Peer Review of the Lido Key Federal Shore Protection Project

Sarasota County
Environmental Planning Department

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Executive Summary

The Lido Key Federal Shore Protection Project (Lido SPP) is a federally authorized Hurricane and Storm Damage Reduction (HSDR) project proposed by the U.S. Army Corps of Engineers (USACE) with the City of Sarasota (City) as local sponsor. Atkins was tasked by Sarasota County, a key stakeholder, to review elements of the Lido SPP specific to the potential for physical impacts to Ted Sperling Park, north Siesta Key and navigation through Big Sarasota Pass as documented by USACE studies and reports provided by the County.

Reports supplied span approximately 15 years of significant effort by the USACE to assess feasibility and analyze several design alternatives. However, the reports provided do not always include input data (and metadata) used for analysis. This leaves question and uncertainty with respect to data quality, repeatability, and geographic coverage as well as model calibration, verification and results. The reports lack the supporting documentation necessary to confidently accept the conclusions.

There appears to be conflicting information about proposed project elements (i.e. number, location and geometry of groins; dredge volumes, boundaries, depths and frequency, etc.) between the supplied reports, information provided in public meetings and that contained in the Joint Coastal Permit (JCP) application to the Florida Department of Environmental Protection (FDEP). The USACE reports do not conclude with a comprehensive presentation of results for the final selected design alternative. A request to the USACE for clarification and additional information have been made by the reviewer through the County, but as of this report not received. We believe that understanding the long-term plan would aid in the evaluation of this initial action presented. Is this proposal a one-time event or an overall inlet management strategy of cyclically mining sand to maintain Lido Key beaches?

Results presented in the USACE reports consider an initial ebb shoal dredging event with groin construction and beach nourishment. Studies have not been provided that present analysis of the long term effects of the proposed activities. Reports indicate that natural sand bypassing occurs from Lido Key, across the Big Sarasota Pass and onto Siesta Key. This natural transfer of sand maintains beach conditions on Siesta Key. Back-passing of sand by dredging a portion of the ebb shoal may interrupt this movement with consequent effects for Siesta Key. The proposed back-passing volume of 1.3 MCY is an order of magnitude greater than the estimated annual net southward transport of approximately 118,000 cy/yr across the ebb shoal. The report states that there is no effect on downdrift beaches due to the proposed back passing of this material. We would expect, however, that the removal of the sand from the ebb shoal would delay (reduce) the southerly transport of some percentage of the reported natural by-passing after dredging. The physical processes that dictate how much delay or potential impact dredging may cause is not described.

Atkins has concerns with respect to documentation of the accuracy and extent of the ebb shoal surveys. Much of the data (surveys) used to document the basis of design report was collected prior to 2002 (i.e. latest shoreline change analyzed was dated 2000). We recommend an update to analyze shoreline change, volume change and erosion rates with more recent data (2000 to 2015). This effort would be prudent to assure that conditions have not changed which may influence final project recommendations and design.

The discussion related to the sediment budget is incomplete. The sediment budget developed by Coastal Tech and USF did not include accompanying information to document its validity. Information related to onshore transport and the north and south boundary conditions reference other work without comment to the reliability of that information. The USACE refined the Coastal Tech/USF sediment budget, but a key feature of both budgets is that they represent periods of nourishment. There is no documentation of an “un-nourished” condition to describe the background erosion and subsequent sediment budget for the Lido Key cell and the regional system.

Concerns regarding model selection and calibration/verification led us to question the results of the modeling and subsequent coastal engineering analysis for the use of groins. The Generalized Model for Simulating Shoreline Change (GENESIS) is a one-line (one contour) sediment transport model which is used for shoreline change and not capable of providing nearshore current patterns at the proposed groins. The reports

do not document the potential for longshore currents at the groins to divert sand offshore and away from downdrift beaches. This could impair the natural transport to the ebb shoal at Big Sarasota Pass. Additional concerns regarding the use of the GENESIS model include a lack of detail concerning documentation of model domain boundary conditions, and proper calibration and verification. The USACE reports did not indicate whether the LiDAR data used in the model was properly ground-truthed which could explain reported large increases to the ebb shoal volume. Due to the potential risk of impacts to downdrift beaches associated with this project, a model that can accurately describe the currents and two-dimensional (longshore and offshore) transport should be considered.

This peer-review of select reports was initiated to critically review the work by the USACE with regard to 1) impact to Ted Sperling Park, 2) impact to navigation, 3) impact to downdrift shorelines and 4) impact of a no-action alternative. Based on the information that has been provided, Atkins cannot provide a professional opinion on the various recommendations provided in the USACE reports. To do so without the information and subsequent analysis required would be as qualitative in nature as those recommendations described by the USACE. The comments below are related specifically to the USACE recommendations.

1. Lido Beach and Ted Sperling Park - The analysis of the impact of the groins in the reports is not conclusive (i.e. additional modeling of the existing longshore currents and predictive model runs to study the effect proposed groins will have on the longshore transport of sediment is needed). Groins as located are a concern as they may impede the downdrift flow of sand and starve the beaches to the south. Permeable versus non-permeable groins may need to be evaluated to mitigate this impact of the groins. The end effects on Ted Sperling Park need to be better understood. It is not clear to us why the terminal groin was removed.
2. Navigation of Big Sarasota Pass – Based on the analysis performed in the Mining Alternatives report, the apparent preferred alternative of dredging the ebb shoal for navigation purposes is D3*+C+B (both channels). This alternative through the Flood Marginal Channel provides a shorter route to open water through Channel C and indicates minimal shoaling in the Main Ebb Channel B. The analysis performed is qualitative in nature as the CMS model was not verified and; therefore, we believe that the conclusions contain risk when interpreting outcomes regarding impacts.
3. Downdrift Shorelines –The report documents no adverse impacts however the deficiencies in the documentation of the data and model create uncertainty in this regard. Without understanding the limitations of the data and modeling efforts we find it difficult to accept the conclusions provided by the USACE without the appropriate documentation or conducting their studies using more resolved models with adequate calibration and validation. After the tools to assess impacts are tested we also suggest that there may be alternative mining sites and configurations.
4. No-Action Alternative – With no nourishment it would be expected that Lido Key (R-32 to R-44) and Ted Sperling Park would continue to experience erosion.

Nourishment of Lido Key and potential shoreline structural components are required to abate the continual erosion on the Key. The reports reviewed are incomplete. Some of the information may be available in companion documents not provided however critical features of those reports should be reproduced as they are the basis of decisions for the project recommended by the USACE. The risk of impacts to downdrift beaches and subsequent physical, social and economic losses warrant quantitatively verified studies if the County wants to be assured that dredging the ebb shoal is appropriate.

The County may want to consider support of an intermediate step in the implementation of the project as long as a long-term project is further studied. When appropriate current and sediment transport modeling is documented and/or accomplished and the results show no impact of the groins on the delay of sand to the downdrift system or diversion of sand from the natural sediment bypassing system, these options may supplement the holding of sand in this reach. Using an offshore sand source or even potentially a significantly smaller amount of sand from Big Sarasota Pass ebb shoal complex for nourishment could prove advantageous. The County should encourage monitoring and evaluate impacts the groins may have on the ebb shoal and downdrift beaches before supporting additional future ebb shoal sand mining.

A detailed plan of project monitoring covering the concerned beaches on Lido Key and Siesta Key, as well as the entire ebb shoal and accreting flood shoal area of Big Sarasota Pass should be required. Surveying of pre-project conditions should commence prior to project implementation.

Previous nourishment of Lido Key has been conducted using sand from New Pass which, in effect, is consistent with the natural southerly transport. Back passing from Big Sarasota pass is contrary to this natural flow and while we believe that there are significant sand resources in the ebb shoal, the mining of these resources should be conducted to marginalize any downdrift impacts and look at alternatives until those impacts can be more accurately quantified.

1. Introduction

1.1. Background

The Lido Key Federal Shore Protection Project (Lido SPP) is a federally authorized Hurricane and Storm Damage Reduction (HSDR) project proposed by the U.S. Army Corps of Engineers (Corps) with the City of Sarasota (City) as the local sponsor. The project was authorized by Congress in Section 364 of the Water Resources Development Act (WRDA) of 1999 allowing federal participation for initial construction and periodic nourishment of Lido Key Beach from R-35 to R-44 over 50 years. Various projects have been constructed since the original authorization. The project as described in the Corps' application (033315-001-JC) for a Florida Department of Environmental Protection (FDEP) Joint Coastal Permit (JCP) contains the following elements and is the basis of the review:

- Beach nourishment of 1.6 mile segment of south Lido Key shore between FDEP Range Monuments R-34.5 and R-44 with approximately 950,000 cubic yards (cy) of sand.
- The primary sand source is the Big Sarasota Pass channel and ebb shoal
- 80-ft wide beach berm width at +4-ft elevation (NAVD88) with a 1V:20H seaward slope
- Construction of two shore perpendicular groins between R-42+400 and R-43+500
- Construction of beach fill proposed to start fall/winter 2015 and conclude in advance of marine turtle nesting season, May 1, 2016
- Timing for construction of the groins is flexible

1.2. Scope of Work

Atkins was tasked by Sarasota County to conduct a peer review of the Lido Key SPP. Since Congressional Authorization of the project in 1999, many detailed studies have been completed addressing project feasibility, design and impacts on the environment and coastal system. While this body of work is significant to the Lido SPP as a whole, the purpose of Atkins peer review is limited to the evaluation of proposed project elements specific to potential physical impacts to Ted Sperling Park, north Siesta Key shoreline and navigation as documented by the USACE studies and reports plus the no-action alternative. Specifically, Sarasota County tasked Atkins to review the Lido SPP with a focus on:

- Whether the USACE has provided assurance that the shoreline and user experience impacts to Ted Sperling Park at South Lido Beach are not impacted
- Whether the USACE has provided assurances that removal of the proposed volume of sand from Big Sarasota Pass channel and ebb shoal would not adversely impact Siesta Key beaches or waterfront property on north Siesta Key
- Whether the USACE as provided assurances that the proposed project will not adversely impact navigation within Big Sarasota Pass

In addition, the scope of work (Attachment A) requests consideration of the 'no-action alternative'. Atkins did not perform any independent analysis and relied on the reports provided by the sponsor provided for this review.

1.3. Documents Identified for Review

The County supplied a collection of studies and reports representing the work conducted or compiled by the USACE on the Lido Key SPP over 14 years (2001 to 2015). Some of the reports contain several appendices. In some cases the appendices are repeated across reports. Atkins performed a cursory review of the collection of reports and appendices to identify those relevant to engineering design and coastal processes and therefore relevant to the specifics of the review requested by the County. Reports and/or appendices not relevant to physical coastal processes were not reviewed. Data or conclusions referenced in the reviewed reports that formed the basis of decisions in the Lido Key SPP in some instances were not provided and therefore excluded from the review. In some cases our comments may have been addressed in part through these companion reports. A listing of reports reviewed are presented in Table 1 below.

Table 1 - List of Reviewed Reports

FURNISHED REPORTS				
	Report Title	**Date of Report**	**Length of Report (pgs.)**	**Included in Review**
1	Draft Environmental Assessment, Additional Sand Sources, Hurricane and Storm Damage Reduction Project Lido Key Feasibility Report, Sarasota County, Florida	March 2015	81	No
1g	Appendix G - Study of Big Sarasota Pass Sediment Mining Alternatives for Sarasota County, Lido Key Federal Shore Protection Project	March 2015	190	Yes
2	Sarasota County, Florida Hurricane and Storm Damage Reduction Project Lido Key Feasibility Report with Environmental Assessment	2002 (and 2004 Addendum)	188	Yes
2a	Appendix A – Engineering Analysis and Design	2004	117	Yes
3	Lido Key Genesis Shoreline Modeling Study	May 2014	35	Yes
SUPPLEMENTAL/REFERENCE REPORTS				
	Report Title	**Date of Report**	**Length of Report (pgs.)**	**Read for Reference (Yes/No)**
1	Sediments and Processes at Big Sarasota Pass, Sarasota County, Davis & Wang	2004	32	Yes
2	Cumulative Effects of Channel and Ebb Shoal Dredging on Inlet Evolution in Southwest Florida, Dabees & Kraus	2008	13	Yes
3	Comprehensive Inlet Management Plan Big Sarasota Pass and New Pass System for Sarasota County	May 2010	31	Yes
4	Analysis of Lido Key Groin Field – December 2014, Sarasota County, Florida, HSDR Project (USACE, Jacksonville District – December 2014)	December 2014	-	Yes

2. Report Reviews

2.1. General Comments

2.1.1. Data

The ebb shoal survey data sets used in the USACE reports vary in extent of coverage with little information on transect lines, geometry, density, or vertical datum. Data collection methods were not described in detail or referenced. There are no statements in the reports regarding survey data quality control or equipment accuracy. The USACE reports did not indicate whether LiDAR data used was appropriately ground-truthed. As a result there is a question regarding accuracy of the calculations of recent large gains in ebb shoal volume. At a minimum, datum conversions should be provided and random profiles should be checked for agreement at the monument and depth of closure.

Much of the data used in the basis of design report (Report #2: Sarasota County, Florida Hurricane and Storm Damage Reduction Project Lido Key Feasibility Report with Environmental Assessment) was acquired prior to 2002 (i.e. latest shoreline change analyzed was dated 2000). As the report is over a decade old, we recommend that the reports are updated to include shoreline and volume change as well as erosion rates with more recent data (2000 to 2015) to confirm project recommendations and design.

2.1.2. Models

GENESIS was used in the reports to define shoreline change and inform groin design. GENESIS is a one line (one contour) sediment transport model and does not predict nearshore current patterns. The use of GENESIS as the basis of design for the proposed groins is not appropriate as the model does not describe

the longshore current interaction with the proposed groins. Improper length and alignment of the groins has potential to divert sand offshore where it may be lost from the littoral system and not be entrainment into the Big Sarasota Pass ebb shoal complex. Additional concerns regarding use of the GENESIS model include a lack of documentation of model domain boundary conditions, model calibration and verification.

Atkins also has concerns with regards to the application of the CMS model. CMS contains three different sediment transport models, four different sediment transport equations, and approximately ten user set parameters. This leads to 120 potential settings that can be used in the "fitting" process (i.e. calibration). As such, model verification is critically important in acceptance of the ability of the model to predict results of the various alternatives. Information on model verification was not provided with the USACE studies.

The reviewed document states that the CMS (Version 4) model was chosen because *"...of its capability to reproduce nearshore sediment dynamics at tidal inlets."* Atkins knows of no studies where there is evidence that the model can prognosticate inlet changes. The USACE's choice of CMS over other models was not discussed. Atkins would offer that Mike 21 or Delft3D would be better suited to model the existing and future conditions at Big Sarasota Pass.

2.2. Report #1g: Appendix G – Study of Big Sarasota Pass Sediment Mining Alternatives for Sarasota County, Lido Key Federal Shore Protection Project (USACE, Jacksonville)

This report focuses on modeling the bathymetry, wave, current and sediment transport effects of four selected ebb shoal dredging alternatives and the no-action alternative. The USACE provides some discussion on the sediment budget which covers Lido Beach to Siesta Beach and provides recommendations regarding navigation in Big Pass and potential impacts to downdrift properties based on the model analysis.

2.2.1. Sediment Budgets

The sediment budget presented in the report and is repeated below (Figure 53: Sediment Budget from 1987 – 2006) is from previous studies. Data used to develop Figure 53 is not discussed in the reviewed reports. The budget demonstrates that there is a net gain to Lido Key beaches which we assume is due to nourishment events. A table showing beach nourishment volumes added to Lido Key during the period 1987 to 2006 should be provided to clarify sand volume added via anthropogenic means versus input through natural processes.

Figure 53 - Sediment Budget from 1987 – 2006.

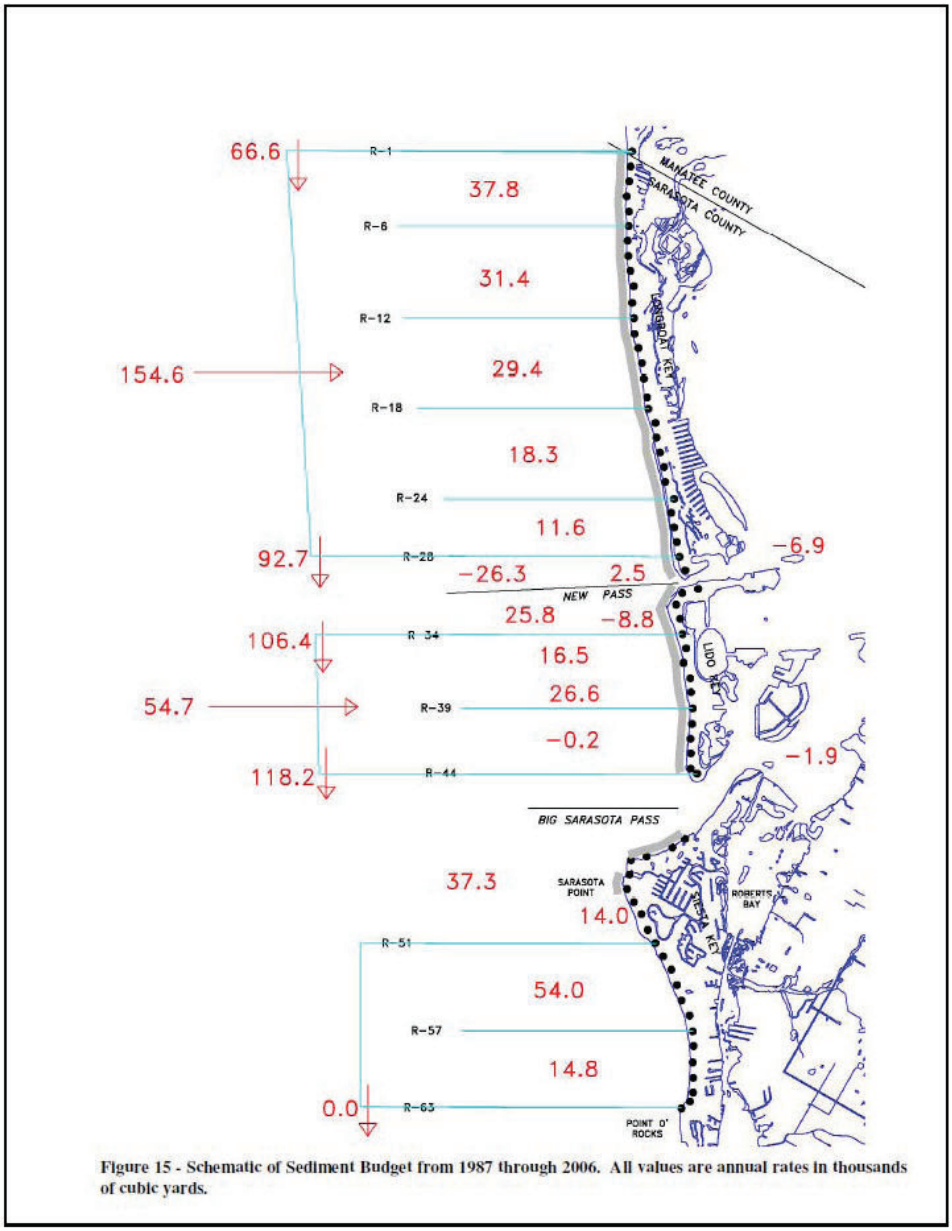
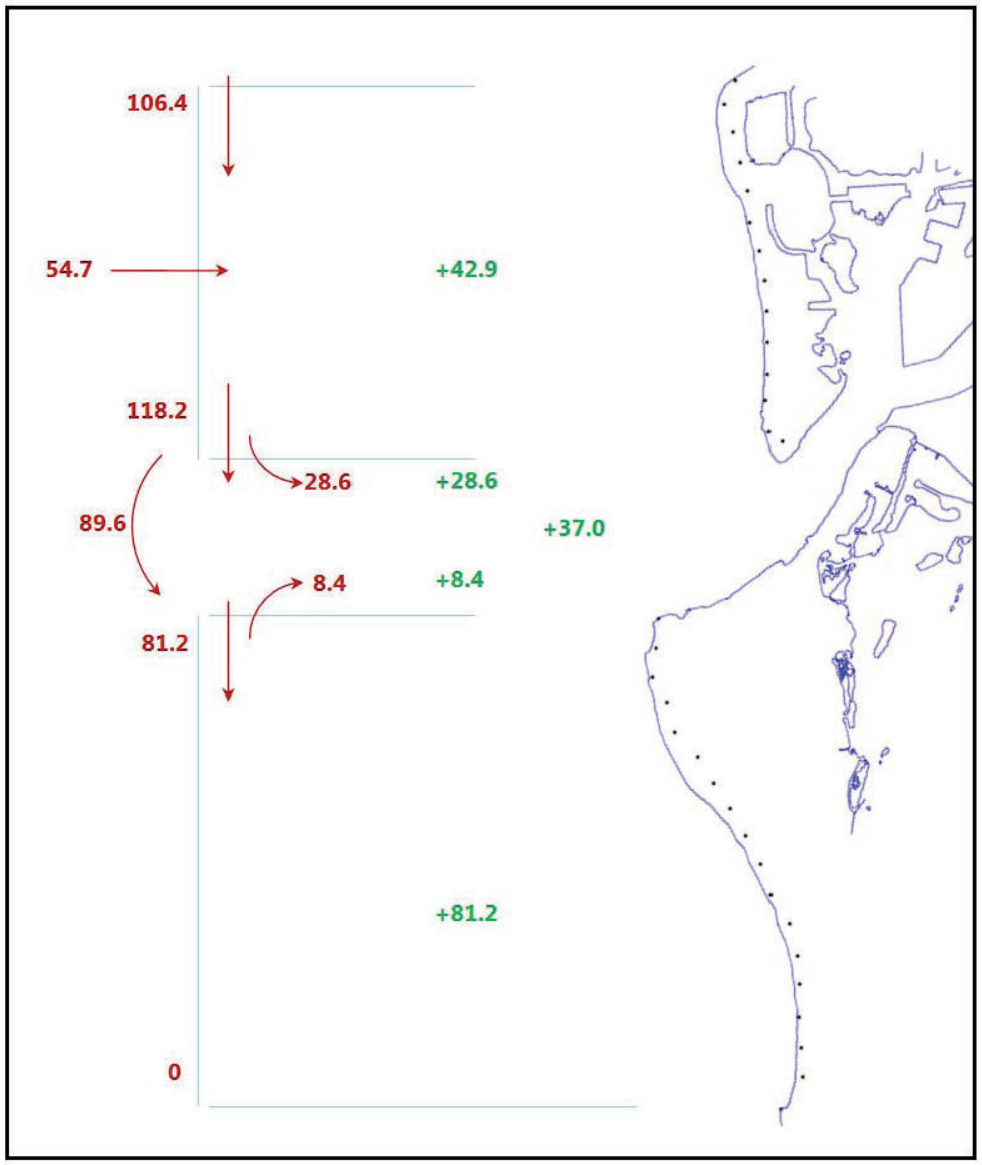


Figure 15 - Schematic of Sediment Budget from 1987 through 2006. All values are annual rates in thousands of cubic yards.

The USACE advanced the sediment budget estimates as summarized in Figure 56 repeated below. This budget was developed by the “family of solutions” method (Bodge, 1993; USACE, 2008) that provides an infinite number of solutions (due to more unknowns than equations). The sediment budget is then deduced using information derived from the previously formulated sediment budget. This approach cannot be reviewed as it uses proprietary (i.e. not peer reviewed) Matlab code to provide the “family of solutions”. The final result of the USACE refined budget demonstrates what appears to be either onshore transport or the addition of dredged material into the Lido Key cell. In both budgets, onshore transport in the Siesta Key cell is absent. As the wave climate would be expected to be somewhat similar for the two cells, rationale for the onshore transport differences (natural onshore transport or dredge material placement) should be provided. No basis for the shoaling volumes provided from the north and south into the inlet is given.

Figure 56 - Finalized Sediment Budget Existing Condition 1987 - 2006



The report notes, "*First, it was specified that net transport into the system is 106,000 cy/yr based upon the sediment budget developed from the Inlet Management Program (2008)*". In a major study such as this, the modeling and sediment budget work is highly dependent on net transport. This subject should be a high priority in the investigation however, there was no review of the net transport estimates provided by others. Also there was no discussion of the development of an independent estimate. Any net transport provided should be well documented including the rationale for accepting the chosen values. Additionally, sensitivity studies should be made to assess different results dependent on the uncertainty of the net transport. Numerous other cases where assumed sediment budget input values have been used without any rationale or independent investigation are noted in the report (i.e. "*Further, it is **assumed** that bypassing from Lido Key is 53,000 cy/yr*"; *Finally, it was **assumed**, due to the significant amount of net transport from the north, that shoaling from Siesta Key is less than 20% of the total sediment volume entering the ebb shoal each year."*). The report states that "*At the southern boundary of the study area at Point of Rocks, the net longshore sand transport was to the south at 0 cy/year*", which is undocumented and lacking discussion in the formulation of this conclusion.

Figures 169 through 175 (see Attachment B) do not provide balanced sediment budgets within the cells (i.e. the cell [input-output] must equal the [accretion/erosion] within the cell. A representation of the sediment budget should be prepared that estimates the natural state of Lido Key erosion to clearly represent future concerns of Lido Key with and without nourishment projects. Understanding the interaction between the Lido Key cell, the inlet cell, and the Siesta Key cell is important in determining an estimate for the removal of sand from the ebb shoal.

We suggest that as a starting point for a "refined sediment budget", the study should develop independent estimates of longshore sediment transport at the north and south boundaries of the regional sediment cell. Then, use a linear system of equations as per Weggel (1983) with a check for independence in equations as provided by Walton et al (2012). With this approach, a solution is given for the sediment budget (rather than an "[infinite] family of solutions") and may be used to compare against the USACE method to provide added confidence in the report recommendations.

2.2.2. Shoreline Modeling

The report notes that the "*GENESIS numerical model was used to verify the groin design and is presented in Appendix B*". An Appendix B was not included in the report. The report further states "(USACE) *sought to examine how the ebb shoal morphology would evolve from its 2013 condition under both the storm condition of 2004 and under a 1.5 wave condition from 2005 – mid-2006. Alternative cases were run as well as the "No Action" Alternative (no ebb shoal mining) to examine change in ebb shoal morphology and evolution from the "No Action" Alternative. For all model runs, the beach nourishment project and groin fields were included in the model.*" The "*1.5 wave condition*" is not defined. It is also unclear how other alternatives noted in Table 7: Description of Model Alternatives were discounted or ruled out to arrive at the four options reviewed as noted in Table 11: Description of Model Alternatives.

Table 7 - Description of Model Alternatives

Alt	*Description*	*Cut Depth (ft MLW)*
A	No Action / No Dredging	0
B	Existing Channel : Dredge Southwestern Portion	12
C	Ebb Shoal: Dredging of Ephemeral Flood Channel	12
D1	Ebb Shoal: Emergent Shoal	10
D2	Ebb Shoal: Rectangular Geometry	12
D3	Ebb Shoal: Contour Dredging	16
D3*	Ebb Shoal: Contour Dredging north of Alt C, only	12
D1-C-B	Emergent Shoal, Extension Existing Channel, Ephemeral Channel	10,12
D2-C-B	Rectangular Geom, Extension Existing Channel, Ephemeral Channel	12
D3*-C-B	Contour Dredging, Extension Existing Channel, Ephemeral Channel	12
D3**-B	Contour Dredging to 14', Extension Existing Channel	14,12

Table 11 - Description of Model Alternatives

Alt	*Groins Present*	*Nourishment Present*	*Description*	*Cut Depth (ft MLW)*
A	YES	YES	No Action	0
D2-C-B	YES	YES	Rectangular Geometry, Extension Existing Channel, Ephemeral Channel	12
D3*-C-B	YES	YES	Contour Dredge, Extension Existing Channel, Ephemeral Channel	12
D3**-B	YES	YES	Contour Dredge, Extension Existing Channel	14

The USACE provided graphic descriptions of morphology changes of Big Sarasota Pass including the ebb shoal, updrift and downdrift shorelines over a given time period (for example, “6 month runs”) however only limited analysis and explanation is provided. Figures 115 through 127 have insufficient information in their figure titles and text to define their implications on the impacts to the various cells. There is no discussion regarding the effects dredging has on interruption of the bypassing paths of sand on the ebb shoal and/or to Siesta Key. In all morphologic comparisons among alternatives, clear descriptions should be provided that show actual depth differences of the discussed plan to the “no action” alternative to clarify what differences may occur. The small size of the figures and inability to overlay figures combined with limited narrative does not allow reasonable comparison to be made of various alternatives nor independent review.

There is a limited discussion in the report on the navigation component of each of the alternatives with regard to shoaling in the Pass and the northern shoreline of Siesta Key. Greater detail should be provided. The report lacks discussion about what differences are evident in the model results and figures. The USACE should extend the discussion to include what effect these changes will have on Lido Key, Ted Sperling Park, and Siesta Key Beaches. For example, Atkins notes that there appears to be implications to Ted Sperling Park based on the figures if Channel C is dredged. The USACE does not discuss these impacts and the figures included in the report are not detailed enough for independent conclusions to be made.

2.2.3. Surveys

Figures 176 and 177 show the volume of the ebb shoal with time. Error bars on the survey data should be developed, shown, and discussed. To assess the quality and reliability of the results, the surveys should be shown along with the boundary (i.e. domain area) for the volumetric computation. Survey information documentation should also be provided. It is not clear that the same survey areas are involved in the volumetric computations nor that the data density and/or coverage is coincident or, if not corrected and documented. An independent assessment of the calculated ebb shoal volumes is not possible and, based on the lack of information, there is no commentary on the certainty of the calculations. Therefore, the statement that “*The volume of the ebb shoal has increased in the last decade …*” may be appropriate however the quantity does not appear to be reliable. This potentiality needs to be thoroughly investigated as critical decisions concerning the ebb shoal dredging for back-passing are dependent on the accuracy of these calculations.

Figures 176 and 177 – Big Sarasota Pass Ebb Shoal Volumes

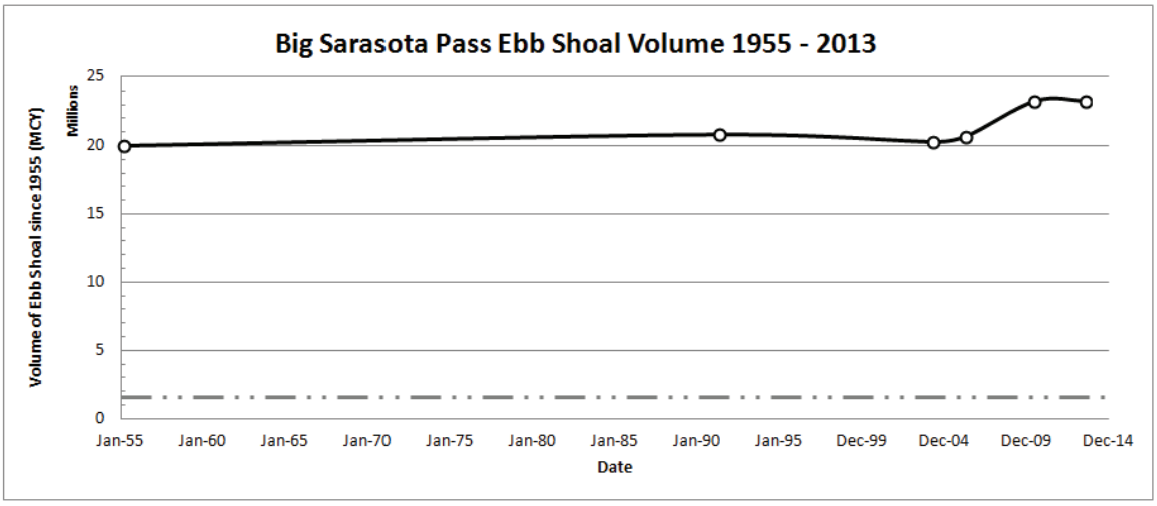


Figure 176: Volume of sediment using method by Walton and Adams (1979) at Big Sarasota Pass, change in volume from 1955 to 2013. Grey dotted line represents the volume to be removed from the ebb shoal by the Lido Key Shore Protection Project.

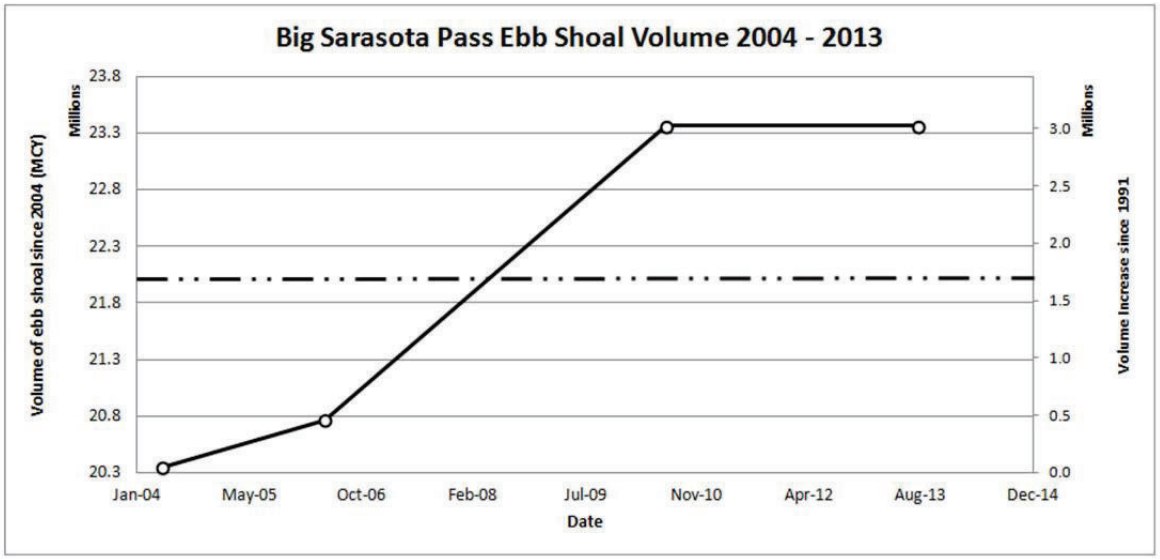


Figure 177: Ebb Shoal Growth in the past decade; 1.3 MCY reduction leaves a surplus of sediment

2.2.4. Analysis of Model Results

The report states that "*Alternatives D2, D1, C, and B; all had acceptable results from the CMS [modeling] and did not cause adverse impacts to ebb shoal-inlet complex… and to the navigation channel*". Alternative D1 appears to be dismissed after this statement due to potential shoaling implications during construction (page 73). At the top of page 160 the report states that "*Overall, option D3**-B is a very conservative option…. [and] carries very little risk…."* yet at the bottom of the same page it is noted that *"…options D3*-C-B and D3**-B .. [have] risks associated with each*. These inconsistencies need to be discussed.

The report Table 14: *Alternatives Risks and Benefits* needs clarification. Questions regarding the comments extend throughout this table, therefore the risks and benefits need to be reworded and clarified in the table. A statement is made that, "*There appears to be strong correlation between the volume of sediment …*

transported to Sarasota County beaches from offshore and growth of the ebb shoal." which needs documentation and basis/rationale for this statement. The sediment budgets previously discussed does not clearly demonstrate a natural on-shore component of sand transport. This table should discuss the alternatives in depth to aid in the understanding of the selection of one alternative out of the four.

Table 14 - Alternatives Risks and Benefits

	Alternative D*-C-B	Alternative D**-B
Meets volume requirement for the project	Yes	Yes
Does not alter ebb shoal planform beyond the borrow sites	Yes	Yes
Does not change sediment transport pathways	No, sediment is redirected into Cut C. This is a change from the Existing and No Project Condition. There exists inherent risk in the alteration of sediment transport pathways, however major benefits can be provided by providing relief for the eastern migration of the main ebb channel which continues to cut into the northern shoreline of Siesta Key. Existing transport pathways across the northern lobe and into the main ebb channel are still intact.	Yes
Does not affect navigation	Yes. Improves navigation by redirecting sediment away from the main ebb channel. This seems conter-intuitive from the Bernoulli principle, however, flows remain strong enough to keep the main ebb channel from shoaling to a greater extent than the "No Action" Alternative	Yes. No excessive shoaling exists.
Does not significantly increase wave energy	Yes	Yes

Does not change the morphology at Siesta Key	Yes	Yes
Does not cause the attachment point for Siesta Key to move further to the southeast	Yes.	Increased transport to Siesta Key which will include some of the sediment mined from the ebb shoal and placed on Lido Key may cause the attachment point to migrate further to the east because of the increased sediment load
Does not cause downdrift effects as indicated by the sediment budget	Yes.	Yes. In fact, may significantly increase transport to downdrift beaches
Does not cause the volume of the ebb shoal to decrease over time	Yes. Numerical modeling indicates that close to 100% of the sediment removed from the ebb shoal will return to the ebb shoal.	No. Numerical modeling indicates that approximately 44% of the sediment removed from the ebb shoal will be bypassed south of the shoal.

There is little substantive discussion in the report of the effects of the navigation channels on the north shoreline of Siesta Key or how the mining alternatives would affect the north shoreline of Siesta Key.

2.3. Report #2: Sarasota County, Florida Hurricane and Storm Damage Reduction Project Lido Key Feasibility Report with Environmental Assessment

This report, along with the Engineering Analysis and Design Appendix, provides the basis of design for the 2015 Lido Key nourishment project. This report focuses on Lido Key, the groin locations and Ted Sperling Park. No discussion is included on the impacts to navigation, downdrift shoreline or the no-action alternative. The design as presented in 2004, proposed three groins however the USACE has since modified the proposed project, removing the terminal groin, and leaving two groins near R-43.

The report states on page 55, "*Selected plan-this would be the 80' berm for 9,100 feet with a renourishment interval of 5 years and would include a 3-groin groin field at the south end of the project.*" The rationale for the groin field is not specifically stated and there is no analysis that demonstrates that it is advantageous at this location. The groins field appears to be located to prevent private property damage however the use of hard structures on a beach face needs to be examined. Other options can be employed if the rationale is to protect private property. Although GENESIS modeling was performed to investigate longshore transport changes due to the groins, we have previously noted that GENESIS is primarily a longshore transport change model and cannot deal with potential offshore directed currents that may develop at the groins and shunt sediment offshore. While filled groins may provide a potential approach to help hold the nourished beach in place, the rationale for groin construction as opposed to other alternatives should be examined. If groins are the preferred method to hold the beach, and this is a hot spot that needs to be protected, we suggest that the USACE examines permeable groins and other alternatives rather than the totally impermeable structures proposed which use sheet pile centers. There may be a benefit to allow for some level permeability thereby maintaining a net downdrift sand transport and decreasing potential for development of offshore directed currents at the groins and loss of sand to the system as well as the potential erosion immediate downdrift of each groin.

The statement on page 159, "*A groin field in the problem area would help hold a beach in front of existing development and prevent further loss of land on its updrift side through sand impoundment. However, any beaches present on the downdrift side would suffer concomitant sand losses. The construction of groins would have to be supplemented with nourishment so that adjacent beaches would not be starved of sand.*"

This statement infers that Ted Sperling Park would likely become sand-starved without regular nourishment. Atkins site visit on June 18th, indicated erosion was already evident at the south end of the park after a May 2015 FEMA nourishment project. An alternative that incorporates dunes and a protective revetment embedded within a dune may be a better approach to minimize the potential for damage to private development above the beach face from storms.

Change in shoreline position analysis as discussed on pages 110-118 of the report used survey data from 1971 to 2000 over different time intervals leading to highly variable change rates. Table III-3 below, provides a summary of Mean High Water (MHW) change rates for 1991-2000 and is "*Adjusted for the 1996 and 1998 fills…."* However, there appears to be no adjustment for the entire period of the data (i.e. prior to 1971). Absalonsen and Dean (2010) looked at shoreline change rates over a historical period as well as more recent times of beach nourishment. Atkins recommends that the rates provided in the USACE report be compared to Absalonsen and Dean (2010) for consistency and differences between the two data sets explained. Atkins has not conducted a detailed review of the Absalonsen and Dean (2010) report; however, in light of the reliance of data generated by others this appears to be source of information that should be considered and related to the present findings.

Table III-3 - Historic Shoreline Change (ft/yr) Summary (March 1991-May 2000)

Reach	*MHW Change Rate March 1991 – May 2000 (ft/yr)*	*MHW Change Rate March 1991 – May 2000 (ft/yr), Adjusted for 1996 and 1998 Fills*
New Pass	-9.5	-9.5
Reach 1	35.7	25.6
Reach 2	-1.1	-21.1
Reach 3	-6.2	-6.2
Reach 4	-35.2	-35.2
Project Area: R-35 to Big Sarasota Pass (R-44)	-6.6	-17.7
Lido Key: New Pass (R-32) to Big Sarasota Pass (R-44)	-0.5	-9.8

The report suggests the shoreline is highly variable with change rates up to -35 ft/yr, however, Reach 3 for example shows a change rate of only -6.2 ft/year. The USACE does not make it clear that the large change rates occur at either end of Lido Key and are potentially due to the proximity to inlets/passes and are due to inlet influence on the shoreline rather than changes to a comparable shoreline with no inlets present. The reviewer recommends a regional shoreline change rate for the area be discussed and Lido Key change rates should be compared to rates developed in Absalonsen and Dean (2010) with considerations noted for the inlet influence on Lido Key shoreline change rates. Shoreline change rates presented in this report may also be directly correlated with changes in the inlet/pass ebb shoals. Similar consideration of volumetric changes is recommended since it appears these changes "*were estimated assuming a volumetric change of 0.60 cy/ft for each foot of shoreline change…*" In other words, the report assumes a direct linear relationship between shoreline change and volume change even though the volumetric changes near the inlets/passes are substantially different.

The statement on page 107 "*A key recommendation of {CP&E Sept 1993} report is to use the Big Sarasota Pass ebb shoal as a borrow area source of beach quality sand for Lido Key"*, suggests the {CP&E} rationale for the back-pass dredging decision. This recommendation seems to drive the present studies, hence a re-review of the {CP&E Sept 1993} study should be made to assess the quality of data and subsequent analysis the formed the basis of this decision as well as why other mining options were discounted for sources of nourishment material (i.e. imported sand from offshore, inland mining, or other locations).

The report contains a statement on page 179 that, "*Three separate borrow areas (i.e., Borrow Areas 5 -7) selected for Lido Key potentially contain about 1,800,000 cubic yards of sand. Each area, located 7-9.5 nautical miles offshore of Lido Key, consist of beach quality material in sufficient amount for the immediate*

requirement.", therefore sufficient offshore sand deposits appear to exist for use in the 2015 Lido Key nourishment project. If so, using this offshore source to address immediate needs of the 2015 project may be prudent if there is determined the need to further investigate or better document and understand effects of mining the ebb shoal.

Historically, Lido Key was once a series of keys and not naturally a single barrier island; it was created by reclamation. This suggests that sand necessary to maintain Lido Key may be a long-term requirement and a long-term plan is needed to clarify options to maintain Lido Key.

The berm design elevation for the Lido Key project is based on a "*10 year return period surge event*" yet the groin structural cross section is designed to "*withstand a 20-year storm….*". It is not clear why the groin design is more conservative than the berm design? More detail is needed on the basis for the berm and groin design parameters.

The reviewed report is dated "October 2002 w/ April 2004 Addendum". We assumed that much of the report was completed prior to that (i.e. latest shoreline change analyzed was dated 2000). As the report is now a minimum of 11 years old, updating many of the report sections with more recent data (2000 to 2015) should be considered to review that conditions have not changed which may influence project recommendations and design.

2.4. Report #2a: Appendix A – Engineering Analysis and Design: Appendix to Sarasota County, Florida Hurricane and Storm Damage Reduction Project Lido Key Feasibility Report with Environmental Assessment (provided to USACE-Jacksonville by CP&E)

This document provides backup design information for the 2002-2004 design of the Lido Key nourishment project and groin system. The report focuses on the Lido Key beach nourishment design and makes mention of the no-action alternative and does not speak to navigation issues or potential impacts to downdrift properties or Ted Sperling Park. Table A-4: Combined Storm Stages, Middle Sarasota County, FL from Dean, et al 1988 notes that 10 year storm return period surge is +6 ft. (NGVD), but berm design for 10 year protection in the report is noted as +5ft NGVD. The report does not offer a reason for the lower berm height.

Table A-4 - Combined Storm Stages, Middle Sarasota County, FL

Combined Storm Stages,
Middle Sarasota County, FL
Dean, et al. (1988)

Return Period (years)	Storm Stage (feet NGVD)
10	6.0
20	8.8
50	11.3
100	12.6
200	14.0
500	15.6

Note: Stage includes wind stress, barometric pressure, dynamic wave setup, and astronomical tides.

Wave statistics are provided in Table A-6: Monthly Wave Statistics at WIS Station G1020. The shore normal direction on Lido Key is noted as 240 degrees in the report and the mean wave direction in the table is from 211.5 degrees which suggests a northward transport. Net longshore sand transport is noted as southward along Lido Key south of the influence of New Pass. The wave direction data needs to be verified and there needs to be additional discussion concerning the sediment transport (local and net) from Lido Key.

Table A-6 - Monthly Wave Statistics at WIS Station G1020

Monthly Wave Statistics at WIS Station G1020 (27.25N, 82.75W, depth 39.4 feet), Lido Key, FL

YEAR	MEAN WAVE DIRECTION in degrees: JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Annual
1976	4.7	270.1	149.1	324.6	206.8	148.5	211.9	203.8	203.3	28.3	25.3	16.9	184.9
1977	287.1	316.2	145.2	82.8	101.2	260.2	150.6	145.5	205.7	345.9	65.7	261.9	198.2
1978	279.4	260.3	221.1	184.9	162.3	182.0	206.0	169.5	127.8	30.9	41.7	161.5	183.5
1979	249.8	290.4	163.6	176.6	153.4	337.9	204.1	176.7	203.7	356.4	29.7	34.5	192.7
1980	192.5	314.3	204.0	246.1	192.5	266.7	247.8	227.5	162.7	310.3	268.0	339.8	238.5
1981	308.9	268.0	267.6	119.0	242.7	168.4	214.1	176.7	7.7	46.3	342.2	265.2	236.8
1982	198.4	193.1	157.8	166.3	132.1	201.0	176.8	195.2	201.1	76.5	81.3	125.0	156.6
1983	297.0	233.2	241.6	223.7	165.2	172.0	194.1	227.6	132.1	49.6	257.2	294.9	222.8
1984	321.6	225.6	222.2	203.6	139.2	161.0	183.9	244.1	35.9	68.1	32.7	96.9	150.8
1985	274.1	164.1	244.4	190.9	248.2	238.6	238.8	237.5	124.5	111.0	197.4	336.2	234.2
1986	288.7	234.2	202.9	274.8	133.9	186.3	243.8	207.4	130.0	103.4	104.0	340.2	197.6
1987	256.3	238.3	198.5	274.8	130.4	164.7	174.6	248.8	240.6	359.5	62.6	190.8	229.8
1988	78.2	300.3	209.7	231.3	255.6	193.4	183.3	189.4	220.2	353.5	230.3	47.4	225.4
1989	124.3	212.6	209.2	236.7	240.1	183.8	227.1	226.0	168.8	293.3	336.8	270.3	218.4
1990	95.2	147.0	96.4	103.7	184.1	231.9	246.5	254.6	195.5	359.9	12.4	93.5	198.4
1991	182.6	293.1	204.3	160.1	148.8	233.8	260.0	234.5	150.1	30.1	23.1	45.9	195.3
1992	289.9	222.9	259.2	232.0	292.9	227.9	202.1	244.6	140.9	333.9	69.5	35.1	248.3
1993	124.7	248.5	251.3	234.0	172.5	161.9	226.9	236.7	214.7	244.8	19.8	295.9	225.7
1994	118.3	111.9	250.7	166.2	252.3	200.9	201.5	204.9	179.4	193.9	60.0	335.2	203.1
1995	266.0	227.4	183.8	166.8	182.4	203.5	251.5	253.8	182.8	142.6	21.8	332.1	218.4
AVERAGE	211.9	238.6	204.1	199.9	186.8	206.2	212.3	215.2	161.4	191.9	114.1	196.0	211.5

Sea level rise guidance derived from USACE (1990) and NRC (1987) reports and are 25 years old leading to Bruun rule shoreline recession estimates that would also be outdated in accord with present knowledge. Atkins suggests using the most likely sea level rise scenario from the Intergovernmental Panel on Climate Change (2013) for sea level rise estimates.

The potential impact of the no–action alternative is shown in Figure A-16: Without Project Future Shoreline, Lido Key, Sarasota, FL. These future shoreline projections are not clear as to which shoreline goes with which data. Most of the black and white figures of shoreline changes on Lido Key are illegible.

Figure A-16 - Without Project Future Shoreline, Lido Key, Sarasota, FL

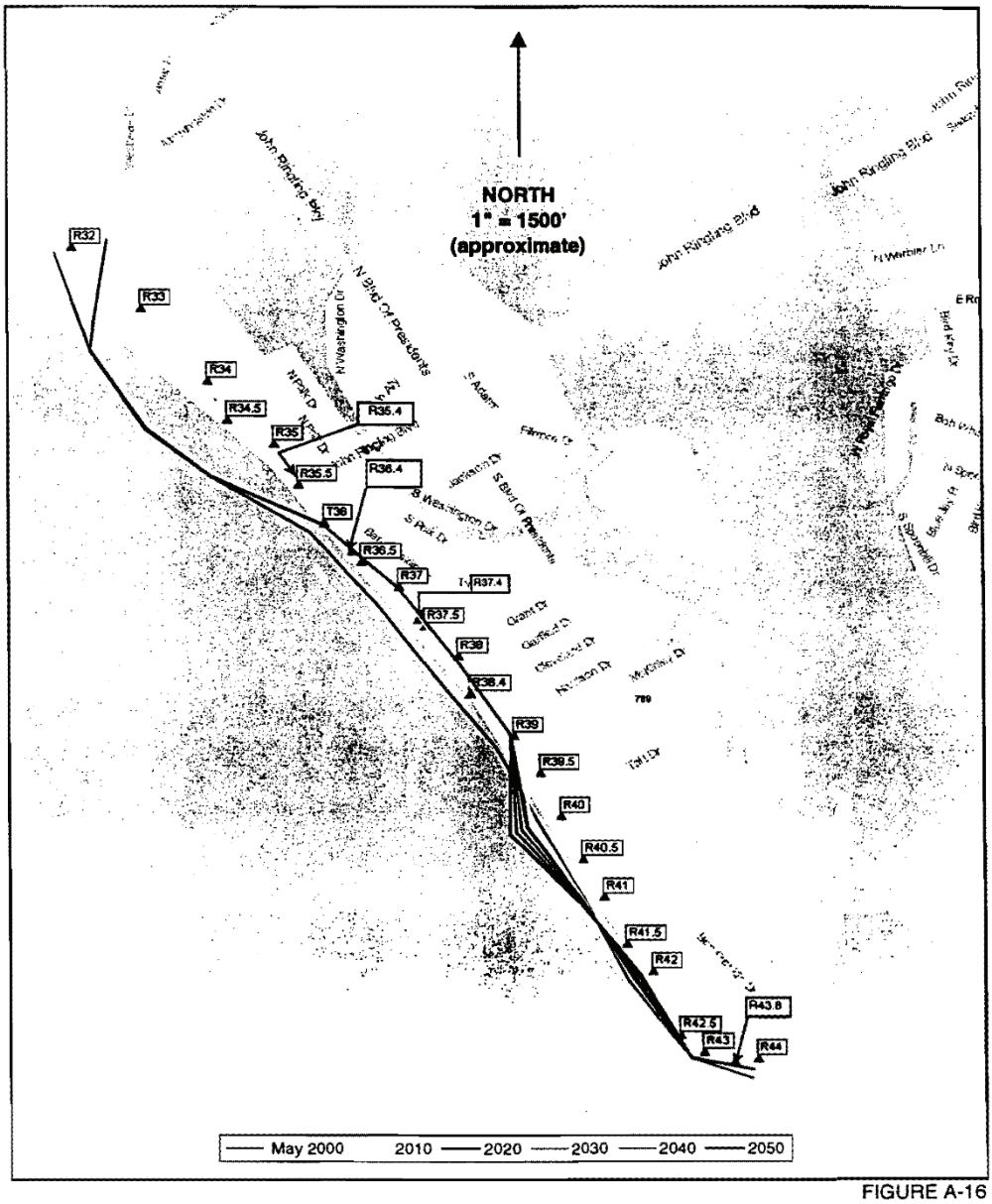


FIGURE A-16

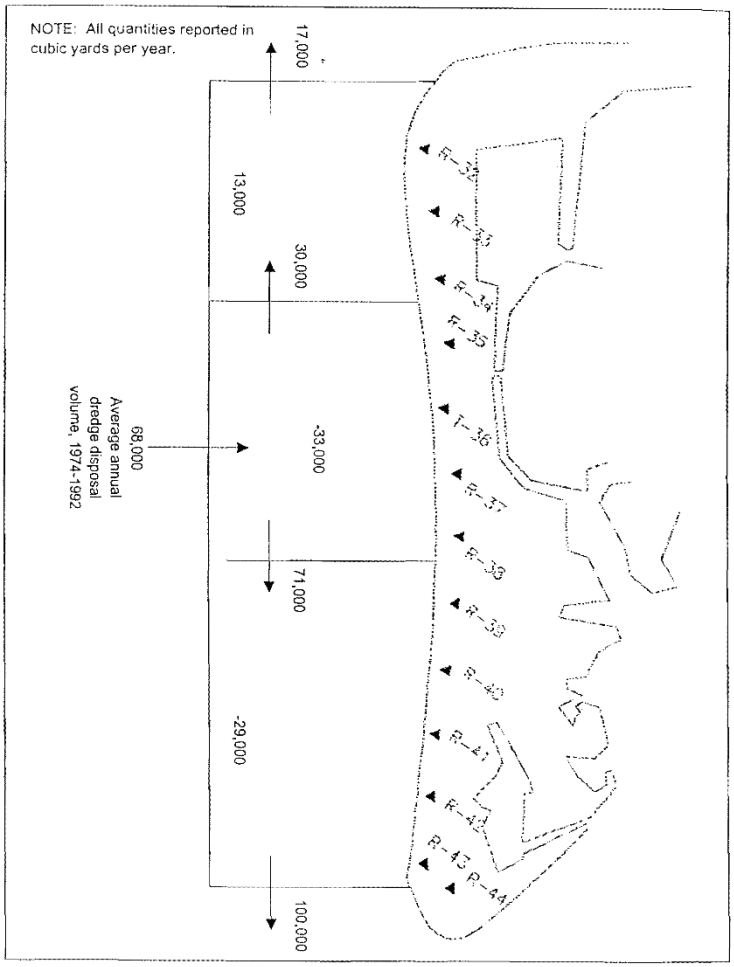
WITHOUT PROJECT FUTURE SHORELINE, LIDO KEY, SARASOTA, FL

The report notes that the southward littoral drift into Big Sarasota Pass from Lido Key is approximately 100,000 cy/yr and that the ebb shoal of Big Sarasota Pass holds > 44,000,000 cy of sand and is growing by 30,000 to 64,000 cy/yr. References cited are not within the scope of the present review but should be investigated thoroughly for reliability (i.e. data amount, data quality, data coverage, methodology used in calculation, etc.) and possible statistical variance considerations.

Also in the report, Wave Information Studies (WIS) wave hindcast data appear to have been used along with the REF/DIF 1.0 model to develop the longshore sediment transport calculations. Wave information from the WIS studies has changed over time with newer wave hindcast data replacing previously calculated hindcast data. Wave direction estimates based on WIS hindcast data are not confirmed (i.e. no blind verification of the developed data). The data used should be referenced and archived for comparison with present WIS

hindcast data to update the sediment budget developed below in Figure A-21: 1974 – 1992 Sediment Budget, Lido Key, Sarasota, FL.

Figure A-21 - 1974 – 1992 Sediment Budget, Lido Key, Sarasota, FL.



The SBEACH model was used to assess shoreline recession for given wave conditions. SBEACH is highly sensitive to the coefficients and parameterization of the conditions incorporated into the input of the model. Both the version of the model as well as a listing of SBEACH model parameters used to develop shoreline recessions should be provided. Blind testing of the model with the parameters used should be compared to the FDEP survey profiles for Lido Key to assess potential bias and accuracy of results provided. Although a discussion of calibration and verification are provided, it appears a different set of parameters was utilized for calibration of the model for different storms. Appropriate technique for numerical modeling requires the same parameters established during calibration are maintained for verification. If the model cannot be verified with the parameters used during calibration the calibration process is revisited. It is not proper to change parameters during verification to achieve “better” conformability. Table A-19 is titled “Model Calibration and Verification” although it appears to just be numbers provided by SBEACH for various trial runs of SBEACH with different parameters. Documentation that clarifies the selected set of parameters used for calibration and a “blind test” verification of SBEACH numerical modeling should be provided within the report.

Table A-19 - Model Calibration and Verification

SBEACH Model Calibration and Verification, Lido Key, Sarasota, FL

		TRIAL A	TRIAL B	TRIAL C	TRIAL D
MODEL PARAMETERS:					
Surf Zone Depth (feet) =		0.5	0.5	0.5	0.5
Avalanche Slope (degrees) =		30	30	30	30
Transport Rate Coef. (m^4/N) =		7.5E-07	2.50E-07	2.50E-07	2.50E-07
Slope Dependent Coef. (m^2/s) =		0.0015	0.0015	0.0015	0.0040
Transport Rate Decay Coef. (m^{-1}) =		0.5	0.5	0.1	0.5
STORM RECESSION:					
R35	669-GLADYS	252.3	58.1	58.6	54.4
R35	712-AGNES	51.6	39.5	40.2	0.0
R38	669-GLADYS	147.6	112.8	113.2	112.5
R38	712-AGNES	88.2	38.5	39.0	38.5
R41	669-GLADYS	74.5	46.9	48.1	47.0
R41	712-AGNES	49.4	40.3	40.8	40.7
R44	669-GLADYS	69.2	55.0	57.3	55.7
R44	712-AGNES	56.8	47.3	47.1	47.8
AVERAGE	669-GLADYS	135.9	68.2	69.3	67.4
	712-AGNES	61.5	41.4	41.7	31.7
AVERAGE EXCLUDING R38	669-GLADYS	132.0	53.3	54.7	52.4
	712-AGNES	52.6	42.4	42.7	29.5

NOTES:

1. Storm number corresponds to HURDAT (Unisys, 2000) database.
2. Storm recession is the distance from the pre-storm MHW contour to the landward limit of vertical change > 0.5 feet.

Risk and uncertainty within the report are defined using the Empirical Simulation Technique (EST) approach. However, it appears that neither the USACE nor the Federal Emergency Management Agency (FEMA) continue to use this approach. Additionally this EST approach does not appear to have been assessed via a comparison with actual probability distribution simulation.

The GENESIS model was used to model shoreline changes and sediment transport quantities with and without project improvements. The RCPWAVE model was used to assess wave refraction. Model calibration utilizes one set of parameters (K1=0.6 and K2=0) while model verification utilizes a different set of parameters (K1=0.4 and K2=0). Therefore, this is not a true verification of GENESIS, but rather fitting of the model output the data. This leaves in question the certainty in the model results. Additionally, the report attributes "*discrepancies are due to inlet shoals and headland features which characterizes the island south of R-40.5 ….. As the GENESIS and RCPWAVE models cannot accurately represent such phenomena, variation of the coefficients… was not able [to] remove these discrepancies.*" This statement acknowledges that GENESIS and RCPWAVE are not capable of describing or prognosticating changes that occur on Lido

Key south of R-40.5 which is in the area of the proposed groin placement. Details of the procedure to obtain the boundary conditions used in the modeling are not provided but are of necessary to verify the results provided by the modeling efforts and understand the subsequent risk of the structure.

The location of the proposed groins is not clear in the report. The groin design for the project provides for a vinyl sheet pile to make the groin impermeable. Such impermeability may further aggravate any offshore currents that may be developed with construction of the groins. No hydraulic or numerical model studies have been provided to assess the potential of the possibility of directing sediment materials offshore nor are the erosional effects appropriately accounted for downdrift Groins are suggested to be the best approach to anchor the beach in the area desired.

2.5. Report #3: Lido Key Genesis Shoreline Modeling Study (Author Unknown)

This document appears to be an update of numerical modeling using the GENESIS numerical model embedded within the proprietary Coastal Engineering Design and Analysis System (CEDAS) software system as previously discussed in Reports 2 and 2a. This update was noted to be due to changes in shoreline positions over the intervening 12 years between reports with the purpose of re-evaluating the 3 groin system under 2014 conditions. The report was conducted to determine optimal groin length and location.

The report notes that the "*groins would be constructed with a sheet pile wall along the centerline to sand tighten the structures*". As noted in previous comments (in Reports 2 and 2a), impermeability of the groins may aggravate any offshore currents that may develop at the groins. No hydraulic model or numerical model studies have been provided to assess the effects of the groins on potential of directing currents and sediments offshore. Further consideration should be given to utilizing permeable groins as opposed to the impermeable design provided in the report.

Additionally, the report notes that the design is adequate to withstand a 20 year storm although no calculations are provided within the report to support this assertion. Note that although the 20 year storm has an associated 8.8 ft storm stage (See Table A-4: Combined Storm Stages, Middle Sarasota County, FL in Section 2.4 above) and the berm is designed to a 5 ft storm stage.

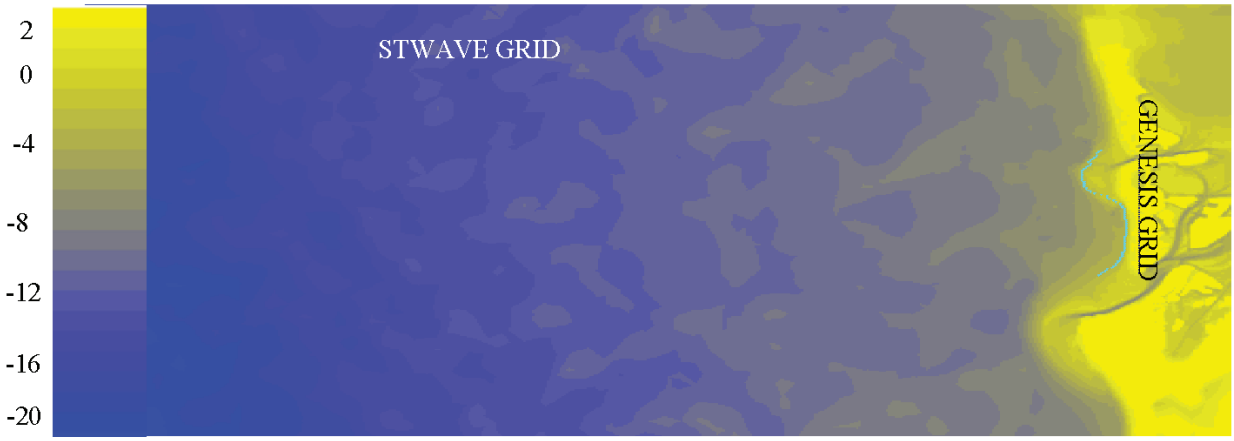
Numerous changes to the groin design and design lengths were made in a 2013 Value Engineering (VE) study that are not detailed in this Report #3 and were not part of the review process conducted.

The report notes that "*In developing a sediment budget for {the} numerical simulation {of Big Sarasota Pass} the volume of material feeding into Big Sarasota Pass from the north was calculated using ….. GENESIS*" but no details or results of this calculation are discussed in the report.

This updated report does not specify which version of the STWAVE/GENESIS/CEDAS software was used. As software changes occur with time that could impact project results, documentation of all software versions should be provided with archived code. If GENESIS software is non-proprietary, then it should be additionally run outside of the Veri-Tech interface to assure that answers are the same in both instances.

Figure 5 below, which shows the domain of both the STWAVE grid and the GENESIS grid, is not clear as to the axis scales or domain boundaries.

Figure 5 - STWAVE Bathymetry Grid



The report notes that bathymetry to construct a STWAVE grid is derived from LiDAR measurements but the vertical accuracy of the measurements is not discussed and sensitivity of the model to potential error in vertical accuracy should be investigated.

The report notes that two different wave hindcast datasets were used in driving the model, the Wave Information Study (WIS) for calibration, and Wave Watch III (WW3) for verification and production (i.e. prognostication) runs. As noted earlier, these two data sets show different 20 year sets of statistics for the two periods (i.e. mean wave height and direction) hence a question arises as to the reliability of the hindcast data sets for modeling. An explanation for data set differences and verification of the two wave hindcast models is necessary to assure that the input data is reasonable and valid. A suggested approach is to run each hindcast data set for both periods and compare the results of the two models for each 20 year period to assure that wave height, period, and direction results are within acceptable error for each hindcast model during each 20 year period (i.e. GENESIS calibration and verification periods). An additional qualitative test of wave hindcast directional data that would be useful is to compare the calculated longshore transport at a semi-infinite jetty during a given period of time (i.e. the same 5 year time period for both) with the estimated sand trapped by the two hindcast models using GENESIS. Again, versions of the models utilized and any parameters that are user set within the models should be documented.

Regarding the WIS data, the report notes that "*Wave direction data… are referenced to the local shore normal which is to the southwest.*" Southwest approximately 225 degrees (azimuth) whereas the report also notes that "the zero degree direction of wave approach is 240 degrees clockwise as measured from due north". The above suggests that there may be a 15 degree discrepancy in how the wave direction is treated or reported.

In Table 3 – *GENESIS Calibration Parameters* repeated below, the lateral boundary conditions (BC's) are not clear as to the transports assumed at the boundaries. A "pinned" boundary would imply that the time value of longshore transport is varying. Insufficient detail on the boundary conditions is provided to assess possible modeling concerns for model calibration. Within the GENESIS calibration section of the report it is noted that "*The model demonstrated good predictive ability…..*" Calibration of a model does not provide an assessment of model predictive ability, it is simply a best fitting of the model to the prototype data. A verification is needed to assure that the model is acceptable for conditions outside of those for which it is calibrated.

Table 3 - GENESIS Calibration Parameters

Table 3. GENESIS Calibration Parameters	
K_1	0.15
K_2	0.07
Median Grain Size D_{50}	0.24 mm
Berm Height	2.0 m
Depth of Closure	5.0 m
Left lateral BC	Gated (10 m from BC, 15^o orientation)
Right lateral BC	pinned
Regional Contour Trend	Temporally averaged shoreline

In the verification stage of GENESIS modeling, the report notes, "*If results {of the calibration} are not acceptable, the calibration constants can be adjusted and the process repeated. If results are acceptable, the model is considered to be verified and ready for production runs.*" The purpose of a two-step calibration and verification procedure are to ensure model parameters determined by fit during the calibration stage, are the same parameters used during the verification phase. This demonstrates that model parameters chosen are reasonable and will allow other varying environmental conditions to be run with confidence. From the above statement it appears calibration parameters may have been changed during the verification phase. No verification parameters were provided in the report. Both calibration and verification parameters of the model runs should be the same. Request for confirmation of calibration and verification parameters would be appropriate.

Since calibration and verification do not include the groins (i.e. they have not been built yet), there are additional questions regarding the ability of GENESIS to accurately assess sediment bypassing at the groins. Independent verification of the model's ability to handle sediment bypassing at the groins (embedded within the model domain) needs to be addressed by verification through analytic models (assuming the physics are well understood), or physical model studies and prototype data (assuming that the physics are not well understood).

3. Supplemental/Reference Reports

3.1. Sediments and Processes at Big Sarasota Pass, Sarasota County (Davis & Wang)

This report contains subjective information regarding Florida West Coast inlets and in particular Big Sarasota Pass, Lido Key, and Siesta Key. Numbers provided in this (dated) report cannot be substantiated due to lack of documentation and as such it should not be used as the basis of design or engineering conclusions. An interesting 1883 USCGS hydrographic and topographic chart is provided and shows the dominant barrier offset at the North end of Siesta Key at a time when Lido Key was a series of smaller (mangrove) islands. The report suggests that Siesta Key is a "drumstick" type of barrier and reversals of dominant longshore currents would be expected at the North end of the Key similar to what has been shown quantitatively by previous authors (i.e. see Shore Protection Manual (1984)).

Historical qualitative information on the history of the ebb shoal and sediment sizes from surface sediment samples were provided from a Master's thesis document. Surface sample grain sizes appear to compare the mechanical size of the sediment rather than the hydraulic equivalent grain sizes. Limited information can be obtained from the sample analysis.

Limited inlet current information is provided again from a Master's thesis document. Summary conclusions note that the Big Sarasota Pass shoal benefits from updrift restoration (i.e. Lido Key) and nourishment and that portions of the ebb delta can be mined without causing problems on the Siesta Key shoreline, especially the distal southern end. An additional recommendation given, "*It is not recommended to dredge the main channel of Big Pass which is stabilized and maintains a depth of 5-8 m.*"

3.2. Cumulative Effects of Channel and Ebb Shoal Dredging on Inlet Evolution in Southwest Florida (Dabees & Kraus)

This report pertains to the use of the Inlet Reservoir Model to Longboat Pass, Florida and contains no relevant information regarding inlet processes at Big Sarasota Pass. It is felt that the use of an Inlet Reservoir Model is far too subjective in regard to setting up cells for model usage (i.e. shoals are dynamic not static reservoirs) and does not add information to an understanding of the pass that simple volumetric change diagrams of the ebb and flood shoal areas would not provide.

3.3. Comprehensive Inlet Management Plan Big Sarasota Pass and New Pass System for Sarasota County (Coastal Technology, Coastal Engineering Consultants, Inc. & University of South Florida)

This report discusses overall recommendations for Big Sarasota Pass inlet management based on biographical references furnished in the report. No additional data appears to have been collected or developed to provide recommendations summarized in the report. The main summary comments noted from this report overview that are most pertinent to the present study are as follows:

1) "*place future beach nourishment efforts as far updrift along the receiving beach as possible….*"
2) "*future direction may suggest that some types of structures…. like groins…. should be evaluated to help improve the stability of the shoreline for placed material as well as to control and direct the natural by-passing that takes place…..*"
3) "*.. with minor care and monitoring, sand could be successfully mined from the ebb shoal with only minor potential impacts….*"
4) "*… consider… full time coastal zone monitoring system that surveys and documents the evolution of the shoreline and Passes*."

5) "Any *compatible sand removed from navigation channels in Big Pass should be directed to the Siesta Key beaches, with particular focus on the "hot spots' at the northern end of Siesta Key.*"
6) " *…the County should support and where feasible sponsor limited sand mining projects that….. back-pass sand from northern and western lobes of the ebb shoals to the updrift beaches from which that sand typically originated.*"
7) "*A sand proactive management alternative of mining roughly 850,000 cubic yards of sand from a borrow area along the outer (northwestern) edge of the Big Sarasota Pass ebb shoal* ……" The ebb shoal recovery rate is not clearly known and should be subject of regular monitoring surveys. Unless recovery is affirmed by the monitoring data, the use of the borrow area as described should be considered as a "one time" opportunity.

The analysis in this report indicates that a lesser volume of material nearer to 850,000 cubic yards should be mined as a one-time source "with minor care and monitoring". The amount, location and depth of sediment mining could be altered based on post-construction monitoring and engineering reports which are typically requirements of the regulatory agencies stated in permits.

4. Additional Reviewed Reports

4.1. Analysis of Lido Key Groin Field – December 2014, Sarasota County, Florida, HSDR Project (USACE, Jacksonville District – December 2014)

This report notes that "*Several methods of analysis are available…*" to determine the effect of groin fields, but does not state what they are. Reference is made to Silvester, Hsu but references are not provided for the methods in the reference section. Design methods provided in Method #2 and Method #3 use empirical methods based on a dominant wave direction. There is no substantive discussion that this is suitable for this location. A non-empirical approach (Walton (1977)) that takes into account the directional spread of energy density is better suited to the type of equilibrium analysis provided in the reviewed report although none of the above methods account for sediment bypassing of the groin system.

5. Summary/Conclusions

5.1. Lido Key Nourishment Project

This peer-review of select reports was initiated to critically review the work by the USACE with regard to 1) impact to Ted Sperling Park, 2) impact to navigation, 3) impact to downdrift shorelines and 4) impact of a no-action alternative. Based on the information that has been provided Atkins cannot provide a professional opinion on the various recommendations provided in the USACE reports. To do so without the information and subsequent analysis required would be as qualitative in nature as those recommendations described by the USACE. The comments below are related specifically to the USACE recommendations.

1. Lido Beach and Ted Sperling Park - The analysis of the impact of the groins in the reports is not conclusive (i.e. additional modeling of the existing longshore currents and predictive model runs to study the effect proposed groins will have on the longshore transport of sediment is needed). Groins as located are a concern as they may impede the downdrift flow of sand and starve the beaches to the south. Permeable versus non-permeable groins may need to be evaluated to mitigate this impact of the groins. The end effects on Ted Sperling Park need to be better understood. It is not clear to us why the terminal groin was removed.
2. Navigation of Big Sarasota Pass – Based on the analysis performed in the Mining Alternatives report the apparent preferred alternative of dredging the ebb shoal for navigation purposes is D3*+C+B (both channels). This alternative through the Flood Marginal Channel provides a shorter route to open water through Channel C and indicates minimal shoaling in the Main Ebb Channel (B). The analysis performed is qualitative in nature as the CMS model was not verified and; therefore, the conclusions contain risk when interpreting outcomes.
3. Downdrift Shorelines –The report documents no adverse impacts however the deficiencies in the documentation of the data and model create uncertainty in this regard. Without understanding the limitations of the data and modeling efforts we find it difficult to accept the conclusions provided by the USACE without the appropriate documentation or conducting their studies using more resolved models with adequate calibration and validation. After the tools to assess impacts are tested we also suggest that there may be alternative mining sites and configurations.
4. No-Action Alternative – With no nourishment it would be expected that Lido Key (R-32 to R-44) and Ted Sperling Park would continue to experience erosion.

Nourishment of Lido Key and potential shoreline structural components are required to abate the continual erosion on the Key. The reports reviewed are incomplete. Some of the information may be available in companion documents not provided however critical features of those reports should be reproduced as they are the basis of decisions for the project recommended by the USACE. The risk of impacts to downdrift beaches and subsequent physical, social and economic losses warrant quantitatively verified studies if the County wants to be assured that dredging the ebb shoal is appropriate. Although the proposed groins have been studied using a combination of the GENESIS numerical model and empirical approaches, Atkins believes that insufficient documentation, and verification have been provided to assure that the groins will not hinder the natural transport of sand from Lido Key to Ted Sperling Park and the then to Big Sarasota Pass ebb shoal, potentially creating a deficit and inciting erosion below the groins and on Siesta Key. Further modeling of nearshore currents would be useful to assure that the proposed groins do not deflect currents offshore which would carry sediment offshore and out of the natural transport system. The GENESIS model is not capable of providing nearshore current patterns at the proposed groins, therefore other methods should be considered to describe these processes.

Specific concerns regarding the application of the GENESIS model for this project include the lack of documentation of model domain boundary conditions and proper verification of the model results. These comments are expanded upon in Sections 2.3 & 2.5 above. For example, empirical approach used to assess groin lengths and spacing are based on a single dominant wave direction incident upon the site and no consideration was given to bypassing at the groins. The wave climate provided suggests that there is no one predominant wave direction at the site. An alternate physically-based approach to this design method is referenced in the commentary review for both the empirical and the recommended alternate method, but considerations need to be given to bypassing of sediment at the groin system. In the GENESIS numerical model, two different 20 year periods of hindcast wave data were used in the calibration and verification

discussion. Questions arise as to how the models used would compare for the same time period because the statistical mean wave climate is different for the different 20 year periods. Regardless of the wave hindcast model statistics used, future wave conditions may not be similar to past conditions, yet no probabilistic considerations regarding model results are provided.

Alternate potential approaches to prevent erosion damage to subject private properties that extend beyond the natural beach appear not to have been investigated (i.e. dunes, expanded nourishment, embedded “last line of defense” storm protection shoreline revetments along with expanded nourishment). The advantage of these alternatives is that they would not be subject to the potential impacts caused by groins.

As to the sand required for nourishment, it appears that there may be sufficient offshore sand for an initial project (as noted in the 2002-2004 feasibility report) which could provide time for studies to further document and enhanced the analysis with additional data and appropriate tools. Additional assessment of the effects of back-passing of sand to Lido Key from Big Sarasota Pass should be developed. This would include performing the shoreline width and volumetric change analysis recent survey data sets (2000 to 2015) to capture recent trends in shoreline and volume change.

The quality of modeling input data is always an issue, as are conclusions arrived at as a result of using uncertain data. As considerable usage is made of LiDAR data within the reports reviewed, Atkins believes that documentation should be provided that addresses “ground truth” tests of the LiDAR data and vertical accuracy of the systems used under both ideal and typical field conditions. The assessment of LiDAR accuracy will allow a basis for estimation of volumetric computation uncertainty in report results.

5.2. Dredging of Big Sarasota Pass and Back-Passing of Material to Lido Key

The USACE estimated ebb shoal volumes and calculated a sediment budget for the inlet cell. CMS numerical modeling was conducted for the analysis of dredging alternatives for the potential back-passing to the Lido Key beaches. Concerns regarding the modeling performed to date do not provide the reviewers with assurances that natural sand bypassing from Lido Key to Siesta Key will not be interrupted with the proposed project (with consequent adverse effects for Siesta Key) or that the reported dredging alternatives recommended in the report are optimal. The USACE work proposed is especially important to Siesta Key since it involves back-passing at an inlet ebb shoal rather than bypassing of sand to the downdrift side of the inlet. Most inlet ebb shoal mining projects move the material dredged from the ebb shoal to a downdrift shorelines to help restore the flow of sand in the direction of natural net transport. As the present situation is one of back-passing material to an updrift shoreline, potentially more risk exists due to interference with the natural net directional movement of sediments. In the present case, approximately 1.3 MCY of sand is being considered for placement on updrift beaches which is about 10 times the estimated net annual, southward transport of sediment into the Lido Key cell as defined in the sediment budgets provided. Below are summary statements concerning the reviewed documents.

It appears that justification for the dredging of Big Sarasota Pass is based on measurements developed by the USACE estimating recent growth of the ebb shoal. This rationale is not clear due to data limitations and estimation methodology noted in the commentary above. Better documentation on the datums and a clearer presentation as to how the calculations were developed may clarify this issue somewhat, but at present, reviewer confidence in the computational results suggests that no quantitative conclusions relative to increases in the ebb shoal should be reported.

Insights into the sediment budget detailed in the report relies on past assumptions and the new information is a recast of the old studies. No new data has been incorporated to represent that this work is based on an independent analysis. Questions concerning the adequacy of the following items does not provide the reviewers with confidence that the sediment budget is well understood in this area:

1) boundary conditions
2) onshore/offshore sand transport assumptions
3) sediment cell balance problems
4) methodology

The proposed back-passing approach should be looked at in more detail to assure that ebb shoal sand proposed for dredging is not part of the active bypassing system, or if it is then the relative removal of this source is documented. The early history of Lido Key as a series of small keys developed by reclamation, it is apparent that Lido Key will be a long-term struggle to maintain its planform stability. Long-term planning and continued monitoring will be needed to determine the best methods to stabilize Lido Key.

The CMS modeling effort appears to be the primary basis of the decision to dredge the Big Sarasota Pass ebb shoal. Verification" of the CMS model's ability to prognosticate in the Lido Key-Big Sarasota Pass project proposal under conditions other than that used in its "calibration" is needed prior to acceptance of the modeling results. Until then, we cannot confidently accept the conclusions that suggest the dredging alternatives will not impact Siesta Key. Atkins has specific concerns over survey data documentation and resultant error bars. The uncertainty directly relates to the confidence in the development of a sediment budget and model selection/calibration/verification. This puts into question the ability to generate valid conclusions derived from these model results.

Possible considerations for further study could involve the use of natural or artificial tracers to determine natural sediment movement paths from the south beaches of Lido Key to the areas of concern on Siesta Key. To assess the validity of the sediment transport physics defined by CMS modeling we suggest; (1) Use of additional comparable numerical models (i.e. Delft3D, Mike21, XBeach, etc.) to assess the reproducibility of model results for the Big Sarasota mining recommended alternatives and 2) Utilize model results to assess the potential of forcing currents offshore at the groin sites under a condition of depleted sand (pre-fill conditions) on the Lido Key beaches.

If all alternatives to protecting property (i.e. sand dunes and emergency revetment for upland infrastructure) have been studied and after further current modeling study is accomplished and the results demonstrate limited impact of the groins on the delay of sand to the downdrift system or diversion of sand from the natural sediment bypassing system, the sponsor could then consider building the groins and using an offshore sand source or a smaller amount of sand from Big Sarasota Pass ebb shoal complex for nourishment. The County should monitor and evaluate the impacts the groins have on the ebb shoal and downdrift beaches.

The coastal resources of the County are important socially and economically. Conditions on Lido Key require nourishment to maintain the beaches and identifying sand sources for this purpose are continually a challenge. We recognize the potential for using sand from Big Sarasota Pass for back-passing, however we would expect that studies generated would sufficiently assure the County and all of the stakeholders that the use of this material would not adversely affect the natural transport in the system. This is even more important if sand from Big Sarasota Pass is considered part of a cyclic mining process to permanently manage the inlet and nourish Lido Key. Without those assurances we recommend that the County should consider actions to hold a responsible entity accountable for activities that directly or indirectly result in impacts. We also suggest that pre-defined mitigation plans are developed by a responsible entity and funding is in place so that immediate efforts can be employed to minimize potential damage if that damage results from these actions.

Regardless of the final approved project, a detailed physical monitoring program is highly recommended and should be required. The geographic coverage of a monitoring program should encompass the beaches of Lido Key and Siesta Key, as well as the Big Sarasota Pass shoal complex. Beach profiles and bathymetric surveys of sufficient detail, spacing and frequency should be the basis of the program. Supplemental coastal aerial photography is also recommended. A comprehensive physical monitoring program will provide the data for use in more advanced predictive modeling and subsequent analysis and will build confidence in the reliability of management decisions.

5.3. Recommended Study Guidance

In accord with Atkins' Scope of Work with Sarasota County to review selected Corps of Engineers (COE) reports, Atkins has concluded that insufficient documentation of the engineering analysis and subsequent study conclusions presently exists to address the concerns of the County. We recognize the need to nourish Lido Key and believe that there are ways to provide an intermediate nourishing while studies are validated or,

if needed additional studies implemented. To assure the County that there will be minimal impacts from a proposed project, we recommend that the following information be generated or defined through additional studies using the most up-to-date information and data as possible:

1. To clarify the discrepancy with the use of two hindcast model data sets within the COE studies (WIS, Wavewatch), we recommend that the two data sets be run for both time periods and compare the statistical results to determine if the hindcast data (and hence the two models) are equivalent for each respective time period.

2. Lidar data verification via ground truth with accurate survey data (both above and below water at Big Sarasota Pass) along with potential error estimates in ebb shoal calculations.

3. Estimated erosion rates cited in reports should be compared to Absalonsen and Dean (2010). Compile new surveys to verify existing erosion rates and use the methodology of Absalonsen and Dean (2010) for consistency. Major discrepancies in erosion rates over the study area should be explained, and the feasibility reports revised based on best estimated erosion rates.

4. Develop independent estimates of longshore sediment transport at sediment budget cell boundaries to assure adequacy of final developed sediment budgets for back-passing decision making. Sediment budgets should be prepared for “existing historical”, “no action”, and “proposed back-passing” situations for use in decision making regarding the back-passing of Big Sarasota Pass. A discussion related to how nourishment affects the sediment budget should be included.

5. Groin field study recommendations:

   a. Verify GENESIS one-line sediment transport model bypassing at groins via a study showing groin bypassing of sediment under varying conditions of groin field fill as will be encountered during the nourishment to re-nourishment cycle of the proposed groin field (i.e. groin field filled and groin field at time of projected re-nourishment).

   b. Current/sediment transport numerical modeling study at proposed groins to establish that currents/sediment at groins will not be deflected out of the natural bypassing system (hence doing potential damage to Ted Sperling Park and Siesta Key). If groins are found to be diverting sediment out of natural sediment transport pathways, alternatives to groins should be considered for subject beach property protection (i.e. dune storage of sand and emergency revetment).

6. Verification of CMS model sediment transport modeling needs to be provided for the sediment transport model equations and method defined in the reviewed COE reports. Multiple methods of validation are recommended such as:

   a. Prototype current and wave data collection along with before/after surveys at Big Sarasota Pass during a high wave event. Model results should be compared with prototype natural/artificial sediment tracer and dye studies for verification of model prognosticated sediment movement paths.

   b. Laboratory verification of CMS modeling using idealistic ebb shoal configuration.

   c. Verification of CMS output with another well used non-proprietary numerical model (i.e. suggested Delft3D or XBEACH) for the same model input data on an idealized ebb shoal should be run to assure consistency with existing model results.

In addition to the above noted studies, any decision to back-pass material from the Big Sarasota Pass area should be extensively monitored via pre-project and post-project surveys for the entire studied area along with collected wave and current data in selected areas on the Big Sarasota Pass ebb shoal.

6. Literature Cited

Absalonsen, L. and Dean, R.G. (2010).Characteristics of shoreline change along the sandy beaches of the State of Florida: an atlas, Department of Civil and Coastal Engineering, University of Florida, Gainesville, Florida 32611

IIPCC-Intergovernmental Panel on Climate Change (2013), Climate Change 2013: The Physical Science Basis Cambridge University Press.

Shore Protection Manual (1984). Government Printing Office, Washington, D.C.

Verification and Validation of the Coastal Modelling System, Report 4, CMS-Flow: Sediment Transport and Morphology Change (December 2011). ERDC/CHL TR-11-10, Coastal and Hydraulics Laboratory, U.S. Army Engineer Research and Development Center 3909 Halls Ferry Road, Vicksburg, MS 39180-6199

Walton, T.L. Jr. (1977). Equilibrium Shores and Coastal Design, Proceedings of Coastal Sediments, 1977, American Society of Civil Engineers, Reston, VA.

Walton, T.L. Jr., Dean, R.G., J.D. Rosati (2012). Sediment Budget Possibilities and Improbabilities, Coastal Engineering, 60, 323-325, Elsevier Publishing, The Netherlands.

Weggel, J.R., and Clark, G.R. (1983). Sediment Budget Calculations Oceanside, California CERC Miscellaneous Paper 83-7, Coastal Engineering Research Center, Washington, D.C.

Attachments

Attachment A: Peer Review of the Lido Key Federal Shore Protection Project - Scope of Work

AGREEMENT NO. 2011-505 **ORG CODE/CIP #**
BETWEEN
NAME OF CONSULTING FIRM: Atkins
and
SARASOTA COUNTY

WORK ASSIGNMENT NO. 532

WORK ASSIGNMENT TITLE: Peer Review of the Lido Key Federal Shore Protection Project

The following are attached and incorporated as part of this Work Assignment:

☒ SCOPE OF WORK
☒ LOCAL SUB-CONSULTANT USAGE
☒ WORK ASSIGNMENT SCHEDULE
☒ LOCAL SUB-CONSULTANT AFFIDAVIT
☒ PROJECT BUDGET
☒ FEE SUMMARY/REQUEST FOR PAYMENT

TOTAL NEGOTIATED FEE: $ 49,620.00

CONSULTANT'S PROJECT MANAGER:
NAME: Bryan D. Flynn TITLE: Project Manager

EMAIL: bryan.flynn@atkinsglobal.com PHONE: 813-281-7689

COUNTY'S PROJECT MANAGER:
NAME: Laird Wreford TITLE: Coastal Manager

EMAIL: lwreford@scgov.net PHONE: 941-809-7491

Upon execution below by both parties this Work Assignment shall be deemed to be an integral part of the above Agreement.

APPROVED BY CONSULTANT APPROVED BY SARASOTA COUNTY

CONSULTANT'S NAME:
Bryan D. Flynn, PE

ADMIN AGENT'S NAME:

CONSULTANT'S SIGNATURE

ADMIN AGENT'S SIGNATURE

Date:

Date:

EXHIBIT A

WORK ASSIGNMENT NO. 532
CONTRACT NO. 2011-505

PEER REVIEW OF THE

LIDO KEY FEDERAL SHORE PROTECTION PROJECT

SCOPE OF WORK

I. PROJECT BACKGROUND & OBJECTIVE

The Lido Key Federal Shore Protection Project is in the final design phase and proposes construction of coastal structures (groins) in conjunction with beach nourishment. The proposed sand source for the beach project is the Big Sarasota Pass ebb shoal. This federal project is proposed by the U.S. Army Corps of Engineers (Corps) with the City of Sarasota as the local sponsor. In June 2014, the Corps released a draft study titled, "Study of Big Sarasota Pass Sediment Mining Alternatives for Sarasota County Lido Key Federal Shoreline Project", which was subsequently updated in March 2015.

Atkins has been tasked with completing a third-party peer review of the project elements at the direction of the Sarasota County Board of County Commissioners (BOCC). The purpose of this project is to have a coastal consultant, well-versed in coastal processes and engineering design, review, but not repeat work completed by Corps. This effort will entail review of work done by others with a focus on:

1) The Lido Beach Shoreline (R-35 to R-44), with a focus on the physical effects to Ted Sperling Park at South Lido Beach. User impacts will be addressed to the extent they relate to the physical effects.

2) Evaluate whether project conclusions are reasonable, related to the physical effects to the Siesta Key beaches (R-45 to R-64) and/or waterfront property on North Siesta Key.

3) Evaluate the project conclusions regarding the navigability of Big Sarasota Pass.

The Lido Key Federal Shore Protection Project (Lido SPP) has undergone significant evaluation by the Corps and other interested parties since initial authorization by Congress in 1999. Throughout the process, a host of various studies and reports have been published on the topic; all of which have specific relevance to the individual aspects of the Lido SPP. The entirety of materials relevant to the Lido SPP as a whole is significant, but this project is not intended to redo the Lido SPP studies or address all of its individual components. The purpose of this work assignment is limited to a peer review of the Lido SPP, as it pertains to

the physical impacts addressed above (at the Pass, the Park, and Siesta Shoreline). In essence, our objective is to help gauge a "level of comfort" on the thoroughness and appropriateness of the relevant work and conclusions regarding those physical impacts. It is important to re-iterate that our task is not to analyze each individual element of the project, but to focus on those that align specifically with our objective. Atkins will work with the County to select which individual components should be included in our review.

II. SCOPE OF WORK

The Consultant (Atkins) will provide the following services:

The County supplied a collection of project reports that represent the Corps' work on this project over a period of 14 years (2001 to 2015). Some of the reports contain several appendices, in some cases the appendices are repeated across different reports. Atkins did a cursory review of the collection of reports and appendices in order to determine those that are relevant to the engineering design and coastal processes and therefore relevant to the review requested by the County. Those reports and/or appendices that are not germane to physical coastal processes will not be reviewed in order to focus the review and complete the task within the period requested.

FURNISHED REPORTS				
	Report Title	**Date of Report**	**Length of Report (pgs.)**	**Included in Review**
1	Draft Environmental Assessment, Additional Sand Sources, Hurricane and Storm Damage Reduction Project Lido Key Feasibility Report, Sarasota County, Florida	March 2015	81	No
1a	Appendix A – Section 404(B) Evaluation	March 2015	8	No
1b	Appendix B – Coastal Zone Management Consistency Determination	March 2015	6	No
1c	Appendix C – Agency Correspondence	June 2014	30	No
1d	Appendix D – Public Participation	March 2015	46	No
1e	Appendix E – Mailing List	March 2015	6	No
1f	Appendix F - CBI Field Observation Report	September 2015	13	No
1g	**Appendix G - Study of Big Sarasota Pass Sediment Mining Alternatives for Sarasota County, Lido Key Federal Shore Protection Project**	**March 2015**	**190**	**Yes**
1h	Appendix H – USACE Sediment Compatibility Analysis Lido Key, Sarasota County Shore Protection	October 2014	158	No
2	**Sarasota County, Florida Hurricane and Storm Damage Reduction Project Lido Key Feasibility Report with Environmental Assessment**	**2002 (and 2004 Addendum)**	**188**	**Yes**
2a	**Appendix A – Engineering Analysis and Design**	**2004**	**117**	**Yes**
2b	Appendix B – Geotechnical Appendix	2001	30	No
2c	Appendix C – MCASES Cost Estimate	2001	1	No
2d	Appendix D - Economics	2001	26	No

FURNISHED REPORTS (cont'd)				
	Report Title	**Date of Report**	**Length of Report (pgs.)**	**Included in Review**
2e	Appendix E – Real Estate Plan	2001	10	No
2f	Appendix F – Pertinent Correspondence	2001	197	No
2g	Appendix G – Section 902 Spreadsheets	2001	8	No
3	**Lido Key Genesis Shoreline Modeling Study**	**May 2014**	**35**	**Yes**

SUPPLEMENTAL/REFERENCE REPORTS				
	Report Title	**Date of Report**	**Length of Report (pgs.)**	**Read for Reference (Yes/No)**
1	**Sediments and Processes at Big Sarasota Pass, Sarasota County, Davis & Wang**	**2004**	**32**	**Yes**
2	**Cumulative Effects of Channel and Ebb Shoal Dredging on Inlet Evolution in Southwest Florida, Dabees & Kraus**	**2008**	**13**	**Yes**
3	**Comprehensive Inlet Management Plan Big Sarasota Pass and New Pass System for Sarasota County**	**May 2010**	**31**	**Yes**

TASK 1 – REVIEW AND REPORT FINDINGS

Site Visit - This task will also include a site visit to meet with the County and tour the project area discussing areas of concern after the desktop review is complete. No new field data will be collected during these efforts, only photographs of the project area.

Peer Review - Atkins will render a professional opinion on the findings of the peer review of the physical effects of the proposed shore protection project. This will focus on:

a) The shoreline of Ted Sperling Park
b) Siesta and Lido Key Beaches
c) Navigation in Big Sarasota Pass
d) The north shoreline of Siesta Key adjacent to the Pass
e) The no-action alternative will also be reviewed.

The review will include review of input data, comparative profiles, model calibration and output. Commentary on the feasibility study and alternatives analysis will be included as well. Atkins will cite published reports, journal articles of importance, and industry standard manuals (Coastal Engineering Manual and Shore Protection Manual) where appropriate. Atkins may provide discussion on any apparent deficiencies in the engineering reports (calculations, data collection, and modeling), to assure the County of the suitability of the project and assuaging concerns.

The County has requested Atkins render professional opinion on likely recreational impacts to Ted Sperling Park at South Lido Beach. Without quantitative information on user activities, this task will be limited to providing an opinion as it relates to physical effects of the project on the Park shoreline. This will allow for a generalized analysis of impacts to user groups due to changes in the Park shoreline.

Report - Atkins will prepare a draft report detailing the findings of the peer review analysis. The draft report will be provided to the County for review and comment. Atkins will meet with the County after a one week review period to walk-thru the comments and edits from the County.

Presentation of Findings – Atkins will prepare for, attend and present the findings of the report at the Coastal Advisory Committee (CAC) meeting and the BOCC. Atkins' Senior Project Manager will attend and present at the meetings.

Task 1 - Deliverables:
Comprehensive Peer Review Report, Presentation materials (three printed copies and the electronic file in pdf format and MSWord).

*The Atkins Project Manager will also provide a bi-monthly update to the County on project progress.

Task 1 - Schedule:
Draft Report to County 90 days from Notice to Proceed, Final Report 107 days from Notice to Proceed, Presentations 120 days from Notice to Proceed.

III. Schedule

The work outlined in this scope of services shall commence upon receipt of a Notice to Proceed from the County and remain in effect during the full duration of this project, which is expected to be **120** days until completion (See Exhibit C).

IV. Compensation

Compensation for the above scope of services will be on a lump sum basis, and not to exceed $49,620.00. Billing shall be based upon percentage of work completed and accepted. If necessary the consultant shall provide other additional services as requested and approved by the County at an agreed additional cost.

EXHIBIT B

WORK ASSIGNMENT 532
CONTRACT NO. 2011-505

HOURLY RATE SCHEDULE

CLASSIFICATION	HOURLY RATE ($)
Principal Coastal Engineer	180
Senior Project Manager	155
Coastal Engineer	115
Administrative Support	65

The above hourly rates include day-to-day direct expenses incurred for advancement of the work including working copies, reproductions, shipping, local travel, communications, and computer charges.

Hourly billing rates for personnel classifications not listed shall be negotiated as the need arises.

Costs for Professional Associates (whose expertise is required to complete the project) shall be charged at actual costs plus an administrative charge of ten percent (10%).

Sarasota County

EXHIBIT B
WORK ASSIGNMENT 532
CONTRACT NO. 2011-505

WORK ASSIGNMENT TITLE: Peer Review of the Lido Key Federal Shore Protection Project

POSITION CLASSIFICATION	Hourly Rate	x	# Hours	=	Total Fee
Principal Coastal Engineer	$180.00	x	113	=	$20,340
Senior Project Manager	$155.00	x	80	=	$12,400
Coastal Engineer	$115.00	x	92	=	$10,580
Administrative Support	$65.00	x	20	=	$1,300
		x		=	
		x		=	
SUBCONSULTANTS (IF ANY) % mkup	x	x		=	
	x	x		=	
	x	x		=	
	x	x		=	
	x	x		=	
	x	x		=	
ADDITIONAL SERVICES					$5,000
TOTAL FEE FOR THIS WORK ASSIGNMENT					$49,620

Work Assignment Project Budget Form Version 1.0 Adopted 05/18/10

EXHIBIT C
WORK ASSIGNMENT 532
CONTRACT NO. 2011-505

PROJECT MILESTONE COMPLETION SCHEDULE

Description of Milestone	Calendar Days from NTP. to Completion of Milestone
Notice to Proceed	1
Site Visit	14
Review & Draft Report	90
County Review	100
Final Report	107
BOCC Presentations	120

Sarasota County

LOCAL SUB-CONSULTANT AFFIDAVIT

I, Bryan D. Flynn, PE (print name), the Project Manager (title) of Atkins (company name) swear or affirm that we have made a good faith effort[1] to partner with local sub-consultants for Work Assignment No. 532 to Agreement No. 2011-505. I am authorized to complete this affidavit on behalf of the company. I have read and understand the applicable provisions of the Sarasota County Procurement Manual and am aware of the penalties associated with falsifying information related to the utilization and availability of local sub-consultants.

_____ _____

Signature Date

NOTARY

The foregoing affidavit was subscribed and sworn to before me on this _____day of _____, 20___.

SEAL

Notary Public: _____

Commission Expires: _____

[1] For the purposes of this work assignment, a "good faith effort" means no fewer than 3 local firms were contacted in an effort to utilize local sub-consultants, provided the required experience and qualifications were available locally.

Sarasota County

LOCAL SUB-CONSULTANT USAGE LIST

Work Assignment No. 532 Peer Review of the Lido Key Federal Shore Protection Project

Agreement No. 2011-505

DISCIPLINE	SUB-CONSULTANT (NAME OF FIRM)	LOCATION	REASON (IF NOT SELECTED)	% OF WORK
NONE				
PERCENTAGE OF WORK ASSIGNED TO LOCAL SUB-CONSULTANTS				0%

EXHIBIT D – FEE SUMMARY/REQUEST FOR PAYMENT

Atkins

Address 100 Paramount Dr., Suite 207
City, State Zip Sarasota, FL 34232

Project Name: Peer Review of the Lido Key Federal Shore Protection Project
Project Limits

Date Submitted
Invoice No.
Payment No.
Billing for Services through _____

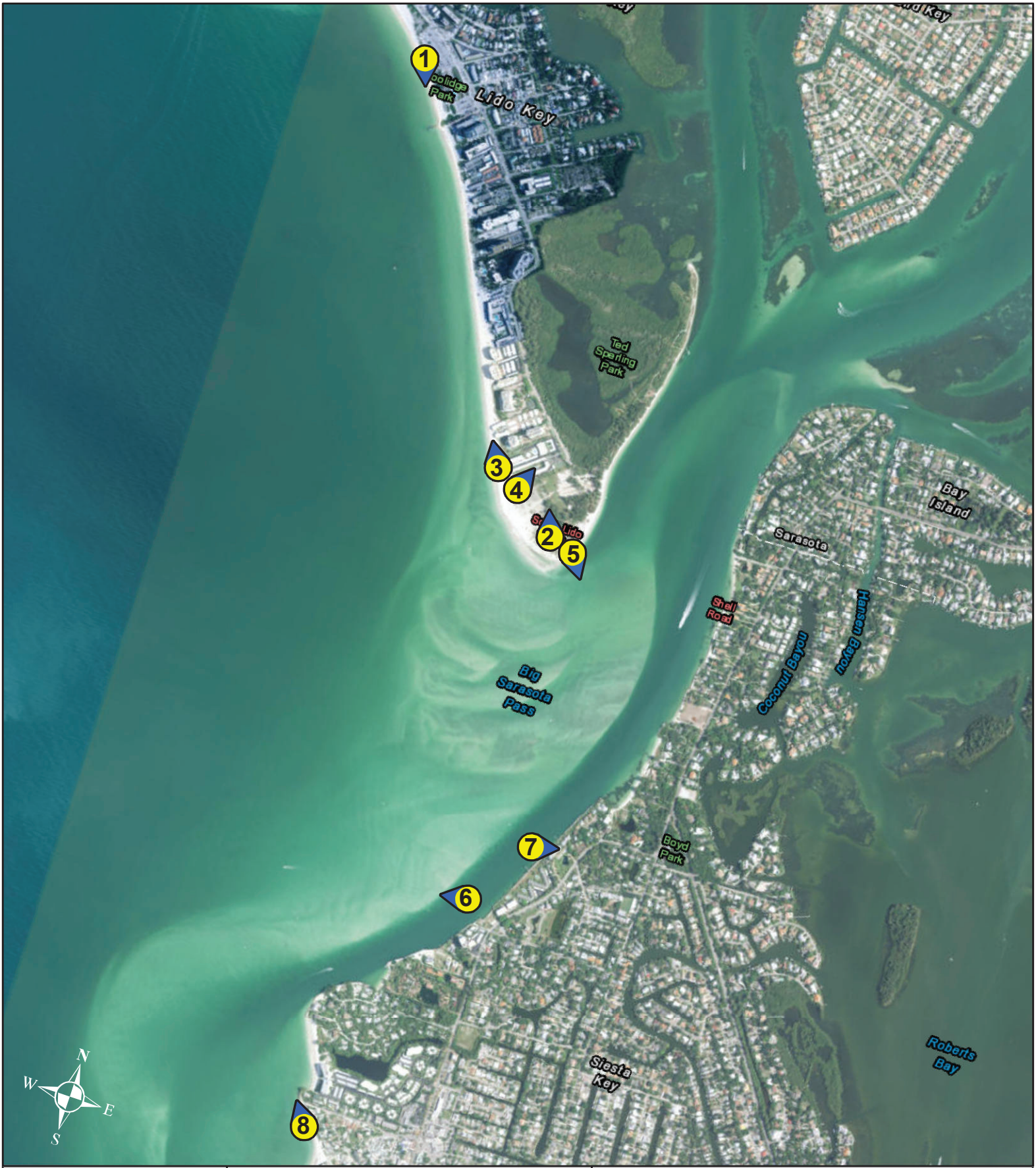
Contract No: 2011-505
Purchase Order No:
Work Assignment No. 532

ACTIVITY	**LUMP SUM SERVICES**	FEE APPORTIONMENT	AMOUNT COMPLETE	LESS AMOUNT PREV. BILLED	AMOUNT REMAINING	AMOUNT DUE THIS PERIOD
1a	Site Visit	$1,080	$	$	$	$
1b	Document Review	$28,920	$	$	$	$
1c	Draft Report	$11,320	$	$	$	$
1d	Final Report	$2,060	$	$	$	$
1e	Presentations	$1,240	$	$	$	$
			$	$	$	$
			$	$	$	$
			$	$	$	$
	Subtotal	$44,620	$	$	$	$
	NOT TO EXCEED SERVICES					
2	Additional Services	$5,000	$	$	$	$
3			$	$	$	$
4			$	$	$	$
5			$	$	$	$
6						
	Subtotal	$5,000	$	$	$	$
	OUTSIDE SERVICES					
7		$	$	$	$	$
8		$	$	$	$	$
9		$	$	$	$	$
	Subtotal	$	$	$	$	$
	TOTAL FEE	$49,620	$	$	$	$

Certified True and Correct By: _____

_____
ATKINS's PM REPRESENTATIVE

Attachment B: Site Visit Photos



ATKINS

Lido-Siesta Photo Log Key

Photo Locations and Direction

Service Layer Credits: Source: Esri, i-cubed, USDA, USGS, AEX, GeoEye, Getmapping, Aerogrid, IGN, IGP, and the GIS User Community

Graphical Scale:

0 0.25 0.5 1

Miles

Site Visit

Atkins coastal engineering staff visited the project area on June 18-19, 2015 to view the extents of the Lido Key project area, the current condition of Ted Sperling Park, the proposed groin locations, Big Sarasota Pass, the North Shore of Siesta Key and the Siesta Key Beaches.

Figure 1 - Lido Beach Looking South

Figure 2 - Panoramic View of Ted Sperling Park

Figure 3 - Proposed Location of Groin near R-42+400

Figure 4 - Proposed Location of Groin Near R-43+500

Figure 5 - Big Sarasota Pass Ebb Shoal from Ted Sterling Park

Figure 6 - Big Sarasota Pass Ebb Shoal from Ebb Shoal Channel

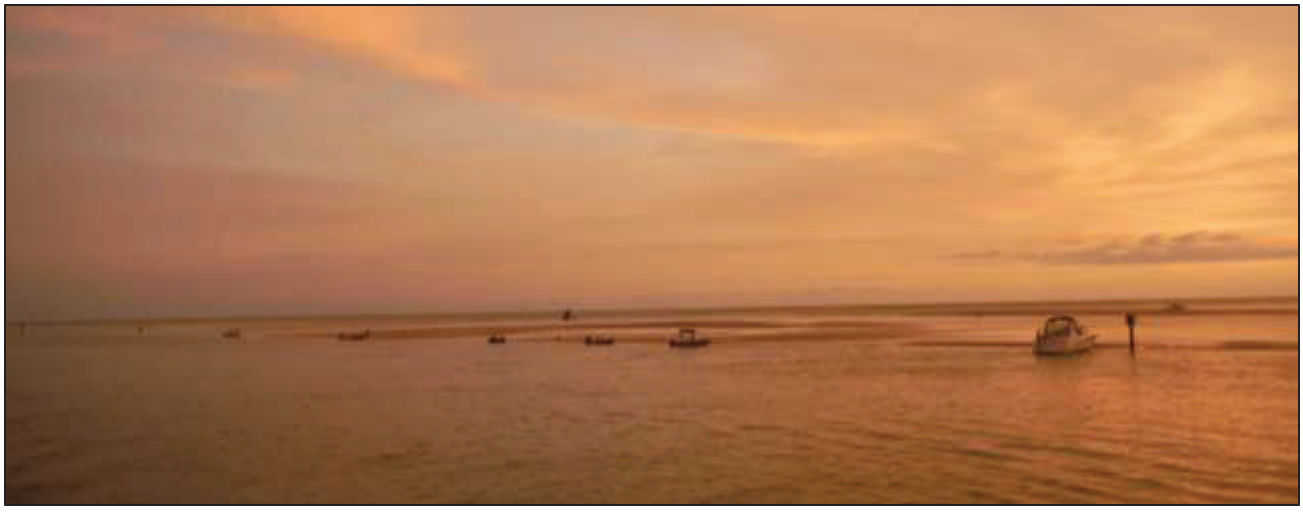


Figure 7 - North Shore of Siesta Key Shoreline in Big Sarasota Pass

Figure 8 - North End of Siesta Key (Looking North), Near Avenida Messina

Figure 9 - North End of Siesta Key (Looking South), Near Avenida Messina

Attachment C: Technical Literature Review Notes from Atkins

REVIEW OF CORPS OF ENGINEERING WORK REPORTS-
For Lido Key Nourishment Project and Big Sarasota Pass Mining

Executive Summary

Lido Key Nourishment Project

The present plan to nourish Lido Key is a worthwhile endeavor however this reviewer presents concerns pertaining to the reviewed documents that would suggest that more work and consideration be provided for the proposed groin system prior to implementation and also to the source for the nourishment sand for the project. Below are brief summary statements concerning the documents reviewed in accord with the present Scope of Work. More detailed comments are provided within the reviewed report commentaries.

Although the proposed groins have been studied using the GENESIS numerical model as well as some empirical approaches, it is believed that insufficient documentation, and verification have been provided to assure that the groins will not hinder the bypassing of sand to the downdrift beach and to the Big Sarasota Pass ebb shoal. Additionally, further modeling of nearshore currents would be useful to assure that the proposed groins do not deflect currents offshore during storms which would be capable of carrying sediment offshore and out of the natural bypassing system. GENESIS is a one line sediment transport model and not capable of providing nearshore current patterns at the proposed groins, therefore particular concerns (that are not clearly addressed in the reviewed Corps of Engineers (COE) work) are that longshore currents at the groins will divert sand offshore and away from downdrift beaches and consequent ebb shoal at Big Sarasota Pass.

Additional concerns regarding the GENESIS model usage include:

1) lack of rationale concerning documentation of model domain boundary conditions
2) proper verification

which are expanded upon in the individual reviewed report comments. Empirical approaches utilized to assess groin lengths and spacing are based on one dominant wave direction incident upon the site and no consideration was given to bypassing at the groins. The wave climate provided suggests that there is no one predominant wave direction at the site. An alternate physically-based approach to this design method is referenced in the commentary review for both the empirical and the recommended alternate method, but considerations need to be given to bypassing of sediment at the groin system. In the GENESIS numerical model, two different 20 year periods of hindcast wave data were utilized in calibration and verification discussion. Questions arise as to how the models utilized would compare for the same time period because the statistical mean wave climate is different for the different 20 year periods. Regardless of the wave hindcast model statistics used, future wave conditions may not be similar to past conditions, yet no probabilistic considerations regarding model results are provided.

Alternate potential approaches to prevent erosion damage to subject private properties that extend beyond the natural beach appear not to have been investigated (i.e. dunes, expanded nourishment, embedded “last line of defense” storm protection shoreline revetments along

with expanded nourishment) the advantage of these alternatives is that they would not be subject to the groin concerns discussed above.

As to the sand required for nourishment, it appears that there may be sufficient offshore sand for the initial project (as noted in the 2002-2004 feasibility report) which would provide more time for proper studies and assessment of the effects of back-passing of sand to Lido Key from Big Sarasota Pass. Additional thoughts regarding material source for nourishment are made within the reviewed report commentaries.

The quality of the model input data is always an issue, as are conclusions arrived at as a result of using uncertain data. As considerable usage is made of LiDAR data within the reports reviewed, it is believed that a separate report, should be provided that addresses "ground truth" tests of the LiDAR data and vertical accuracy of the systems used under both ideal and typical field conditions. The assessment of LiDAR accuracy will allow a basis for estimation of volumetric computation uncertainty in report results.

Regardless of Sarasota County's final decisions on the nourishment project sand source and groin construction, a detailed plan of project monitoring covering the concerned beaches on Lido Key and Siesta Key, as well as the entire ebb shoal and accreting flood shoal area of Big Sarasota Pass should be required, with provisions for detailed synoptic pre-construction and pre-dredging surveys to take place just prior to project construction and dredging. Possible considerations for further study should involve the use of natural or artificial tracers to determine natural sediment movement paths from the south beaches of Lido Key to the areas of concern on Siesta Key. A recommendation is made that an additional numerical model similar to CMS (Delft3D, Mike21, etc.) should be utilized to assess potential offshore currents at the groin sites under a condition of depleted nourishment sand (pre-fill conditions) on the beaches.

Dredging of Big Sarasota Pass and Back-passing of material to Lido Key

A significant effort has been made by COE to define volumetric ebb shoal calculations and sediment budget scenarios, and considerable CMS numerical modeling has been accomplished for the analysis of dredging alternatives for the potential back-passing of beach material to the Lido Key beach nourishment project. Concerns regarding the methods used and the modeling accomplished to date do not provide the reviewers with complete confidence that the natural sand bypassing from Lido Key to Siesta Key will not be interrupted (with consequent adverse effects for Siesta Key) or that the dredging alternatives recommended in the report are necessarily the optimal ones. Specifics on these concerns are noted in the following paragraphs along with extended comments in the detailed review. The COE work proposed is especially important to Siesta Key since it involves back-passing at an inlet ebb shoal rather than moving material from the pass to the Siesta Key shoreline where a net flow of sand southward would be more in tune with natural processes believed to take place in the area. In the majority of inlet ebb shoal mining cases that the reviewers are aware of, material dredged from the ebb shoal is placed on the downdrift shoreline helping nature to restore the net flow of sand in the proper direction. As the present situation is one of back-passing material to an updrift shoreline, more risk is entailed in the project due to interference with the natural net directional movement of the sediment. In the present case approximately 1.3 MCY of sand is being considered for placement on updrift beaches which is over 10 times the estimated net southward transport of beach material. Below are summary

statements concerning the documents reviewed to date. More detailed comments are provided within the reviewed report commentaries.

Specific rationale regarding the assumption that Big Sarasota Pass ebb shoal is growing in recent times is not clear due to data considerations and calculation considerations noted in the detailed reviewer commentary. It appears to the reviewers that partial justification for the dredging of Big Sarasota Pass is based on this recent growth of the ebb shoal. A more clear presentation as to how the calculations were developed may clarify this issue somewhat, but, at present, reviewer confidence in computational results suggests that no hard conclusions should be pursued from the reported recent ebb shoal size increase.

In regard to sediment budget work detailed in the reports, much of the work relies on past assumptions and studies with little added information based on independent analysis for the present study. Questions concerning the adequacy of:

1) boundary conditions
2) onshore/offshore sand transport assumptions
3) sediment cell balance problems, and
4) methodology

do not provide the reviewers with confidence that the sediment budget is well understood in this area.

Although the Lido Key nourishment will provide sand to the Big Sarasota Pass ebb shoal as a result of back-passing from the shoal, the creation of this "perpetual motion machine" approach to delivering sand to Lido Key should be looked at in more detail to assure that the sand being dredged is not part of the active bypassing system. Keeping in mind the early history of Lido Key as a series of small keys, it is apparent that Lido Key will be a long term struggle to maintain its planform stability and therefore long term planning will be needed to determine the best methods to stabilize Lido Key in the future. As the numerical modeling performed by the CMS modeling effort appears to be the primary basis of the decision to dredge in the Big Sarasota Pass ebb shoal, it is felt that a required "verification" of the ability of the CMS model to prognosticate in the Lido Key-Big Sarasota Pass under different conditions than used in its "calibration" is needed prior to acceptance of CMS modeling results that dredging of suggested alternatives will not impact Siesta Key. Further details on various concerns regarding the CMS numerical modeling efforts are provided in the detailed commentary.

Regardless of Sarasota County's final decision on the suitability of dredging Big Sarasota Pass and back-passing the sediment material to Lido Key, a detailed plan of project monitoring covering the concerned beaches on Lido Key and Siesta Key, as well as the entire ebb shoal and accreting flood shoal area of Big Sarasota Pass should be required. Provisions should be made for detailed synoptic pre-construction and pre-dredging surveys to take place just prior to project construction and dredging. Possible considerations for further study should involve the use of natural or artificial tracers to determine natural sediment movement paths from the south beaches of Lido Key to the areas of concern on Siesta Key. Additional recommendations for consideration regarding the CMS modeling efforts are: (1) Develop a number of well though-out physical model experiments to assess the validity of the sediment transport physics in the CMS morphological model; and (2) Use additional comparable numerical models (i.e. Delft3D, Mike21, etc.) to assess if prognostication by these models provides similar results to the CMS model results for the Big Sarasota mining recommended alternatives.

Detailed Review Report (T.Walton)

The following Table 1 lists the reviewed reports in accord with Atkins contract Scope of Work with Sarasota County. A limited number of added reports not noted in the table below have also been reviewed to obtain critical information regarding the project but are not commented on herein due to limited contract funding. These documents are referenced throughout the report.

Table 1. Listing of Reviewed Reports

REVIEWED REPORTS				
	Report Title	**Date of Report**	**Length of Report (pgs.)**	**Included in Review**
1g	Appendix G - Study of Big Sarasota Pass Sediment Mining Alternatives for Sarasota County, Lido Key Federal Shore Protection Project	Feb 2015	181	Yes
2	Sarasota County, Florida Hurricane and Storm Damage Reduction Project Lido Key Feasibility Report with Environmental Assessment	2002 (and 2004 Addendum)	188	Yes
2a	Appendix A – Engineering Analysis and Design	2004	117	Yes
3	Lido Key Genesis Shoreline Modeling Study	May 2014	35	Yes

SUPPLEMENTAL/REFERENCE REPORTS				
	Report Title	**Date of Report**	**Length of Report (pgs.)**	**Read for Reference (Yes/No)**
1	Sediments and Processes at Big Sarasota Pass, Sarasota County, Davis & Wang	2004	32	Yes
2	Cumulative Effects of Channel and Ebb Shoal Dredging on Inlet Evolution in Southwest Florida, Dabees & Kraus	2008	13	Yes
3	Comprehensive Inlet Management Plan Big Sarasota Pass and New Pass System for Sarasota County	May 2010	31	Yes

REVIEWED REPORTS

(Report #2)- Sarasota County, Florida Hurricane and Storm Damage Reduction Project Lido Key Feasibility Report with Environmental Assessment (U.S. Army Corps of Engineers, Jacksonville District)

This report along with Report 2a – Engineering Analysis and Design provides the major basis of design for the original Lido Key nourishment project design and groin design. Specific information provided in the report and reviewer comments that have bearing on the present review and issues at question are as follows:

- Statement that "…[Big Sarasota Pass] shoal has grown significantly in size over the past 20 years….." suggests that either the dominant southward net drift at the south end of Lido Key has not been bypassed to Siesta Key OR that the erosion of Lido Key is due to the growth of the Big Sarasota Pass ebb shoal. As this ebb shoal is due to a natural pass that has been in existence over historical record and therefore not likely to increase in size, it is important to clarify the reported basis for the ebb shoal growth to assure that in fact the growth is real and not a figment of uncertain/incomplete data or incorrect analysis. As ebb shoal volume is highly dependent on quality of survey, density of survey lines, spacing of survey lines, and area of ebb shoal surveyed, considerable variance in volumetric calculation can overwhelm actual volumetric change noted although the report does not attempt to quantify potential uncertainty in these calculations. It is believed by the reviewers that this shoal growth assumption should be investigated more thoroughly prior to making important decisions regarding quantity and location of ebb shoal mining (specifically ebb shoal back-pass dredging).

  Shoreline changes are analyzed from 1971 to 2000 over many different short intervals of time leading to highly variable change rates. Although Table III-3 provides a summary of MHW change rates for 1991-2000 "Adjusted for the 1996 and 1998 fills….", there appears to be no adjusted rates for the entire period of the shoreline change data (i.e. there appears to be no historical rates of shoreline change provided prior to 1971). As Absalonsen and Dean(2010) have also looked at shoreline change rates both during a historical period and during more recent times of beach nourishment, the rates provided in this report should be compared to Absalonsen and Dean(2010) for consistency and explain differences that may be present between the two data sets. The basis of the reviewed Corps of Engineers (COE) report suggests that shoreline is highly variable with change rates up to -35 ft/yr, yet Reach 3 shows a change rate of only -6.2 ft/year. The COE reviewed report does not make clear that the large change rates are noted at the ends of Lido Key and are due to the inlets/passes which is typical. These large variable shoreline change rates in the reviewed report are due to inlet influence on the shoreline rather than changes to a comparable shoreline with no inlets present. In this respect it is felt that a regional shoreline change rate for the area should be discussed within the report and the Lido Key change rates should be compared to the rates developed in this report and in the Absalonsen and Dean (2010) report with considerations noted for the inlet influence on Lido Key shoreline change rates. Shoreline change rates produced in the reviewed COE report may also be directly correlated with the changes in the inlet/pass ebb shoals although this potential correlation appears not to have been looked at. Similar comments also apply to volumetric changes since it appears that volumetric changes "were estimated assuming a volumetric change of 0.60 cy/ft for each foot of shoreline change…" i.e. a direct linear relationship between shoreline change and volume change even though the volumetric changes near the inlets/passes may not be directly linearly related as assumed in the report.

- The rationale for the statement that "Selected plan……. Would include a 3-groin groin field at the south end of the project" is not clear. It appears that the three groin system is desired to prevent private property damage on Lido Key although no other options have been investigated to hold this property (i.e. dune sand storage reservoirs with buried revetments as a last line of defense during storms along with the

possibility of a terminal groin at the end of the Key). Although GENESIS modeling has been accomplished to investigate the longshore transport change aspects due to the groins, it should be noted that GENESIS is primarily a longshore transport change model and cannot deal with potential offshore directed currents that may develop at the groins and shunt sediment offshore. Although filled groins provide a potential approach to helping to hold the nourished beach in place, the rationale for construction of the groins as opposed to other potential alternatives to groins should be looked at very carefully. If groins are the preferred methodology to hold the beach, it is suggested that the groins not be made totally impermeable by using sheet pile centers but rather allow a limited amount of permeability and less potential for development of offshore directed currents at the groins.

- The statement that "….initial construction and one future nourishment " from 3 offshore sand sources appears to suggest that there is enough offshore sand for the initial Lido Key nourishment project, hence perhaps it would be better to utilize this offshore sand for the nourishment project (or excess material at the north end of Lido) rather than to back-pass from Big Sarasota Pass (at least until such sand is necessary and a better understanding of the back-passing effects of the proposed pass dredging is investigated). The fact that the present Lido Key was historically a series of keys and not a natural barrier island and that Lido Key is a reclamation project suggests that sand necessary to maintain Lido Key will be a long term problem that requires serious study and better data to clarify the best options to maintain Lido Key.

- The statement "A key recommendation of {CP&E Sept 1993} report is to use the Big Sarasota Pass ebb shoal as a borrow area source of beach quality sand for Lido Key." suggests the {CP&E} rationale for the back-pass dredging decision seems to drive the present studies, hence a re-review of the {CP&E Sept 1993} study should be made to assess the quality of data driving this decision and why other options were ruled out for nourishment (i.e. imported sand from offshore, inland mining, or other locations).

- The statement "…. groin field in the problem area would help hold a beach in front of existing development …… The construction of groins would have to be supplemented with nourishment so that adjacent beaches would not be starved of sand", without additional supporting evidence, suggests that justification for the groin field as opposed to other alternatives is not necessarily an optimal solution. It is not clear that dunes and possible emergency revetment embedded within the dunes would not be a better approach to hold and minimize damage to structural development in the area from large storms.

- Berm elevation for design of the Lido Key project is based on a "10 year return period surge event" yet the groin structural cross section is designed to "withstand a 20-year storm….". It is not clear why the groin design is more conservative than the berm design?

- The reviewed report is dated "October 2002 w/ April 2004 Addendum". It is assumed that much of the report was completed prior to that (i.e. latest shoreline change analyzed was dated 2000). As the report is now a minimum of 11 years old, it is believed that updating of many report sections with more recent data should be accomplished to assure that facts have not changed which may change final project recommendations and design.

Reference:

Absalonsen,L. and Dean, R.G. (2010).
Characteristics of shoreline change along the sandy beaches of the State of Florida: an atlas, Department of Civil and Coastal Engineering, University of Florida, Gainesville, Florida 32611

(Report #2a)- Appendix A-Engineering Analysis and Design: Appendix to Sarasota County, Florida Hurricane and Storm Damage Reduction Project Lido Key Feasibility Report with Environmental Assessment (provided to USACE/Jacksonville by CP&E)

This document provides backup design information for the overall 2002-2004 design of the Lido Key nourishment project and groin system.

Appendix A report comments are as follows:

- NGVD is listed as the vertical datum throughout the report but no year is noted. Proper reference to vertical datum should provide year (1929?);

- Table A-4 notes that 10 year storm return period is 6 ft. (NGVD) but berm design for 10 year protection is noted as +5ft NGVD;

- Often data is provided in reviewed report but reference cited is either incomplete or missing (i.e. Table A-5 with Source CHL 2000 which is missing, Figure A-12 cites Brungardt,1977 which is missing).

- Net longshore sand transport is noted as southward along Lido Key for the portion of the Key south of the influence of New Pass although wave statistics as provided in Table A-6 note the mean wave direction from 211.5 degrees and in the report the normal to the shoreline on the Key is noted as 240 degrees suggesting a northward transport?

- Sea level rise guidance derived from USACE(1990) and NRC(1987) reports and is 25 years old leading to Bruun rule shoreline recession estimates that would also be outdated in accord with present knowledge.

- Figure A-12 shows offset overlays of Lido Key history. As the figure does not separate the subfigures or perhaps provide overlays of the different years, the figure provides limited information and should be redone to clarify Lido Key history.

- Most of the black and white figures of shoreline changes on Lido Key are not readable;

- Figure A-16 future shoreline projections are not clear as to which shoreline goes with which data.

- Volumetric changes provided in the report are based on a linear estimate of shoreline changes which may not correlate well with actual surveyed volumetric changes in areas of pass/inlet influence. Actual volumetric survey changes (i.e. from survey cross

section changes) should also be utilized to see if the linear assumption is valid and if not, the surveyed volumetric changes should be used for volumetric work.

- Information on New Pass area provides sediment transport rates at North end of Lido Key and also a net southerly directed longshore transport rate of 74,000 cy/yr from Longboat Key but no reference or supporting documentation is provided.

- Information on Big Sarasota Pass notes that the southward littoral drift into the inlet from Lido Key is 100,000 cy/yr and that the ebb shoal of Big Sarasota Pass holds > 44,000,000 cy of sand and is growing by 30,000 to 64,000 cy/yr. References cited are not within scope of the present review but should be investigated thoroughly for reliability (i.e. data amount, data quality, data coverage, methodology used in calculation, etc.) and possible statistical variance considerations.

- In the report, Wave Information Studies (WIS) wave hindcast data appear to have been utilized to develop some of the longshore sediment transport calculations along with the REF/DIF 1.0 model. Wave information from the WIS studies has changed over time from its inception with newer wave hindcast data replacing previously calculated hindcast data and the fact that wave direction estimates based on WIS hindcast data are of questionable reliability (i.e. no blind verification of the developed data), the data utilized should be referenced and archived for further checking and comparison with present WIS hindcast data for project design confidence of the sediment budget developed in Figure A-21.

- Sediment characteristics are mentioned in the report although it is unclear as to the amount of carbonates in the sediment and the resulting influence these carbonates have on the grain sizes reported if mechanical material sizing was the method utilized to assess the sediment sizes.

- The SBEACH model has been utilized within the report as a means to assess shoreline recession for given wave conditions. It is noted that the SBEACH model is an empirical model and can produce different answers depending on parameters utilized within the model. Both the version of the model utilized as well as a listing of SBEACH model parameters utilized to develop shoreline recessions should be provided. Blind testing of the model with the parameters utilized should be compared to a data set of FDEP survey profiles for Lido Key to assess potential bias and accuracy of results provided. Although a discussion of calibration and verification are provided, it appears a different set of parameters was utilized for calibration of the model for different storms although proper numerical modeling requires both the calibration and verification parameters of the model remain the same for calibration and verification processes of a model. Table A-19 is titled “Model Calibration and Verification” although it appears to just be numbers provided by SBEACH for various trial runs of SBEACH with different parameters. Document clarification regarding the one set of parameters used for calibration and “blind test” verification of SBEACH numerical modeling should be provided within the report.

- Risk and uncertainty within the report are handled with the Empirical Simulation Technique (EST) approach although it appears that the COE nor FEMA no longer utilize this approach. Additionally this EST approach appears never to have been assessed via a comparison with actual probability distribution simulation.

- Rationale for the combined storm recession equation provided at the top of pg A-70 is not provided and should be referenced to assess its applicability.

- The Generalized Model for Simulating Shoreline Change (GENESIS) model is a one-dimensional shoreline change model that has been used to model shoreline changes and sediment transport quantities with and without project improvements in the reviewed report along with the RCPWAVE model to assess wave refraction. The calibration of the model utilizes one set of parameters (K1=0.6 and K2=0) while the verification of the model utilizes a different set of parameters (K1=0.4 and K2=0) therefore this is NOT a true verification of GENESIS but rather another fitting of the model and data, hence prognostication results of the model within the report are in question. Additionally, the report discusses the fact that "discrepancies are due to inlet shoals and headland features which characterizes the island south of R40.5 ….. As the GENESIS and RCPWAVE models cannot accurately represent such phenomena, variation of the coefficients… was not able [to] remove these discrepancies." This statement suggests that GENESIS and RCPWAVE are not capable of describing or prognosticating changes that occur on Lido Key south of R40.5 which is the area of potential groin placement.

- Groin design for the project provides a vinyl sheet pile to make the groin impermeable although such impermeability also may aggravate any offshore currents that may develop due to the groins. As no hydraulic model nor numerical model studies have been provided to assess the effects of the groins on potential offshore currents and the possibility of directing sediment materials offshore, it is felt that if groins are proven to be the best approach to holding the beach in the area desired, further consideration should be given to utilizing permeable groins as opposed to the impermeable design provided in the report. Location of the proposed groins is not clear within the documentation of the reviewed report. Details of the procedure to obtain the boundary conditions utilized in the modeling are not provided in the reviewed report but are of vital concern to the results provided by the modeling efforts.

(Report #3)- Lido Key Genesis Shoreline Modeling Study (Author Unknown)

This document appears to be an update of numerical modelling using the GENESIS numerical model embedded within the proprietary CEDAS software system as previously discussed in Reports 2 and 2a. This update was noted to be due to changes in shoreline positions over the intervening 12 years between reports with the purpose of re-evaluating the 3 groin system under 2014 conditions to determine optimal placing and lengths of the groins. It is felt that the use of proprietary software should not be used in the design of public projects and that software utilized should be open source for critical review should the design be questioned.

Report comments are as follows:

- The reviewed report notes that the "groins would be constructed with a sheet pile wall along the centerline to sand tighten the structures". As noted in previous comments (in Reports 2 and 2a) regarding this feature, impermeability of the groins may aggravate any offshore currents that may develop at the groins. As no hydraulic model nor numerical model studies have been provided to assess the

effects of the groins on potential offshore currents and the possibility of directing sediment materials offshore, it is felt that should groins be proven to be the best approach to holding the beach in the area desired, further consideration should be given to utilizing permeable groins as opposed to the impermeable design provided in the report.

- Datums are not labeled with year therefore this omission should be corrected to assure that the correct datum changes have been made to NAVD88.

- Report notes that the design is adequate to withstand a 20 year storm although no calculations are provided within the report to support this assertion. Note that although the 20 year storm has an associated 8.8 ft storm stage (Table A-4 of Report 2a) and the berm is designed to a 5 ft storm stage.

- Numerous changes to the groin design and design lengths were made in a 2013 Value Engineering (VE) study that are not detailed in this Report #3 and were not part of the review process conducted, hence they cannot be commented on herein.

- The report notes that "In developing a sediment budget for {the} numerical simulation {of Big Sarasota Pass} the volume of material feeding into Big Sarasota Pass from the north was calculated using ….. GENESIS" but no details or results of this calculation are further discussed in the report.

- The report discusses the use of the STWAVE numerical model code embedded within the CEDAS (Veri-Tech) proprietary software for refraction calculation input for the GENESIS modeling but does not specify which version of the software was used. As software changes occur with time that could impact project results, documentation of all software versions should be provided with archived code. Proprietary software should not be utilized for design of public structures. If GENESIS software is non-proprietary, then it should be run outside of the Veri-Tech interface to assure that answers are the same in both instances. Figure 5 which shows the domain of both the STWAVE grid and the GENESIS grid is not clear as to the axis scales or domain boundaries.

- Report notes that bathymetry to construct STWAVE grid is derived from LiDAR measurements but no vertical accuracy of the measurements is discussed and sensitivity of the model to potential error in vertical accuracy should be investigated.

- Report notes that two different sets of wave hindcast databases were used in driving the model, the Wave Information Study (WIS) for calibration, and Wave Watch III (WW3) for verification and production (i.e. prognostication) runs. As noted in the report, these two data sets show different 20 year sets of statistics for the two periods (i.e. mean wave height and direction) hence a question arises as to the reliability of the hindcast data sets for modeling. A rational explanation for these differences in the data sets and verification of the two wave hindcast models is necessary to assure that the input data is reasonable and valid. One approach to doing this would be to run each hindcast data set for both periods and compare the results of the two models for each 20 year period to assure that wave height, period, and direction results are within acceptable error for each hindcast model

during each 20 year period (i.e. GENESIS calibration and verification periods). An additional qualitative test of the wave hindcast directional data that would be most useful is to compare the calculated longshore transport at a semi-infinite jetty during a given period of time (i.e. say the same 5 year time period for both) with the estimated sand trapped by the two hindcast models using GENESIS. Again versions of the models utilized and any parameters that are user set within the models should be documented.

- Regarding the WIS data, the report notes that "Wave direction data… are referenced to the local shore normal which is to the southwest." Southwest would be 225 degrees (azimuth) whereas the report also notes that "the zero degree direction of wave approach is 240 degrees clockwise as measured from due north". The above suggests that there may be a 15 degree discrepancy in how the wave direction is treated.

- Table 3 of report describes GENESIS calibration parameters although the lateral BC's (boundary conditions) are not clear as to the transports assumed at the boundaries. A "pinned" boundary suggestion would imply that the time value of longshore transport is varying. Insufficient detail on the boundary conditions is provided to assess possible modeling concerns for model calibration. Within the GENESIS calibration section of the report it is noted that "The model demonstrated good predictive ability….." although no calibration of a model provides an assessment of model predictive ability, it is simply a best fitting of the model to the prototype data. A verification is needed to assure that the model is acceptable for conditions outside of those calibrated for.

- In the verification stage of the GENESIS modeling, the report notes that "If results {of the calibration} are not acceptable, the calibration constants can be adjusted and the process repeated. If results are acceptable, the model is considered to be verified and ready for production runs." The entire purpose of a two-step calibration and verification procedure are that the parameters of the model are determined by a model fit during the calibration stage, and then these same parameters are used during the verification phase to show that the model parameters chosen are reasonable and will allow for other varying environmental conditions to be run with confidence. From the above statement it appears that calibration parameters may have been changed during the verification phase hence making the modeling exercise a curve fitting exercise with no real meaning. No verification parameters have been provided within the reviewed report. Statements need to be made that both the calibration and verification parameters of the model runs are the same and model calibration and verification parameters should be listed in two tables to assure that this has been done.

- As the calibration and verification periods do not include the groins (i.e. they have not been built yet), there are additional questions regarding the ability of the GENESIS model to accurately assess the sediment bypassing that occurs at the groins. Independent verification of the GENESIS model ability to handle sediment bypassing at the groins (embedded within the model domain) needs to be addressed by verification through analytic models(assuming the physics are well understood), or physical model studies and prototype data (assuming that the physics are not well understood).

(Report #1g)- Appendix G - Study of Big Sarasota Pass Sediment Mining Alternatives for Sarasota County, Lido Key Federal Shore Protection Project (USACE, Jacksonville District, 20 February 2015)

Due to the length of the review comments, various sections of the report were commented on as follows:

1.0 Overview

Clarification needs to be provided regarding statement "Analysis of existing data alone cannot not be used to infer whether additional, future excavations of the ebb shoal alone will (or will not) result in a significant adverse impact." This statement appears to suggest that the determination of adverse impacts caused by the project cannot be determined by existing data alone. Is this paragraph suggesting more data is needed prior to "future excavation of the ebb shoal" as envisioned? More clarity as to what is being said here is needed.

1.5 Big Sarasota Pass

Table 1 lists recent ebb shoal surveys from 2004 through 2013 but documentation and survey reference citation needs to be provided on all surveys. Considerable differences exist in volume estimates of ebb shoal, hence discussion of the types of bathymetric data error, spatial coverage differences between surveys, and potential LiDAR survey error needs to be provided, along with confidence limits on the calculations. Table 2 provides calculated ebb shoal volumes for various surveys and needs documentation and survey reference citations. More detail needs to be provided on exactly how the calculations were made (i.e. It appears that the area of calculation may be the black line outline shown in Figures 17 -22 but should be so stated if this is correct.) As it appears that the survey coverage plan area is different on each of the surveys, the volumetric comparison may be comparing "apples to oranges" (i.e. a clear comparison of the same surveyed area in each of the surveys needs a volumetric comparison).

Figure 16 should show error bars on the surveys as many of the surveys were accomplished by different methods and have different vertical accuracy. Figure 24 shows a volumetric difference between the 2004 and 2013 surveys but it is not clear what plan area the computation is for? Report notes that "Today the ebb shoal volume remains > 20MCY" suggesting the ebb shoal has grown in recent times, but, considering the 20-24 MCY range of the 1883 ebb volume comparison (not shown in Figure 16) as well as other accuracy considerations and survey plan area differences, this growth may well be in question.

Equation (1) provided in report is utilized to calculate (an incorrect?) equilibrium ebb volume of sand = 6 MCY (which should actually show approximately 10 MCY?). A more appropriate version of this equation for mildly exposed inlets is provided via Equation 4 in Walton and Adams (1976) which suggests approximately 11 MCY of sand. Figures 29 and 30 show the outline of the ebb shoal at a given contour but no information is provided in the figures as to what the contour represents and do not include 1953 survey (i.e. Figure 11). Figures 29, 30 would be additionally clarified by showing contour outlines on original survey sheets that show spot depths. As

limited data is provided for the ebb shoal of Big Sarasota Pass, a comprehensive survey of the ebb shoal is recommended to assess the volume under present day conditions although due to the limits of previous surveys spatial coverage and data coverage a valid comparison of past and recent ebb shoal total volume may not be possible.

2.1 Sediment budget comments

Figure 53 provides a sediment budget figure from a report that was not reviewed and was unavailable to the reviewers at the time of this review. The sediment budget presented within the figure appears to have errors as no material appears to be entering the Siesta Key area from the North and the sediment cells on Siesta Key do not balance in this area. Additional concerns are that the Lido Key cell of the sediment budget appears to suggest that Lido Key is not in need of much nourishment as the longshore gradient loss of sand to the island is only 118,2000 – 106,400 = 11,800 cy/yr. This budget representation suggests that to maintain its present configuration Lido Key only needs 11,800 cy/yr, which further suggests that the placement of 1,300,000 cy is well over 100 years of nourishment for Lido Key? A table showing the volumes of material added to Lido Key during the period 1987 to 2006 should be provided to clarify what has been added via anthropogenic means and if sand is added to Lido Key from natural onshore transport. A representation of the sediment budget should also be prepared (if feasible) that shows the natural state of Lido Key erosion (i.e. without added nourishment) to clearly represent future concerns of Lido Key with and without the nourishment project.

Further work on the Figure 53 sediment budget is discussed in the report reviewed and summarized in Figures 54 through 57 by means of a method (Bodge,1993; USACE,2008) that provides an infinite number of solutions (due to more unknowns than equations) and then attempts a refined sediment budget using information derived from the previously formulated sediment budget. The approach utilizes a proprietary Matlab code to provide a "family of solutions" which, due to unverified (i.e. not peer reviewed) code, is subject to concerns. The final result of this "refined" attempt is provided in Figure 56 which provides what appears to be onshore transport (or anthropogenic placed material from offshore) in the Lido Key cell but no onshore transport in the Siesta Key cell. As the wave climate would be expected to be somewhat similar for the two cells, a rationale for the onshore transport differences noted needs to be provided if onshore transport is utilized in the sediment budget. No basis for the shoaling volumes provided from the north and south into the inlet is given, and Figure 56 appears to have errors as some of the cells do not balance. It is suggested that as a starting point for a "refined sediment budget", the study should develop independent estimates of longshore sediment transport at the north and south boundaries of the sediment budget and then utilize a linear system of equations as per Weggel(1983) with a check for independence in equations as provided by Walton et al(2012). This approach in which an actual solution is given for sediment budget (rather than an "[infinite] family of solutions") may provide added confidence in the recommendations within the report.

References:

Walton, T.L. Jr., Dean, R.G., J.D. Rosati (2012).

Sediment Budget Possibilities and Improbabilities, Coastal Engineering, 60, 323-325, Elsevier Publishing, The Netherlands.

Weggel,J.R., and Clark,G.R.(1983)
Sediment Budget Calculations Oceanside, California
CERC_Miscellaneous Paper 83-7,
Coastal Engineering Research Center,
Washington, D.C.

3.0 CMS modeling comments

The reviewed document states that the CMS (Version 4) model was chosen because "...of its capability to reproduce nearshore sediment dynamics as tidal inlets." The reviewers know of no studies where there is evidence that the model can prognosticate inlet changes accurately. Difficulty in providing accurate inlet modelling of sediment transport may in part be due to a lack of detailed verification data for the model as well as detailed input conditions for the model. Model verification evidence should be provided prior to "blind faith" belief in modeling results. As to the present model's choice (CMS) above others, it is not clear that a valid comparison has been made to other modelling systems (i.e. Mike21, DELFT3D, etc.) hence it should not be assumed that the model will provide more accurate answers than other models.

LiDAR data have been utilized for topography and bathymetry within the model, therefore discussion should be made as to ground truth tests of the LiDAR data as well as vertical accuracy of the LiDAR systems utilized and results provided on "ideal" and "typical" vertical accuracy in a field situation such as Big Sarasota Pass. Confidence limits on sediment volumes should be provided where limited vertical accuracy in data is a concern.

Median sediment grain sizes were used in the model although no discussion is made as to whether the median grain sizes are from mechanical sizing analysis or fall velocity testing. If shell is present, this sizing analysis is important to the results and the approach to do the sediment modeling within CMS. A discussion of this impact on the results provided by the modeling should be provided.

Regarding the hydrodynamic calibration of the CMS model, friction factors appear to be set using assumed parameters rather than via calibration runs of the model. It is not clear where friction coefficients come from or how reasonable they are for the situation discussed. Friction parameters provided in Table 5 are not clear as to whether these parameters were model initial values for starting the calibration process, results of calibration parameters, the same as the model run parameters, or all of the above. Manning's "n" is a dimensional parameter (i.e. not dimensionless) although no units are shown hence questioning the validity of the number used. A Darcy-Weisbach friction factor is provided although no equation is presented for velocity, hence it is not clear whether this is the correct friction factor or a linearly related friction factor to the Darcy-Weisbach friction factor. Hydrodynamic calibration of the model is not clear as to what parameters were used/varied in the calibration, nor what the final hydrodynamic calibration parameters set in the model were. A requirement of the modelling exercise should be to include a clear listing of the hydrodynamic model parameters in the report. Although calibration of the

hydrodynamic model is discussed, no verification of the hydrodynamic modeling appears to have been done. Verification of the hydrodynamic portion of the model could be provided by comparison of calculated radiation stresses to prototype computed radiation stresses from wave gage arrays within the model domain.

Regarding morphological calibration of the CMS model, three sediment transport models are noted to be available in the model yet an empirical "Watanabe" transport formula is chosen without sufficient justification as to the decision making process for this choice. A useful test of the sensitivity of CMS modeling results would be to run each of the three transport model possibilities and then see what differences are noted by the different choices of transport model (i.e. Do the different models lead to similar conclusions/results?). The calibration period contains a specific ensemble of hurricanes/extreme events although hurricanes are sufficiently different in tracks that a similar time period with different hurricanes could provide completely different results. Although comparisons of measured and modeled bathymetry are given for the calibration period, the figures (72 & 73) are so small that no useful comparison can be made. A figure showing the actual difference in depth between model and prototype measurement for the calibration time period should be provided to assess the quality of the model fit. There appears to be no morphology model verification provided hence the later comparisons of shoal change due to inlet dredging alternatives are in question. Figures such as Figure 79 are noted to show the "wave energy" changes but rather show wave energy density changes (no wave direction is included in the approach). A better approach to showing meaningful changes in wave activity on the ebb shoal would be provided by simply showing radiation stress changes from the "no dredging" conditions for the various shoal mining alternatives.

The CMS model has 3 different sediment transport models along with 4 different sediment transport equations to choose from and approximately 10 user set parameters within the model that can be adjusted, leading to approximately 3*4*10=120 different settings for the model that can be used in the "fitting" process (i.e. the calibration process). As such, model verification takes a most important role in providing the ability of the model to do prognostication for the various alternatives, but no model verification appears to have been provided for the Big Sarasota Pass study. Along with the fact that future wave climate is in question, it is not clear how much confidence can be placed in the modeling results for the various ebb shoal dredging alternatives.

4.4 Sediment transport pathways comments

The sediment transport pathways discussion in the report reviewed discusses "sediment concentration and transport vectors" but does not define exactly what the vectors in the Figures 95 through 109 physically represent therefore it is unclear what is being concluded within this section. It appears from the figures provided that only instantaneous sediment transport concentration flows are considered and that bed load is not considered within the sediment pathway discussion? As only the finer sands might be suspected of being carried by suspended load (as opposed to bedload) there is a question as to the utility of considering concentration vectors alone. It may be that the total load has been divided by the depth of flow and velocity but that is not stated in the reviewed report. As bedload transport driven by wave and current bottom stresses, an important component of the sediment pathways may be missing. It is believed by the reviewer that this discussion of sediment pathways would be

enhanced by consideration of diagrams of bottom bed stress due to the waves and currents. A Lagrangian particle transport model may provide a more useful approach to tracking of actual sediment pathways across the ebb shoal under a continuous dynamic time set of wave and current conditions.

5.0 Role of groins and beach nourishment on the selected alternative

The reviewed report notes that the "GENESIS numerical model was used to verify the groin design and is presented in Appendix B" of the report although there is no Appendix B in the reviewed (181 page) report.

6. Role of selected alternatives on future morphology

Report notes a "1.5 wave condition" is utilized but this condition is undefined as to what it means. It is unclear in Table 11 why all of the alternatives in Table 7 were not considered? Note is made throughout report that often plan designation is of form "D2-B-C" rather than "D2+B+C" (i.e. minus rather than plus) which should be corrected to assure plan being discussed is the same in both of the above. In the morphology changes over a given time period (for example, "6 month runs"), although change in borrow area is shown via figures, this does not address what effects dredging has on interruption of the bypassing paths of sand on the ebb shoal to Siesta Key. With regard to shoreline change for the alternatives, it is stated that "…all the alternatives…" are included but only the 4 alternatives shown in Table 11 are provided rather than all the alternatives as specified in Table 7. Figures 115 through 127 have insufficient information in their figure titles and text to define what they refer to. In all morphologic comparisons among alternatives, much larger figures should be provided that show actual depth differences of the discussed plan to the "no action" alternative to clarify what differences actually occur. Small size of figures and inability to overlay figures does not allow reasonable comparison to be made of various alternatives.

Figures 128 through 150 describe time integrated sediment transport pathways but only suspended sediment (i.e. concentration flows) are provided and the bed load transport appears to be ignored as noted previously. As mentioned previously in reviewer comments on the sediment transport pathways section, "sediment concentration and transport vectors" does not define exactly what the vectors in the figures physically represent therefore it is unclear what may be concluded from these figures. It appears from the figures provided that only time integrated sediment transport concentration flows are considered and that bed load may not be considered? As only the finer sands might be suspected of being carried by suspended load (as opposed to bedload) there is a question as to the utility of considering concentration vectors alone. As bedload transport driven by wave and current bottom stresses, an important component of the sediment pathways may be missing? It is believed by the reviewers that this discussion of sediment pathways would be enhanced by consideration of time integrated diagrams of bottom bed stress due to the waves and currents. The same comments pertain to figures detailing longer run times and different model scaling factors. The fact that different model scaling factors are used within the comparison suggests that there is considerable uncertainty in the model parameters and hence conclusions that may be drawn from the modeling results.

7. Updated sediment budgets

The report notes "…it was specified that net transport into the system is 106,000 cy/yr based upon….". In a major study such as this where all the modeling and sediment budget work done is highly dependent on the net transport, it would be expected that this subject would take a first priority in investigation and provide an extensive review of net transport estimates and also develop independent ones prior to assuming a value ad hoc. Any net transport value provided in the study should be documented, and rationale for accepting the chosen value should be noted. Additionally, sensitivity studies should be made to assess different results dependent on this (uncertain) net transport value. Numerous other cases where assumed sediment budget input values have been utilized without any rationale or independent investigation are noted in report (i.e. "… it is assumed that bypassing from Lido Key is …" ; "… it was assumed due to … that shoaling from Siesta Key is…."). The report states that "At the southern boundary of the study area at Point of Rocks, the net longshore sand transport was to the south at 0 cy/year" which is again undocumented without any rationale for this conclusion being provided. Additionally if the net transport = 0 then there should be no direction associated with it. Figures 169 through 175 do not provide balanced sediment budgets within the cells (i.e. the cell [input-output] must equal the [accretion/erosion] within the cell but it does not in the reviewed report figures).

8. Discussion

Figures 176 and 177 show volume of ebb shoal with time although no error bars are shown. To assess the quality and quantity of the data, the surveys should be shown along with the boundary (i.e. domain area) for the volumetric computation. Survey information documentation should also be provided in a table. It is not clear that the same survey areas are involved in the volumetric computations nor that the data density and/or coverage is the same. If this turns out to be the situation, it would be expected that the calculated ebb shoal volumes may entail considerable uncertainty and hence the statement that "The volume of the ebb shoal has increased in the last decade …" may not be correct. This possibility needs to be thoroughly investigated as COE critical decisions concerning the ebb shoal dredging for back-passing are strongly dependent on it. Various CMS modeling done on the alternative dredging locations with regard to sediment pathways, transport vectors, integrated sediment transport vectors, and morphological change suffer the same concerns noted in previous commentary in the section entitled "*3.0 CMS modelling comments".*

8.3 Selected Alternatives

The report states that "Alternatives D2, D1, C, and B all had acceptable results from the CMS [modeling] and did not cause adverse impacts to ebb shoal-inlet complex… and to the navigation channel" yet alternative D1 appears to be ignored after this statement with no rationale provided for not considering it further? At the top of page 160 the report states that "Overall, option D3**-B is a very conservative option…. [and] carries very little risk…." yet at the bottom of the same page it is noted that "…options D3*-C-B and D3**-B .. [have] risks associated with each"?

Table 14 needs clarification as to wording regarding Risks and Benefits (i.e. left column notes "Does not affect navigation" and the answer for both alternatives is

"YES" suggesting that they do affect navigation!). Similar questions regarding the desired comments extend throughout this table, therefore the risks and benefits need to be reworded and clarified in the table. A statement is made that " There appears to be strong correlation between the volume of sediment … transported to Sarasota County beaches from offshore and growth of the ebb shoal.." which needs documentation and basis/rationale for this statement.

10. References
Many of the references do not provide complete information and should be corrected to show sufficient information such that independent reviewer(s) can obtain the papers, reports, and publications.

References:

Verification and Validation of the Coastal Modelling System, Report 4, CMS-Flow: Sediment Transport and Morphology Change (December 2011)
ERDC/CHL TR-11-10,
Coastal and Hydraulics Laboratory, U.S. Army Engineer Research and Development Center 3909 Halls Ferry Road, Vicksburg, MS 39180-6199

SUPPLEMENTAL/REFERENCE REPORTS REVIEW

1. **Sediments and Processes at Big Sarasota Pass, Sarasota County (Davis & Wang)**

This report contains subjective information regarding Florida West Coast inlets and in particular Big Sarasota Pass, Lido Key, and Siesta Key although lack of documentation concerning the numbers provided within the (dated) report cannot be substantiated, hence should not be utilized as the basis of any design or engineering conclusions. An interesting 1883 USCGS hydrographic and topographic chart is provided within the report showing the dominant barrier offset at the North end of Siesta Key as well as the fact that the present Lido Key was a series of smaller (mangrove) islands at that time. The report suggests that Siesta Key is a "drumstick" type of barrier and that reversals of dominant longshore currents would be expected at the North end of the Key similar to what has been shown quantitatively by previous authors (i.e. see Shore Protection Manual (1984)). Additional historical qualitative information on the history of the ebb shoal and sediment sizes from surface sediment samples has been provided from a Master's thesis document. As surface sample sizes appear to compare the mechanical size of the sediment rather than the hydraulic equivalent grain sizes, limited information can be obtained from the sample analysis. Limited inlet current information is provided again from a Master's thesis document. Summary conclusions reached from the document note that the Big Sarasota Pass shoal benefits from updrift restoration (i.e. Lido Key) nourishment and that portions of the ebb delta can be removed without causing problems on the Siesta Key shoreline, especially the distal southern end. An additional recommendation is that "It is not recommended to dredge the main channel of Big Pass which is stabilized and maintains a depth of 5-8 m."

Reference:
Shore Protection Manual (1984).

Government Printing Office, Washington, D.C.

2. **Cumulative Effects of Channel and Ebb Shoal Dredging on Inlet Evolution in Southwest Florida (Dabees & Kraus)**

   This report pertains to the use of the Inlet Reservoir Model to Longboat Pass, Florida and contains no useful information regarding inlet processes at Big Sarasota Pass. It is felt that the use of an Inlet Reservoir Model is far too subjective in regard to setting up cells for model usage (i.e. shoals are dynamic not static reservoirs) and does not add any useful information to an understanding of the pass that simple volumetric change diagrams of the ebb and flood shoal areas would not provide.

3. **Comprehensive Inlet Management Plan Big Sarasota Pass and New Pass System for Sarasota County- (Coastal Technology , Coastal Engineering Consultants, Inc. & University of South Florida)**

   This report discusses overall recommendations for Big Sarasota Pass inlet management based on biographical references furnished in the report. No additional data appears to have been collected or developed to provide recommendations summarized in the report. The main summary comments noted from this report overview that are most pertinent to the present study are as follows:

   - "place future beach nourishment efforts as far updrift along the receiving beach as possible…."
   - "future direction may suggest that some types of structures…. like groins…. should be evaluated to help improve the stability of the shoreline for placed material as well as to control and direct the natural by-passing that takes place….."
   - ".. with minor care and monitoring, sand could be successfully mined from the ebb shoal with only minor potential impacts…."
   - "… consider… full time coastal zone monitoring system that surveys and documents the evolution of the shoreline and Passes."
   - " Any compatible sand removed from navigation channels in Big Pass should be directed to the Siesta Key beaches, with particular focus on the "hot spots' at the northern end of Siesta Key."
   - " …the County should support and where feasible sponsor limited sand mining projects that….. back-pass sand from northern and western lobes of the ebb shoals to the updrift beaches from which that sand typically originated."
   - "A sand proactive management alternative of mining roughly 850,000 cubic yards of sand from a borrow area along the outer (northwestern) edge of the Big Sarasota Pass ebb shoal …… recovery rate is not clearly known and should be subject of regular monitoring surveys. Unless that recovery is affirmed by the monitoring, the use of the borrow area as described should be considered as a "one time" opportunity.

ADDITIONAL REVIEWED REPORTS (not provided or in original Scope Of Work)

Analysis of Lido Key Groin Field – December 2014, Sarasota County, Florida, HSDR Project (USACE, Jacksonville District -December 2014)

Comments: Reviewed report notes that "Several methods of analysis are available…" but does not state what they are? Reference is made to Silvester, Hsu but references are not provided for the methods in the reference section. Design methods provided in Method #2 and Method #3 utilize empirical methods based on a dominant wave direction and are really only suited to areas where there is a dominant wave direction. A non-empirical approach (Walton (1977)) that takes into account the directional spread of energy density is better suited to the type of equilibrium analysis provided in the reviewed report although none of the above methods account for sediment bypassing of the groin system.

References:

Walton, T.L. Jr. (1977).
Equilibrium Shores and Coastal Design,
Proceedings of Coastal Sediments, 1977,
American Society of Civil Engineers,
Reston, VA.