling areas to avoid frequent re-dredging and ensure the reliability and least overall cost of operating and maintaining the project to the design dimensions. The quantity estimates for the recommended plan include 2 feet of allowable overdepth dredging. Overdepth dredging is allowed due to inaccuracies in the dredging process caused by wave action and tidal fluctuations in the Gulf and bay environments; it helps ensure that there will be no negative environmental impacts outside of the permitted channel dimensions. Typical sections based on the recommended plan are included in Appendix B – Engineering.

4.2.3 Navigation Aids

The Coast Guard is currently formulating a navigation aid plan for the selected design, and their results will included in the final design. The FY15 estimated cost at this time is $110,000 without contingency.

4.2.4 Dredge Material Placement Description

In-bay placement was determined to be the only feasible alternative for dredge material placement. A suitable location was found approximately 0.6 miles southeast of the turning basin, in a long trench like depression. The dredge material will be placed in the trench up to elevation -46 MLLW, which will leave a lip of natural bottom to help prevent the movement of the material after placement. Approximately 4,000 feet of the trench will be filled to -46 MLLW after the completion of the project. A sewer line, a fiber optics cable and a power line cross the bay near this location, however, dredge material placement will avoid all underwater utilities.

4.2.5 Future Maintenance

The shoaling rate for the dredged portions of Panama City Harbor was estimated by determining the difference in the bay bottom between the 2013 channel survey and the 2010 channel survey. This method resulted in annual shoaling rate of 6,600 cubic yards, which was then increased to 10,000 cubic yards per year to help account for error incurred from the use of such a small historical time period. Maintenance material disposal will be the same as for the initial construction; the disposal area has adequate storage capacity for more than the next 25 years of estimated maintenance dredging. Routine condition surveys will be conducted on a semi- annual basis, and are expected to cost $12,000 per year. If possible, maintenance dredging will take place on the same 4-year cycle used for the Dyers Point Channel. Dyers Point has historically been maintained via pipeline dredge using a small upland disposal area on the Navy base. An interim mobilization of the dredge is included in the annual maintenance unit cost totaling approximately $100,000.

Reaction time to sea level change impacts depends greatly on the rate at which the sea level changes. The relative rate of local sea level change in the project area should allow for modifications to structures and critical infrastructure to occur in such a way as to allow for timely adaptation. It is likely that, if the project area were to experience inundation by intermediate and high rates of projected sea level change, the magnitude and frequency of flooding would be so rapid as to prevent timely adaptation and force either a reaction or retreat to occur. These assumptions are based largely on qualitative information provided in Kriebel et al. (Kriebel, Geiman and Henderson) and are discussed further in the *Tier 2, Frequency of Events* section of Appendix B – Engineering.

An adaptive or reactionary approach to sea level rise is recommended for implementation in the future depending on the rate of sea level rise. In anticipation of rehabilitation and maintenance of the jetty structures, the breaking wave height, rock size, wave run-up and overtopping, crest elevation, layer thickness, and crest width of the jetties were analyzed under various sea level rise scenarios. Analysis of the Port facilities adjacent to Watson Bayou assumed that maintenance and rehabilitation of the seawall and bulkhead structures would continue into the future. Analysis at the Port facility area within the bay included fetch-limited wave height and overtopping rates under the various sea level rise scenarios.

Adaptive and reactive planning strategies for the various sea level rise scenarios over the 20-, 50-, and 100-year project horizons are presented along with the results of the *Tier 3* analysis in Appendix B - Engineering. Using an adaptive or reactive planning strategy requires that seal level change effects to the project be re-analyzed when new data and tools become available. It is assumed for this report that the analysis will need to be updated on a 5-year cycle, and will cost approximately $2,000 per year.

4.3 ECONOMIC INVESTIGATIONS

The purpose of the socioeconomic study is to assist in identifying water resources related problems, identifying the social and demographic characteristics of the affected populations, and quantifying the economic benefits and costs of proposed solutions, as well as the conditions that would prevail under the without project and with project scenarios. Study documentation includes quantification and description of the impact of the alternative plans on the NED account for the 2020-2069 period of analysis. All economic benefits are stated at current FY16 price levels and discounted to the effective date of the project at the current Federal discount rate of 3.125 percent. The primary potential contributors to the NED account are transportation cost savings.

The Port of Panama City is a deep-water harbor offering access to the Gulf of Mexico and the GIWW. The existing 32-foot navigation channel has produced depth-related operational inefficiencies for the fleet servicing the Bay Harbor Terminal. Channel deepening to 34 feet or 36 feet is being considered to resolve these problems. A 35-foot alternative was considered, but since the existing warehouse still has limited capacity, the quantity of cargo cannot be exported over the mill dock as with the 36-foot channel. Therefore, this alternative was screened from further analysis as it has higher cost associated with additional cubic yards dredged, but does not return the benefits of the 36-foot alternative. This section summarizes the findings of the economic evaluation. More detailed documentation of the economic evaluation is provided in Appendix C – Economic Analysis.

4.3.1 Economic Study Area

Panama City is located in the northwestern panhandle of Florida in Bay County. It is approximately 75 miles southwest of Tallahassee, Florida and approximately 45 miles east of Pensacola, Florida. Panama City was incorporated in 1909, and encompasses an area of 35.4 square miles. Figure 4-2 is a map of Florida showing Bay County in the northwestern region of the State which is where Panama City can be found. This area of Bay County is bordered by Walton County, Washington County, Jackson County, Calhoun County, and Gulf County.

Figure 4-2. Bay County, Florida Location Map

4.3.1.1 Port Facility

The WestRock Company owns and operates a deep-water cargo terminal adjacent to their plant on the Bay Harbor Channel. The company has facilities all over the world and specializes in corrugated packaging and consumer packaging. The mill located in Panama City produces containerboard and forest resources. The company uses the Bay Harbor Terminal to export these products at the plant adjacent to the dock terminal as well as rails commodities from other mills to the Panama City Plant to export to South America. The warehouse has a current capacity of 15,000 short tons and is at capacity to store its products for export. There is rail access to the warehouse on the northern side and a berth on the southern side 50 feet wide by 920 feet long by 32 feet deep, only capable of harboring one vessel at a time. Tidal range is typically one and a half feet and vessels usually require one to two feet of underkeel clearance. Currently, the terminal receives approximately three vessels a month. The company maintains a separate port tariff than that of the users of the west channel and has handled third party cargo from time to time.

4.3.1.2 Transportation and Utility

Bay County has two U.S. highways within its boundaries, Highway 98 that traverses the county east and west, near the coast, and Highway 231 that enters the county from the north and provides the best access for tourist and beach users coming from northern points. Major state and county highways crisscrossing the county provide easy highway access to the beaches.

The only rail service available in the county is the Atlanta and St. Andrews Bay Railway, which originates in Panama City and runs north to connect with the CSX Railroad in Jackson County, Florida. The county has three commercial airfields and a major Air Force installation, Tyndall Air Force Base. Northwest Florida Beaches International Airport is the major air facility serving the area with service provided by Southwest and Delta Airlines. Local and interstate bus lines provide additional passenger service.

Available utilities in the area include electricity, natural gas, water service, countywide telephone service and sewer service in Panama City, Panama City Beach, Mexico Beach and in some isolated developments with small treatment units.

4.3.1.3 Demographic and Population

As of the 2010 census data, there were 36,484 people in Panama City which is an increase of 0.18 percent since the 2000 census of 36,417 people. There were 17,438 housing units, with 84.8 percent being occupied and 15.2 percent being vacant housing units mainly for rent or seasonal use. There were 14,792 households out of which 23.6 percent had children under the age of 18 living with them, 36.3 percent were married couples living together, 16.8 percent had a female householder with no husband present, and 41.8 percent were non-families. The average household size was 2.28, and the average family size was 2.91. The population was spread out with approximately 23.3 percent under the age of 19, 7.6 percent from 20 to 24, 25.9 percent from 25 to 44, 26.9 percent from 45 to 64, and 16.3 percent who were 65 years of age or older. The median age was 39.7 years.

Table 4-1 shows the population characteristics for the United States, Florida, Bay County, and Panama City. As a tourism community, population in Panama City fluctuates significantly during the year.

Table 4-1. Population Characteristics

	Population			**Percent Change**		
	1990	2000	2010	1990-2000	2000-2010	1990-2010
United States	248,709,873	281,421,906	308,745,538	13.2%	9.7%	24.14%
Florida	12,938,071	15,982,824	18,801,310	23.5%	17.6%	45.32%
Bay County	126,994	148,217	168,852	16.71%	13.92%	32.96%
Panama City	34,378	36,417	36,484	5.9%	0.18%	6.1%

4.3.1.4 Employment and Income

In 2010, approximately 80.4 percent of the population for Panama City was 16 years and over, with 62.6 percent of the population 16 years and over in the labor force. The unemployment rate for Panama City is 12.4 percent, higher than the State of Florida at 11.3 percent, and higher than the United States at 9.6 percent. Major employers in the Bay County area include Gulf Power, Eastern Shipbuilding, WestRock (formerly RockTenn and formerly Smurfit-Stone Container), and Arizona Chemical. The occupations in Panama City are as follows: management, business, service occupation, sales, office, natural resources, construction and maintenance, production, transportation and material moving.

In 2010, the per capita income was $22,088. The median income for a household in Panama City was $39,072, and the median income for a family was $47,800. About 19.1 percent of persons were below the poverty level.

4.3.1.5 Education

The education level of Bay County is relatively high. According to the 2010 census, 87.4 percent of the population 25 years or older are high school graduates. The percentage of the population 18 to 24 years old who completed some college or Associate's Degree was 42.3 percent, and 6.1 percent received a Bachelor's Degree or higher. The population 25 years and older that have less than a ninth grade education was 3.8 percent. The percentage of 25 years or older have a Bachelor's Degree or higher was 21.3 percent. The population ages 25 to 34 years had a Bachelor's Degree or higher was 20 percent.

4.3.1.6 Land Use and Development

The Bay County municipalities of Panama City and Panama City Beach are well established as vacation destinations and for people from the northern United States who relocate to Florida during the winter months to enjoy the mild climate. Panama City Beach is particularly well noted for its white sand beaches, with hotels, condominiums, restaurants, and shops lining the shore of the Gulf of Mexico. The economic anchors are tourism, military and a diverse group of local industries. The nearby Towns of Callaway, Springfield, Parker, Cedar Grove, and Mexico Beach also cater to the tourist trade, but to a lesser degree than Panama City and Panama City Beach.

The county is well developed for residential and commercial activities along the coast and is less densely populated in the northern part of the county. There are a number of public parks, natural and artificial reefs for skin and scuba diving, a branch of Florida State University, numerous arts and civic facilities, an extensive public school system, and other amenities that serve the permanent population, temporary residents, and tourists.

4.3.2 Commodity Information

The cargo being exported through the Bay Harbor Channel is mainly kraft linerboard, wood pulp and medium. Linerboard and medium is designed for packaging products with high demand for strength and durability. Wood pulp is used to make paper. Typically, a historical time series of commodity flows provide the baseline for the 50-year commodity projections. For this analysis, the assumption is production and demand remain flat and therefore, the commodity tonnage is held constant from the baseline year. Table 4-2 shows the commerce for the exports on the Bay Harbor Channel.

Table 4-2. Exports from Bay Harbor (short tons)

Commodity	2009	2010	2011	2012	2013
Paper and Paperboard	143,494	223,839	108,220	167,041	185,987

Commodity flows for Bay Harbor are different in the future without and with project condition. In the without project condition, production of the commodities at the WestRock Plant will continue, but cargo moving over the mill dock will decrease. In the with project 36-foot alternative condition, additional tonnage will be moving through the Port.

In the existing condition, storage capacity is limited and at capacity. Cargo typically is produced at the adjacent mill plant and stored until ready to be shipped at the mill dock. In the with-future without project condition, some cargo will be railed to other ports for export. In the with project condition, added landside storage facilities will allow for additional cargo to be exported across the dock.

Potential Commerce: New cargo opportunities for export and import at Bay Harbor are expected in the with project condition. Agreements have been made that with a deeper channel and vessels continuing to call, wood pulp and linerboard from other mills in the southeast will be exported over the Bay Harbor dock in Panama City. The tonnage is currently moving through the Port of Pascagoula, however, would be more efficient for landside transportation to be exported from Panama City. Other cargo opportunities with expansion of the landside facilities at Bay Harbor include steel, cement and lumber. The hinterland for the new cargo is the southeast, specifically Florida, Alabama and Georgia.

Once the landside facilities are updated in the with project condition, warehouse and storage capacity increases to 34,000 tons. The baseline production of commodity tonnage produced at the Panama City Mill for wood pulp and kraft linerboard is reflected above and held constant after the base year. The tonnage is being exported to northern Europe, the Mediterranean and South America.

The origin and destination of the cargoes change by project condition. Tables 4-3, 4-4 and 4-5 shows the origin and destination of the cargo based on project condition. In the without project condition, carriers moving cargo to northern Europe and the Mediterranean are expected to cease to call in the next three to five years. Growth in petrochemicals from the west Gulf ports to north Europe and the Mediterranean load the vessels too deep to transit the east channel in Panama City to pick up cargo. Therefore, cargo produced at the Panama City Mill will be railed to Savannah, Georgia to be loaded on a vessel. Other cargo that could potentially gain efficiency by exporting from Panama City is currently moving through Pascagoula, Mississippi. In the with project condition, cargo can continue to be exported over the mill dock along with cargo that is currently being railed to Savannah, Georgia going to the Far East. A carrier currently calling Bay Harbor agreed to add a call to Bay Harbor for their Far East service therefore, cargo currently being railed to Savannah will be exported over the dock in Panama City.

Table 4-3. Without Project Cargo Origins and Destinations - Rail

Origin	Destination	Trade Region
Panama City, FL	Savannah, GA	Northern Europe, Mediterranean & Far East
Hodge, LA	Savannah, GA	Far East
Cedar Springs, GA	Pascagoula, MS	South America
Valdosta, GA	Pascagoula, MS	South America

Table 4-4. With Project 34' Origins and Destination - Rail

Origin	Destination	Trade Region
Panama City, FL	Savannah, GA	Northern Europe, Mediterranean
Panama City, FL	Panama City, FL	Far East
Hodge, LA	Panama City, FL	Far East
Cedar Springs, GA	Pascagoula, MS	South America
Valdosta, GA	Pascagoula, MS	South America

Table 4-5. With Project 36' Origins and Destinations - Rail

Origin	Destination	Trade Region
Panama City, FL	Panama City, FL	Northern Europe, Mediterranean
Panama City, FL	Panama City, FL	Far East
Hodge, LA	Panama City, FL	Far East
Cedar Springs, GA	Panama City, FL	South America
Valdosta, GA	Panama City, FL	South America

4.3.3 Vessel Fleet Characteristics

The study details the composition of the vessel fleet expected to utilize the port facilities at Bay Harbor Terminal under the different alternatives, the vessel operating cost, the origin and destinations of commodities under each alternative and any shifts in origin or destination that may result under the different alternatives.

The major problem for the existing fleet produced by current draft restrictions in the channel is an inability to obtain optimum itineraries. An increased channel depth would provide more efficient utilization of vessels presently calling at the port and more efficient dispatching of vessels. Specifically, the benefit categories would be the elimination of losses associated with the need to shift vessels out of natural rotation.

Data was gathered for the study from conducting interviews with shippers and shipping companies, the harbor pilots, data from the Waterborne Commerce Statistics Center (WCSC), and data supplied by the Panama City Harbor facilities (*RockTenn, Port Panama City*).

Bay Harbor typically has three vessel calls per month. There are two carriers that service Bay Harbor in the existing condition that carry cargo to three different world trade regions; northern Europe, Mediterranean and West Coast South America. Vessel call data was analyzed for 2011-2013 to determine the vessel sizes based on deadweight tons (DWT), length overall (LOA) and beam. Vessel drafts range from 17 feet to 31 feet. Table 4-6 shows representative vessel characteristics of the fleet calling from 2011 to 2013.

Table 4-6. Representative Vessel Fleet Characteristics

Beam	Length overall	Deadweight Tons
106	656	61,400
106	655	51,421
100	656	45,295
97	615	40,850

The eastward navigation channel to Bay Harbor Terminal requires improvements to address navigation inefficiencies being faced by navigation vessels calling Panama City Harbor.

4.3.4 Landside Transportation Cost

The transportation cost savings benefits for this study are mainly landside. In the existing condition, products made at the Panama City WestRock Mill are able to be shipped at the dock adjacent to the mill. In the future without project condition and the channel remains the current depth, the carrier that moves cargo from the Panama City WestRock Mill to northern Europe and Mediterranean ports will cease to call. Therefore this cargo will be railed to Savannah for export. The cargo exported to South America will continue to be exported over the mill dock, and the inefficiency of double rotating will continue.

Other WestRock Mills in the southeast can obtain benefit from shipping over the WestRock Mill in Panama City due to location and the logistics of railing cargo to a geographically closer location. However, the warehouse facilities at the WestRock Mill in Panama City are currently at capacity and therefore cannot accept additional cargo from other mills even though cost savings could be achieved.

4.3.5 Transportation Cost Savings Benefits

The analysis of the economic feasibility of deepening access to Bay Harbor at Panama City was conducted through interviews with shippers and shipping companies, data from the WCSC and data supplied by the PCPA.

4.3.5.1 Without Project Condition

In the without project condition, the channel will remain at the existing depth. One of the carriers calling the Port will continue the double rotating operation and the other will cease to call on the Bay Harbor Terminal in the next three to five years.

Northern Europe and the Mediterranean: In the future without project condition, instead of the cargo being loaded from the Panama City mill dock, the cargo is railed to Savannah, Georgia to be loaded on a containership. .

Far East: Cargo will continue to be railed to Savannah to be loaded on a containership for export.

South America: Cargo will continue to be exported over the mill dock with the continued double rotating operation.

Table 4-7 shows the without project condition rail transportation origin and destination and costs per year. The trade region is the region of the world the cargo is ultimately going to, the origin is the city in which the product is manufactured, the destination is the port the cargo will be exported from, the rail distance is the distance in miles the cargo will travel from origin to destination. The rail cost per box car was determined by rail rate estimates for route possibilities for the WestRock Company based on CSX Corporation's "Ship CSX" price lookup tool. The two main rail shipping companies involved, CSX Corporation and Norfolk Southern, do not publicize the majority of rate estimates. Rail rates between relevant WestRock Company facilities and their exporting docks under the without project condition and the with project condition were found using CSX Corporation's "Ship CSX" price tool. This tool provides current rail rates per box car for 10 routes required for this study. To estimate the cost per box car for the remaining routes, a linear-regression was used. By finding the most likely route taken by CSX and estimating each route mileage using Google Maps, a relationship between cost per box car and route distance is established. The number of box cars per year was determined by dividing the annual metric tons by 58 metric tons per box car, as reported by WestRock. The cost per year is the number of box cars per year multiplied by rail cost per box car. The without project rail cost per year totals approximately $9.8 million per year.

Table 4-7. Without Project Condition Rail Costs

Without Project Condition - Rail					
Trade Region	Origin	Destination	Rail Distance in Rail Miles*	Rail Cost per Box Car	Cost per Year
Northern Europe and Mediterranean	Panama City, FL	Savannah, GA	404	$ 3,083	$ 5,388,000
Far East	Panama City, FL	Savannah, GA	404	$ 3,083	$ 1,206,000
Far East	Hodge, LA	Savannah, GA	852	$ 4,749	$ 505,000
South America	Cedar Springs, GA	Pascagoula, MS	357	$ 2,908	$ 1,091,000
South America	Valdosta, GA	Pascagoula, MS	473	$ 3,340	$ 1,565,000
Total Rail Cost per Year					**$ 9,755,000**

Table 4-8 shows the waterborne information for the without project condition. The trade region is the region of the world to which the cargo is going. The origination port is the port of origin in which the cargo is being exported. The destination port is actually a combination of ports, but for simplification grouped into the world region. The waterborne hours were determined by gathering all the ports of call and using www.sea-distances.org to get a total mileage distance. The vessel size was reported by the carrier of the vessel size expected by the base year of 2020. The annual metric tons were provided by the Port and Waterborne Commerce, and then calculated into metric tons by month using 12 months to determine the percentage of the vessel the cargo is using in order to attribute benefits to Bay Harbor cargo. The total annual waterborne cost is $3.4 million.

Table 4-8. Without Project Condition Waterborne Cost

Trade Region	Origination Port	Destination Port	Waternborne Hours	Vessel Size (DWT)	Vessel Capacity based on DWT	Annual Vessel	Cost of Panama City Cargo	Annual waterborne
Northern Europe	Savannah, GA	Northern Europe	301	90,456	83,220	$ 1,867,404	$ 58,385	$ 700,616
Mediterranean		Mediterranean	357	85,797	78,933	$ 2,027,046	$ 50,443	$ 605,321
Far East	Panama City, FL	Far East			-			
Far East	Hodge, LA	Far East			-			
Combined Tonnage Exported from Savannah on Containership			1,115	97,552	92,674	$ 4,984,050	$ 129,453	$ 1,553,442
South America	Pascagoula, MS	South America			-			
South America	Pascagoula, MS	South America			-			
Combined Tonnage Exported from Pascagoula, MS			338	50,000	46,000	$ 363,350	$ 32,246	$ 386,952
South America	Panama City, FL	San Antonio	338	55,000	50,600	$ 363,350	$ 41,870	$ 502,435
Total Waterborne Annual Cost								**$ 3,748,766**

Percent of cargo associated with Panama City was used to calculate the cost of Panama City

The breakbulk trade in forest products is dominated by carriers who operate "open hatch" vessels. These vessels are specialized in that they have very large hatch covers and holds are perfectly boxed shaped. The vessels have dehumidifiers to keep wood pulp and fluff pulp dry. They also have very sophisticated cranes which support specialized lifting equipment including vacuum lift attachments. There are limited number of these specialized carriers. Also, the minimum size vessel in the fleet of these carriers is around 45,000 DWT. Smaller builds of these vessels, around 30,000 DWT, were in service approximately 20 years ago and have been replaced by larger vessels. Therefore, a smaller vessel would not likely continue to service the port when the vessel of larger size ceases to call Panama City east leg or a replacement carrier introduced.

However, a sensitivity scenario of a smaller 30,000 DWT vessel calling the Port in the future without project condition is included in Appendix C – Economics. The scenario entails a 30,000 DWT vessel calling to transport the cargo out of Panama City Harbor to Europe and the Mediterranean. In this scenario, no rail cost are incurred and only the changes in waterborne transportation cost are captured as benefit to the project.

4.3.5.2 With 34 Feet Project Condition

With the channel deepened to 34 feet, transportation cost savings benefits would be obtained based on changed inland logistic operations associated with some of the waterborne routes and some of the waterborne trade routes.

Northern Europe and Mediterranean: The Northern Europe and Mediterranean trade route would not change with a 34 feet channel. The vessels on this route would be loaded too deep to call Bay Harbor Channel due to cargo growth from the ports in the western Gulf ports.

Far East: With a deeper channel, vessels on the Far East trade route are able to transit the Bay Harbor Channel. Since cargo destined for northern Europe and the Mediterranean will be railed for export to another port, warehouse space will be available for Panama City WestRock cargo and cargo from the Hodge, Louisiana Plant. One vessel call per month will handle the cargo to the Far East.

South America: Cargo destined for South America produced at the Panama City WestRock Plant will continue to be exported over the mill dock. One vessel a month will call to handle this cargo.

Table 4-9 shows the with 34 feet project condition trade regions, origin, destination port, rail distance and associated rail cost per box car, tonnage and the cost per year. The total rail cost per year is $8.5 million.

Table 4-9. 34 Feet With Project Condition Rail Cost

Trade Region	Origin	Destination	Rail Distance in Rail Miles	Rail Cost per Box Car	Cost per Year
Northern Europe and Mediterranean	Panama City, FL	Savannah, GA	404	$ 3,083	$ 5,388,435
Far East	Panama City, FL	Savannah, GA	0	$ -	$ -
Far East	Hodge, LA	Savannah, GA	605	$ 3,831	$ 407,016
South America	Cedar Springs, GA	Pascagoula, MS	357	$ 2,908	$ 1,090,507
South America	Valdosta, GA	Pascagoula, MS	473	$ 3,340	$ 1,565,465
Total Rail Cost per Year					**$ 8,451,423**

Table 4-10 shows the waterborne information for the with 34 feet project condition. The trade region is the region of the world to which the cargo is going. The origination port is the port of origin in which the cargo is being exported. The destination port is actually a combination of ports, but for simplification grouped into the world region. The waterborne hours were determined by gathering all the ports of call and using www.sea-distances.org to get a total mileage distance. The vessel size was reported by the carrier of the vessel size expected by the base year of 2020 and held constant. The annual metric tons were provided by the port and Waterborne Commerce, and then calculated into metric tons by month using 12 months to determine the percentage of the vessel the cargo is using in order to attribute benefits to Bay Harbor cargo. With the channel deepened to 34 feet, the origination port changes to Panama City Bay Harbor for the Far East trade route. Also, cargo going to South America from southeast plants and the WestRock Mill will be exported from Bay Harbor. The total annual waterborne cost is $2.4 million.

Table 4-10. With 34 Feet Project Condition Waterborne Cost

Trade Region	Origination Port	Destination Port	Waterborne Hours	Vessel Size (DWT)	Vessel Capacity based on DWT	Annual Vessel Operating Cost	*Cost of Panama City Cargo	Annual waterborne cost
Northern Europe	Savannah, GA	Northern Europe	301	90,456	83,220	$ 1,867,404	$ 58,385	$ 700,616
Mediterranean		Mediterranean	357	85,797	78,933	$ 2,027,046	$ 50,443	$ 605,321
Far East	Panama City, FL	Far East			-			
Far East	Panama City, FL	Far East			-			
Combined Tonnage Exported from Panama City, FL			926	58,000	53,360	$ 1,022,304	$ 46,116	$ 553,397
South America	Pascagoula, MS	South America			-			
South America	Pascagoula, MS	South America			-			
Combined Tonnage Exported from Panama City, FL			338	50,000	46,000	$ 363,350	$ 32,246	$ 386,952
South America	Panama City, FL	San Antonio	322	55,000	50,600	$ 346,150	$ 39,888	$ 478,652
Total Waterborne Annual Cost								**$ 2,724,937**

4.3.5.3 With 36 Feet Project Condition

With the channel deepened to 36 feet, transportation cost savings benefits would be obtained based on changed inland logistic operations associated with waterborne routes and more efficient rail routes.

Northern Europe and Mediterranean: With 36 feet of depth, carriers on routes to these regions could continue their call patterns. The carriers could load in Panama City the existing cargo produced at the Panama City Mill as well as combine cargo from another mill in south Louisiana.

Far East: With a deeper channel, vessels on the Far East trade route are able to transit the Bay Harbor Channel. It is assumed one vessel call per month will handle the cargo to the Far East.

South America: Cargo destined for South America produced at the Panama City WestRock Plant will continue to be exported over the mill dock. Additional cargo from plants in the southeast that produce the same type of commodity, kraft linerboard and wood pulp, will rail cargo to Bay Harbor for export over the east channel dock. One vessel a month will call to handle this cargo.

Table 4-11 shows the with 36 feet project condition trade regions, origin, destination port, rail distance and associated rail cost per box car, tonnage and the cost per year. The total rail cost per year is $2.3 million.

Table 4-11. 36 Feet With Project Condition Rail Cost

Trade Region	Origin	Destination	Rail Distance in Rail Miles*	Rail Cost per Box Car	Cost per Year
Northern Europe and Mediterranea	Panama City, FL	Panama City, FL	0	$ -	$ -
Far East	Panama City, FL	Panama City, FL	0	$ -	$ -
Far East	Hodge, LA	Panama City, FL	605	$ 3,831	$ 407,016
South America	Cedar Springs, GA	Panama City, FL	111	$ 1,993	$ 747,341
South America	Valdosta, GA	Panama City, FL	220	$ 2,398	$ 1,124,284
Total Rail Cost per Year					**$ 2,278,640**

Table 4-12 shows the waterborne information for the with 36-feet project condition. The trade region is the region of the world to which the cargo is going. The origination port is the port of origin in which the cargo is being exported. The destination port is actually a combination of ports, but for simplification grouped into the world region. The waterborne hours were determined by gathering all the ports of call and using www.sea-distances.org to get a total mileage distance. The vessel size was reported by the carrier of the vessel size expected by the base year of 2020 and held constant. The annual metric tons were provided by the port and Waterborne Commerce, and then calculated into metric tons by month using 12 months to determine the percentage of the vessel the cargo is using in order to attribute benefits to Bay Harbor cargo. With the channel deepened to 36 feet, the origination port changes to Panama City Bay Harbor for the northern Europe, Mediterranean and Far East trade route. Also, cargo going to South America from southeast plants and the WestRock Mill will be exported from Bay Harbor. The total annual waterborne cost is $2.4 million.

Table 4-12. 36 Feet Project Condition Waterborne Annual Cost

Trade Region	Origination Port	Destination Ports	Waternborne Hours	Vessel Size (DWT)	Vessel Capacity based on DWT	Annual Vessel Operating Cost	Cost of Panama City Cargo	Annual waterborne cost
Northern Europe	Panama City, FL	Northern Europe	0	58,000	53,360	$ 452,640	$ 46,568	$ 558,819
Mediterranean		Mediterranean	0	58,000	53,360	$ 515,568	$ 36,036	$ 432,436
Far East	Panama City, FL	Far East			-			
Far East	Panama City, FL	Far East			-			
Combined Tonnage Exported from	Panama City, FL		0	58,000	53,360	$ 1,022,304	$ 46,116	$ 553,397
South America	Panama City, FL	South America			-			
South America	Panama City, FL	South America			-			
Combined Tonnage Exported from	Panama City, FL		0	50,000	46,000	$ 363,350	$ 32,246	$ 386,952
South America	Panama City, FL	San Antonio	322	55,000	50,600	$ 346,150	$ 39,888	$ 478,652
Total Waterborne Annual Cost								**$ 2,410,255**

With the 36 foot deepening alternative, the Port of Panama City will make landside improvements at Bay Harbor to include building new warehouses, rail improvements and dock improvements. These costs have been captured in the associated cost of the project. Associated cost are the costs of the measures needed over and above project measures to achieve the benefits claimed during the period of analysis. The associated cost are an economic cost associated with the project and appear as costs in the benefit-cost ratio.

The average annual equivalent (AAE) values of the recommended plan benefits, which reflect present values of savings in transportation costs using the FY16 3.125 percent discount rate, were computed for the rail and waterborne cargo movements. The AAE values were determined to be $2,328,000 for the 34-foot channel alternative and $8,815,000 for the 36-foot channel alternative.

Table 4-13 shows the summary of AAE benefits for the without project and with project conditions.

Table 4-13. Summary of AAE Benefits for Without Project and With Project Conditions

	Without Project	34 Ft Project	36 Ft Project Project	34 Ft Project Benefits	36 Ft Project Benefits
Total Annual Rail Cost	$ 9,755,000	$ 8,451,000	$ 2,279,000	$ 1,304,000	$ 7,476,000
Total Annual Waterborne Cost	$ 3,749,000	$ 2,725,000	$ 2,410,000	$ 1,024,000	$ 1,339,000
Total Annual Transportation Cost	$ 13,504,000	$ 11,176,000	$ 4,689,000	$ 2,328,000	$ 8,815,000

4.3.5.4 Sensitivity Analysis

Risk and uncertainty related to deep draft shipping identifies those factors that are the major determinants of the level of project benefits and cost. The sensitivity analysis will assist in identifying critical study parameters and how they impact the results. In the case of this study, they include rail box car cost and number of box cars used per year. There are no changes to the waterborne routes of the analysis. The majority of benefits are for inland transportation rail. The following paragraphs discuss these factors as they relate to this project.

Sensitivity Scenario 1: As discussed previously, the rail cost per box car is determined by using a tool that uses current rail rates per box car and shipping distance of the route. For sensitivity, the rail cost per box car was reduced by 25 percent to determine a cost per year adjustment to benefits. The trade region and waterborne leg of the origin and destination was held constant as well as the rail distance in miles. The rail cost per box car was adjusted 25 percent lower to capture variability in the box car that is multiplied by the number of box cars per year to determine and total cost per year. The without project condition transportation cost total $11,065,000, the with project transportation cost total $4,119,000 with 36 foot project benefits totaling $6,946,000.

Sensitivity Scenario 2: The second sensitivity scenario changed the metric tons loaded on each box car. This calculation was important because the number of metric tons loaded on the box car determined the number of cars needed which is multiplied by the cost per box car to determine the total annual cost. The tonnage was adjusted from 58 metric tons to 75 metric tons, roughly 25 percent. With change in the amount of tons loaded per box car, the without project condition transportation cost is $11,301,000, the with project condition transportation cost totals $4,174,000 with the AAE 36 foot project benefits of $7,127,000.

Sensitivity Scenario 3: The third sensitivity scenario includes both sensitivity scenarios one and two. The box car price was adjusted 25 percent of the economic analysis costs and the tons per box car was increased to 75 metric tons per car, approximately 25 percent of the metric tons per box car in the economic analysis. The transportation cost in the without project condition total $9,713,000, the with project condition transportation cost total $3,733,000. The AAE benefits for the 36 foot project are $5,680,000.

Sensitivity Scenario 4: The fourth sensitivity scenario includes a vessel continuing to service the east channel on the Europe and Mediterranean route in the future without project condition. The scenario uses a 30,000 DWT bulk carrier calling on the existing 32 foot channel. The annual and monthly metric tons remained the same as the analysis as well as the percentage of cargo capacity used on the vessels. The number of vessels needed per year was determined by taking the vessel capacity multiplied by the percentage of the vessel WestRock cargo typically uses. The number of calls needed was determined by dividing the amount of cargo each vessel call would potentially carry by the total annual metric tons. The operating cost per call attributed to Panama City cargo was then multiplied by the number of calls to determine the annual operating cost. The without project was compared to the 36-foot with project condition of using existing vessels calling the terminal. Since waterborne transportation would continue to be used in this scenario, rail cost would be eliminated. The waterborne transportation cost in the without project condition total $3,870,700 and the with project transportation cost total $2,706,600. The AAE benefits for the 36-foot project are $1,164,100.

Table 4-14 shows the sensitivity scenario comparison.

Table 4-14. Sensitivity Scenario Results

		Without Project	With Project	With 36' Project Benefits
Scenario 1 – 25% reduction in rail cost	Total Annual Rail Cost	$ 7,316,000	$ 1,709,000	$ 5,607,000
	Total Annual Waterborne Cost	$ 3,749,000	$ 2,410,000	$ 1,339,000
	Total Annual Transportation Cost	$11,065,000	$ 4,119,000	$ 6,946,000
Scenario 2 – adjustment in tons per box car	Total Annual Rail Cost	$ 7,551,000	$ 1,764,000	$ 5,788,000
	Total Annual Waterborne Cost	$ 3,749,000	$ 2,410,000	$ 1,339,000
	Total Annual Transportation Cost	$ 11,301,000	$ 4,174,000	$ 7,127,000
Scenario 3 – 25% reduction in rail cost and adjustment in tons per box car	Total Annual Rail Cost	$ 5,664,000	$ 1,323,000	$ 4,341,000
	Total Annual Waterborne Cost	$ 3,749,000	$ 2,410,000	$ 1,339,000
	Total Annual Transportation Cost	$ 9,413,000	$ 3,733,000	$ 5,678,000
Scenario 4 – continuation of waterborne transport from Panama City Harbor	Total Annual Rail Cost	$ 0	$ 0	$ 0
	Total Annual Waterborne Cost	$ 3,898,500	$ 2,706,600	$ 1,192,000
	Total Annual Transportation Cost	$3,898,500	$ 2,706,600	$ 1,192,000

5.0 PLAN SELECTION*

5.1 Key Concepts

A plan recommending Federal action is to be the alternative plan with the greatest net economic benefit consistent with protecting the Nation's environment, and is called the NED Plan. The primary contributors to the NED account are transportation cost savings. The AAE values of the NED benefits, which reflect present values of savings in transportation costs using the FY16 3.125 percent discount rate, were computed for the rail and waterborne cargo movements. The AAE values were determined to be $8,815,000 for the 36-foot channel alternative. The primary contributor to protecting the Nation's environment is shown by the PDT working closely with environmental agencies, both State and Federal, to review proposed project requirements and how those requirements will impact the environment and what can be done to minimize impacts.

The significance of the selected plan is to keep the fleet calling on the Port and become more efficient. The existing fleet is produced by draft restrictions in the channel resulting in an inability to obtain optimum itineraries. An increased channel depth would provide more efficient utilization of vessels presently calling at the port and more efficient dispatching of vessels. Specifically, the benefit category is transportation cost savings due to the elimination of losses associated with the need to shift vessels out of natural rotation.

For this analysis, four alternatives were considered; without project, 34-foot deepening, 35-foot deepening and 36-foot deepening. The 34-foot and 36-foot depths were carried forward for detailed analysis and comparison. The 34-foot alternative was analyzed to see if benefits would accrue with the channel improvement of an additional 2 feet. The 35-foot alternative was considered, but since the existing warehouse still has limited capacity, the quantity of cargo cannot be exported over the mill dock as with the 36-foot channel. Therefore, this alternative was screened from further analysis as it has higher cost associated with additional cubic yards dredged, but does not return the benefits of the 36-foot alternative.

The 34-foot alternative involved dredging approximately 300,900 cubic yards with a rough order magnitude total cost of $5,200,000. The 36-foot alternative involved dredging approximately 372,000 cubic yards with a total cost of $7,052,000. Associated cost were included in the 36 foot alternative for improvements to warehouses and docks. Associated cost are the costs of the measures needed over and above project measures to achieve the benefits claimed during the period of analysis. The associated cost are an economic cost associated with the project and appear as costs in the benefit-cost ratio. Table 5-1 summarizes the average annual benefits and costs for the 34- and 36-foot project alternative.

The net benefits of Alternative 2 are $1,994,000 while the net benefits of Alternative 4 are $7,690,000. The 36 feet plan maximized net benefits and is therefore the NED Plan.

Table 5-1 below shows the cost benefit analysis summary.

Table 5-1. Cost Benefit Analysis Summary

Benefits	Alternative 1	Alternative 2	Alternative 3	Alternative 4

	No Action Without Project	34 Feet	35 Feet	36 Feet
Rail Transportation Costs	$9,755,000	$8,451,000	-	$2,279,000
Waterborne Transportation Costs	$3,749,000	$2,725,000	-	$2,410,000
Total Transportation Cost	$13,504,000	$11,176,000	-	$4,689,000
Rail Transportation Cost Savings Benefits		$1,304,000	-	$7,476,000
Waterborne Transportation Cost Savings Benefits		$1,024,000	-	$1,339,000
Total AAE Transportation Cost Savings Benefits		$2,328,000	-	$8,815,000
Costs				
Project Cost		$5,200,000	-	$7,052,000
Associated Cost				$18,000,000
IDC		$73,000	-	$357,000
Total Investment Cost		$5,272,000	-	$25,409,000
Average Annual Project Cost		$220,000	-	$1,011,000
Annual O&M		$114,000	-	$114,000
Average Annual Cost		$334,000	-	$1,125,000
Net Benefits		$1,994,000		$7,690,000
Benefit-to-cost ratio		6.9 to 1		7.8 to 1

5.2 Proposed Action

The recommended plan for the improved Federal navigation channel at Bay Harbor will deepen the channel from the existing depth of -32 feet MLLW to -36 feet MLLW, which will allow the current vessel fleet calling at the Port to enter and exit at a deeper draft. The final Bay Harbor Channel will be approximately 3.5 miles long with a depth of 36 feet, a width of 300 feet, and a turning basin with a length of 1,700 feet and a width of 1,100 feet. Excavation includes an additional 2 feet for allowable overdepth and will require the removal of approximately 372,000 cubic yards of material. Figure 4-1 displays the recommended dredge plan. Shoaling of the improvement navigation channel would be minimal; however, to ensure channel depths it is anticipated future O&M of the navigation channel would require the removal of approximately 40,000 cubic yards on a 4-year dredging cycle.

6.0 ENVIRONMENTAL EFFECTS*

6.1 Physical Setting

The following sections describe changes to the physical setting of St. Andrew Bay due to the preferred alternative.

No Action: The No Action alternative would result in the continuation of existing conditions. This alternative avoids both the monetary investment and potential adverse impacts associated with dredging and placement activities. The implementation of the No Action alternative would result in the Bay Harbor Channel remaining at current depths and project benefits not being realized by the improvements project being constructed. There should be no changes to Geology, Climate, Bathymetry, Tides, or the rate of Sea Level Change associated with the No Action alternative. Sedimentation would likely continue to occur within the Bay Harbor Channel and would more than likely limit current navigation depths further.

Proposed Action: The impacts of the Proposed Action to the Physical Setting are discussed below:

6.1.1 Geology

The preferred alternative is not anticipated to have any impacts on the existing geology of the project vicinity.

6.1.2 Climate

The preferred alternative is not anticipated to have any impacts on the existing climatic conditions with the project vicinity.

6.1.3 Bathymetry

The bay bathymetry will only be changed in the dredged locations and in the disposal area. The preferred alternative calls for the removal of approximately 372,000 cubic yards of dredged material from the authorized channel. The dredging will only be needed in two areas where the desired depth of -36 feet MLLW was not naturally occurring. The first dredge area starts near station 40+00 and runs for 400 feet along the northern edge of the channel. The minimum depth created by the shoal is -32 feet MLLW. The second dredge area starts near station 168+00 and runs to the berthing area. The minimum depth in this area is approximately -28 feet MLLW near the northern end of turning basin. Future shoaled material is anticipated for removal every four years to sustain the 36 feet MLLW depth. The proposed in-bay disposal area is a located approximately 0.5 miles to the southeast of the turning basin, near Military Point. The maximum depth in the area before disposal is near -64 feet MLLW, with the dredge material bringing it up to -46 feet MLLW.

6.1.4 Sediment

The proposed action will result in the relocation of sediment from the channel to the designated in-bay placement area. The dredged material is similar in composition to that found within the in-bay placement area. A USACE contractor collected vibracore samples representative of the material proposed for dredging and performed physical and chemical evaluations to facilitate determination of appropriate placement options. This investigative work was conducted by EA Engineering, Science, and Technology, Inc. in 2014. Vibracore samples were collected within the project vicinity (Figure 3-1) to analyze grain size.

Sediment samples were collected within each vibracore based on lithologic changes and submitted for grain size analysis, providing greater detail of compositional variations with depth. The composition at vibracore PC-01 was consistently clayey sand from 0 to 6.67 feet. At PC-02, there was a 3.3-foot layer of clay at the surface, underlain by a foot of sand with silt. The bottom 5 feet was composed of silty sand. At PC-03, there was a 1.25-foot layer of clayey sand, underlain by well-graded sand with silt to a depth of 2.6 feet and silty sand to 6.4 feet. At PC-04, the sediments were composed of clayey sand grading to silty clay in the top 3.5 feet, underlain by silty sand down to 6.25 feet. At PC-05, there was clayey-sand in the top 2 feet, underlain by silty sand to 3.7 feet and then poorly graded sand to 6.4 feet. At PC-06 there was clayey sand in the top 0.6 feet, underlain by silty sand and shell hash to 5.3 feet. At PC-07 there was clayey sand in the top 1.2 feet, underlain by silty sand with shell hash to 6.3 feet and shell fragments from 6.3 to 6.8 feet. PC-08 was composed of clay to 5.25 feet, and PC-09 was composed of silty fine-grained sand with shell hash to 6 feet.

With the exception of PC-08, the sediments from each vibracore location were composed predominantly of sandy substrate and shell, each approximately greater than or equal to 73 percent sand and gravel.

The in-bay placement area was also sampled during the 2014 sampling event using a sonar grab sampler. Grain size information is reliable to a depth of approximately 0.5 to 1.0 feet. Three surface grab samples were taken and composited for testing. The sample contained approximately 76.5 percent sand and 23.5 percent silts and clays. The overall Unified Soil Classification System (USCS) classification was a clayey sand (SC).

Based on information obtained during the recent sediment testing, it has been determined that the placement of the proposed dredged material within the in-bay placement area would have no long-term adverse effects given the similarities between the dredge areas and the in-bay placement area. Future sediments are anticipated to be comparable to those initial testing results for the placement of approximately 40,000 cubic yards every four years of O&M material within the in-bay placement area.

6.1.5 Tides

The preferred alternative calls for the removal of 372,000 cubic yards of dredged material. The small amount of dredging, the majority of which was located near the dock, was not expected to cause a noticeable change in the tidal flushing of the east leg of St. Andrew Bay. A 3-diminsional Environmental Fluid Dynamics Code (EFDC) calibrated model of the bay was utilized to verify that the project would have no impacts to the tidal flushing of the bay. Preliminary model results have shown no change in flushing from the pre- and post- project scenarios. Very little change was noted when the pre-post project fetch limited wave height was calculated within the dredged area.

6.1.6 Sea Level Change

Key coastal processes specifically related to the Federal navigation channel and sensitive to projected sea level increases include:

- Jetty flanking, overtopping, and armor stone shifting
- Erosion and scour at the jetties and main entrance channel
- Inundation of beaches, low lying areas, infrastructure, and facilities adjacent to the channel
- Dune erosion and overwash of beach areas along Panama City Beach and Shell Island peninsulas under accelerated sea level rise could induce additional flooding in the St. Andrew Bay and possibly increase the risk of storm exposure to the PCPA facilities

These same processes will affect the natural systems and habitat areas in Bay County. These processes also have the potential to affect a major anthropogenic change to the coastal areas of Bay County. Increased frequency and magnitude of flooding and storm inundation could encourage residents and industry to retreat to higher ground thereby spreading development within the county. Inundation and flooding could also influence the industrial Bay occupants to use structural measures to protect their facilities, which could further complicate the hydrodynamic processes of the area.

6.2 Biological Resources

No Action: The No Action alternative would avoid disruptions to the resources caused by construction of the project; however, no benefits of the project would be recognized. The No Action alternative would avoid losses of plankton, nekton/epifauna, and benthic fauna associated with dredging and disposal activities. The motile and non-mobile species would not be disturbed and there would be no loss to larval and juvenile species. There would be no disruptions to marine mammals and birds within the area associated with the No Action alternative and their actions should continue similar to what currently exists. The SAV and wetlands currently in the vicinity of the project site would remain unchanged and should continue to be protected under current regulatory laws into the future. It is anticipated the channel would continue to experience slight shoaling limiting its use due to shallower depths.

Proposed Action: The impacts of the Proposed Action to the Biological Resources are discussed below:

6.2.1 Plankton

Impacts to plankton would result primarily from temporary increases in turbidity and nutrients. These impacts would be short-term in nature and restricted to the immediate vicinity of the dredging and placement activities and are not expected to cause significant increases in productivity of the bay system.

6.2.2 Nekton/Epifauna

Due to the highly motile nature of the majority of these forms, impacts due to the proposed dredging and placement would be minimal. Some epifaunal forms could be entrained by the dredge and impacted by the disposal operations, but the total impact would be minor since the areas are only a small percentage of the suitable habitat present within the system. The majority of these forms would avoid the area of dredging and placement. No increase in competition or predation in areas outside of the construction, and future O&M, would be expected.

6.2.3 Benthos

Dredging and dredged material placement activities would result in impacts to benthos. Benthos within the channel dredging limits would be destroyed by the removal of sediment. Dredged material placement activities would result in direct burial of benthic infauna within the in-bay placement area. It is expected that benthic infauna would recover the year, if not sooner, following dredging and dredged material placement activities given the opportunistic nature of infaunal constituents. Changes in the dredged material placement area bathymetry may cause temporary impacts which could cause changes in benthic community structure. No invasive species would be introduced by the proposed dredging and placement activities. Based on past study findings, it is anticipated any unavoidable impacts would be temporary and short-term in nature.

6.2.4 Marine Mammals

No impacts to marine mammals are expected to occur during the construction or future maintenance of the proposed project. The West Indian Manatee will be addressed in Section 7.9, Threatened and Endangered Species.

6.2.5 Submerged Aquatic Vegetation (SAV)

All known areas of seagrasses are located away from the dredge areas and dredged material placement area. There will be no direct impacts to SAVs located along the shorelines within the project vicinity. To ensure that increased turbidity is not occurring within SAV areas, turbidity measurements will be taken during dredging operations and compared to background readings. Prior to any dredging or dredged material placement activities within these areas, proper coordination with all appropriate agencies will be made, and suitable dredged material placement plans would be determined as to avoid adverse impacts to these productive and vital environments.

6.2.6 Wetlands

All known wetland marshes are located along the shorelines and away from the dredge areas and dredged material placement area. There will be no direct impacts to any wetlands located within the project vicinity. Turbidity monitoring during construction and future maintenance dredging events would ensure no associated sedimentation would occur as a result of the project. There would be no placement of dredged material within areas that contain wetlands. It is anticipated there would be no direct or indirect adverse impacts to wetlands located within the project vicinity.

6.2.7 Birds

No adverse impacts to nesting migratory shorebirds are anticipated with the implementation of the project. If nesting is evident within the vicinity of the project area including any potential upland staging areas, all project related activities would be restricted from within 300 feet of the nesting area and coordination with the Florida Wildlife Commission (FWC) would occur. The project staging areas would be inspected prior to commencement of construction activities. The FWC would be contacted if nesting is identified and appropriate actions would be taken to avoid adverse impacts.

6.3 Essential Fish Habitat

No Action: The No Action alternative would avoid any disruptions to EFH within the project area. The species that would use the project area would not be disrupted and would remain in the area. There would be no loss of benthic invertebrates as a result of dredging within the channel and placement activities within the in-bay disposal site. The Bay Harbor Channel would continue to be utilized by vessels calling upon the associated industries and this movement into and out of the area would continue to have temporary EFH impacts. However, the Bay Harbor Channel would continue to experience slight shoaling limiting its use due to shallower depths. The benefits of the improvements project would not be realized by implementation of the No Action alternative.

Proposed Action: Brown shrimp (*Penaeus aztecus)*, pink shrimp (*P. duorarum)*, white shrimp (*P. setiferus)*, king mackerel (*Scomberomorus cavalla)*, Spanish mackerel (*S. maculate)*, gray snapper (*Lutjanus griseus)*, lane snapper (*L. synagris)*, gag grouper (*Mycteroperca microlepis)*, and red drum (*Sciaenops oellatus)* are expected to occur within the vicinity of the project. No estuarine emergent wetlands, oyster reefs, or SAVs would be adversely affected by the proposed action. Dredging and dredged material placement operations would impact benthic organisms within the footprint of the navigation channel and dredged material placement site. However, it is anticipated there would be no significant long-term impacts to this resource as a result of this action. Increased water column turbidity during dredging and placement activities would be temporary and localized. The spatial extent of elevated turbidity is expected to be within 1,000 meters of the operation, with turbidity levels returning to ambient conditions within a few hours after completion of the activities. Therefore, no significant long-term impacts to water quality are expected to occur.

Notwithstanding the potential harm to some individual organisms, no significant impacts to managed species of finfish or shellfish populations are anticipated from the improvement and future maintenance dredging activities. Therefore, it is the opinion of the USACE, Mobile District that this project would have no significant effects on EFH. The effects determination of the proposed action has been forwarded to the NMFS for their review and comment.

6.4 Water Quality

No Action: The No Action alternative would avoid any temporary increased turbidity associated with dredging and placement activities. The existing water quality conditions would be expected to remain unchanged due to current Florida water quality statutes and regulatory programs in place for evaluations.

Proposed Action: The placement of dredged material within the in-bay dredged material placement area would have no long-term impacts to water quality. Chemistry and elutriate tests were performed on representative samples of material to be dredged. Results are discussed in Section 3.1.4. The grand composite that represents the dredged material as a whole during the operations were within water quality standards for the State of Florida. A temporary localized increase in turbidity is expected; however, during dredging and dredged material placement activities, turbidity levels would be monitored to ensure compliance with the state water quality certification from the FDEP and their guidelines will be maintained during the proposed activity. Placement of the dredged material within the deep area adjacent and east of the Federal channel was modeled using a hydrodynamic model as requested by the State to determine flushing times. Based on preliminary results, the East Bay system flushes within a day and should experience no significant changes due to dredge and placement activities. The project will remain in compliance with state water quality certification and the permit conditions will be met. It is anticipated that daily turbidity monitoring will be required to be taken on 4-hour intervals at bottom, mid, and surface depths to ensure that turbidity remains at or lower than state requirements. Exceeding state limits would require suspension of operations activities until turbidity returns to acceptable levels and notification will be made to the state compliance officer. The water quality certification will address the future O&M of the navigation channel and is anticipated to be issued for 15 years.

6.5 Cultural Resources

No Action: The No Action alternative would avoid any dredging activities within the project area and the area would remain unchanged.

Proposed Action: As per the requirements outlined in Section 106 of the National Historic Preservation Act, the lead Federal agency must consider the effects of the proposed action on historic properties. The USACE, Mobile District is the lead for this project for Section 106 compliance. This project, being an inland waterway associated with a port, is sensitive for cultural resources based on several Federally-funded scientific studies. As such, this project required a Phase I maritime cultural resources survey as no survey has been previously conducted in this area. Phase I maritime cultural resources survey coverage for this project consisted of approximately 40 line miles at the State of Florida mandated 50 feet (15 meters) survey spacing lines. This included survey of approximately 143 acres for the dredge material placement area, approximately 86 acres for the larger dredge area, and approximately seven acres for the smaller dredge area. Instrumentation for this Phase I survey included a high-resolution side scan sonar, a magnetometer, and sub-bottom sonar. This instrumentation is designed to locate shipwrecks as well as potential inundated terrestrial archaeological sites such as high sensitivity relic landforms. Fieldwork for this survey was completed in September 2015. A Management Summary outlining the results of this survey was delivered to the USACE maritime archaeologist one week later. Based on the data collected from this survey the USACE, Mobile District maritime archaeologist determined that there will be No Effect to cultural resources as a result of this undertaking. This determination will be coordinated with the Florida SHPO with a 30-day timeline for response and interested tribes (no legal timeline for response but anticipated within 30 days).

6.6 Aesthetics

No Action: The No Action alternative would avoid any changes to the aesthetics within the project area. The project vicinity within Panama City would remain a developed commercial and industrial port area with nearby residential communities; however, the Bay Harbor Channel would continue to experience slight shoaling limiting its use due to shallower depths. The benefits of the improvements project would not be realized by implementation of the No Action alternative.

Proposed Action: Presence of dredge equipment within the existing navigation channel will have no significant impact to the area esthetics. The equipment would be mobilized within the project area for a relatively short period of time. No permanent visible effects to local aesthetics would result from this improvement project and its future O&M.

6.7 Noise

No Action: The No Action alternative would avoid temporary increases in noise levels associated with construction activities. The continuation of noise levels associated with the Bay Harbor Terminal port area would continue.

Proposed Action: Noise from the dredge equipment and other job-related equipment is expected to temporarily increase during the proposed dredging and placement activities in the project vicinity. Noise levels will resume to prior conditions once the dredging and dredged material placement operations are complete. Noise levels will blend with those from adjacent activities and are not significant.

6.8 Air Quality

No Action: The No Action alternative would avoid any added exhaust emissions associated with construction activities. The existing conditions would be expected to remain unchanged as Bay County is currently in attainment with the National Ambient Air Quality Standard (NAAQS) of the Clean Air Act.

Proposed Action: The proposed action would have no significant long-term effect on air quality. Air quality in the immediate vicinity of the dredge and other equipment would be slightly affected for a short period of time by the fuel combustion and resulting engine exhausts. The exhaust emissions are considered insignificant in light of prevailing breezes. The Panama City Harbor area is in attainment with NAAQS parameters.

These standards would not be violated by the implementation of the proposed action. The proposed action would not affect the attainment status of the project area or region.

6.9 Threatened and Endangered Species

No Action: The No Action alternative would avoid any disruptions to any listed species that would be caused by dredging and placement activities; however, the Bay Harbor Channel would continue to experience slight shoaling limiting its use due to shallower depths. The benefits of the improvements project would not be realized by implementation of the No Action alternative. Continued protection of listed species would continue to occur under purview of the U.S. Fish and Wildlife Service (USFWS) and NMFS-PRD through implementation of the Endangered Species Act.

Proposed Action: Manatees may be occasionally found in the shallow waters of the project area during the warmer months of the year. Given their slow-moving and low visibility nature, it is possible that manatees could wander into close proximity of the dredging and placement operations. To minimize contact and potential injury to Manatees, the Manatee Construction Conservation Measures as specified by the USFWS will be strictly observed. The loggerhead, Kemp's ridley, and green sea turtles would not be impacted, as the proposed action will be conducted via a hydraulic cutter-head dredge which has been documented to have no significant effects to marine turtles (GRBO 2003, and amended in 2005 and 2007). The project is located outside of critical habitat for Gulf sturgeon. It is also unlikely that adverse effects to Gulf sturgeon would occur because the operations will be conducted by a hydraulic cutter-head dredge and those impacts to the species were discounted in the GRBO 2003 (amended 2005 and 2007). Furthermore, it is unlikely any of the above listed marine turtle species or Gulf sturgeon would be found within the vicinity of the disposal area as they are most often found foraging along the sandy Gulf front shoreline (or Gulf sturgeon within their native rivers) and are not typically seen within the back-bay closed systems. Should an unlikely occurrence happen, these species are mobile and will likely avoid disposal activities due to the increased noise associated with the cutter-head and/or mechanical type dredge equipment. In the unlikely event a hopper dredge is used, the terms and conditions of the GRBO would be adhered to and minimization measures would be undertaken to reduce potential impacts to listed species. Further coordination with the USFWS is ongoing regarding this project and formal consultation would be initiated should a hopper dredge be utilized. The Mobile District will continue coordination on the improvements and future O&M, in order, to receive concurrence from the USFWS concerning impacts of the proposed project.

6.10 Hazardous, Toxic, and Radioactive Waste (HTRW)

No Action: The No Action alternative would avoid any Hazardous, Toxic, and Radioactive Waste (HTRW) changes to the project area.

Proposed Action: The sediments proposed for dredging do not qualify as HTRW in accordance with ER 1165-2-132 since there are no sites designated by the Environmental Protection Agency or the State for response action under Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) or

National Priority List (NPL) within the proposed dredging or dredge material placement areas. The sediments have been tested to determine any contaminants and to what levels the dredged material contained. Based on this assessment, no significant environmental concerns have been identified that would affect the proposed project.

6.11 Cumulative Effects

Cumulative impacts are those impacts on the environment that result from the incremental impacts of the action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency (Federal or non-Federal) or person undertakes such other actions. This analysis considers the impacts of the proposed action as well as any connected, cumulative, and similar existing and potential actions occurring in the area surrounding the site.

Industrial, transportation, commercial, restoration, and beneficial use projects are considered because of the similarity of their operations and/or associated impacts to the proposed project, and the resulting potential for cumulative impacts. Future maintenance dredging of the improved Federal channel associated impacts was discussed in Section 5, Environmental Effects. State permitting agencies indicate numerous past, present, and reasonably foreseeable projects within the study area for consideration of potential cumulative impacts analysis. Numerous discussions with Florida DEP and stakeholder groups helped identify potential projects occurring in the project area within the foreseeable future. Initial research through the Florida DEP permitting database indicated ten existing managed entities with reporting requirements and approximately sixty-five ongoing varying permit requests undergoing review.

The future expansion of PCPA into Bay Harbor associated with improvements to the navigation channel are discussed in Section 10.3. The expansion will take place on the existing industrial site, although some land clearing and development would be needed. Any environmental impacts from expansion would be assessed during future permit requests by PCPA in the future and associated cumulative impacts that would arise is anticipated to be minimal due to the industrial nature of the site. The potential exists for impacts associated with future industrial improvements being planned by near-by businesses, however, it is expected that these impacts would be assessed during future permit requests and evaluations. Cumulative impacts associated with these future actions should be minor collectively as they would occur within the heavily industrialized project vicinity. Potential projects include dredging within Walker Bayou in support of an existing shipbuilder, and an existing bridge on a local city avenue is in planning for maintenance and some upgrades for increased capacity. Another concern brought up by stakeholder groups was regarding two outfall permit renewals currently being assessed in permit reviews and final assessments are ongoing with the State and Federal regulatory agencies. There are no known new industrial sites being proposed at this time and of those discussed above, it is anticipated that not all of them would occur at one time and many are in early planning stages. Existing governmental regulations will address the issues that influence local and ecosystem-level conditions. Natural resources in the area are provided protection through coordination with stakeholder groups, local organizations, and State and Federal regulatory agencies implementing environmental laws and regulations. This collaboration and regulation of impacted resources should avoid and minimize impacts that could contribute negative cumulative impacts in the region. It is anticipated the proposed project, in combination with other reasonably foreseeable projects, will not have significant cumulative adverse effects on resources.

7.0 REAL ESTATE

7.1 Description of Lands, Easements, Rights-of-Way, and Relocations (LERR)

The requirements for Lands, Easements, Rights-of-way and Relocations (LERR) should include the rights to construct, operate, and maintain channel improvement works in connection with the proposed project. Based on the current plan/profile study drawings attached herein as Exhibit “A”, no fee or easement acquisition would be required for staging, access, construction, O&M in furtherance of the project because the proposed deepening will take place within the channel from barges impacting material only along the waterbottoms of St. Andrews Bay. As such, no fast lands will be impacted. These project requirements can be fully exercised under the doctrine of navigational servitude.

The proposed project set out herein follows an existing authorized and navigable watercourse and potential deepening of this channel falls within the jurisdiction of the navigable waters of the United States which is identified as that area below the ordinary high water mark. Furthermore, it is readily apparent that said purposes of the proposed project have a nexus to navigation. As a result of applying the Determination of Availability two-step process, the issue of navigational servitude is deemed applicable to this project as it relates to the Federal construction and subsequent operation and maintenance responsibilities. Therefore, no further Federal real estate interest is required for project construction and operation and maintenance in navigable waters below the ordinary high water mark.

There are no real estate requirements for upland dredged material disposal sites for the placement of dredged material. Moreover, Section 201 of WRDA 96 redefined disposal site preparation costs as being General Navigation Features and not a real estate requirement. As shown on the study drawings, the aquatic placement area is located in St. Andrews Bay southeast of Dredge Area A and adjacent to the GIWW Channel. All material associated with the channel improvement project will be excavated and placed in this aquatic placement area. No material will be placed above elevation -46 MLLW. No relocations of facilities or utilities will be required based on research and project footprint noted in the plan/profile drawings.

There are no additional lands, easements, or rights-of-way to be acquired by the non-Federal sponsor in furtherance of the proposed project. There are no real estate requirements anticipated for project access or temporary staging areas.

For additional information, refer to the Appendix F - Real Estate Plan attached to this report.

8.0 PROJECT PARTNERSHIP AGREEMENT

8.1 General

A draft Project Partnership Agreement (PPA) will be submitted separately from the LRR. The following are specific areas that will be addressed.

8.2 Lands, Easements and Rights-of-Way

Lands, easements and rights-of-way are a non-Federal responsibility however, it is anticipated that no additional lands, easements and rights-of-way will be needed for this project. All dredged material will be placed in the in-bay disposal site adjacent to the channel. See drawing of planned dredging and disposal locations in the Appendix B – Engineering.

8.3 Financial Analysis

The purpose of financial analysis is to ensure that the non-Federal sponsor has a reasonable plan for meeting its financial commitment. In accordance with ER 1105-2-100, the financial analysis consists of the non-Federal sponsor's statement of financial capability and a financing plan. The statement of financial capability will be a description submitted by the non-Federal sponsor of its capability to meet its financial obligations for the project in accordance with the project-funding schedule. The financing plan will consist of a description of how the non-Federal sponsor plans to meet its financial obligations for the project in accordance with the project funding and Operation, Maintenance, Repair, Replacement and Rehabilitation (OMRR&R) schedules.

8.4 Items of Local Participation

The following is a list of the items of local participation, which are applicable to commercial navigation projects.

a. Enter into an agreement, which provides, prior to execution of the PPA, 25 percent of design costs;

b. Provide, during construction, any additional funds needed to cover the non-Federal share of design costs;

c. Provide, during the period of construction, a cash contribution equal to the following percentages of the total cost of construction of the general navigation features (which include the construction of land-based and aquatic dredged material disposal facilities that are necessary for the disposal of dredged material required for project construction, operation, or maintenance and for which a contract for the Federal facility's construction or improvement was not awarded on or before October 12, 1996):

(1) 10 percent of the costs attributable to dredging to a depth not in excess of 20 feet; plus

(2) 25 percent of the costs attributable to dredging to a depth in excess of 20 feet but not in excess of 45 feet; plus

(3) 50 percent of the costs attributable to dredging to a depth in excess of 45 feet;

d. Pay with interest, over a period not to exceed 30 years following completion of the period of construction of the project, up to an additional 10 percent of the total cost of construction of general navigation features. The value of lands, easements, rights-of-way, and relocations provided by the non-Federal sponsor for the general navigation features, described below, may be credited toward this required payment. If the amount of credit exceeds 10 percent of the total cost of construction of the general navigation features, the non-Federal sponsor shall not be required to make any contribution under this paragraph, nor shall it be entitled to any refund for the value of lands, easements, rights-of-way, and relocations in excess of 10 percent of the total cost of construction of the general navigation features;

e. Provide all lands, easements, and rights of way, and perform or ensure the performance of all relocations determined by the Federal Government to be necessary for the construction, operation, maintenance, repair, replacement, and rehabilitation of the general navigation features (including all lands, easements, and rights-of-way, and relocations necessary for dredged material disposal facilities).

f. Provide, operate, maintain, repair, replace, and rehabilitate, at its own expense, the local service facilities, berthing areas, warehouses etc.; in a manner compatible with the project's authorized purposes and in accordance with applicable Federal and State laws and regulations and any specific directions prescribed by the Federal Government;

g. Accomplish all removals determined necessary by the Federal Government other than those removals specifically assigned to the Federal Government;

h. Give the Federal Government a right to enter, at reasonable times and in a reasonable manner, upon property that the non-Federal sponsor owns or controls for access to the general navigation features for the purpose of inspection, and, if necessary, for the purpose of operating, maintaining, repairing, replacing, and rehabilitating the general navigation features;

i. Hold and save the United States free from all damages arising from the construction, operation, maintenance, repair, replacement, and rehabilitation of the project, any betterments, and the local service facilities, except for damages due to the fault or negligence of the United States or its contractors;

j. Keep, and maintain books, records, documents, and other evidence pertaining to costs and expenses incurred pursuant to the project, for a minimum of three years after completion of the accounting for which such books, records, documents, and other evidence is required, to the extent and in such detail as will properly reflect total cost of construction of the general navigation features, and in accordance with the standards for financial management systems set forth in the Uniform Administrative Requirements for Grants and Cooperative Agreements to State and local governments at 32 CFR, Section 33.20;

k. Perform, or cause to be performed, any investigations for hazardous substances as are determined necessary to identify the existence and extent of any hazardous substances regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 U.S.C. 9601 9675, that may exist in, on, or under lands, easements, or rights-of-way that the Federal Government determines to be necessary for the construction, operation, maintenance, repair, replacement, or rehabilitation of the general navigation features. However, for lands that the Government determines to be subject to the navigation servitude, only the Government shall perform such investigation unless the Federal Government provides the non-Federal sponsor with prior specific written direction, in which case the non-Federal sponsor shall perform such investigations in accordance with such written direction;

l. Assume complete financial responsibility, as between the Federal Government and the non-Federal sponsor, for all necessary cleanup and response costs of any CERCLA regulated materials located in, on, or under lands, easements, or rights-of-way that the Federal Government determines to be necessary for the construction, operation, maintenance, repair, replacement, and rehabilitation of the general navigation features;

m. To the maximum extent practicable, perform its obligations in a manner that will not cause liability to arise under CERCLA;

n. Comply with the applicable provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, Public Law 91 646, as amended by Title IV of the Surface Transportation and Uniform Relocation Assistance Act of 1987, and the Uniform Regulations contained in 49 CFR Part 24, in acquiring lands, easements, and rights-of-way, required for construction, operation, maintenance, repair, replacement, and rehabilitation of the general navigation features, and inform all affected persons of applicable benefits, policies, and procedures in connection with said act;

o. Comply with all applicable Federal and State laws and regulations, including, but not limited to, Section 601 of the Civil Rights Act of 1964, Public Law 88 352 (42 U.S.C. 2000d), and Department of Defense Directive 5500.11 issued pursuant thereto, as well as Army Regulation 600-7, entitled "Nondiscrimination on the Basis of Handicap in Programs and Activities Assisted or Conducted by the Department of the Army;"

p. Provide the non-Federal share of that portion of the costs of mitigation and data recovery activities associated with historic preservation, that are in excess of one percent of the total amount authorized to be appropriated for the project, in accordance with the cost sharing provisions of the agreement;

q. Do not use Federal funds to meet the non-Federal sponsor's share of total project costs unless the Federal granting agency verifies in writing that the expenditure of such funds is authorized.

9.0 CONSTRUCTION SCHEDULE AND COSTS

9.1 General

The goal of the cost estimates in support of the Panama City Harbor Improvements to Bay Harbor Channel Limited Reevaluation Report is to provide a total project cost for identifying a tentatively selected plan (TSP), justification of economic impacts, and potential funding obligations for the Federal Government and the non-Federal sponsor. A narrative and the development of The Total Project Cost Summary (TPCS), Microcomputer Aided Cost Estimating System version 4.2 (MCACES/MII) report, and an Abbreviated Risk Analysis (ARA) report can be found in Appendix D – Cost Estimate. The USACE Cost Engineering Dredge Estimating Program (CEDEP) report may be viewed upon request.

The study yielded multiple alternative plans to support the deep draft requirements and determination of a plan maximizing net benefits. The fully funded cost of the TSP at mid-point of construction is $7,293,000 as seen in Table 9-2. The first costs also known as the cost at expected program year are detailed in Table 9-1.

Table 9-1
Estimated First Cost Project Cost

Description	**Total (x $1,000)**
12 Navigation Ports & Harbors, Dredging	$5,757
09 Channels and Canals, ATON	$158
01 LERR, (admin)	$17
30 Planning, Engineering & Design	$818
31 Construction Management	$302
Total Project Cost*	**$7,052****
*Does not include additional 10% of GNF, reduced by the value of creditable LERR **Rounded value	

See Appendix D – Cost Estimate for the signed Value Management Planstating a VE study is not recommended due to low opportunity for value added to the selected alternative. .

9.2 Cost Apportionment

The sharing of costs between Federal and non-Federal interests for the Selected Plan is based on policy established by the WRDA of 1986. If required, non-Federal interests will be required to furnish all lands, easements and rights-of-way, and relocations, necessary for navigation. The 01 Account only includes administrative costs. The 09 Account, Channels and Canals, related to the provision of aids to navigation (ATON) (see Paragraph 4.2.3) are a 100 percent Federal cost, but not a USACE cost. The General Navigation Features (GNF) include mobilization, demobilization, dredging of the inner and outer channel segments and inner and outer turning basin. The inner turning basin is 100 percent non-Federally sponsored. The mobilization and demobilization cost is proportionally shared based on the dredge quantities of the outer turning basin which is approximately 21% before the 1986 WRDA based apportionment is applied. The result after application of the non-federal portions is 34.8% non-federal and 65.2% Federal. An additional 10 percent of the GNF is required from the non-Federal sponsor. The Apportionment for the fully funded cost is shown in Table 9-2.

Table 9-2 Estimated Cost Sharing Fully Funded Total Project Cost (x 1,000)			
Description	**Total**	**Federal**	**Non-Federal**
General Navigation Features			
12 Mobilization/Demobilization	$2,611	$1,958	$653
12 Mobilization/Demobilization (portion applied to turning basin)	$703		$703
12 Dredging, turning basin	$304	$0	$304
12 Dredging inner and outer channel segments and the inner turning basin	$2,330	$1,748	$582
Subtotal GNF	$5,948	$3,706	$2,242
09 Aids to navigation	$164	$164	$0
01 LERR (admin)	$17	$12	$5
30 Planning, Engineering & Design	$840	$630	$210
31 Construction Management	$323	$242	$81
Project Cost Apportionment	**$7292**	**$4,754**	**$2,538**
Plus an additional 10% of GNF, reduced by the value of creditable LERR	$595		$595
Final Distribution of Costs	**$7,887**	**$4,754**	**$3,133**
Note that LERR credit cannot exceed the 10% over time adjustment (excludes admin cost)			

9.3 Construction Schedule

The construction and planning, engineering and design durations were combined with the project study schedule then applied in the TPCS. The construction schedule for the TSP was prepared with input from the PDT and production rates from CEDEP. The construction phase is estimated to be six months, while the actual duration of construction is estimated to be three months. The planning, engineering and design phase is expected to begin in FY17. The construction phase is expected to begin FY18. The project and construction schedule is a living document, meaning it will change as tasks and phases are complete. The schedule is provided in Appendix D – Cost Estimate.

10.0 PUBLIC INVOLVEMENT AND NON-FEDERAL SPONSOR'S VIEWS*

10.1 General

The objective of public involvement and coordination is to open and maintain channels of communication with the public in order to give full consideration to public views and information in the planning process. This section will summarize public involvement efforts by the USACE, Mobile District and the non-Federal sponsor, and present the non-Federal sponsor's views on the project.

10.2 Public Involvement

The public will be notified of the proposed project by the USACE, Mobile District's Public Notice and distribution emails, Legal Notices in local newspapers as required by FDEP during the permitting of the proposed project, and various news releases distributed by the Mobile District's Public Affairs Division.

10.3 Non-Federal Sponsor's Views

The long term plan for the Port is to add significant new cargo capacity at the Bay Harbor Terminal over time, as the Port Authority's current facilities at Dyers Point are already near capacity. The initial project based on the improved water depth, expanded warehouse capacity, and new open storage area will accommodate WestRock and an equal or larger volume from other shippers. However, as the Port is able to add more berth and cargo capacity on this site, the percentage of cargo shipped by WestRock will be less.

In late 2012, the owners of the Bay Harbor Terminal port facilities (then RockTenn) agreed to sell lands adjoining the channel and the pier operations at the terminal to the PCPA in order for the port to pursue a deepening project concurrent with an increase in the capacity of the cargo handling facilities on the site. The goal of the project is to allow the PCPA to accommodate the anticipated growth of WestRock's export activity as well as provide new capacity for other shippers at the terminal. The proposed new warehouse and related 40 car rail receiving yard will be designed to handle between 350,000 and 400,000 tons of forest products cargo. The PCPA expects warehouse related activity from other shippers to be primarily export cargoes of kraft linerboard and wood pulp produced by other paper companies in the region, including Georgia Pacific and Packaging Corporation of America.

In addition to the development of a new forest products terminal, the PCPA believes the project will allow for significant expansion of other cargo activity on the site. The Port intends to purchase 39 acres during the second quarter of 2016, with an option to purchase an additional 26 acres within seven years. This land will be adequate to support a second berth and up to 500,000 square feet of additional warehouse space and allow the port to improve approximately ten acres of open cargo lay down area which would be suitable for lumber (export or import), steel products, and project cargoes. The Port expects to handle up to 150,000 tons per year of cargo over the outside storage area. Over the last 15 years, the Port has averaged an annual growth rate of 8%. Its Dyers Point facilities are near capacity. Looking ahead, the Port expects continued growth in general cargoes (steel and non- ferrous metals), imported and exported forest products, project cargoes, and regional containerized cargo. The improved water depth to the new Forest Products Terminal and the additional land available on this site will give the Port Authority the ability to continue growing and providing services to the region for the next 50 years.

Informal discussions for the sale of the Bay Harbor Terminal to the PCPA were captured in a Letter of Intent between PCPA and RockTenn (now WestRock), dated May 27, 2014 and a follow up letter between the PCPA and WestRock dated November 17, 2015 (See Real Estate, Appendix F). At this time, WestRock has obtained an appraisal of the land, a survey of the site, and has conducted a Phase I and Phase II environmental assessment. The PCPA has amended its Master Plan (with local government approval and State approval) to include the project. It has sought and received $12.5 million in matching grant commitments for this project from the Florida Department of Transportation. It has also received a loan commitment of $12 million from the State Infrastructure Bank. The PCPA's engineers have developed preliminary design and budgetary cost estimates for the bulkhead reinforcement and for the new warehouse and terminal facilities, and are currently reviewing the Environmental Site Assessment (ESA) reports to confirm site related costs of the project. Over the last year, the PCPA and WestRock have met three times in Atlanta and twice in Panama City to work through the terms of the sale and the operational handover of the facility. The parties are currently marking up a master sales agreement, a terminal service agreement, and related easements and covenants. Currently the sale is expected to close in the first quarter of 2016 and will include the existing berth and warehouse facilities, 40 acres of land, and an option for the purchase of an additional 26 acres of land- providing the Port Authority with long-term growth potential on the site.

11.0 ENVIRONMENTAL COMPLIANCE AND COMMITMENTS*

11.1 National Environmental Policy Act (NEPA) of 1969

Environmental information on the project has been compiled and this integrated document has been prepared in accordance with the NEPA.

11.2 Endangered Species Act of 1973

This proposed action is being coordinated with the USFWS and NMFS. Comments received through coordination will be incorporated to the maximum extent practicable. It is anticipated no formal consultation will be required.

11.3 Coastal Zone Management Act of 1972

The USACE, Mobile District determined that the proposed action is consistent with the Florida Coastal Management Program to the maximum extent practicable. A coastal zone consistency determination has been forwarded to the State for their concurrence.

11.4 Clean Air Act of 1972

No air quality permits are required for this project.

11.5 Clean Water Act of 1972

A request for Section 401 water quality certification is being prepared and will be submitted to FDEP in the near future. In accordance with the Inter-agency agreement between the USACE, Mobile and Jacksonville Districts and FDEP, a representative has been participating in PDT meetings and actions. Early coordination with the FDEP indicates a favorable permit decision. No action would take place until the State has issued water quality certification covering the proposed action. A Section 404 (b)(1) evaluation is included in this integrated EA and is found in Appendix E – Environmental Correspondence.

11.6 Rivers and Harbors Act of 1899

The proposed work would not obstruct navigable waters of the United States as the project purpose is for improved commercial navigation for the Bay Harbor Terminal.

11.7 National Historic Preservation Act of 1966 (Inter Alia) – (PL 89-665, The Archeology and Historic Preservation Act (PL 93-291), and Executive Order (EO) 11593)

Archival research and field work are ongoing and consultation with the Florida SHPO is being conducted in accordance with the National Historic Preservation Act, as amended; the Archeological and Historic Preservation Act, as amended and Executive Order 11593.

11.8 Migratory Bird Treaty Act

No migratory birds would be adversely affected by project activities.

11.9 Coastal Barrier Resources Act (CBRA) and Coastal Barrier Improvement Act of 1990

There are no CBRA zones within the project vicinity.

11.10 Magnuson Fishery Conservation and Management Act

This project is being coordinated with the NMFS, and will be in full compliance with the Act.

11.11 Marine Mammal Protection Act of 1972, As Amended

Incorporation of the safe guards used to protect threatened or endangered species during project implementation would also protect any marine mammals in the area; therefore, the project is in compliance with this Act.

11.12 Fish and Wildlife Coordination Act of 1958, As Amended

This project is being coordinated with the USFWS, and will be in full compliance with the Act.

11.13 Marine Protection, Research and Sanctuaries Act

The term "dumping" as defined in the Act (3[33 U.S.C. 1402](f)) does not apply to the placement of material within State waters. Therefore, the Marine Protection, Research and Sanctuaries Act does not apply to this project. The dredged material placement activities addressed in this integrated document have been evaluated under Section 404 of the Clean Water Act.

11.14 Submerged Lands Act of 1953

The project would occur on submerged lands of the State of Florida. The project has been coordinated with the State.

11.15 Executive Order (EO) 13045, Protection of Children

Executive Order (EO) 13045*, Protection of Children from Environmental Health Risks and Safety Risks* (April 21, 1997), recognizes a growing body of scientific knowledge and demonstrates that children may suffer disproportionately from environmental health risks and safety risks. These risks arise because children's bodily systems are not fully developed; because children eat, drink, and breathe more in proportion to their body weight; because their behavior patterns may make them more susceptible to accidents. Based on these factors, the President directed each Federal agency to make it a high priority to identify and assess environmental health risks and safety risks that may disproportionately affect children. The President also directed each Federal agency to ensure that its policies, programs, activities, and standards address disproportionate risks to children that result from environmental health risks or safety risks.

The proposed action complies with EO 13045, "Protection of Children from Environmental Health Risks and Safety Risks", and does not represent disproportionally high and adverse environmental health or safety risks to children in the United States. The proposed site is not used disproportionally by children.

11.16 Executive Order (EO) 12898, Environmental Justice

Executive Order (EO) 12898, *Federal Actions to Address Environmental Justice in Minority and Low-Income Populations* (February 11, 1994) requires that Federal agencies conduct their programs, policies, and activities that substantially affect human health or the environment in a manner that ensures that such programs, policies, and activities do not have the effect of excluding persons (including populations) from participation in, denying persons (including populations) the benefits of, or subjecting persons (including populations) to discrimination under such programs, policies, and activities because of their race, color, or national origin. On February 11, 1994, the President also issued a memorandum for heads of all departments and agencies, directing that the Environmental Protection Agency, whenever reviewing environmental effects of proposed actions pursuant to its authority under Section 309 of the Clean Air Act, ensure that the involved agency has fully analyzed environmental laws, regulations, and policies.

The proposed action complies with EO 12898, “Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations”, and does not represent disproportionally high and adverse human health or environmental effects on minority populations and low-income populations in the United States. The proposed site is not used disproportionally by these populations.

11.17 Executive Order (EO) 11988, Floodplain Management

Executive Order (EO) 11988 requires Federal agencies to avoid, to the extent possible, the long- and short-term adverse impacts associated with occupancy and modification of floodplains. It further directs Federal agencies to avoid direct and indirect support of floodplain development wherever there is a practicable alternative. The project is in the base floodplain (100-year flood) and has been evaluated in accordance with this EO. The action is in compliance.

11.18 Adaptive Management

Adaptive Management (AM) is distinguished from traditional long-term monitoring in part through implementation of an organized, coherent, and documented decision process. Important aspects of the AM process lie in exploring alternative ways to meet management objectives predicting the outcomes of alternatives based on the current state of knowledge, implementing one or more alternatives, and establishing a feedback mechanism whereby monitored conditions may be used to update the knowledge base and adjust management actions to refine and/or better achieve project goals and objectives. The development of AM actions associated with navigation improvement projects is relatively new and typically incorporates management actions and monitoring of specific species found within the project area. The use of AM in association with this LRR is not warranted.

12.0 DETAILED DESCRIPTION OF RECOMMENDED PLAN

The recommended plan for the improved Federal navigation channel at Bay Harbor will deepen the channel from the existing depth of -32 feet MLLW to -36 feet MLLW, which will allow the current vessel fleet calling at the Port to enter and exit at a deeper draft. The final Bay Harbor Channel will be approximately 3.5 miles long with a depth of 36 feet, a width of 300 feet, and a turning basin with a length of 1,700 feet and a width of 1,100 feet. Excavation includes an additional 2 feet for allowable overdepth and will require the removal of approximately 372,000 cubic yards of material. Figure 4-1 displays the recommended dredge plan.

13.0 CONCLUSION

After carefully reviewing all pertinent information and considering the effects of modifying the authorized navigation project for Bay Harbor Channel, it is concluded that the proposed plan is consistent with national policy, statutes, and administrative directives, and that the project construction would contribute greatly to the operational efficiency of Bay Harbor Terminal by supporting additional project users. The considered modification is economically justified with a benefit-to-cost ratio of 8 to 1, and average annual benefits of $8,815,000. The estimated project first cost totals $7,052,000.

14.0 RECOMMENDATION

It is recommended that the Commander, South Atlantic Division, approve this LRR and the plan contained therein for modification of the existing Federal navigation project at Panama City Harbor, Bay Harbor Channel, Florida. Further, that the Commander, South Atlantic Division, exercise the authority provided him by CECW-PC Memorandum dated 30 June 2004, approving the execution of a model Project Partnership Agreement for same.

There is a Federal interest in pursuing a deep draft navigation project at Bay Harbor Channel. The Mobile District recommends preparation of plans and specifications and construction of a deepened channel for Bay Harbor Terminal. The navigation channel will be constructed to a depth of 36 feet and will remain the same width, 300 feet. Also, the project area will include 2 feet of additional excavation for the purpose of allowable overdepth. The dredged material will be placed within an in-bay disposal area located adjacent and east of the area to be dredged within a naturally deep area of the bay.

15.0 PREPARERS*

Discipline	Team Member	Discipline	Team Member
Project Manager	David Newell	H&H Engineer	Elizabeth Godsey / Jacqueline Wittmann
Lead Planner	Rick Darnell	Geotechnical	Michael FitzHarris
Economist	Julie McGuire	Cost Engineer	Rita Perkins
Environmental	Linda Barnett	Real Estate	Russell Blount
Cultural	Allen Wilson	Operations	Thomas Beckham
Office of Counsel	Joe Givhan	Site Office	Waylon Register
Engineer Lead	Micah Wiggins	ERDC	Dennis Webb

16.0 REFERENCES*

Brim, Micheal S. and Lawrence R. Handley. "St. Andrew Bay." 2006.

Brusher, H.A., and L.H. Ogren. 1976. Distribution, abundance, and size of penaeid shrimps in the St. Andrew Bay system, Florida. Fish. Bull. 74: 158-166.

Burkenroad, M.D. 1931. Notes on the Louisiana conch, *Thais haemastoma* Linn., in relation to the oyster *Ostrea virginica*. Ecology 12: 656-664.

Chaunu, P. and H. Chaunu.
1955-1957. Séville et l'Atlantique, 1504-1650. 11 vols. Partie Statistique, Tome Premier Introduction Méthodologique. Paris: Librairie Armand Colin.

Chittenden, M.E., Jr. and J.D. McEachern. 1976. Composition, ecology, and dynamics of demersal fish communities on the northwestern Gulf of Mexico continental shelf, with a similar synopsis for the entire Gulf. Dept. of Wildlife and Fisheries Sciences. Texas A&M University, College Station, TX. 194 pp.

Coastal Environments, Inc. (CEI).
1977. Cultural resources evaluation of the northern Gulf of Mexico shelf. 3 vols. Report to the New Orleans Outer Shelf Office, Bureau of Land Management, U.S. Dept. of the Interior, New Orleans, LA.

Coutu, S., J. Fraser, J. McConnaughey, and J. Loegering. 1990. Piping plover distribution and reproductive success on Cape Hatteras National Seashore. Unpublished Report Cape Hatteras National Seashore, Manteo, North Carolina. 67 pp.

Dardeau, M.R., R.F. Modlin, W.W. Schroeder, and J.P. Stout. 1992. Estuaries. Pp.:614-744, In: Biodiversity of the Southeastern United States. Hackney, CT., S.M. Adams, and W.H. Martin (eds.). J. Wiley & Sons, Inc., New York.

Federal Emergency Management Agency. "Flood Insurance Study Bay County, Florida and Incorporated Areas FIS Number 12005CV000B." 2009.

Garrison, E.G., C.P. Giammona, F. Kelly, A.R. Tripp, and G.A. Wolf.
1989. Historic shipwrecks and magnetic anomalies of the northern Gulf of Mexico: Reevaluation of Archaeological Resources Management Zone 1. Report to the U.S. Dept. of the Interior, Minerals Management Service, Gulf of Mexico OCS Region, New Orleans, LA. OCS Study MMS 89-0024.

Gunter, G. 1979. Studies of the southern oyster borer, *Thais haemastoma*. Gulf Res. Rep. 6: 249-260.

Hartman, D.S. 1979. Ecology and Behavior of the Manatee (Trichechus manatus) in Florida. The American Society of Mammalogists, Special Publication No. 5. 153 pp.

Hopkins, T.L. 1964. The plankton of the St. Andrew Bay system, Florida. PhD Dissertation, Florida State University, Tallahassee, Florida.

Hopkins, T.L. 1966. The plankton of the St. Andrew Bay system, Florida. Publ. inst. Mar. Sci., Univ. Texas 11: 12-64.

Kriebel, David L., Joseph D. Geiman and Gina R. Henderson. "Future Flood Frequency under Sea-Level Rise Scenarios." *Journal of Coastal Research* (2015).

Lackey, J.B. 1967. The microbiota of estuaries and their roles. Pp: 291-302. In: G.H. Lauf (ed.). Estuaries. AAAS, Washington D.C.

Livingston, R.J. 1984. The ecology of Apalachicola Bay: a community profile. U.S. Fish Wildlife Service. Office of Biological Services. FWS/OBS/-82/05. Washington, D.C. 148 pp.

Nakamura, E.L. 1976. Scombid fishes in St. Andrew Bay, Florida. Bull. Mar. Sci. 26: 619-621.

Naughton, S.P., and C.H. Saloman. 1978. Fishes of the nearshore zone of St. Andrew Bay, Florida, and adjacent coast. N.E. Gulf Sci. 2: 43-44.

Ogren, L.H., and H.A. Brusher. 1977. The distribution and abundance of fishes caught with a trawl in the St. Andrew Bay system, Florida. Northeast Gulf Sci. 1:83-105.

Pearson, C.E., S.R. James Jr., M.C. Krivor, S.D. El Darragi, and L. Cunningham. 2003. Refining and revising the Gulf of Mexico Outer Continental Shelf region high-probability model for historic shipwrecks. Report to the U.S. Dept. of the Interior, Minerals Management Service, Gulf of Mexico OCS Region, New Orleans, LA. OCS Study MMS 2003:061.

http://www.unece.org/fileadmin/DAM/timber/meetings/20131209/4-North_America.pdf

http://www.risiinfo.com/Marketing/Commentaries/paper_packaging_monitor.pdf

Pristas, P.J., and L. Trent. 1978. Seasonal abundance, size and sex ratio of fishes caught with gill nets in St. Andrew Bay, Florida. Bull. Mar. Sci. 28: 581-589.

Schmidt, W. and M.W. Clark. 1980. Geology of Bay County, Florida. FGS: Bulletin 57.

Simmons, E.G., and W.H. Thomas. 1962. Phytoplankton of the eastern Mississippi Delta. Publ. Inst. Mar. Sci. 8: 269-298.

Steidinger, K.A. 1973. Phytoplankton ecology: a conceptual review based on eastern Gulf of Mexico research. CRC Crit. Rev. Microbiol. 3: 49-68.

Sutherland, D.F. 1978. Estimated average daily instantaneous numbers of recreational and commercial fisherman and boaters in the St. Andrew Bay System, Florida and adjacent coast waters, 1973. NOAA Technical Report NMFS SSRF-724. 23 pp.

Wilber, D.H. and D.G. Clarke. 2001. Biological effects of suspended sediments: a review of suspended sediment impacts on fish and shellfish with relation to dredging activities in estuaries. North American Journal of Fisheries Management. l21:855-875.

Wood, E.J.F. 1965. Marine microbial ecology. Reinhold Publ. Corp.

Zieman, J.C., and R.T. Zieman. 1989. The ecology of the seagrass meadows of the west coast of Florida: a community profile, U.S. Fish Wildl. Serv. Biol. Rep. 85. 155 pp.

APPENDIX A

Correspondence

APPENDIX B

Engineering

APPENDIX C

Economic Analysis

APPENDIX D
Cost Estimate

APPENDIX E

Environmental Correspondence

SECTION 404(b)(1) EVALUATION REPORT

BAY HARBOR TERMINAL IMPROVEMENTS PROJECT
PANAMA CITY HARBOR FEDERAL NAVIGATION PROJECT
LIMITED REEVALUATION REPORT
PANAMA CITY, BAY COUNTY, FLORIDA

PURPOSE: To ensure that the proposed placement of fill material does not violate any applicable State water quality standards; or does not violate the Toxic Effluent Standard of Section 307 of the Clean Water Act (CWA). Further to ensure placement of fill material would not jeopardize the continued existence of any federally-listed endangered or threatened species or contribute to significant degradation of waters of the United States.

I. **PROJECT DESCRIPTION**:

A. **Location:** Bay Harbor Terminal channel is located in Panama City, Bay County, Florida within the eastern portion of St. Andrew Bay.

B. **General Description:** The proposed action as described in the integrated LRR and EA consists of improving the Bay Harbor channel to a 36-foot depth to the Bay Harbor Terminal and includes a turning basin area of approximately 42 acres. The proposed action would require the removal of approximately 373,000 cubic yards of material from the Bay Harbor Terminal Channel. The placement plan includes placing the dredged material in a deep area within St. Andrew Bay located adjacent and east approximately 0.5 mile from the dredge area.

C. **Authority and Purpose:** The authority and purpose of the proposed action is described in Sections 1.1 and 1.3 of the integrated LRR and EA to which this evaluation is appended.

D. **General Description of Dredged or Fill Material:**

(1) **General Characteristics of Material:** The sediments that would be dredged and placed within the in-bay disposal area are classified as clayey sand, silty sand, sand and gravel, and silty sand with gravel within four samples areas within the area to be dredged.

(2) **Quantity of Material:** The quantity of material dredged is up to approximately 373,000 cubic yards. It is anticipated the Bay Harbor Terminal Channel would experience up to 10,000 cubic yards per year in shoaling for future maintenance activities. Due to the low shoaling rates occurring in St. Andrews Bay, it was determined that no advanced maintenance would be needed or allowed.

(3) **Source of Material:** Material consists of clays, sands and silts dredged from within the authorized Bay Harbor Terminal Federal navigation channel.

E. **Description of the Proposed Discharge Site:**

(1) **Location:** The designated disposal area is located approximately 0.5 miles southeast of the Bay Harbor Terminal turning basin, in a long trench like depression. The dredged material would be placed in the trench up to elevation -46 MLLW, which would leave a lip of natural bottom to help prevent the movement of the material after placement. Approximately 3,300 feet of the trench would be filled to -46 MLLW after the completion of the project. A sewer line, a fiber optics cable and a power line cross the bay near this location. The sewer line managers have stated their desire for dredge material to be placed over the existing sewer line to protect it. No information on the fiber optics cable has been found other than a reference to its location on an old National Oceanic and Atmospheric Administration (NOAA) chart, while the power line is above the water, with power poles set on either side of the trench.

(2) **Size:** The size of the disposal area is approximately 200 acres.

(3) **Type of Site:** The disposal site is located in an elongated trench-like depression within deep waters of the bay located approximately 0.5 miles southeast of the area to be dredged. The proposed disposal site has similar water bottom sediments similar to what is proposed for removal and placement.

(4) **Type of Habitat:** The open water placement site is unvegetated open water estuarine habitat.

(5) **Timing and Duration of Discharge:** It is anticipated dredging operations would take up to 6 months for completion. Future maintenance activities are expected to be minimal due to the low shoaling rates.

F. **Description of the Disposal Method:** The project will likely be dredged using a hydraulic pipeline cutter-head dredge, mechanical dredge, or a combination of both and the dredged material would be pumped via pipeline to the in-bay disposal area located adjacent to and east of the project area. The disposal method used will be a submerged pipeline to reduce disposal generated turbidity to a minimum. It is expected that this turbidity would be short-term in nature and localized to the immediate vicinity of the disposal operation.

II. **Factual Determinations (Section 230.11)**:

A. **Physical Substrate Determinations:**

(1) **Substrate Elevation and Slope:** The project would result in the removal of substrate as needed to a depth of 36 feet MLLW with two feet of allowable overdepth within the area to be dredged. The dredged material would be placed in the proposed in-bay disposal area that is characteristic of a trench-like depression up to elevation -46 MLLW, which would leave a lip of natural bottom to help prevent the movement of the material after placement. Approximately 3,300 feet of the trench would be filled to -46 MLLW after the completion of the project.

(2) **Sediment Type:** The dredged material proposed for disposal is comprised of primarily clayey sand, silty sand, sand and gravel, and silty sand with gravel.

(3) **Dredged/Fill Material Movement**. The dredged material would be placed in the deep area of the bay within water depths of up to 55 feet to an elevation of -46 MLLW, which would leave a lip of natural bottom to help prevent the movement of the material after placement.

(4) **Physical Effects on Benthos**. Disruption in the benthic community is expected to be temporary and minimal. Immobile benthic fauna within the proposed project area may be covered, but the community should repopulate within several months of completion. Other mobile benthic fauna will avoid the disturbed area and return upon project completion. No adverse impacts are anticipated to occur to benthos.

(5) **Other effects**. No other effects are anticipated.

(6) **Actions Taken to Minimize Impacts (Subpart H)**. The dredged material disposal is would utilize a submerged pipeline and a downspout at the end of the discharge pipe to lessen turbidity during placement activities. No other actions to minimize impacts are deemed appropriate for this project.

B. **<u>Water Column Determinations:</u>**

(1) **Salinity**. There would be no change in salinity gradients or patterns.

(2) **Water Chemistry (pH, etc.)**. No effect.

(3) **Clarity**. Minor increases in turbidity may be experienced in the immediate vicinity of the project during disposal operations. However, these increases will be temporary and would return to pre-project conditions shortly after completion.

(4) **Color**. No effect.

(5) **Odor**. No effect.

(6) **Taste**. No effect.

(7) **Dissolved Gas Levels**. Temporary decreases in dissolved oxygen could likely result from the operations depending on timing of discharge. If decreases occur, they will be of a short duration. No significant effect to the water column is anticipated.

(8) **Nutrients**. Slight increases in nutrient concentrations may occur; however, these would rapidly return to normal. These described increases would have no significant effect to the water column.

(9) **Eutrophication**. No effect.

C. **<u>Water Circulation, Fluctuation, and Salinity Gradient Determinations:</u>**

(1) **Current Patterns and Circulation.**

(a) **Current Patterns and Flow**. Placement of dredged material into the open water disposal site would have no effect on current patterns and flow in the vicinity of the project area. No changes to currents are anticipated.

(b) **Velocity**. No effect.

(2) **Stratification**. No effect.

(3) **Hydrologic Regime**. No effect.

(4) **Normal Water Level Fluctuations**. No effect.

(5) **Salinity Gradient**. The salinities in the project vicinity are primarily constant due to minimum inflows of freshwater from surrounding creeks and tidal influence from the Gulf of Mexico. No effect on the salinity gradient is anticipated.

D. **Suspended Particulate/Turbidity Determination:**

(1) **Expected Changes in Suspended Particulates and Turbidity Levels in Vicinity of Placement Site:** Dredged material consists of clayey sand, silty sand, sand and gravel, and silty sand with gravel. Impacts from sediment disturbance during dredging operations are expected to be temporary, minimal and similar to conditions experienced during past improvement activities within the western segment of the Federal navigation channel. Suspended particles are expected to settle out within a short time frame (hours to days), with no long-term significant effects on water quality. Turbidity during disposal is not expected to violate State water quality certification criteria.

(2) **Effects on Chemical and Physical Properties of the Water Column:**

(a) **Light Penetration**. No significant effects.

(b) **Dissolved Oxygen**. No significant effects.

(c) **Toxic Metals and Organics**. No effects.

(d) **Pathogens**. No effect.

(e) **Esthetics**. No effect.

(3) **Effects on Biota:**

(a) **Primary Production Photosynthesis**. No significant effects.

(b) **Suspension/Filter Feeders**. No significant effects.

(c) **Sight Feeders**. No effect.

(4) **Actions Taken to Minimize Impacts (Subpart H)**. No further actions are deemed appropriate.

E. **Contaminant Determinations**. The USACE, Mobile District by contract collected and analyzed sediment samples to conduct physical, chemical Tier II testing including elutriates from the proposed improvements dredge areas within the Federal navigation project at Bay Harbor Terminal. Efforts consisted of collecting sediment samples and sufficient site water within four separate dredge areas, Outer Channel, Inner Channel, Outer Turning Basin, and Inner Turning basin. Further information regarding sediment sampling and results can be found in Section 3.1.4 of the EA in Section 3.1.4. The specific data tables and further analyses of testing results from the Bay Harbor channel are presented in the Sediment Evaluation Report in Appendix E – Environmental Correspondence.

F. **Aquatic Ecosystem and Organism Determinations:**

(1) **Effects on Plankton**. No significant effects.

(2) **Effects on Benthos**. No significant long-term effects would occur to the benthos.

(3) **Effects on Nekton**. No significant effects.

(4) **Effects on Aquatic Food Web**. No significant effects.

(5) **Effects on Special Aquatic Sites**. No effect.

(a) **Sanctuaries and Refuges**. Not applicable.

(b) **Wetlands**. Not applicable.

(c) **Mud Flats**. Not applicable.

(d) **Vegetated Shallows**. No significant impacts to the submerged aquatic vegetation (SAV) were identified in this evaluation. The integrated LRR and EA, Sec 3.2.5 provides a description of all known SAVs sites within the vicinity of the project area.

(e) **Coral Reefs**. Not applicable.

(f) **Riffle and Pool Complexes**. Not applicable.

(6) **Effects on Threatened and Endangered Species**. The USACE, Mobile District determined that no federally-protected species or designated critical habitat were likely to be adversely affected as a result of the proposed project. Further coordination with the NMFS and the FWS is ongoing.

(7) **Effects on Other Wildlife**. No significant effects.

(8) **Actions to Minimize Impacts**. No other actions to minimize impacts on the aquatic ecosystem are deemed appropriate.

G. **Proposed Disposal Site Determinations:**

(1) **Mixing Zone Determination**. The State of Florida's specified a mixing zone for turbidity compliance along all other reaches of the project is 29 NTUs above background at the edge of 150 meter mixing zone. The Corps will comply with all turbidity standards specified by the State of Florida water quality certification (WQC).

(a) **Depth of water at the disposal sites**. Elevations within the in-bay disposal area range from 40 feet to 60 feet MLLW

(b) **Current velocity, direction, and variability at the disposal site**. Not significant.

(c) **Degree of turbulence**. Not significant.

(d) **Stratification attributable to causes such as obstructions, salinity or density profiles at the disposal site**. No effect.

(e) **Discharge vessel speed and direction, if appropriate**. No effect.

(f) **Rate of discharge**. Rate of discharge will vary according to the particular type of dredge disposing of the material.

(g) **Ambient concentrations of constituents of interest**. Sediment sampling and testing was undertaken to determine presence of contaminants in sediments to be dredged. Further information related to the type constituents present can be found in Section 3.1.4 of the integrated LRR and EA and the complete Sediment Evaluation Report is presented in Appendix E – Environmental Correspondence.

(h) **Dredged material characteristics, particularly concentrations of constituents, amount of material, type of material (sand, silt, clay, etc.) and settling velocities.** The proposed action would involve dredging and disposal for improvements to Bay Harbor Terminal Federal navigation channel in Panama City, Florida. The quantity of material to be dredged would be 373,000 cubic yards. The type of material removed would consist of clay, silt and sand. Settling of particles is anticipated.

(i) **Number of discharge actions per unit of time**. The number of discharge actions per unit of time will vary depending upon the particular disposal activity.

(2) **Determination of Compliance with Applicable Water Quality Standards**. The

proposed activity is in compliance with all applicable water quality standards.

(3) **Potential Effects on Human Use Characteristics**.

(a) **Municipal and Private Water Supply**. No effect.

(b) **Recreational and Commercial Fisheries**. Recreational and commercial fishing would be temporarily impacted primarily as a result of the physical presence of heavy equipment during operation activities.

(c) **Water Related Recreation**. No significant effects.

(d) **Aesthetics**. No significant effects.

(e) **Parks, National and Historical Monuments, National Seashores, Wilderness Areas, Research Sites, and Similar Preserves**. No effect.

(f) **Other Effects**. No effect.

H. **Determination of Cumulative Effects on the Aquatic Ecosystem**. The proposed action is not expected to have significant cumulative adverse impacts.

I. **Determination of Secondary Effects of the Aquatic Ecosystem**. The proposed action is not expected to have any significant secondary adverse effects on the aquatic ecosystem.

III. **Finding of Compliance with the Restrictions on Discharge:**

A. No significant adaptations of the Section 404(b)(1) guidelines were made relative to this evaluation.

B. The proposed discharge represents the least environmentally damaging practicable alternative.

C. The planned placement of dredged materials would not violate any applicable State water quality standards; nor will it violate the Toxic Effluent Standard of Section 307 of the Clean Water Act (CWA).

D. Use of the in-bay disposal area will not jeopardize the continued existence of any federally-listed endangered or threatened species or their critical habitat provided the specified conditions in this document are implemented during maintenance dredging and disposal operations.

E. The proposed placement of fill material will not contribute to significant degradation of waters of the United States, nor will it result in significant adverse effects on human health and welfare, including municipal and private water supplies, recreation and commercial fishing; life stages of organisms dependent upon the aquatic ecosystem; ecosystem diversity, productivity and stability; or recreational, aesthetic or economic values.

F. Appropriate and practicable steps will be taken to minimize potential adverse impacts of the discharge on the aquatic ecosystem.

DATE____________________

____
Jon J. Chytka
Colonel, Corps of Engineers
District Commander

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Field Office
1601 Balboa Avenue
Panama City, FL 32405-3721

IN REPLY REFER TO:

Tel: (850) 769-0552
Fax: (850) 763-2177

September 18, 2015

Jennifer Jacobson, Chief
Coastal Environmental Team
Planning and Environmental Division
Department of the Army, Corps of Engineers
109 St. Joseph Street
Mobile, Alabama 36602

Dear Ms. Jacobson:

The Fish and Wildlife Service (Service) has prepared this Planning Aid Letter (PAL) in support of the Panama City Harbor Improvements to Bay Harbor Channel Project (BHC Project). The BHC Project is a component of the Panama City Harbor Federal Navigation Project, Panama City, Bay County, Florida. This PAL is provided in accordance with the Fish and Wildlife Coordination Act (FWCA) of 1958, as amended (48 Stat. 401; 16 U.S.C. 661 *et seq.*), the Endangered Species Act (ESA) of 1973, as amended (87 Stat. 884; 16 U.S.C. 1531 *et seq.*), and the scope of work agreed upon by the U.S. Army Corps of Engineers and the Service. This PAL does not constitute the report of the Secretary of Interior as required by section 2(b) of the FWCA, nor does it constitute a biological opinion under section 7 of the ESA. The purpose of this PAL is to deliver a final Environmental Existing Conditions (EEC) report for the use by the Project Delivery Team (PDT) in completing a BHC Project Implementation Report.

We appreciate this opportunity to provide comments and look forward to working with you during the final report process. Please contact Lisa Lehnhoff (850-769-0552 ext. 225) for any questions or comments on this consultation.

Sincerely,

Dr. Sean Blomquist
Ecological Services Chief

EVALUATION OF DREDGED MATERIAL

PANAMA CITY HARBOR, BAY HARBOR CHANNEL
PANAMA CITY BEACH, BAY COUNTY, FLORIDA

TECHNICAL MEMORANDUM

Prepared for

Department of the Army
U.S. Army Corps of Engineers
Mobile District
109 St. Joseph Street
Mobile, AL 36602

Prepared by

EA Engineering, Science, and Technology, Inc.
225 Schilling Circle, Suite 400
Hunt Valley, Maryland 21031

Under Contract to

The Louis Berger Group, Inc.
1250 23rd Street, NW
Washington D.C. 20037-1164

October 2014 62402.05

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LIST OF ACRONYMS AND ABBREVIATIONS

°C	Degrees Celsius
μg/kg	Microgram(s) per kilogram
BTEX	Benzene, toluene, ethylbenzene, and xylenes
CAB	Cellulose acetate butyrate
CCME	Canadian Council of Ministers of the Environment
CFR	Code of Federal Regulations
COC	Chain of custody
DBT	Dibutyltin
DI	Deionized
DRO	Diesel range organics
DU	Dredging unit
EA	EA Engineering, Science, and Technology, Inc.
ft	Foot (feet)
GRO	Gasoline range organics
HNO_3	Nitric acid
HPAH	High molecular weight PAH
ID	Identification
in.	Inch(es)
ITM	Inland Testing Manual
LPAH	Low molecular weight PAH
MBT	Monobutyltin
mg/kg	Milligram(s) per kilogram
mg/L	Milligram(s) per liter
MLLW	Mean lower low water
MS	Matrix spike
MSD	Matrix spike duplicate
ND	Non-detect
NOAA	National Oceanic and Atmospheric Administration
ODMDS	Ocean Dredged Material Disposal Site
PAH	Polycyclic aromatic hydrocarbon
PCB	Polychlorinated biphenyl

PEL	Probable effects level
pg/g	Picogram(s) per gram
QA/QC	Quality assurance/quality control
RL	Reporting limit
SERIM	Southeast Regional Implementation Manual
SQG	Sediment quality guidelines
SVOC	Semivolatile organic compound
TBT	Tributyltin
TCLP	Toxicity Characteristic Leaching Procedure
TDL	Target detection limit
TEF	Toxicity equivalency factor
TEL	Threshold effects limit
TEQ	Toxicity equivalency quotient
TKN	Total Kjeldahl nitrogen
TOC	Total organic carbon
TPH	Total petroleum hydrocarbons
U.S.	United States
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
VOC	Volatile organic compound
WES	Waterways Experiment Station
WHO	World Health Organization

1. PROJECT DESCRIPTION

The United States (U.S.) Army Corps of Engineers (USACE)-Mobile District is evaluating proposed new work dredging in the Panama City Bay Harbor Channel (Bay Harbor Channel). Sampling of the proposed dredged material was conducted in four dredging units (DUs) in the Bay Harbor Channel at St. Andrews Bay: Inner Turning Basin, Outer Turning Basin, Inner Channel, and Outer Channel. The purpose of this project was to collect samples representative of the material proposed for dredging and perform physical and chemical evaluations to facilitate determination of appropriate placement options.

EA Engineering, Science, and Technology, Inc. (EA) was contracted by the Louis Berger Group to conduct the dredged material evaluation for the Bay Harbor Channel for the USACE-Mobile District. The investigation consisted of vibracore sampling at specified locations in the Bay Harbor Channel, creating lithologic core logs for each location, conducting physical and chemical testing of sediments, and evaluating test results with respect to the feasibility of potential upland placement.

This technical memorandum summarizes the field collection and sample processing activities for the Bay Harbor Channel project and presents the analytical results.

1.1 PROJECT PURPOSE AND LOCATION

The Bay Harbor Channel is located in the St. Andrews Bay area in Bay County, Florida (Figure 1-1). The Bay Harbor Channel has authorized dimensions of 38 by 300 feet (ft) with a turning basin located at the terminus, authorized to a depth of 38 ft mean lower low water (MLLW). The authorized channel is approximately 3.5 miles in length. The proposed new work dredging would be conducted to a depth of 36 ft plus an additional 2 ft for overdepth allowance. The target project sampling depth will include 36 ft + 2 ft allowable overdepth +3 ft of non-paid overdepth (to account for potential disturbance by hydraulic/cutterhead dredge) = 41 ft MLLW.

Sample locations were distributed in four DUs as follows:

- **DU-1 (Inner Turning Basin)** represents the turning basin area in closest proximity to the seawall, and west of the pier/dock. Cores were collected from three discrete sampling locations (PC-1, PC-2, and PC-3) in this DU.

- **DU-2 (Outer Turning Basin)** represents the outer turning basin area adjacent to DU-1. Cores were collected from two discrete sampling locations (PC-4 and PC-5) in this DU.

- **DU-3 (Inner Channel)** represents the channel area proposed for dredging in closest proximity to the turning basin. Cores were collected from three discrete sampling locations (PC-6, PC-7, and PC-8) in this DU.

- **<u>DU-4 (Outer Channel)</u>** represents an outer portion of the channel where dredging is required in closest proximity to Saint Andrew Bay. Cores were collected from one discrete sampling location (PC-9) in this DU.

1.2 PROJECT OBJECTIVES

The overall objective of the sampling effort was to obtain and analyze sediment samples representative of each DU proposed for dredging. The sampling scheme is provided in Table 1-1. Physical testing included grain size, specific gravity, and total solids for each individual location as well as grain size for subsamples from each core. Chemical concentrations of semivolatile organic compounds (SVOCs); metals (including mercury); chlorinated pesticides; polycyclic aromatic hydrocarbons (PAHs); polychlorinated biphenyl (PCBs) congeners; dioxin/furan congeners; butyltins; cyanide; total sulfides; ammonia as N; total Kjeldahl nitrogen (TKN); total phosphorus, nitrate + nitrite; total organic carbon (TOC); benzene, toluene, ethylbenzene, and xylenes (BTEX); ignitability; corrosivity; pH; total petroleum hydrocarbons (TPH) (diesel range organics and gasoline range organics [DRO/GRO]); and toxicity characteristic leaching procedure (TCLP) were identified in whole-core composites from individual locations. Lithologic core logs were prepared for one core from each location and each core was sub-sampled for grain size analysis at intervals determined by lithologic changes.

Specific objectives of the Bay Harbor Channel project were to:

- Collect the required volume of sediment for physical and chemical analysis.

- Collect sediment cores from nine locations distributed in four DUs within positioning accuracy appropriate for the project objectives.

- Submit sediment samples from each of the nine locations for bulk sediment testing required for upland placement options (see Table 1-2).

- Submit a maximum of 27 discrete grain size samples based on lithographic changes to project depth at each location.

- Collect and transfer sediment to appropriate laboratory-prepared containers and preserve/hold samples for analysis according to protocols that ensure sample integrity.

- Test and characterize sediments with regard to physical and chemical characteristics.

- Evaluate physical and chemical data for the Bay Harbor Channel project sediments to determine the suitability placement options.

1.3 STUDY DESIGN

This investigation was designed to identify, analyze, and evaluate the physical and chemical characteristics of sediment that are representative of the new work dredging area. The sampling and testing design was intended to provide a first-step, screening-level assessment to determine if any contaminants were present at concentrations that would require special handling, treatment, or management at an upland placement site. Based on the results of the screening-level assessment, additional sampling/testing may be necessary to further delineate contaminants, assess the quality of effluent from upland dewatering, or assess water quality impacts during dredging.

Sampling locations and coordinates were determined in consultation with USACE-Mobile District. The configuration of the DUs and the sampling locations within the DUs targeted the areas that required dredging. The sampling and analytical components (list of target analytes, target detection limits, methodologies, elutriate preparation procedures, and sample holding times) of the Bay Harbor Channel dredged material evaluation were derived from the following guidance documents:

- USACE. 2003. *Evaluation of Dredged Material Proposed for Disposal at Island, Nearshore, or Upland Confined Disposal Facilities – Testing Manual.* ERDC/EL TR-03-1.
- U.S. Environmental Protection Agency (USEPA). 2001. *Methods for Collection, Storage, and Manipulation of Sediments for Chemical and Toxicological Analyses: Technical Manual*. EPA-823-B-01-002.
- USEPA/USACE. 1991. *Evaluation of Dredged Material Proposal for Ocean Disposal, Testing Manual* (commonly called "The Green Book"). EPA 503/8-91/001.
- USEPA/USACE. 1995. *QA/QC Guidance for Sampling and Analysis of Sediments, Water, and Tissues for Dredged Material Evaluations Chemical Evaluations*. EPA-823-B-95-001.
- USEPA/USACE. 1998. *Evaluation of Dredged Material Proposed for Discharge in Waters of the U.S.-Testing Manual: Inland Testing Manual* (ITM). EPA-823-B-98-004.
- USEPA/USACE. 2008. *Southeast Regional Implementation Manual (SERIM): Requirements and Procedures for Evaluation of the Ocean Disposal of Dredged Material in Southeastern U.S. Atlantic and Gulf Coast Waters*. EPA 904-B-08-001.

1.4 TECHNICAL MEMORANDUM ORGANIZATION

This technical memorandum provides a narrative of the sampling program and results of bulk sediment testing for the Panama City Bay Harbor Channel project. Field sampling and sample processing are described in Section 2. Section 3 provides the results of the bulk sediment physical and chemical analysis. References cited are provided in Section 4. Field notes, lithologic core logs, and laboratory analytical reports are provided in Appendices A, B, and C, respectively.

2. FIELD SAMPLING AND SAMPLE PROCESSING

The core collection field effort commenced on 26 August 2014 and continued through 31 August 2014. Core processing was conducted on 3 September 2014.

Nine locations in the Panama Bay Harbor Channel were successfully sampled using vibracoring equipment (Figure 1-1). Coordinates and sample coring depth information are summarized in Table 2-1. A total of 30 cores were collected with coring depths ranging from -28.7 to -36.6 ft MLLW. Water depths were tide corrected in the field based on data obtained from the Panama City, Florida tide gauge (maintained by the National Oceanic and Atmospheric Administration [NOAA] National Ocean Service [Station ID# 8729108]). All sampling locations were located in the field using a differential global positioning system.

A log of sampling activities and locations, water depths, and water quality information was recorded in permanently bound logbooks in indelible ink. Personnel names, local weather conditions, and other information that impacted the field sampling program were also recorded. Each page of the logbook was numbered and dated by the personnel entering information. A full copy of the project logbook is provided in Appendix A.

Water quality measurements were recorded *in situ* at each location using a YSI water quality probe. Water temperature (degrees Celsius [°C]), salinity (parts per thousand), pH, and dissolved oxygen (milligrams per liter [mg/L]) measurements were recorded at each location at 5-ft depth intervals from the surface to the bottom of the water column. A table of water quality parameters is provided in Appendix A. The salinity probe malfunctioned; no data were collected.

2.1 SEDIMENT CORE COLLECTION

Sediment core samples in the Bay Harbor Channel were collected using a vibracoring system supplied by Athena Technologies. A 35-ft research vessel (*R/V Artemis*) was used as the sampling platform for the field event.

The vessel was maneuvered to the desired sample site, and once on station the core location was marked and vessel immobilized. A vibracore system was deployed from the sampling platform, and consisted of a generator with mechanical vibrator attached via cable. The generator was attached directly to a 3-inch (in.) decontaminated stainless steel sample barrel with a 2.875-in. inner diameter cellulose acetate butyrate (CAB) liner insert. The sample barrel was lowered to the sediment surface through a moonpool in the deck of the sampling platform, turned on, and advanced to target depth (-41 ft MLLW) or refusal. The sample barrel was retrieved using an electric winch, and the CAB liner was removed, cut to length, capped, and labeled. Core penetration (in feet, relative to MLLW) and recovery are provided in Table 2-1.

2.1.1 Sediment Storage and Transport

Cores collected during each work day were stored onboard the barge or sampling platform on ice. Cores were transferred to a refrigeration unit (at 4 degrees Celsius [°C]) at the onshore staging area at the end of each workday. The refrigeration unit at the staging area was secured with a padlock when unattended. After completion of the coring activities, the sediment cores were transported in a refrigerated truck (at 4°C) to EA in Hunt Valley, Maryland, where they were processed for analytical testing. The cores were stored in a secured refrigeration unit at EA (at 4°C) until they were processed.

2.2 CORE PROCESSING

Prior to processing, cores were inspected, sorted, and checked against the field notebook. Cores were cut to target depth (-41 ft MLLW), and deeper material was discarded.

Multiple cores from each location were composited to obtain adequate sample volume. Sediments were extracted from each core using a stainless steel extrusion rod, composited, and homogenized in decontaminated 20-gallon stainless steel holding containers. Each sample was homogenized until the sediment was thoroughly mixed and of uniform consistency, then transferred to laboratory-approved containers and labeled for testing. Individual location samples consisting of whole-core composites were submitted for grain size and chemical analysis.

One core from each location was logged to describe lithology and physical characteristics (Appendix B). Each core was subsampled based on lithologic changes, and samples were submitted for grain size analysis. Sediments from an interval were removed using a decontaminated stainless steel spoon and placed into a stainless steel bowl. The sample was homogenized and put into sample jars for shipment to the lab.

Sample processing equipment that came into direct contact with the sediment was decontaminated according to the protocols specified in Section 2.3.

Because sediments were collected in core liners, holding times for the composite sediment samples from each location began when the sediment was composited, homogenized, and placed in the appropriate sample containers. Sample containers, preservation techniques, and holding time requirements for sediment samples are provided in Table 2-2. A chain-of-custody (COC) form was submitted to the laboratory when the processed sediment was delivered (Appendix C).

2.2.1 Sample Volume Requirements

Approximately 20 gallons of sediment were collected for the Bay Harbor Channel project:

- For each sample submitted for analytical testing for upland placement, a total of approximately 2 gallons of sediment were required for bulk physical and chemical sediment analysis.

- Additional sediment volume for the matrix spike/matrix spike duplicate (MS/MSD) analysis for bulk chemistry was collected from composite PC-02.

- Additional sediment cores collected that were not sent for analysis were kept in archive for possible additional testing.

2.3 EQUIPMENT DECONTAMINATION AND WASTE HANDLING PROCEDURES

Equipment that came into direct contact with sediment during sampling was decontaminated prior to deployment in the field and between each sampling location to minimize cross-contamination. This included the core tubes, the 5-gallon stainless steel holding container, and the stainless steel processing equipment (spoons, knives, bowls, etc.). While performing the decontamination procedure, phthalate-free nitrile gloves were worn to prevent phthalate contamination of the sampling equipment or the samples.

The decontamination procedure for the core catcher and core cutter is detailed below:

- Scrubbed with Liquinox phosphate-free detergents
- Rinsed with site water
- Rinsed with deionized (DI) water
- Rinsed with isopropanol
- Rinsed with 10 percent nitric acid (HNO_3)
- Rinsed with DI water
- Equipment allowed to air dry (in area not adjacent to decontamination area).

The decontamination procedure for all equipment other than core tubes described below was utilized:

- Rinse with DI water
- Rinse with 10 percent HNO_3
- Rinse with distilled or DI water
- Rinse with methanol followed by hexane
- Rinse with DI water
- Air dry (in area not adjacent to the decontamination area).

Waste liquids were contained during decontamination procedures in 5-gallon buckets with lids and transferred to a 55-gallon drum for characterization and disposal at the end of the field and sample processing effort. Waste liquids were disposed from EA's warehouse facility (Hunt Valley, Maryland) using standard disposal procedures and contractors.

2.4 SAMPLE LABELING, CHAIN-OF-CUSTODY, AND DOCUMENTATION

2.4.1 Numbering System

The sample numbering system was used to communicate sample location and sample type between the field crew and the laboratory (Appendix A).

An example of the sample identification (ID) is as follows:

PC-01-SED

where the set of letters denoted the site designation (PC=Bay Harbor Channel). The numbers after the dash indicated the location ID (locations 01-09). Whole-core composite samples from each location had one or more of the following suffixes to denote the sample type:

- SED – sediment sample submitted for chemical and physical analyses
- MS or MSD – matrix spike or matrix spike duplicate.

Lithologic samples taken from each core were labeled with four digits following the location ID rather than a suffix. These digits denoted the interval at which the sample was taken, in inches. For example, the sample ID PC-01-0020 is the sample taken from location 01 at an interval of 0 to 20 in.

Sample containers for the processed sediment were labeled with the following information:

- Client name
- Project number
- Sample ID
- Sampling location
- Date and time of collection
- Sampler's initials
- Type of analyses required.

2.4.2 Core Labeling

Upon collection, each core was removed from the vibracore barrel, cut to length based on dredging depth, capped at either end, and secured with duct tape. Each cap was be labeled with the sample location, core replicate (A through D, as necessary for adequate sample volume), date and time, and designated as top or bottom. This same information was written on the core tube, as well. An example of a labeled core tube is as follows:

← TOP	PC04 A 8/27/14 1440	BTM→

2.5 CHAIN-OF-CUSTODY (COC) RECORDS

Sample processing personnel prepared separate COCs for samples submitted to TestAmerica-Pittsburgh. Copies of the COC forms for bulk sediment are provided in Appendix C.

3. BULK SEDIMENT CHEMISTRY

The physical and chemical characteristics of nine whole-core composite sediment samples from the Bay Harbor Channel (Table 1-1) were determined to assess the sediment quality of the material proposed for dredging. Additionally, between 1 and 4 subsamples were submitted from each location (23 samples total) to determine physical characteristics to depth.

3.1 DATA ANALYSIS

3.1.2 Calculation of Total Polychlorinated Biphenyls (PCBs) and Total Polycyclic Aromatic Hydrocarbons (PAHs)

For each sample, two total PCB concentrations were determined—total USEPA Region 4 PCBs. USEPA Region 4 PCBs were calculated by summing the 26 congeners (as specified by Table 5-6 of the SERIM [USEPA/USACE 2008]). As per USEPA Region 4 guidance, the total USEPA Region 4 PCBs were used in this evaluation for the comparisons to sediment quality guidelines (SQGs).

NOAA PCBs were calculated for comparison to data collected as part of the Mussel Watch Status and Trends Programs. Total NOAA PCBs were calculated by summing the concentrations of the 18 summation congeners (as specified in Table 5-6 of the SERIM) and multiplying the total by a factor of two. Multiplying by a factor of two estimated the total PCB concentration and accounted for additional congeners that were not tested as part of this program. These determinations were based upon testing of specific congeners recommended in the SERIM (USEPA/USACE 2008).

PAHs were also summed together because PAHs are usually found in mixtures containing two or more compounds (Agency for Toxic Substances and Disease Registry 1995). Total PAH concentrations were determined for each sample by summing the concentrations of the individual PAHs. In addition, total PAHs were determined as total low molecular weight PAHs (LPAHs) and total high molecular weight PAHs (HPAHs) as recommended in the SERIM (USEPA/USACE 2008) based on the LPAHs and HPAHs recommended by NOAA (1989).

HPAHs and LPAHs were calculated as the sum of the PAHs that were classified into each PAH group. PAHs were assigned to groups based on their molecular weight—PAHs with two or three carbon rings were classified as LPAHs, and PAHs with four, five, or six carbon rings were classified as HPAHs—because they have different sources as well as act differently in marine environments. LPAHs are often associated with petroleum, while HPAHs are associated with combustion products (NOAA 1989). If one of the PAHs was not-detected ("U" qualified), one-half the RL was utilized in the calculation.

- LPAHs included: 1-methylnaphthalene, 2-methylnaphthalene, anthracene, acenaphthene, fluorene, naphthalene, and phenanthrene.

- HPAHs included: Benzo(a)anthracene, benzo(a)pyrene, pyrene, chrysene, dibenzo(a,h)anthracene, and fluoranthene.

3.1.3 Calculation of Dioxin Toxicity Equivalency Quotients (TEQs)

The TEQs for dioxin and furan congeners were calculated following the approach recommended by the World Health Organization (WHO) (Van den Berg et al. 2006). Each congener was multiplied by a WHO recommended Toxicity Equivalency Factor (TEF) for human health (Van den Berg et al. 2006) and then the congener concentrations were summed. Concentrations that were flagged with a "Q" (estimated maximum possible concentration) were not included in the TEQ calculation as per the USEPA dioxin validation guidance (USEPA 2005). The dioxin TEQs were calculated using ND=RL. Substituting the reporting limit (ND=RL) for each value below the reporting limit provides a conservative estimate of the concentration. This method, however, tends to produce results that are biased high, especially in data sets where the majority of samples are below the reporting limit. Adjusted values used in the calculation are provided in Appendix C

3.1.4 Calculation of Total Butyltins

For each sample, total butyltins were calculated according to the following equation as recommended by the SERIM (USEPA/USACE 2008):

$$\text{Total Butyltins as Tin [Sn]} = \sum \left[\frac{TBT}{2.44} + \frac{DBT}{1.96} + \frac{MBT}{1.48} \right]$$

where TBT = tributyltin, DBT = dibutyltin, and MBT = monobutyltin concentrations. Total butyltins were calculated using ND=RL. Adjusted values used in the calculation are provided in Appendix C

3.1.5 Comparison to Sediment Quality Guidelines (SQGs)

SQGs are numerical chemical concentrations intended to either be protective of biological resources, or predictive of adverse effects to those resources, or both (Wenning and Ingersoll 2002). USACE's guidance on using SQGs in dredged material management acknowledges the limitations of each approach used to derive SQGs to date, but concludes that SQGs are still useful as initial screening values. If, based on the initial screening using established SQGs, there is a "reason to believe" that the material is not contaminated, no further chemical or toxicological testing would be necessary as indicated by the ITM (USACE–Waterways Experiment Station [WES] 1998). SQGs are provided in Table 3-1.

The SQGs were developed as informal (non-regulatory) guidelines for use in interpreting chemical data from analyses of sediments. Several biological-effects approaches have been used to assess marine/estuarine sediment quality relative to the potential for adverse effects on benthic organisms, including the threshold effects level (TEL)/probable effects level (PEL) (MacDonald et al. 1996) approach. The TEL and PEL values were derived using concentrations with both effects and no observed effects (Long and MacDonald 1998). TELs typically represent concentrations below which adverse biological effects were rarely observed, while PELs typically represent concentrations in the middle of the effects range and above which effects were more frequently observed (Long and MacDonald 1998). Concentrations that are between the TEL and PEL represent the concentrations at which adverse biological effects occasionally occur.

The heptachlor epoxide PEL value was developed for the Canadian Council of Ministers of the Environment (CCME) (CCME 1995, 2001). The Canadian heptachlor epoxide PEL value was initially developed for freshwater sediment through a modification of the approach used by the National Status and Trends Program. Because of data gaps in toxicity data for heptachlor epoxide in marine sediments, CCME provisionally adopted the freshwater heptachlor epoxide PEL value for marine sediments (CCME 2001).

Concentrations of detected analytes in sediment samples from Bay Harbor Channel project were compared to SQGs (MacDonald et al. 1996) for marine sediments to assess the sediment quality of the material proposed for dredging. SQGs were used to identify potential adverse biological effects associated with contaminated sediments. TEL and PEL values for marine/estuarine sediments are provided in Table 3-1.

Evaluations of large chemical and toxicity data sets (O'Connor et al. 1998; O'Connor and Paul 1999) have indicated that TEL/PEL screening is not a reliable method for predicting sample toxicity or for screening samples out as non-toxic. The studies indicate that:

- Not exceeding a TEL should reliably predict the absence of whole-sediment toxicity
- Exceeding a PEL (much less a TEL) does not reliably indicate toxicity
- Many, perhaps even most, sediments that exceed one or more PELs are not toxic.

Since TELs/PELs are widely used despite their recently demonstrated over-sensitivity in predicting toxicity, the concentrations of contaminants in the sediments sampled in this project were compared to the TEL and PEL values for all chemical constituents for which TEL/PEL values have been developed. For dredged material evaluations, SQGs are used as a tool to assist with identification of constituents of potential concern and to provide additional weight of evidence in the evaluation (USACE–WES 1998).

3.1.6 Toxicity Characteristic Leaching Procedure (TCLP)

Concentrations of chemical constituents in the TCLP leachate were compared to regulatory limits of contaminants for toxicity characteristics (40 Code of Federal Regulations [CFR] 261.24) to evaluate if the sediment proposed to be dredged from the Bay Harbor Channel could be placed in an upland site. TCLPs, which are routinely required for dredged material placement at landfills and upland locations, are used to identify the potential for toxicity and to determine if the dredged material would be classified as a hazardous waste. The TCLP involves adding a low strength acid (acetic acid) to the sample and analyzing the leachate generated.

The sediments were extracted following the TCLP procedures specified in SW-846 Method 1311. If any analyte on the TCLP list (volatiles, SVOCs, metals, chlorinated pesticides, and herbicides) exceeds the regulatory limit, then that sample fails the TCLP and additional delineation of the source material may be warranted to evaluate placement alternatives.

3.1.1 Treatment of Data Below the Reporting Limit (RL)

For data that were below the reporting limit, specifically the J-qualified and U-qualified results (non-detects [ND]), the following adjustments were made prior to calculating total PAHs, total PCBs, dioxin toxicity equivalency quotients (TEQs), and total butyltins as prescribed in the *SERIM* (USEPA/USACE 2008):

- For analytes with an RL that exceeded the target detection limit (TDL), all concentrations below RL (J-qualified and U-qualified data) were adjusted to the RL, and

- For analytes with an RL that was lower than the TDL, all concentrations below the RL (J-qualified and U-qualified data) were adjusted to one-half the RL.

These adjustments are applied to datasets where material is expected to be placed in an ocean dredged material disposal site (ODMDS). While this placement option is not viable based on current data for the material from Panama City Harbor, the adjusted totals are provided in Appendix C for comparison to other regional projects. Substituting one-half the reporting limit (ND=½RL) or the reporting limit (ND=RL) for each value below the reporting limit provides a conservative estimate of the concentration. This method, however, tends to produce results that are biased high, especially in data sets where the majority of samples are below the RL. This overestimation is important to consider when comparing the calculated total values to criteria values.

3.2 BULK SEDIMENT RESULTS

Results of the bulk sediment chemistry analyses of the Bay Harbor Channel project sediments collected in August 2014 are presented in the following sub-sections. The sub-sections discuss sediment analysis results for each sample.

Bulk sediments were analyzed for target analytes. Sample weights were adjusted for percent moisture (up to 50 percent moisture) prior to analysis to achieve the lowest possible detection limits. Analytical results are reported on a dry weight basis.

Definitions of inorganic, organic, and dioxin data qualifiers are presented in Tables 3-2 through 3-4, respectively. Values for detected chemical constituents are bolded in the data tables (Tables 3-5 through 3-15), and RLs are presented for non-detected chemical constituents. Shaded cells indicate that detected concentrations exceed applicable sediment quality criteria (Tables 3-5 to 3-15).

Analytical narratives that include an evaluation of laboratory quality assurance/quality control (QA/QC) results and copies of final raw data sheets (Form Is) are provided in Appendix C. TestAmerica-Pittsburgh will retain and archive the results of these analyses for 7 years from the date of issuance of the final results.

3.2.1 Physical Analyses

Results of the grain size and physical analyses for each location whole-core composite are presented in Table 3-5A. Subsamples removed for testing during lithologic processing are presented in Table 3-5B.
With the exception of PC-08, the sediments from each location were composed predominantly of sand and gravel, each approximately greater than or equal to 70 percent sand. PC-06 and PC-07 had the highest gravel concentrations, ranging from 18.3 to 20.5 percent. PC-08 was composed primarily of silt and clay (58.2 percent) (Table 3-5A).

Samples submitted for grain size based on lithologic changes within each core provided greater detail of compositional variations with depth. The composition at PC-01 was consistently clayey sand from 0 to 6.67 ft. At PC-02, there was a 3.3-ft layer of clay at the surface, underlain by a foot of sand with silt. The bottom 5 ft was composed of silty sand. At PC-03, there was a 1.25-ft layer of clayey sand, underlain by well-graded sand with silt to a depth of 2.6 ft and silty-sand to 6.4 ft. At PC-04 the sediments were composed of clayey sand in the top 3.5 ft, underlain by poorly-graded sand with silt down to 6.25 ft. At PC-05 there was clayey-sand in the top 2 ft, underlain by poorly-graded sand with silt to 6.4 ft. At PC-06 there was clayey sand in the top 0.6 ft, underlain by silty sand and gravel to 5.3 ft. At PC-07 there was clayey sand in the top 1.2 ft, underlain by silty sand with gravel to 6.3 ft and increased gravel from 6.3 to 6.8 ft. PC-08 was composed of clay to 5.25 ft, and PC-09 was composed of well-graded sand with silt to 6 ft (Table 3-5B).

3.2.2 General Chemistry Parameters

The results of the nutrient and general chemistry analyses for the channels are presented in Table 3-6. TOC concentrations ranged from 0.59 (PC-05) to 6.2 percent (PC-06). Ammonia was detected in the method blank and in all samples (ranging from 7.8 to 56 mg/kg), but was estimated below the laboratory reporting limit at PC-06. Dissolved cyanide was only detected at one location, PC-04, at a concentration estimated below the laboratory reporting limit. Dissolved nitrate concentrations were detected in two samples (PC-01 and PC-08), but only PC-08 was detected above the reporting limit at 4 mg/kg (PC-01 was estimated to be 0.3 mg/kg). Dissolved nitrite was not detected. TKN was detected at each location ranging from 310 mg/kg (PC-06) to 1,700 mg/kg (PC-08). Sulfide was detected at six of the nine locations ranging from 9.6 to 210 mg/kg. Total phosphorous was detected in each of the samples ranging from 4.3 mg/kg (PC-04) to 800 mg/kg (PC-01). Sediment from each location had non-ignitable properties. The pH of each sample was within 7–8 value range.

3.2.3 Metals

The results of the metals analyses for the Bay Harbor Channel sediments are presented in Table 3-7. Of the 15 tested metals, 9—arsenic, cadmium, chromium, copper, lead, mercury, nickel, silver, and zinc—have TEL and PEL values (Table 3-1). Each of the tested metals was detected in the Bay Harbor sediment samples. The arsenic concentration was between the TEL (7.24 mg/kg) and PEL (41.6 mg/kg) at PC-02 and PC-08, and arsenic exceeded the PEL at PC-01 (47 mg/kg). None of the other tested metals exceeded TEL/PEL values.

3.2.4 Polycyclic Aromatic Hydrocarbons (PAHs)

Results of the PAH analyses are presented in Table 3-8. Of the 18 tested PAHs, 13 have TEL/PEL values (Table 3-1). Two of the HPAHs (benzo(a)anthracene and chrysene) were detected between TEL and PEL values at PC-02. Total PAH (ND=RL) concentrations were below the TEL for each location, ranging from 137 to 624 micrograms per kilogram (µg/kg).

3.2.5 Polychlorinated Biphenyl (PCB) Congeners

Results of the PCB congener analyses for the Bay Harbor Channel are presented in Table 3-9. None of the 26 tested individual PCB congeners have TEL or PEL values; however there are TEL and PEL values for total PCB concentrations (Table 3-1). Of the PCB congeners, 22 of the 26 tested were detected. The majority were estimated at concentrations below the reporting limits. Total USEPA-Region 4 PCB (ND=RL) concentrations were between the TEL (21.6 µg/kg) and PEL (189 µg/kg) values at each location and ranged from 24 to 56 µg/kg. Total USEPA-NOAA PCB concentrations (ND=RL) were between the TEL and PEL values in six of the nine locations and ranged from 14 to 37 µg/kg.

3.2.6 Chlorinated Pesticides

Results of the chlorinated pesticide analysis for the Bay Harbor Channel are provided in Table 3-10. Of the 22 tested chlorinated pesticides, 7 have TEL/PEL values (Table 3-1). Chlorinated pesticides were not detected at locations PC-06, PC-07, or PC-08. Location PC-09 had one detection (endrin aldehyde) at a concentration estimated below the laboratory reporting limit. Twelve of the 22 tested chlorinated pesticides were detected in locations PC-01 through PC-05. The 4,4'-DDT concentration exceeded the TEL (1.19 µg/kg) at PC-04 (1.3µg/kg).

3.2.7 Dioxin and Furan Congeners

The results of the dioxin and furan congener analyses for the Bay Harbor Channel are provided in Table 3-11. There are no TEL or PEL values for dioxin and furan congeners. Each of the 17 tested dioxin congeners was detected in the Bay Harbor Channel sediment samples. The most toxic congeners, 2,3,7,8-TCDD and 1,2,3,7,8-PECDD, were estimated at concentrations below the reporting limit in the majority of samples; however, 2,3,7,8-TCDD was detected at a concentration of 1.7 and 6.10 picograms per gram (pg/g) at PC-01 and PC-02, respectively. The dioxin TEQ in the project sediments ranged from 1.2 pg/g (PC-05) to 17.4 pg/g (PC-02).

3.2.8 Semivolatile Organic Compounds (SVOCs)

The results of the SVOC analyses for the Bay Harbor Channel are presented in Table 3-12. Of the 46 analyzed SVOCs, only 1 (nitrobenzene) has TEL and PEL values. Of the 46 tested SVOCs, only 5 were detected at low concentrations in the project sediments. Phenol was the only SVOC detected above the RL and was detected in seven of the nine sediment samples.

3.2.9 Volatile Organic Compounds (VOCs)

The results of VOC analyses (BTEX, DRO/GRO) for the Bay Harbor Channel are provided in Table 3-13. None of the analyzed VOCs were detected.

3.2.10 Butyltins

Results of butyltin analyses for the Bay Harbor Channel are provided in Table 3-14. There are no TEL or PEL values for butyltins. None of the analyzed butyltins were detected.

3.2.11 Toxicity Characteristics Leaching Procedure (TCLP)

TCLP tests were completed for metals, chlorinated pesticides, herbicides, SVOCs, and VOCs. Results are presented in Table 3-15. Barium was detected at each location, cadmium was detected in eight out of the nine locations, and arsenic was detected at one of the nine locations. Concentrations of each metal were estimated below the laboratory reporting limit at each location. No other constituents were detected in any of the samples.

The concentrations of the detected chemical constituents were compared to the limiting concentration of contaminants for toxicity characteristics (40 CFR 261.24). Concentrations of detected constituents were well below the toxicity characteristic criteria. The results also indicate that the materials were not corrosive or ignitable (Table 3-15). Therefore, the sediments from the Bay Harbor Channel would not be considered a hazardous waste per USEPA criteria.

4. REFERENCES

Agency for Toxic Substances and Disease Registry. 1995. *Toxicological Profile for Polycyclic Aromatic Hydrocarbons*. August.

Canadian Council of Ministers of the Environment (CCME). 1995. Protocol for the derivation of Canadian Sediment Quality Guidelines for the Protection of Aquatic Life. CCME PN 1176. Prepared by Environment Canada, Guidelines Division, Technical Secretariat of the CCME Task Group on Water Quality Guidelines, Ottawa.

———. 2001. *Canadian sediment quality guidelines for the protection of aquatic life: Polychlorinated dioxins and furans (PCDD/Fs)*, in: *Canadian Environmental Guidelines*, Canadian Council of Ministers of the Environment, Winnipeg.

Long, E.R. and D.D. MacDonald. 1998. Recommended uses of empirically derived sediment quality guidelines for marine and estuarine ecosystems. *Human and Ecological Risk Assessment* 4(5):1019-1039.

MacDonald, D.D., R.S. Carr, F.D. Calder, E.R. Long, and C.G. Ingersoll. 1996. Development and evaluation of sediment quality guidelines for Florida coastal waters. *Ecotoxicology* 5:253-278.

National Oceanic and Atmospheric Administration (NOAA). 1989. *A Summary of Data on Tissue Contamination From the First Three Years (1986-1989) of the Mussel Watch Project.* NOAA Tech. Mem. NOS OMA 49. Rockville, Maryland.

O'Connor, T.P. and J.F. Paul. 1999. Misfit between sediment toxicity and chemistry. *Marine Pollution Bulletin* 40:59-64.

O'Connor, T.P., K.D. Daskalakis, J.L. Hyland, J.F. Paul, and J.K. Summers. 1998. Comparisons of measured sediment toxicity with predictions based on chemical guidelines. *Environ. Toxicol. Chem.* 17:468:471.

United States Army Corps of Engineers (USACE). 2003. *Evaluation of Dredged Material Proposed for Disposal at Island, Nearshore, or Upland Confined Disposal Facilities – Testing Manual*. ERDC/EL TR-03-1. Final Report. U.S. Army Engineering Research and Development Center, Vicksburg, Mississippi. January.

United States Army Corps of Engineers, Waterways Experiment Station (USACE-WES). 1998. *Use of Sediment Quality Guidelines (SQGs) in Dredged Material Management*. Dredging Research Technical Note EEDP-04-29.

United States Environmental Protection Agency (USEPA). 2001. *Methods for Collection, Storage, and Manipulation of Sediments for Chemical and Toxicological Analyses: Technical Manual*. EPA-823-B-01-002. Office of Water. October.

———. 2005. *National Functional Guidelines for Chlorinated Dibenzo-p-Dioxins (CDDs) and Chlorinated Dibenzofurans (CDFs) Data Review*. OSWER 9240.1-51. EPA-540-R-05-001. Office of Superfund Remediation and Technology Innovation, Washington, DC. September.

United States Environmental Protection Agency (USEPA) / United States Army Corps of Engineers (USACE). 1991. *Evaluation of Dredged Material Proposed for Ocean Disposal, Testing Manual*. EPA-503/8-91/001. "The Green Book." Office of Water. February.

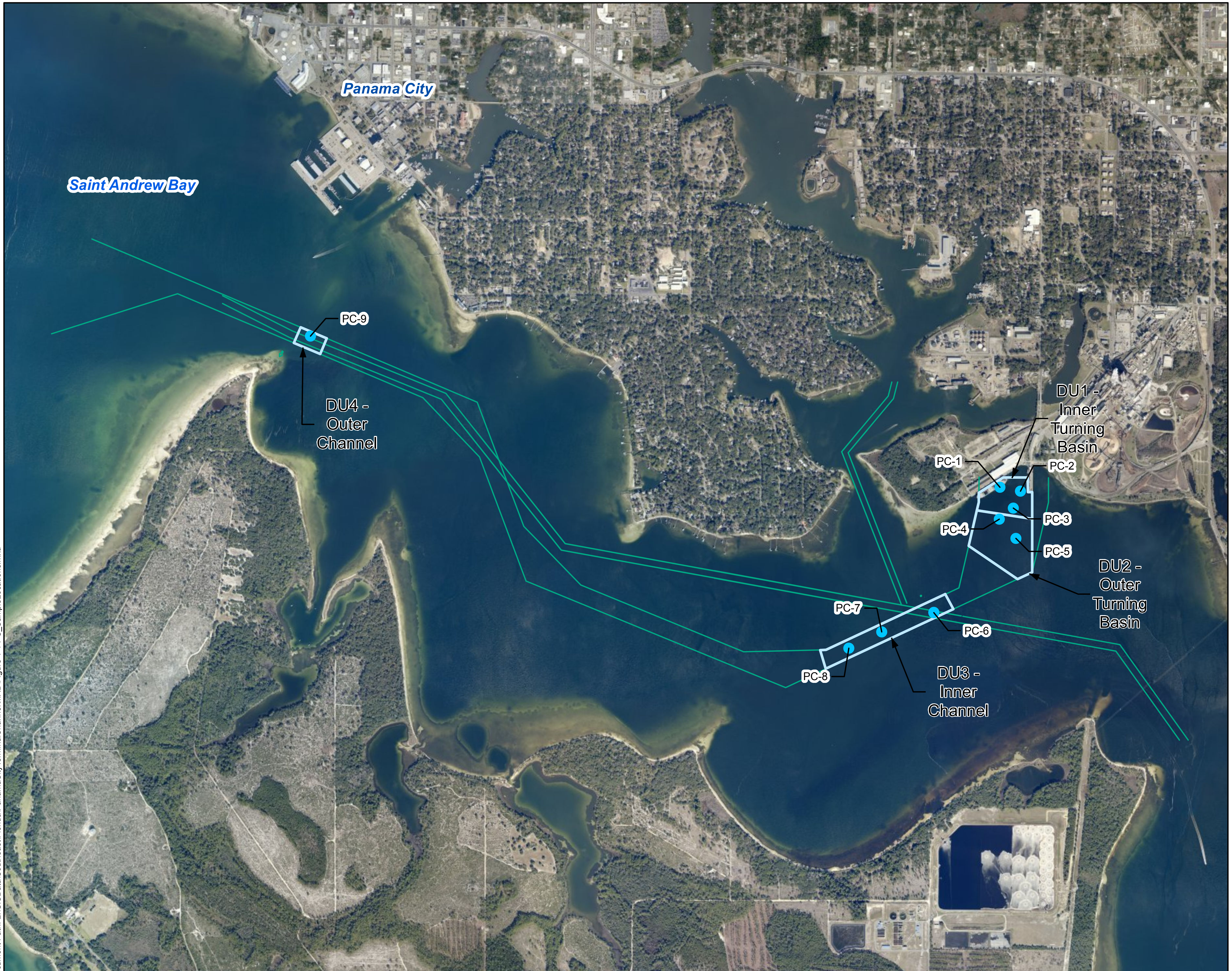
———. 1995. *QA/QC Guidance for Sampling and Analysis of Sediment, Water, and Tissue for Dredged Material Evaluations: Chemical Evaluations*. EPA-823-B-95-001. Office of Water. April

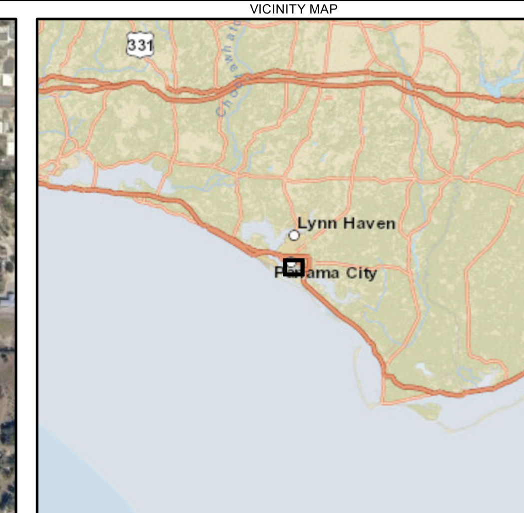
———. 1998. *Evaluation of Dredged Material Proposed for Discharge in Waters of the U.S. – Inland Testing Manual*. EPA-823-B-98-004. February.

———. 2008. *Southeastern Regional Implementation Manual (SERIM): Requirements and Procedures for Evaluation of the Ocean Disposal of Dredged Material in Southeastern U.S. Atlantic and Gulf Coast Waters.* EPA 904-B-08-001. EPA Region 4 and USACE South Atlantic Division with assistance from ANAMAR Environmental Consulting, Inc., Gainesville, Florida. August.

Wenning, R.J. and C.G. Ingersoll. 2002. *Summary of the SETAC Pellston Workshop on Use of Sediment Quality Guidelines and Related Tools for the Assessment of Contaminated Sediments*; 17-22 August 2002. Fairmount, Montana, USA. Society of Environmental Toxicology and Chemistry (SETAC). Pensacola, Florida, USA.

Van den Berg, M, L. Birnbaum, M. Denison, M. DeVito, W. Farland, M. Feeley, H. Fiedler, H. Hakansson, A. Hanberg, L. Haws, M. Rose, S. Safe, D. Schrenk, C. Tohyama, A. Tritscher, J. Tuomisto, M. Tysklind, N. Walker, and R. Peterson. 2006. The 2005 World Health Organization reevaluation of human and mammalian toxic equivalency factors for dioxins and dioxin-like compounds. *Toxicological Sciences* 93(2):223-241.





Legend

- Sample Locations
- Channel
- Dredging Unit

Aerial: ESRI ArcGIS Map Service, 2010

Map Date: August 2014

N

0 1,500 3,000
Feet

FIGURE 1-1
Panama City Bay Harbor Channel Dredging Units and Sample Locations
Panama City, Florida

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TABLE 1-1. SAMPLE SCHEME FOR PANAMA CITY BAY HARBOR CHANNEL

PANAMA CITY HARBOR, BAY CITY CHANNEL
PANAMA CITY BEACH, BAY COUNTY, FLORIDA (AUGUST 2014)

Dredging U nit	Location ID	Core ID	Sample ID
Inner Turning Basin	PC-1	A	PC-01-SED
		B	
		C	
	PC-2	A	PC-02-SED
		B	
		C	
	PC-3	A	PC-03-SED
		B	
		C	
		D	
Outer Turning Basin	PC-4	A	PC-04-SED
		B	
		C	
		D	
	PC-5	A	PC-05-SED
		B	
		C	
		D	
Inner Channel	PC-6	A	PC-06-SED
		B	
		C	
		D	
	PC-7	A	PC-07-SED
		B	
		C	
		D	
	PC-8	A	PC-08-SED
		B	
		C	
		D	
Outer Channel	PC-9	A	PC-09-SED
		B	
		C	

TABLE 1-2: ANALYTICAL METHODS

PANAMA CITY HARBOR, BAY CITY CHANNEL
PANAMA CITY BEACH, BAY COUNTY, FLORIDA (AUGUST 2014)

Parameters	Method
Semivolatiles / PAHs	Low Level SW846 8270C
Metals *	SW846 6020
Mercury	SW846 7471A
PCB Congeners	SW846 8082
Organochlorine Pesticides**	SW846 8081A
Dioxins/Furans	EPA 1613B
Butyltins	TA SOP
Cyanide	SW846 9012A
Nitrogen, Ammonia	EPA 350.1
Sulfide	SW846 9030B/9034
Nitrogen, Nitrate	EPA 353.2
Nitrogen, Nitrite	EPA 353.2
Total Kjeldahl Nitrogen	SM 4500 NH3 E
Total Phosphorus	SM 4500 P E
Total Organic Carbon by Combustion	Lloyd Kahn
Total Solids	SM 2540G
Specific Gravity	ASTM D854
Total Petroleum Hydrocarbons - DRO/GRO	SW846 8015
BTEX	SW846 8260B
TCLP Analysis (includes TCLP Volatiles, Semivolatiles, Pesticides, Herbicides, Metals, Mercury, and TCLP Extraction)	SW846 1311
ICR (Ignitability, Corrosivity)	SW7.1.2
pH	SW846 9045D
Unified Soil Classification System (includes Atterberg limits and grain size)	ASTM D2487

*Metals list includes: Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Hg, Ni, K, Se, Ag, Na, Th, V, Zn

**Includes ortho- and para- DDT, DDD, and DDE

TABLE 2-1. SAMPLE LOCATION COORDINATES, CORING DEPTHS, AND SEDIMENT RECOVERY INFORMATION
PANAMA CITY HARBOR, BAY CITY CHANNEL
PANAMA CITY BEACH, BAY COUNTY, FLORIDA (AUGUST 2014)

Location ID	Date	Time	Easting	Northing	Water Depth (feet)	Tide Elevation (feet relative to MLLW)	Top of Core Elevation (feet relative to MLLW)	Core ID	Penetration (feet)	Penetration Depth (feet relative to MLLW)	Recovery (feet)	Notes
PC-1	8/26/14	9:44:06	1612140.44	415184.12	34.6	1.3	-33.3	A	8.0	-41.3	5.1	
								B	8.0	-41.3	6.8	Used for lithologic log and grain size subsamples.
								C	8.0	-41.3	6.0	Archived at EA
PC-2	8/26/14	10:57:24	1612499.79	415111.56	29.9	1.2	-28.7	A	9.0	-37.7	7.4	
								B	12.0	-40.7	10.3	Used for lithologic log and grain size subsamples.
								C	12.0	-40.7	7.7	
PC-3	8/26/14	13:03:53	1612372.81	414816.57	33.7	1.8	-31.9	A	10.0	-41.9	6.6	Used for lithologic log and grain size subsamples.
								B	10.0	-41.9	6.4	Archived at EA
								C	10.0	-41.9	5.3	No core collected for this replicate
								D	10.0	-41.9	5.9	
PC-4	8/27/14	9:12:23	1612128.76	414618.34	33.4	1.1	-32.3	A	9.0	-41.3	6.3	Used for lithologic log and grain size subsamples.
								B	9.0	-41.3	4.9	No core collected for this replicate
								C	9.0	-41.3	5.9	Archived at EA
								D	9.0	-41.3	5.4	
PC-5	8/27/14	10:15:27	1612417.85	414278.74	34.3	1.0	-33.3	A	8.0	-41.3	6.5	Archived at EA
								B	8.0	-41.3	3.0	No core collected for this replicate
								C	8.0	-41.3	6.5	Used for lithologic log and grain size subsamples.
								D	8.0	-41.3	4.9	
PC-6	8/27/14	12:21:15	1610972.11	412971.14	34.0	1.0	-33.0	A	9.0	-42.0	4.5	
								B	9.0	-42.0	5.3	Used for lithologic log and grain size subsamples.
								C	9.0	-42.0	4.7	Archived at EA
	8/28/14	10:40:28	1610974.31	412972.97	33.8	1.0	-32.8	D	9.0	-41.8	4.5	Archived at EA
Project Notes	Coordinates were recorded in North American Datum of 1983 (NAD83) State Plane, Florida West (Zone 0902), U.S. Survey Feet.											
	Tide elevations taken from National Oceanic and Atmospheric Administration (NOAA) active tide station (Station ID#: 8729108)											

Location ID	Date	Time	Easting	Northing	Water Depth (feet)	Tide Elevation (feet relative to MLLW)	Top of Core Elevation (feet relative to MLLW)	Core ID	Penetration (feet)	Penetration Depth (feet relative to MLLW)	Recovery (feet)	Notes
PC-7	8/27/14	13:31:36	1610052.48	412632.68	35.0	1.2	-33.8	A	7.5	-41.3	4.3	
								B	7.5	-41.3	6.9	Used for lithologic log and grain size subsamples.
								C	7.5	-41.3	5.0	Archived at EA
								D	7.5	-41.3	5.3	Archived at EA
PC-8	8/28/14	9:31:42	1609475.32	412343.79	37.6	1.0	-36.6	A	6.0	-42.6	4.8	Archived at EA
								B	6.0	-42.6	4.4	Archived at EA
								C	6.0	-42.6	5.2	Used for lithologic log and grain size subsamples.
								D	6.0	-42.6	4.3	
PC-9	8/26/14	14:40:07	1599975.79	417847.16	34.1	1.5	-32.6	A	9.0	-41.6	6.0	Used for lithologic log and grain size subsamples.
								B	9.0	-41.6	5.4	
								C	9.0	-41.6	6.0	Archived at EA
Project Notes	Coordinates were recorded in NAD83 State Plane, Florida West (Zone 0902), US Survey Feet.											
	Tide elevations taken from NOAA active tide station (Station ID#: 8729108)											

TABLE 2-2. REQUIRED CONTAINERS, PRESERVATION TECHNIQUES, AND HOLDING TIMES FOR SEDIMENT SAMPLES[(a)]

PANAMA CITY HARBOR, BAY CITY CHANNEL
PANAMA CITY BEACH, BAY COUNTY, FLORIDA (AUGUST 2014)

Parameter	Volume Required [(b)]	Container [(c)]	Preservative	Holding Time
Inorganics				
Metals (including Mercury)	8 oz	P,G	4ºC	6 months (28 days for Hg)
Cyanide	8 oz	P,G	4ºC	14 days
Total Sulfide	(e)	P,G	4ºC	7 days
Nitrogen, Ammonia Nitrogen, Nitrate + Nitrite	(e)	P,G	4ºC	28 days
Nitrogen (Total Kjeldahl) Total Phosphorus	4 oz	P,G	4ºC	28 days
Physical Parameters				
Grain Size, Specific Gravity, Atterberg Limits	32 oz	P,G	4ºC	6 months
Toxicity Characteristic Leaching Procedure (TCLP) and Ignitability	32 oz + 4 oz	P,G	4º C	14 days until extraction, 40 days after extraction
Organics				
Total Organic Carbon	(d)	G	4ºC	14 days
Organochlorine Pesticides, Semivolatile Organics (SVOCs), Polychlorinated Biphenyl Congeners (PCBs), and Polycyclic Aromatic Hydrocarbons (PAHs)	(d)	G	4ºC	14 days until extraction, 40 days after extraction
Total Petroleum Hydrocarbons (TPH) Diesel Range Organics (DRO)	4 oz	G	4ºC	14 days until extraction, 40 days after extraction
Total Petroleum Hydrocarbons (TPH) Gasoline Range Organics (GRO)	4 oz	G	4ºC	14 days until analysis
BTEX (benzene, toluene, ethylene, xylene)	4 oz	G	4º C	14 days until extraction, 40 days after extraction
Butyltins	(f)	G	4ºC	14 days until extraction, 40 days after extraction
Dioxins / Furans	4 oz	G	4ºC	1 year until extraction, 40 days after extraction

(a) From time of sample collection.

(b) Additional volume will need to be provided for samples designated as matrix spike/matrix spike duplicates.

(c) P=plastic; G=glass.

(d) Can be taken from the 8 oz noted for metals.

(e) Can be taken from the 8 oz noted for cyanide.

(f) Can be taken from the 32 oz for grain size.

TABLE 3-1. MARINE SEDIMENT QUALITY GUIDELINES (SQGs)

Chemical Name	Units	Threshold Effects Level (TEL)	Probable Effects Level (PEL)
METALS			
ARSENIC	MG/KG	7.24	41.6
CADMIUM	MG/KG	0.68	4.21
CHROMIUM	MG/KG	52.3	160
COPPER	MG/KG	18.7	108
LEAD	MG/KG	30.2	112
MERCURY	MG/KG	0.13	0.7
NICKEL	MG/KG	15.9	42.8
SILVER	MG/KG	0.73	1.77
ZINC	MG/KG	124	271
CHLORINATED PESTICIDES			
4,4-DDD	UG/KG	1.22	7.81
4,4-DDE	UG/KG	2.07	374
4,4-DDT	UG/KG	1.19	4.77
CHLORDANE	UG/KG	2.26	4.79
DIELDRIN	UG/KG	0.72	4.3
GAMMA-BHC	UG/KG	0.32	0.99
HEPTACHLOR EPOXIDE	UG/KG	--	2.74*
POLYCYCLIC AROMATIC HYDROCARBONS (PAHs)			
2-METHYLNAPHTHALENE	UG/KG	20.2	201
ACENAPHTHENE	UG/KG	6.71	88.9
ACENAPHTHYLENE	UG/KG	5.87	128
ANTHRACENE	UG/KG	46.9	245
BENZO(A)ANTHRACENE	UG/KG	74.8	693
BENZO(A)PYRENE	UG/KG	88.8	763
CHRYSENE	UG/KG	108	846
DIBENZ(A,H)ANTHRACENE	UG/KG	6.22	135
FLUORANTHENE	UG/KG	113	1,494
FLUORENE	UG/KG	21.2	144
NAPHTHALENE	UG/KG	34.6	391
PHENANTHRENE	UG/KG	86.7	544
PYRENE	UG/KG	153	1,398
PAHs, TOTAL	UG/KG	1,684	16,770
POLYCHLORINATED BIPHENYL (PCB) CONGENERS			
PCBs, TOTAL	UG/KG	21.6	189

Source: MacDonald et al. 1996. Ecotoxicology 5: 253-278.

**Source*: Canadian Council of Ministers of the Environment. 2001. Canadian sediment quality guidelines for the protection of aquatic life.

TABLE 3-2. INORGANIC DATA QUALIFIERS
PANAMA CITY HARBOR, BAY CITY CHANNEL,
PANAMA CITY BEACH, BAY COUNTY, FLORIDA (AUGUST 2014)

C ***(Concentration) qualifiers:***

- **J** Estimated result; reported value is less than the project-specified Reporting Limit (RL), but greater than the method-specified Instrument Detection Limit (IDL) or Method Detection Limit (MDL).
- **U** Analyte analyzed for but not detected (concentration is less than the method-specified IDL or MDL.

Q ***(Quality control) qualifiers:***

- **E** Matrix interference; the serial dilution was outside of the percent difference control limits.
- **B** Method blank contamination. This qualifier is used when the analyte is found in the associated method blank as well as in the sample. It indicates possible/probable blank contamination. For Gas Chromatography/ Mass Spectrometry (GC/MS) analyses, this qualifier is used for a Tentatively Identified Compound (TIC), as well as, for a positively identified target compound.
- **M** Duplicate injection precision not met.
- **N** Spiked sample recovery is not within control limits.
- **S** Reported value is determined by the method of standard additions (MSA).
- **W** Postdigestion spike for furnace Atomic Absorption Spectrophotometric (AAS) AAS analysis is out of control limits (85-115%) and sample absorbance is less than 50% of spike absorbance.
- ***** Duplicate analyses and/or relative percent difference (RPD) is not within control limits.
- **+** Correlation coefficient for MSA is less than 0.995.

TABLE 3-3. ORGANIC DATA QUALIFIERS
PANAMA CITY HARBOR, BAY CITY CHANNEL, PANAMA CITY BEACH, BAY COUNTY, FLORIDA (AUGUST 2014)

C ***(Concentration) qualifiers:***

- **COL** There was more than 40% difference between initial and confirmation results. The lower result was reported. (PCBs only)
- **EST** PCB congeners flagged with "EST" indicate that the value is estimated because of coelution with another PCB congener.
- **G** Elevated reporting limit, reporting limit elevated because of matrix interference.
- **I** Matrix interference.
- **J** Estimated result; reported value is less than the project-specified Reporting Limit (RL), but greater than the method-specified Instrument Detection Limit (IDL) or Method Detection Limit (MDL).
- **PG** Compound was detected, but the percent difference between the original and confirmation analyses between the two GC columns is greater than 40%. The highest value is presented.
- **Q** Compound was detected, but as an estimated maximum possible concentration (EMPC).
- **U** Analyte analyzed but not detected (concentration is less than the method-specified IDL or MDL.

Q ***(Quality control) qualifiers:***

- **A** Tentatively identified compound is a suspected aldol condensation.
- **B** Method blank contamination. This qualifier is used when the analyte is found in the associated method blank as well as in the sample. It indicates possible/ probable blank contamination.
- **D** Compound analyzed at a secondary dilution factor.
- **E** Compound was over the calibration range.
- **M** Duplicate injection precision not met.
- **N** Identification of tentatively identified compound is based on a mass spectral library search.
- ***** Duplicate analysis is not within control limits.
- **+** Correlation coefficient for MSA is less than 0.995.

TABLE 3-4. DIOXIN AND FURAN DATA QUALIFIERS
PANAMA CITY HARBOR, BAY CITY CHANNEL,
PANAMA CITY BEACH, BAY COUNTY, FLORIDA (AUGUST 2014)

B	The analyte is reported in the associated method blank at a reportable level.
C	"Coeluting Isomer" – The isomer is known to coelute with another member of its homologue group, or the peak shape is shouldered, indicating the likelihood of a coeluting isomer.
E	The amount reported is above the upper calibration limit in the method, and therefore the reported result is an estimate.
J	The amount reported is below the lowest calibration standard, and therefore the reported result is an estimate.
Q	Reported value is estimated maximum possible concentration. This qualifier is used when chromatographic data does not meet all positive identification criteria, such as ion ratios, retention time, co-maximization criteria and polychlorinated dibenzofuran purity.
S	"Ion suppression event" – Signal is deflected when analyte is measured, possibly because of matrix-borne interference.
U	Compound was analyzed, but not detected.
X	Other. See explanation for specific definition.

TABLE 3-5A. PHYSICAL CHARACTERISTICS OF SEDIMENT, WHOLE-CORE COMPOSITES

PANAMA CITY HARBOR, BAY CITY CHANNEL

PANAMA CITY BEACH, BAY COUNTY, FLORIDA (AUGUST 2014)

		DU1			DU2		DU3			DU4
		Panama City Inner Turning Basin			Panama City Outer Turning Basin		Panama City Inner Channel			Panama City Outer Channel
ANALYTE	UNITS	PC-01	PC-02	PC-03	PC-04	PC-05	PC-06	PC-07	PC-08	PC-09
GRAVEL	%	4.5	0	0	2.3	7.4	20.5	18.3	3.7	16.1
SAND	%	65.3	70.2	84.4	82.1	83.1	69.1	68.2	38.1	75.5
COARSE SAND	%	7.9	1.7	2	2.2	5.2	48.7	25.7	5	22.4
MEDIUM SAND	%	20.7	11.1	26.7	8.2	8	10.5	13.4	3.7	16.3
FINE SAND	%	36.7	57.4	55.7	71.7	69.9	9.9	29.1	29.4	36.8
SILT	%	16.7	19.6	8.1	7.5	3.6	7.2	7.9	36.2	4.5
CLAY	%	13.5	10.2	7.5	8.1	5.9	3.2	5.6	22	3.9
SILTCLAY	%	30.2	29.8	15.6	15.6	9.5	10.4	13.5	58.2	8.4
LIQUID LIMIT	--	59	27	32	0	0	0	32	87	0
SPECIFIC GRAVITY	--	2.7	2.6	2.6	2.6	2.7	2.7	2.7	2.6	2.6
PLASTIC LIMIT	--	30	24	23	0	0	0	22	35	0
PLASTICITY INDEX	--	29	3	9	NP	NP	NP	10	52	NP
Soil Classification Symbol	--	SC	SC-SM	SC	SM	SP-SM	SP-SM	SC	CH	SP-SM
Soil Classification Name	--	CL-SAND	SI-CL-SAND	CL-SAND	SI-SAND	PG-SAND-W-SILT	PG-SAND-W-SILT-GRAVEL	CL-SAND-W-GRAVEL	FAT-CLAY	PG-SAND-W-SILT-GRAVEL

CH = high plasticity clay
CL = low plasticity clay
NP = no plasticity
PG = poorly graded
SC = clayey sand
SI = silty
SM = silty sand
SP = poorly graded sand
W = with

TABLE 3-5B. PHYSICAL CHARACTERISTICS OF SEDIMENT, SUBSAMPLED TO DEPTH AT EACH LOCATION
PANAMA CITY HARBOR, BAY CITY CHANNEL
PANAMA CITY BEACH, BAY COUNTY, FLORIDA (AUGUST 2014)

		DU1									
		Panama City Inner Turning Basin									
		PC-01			**PC-02**				**PC-03**		
	Sample Intervals, ft	**0-1.67**	**1.67-4.6**	**4.6-6.7**	**0-3.3**	**3.3-4.8**	**4.8-6.75**	**6.75-10.4**	**0-1.25**	**1.25-2.6**	**5.5-6.4**
ANALYTE	**UNITS**										
GRAVEL	%	2.3	1	6.5	0	0.2	0.5	1.4	0	11.9	0.2
SAND	%	71.3	72	61.3	46.7	90.4	81.3	70.8	62.2	78.2	85.6
COARSE SAND	%	0.9	2.3	7.1	0.2	1.6	2	1.8	0.9	1.9	1.6
MEDIUM SAND	%	15.1	27.6	24.4	8.2	28.3	21.9	8.3	13.2	25.8	31.5
FINE SAND	%	55.3	42.1	29.8	38.3	60.5	57.4	60.7	48.1	50.5	52.5
SILT	%	18	21.7	19.5	35.5	4.7	13.1	17.7	26	4.9	12.2
CLAY	%	8.4	5.3	12.7	17.8	4.8	5.1	10.1	11.8	5	2
SILTCLAY	%	26.4	27	32.2	53.3	9.5	18.2	27.8	37.8	9.9	14.2
LIQUID LIMIT	--	57	61	54	94	0	0	0	69	0	0
PLASTIC LIMIT	--	25	30	30	28	0	0	0	32	0	0
PLASTICITY INDEX	--	33	31	23	66	NP	NP	NP	38	NP	NP
Soil Classification Symbol	--	SC	SC	SC	CH	SP-SM	SM	SM	SC	SW-SM	SM
Soil Classification Name	--	CL-SAND	CL-SAND	CL-SAND	FAT-CLAY	PG-SAND-W-SILT	SI-SAND	SI-SAND	CL-SAND	WG-SAND-W-SILT	SI-SAND

		DU2					**DU3**							**DU4**
		Panama City Outer Turning Basin					**Panama City Inner Channel**							**Panama City Outer Channel**
		PC-04		**PC-05**			**PC-06**		**PC-07**				**PC-08**	**PC-09**
	Sample Intervals, ft	**0-3.5**	**3.5-6.25**	**0-2.0**	**2.0-3.7**	**3.7-6.4**	**0-0.6**	**0.6-5.3**	**0-1.2**	**1.2-5.2**	**5.2-6.3**	**6.3-6.8**	**0-5.25**	**0-6.0**
ANALYTE	**UNITS**													
GRAVEL	%	1.2	0.6	6.1	4.6	0	6.9	20.3	8.5	23.3	13	0.7	0	8.8
SAND	%	67.7	87.4	69	85.5	91.9	62.7	53.7	56.9	52	83	85.3	41.6	79.7
COARSE SAND	%	0.8	0.7	4.1	5.7	0.3	19.9	23.6	5.1	15.8	3.8	0.7	1.9	10.2
MEDIUM SAND	%	12.1	7.3	13.3	11.3	2.3	28.1	19.4	16.6	15.7	8.4	5.9	4.9	20
FINE SAND	%	54.8	79.4	51.6	68.5	89.3	14.7	10.7	35.2	20.5	70.8	78.7	34.8	49.5
SILT	%	20.1	8.5	17.1	5.4	5.8	22.8	21.3	22.2	20.4	1.9	5.2	35.9	7.2
CLAY	%	11	3.5	7.8	4.5	2.3	7.6	4.7	12.4	4.3	2.1	8.8	22.5	4.3
SILTCLAY	%	31.1	12	24.9	9.9	8.1	30.4	26	34.6	24.7	4	14	58.4	11.5
LIQUID LIMIT	--	59	0	38	0	0	67	0	64	0	0	0	98	0
PLASTIC LIMIT	--	23	0	23	0	0	32	0	26	0	0	0	26	0
PLASTICITY INDEX	--	36	NP	16	NP	NP	36	NP	38	NP	NP	NP	72	NP
Soil Classification Symbol	--	SC	SP-SM	SC	SP-SM	SP-SM	SC	SM	SC	SM	SP	SM	CH	SW-SM
Soil Classification Name	--	CL-SAND	PG-SAND-W-SILT	CL-SAND	PG-SAND-W-SILT	PG-SAND-W-SILT	CL-SAND	SI-SAND-GRAVEL	CL-SAND	SI-SAND-GRAVEL	PG-SAND-W-GRAVEL	SI-SAND	SN-FAT-CLAY	WG-SAND-W-SILT

CH = high plasticity clay
CL = low plasticity clay
NP = no plasticity
PG = poorly graded
SC = clayey sand
SI = silty
SM = silty sand
SP = poorly graded sand
W = with
WG = well graded

TABLE 3-6. GENERAL CHEMISTRY CONCENTRATIONS (MG/KG) IN SEDIMENT

PANAMA CITY HARBOR, BAY CITY CHANNEL

PANAMA CITY BEACH, BAY COUNTY, FLORIDA (AUGUST 2014)

			DU1			DU2		DU3			DU4
			Panama City Inner Turning Basin			Panama City Outer Turning Basin		Panama City Inner Channel			Panama City Outer Channel
ANALYTE	UNITS	Average RL	PC-01	PC-02	PC-03	PC-04	PC-05	PC-06	PC-07	PC-08	PC-09
AMMONIA AS N	MG/KG	7.6	**56 B**	**21 B**	**33 B**	**22 B**	**12 B**	**5 J B**	**7.8 B**	**26 B**	**29 B**
CYANIDE, TOTAL	MG/KG	0.38	0.45 U	0.36 U	0.36 U	**0.3 J**	0.33 U	0.34 U	0.37 U	0.54 U	0.32 U
IGNITABILITY	NO UNIT	1	NO	NO	NO	NO	NO	NO	NO	NO	NO
NITRATE AS N	MG/KG	0.94	**0.3 J**	0.73 U	0.74 U	0.76 U	0.66 U	0.65 U	0.72 U	**4**	0.63 U
NITRITE AS N	MG/KG	0.94	0.89 U	0.73 U	0.74 U	0.76 U	0.66 U	0.65 U	0.72 U	2.7 U	0.63 U
NITROGEN, KJELDAHL (TKN)	MG/KG	224	**820**	**840**	**450**	**490**	**400**	**310**	**620**	**1700**	**410**
PH	SU	0.10	**7.4**	**7.56**	**7.66**	**7.78**	**7.83**	**7.98**	**7.54**	**7.89**	**7.53**
SULFATE	MG/KG	19	**1400 B**	**510 B**	**670 B**	**750 B**	**930 B**	**1100 B**	**1300 B**	**3200 B**	**980 B**
SULFIDE	MG/KG	46	**210**	**83**	**32 J**	46 U	**18 J**	**36 J**	44 U	65 U	**9.6 J**
TOTAL ORGANIC CARBON	%	0.16	**1.50**	**0.95**	**0.78**	**0.67**	**0.59**	**6.2**	**3.6**	**2.4**	**1.3**
ORTHOPHOSPHATE AS P	MG/KG	9.4	8.9 U	7.3 U	**1.6 J**	7.6 U	6.6 U	6.5 U	7.2 U	27 U	6.3 U
TOTAL PHOSPHORUS AS P	MG/KG	43	**800 B**	**84 B**	**110 B**	**4.3 J B**	**120 B**	**98 B**	**260 B**	**660 B**	**160 B**

There are no sediment quality guidelines for the general chemistry parameters

NOTES: Bold values represent detected concentrations; RL is reported for non-detected constituents.

RL = average reporting limit

B = detected in the laboratory method blank

J = compound was detected, but below the reporting limit (value is estimated)

U = compound was analyzed but not detected

TABLE 3-7. METAL CONCENTRATIONS (MG/KG) IN SEDIMENT
PANAMA CITY HARBOR, BAY CITY CHANNEL
PANAMA CITY BEACH, BAY COUNTY, FLORIDA (AUGUST 2014)

					DU1			DU2		DU3			DU4
					Panama City Inner Turning Basin			Panama City Outer Turning Basin		Panama City Inner Channel			Panama City Outer Channel
ANALYTE	UNITS	Average RL	TEL*	PEL*	PC-01	PC-02	PC-03	PC-04	PC-05	PC-06	PC-07	PC-08	PC-09
ALUMINUM	MG/KG	8.5	--	--	**5,200**	**2,100**	**2,000**	**2,100**	**1,800**	**1,500**	**2,200**	**8,800**	**1,200**
ANTIMONY	MG/KG	0.56	--	--	**0.91**	**0.42**	**0.14 J**	**0.083 J**	**0.05 J**	**0.083 J**	**0.065 J**	**0.072 J**	**0.026 J**
ARSENIC	MG/KG	0.28	7.24	41.6	**47**	**29**	**4.4**	**4**	**5.7**	**3.1**	**3.7**	**9.7**	**2.1**
BARIUM	MG/KG	2.83	--	--	**34**	**3.7**	**3.7**	**3.5**	**3.1**	**12**	**5.1 J**	**9.9**	**6.2 J**
BERYLLIUM	MG/KG	0.28	--	--	**4.9**	**0.14**	**0.16**	**0.14**	**0.16**	**0.088 J**	**0.11 J**	**0.69**	**0.054 J**
CADMIUM	MG/KG	0.28	0.676	4.21	**0.26**	**0.05 J**	**0.049 J**	**0.062 J**	**0.033 J**	0.67 U	0.75 U	**0.15**	**0.058 J**
CALCIUM	MG/KG	28.28	--	--	**79,000**	**3,600**	**10,000**	**17,000**	**46,000**	**340,000**	**290,000**	**55,000**	**170,000**
CHROMIUM	MG/KG	0.56	52.3	160.4	**38 B**	**25 B**	**7.8 B**	**7.6 B**	**5.8 B**	**6**	**7.2**	**27 B**	**5**
COBALT	MG/KG	0.14	--	--	**4.1**	**0.39**	**0.49**	**0.43**	**0.43**	**0.49**	**0.5**	**1.3**	**0.31 J**
COPPER	MG/KG	0.56	18.7	108.2	**6.3**	**3.7**	**2.6**	**2.4**	**1.6**	**1.2 J**	**1.4 J**	**5.5**	**1 J**
IRON	MG/KG	14.26	--	--	**36,000**	**6,700**	**3,300**	**3,300**	**2,800**	**2,800**	**3,000**	**11,000**	**1,700**
LEAD	MG/KG	0.28	30.24	112.18	**9.8**	**6.7**	**3.7**	**3.3**	**2.6**	**1.8**	**2.2**	**6.6**	**1.2**
MAGNESIUM	MG/KG	28.28	--	--	**3,500 B**	**1,200 B**	**1,500 B**	**1,800 B**	**1,700 B**	**2,500**	**3,200**	**7,900 B**	**2,000**
MERCURY	MG/KG	0.02	0.13	0.696	**0.035**	**0.026**	**0.015 J**	**0.015 J**	**0.0095 J**	0.021 U	0.024 U	**0.017 J**	0.021 U
NICKEL	MG/KG	0.28	15.9	42.8	**11**	**1.9**	**2.1**	**2.1**	**1.8**	**1.8**	**1.9**	**7.8**	**1.4**
POTASSIUM	MG/KG	28.28	--	--	**950 B**	**420 B**	**400 B**	**420 B**	**340 B**	**310 B**	**380 B**	**1400 B**	**280 B**
SELENIUM	MG/KG	1.43	--	--	**0.93**	**0.28 J**	**0.25 J**	**0.27 J**	**0.25 J**	3.4 U	3.8 U	**0.98**	3.2 U
SILVER	MG/KG	0.28	0.73	1.77	**0.064 J**	**0.041 J**	**0.018 J**	**0.018 J**	**0.0087 J**	0.67 U	0.75 U	**0.099 J**	0.64 U
SODIUM	MG/KG	28.28	--	--	**5,400**	**3,800**	**3,400**	**3,700**	**3,100**	**6,100**	**6,200**	**10,000**	**4,600**
THALLIUM	MG/KG	0.28	--	--	**0.26**	**0.081**	**0.088**	**0.093**	**0.088**	**0.036 J**	**0.062 J**	**0.2**	**0.026 J**
VANADIUM	MG/KG	0.28	--	--	**45 B**	**26 B**	**5.7 B**	**5.7 B**	**4.4 B**	**5.7**	**6.9**	**17 B**	**5**
ZINC	MG/KG	1.43	124	271	**53**	**8**	**6.3**	**5.2**	**3.7**	**3.3 J**	**3.1 J**	**14**	**2.9 J**

**Source*: MacDonald et al. 1996. Ecotoxicology 5: 253-278.

NOTES: Bold values represent detected concentrations. Shaded concentrations exceed sediment quality guidelines.
RL is reported for non-detected constituents.

RL = average reporting limit
TEL = threshold effects level
PEL = probable effects level
B = detected in the laboratory method blank
J = compound was detected, but below the reporting limit (value is estimated)
U = compound was analyzed but not detected

TABLE 3-8. PAH CONCENTRATIONS (UG/KG) IN SEDIMENT
PANAMA CITY HARBOR, BAY CITY CHANNEL
PANAMA CITY BEACH, BAY COUNTY, FLORIDA (AUGUST 2014)

					DU1			DU2		DU3			DU4
					Panama City Inner Turning Basin			Panama City Outer Turning Basin		Panama City Inner Channel			Panama City Outer Channel
ANALYTE	UNITS	Average RL	TEL**	PEL**	PC-01	PC-02	PC-03	PC-04	PC-05	PC-06	PC-07	PC-08	PC-09
Low Molecular Weight PAHs (LPAHs)													
1-METHYLNAPHTHALENE*	UG/KG	10	--	--	**1.5 J**	**1.5 J**	9.8 U	**1.1 J**	9.1 U	8.7 U	9.9 U	15 U	8.6 U
2-METHYLNAPHTHALENE*	UG/KG	10	20.2	201	**2.5 J**	**2.6 J**	**1.3 J**	**1.9 J**	9.1 U	8.7 U	9.9 U	15 U	8.6 U
ACENAPHTHENE*	UG/KG	10	6.71	88.9	**3.4 J**	9.7 U	9.8 U	10 U	9.1 U	8.7 U	9.9 U	15 U	8.6 U
ACENAPHTHYLENE	UG/KG	10	5.87	128	**3 J**	9.7 U	9.8 U	10 U	9.1 U	8.7 U	9.9 U	15 U	8.6 U
ANTHRACENE*	UG/KG	10	46.9	245	**5.1 J**	**5.1 J**	**3.2 J**	**1.5 J**	9.1 U	8.7 U	9.9 U	15 U	8.6 U
FLUORENE*	UG/KG	10	21.2	144	**3.7 J**	9.7 U	9.8 U	10 U	9.1 U	8.7 U	9.9 U	15 U	8.6 U
NAPHTHALENE*	UG/KG	10	34.6	391	**6.2 J**	9.7 U	9.8 U	**1.9 J**	9.1 U	8.7 U	9.9 U	15 U	8.6 U
PHENANTHRENE*	UG/KG	10	86.7	544	**8.5 J**	**7.4 J**	**3.7 J**	**3.5 J**	**2.5 J**	8.7 U	9.9 U	15 U	8.6 U
TOTAL LPAHS (a) (ND=RL)	UG/KG	--	1,684	16,770	30.9	45.7	47.4	29.9	57.1	60.9	69.3	105	60.2
High Molecular Weight PAHs (HPAHs)													
BENZO(A)ANTHRACENE*	UG/KG	10	74.8	693	**29**	**90**	9.8 U	**8.4 J**	9.1 U	8.7 U	9.9 U	15 U	8.6 U
BENZO(A)PYRENE*	UG/KG	10	88.8	763	**25**	**68**	9.8 U	**7.5 J**	9.1 U	8.7 U	9.9 U	15 U	8.6 U
BENZO(B)FLUORANTHENE	UG/KG	10	--	--	**30**	**38**	9.8 U	10 U	9.1 U	8.7 U	9.9 U	15 U	8.6 U
BENZO(G,H,I)PERYLENE	UG/KG	10	--	--	**26**	**60**	9.8 U	**7.7 J**	9.1 U	8.7 U	9.9 U	15 U	8.6 U
BENZO(K)FLUORANTHENE	UG/KG	10	--	--	**18**	**12**	9.8 U	10 U	9.1 U	8.7 U	9.9 U	15 U	8.6 U
CHRYSENE*	UG/KG	10	108	846	**36**	**120**	9.8 U	**8.3 J**	9.1 U	8.7 U	9.9 U	15 U	8.6 U
DIBENZO(A,H)ANTHRACENE*	UG/KG	10	6.22	135	12 U	9.7 U	9.8 U	10 U	9.1 U	8.7 U	9.9 U	15 U	8.6 U
FLUORANTHENE*	UG/KG	10	113	1,494	**64**	**30**	**12**	**12**	**3.7 J**	8.7 U	9.9 U	15 U	8.6 U
INDENO(1,2,3-CD)PYRENE	UG/KG	10	--	--	**20**	**21**	9.8 U	10 U	9.1 U	8.7 U	9.9 U	15 U	8.6 U
PYRENE*	UG/KG	10	153	1,398	**68**	**120**	**13**	**13**	**3.4 J**	8.7 U	9.9 U	15 U	8.6 U
TOTAL HPAHS (a) (ND=RL)	UG/KG	--	1,684	16,770	234	438	64	59	43.5	52.2	59.4	90	51.6
TOTAL PAHS (b) (ND=RL)	UG/KG	--	1,684	16,770	361.9	624.1	160.6	136.8	146.1	157	178	270	154.8

*PAHs used for Total LPAH and Total HPAH summation, as per Table 5-5 of the SERIM (USEPA/USACE 2008)

***Source*: MacDonald et al. 1996. Ecotoxicology 5: 253-278.

NOTES: Bold values represent detected concentrations. Shaded concentrations exceed sediment quality guidelines.
RL is reported for non-detected constituents.

(a) Low molecular weight and high molecular weight polycyclic aromatic hydrocarbons (LPAHs and HPAHs), as per SERIM Table 5-5 (USEPA/USACE 2008).

(b) Total PAHs is a sum of each individual PAH, NOT the sum of the LPAHs and HPAHs.

RL = average reporting limit

TEL = threshold effects level

PEL = probable effects level

J = compound was detected, but below the reporting limit (value is estimated)

U = compound was analyzed, but not detected

TABLE 3-9. PCB CONGENER CONCENTRATIONS (UG/KG) IN SEDIMENT
PANAMA CITY HARBOR, BAY CITY CHANNEL
PANAMA CITY BEACH, BAY COUNTY, FLORIDA (AUGUST 2014)

					DU1			DU2		DU3			DU4
					Panama City Inner Turning Basin			Panama City Outer Turning Basin		Panama City Inner Channel			Panama City Outer Channel
ANALYTE	UNITS	Average RL	TEL**	PEL**	PC-01	PC-02	PC-03	PC-04	PC-05	PC-06	PC-07	PC-08	PC-09
PCB 8 (BZ) *†	UG/KG	0.76	--	--	**0.52 J P**	**0.54 J P**	**0.76 P**	**0.25 J P**	**0.37 J P**	**2.2 P**	**0.75 P**	**0.54 J P**	**1.4 P**
PCB 18 (BZ) *†	UG/KG	0.76	--	--	**0.84 J**	**1.30**	**0.43 J P**	**0.48 J**	**0.25 J P**	**0.17 J P**	**0.066 J P**	**0.57 J**	**0.14 J P**
PCB 28 (BZ) *†	UG/KG	0.76	--	--	**0.25 J P**	**0.22 J P**	**0.13 J P**	**0.16 J P**	0.65 U	**0.07 J P**	**0.17 J P**	**0.36 J P**	**0.13 J P**
PCB 44 (BZ) *†	UG/KG	0.76	--	--	**0.45 J**	**0.47 J**	**0.15 J P**	**0.65 J**	**0.15 J P**	0.63 U	0.74 U	1.1 U	**0.36 J**
PCB 49 (BZ) *	UG/KG	0.76	--	--	**1.00**	**0.75**	0.71 U	**0.37 J**	0.65 U	0.63 U	0.74 U	1.1 U	0.63 U
PCB 52 (BZ) *†	UG/KG	0.76	--	--	**1.50**	**1.30**	**0.27 J P**	**1.40**	0.65 U	0.63 U	0.74 U	1.1 U	0.63 U
PCB 66 (BZ) *†	UG/KG	0.76	--	--	0.9 U	**0.27 J P**	**0.15 J P**	**0.26 J P**	0.65 U	0.63 U	0.74 U	1.1 U	0.63 U
PCB 77 (BZ) *	UG/KG	0.76	--	--	**4.40**	**4.40**	**0.54**	0.75 U	0.65 U	0.63 U	0.74 U	1.1 U	0.63 U
PCB 87 (BZ)*	UG/KG	0.76	--	--	**0.55 J P**	**0.75 P**	**0.34 J P**	**1.5 P**	**0.12 J P**	**0.046 J P**	**0.08 J**	**0.089 J P**	**0.044 J P**
PCB 101 (BZ) *†	UG/KG	0.76	--	--	**2.9 B**	**2.6 B**	**1.1 B**	**2.6 P B**	**0.3 J P B**	**0.13 J B**	**0.098 J B**	**0.27 J B**	**0.099 J B**
PCB 105 (BZ) *†	UG/KG	0.76	--	--	**0.4 J**	**0.52 J**	**0.26 J**	**0.85**	0.65 U	0.63 U	0.74 U	1.1 U	0.63 U
PCB 118 (BZ) *†	UG/KG	0.76	--	--	**0.98 P**	**0.54**	**0.39 J P**	**1.3 P**	**0.13 J P**	0.63 U	0.74 U	1.1 U	0.63 U
PCB 126 (BZ) *	UG/KG	0.76	--	--	0.9 U	**0.31 J P**	**0.14 J**	0.75 U	0.65 U	0.63 U	0.74 U	1.1 U	0.63 U
PCB 128 (BZ) *†	UG/KG	0.76	--	--	**0.83 J**	**0.69 J**	**0.27 J**	**0.88**	**0.11 J**	0.63 U	0.74 U	**0.14 J**	0.63 U
PCB 138 (BZ) *†	UG/KG	0.76	--	--	**1.90**	**2.00**	**0.82**	**2.40**	**0.18 J P**	0.63 U	0.74 U	**0.15 J**	0.63 U
PCB 153 (BZ) *†	UG/KG	0.76	--	--	**2.20**	**1.70**	**0.65 J**	**1.90**	**0.26 J**	**0.093 J**	0.74 U	**0.25 J**	0.63 U
PCB 156 (BZ) *	UG/KG	0.76	--	--	0.9 U	**0.36 J**	0.71 U	**0.39 J**	0.65 U	0.63 U	0.74 U	1.1 U	0.63 U
PCB 169 (BZ) *	UG/KG	0.76	--	--	0.9 U	0.71 U	0.71 U	0.75 U	0.65 U	0.63 U	0.74 U	1.1 U	0.63 U
PCB 170 (BZ) *†	UG/KG	0.76	--	--	**0.79 J**	**0.54 J**	**0.2 J**	**0.65 J**	0.65 U	0.63 U	0.74 U	1.1 U	0.63 U
PCB 180 (BZ) *†	UG/KG	0.76	--	--	**1.20**	**0.67 J**	**0.28 J**	**0.93**	**0.14 J**	0.63 U	0.74 U	1.1 U	0.63 U
PCB 183 (BZ) *	UG/KG	0.76	--	--	**0.3 J P**	**0.37 J P**	0.71 U	**0.23 J P**	0.65 U	0.63 U	0.74 U	1.1 U	0.63 U
PCB 184 (BZ) *	UG/KG	0.76	--	--	0.9 U	0.71 U	0.71 U	0.75 U	0.65 U	0.63 U	0.74 U	1.1 U	0.63 U
PCB 187 (BZ) *†	UG/KG	0.76	--	--	**0.78 J**	**0.53 J**	**0.078 J P**	**0.54 J**	**0.1 J P**	0.63 U	0.74 U	1.1 U	**0.068 J P**
PCB 195 (BZ) *†	UG/KG	0.76	--	--	0.9 U	0.71 U	0.71 U	0.75 U	0.65 U	0.63 U	0.74 U	1.1 U	0.63 U
PCB 206 (BZ) *†	UG/KG	0.76	--	--	**0.13 J**	**0.1 J**	0.71 U	**0.064 J P**	0.65 U	0.63 U	0.74 U	1.1 U	0.63 U
PCB 209 (BZ) *†	UG/KG	0.76	--	--	0.9 U	0.71 U	0.71 U	0.75 U	0.65 U	0.63 U	0.74 U	1.1 U	0.63 U
Total USEPA-Region 4 PCBs (ND=RL)	UG/KG	--	21.6	189	56	48	26	45	24	31	33	44	28
Total USEPA-NOAA PCBs (ND=RL)	UG/KG	--	21.6	189	37	32	16	34	14	22	23	29	20

* PCB congeners used for the Total USEPA Region 4 PCB summation, as per Table 5-6 of the SERIM (USEPA/USACE 2008).
† PCB congeners used for the Total USEPA-NOAA PCB summation, as per Table 9-3 of the ITM (USEPA/USACE 1998).
***Source*: MacDonald et al. 1996. Ecotoxicology 5: 253-278.
NOTES: Bold values represent detected concentrations. Shaded concentrations exceed sediment quality guidelines.
RL is reported for non-detected constituents.

RL = average reporting limit
TEL = threshold effects level
PEL = probable effects level
B = detected in the laboratory method blank
J = compound was detected, but below the reporting limit (value is estimated)
P = the percent difference between the original and confirmation analysis is greater than 40%
U = compound was analyzed, but not detected

TABLE 3-10. CHLORINATED PESTICIDE CONCENTRATIONS (UG/KG) IN SEDIMENT

PANAMA CITY HARBOR, BAY CITY CHANNEL

PANAMA CITY BEACH, BAY COUNTY, FLORIDA (AUGUST 2014)

					DU1			DU2		DU3			DU4
					Panama City Inner Turning Basin			Panama City Outer Turning Basin		Panama City Inner Channel			Panama City Outer Channel
ANALYTE	**UNITS**	**Average RL**	**TEL***	**PEL***	**PC-01**	**PC-02**	**PC-03**	**PC-04**	**PC-05**	**PC-06**	**PC-07**	**PC-08**	**PC-09**
2,4'-DDD	UG/KG	0.32	--	--	**0.62**	**0.61**	**0.22 J**	**0.73**	**0.028 J P**	0.27 U	0.31 U	0.45 U	0.27 U
2,4'-DDE	UG/KG	0.32	--	--	0.38 U	0.3 U	0.31 U	**0.12 J P**	0.28 U	0.27 U	0.31 U	0.45 U	0.27 U
2,4'-DDT	UG/KG	0.32	--	--	0.38 U	0.3 U	0.31 U	0.32 U	0.28 U	0.27 U	0.31 U	0.45 U	0.27 U
4,4'-DDD	UG/KG	0.32	1.22	7.81	**0.27 J P**	**0.3 P**	**0.16 J P**	**0.48 P**	**0.14 J P**	0.27 U	0.31 U	0.45 U	0.27 U
4,4'-DDE	UG/KG	0.32	2.07	374.17	**0.35 J P**	**0.4 P**	**0.14 J P**	**0.5 P**	**0.18 J**	0.27 U	0.31 U	0.45 U	0.27 U
4,4'-DDT	UG/KG	0.32	1.19	4.77	**1**	**1.1**	**0.49**	**1.3**	0.28 U	0.27 U	0.31 U	0.45 U	0.27 U
ALDRIN	UG/KG	0.32	--	--	0.38 U	0.3 U	0.31 U	0.32 U	0.28 U	0.27 U	0.31 U	0.45 U	0.27 U
ALPHA-BHC	UG/KG	0.32	--	--	0.38 U	**0.062 J P**	0.31 U	0.32 U	0.28 U	0.27 U	0.31 U	0.45 U	0.27 U
BETA-BHC	UG/KG	0.32	--	--	0.38 U	0.3 U	0.31 U	0.32 U	0.28 U	0.27 U	0.31 U	0.45 U	0.27 U
CHLORDANE (TECHNICAL)	UG/KG	3.21	2.26	4.79	3.8 U	3 U	3.1 U	3.2 U	2.8 U	2.7 U	3.1 U	4.5 U	2.7 U
CHLOROBENSIDE	UG/KG	0.32	--	--	0.38 U	**0.35**	0.31 U	0.32 U	0.28 U	0.27 U	0.31 U	0.45 U	0.27 U
DCPA	UG/KG	0.32	--	--	**0.062 J P**	0.3 U	0.31 U	0.32 U	0.28 U	0.27 U	0.31 U	0.45 U	0.27 U
DELTA-BHC	UG/KG	0.32	--	--	**0.069 J P**	0.3 U	0.31 U	**0.062 J P**	0.28 U	0.27 U	0.31 U	0.45 U	0.27 U
DIELDRIN	UG/KG	0.32	0.715	4.3	0.38 U	0.3 U	0.31 U	0.32 U	0.28 U	0.27 U	0.31 U	0.45 U	0.27 U
ENDOSULFAN I	UG/KG	0.32	--	--	0.38 U	0.3 U	0.31 U	0.32 U	0.28 U	0.27 U	0.31 U	0.45 U	0.27 U
ENDOSULFAN II	UG/KG	0.32	--	--	**0.13 J**	0.3 U	0.31 U	**0.066 J P**	0.28 U	0.27 U	0.31 U	0.45 U	0.27 U
ENDOSULFAN SULFATE	UG/KG	0.32	--	--	**0.23 J**	**0.13 J P**	**0.11 J**	0.32 U	**0.056 J P**	0.27 U	0.31 U	0.45 U	0.27 U
ENDRIN	UG/KG	0.32	--	--	**0.87**	**0.87**	**0.32**	**0.82**	0.28 U	0.27 U	0.31 U	0.45 U	0.27 U
ENDRIN ALDEHYDE	UG/KG	0.32	--	--	0.38 U	0.3 U	0.31 U	0.32 U	0.28 U	0.27 U	0.31 U	0.45 U	**0.071 J P**
GAMMA-BHC (LINDANE)	UG/KG	0.32	0.32	0.99	0.38 U	0.3 U	0.31 U	0.32 U	0.28 U	0.27 U	0.31 U	0.45 U	0.27 U
HEPTACHLOR	UG/KG	0.32	--	2.74**	0.38 U	0.3 U	0.31 U	0.32 U	0.28 U	0.27 U	0.31 U	0.45 U	0.27 U
HEPTACHLOR EPOXIDE	UG/KG	0.32	--	--	0.38 U	0.3 U	0.31 U	0.32 U	0.28 U	0.27 U	0.31 U	0.45 U	0.27 U
METHOXYCHLOR	UG/KG	0.64	--	--	0.75 U	0.61 U	0.61 U	0.64 U	0.56 U	0.54 U	0.61 U	0.9 U	0.54 U
MIREX	UG/KG	0.32	--	--	0.38 U	0.3 U	0.31 U	0.32 U	0.28 U	0.27 U	0.31 U	0.45 U	0.27 U
TOXAPHENE	UG/KG	12.78	--	--	15 U	12 U	12 U	13 U	11 U	11 U	12 U	18 U	11 U

**Source*: MacDonald et al. 1996. Ecotoxicology 5: 253-278.

NOTES: Bold values represent detected concentrations. Shaded concentrations exceed sediment quality guidelines.
RL is reported for non-detected constituents.

RL = average reporting limit

TEL = threshold effects level

PEL = probable effects level

J = compound was detected, but below the reporting limit (value is estimated)

P = the percent difference between the original and confirmation analysis is greater than 40%

U = compound was analyzed, but not detected

TABLE 3-11. DIOXIN AND FURAN CONGENER CONCENTRATIONS (PG/G) IN SEDIMENT

PANAMA CITY HARBOR, BAY CITY CHANNEL

PANAMA CITY BEACH, BAY COUNTY, FLORIDA (AUGUST 2014)

				DU1			DU2		DU3			DU4
				Panama City Inner Turning Basin			Panama City Outer Turning Basin		Panama City Inner Channel			Panama City Outer Channel
ANALYTE	**UNITS**	**Average RL**	**TEF***	**PC-01**	**PC-02**	**PC-03**	**PC-04**	**PC-05**	**PC-06**	**PC-07**	**PC-08**	**PC-09**
2,3,7,8-TCDD	PG/G	1	1	**1.7 Q**	**6.10**	**0.14 Q J**	**0.17 Q J**	**0.25 Q J**	0.65 U	**0.22 Q J**	1.1 U	0.65 U
1,2,3,7,8-PECDD	PG/G	4	1	**1.3 Q B J**	**3.2 B J**	**0.78 B J**	**0.55 Q B J**	**0.41 Q B J**	**0.053 Q B J**	**0.45 B J**	**0.92 B J**	**0.18 B J**
1,2,3,4,7,8-HXCDD	PG/G	4	0.1	**1.6 B J**	**4.2 B J**	**0.64 Q B J**	**0.79 Q B J**	**0.3 Q B J**	3.2 U	**0.39 Q B J**	**1 Q B J**	**0.24 B J**
1,2,3,6,7,8-HXCDD	PG/G	4	0.1	**7.10**	**15.00**	**3 J**	**4.40**	**1.3 J**	**0.063 Q J**	**0.99 J**	**2.1 J**	**0.45 J**
1,2,3,7,8,9-HXCDD	PG/G	4	0.1	**6.2 C B**	**13 C B**	**3.4 C B J**	**3.8 C B**	**1.8 C B J**	**0.16 Q B J**	**2.1 C B J**	**5.1 B J**	**1.2 Q B J**
1,2,3,4,6,7,8-HPCDD	PG/G	4	0.01	**120 B**	**270 B**	**55 B**	**110 B**	**24 B**	**2.2 B J**	**22 B**	**31 B**	**9.6 B**
OCDD	PG/G	8	0.0003	**1200 B**	**2400 B**	**510 B**	**1200 B**	**240 B**	**27 B**	**180 B**	**250 B**	**87 B**
2,3,7,8-TCDF	PG/G	1	0.1	**12.00**	**35 Q**	**4.6 Q**	**0.68 J**	**1.1**	**0.23 Q J**	**1.1 Q**	**1.4**	**0.14 Q J**
1,2,3,7,8-PECDF	PG/G	4	0.03	**0.68 B J**	**1.2 B J**	**0.25 Q B J**	3.5 U	3.2 U	3.2 U	**0.055 Q B J**	5.7 U	3.3 U
2,3,4,7,8-PECDF	PG/G	4	0.3	**0.69 Q B J**	**2.4 B J**	**0.26 Q B J**	**0.25 B J**	**0.15 Q B J**	3.2 U	**0.14 B J**	5.7 U	**0.042 Q B J**
1,2,3,4,7,8-HXCDF	PG/G	4	0.1	**1.3 C B J**	**4.8 Q B J**	**0.48 Q B J**	**0.81 Q B J**	**0.12 Q B J**	**0.044 Q B J**	**0.16 Q B J**	**0.16 Q B J**	**0.059 Q B J**
1,2,3,6,7,8-HXCDF	PG/G	4	0.1	**2.1 Q B J**	**2.7 Q B J**	**0.8 Q B J**	**1.3 Q B J**	**0.35 Q B J**	**0.031 Q B J**	**0.28 Q B J**	**0.21 Q B J**	**0.061 Q B J**
2,3,4,6,7,8-HXCDF	PG/G	4	0.1	**0.8 Q B J**	**1.9 B J**	**0.26 B J**	**0.3 Q B J**	**0.1 Q B J**	3.2 U	3.6 U	**0.069 Q B J**	3.3 U
1,2,3,7,8,9-HXCDF	PG/G	4	0.1	**0.77 B J**	**1 B J**	**0.098 Q B J**	3.5 U	3.2 U	3.2 U	3.6 U	5.7 U	3.3 U
1,2,3,4,6,7,8-HPCDF	PG/G	4	0.01	**17 B**	**35 B**	**6.4 B**	**16 B**	**3 B J**	**0.26 Q B J**	**1.6 B J**	**1.3 B J**	**0.26 Q B J**
1,2,3,4,7,8,9-HPCDF	PG/G	4	0.01	**2.1 Q B J**	**2.7 B J**	**0.34 Q B J**	**0.99 B J**	**0.2 Q B J**	**0.057 Q B J**	**0.15 Q B J**	**0.15 Q B J**	3.3 U
OCDF	PG/G	8	0.0003	**54 B**	**110 B**	**22 B**	**50 B**	**10 B**	**1.2 B J**	**5.5 Q B J**	**3 Q B J**	**1.1 Q B J**
DIOXIN TEQ (ND=RL)	PG/G	--	--	**4.7**	**17.4**	**2.2**	**3.1**	**1.2**	**2.7**	**1.8**	**5.7**	**1.8**

**Source* : Van den Berg, M, et al. 2006. The 2005 World Health Organization re-evaluation of human and mammalian toxic equivalency factors for dioxins and dioxin-like compounds. *Toxicological Sciences 93(2):223-241.*

There are no sediment quality guidelines for dioxins and furans.

NOTES: Bold values represent detected concentrations; RL is reported for non-detected constituents.

RL = average reporting limit
TEF = toxicity equivalency factor
TEQ = toxicity equivalency quotient

B = detected in the laboratory method blank
C = co-eluting isomer
E = the amount reported is above the calibration limit (value is estimated)
J = compound was detected, but below the reporting limit (value is estimated)
Q = estimated maximum possible concentration (EMPC)
U = compound was analyzed, but not detected

TABLE 3-12. SEMIVOLATILE ORGANIC COMPOUND (SVOC) CONCENTRATIONS (UG/KG) IN SEDIMENT
PANAMA CITY HARBOR, BAY CITY CHANNEL
PANAMA CITY BEACH, BAY COUNTY, FLORIDA (AUGUST 2014)

					DU1			DU2		DU3			DU4
					Panama City Inner Turning Basin			Panama City Outer Turning Basin		Panama City Inner Channel			Panama City Outer Channel
ANALYTE	**UNITS**	**Average RL**	**TEL***	**PEL***	**PC-01**	**PC-02**	**PC-03**	**PC-04**	**PC-05**	**PC-06**	**PC-07**	**PC-08**	**PC-09**
1,2,4-TRICHLOROBENZENE	UG/KG	51	--	--	60 U	48 U	48 U	50 U	45 U	43 U	49 U	72 U	42 U
1,2-DICHLOROBENZENE	UG/KG	51	--	--	60 U	48 U	48 U	50 U	45 U	43 U	49 U	72 U	42 U
1,2-DIPHENYLHYDRAZINE(AS AZOBENZENE)	UG/KG	51	--	--	60 U	48 U	48 U	50 U	45 U	43 U	49 U	72 U	42 U
1,3-DICHLOROBENZENE	UG/KG	51	--	--	60 U	48 U	48 U	50 U	45 U	43 U	49 U	72 U	42 U
1,4-DICHLOROBENZENE	UG/KG	51	--	--	60 U	48 U	48 U	50 U	45 U	43 U	49 U	72 U	42 U
2,2'-OXYBIS[1-CHLOROPROPANE]	UG/KG	10	--	--	12 U	9.7 U	9.8 U	10 U	9.1 U	8.7 U	9.9 U	15 U	8.6 U
2,4,6-TRICHLOROPHENOL	UG/KG	51	--	--	60 U	48 U	48 U	50 U	45 U	43 U	49 U	72 U	42 U
2,4-DICHLOROPHENOL	UG/KG	10	--	--	12 U	9.7 U	9.8 U	10 U	9.1 U	8.7 U	9.9 U	15 U	8.6 U
2,4-DIMETHYLPHENOL	UG/KG	51	--	--	60 U	48 U	48 U	50 U	45 U	43 U	49 U	72 U	42 U
2,4-DINITROPHENOL	UG/KG	262	--	--	310 U	250 U	250 U	260 U	230 U	220 U	250 U	370 U	220 U
2,4-DINITROTOLUENE	UG/KG	51	--	--	60 U	48 U	48 U	50 U	45 U	43 U	49 U	72 U	42 U
2,6-DINITROTOLUENE	UG/KG	51	--	--	60 U	48 U	48 U	50 U	45 U	43 U	49 U	72 U	42 U
2-CHLORONAPHTHALENE	UG/KG	10	--	--	12 U	9.7 U	9.8 U	10 U	9.1 U	8.7 U	9.9 U	15 U	8.6 U
2-CHLOROPHENOL	UG/KG	51	--	--	60 U	48 U	48 U	50 U	45 U	43 U	49 U	72 U	42 U
2-METHYLPHENOL	UG/KG	51	--	--	60 U	48 U	48 U	50 U	45 U	43 U	49 U	72 U	42 U
2-NITROPHENOL	UG/KG	51	--	--	60 U	48 U	48 U	50 U	45 U	43 U	49 U	72 U	42 U
3,3'-DICHLOROBENZIDINE	UG/KG	51	--	--	60 U	48 U	48 U	50 U	45 U	43 U	49 U	72 U	42 U
4,6-DINITRO-2-METHYLPHENOL	UG/KG	262	--	--	310 U	250 U	250 U	260 U	230 U	220 U	250 U	370 U	220 U
4-BROMOPHENYL PHENYL ETHER	UG/KG	51	--	--	60 U	48 U	48 U	50 U	45 U	43 U	49 U	72 U	42 U
4-CHLORO-3-METHYLPHENOL	UG/KG	51	--	--	60 U	48 U	48 U	50 U	45 U	43 U	49 U	72 U	42 U
4-CHLOROPHENYL PHENYL ETHER	UG/KG	51	--	--	60 U	48 U	48 U	50 U	45 U	43 U	49 U	72 U	42 U
4-NITROPHENOL	UG/KG	262	--	--	310 U	250 U	250 U	260 U	230 U	220 U	250 U	370 U	220 U
BENZIDINE	UG/KG	1,031	--	--	1200 U	970 U	980 U	1000 U	910 U	870 U	990 U	1500 U	860 U
BENZOIC ACID	UG/KG	262	--	--	310 U	**130 J**	250 U	**130 J**	230 U	220 U	250 U	370 U	220 U
BENZYL ALCOHOL	UG/KG	51	--	--	60 U	48 U	48 U	50 U	45 U	43 U	49 U	72 U	42 U
BIS(2-CHLOROETHOXY)METHANE	UG/KG	51	--	--	60 U	48 U	48 U	50 U	45 U	43 U	49 U	72 U	42 U
BIS(2-CHLOROETHYL)ETHER	UG/KG	10	--	--	12 U	9.7 U	9.8 U	10 U	9.1 U	8.7 U	9.9 U	15 U	8.6 U
BIS(2-ETHYLHEXYL) PHTHALATE	UG/KG	102	--	--	**19 J**	97 U	**16 J**	100 U	**16 J**	**12 J**	98 U	140 U	86 U
BUTYL BENZYL PHTHALATE	UG/KG	51	--	--	**29 J**	48 U	**24 J**	50 U	**32 J**	**18 J**	**12 J**	**12 J**	**12 J**
DIBENZOFURAN	UG/KG	51	--	--	60 U	48 U	48 U	50 U	45 U	43 U	49 U	72 U	42 U
DIETHYL PHTHALATE	UG/KG	51	--	--	60 U	48 U	48 U	50 U	45 U	43 U	49 U	72 U	42 U
DIMETHYL PHTHALATE	UG/KG	51	--	--	60 U	48 U	48 U	50 U	45 U	43 U	49 U	72 U	42 U
DI-N-BUTYL PHTHALATE	UG/KG	51	--	--	60 U	48 U	48 U	50 U	45 U	43 U	49 U	72 U	42 U
DI-N-OCTYL PHTHALATE	UG/KG	51	--	--	60 U	48 U	48 U	50 U	45 U	43 U	49 U	72 U	42 U
HEXACHLOROBENZENE	UG/KG	10	--	--	12 U	9.7 U	9.8 U	10 U	9.1 U	8.7 U	9.9 U	15 U	8.6 U
HEXACHLOROBUTADIENE	UG/KG	10	--	--	12 U	9.7 U	9.8 U	10 U	9.1 U	8.7 U	9.9 U	15 U	8.6 U
HEXACHLOROCYCLOPENTADIENE	UG/KG	51	--	--	60 U	48 U	48 U	50 U	45 U	43 U	49 U	72 U	42 U
HEXACHLOROETHANE	UG/KG	51	--	--	60 U	48 U	48 U	50 U	45 U	43 U	49 U	72 U	42 U
ISOPHORONE	UG/KG	51	--	--	60 U	48 U	48 U	50 U	45 U	43 U	49 U	72 U	42 U
METHYLPHENOL, 3 & 4	UG/KG	51	--	--	60 U	**6.9 J**	48 U	50 U	45 U	43 U	49 U	72 U	42 U
NITROBENZENE	UG/KG	102	182.16	2,647	120 U	97 U	98 U	100 U	90 U	87 U	98 U	140 U	86 U
N-NITROSODIMETHYLAMINE	UG/KG	51	--	--	60 U	48 U	48 U	50 U	45 U	43 U	49 U	72 U	42 U
N-NITROSODI-N-PROPYLAMINE	UG/KG	10	--	--	12 U	9.7 U	9.8 U	10 U	9.1 U	8.7 U	9.9 U	15 U	8.6 U
N-NITROSODIPHENYLAMINE	UG/KG	51	--	--	60 U	48 U	48 U	50 U	45 U	43 U	49 U	72 U	42 U
PENTACHLOROPHENOL	UG/KG	51	--	--	60 U	48 U	48 U	50 U	45 U	43 U	49 U	72 U	42 U
PHENOL	UG/KG	10	--	--	**81**	**120**	**100**	**160**	**94**	8.7 U	**49**	**210**	8.6 U

* *Source:* MacDonald et al. 1996. Ecotoxicology 5:253-278.
NOTES: Bold values represent detected concentrations. Shaded concentrations exceed sediment quality guidelines.
RL is reported for non-detected constituents.
RL = average reporting limit
TEL = threshold effects level
PEL = probable effects level
J = compound was detected, but below the reporting limit (value is estimated)
U = compound was analyzed but not detected

TABLE 3-13. VOLATILE ORGANIC COMPOUND (SVOC) CONCENTRATIONS (UG/KG) IN SEDIMENT

PANAMA CITY HARBOR, BAY CITY CHANNEL

PANAMA CITY BEACH, BAY COUNTY, FLORIDA (AUGUST 2014)

			DU1			DU2		DU3			DU4
			Panama City Inner Turning Basin			Panama City Outer Turning Basin		Panama City Inner Channel			Panama City Outer Channel
ANALYTE	UNITS	Average RL	PC-01	PC-02	PC-03	PC-04	PC-05	PC-06	PC-07	PC-08	PC-09
BENZENE	UG/KG	7.7	9.1 U	7.3 U	7.3 U	7.7 U	6.8 U	6.6 U	7.4 U	11 U	6.4 U
ETHYLBENZENE	UG/KG	7.7	9.1 U	7.3 U	7.3 U	7.7 U	6.8 U	6.6 U	7.4 U	11 U	6.4 U
M-XYLENE & P-XYLENE	UG/KG	16	18 U	15 U	15 U	15 U	14 U	13 U	15 U	22 U	13 U
O-XYLENE	UG/KG	7.7	9.1 U	7.3 U	7.3 U	7.7 U	6.8 U	6.6 U	7.4 U	11 U	6.4 U
TOLUENE	UG/KG	7.7	9.1 U	7.3 U	7.3 U	7.7 U	6.8 U	6.6 U	7.4 U	11 U	6.4 U
GASOLINE RANGE ORGANICS (C6-C12)	UG/KG	153	180 U	140 U	150 U	150 U	130 U	130 U	150 U	220 U	130 U
DIESEL RANGE ORGANICS (C10-C34)	UG/KG	153	180 U	140 U	150 U	150 U	130 U	130 U	150 U	220 U	130 U

RL is reported for non-detected constituents.

RL = average reporting limit

U = compound was analyzed but not detected

TABLE 3-14. BUTYLTIN CONCENTRATIONS (UG/KG) IN SEDIMENT

PANAMA CITY HARBOR, BAY CITY CHANNEL

PANAMA CITY BEACH, BAY COUNTY, FLORIDA (AUGUST 2014)

ANALYTE	UNITS	Average RL	DU1			DU2		DU3			DU4
			Panama City Inner Turning Basin			Panama City Outer Turning Basin		Panama City Inner Channel			Panama City Outer Channel
			PC-01	PC-02	PC-03	PC-04	PC-05	PC-06	PC-07	PC-08	PC-09
MONOBUTYLTIN*	UG/KG	31	37 U	30 U	30 U	31 U	27 U	27 U	30 U	45 U	26 U
DIBUTYLTIN*	UG/KG	2.0	2.4 U	1.9 U	1.9 U	1.9 U	1.7 U	1.7 U	1.9 U	2.8 U	1.7 U
TRIBUTYLTIN*	UG/KG	2.3	2.7 U	2.1 U	2.2 U	2.2 U	2 U	1.9 U	2.2 U	3.2 U	1.9 U
TETRABUTYLTIN	UG/KG	2.6	3.1 U	2.4 U	2.4 U	2.5 U	2.2 U	2.2 U	2.5 U	3.7 U	2.2 U
TOTAL BUTYLTINS	UG/KG	--	27.3	22.1	22.1	22.8	19.9	19.9	22.1	33.1	19.2

NOTES: Bold values represent detected concentrations.
RL is reported for non-detected constituents.

* = Butyltins used to calculate total organotins

RL = average reporting limit **U** = compound was analyzed, but not detected

TABLE 3-15. ANALYTE CONCENTRATIONS IN TCLP LEACHATE

PANAMA CITY HARBOR, BAY CITY CHANNEL

PANAMA CITY BEACH, BAY COUNTY, FLORIDA (AUGUST 2014)

ANALYTE	TCLP SCREENING VALUE*	UNITS	RL	DU1 Panama City Inner Turning Basin			DU2 Panama City Outer Turning Basin		DU3 Panama City Inner Channel			DU4 Panama City Outer Channel
				PC-01	PC-02	PC-03	PC-04	PC-05	PC-06	PC-07	PC-08	PC-09
METALS												
ARSENIC	5	MG/L	0.5	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	**0.031 J**
BARIUM	100	MG/L	2	**0.087 J B**	**0.035 J B**	**0.03 J B**	**0.025 J B**	**0.022 J B**	**0.027 J B**	**0.014 J B**	**0.014 J B**	**0.032 J B**
CADMIUM	1	MG/L	0.5	**0.0017 J**	**0.0021 J**	**0.0024 J**	0.5 U	**0.0034 J**	**0.0017 J**	**0.0021 J**	**0.002 J**	**0.0018 J**
CHROMIUM	5	MG/L	0.5	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
LEAD	5	MG/L	0.5	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
MERCURY	0.2	MG/L	0.0002	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U
SELENIUM	1	MG/L	0.5	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
SILVER	5	MG/L	0.5	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CHLORINATED PESTICIDES												
CHLORDANE (TECHNICAL)	0.03	MG/L	0.005	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U
ENDRIN	0.02	MG/L	0.0005	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U
GAMMA-BHC (LINDANE)	0.4	MG/L	0.0005	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U
HEPTACHLOR	0.008	MG/L	0.0005	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U
HEPTACHLOR EPOXIDE	0.008	MG/L	0.0005	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U
METHOXYCHLOR	10	MG/L	0.001	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
TOXAPHENE	0.5	MG/L	0.02	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
HERBICIDES												
2,4,5-TP (SILVEX)	1	MG/L	0.01	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
2,4-D	10	MG/L	0.04	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
SEMIVOLATILE ORGANIC COMPOUNDS (SVOCs)												
1,4-DICHLOROBENZENE	7.5	MG/L	0.05	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
2,4,5-TRICHLOROPHENOL	400	MG/L	0.05	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
2,4,6-TRICHLOROPHENOL	2	MG/L	0.05	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
2,4-DINITROTOLUENE	0.13	MG/L	0.05	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
2-METHYLPHENOL	200	MG/L	0.05	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
HEXACHLOROBENZENE	0.13	MG/L	0.05	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
HEXACHLOROBUTADIENE	0.5	MG/L	0.05	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
HEXACHLOROETHANE	5	MG/L	0.05	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
METHYLPHENOL, 3 & 4	200	MG/L	0.05	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
NITROBENZENE	2	MG/L	0.05	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
PENTACHLOROPHENOL	100	MG/L	0.25	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
PYRIDINE	5	MG/L	0.1	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
VOLATILE ORGANIC COMPOUNDS (VOCs)												
1,1-DICHLOROETHENE	0.7	MG/L	0.2	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
1,2-DICHLOROETHANE	0.5	MG/L	0.2	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
2-BUTANONE (MEK)	200	MG/L	0.2	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
BENZENE	0.5	MG/L	0.2	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
CARBON TETRACHLORIDE	0.5	MG/L	0.2	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
CHLOROBENZENE	100	MG/L	0.2	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
CHLOROFORM	6	MG/L	0.2	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
TETRACHLOROETHENE	0.7	MG/L	0.2	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
TRICHLOROETHENE	0.5	MG/L	0.2	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
VINYL CHLORIDE	0.2	MG/L	0.2	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U

**Source* : 40 CFR 261.24

NOTE: Bold values represent detected concentrations.

RL = reporting limit

B = compound was detected in the method blank

J = compound was detected, but below the reporting limit (value is estimated)

U = compound was analyzed, but not detected

TABLE A-1. *IN SITU* WATER QUALITY MEASUREMENTS

PANAMA CITY HARBOR, BAY CITY CHANNEL

PANAMA CITY BEACH, BAY COUNTY, FLORIDA (AUGUST 2014)

Location	Date & Time Sampled	Water Depth (ft)	Sample Depth (ft)	Water Temperature (°C)	Dissovled Oxygen (mg/L)	pH	Turbidity (NTU)
PC-01	8/26/14 850	35	Surface	29.4	6.7	8.1	3.7
			5	30.2	6.5	8.1	3.6
			10	29.3	5.9	8.1	3.7
			15	28.9	5.9	8.1	3.7
			20	28.8	5.9	8.1	3.7
			25	28.5	5.9	8.1	3.5
			30	28.4	5.7	8.1	3.7
			35	28.2	5.7	8.1	3.7
PC-02	8/26/14 1000	30	Surface	29.7	6.7	8.2	2.3
			5	30.3	6.6	8.2	3.7
			10	29.9	6.5	8.2	3.6
			15	29.0	5.9	8.1	3.9
			20	28.7	5.7	8.1	3.7
			25	28.5	5.7	8.1	3.3
			30	28.5	5.5	8.1	3.0
PC-03	8/26/14 1207	34	Surface	29.7	6.8	8.2	3.7
			5	29.8	6.7	8.2	3.7
			10	29.7	6.6	8.2	3.6
			15	29.3	6.3	8.2	3.6
			20	28.9	6.0	8.2	3.4
			25	28.4	6.0	8.1	3.4
			30	27.9	5.8	8.1	3.0
PC-04	8/27/14 0820	34	Surface	29.1	8.5	8.0	0.2
			5	29.6	8.1	8.0	0.2
			10	28.9	7.8	8.0	0.3
			15	28.9	7.7	8.0	0.4
			20	28.4	7.8	8.0	0.3
			25	28.2	7.8	8.0	0.3
			30	28.1	7.5	8.0	0.4

Note: Salinity probe malfunction. Salinity range expected to be 25-33 ppt based on previous studies (EA 2012ab) and time of year.

TABLE A-1. *IN SITU* WATER QUALITY MEASUREMENTS (Continued)
PANAMA CITY HARBOR, BAY CITY CHANNEL
PANAMA CITY BEACH, BAY COUNTY, FLORIDA (AUGUST 2014)

Location	Date & Time Sampled	Water Depth (ft)	Sample Depth (ft)	Water Temperature (°C)	Dissovled Oxygen (mg/L)	pH	Turbidity (NTU)
PC-05	8/27/14 0920	34	Surface	29.5	8.3	8.0	0.0
			5	29.1	8.2	8.0	0.4
			10	28.8	8.2	8.0	0.3
			15	28.3	7.7	8.0	0.3
			20	28.1	7.5	7.9	0.3
			25	28.1	7.2	7.9	0.1
			30	28.1	7.3	7.9	0.1
PC-06	8/27/14 1120	34	Surface	29.6	8.4	8.0	0.5
			5	29.2	8.4	8.0	0.7
			10	28.8	8.5	8.0	0.7
			15	28.3	7.9	8.0	0.2
			30	28.2	7.9	7.9	0.1
			35	28.1	7.6	7.9	0.1
PC-07	8/27/14 1230	35	Surface	29.7	8.2	8.0	0.6
			5	29.4	8.4	8.0	0.4
			10	29.2	8.4	8.0	0.4
			15	28.8	8.3	8.0	0.3
			20	28.6	8.0	8.0	0.3
			25	28.5	8.1	8.0	0.3
			30	28.4	7.8	7.9	0.1
			35	28.2	7.5	7.9	0.1
PC-08	8/28/14 0810	38	Surface	29.5	8.3	7.9	0.4
			5	29.9	8.5	8.1	0.3
			10	29.2	8.7	8.1	0.3
			15	28.7	8.0	8.1	0.3
			20	28.5	8.0	8.1	0.3
			25	28.4	7.4	8.0	0.0
			30	28.2	7.5	8.0	0.0
			35	28.2	7.2	8.0	0.7

Note: Salinity probe malfunction. Salinity range expected to be 25-33 ppt based on previous studies (EA 2012ab) and time of year.

TABLE A-1. *IN SITU* WATER QUALITY SAMPLES - SEDIMENT SAMPLING (Continued)

PANAMA CITY HARBOR, BAY CITY CHANNEL

PANAMA CITY BEACH, BAY COUNTY, FLORIDA (AUGUST 2014)

Location	Date & Time Sampled	Water Depth (ft)	Sample Depth (ft)	Water Temperature (°C)	Dissovled Oxygen (mg/L)	pH	Turbitidy (NTU)
PC-09	8/26/14 1324	34	Surface	29.7	7.7	8.2	3.3
			5	29.1	7.9	8.2	4.1
			10	30.0	7.9	8.2	4.1
			15	28.5	8.0	8.2	4.2
			20	28.2	7.7	8.2	3.8
			25	28.3	7.6	8.2	3.8
			30	28.3	7.6	8.2	3.7
			Bottom	28.2	7.6	8.2	3.6

Note: Salinity range expected to be 30-33 ppt based on previous studies (EA 2012ab)

EVALUATION OF STANDARD ELUTRIATES

PANAMA CITY HARBOR, BAY HARBOR CHANNEL
PANAMA CITY BEACH, BAY COUNTY, FLORIDA

TECHNICAL MEMORANDUM

Prepared for

Department of the Army
U.S. Army Corps of Engineers
Mobile District
109 St. Joseph Street
Mobile, Alabama 36602

Prepared by

EA Engineering, Science, and
Technology, Inc., PBC
225 Schilling Circle, Suite 400
Hunt Valley, Maryland 21031

Under Contract to

The Louis Berger Group, Inc.
1250 23rd Street, NW
Washington D.C. 20037-1164

August 2015

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LIST OF ACRONYMS AND ABBREVIATIONS

°C	Degrees Celsius
µg/kg	Microgram(s) per kilogram
µg/L	Microgram(s) per liter
CAB	Cellulose acetate butyrate
CFR	Code of Federal Regulations
COC	Chain of custody
DA	Disposal area
DEP	Department of Environmental Protection
DI	Deionized
DU	Dredging unit
EA	EA Engineering, Science, and Technology, Inc., PBC
F.A.C.	Florida Administrative Code
FL	Florida
ft	Foot (feet)
HNO_3	Nitric acid
ID	Identification
in.	Inch(es)
MLLW	Mean lower low water
MS/MSD	Matrix spike/matrix spike duplicate
ND	Non-detect
PCB	Polychlorinated biphenyl
pg/g	Picogram(s) per gram
QA/QC	Quality assurance/quality control
RL	Reporting limit
SERIM	Southeast Regional Implementation Manual
SET	Standard elutriate testing
TDL	Target detection limit
TEQ	Toxicity equivalency quotient
U.S.	United States
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency

WHO	World Health Organization

1. PROJECT DESCRIPTION

The United States (U.S.) Army Corps of Engineers (USACE)–Mobile District is evaluating proposed new work dredging in the Panama City Bay Harbor Channel (Bay Harbor Channel). In August 2014, sampling and bulk sediment testing of the proposed dredged material was conducted in four dredging units (DUs) in the Bay Harbor Channel at St. Andrews Bay: Inner Turning Basin, Outer Turning Basin, Inner Channel, and Outer Channel. Results of that sampling and testing effort, presented in *Evaluation of Dredged Material Panama City Harbor, Bay Harbor Channel, Panama City Beach, Bay County, Florida* (EA 2014), indicated that additional analysis was necessary to determine appropriate placement options. The purpose of this 2015 project was to provide supplemental standard elutriate testing (SET) targeting specific analytes of concern identified in the 2014 testing event. The SET provides further information to facilitate determination of appropriate placement options including in-water placement.

EA Engineering, Science, and Technology, Inc., PBC (EA) was contracted by the Louis Berger Group to conduct the additional SET for the Bay Harbor Channel for the USACE-Mobile District. The investigation consisted of vibracore sampling at specified locations in the Bay Harbor Channel, collecting site water and elutriate preparation water at one location in the Bay Harbor Channel, collecting sediment from the proposed in-water placement/disposal area, creating lithologic core logs for each location, conducting physical and chemical testing of sediments and standard elutriates, and evaluating test results with respect to the feasibility of potential in-water placement.

This technical memorandum summarizes the field collection and sample processing activities for the Bay Harbor Channel SET project and presents the analytical data for sediment composites and standard elutriates.

1.1 PROJECT PURPOSE AND LOCATION

The Bay Harbor Channel is located in the St. Andrews Bay area in Bay County, Florida (Figure 1-1). The Bay Harbor Channel has authorized dimensions of 38 by 300 feet (ft) with a turning basin located at the terminus, authorized to a depth of 38 ft mean lower low water (MLLW). The authorized channel is approximately 3.5 miles in length. The proposed new work dredging would be conducted to a depth of 36 ft plus an additional 2 ft for overdepth allowance. The target project sampling depth will include 36 ft + 2 ft allowable overdepth +3 ft of non-paid overdepth (to account for potential disturbance by hydraulic/cutterhead dredge) = 41 ft MLLW.

Coring locations were distributed in four DUs as follows:

- **DU-1 (Inner Turning Basin)** represents the turning basin area in closest proximity to the seawall, and west of the pier/dock. Cores were collected from three discrete sampling locations (PC-1, PC-2, and PC-3) in this DU.

- **DU-2 (Outer Turning Basin)** represents the outer turning basin area adjacent to DU-1. Cores were collected from two discrete sampling locations (PC-4 and PC-5) in this DU.

- **<u>DU-3 (Inner Channel)</u>** represents the channel area proposed for dredging in closest proximity to the turning basin. Cores were collected from three discrete sampling locations (PC-6, PC-7, and PC-8) in this DU.

- **<u>DU-4 (Outer Channel)</u>** represents an outer portion of the channel where dredging is required in closest proximity to Saint Andrew Bay. Cores were collected from one discrete sampling location (PC-9) in this DU.

1.2 STUDY DESIGN

This investigation was requested based on the results of the screening-level sediment assessment completed in August 2014 (EA 2014). PCB and dioxin and furan congener concentrations required further evaluation in the dredging prism of each DU and were targeted in this SET program to assess possible water quality impacts during dredging and subsequent open-water placement. Standard elutriates, which simulate release of metals and organic constituents in the water column during open water placement of material, were prepared for each of the DU composite samples and one grand composite sample, comprised of representative volumes from each DU. Surficial sediment was collected with a grab sampler at the disposal/placement site and compared to bulk sediment samples from each DU and the grand composite sample to determine if project samples were of similar physical and chemical quality.

Coring locations and coordinates were determined in July 2014 and site water/elutriate preparation water and placement/disposal area sediment sampling locations were determined in May 2015 through consultation with USACE-Mobile District. The configuration of the DUs and the coring locations within the DUs targeted the areas that will require dredging; the placement/disposal area surface sampling locations were chosen to fully represent the geographical area of the site, and the site water/elutriate preparation water location was targeted as being representative of the proposed dredging area.

The sampling and analytical components (target detection limits, methodologies, elutriate preparation procedures, and sample holding times) of the Bay Harbor Channel elutriate evaluation were derived from the following guidance documents:

- U.S. Environmental Protection Agency (USEPA). 2001. *Methods for Collection, Storage, and Manipulation of Sediments for Chemical and Toxicological Analyses: Technical Manual*. EPA-823-B-01-002.

- USEPA/USACE. 1991. *Evaluation of Dredged Material Proposal for Ocean Disposal, Testing Manual* (commonly called "The Green Book"). EPA 503/8-91/001.

- USEPA/USACE. 1995. *QA/QC Guidance for Sampling and Analysis of Sediments, Water, and Tissues for Dredged Material Evaluations Chemical Evaluations*. EPA-823-B-95-001.

- USEPA/USACE. 1998. *Evaluation of Dredged Material Proposed for Discharge in Waters of the U.S.-Testing Manual: Inland Testing Manual*. EPA-823-B-98-004.

- USEPA/USACE. 2008. *Southeast Regional Implementation Manual (SERIM): Requirements and Procedures for Evaluation of the Ocean Disposal of Dredged Material in Southeastern U.S. Atlantic and Gulf Coast Waters*. EPA 904-B-08-001.

1.3 PROJECT OBJECTIVES

The overall objective of the sampling effort was to create and analyze sediment composites and standard elutriates representative of the proposed dredging prism in each DU, as well as one grand composite sample that was proportionately representative of the mixture of DUs proposed for dredging. A surface placement/disposal area sample was also submitted for bulk sediment analysis.

The sampling scheme is provided in Table 1-1. Physical testing of bulk sediment included grain size, Atterberg limits, specific gravity, and total solids for each DU, for the grand composite sample, and for the placement/disposal area sediment sample. Chemical concentrations of polychlorinated biphenyl (PCB) aroclors and dioxin/furan congeners were identified in the placement/disposal area (DA) sample for bulk sediment, as well as each of the DU samples and the grand composite sample for both bulk sediment and standard elutriates. Lithologic core logs were prepared for cores from each project coring location to verify that lithology was comparable to previous cores tested in August 2014.

Specific objectives of the Bay Harbor Channel SET project were to:

- Collect the required volume of sediment and site water for physical and chemical analysis and standard elutriate preparation.

- Process sediment cores representative of the proposed dredging prism from nine locations distributed in four DUs collected within positioning accuracy appropriate for the project objectives.

- Homogenize sediment samples from multiple project locations into DU composite samples for bulk sediment analysis and standard elutriate preparation.

- Create and analyze a grand composite sediment sample comprised of representative proportion of sediment (by volume) from each DU as determined by planned future dredging volumes.

- Collect site water for chemical analysis and elutriate preparation from one location in the Bay Harbor Channel (Figure 1-1).

- Collect surficial sediment from three locations within the placement/disposal area and composite into one sample for bulk sediment testing.

- Collect and transfer sediment and site water to appropriate laboratory-prepared containers and preserve/hold samples for analysis according to protocols that ensure sample integrity.

- Measure and record *in situ* water quality information (temperature, salinity, pH, and dissolved oxygen).

- Complete appropriate chain-of-custody (COC) documentation.

- Test and characterize DU composites, grand composite, and DA composite sediments with regard to physical and contaminants of concern.

- Test and characterize standard elutriates for the DU composites and grand composite and site water and with regard to contaminants of concern.

- Evaluate supplemental physical and chemical data for the Bay Harbor Channel project to assess suitability for in-water placement.

1.4 TECHNICAL MEMORANDUM ORGANIZATION

This technical memorandum provides a narrative of the supplemental sampling program and results of bulk sediment testing and SET for the Panama City Bay Harbor Channel SET project. Field sampling and core processing are described in Section 2. Section 3 provides the results of the bulk sediment physical and chemical analysis and the standard elutriate and preparation/site water chemical analysis. References cited are provided in Section 4. Field notes, lithologic core logs, and laboratory analytical reports are provided in Appendices A, B, and C, respectively.

2. FIELD SAMPLING AND SAMPLE PROCESSING

For the SET testing, site water/elutriate preparation water, disposal area (DA) sediment, and two cores from PC-2 were collected on 9 June 2015 (Figure 1-1). These cores were combined with archived cores from 2014 (EA 2014) and processed for SET testing on 17 June 2015. The archived material from the 2014 sampling event provided adequate volume within holding time for the other eight project locations; sampling at these locations in 2015 was not necessary.

Coordinates and sample coring depth information for material used in the SET program are summarized in Table 2-1; and site water/elutriate preparation water and DA sampling location coordinates are provided in Table 2-2. Water depths were tide corrected in the field based on data obtained from the Panama City, Florida tide gauge (maintained by the National Oceanic and Atmospheric Administration [NOAA] National Ocean Service [Station ID# 8729108]). All sampling locations were located in the field using a differential global positioning system.

A log of sampling activities and locations, water depths, and water quality information was recorded in permanently bound logbooks in indelible ink. Personnel names, local weather conditions, and other information that impacted the field sampling program were also recorded. Each page of the logbook was numbered and dated by the personnel entering information. A full copy of the project logbook is provided in Appendix A.

Water quality measurements were recorded *in situ* at PC-2, the water sampling location, and the disposal area using a YSI water quality probe. Water temperature (degrees Celsius [°C]), salinity (parts per thousand), pH, and dissolved oxygen (milligrams per liter) measurements were recorded at each location at 5-ft depth intervals from the surface to the bottom of the water column. A table of water quality parameters for the June 2015 SET project locations is provided in Appendix A. Water quality measurements for all other sample locations are provided in *Evaluation of Dredged Material Panama City Harbor, Bay Harbor Channel, Panama City Beach, Bay County, Florida* (EA 2014).

2.1 SAMPLE COLLECTION

2.1.1 Sediment Cores

Sediment core samples at PC-2 were collected using a vibracoring system supplied by Athena Technologies. A 35-ft research vessel (*R/V Artemis*) was used as the sampling platform for the field event.

The vessel was maneuvered to the desired sample site, and once on station the core location was marked and vessel immobilized. A vibracore system was deployed from the sampling platform, and consisted of a generator with mechanical vibrator attached via cable. The generator was attached directly to a 3-inch (in.) decontaminated stainless steel sample barrel with a 2.875-in. inner diameter cellulose acetate butyrate (CAB) liner insert. The sample barrel was lowered to the sediment surface through a moonpool in the deck of the sampling platform, turned on, and advanced to target depth (-41 ft MLLW) or refusal. The sample barrel was retrieved using an electric winch, and the CAB liner was removed, cut to length, capped, and labeled. Core penetration (in feet, relative to MLLW) and recovery are provided in Table 2-1.

2.1.2 Sediment Grab Samples

Surficial sediment from the disposal area was collected from the *R/V Artemis* using a decontaminated stainless-steel ponar grab sampler. Multiple grabs from three locations (Figure 1-1) were composited on board the work platform in a decontaminated stainless steel container and mixed until of uniform consistency. Sediment was transferred directly to laboratory-approved pre-cleaned sampling containers for testing and analysis.

Sample containers, preservation techniques, and holding times for the sediment samples for physical and chemical analyses are provided in Table 2-3. Because the sediment samples were collected using a grab sampler, the holding time was initiated at the time of sample collection. Samples for bulk sediment chemistry, physical parameters, and standard elutriate preparation were shipped on the day of collection directly to the analytical laboratory (TestAmerica) from the field via overnight delivery. COC documentation was submitted with the sediment samples.

2.1.3 Site Water and Elutriate Preparation Water

Site water and elutriate preparation water were collected from within 3 ft off the bottom of the sediment bed. Water was collected from one location, PC-WAT, on 9 June 2015 (Figure 1-1) using peristaltic pumps with dedicated Tygon tubing. Sample containers, preservation techniques, and holding times for the site water/elutriate preparation water chemical analyses are provided in Table 2-4.

2.1.4 Sediment Storage and Transport

Cores collected during the work day were stored onboard the barge or sampling platform on ice. Cores were transferred to a refrigeration unit (at 4 °C) at the onshore staging area at the end of the workday, which was secured when unattended. The cores were transported at 4 °C to EA in Hunt Valley, Maryland, where they were processed for analytical testing.

The placement/disposal area sediment, site water, and elutriate preparation water were shipped on the day of collection directly to the analytical laboratory (TestAmerica) from the field via overnight delivery. COC documentation was submitted with the samples.

2.2 COMPOSITE SAMPLE PREPARATION

Prior to core processing and compositing, cores were inspected, sorted, and checked against the field notebook. Cores were cut to target depth (-41 ft MLLW), and deeper material was discarded.

Four DU samples were created, each comprised of between one and two whole-core core composites from individual locations to obtain adequate sample volume and equal representation of each individual location in each DU sample. Additionally, one grand composite sample was created, comprised of representative volumes of each DU sample that was created.

Each core included in the DU samples was split length-wise, photographed, and lithologically logged (Appendix B). Sediment was extracted from each core using decontaminated stainless stools and homogenized in decontaminated 20-gallon stainless steel holding containers until of uniform consistency, then transferred to laboratory-approved containers and labeled for bulk sediment and standard elutriate testing. Once each DU composite sample was created and sampled, subsamples of the remaining DU composite samples were volumetrically measured using decontaminated pyrex glassware to create a grand composite. The volume of sediment from each DU sample included in the grand composite was determined based on the percentage of the total dredged material volume (336,000 cubic yards) expected to be removed from each DU:

Dredging Unit	Expected Volume to be Dredged (cubic yards)	% Grand Composite (by volume)
DU1	150,000	45
DU2	110,000	33
DU3	70,000	20
DU4	6,000	2
TOTAL	**336,000**	100

Sample processing equipment that came into direct contact with the sediment was decontaminated according to the protocols specified in Section 2.3.

Because sediment cores were collected in core liners, holding times for the DU composite sediment and grand composite began when the sediment was composited, homogenized, and placed in the appropriate sample containers. Sample containers, preservation techniques, and holding time requirements for sediment samples are provided in Table 2-3. A COC form was submitted to the laboratory when the processed sediment was delivered (Appendix C).

2.2.1 Sample Collection Volumes

Approximately 20 gallons of sediment and 20 gallons of water were collected and submitted for the Bay Harbor Channel SET project:

- Approximately 2 gallons of sediment were submitted for each composite for bulk physical and chemical sediment analysis and standard elutriate preparation.
- Additional sediment volume for the matrix spike/matrix spike duplicate (MS/MSD) analysis for bulk chemistry was collected from the grand composite.
- For the site water sample, approximately 2 gallons of water were collected for chemical analysis, plus additional water for MS/MSD analysis.

- Approximately 2.5 gallons of water were required to prepare each of the five standard elutriates for a total of 11 gallons.

2.3 EQUIPMENT DECONTAMINATION AND WASTE HANDLING PROCEDURES

Equipment that came into direct contact with sediment during sampling was decontaminated prior to deployment in the field and between each sampling location to minimize cross-contamination. This included the core tubes, the 20-gallon stainless steel holding container, and the stainless steel processing equipment (spoons, knives, bowls, etc.). While performing the decontamination procedure, phthalate-free nitrile gloves were worn to prevent phthalate contamination of the sampling equipment or the samples.

The decontamination procedure for the core catcher and core cutter is detailed below:

- Scrubbed with Liquinox phosphate-free detergents
- Rinsed with site water
- Rinsed with deionized (DI) water
- Rinsed with isopropanol
- Rinsed with 10 percent nitric acid (HNO_3)
- Rinsed with DI water
- Equipment allowed to air dry (in area not adjacent to decontamination area).

The decontamination procedure for all equipment other than core tubes described below was utilized:

- Rinse with DI water
- Rinse with 10 percent HNO_3
- Rinse with distilled or DI water
- Rinse with methanol followed by hexane
- Rinse with DI water
- Air dry (in area not adjacent to the decontamination area).

Waste liquids were contained during decontamination procedures in 5-gallon buckets with lids and transferred to a 55-gallon drum for characterization and disposal at the end of the field and sample processing effort. Waste liquids were disposed from EA's warehouse facility (Hunt Valley, Maryland) using standard disposal procedures and contractors.

2.4 SAMPLE LABELING, CHAIN-OF-CUSTODY, AND DOCUMENTATION

2.4.1 Numbering System

The sample numbering system was used to communicate sample location and sample type to the laboratory (Appendix A).

An example of a sediment composite sample identification (ID) is as follows:

DU1-SED

where the first set of letters denoted the area (PC was Panama City), dredging unit (DU1 through DU4), or disposal area (DA). The letters after the dash indicated the matrix:

- SED – sediment
- WAT – water
- SET – standard elutriate
- MS or MSD – matrix spike or matrix spike duplicate.

Sample containers for the processed sediment were labeled with the following information:

- Client name
- Project number
- Sample ID
- Sampling location
- Date and time of collection
- Sampler's initials
- Type of analyses required.

2.4.2 Core Labeling

Upon collection, each core was removed from the vibracore barrel, cut to length based on dredging depth, capped at either end, and secured with duct tape. Each cap was be labeled with the sample location, core replicate (A through D, as necessary for adequate sample volume), date and time, and designated as top or bottom. This same information was written on the core tube, as well. An example of a labeled core tube is as follows:

← TOP	PC02 E	BTM→
	6/9/15 0944	

2.5 CHAIN-OF-CUSTODY (COC) RECORDS

Sample processing personnel prepared separate COCs for samples submitted to TestAmerica-Pittsburgh. Copies of the COC forms for bulk sediment are provided in Appendix C.

3. RESULTS

The physical and chemical characteristics of four DU composite sediment samples and one grand sediment composite from the Bay Harbor Channel (Table 1-1) and five standard elutriates created from each sediment sample were determined to assess the sediment quality of the material proposed for dredging. In addition, physical and chemical characteristics of surficial sediments from the proposed placement/disposal area were assessed.

3.1 DATA ANALYSIS

3.1.1 Calculation of Total Polychlorinated Biphenyls (PCBs) and Dioxin Toxicity Equivalency Quotients (TEQs)

The total PCB aroclor concentration was determined by summing the concentrations of the seven aroclors. The total PCB aroclor concentrations were calculated using ND=0 (non-detect equals zero).

The TEQs for dioxin and furan congeners were calculated following the approach recommended by the World Health Organization (WHO) (Van den Berg et al. 2006). Each congener was multiplied by a WHO recommended Toxicity Equivalency Factor for human health (Van den Berg et al. 2006) and then the congener concentrations were summed. Concentrations that were flagged with a “Q” (estimated maximum possible concentration) were not included in the TEQ calculation as per the USEPA dioxin validation guidance (USEPA 2005). The dioxin TEQs were calculated using ND=0 (non-detect equal 0).

3.1.2 Comparison to Surface Water Quality Standards and Contaminant Cleanup Target Levels

The federal Clean Water Act provides the basis for state water quality standards programs. The regulatory requirements governing these programs (Water Quality Standards Regulation) are published in the Code of Federal Regulations (CFR), 40 CFR 131. States are responsible for reviewing, establishing, and revising water quality standards. As per Florida Department of Environmental Protection (FL DEP) request, site water and standard elutriate results were compared to the Florida Administrative Code (F.A.C.) Ch. 62-302.530, surface water quality standards (Table 3-1). Dioxins are not listed specifically in that chapter and were compared to F.A.C. Ch. 62-777, contaminant cleanup target levels for groundwater and surface water (human health criterion).

3.2 BULK SEDIMENT RESULTS

Results of the bulk sediment chemistry analyses of the Bay Harbor Channel SET project sediments analyzed in June 2015 are presented in the following subsections. Definitions of organic and dioxin data qualifiers are presented in Tables 3-1 and 3-2, respectively. Values for detected chemical constituents are bolded in the data tables (Tables 3-3 through 3-5), and RLs are presented for non-detected chemical constituents.

DU composite, the grand composite, and the placement/disposal area bulk sediment samples were analyzed for target analytes specified in Section 1.3. Sample weights were adjusted for percent moisture (up to 50 percent moisture) prior to analysis to achieve the lowest possible detection limits. Analytical results are reported on a dry weight basis.

Analytical narratives that include an evaluation of laboratory quality assurance/quality control (QA/QC) results and copies of final raw data sheets (Form I's) are provided in Appendix C. TestAmerica-Pittsburgh will retain and archive the results of these analyses for 7 years from the date of issuance of the final results.

3.2.1 Physical Analyses

Results of the grain size and physical analyses for each DU composite sample, the grand composite sample, and the DA sample are presented in Table 3-3. The sediments from each DU composite sample and the Disposal Area sample were composed predominantly of sand and gravel, ranging from 63.9 to 78.4 percent, and 0 to 15.6 percent, respectively. Four of the sediment samples were classified as clayey sand (DA, DU1, DU3, and GRAND), one was classified as silty sand (DU2), and one was classified as silty sand with gravel (DU4) (Table 3-3).

The lithologic core logs for the material used in the SET program are provided in Appendix B.

3.2.2 Organic Constituents

Results of the PCB aroclor analyses for sediment from the Bay Harbor Channel SET project are presented in Table 3-4. None of the seven tested individual PCB aroclors were detected in DU3 or DU4 sediment samples. PCB-1254 was detected in three project samples, ranging from 5.2 to 11 micrograms per kilogram (µg/kg). It was not detected in the DA sample. PCB 1260 was detected in three project samples, ranging from 7.4 to 11 µg/kg, slightly higher than the concentration in the DA sample (4.4 µg/kg). Total PCB aroclors (ND=0) ranged from 0 to 22 µg/kg in the DU and grand composite project samples, comparable to the total PCB aroclor concentration (ND=0) in the DA sample, 4.4 µg/kg (Table 3-5).

The results of the dioxin and furan congener analyses for sediment composites from the Bay Harbor Channel SET project are provided in Table 3-5. The most toxic congeners, 2,3,7,8-TCDD and 1,2,3,7,8-PECDD, were either not detected or were estimated at concentrations below the laboratory reporting limit in each of the project samples. 2,3,7,8-TCDD was detected at a concentration of 1.1 picograms per gram (pg/g) in the DA sample. The dioxin TEQ (ND=0) in the project sediments ranged from 0.1 to 3.4 pg/g. The dioxin TEQ (ND=0) in the DA sample was 1.1 pg/g (Table 3-6).

3.3 SITE WATER AND STANDARD ELUTRIATE RESULTS

Five standard elutriate samples were created using each of the four DU sediment samples and grand composite sediment sample and the site water collected in June 2015. Results of the analyses are presented in the following subsections. Definitions of organic, and dioxin data qualifiers are presented in Tables 3-1 and 3-2, respectively. Values for detected chemical constituents are bolded in the data tables (Tables 3-6 and 3-7), and RLs are presented for non-detected chemical constituents.

Analytical narratives that include an evaluation of laboratory QA/QC results and copies of final raw data sheets (Form Is) are provided in Appendix C. TestAmerica-Pittsburgh will retain and archive the results of these analyses for 7 years from the date of issuance of the final results.

3.3.2 Organic Constituents

Results of the PCB aroclor analyses for site water and standard elutriates from the Bay Harbor Channel SET project are presented in Table 3-6. None of the 7 tested individual PCB aroclors were detected in the site water or in the DU2, DU3, DU4, or grand composite standard elutriates. PCBs 1254 and 1260 were detected in the DU1 standard elutriate at concentrations of 0.02 and 0.011 micrograms per liter (µg/L), respectively. The total PCB Aroclor (ND=0) concentration was 0.03 µg/L in the standard elutriate for DU1, which is equivalent to the surface water quality standard.

The results of the dioxin and furan congener analyses for site water and standard elutriates from the Bay Harbor Channel SET project are provided in Table 3-7. The most toxic congeners, 2,3,7,8-TCDD and 1,2,3,7,8-PECDD, were not detected in the elutriates. Each of the detected dioxin/furan congeners was estimated below the laboratory reporting limit. The dioxin TEQ (ND=0) was 0.026 pg/L in the elutriate from DU1 and exceeded the contaminant target clean-up level (0.005 pg/L) (Table 3-7).

4. REFERENCES

EA Engineering, Science, and Technology, Inc., PBC. 2014. *Evaluation of Dredged Material, Panama City Harbor, Bay Harbor Channel, Panama City Beach, Bay County, Florida.* Prepared for the U.S. Army Corps of Engineers, Mobile District. October.

United States Environmental Protection Agency (USEPA). 2001. *Methods for Collection, Storage, and Manipulation of Sediments for Chemical and Toxicological Analyses: Technical Manual*. EPA-823-B-01-002. Office of Water. October.

———. 2005. *National Functional Guidelines for Chlorinated Dibenzo-p-Dioxins (CDDs) and Chlorinated Dibenzofurans (CDFs) Data Review.* OSWER 9240.1-51. EPA-540-R-05-001. Office of Superfund Remediation and Technology Innovation, Washington, DC. September.

United States Environmental Protection Agency (USEPA) / United States Army Corps of Engineers (USACE). 1991. *Evaluation of Dredged Material Proposed for Ocean Disposal, Testing Manual*. EPA-503/8-91/001. "The Green Book." Office of Water. February.

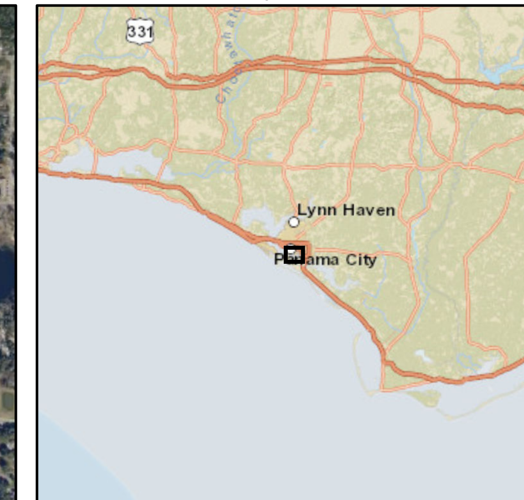
———. 1995. *QA/QC Guidance for Sampling and Analysis of Sediment, Water, and Tissue for Dredged Material Evaluations: Chemical Evaluations*. EPA-823-B-95-001. Office of Water. April

———. 1998. *Evaluation of Dredged Material Proposed for Discharge in Waters of the U.S. – Inland Testing Manual*. EPA-823-B-98-004. February.

———. 2008. *Southeastern Regional Implementation Manual (SERIM): Requirements and Procedures for Evaluation of the Ocean Disposal of Dredged Material in Southeastern U.S. Atlantic and Gulf Coast Waters.* EPA 904-B-08-001. EPA Region 4 and USACE South Atlantic Division with assistance from ANAMAR Environmental Consulting, Inc., Gainesville, Florida. August.

Van den Berg, M, L. Birnbaum, M. Denison, M. DeVito, W. Farland, M. Feeley, H. Fiedler, H. Hakansson, A. Hanberg, L. Haws, M. Rose, S. Safe, D. Schrenk, C. Tohyama, A. Tritscher, J. Tuomisto, M. Tysklind, N. Walker, and R. Peterson. 2006. The 2005 World Health Organization reevaluation of human and mammalian toxic equivalency factors for dioxins and dioxin-like compounds. *Toxicological Sciences* 93(2):223-241.

VICINITY MAP



Legend

- Sediment Sample Locations
- Water Sample Location
- Channel
- Dredging Unit
- Proposed Placement/Disposal Area

Aerial: ESRI ArcGIS Map Service, 2010

Map Date: August 2014

N

0 1,500 3,000
Feet

FIGURE 1-1
Panama City Bay Harbor Channel Dredging Units and Sample Locations
Panama City, Florida

Document Path: L:\GISData\Southeast\Florida\PanamaCityTerminalChannel\MXD\Figure 1-1 PC_SampleLocations.mxd

TABLE 1-1. SAMPLING AND COMPOSITING SCHEME

PANAMA CITY HARBOR SET TESTING, BAY CITY CHANNEL

PANAMA CITY BEACH, BAY COUNTY, FLORIDA (JUNE 2015)

Dredging Unit	Individual Location ID	Core ID	Sediment Sample IDs		Site Water ID	Standard Elutriate Sample IDs	
Inner Turning Basin DU1	PC-1	C	DU1-SED	GRAND-SED*	PC-WAT	DU1-SET	GRAND-SET
	PC-2	D					
	PC-3	B					
Outer Turning Basin DU2	PC-4	C	DU2-SED			DU2-SET	
	PC-5	A					
Inner Channel DU3	PC-6	C	DU3-SED			DU3-SET	
		D					
	PC-7	C					
		D					
	PC-8	A					
		B					
Outer Channel DU4	PC-9	C	DU4-SED			DU4-SET	

*Sample created in the field using representative volumes of each DU sample as determined based on proposed dredging volumes.

TABLE 2-1. SAMPLE LOCATION COORDINATES, CORING DEPTHS, AND SEDIMENT RECOVERY INFORMATION

PANAMA CITY HARBOR SET TESTING, BAY CITY CHANNEL

PANAMA CITY BEACH, BAY COUNTY, FLORIDA (AUGUST 2014)

Location ID	Date	Time	Easting	Northing	Water Depth (feet)	Tide Elevation (feet relative to MLLW)	Top of Core Elevation (feet relative to MLLW)	Core ID	Penetration (feet)	Penetration Depth (feet relative to MLLW)	Recovery (feet)	Notes
PC-1	8/26/14	9:44:06	1612140.44	415184.12	34.6	1.3	-33.3	C	8.0	-41.3	6.0	
PC-2	6/9/2015*	9:45:00	1612141.31	415184.32	34.5	1.1	-33.3	D	10.0	-43.3	7.8	
								E	10.0	-43.3	7.1	Archived at EA
PC-3	8/26/14	13:03:53	1612372.81	414816.57	33.7	1.8	-31.9	B	10.0	-41.9	6.4	
PC-4	8/27/14	9:12:23	1612128.76	414618.34	33.4	1.1	-32.3	C	9.0	-41.3	5.9	
PC-5	8/27/14	10:15:27	1612417.85	414278.74	34.3	1.0	-33.3	A	8.0	-41.3	6.5	
PC-6	8/27/14	12:21:15	1610972.11	412971.14	34.0	1.0	-33.0	C	9.0	-42.0	4.7	
	8/28/14	10:40:28	1610974.31	412972.97	33.8	1.0	-32.8	D	9.0	-41.8	4.5	
PC-7	8/27/14	13:31:36	1610052.48	412632.68	35.0	1.2	-33.8	C	7.5	-41.3	5.0	
								D	7.5	-41.3	5.3	
PC-8	8/28/14	9:31:42	1609475.32	412343.79	37.6	1.0	-36.6	A	6.0	-42.6	4.8	
								B	6.0	-42.6	4.4	
PC-9	8/26/14	14:40:07	1599975.79	417847.16	34.1	1.5	-32.6	C	9.0	-41.6	6.0	

Project Notes	Cores collected in August 2014 and used in the 2015 elutriate testing program were archived and stored in refrigeration at EA.
	*Additional cores from PC-2 were collected in June 2015 for adequate bulk sediment and elutriate testing sample volume.
	Coordinates were recorded in NAD83 State Plane, Florida West (Zone 0902), US Survey Feet.
	Tide elevations taken from NOAA active tide station (Station ID#: 8729108).

TABLE 2-2. SAMPLE LOCATION COORDINATES FOR SITE WATER/ELUTRIATE PREPARATION WATER AND DISPOSAL AREA SEDIMENT

PANAMA CITY HARBOR SET TESTING, BAY CITY CHANNEL
PANAMA CITY BEACH, BAY COUNTY, FLORIDA (JUNE 2015)

Location ID	Date	Time	Easting	Northing	Water Depth (Observed)	Tide Elevation (feet relative to MLLW)	Water Depth (MLLW)
PC-WAT	6/9/15	10:30:00	1612353.77	414570.82	31.7	1.1	-30.6
DA-1	6/9/15	12:07:16	1614166.77	413351.88	57.2	1.1	-56.1
DA-2	6/9/15	12:14:51	1615071.86	412216.18	55.7	1.1	-54.6
DA-3	6/9/15	12:20:49	1615958.27	411267.13	55.2	1.1	-54.1
Project Notes	Coordinates were recorded in North American Datum of 1983 (NAD83) State Plane, Florida West (Zone 0902), US Survey Feet.						
	Tide elevations taken from NOAA active tide station (Station ID#: 8729108)						

TABLE 2-3. REQUIRED CONTAINERS, PRESERVATION TECHNIQUES, AND HOLDING TIMES FOR SEDIMENT SAMPLES[a]

PANAMA CITY HARBOR, BAY CITY CHANNEL
PANAMA CITY BEACH, BAY COUNTY, FLORIDA (JUNE 2015)

Parameter	Volume Required [b]	Container [c]	Preservative	Holding Time
Physical Parameters				
Standard Elutriate	3x32 oz	G	4ºC	14 days until elutriate creation
Grain Size, Specific Gravity, Atterberg Limits	32 oz	P,G	4ºC	6 months
Organics				
Polychlorinated Biphenyl (PCB) Aroclors	4 oz	G	4ºC	14 days until extraction, 40 days after extraction
Dioxins / Furans	4 oz	G	4ºC	1 year to analysis

(a) From time of sample collection.

(b) Additional volume will need to be provided for samples designated as matrix spike/matrix spike duplicates.

(c) P=plastic; G=glass.

TABLE 2-4. REQUIRED CONTAINERS, PRESERVATION TECHNIQUES, AND HOLDING TIMES FOR AQUEOUS SAMPLES[a]

PANAMA CITY HARBOR, BAY CITY CHANNEL
PANAMA CITY BEACH, BAY COUNTY, FLORIDA (JUNE 2015)

Parameter	Volume Required [b]	Container [c]	Preservative	Holding Time
Physical Parameters				
Standard Elutriate	2.5 gallons	P	4ºC	14 days until elutriate creation
Organics				
Polychlorinated Biphenyl (PCB) Aroclors	2 Liters	G, teflon-lined cap	4ºC	7 days until extraction, 40 days after extraction
Dioxins / Furans	2 Liters	G, teflon-lined cap	4ºC	1 year to analysis

(a) From time of sample collection.

(b) Additional volume will need to be provided for samples designated as matrix spike/matrix spike duplicates.

(c) P=plastic; G=glass.

TABLE 3-1. ORGANIC DATA QUALIFIERS
PANAMA CITY HARBOR, BAY CITY CHANNEL, PANAMA CITY BEACH, BAY COUNTY, FLORIDA (JUNE 2015)

C ***<u>(Concentration) qualifiers:</u>***

COL	There was more than 40% difference between initial and confirmation results. The lower result was reported. (PCBs only)
EST	PCB congeners flagged with "EST" indicate that the value is estimated because of coelution with another PCB congener.
G	Elevated reporting limit, reporting limit elevated because of matrix interference.
I	Matrix interference.
J	Estimated result; reported value is less than the project-specified Reporting Limit (RL), but greater than the method-specified Instrument Detection Limit (IDL) or Method Detection Limit (MDL).
PG	Compound was detected, but the percent difference between the original and confirmation analyses between the two GC columns is greater than 40%. The highest value is presented.
Q	Compound was detected, but as an estimated maximum possible concentration (EMPC).
U	Analyte analyzed but not detected (concentration is less than the method-specified IDL or MDL.

Q ***<u>(Quality control) qualifiers:</u>***

A	Tentatively identified compound is a suspected aldol condensation.
B	Method blank contamination. This qualifier is used when the analyte is found in the associated method blank as well as in the sample. It indicates possible/ probable blank contamination.
D	Compound analyzed at a secondary dilution factor.
E	Compound was over the calibration range.
M	Duplicate injection precision not met.
N	Identification of tentatively identified compound is based on a mass spectral library search.
*****	Duplicate analysis is not within control limits.
+	Correlation coefficient for MSA is less than 0.995.

TABLE 3-2. DIOXIN AND FURAN DATA QUALIFIERS
PANAMA CITY HARBOR, BAY CITY CHANNEL, PANAMA CITY BEACH, BAY COUNTY, FLORIDA (JUNE 2015)

B The analyte is reported in the associated method blank at a reportable level.

C "Coeluting Isomer" – The isomer is known to coelute with another member of its homologue group, or the peak shape is shouldered, indicating the likelihood of a coeluting isomer.

E The amount reported is above the upper calibration limit in the method, and therefore the reported result is an estimate.

J The amount reported is below the lowest calibration standard, and therefore the reported result is an estimate.

Q Reported value is estimated maximum possible concentration. This qualifier is used when chromatographic data does not meet all positive identification criteria, such as ion ratios, retention time, co-maximization criteria and polychlorinated dibenzofuran purity.

S "Ion suppression event" – Signal is deflected when analyte is measured, possibly because of matrix-borne interference.

U Compound was analyzed, but not detected.

X Other. See explanation for specific definition.

TABLE 3-3. PHYSICAL CHARACTERISTICS OF SEDIMENT

PANAMA CITY HARBOR, BAY CITY CHANNEL

PANAMA CITY BEACH, BAY COUNTY, FLORIDA (JUNE 2015)

		DA-SED	DU1-SED	DU2-SED	DU3-SED	DU4-SED	GRAND-SED
ANALYTE	UNITS	Disposal Area	Panama City Inner Turning Basin	Panama City Outer Turning Basin	Panama City Inner Channel	Panama City Outer Channel	Volume-Weighted by DU
GRAVEL	%	0	5.6	1.1	12.4	15.6	14.9
SAND	%	76.5	67.1	78.4	63.9	70.5	66.1
COARSE SAND	%	10.8	4.7	1.7	19.7	15.6	9.3
MEDIUM SAND	%	22.2	24	7.3	18	15.7	17.3
FINE SAND	%	43.5	38.4	69.4	26.2	39.2	39.5
SILT	%	15.4	16.3	14.3	14.3	9.9	9.1
CLAY	%	8.1	11	6.2	9.4	4	9.9
SILTCLAY	%	23.5	27.3	20.5	23.7	13.9	19
LIQUID LIMIT	--	52	43	0	51	0	36
SPECIFIC GRAVITY	--	43.5	33.7	22.5	36.8	20.8	29.9
PLASTIC LIMIT	--	24	24	0	23	0	23
PLASTICITY INDEX		28	19	NP	28	NP	12
SPECIFIC GRAVITY	--	2.65	2.65	2.65	2.65	2.65	2.65
Soil Classification Symbol	--	SC	SC	SM	SC	SM	SC
Soil Classification Name		CL-SAND	CL-SAND	SI-SAND	CL-SAND	SI-SAND-GRAVEL	CL-SAND

CL = clayey
NP = no plasticity

SC = clayey sand
SI = silty
SM = silty sand

TABLE 3-4. PCB AROCLOR CONCENTRATIONS (UG/KG) IN SEDIMENT

PANAMA CITY HARBOR, BAY CITY CHANNEL

PANAMA CITY BEACH, BAY COUNTY, FLORIDA (JUNE 2015)

ANALYTE	UNITS	Average RL	DA-SED Disposal Area	DU1-SED Panama City Inner Turning Basin	DU2-SED Panama City Outer Turning Basin	DU3-SED Panama City Inner Channel	DU4-SED Panama City Outer Channel	GRAND-SED Volume-Weighted by DU
PCB-1016	UG/KG	3.13	3.8 U	3.3 U	2.9 U	3.2 U	2.6 U	3 U
PCB-1221	UG/KG	3.13	3.8 U	3.3 U	2.9 U	3.2 U	2.6 U	3 U
PCB-1232	UG/KG	3.13	3.8 U	3.3 U	2.9 U	3.2 U	2.6 U	3 U
PCB-1242	UG/KG	3.13	3.8 U	3.3 U	2.9 U	3.2 U	2.6 U	3 U
PCB-1248	UG/KG	3.13	3.8 U	3.3 U	2.9 U	3.2 U	2.6 U	3 U
PCB-1254	UG/KG	3.13	3.8 U	**11**	**6.6**	3.2 U	2.6 U	**5.2**
PCB-1260	UG/KG	3.13	**4.4**	**11**	**7.4**	3.2 U	2.6 U	**9**
Total PCBs (ND=0)	UG/KG	--	**4.4**	**22.0**	**14.0**	**0.0**	**0.0**	**14.2**

NOTES: Bold values represent detected concentrations.
RL is reported for non-detected constituents.

RL = average reporting limit **U** = compound was analyzed, but not detected

TABLE 3-5. DIOXIN AND FURAN CONGENER CONCENTRATIONS (PG/G) IN SEDIMENT

PANAMA CITY HARBOR, BAY CITY CHANNEL

PANAMA CITY BEACH, BAY COUNTY, FLORIDA (JUNE 2015)

ANALYTE	UNITS	Average RL	TEF*	DA-SED Disposal Area	DU1-SED Panama City Inner Turning Basin	DU2-SED Panama City Outer Turning Basin	DU3-SED Panama City Inner Channel	DU4-SED Panama City Outer Channel	GRAND-SED Volume-Weighted by DU
2,3,7,8-TCDD	PG/G	1	1	**1.1 Q**	**0.89 Q J**	0.97 U	**0.41 J**	0.97 U	**0.63 Q J**
1,2,3,7,8-PECDD	PG/G	4	1	**1.3 Q J**	**1.1 Q J**	**0.25 Q J**	**0.32 Q J**	**0.16 Q J**	**0.65 Q J**
1,2,3,4,7,8-HXCDD	PG/G	4	0.1	**1.5 Q B J**	**1.3 J**	**0.66 Q J**	**0.39 Q J**	**0.14 J**	**0.94 J**
1,2,3,6,7,8-HXCDD	PG/G	4	0.1	**4 J**	**7**	**3.1 J**	**1.5 J**	**0.33 J**	**4.4 J**
1,2,3,7,8,9-HXCDD	PG/G	4	0.1	**5.3 B**	**6 C B**	**3.1 C B J**	**3.3 C B J**	**0.72 Q B J**	**3.9 C B J**
1,2,3,4,6,7,8-HPCDD	PG/G	4	0.01	**100 B**	**120**	**93**	**26**	**5.8**	**89**
OCDD	PG/G	8	0.0003	**1100 B**	**1200 B**	**500 B**	**270 B**	**61 B**	**850 B**
2,3,7,8-TCDF	PG/G	1	0.1	**6.8**	**12**	**0.64 Q J**	**0.36 Q J**	0.97 U	**5.3**
1,2,3,7,8-PECDF	PG/G	4	0.03	**0.3 Q B J**	**0.25 Q J**	4.8 U	**0.073 Q J**	**0.072 Q J**	**0.2 J**
2,3,4,7,8-PECDF	PG/G	4	0.3	**0.5 B J**	**0.42 Q J**	4.8 U	**0.043 Q J**	**0.04 Q J**	**0.38 J**
1,2,3,4,7,8-HXCDF	PG/G	4	0.1	**0.99 C B J**	**1.1 C B J**	**0.34 B J**	4.8 U	4.9 U	**0.87 C B J**
1,2,3,6,7,8-HXCDF	PG/G	4	0.1	**0.81 Q J**	**1.4 Q B J**	**0.31 Q B J**	**0.13 Q B J**	**0.043 Q B J**	**1.1 Q B J**
2,3,4,6,7,8-HXCDF	PG/G	4	0.1	**0.44 Q B J**	**0.37 Q J**	**0.16 Q J**	4.8 U	4.9 U	**0.16 Q J**
1,2,3,7,8,9-HXCDF	PG/G	4	0.1	**0.1 Q J**	4.8 U	4.8 U	4.8 U	4.9 U	4.9 U
1,2,3,4,6,7,8-HPCDF	PG/G	4	0.01	**11 B**	**17**	**5.30**	**1.3 J**	**0.089 Q J**	**12**
1,2,3,4,7,8,9-HPCDF	PG/G	4	0.01	**0.91 B J**	**1.5 J**	**0.37 Q J**	**0.096 Q J**	4.9 U	**0.8 J**
OCDF	PG/G	8	0.0003	**55 B**	**63 B**	**18 B**	**3.3 Q B J**	**0.51 Q B J**	**38 B**
DIOXIN TEQ (ND=0)	PG/G	--	--	**1.1**	**3.4**	**1.3**	**0.8**	**0.1**	**2.2**

**Source* : Van den Berg, M, et al. 2006. The 2005 World Health Organization re-evaluation of human and mammalian toxic equivalency factors for dioxins and dioxin-like compounds. *Toxicological Sciences 93(2):223-241.*

There are no sediment quality guidelines for dioxins and furans.

NOTES: Bold values represent detected concentrations; RL is reported for non-detected constituents.

RL = average reporting limit
TEF = toxicity equivalency factor
TEQ = toxicity equivalency quotient

B = detected in the laboratory method blank
C = co-eluting isomer
E = the amount reported is above the calibration limit (value is estimated)
J = compound was detected, but below the reporting limit (value is estimated)
Q = estimated maximum possible concentration (EMPC)
U = compound was analyzed, but not detected

TABLE 3-6. PCB AROCLOR CONCENTRATIONS (UG/L) IN SITE WATER AND STANDARD ELUTRIATES

PANAMA CITY HARBOR, BAY CITY CHANNEL

PANAMA CITY BEACH, BAY COUNTY, FLORIDA (JUNE 2015)

				PC-WAT	DU1-SET	DU2-SET	DU3-SET	DU4-SET	GRAND-SET
ANALYTE	UNITS	Average RL	Surface Water Quality Standards*	Site Water	Panama City Inner Turning Basin	Panama City Outer Turning Basin	Panama City Inner Channel	Panama City Outer Channel	Volume-Weighted by DU
PCB-1016	UG/L	3.13	--	0.0095 U	0.01 U	0.01 U	0.01 U	0.01 U	0.0094 U
PCB-1221	UG/L	3.13	--	0.0095 U	0.01 U	0.01 U	0.01 U	0.01 U	0.0094 U
PCB-1232	UG/L	3.13	--	0.0095 U	0.01 U	0.01 U	0.01 U	0.01 U	0.0094 U
PCB-1242	UG/L	3.13	--	0.0095 U	0.01 U	0.01 U	0.01 U	0.01 U	0.0094 U
PCB-1248	UG/L	3.13	--	0.0095 U	0.01 U	0.01 U	0.01 U	0.01 U	0.0094 U
PCB-1254	UG/L	3.13	--	0.0095 U	**0.02**	0.01 U	0.01 U	0.01 U	0.0094 U
PCB-1260	UG/L	3.13	--	0.0095 U	**0.011**	0.01 U	0.01 U	0.01 U	0.0094 U
Total PCBs (ND=0)	UG/L	--	0.03	**0.00**	**0.03****	**0.00**	**0.00**	**0.00**	**0.00**

**Source* : F.A.C. 62-302.530

** equivalent to the surface water quality standards

NOTES: Bold values represent detected concentrations.
RL is reported for non-detected constituents.

RL = average reporting limit **U** = compound was analyzed, but not detected

TABLE 3-7. DIOXIN AND FURAN CONGENER CONCENTRATIONS (PG/L) IN SITE WATER AND STANDARD ELUTRIATES

PANAMA CITY HARBOR, BAY CITY CHANNEL

PANAMA CITY BEACH, BAY COUNTY, FLORIDA (JUNE 2015)

ANALYTE	UNITS	Average RL	TEF*	Target Cleanup Level (Human Health) **	PC-WAT	DU1-SET	DU2-SET	DU3-SET	DU4-SET	GRAND-SET
					Site Water	Panama City Inner Turning Basin	Panama City Outer Turning Basin	Panama City Inner Channel	Panama City Outer Channel	Volume-Weighted by DU
2,3,7,8-TCDD	PG/L	10	1	--	10 U	11 U	10 U	10 U	10 U	9.4 U
1,2,3,7,8-PECDD	PG/L	51	1	--	51 U	53 U	51 U	52 U	52 U	47 U
1,2,3,4,7,8-HXCDD	PG/L	51	0.1	--	51 U	53 U	51 U	52 U	52 U	47 U
1,2,3,6,7,8-HXCDD	PG/L	51	0.1	--	51 U	**0.45 Q B J**	51 U	52 U	52 U	**0.63 B J**
1,2,3,7,8,9-HXCDD	PG/L	51	0.1	--	51 U	**0.17 Q B J**	51 U	52 U	52 U	**0.61 Q B J**
1,2,3,4,6,7,8-HPCDD	PG/L	51	0.01	--	51 U	**8.4 Q B J**	**0.73 Q B J**	**0.27 Q B J**	**0.44 Q B J**	**22 B J**
OCDD	PG/L	101	0.0003	--	**2.9 B J**	**75 B J**	**8.8 B J**	**3 Q B J**	**3.7 B J**	**360 B**
2,3,7,8-TCDF	PG/L	10	0.1	--	10 U	11 U	10 U	10 U	10 U	**0.24 Q J**
1,2,3,7,8-PECDF	PG/L	51	0.03	--	51 U	53 U	51 U	52 U	52 U	47 U
2,3,4,7,8-PECDF	PG/L	51	0.3	--	51 U	53 U	51 U	52 U	52 U	47 U
1,2,3,4,7,8-HXCDF	PG/L	51	0.1	--	51 U	**0.2 Q B J**	51 U	52 U	52 U	**0.18 Q B J**
1,2,3,6,7,8-HXCDF	PG/L	51	0.1	--	51 U	**0.85 Q B J**	51 U	52 U	52 U	**0.53 Q B J**
2,3,4,6,7,8-HXCDF	PG/L	51	0.1	--	51 U	53 U	51 U	52 U	52 U	47 U
1,2,3,7,8,9-HXCDF	PG/L	51	0.1	--	51 U	**0.26 J**	51 U	52 U	52 U	47 U
1,2,3,4,6,7,8-HPCDF	PG/L	51	0.01	--	**0.091 Q J**	**2.4 B J**	51 U	52 U	**0.18 Q B J**	**4.4 B J**
1,2,3,4,7,8,9-HPCDF	PG/L	51	0.01	--	**0.19 Q J**	53 U	51 U	**0.13 Q B J**	52 U	47 U
OCDF	PG/L	101	0.0003	--	100 U	**6.3 B J**	**0.2 Q B J**	**0.26 Q B J**	100 U	**23 B J**
DIOXIN TEQ (ND=0)	PG/L	--	--	0.005	**0.00**	**0.026**	**0.00**	**0.00**	**0.00**	**0.00**

**Source* : Van den Berg, M, et al. 2006. The 2005 World Health Organization re-evaluation of human and mammalian toxic equivalency factors for dioxins and dioxin-like compounds. *Toxicological Sciences 93(2):223-241.*

** Source: F.A.C. 62-777

NOTES: Bold values represent detected concentrations; RL is reported for non-detected constituents.

RL = average reporting limit

TEF = toxicity equivalency factor

TEQ = toxicity equivalency quotient

B = detected in the laboratory method blank

J = compound was detected, but below the reporting limit (value is estimated)

Q = estimated maximum possible concentration (EMPC)

U = compound was analyzed, but not detected

Appendices