ATTACHMENT NO. 33a

PHYSICAL MONITORING PLAN

Lido Key Hurricane and Storm Damage Reduction Project
City of Sarasota (JCP File Number: 0333315-001-JC, Sarasota County)
Physical Monitoring Plan
August 2016

Pursuant to 62B-41.005(16), F.A.C., physical monitoring of the proposed federally authorized Lido Key Hurricane and Storm Damage Reduction (HSDR) Project requires the acquisition of project specific data to include topographic and bathymetric surveys of the beach, offshore, and borrow site areas, hydrodynamic measurements related to the borrow site areas, and engineering analysis. The monitoring data is necessary in order for both the City of Sarasota (City), the U.S. Army Corps of Engineers (USACE) and the Florida Department of Environmental Protection (FDEP) to regularly observe and assess, with quantitative measurements, the performance of the project and areas of accretion/erosion, and to determine the need for any adjustments, modification, or mitigative response related to the project. The monitoring process also provides information necessary to plan, design, and optimize subsequent projects.

This Physical Monitoring Plan may be revised at a later date by written request of the City of Sarasota and with written approval of the FDEP. A schedule of monitoring events is presented below in Table 1. The physical monitoring schedule shall reset for subsequent nourishment events under this permit.

Table 1. Physical Monitoring Schedule

Monitoring Event*	Topographic & Bathymetric Surveys	Groin Monitoring Surveys	Borrow Area & Ebb Shoal Surveys	Borrow Area Hydrodynamic Measurements	Engineering Monitoring Reports & Data Transmittal
Pre-Construction	x	x	x	x	
Post-Construction	x	x	x	x	x
Year 1	x	x	x	x	x
Year 2	x	x			x
Year 3	x	x	x	x	x
Year 4					
Year 5	x	x	x	x	x

*Monitoring will continue biennially until the next beach nourishment event or the expiration of the project life.

1. Topographic & Bathymetric Surveys (Beach Profile Surveys)

Topographic and bathymetric profile surveys of the beach and offshore will be conducted within 90 days prior to commencement of construction, and within 60 days following the completion of the project. Thereafter, monitoring surveys will be conducted annually for a period of three (3) years, then biennially until the next beach nourishment event or the expiration of the project life, whichever comes first (Table 1). The monitoring surveys will be conducted during a spring or summer month and repeated as close as practicable during the same month of the year. If the time period between the immediate post-construction and the first annual monitoring survey is less than

six months, the City can request a postponement of the first monitoring survey until the following spring/summer.

The monitoring area will include profile surveys at each of the published FDEP reference monuments on Lido Key between R-31 and R-44, inclusive, and on Siesta Key between R-45 and R-55, inclusive. Profile surveys will be conducted along published azimuths extending a minimum of 3000 feet offshore of the FDEP monument or to the -16 ft-NAVD contour, whichever is closer to shore. The profiles at the north end of Lido Key and Siesta Key shall extend beyond the channel and/or previously dredged areas until the offshore limit described above is met.

All work activities and deliverables shall be conducted in accordance with the *Division of Water Resource Management Monitoring Standards for Beach Erosion Control Projects, Sections 01000 and 0110.*

2. Groin Monitoring (Intermediate Profiles)

Groin monitoring will be conducted concurrently with the beach monitoring to assess the performance of the beach in the vicinity of the existing and new groins (Table 1).

Intermediate profiles will be established to monitor the area adjacent to the existing 165-foot rock groin, which is located near R-38.3. Eight (8) profiles will be established at approximately R-37.4, R-37.6, R-37.8, R-38.2, R-38.4, R-38.6, R-38.8 and R-39.2 along the azimuth of 225 degrees. These additional profiles will result in a 1,800 ft long subarea for analysis containing profile data at approximately 200' spacing when evaluated with the primary FDEP profiles.

Intermediate profiles will be established to monitor the area adjacent to the 170-foot rock groin located near R-42.5 and the 345-foot rock groin located near R-43.2. Nine (9) profiles will be established at approximately R-42.2, R-42.4, R-42.6, R-42.8, R-43.5, R-44, R-44.2, R-44.4 and R-44.6 along the azimuth of 230 degrees. The groin monitoring will result in a 1,800 ft long subarea for analysis containing profile data at approximately 200' spacing when evaluated with the beach monitoring performed at the published FDEP profiles.

A total of seventeen (17) intermediate profiles will collected, extending a minimum of 1000 feet offshore of the FDEP monument or to the -6 ft-NAVD contour, whichever is closer to shore.

All work activities and deliverables shall be conducted in accordance with the *Division of Water Resource Management Monitoring Standards for Beach Erosion Control Projects, Sections 01000 and 0110.*

3. Borrow Area & Ebb Shoal Monitoring

Bathymetric surveys of the borrow area and ebb shoal complex of the dredge area(s) will be conducted within 90 days prior to commencement of construction, unless a waiver is granted to use a prior borrow area survey. Surveys will also be conducted within 60 days following completion of the construction project concurrently with the beach profile surveys. Borrow area surveys will then be conducted every two years concurrently with the profile surveys beginning during the one-year monitoring event as described in Table 1. Survey grid lines across the borrow

area and ebb shoal complex shall be spaced to provide sufficient detail for accurate volumetric calculations but not more than a maximum of 500 feet apart, and shall extend a minimum of 500 feet outside the boundaries of the borrow site.

All work activities and deliverables shall be conducted in accordance with the *Division of Water Resource Management Monitoring Standards for Beach Erosion Control Projects, Sections 01000 and 0110.*

4. Borrow Area Hydrodynamic Measurements

Hydrodynamic measurements landward and seaward of the borrow area(s) will be collected within 6 months prior to commencement of construction, unless a waiver is granted to use an existing dataset. Measurements will also be collected at the same locations, or as close as practicable, within 6 months following completion of the construction project. If deemed necessary based on changes observed through comparison of the pre and post-construction data, additional measurements may then be collected in subsequent years (i.e. every two years beginning with the one-year monitoring event as shown in Table 1).

To collect the hydrodynamic measurements, Acoustic Doppler Current Profilers (ADCP) gages will be deployed seaward and landward of the dredged area(s). These instruments will be deployed for a minimum of one month to include a full spring-neap tidal cycle and will collect the current, water level and wave data. The exact locations of gage deployment will be dependent upon actual borrow area usage and local conditions at the time of deployment, and will be situated with the intent of comparing shoaling effects before and after the dredging events.

5. Engineering Monitoring Report & Data Transmittal

The City of Sarasota will submit a digital copy of the engineering report and the monitoring data to the Division of Water Resource Management within 90 days following the completion of the post-construction survey and each monitoring survey (Table 1). The survey data and control information will be submitted as specified in the *Division of Water Resource Management Monitoring Standards for Beach Erosion Control Projects, Sections 01000, 01100, and 01200.*

The engineering monitoring report will summarize and discuss the survey data, the performance of the project, and identify erosion and accretion patterns within the monitoring area. In addition, the report will include a comparative review of project performance to performance expectations and identification of adverse impacts attributable to the project. An evaluation of the intermediate profiles will be included to monitor the ebb shoal and analyze the effects of the groins as described above. Oblique ground photographs of the existing groin in the project area will be included in the report to show the condition, burial or exposure of the groin. Results will be analyzed for patterns, trends, or changes between monitoring surveys and cumulatively since project construction. The report shall specifically include:

i. The volume (cy) and percentage of advanced nourishment lost since the last beach nourishment project as measured landward of the MHW contour based on the most recent survey;
ii. The most recent MHW shoreline positions (ft) in comparison with the design profile at each individual monument location;

iii. The MHW shoreline position changes (ft) relative to the pre-construction survey at each individual monument location for all monitoring periods;
iv. The total measured remaining volume (cy) landward of the MHW contour and above the Depth of Closure for the entire project area over the monitoring periods; and,
v. An estimate of the volumetric changes within the ebb shoal complex of the borrow area;
vi. Any other shoreline position and volumetric analysis the Permittee or engineer deem useful in assessing, with quantitative measurements, the performance of the project;
vii. Analysis of the shoaling effects (landward to seaward changes) based on hydrodynamic data consisting of currents, water levels and waves collected prior to construction compared to post-dredge conditions at the borrow area deployment locations.

The report shall include computations, tables and graphic illustrations of volumetric and shoreline position changes and the hydrodynamic measurements for the monitoring area. An appendix shall include superimposed plots of the two most recent beach profiles surveys, the design profile, and pre- and post-construction beach profile at each individual monument location and the two most recent sets of hydrodynamic measurements.