Brunswick Harbor Modification Project
Jekyll Island Fishing Pier Shoreline Placement
Glynn County, Georgia
Draft Supplemental Environmental Assessment and Finding of No Significant Impact

Appendix E

Magnuson–Stevens Fishery Conservation and Management Act

U.S. ARMY CORPS OF ENGINEERS
SAVANNAH DISTRICT
100 WEST OGLETHORPE AVENUE
SAVANNAH, GEORGIA 31401

January 2024

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Brunswick Harbor Modification Project
Jekyll Island Fishing Pier Shoreline Nourishment

Glynn County, Georgia

Draft Supplemental Environmental Assessment and FONSI

E.1

Correspondence

U.S. ARMY CORPS OF ENGINEERS

SAVANNAH DISTRICT

100 WEST OGLETHORPE AVENUE

SAVANNAH, GEORGIA 31401

January 2024

Wright, Summer G CIV USARMY CESAS (USA)

From: Hill, Suzanne CIV USARMY CESAS (USA)
Sent: Thursday, December 21, 2023 4:07 PM
To: Pace Wilber - NOAA Federal
Cc: Wright, Summer G CIV USARMY CESAS (USA); Monroe, E Madison CIV (USA)
Subject: RE: [Non-DoD Source] Re: Jekyll Island Shoreline Nourishment Beneficial Use- MSA Coordination

Understood, thank you.

From: Pace Wilber - NOAA Federal <pace.wilber@noaa.gov>
Sent: Thursday, December 21, 2023 4:05 PM
To: Hill, Suzanne CIV USARMY CESAS (USA) <Suzanne.Hill@usace.army.mil>
Cc: Wright, Summer G CIV USARMY CESAS (USA) <Summer.G.Wright@usace.army.mil>; Monroe, E Madison CIV (USA) <Emily.M.Monroe@usace.army.mil>
Subject: [Non-DoD Source] Re: Jekyll Island Shoreline Nourishment Beneficial Use- MSA Coordination

Hi Suzy. You cannot assume concurrence based on no response. No response just means no response and you are moving forward. Pace

On Thu, Dec 21, 2023 at 3:58 PM Hill, Suzanne CIV USARMY CESAS (USA) <Suzanne.Hill@usace.army.mil> wrote:

> Pace-
>
> We are very appreciative of the input and comments you have provided for this project. Please find attached our coordination request letter, along with our EFH assessment. I am also attaching a track changes version so that you can review our responses to your comments on the draft EFH assessment.
>
> Please let me or Summer Wright, cced on this email if you have any questions.
>
> Thanks again and Happy Holidays,
>
> Suzy
>
> Suzanne Hill
>
> NEPA Team Lead

USACE Savannah District, Planning Branch

Ph. 912.423.2324

--
Pace Wilber, Ph.D.
South Atlantic and Caribbean Branch Chief
Habitat Conservation Division
NOAA Fisheries Service
331 Ft Johnson Road
Charleston, SC 29412

843-592-3024 (NOAA Google Voice)
Pace.Wilber@noaa.gov

Brunswick Harbor Modification Project
Jekyll Island Fishing Pier Shoreline Nourishment

Glynn County, Georgia

Draft Supplemental Environmental Assessment and FONSI

E.2

EFH Assesment

U.S. ARMY CORPS OF ENGINEERS

SAVANNAH DISTRICT

100 WEST OGLETHORPE AVENUE

SAVANNAH, GEORGIA 31401

January 2024

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, SAVANNAH DISTRICT
100 W. OGLETHORPE AVENUE
SAVANNAH, GEORGIA 31401-3604

December 21, 2023

Planning Branch

Mr. Pace Wilber
Branch Chief, Habitat Conservation Division
Atlantic Branch
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
331 Fort Johnson Road
Charleston, South Carolina 29412

Dear Mr. Wilber:

The U.S. Army Corps of Engineers, Savannah District (Corps) has evaluated the feasibility of using the Brunswick Harbor Modification Project (BHMP) Cedar Hammock bend widener expansion new work material and the Brunswick Harbor Navigation Project (BHNP) operations and maintenance (O&M) dredged material beneficially to nourish the degraded shoreline southwest of the Jekyll Island Fishing Pier on Jekyll Island, GA.

Approximately 205,000 cubic yards will be removed from the Cedar Hammock bend widener and placed into the shoreline southwest of the Jekyll Island Fishing Pier for initial placement. Future maintenance placement volumes using O&M material will be dependent on erosion and amount of suitable material available from the Federal navigation channel.

With implementation of the proposed action, there is the potential to alter Essential Fish Habitat (EFH) within the project area as described in the enclosed EFH assessment. The Corps has determined that the proposed action would not cause significant and adverse impacts to EFH and managed species located within the action area. Impacts to EFH and managed species that use the proposed action area would be temporary and minor in nature and do not reduce either the quality or quantity in the project area.

The Corps has prepared a supplemental Environmental Assessment (SEA) to the 2022 Brunswick Harbor Modification Study Integrated Feasibility Report and Environmental Assessment and Finding of No Significant Impact (IFREA/FONSI) in accordance with the National Environmental Policy Act. The draft SEA and draft FONSI will be available for a 15-day public comment starting on January 8, 202, concluding on January 23, 2024. The draft SEA/FONSI will be available at the following website beginning on January 8, 2024: https://www.sas.usace.army.mil/About/Divisions-and-Offices/Planning-Division/Plans-and-Reports/. A Public Notice will also be sent to all the parties on the Corps' Regulatory mailing list in Georgia for the project area and will be available at: https://www.sas.usace.army.mil/Missions/Regulatory/Public-Notices/. In addition, we will send a notification to the resource agencies and stakeholders via email.

We request your review of the enclosed EFH assessment under the authority of the Magnuson-Stevens Fishery Conservation and Management Act. In accordance with the provisions of the NEPA, we are also requesting your comments on the draft SEA and FONSI during the public comment period beginning on January 8, 2024. If no EFH Conservation Recommendations or a “no objection” response is received from NMFS HCD at the conclusion of the public comment period of the draft EA, we will assume that NMFS HCD is in concurrence with our findings in the enclosed EFH assessment and EFH consultation on this action is complete.

Questions or comments concerning this request can be directed to Ms. Summer Wright, Biologist, at Summer.G.Wright@usace.army.mil or (912)-222-8945.

Sincerely,

Suzanne Hill
Environmental Team Lead, Planning Branch

Enclosure

Table of Contents

1. Introduction

The U.S. Army Corps of Engineers, Savannah District (the Corps) is seeking to utilize beneficial use of dredged material (BUDM) by placing material along the degraded shoreline south of the Jekyll Island Fishing Pier on the leeward side of Jekyll Island in Glynn County, Georgia. This effort is part of the Brunswick Harbor Modification Project (BHMP). The Brunswick Harbor Modifications Study (BHMS) Integrated Feasibility Report and Environmental Assessment/Finding of No Significant Impact (BHMS IFREA/FONSI) was completed with the signing of the FONSI on May 25, 2022. The BHMS IFREA/FONSI evaluated the expansion of the Colonel's Island Terminal turning basin and the Cedar Hammock Bend Widener, as well as the creation of a vessel meeting area in the St. Simons Sound. The expansions require the removal of 346,000 cy of material from the turning basin, and 205,000 cy of material from the bend widener.

The BHMP has been funded for construction through the Water Resources Development Act (WRDA) 2022 and is currently in the Pre-construction Engineering and Design (PED) phase. The dredged material from the bend widener is mostly sandy material and is considered suitable for beneficial use. Beneficial use sites were previously evaluated for feasibility during the study; however, no beneficial use sites were identified that were feasible or within the Federal Standard during the development of the BHMS. During the PED phase, in accordance with Water Resources Development Act (WRDA) of 2020, Section 125, the Corps posted a public notice on July 5, 2023, requesting beneficial use site proposals. The Jekyll Island Authority (JIA) submitted a proposal in response to the July 2023 Public Notice. The shoreline nourishment was chosen by the JIA with considerations toward environmental, economic, and recreational resources. Anticipated start date for the construction of the nearshore site is estimated to occur in late 2024-early 2025, depending on contract award of the BHMP.

The Magnuson-Stevens Fishery Conservation and Management Act (MSA) requires federal agencies to consult with the National Oceanic and Atmospheric Administration, National Marine Fisheries Service (NMFS) when their actions or the result of their actions may adversely affect essential fish habitat (EFH) or federally managed fisheries. MSA defines EFH as "those waters and substrate necessary to fish for spawning, breeding, feeding or growth to maturity. "EFH is designated through federal Fishery Management Plans developed by Fishery Management Council (stewards of nearly all plans) or NMFS (steward of the plan for Highly Migratory Species). The Corps pursuant to section 305(b)(2) of the MSA has prepared this assessment to support consultation with NMFS regarding the proposed federal action that may adversely affect EFH.

Pursuant to the National Environmental Policy Act (NEPA), the Corps is in the process of preparing a draft Supplemental Environmental Assessment (SEA) to the 2022 BHMS IFREA/FONSI for the proposed BUDMat Jekyll Island. The Corps is initiating consultation with NMFS under MSA through providing this assessment prior to release of the Draft SEA for public comment and is requesting comment at the close of the public comment period of the Draft SEA. The EFH Assessment includes a brief

description of the proposed Federal action, an inventory of the habitats and managed fishery resources that are present within the project action area, and assessment of potential effects of the proposed Federal action on the resources.

2. Project Description

The proposed federal action is to directly place approximately 205,000 cy of primarily sandy dredged material from the Cedar Hammock Bend Widener expansion onto the degraded shoreline southwest of the Jekyll Island Fishing Pier (Figure 1). This location is on the leeward side of northern Jekyll Island. The purpose of the proposed beneficial use action is to stabilize and protect the shoreline and adjacent marshland southwest of the Jekyll Island Fishing Pier. Placement of sediment in this area will provide valuable protection and attenuate wave energy along the adjacent shoreline. The additional substrate may also encourage natural recruitment of vegetation from the adjacent marsh, allowing for further stabilization of the existing topographic landscape. Table 1provides the estimated initial and maintenance placement volumes, the estimated area and the approximate minimum reoccurrence rate.

Table ***2*** provides the specific amount of acreage impacted from initial and future maintenance placements.

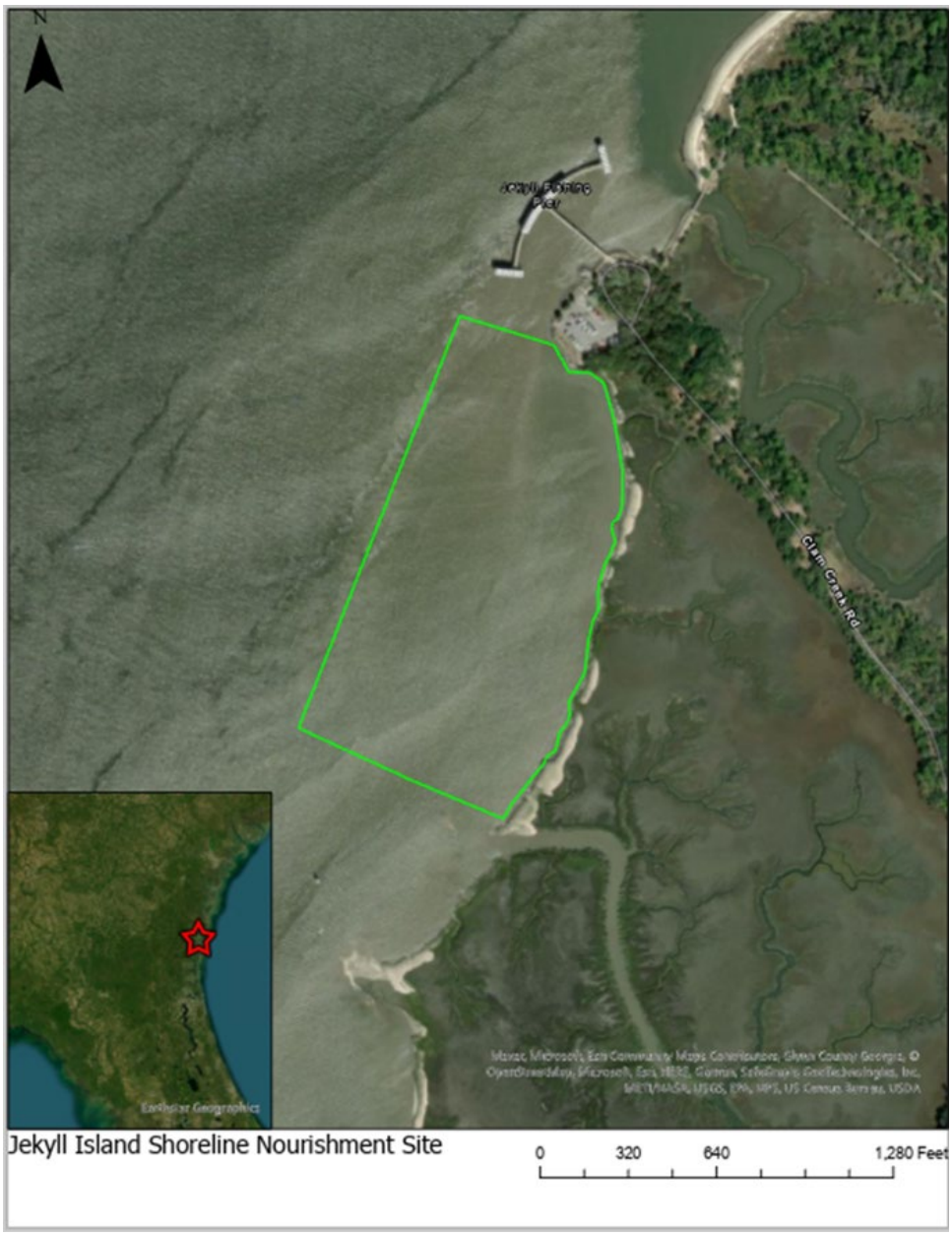


Figure 1. Jekyll Island nearshore placement site (green polygon).

Table 1. Estimated initial and maintenance placement volumes and approximate placement reoccurrence rate.

Initial Placement Volume (CY)	Maintenance Placement Minimum (CY)	Maintenance Placement Maximum (CY)	Acreage	Approx. Minimum Reoccurrence Rate (Yrs)
205,000	Dependent upon shoreline erosion extent and amount of material available.	100,000 cy	30	2-5

Table 2. Estimated impacted acres.

Habitat	Initial Placement (Acres)	Maintenance Placement (Acres)
Supratidal	1	1
Intertidal	2	2
Subtidal	27	17

Initial placement will occur during dredging operations under the BHMP. This site will not receive any hardened structure after sediment placement completion; therefore, material is expected to migrate within the system over time from natural forces. Future maintenance of this site may be required to restore lost sediment within the original design template by utilizing operations and maintenance (O&M) material from the Brunswick Harbor Modification project (BHNP), as needed. The material will be placed in shallow areas that were historically marsh and sandy mudflat habitat that has been extirpated or degraded due to loss of elevation from tidal and wave-driven erosional forces.

Maximum placement elevation at the top of the shoreline nourishment berm as shown in the attached current 60% design is 7.0 +/- 0.5 ft mean lower low water (MLLW) in the area closest to the shoreline (Attachment 1; Figure 2). While the attached current 60% design document indicates a 0.5ft tolerance, industry feedback and technical constraints may require a +/- 1.0 ft tolerance. MHW is approximately 7.35 MLLW in the Brunswick area (**Figure 2**). The slope into the subtidal zone descends by 1 ft MLLW until reaching the existing elevation. The slope of the placement will mimic natural features in the surrounding area. Heavy equipment such as bulldozers will be used to shape the material to design specifications. While the estimated material to be removed from the bend widener is 205,000 cy, approximately 118,000 cy is expected to be placed within the design template due to the estimation that 20% of the fine-grained material is

expected to winnow away with the tidal and riverine flows. Five borings within the bend widener area were taken in 2021 as part of the BHMS (
Figure **3**). The dredge material at the bend widener consists of poorly graded sands, silty sands, and highly weathered limestone (Table 3). Future maintenance placements will utilize sediment from shoals within the inner harbor or entrance channel. Exact location of the material would be dependent on proximity to the placement site and percent fines based on the 2016 Marine Protection, Research and Sanctuaries Act (MPRSA) Tier III sediment data (Anamar Environmental Consulting, Inc, 2016).

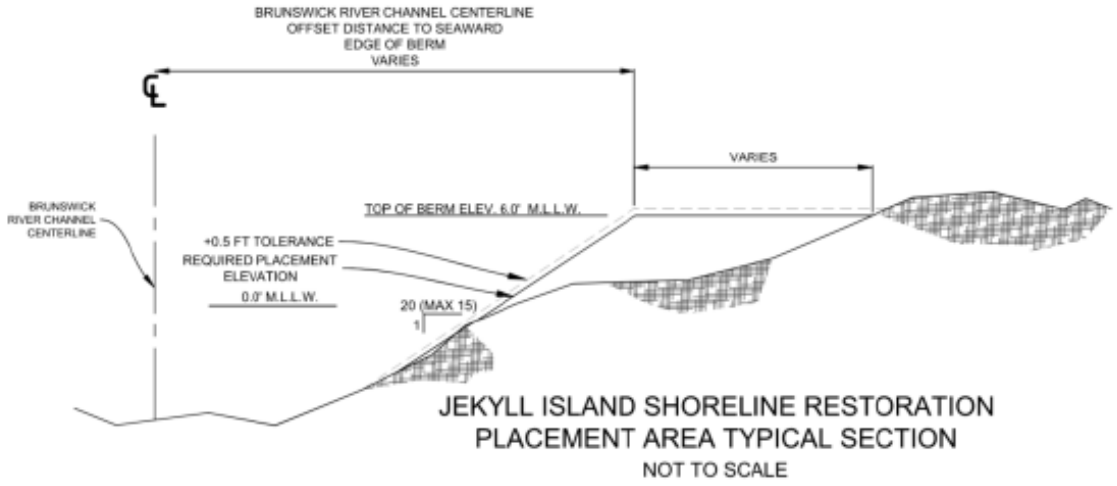


Figure 2. 60% design cross-section of the shoreline nourishment.

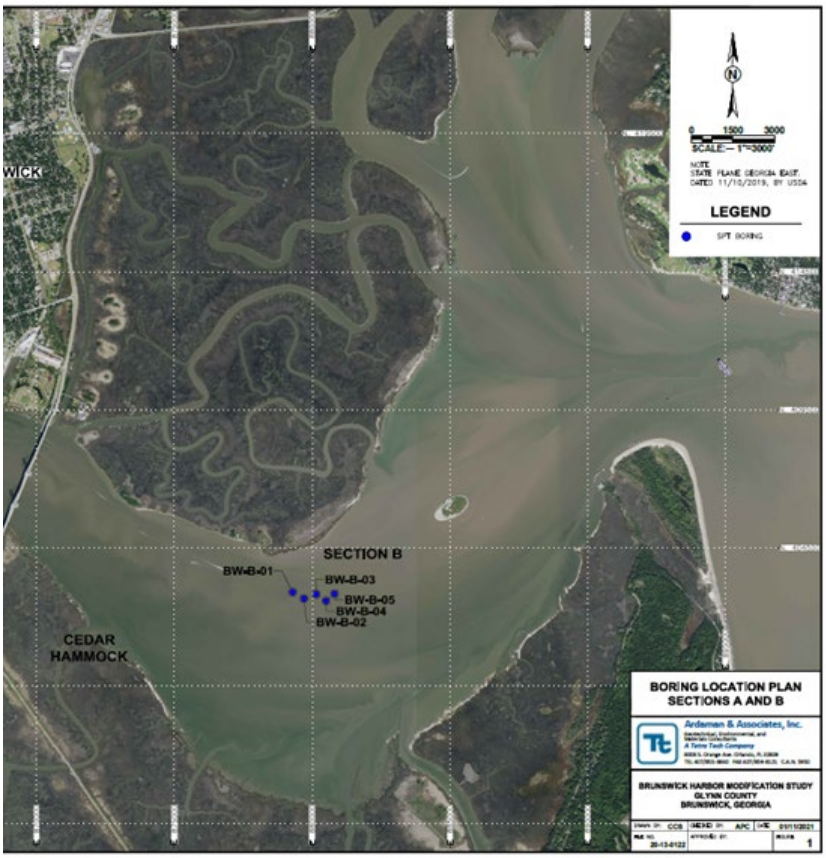


Figure 3. Location of the 2021 BHMP geotechnical borings in the Cedar Hammock bend widener expansion.

Table 3. Percent fines of the bend widener geotechnical borings.

Boring	Percent Fines
BW-01	82
BW-02	71
BW-03	8
BW-04	6
BW-05	8

The design avoids any placement within the inflow/outflow points of the two adjacent tidal marsh creeks to address concerns regarding placement material migrating and impeding flow into and out of the creeks. Buffer zones were included in the 60% design (Attachment 1). The buffer zones are approximately 350 ft north to south of the inflow/outflow points of the creeks. The zone depicted by hatch marks in the 60% design will have no placement within this area. Placement around this zone will increase by 1 ft MLLW until reaching the maximum 7.0 ft MLLW elevation of the berm. If sediment sloughing into the tidal creek buffer zones does occur, however, it is anticipated that flows will be naturally restored via tidal flows and precipitation events. The placement site has sufficient tidal range and prism such that tidal creeks are expected to equilibrate quickly to pre-project creek channel area and flow magnitude.

Furthermore, it is expected that any placement material deposited into the creeks via migration will be removed during ebb tide and due to precipitation events that sustain downstream flows strong enough to remove the deposited material when the bed stress exceeds the critical stress to move sediments. The placement site has sufficient tidal range and prism such that tidal creeks are expected to equilibrate quickly to pre-project creek channel area and flow magnitude (see Section 7.1 for full tidal creek analysis). Monitoring of the tidal creeks will occur during construction and afterwards by JIA to ensure that tidal creek flows are not inhibited by migration of the material placed. If tidal creeks do become blocked by sediment migration as a result of construction, actions will be taken to restore tidal flows. For initial placement, a hydraulic cutterhead dredge will be the means of placing the dredged sediment into the proposed shoreline nourishment site. The pipeline will be moved around to achieve target design elevations, with the use of heavy machinery to create an even grade and design contours if needed. Future O&M placement may be done with either cutterhead pipeline or hopper dredge.

Design and construction restraints include the following:

- No material placement within the tidal creek restricted zones.
- No material placement on the oyster bed and shell rake located south of the placement area.
- No material placement on the adjacent saltmarsh and vegetation.
- No construction equipment on or pipeline placed on the adjacent saltmarsh.

The Corps proposes to conduct bathymetric monitoring of the placement area to assess changes in elevation immediately following, six months, and one-year post-construction. For monitoring and adaptive management, JIA proposes the following post-construction activities:

- Real-Time Kinematic surveys to evaluate elevation changes.
- Drone footage to monitor sediment movement and tidal creek flows (dependent upon FAA approval).
- Provide labor and use of handheld equipment to remove sediments in the event that tidal creek flows are negatively impacted by the migration of dredged sediment upstream beyond the ability for natural tidal and precipitation forces to reopen the creeks.

3. Existing Conditions

Northern Jekyll Island on the Brunswick River side historically has a shoreline consisting of mudflats with abutting saltmarsh with a few tidal creeks flowing throughout. The nearshore area of the northern leeward side of Jekyll Island is heavily influenced by ebb/flood tides from the Atlantic Ocean, precipitation, and wave refraction energy. The National Oceanic and Atmospheric Administration (NOAA) operates and maintains two nearby tide gages which track tidal fluctuations in the area and is located approximately 1 mile from the nearshore site. Datum information is provided in Table 3. The tidal range in this area is 0.00 ft (MLLW) to 7.39 ft (MHHW) (Table 4).
A mixture of freshwater from the Brunswick River and saltwater from the Atlantic Ocean causes varying amounts of salinity levels. Most of the project area is open water that receives semidiurnal tidal flushing from St. Simons Sound. As a result, the salinity levels tend to be approximately 25 parts per thousand (ppt), depending on tide stage. The average St. Simons Sound tide range is approximately 6.5 feet, and the water in the harbor is well-mixed with a relatively uniform salinity. The proposed action area is adjacent to smooth cordgrass-dominated saltmarsh with two tidal creek inflow/outflow points.

Table 4. Water Levels and Tide Ranges for the Two Nearby NOAA Stations.

Station ID	Station Name	Mean Higher High Water (feet)	Mean High Water (feet)	Mean Tide Level (feet)	Mean Sea Level (feet)	Mean Low Water (feet)	Mean Lower Low Water (feet)
8677832	Jekyll Island Marina, Jekyll Creek, GA	7.39	7.04	3.63	3.75	0.22	0.00
8677406	Howe Street Pier, Brunswick, GA	7.72	7.35	3.79	4.01	0.22	0.00

Numerous hydrologic inputs influence the geomorphology of the project area. The

project area is located approximately 2 miles from the open Atlantic Ocean, and therefore, is heavily influenced by flood/ebb tides. The project area is also influenced by riverine flows from the Brunswick River and ship wake from passing ships entering and leaving the Brunswick Harbor. Hydrologic inputs have caused degradation and loss of shoreline in this area over time. The project area has lost approximately 22 acres of shoreline and marsh since February 1988, according to aerial and historical imagery from the Georgia Wetlands Restoration Access Portal (G-WRAP) (Figure 4). Calculated rate of erosion based on the historical imagery is approximately 2 m/yr. Figure 5shows current aerial imagery from June 2023 compared with historical shorelines from 1855, 1933, and 2003.

Figure 4. 1988 aerial imagery of the proposed placement location. The proposed placement polygon is in red. The blue line is historical shoreline from 1855, and the yellow is historical shoreline from 1933 (G-WRAP, 2023).

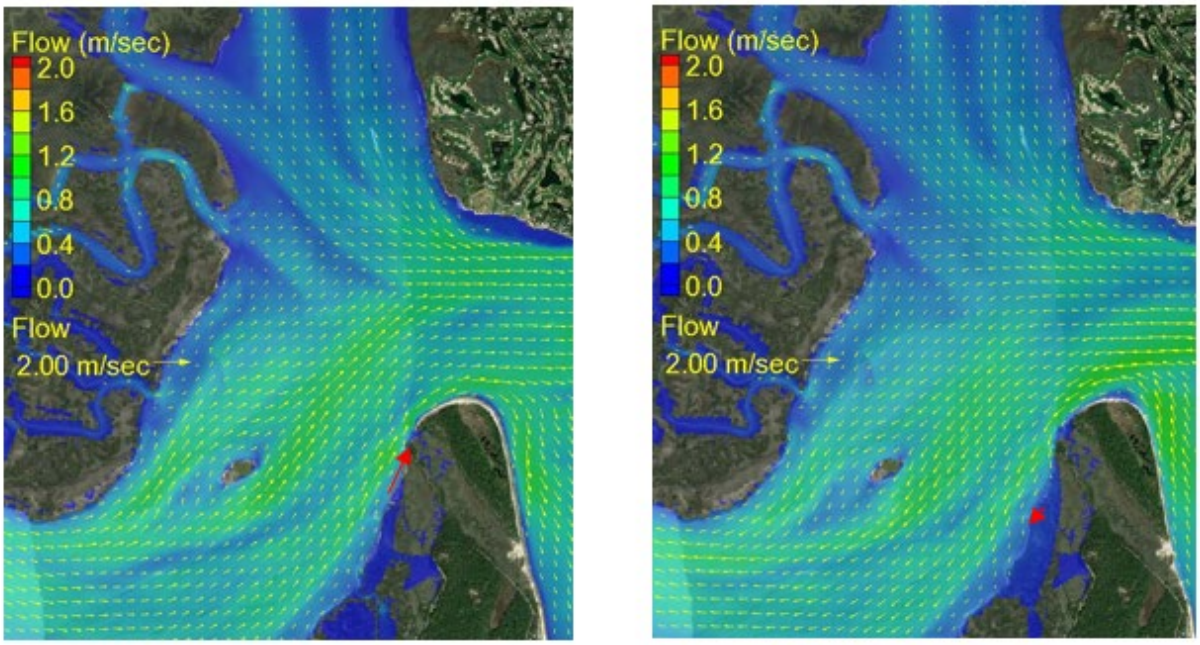
Figure 5. June 2023 aerial imagery of the current shoreline with comparisons to the proposed placement and the historical shorelines (blue-1855, yellow-1933, white-2003) (G-WRAP, 2023).

3.1 Sediment Transport

Based on scientific literature and information provided by the NOAA Greater Atlantic Region regarding the expected effects for turbidity from dredging and placement, material placement-generated turbidity plumes are limited to an area only a few hundred feet to a few thousand feet and most turbidity settles out quickly once material placement is complete (NOAA, 2023). Wilber et al., 2006 reported that elevated total suspended solids (TSS) concentrations associated with active material placement along a beach were limited to within 1,312 feet of the discharge pipe in the swash zone. Turbidity plume directions have been estimated for the placement activity (Figures 6 and 7). Turbidity plumes estimations were generated based on GENCADE modeling completed by the USACE Engineer Research Development Center (ERDC). GenCade is a numerical model that calculates shoreline change, wave-induced longshore sediment transport, and morphology. Ebb-tidal flows and flood tidal flows were simulated using the Coastal Modeling System (CMS-Flow) numerical model. Based on this modeling effort, the general flow in the proposed action area is north to south (littoral) along the shoreline. The flow along the area appears to be up to 0.4 m/sec during the ebb and tidal flow simulations. The general, net sediment transport is shown with red arrows.

It is expected that most of the material placed will remain in the template, but there may be some minor dredged material spillage as a result of sediment migration from currents and tidal flows. It is estimated that about 20% of the material placed will be lost due to flows, material lost is primarily the fines that are present. The direction will be dependent on the tidal flows at time of construction. According to the modeling, the

longshore transport south of the Jekyll Island Pier, which is primarily affected by daily tidal currents (both flood and ebb currents), is primarily flood tide and is therefore directed more southward along the shoreline. The cross-shore transport from wind wave generation, particularly during storm events, is also significant to cause shoreline erosion and deposit sediment away from the shoreline. Therefore, sediment movement is expected to primarily move southward with some moving cross-shore, but this is also dependent upon tidal flows (flood and ebb conditions). It is expected that the material placed will migrate back into the riverine system over time.



(1) An ebb tidal flow simulated by CMS-flow

(2) A flood tidal flow simulated by CMS-flow

Figure 6. (1) Red arrow is estimated turbidity plume direction during ebb tide. (2) Red arrow is estimated turbidity plume direction during flood tide. Further detail of flow is depicted by the yellow arrows from the GenCade modeling results.

Figure 7. General turbidity plume directions at placement location during ebb and flood tides.

4. Essential Fish Habitat in Project Area

The final rule for implementing the EFH provisions of the MSA was released on 17 January 2002. Fishery Management Plans administered by the NMFS, South Atlantic Fishery Management Council (SAFMC), and Mid-Atlantic Fishery Management Council (MAFMC) designate EFH in the project area. The EFH for a given species can include multiple habitats to support reproduction, juvenile and adult development, feeding, protection, and shelter during species' various life stages. This EFH assessment describes the habitat(s) and managed fishery resource(s) that would potentially be present within the potential project footprint. If any activities could potentially affect EFH adversely, the applicable federal agency must consult with the NMFS to develop measures to conserve EFH and support management of sustainable marine fisheries.

Essential fish habitat in estuarine areas for fisheries managed by the SAFMC and MAFMC and occurring within the placement or project area are listed in Table 5. Essential Fish Habitat (EFH) was identified within the project area using NOAA Fisheries Essential Fish Habitat Mapper (https://coast.noaa.gov/digitalcoast/tools/efhmapper.html) along

with the Users Guide to Essential Fish Habitat Designations by the South Atlantic Fisheries Management Council (SAFMC and NOAA, 2021). Table 6 provides the common species that may be located in the project area, as listed on the NOAA EFH Mapper (accessed on 23 October 2023).

Table 5. Essential fish habitat categories likely to be in project area (NOAA, 2023).

Essential Fish Habitats	Potential Presence	Potential Effects	Potential Impacts
	Within Placement Area	Within Project Area	Sediment Placement Activities
Intertidal Flats	☑		Yes
Estuarine Water Column	☑	☑	Minor and Temporary
Open waters/Unconsolidated Bottom	☑	☑	Yes
Tidal Creeks		☑	Minor and Temporary
Oyster Reefs		☑	Yes
Coastal Inlets	☑	☑	Minor and Temporary

Table 6. Common species potentially located in project area.

Common Name	Scientific Name	Function	Life Stage Use(s)	Fisheries Management Plan
Atlantic butterfish	*Peprilus triacanthus*	Refuge, Forage	Adult	MAFMC
Atlantic sharpnose shark	*Rhizoprionodon terraenovae*	Refuge, Forage, Nursery	Juvenile, Neonate	NMFS Highly Migratory Species
Blacknose shark	*Carcharhinus acronotus*	Refuge, Forage	Juvenile, Adult	NMFS Highly Migratory Species
Blacktip shark	*Carcharhinus limbatus*	Refuge, Forage, Nursery	Juvenile, Adult, Neonate	NMFS Highly Migratory Species
Bluefish	*Pomatomus saltatrix*	Refuge	Juvenile	MAFMC Bluefish
Bonnethead shark	*Sphyma tiburo*	Refuge, Forage, Nursery	Juvenile, Adult, Neonate	NMFS Highly Migratory Species EFH
Brown shrimp	*Penaeus aztecus*	Refuge, Forage, Nursery	ALL	SAFMC Shrimp
Bull shark	*Carcharhinus leucas*	Refuge, Forage	Juvenile, Adult	NMFS Highly Migratory Species
Mackerels		Refuge, Forage, Nursery	ALL	SAFMC Coastal Migratory Pelagics
Finetooth shark	*Carcharhinus isodon*	Refuge, Forage	ALL	NMFS Highly Migratory Species
Lemon shark	*Negaprion brevirostis*	Refuge, Forage	Juvenile, Adult	NMFS Highly Migratory Specie
Pink shrimp	*Penaeus duorarum*	Refuge, Forage, Nursery	ALL	SAFMC Shrimp
Sandbar shark	*Carcharhinus plumbeus*	Refuge, Forage	Juvenile, Adult	NMFS Highly Migratory Species
Scalloped hammerhead shark	*Sphyrna lewini*	Refuge	Neonate	NMFS Highly Migratory Species
Gray snapper, gag		Forage	ALL	SAFMC Snapper Grouper
Spinner shark	*Carcharhinus brevipinna*	Nursery	Neonate	NMFS Highly Migratory Species
Summer flounder	*Paralichthys dentatus*	Forage	Juvenile, Larvae	MAFMC Summer Flounder, Scup, Black Sea Bass
Tiger shark	*Galeocerdo cuvier*	Forage	Juvenile/Adult	NMFS Highly Migratory Species
White shrimp	*Penaeus setiferus*	Refuge, Forage, Nursery	ALL	SAFMC Shrimp

4.1 Intertidal Flats

The distribution and individual characteristics of intertidal flats are dynamic features of an estuarine system. An intertidal flat's shape and size varies by changing erosion and depositional rates influenced by tide ranges, coastal geology, freshwater inflow, weather patterns, and anthropogenic factors. Intertidal flat locations with minor tide variations are primarily influenced by wind and waves unless located near a tidal inlet or river mouth discharge. Tidal flats within systems of larger tidal fluctuations are principally formed and fashioned by the area's tidal action. Sediment size interacting with wind, wave, and tidal forces shape and manage intertidal flat development and movement. As the distance from an inlet increases, the intertidal flats' substrates become finer and more susceptible to wind fetch influences (SAFMC 2009).

Intertidal flats serve various functions for many species' life stages. Estuarine flats serve as a feeding ground, refuge, and nursery area for many mobile species, as well as the microalgal community that can function as a nutrient (nitrogen and phosphorus) stabilizer between the substrate and water column. The benthic community of an intertidal flat can include polychaetes, decapods, bivalves, and gastropods. This tidally influenced, constantly changing EFH provides feeding grounds for predators, refuge and feeding grounds for juvenile and forage fish species, as well as nursery grounds for estuarine-dependent benthic species (SAFMC 2009).

Species that move from a pelagic larval to a benthic juvenile existence make use of flats during development. These flats can provide a comparatively low energy area with tidal phases that allow species the use of shallow water habitat as well as relatively deeper water within small spatial areas. Many different species use this EFH as a nursery. These flats also serve as refuge areas for species avoiding predators, which use the tidal cycles to gain access to estuarine feeding grounds. In addition, these habitats are important for both migration routes and foraging for managed species. Frequently, nursery areas can include unvegetated soft bottom areas surrounded by salt/brackish emergent marsh (Street et al. 2005). This intertidal flat EFH is found within the proposed placement area along the Jekyll Island shoreline on the Brunswick River.

4.2 Estuarine Water Column

The transient boundaries of the estuarine water column are variable due to wind- and tidal-driven inlet sea water mixing with upland freshwater sources and land surface runoff. With these mixing attributes, salinity levels vary within this estuarine EFH. Typically, the salinity groups include four ranges: oligohaline [< 8 parts per thousand (ppt)], mesohaline (8 to 18 ppt), polyhaline (18 to 30 ppt), and euryhaline (>30 ppt). The saltwater tidal action and freshwater inflows are primary factors in estuarine circulation and nutrient/waste removal. Strong wind events and freshwater tributaries can increase turbidity, reducing light penetration, and adversely effecting submerged vegetation and phytoplankton photosynthesis. Freshwater rivers and stream inflows provide this EFH organic matter, nutrients, and finer grained sediments, whereas ocean-driven tides

provide coarser sediments and a transport mechanism for estuarine-dependent species. The ocean waters within this EFH act as a temperature stabilizer that offsets seasonal temperature extremes that would reduce productivity and diversity in the shallow upstream waters. Salinity, temperature, dissolved organic matter, dissolved inorganic nitrogen, and oxygen are components normally used to characterize the estuarine water column. Other descriptors, such as adjacent structures (shoals, channels, and marshes), water depth, available fetch, and turbidity are used to further describe this EFH. The estuarine water column provides both migrating and residential species of varying life stages the opportunity to survive in a productive, active, unpredictable, and at times strenuous environment. As the transport medium for nutrients and organisms between the ocean and the upstream rivers and inland freshwater systems, the estuarine water column is as essential a habitat as any marsh, seagrass bed, or reef (SAFMC 2009). The proposed placement area is classified as estuarine with freshwater flows from the Brunswick River and oceanic flows from the Atlantic. There are a few tidal creeks along the placement area.

4.3. Open Waters/Unconsolidated Bottoms

Unconsolidated bottom is defined as all wetland and deep-water habitats with at least 25% cover of particles smaller than stones, and a vegetative cover less than 30% (Cowardin et al., 1985). Water regimens are restricted to subtidal, permanently flooded, intermittently exposed, and semi-permanently flooded. Diverse assemblages of benthic macroinvertebrates utilize these areas and serve as food sources for demersal fish species. The open water/unconsolidated bottom EFH is found within the proposed placement area in the Brunswick River.

4.4. Tidal Creeks

Small tidal creeks begin in upland areas of an ecosystem and drain into larger creeks to form connected networks of tidal systems. The creeks connect to form large network systems that eventually reach bays, harbors, or oceans. Tidal creeks provide critical nursery areas for many species of fish and invertebrates with ample amounts of food and protection, making them ideal nursery grounds (SCDNR 2012). Many Council- and NMFS-managed species including shrimp and snapper-grouper species have cyclic life cycles, where they enter the tidal creeks during their post-larval or young juvenile stage, mature for several months during a maturation season, and then move to progressively deeper water. When the high tide floods the beds of the marsh and tidal creeks, these animals have access to nutrient-rich marsh mud, while the dense growth of cord grass restricts entry of large predators (SCDNR 2012). On the outgoing tide, larger predators such as drums or seatrout wait at the mouths of the creeks feeding on the smaller organisms flushed out of the tidal creeks, providing a valuable food source to Council- and NMFS-managed species. Two tidal creeks are found within the proposed placement area along the Jekyll Island shoreline.

4.5. Oyster Reefs

Oyster reefs and shell banks are defined by SAFMC as being the “natural structures found between and beneath tide lines, which are composed of oyster shell, live oysters, and other organisms.” This habitat is usually found adjacent to emergent marsh vegetation and provides the other three-dimensional structural relief in soft-bottom, benthic habitat (Wenner et al., 1996). Optimal salinity for Crassostrea virginica ranges from 12ppt to 25ppt, and in Georgia the majority of reefs are intertidal. Oyster reefs are extremely important to the aquatic ecosystem as they remove particulate matter, release inorganic and organic nutrients, stabilize sediments, provide habitat cover and serve as both indirect (i.e., house macroinvertebrates) and direct food sources for various fish species. While the oyster reef EFH is not found in the placement area, there are a few small reefs, less than an acre, located south of the placement area. Highly productive oyster reefs and oyster beds are found north of the placement area in Clam Creek and north of the fishing pier and are popular recreational oystering sites.

4.6. Coastal Inlets

Sand splits, jetties, islets, tidal flats, shoals, and sandbars are often associated with costal inlets which themselves are restricted areas of intense ebb and flow tidal changes. Inlets are often the bottlenecked area where the currents of the ocean. Driven by tides, meet the freshwater flow from upland and upstream rivers, tidal creeks, and streams. Coastal inlets are areas of intense changes in energy caused by the daily tidal changes. Inlet habitats in the southeastern United States are frequently affected by waterway and beach nourishment projects. Coastal inlets provide protection and serve as nursery grounds for fish species. The coastal inlet EFH is found within the proposed placement area in the Brunswick River and St. Simon Sound.

5. Habitats Areas of Particular Concern (HAPC)

Habitat Areas of Particular Concern (HAPC) are a subset of EFHs that are rare, stressed by development, provide important ecological functions for federally managed species, or are especially vulnerable to anthropogenic (or human impact) degradation. HAPCs may include areas used for migration, reproduction, and development. HAPCs can include intertidal and estuarine habitats. The Magnuson-Stevens Act does not provide any additional regulatory protection to HAPCs. However, if HAPCs are potentially adversely affected, additional inquiries and conservation guidance may result during the NMFS EFH consultation (NMFS 2008).

The SAFMC has designated coastal inlets and state-designated areas serving as nursery grounds of Georgia and South Carolina as HAPCs for white, brown, and pink shrimp.

6. Managed Species and Essential Fish Habitat Use

6.1 Penaeid Shrimp and Relevant EFH

White, brown, and pink shrimp (penaeids) are managed by the SAFMC. The more common South Carolina/Georgia species is white shrimp.These and other managed species that may be found in the project area are listed in Table 5.

Environmental conditions are believed to primarily control shrimp population sizes even though fishing reduces the populations over the season. Shrimping is not thought to affect successive year totals, unless the reproduction stock is affected by environmental circumstances. Each species, due to their migratory nature and reproductive capability, are able to recover from a low population from one year to the next. The loss or degradation of saltmarsh nursery habitat for juvenile white and brown shrimp is one of the most serious threats (NCDENR, 2006) to southeastern United States stocks. All coastal inlets and respective nursery habitats are of particular importance to shrimp.

The brown and white shrimp species' lifecycles are similar in that adults reproduce offshore, and eggs are hatched into free-swimming larvae. Both species undergo 11 larval stages to produce post-larvae. Within the estuary, post-larval shrimp grow rapidly; however, the rate is salinity- and temperature-dependent (SAFMC 2004). These shrimp species utilize related habitats with minor differences in substrate and salinity partiality. Once reaching a sub-adult size of three to five inches, the shrimp migrate seaward. Juvenile and adult shrimp are omnivores, feeding mostly at night on benthic organisms, algae, and detritus. Daytime feeding may occur in turbid waters rich in mysids, amphipods, polychaetes, and various types of organic debris (SAFMC 2004, NCDENR 2006). As with brown shrimp, pink shrimp eggs are also demersal. Records suggest a larval period of 15 to 25 days. The mechanism by which post-larvae are brought from spawning areas to inside the estuaries is not well-known. Post-larvae move into estuaries during late spring and early summer. In the South Atlantic, the nursery areas utilized within the estuaries are primarily dominated by the marsh grass *Spartina alterniflora.*

Shrimp have separate sexes (dioecious); females grow larger and are able to reproduce in less than 12 months and can expel between 500,000 and 1,000,000 eggs in a single event. Adult brown shrimp spawn in deep ocean waters over the continental shelf, while white shrimp remain nearshore. Larvae and post-larvae depend on ocean currents for transportation through inlets into estuarine nursery grounds. River mouths and inlet entrances are particularly important to estuarine shrimp recruitment. The majority of estuarine shrimp are found near shallow wetland systems. White shrimp may use freshwater submerged vegetation to some degree. However, brown shrimp primarily utilize estuarine submerged vegetation because of salinity inclinations. The use of oyster beds by white and brown shrimp occurs and is considered crucial in the absence of submerged vegetation (NCDENR 2006). In North Carolina sounds/estuaries, juveniles and adult phases of pink shrimp appear in June and July, whereas, in the southern

portion of their range this occurs in April and May. Pink shrimp leave Florida estuaries within two to six months after having arrived as post larvae. Smaller pink shrimp may remain in the estuary during winter. Pink shrimp that survive the winter grow rapidly during late winter and early spring before migrating to the ocean.

NOAA's Estuarine Living Marine Resources (ELMR) database has identified shrimp species as being present (rare, common, abundant, or highly abundant) or not present for the "Tidal Fresh," "Mixing," and "Seawater" salinity zones in the St. Simons sound area (Table 7).

Table 7. Spatial Distribution and Relative Abundance of Penaeid Shrimp (Nelson et al. 1991).

		Southeast Estuaries- St. Andrew/St. Simon Sound		
		Tidal Fresh	**Mixing**	**Seawater**
White Shrimp ***P****enaeus setiferus*	**Adult**	**Not Present**	**Highly Abundant**	**Highly Abundant**
	Spawning Adult	**Not Present**	**Not Present**	**Not Present**
	Juveniles	**Not Present**	**Highly Abundant**	**Highly Abundant**
	Larvae	**Not Present**	**Common**	**Common**
	Eggs	**Not Present**	**Not Present**	**Not Present**
Brown Shrimp ***P****enaeus aztecus*	**Adult**	**Not Present**	**Abundant**	**Abundant**
	Spawning Adult	**Not Present**	**Not Present**	**Not Present**
	Juveniles	**Not Present**	**Abundant**	**Abundant**
	Larvae	**Not Present**	**Not Present**	**Not Present**
	Eggs	**Not Present**	**Not Present**	**Not Present**
Pink Shrimp *Penaeus duorarum*	**Adult**	**Not Present**	**Rare**	**Rare**
	Spawning Adult	**Not Present**	**Not Present**	**Not Present**
	Juveniles	**Not Present**	**Common**	**Common**
	Larvae	**Not Present**	**Not Present**	**Rare**
	Eggs	**Not Present**	**Not Present**	**Not Present**

White Shrimp

White shrimp are found along the Atlantic coast from New York to Florida. Spawning along the south Atlantic coast occurs from March to November, while May and June are reported as peak months. Spawning takes place in water ≥ 30 feet deep and within five miles of shore where they prefer salinities of ≥ 27 ppt (Muncy 1984). The increase in bottom water temperature in the spring is thought to trigger spawning. After the demersal eggs hatch, the planktonic post-larvae live offshore for approximately 15 to 20 days. During the second post-larval stage, they move inshore on tidal currents and enter estuaries two to three weeks after hatching. Shallow muddy bottoms in low to moderate

salinities are the optimum nursery areas for these benthic juvenile white shrimp. During this stage, the diet consists of zooplankton and phytoplankton. By June or July, the juveniles move to deeper creeks, rivers, and sounds. It has been documented that juvenile white shrimp tend to migrate further upstream than do juvenile brown shrimp; as far as 130 miles in nearby northeast Florida (Pérez-Fartante 1969). Juveniles prefer to inhabit shallow estuarine areas with a muddy, loose peat, and sandy mud substrate with moderate salinities. Juvenile white shrimp are benthic omnivores (e.g., fecal pellets, detritus, chitin, bryozoans, sponges, corals, algae, and annelids) and feed primarily at night. White shrimp usually become sexually mature at age one during the calendar year after they hatch. The emigration of sexually mature adults to offshore waters is influenced primarily by body size, age, and environmental conditions. Studies have shown that a decrease in water temperature in estuaries triggers emigration in the south Atlantic (Muncy 1984). During fall and early winter, the south-migrating white shrimp provide a valuable fishery in southern North Carolina, South Carolina, and Georgia. White shrimp are omnivores preferring soft-muddy bottoms in areas of expansive brackish marshes (SAFMC 2004). The life span of white shrimp usually does not extend beyond one year.

Brown Shrimp

Brown shrimp occur from Massachusetts to the Florida Keys and west into the Gulf of Mexico. They support an important commercial fishery along the south Atlantic coast, primarily in North and South Carolina. This species spawns in deep ocean waters during late winter or early spring. Larvae migrate from offshore to inshore areas as post-larvae (peak migration from February through April), frequently at night on incoming tides. Carried by currents and tides into estuaries, the larvae develop into post-larvae within 10 to 17 days. Once in the estuaries, post-larvae seek out the soft silty/muddy substrate common to vegetated and non-vegetated, shallow, estuarine environments. This environment yields an abundance of detritus, algae, and microorganisms that comprise their diet at this developmental stage. Post-larvae have been collected in salinities ranging from zero to 69 ppt with maximum growth reported between 18 degrees centigrade (°C) and 25°C, peaking at 32°C. Maximum growth, survival, and efficiency of food utilization have been reported at 26°C (Lassuy 1983). Juveniles develop in four to six weeks, continuing into rapid sub-adult development depending on salinities and temperatures. The density of post-larvae and juveniles is highest among emergent marsh and submerged aquatic vegetation (Howe et al. 1999, Howe and Wallace 2000), followed by tidal creeks, inner marsh, shallow non-vegetated water, and oyster reefs. The diet of juveniles consists primarily of detritus, algae, polychaetes, amphipods, nematodes, ostracods, chironomid larvae, and mysids (Lassuy 1983). Emigration of sub-adults from the shallow estuarine areas to deeper, open water takes place between May through August, with June and July reported as peak months. The stimulus behind emigration appears to be a combination of increased tidal height and water velocities associated with new and full moons. As individuals increase in size, they move to deeper and saltier waters of the inlets until exiting to the ocean in late fall. After exiting the estuaries, adults seek out deeper (60-foot) offshore waters. Brown shrimp are omnivores and prefer muddy and peat bottoms, but can be found on sand, silt, or clay mixed shell hash bottoms (SAFMC 2004, NCDENR 2006). Adults reach maturity in offshore waters

within the first year of life at 5.5 to 5.7 inches long. They have a maximum life span of 18 months (NOAA 2023b).

Pink Shrimp

Pink shrimp occur on the Atlantic Coast from Chesapeake Bay south to the Florida Keys and are most abundant in water depths of 11-37 m. Pink shrimp reach sexual maturity at about 85 mm total length. Spawning occurs during the early part of the summer at depths of 3.7 to 15.8 m. During the larval stages, development is dependent on food availability, water temperature and quality of habitat. Depending on the environmental conditions, the larval period can last from 15-25 days. Post-larval movement from the spawning areas to estuaries are not well known, although some literature suggests that wind conditions and current movements assist in transport from the estuaries to offshore habitats. Migration offshore occurs during May/June off the Georgia coast (SAFMC 2009).

Penaeid Shrimp EFH in the Project Area

Of the shrimp EFH listed in the 2008 NMFS Essential Fish Habitat: A Marine Fish Habitat Conservation Mandate for Federal Agencies, those that exist within the placement area include: intertidal flats, estuarine water column, tidal creeks, and coastal inlets. These EFHs provide transport, refuge, and feeding/developmental areas for post- larval, juvenile, and sub-adult penaeid shrimp. Tidal inlets and state-designated nursery areas are considered HAPCs for white, pink, and brown shrimp species.

Potential shrimp EFHs within the project footprint would include the adjacent Jekyll Island saltmarsh, intertidal mud flats, estuarine water column. The proposed project area is also abutting the coastal inlet HAPC for white, pink, and brown shrimp.

6.2 Snapper/Grouper Species Complex and Relevant EFH

Snapper/Grouper

Many deepwater snapper grouper species utilize both pelagic and benthic habitats during several stages of their life histories; larval stages of these species live in the water column and feed on plankton. Most juveniles and adults are demersal (bottom dwellers) and associate with hard structures like artificial reef structures, rocky hard-bottom substrates, ledges and caves, sloping soft-bottom areas, and limestone outcroppings). Juvenile stages of some snapper grouper species also utilize inshore seagrass beds, mangrove estuaries, lagoons, oyster reefs, and embayment systems. In many species, various combinations of these habitats may be utilized during daytime feeding migrations or seasonal shifts in cross-shelf distributions (Gore et al. 2013).

Gray Snapper

The project area is designated as EFH for the snapper grouper complex. Since there is

limited data on species in the southeastern estuaries, the gray snapper is used as a proxy for other estuarine dependent species (SAFMC, 1998). Gray snapper – a snapper species in the Lutianidae family- are one of the few estuarine dependent species in the snapper grouper complex (SAFMC, 1998). EFH for gray snappers ranges from shallow estuarine areas (e.g., vegetated sand bottom, mangroves, jetties, pilings, bays, channels, and mud bottom) to offshore areas (e.g., hard and live bottom, coral reefs, and rocky bottom) as deep as 300 feet (Allen, 1985; Bortone and Williams, 1986). Like most snappers, these species participate in group spawning, which indicates either an offshore migration or a tendency for larger, mature individuals to take residency in deeper, offshore waters. Both the eggs and larvae of these snappers are pelagic (Richards et al. 1994). After an unspecified period in the water column, the planktivorous larvae move inshore and become demersal juveniles. Juvenile Gray Snapper are euryhaline and occur at salinities from 0-37 ppt (SAMFC, 1998). The diet of these newly settled juveniles primarily consists of benthic crustaceans, but can also consume fish, mollusks, and polychaetes. Juveniles inhabit a variety of shallow, estuarine areas including vegetated sand bottom, bays, mangroves, finger coral, and seagrass beds. As adults, most are common to deeper offshore areas such as live and hardbottom, coral reefs, and rock rubble. However, adult gray snapper also inhabit vegetated sand bottoms but occur less frequently in estuaries and mangroves (Bortone and Williams, 1986). Data suggests that adults tend to remain in one area. The diet of adult gray snappers includes a variety of fish, shrimp, crabs, gastropods, cephalopods, worms, and plankton. This species is of commercial and/or recreational importance (Bortone and Williams 1986).

Since the Gray snapper is the only estuarine dependent species under the Snapper Grouper FMP in the ELMR data set, it is used as a proxy for other estuarine dependent species, such as gag grouper (SAFMC, 1998). EFH in the project area includes estuary emergent wetlands, unconsolidated bottom, and coastal inlets.

NOAA's Estuarine Living Marine Resources (ELMR) database has identified Gray snapper species as being present (rare, common, abundant, or highly abundant) or not present for the "Tidal Fresh," "Mixing," and "Seawater" salinity zones in the St. Simons sound area (Table 8).

Table 8. Spatial Distribution and Relative Abundance of Gray Snapper (Nelson et al. 1991).

Gray Snapper *Lutjanus griseus*	**Adult**	**Not Present**	**Not Present**	**Not Present**
	Spawning Adult	**Not Present**	**Not Present**	**Not Present**
	Juveniles	**Rare**	**Rare**	**Rare**
	Larvae	**Not Present**	**Not Present**	**Not Present**
	Eggs	**Not Present**	**Not Present**	**Not Present**

Snapper/Grouper Complex EFH in Project Area

EFH for the grouper/snapper complex species discussed above include the estuarine water column, intertidal flats, coastal inlets, and unconsolidated bottom. These habitats

provide migration, refuge, and feeding/developmental areas for post-larval, juvenile, and/or adults of these species. Furthermore, Georgia and South Carolina tidal inlets, state-designated nursery areas, and oyster/shell bottoms are considered HAPCs for the grouper-snapper complex; however, there are no HAPCs for the snapper/grouper complex within the project footprint (NMFS 2008).

6.3 Coastal Migratory Pelagics and Relevant EFH

The coastal migratory pelagic (CMP) species are jointly managed by the Gulf of Mexico and the South Atlantic Fishery Management Councils. The area of management is from the Mexico/Texas border to New York. The mackerels in this management unit are often referred to as scombrids. The family Scombridae also includes tunas, mackerels, and bonitos. They are among the most important commercial and sport fishes. The habitat of adults in the coastal pelagic management unit is the coastal waters out to the edge of the continental shelf in the Atlantic Ocean. Within the area, the occurrence of coastal migratory pelagic species is governed by temperature and salinity. These species are seldom found in water temperatures less than 20°C. Salinity preference varies, but these species generally prefer high salinity, less than 36 ppt (Gore et al. 2013).

Information captured in the NOAA's Estuarine Living Marine Resource Program (ELMR) emphasized the importance and essential nature of estuarine habitat to all life stages of spanish mackerel (SAFMC 1998).

Spanish Mackerel

The Spanish mackerel is important both commercially and recreationally. The Atlantic States Marine Fisheries Commission (ASFMC) and the SAFMC cooperatively manage Spanish mackerel, a member of the Scombridae family. Spanish mackerel management has resulted in a steady stock abundance increase since 1995; and based on 2002/2003 data, the population is not over-fished. Spanish mackerel are found within the coastal waters of the eastern United States and the Gulf of Mexico. NOAA's Estuarine Living Marine Resource Program, a cooperative effort of the National Ocean Service and NMFS, compiles regional information on estuarine habitat by select marine fish and invertebrates. The accumulated data emphasize the essential nature and extreme importance that estuarine habitats have on Spanish mackerel life stages (**Nelson et al. 1991**).

Smaller than its congener the king mackerel (but have been reported to reach three feet in length), the Spanish mackerel's average adult weight is two to three pounds. Spanish mackerel are a fast- growing species, and both sexes are capable of reproduction by the second or third year (Mercer et.al. 1990). They have a life span of five to eight years (ASMFC 2009). Spanish mackerel form immense, fast-moving, and surface- feeding schools of comparable-sized individuals. The diet of scombrids consists primarily of fish and, to a lesser extent, penaeid shrimp and cephalopods. The fish that make up the bulk of their diet are small schooling clupeids [e.g., Atlantic menhaden, alewives (*Alosa pseudoharengus*), Atlantic thread herring (*Opisthonema oglinum*), anchovies],

atherinids, and to a lesser extent jack mackerels (*Trachurus symmetricus*), snappers, grunts (H*aemulidae* sp.), and half beaks (*Hemiramphidae* sp.) (Collette and Nauen, 1983). Shrimp and jellyfish have also been reported in stomach contents (Mercer et.al., 1990).

As ocean temperatures warm, Spanish mackerel seasonally migrate along the western Atlantic coast. With increasing water temperatures, Spanish mackerel move northward from Florida to Rhode Island between late February and July and return in the fall (Collette and Nauen, 1983). Spanish mackerel spawn in groups over the inner continental shelf, and spawning takes place May through September with peaks in July and August. Batch spawning takes place, frequently inshore. Females grow faster and larger than males; and by age two, females may release up to 1.5 million eggs (Mercer et al., 1990). The eggs are pelagic and hatch into planktonic larvae. Larvae grow quickly and may be found inshore at shallow depths less than 30 feet. There are indications of vertical larval migration during night-time hours (Mercer et al. 1990). Spanish mackerel are dependent on estuaries during larval and juvenile life stages (SAFMC, 1998). Juveniles use estuaries as nursery areas. The continental shelf, tidal estuaries, and coastal waters are all habitats for adult Spanish mackerel. However, adults spend most of their life in the open ocean; but can be found over deep reefs, grass beds, and estuarine shallows (ASMFC 2009). Their distribution is considered primarily dependent on water salinity and temperature (ASMFC, 2009; Mercer et al.1990).

NOAA's Estuarine Living Marine Resources (ELMR) database has identified Spanish mackerel species as being present (rare, common, abundant, or highly abundant) or not present for the "Tidal Fresh," "Mixing," and "Seawater" salinity zones in the St. Simons sound area (Table 9).

Table 9. Spatial Distribution and Relative Abundance of Spanish Mackerel (Nelson et al. 1991).

Spanish Mackerel	**Adult**	**Not Present**	**Common**	**Common**
	Spawning Adult	**Not Present**	**Not Present**	**Not Present**
Scomberomorus maculatus	**Juveniles**	**Not Present**	**Common**	**Common**
	Larvae	**Not Present**	**Not Present**	**Not Present**
	Eggs	**Not Present**	**Not Present**	**Not Present**

Coastal Pelagic Species EFH in the Project Area

Coastal migratory pelagic species depend on estuarine systems for various life stages. Spanish mackerel juveniles depend on estuarine habitats. Estuarine EFHs provide transport, refuge, and feeding grounds, as well as developmental areas. Many important prey species for coastal pelagics are associated with estuarine areas. As the transport medium for nutrients and organisms between the ocean and inland freshwater systems, the estuarine water column is a very important essential habitat, and emergent saltmarshes provide important refuge and foraging grounds. There is estuarine habitat in the

placement area for coastal pelagic species.

6.4 Other Managed Species

Other managed species like highly migratory species and those in the summer flounder, scump, and black sea bass fisheries, include those listed in Table 5. Of these species, sharks and summer flounder are the most likely to use EFHs in the project area.

Summer Flounder

The summer flounder's range includes shallow estuarine and outer continental shelf waters from Nova Scotia to Florida and the northern Gulf of Mexico (NEFSC 1999). Summer flounder display intense seasonal inshore/offshore migration patterns. From late spring through early fall, summer flounder are concentrated in estuaries and sounds until migrating to the offshore outer continental shelf wintering grounds (NEFSC 1999, ASMFC 2009). During fall and early winter, offshore spawning occurs and the larvae are carried by wind currents into coastal areas. Most larvae and juvenile development occurs principally within the estuaries and sounds. Most individuals are sexually mature at age two. Growth rates and maximum ages vary substantially between sexes; adult females routinely grow larger and older than males (NEFSC, 2009).

Summer flounder will begin spawning at age two or three. Summer flounder eggs are pelagic, buoyant, and most plentiful between Cape Cod and Cape Hatteras. The eggs are spherical with a transparent rigid shell, and the yolk occupies approximately 95 percent of the egg volume (ASMFC 2009). Larval free feeding is initiated once the yolk-sac material is consumed, which is a function of the incubation temperature (NEFSC, 1999).

The left-eyed flatfish begin with eyes on both sides of its body; the right eye migrating to the left side in 20 to 32 days post-emergence. Larvae migrate to inshore coastal areas from October to May where they burrow into the sediment and develop into juveniles. Late larval and juvenile summer flounder are active predators, preying on crustaceans, copepods, and polychaetes. Research indicates that appendages of benthic fauna are an important food source for post-larval summer flounders (NEFSC, 1999). Burrowing behavior is influenced by predator and prey abundance, salinity, water temperature, tides, and time of day. Juveniles inhabit marsh creeks, mud flats, and seagrass beds; but prefer primarily sandy shell substrates. Juveniles often remain inshore for 18 to 20 months. Males reach maturity at approximately ten inches; while females reach maturity at approximately 11 inches (NEFSC, 1999; ASMFC, 2009).

Adults primarily inhabit sandy substrates, but have been documented in seagrass beds, marsh creeks, and sand flats. Summer flounders are quick, opportunistic predators that ambush their prey, making use of a well-developed dentition. Their camouflage and bottom positioning allow for efficient predation on small fish and squid; crustaceans make up a large percentage of their diet (ASMFC, 2009; NEFSC, 1999). Adults are active during daylight hours and normally inhabit shallow, warm, coastal estuarine

waters before wintering offshore on the outer continental shelf. Some research suggests that some older individuals may remain offshore year-round (NEFSC, 1999).

NOAA's Estuarine Living Marine Resources (ELMR) database has identified Summer flounder as being present (rare, common, abundant, or highly abundant) or not present for the "Tidal Fresh," "Mixing," and "Seawater" salinity zones in the St. Simons sound area (Table 10).

Table 10. Spatial Distribution and Relative Abundance of Summer Flounder (Nelson et al. 1991).

		Southeast Estuaries- St. Andrew/St. Simon Sound		
		Tidal Fresh	**Mixing**	**Seawater**
Summer Flounder	**Adult**	**Not Present**	**Rare**	**Rare**
	Spawning Adult	**Not Present**	**Not Present**	**Not Present**
Paralichthys dentatus	**Juveniles**	**Not Present**	**Abundant**	**Abundant**
	Larvae	**Not Present**	**Common**	**Common**
	Eggs	**Not Present**	**Not Present**	**Not Present**

Other Managed Species EFH in the Project Area

Potential EFH locations for the species discussed above include estuarine water column, unconsolidated bottoms, tidal creeks, and coastal inlets. Sharks may utilize any of the EFHs in the project area, especially for foraging. Their use of tidal areas may be limited based on size of individuals and high tide water depths. Summer Flounder utilize the EFH in the project area during the juvenile and larval life stages as important nursery habitats. As adults, summer flounder utilize the EFH as important foraging grounds and habitat during warmer months. Table 11 provides the other potential managed species within the project area.

Table 11. Managed species potentially located within the project area.

Common Name [1]	Scientific Name	Management Plan Agency [2]	Fishery Management Plan (FMP) [4]	Life Stage in EFH [3]	Marine Water Column
Brown shrimp	*Farfantepenaeus aztecus*	SAFMC	Shrimp	P,J,A	L, A
White shrimp	*Lytopenaeus setiferus*	SAFMC	Shrimp	P,J,S	L, A
Pink shrimp	*Farfantepenaeus duorarum*	SAFMC	Shrimp	P, J, S	L, A
(HAPC FOR SHRIMP: Tidal inlets, state-designated nursery and overwintering habitats) [5]					
Gray snapper	*Lutjanus griseus*	SAFMC	Snapper Grouper	P,J,A	
Cobia	Rachycentron canadum	SAFMC	CMP	L,P,J,A	A
Spanish mackerel	Scomberomorus maculatus	SAFMC	CMP	J	A

Bluefish	*Pomatomus saltatrix*	MAFMC	Bluefish	J,A	
Atlantic sharpnose shark	*Rhizoprionodon terraenovae*	NMFS	HMS	J	A
Blacknose shark	*Carcharhinus acronotus*	NMFS	HMS	J	A
Blacktip Shark	*Carcharhinus limbatus*	NMFS	HMS	J	A
Bonnethead shark	*Sphyma tiburo*	NMFS	HMS	J	A
Bull shark	*Carcharhinus leucas*	NMFS	HMS	J	A
Finetooth shark	*Carcharhinus isodon*	NMFS	HMS	J,A	A
Lemon shark	*Negaprion brevirostris*	NMFS	HMS	J,A	A
Sandbar shark	*Carcharhinus plumbeus*	NMFS	HMS	J	A
Scalloped hammerhead	*Sphyrma lewini*	NMFS	HMS	J	A
Spinner shark	*Charcharhinus brevipinna*	NMFS	HMS	J,A	A
Summer flounder	*Paralichthys dentatus*	NMFS	SF,S, BSB	J, L	
Tiger shark	*Galeocerdo cuvier*	NMFS	HMS	J, A	

Notes:
[1]. These EFH species were based on species lists from SAFMC 2008.
[2]. Fishery Management Plan (FMP) Agencies: SAFMC = South Atlantic Management Council; MAFMC = Mid- Atlantic Fishery Management Council; NMFS = National Marine Fisheries Service.
[3]. Life stages include: E = Eggs, L = Larvae, N = Neonate, P = Post-Larvae, J = Juveniles, S = Sub-Adults, A = Adults
[4] Fishery Management Plans: CMP = Coastal Migratory Pelagics; HMS = Highly Migratory Species, SF, S, BSB = Summer Flounder, Scup, and Black Sea Bass
5. HAPC = Habitat Areas of Particular Concern; if not listed for certain fishery management plans, appropriate HAPC for respective species is not found in the project area or vicinity.

7. Assessment of Impacts

In this section, potential impacts to EFH as well as to managed species within the action area are evaluated. Impacts to managed species is focused on the following diagnostic species: penaeid shrimp, gray snapper, and summer flounder. Diagnostic species are used because of similarities in environmental conditions and preferences among different species. The chosen diagnostic species can be used to predict impacts to similar species in the area.

7.1 Potential Effects to EFH

Direct placement of Dredged Material for Shoreline Nourishment

The Corps evaluation of impacts from direct placement of material for shoreline stabilization are summarized below.

Intertidal Flats

The proposed project will place fill in areas of Jekyll Island's intertidal flats burying some organisms while others more motile will likely avoid and survive the dispersal event. Impacts to intertidal areas are expected to be temporary and minor in nature. Approximately 2 acres of intertidal habitat will be impacted by initial and future

placements. Although intertidal areas will experience some negative effects the habitat will increase in size due to the fill placement resulting in an overall benefit. The additional fill will provide substrate for intertidal flat habitat, and according to Wilber and Clarke 2007, it is expected that species will colonize the new fill and be comparable to other nearby intertidal habitats within two years of construction.

Estuarine Water Column and Coastal Inlets

Placement of sediment for shoreline nourishment will cause short-term and minor impacts to turbidity within the estuarine water column and coastal inlets. Material placement-generated turbidity plumes are limited to an area only a few hundred feet to a few thousand feet and most turbidity settles out quickly once material placement is complete (2020 SARBO Section 3.1.1.2, p.96). There would be only short-term and minimal effects from turbidity because sediment being proposed for placement activities is mostly sand and the expected construction duration is 30 days. Due to the sediment being coarse-grained material, it will settle out quickly and not result in long lasting turbidity plumes. In a study conducted in the Savannah Harbor, it was found that after construction ends increases in total suspended solids (TSS) are negligible within 12 to 24 hours (Gailani et al. 2003).

Short-term increases in turbidity will not have a measurable effect on the water temperature or dissolved oxygen concentrations. Turbidity plumes would occur during placement of sediment and would quickly dissipate. No permanent or temporary impacts or changes in temperature, dissolved oxygen levels, salinity or pH would occur within the St. Simons Sound or Brunswick River as a result of turbidity plumes from the placement activities (Section 3.1).

Unconsolidated Bottom

The proposed footprint for the shoreline nourishment is in a very dynamic system. Between the years of 2005 and 2017, as shown in Figure 1, the proposed placement site for restoration experienced erosion resulting from the dynamic nature of the river flows and effects from the pier placement. Current trends, as seen in Google Earth images, have shown a pattern of erosion and loss of habitat over time, with an average rate of 2 m/yr, according to shoreline calculation changes using the Georgia Wetland Restoration Access Portal (G-WRAP). The proposed placement activities associated with the project are designed to provide additional sediment to the system to enhance/restore that lost habitat.

The amount of unconsolidated bottom that would be impacted by the proposed placement activities would be temporary and because no hardening measures will be in place the sediment will be allowed to move within the river system during normal tidal cycles. Early successional benthic organisms would rapidly colonize the placement footprint. Through primary and secondary succession, the reestablishment of the existing benthic communities or capacity of EFH will occur slowly over years as the placed material continues to erode. It is expected that species would colonize from abundant adjacent habitat (McCall, 2012).

The amount of unconsolidated bottom that will be temporarily impacted by the shoreline nourishment will account for much smaller percentage of the total area supporting this EFH type within the study area. Approximately 30 acres of unconsolidated bottom may be temporarily impacted from initial and future placements for shoreline nourishment. The abundance of habitat adjacent to the proposed placement area will be available for species to use, therefore, the predicted temporary impacts from placement will have minor long-term (approximately 2 years) impacts to this EFH or dependent species.

Tidal Creeks

In these habitats, coarser-grained sediments, saline waters, and migrating organisms are introduced from the ocean, while finer grained sediments, nutrients, organic matter, and fresh water are input from rivers and tidal creeks. The proposed placement of the material is adjacent to the inflow/outflow points of a tidal creek; however, two buffer areas will be set at lower elevations to ensure continued tidal fluxes of organic material and nutrients The tidal creeks may experience increased sediment loading in the mouth of the creeks. It is expected that this impact will be temporary; the hydrology of the creeks and high flows during precipitation events flush the system of the extraneous sediment. Impacts to creeks may occur during the estimated 30 days of construction and 15-30 days after construction completion. The tidal creek habitat may experience long-term benefits from additional shoreline protection from the proposed action due to reduced erosion.

An Escoffier curve analysis was conducted to examine the stability of the existing tidal creeks and of the creeks once the project has been constructed. Escoffier curve analysis uses a diagram that plots in-situ flow velocity and the channel equilibrium velocity against the inlet equilibrium cross sectional flow area (Figure 7). Firstly, for an inlet to remain open, the in-situ velocity in the inlet channel must be greater than the equilibrium velocity calculated by the empirical relationship between the tidal prism and channel area. Hume (1991) developed the relationship between channel area (A) and tidal prism (P) for estuaries, whereby $A = 4.37x10^{-4} * P^{0.915}$, and was used for this study. The tidal prism for the two creeks within the adjacent Jekyll Island marsh were calculated based upon the tidal range and marsh area. The Channel Equilibrium Area (CEA) PC Program was used to calculate the tidal prism in relation to the tide range and the marsh area that is inundated at mean high water (MHW) associated with both creeks. The CEA program determines the minimum cross-section for a coastal inlet. For a given inlet or creek scenario, an analytical 1-D model is used to calculate inlet hydraulics. This information is combined with a tidal prism-minimum channel area relationship using the channel stability concept of Escoffier to determine the minimum equilibrium area. The tidal prism for the two adjacent creeks was $5.8x10^5$ cubic feet.

Positions B and D on the curve in Figure 7 represent unstable and stable equilibrium, respectively. If the channel area and in situ velocity is plotted at position B, the inlet will close owing to friction and sediment deposition in a channel too narrow to support inlet development. If the channel area and in situ velocity is plotted at position D, the inlet will remain open and stable because the flow velocity, bed stress and channel area are

in dynamic equilibrium. Any change in a hydraulically stable creek that changes the cross-sectional area out of its natural equilibrium size will result in a change in channel velocity that will force the inlet to return to equilibrium through scour (Duong et al., 2012). Table 12 provides comparisons of the equilibrium channel area and velocity of the creeks without and with shoreline nourishment.

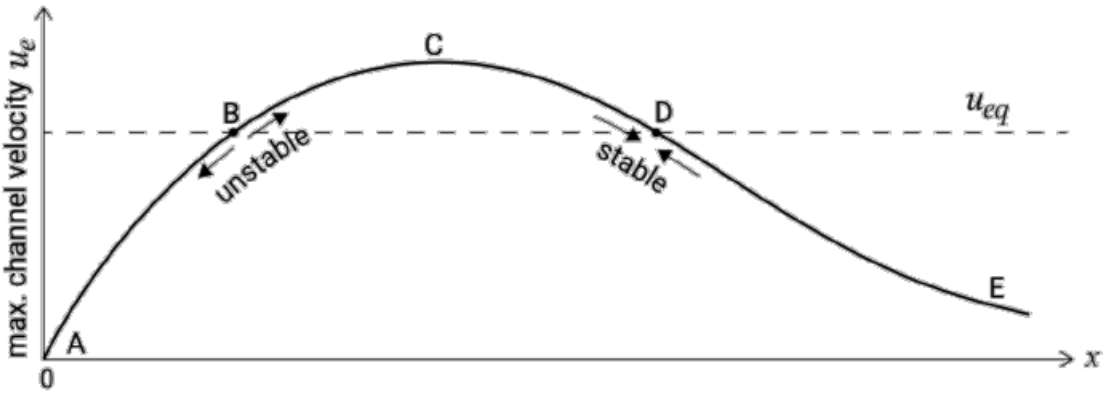


Figure 7. Escoffier curve analysis plots maximum channel velocity (y-axis) against cross sectional flow area (x-axis).

Table 12. Equilibrium channel area and velocity calculations for the tidal creeks without and with shoreline nourishment.

	Equilibrium Channel Area	Channel Velocity
Without Shoreline Nourishment	2.56 m^2	0.43 m/s
With Shoreline Nourishment	2.57 m^2	0.44 m/s

According to the Escoffier curve diagram, the current existing conditions of the two tidal creeks are hydraulically stable. With shoreline nourishment, the creeks remain hydraulically stable according to the Escoffier curve diagram whereby the calculated channel velocity (0.4 m/s) and the equilibrium channel area (2.6 m^2) falls close to point D along the curve (Figure 8). The only significant difference between with and without project calculations were that the peak calculated velocities decreased with project owing to additional friction from the placement of sediments, however, the with-project velocities exceed the equilibrium maximum velocity. As the channel width decreases, the channel velocity increases, and sediment erosion will increase until the creeks reach equilibrium between channel area and flow velocity once again after placement. Intermittent closure of the creeks may occur during placement, but it is expected that the tidal prism will be large enough to re-open the creeks with normal tidal flows. Precipitation inputs will also provide additional volume flow, which will be expressed as an increased ebb velocity to further suspend and erode any deposited material from the channels as a result of placement. Therefore, this EFH may experience minor impacts until a few tidal cycles or precipitation event restores natural flows. As part of adaptive management, JIA will provide monitoring post-construction and has proposed to provide labor using handheld equipment to remove sediment and maintain flow in the tidal

creeks should natural tidal and precipitation events be insufficient in providing flushing of sediment from the tidal creek.

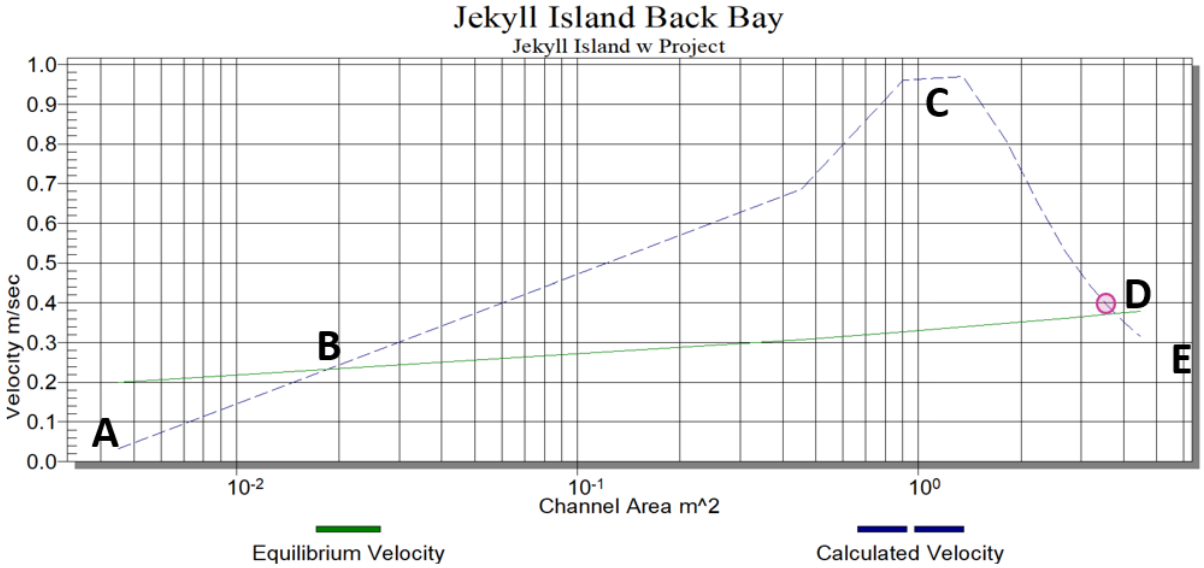


Figure 8. Escoffier curve analysis for the tidal creeks with shoreline nourishment.

Oyster Reefs

Oyster reefs and live oyster beds located south of the placement area may experience indirect effects from sediment movement from the site during construction and long-term from natural processes. Direct impacts are not anticipated as the project specifications include the provision of no direct placement on live oyster reefs.

The indirect impacts may occur from sedimentation from placement-generated turbidity plumes during construction. The plumes will settle out quickly and increases in TSS are negligible within 12 to 24 hours (See Section 3.1). Throughout their range, oysters occur in naturally turbid environments and have adapted a filtering mechanism for inorganic particulates. Oysters filter and reject the inorganic particulates through production of pseudofeces (Wilber and Clarke, 2010). The filtration rate of oysters is similar under the optimal temperature range of approximately 62°F to 86°F (Casas et al. 2018). The average annual water temperature on the coast in Jekyll Island is 70°F, by the seasons: in winter 59°F, in spring 66°F, in summer 81°F, in autumn 76°F. Minimum water temperature (55°F) in Jekyll Island happens in February, maximum (85°F) in August. Therefore, the filtration rate of the oysters near Jekyll island would be expected to be similar year- round and can filter suspended solids due to adjacent placement activities. As oysters are adapted to naturally turbid environments and temperatures year-round in Jekyll are generally within optimal range for filtration, impacts would be similar regardless of the time of year placement could occur. It is expected that the turbidity plumes generated during placement would have negligible temporary impacts to oyster reef EFH in the project vicinity. The highly productive oyster reefs located to the north of the placement site would not be expected to be indirectly impacted as turbidity levels from placement would attenuate and be similar to background levels.

Long-term indirect impacts from sediment movement from the site are expected to be negligible, as the coarse sand material is expected to migrate slowly over time from the site in response to the natural processes such as wind wave action, precipitation events and tidal flows, as described in Section 3.1. Long-term migration of the sediment is primarily anticipated to occur southward and would not impact the highly productive oyster reefs located north of the site. Given the slow migration of the coarser material southward, it is not anticipated that this sedimentation would be at rate that would affect the oyster's natural filtration of inorganics.

Additionally, the extent of the oyster reefs adjacent to the placement site are minimal compared to the amount of oyster reef habitat to the north and further south of the placement site. Overall, the predicted temporary indirect impacts from placement will have minor impacts to this EFH.

7.2 Potential Effects to Managed Species

Effects to Penaeid Shrimp Species

EFH-HAPCs for brown, pink and white shrimp include coastal inlets (SAFMC, 2009). Over-wintering areas and nursery habitats inside inlets are also important. The project area includes productive estuarine habitats that may be used by brown and white shrimp, such as emergent marsh, unvegetated bottom, and oyster beds. Localized temporary turbidity would occur during placement activities. This could potentially have adverse effects on shrimp physiology and behavior. However, the locations being proposed placement activities are in already naturally turbid environments and due to the high sand content of the material being proposed for placement activities, turbidity levels will return quickly back to background levels after construction efforts are completed. In addition, the food-base of shrimp within the potential project footprint would likely be affected by changes in water quality. However, the food-base would recover rapidly as water quality rebounds quickly following construction. Individuals would likely forage in adjacent areas that have not been physically affected.

Effects to Snapper Grouper Complex

The project area includes estuarine resources that may be used by snapper species and their prey. Adult, juvenile, and post-larval snapper may be directly taken through filling effects. Productive estuarine marshes and benthic habitat, particularly useful for snapper foraging and refuge for young, would be indirectly impacted. The project would potentially cause localized turbidity from suspended materials, which would be minor and temporary. More developed and mobile life stages would migrate to other suitable area habitats avoiding localized construction, but adjacent habitats to the placement location may still be temporarily affected by changes in turbidity. There is abundant similar adjacent habitat around the Brunswick River. These factors and any changes in prey fish populations would potentially cause temporary affects to the health and condition of juvenile and adult snapper in the area; however, because these fish have the ability to migrate away from the placement activities, the effects of any turbidity

plumes, which are transient and temporary, would be minimal. Overall impacts associated with the proposed placement activities to the grouper-snapper complex would occur only during construction activities and would be temporary and minor in nature.

Effects to Coastal Migratory Pelagics

Juvenile and adult individuals of the coastal migratory pelagic species complex, like spanish mackerel, utilize estuarine habitats in the project area. Estuarine marshes and other inlet habitats are particularly important for feeding and refuge/development. Developmental areas and dredging effected prey species would be indirectly affected by the project. More developed and mobile life stages would migrate to other suitable area habitats avoiding localized construction, but adjacent habitats to the placement location may still be temporarily affected by changes in turbidity and circulation patterns. These factors and any changes in prey fish populations would potentially cause temporary affects to the health and condition of mackerel in the area. However, because these fish have the ability to migrate away from the placement activities, the effects of any turbidity plumes, which are transient and temporary, would be minimal. Overall impacts associated with the proposed placement activities to the coastal migratory pelagic complex would occur during construction activities and would be temporary and minor in nature.

Effects to Other Managed Species

Other managed species potentially using the project area include summer flounder during almost all their life stages. For these species, foraging and other behaviors may be altered as a result of placement activities. However, summer flounder are opportunistic feeders and can adapt their diet based on the availability of prey (MAFMC 2002). Indirect effects on summer flounder may result if prey habitat is removed or prey populations decline in the project area. However, these migratory species are likely to move to another area where suitable prey would be found, or the species would adapt their diet. There is abundant similar adjacent habitat around the Brunswick River. In addition, because summer flounder have the ability to migrate away from the placement activities, the effects of any turbidity plumes, which are transient and temporary, would be minimal. Summer flounder located in the tidal and intertidal marshes are not likely to be affected as placement will not directly impact tidal and intertidal marshes in the long-term. Sediment migration is expected to be gradual, and the adverse impacts to tidal creek habitats are expected to be minor. The tidal creeks within the adjacent marsh are expected to experience tidal and precipitation flushing of any dredged material that may migrate into the creeks (see Section 7.1, Tidal Creeks). Therefore, overall impacts associated with the proposed placement activities to the managed species within the action area would only occur during construction activities and would be temporary and minor in nature. JIA would perform post construction monitoring and would provide labor and use of handheld equipment to remove sediments in the event that tidal creek flows are negatively impacted by the migration of dredged sediment upstream beyond the ability for natural tidal and precipitation

forces to reopen the creeks.

8. Summary of Effects and Determination

The proposed project would have potential direct and indirect effects on EFH, managed species, and habitat associated with managed species. During placement construction activities, there will be some direct and indirect effects to intertidal flats, estuarine water column, open waters/unconsolidated bottom, tidal creeks, oyster reefs, and coastal inlet habitats.

Species and habitats associated with EFH are typically affected temporarily when placement activities occur. Overall impacts associated with the proposed placement activities to shrimp species, the grouper-snapper complex, coastal migratory pelagics, and other managed species, would occur only during construction activities and would be temporary and minor in nature. These species have the ability to migrate to other adjacent habitat to avoid direct impacts like construction and turbidity. Indirect placement impacts such as reduced water quality due to temporary increases in turbidity levels for activities such as feeding or spawning may also occur however these impacts would be short-term (within 12-24 hours) and minor in nature as the St. Simons Sound and the Brunswick River is a naturally turbid area due to tidal influences. Once placement activities are completed, any turbidity will quickly dissipate given the riverine/tidal currents. Short-term increases in turbidity will not have a measurable effect on the water temperature or dissolved oxygen concentrations.

Placement of dredged material may temporarily impact infaunal and bottom-dwelling organisms (*e.g.,* invertebrate prey species) at the site by temporary minor sediment deposition from turbidity plumes, or forcing mobile animals (*e.g.,* benthic oriented fish species) to migrate from the area. However, natural disturbances are common in coastal environments so faunal communities are resilient to many kinds of periodic disturbances. Recovery is normal for healthy saltmarsh habitats if the disturbance event is under the critical threshold and if there are adjacent unaffected habitats that can serve as a source for colonists (McCall, 2012). This impact would be minor and long-term (approximately 2 years); however, these effects are balanced with the benefits that BU provides to species and the overall system.

Based on the analysis above, the Corps has determined that the proposed action would not cause significant adverse impacts to EFH and managed species located within the action area. Impacts to EFH and managed species that use this habitat would be temporary and minor in nature and do not reduce either the quality or quantity of EFH in the project area or vicinity. The Corps has used the best scientific and commercial data available to complete this analysis.

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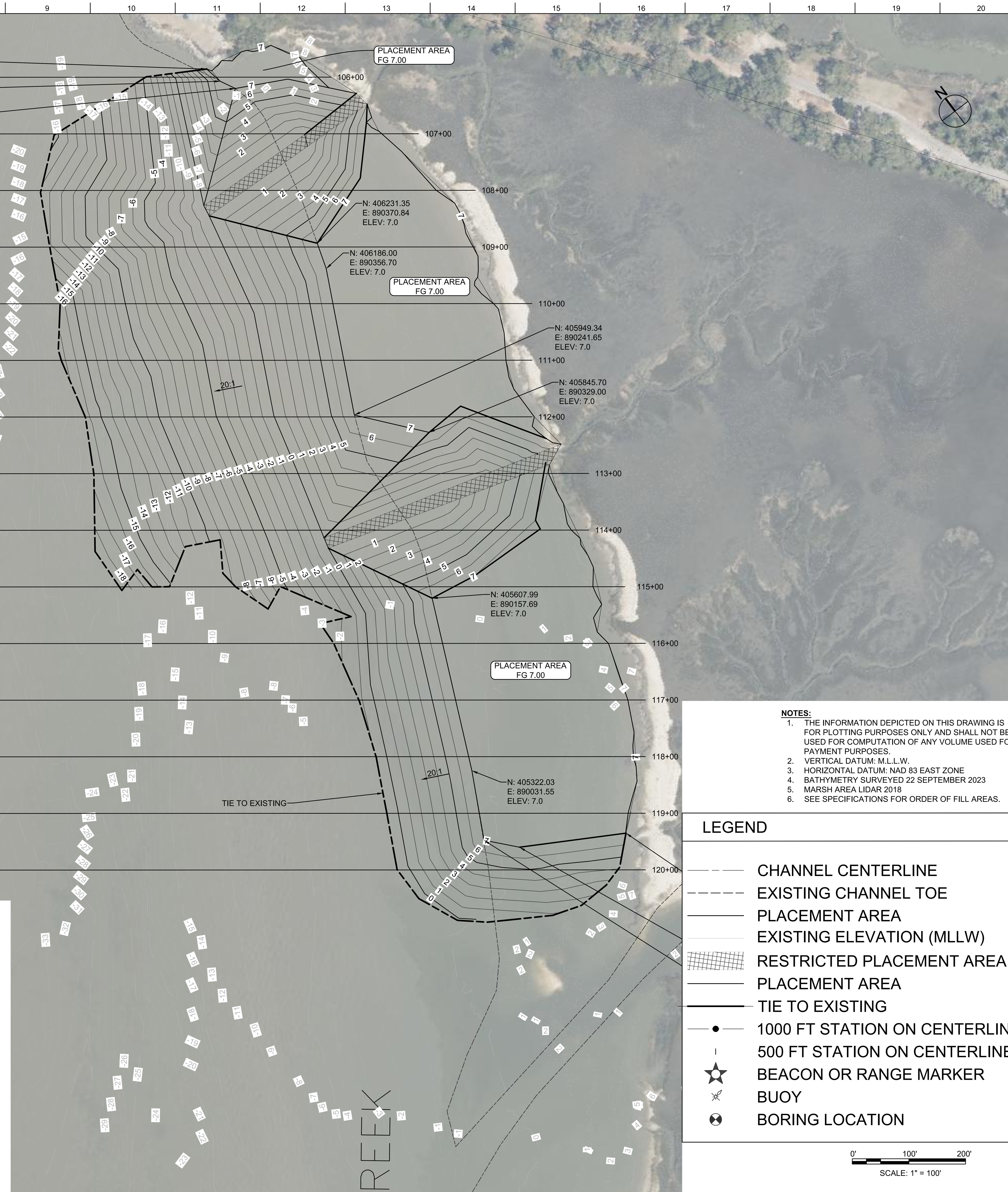
Attachment 1:
Jekyll Island Fishing Pier Shoreline Nourishment 60% Design



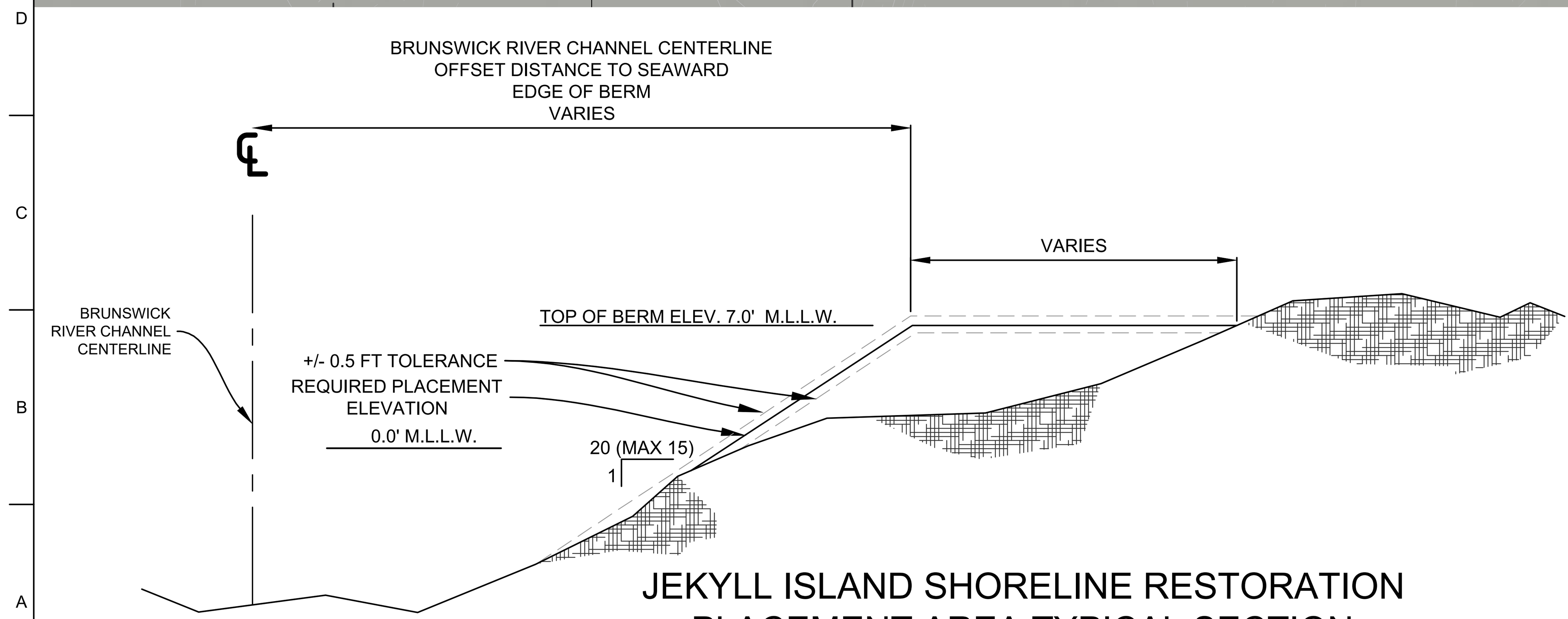
NOTES:

1. THE INFORMATION DEPICTED ON THIS DRAWING IS FOR PLOTTING PURPOSES ONLY AND SHALL NOT BE USED FOR COMPUTATION OF ANY VOLUME USED FOR PAYMENT PURPOSES.
2. VERTICAL DATUM: M.L.L.W.
3. HORIZONTAL DATUM: NAD 83 EAST ZONE
4. BATHYMETRY SURVEYED 22 SEPTEMBER 2023
5. MARSH AREA LIDAR 2018
6. SEE SPECIFICATIONS FOR ORDER OF FILL AREAS.

LEGEND

- CHANNEL CENTERLINE
- EXISTING CHANNEL TOE
- PLACEMENT AREA
- EXISTING ELEVATION (MLLW)
- RESTRICTED PLACEMENT AREA
- PLACEMENT AREA
- TIE TO EXISTING
- 1000 FT STATION ON CENTERLINE
- 500 FT STATION ON CENTERLINE
- BEACON OR RANGE MARKER
- BUOY
- BORING LOCATION

0' 100' 200'
SCALE: 1" = 100'



JEKYLL ISLAND SHORELINE RESTORATION
PLACEMENT AREA TYPICAL SECTION
NOT TO SCALE

US Army Corps of Engineers®

MARK	DESCRIPTION	DATE

DESIGNED BY: E. WORTMAN
DRAWN BY: E. WORTMAN
CHECKED BY: L. WILLIAMS
SUBMITTED BY: J. LAVECCHIA
SIZE: ANSI D

ISSUE DATE: OCTOBER 2023
SOLICITATION NO.: -
CONTRACT NO.: -
CATEGORY CODE: CWK0635

U.S. ARMY CORPS OF ENGINEERS
SAVANNAH DISTRICT
100 W. OGLETHORPE AVE.
SAVANNAH, GA 31401

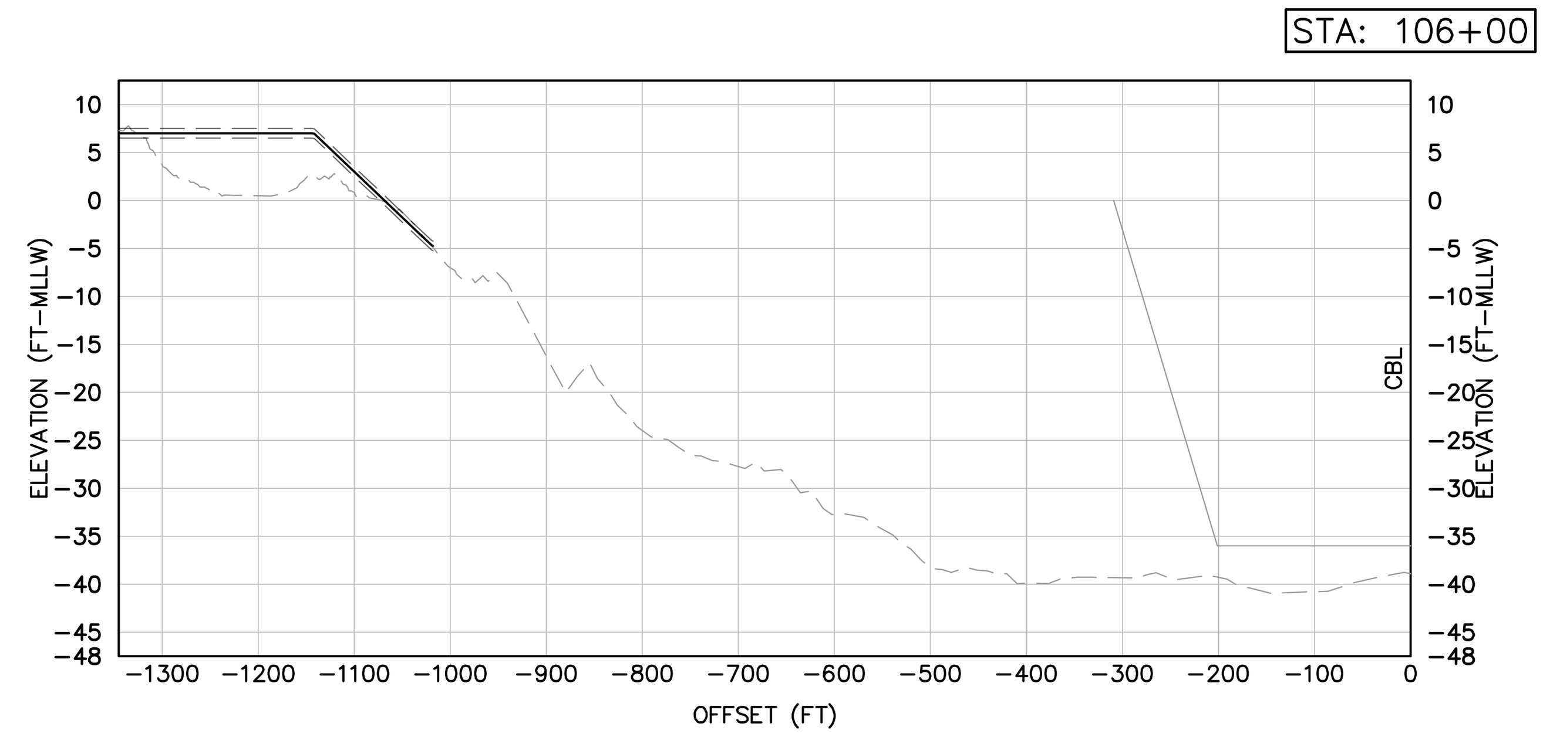
GLYNN COUNTY, GEORGIA
BRUNSWICK HARBOR MODIFICATION PROJECT
FY24

SHORELINE RESTORATION PLACEMENT AREA

SHEET ID
CB103

60% SUBMITTAL (NOT FOR CONSTRUCTION)

STA: 106+00



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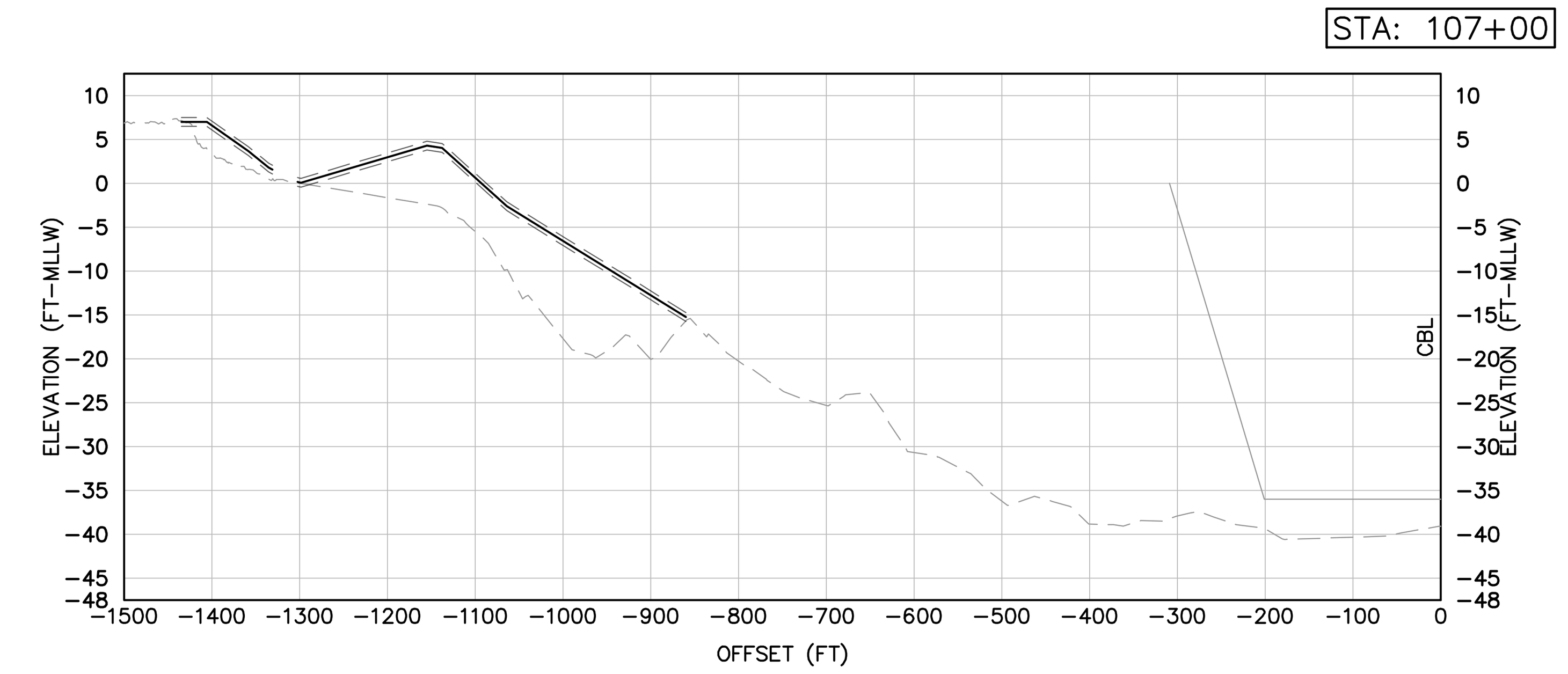

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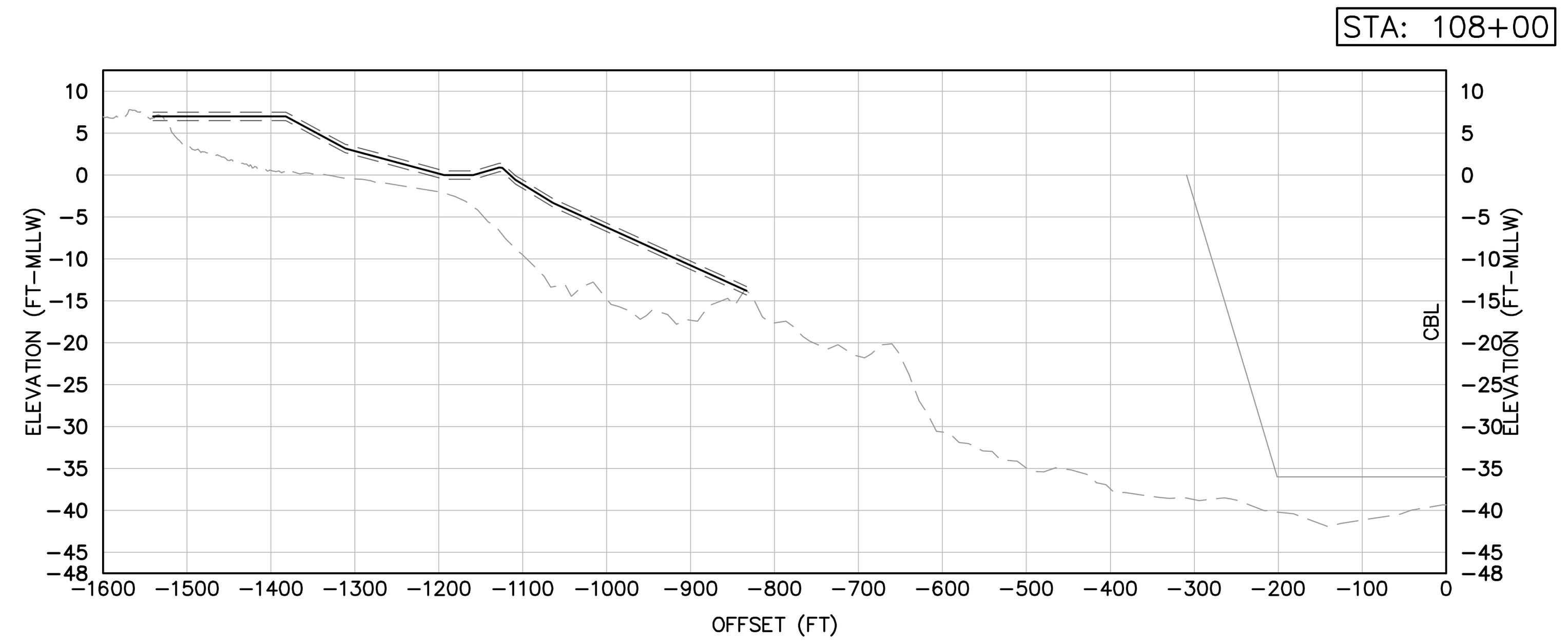

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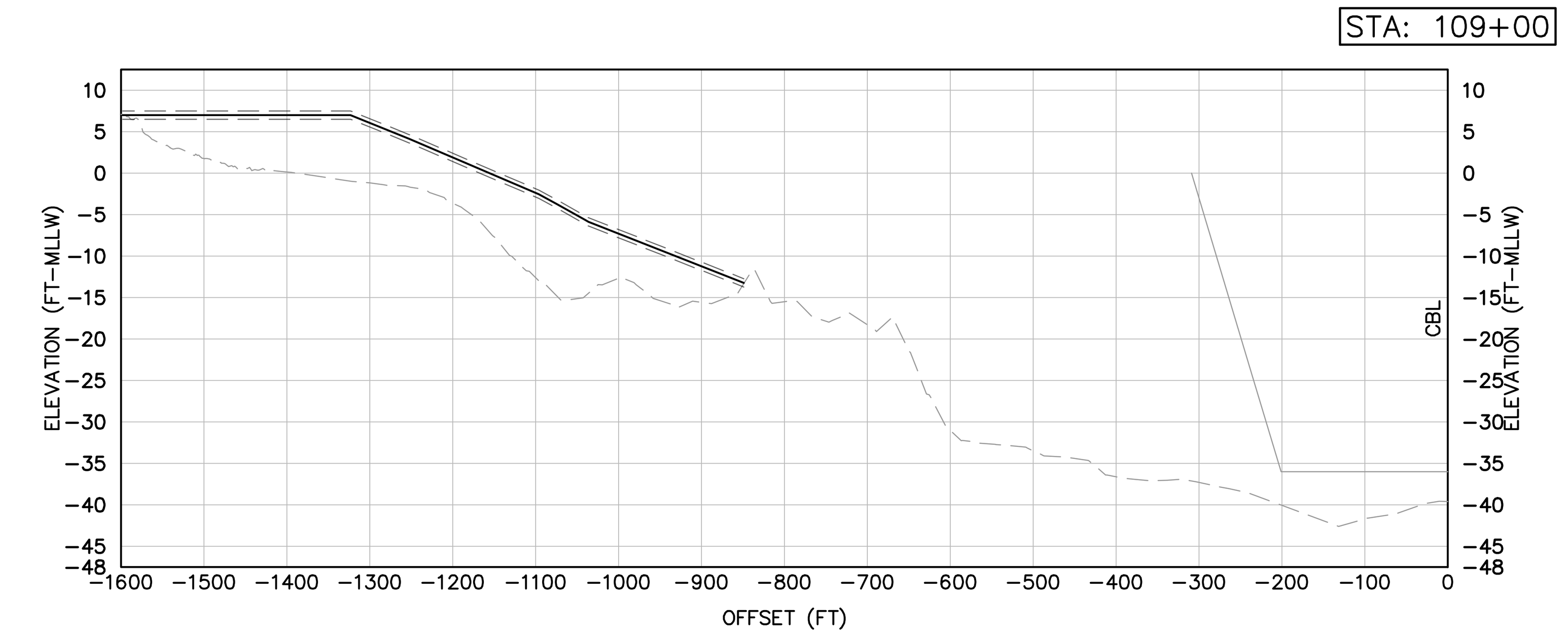

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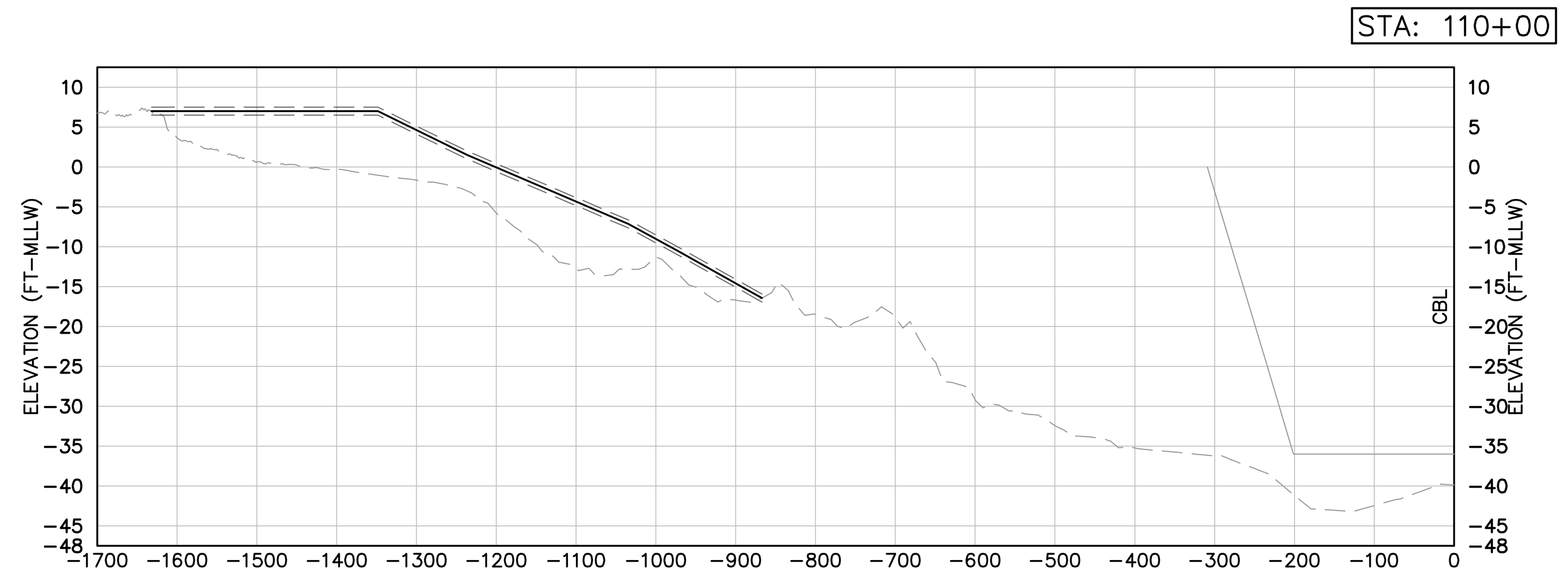
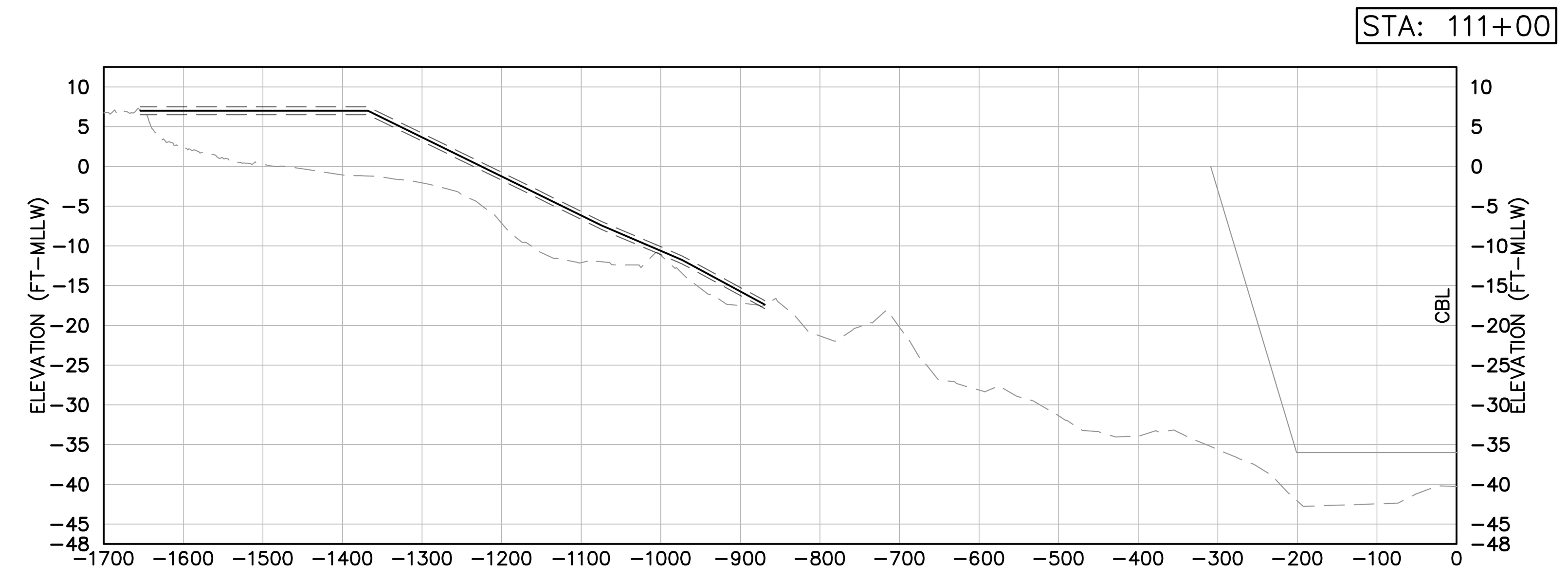


STA: 111+00



LEGEND

EXISTING BATHYMETRY
EXISTING CHANNEL TEMPLATE
SHORELINE RESTORATION TEMPLATE (REQUIRED & TOLERANCE)

0' 200' 400'
HORIZONTAL SCALE: 1" = 200'

0' 20' 40'
VERTICAL SCALE: 1" = 20'

US Army Corps of Engineers®

MARK	DESCRIPTION	DATE

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100 W. OGLETHORPE AVE.
SAVANNAH, GA 31401

GLYNN COUNTY, GEORGIA
BRUNSWICK HARBOR MODIFICATION PROJECT
FY24

CHANNEL CROSS SECTIONS
SHORELINE RESTORATION
PLACEMENT AREA CROSS SECTIONS

SHEET ID
CB301

60% SUBMITTAL (NOT FOR CONSTRUCTION)

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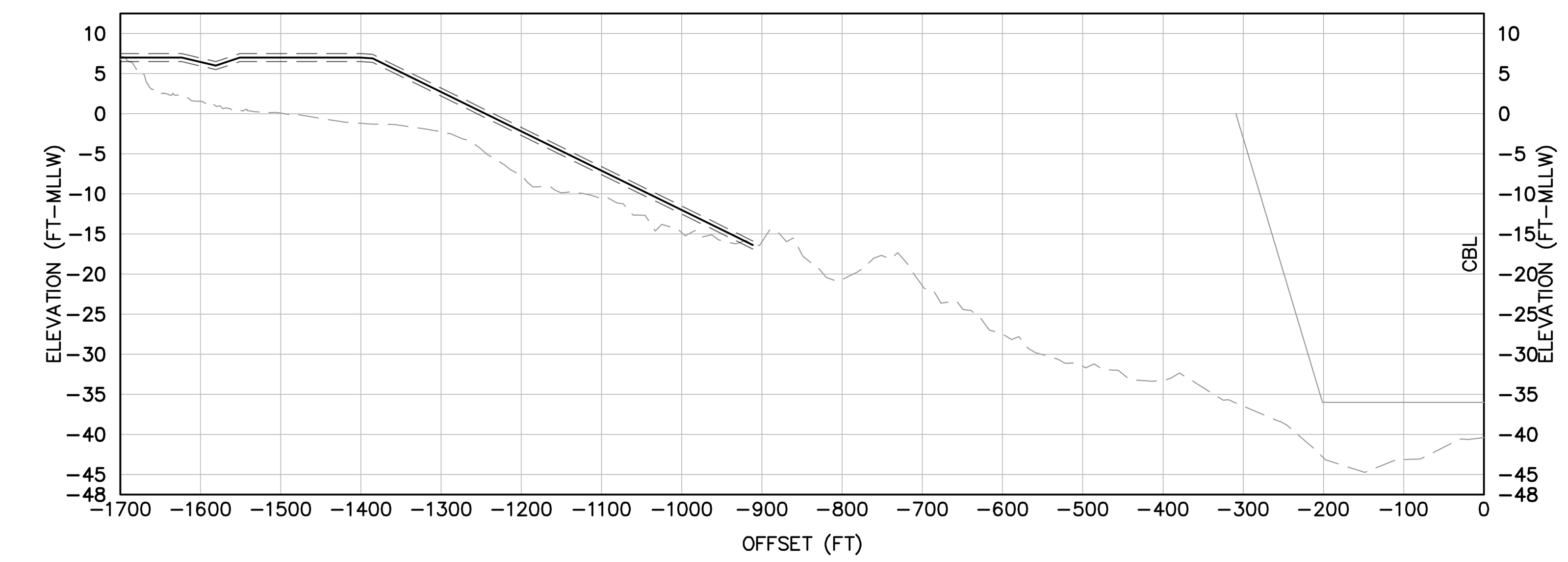
STA: 112+00



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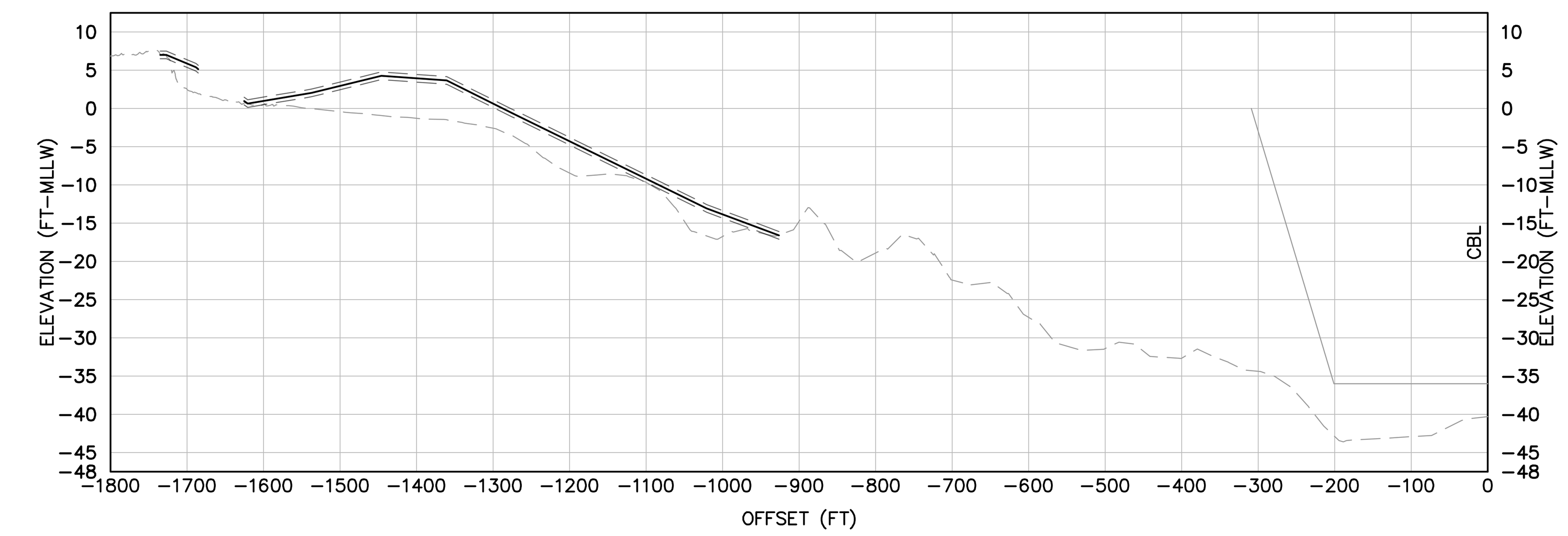

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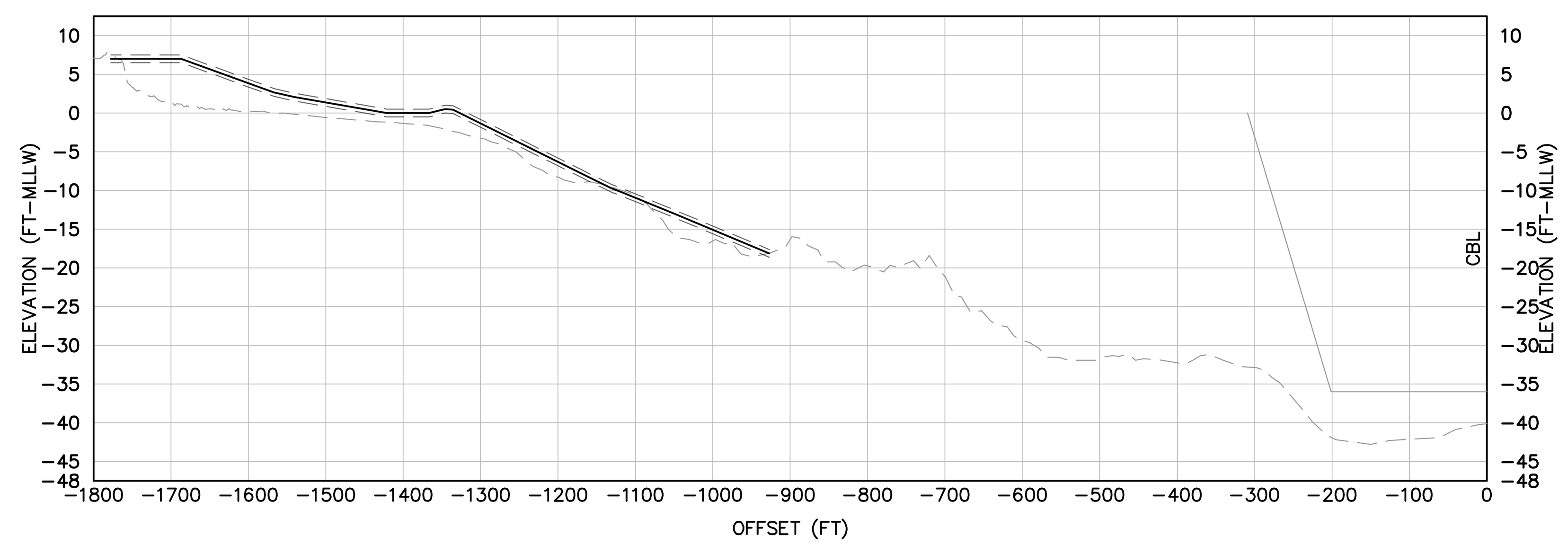

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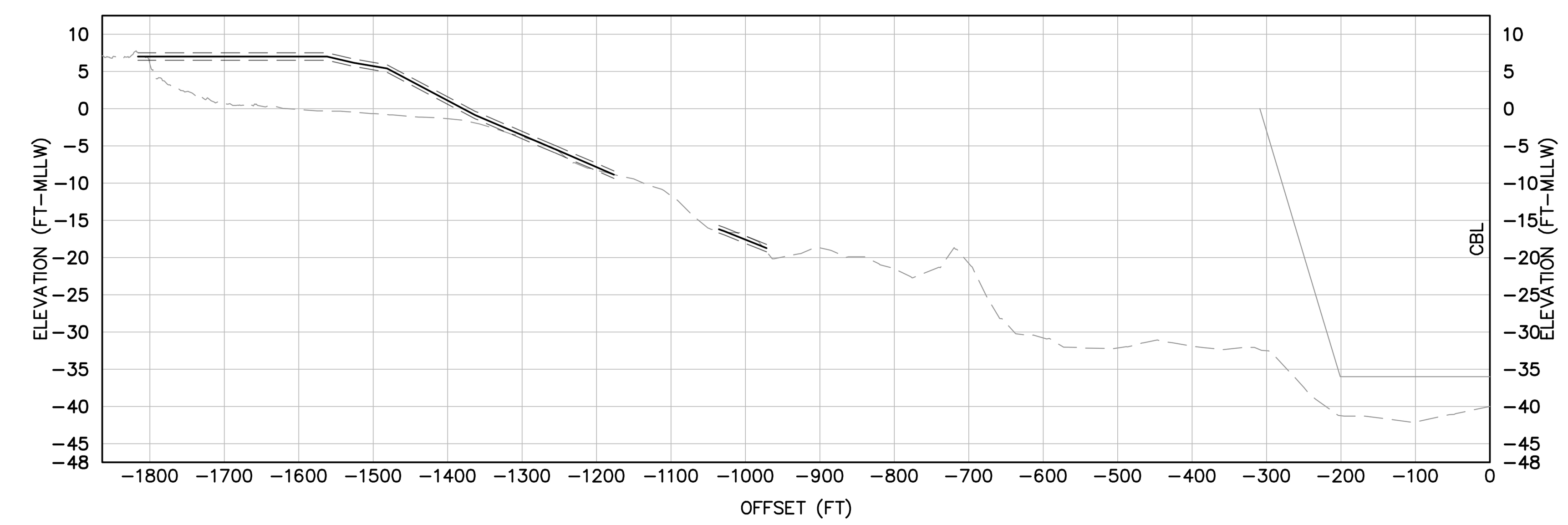

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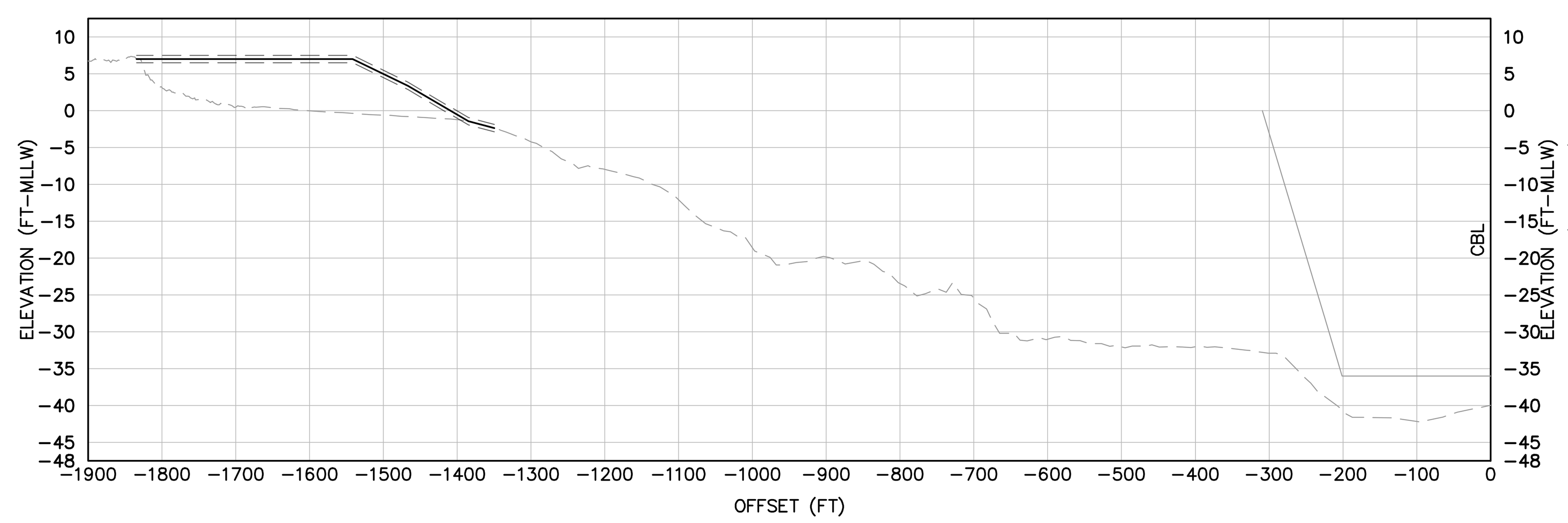

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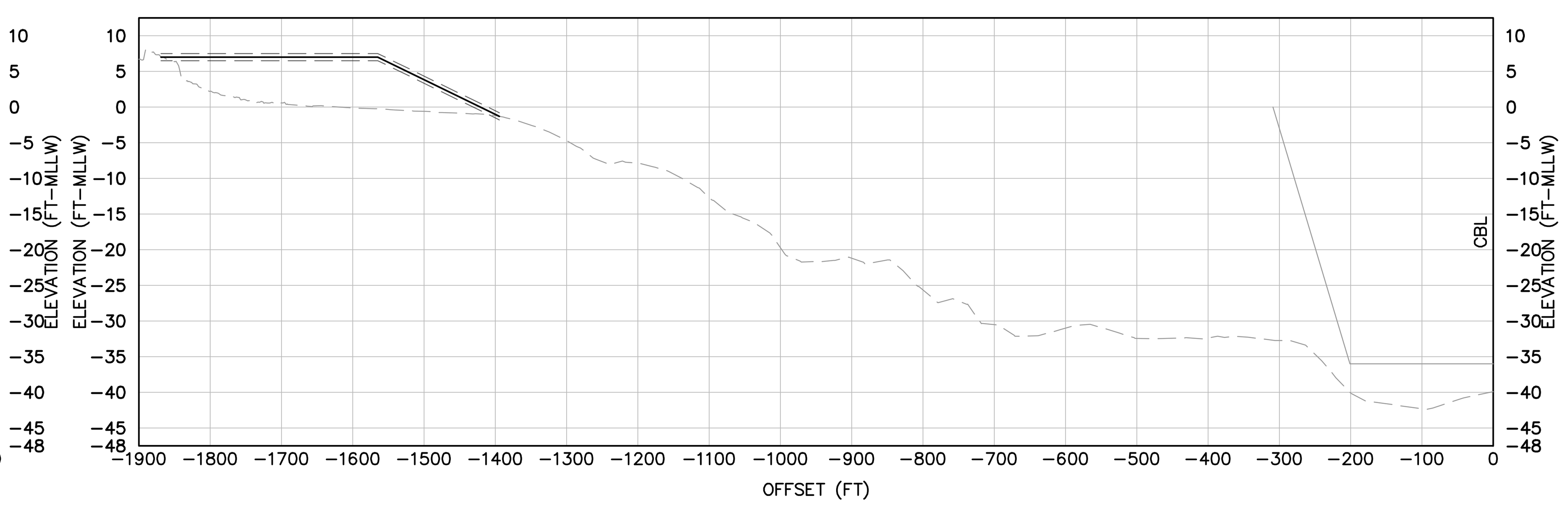

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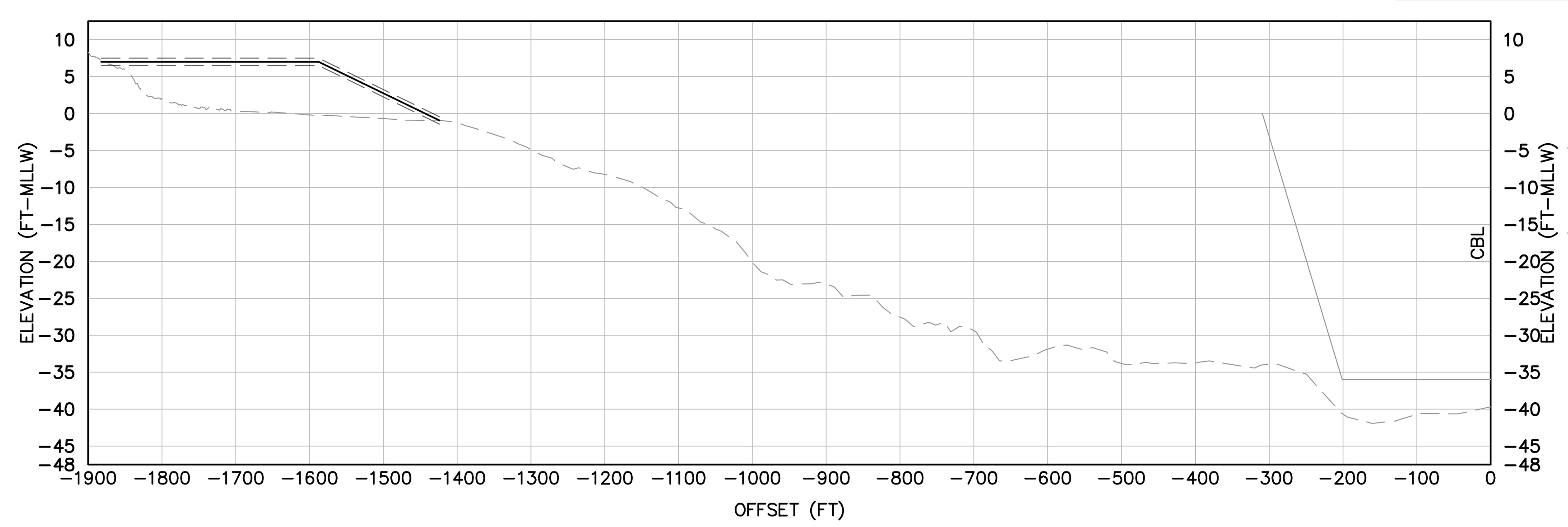

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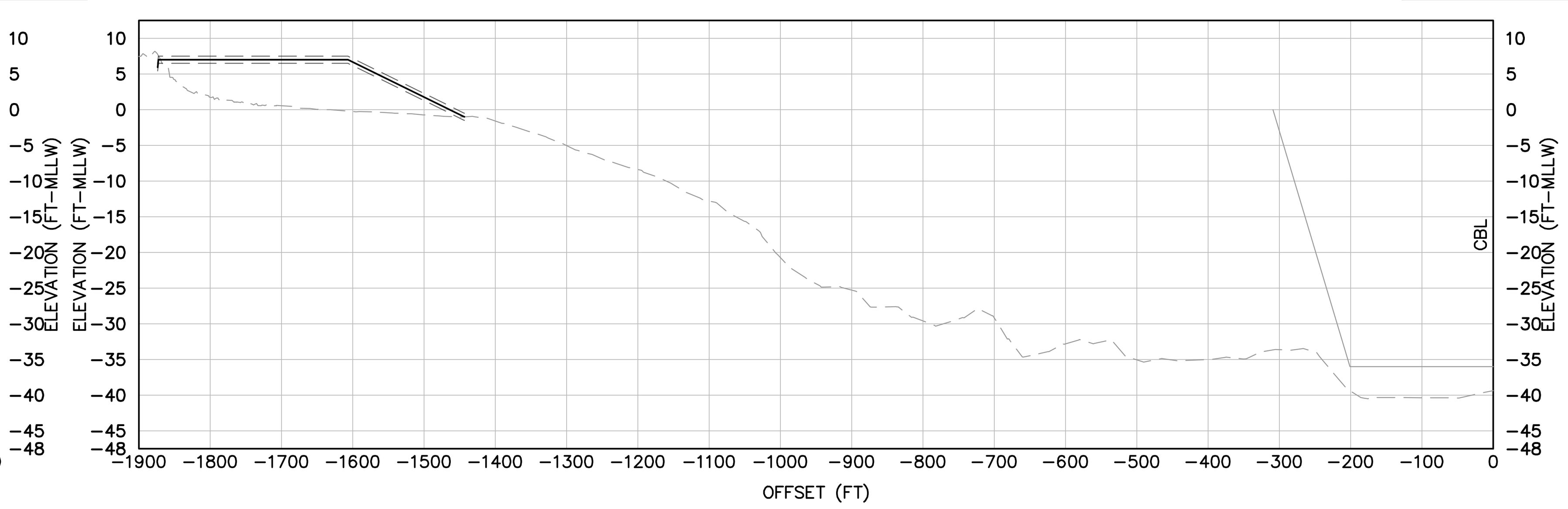

LEGEND

- EXISTING BATHYMETRY
- EXISTING CHANNEL TEMPLATE
- SHORELINE RESTORATION TEMPLATE (REQUIRED & TOLERANCE)

0' 200' 400'
HORIZONTAL SCALE: 1" = 200'

0' 20' 40'
VERTICAL SCALE: 1" = 20'

US Army Corps of Engineers®

MARK	DESCRIPTION	DATE

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ISSUE DATE: OCTOBER 2023
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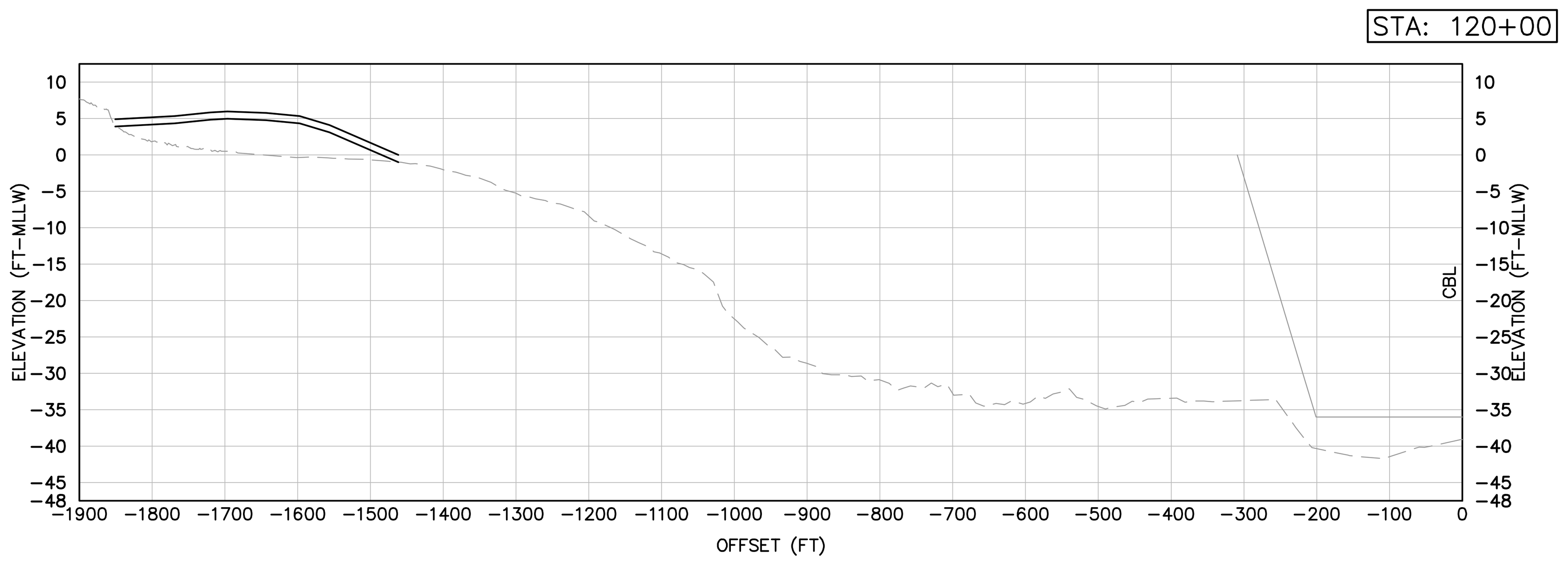
SAVANNAH DISTRICT
100 W. OGLETHORPE AVE.
SAVANNAH, GA 31401

GLYNN COUNTY, GEORGIA
BRUNSWICK HARBOR MODIFICATION PROJECT
FY24

CHANNEL CROSS SECTIONS
SHORELINE RESTORATION
PLACEMENT AREA CROSS SECTIONS

SHEET ID
CB302

60% SUBMITTAL (NOT FOR CONSTRUCTION)



LEGEND

- EXISTING BATHYMETRY
- EXISTING CHANNEL TEMPLATE
- SHORELINE RESTORATION TEMPLATE (REQUIRED & TOLERANCE)

0' 200' 400'
HORIZONTAL SCALE: 1" = 200'

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US Army Corps of Engineers®

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SHORELINE RESTORATION
PLACEMENT AREA CROSS SECTIONS

SHEET ID
CB303

60% SUBMITTAL (NOT FOR CONSTRUCTION)