Agenda Item #: 3L-2

PALM BEACH COUNTY
BOARD OF COUNTY COMMISSIONERS

AGENDA ITEM SUMMARY

Meeting Date: October 6, 2009

(X) Consent ( ) Regular
( ) Workshop ( ) Public Hearing

Department
Submitted By: Environmental Resources Management
Submitted For: Environmental Resources Management

I. EXECUTIVE BRIEF

Motion and Title: Staff recommends motion to approve: Task Change Order No. 0410-07A to a continuing Contract (R2008-0410) with Taylor Engineering, Inc. (Taylor) for an amount not to exceed $283,649 for completion of the United States Army Corps of Engineers (USACE) required Reevaluation Report, Section 934 (Report) for the Jupiter/Carlin Shore Protection Project (Project).

Summary: The BCC approved the Contract with Taylor on March 11, 2008 (R2008-0410). Eleven (11) task orders totaling $1,669,177.19 have been issued under the Contract. Task Change Order No. 0410-07A authorizes Taylor to incorporate the USACE's required economic model, Beach-fx, within the Report. There is 5.1% SBE subconsultant participation on this Task Change Order. Taylor committed to an overall 15% Small Business and Minority Business (SBE-MBE) participation in the Contract. Taylor has achieved 15% cumulative SBE-MBE participation on the Contract including this Task Change Order. Funding for the Change Order is from a combination of Tourist Development Taxes and interest in the Beach Improvement Fund. The work is also eligible for reimbursement from the USACE and Florida Department of Environmental Protection (FDEP) as funding becomes available to them. District 1 (JM)

Background and Justification: On February 24, 2009, the BCC approved Task Order No. 0410-07 (R2009-0322) which enabled completion of the USACE-required 934 Report. This task order included the less expensive Storm Damage Model (SDM) as the economic model for the Report and totaled $190,744. County staff requested to use the SDM for the Report since it was originally used in the 1994 USACE General Design Memorandum (GDM) to estimate the economic feasibility of the Project. Despite multiple requests to the USACE Jacksonville District to use SDM, the South Atlantic Division in Atlanta recently determined that the Report must use the USACE-certified Beach-fx economic model to estimate storm reduction benefits. Because of the additional data and modeling required to include Beach-fx within the Report, this will cost an additional $283,649. The total cost of the Report is now $474,393.

Federal cost-share for Report costs will be available after the County completes the Report and
(Continued on Page 3.)

Attachments:
1. Task Change Order No. 0410-07A with Contract History
2. Contract (pages 1, 18, Fee Schedule)

Recommended by: [signature] 9/15/09
Department Director **Date**

Approved by: [signature] 9/22/09
County Administrator **Date**

II. FISCAL IMPACT ANALYSIS

A. Five Year Summary of Fiscal Impact:

Fiscal Years	**2010**	**2011**	**2012**	**2013**	**2014**
Capital Expenditures					
Operating Costs	283,649				
External Revenues					
Program Income (County)					
In-Kind Match (County)					
NET FISCAL IMPACT	283,649				
# ADDITIONAL FTE POSITIONS (Cumulative)					

Is Item Included in Current Budget? **Yes** X **No** ____

Budget Account No.:	**Fund**	**Department**	**Unit**	**Object**
Feasibility Study	3652	381	M045	3120

Program ____________

B. Recommended Sources of Funds/Summary of Fiscal Impact:
Beach Improvement Fund $64,232.31 + $155,184.37 (USACE anticipated share) + $64,232.32 (FDEP anticipated share)

C. Department Fiscal Review: [signature]

III. REVIEW COMMENTS

A. OFMB Fiscal and /or Contract Dev. and Control Comments:

[signature] 9/11/09
OFMB [initials] 9/17/09 9/16/09

[signature] 9/18/09
Contract Development and Control C. Jones 9/18/09

B. Legal Sufficiency:

[signature] 9/22/09
Assistant County Attorney

C. Other Department Review:

____
Department Director

Background and Justification (continued from page 1):
finalizes a new Project Cooperation Agreement (PCA) with the USACE. Federal cost share is expected to be 54.71% of the total costs or $155,184.37 for this Task Change Order.

The engineering, design & permitting phase of the Project commenced when the BCC approved Task Order No. 0410-05 (R2008-1510) and FDEP Grant Agreement 09PB1 (R2008-1509) on September 9, 2008. FDEP has determined that this Report is eligible for cost-sharing of the non-Federal Project costs, although funding is not currently in place.

The Project area is located directly south of the Jupiter Inlet and encompasses 1.05 miles of beach. To date, two (2) large-scale federally authorized beach nourishment projects (1995 & 2002) have been completed. The second large-scale beach renourishment is presently scheduled for fall 2011.

The Project was identified as eligible for Federal participation in both the USACE's General Design Memorandum (1987) and Coast of Florida Study (COFS 1995). WRDA 1986 authorized Federal participation in the Project for 50 years. The USACE recommended within the COFS that Federal participation extend beyond the scheduled 10 years to include the "economic life of the project." Current Federal participation for the Project expired in 2005.

The Report will evaluate the "economic feasibility of extending federal participation" for the next 37 years of the 50 year project life (Taylor Engineering 2008 proposal).

Attachment 1

TASK CHANGE ORDER

CHANGE ORDER: 0410-07A CONSULTANT: Taylor Engineering, Inc.

ACCOUNT: 3652-381-M045-~~4630~~ 3120 CONTRACT: R2008-0410
[Fiscal approval of Budget Availability: ________]

PROJECT MANAGER: Kimberly Miranda PHONE: 561-233-2465

CONTRACT MANAGER: Juan Cueto PHONE: 561-233-2431

PROJECT NAME: Jupiter/Carlin Section 934 Study

LOCATION/DISTRICT #: Jupiter / District 1

DESCRIPTION OF CHANGE: The Consultant shall estimate storm damage reduction benefits using the Beach-*fx* model, as described in the August 27, 2009 proposal. Due date extended to December 31, 2011.

Task Change Order Type: Fixed Price Original Task Amount $ 190,744.00

Change Order Amount* $ 283,649.00 Net increase $ 283,649.00
*See attached spreadsheet dated: 8/27/09

Total task amount w/changes: $ 474,393.00

(Check where appropriate)
for Contract and Subcontract Amounts:

	Black	Hispanic	Women	Other (specify)	White Male
M/WBE (State) ☐	$	$	$	$	
SBE-M/WBE* ☒	$	$	$14,575.00	$	
SBE ☐	$	$	$	$	$

*certified as both an SBE and a State MBE

SUBTOTAL M/WBE-SBE participation amount for this Change Order: $ 14,575.00
TOTAL M/WBE-SBE participation amount on Task Order with changes: $ 14,575.00

CONSULTANT REP: ________ DATE: 9/9/09

DIVISION DIRECTOR: ________ DATE: 9/15/09

APPROVED AS TO TERMS AND CONDITIONS:

ERM DIRECTOR: ________ DATE: 9/15/09

APPROVED AS TO FORM AND LEGAL SUFFICIENCY:

ASSISTANT COUNTY ATTORNEY: ________ DATE: ________

BOARD OF COUNTY COMMISSIONERS: ________ DATE: ________
John F. Koons, Chairman

TAYLOR ENGINEERING INC

August 27, 2009

Ms. Kimberly Miranda
Palm Beach County
2300 North Jog Road
4th Floor
West Palm Beach, FL 33411-2743

EMAILED

Re: Jupiter/Carlin Section 934 Study
Task Change Order #0410-07A

Dear Ms. Miranda,

As per the county's request, please find enclosed our change order scope of work (Attachment A) and revised cost proposal (Attachment B) for modeling storm damage benefits with Beach-*fx*.

The scope of work includes a fee summary for a total additional fixed fee amount of $294,541.00. However, this letter also serves to omit Tasks 4.1 ("Update coastal armor costs"), 4.2 ("SDM model w/o project set-up), 4.3 (SDM model w/ project set-up), 4.4 ("Calculation of without project damages"), and 4.5 ("Calculation of with project damages") and associated cost ($10,892.00) from the original authorization (Task Order # 0410-07). In effect, we propose to apply the fees for Tasks 4.1 through 4.5 to the fee for the present scope of work for a net total authorization increase of $283,649.00.

The original task order, fixed fee amount equals $182,824.00 and the not-to-exceed amount equals $7,920. This proposed change order increases the fixed fee amount by $283,649.00 and produces a new task order, fixed fee total of $466,473.00. The not-to-exceed amount remains unchanged.

Please contact me at 904-256-1341 or at mkrecic@taylorengineering.com if you have any questions or require additional information.

Sincerely,

Michael R. Krecic, P.E.
Director of Coastal Engineering

Enclosure

L:\PROPOSAL\P2009-083 PBC Jupiter-Carlin Section 934 Beach-fx\Round 4\KMiranda LoT_2009-08-27.doc

10151 DEERWOOD PARK BLVD BLDG 300 STE 300, JACKSONVILLE, FL 32256 TEL. 904 731 7040 FAX 904 731 9847
(Mailing Address) PO BOX 550510 JACKSONVILLE FL 32255-0510

Attachment A

Palm Beach County
Jupiter/Carlin Shore Protection Project
Section 934 Study
Beach-*fx*

August 20, 2009

Overview

As originally outlined in Taylor Engineering's task order number 0410-07, Palm Beach County Environmental Resource Management (ERM) requested Taylor Engineering develop storm damage reduction benefits with the U.S. Army Corps of Engineers (USACE) Jacksonville District's Storm Damage Model (SDM). Subsequent guidance from the USACE Jacksonville District and South Atlantic Division recommend ERM estimate storm damage reduction benefits with Beach-*fx*, now fully certified by the USACE Planning Center of Expertise (PCX). As such, ERM requested Taylor Engineering develop a proposal to estimate storm damage reduction benefits with Beach-*fx* instead of SDM.

Assumptions

We have developed our Scope of Services with the following understandings and assumptions:

- The USACE Jacksonville District will provide Taylor Engineering the latest version of Beach-*fx* and ancillary tools (e.g., SBEACHGenerator.exe) to facilitate data input.
- The USACE Jacksonville District will provide Beach-*fx* model support to help resolve model issues.
- Our analysis area will include the shoreline from FDEP reference monuments R-13 to R-19 in the project area and FDEP reference monuments R-19 to R-26 outside of the project area. Both areas will require detailed inventories of damage elements.
- We recently learned from the Jacksonville District that draft USACE Planning Guidance suggests projects may require a benefit-to-cost ratio of 1.5 for the federal government to recommend funding a project.
- Current guidance suggests that incidental recreational benefits cannot exceed more than 50% of the total project benefits.
- This study attempts to include many possible benefits in its evaluation to produce a recommendation that serves the county's beneficiaries, as well as those who will incur the costs (both local and federal).

Attachment A

Task Descriptions

Task 9 Wave and Storm Surge Data Analyses

Task 9.1 Plausible Storm Suite

Beach-*fx* generates a synthetic sequence of storms for each life cycle simulation. It applies a "plausible" set of storms, derived from an historical record, to develop this synthetic sequence. Extending an historical record by assuming the historical storm can occur at various combinations of tidal phase and tidal water level helps define the set of plausible storms. In general, developing a storm set requires the following steps:

1. Identification of site-specific significant storm events in the tropical and extra-tropical (e.g., northeasters) storm surge record;
2. Extraction of the storm surge hydrographs corresponding to the identified significant storm events;
3. Estimation of wind wave conditions corresponding to the identified significant storm events;
4. Statistical characterization of project specific astronomical tides and estimation of representative high, mean, and low tidal ranges; and
5. Development of 12 (4 tidal phases — high, mean falling, low, and mean rising times 3 tidal amplitudes — lower quartile [neap], mean, and upper quartile [spring]) plausible total water level hydrographs for each of the identified significant storm events.

We will identify tropical and extra-tropical storms via different methods.

<u>Tropical Storms</u>

We will identify tropical storms via two methods for the periods 1886 to 2001 and 2002 to 2008.

To identify site-specific tropical storm surge events for the period 1886 to 2001, we will query the USACE Dredging Research Program (DRP) tropical storm database (Scheffner et al., 1994), which consists of storm surge elevation and current hydrographs along the east and Gulf coasts of the U.S. and Puerto Rico corresponding to selected USACE Wave Information Study (WIS) and other nearshore stations. The finite-element-based model, ADCIRC (Westerink et al., 1992; Westerink et al., 1993), generated the storm surge database from National Oceanic and Atmospheric Administration's (NOAA) National Hurricane Center's HURDAT (HURricane DATabase) information. We will identify station(s) closest to the project area, find the peak storm surge elevation at the station(s) of interest, and develop a preliminary list of significant storms based on the criterion that the storm produced at least one foot of surge.

Upon developing a preliminary list of storms based on peak surge conditions, we will extract storm surge hydrographs from the selected station(s). We will import each hydrograph into MS Excel to visualize and possibly, modify each of the hydrographs. We will assess the variability of the surge between the station(s) of interest and the quality of the surge hydrograph in terms of numerical stability. We will apply engineering judgment to eliminate storms where the average storm surge did not at some point exceed a minimum threshold (one foot) and where severe numerical instability existed that we could not discern general trends from the surge hydrograph data. We will identify and select the portion of storm that we deem important in the context of beach profile response modeling. Finally, we will adjust or "smooth" apparent numerical instabilities in the selected portions of the storm surge hydrographs.

Tropical storms for the period 2002 to 2008 require obtaining storm surge information via alternate methods. For this work, we propose to examine two NOAA water stations: Station 8722670 at Lake Worth Pier and Station 8722588 at Port of West Palm Beach. Note that the Lake Worth Pier station, the nearest gage to the project area, has data through October 5, 2004; the Port of West Palm Beach station has data available beginning on January 25, 2008. Barring any data gaps, we will adopt the Lake Worth Pier data for the period 2002 through October 5, 2004 and the Port of West Palm Beach station data for 2008. Note that because the Lake Worth Pier gage lies in the ocean, we will carefully examine the possible influence of wave setup on its measurements. Cross-shore erosion modeling, discussed in Task 10, will include the effects of static wave setup on beach profile responses. Including the effects of static wave setup in both the measured water levels and cross-shore erosion modeling will lead to overestimates of beach profile recession.

To extract the effects of wave setup, we will employ the following steps. We will take the measured storm surge data, wave field, and beach profiles at Lake Worth Pier, input them into SBEACH, and run the model. [We will develop wave field based on hurricane wave methods outlined in the *Shore Protection Manual* (USACE, 1984).] SBEACH produces water level output that contains the inputted storm surge plus static wave setup calculated by SBEACH. We will extract the wave setup from the output water level at the tide gage location for the duration of the storm by subtracting the measured storm surge data from the SBEACH water level output. Then, we will subtract these setup values from the measured storm surge data to generate a modified, measured storm surge. Finally, we will input this modified storm surge data into SBEACH and re-run the model to verify that the original measured storm surge data match the SBEACH output. We will then adopt the modified, measured storm surge data in subsequent modeling tasks. Note that we will not calibrate this SBEACH model before performing these simulations. We have an interest in only the water levels at the tide gage location and do not have an interest in the erosion that may occur at the beach.

For the period October 5, 2004 through 2007, we will develop tropical storm surge hydrographs via the following approach. We will obtain tropical event characteristics (e.g., radius to maximum wind, central pressure, forward speed, and track) and estimate an event's corresponding storm surge at the site via (bathystrophic storm surge) methods presented in the *Shore Protection Manual* (USACE, 1977 and 1984). To ensure this approach produces reasonable results, we will perform a limited calibration of bottom friction applied in the method to a peak storm surge value supplied in the DRP database.

We will use the list of tropical storms identified in previous studies for the county (e.g., Jupiter/Carlin Structures – Feasibility Study, period 1901 – 2007) as a basis for selecting recent (after 2002) storms in the project area. To obtain storm surge data, we will subtract predicted astronomical tide from the total water level to yield the non-periodic residual water level, which includes effects from winds, atmospheric pressure fluctuations, and other non-tidal factors that raise or depress the water level. We will adopt the same criterion (minimum one foot of surge) as above for identifying significant storms. We will plot each hydrograph in MS Excel to visualize and possibly, modify each of the hydrographs. We will identify and select the portion of storm that we deem important in the context of beach profile response modeling. Finally, we will adjust or "smooth" the selected portions of the storm surge hydrographs.

We will estimate tropical event wave conditions via the hurricane waves methods outlined in the *Shore Protection Manual* (USACE, 1984). Following these procedures, we will estimate wave heights and periods for each identified tropical event at a location coincident with an ADCIRC, DRP station.

Finally, we will create individual MS Excel files from each of the identified significant storms with both the surge and wave information for the storm in the file. In some cases, we will need to shift the wave information in time because of incompatibility between the timing of the surge and wave information. Where necessary, we will assume the peak wave height occurs at the time of the peak storm surge. Finally, we will make a visual quality assessment of the wave height and period information and adjust as needed.

Attachment A

Extra-tropical Storms

In addition to tropical storms, extra-tropical storms can also affect the project area. We will examine previous work done for the Jupiter/Carlin Structures – Feasibility Study, wherein Taylor Engineering determined northeasters for the period 1985 – 2006 at the National Weather Service Coastal Marine Automated Network station in Palm Beach, Florida (LKWF1) based on wind speeds. We will, however, limit our identification of extra-tropical storms to the period 1996 to 2004 for the following reason — concurrent availability of water level and wave data near the project area.

Recorded water levels at NOAA Station 8722670 at Lake Worth Pier are only available for the period 1996 to October 5, 2004. To obtain storm surge data from the Lake Worth Pier data, we will subtract the astronomical tide from the total water level to yield the non-periodic residual water level, which includes effects from winds, atmospheric pressure fluctuations, and other non-tidal factors that raise or depress the water level. Similar to tropical storm surge hydrograph development, we will employ the same method to carefully examine the possible influence of wave setup on the Lake Worth Pier measurements for extra-tropical events with one exception. We will develop the wave field at the pier with data described in the next paragraph. We will select storms based on wave heights exceeding three feet and storm surge greater than one foot. We will plot each hydrograph into MS Excel to visualize and possibly, modify each of the hydrographs. We will identify and select the portion of storm that we deem important in the context of beach profile response modeling. Finally, we will adjust or "smooth" the selected portions of the storm surge hydrographs.

To find the corresponding waves, we will examine WIS data at Station 457 for the same period. The USACE WIS provides a 20-year (1980 – 1999) wind and wave hindcast dataset at select locations along the Atlantic Ocean. These hindcast data, reported hourly, include wave height, wave period, wave direction, wind speed, and wind direction. In addition to the WIS data, Surfbreak Engineering Sciences, Inc. (Surfbreak), as part of ongoing work for the FDEP, developed nearshore wave hindcasts for several southeast Florida counties including Martin County, which lies very near the project area. These data span 52 years (1954 – 2005) and also include hindcasted wave information. We will examine each of these datasets to identify storms from 1996 to 2004, the period of available water level data.

We will apply a peak-over-threshold analysis to identify extra-tropical storms, defined as events with peak wave heights exceeding some height (e.g., three feet). Upon developing a preliminary list of storms based on peak wave conditions, we will extract wave height, period, and direction time series from

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WIS and/or Surfbreak data. We will import each time series into MS Excel to visualize and possibly, modify each of the hydrographs.

Note that once we have confirmed storms that produced significant storm surge near the project area, we will identify and select the portion of wave time series that we deem important in the context of beach profile response modeling. We will adjust or "smooth" these selected portions of the wave time series. Because the WIS data lie significantly offshore the project area, we will apply the WIS Phase III transformation technique (WISPH3) in the Coastal Engineering Design and Analysis System (CEDAS) software to transform time series of wave height, period, and direction to a water depth closer to the project area. This water depth will likely coincide with the farthest offshore extent of beach profiles in the area and applied in cross-shore erosion modeling (Task 10).

Finally, we will create individual MS Excel files from each of the identified significant storms with both the surge and wave information for the storm in the file. In some cases, we will need to shift the wave information in time because of incompatibility between the timing of the surge and wave information. Where necessary, we will assume the peak wave height occurs at the time of the peak storm surge. Finally, we will make a visual quality assessment of the wave height and period information and adjust as needed.

Tides

We will characterize the statistics of the site-specific astronomical tides and estimate representative high, mean, and low tidal ranges. The USACE maintains a database of tidal constituents for the western North Atlantic Ocean, Caribbean Sea, Gulf of Mexico, and eastern Pacific Ocean. We will extract tidal constituent information at a central location within the project area and generate a 20-year synthetic tidal record for statistical analysis. From the record, we will develop a cumulative probability distribution function and analyze the statistics to determine the high, mean, and low tidal ranges.

Final Storm Surge Hydrographs

We will combine each storm surge hydrograph with a cosine representation of the astronomical tide to generate a plausible total water elevation. We will combine each storm surge hydrograph with the three representative tidal ranges and align the peak surge elevation with four tidal phases (high tide, mid-tide falling, low tide, and mid-tide rising) to obtain 12 variants of each historical storm surge hydrograph.

Combining *N* storm events with three tidal ranges (spring, neap, and mean) at four different tidal phases (high tide, mean falling tide, low tide, and mean rising tide) results in a total of *N* x 3 x 4 storm events. For example, should we identify 50 tropical and extra-tropical storms, the above procedures will yield 600 plausible storms.

Task 9.2 Storm Seasons

Beach-*fx* requires specifying up to 12 storm seasons, corresponding to each month in a year. The model assumes each plausible storm occurs within the season when the original historical storm fell. Based on those storms identified and developed, we will define the storm seasons and the probability of occurrence of extra-tropical storms and tropical storms, the minimum storm arrival time, and the maximum number of extra-tropical and tropical storms in each season. Importantly, the minimum arrival time maintains separation between successive storm events during Beach-*fx*'s lifecycle analyses.

Task 9 Deliverables

- MS Excel spreadsheets of identified historical storm waves and surges
- ASCII files of generated synthetic, plausible storms for 12 different variants of storm surge

Task 10 Coastal Processes Analyses

The Storm-induced Beach Change model (SBEACH) allows numerical simulation of cross-shore beach, berm, and dune erosion produced by storm waves and water levels. Individual SBEACH runs with simplified beach configurations serve to populate the Shore Response Database (SRD) in Beach-*fx*. SBEACH simulates the individual storms from the plausible storm suite for each simplified profile configuration. When completed, the SRD provides a look-up table (matrix) of shoreline response for each representative reach and greatly improves the efficiency of the Beach-*fx* model.

Task 10.1 Define Study Reaches and Representative Profiles

This study will likely apply three to four representative SBEACH reaches to depict the one-mile project segment (from FDEP reference monuments R-13 to R-19) and adjacent segment (FDEP reference monuments R-19 to R-26) (that may also receive benefits from updrift beach fill) as input to develop the SRD. Geomorphologic characteristics (e.g., similar shape of the upper beach profile, shape of the offshore profile, proximity to Jupiter Inlet) will distinguish the reach areas. Development of the representative profiles for each reach will begin with collecting historical survey data (from previous Palm Beach County projects) and aligning of all data (excluding post-storm survey data) at geomorphologic features of interest, specifically the dune, the foreshore slope, and the submerged area just seaward of the offshore bar. The development of the representative profiles intends to create profiles that represent conditions over the period of interest (temporal variations) and the area of interest near the representative profile (spatial variations). The representative profile should provide a predictive model, such as SBEACH, with a beach profile that captures average conditions over the time period and shoreline reach of interest.

After generating representative profiles for each reach, we will need to develop simplified beach profiles for input into Beach-*fx*. Simplified profiles consist of a trapezoidal dune with a horizontal berm feature seaward of the dune and a horizontal upland feature landward of the dune. Note that — within each simplified profile — that the upland elevation, dune slope, berm elevation, and foreshore slope remain constant in Beach-*fx* whereas the upland width, dune width, dune elevation, and berm width may vary. By varying some features, we can develop different representative profiles for each reach to bound the range of expected beach conditions (such as those conditions resulting from beach nourishment) in that reach. That is, the representative profile should include future estimates of the profiles of interest. For example, the maximum profile condition would include an equilibrated beach fill whereas the minimum condition would include the limit of what people tolerate (generally, the existing condition). We will define the maximum berm width based on one-year post-construction beach profiles from the two previous beach nourishments in the project area. The submerged portion of the profiles requires no simplification because Beach-*fx* uses this part of the profile for visualization purposes only.

We will apply the SBEACH data generator tool developed by Mark Gravens, USACE Engineering and Research Development Center, to generate simplified geometric profiles for each reach. For reference, Taylor Engineering recently generated nearly 250 simplified profiles for a one mile project area in the Florida Panhandle.

Task 10.2 SBEACH Calibration and Verification

To ensure that SBEACH produces reasonably accurate storm-eroded profiles, model simulations require calibration to a known storm event. As part of its 2008 regional monitoring surveys, the county collected two sets of beach profiles along FDEP reference monuments R-13 through R-19. The county collected the first set of surveys in mid August and the second set of surveys in late September. Three storms — Tropical Storm Fay and Hurricanes Hanna and Ike — passed near the project area between these two surveys. We will calibrate SBEACH by inputting the available pre-storm profile and the characteristics of the three storms to produce a post-storm profile. We will then try to match the modeled post-storm profile to the measured post-storm profile. Hurricane Ike may have had little effect on the project beach. We will, however, examine its effect as part of the model calibration process.

As discussed above, the project area may consist of multiple reaches. Therefore, we will select one measured profile from each reach for calibration purposes.

SBEACH calibration parameters include the sediment transport rate coefficient (k), the coefficient for slope-dependent transport term (ε), the effective grain size, and the maximum slope before avalanching. The calibration coefficients applied in previous studies performed in Palm Beach, Broward, and Miami-Dade Counties (USACE; 1996; Coast of Florida Erosion and Storm Effects Study, Region III) will serve as a base for the Jupiter/Carlin segment. Simulations will vary values for k, ε, effective grain size, and maximum slope before avalanching to reasonably reproduce the observed post-storm profiles. Notably, given the application intent of the SBEACH results in the Beach-*fx* model, we will focus SBEACH calibration on matching the upper (dry) beach changes. Note that Hurricanes Frances and Jeanne in 2004 produced little dry beach changes and significant offshore changes in the project area. As such, we do not propose to utilize these hurricanes for SBEACH calibration despite the availability of pre- and post-storm survey data.

Task 10.3 Create Shore Response Database (SRD)

Following successful SBEACH model calibration (and verification), we will apply the model to develop the SRD required by Beach-*fx*. After generation of all simplified profiles, an initial SBEACH run will simulate each profile response with each plausible storm. Our experience has shown that the output of these SBEACH simulations may demonstrate some large storms overtopping the dunes on some profiles. At times, this overtopping resulted in unstable and unrealistic dune formations (e.g., sharp slope breaks in the overwash feature) located landward of the pre-storm dunes. For the storms that produce this unrealistic output, a smaller time increment and the application of mild seaward slopes on the dunes and berms of the profiles proved necessary to improve the output. Because the SBEACH data generator tool can only generate level or flat dunes and berms, adding slopes will require manual adjustments after profile generation. Similarly, time adjustments will also require manual changes to the model parameters. After making these adjustments, we will produce SBEACH responses of each profile configuration to each storm event. These SBEACH profile responses will populate the SRD for subsequent input into the Beach-*fx* economic model. For reference, Taylor Engineering recently simulated about 135,000 profile responses for a one mile project area in the Florida Panhandle.

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Attachment A

Task 10.4 Beach-fx Calibration to Coastal Processes

In addition to storm-induced beach profile responses, Beach-*fx* also requires specifying other morphological changes including an applied erosion rate, a project-induced planform change rate, and a post-storm recovery factor.

The applied erosion rate, with units of feet per year, acts as a tuning parameter such that this input erosion rate combined with the storm-induced erosion produces the historical erosion rate for each particular reach. We will define the historical erosion rate for each reach based on previous shoreline change analyses performed for the county (e.g., Jupiter/Carlin Structures – Feasibility Study, Jupiter/Carlin Design and Permitting) with some exceptions. We will determine mean high water shoreline change rates for each FDEP reference monument via three different methods — end point, regression, and rate-averaging — over a period of calm (non-stormy) and stormy periods but absent the influence of beach nourishment or immediate post-dredge beach disposal projects such as Jupiter Inlet District sand trap and Intracoastal Waterway dredging. We want to exclude times of accretive shoreline changes because future beach nourishment timing remains unknown. We will then average the results of the three methods for each reference monument and fit a linear trend line to the average to reduce longshore variability. Shoreline change rates read from the trend line will serve as targets for calibrating Beach-*fx* to the coastal processes. Note that we will also assess the significance of sea level rise in the long-term shoreline change rates. As per the county's request, we will also determine the 30-year erosion rate for the project area.

The project-induced planform change rate accounts for longshore dispersion of any beach nourishment material and changes for each year and nourishment cycle. For example, a beach fill project disperses alongshore more quickly near its initial construction than it does the years following construction. Additionally, a project will tend to exhibit a decreasing trend in dispersion losses with each subsequent nourishment. Typically, an external model, such as GENESIS (Generalized Model for Simulating Shoreline Change), would provide the needed change rates over the fill's nourishment cycle. In this case, however, we will apply the observed rates (e.g., see Taylor Engineering Jupiter/Carlin monitoring reports). We will develop the project-induced planform change rates from Jupiter/Carlin monitoring data from initial construction in 1996 and renourishment in 2002. In addition, we will develop a project-induced planform change rate for the downdrift beaches to account for the positive effects of fill dispersion into areas outside of the fill placement area. Again, we will examine the available monitoring data to determine a justifiable rate to apply.

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The post-storm recovery factor represents restoration of the berm width to a user-specified percentage of the storm-induced berm width change. The post-storm recovery occurs over a user-specified time. This factor accounts for some natural beach recovery that occurs after the passage of a major storm. We will apply values in consultation with the USACE Jacksonville District.

After setting the project-induced planform change rate and post-storm recovery factor, we will calibrate Beach-*fx* to coastal processes by tuning the applied erosion rates to match the historic shoreline erosion rates for each reach. This process requires simulating hundreds of iterations of the remaining years (of Jupiter/Carlin project life) period of analysis such that Beach-*fx* returns, on average, the historical erosion rates for each reach.

Task 10 Deliverables

- Calibrated and verified SBEACH project files (delivered to county and FDEP [with Task 14 SBEACH modeling report])
- SRD file(s)
- Calibrated Beach-*fx* model

Task 11 Economic Analyses

Task 11.1 Structural and Content Inventory and Values

Beach-*fx* requires identifying damage elements (DE) or anything of value that can incur damage. DE's lie within lots, defined as quadrilaterals that approximate lot parcels as delineated by the property appraiser. A group of lots generally compose a reach within Beach-*fx*. All reaches taken in aggregate compose the project area.

Specifically, the model needs the following DE information:

- Geographical reference (northing and easting of center point)
- Alongshore length and cross-shore width
- Usage (e.g., single family, multi-family, commercial, walkover, pool, gazebo, tennis court, parking lot)
- Number of floors
- Construction type (e.g., wood frame, concrete, masonry)
- Foundation type (e.g., shallow piles, deep piles, slab)
- Armor type (e.g., seawall)
- Ground and/or first floor elevation

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- Value of structure (replacement cost less depreciation)
- Value of contents

As part of our original task order, we are developing the value of structures and their usage. All other information represents items specifically related to Beach-*fx* inputs. We will create an ArcGIS database (shapefiles) for import into Beach-*fx*. We will use recent countywide aerials to geo-reference structures. We will obtain structure lengths and widths from aerials and the county property appraiser. The number of floors will derive from the property appraiser. Assessing construction type will require obtaining information from the property appraiser and visual field observations. Determining foundation type will rely on visual observations and other published information. Subtask 11.2 details determining foundation types for the large condominiums.

Our proposed subcontractor, Betsy Lindsay, Inc., will obtain the ground/first floor elevation for each structure lying from the Jupiter Beach Park (R-13) south to FDEP reference monument R-26. Jupiter Beach Rd, the lagoon west of Ocean Trail Way, and S.R. A1A limits the structural inventory on the west. We have identified 90 structures (excluding dune walkovers) as part of the inventory. This inventory includes many more DE's than the SDM. The proposed inventory includes buildings, pools, tennis courts, hot tubs, cabanas, parking lots, pavilions, and shower stations. Beach-*fx* handles dune walkovers differently from other structures and does not require specific elevation information. Betsy Lindsay will have vertical and horizontal positional accuracies of 0.2 and 0.1 ft. These accuracies are similar to those the USACE Jacksonville District is currently applying to its Beach-*fx* studies in Flagler and St. Johns counties.

In addition to structure value, Beach-*fx* allows users to specify a corresponding content value. According to Engineering Regulation 1105-2-100, content values cannot exceed 75% of the structure value without justification. Previous studies in the Florida Panhandle have shown this percentage can significantly exceed 75%. We will perform an empirical study to assess the possibility of increasing this percentage only upon receiving written authorization from the county to proceed with this empirical study. We will conduct interviews with local insurance agents to develop this content value based on issued policies and aggregate claims for representative structure types. In addition, we will inventory a representative sample of residences and assess the replacement value of their belongings. Note that each structure will have a corresponding content value.

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To incorporate uncertainty in the values of contents and structures, one needs to develop three values — minimum, mean, and maximum — for each structure and corresponding content. We will develop these ranges (minimum, mean, and maximum) based on a statistical analysis of similar structures within the project area. For example, several pavilion type structures lie within the project area. Each pavilion will have its own structure value (replacement value less depreciation). An examination of the statistics of these values allows for determining the mean and standard deviation, which will help derive the appropriate ranges to apply in the model. Similarly, we will follow this procedure to account for uncertainty in structure ground/first floor elevations.

The model allows users to define a distribution of the number of days required for rebuilding at the DE level. Each DE can have its own distribution. Thus, the user might enter 350, 365, and 380 to get a distribution around one year. For this project, we will estimate possible existing condition rebuilding parameters for each type of construction.

Beach-*fx* reaches must have a representative beach profile associated with each reach for damage calculations. Multiple reaches may point to the same representative beach profile. One defines reaches based on beach and dune features and proximity of structures to those features. A critical step in Beach-*fx* setup includes aligning representative profiles with the beach and structure features. Specifying a starting point of a beach profile too far landward or seaward of observed beach and structure features can misalign the profile from the features and adversely skew model results from reality. Therefore, we will use ArcGIS with the county's 2008 aerials to specify appropriate Beach-*fx* reaches and starting locations of the representative beach profiles.

Task 11.2 Develop Damage Functions

Beach-*fx* calculates storm damages (benefits) from inundation, storm-induced erosion, long term erosion and wave attack on a DE-by-DE basis for each storm event. Known recent applications of Beach-*fx* have applied damage functions developed by the Institute for Water Resources (IWR), Coastal Storm Damage Workshop (CSDW), Coastal Storm Damage Relationships Based on Expert Opinion Elicitation in 2002. The CSDW, resulted in a set of lookup curves, defined for various damage and foundation types, to calculate percentage loss associated with structure and contents. For each damage type, the input to these curves, or the "damage driving parameter", defined by the CSDW, includes

- Flooding: Depth of water over walking surface of lowest walking floor
- Waves: Difference between the top of wave (crest) and the bottom of the lowest horizontal member

- Erosion: Percent of footprint compromised

Damage functions for each damage type (erosion, inundation [flooding], and wave) correspond with damage element type (e.g., single family residential), foundation type (e.g., shallow piles, deep piles, and slab on grade), construction type (e.g., wood frame, concrete, and masonry) and armor type (e.g., no armor, and sheet pile) and drive the selection of the appropriate damage function. Note that these damage curves also have upper, lower, and median ranges that we will incorporate into Beach-*fx*.

This present study will adopt these CSDW curves to the maximum extent possible. Unfortunately, these functions apply to single story houses and not to large condominiums such as those situated along the Jupiter/Carlin shoreline. Furthermore, no functions currently exist for large structures based on discussions with USACE Jacksonville and Mobile Districts and IWR. As such, we will need to develop these damage functions for large structures. To accomplish this, we have enlisted the help of Christopher Jones, an independent consultant with over 25 years experience in coastal flood hazard mapping. He is currently working on evaluating National Flood Insurance Program (NFIP) building standards for FEMA. He was part of the panel of experts who developed the IWR suite of damage functions.

We will first meet with representatives from USACE Jacksonville District, FDEP, and IWR to discuss ideas and experience regarding damage to large structures. We assume this meeting will either occur on site or in Jacksonville at the USACE offices. Next, we will review available data including

- Existing damage functions such as the USACE and FEMA water-depth damage curves for inland and coastal flooding
- FEMA flood maps at the time of these structures' construction. Flood zone designation at the time of construction may provide insight into foundation type.
- Other FEMA published studies such as Mitigation Assessment Team Reports after hurricanes (e.g., Mitigation Assessment Team Report; Hurricane Ivan in Alabama and Florida; Observations, Recommendations, and Technical Guidance; FEMA 489; August 2005)
- NFIP underwriter information
- Site-specific information on the foundation design and construction of the existing structures as gleaned from available as-built drawings. We will also visually observe each condominium to assess foundation type. Conditions as observed in the field give the

engineer the confidence to make sound engineering judgment regarding damage mechanisms to coastal structures.

We will synthesize the above information to develop inundation (flood), wave, and erosion functions for condominiums (large structures). Prudence dictates accurate development of damage functions for condominiums given these large structures likely comprise the majority of the storm damage reduction benefits associated with beach fill placement along the Jupiter/Carlin beach area. Poorly defined damage functions may lead to inaccurate estimates of storm damage reduction benefits.

Importantly, we will also account for the presence of any shore protection measures in developing these functions. While structural design can reveal deficiencies related to storm damage prevention, the presence of shore protection can reduce damage to these structures such that a storm that would otherwise damage a structure does not because of the presence of shore protection devices (e.g., seawalls). As such, we will include the seawalls that exist in front of the Jupiter Beach restroom facility and the Jupiter Reef Club.

Task 11 Deliverables

- GIS data files of DE's, lots, and reaches
- Summary of contents empirical study results in PDF format
- Summary of large structure (multi-story condominium) damage functions development in PDF format

Task 12 Beach Management Measures

Beach-*fx* can account for emergency and planned beach nourishment activities. As defined in Beach-*fx*, emergency nourishment includes immediate, local government response to post-storm conditions by adding limited sand volume to the post-storm beach. For this project, planned beach nourishment activities include both periodic Jupiter Inlet sand trap dredging, Intracoastal Waterway (ICWW) dredging, and regular Jupiter-Carlin beach nourishment.

Including emergency dune work may benefit the county regarding federal participation in the beach fill project. Overall, benefits represent the difference between conditions with the project and conditions without the project. The presence of the beach nourishment project (i.e., with project condition) may reduce the need, and therefore cost, of emergency dune projects. Therefore, with respect

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to emergency dune work, higher costs will likely occur for without project conditions. Given this case, the cost differential will lead to a larger project benefit.

As a result of storms and ongoing chronic erosion, we understand the county will continue to place sand along the project area should conditions warrant. For example, if erosion threatens the Jupiter Beach Park parking lot and bath house, the county has historically placed truck hauled sand in the form of a dune to prevent further erosive damage. Beach-*fx* can account for these placements. We will work with the county to develop the minimum thresholds of dune height, dune width, or berm width, which when met, will trigger emergency beach placement. We will also obtain typical mobilization, placement costs, and production rates for incorporation into the model.

Additionally, we will specify planned beach nourishment triggers, design templates, and nourishment cycles. Similar to emergency beach placement, planned nourishment activities will also require beach placement rates, production rates, and unit costs. Unlike trucked material, offshore-derived material will require a borrow area to placement volume ratio. Note that sand trap and ICWW dredging activities typically require no county monetary support for construction. We will use the costs developed with MCACES under our current task order to represent costs of regular Jupiter-Carlin beach nourishment.

Task 12 Deliverables

- Summary of minimum dune/beach thresholds for emergency dune placement in PDF format
- Summary of mobilization, placement costs, and production rates (and borrow area to placement volume ratio) for emergency and planned beach nourishment activities in PDF format

Task 13 Beach-*fx* Simulations

Calculating benefits requires simulating with and without project conditions. Past modeling experience has shown that running 300, 50-yr lifecycle Monte Carlo simulations will likely achieve unchanging probability distributions of storm damages and renourishment intervals. We anticipate performing many iterations of these 300 lifecycle simulations to produce reasonable and justifiable results.

In addition, we will need to perform sensitivity analyses as part of justifying the reasonableness of results. Analyses will include model sensitivity to

- Structure values ranges

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- Content values ranges
- Damage functions and ranges
- Nourishment (including sand trap and ICWW) triggers
- Nourishment costs
- Shoreline change rates
- Planform losses and gains (outside of project area)

These many iterations and sensitivity analyses will attempt to completely assess project benefits through the application of justified model inputs.

Task 13 Deliverables
No separate deliverables for this task.

Task 14 Additional Reporting and Appendices

Because of greater complexity associated with Beach-*fx*, the Section 934 report will require more documentation above and beyond that originally scoped in our current task order. Additional information includes

- An explanation of the modeling framework
- Development and presentation of wave and storm surge data analyses
    - Plausible storm suite
    - Storm seasons
- Coastal processes analyses
    - Study reaches and representative profiles
    - SBEACH calibration and verification
    - Creation and presentation of Shore Response Database (SRD)
    - Beach-*fx* calibration to coastal processes
- Economic analyses
    - Structural and content inventory, values, and uncertainty
    - Damage functions' descriptions and development
- Emergency and planned beach nourishment measures
- Beach-*fx* simulations and sensitivity analyses
- Discussion and presentation of Beach-*fx* model output files and results

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Portions of this new material will appear in the engineering section and appendix of the report while the remainder will reside in the economic section with new supporting appendices, such as the large structure damage function development summary.

Because of the added complexity of Beach-*fx* as compared to the USACE Jacksonville District's SDM, we have included additional time for responding to comments from the county, USACE Jacksonville District, Agency Technical Review, SAD, other federal/state agencies, and USACE Chief of Engineers.

Finally, we have allotted additional time to meet the FDEP's reporting requirements for SBEACH modeling as outlined in "Guidelines for Documenting SBEACH Model Applications in Submittals to the FDEP Bureau of Beaches and Coastal Systems," dated July 16, 2009.

Task 14 Deliverables

- Engineering and economic sections and supporting appendices summarizing Beach-*fx* analyses according to the deliverable schedule as per original task order (Taylor Engineering Task 7 of county task order number 0410-07).
- Draft SBEACH modeling report to county in PDF format for county comments
- Final SBEACH modeling report to FDEP (2 hard copies) and county (1 hard copy)

Task 15 Coordination

Given this project will extend beyond December 2009, we have added additional time for one director to participate in monthly USACE Jacksonville District Project Delivery Team teleconferences through December 2011.

END OF SCOPE OF SERVICES

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Attachment B

TAYLOR ENGINEERING, INC.
COST SUMMARY
P2009-083: PBC: JUPITER-CARLIN SECTION 934 BEACH-FX

I. LABOR COST

	Man-Hours												
Description	**CEO**	**Pres**	**VP**	**Sr Adv**	**Director**	**Sr Prof**	**Proj Prof**	**Prof**	**Sr Edit**	**Sr Tech**	**Tech**	**Admin**	**Cost**
Hourly Burdened Rate	247.00	186.00	165.00	144.00	125.00	103.00	103.00	73.00	95.00	85.00	58.00	43.00	
Task 9: Wave and Storm Surge Data Analyses													
9.1 Storm suite - Identify storms			1.0		8.0	24.0	112.0					1.0	15,216.00
9.2 Storm suite - Extract storms			1.0		12.0	32.0	136.0					1.0	19,012.00
9.3 Storm suite - Estimate wind-waves			1.0		8.0	24.0	112.0					1.0	15,216.00
9.4 Storm suite - Astronomical tides			1.0		4.0	4.0	16.0					1.0	2,768.00
9.5 Storm suite - plausible water levels			1.0		8.0	10.0	40.0					1.0	6,358.00
9.6 Storm seasons			1.0		1.0		8.0					1.0	1,157.00
Task 9 Totals			6.0		41.0	94.0	424.0					6.0	59,727.00
Task 10: Coastal Processes Analyses													
10.1 Define study reaches and representative profiles			3.0		4.0	16.0	80.0					2.0	10,969.00
10.2 SBEACH calibration and verification			1.0		8.0	12.0	80.0					2.0	10,727.00
10.3 Create Shore Response Database (SRD)			1.0		8.0	40.0	160.0					2.0	21,851.00
10.4 Beach-fx calibration to coastal processes			2.0		4.0	12.0	40.0					2.0	6,272.00
Task 10 Totals			7.0		24.0	80.0	360.0					8.0	49,819.00
Task 11: Economic Analyses													
11.1 Structural and content inventory and values													-
Structures			1.0		4.0		40.0					2.0	4,871.00
Contents			1.0	4.0	4.0		80.0					8.0	9,825.00
Define Beach-fx reaches			1.0		2.0		24.0			8.0			3,567.00
11.2 Develop damage functions			4.0		40.0	24.0							8,132.00
Task 11 Totals			7.0	4.0	50.0	24.0	144.0			8.0		10.0	26,395.00
Task 12: Beach Management Measures													
12.1 Emergency beach nourishment			1.0	8.0	4.0	40.0	40.0					2.0	10,143.00
12.2 Planned beach nourishment			1.0		2.0	12.0	12.0					2.0	2,973.00
Task 12 Totals			2.0	8.0	6.0	52.0	52.0					4.0	13,116.00
Task 13: Beach-fx Simulations													
13.1 Simulations and sensitivity analysis				40.0	80.0	160.0	160.0						48,720.00
Task 14: Additional Reporting and Appendices													
14.1 New Beach-fx documentation			1.0	4.0	16.0		64.0		4.0	4.0		4.0	10,225.00
14.2 Respond to county comments			1.0	2.0	8.0		24.0		1.0			1.0	4,063.00
14.3 Draft Section 934 (economics) to USACE Jacksonville			1.0	2.0	2.0		24.0		2.0	1.0		1.0	3,493.00
14.4 Respond to USACE Jacksonville comments			1.0	2.0	2.0		24.0		1.0			1.0	3,313.00
14.5 Draft Section 934 (economics) to ATR			1.0	2.0	2.0		24.0		2.0	1.0		1.0	3,493.00
14.6 Respond to ATR comments			1.0	2.0	2.0		24.0		1.0			1.0	3,313.00
14.7 Draft Section 934 (economics) to USACE SAD			1.0	2.0	2.0		24.0		2.0	1.0		1.0	3,493.00
14.8 Respond to USACE SAD comments			1.0	2.0	2.0		24.0		1.0			1.0	3,313.00
14.9 Draft Section 934 (economics) to state/federal agencies			1.0	2.0	2.0		24.0		1.0	1.0		1.0	3,398.00
14.10 Respond to other state and federal agencies' comments			1.0	2.0	2.0		24.0		1.0			1.0	3,313.00
14.11 Draft Section 934 (economics) to USACE Office of Chief			1.0	2.0	2.0		24.0		1.0	1.0		1.0	3,398.00
14.12 Respond to USACE Office of Chief comments			1.0	2.0	2.0		24.0		1.0			1.0	3,313.00
14.13 Draft Section 934 (economics) to USACE			1.0	2.0	2.0		24.0		1.0	1.0		1.0	3,398.00
14.14 Draft SBEACH modeling report			1.0		4.0		20.0		4.0			4.0	3,277.00

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	Man-Hours												
Description	**CEO**	**Pres**	**VP**	**Sr Adv**	**Director**	**Sr Prof**	**Proj Prof**	**Prof**	**Sr Edit**	**Sr Tech**	**Tech**	**Admin**	**Cost**
Hourly Burdened Rate	247.00	186.00	165.00	144.00	125.00	103.00	103.00	73.00	95.00	85.00	58.00	43.00	
14.15 Final SBEACH modeling report					2.0		4.0		1.0			3.0	886.00
Task 14 Totals			14.0	28.0	52.0		376.0		24.0	10.0		23.0	55,689.00
Task 15: Coordination													
15.1 Monthly PDT teleconference					24.0								3,000.00
LABOR TOTALS — HOURS			*36.0*	*80.0*	*277.0*	*410.0*	*1,516.0*		*24.0*	*18.0*		*51.0*	***2,412.0***
LABOR TOTALS — COST			*5,940.00*	*11,520.00*	*34,625.00*	*42,230.00*	*156,148.00*		*2,280.00*	*1,530.00*		*2,193.00*	***$256,466.00***

II. OTHER DIRECT COSTS

Description	**Quantity**	**Unit Cost**	**Direct Cost**	**Burden**	**Burdened Cost**
Task 11: Economic Analyses					
Betsy Lindsay Inc. (surveying)	1.0	14,575.00	14,575.00	1.00	14,575.00
Christopher Jones, P.E. (flood hazard expert)	1.0	23,500.00	23,500.00	1.00	23,500.00
TOTAL OTHER DIRECT COSTS					*38,075.00*

TOTAL PROJECT COST	***$294,541.00***

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BETSY LINDSAY, INC.
SURVEYING AND MAPPING

May 28, 2009 (revised August 28, 2009)

Michael Krecic
Taylor Engineering Inc.
1665 Palm Beach Lakes Blvd., Suite 803
West Palm Beach, Florida 33401 VIA FAX 561-640-7805

SUBJECT: PALM BEACH COUNTY BEACH -FX SURVEYS

Dear Mr. Krecic:

Per your request, this proposal for professional services between Betsy Lindsay, Inc. (Consultant) and TAYLOR ENGINEERING, INC. (Client) has been prepared for your approval. The following sections outline the elements of my proposal for surveying services required for the **BEACH - FX SURVEYS.**

SUBJECT PROPERTY

All of the features including buildings, pools, hot tubs, cabanas, parking lots, tennis courts, pavilion and shower stations located east of Jupiter Beach Road, to the lagoon west of Ocean Trail Way and S.R. A1A, from R13 – R26 in Palm Beach County, Florida.

SCOPE OF SERVICES

1. Compile the horizontal and vertical control to be utilized throughout the survey.
2. Establish a site calibration using GPS with RTK
3. Shoot the finished elevation for each structure and collect x, y, and z for each structure utilizing GPS with RTK. The horizontal positional accuracy will be 0.1' and a vertical positional accuracy of 0.2'. Take a digital photo of each structure.
4. Compile that data into an excel spreadsheet with reference to photograph number for each feature.
5. Prepare a survey report certifying that the data meets Minimum Technical Standards.

DELIVERABLES

We will deliver 2 signed and sealed copies of the report and 2 CD's containing all digital data.

PROFFESSIONAL FEES

The fee for the services as described in items 1-5 will be a lump sum fee of $14,575.00.
Any additional services required will be done on a time & materials basis.

Thank you for this opportunity to serve you. If you should have any questions or problems with regards to this proposal please do not hesitate to call me.

Respectfully,

Elizabeth A. Lindsay, P.L.S. (Betsy)
President

Approved and accepted this ________ day of ____________________, 2009. TAYLOR ENGINEERNG, INC. (client).

Witness: ______________________________ ______________________________
Authorized Client Representative

S:/Proposal/BL5/mydocs/TAYLOR/09beach-fx.doc

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Send all correspondence
7997 SW Jack James Drive
Stuart, FL 34997
(772) 286-5753 • Fax (772) 286-5933

208 North U.S. Highway One, #8
Tequesta, FL 33469
(561) 575-5275

Betsy Lindsay, Inc.

beach -fx
TAYLOR ENGINEERING

05/27/09	*# of items*	*Admin Asst $46*	*2-man crew $88*	*3-man crew $103*	*2-man GPS $130*	*3-man GPS $150*	*PLS $88*	*Proj Surveyor $67*	*Cadd Tech $57*	
SPECIFIC PURPOSE SURVEY										
compile control data	5	2					2	2		402
establish calibration								6		402
shoot fin floor-x,y, photo	90				67.5		6	10		9,973
process data	2	4					6	8	10	1,818
prepare report		4					8	16		1,960
										0
										0
Total										$ 14,555.00
		10	0	0	67.5	0	22	42	10 ~~0~~	

EXPENSES										
class c bench mark										
boat rental										
Perdium										
Mileage										
Reproduction										20
										$ 20.00

TOTAL CONTRACT WITH EXPENSES									$ 14,575.00

S/proposals/BL5/mydocs/taylor/09Beach-fx.xls

Christopher P. Jones, P.E.

5525 Jomali Drive Durham, NC 27705
(919) 382-0130 (919) 382-8742 Fax
chris.jones@earthlink.net

July 17, 2009

Michael R. Krecic, P.E.
Director of Coastal Engineering
TAYLOR ENGINEERING, INC.
10151 Deerwood Park Blvd., Bldg. 300, Suite 300,
Jacksonville, FL 32256

Re: Costs for Palm Beach Co. Project, Large Building Damage Functions for Beach-f_x

Dear Mike:

Here is a cost breakdown for the work I proposed to you on June 1:

1. Review of existing small- and large-building damage functions. *(16.0 hours @ $150.00/hr = $2,400.00)*
2. Collection and analysis of recent large-building damage data from FEMA, FDEP and others. *Note that this task includes review of recent tsunami damage data (24.0 hours @ $150.00/hr = $3,600.00)*
3. Participation in a one-day meeting (Jacksonville or Palm Beach County) to review available data and discuss incorporation of recent data into existing damage databases and damage functions. *Note that the time included in this task assumes development of a white paper and presentation for the meeting (30.0 hours @ $150.00/hr = $4,500.00).*
4. Two-day Jupiter/Carlin site-visit to assist Taylor Engineering with the inspection and characterization of large buildings within the project area. *Note that this task includes review of building plans and other data in advance of the site visit, and preparation of a summary memorandum of building and site observations (40.0 hours @ $150.00/hr = $6,000.00).*
5. Assist Taylor Engineering with the development/update of large-building depth damage functions for application in the Jupiter/Carlin project area. *(48.0 hours @ $150.00/hr = $7,200.00).*

The total cost equaled $23,700 but I rounded to $23,500. Please call if you have any questions or need additional information.

Sincerely yours,

Christopher P. Jones, P.E.
CPJ/

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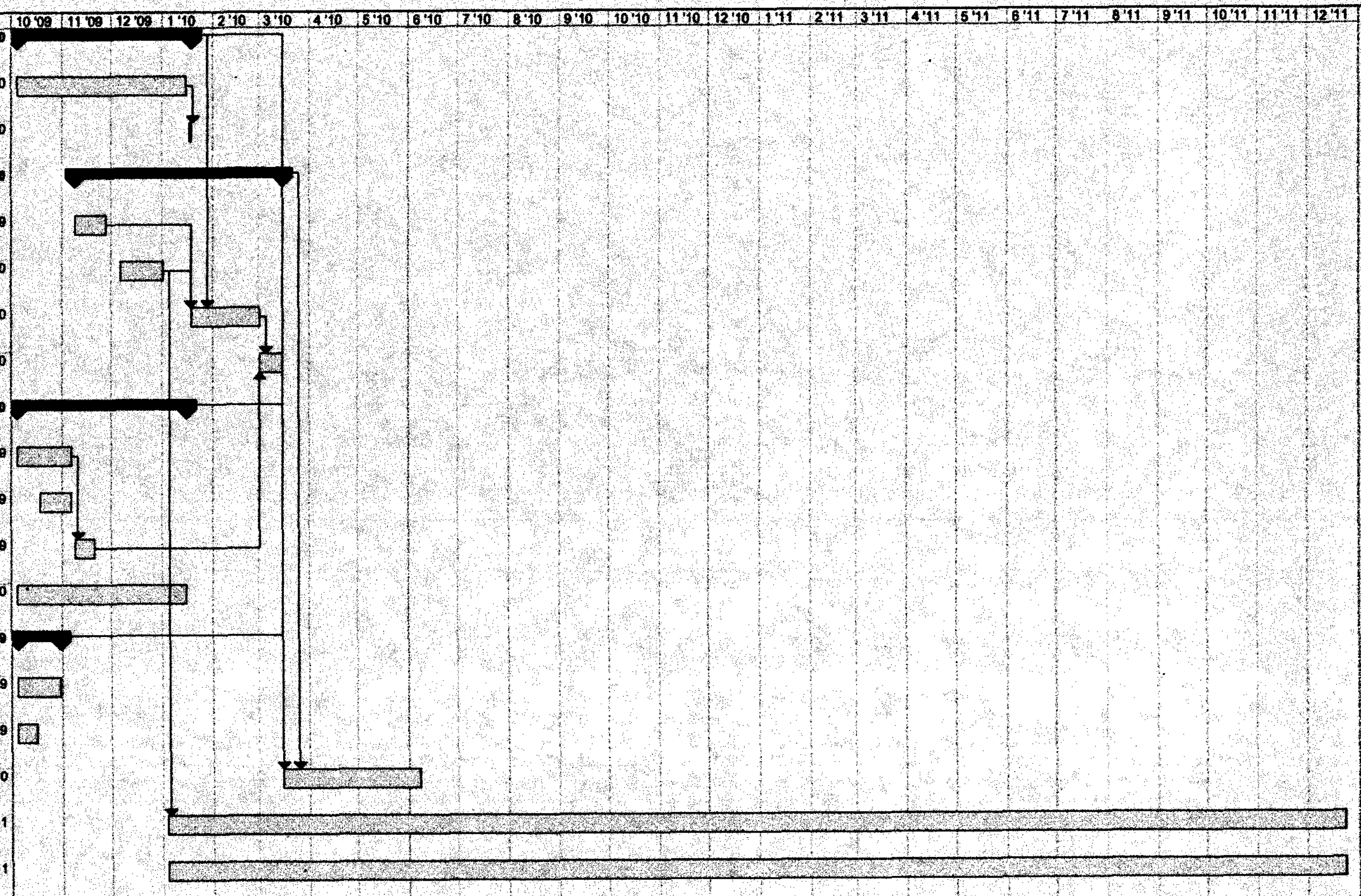
Taylor Engineering, Inc.

ID	Task Name	Duration	Start	Finish
1	**Wave and Storm Surge Data Analys**	**76 days**	**Mon 10/5/09**	**Mon 1/18/10**
2	Storm Suite	75 days	Mon 10/5/09	Fri 1/15/10
3	Storm Seasons	1 day	Mon 1/18/10	Mon 1/18/10
4	**Coastal Processes Analysis**	**91 days**	**Mon 11/9/09**	**Mon 3/15/10**
5	Define Study Reaches	15 days	Mon 11/9/09	Fri 11/27/09
6	SBEACH Calibration	20 days	Mon 12/7/09	Fri 1/1/10
7	SRD	30 days	Tue 1/19/10	Mon 3/1/10
8	Beach-fx Calibration	10 days	Tue 3/2/10	Mon 3/15/10
9	**Economic Analyses**	**75 days**	**Mon 10/5/09**	**Fri 1/15/10**
10	Structural Inventory and Values	25 days	Mon 10/5/09	Fri 11/6/09
11	Content Inventory and Values	15 days	Mon 10/19/09	Fri 11/6/09
12	Define Beach-fx Reaches	10 days	Mon 11/9/09	Fri 11/20/09
13	Develop Damage Functions	75 days	Mon 10/5/09	Fri 1/15/10
14	**Beach Management Measures**	**20 days**	**Mon 10/5/09**	**Fri 10/30/09**
15	Emergency Beach Nourishment	20 days	Mon 10/5/09	Fri 10/30/09
16	Planned Beach Nourishment	10 days	Mon 10/5/09	Fri 10/16/09
17	Beach-fx Simulations	60 days	Tue 3/16/10	Mon 6/7/10
18	Additional Reporting and Appendices	515 days	Mon 1/4/10	Fri 12/23/11
19	PDT Teleconferences	515 days	Mon 1/4/10	Fri 12/23/11



Project: P2009-083 PBC Section 934 I
Date: Mon 8/24/09

Task | Split | Progress | Milestone | Summary | Project Summary | External Tasks | External Milestone | Deadline

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Taylor Engineering
Continuing Contract for Coastal and Marine Engineering

Contract R2008-0410 dated March 1, 2008 for period of two years expires on Feb. 28, 2010
SBE-MBE Goal 15.0% (10% SBE/W; 5% MBE/H)
Task order summary:

TASK NUMBER	TOTAL/ SBE and/or MWBE AMOUNT	TASK DUE DATE	TASK DESCRIPTION	APPROVED BY/DATE
Taylor-01	316,582.00 0.00	1/31/2009	2008 North County Sea Turtle Monitoring	BCC 3/11/2008
Taylor-01A	49,023.00 0.00	1/31/2009	2008 North County Sea Turtle Monitoring	ERM 3/11/2008
0410-02	5,000.00 0.00	4/30/2008	2007 Jupiter Inlet Ebb Shoal Survey	ERM 4/29/2008
0410-03	93,924.00 35,462.00	10/31/2008	2008 Regional Monitoring Beach Profiles and 3 Ebb Shoal Surveys	CRC 8/6/2008
0410-04	21,766.00 0.00	10/31/2008	Ocean Ridge 36 Month Monitoring Report	ERM 7/25/2008
0410-05	164,763.00 0.00	9/9/2009	Jupiter/Carlin Renourishment Beach Fill and Permitting	BCC 9/9/2008
0410-03A	18,363.00 8,046.00	10/31/2008	2008 Regional Monitoring Beach Profiles and 3 Ebb Shoal Surveys	ERM 10/22/2008
Taylor-01B	9,852.50 0.00	1/31/2009	2008 North County Sea Turtle Monitoring	ERM 11/10/2008
0410-05A	25,168.84 0.00	9/9/2009	Jupiter/Carlin Renourishment Beach Fill and Permitting	ERM 11/17/2008
0410-06	91,660.00 13,776.00	4/24/2009	Zeke's Parcel Waterfront Design	CRC 12/17/2008
0410-07	190,744.00 0.00	8/31/2010	Jupiter/Carlin Section 934 Study	BCC 2/24/2009
0410-08	196,985.00 191,445.00	1/31/2010	2009 Sea Turtle Monitoring - Singer Island & Ocean Ridge	BCC 2/24/2009
0410-09	362,811.85 0.00	11/1/2010	South Palm Beach/Lantana Environmental Impact Statement	BCC 4/21/2009
0410-10	47,566.00 0.00	6/30/2009	Expert Testimony Services for South Cove Hearing	ERM 4/6/2009
0410-11	74,102.00 29,275.00	11/30/2009	2009 Regional Monitoring Beach Profiles and 2 Ebb Shoal Surveys	CRC 9/2/2009
0410-08A	866.00 840.00	1/31/2010	2009 Sea Turtle Monitoring - Singer Island & Ocean Ridge	ERM 8/27/2009
0410-07A	283,649.00 14,575.00	12/31/2011	Jupiter/Carlin Section 934 Study	BCC

Subtotal: 1,952,826.19
Subtotal SBE-MBE: 293,419.00
Subtotal SBE-MBE Part.: 15.0%
Report Date & Filename: 09/09/09 T:\eer\engser\Consultants\TAYLOR_2008\[history_0410.xls]Sheet1

Attachment 2

JC
copy

R2008 0410

CONTRACT FOR PROFESSIONAL CONSULTANT SERVICES
BETWEEN PALM BEACH COUNTY AND
TAYLOR ENGINEERING, INC.

This is a Contract made as of MAR 1 1 2008, by and between Palm Beach County, a Political Subdivision of the State of Florida, by and through its Board of County Commissioners, hereinafter referred to as the COUNTY, and Taylor Engineering, Inc., 9000 Cypress Green Drive, Suite 200, Jacksonville, Florida 32256, an engineering firm, a corporation, authorized to do business in the State of Florida, hereinafter referred to as the CONSULTANT, whose Federal I.D. Number is 59-2850478.

In consideration of the mutual promises contained herein, the COUNTY and the CONSULTANT agree as follows:

ARTICLE 1 - SERVICES

The CONSULTANT's responsibility under this Contract is to perform professional coastal and marine engineering services and incidental services as more specifically set forth in the Scope of Work attached hereto as Exhibit "A". In the event services are required to be performed that are not described in Exhibit "A", but are within the general scope of services, the COUNTY and the CONSULTANT hereby reserve the right to negotiate task orders covering the desired services.

The CONSULTANT shall conduct professional services in accordance with Chapters 471 and 472, Florida Statutes and other applicable local, state and federal standards. The CONSULTANT shall conduct topographic and hydrographic survey work in compliance with the U.S. Army Corps of Engineers "Technical Requirements for Surveying, Mapping and Photogrammetric Services," Revised March 1989 and the U.S. Army Corps of Engineers "Engineering Design: Hydrographic Surveying," EM 1110-2-1003, January 1, 2001, and the most current Florida Department of Environmental Protection specifications for topographic (section 02000) and bathymetric (section 02100) surveying.

ARTICLE 2 - PERIODS OF SERVICE AND SCHEDULES

This Contract commences on March 1, 2008 and ends two years later. At the option of the COUNTY, the Contract can be renewed for an additional one-year period.

Reports and other work items shall be delivered or completed according to schedules established in each task order.

ARTICLE 3 - ASSIGNMENT OF WORK

The CONSULTANT shall provide professional services on a task order basis. A copy of the Task Order form and Task Change Order form are attached hereto as Exhibit "C" and Exhibit "D". The COUNTY reserves the right to modify these forms during the term of the Contract.

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ARTICLE 32 - CRIMINAL HISTORY RECORDS CHECK

The CONSULTANT shall comply with the provisions of Ordinance 2003-030, the Criminal History Records Check Ordinance ("Ordinance"), if CONSULTANT's employees or subcontractors are required under this contract to enter a "critical facility" as identified in Resolution R-2003-1274. The CONSULTANT acknowledges and agrees that all employees and subcontractors who are to enter a "critical facility" will be subject to a fingerprint based criminal history records check. Although COUNTY agrees to pay for all applicable FDLE/FBI fees required for criminal history record checks, the CONSULTANT shall be solely responsible for the financial, schedule, and staffing implications associated in complying with Ordinance 2003-030.

IN WITNESS WHEREOF, the Board of County Commissioners of Palm Beach County, Florida has made and executed this Contract on behalf of the COUNTY and CONSULTANT has hereunto set its hand the day and year above written. R2008 0410 MAR 11 2008

ATTEST:
Sharon R. Bock, Clerk & Comptroller

By: [signature]
Deputy Clerk

BOARD OF COUNTY COMMISSIONERS PALM BEACH COUNTY FLORIDA

WITNESS:

[signature]
Signature

Carla M. Cannon
Name (type or print)

APPROVED AS TO FORM
AND LEGAL SUFFICIENCY:

By: [signature]
Assistant County Attorney

APPROVED AS TO TERMS
AND CONDITIONS:

By [signature]
Richard E. Walesky, Director
Dept. of Environmental Resources Mgmt.

PALM BEACH COUNTY
BOARD OF COUNTY COMMISSIONERS:

By: [signature]
Addie L. Greene, Chairperson

CONSULTANT:

Taylor Engineering, Inc.
Company Name

[signature]
Signature

Steven J. Schropp
Name (type or print)

Vice President
Title

(corp.seal)

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EXHIBIT B
Taylor Engineering, Inc.
Schedule of Hourly Labor Rates
and Equipment Fees and Other Direct Costs
for 2008
Palm Beach County
Coastal & Marine Engineering Services

Position	Rate Basis Hourly Wage	Burdened Hourly Billing Rate*
CEO	86.67	247.00
President	65.26	186.00
Vice President	57.89	165.00
Senior Advisor	50.53	144.00
Director	43.86	125.00
Senior Professional	36.14	103.00
Project Professional	36.14	103.00
Staff Professional	25.61	73.00
Senior Editor	33.33	95.00
Sr. Technical Support	29.82	85.00
Technical Support	20.35	58.00
Administrative	15.09	43.00

Equipment Fee and Other Direct Costs	Rate	Unit
Black & White Photocopies (8-1/2 x 11)	$0.15	/page
Black & White Photocopies (11 x 17)	$0.20	/page
Color Photocopies (8-1/2 x 11)	$1.25	/page
Color Photocopies (11 x 17)	$1.50	/page
Computer Generated Glossy Plots (24" x 36" Glossy Paper)	$65.00	/page
Computer Generated Glossy Plots (24" x 36" Standard Paper)	$35.00	/page
14' Aluminum Jonboat	$80.00	/day
Truck	$85.00	/day
Trimble Differential GPS	$100.00	/day
ADFM Velocity Profiler Pro20	$200.00	/day
ADCP Rio Grande Current Meter	$200.00	/day
Sokkia SET6E Total Station	$350.00	/day
Cone Penetrometer	$15.00	/day
YSI SCT Meter	$50.00	/day
YSI DO Meter	$50.00	/day
Hand-held GPS	$10.00	/day

*The Burdened Hourly Billing Rates are based on a 2.85 mulitplier.

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