INTERA - GEC
A joint venture of INTERA and G.E.C.

March 12, 2025

Niles Cyzycki
Volusia County Coastal Division
515 S. Atlantic Ave.
Daytona Beach, FL 32118

Re: Ponce de Leon Inlet Flood Shoal Surveys Summary Report

Dear Mr. Cyzycki,

In support of Volusia County's plan to dredge portions of the Ponce de Leon Inlet flood shoals to provide beach quality sand for beach and/or dune restoration, INTERA-GEC has conducted this flood shoal assessment to support future state and federal permit applications. The assessment included collection and analysis of a bathymetric and topographic survey and geotechnical data to identify the horizontal and vertical limits of beach quality sand that could potentially serve as borrow material. The assessment targeted the shoals shown in Figure 1, as directed by the County.

As subcontractors to INTERA-GEC, Morgan & Eklund, Inc. collected the bathymetric and topographic survey data in accordance with Florida Department of Environmental Protection (FDEP) surveying standards during April 2024, and Athena Technologies, Inc. collected vibracores and surface samples during July 2024. Attachment A contains the survey report and drawings, and Attachment B contains the 2024 geotechnical report. Of note, INTERA-GEC received prior approval (i.e., confirmation of sufficiency for permitting purposes) from FDEP of the survey line layout and geotechnical data collection plan (G. Garis, personal communication, February 29, 2024). Figure 2 presents the July 2024 elevation contours of the study area, the locations of the vibracores and grab samples, and outlines of the eight separate shoaling areas. The following sections discuss (1) the characteristics of the flood shoal material, as well as existing beach sand; (2) the compatibility of the material with the existing beach sand north and south of the inlet; and (3) the approximate volume and location of potential borrow material.

Ponce de Leon Inlet Flood Shoal Material Characteristics

The geotechnical investigation collected and analyzed 19 vibracores (10-foot target penetration depths) and 22 surface grab samples, at the locations shown in Figure 2. Laboratory testing of three-to-five samples per core and the surface grab samples determined the grain size distribution and Munsell color of the material as well as the carbonate content of one representative sample per core and one representative grab sample per shoal. summarizes the vibracoring results, Table 2 presents the composite characteristics of the beach compatible material within each core, and Table 3 presents the surface sample characteristics. The beach compatible samples exclude samples S-3 of CB-01 and S-04 and S-05 of CB-17 that identified unfavorable material, as well as samples S-03 and S-04 of CB-06 that characterized a layer of shell hash. The sediment samples consisted mostly of poorly graded fine-grained quartz sand with trace amounts of silt, sand-size shell fragments, and gravel-size shell fragments. Overall, the beach compatible materials within the flood shoals combined have a mean grain size of 0.17 mm (2.61 ϕ), standard deviation of 0.56 ϕ, 1.8% fines, 6.4% carbonates, and Munsell color of 5Y 7/1.

Figure 1 Potential Flood Shoal Borrow Areas

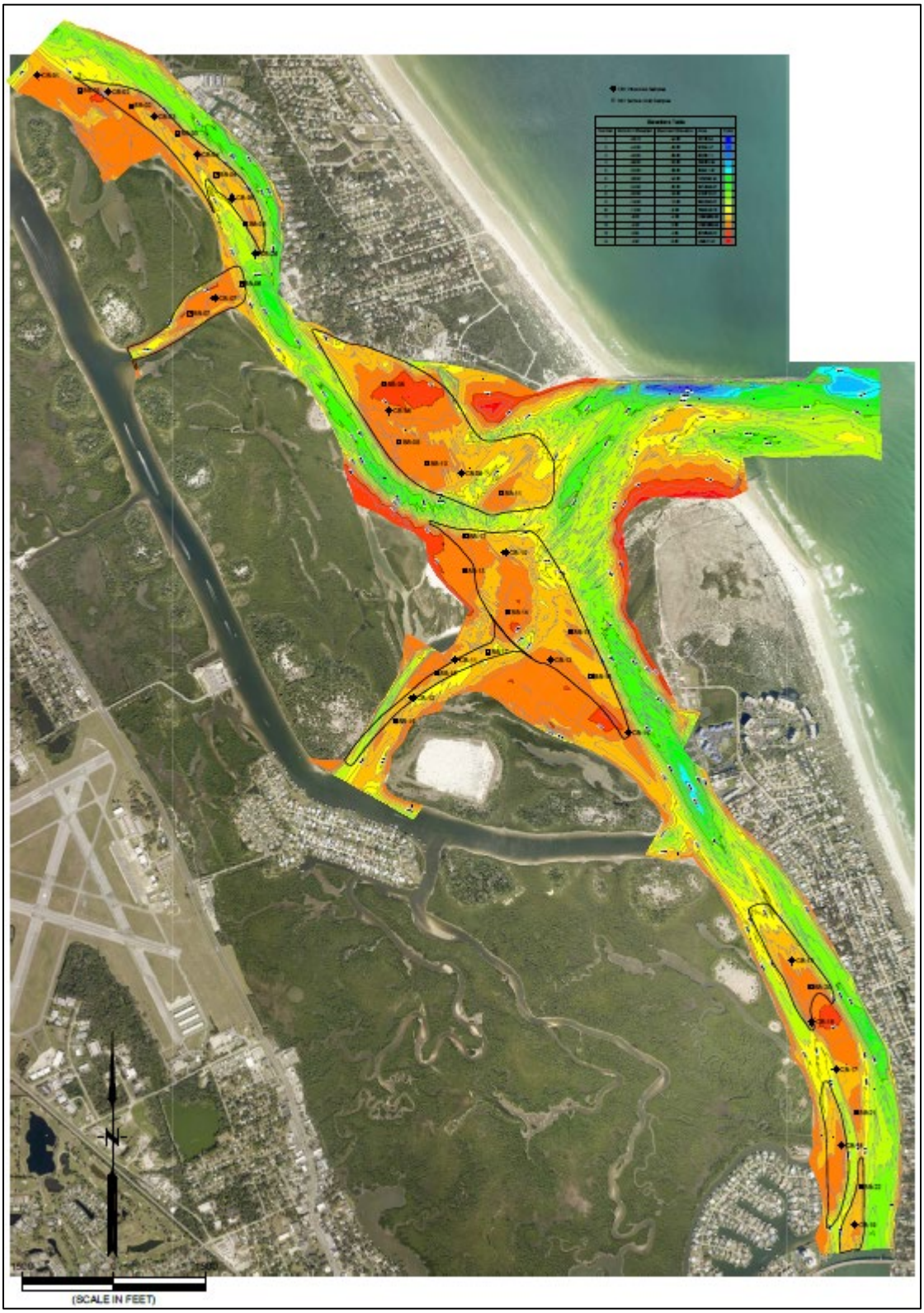

Figure 2 Elevation Contours (July 2024) and Sediment Sampling Locations

Table 1 Vibracore Results Summary

ID	Easting[1]	Northing[1]	Sediment Surface Elevation (ft NAVD88)	Core Penetration (ft)	Core Recovery (ft)	Bottom of Recovered Core Elevation (ft NAVD88)	Limit of Beach Compatible Sand (ft NAVD 88)
CB-01	672,788	1,729,685	-3.7	10	6.2	-9.9	-8.3
CB-02	673,932	1,729,413	-0.6	11.5	10.9	-11.5	-11.5
CB-03	674,682	1,729,017	-4.1	11.5	9.8	-13.9	-13.9
CB-04	675,390	1,728,384	-4.8	12	10.5	-15.3	-15.3
CB-05	675,957	1,727,681	-9.3	10.5	8.9	-18.2	-18.2
CB-06	676,339	1,726,771	-12.8	10.5	8.6	-21.4	-21.4
CB-07	675,670	1,726,052	-2.2	10.5	9.1	-11.3	-11.4
CB-08	678,509	1,724,220	-0.9	10.5	8.8	-9.7	-9.7
CB-09	679,680	1,723,207	-3.6	11	9	-12.6	-12.6
CB-10	680,399	1,721,912	-4.1	10	8.4	-12.5	-12.5
CB-11	679,585	1,720,177	-5.4	12	11.4	-16.8	-16.8
CB-12	678,894	1,719,555	-6.7	12	10.1	-16.8	-16.8
CB-13	681,129	1,720,168	-2.2	10	8.3	-10.5	-10.5
CB-14	682,392	1,718,986	-1.2	10.5	9.1	-10.3	-10.3
CB-15	685,065	1,715,270	-4.7	11.5	9.8	-14.5	-14.5
CB-16	685,388	1,714,274	-1.2	11	9.9	-11.1	-11.1
CB-17	685,777	1,713,499	-7.1	10	8.6	-15.7	-13.3
CB-18	685,868	1,712,265	-1.7	10	8.3	-10	-10
CB-19	686,081	1,710,985	-4.2	12	10.7	-14.9	-14.9

[1]State Plane Florida East (NAD 83) in feet

Table 2 Vibracore Composite Characteristics

ID[1]	Number of Samples Tested	Mean Grain Size (mm)	Mean Grain Size (ϕ)	St. Dev. (ϕ)	Carbonate Content (%)	Fines Content (%)	Munsell Color
CB-01	3	0.14	2.83	0.82	3.1	2.1	5Y 6/2
CB-02	4	0.14	2.81	0.44	2.3	1.5	5Y 6/2
CB-03	4	0.15	2.75	0.45	3.6	1.5	5Y 6/1
CB-04	4	0.17	2.61	0.68	5.7	2.0	5Y 6/2
CB-05	4	0.27	2.10	1.09	14.6	2.0	5Y 7/1
CB-06	5	0.42	1.52	1.61	30.9	2.1	5Y 7/1
CB-07	3	0.14	2.80	0.36	2.3	1.3	5Y 7/1

ID[1]	Number of Samples Tested	Mean Grain Size (mm)	Mean Grain Size (ϕ)	St. Dev. (ϕ)	Carbonate Content (%)	Fines Content (%)	Munsell Color
CB-08	3	0.16	2.66	0.50	3.9	1.2	5Y 7/1
CB-09	3	0.15	2.70	0.37	2.9	1.1	5Y 7/1
CB-10	4	0.19	2.39	0.55	6.4	1.5	5Y 7/1
CB-11	4	0.15	2.77	0.40	2.2	2.7	5Y 7/1
CB-12	4	0.15	2.77	0.39	2.9	1.6	5Y 7/1
CB-13	3	0.15	2.71	0.39	2.7	1.8	5Y 7/1
CB-14	4	0.14	2.87	0.39	3.2	2.2	5Y 7/1
CB-15	4	0.18	2.52	0.81	8.8	1.8	5Y 7/1
CB-16	3	0.14	2.85	0.35	2.7	1.8	5Y 7/1
CB-17	5	0.21	2.27	1.28	13.0	1.9	5Y 7/1
CB-18	3	0.14	2.84	0.49	4.3	1.5	5Y 7/1
CB-19	5	0.19	2.51	0.72	5.2	2.6	5Y 7/1
Average2	72	0.17	2.61	0.56	6.4	1.8	5Y 7/1

[1]Composite calculations exclude samples S-3 of CB-01 and S-04 and S-05 of CB-17 which identified unfavorable material, as well as samples S-03 and S-04 of CB-06 which characterized a layer of shell hash.
[2]The average mean grain size and standard deviation were calculated by the method of moments.

Table 3 Surface Sample Summary

Sample ID	Easting[1]	Northing[1]	Sediment Surface Elevation (ft NAVD88)	Mean Grain Size (mm)	Mean Grain Size (ϕ)	St. Dev. (ϕ)	Carbonate Content (%)
SS-01	673,475	1,729,427	-0.8	0.14	2.82	0.32	-
SS-02	674,310	1,729,182	-3.1	0.12	3.03	1.17	-
SS-03	675,069	1,728,727	-3.3	0.29	1.79	1.24	13.6
SS-04	675,694	1,728,059	-6.2	0.25	2.01	1.32	-
SS-05	676,174	1,727,266	-9.5	0.21	2.26	0.88	-
SS-06	676,101	1,726,283	-8.4	0.17	2.52	0.53	3.9
SS-07	675,265	1,725,804	-0.4	0.15	2.77	0.37	-
SS-08	678,425	1,724,662	0.5	0.15	2.70	0.41	-
SS-09	678,672	1,723,708	-1.2	0.17	2.59	0.41	2.5
SS-10	679,122	1,723,370	-3.1	0.17	2.58	0.36	-
SS-11	680,335	1,722,893	-2.7	0.17	2.55	0.39	-
SS-12	679,750	1,722,178	-2.8	0.15	2.75	0.38	2.7
SS-13	679,734	1,721,624	-1.3	0.18	2.45	0.73	-
SS-14	680,441	1,720,945	-1.7	0.15	2.74	0.35	-
SS-15	681,456	1,720,618	-2.4	0.16	2.63	0.35	2.1

Sample ID	Easting[1]	Northing[1]	Sediment Surface Elevation (ft NAVD88)	Mean Grain Size (mm)	Mean Grain Size (ϕ)	St. Dev. (ϕ)	Carbonate Content (%)
SS-16	681,794	1,719,910	-4.6	0.16	2.64	0.49	-
SS-17	680,122	1,720,291	-8.7	0.14	2.82	0.361.2	-
SS-18	679,277	1,719,957	-3.3	0.16	2.61	0.441.1	3.3
SS-19	678,602	1,719,168	-5.3	0.21	2.26	0.60	-
SS-20	685,367	1,714,853	-1.8	0.15	2.78	0.37	-
SS-21	686,106	1,712,803	-0.3	0.12	3.06	0.39	1.9
SS-22	686,186	1,711,592	-4.1	0.30	1.73	2.57	-
			Average	0.18	2.55	0.66	4.3[2]

[1]State Plane Florida East (NAD 83) in feet

[2]Excluding sample SS-03 with an abnormally high carbonate content, the average carbonate content equals 2.7%.

Natural Beach Sediment — New Smyrna Beach South of Ponce de Leon Inlet

Coastal Technology Corporation (2005) (Attachment C) presents gINT-based gradation curves and sedimentology data for native beach samples collected during summer (June 2002) and winter (February 2005). Summer samples were collected at toe of dune, mid-backshore, mean high water (MHW), and mean low water (MLW) positions along shore-perpendicular transects at DEP monuments R-150, R-155, R-160, R-165, R-170, R-175, R-180, R-185, R-190, R-195, R-200, and R-205. Winter samples were collected at toe of dune, mid-backshore, MHW, MLW, and -5 ft positions along shore-perpendicular transects at DEP monuments R-161, R-165, R-170, R-175, R-180, R-185, R-190, R-195, R-200, R-205, and R-210. Attachment D (from INTERA-GEC [2024]) summarizes the mean grain size, fines content, carbonate content, and Munsell color of the native beach samples from R-160 to R-195 covering the proposed beach fill placement area. Overall, the summer samples have a mean grain size and standard deviation (calculated via the moment method) of 0.17 mm (2.53 ϕ), standard deviation of 0.44 ϕ, 0.6% fines, and 5.6% carbonates on average; excluding samples with abnormally high (>10%) carbonate content (i.e., the MLW samples S-R160L, S-R175L, S-R190L and S-R195L), the average values reduce to a mean grain size and standard deviation of 0.16 mm (2.65 ϕ), standard deviation of 0.34 ϕ, 0.5% fines, and 2.3% carbonates. The winter samples have a mean grain size and standard deviation of 0.30 mm (1.74 ϕ), standard deviation of 0.79 ϕ, 0.8% fines, and 24.1% carbonates on average; excluding samples with >10% carbonates (the -5 ft samples at R-165 and R-175 and all samples at R-185, R-190, and R-195), the average values reduce to a mean grain size and standard deviation of 0.18 mm (2.44 ϕ), standard deviation of 0.49 ϕ, 0.9 % fines, and 5.3% carbonates.

Of note, Taylor Engineering (2000) — prepared on behalf of FIND in support of the application for FDEP Permit 0177220-001-JC (issued August 6, 2001) for the 2006 offloading of Rattlesnake Island with fill placement along New Smyrna Beach — summarizes geotechnical characteristics of the natural beach sediment. The reported testing results (Attachment E) characterize 29 samples collected from

approximately +10 ft to -10 ft along shore-perpendicular profiles spaced approximately 3,000 ft from R-161 to R-176. All samples were tested for gradation and carbonate content. The composite of all samples combined had an average mean grain size of 0.19 mm (2.44 ϕ), standard deviation of 0.614 ϕ, 0.4% fines, and 6.2% carbonates. Gradation tables and curves for these data are unavailable.; thus, the following compatibility analysis relies on the data, discussed above, provided in Coastal Technology Corporation (2005).

Natural Beach Sediment – North of Ponce de Leon Inlet

Taylor Engineering (2022) — prepared on behalf of Volusia County in support of the application for FDEP Permit 0428162-001-JC (issued October 24, 2023) for the nearshore placement of maintenance dredging materials — summarizes the geotechnical characteristics of the natural beach sediment lying within four miles north of the inlet. The reported testing results (Attachment F) characterize 20 samples collected from approximately MHW, -10 ft, -20 ft, and -30 ft along shore-perpendicular profiles at R-125, R-130, R-125. R-140, and R-145. All samples were tested for gradation, carbonate content, organic content, visual shell, and Munsell color. Taylor Engineering (2022) summarizes the results as follows:

> *The sediment samples consisted mostly of poorly graded fine grain sand with trace amounts of silt, shell, and shell hash. The mean grain size ranged from 0.13 mm to 0.21 mm with an average mean grain size of 0.16 mm. Fines content (% passing #230 sieve) ranged from 0.78% to 2.26% with an average content of 1.54%. Fine gravel content (% retained on #4 sieve) consisted of shell and ranged from 0.00% to 5.30% with an average content of 0.40%. Carbonate content ranged from 4.0% to 14.0% with an average content of 6.1%. Organic content ranged from 0.2% to 2.1% with an average content of 0.5%. Visual shell content ranged from 0.0% to 7.0% with an average content of 0.7%. Moist Munsell color ranged from 2.5Y 6/2 (light brownish gray) to 10YR 3/2 (very dark grayish brown). The post carbonate sieve analysis mean grain size ranged from 0.13 mm to 0.19 mm, with an average mean grain size of 0.15 mm.*

Table 4 presents the average sediment characteristics. Additionally, Table 4 includes the native beach sediment characteristics representative of R-139 to R-145 as presented in USACE (2024) (Attachment G).

Compatibility of Flood Shoal and Existing Beach Sediments

As demonstrated in Table 4, the characteristics of the flood shoal material are very similar to the native beach sand. The proposed fill material has an overfill ratio (per the James-Krumbein method [Krumbein and James, 1965]) ranging from approximately 1.0 – 1.12 north of the inlet. Along New Smyrna Beach south of the Inlet, the overfill ratio ranges from 1.18 – 1.25, except for the “unstable” overfill value that results from comparing the flood shoal material to the winter samples with an abnormally high carbonate content, which increases the overall average mean grain size of the native beach.

Table 4 Sediment Compatibility Summary

Characteristic	R-125 to R-145[1]	R-139 to R-145[2]	Summer[3] (R-160 to R-195)	Winter[3] (R-160 to R-195)	Summer (R-160 to R-195)	Winter (R-160 to R-195)	Flood Shoals Composite
Mean Grain Size (mm)	0.16	0.18	0.16	0.18	0.17	0.30	0.17
Mean grain size (ϕ)	2.62	2.50	2.65	2.44	2.53	1.74	2.61
Standard Deviation (ϕ)	0.55	0.59	0.34	0.49	0.44	0.79	0.56
Percent Fines	1.5	1.2	0.5	0.9	0.6	0.8	1.8
Shell (% retained on #4 sieve)	0.4	0.0	N/A	N/A	N/A	N/A	5.6
Percent Carbonates	6.1	2.7	2.3	5.3	5.6	24.1	6.4
Moist Munsell Color	2.5Y 6/2 to 10YR 3/2	N/A	N/A	N/A	N/A	N/A	5Y 7/1
Overfill Ratio	1.0	1.12	1.18	1.25	1.16	unstable	-

[1]Taylor Engineering (2022)

[2]Table 4 of USACE (2024)

[3]Excludes samples with 10% carbonate content

Volume and Location of Potential Flood Shoal Borrow Material

This planning level assessment of the Ponce de Leon Inlet flood shoal identified the limits of beach compatible sand through analysis of the above-mentioned geotechnical data collected in 2024. As shown in the last column of Table 1, the data revealed that beach compatible sand extended to a minimum elevation of approximately -10 ft NAVD88 at all vibracore locations, except for CB-01. Vibracore CB-01, which lies at the north end of the study area, only penetrated 6.2 ft into the sediment bottom and contained a minimal amount of beach compatible sediment; thus, the sediment in the immediate vicinity of CB-01 was excluded from further consideration as borrow material.

For a preliminary estimate of the flood shoal volume that could potentially serve as borrow material, this analysis calculated the volume of sand above the -10 ft NAVD88 contour in the eight separate flood

shoals. Attachment H present plan views and cross sections of the eight sites; the contours in the plan views represent the thickness of the sand layer above -10 ft NAVD88, and the cross sections show the sand layer represented in the plan views. Table 5 summarizes the area and volume of beach compatible sand within each site. In total, the flood shoals contain approximately 2,483,000 cy of sand above -10 ft NAVD88.

Table 5 Surface Sample Summary

Site	Area (sq. ft.)	Cut Elevation (ft NAVD88)	Volume Above Cut (cy)
Site 1	1,493,723	-10	238,388
Site 2	920,362	-10	190,970
Site 3	4,993,813	-10	985,976
Site 4	3,591,431	-10	694,901
Site 5	629,918	-10	70,830
Site 6	1,002,872	-10	148,036
Site 7	643,310	-10	109,273
Site 8	335,227	-10	44,909
Total	13,610,656	-	2,483,283

Conclusion

This preliminary analysis identified a substantial volume of beach compatible sediment within the flood shoals. However, further detailed analysis is required to refine the potential horizontal and vertical dredging boundaries for flood shoal excavation. The detailed analysis may supplement the 2024 data discussed herein with available data from prior geotechnical data collection efforts, will require environmental field studies to identify habitat that future excavation shall avoid, and will require numerical modeling of proposed flood shoal excavation to assess the effects on the inlet and surrounding waterways and habitat. As a rule of thumb, a borrow area should contain approximately 150% (in addition to overfill factors) of the required beach fill volume to account for unexpectedly encountering unsuitable material, sand losses during dredging, and environmental buffers around the dredge areas. Therefore, one should consider a smaller planning volume for beach placement, say near 1.7 million cubic yards of sand.

The data presented herein demonstrates the flood shoal material's compatibility with the natural beach sediment north of Ponce de Leon Inlet and along New Smyrna Beach south of the inlet. Given the flood shoals consist of littoral sediments transported into Ponce de Leon Inlet, excavation and placement of the flood shoal material along the beach represents a prudent bypassing practice of returning material, trapped by the inlet, to the littoral system along the open coast.

Sincerely,

Michael Trudnak, P.E.
Senior Coastal Engineer
INTERA-GEC, LLC

Attachments:
Attachment A —Hydrographic survey (April 2024)
Attachment B — 2024 Geotechnical Report
Attachment C — Coastal Technology Corporation (2005)
Attachment D — New Smyrna Beach Native Beach Sediment Data Summary Tables
Attachment E — Taylor Engineering (2000)
Attachment F — Taylor Engineering (2022)
Attachment G — USACE (2024)
Attachment H — Plan Views and Cross Sections of Sites 1–8

cc: Volusia County – Jessica Fentress
INTERA-GEC - Mike Krecic, Tem Fontaine

REFERENCES

Coastal Technology Corporation. 2005. *Volusia County Sand Search – Geotechnical Investigations Task 2 Reconnaissance Level – Countywide Offshore Investigation Final Report*. Melbourne, FL.

INTERA-GEC (2024). *Attachment B Revised Sediment Compatibility Analysis, Response to First Request for Additional Information, DEP Application No. 0428162-002-JM, Rattlesnake Island Offloading, New Smyrna Beach, Volusia County, FL*. Jacksonville, FL.

Krumbein, W.C., and James, W.R. 1965. "Spatial and temporal variations in geometric and material properties of a natural beach." *Technical Rep No. 44,* Coastal Engineering Research Center, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

Taylor Engineering, Inc. 2000. *MSA 434/434C Offloading Project JCP File Number: 0177220-001-JC Response to December 15, 2000 RAI Attachment F Sediment Data*. Jacksonville, FL.

Taylor Engineering, Inc. 2022. *Nearshore Placement Area North of Ponce de Leon Inlet Volusia County, FL Joint Coastal Permit Application Attachment N North Nearshore Placement Area Sediment Report*. Jacksonville, FL.

U.S. Army Corps of Engineers Jacksonville District. 2024. *Sediment Compatibility Analysis, Intercoastal Waterway (IWW): Volusia County and Ponce de Leon Inlet O&M Dredging Project, 12 Foot Volusia County, Florida*. Jacksonville, FL.