Appendix IV

St. Johns County Sediment Grain Size Summary

Sediment Grain Size Summary for SBEACH Calibration – St. Johns Co.

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A sediment grain size review analysis was conducted initially for SBEACH calibration studies for St. Johns County. Results and findings are described below. A summary of sediment grain size values for use in SBEACH beach and dune erosion simulations for high-frequency storm events is given in a separate summary document of SBEACH input parameters for St. Johns County.

SBEACH Calibration

Mean sediment grain size values are required as model input for SBEACH. Assumed values were used for initial model testing for the 5 identified coastal segments of SJ Co. used in SBEACH calibration work. All 5 segments are outside of beach nourishment project locations, so consist of native beach sediments. Sediment grain size values initially assumed based on knowledge of beach characteristics throughout the County were validated to an extent from limited data found in an old 1965 Corps of Engineers report (Beach Erosion Control Study on St. Johns County, Fla.; USACE-Jax; March 15, 1965).

Geotechnical studies of native beach sands included in report documents of July 2008 by Scientific Environmental Applications, Inc., for PBS&J for a South Ponta Vedra/Vilano Beach project also produced supporting data for mean grain size values for Segment 2. Summary values are listed below along with some study details further below.

Mean grain size values for the County's beach restoration project, between approximately R137 and R151 (not located within the SBEACH calibration segments) are given at the end of this document for use in SBEACH modeling within the project area.

A listing of mean grain size values based on information from these reports, and the initial assumed values (in parentheses) used in the initial SBEACH calibration work, are as follows:

Segment 1: 0.39 mm (0.3mm) (based on USACE report)
Segment 2: 0.25 mm (0.3mm) (based on USACE report)
0.3 - 0.55mm (based on PBS&J report)
Segment 3: 0.1 mm (0.1mm) (based on USACE report)
Segment 4: 0.15 mm (0.1mm) (based on USACE report)
Segment 5: 0.45 mm (0.4mm) (based on USACE report)

A total of 28 profile line locations are identified in the USACE 1965 report, with Profile 1 being near the south County line and profiles extending sequentially northward to Profile 28. The 28 identifed profiles were used in the report to analyze and present historic shoreline (MHW) changes. Sediment data was collected and analyzed at only 11 of the 28 lines. The locations of the 11 profiles will be listed below by corresponding segment and grain size information for each included. No FDEP range monuments nor locations were established at the time of the 1965 report. Subsequent relative location of the 11 Corps profiles are referenced to distances from nearest FDEP range locations below.

A reasonably thorough search for sedimentological (grain size distribution) data for beaches of SJ Co. (pre-nourishment, native beach) has produced no other data than that identified above to represent the County's beaches. The 5 coastal segments are identified here by FDEP range location numbers included within the 5 segments.

The segment boundaries generally align with first and last FDEP range locations, but may extend beyond the end range locations based on like beach and sediment characteristics. An ArcGIS map was prepared to assist in identifying locations of these 5 segments and locations of the sample lines with representative grain size data from the identified reports.

Segment 1:

1) R1,3,6,9,12,15,18

This segment extends from essentially the north SJ Co. boundary line (with Duval Co.) at R1 southward to approximately 17,600 ft. (3.33 mi.) south of the north County line at R18. The Corps' Profile 28 is located approximately 2000 ft. south of the north County line, within the Segment 1 boundaries. The next nearest Corps profile where sediment grain size data was collected and analyzed was Profile 24. The Corps' Profile 24 is located 32,222 ft. (6.1 mi.) south of the north SJ Co. line, and is almost 3 miles south of the south boundary of Segment 1. Therefore, data from Profile 28 is considered as representative of Segment 1. However, the data from Profile 24, which is approx. 200 ft. south of R32, is given here also for informational purposes and for consideration for initial SBEACH model testing in that area.

It is noted that the Segment 1 area, and likely for some additional distance south of Segment 1, has been affected by beach nourishment in Duval County after the 1965 Corps report was completed. That effect is noted, but no recent data within north St. Johns County has been found to determine what the effects have been.

Sediment grain size samples along Profile 28 included 9 samples. Mean grain sizes for each sample extending from upland dune and beach to offshore depths of -30 ft. and a Profile 28 average mean grain size is given below. Coarser grain size is found on the upland in dune and beach areas seaward to shallow water depths at mean low water, and finer grain size is found in offshore locations.

Profile 28: (.23+1.1+.68+.76+.28+.18+.17+.08+.1)/9 = 3.58/9 = 0.397 mm.

The assumed representative mean grain size of 0.39 mm used in the initial SBEACH calibration work for Segment 1 is validated by the data from the 1965 report. A 0.3 mm value will be used in final SBEACH calibration for Segment 1 to account for sand transport from the Duval County beach restoration project into north St. Johns County.

Mean grain size values from Profile 24 from the 1965 Corps report are given here as well:

Profile 24: (1.6+.39+1.05+.94+.2+.2+.13+.12+.55)/9 = 5.18/9 = 0.58 mm.

Segment 2:

2) R86,87,93,94,98,99,105,117,120

This segment extends from approximately 2500 ft. north of St. Augustine Inlet (at R120) to approximately 37,600 ft. (7.1 mi.) north of St. Augustine Inlet (at R86). Two Corps profile lines where sediment grain size data was collected and analyzed are located within or in close proximity to Segment 2. Profile 15 is located 200 ft. north of St. Augustine Inlet, adjacent to R122, and considered to be representative of similar conditions to areas immediately to the north in Segment 2. Profile 18 is located 26,778 ft. (5.1 mi.) north of St. Augustine Inlet, which is approximately 500 ft. north of R97.

Sediment grain size samples along Profile 15 included 10 samples and along Profile 18 included 9 samples. Mean grain sizes for samples along each line extend from upland dune and beach to offshore depths of -30 ft. Average mean grain size values for each line are listed below and are averaged to provide a representative value for Segment 2.

Profile 15: (.23+.35+.25+.33+.18+.19+.15+.18+.14+.15)/10 = 2.15/10 = 0.215 mm.

Profile 18: (.2+.38+.88+.5+.21+.18+.17+.13+.12)/9 = 2.77/9 = 0.31 mm.

Average of Profile 15 and Profile 18 mean grains size values: (0.2+0.3)/2 = 0.25mm

A 0.25 mm value will be used in initial SBEACH calibration testing for Segment 2, as well as, testing with more recent values derived from the PBS&J work summarized below. The 0.31mm value at Profile 18 (500ft. north of R97) will be considered in the final SBEACH calibration and high-frequency storm application work.

A July 2008 geotechnical study by Scientific Environmental Applications, Inc. (S.E.A.) for PBS&J of native beach sands for a S. Ponta Vedra/Vilano Beach project also produced supporting data for grain size values for Segment 2 and are listed below along with some study details further below. Data was obtained at the following FDEP range locations: R70, 77, 84, 91, 98, 105, 112, and 120. The SEA report give avg. mean of 0.55mm, but a direct avg. computed from each sample line composite avg. mean gives a value of 0.41; phone conversation with geologist Gary Zarillo says either value is valid. Both values will be used in initial SBEACH testing, in addition to the Corps 0.25mm value, and considered for final SBEACH calibration and application work.

A Corps line at Profile 14 is located immediately south of St. Augustine Inlet, south of Segment 2. This location has been a highly dynamic area due to inlet influences, but may be used for the area immediately south of the inlet.

Profile 14: (.16+.20+.16+.23+.23+.25+.35+.25+.13+.13)/10 = 2.09/10 = 0.21 mm.

Segment 3 & 4:

3) R148,150,153, 156,160,162,165, 166, 168
4) R177,179,182, 183,186

The limits of Segment 3 are approximately 48,000 ft. (9.1 mi) north of Matanzas Inlet at R148 to approx. 28,000 ft. (5.3 mi.) north of Matanzas Inlet. The Corps' Profile 7 is located approx. 32,444 ft. (6.1 mi.) north of the inlet, approx. 450 ft. north of R164. Despite the limited information available, the sediment grain size data from Profile 7 is considered to be representative of sediment grain size within Segment 3 and 4. Sediment grain size results for Profile 7 are summarized below.

Sediment grain size samples along Profile 7 included 8 samples. Mean grain sizes for each sample extending from upland dune and beach to offshore depths of -30 ft. and a Profile 7 average mean grain size is given below. Coarser grain size is found on the upland in dune and beach areas seaward to shallow water depths at mean low water, and finer grain size is seen in offshore locations.

Profile 7: (.18+.18+.18+.2+.15+.19+.1+.09)/8 = 1.27/8 = 0.15 mm.

The assumed representative mean grain size of 0.1 mm used in initial SBEACH calibration work for Segments 3 is validated by the data from the 1965 report. A value of 0.1 mm will be used in final SBEACH calibration and application work for Segment 3.

Sediment data collection at Profile 4 is south/outside limits of Segment 4 boundaries. Profile 4 is located approx. 550 ft. north of Matanzas Inlet adjacent to R196. Mean grain size for Profile 4 is given below.

Profile 4: (.17+.23+.17+.18+.2+.25+.15+.14+.16)/9 = 1.65/9 = 0.18 mm.

The assumed representative mean grain size of 0.15 mm used in initial SBEACH calibration work for Segments 4 is validated by the data from the 1965 report based on Profile 4 and Profile 7 values. A value of 0.15 mm will be used in final SBEACH calibration and application work for Segment 4.

Segment 5:

5) R201, 204,205,206,207

Based on similar beach slopes and sediment characteristics, this segment could extend from essentially the south SJ Co. boundary line (with Flagler Co.) northward to R200. The Corps' Profile 1 is located 555 ft. north of the south County line at the approximate location of FDEP

range 209. The sediment grain size data from Profile 1 is considered to be representative of sediment grain size within Segment 5. The profiles used in the SBEACH calibration analysis extend from approximately 2600 ft. north of the south County line at R207 to approximately 8,600 ft. (1.63 mi.) north of the south County line.

The next Corps profile northward where sediment grain size data was collected was at Profile 3. Profile 3 is located approximately 11,111 ft. (2.1 mi.) north of the south County line, which is about 500 ft. north of R199. Although Profile 3 is located near the Segment 5 profiles, conditions and sediment grain size data collected and analyzed at Profile 3 at the time of the 1965 Corps report are not considered to be representative of Segment 5 conditions. A significant problem with Profile 3 data is that it only includes locations from mean low water elevation seaward. Sediment grain size results for Profile 1 are summarized below.

Sediment grain size samples along Profile 1 included 9 samples. Mean grain sizes for each sample extending from upland dune and beach to offshore depths of -30 ft. and a Profile 1 average mean grain size is given below. Coarser grain size is found on the upland in dune and beach areas seaward to shallow water depths at mean low water, and finer grain size is seen in offshore locations.

Profile 1: (.26+.65+.88+1.15+.38+.16+.14+.16+.13)/9 = 3.91/9 = 0.434 mm.

The assumed representative mean grain size of 0.45 mm used in the SBEACH calibration work for Segment 5 is validated by the data from the 1965 report. The 0.45 mm value will be used in final SBEACH calibration for Segment 5.

Sediment Grain Size Values for Beach Restoration Project Area

Mean grain size values for the County's beach restoration project, between approximately R137 and R151 (not located within the SBEACH calibration segments) were obtained from the most recent permit application submitted by the USACE-Jax for the FDEP-BBCS. These values were compiled by the Corps from the proposed project borrow area in the St. Augustine Inlet ebb tidal shoals. Continued use of the ebb shoals as a borrow location is controversial. Future use of the ebb shoals has not been approved by the FDEP-BBCS for the next renourishment project. Therefore, the grain size information is considered to be preliminary. However, this information will be used for SBEACH modeling as representative of ebb shoal material used in the project.

The Corps permit application submittal document of August 2009 summarizes the proposed borrow material as having a mean grain size of 0.15mm to 0.3mm. Shell content is given as 5% with possible range up to maximum of 35%. A value of approx. 0.2mm may be used as a representative value for SBEACH modeling. The value for beach areas north of the project location up to the inlet (R123-R137) was given above from Profile 14 (1965 report) as 0.21mm. For areas south of the project, values identified for Segment 3 and 4 will be used for SBEACH modeling.

Reference Documents

1) Beach Erosion Control Study of St. Johns County, Fla., US Army Corps of Engineers-

Jacksonville, Serial No. 53, March 1965.
2) Geotechnical Analysis of Native Beach Samples Collected from St. Johns County, FL, Scientific Environmental Applications, Inc., for PBS&J, July 2008.
3) Joint Coastal Permit Application, St. Johns County Shore Protection Project, St. Johns County, USACE-Jax, August 2009.