

**2011 Beach Renourishment:
South Amelia Island
Shore Stabilization Project
(FDEP Permit No. 0187721-010-JC)**

YEAR FIVE POST-CONSTRUCTION MONITORING REPORT

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EXECUTIVE SUMMARY

The 2011 renourishment of the South Amelia Island Shore Stabilization Project (SAISSP) placed approximately 2.1 million cubic yards (Mcy) of beach quality sand along roughly 3.2 miles of the Atlantic Ocean shoreline of Amelia Island in Nassau County, FL (FDEP survey monuments R-59.5 to R-77). The 2011 renourishment was the second scheduled renourishment of the original 1994 SAISSP restoration and the first renourishment following completion of the Phase II structural stabilization project in 2004-2005. The first maintenance renourishment of the SAISS project was completed in 2002.

The 2011 project was constructed by Marinex Construction, Inc., of Charleston, SC. Olsen Associates, Inc., of Jacksonville, FL, was contracted by the South Amelia Island Shore Stabilization Association (SAISSA) to design and permit the project and to provide contract management, permit compliance, and post-construction monitoring/reporting services for the renourishment. For the latest annual intersurvey period (Year 5 post-construction), the project shoreline and the adjacent areas from FDEP survey R-monument R-55 in American Beach southward to R-82 at the A1A bridge (5.3 miles) were surveyed in May 2016. Arc Surveying and Mapping of Jacksonville, FL, conducted the beach profile surveys and a hydrographic survey of the 2011 borrow area (May 2016) and the Nassau Sound ebb shoal (June 2016). An additional beach profile survey was conducted by Arc for the previous monitoring year (Year 4) in June 2015. Digital aerial orthophotography was collected in conjunction with the May 2016 survey by Kucera International, Inc., of Willoughby, OH.

The Year 4 and Year 5 monitoring periods from May 2014 to June 2015 to May 2016 followed the placement of approximately +581,000 CY of sand dredged by the USACE from the Atlantic Intracoastal Waterway between July and November 2013 and placed placed along the Amelia Island State Park (AISP) shoreline south of the rock breakwater south of survey monument R-75.

Years 4 and 5 Beach Volume Changes Beach profile surveys from May 2014 to May 2016 indicate that the entire monitored shoreline (R-55 in American Beach to R-82 at the A1A bridge) experienced a net gain of +461,900 CY during this two-year period. All of the measured gains, however, occurred below Mean High Water (MHW), and as is discussed throughout the report, the vast majority of the gains occurred in deeper water, below -7 to -8 ft NAVD88. Within the limits of the 3-mile SAISSA portion of the overall project (R-59 to the detached rock breakwater at R-75+250, approx.) the beach gained approximately +125,600 CY of sand in the last two years, the overwhelming majority of which occurred in the submerged portions of the profile. In particular, the volume changes measured along the SAISSA project segment over the latest annual intersurvey period -- June 2015 to May 2016 -- reveal a net loss of -214,700 CY on the dry beach above -8 ft NAVD88, and a substantial gain of sand (+429,900 CY) in the submerged areas below -8 ft, down to -20 ft NAVD88. The Year-5 net loss above -8 ft corresponds to approximately 10.9% of the volume of sand placed along the SAISSA shoreline in the 2011 renourishment.

The gains in the submerged areas below -7 ft to -8 ft include several feet of accretion atop the primary bar and extend seaward into deeper waters below -20 ft NAVD88. A portion of this accretion may be the result of storm-driven offshore transport (prior to the May 2016 year-5 survey), particularly from the upper beach seaward out to the primary bar. Another potential source of accretion is the southward transport of sand from north of the project and survey limits. Over the project life, such influxes of sand have been observed to occur on occasion (reference the Year-2 to Year-3 period). Lastly, because the accretion does extend into deeper water than perhaps expected, interest rises that the hydrographic portion of the survey data may have a small systematic shift in it (on the order of just a few inches)¹. As future surveys are performed, the agreement between surveys, especially in the deeper waters, will be carefully monitored. Regardless, the overall behavior of the beach has been the erosion of sand from the beach above -7 ft to -8 ft, and the accretion of sand in the nearshore areas below and offshore of those depths.

Year 4 & Year 5 Shoreline Changes - Over the two year monitoring period, the MHW shoreline along the SAISSA segment retreated by a weighted average of almost -34 ft. Retreat was measured at each monument located within the segment, with the most severe recession occurring at AP-22 (Riverstone tract, -77 feet) and R-69 (Sea Dunes, -78 feet). Consistent with the long-term behavior of the South Amelia Island shoreline, the central and southern portions of the beach continue to retreat at a faster rate than the northern portion.

¹ It should be recognized that a) the topographic (upland) portion of the surveys is generally considered to have a higher level of accuracy and repeatability compared to the hydrographic component of the surveys. These two survey portions overlap at wading depths in the nearshore. It is also clearly noted that the survey results themselves are well within the standard level of accuracy of hydrographic surveys.

5-Year Project Volume Changes (2011-2016) – **Figure EX-1** plots the 5-year evolution of a representative beach profile along the SAISS project segment, illustrating the profile changes since the renourishment project construction in 2011. The profile plot indicates the erosion of the upper beach from the initial post-construction profile (red shaded area), and a comparable amount of accretion in the submerged areas offshore (green shaded area). A large portion of the accretion can be generally attributed to beach profile equilibration, much of which occurred in the first one to two years of the project. Equilibration is the process by which the steep post-construction profile is reshaped by waves and tides carrying sand offshore from the fill and depositing it to create a more natural profile. More recent accretion in the offshore areas, as discussed above, may be the result of recent storm impacts or sand influxes from outside the project segment limits.

As generally represented by the profile response shown in **Figure EX-1**, during the five-year post-renourishment period from August 2011 to May 2016, the 3-mile SAISSA portion of the project shoreline from Burney Park southward to the rock breakwater (R-59 to R-75+250) lost:

- -720,000 CY measured from the dunes to MHW (+2.0 ft NAVD88)
 - 36.5% of the 2011 overall placement volume
 - 73.2% of the sand placed above MHW in the 2011 project
- -1,216,000 CY, measured from the dunes to -7 ft NAVD88
 - 61.5% of the 2011 placement volume
- -118,400 CY overall, measured from the dunes seaward out to -20 ft NAVD88
 - 6.0% of the 2011 placement volume

The five-year volume losses along the SAISSA portion equate to average annual erosion rates of -151,600 CY/yr (dunes to MHW), -256,000 CY/yr (dunes to -7 ft NAVD88) and -24,900 CY/yr (dunes to -20 ft NAVD88). These rates do include the stabilizing effects of the rock breakwater and the 2013 AIWW disposal project south of the breakwater, as well as potential influxes of sand from not only the 2013 disposal project, but also from areas north of the SAISSA shoreline.

Along the Amelia Island State Park Atlantic Ocean shoreline, over the five year period from August 2011 to May 2016, the beach gained +338,900 cy out to survey closure (approaching -20 ft NAVD88), with only a small portion of that gain, +7,900 cy, occurring above MHW. Much of this gain is related to the 2013 AIWW beach disposal, without which this shoreline segment would have experienced a significant net loss overall.

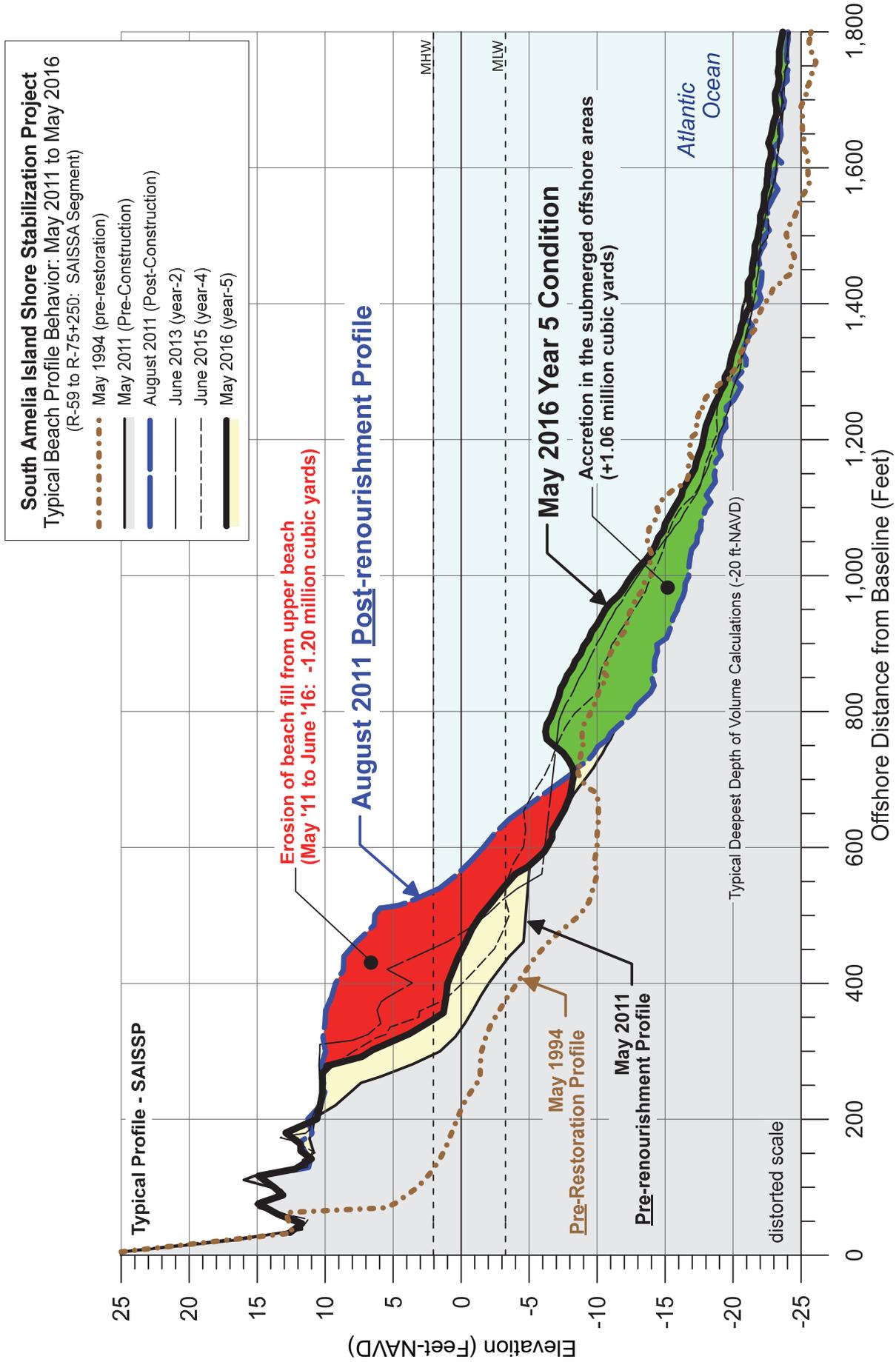


Figure EX-1 Historical beach profile changes representative of the performance of the 3-mile SAISSA portion of the South Amelia Island Shore Stabilization Project over the five-year post-renourishment period from August 2011 to May 2016. For reference the initial May 1994 pre- beach restoration profile is likewise shown.

In regard to the project's renourishment interval, the upper portion of the beach above -7 ft NAVD88 has eroded at an overall pace, approximately -256,000 CY/yr, that is relatively consistent with the historical average for the project, allowing for an 8-9 year renourishment interval under current design plans. The presence of a significant volume of sand deposited in the offshore portions of the beach profile over the last five years is a development not observed in the two previous nourishment cycles. Future storm impacts notwithstanding, the large submerged bar feature in the profile *may* be a source of sand that could migrate onshore in future years and provide storm protection benefits. The sand in the nearshore profile shown in **Figure EX-1** below -7 ft NAVD88, however, is not directly retrievable for placement back on the beach, due in part to the broad area over which the sand is deposited and the shallow and energetic portion of the beach where it lies, among other reasons. Thus it is recommended for project planning purposes that the higher average annual loss rates continue to be relied upon, rather than the very low annual rates suggested by the overall volume changes measured to -20 ft NAVD88. In order to be prepared for the potential need to renourish as early as 2019 (Year 8) or to be better prepared to respond to a potential severe storm event, it is recommended that preparations continue as quickly as possible.

South Amelia Island Overall Volume Changes (1994-2016) - As of the May 2016 annual monitoring survey, the entire monitored area from R-55 in American Beach to the A1A bridge at R-82 holds roughly 4.2 to 4.7 million cubic yards (MCY) of additional sand as compared to the May 1994 pre-restoration condition. As discussed above, a significant fraction of this sand is found in the nearshore submerged portions of the profile. During this 22-year period, approximately 8.08 MCY of sand were placed along this shoreline as part of the three SAISSA projects (6.5 MCY) and the four USACE AIWW disposal projects (1.58 Mcy) ². Accordingly, as of May 2016, between 52% and 58% of the total sand volume placed along the South Amelia Island shoreline remains within the monitored area.

Of the 4.2 to 4.7 MCY of additional sand found within the monitored limits since 1994, 2.87 MCY of sand is estimated to reside within the 3-mile SAISSA project segment from R-59 to R-75+250. This equates to approximately 180 cubic yards of additional sand per foot of shoreline along the SAISSA segment. Along the Park shoreline, including the spit at the south end of the island, an estimated 1.0 to 1.5 MCY of sand have accumulated from the rock breakwater around to the A1A bridge in this period (R-75+250 to R-82)³. An additional 0.33 MCY of sand have accreted along the monitored portions of American Beach north of the SAISSA segment.

² Note: In 1993, the USACE placed approximately 300,000 cy of sand along the American Beach shoreline just north of the project limits. That sand volume has had a beneficial effect on the project area and affects the overall measured volume changes, but is not included in the direct placement volumes calculation..

³ The volume of sand accumulated in the sand spit south of the terminal groin is a very approximate estimate due to insufficient data from 1994, hence the range of possible accretion volumes.

SAISSP Overall Shoreline Changes (1994-2016) - As a result of the shore stabilization efforts over the 22-yr period from May 1994 to May 2016, the 3-mile SAISSA beach segment lies an average of 177 feet seaward of the 1994 pre-project Mean High Water shoreline. This represents an additional 65 acres of dry beach area along the project shoreline. At the southern end of the island in the Park, including the spit formation south of the rock terminal groin at R-79, restoration efforts since 1994 -- principally since 2002 -- have restored the spit and stabilized approximately 105 acres of Park property and habitat (based on comparison of 2001 and 2016 conditions from R-75 to R-82).

2011 Borrow Site - Since the 2011 renourishment project completion (August 2011 to May 2016), the project borrow site has gained approximately +578,900 CY within the excavated limits (permitted limits minus the 16 acre exclusion zone). This represents roughly 28% of the approximately -2,071,500 CY of material that was excavated from within the borrow site limits. Prior post-construction sediment sampling within the site indicated that most of the deposition is fines and muddy sediments.

Nassau Sound Survey Monitoring – Inspection of the changes in Nassau Sound over the last two decades reveals the ongoing southerly migration and northerly channel cutting of the two primary channels through the Sound. In the last two to three years, the southern channel through the Sound has cut through the sand ebb-shoal spit off the northeast tip of Little Talbot Island and has formed its own smaller ebb shoal platform in that area. The northern channel through the Sound has continued to shift southward, and the higher shoals between these two features, including the ephemeral Bird Island shoal complex, have been reduced in elevation and dry acreage and elongated from west-to east between the two primary channels. Comparison of recent Sound surveys does indicate a net gain of sand within the ebb shoal system of Nassau Sound.