

Appendix A
Erosion and Sediment Transport on Jekyll Island

Jekyll Island Phase 2 Shoreline Rehabilitation

Jekyll Island has a long history of erosion, particularly along the northern portion of the island. Exhibit 1 shows a graphic which illustrates the geologic makeup of this Pleistocene Barrier Island and how it has changed over more recent history due to sea level rise and erosion, noting net regional littoral transport. Historic erosion changes to the island shorelines between 1855 and 2004 are provided in a PhD Thesis by Jackson (2010), with a summary shown on Exhibit 2. The project area has undergone net erosion which triggered the placement of the revetment in the 1960s-1970s, following impacts of Hurricane Dora (1964). Since that time, the revetment has fixed the shoreline position along its length. The Driftwood Beach area has undergone erosion north of the revetment but overall been relatively stable in the long-term. The south tip of Jekyll Island has been largely accretional. Estimated erosion rates from Jackson for the oceanfront averages -1.5 ft/yr (1855-2004), while the north inlet (St Simons Sound) facing shoreline erosion averages -5 ft/yr.

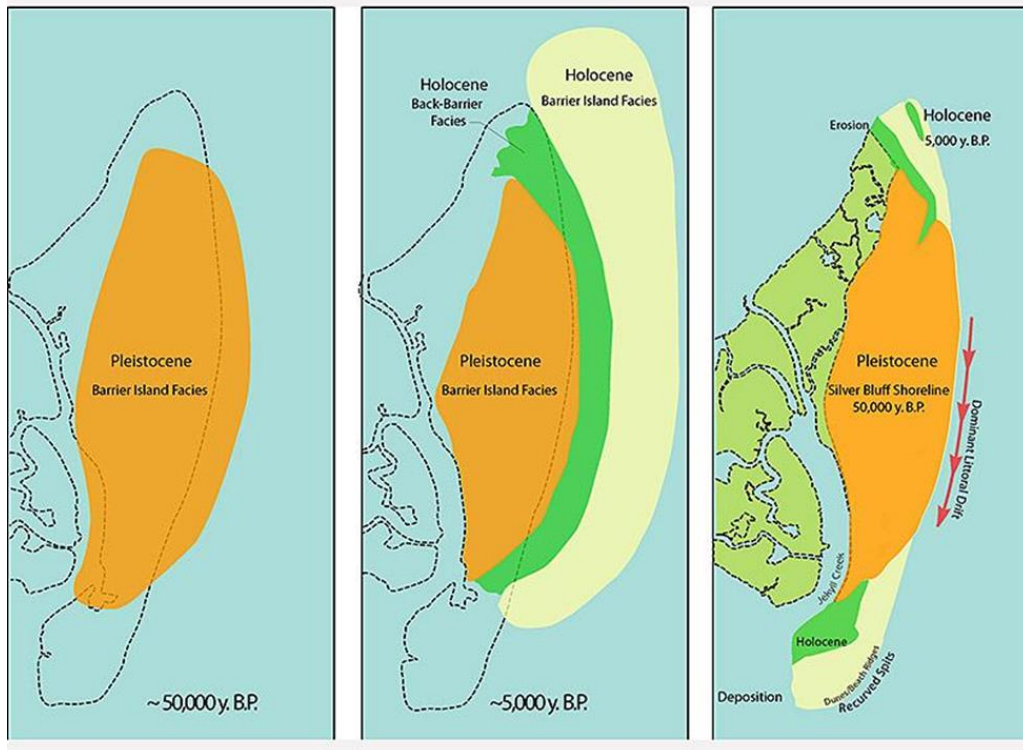


Exhibit 1. Geological Map of Jekyll Island over time
(source: <https://www.georgiaencyclopedia.org/articles/science-medicine/geology-georgia-coast>)

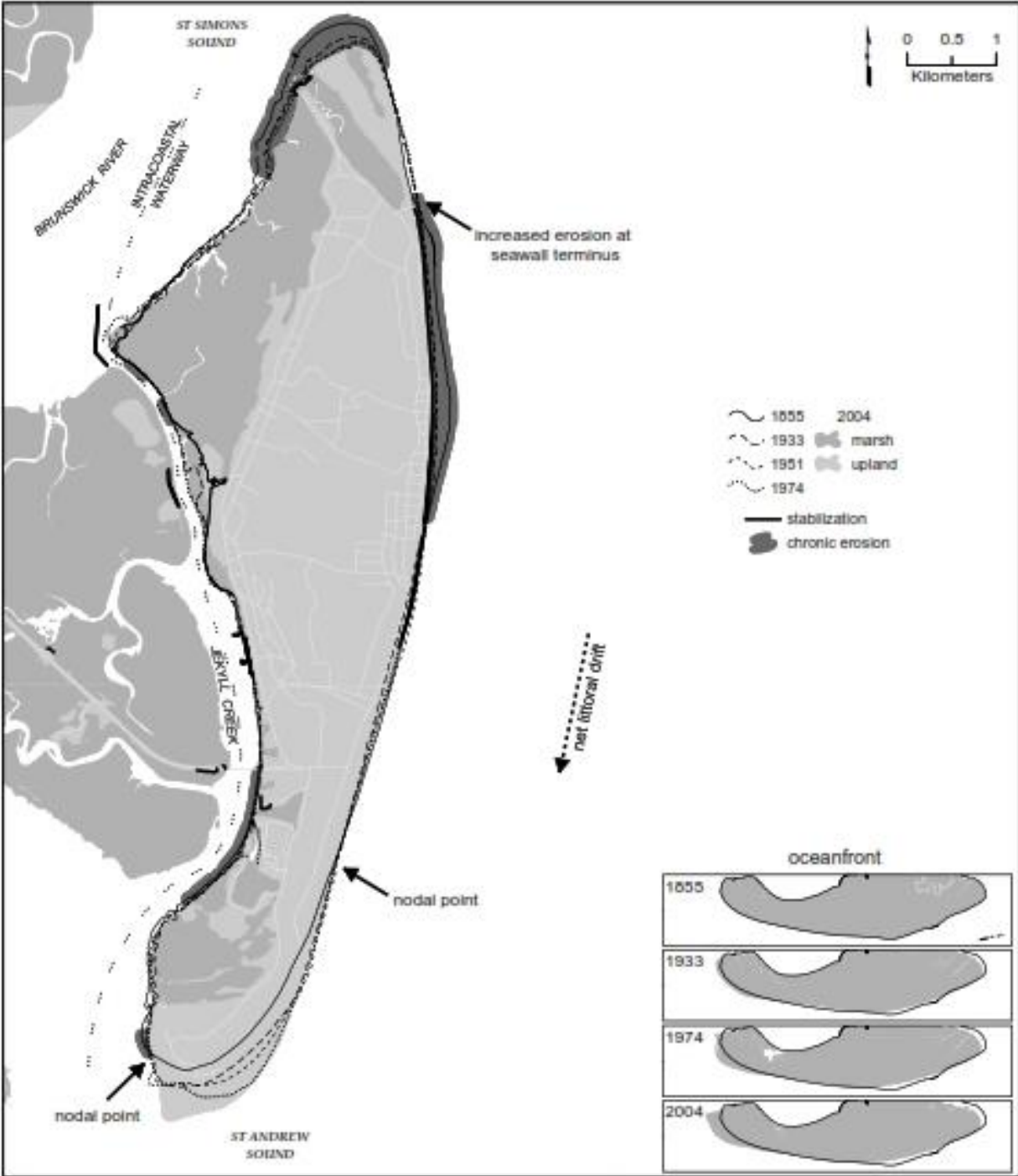


Exhibit 2. Long-term shoreline positions and erosion trends (source: Jackson, 2010)

The north tip of the island has undergone significant erosion and currently high-water conditions cut into the maritime forest in the Driftwood Beach area and north thereof (Exhibit 3). The northernmost approx. 9,800 LF of the revetment has undergone long-term general degradation due to settlement, beach erosion (profile deflation and erosion of fines) and overtopping and more direct damage during storm events.



Exhibit 3. Eroded conditions north of existing revetment limits at Driftwood Beach during King tide conditions

The *Feasibility Study of Glynn County, Georgia, Beach Restoration* (Olsen Associates, 1988) included a summary of erosion rates and numerical model studies which addressed potential sediment transport along Jekyll Island. Reported erosion rates for the project area ranged from -2.7 to -5.7 ft/yr with reduced erosion north of the Driftwood Beach area (until again reaching a peak of -6 to -10 ft/yr at the north tip facing St Simons Sound) and stability near the center of the island. Exhibit 4 shows the general littoral transport patterns along the island, based on numerical wave refraction modeling, which suggests a diverging transport along the center of the project area, with erosion potential increasing toward the north tip of the island and decreasing to a stable zone near the south limit below Capt Wyllly Rd (near the center of the island, and the south limit of the proposed Phase 2 project). This means that there is no natural sand supply to the project area (other than erosion of the shoreline itself) and that any sand placed in the Driftwood section of the project will naturally spread north from the placement area to adjacent areas over time. Potential annual net sediment transport rates along the island were estimated to range from 219,000-459,800 cy/yr. These values may be considered conservative based on the modeling conducted.

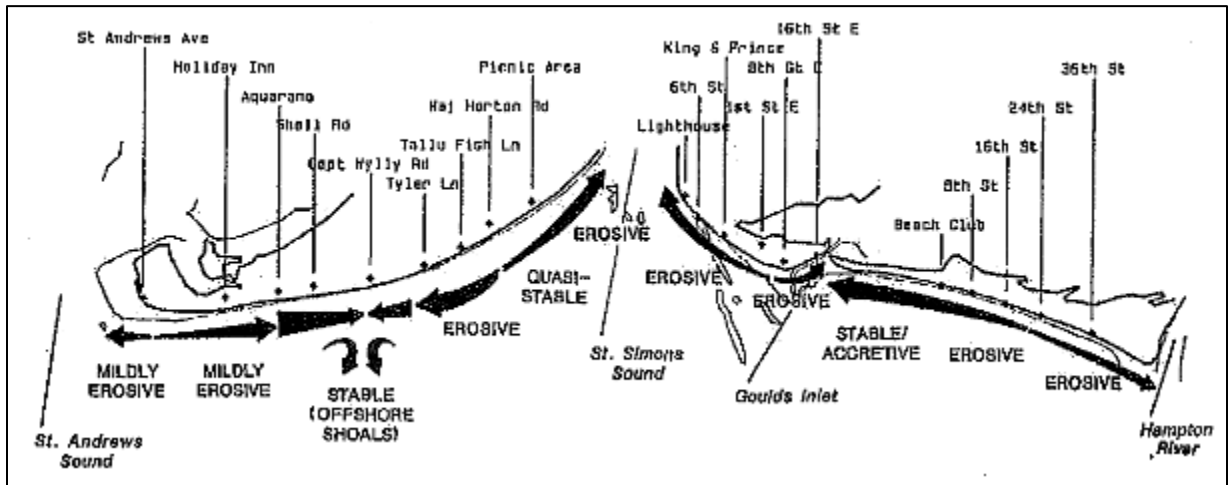


Exhibit 4. Sediment Transport along Glynn County Beaches (source: Olsen Associates, 1988)

Appendix B
Sand Source Supplementary Information

Jekyll Island Phase 2 Shoreline Rehabilitation

Overview

The primary preferred sand source for the proposed project is a USACE confined disposal facility (CDF) called the Jones-Oysterbed Island Disposal Area (herein referred to as Jones Island). The Jones Island sand source is located on the northern bank of the Savannah River, approximately 8.5 miles downriver of the city of Savannah. The Jones Island site has historically been used as a dredge disposal site for maintenance dredging of the federal channel along the Savannah River. Due to the proximity of the area to the inlet and open ocean/sand system, significant amounts of sandy beach quality material have been disposed of at the site during historic and recent dredging events. Ownership of the Jones Island site material is generally divided between two entities: Georgia Department of Transportation (GADOT) owning the northern part of the island and Dept. of Interior – Fish and Wildlife Service owning the southern portion. The proposed source material will be taken from the GADOT area. The JIA has completed initial coordination efforts with GADOT and USACE, including a kickoff coordination meeting on July 9, 2018 with Mr. R.B. “Trey” Daniel III, P.E. (GADOT’s Waterways Program Manager), Burton Moore (Chief of the USACE Dredging Section in Savannah District), and USACE regulatory staff. Following the kickoff meeting, ATM and USACE representatives conducted a field visit to the site to view existing conditions, estimate viable material areas/volumes, discuss logistics, and collect field samples of the preferred sand source material.

Sampling and Volume Estimates

The most recent Savannah River Channel dredging project disposed of quality sand material in two areas along the north/west end of Jones Island. ATM, accompanied by USACE representatives, visited Jones Island on July 18, 2018 to collect samples and estimate volumes of beach quality material available. The approximate locations and areas of quality sand material was estimated as shown in Figure 1 below. Numerous samples of the material were taken from both areas and three representative samples were sent for testing. Grab samples were taken 18 inches below the surface and tested samples were taken from approximate locations shown in Figure 1.

There is not a current detailed site topographic survey of the Jones Island site. However, ATM has estimated that approximately 175,000 CY of beach compatible material is available within the proposed two areas indicated on the Drawings. ATM’s volume estimate is based on site photographs, field GPS data, volume estimates from the recent dredge disposal operations, aerial imagery, and sediment sampling and testing. Height of sand material was determined by visual estimation of the existing surface elevation of the sand deposits and the USACE field representative’s description of elevations of the disposal area prior to the recent dredging operations. Representative observed sand material within the proposed borrow areas are illustrated in Photos 1-3.



Figure 1. Jones Island Sand Material Areas and Test Sampling Locations



Photo 1 – Typical sediment sampling observations, Jones Island.



Photo 2 – Representative view of Jones Island borrow area.



Photo 3 – Representative view of Jones Island borrow area.

Sediment Characteristics

GA DNR provides guideline sediment characteristics for “*beach nourishment*” projects. The purpose of these guidelines is to minimize the effects of beach nourishment projects on sea turtle reproduction and to ensure nourished beaches are compatible with native beaches. Table B.1 compares GA DNR sediment guidelines to the Jones Island and Jekyll Island native project area sediment sample test results.

ATM collected 5 representative sand samples (surface grabs) from the Jekyll Island beach within the limits of the proposed Phase 2 project sand fill for comparison purposes with proposed borrow site samples. Samples were collected landward of the rock revetment (in the proposed terrace berm and dune fill area), as well as samples from the south end of Driftwood Beach. The native beach sample locations are shown as GPS waypoints (WP-xx) on Figures 2 and 3. Sediment grain size distribution curves for both the borrow site and native beach samples, including Munsell Color characterization, are provided as an attachment.

Table B.1 – Sediment Characteristics Guidelines and Testing Results

Sediment Characteristics		GA DNR Guideline Language	Jones Island Sand Samples	Jekyll Island Native Project Area Samples
Grain Size	General	Fill material shall be free of construction debris, rocks, or other foreign matter	Within Guidelines	Generally, within guidelines but scattered rock present along revetment and Driftwood Beach
		Sand grain size on Georgia beaches is generally between 0.15 and 0.3 mm.	D ₅₀ Range: 0.39mm - 0.46mm Average D ₅₀ = 0.42mm	D ₅₀ Range: 0.17mm - .20mm Average D ₅₀ = 0.19mm
	Fines	Fill material...shall not contain, on average, greater than 10% fines (i.e. silt and clay; passing through a #200 sieve; approx. 0.075 mm)	Within Guidelines % fines range: 0.2% - 1.8% Average: 0.8%	Within Guidelines % fines range: 0.6% - 12.1% Average 3.2%
	Coarse Gravel	Fill material...shall not contain, on average, greater than 5% coarse gravel or cobbles (retained by #4 sieve; approx. 4.5 mm)	Within Guidelines 0.5 - 0.6% retained by #4 sieve	Within Guidelines 0 – 1.7% retained by #4 sieve
Composition	General	The sediment composition of Georgia beaches is generally fine-grained silica sand (>90%) with very little fragmented shell	Within Guidelines	Within Guidelines
	Shell Content	Shell content should remain below 15% of total volume.	Within Guidelines	Within Guidelines
Color		Sediment color should be between 10YR 6.5/1 and 10YR 7.0/1 on the Munsell soil color chart.	10YR 6/2 - 10YR 6/3	2.5YR 6/2 – 2.5YR 7/2 to 10YR 7/1 – 10YR 7/2

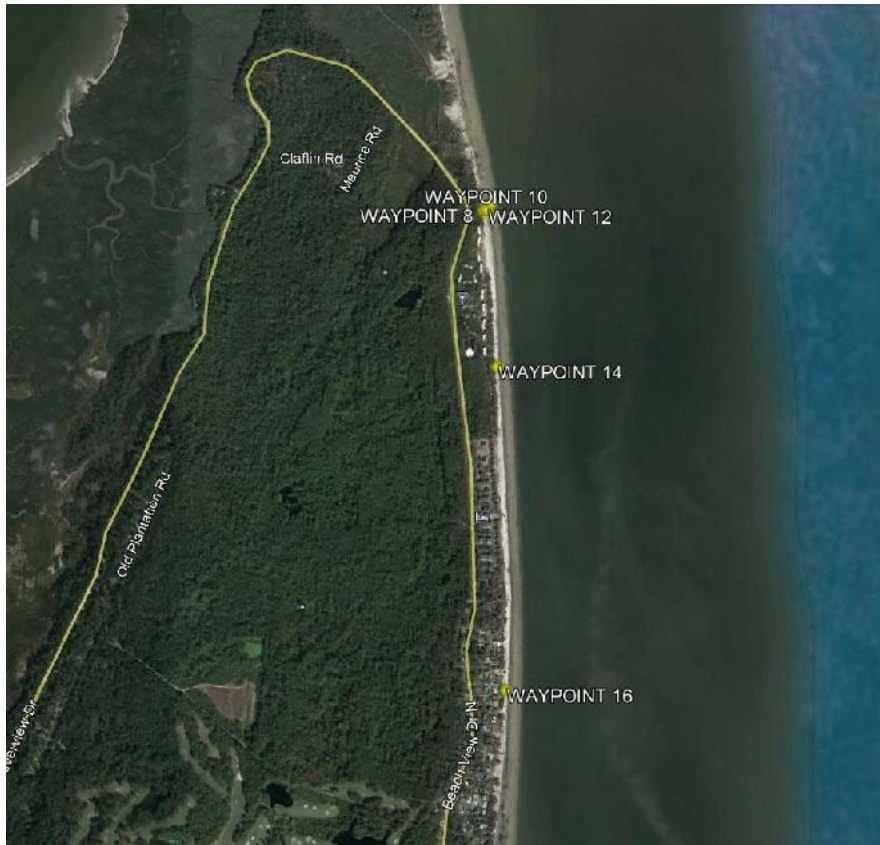


Figure 2. Jekyll Island Native Beach Sand Material Sample Locations

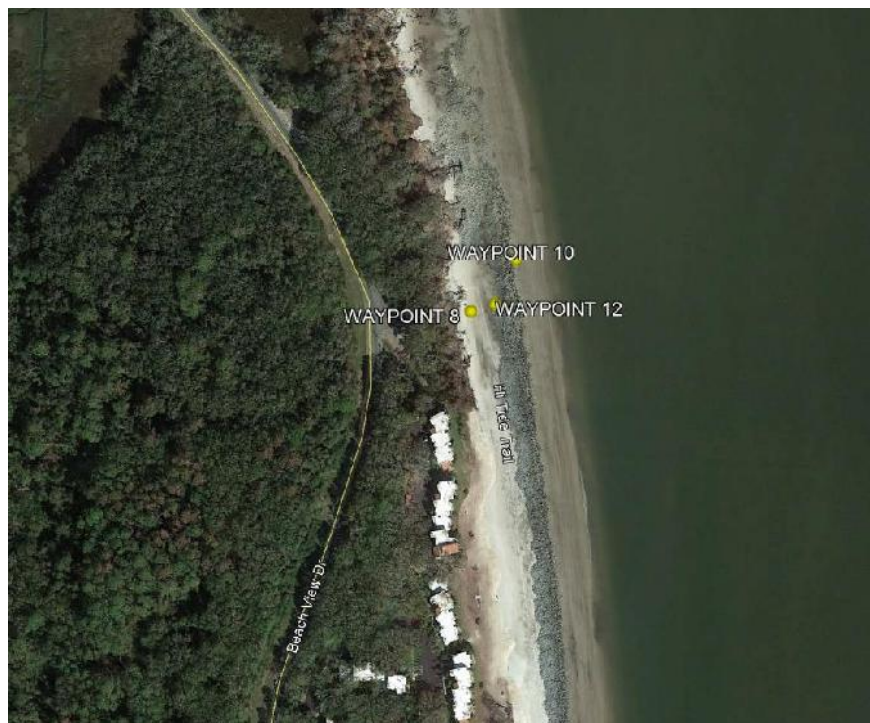


Figure 3. Jekyll Island Native Beach Sand Material Sample Locations – Driftwood Beach Large Scale

Table B.1 indicates that the proposed borrow area provides compatible material of suitable quality for beach and dune placement. All primary parameters are within the GA DNR guidelines, with the following minor deviations:

- Borrow sand grain size: the borrow area median grain size is slightly coarser than the native beach and typical GA beaches, averaging 0.42mm versus 0.19mm. The sand in the borrow source was previously dredged, therefore a portion of the finer materials (including the undesirable fines passing the #200 sieve) have already been washed out of the material, which results in a coarser mean grain size. From an engineering perspective, a larger mean grain size for the borrow material is preferable and typically a goal when performing sand searches. This material will be more stable and accept a somewhat steeper slope than the existing beach.
- Sand color: both the borrow and native beach sands fall slightly outside the very narrow color range indicated by the GA DNR guidelines, with the widest variation observed for the native beach materials. It is noted that color gradations per the Munsell color chart are somewhat subjective. Based on visual review of the sediment samples, it is ATM's opinion that the proposed borrow material is well within suitable ranges for the purposes of beach and dune placement.

In many cases, searching for upland and offshore sand sources is difficult due to finer grain sizes than the existing beach, high percentage fines (>10% passing the #200 sieve), and either large shell/gravel fractions and/or incompatible colors (often much darker than the existing beach). None of these are the case presented herein, and the borrow source represents an excellent source of sand for the intended purpose.

Proposed Project Sediment Use-Fate Details

Sand for the proposed project will generally be used for two major purposes:

- 1) as backfill to restore the terrace berm and dune areas landward of the rehabilitated rock revetment, and
- 2) to be placed along the northern shoreline (beyond the rehabilitated revetment), generally covering existing scattered granite rocks, to create a softer transition to the natural Driftwood Beach shoreline to the north.

While the above two uses differ from a traditional beach nourishment project, the ultimate purpose of the material is similar – to restore berm and dune features where long term and storm erosion has impacted environmental and historical resources, threatened infrastructure, and adversely affected recreational use. The samples collected and observations indicate that the Jones Island sand is considered quality, beach compatible material for the proposed Jekyll Island Phase 2 project. Additional considerations for the primary preferred Jones Island sand source include:

- From a coastal engineering perspective, slightly coarser beach sand provides a more resilient beach, less susceptible to erosive forces of wind, waves, and flowing water. The use of the proposed material would result in an overfill ratio greater than 1.0.

- Over ~75% of the total volume of fill placement is, from an engineering perspective, backfill landward of a retaining structure (the revetment).
 - This material will be retained (contained) by the rehabilitated revetment and filter layer designed for this exact purpose. While some material landward of the revetment can be expected to be lost during elevated water levels and/or extreme storm conditions, it is still considered quality beach sand and the diluted effects when mixed with existing material in the sand sharing system will be negligible. Other material sources introduced into the sand sharing system during extreme events (e.g. erosion of upland non-sandy soils and storm water runoff) would have greater impacts to the sediment characteristics of the overall sand sharing system and potential environmental quality.
- Sand fill placed on the transitional shoreline (~25% of the total project volume) is a vast improvement over existing native beach characteristic, which mainly consists of scattered granite rocks and an eroding maritime forest escarpment.
 - The proposed quantity of sand for this area (37,000 cy) is small relative to historically estimated annual potential net longshore transport rates for Jekyll Island (ranging from 219,000-460,000 cy/yr as described in Appendix A). Losses from natural erosion and spreading of the placed quality sand from this area to the surrounding shorelines/sand sharing system will not be detrimental to adjacent areas. Addition of this sand will be a “net positive” to the total volume of available sand in the local sand-sharing system (8-16% of the estimated annual potential longshore transport). The sand will blend with the existing sand materials in adjacent areas (primarily to the north along Driftwood Beach). Thus, the physical impacts on overall system sediment characteristics will be negligible.

Sand Delivery and Transport

Proposed sand transport from the borrow site to Jekyll Island is as follows. Sand will be excavated at the borrow site using typical earth moving equipment and conveyors, loaded onto the barge via temporary staging barges at the northwest access to Jones Island (refer to Drawings). These barges will be temporarily spudded down to minimize potential impacts to the riverbed. The filled barges will sail south along the Intracoastal Waterway to arrive at Jekyll Island. Similar temporary offloading operations will occur on the north end of Jekyll Island as indicated in the Drawings, at the Clam Creek parking area. Based on the locations of the temporary loading facilities, no impact to navigation or any Federal project is anticipated. The materials will be hauled via dump trucks from the offloading site to the project area for placement and grading, utilizing the access points indicated on the Drawings.

Borrow site operations for mining sand will be constantly monitored for strict control of sediment quality. If any unsuitable material is observed, operations will adjust to avoid unsuitable material. It is noted that since the proposed preferred borrow area is an upland source, all the sand excavated and loaded from the borrow site can be monitored. This is a large advantage over an offshore submerged borrow area, where the quality of the sediments cannot be observed until the material arrives via pipeline to the beach

placement area. A sediment quality monitoring plan is provided in Appendix D, which would be incorporated into the project Plans and Specifications for construction.

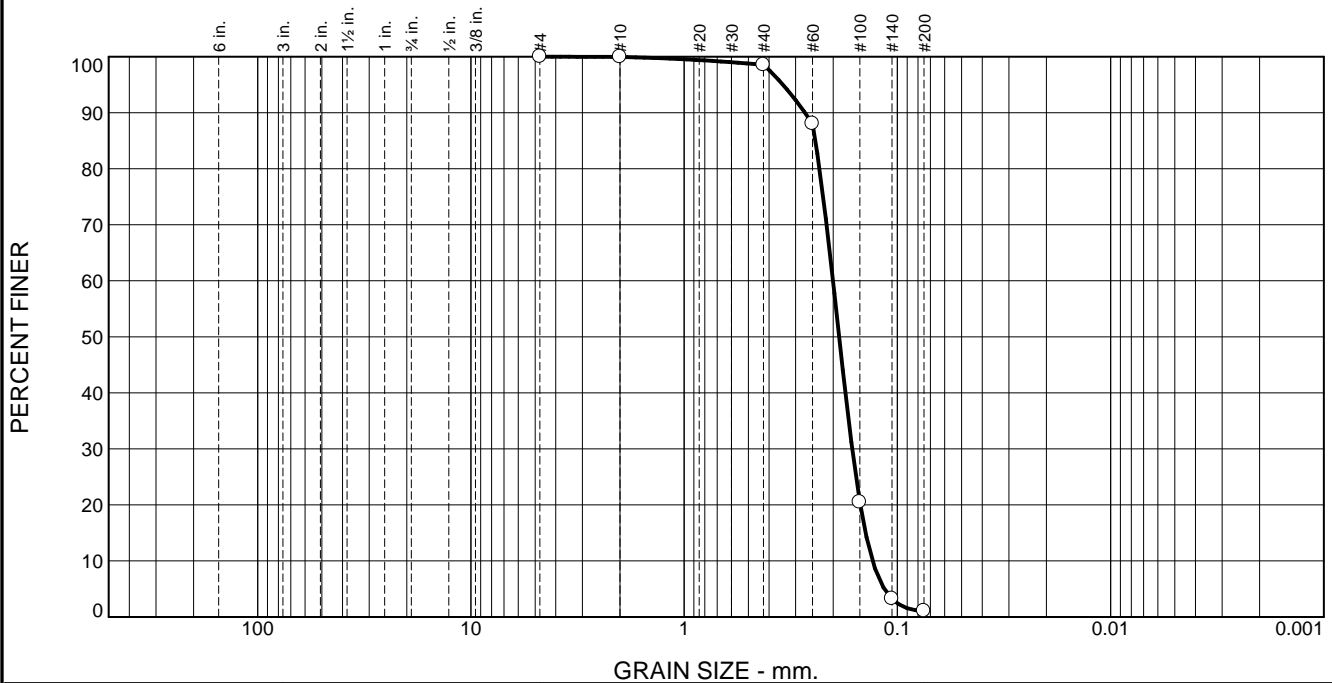
Supplementary Sand Sources

At present time, a screening of potential sand sources in the region has been conducted. The Jones Island site is the preferred primary sand source and is anticipated to contain enough quality material for the project. Several additional upland sources have been investigated and initial sediment data indicates good potential for quality material. An alternate source could be requested if (1) additional compatible material is required for any reason, or (2) if alternate upland source(s) become more advantageous during bidding and contracting of the Phase 2 project. If any alternate source to the proposed Jones Island site is anticipated, sediment testing data to document compliance with the GA DNR guidelines would be submitted for approval prior to use.

Jekyll Island Native Samples

Sediment Testing Data

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	1.4	97.5	1.1	

TEST RESULTS			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#4	100.0		
#10	100.0		
#40	98.6		
#60	88.0		
#100	20.5		
#140	3.3		
#200	1.1		

Material Description

Tan Fine Sand

Atterberg Limits (ASTM D 4318)

PL= _____ LL= _____ PI= _____

Classification

USCS (D 2487)= SP AASHTO (M 145)= _____

Coefficients

D₉₀= 0.2713 D₈₅= 0.2425 D₆₀= 0.2006
D₅₀= 0.1876 D₃₀= 0.1629 D₁₅= 0.1411
D₁₀= 0.1307 C_u= 1.53 C_c= 1.01

Remarks

Date Received: 07.27.2018 Date Tested: 07.31.2018

Tested By: HBN _____

Checked By: HBN _____

Title: _____

* (no specification provided)

Source of Sample: West Driftwood
Sample Number: WP-8

Depth: 0.00-0.10

Date Sampled:



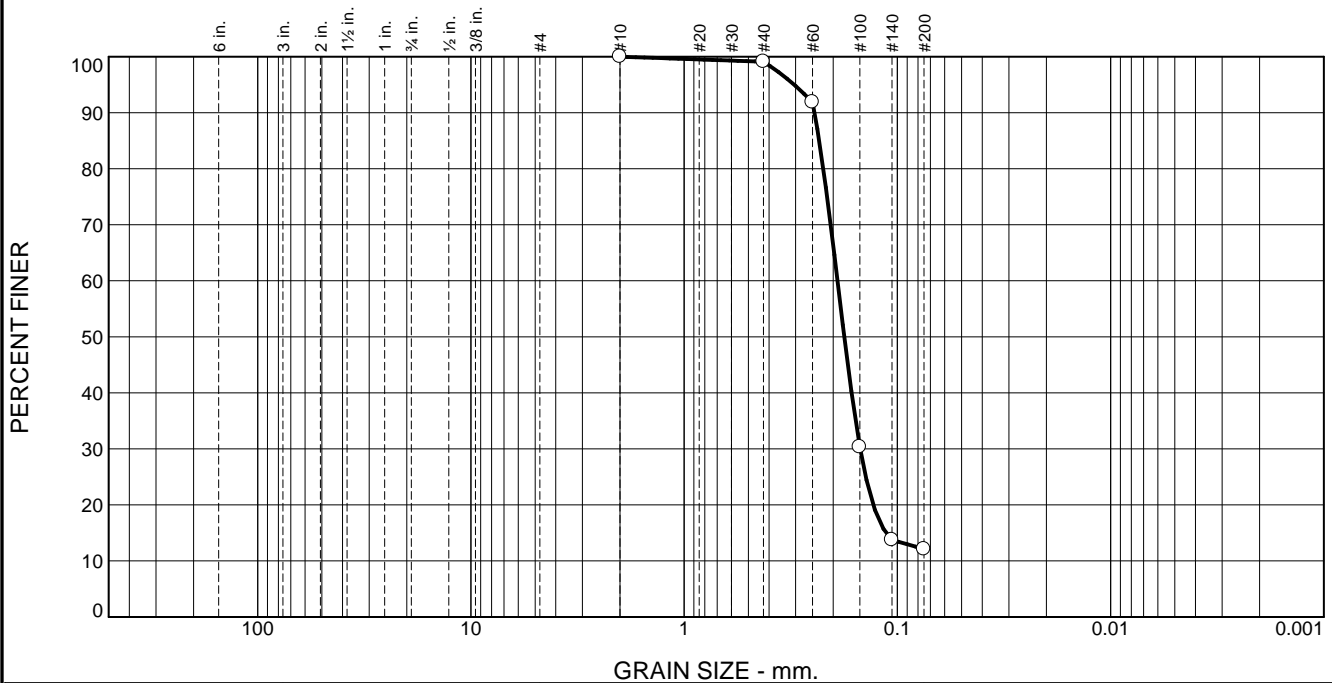
ECS FLORIDA, LLC
7064 Davis Creek Road
Jacksonville, Florida 32256
Phone: (904) 880-0960
Fax: (904) 880-0970

Client: ATM Inc.
Project: Jekyll Island Revetment Rehabilitation

Project No: 27243

Figure

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.9	87.0	12.1	

TEST RESULTS			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#10	100.0		
#40	99.1		
#60	91.9		
#100	30.3		
#140	13.7		
#200	12.1		

Material Description

Gray Fine Sand

Atterberg Limits (ASTM D 4318)

PL= _____ LL= _____ PI= _____

Classification

USCS (D 2487)= _____ AASHTO (M 145)= _____

Coefficients

D₉₀= 0.2447 D₈₅= 0.2326 D₆₀= 0.1910
 D₅₀= 0.1774 D₃₀= 0.1494 D₁₅= 0.1130
 D₁₀= _____ C_u= _____ C_c= _____

Remarks

Date Received: 07.27.2018 Date Tested: 07.31.2018

Tested By: HBN _____

Checked By: HBN _____

Title: _____

* (no specification provided)

Source of Sample: East Driftwood
 Sample Number: WP-10

Depth: 0.00-0.10

Date Sampled:

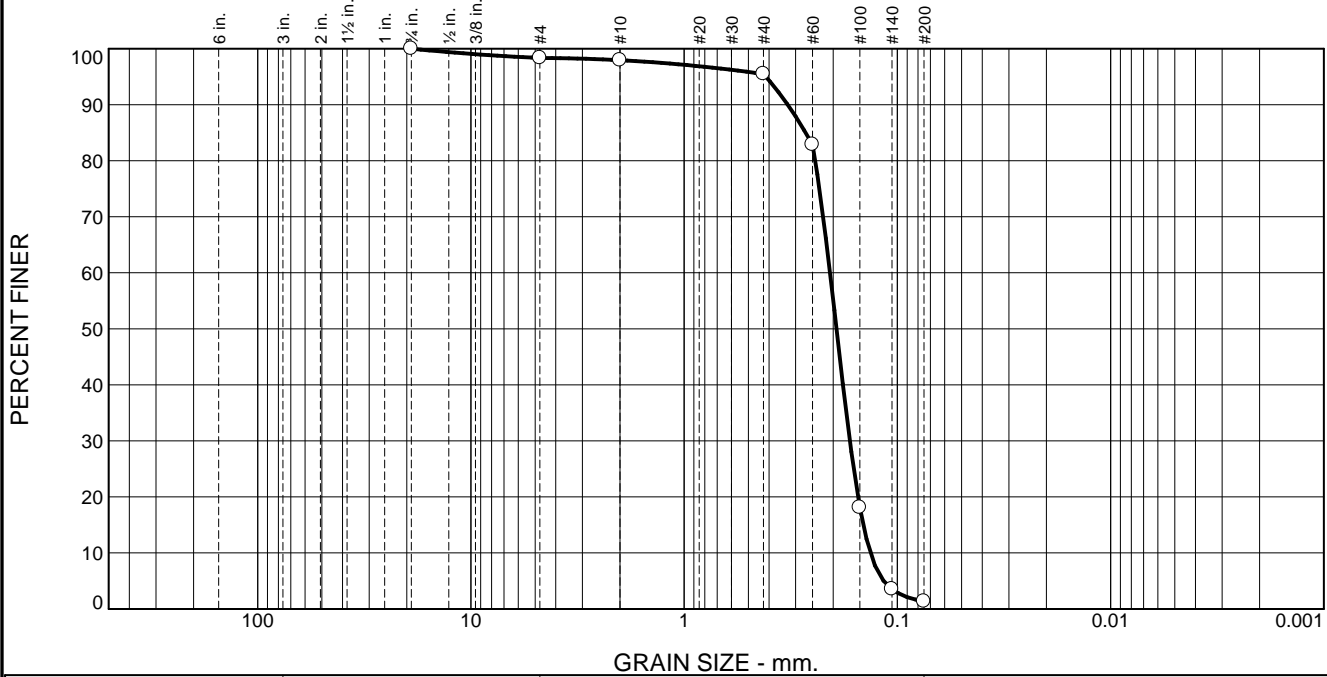


Client: ATM Inc.
 Project: Jekyll Island Revetment Rehabilitation

Project No: 27243

Figure

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	1.7	0.4	2.4	94.1	1.4	

TEST RESULTS			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3/4"	100.0		
#4	98.3		
#10	97.9		
#40	95.5		
#60	82.9		
#100	18.1		
#140	3.5		
#200	1.4		

Material Description

Tan Fine Sand

Atterberg Limits (ASTM D 4318)

PL= _____ LL= _____ PI= _____

Classification

USCS (D 2487)= SP AASHTO (M 145)= _____

Coefficients

D₉₀= 0.3270 D₈₅= 0.2693 D₆₀= 0.2071
D₅₀= 0.1931 D₃₀= 0.1670 D₁₅= 0.1446
D₁₀= 0.1338 C_u= 1.55 C_c= 1.01

Remarks

Date Received: 07.31.2018 Date Tested: 07.31.2018

Tested By: HBN _____

Checked By: HBN _____

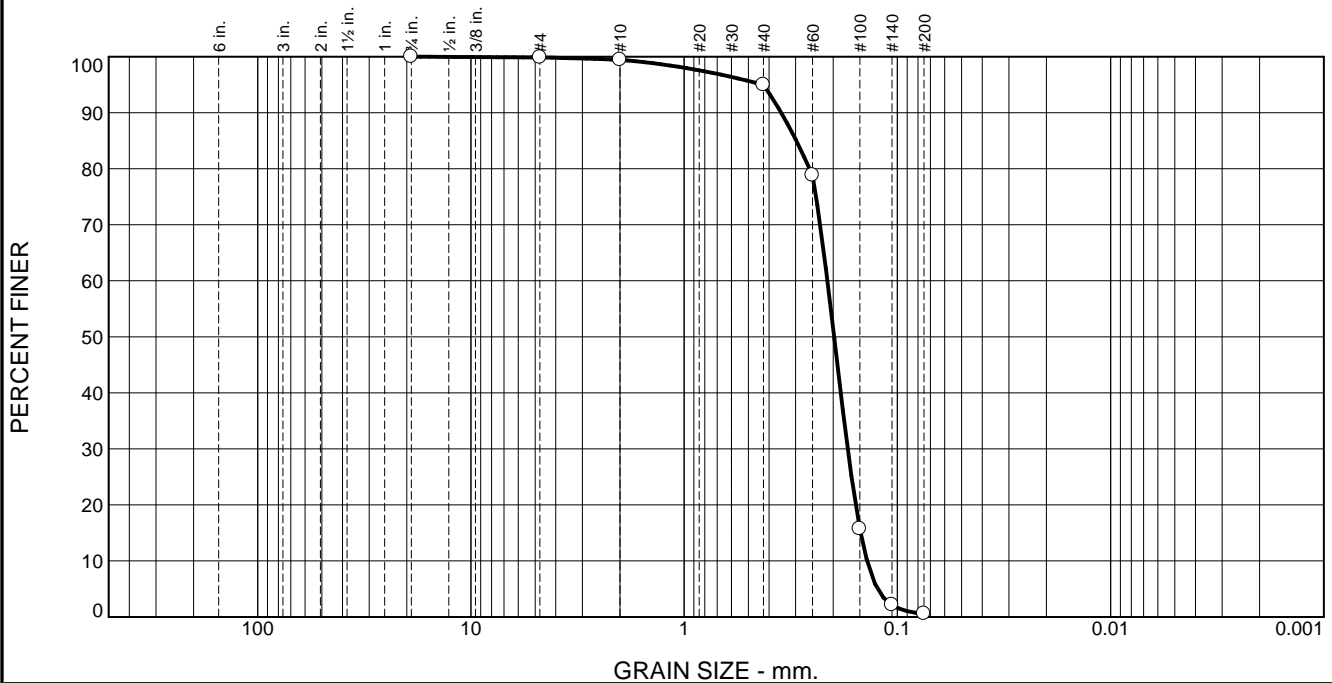
Title: _____

* (no specification provided)

Source of Sample: Mid Driftwood Depth: 0.00-0.10 Date Sampled: _____

ECS FLORIDA, LLC 7064 Davis Creek Road Jacksonville, Florida 32256 Phone: (904) 880-0960 Fax: (904) 880-0970	Client: ATM Inc. Project: Jekyll Island Revetment Rehabilitation Project No: 27243 Figure
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Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.1	0.5	4.4	94.4	0.6	

TEST RESULTS			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3/4"	100.0		
#4	99.9		
#10	99.4		
#40	95.0		
#60	78.8		
#100	15.7		
#140	2.2		
#200	0.6		

Material Description

Tan Fine Sand

Atterberg Limits (ASTM D 4318)

PL= _____ LL= _____ PI= _____

Classification

USCS (D 2487)= SP AASHTO (M 145)= _____

Coefficients

D₉₀= 0.3509 D₈₅= 0.2981 D₆₀= 0.2130
D₅₀= 0.1981 D₃₀= 0.1709 D₁₅= 0.1487
D₁₀= 0.1387 C_u= 1.54 C_c= 0.99

Remarks

Date Received: 07.27.2018 Date Tested: 07.31.2018

Tested By: HBN

Checked By: HBN

Title: _____

* (no specification provided)

Source of Sample: East of Const Access Mid Upper Beach Depth: 0.00-0.10 Date Sampled: _____
Sample Number: WP-14

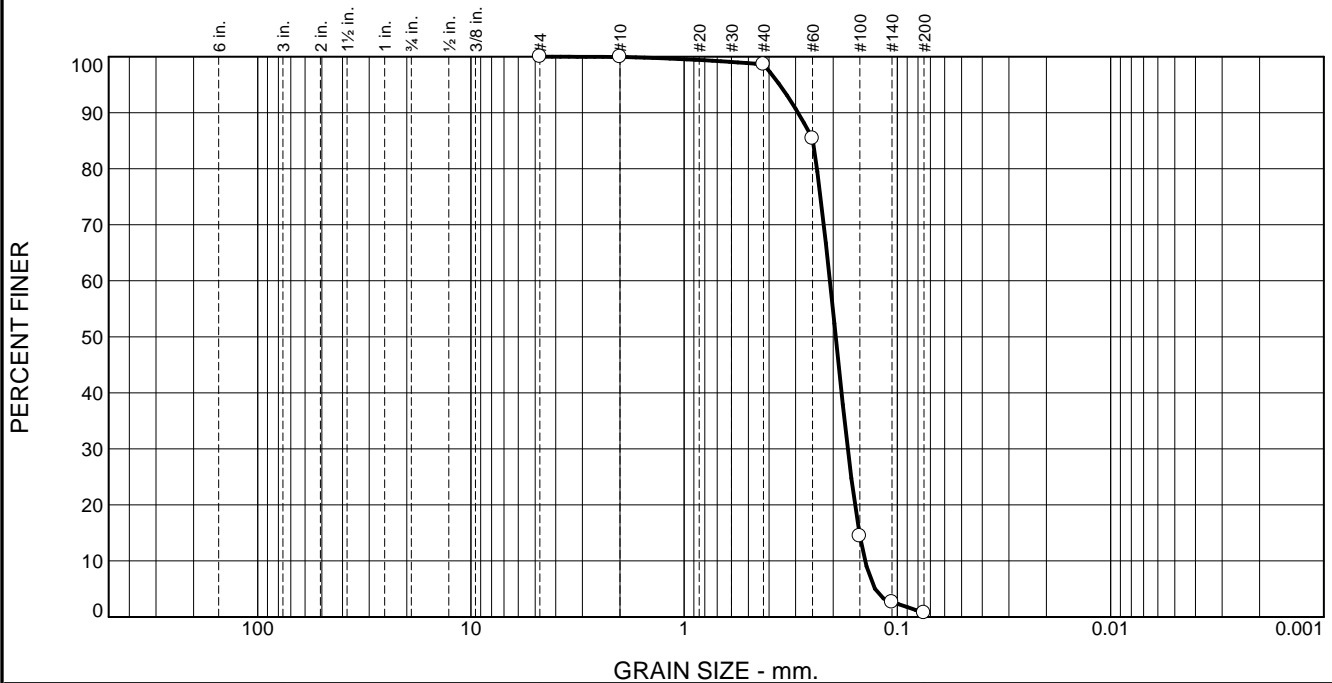


Client: ATM Inc.
Project: Jekyll Island Revetment Rehabilitation

Project No: 27243

Figure

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.1	1.3	97.9	0.7	

TEST RESULTS			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#4	100.0		
#10	99.9		
#40	98.6		
#60	85.4		
#100	14.4		
#140	2.6		
#200	0.7		

Material Description

Gray to Tan Fine Sand

Atterberg Limits (ASTM D 4318)

PL= _____ LL= _____ PI= _____

Classification

USCS (D 2487)= SP AASHTO (M 145)= _____

Coefficients

D₉₀= 0.2926 D₈₅= 0.2490 D₆₀= 0.2073
D₅₀= 0.1947 D₃₀= 0.1709 D₁₅= 0.1509
D₁₀= 0.1418 C_u= 1.46 C_c= 0.99

Remarks

Date Received: 07.27.2018 Date Tested: 07.31.2018

Tested By: HBN

Checked By: HBN

Title: _____

* (no specification provided)

Source of Sample: North Albright Mid Upper Beach
Sample Number: WP-16

Depth: 0.00-0.10

Date Sampled:



ECS FLORIDA, LLC
7064 Davis Creek Road
Jacksonville, Florida 32256
Phone: (904) 880-0960
Fax: (904) 880-0970

Client: ATM Inc.
Project: Jekyll Island Revetment Rehabilitation

Project No: 27243

Figure



ECS Florida, LLC
7064 Davis Creek Road
Jacksonville, FL 32097
Telephone: (904) 880 0960

Soil Descriptions and Munsell Color

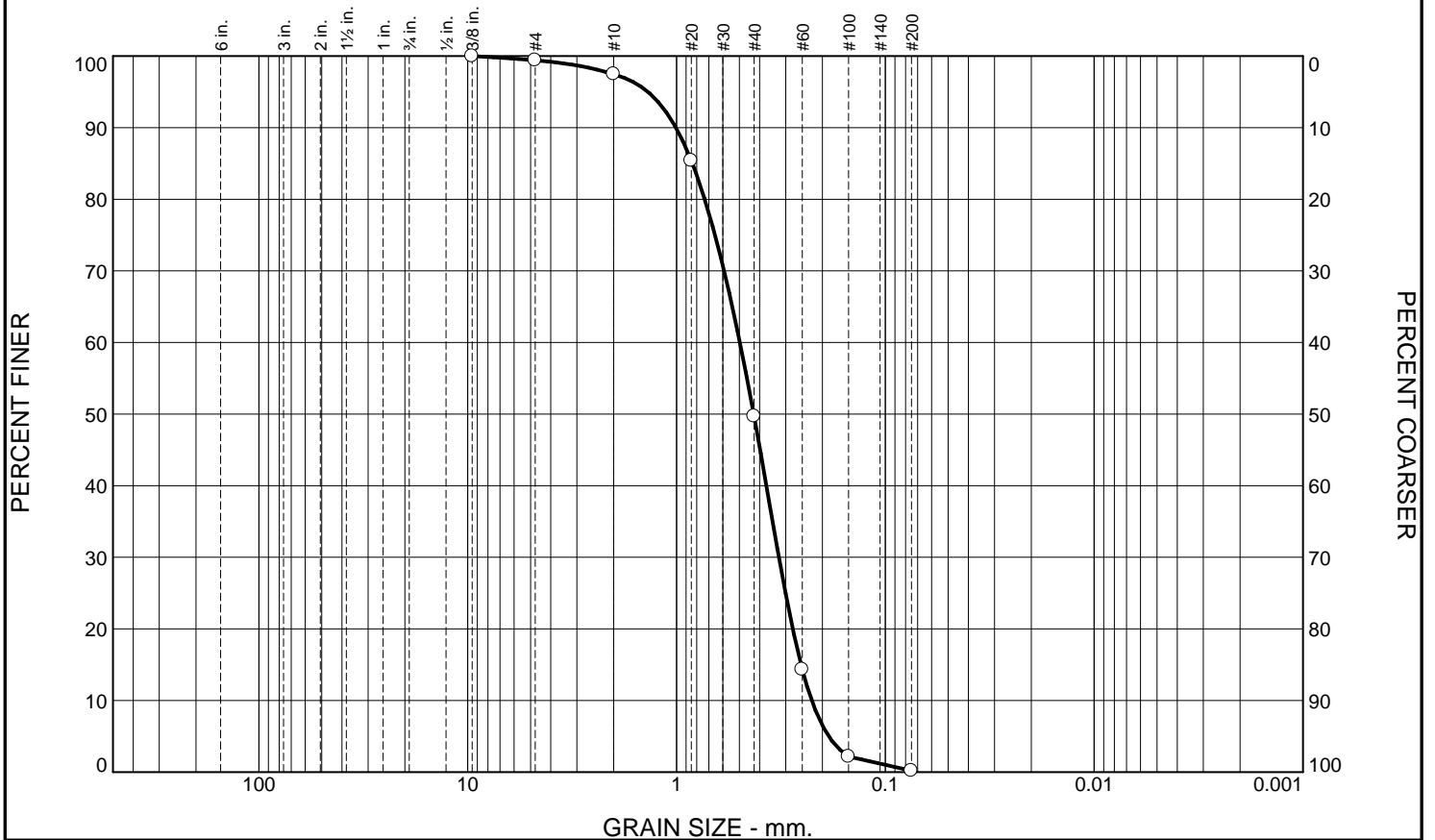
Date: **07.31.2018**
Project Name: **Jeckyll Island Revetment Rehabilitation**
Project Number: **27243**

Sample	Description	Munsell Color
WP8	Tan Fine Sand	2.5 YR 7/2
WP16	Gray-Tan Fine Sand	10 YR 7/1
WP10	Gray Fine Sand	2.5 YR 6/2
WP14	Tan Fine Sand	10 YR 7/2
WP12	Tan Fine Sand	5 YR 6/2
24+00-39+00	Gray Fine Sand	5 YR 4/1

Jones Oysterbed Island

Sediment Testing Data

Particle Size Distribution Report



GRAIN SIZE - mm.

% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.6	1.9	47.8	49.5	0.2	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/8	100.0		
#4	99.4		
#10	97.5		
#20	85.4		
#40	49.7		
#60	14.3		
#100	2.2		
#200	0.2		

* (no specification provided)

Soil Description

Light Brownish Gray to Pale Brown, Poorly Graded SAND, Trace Shell Fragments

Atterberg Limits

PL= LL= PI=

Coefficients

D₉₀= 1.0061 D₈₅= 0.8395 D₆₀= 0.4971
D₅₀= 0.4268 D₃₀= 0.3232 D₁₅= 0.2534
D₁₀= 0.2252 C_u= 2.21 C_c= 0.93

Classification

USCS= SP AASHTO=

Remarks

Visual Estimate of Shell Content < 5%
F.M.=2.12

Location: WPLA 11
Sample Number: S-1

Date: 7/25/18



ECS SOUTHEAST, LLP
6714 Netherlands Drive
Wilmington, NC 28405
Phone: (910) 686-9114
Fax: (910) 686-9666

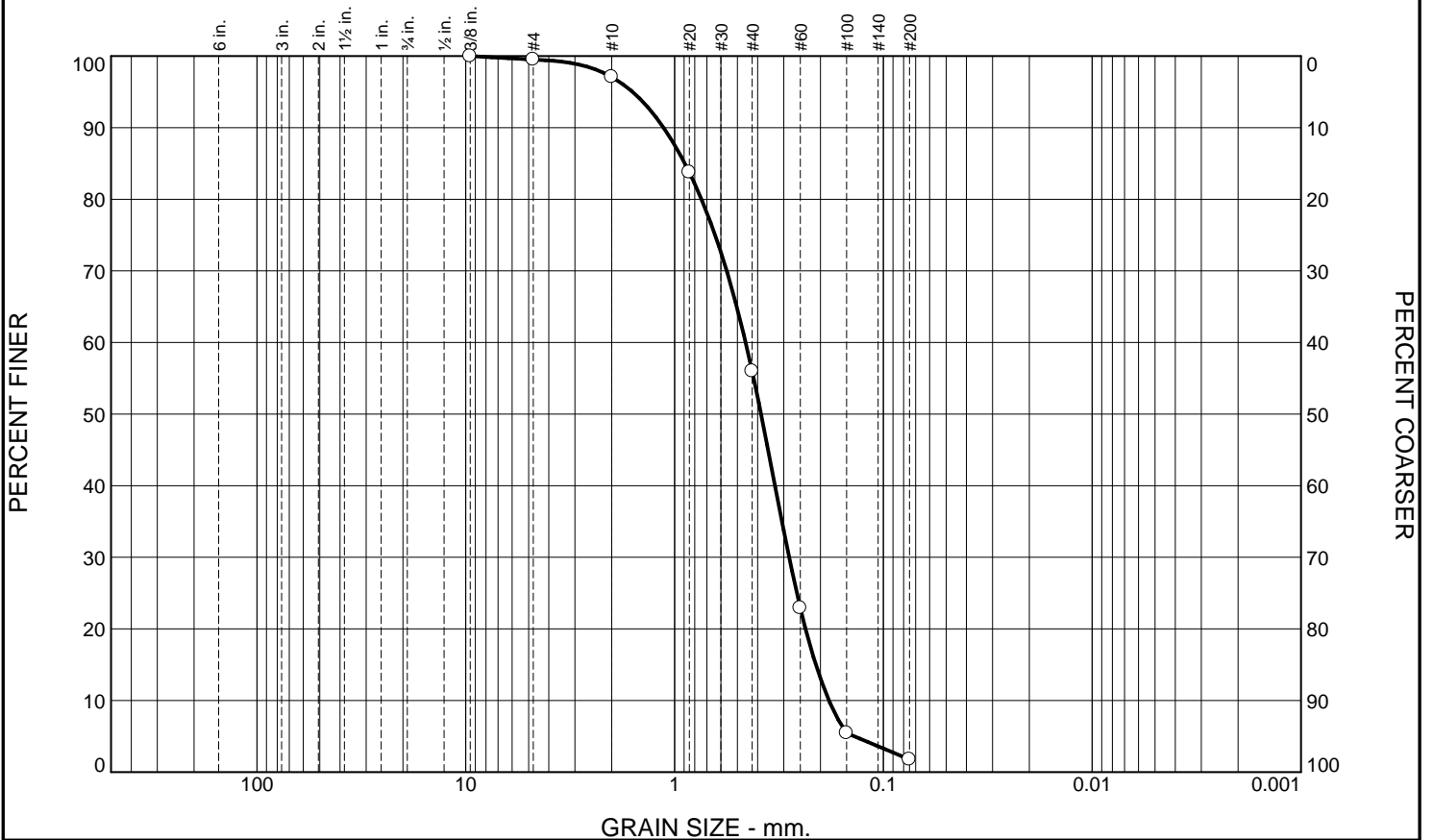
Client: Applied Technology & Management
Project: Jeckyll Island Revetment Rehabilitation - Jones Oyster Bed

Project No: 26966

Figure

Tested By: EG **Checked By:** KEL

Particle Size Distribution Report



GRAIN SIZE - mm.

% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.5	2.4	41.1	54.2	1.8	1.8

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/8	100.0		
#4	99.5		
#10	97.1		
#20	83.8		
#40	56.0		
#60	22.9		
#100	5.4		
#200	1.8		

* (no specification provided)

Soil Description

Light Brownish Gray to Pale Brown, Poorly Graded SAND, trace Shell Fragments

Atterberg Limits

PL= LL= PI=

Coefficients

D₉₀= 1.1279 D₈₅= 0.8930 D₆₀= 0.4565
D₅₀= 0.3852 D₃₀= 0.2827 D₁₅= 0.2106
D₁₀= 0.1822 C_u= 2.51 C_c= 0.96

Classification

USCS= SP AASHTO=

Remarks

Visual Estimate of Shell Content < 5%
F.M.=2.00

Location: WPLA 16
Sample Number: S-2

Date: 7/25/18



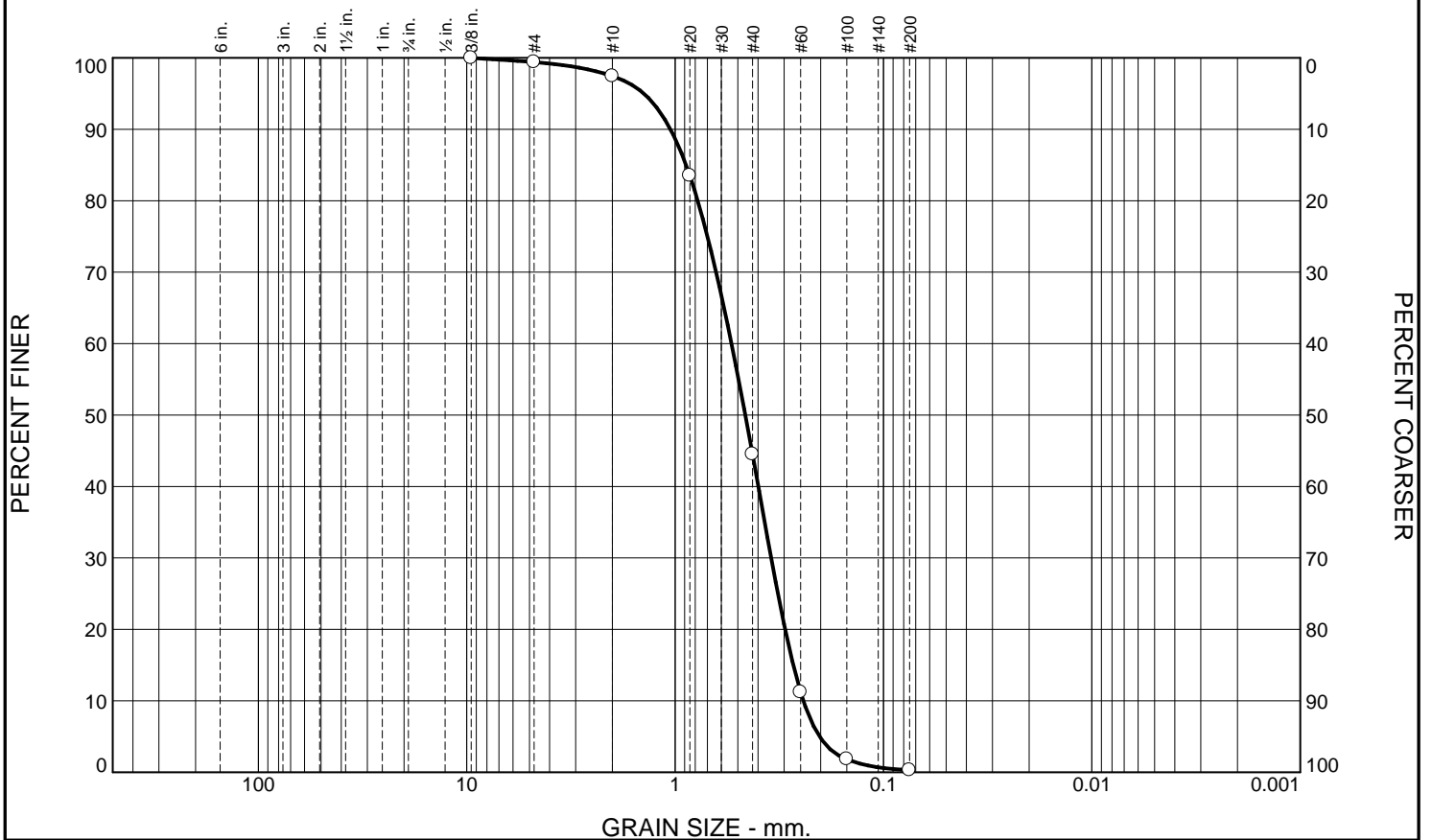
Client: Applied Technology & Management
Project: Jeckyll Island Revetment Rehabilitation - Jones Oyster Bed

Project No: 26966

Figure

Tested By: EG **Checked By:** KEL

Particle Size Distribution Report



GRAIN SIZE - mm.

% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.6	2.0	52.9	44.2	0.3	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/8	100.0		
#4	99.4		
#10	97.4		
#20	83.5		
#40	44.5		
#60	11.2		
#100	1.8		
#200	0.3		

Soil Description

Light Brownish Gray to Pale Brown, Poorly Graded SAND, trace Shell Fragments

Atterberg Limits

PL= LL= PI=

Coefficients

D₉₀= 1.0523 D₈₅= 0.8857 D₆₀= 0.5362
D₅₀= 0.4601 D₃₀= 0.3458 D₁₅= 0.2711
D₁₀= 0.2424 C_u= 2.21 C_c= 0.92

Classification

USCS= SP AASHTO=

Remarks

Visual Estimate of Shell Content < 5%
F.M.=2.21

* (no specification provided)

Location: WPLA 17
Sample Number: S-3

Date: 7/25/18



ECS SOUTHEAST, LLP
6714 Netherlands Drive
Wilmington, NC 28405
Phone: (910) 686-9114
Fax: (910) 686-9666

Client: Applied Technology & Management
Project: Jeckyll Island Revetment Rehabilitation - Jones Oyster Bed

Project No: 26966

Figure

Tested By: EG **Checked By:** KEL



ECS Southeast, LLP
6714 Netherlands Dr.
Wilmington, NC 28405
Telephone: (910) 686-9114 Fax (910) 686-9666

Soil Descriptions and Munsell Color

Date: **7/25/2018**
Project Name: **Jeckyll Island Revetment Rehabilitation - Jones Oyster Bed**
Project Number: **26966**

Sample	Description	Munsell Color
S-1	Light Brownish Gray to Pale Brown, Poorly Graded SAND	10YR 6/2 to 10YR 6/3
S-2	Light Brownish Gray to Pale Brown, Poorly Graded SAND	10YR 6/2 to 10YR 6/3
S-3	Light Brownish Gray to Pale Brown, Poorly Graded SAND	10YR 6/2 to 10YR 6/3

Appendix C
Monitoring and Potential Maintenance Plan

Jekyll Island Phase 2 Shoreline Rehabilitation

A physical monitoring plan is proposed to be implemented for the Jekyll Island transitional shoreline area of the Jekyll Island Phase 2 Shoreline Rehabilitation Project. Due to the unique nature of the existing transitional shoreline area (scattered revetment rock) and proposed sand placement combined with the lack of available historic data, physical monitoring will help observe and assess the performance of the placed sand for use in any future decision making. The goal of the physical monitoring plan is to observe the behavior of placed sand, including accretion and erosion patterns, along the transitional shoreline and areas north and south of this sand placement. No triggers or threshold requirements are incorporated into the monitoring since no baseline data exists.

Topographic & Wading Depth Surveys (Beach Profile Surveys)

Topographic profile surveys of the transitional shoreline area will be conducted within 60 days after completion of the project (post construction survey). Thereafter, surveys will be conducted annually for the next 3 years, unless the area is eroded to pre-project conditions before the third year. Monitoring surveys will be conducted during the summer months and repeated as close as practicable during the same month of the year.

The surveys will include the 8 transects shown on Figure 1 starting with station 96+00 and ending with station 110+00 at 200 ft spacing. The survey transects will begin at the landward edge of existing vegetation and extend waterward out to wading depth. Surveys will be conducted at low tide.

Engineering Monitoring Report

An engineering report will be generated within 90 days after survey completion to discuss the survey data, performance of the fill area, and identify erosion and accretion patterns. The report will include reference to pre-project conditions. The report shall specifically include:

- Survey profiles showing all monitoring surveys to date superimposed.
- Mean High Water Line position changes relative to pre-construction survey.
- Total measured remaining volume in project template relative to pre-construction survey.

Table 1: Monitoring Survey Schedule.

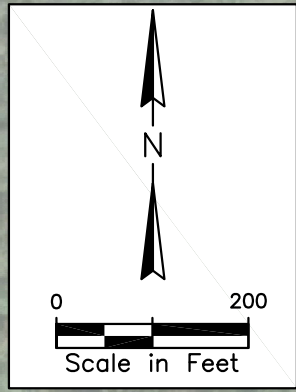
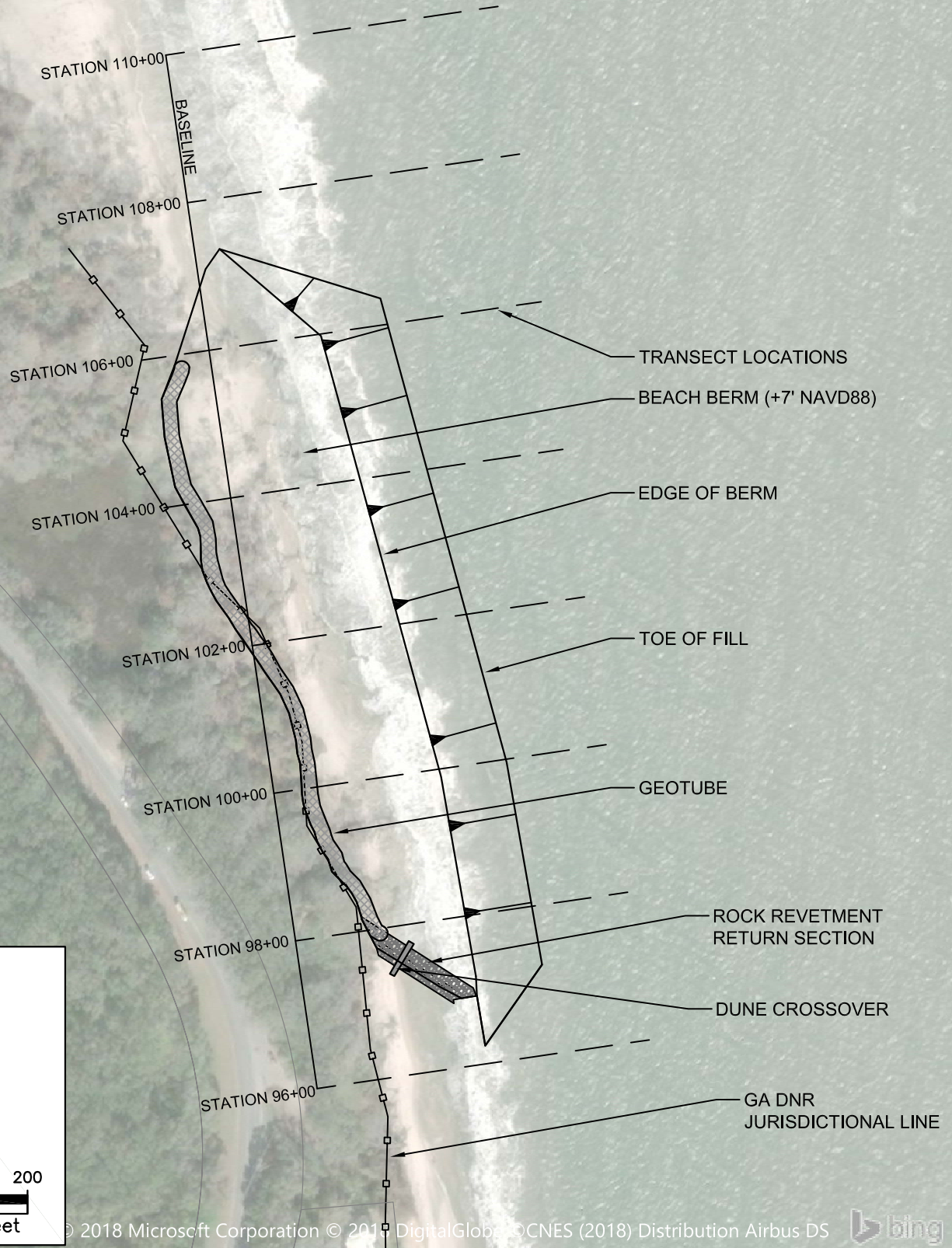
MONITORING EVENT	TOPOGRAPHIC SURVEY
Pre-Construction Survey	November 2017
Post-Construction Survey	60 days after project completion
Year 1	1 yr following post-con (2020)
Year 2	2 yr following post-con (2021)
Year 3	3 yr following post-con (2022)

Note: Additional surveys may be collected following extreme storm events

Potential Maintenance

As desired by JIA and pending funding and material availability, after normal or extreme erosional events, potential maintenance of the project is proposed to restore any deficient areas to permitted conditions. Potential maintenance activities would generally be similar in nature, with volume placement requirements dictated by the results of the monitoring data.

SURVEY NOTES:
 1. SURVEYS TO TAKE PLACE AT LOW TIDE.
 2. SURVEYS TO BEGIN AT SCARP/VEGETATION LINE AND EXTEND WATERWARD TO WADING DEPTH.



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O:\Projects\17-3113 Jekyll Island Revetment\17_CAD_Phase\217-3113-Beach\FIL-Layers-2018-07-30.dwg Monitor: 8/8/18
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North Beach Monitoring Plan
 Jekyll Island Phase 2 - Shoreline Rehabilitation
 August 8, 2018
 Figure 1



Appendix D
Sediment Quality Control/Quality Assurance Plan
For Beach or Dune Restoration Using an Upland Sand Source

Jekyll Island Phase 2 Shoreline Rehabilitation

A. INTRODUCTION

This plan outlines the responsibilities of each stakeholder in the project as they relate to the placement of beach compatible material in the terrace berm, dune, and/or on the beach. These responsibilities are in response to the possibility that non-beach compatible sediments may exist within the upland sand source(s) and could be unintentionally placed on the beach. The QC Plan specifies the minimum proposed construction management, inspection and reporting requirements to be placed on the Contractor and enforced by the JIA, to ensure that the sediment from the upland sand source(s) to be used in the project meet the compliance specifications. The QA Plan specifies the minimum construction inspection and reporting requirements to be undertaken by the JIA or the JIA’s On-Site Representative to observe, sample, and test the placed sediments to verify the sediments are in compliance.

B. SEDIMENT QUALITY SPECIFICATIONS

The sediment from the upland sand source(s) has similar characteristics to the existing coastal system at the beach placement site but is slightly coarser in median grain size. As with all sand borrow sites, it is acknowledged that it is possible that discrete occurrences of non- beach compatible sediments may exist within upland sand source(s) that do not comply with the project sediment compliance requirements as indicated in Table 1.

The compliance specifications consider the variability of sediment on the native or existing beach and are values which may reasonably be attained given what is known about the upland sand source(s). Beach fill material which falls outside of these limits will be considered unacceptable and subject to remediation.

Table 1. Sediment Compliance Specifications

Sediment Parameter	Parameter Definition	Compliance Value*
Max. Silt Content	passing #200 sieve	10%
Max. Fine Gravel/Coarse Content	retained on #4 sieve	5%
Sediment Median Grain Size	D ₅₀	0.15 – 0.46 mm
Max. Carbonate (Shell) Content	Visual; confirm with lab test if required	15% by volume
Munsell Color Value	moist Value (chroma = 1)	10YR6/1 to 10YR7/1
The beach fill material shall not contain construction debris, toxic material, other foreign matter, coarse gravel, or rocks.		

* The above values are taken to be “on average” for materials considered.

C. QUALITY CONTROL PLAN

The Contractor selected for the project will be required to establish a Quality Control Plan and submit it for review and acceptance by the JIA. This Plan will address sediment quality assurance by including: (1) the specific sampling frequency and testing methodology to be provided by the Contractor, (2) the name, address and point of contact for the required collection of samples and Licensed Testing Laboratory to be used for the grain size analysis, and (3) how the Contractor intends to assess compliance with the Sediment Compliance Specifications as shown in Table 1 above.

1. Assessment at Borrow Source. The Contractor will have qualified personnel observing the material being loaded into the barges and/or trucks for transport to Jekyll Island, at all times that loading is occurring. The selected individual shall have training or experience in construction inspection and testing and be knowledgeable of these specifications for dune/beach sand. The Contractor will perform daily visual observation of the fill material with personnel who can identify obvious changes in borrow material quality and has the authority to reject material that does not visually match the acceptable quality requirements.

The Contractor will provide at least one benchmark sample labeled "Benchmark Sample", date collected, site name, and information on where the sample was attained. The Contractor shall also retain a portion of the benchmark sample for his personnel's reference on site. If any material appears to be non-compliant, it shall be set aside for testing and/or further processing and not transported from the borrow area.

The Contractor shall collect 3 representative samples from approximately every 5,000 cubic yards of stockpiled material to visually assess grain size, Munsell color, shell content, and silt content against the benchmark sample. The sample shall be a minimum of 1 U.S. pint (approximately 200 grams). This assessment will consist of handling the fill material to ensure that it is predominantly sand to note the physical characteristics and assure the material meets the sediment compliance parameters specified herein. If deemed necessary, quantitative assessments of the sand shall be conducted for grain size, silt content, visual shell content and Munsell color using the methods outlined in Section D.6.b. Each sample shall be archived with the date, time, and location of the sample. The results of these daily inspections, regardless of the quality of the sediment, shall be appended to or notated on the Contractor's Daily Report. All samples shall be stored until at least 30 days beyond project completion.

If a sample does not meet the Sediment Compliance Specifications in Table 1, then the 5,000 cubic yards of material represented by that sample shall not be transported to the Jekyll Island placement area or any interim storage and staging area(s). The material may undergo further processing to meet the Sediment Compliance Specifications with additional testing to verify the additional processing produce material that meets the Sediment Compliance Specifications, or the material shall be set aside and not used.

2. Beach Observation. The Contractor will continuously visually monitor the sediment being placed on the beach. An assessment will be made during placement at a minimum of once every day. This assessment will consist of handling the fill material to ensure that it is predominantly sand and to note the physical characteristics, and assure the material meets the Sediment Compliance Specifications in Table 1. If noncompliant sediment is placed on the beach, the Contractor will immediately cease placement until any stockpiled material at the beach construction staging area can be verified as beach compatible and verbally notify the JIA's On-site Representative, providing the time, location, and description of the noncompliant sediment. The Contractor will take the appropriate remediation actions as directed by the JIA or JIA's Engineer.

D. QUALITY ASSURANCE PLAN

1. **Construction Observation.** Construction observation by the JIA's On-Site Representative will be performed on a daily basis during periods of active construction. The JIA's On-Site Representative will visually assess grain size, color, shell content, and silt content against the benchmark sample. The observation will include handling the fill material to ensure that it is predominantly sand to note the physical characteristics and assure the material meets the sediment compliance parameter specified in this Plan. If deemed necessary, quantitative assessments of the sand will be conducted for grain size, silt content, shell content and Munsell color using the methods outlined in D.6.b.

2. **On-Site Representative.** The project Engineer will actively coordinate with the JIA's On-Site Representative. Communications will take place between the Engineer and the JIA's On-Site Representative on a weekly basis.

3. **Pre-Construction Meeting.** The project QC/QA Plan will be discussed as a matter of importance at the pre-construction meeting. The Contractor will be required to acknowledge the goals and intent of the above described QC/QA Plan, in writing, prior to commencement of construction.

4. **Contractor's Daily Reports.** The JIA's On-Site Representative will review the Contractor's Daily Reports which will characterize the nature of the sediments encountered at the upland sand source and placed along the project shoreline with specific reference to moist sand color and the occurrence of rock, rubble, shell, silt or debris.

5. **Addendums.** Any addendum or change order to the Contract between the JIA and the Contractor will be evaluated to determine whether or not the change in scope will potentially affect the QC/QA Plan.

6. **Post-Construction Sampling for Laboratory Testing.** To assure that the fill material placed on the beach was adequately assessed by the borrow area investigation and design, JIA will conduct assessments of the sediment as follows:

a. Post-construction sampling of each acceptance section and testing of the fill material will be conducted to verify that the sediment placed on the beach meets the expected criteria/characteristics. Upon completion of an acceptance section of constructed berm and/or dune, the JIA or project Engineer will collect two representative sand samples at approximately 1,000 ft intervals along the completed fill, to quantitatively assess the grain size distribution, moist Munsell color, shell content, and silt content for compliance. The Project Engineer will visually assess grain size, Munsell color, shell content, and silt content of the material by handling the fill material to ensure that it is predominantly sand, and further to note the physical characteristics. One sample will be sent for laboratory analysis while the other sample will be archived by the JIA.

b. The collected samples will be visually analyzed by a certified laboratory for carbonate/shell content and Munsell color and a sieve analysis performed to determine grain size distribution and percent fines. Gradation analysis shall be performed according to applicable sections of ASTM D422, ASTM D1140, and ASTM D2487. U.S. Standard sieve sizes shall include numbers 4, 10, 40, 60, 100, 140, and 200, at a minimum.

c. A summary table of the sediment samples and test results for the sediment compliance parameters will be prepared and indicate whether each sample MET or FAILED the compliance values found in Table 1. The sediment testing results will be certified by a P.E. or P.G. registered in the State of

Georgia. A statement of how the placed fill material compares to the sediment analysis and volume calculations from the project design shall be included. The JIA will submit a sediment testing results and analysis report to the GA DNR and USACE within 90 days following completion of beach fill construction.

d. In the event that a section of fill contains material that is not in compliance with the sediment compliance specifications, then the GA DNR and USACE will be notified. Notification will indicate the volume, aerial extent and location of any unacceptable fill areas and remediation planned.

7. Remediation Actions. The JIA or JIA's Engineer shall have the authority to determine whether the material placed on the beach is compliant or noncompliant. If placement of noncompliant material occurs, the Contractor will be directed by the JIA or JIA's Engineer on the necessary corrective actions. Should a situation arise during construction that cannot be corrected by the remediation methods described within this QC/QA Plan, the GA DNR and USACE will be notified. The remediation actions for each sediment parameter are as follows:

a. Silt: blending the noncompliant fill material with compliant fill material within the adjacent construction berm or dune sufficiently to meet the compliance value or removing the noncompliant fill material and replacing it with compliant fill material.

b. Shell: blending the noncompliant fill material with compliant fill material within the adjacent construction berm or dune sufficiently to meet the compliance value or removing the noncompliant fill material and replacing it with compliant fill material.

c. Munsell color: blending the noncompliant fill material with compliant fill material within the adjacent construction berm or dune sufficiently to meet the compliance value or removing the noncompliant fill material and replacing it with compliant fill material.

d. Coarse gravel: screening and removing the noncompliant fill material and replacing it with compliant fill material.

e. Construction debris, toxic material, or other foreign matter: removing the noncompliant fill material and replacing it with compliant fill material.

All noncompliant fill material removed from the beach will be transported to an appropriate upland disposal facility located landward of the GA DNR SPA line. Re-testing of any remediated sections will be conducted as outlined in Section D.6 above.