Sponsored by: Burnett

CITY OF MARATHON, FLORIDA
RESOLUTION 2009-26

A RESOLUTION OF THE CITY COUNCIL OF THE CITY OF MARATHON, FLORIDA, AUTHORIZING WORK AUTHORIZATION TWENTY FIVE (25) TO WEILER ENGINEERING CORPORATION (WEC) FOR COASTAL ENGINEERING SERVICES IN SUPPORT OF A COASTAL FEASIBILITY STUDY OF SOMBRERO BEACH AND THE ADJACENT CANALS TO THE EAST IN AN AMOUNT OF $57,315 (PLUS REIMBURSABLES); AND PROVIDING FOR AN EFFECTIVE DATE.

WHEREAS, the neighborhood of Tingler Island to the east of Sombrero Beach has experienced significant sand accretion over the years and has had to continually dredge their canals; and

WHEREAS, this coastal feasibility study of Sombrero Beach and the adjacent canals to the East will provide baseline beach and nearshore conditions, develop project alternatives to address shoreline and canal stabilization, and identify a preferred project alternative; and

WHEREAS, the City of Marathon (the "City") has a Continuing Services Agreement with Weiler Engineering; and

WHEREAS, Weiler Engineering submitted the lowest proposal and staff recommends approval of Work Authorization 25.

NOW, THEREFORE, BE IT RESOLVED BY THE CITY COUNCIL OF THE CITY OF MARATHON, FLORIDA, that:

Section 1. The above recitals are true and correct and incorporated herein.

Section 2. The City Council hereby approves the Weiler Engineering Work Authorization #25, a copy of which is attached hereto as exhibit A, for a coastal feasibility study of Sombrero Beach and adjacent canals to the East.

Section 3. This resolution shall take effect immediately upon its adoption.

PASSED AND APPROVED by the City Council of the City of Marathon, Florida, this 24th day of February, 2009.

THE CITY OF MARATHON, FLORIDA

Mike Cinque, Mayor

AYES: Ramsay, Snead, Worthington, Vasil, Cinque
NOES: None
ABSENT: None
ABSTAIN: None

ATTEST:

Diane Clavier, City Clerk

(City Seal)

APPROVED AS TO FORM AND LEGALITY FOR THE USE AND RELIANCE OF THE CITY OF MARATHON, FLORIDA ONLY:

City Attorney

EXHIBIT "A"

PROJECT AGREEMENT

Between

CITY OF MARATHON, FLORIDA

And

WEILER ENGINEERING CORPORATION

for

Work Authorization No. Twenty Five (25)

Sombrero Beach and Tingler Island Feasibility Study

PROJECT AGREEMENT

Between

THE CITY OF MARATHON, FLORIDA

And

WEILER ENGINEERING CORPORATION

For

Work Authorization No. Twenty Five (25)

Sombrero Beach and Tingler Island Feasibility Study

Pursuant to the provisions contained in the "Continuing Services Agreement" between the CITY OF MARATHON, FLORIDA (the "CITY") and THE WEILER ENGINEERING CORPORATION, ("CONSULTANT") dated June 23, 2004, this Project Agreement authorizes the CONSULTANT to provide the services as set forth below:

The CITY and CONSULTANT agree as follows:

SECTION 1. SCOPE OF SERVICES

1.1 The CONSULTANT shall provide engineering services to the CITY for the Project as described in the "Project Description" attached as Exhibit "1."

1.2 The "Scope of Services and Project Schedule" and tasks to be provided by the CONSULTANT for this Project are those services and tasks as listed in Exhibit "2."

1.3 The CITY may request changes that would increase, decrease, or otherwise modify the Scope of Services. Such changes must be contained in a written change order executed by the parties in accordance with the provisions of the Continuing Services Agreement, prior to any deviation from the terms of the Project Agreement, including the initiation of any extra work.

SECTION 2. DELIVERABLES

As part of the Scope of Services and Project Schedule, the CONSULTANT shall provide to the CITY the following Deliverables:

- Sea-grass mapping aerial and plan
- Mangrove mapping and plan
- Bathymetric survey
- Sand grain gradation report w/GPS coordinates
- CEDAS Modeling report-existing conditions/proposed conditions with coastal impacts
- Turtle nesting/Endangered species report/construction guidelines
- Feasibility Study with recommended Course of Action
- List of permitting requirements associated with recommended Course of Action

SECTION 3. TERM/TIME OF PERFORMANCE/DAMAGE

3.1 **Term.** This Project Agreement shall commence on the date this instrument is fully executed by all parties and shall continue in full force and effect **120** days, unless otherwise terminated pursuant to Section 4 or other applicable provisions of this Project Agreement. The City Manager, in his sole discretion, may extend the term of this Agreement through written notification to the CONSULTANT. Such extension shall not exceed 180 days. No further extensions of this Agreement shall be effective unless authorized by the CITY Council.

3.2 **Commencement.** The CONSULTANT'S services under this Project Agreement and the time frames applicable to this Project Agreement shall commence upon the date provided in a written Notification of Commencement ("Commencement Date") provided to the CONSULTANT from the CITY. The CONSULTANT shall not incur any expenses or obligations for payment to third parties prior to the issuance of the Notification of Commencement. CONSULTANT must receive written notice from the City Manager prior to the beginning the performance of services.

3.3 **Contract Time.** Upon receipt of the Notification of Commencement, the CONSULTANT shall commence services to the CITY on the Commencement Date, and shall continuously perform services to the CITY, without interruption, in accordance with the time frames set forth in the "Project Schedule," a copy of which is attached and incorporated into this Agreement as Exhibit "3". The number of calendar days from the Commencement Date, through the date set forth in the Project Schedule for completion of the Project or the date of actual completion of the Project, whichever shall last occur, shall constitute the Contract Time.

3.4 **Liquidated Damages.** Unless otherwise excused by the CITY in writing, in the event that the CONSULTANT fails to meet to the contract time for completion of services as determined by the Project Schedule, the CONSULTANT shall pay to the CITY the sum of dollars identified below per day for each and every calendar day unexcused delay beyond the completion date, plus approved time extensions, until completion of the project: $ N/A per day. The CONSULTANT may claim extension if the factors involved are not under their direct control.

Any sums due and payable hereunder by the CONSULTANT shall be payable, not as a penalty, but as liquidated damages representing and estimate at or before the time of executing this Agreement. When the CITY reasonably believes that completion will be inexcusably delayed, the CITY shall be entitled, but not required, to withhold from any amounts otherwise due the CONSULTANT an amount then believed by the CITY to be adequate to recover liquidated damages applicable to such delays. If and when the CONSULTANT overcomes the delay in achieving completion, or any part thereof, for which the CITY has withheld payment, the CITY shall promptly release to the CONSULTANT those funds withheld, but no longer applicable, as liquidated damages.

3.5 All limitations of time set forth in this Agreement are of the essence.

SECTION 4. AMOUNT, BASIS AND METHOD OF COMPENSATION

4.1 **Lump Sum Compensation.** CITY agrees to pay CONSULTANT as compensation for performance of all services described in Exhibit "2" $ 57,315.00 . ~~[OR, IF HOURLY, "CITY AGREES TO PAY CONSULTANT COMPENSATION AT CONSULTANT'S HOURLY RATES, UP TO A MAXIMUM AMOUNT NOT TO EXCEED $_____.]~~

4.2 **Reimbursable Expenses.** The following expenses are reimbursable at their actual cost: travel and accommodations, long distance telephone calls, facsimile, courier services, mileage (at a rate approved by the CITY), photo and reproduction services. All document reproductions are also reimbursable, at a rate approved by the CITY.

SECTION 5. BILLING AND PAYMENTS TO THE CONSULTANT

5.1 **Invoices**

5.1.1 **Lump Sum Compensation and Reimbursable Expenses.** CONSULTANT shall submit invoices which are identified by the specific project number on a monthly basis in a timely manner. These invoices shall identify the nature of the work performed, the phase of work, and the estimated percent of work accomplished in accordance

with the Payment Schedule set forth in Exhibit "3", to this Project Agreement. Invoices for each phase shall not exceed amounts allocated to each phase of the Project plus reimbursable expenses accrued during each phase. The statement shall show a summary of fees with accrual of the total and credits for portions previously paid by the CITY. The CITY shall pay CONSULTANT within thirty (30) calendar days of approval by the City Manager of any invoices submitted by CONSULTANT to the CITY.

5.2 **Disputed Invoices.** In the event that all or a portion of an invoice submitted to the CITY for payment to the CONSULTANT is disputed, or additional backup documentation is required, the CITY shall notify the CONSULTANT within fifteen (15) working days of receipt of the invoice of such objection, modification or additional documentation request. The CONSULTANT shall provide the CITY with additional backup documentation within five (5) working days of the date of the CITY'S notice. The CITY may request additional information, including but not limited to, all invoices, time records, expense records, accounting records, and payment records of the CONSULTANT. The CITY, at its sole discretion, may pay to the CONSULTANT the undisputed portion of the invoice. The parties shall endeavor to resolve the dispute in a mutually agreeable fashion.

5.3 **Suspension of Payment.** In the event that the CITY becomes credibly informed that any representations of the CONSULTANT, provided pursuant to Subparagraph 5.1, are wholly or partially inaccurate, or in the event that the CONSULTANT is not in compliance with any term or condition of this Project Agreement, the CITY may withhold payment of sums then or in the future otherwise due to the CONSULTANT until the inaccuracy, or other breach of Project Agreement, and the cause thereof, is corrected to the CITY's reasonable satisfaction.

5.4 **Retainage.** The CITY reserves the right to withhold retainage in the amount of ten percent (10%) of any payment due to the CONSULTANT for the design until the design is completed. Said retainage may be withheld at the sole discretion of the City Manager and as security for the successful completion of the CONSULTANT'S duties and responsibilities under the Project Agreement.

5.5 **Final Payment.** Submission of the CONSULTANT'S invoice for final payment and reimbursement shall constitute the CONSULTANT'S representation to the CITY that, upon receipt from the CITY of the amount invoiced, all obligations of the CONSULTANT to others, including its consultants, incurred in connection with the Project, shall be paid in full. The CONSULTANT shall deliver to the CITY all documents requested by the CITY evidencing payments to any and all subcontractors, and all final specifications, plans, or other documents as dictated in the Scope of Services and Deliverable. Acceptance of final payment shall constitute a waiver of any and all claims against the CITY by the CONSULTANT.

SECTION 6. TERMINATION/SUSPENSION

6.1 **For Cause.** This Project Agreement may be terminated by either party upon five (5) calendar days written notice to the other party should the other party fail substantially to perform in accordance with its material terms through no fault of the party initiating the termination. In the event that CONSULTANT abandons this Project Agreement or causes it to be terminated by the CITY, the CONSULTANT shall indemnify the CITY against any loss pertaining to this termination. In the event that the CONSULTANT is terminated by the CITY for cause and it is subsequently determined by a court by a court of competent jurisdiction that such termination was without cause, such termination shall thereupon be deemed a termination for convenience under Section 6.2 of this Project Agreement and the provision of Section 6.2 shall apply.

6.2 **For Convenience.** This Project Agreement may be terminated by the CITY for convenience upon fourteen (14) calendar days' written notice to the CONSULTANT. In the event of termination, the CONSULTANT shall incur no further obligations in connection with the Project and shall, to the extent possible, terminate any outstanding subconsultant obligations. The CONSULTANT shall be compensated for all services performed to the satisfaction of the CITY and for reimbursable expenses incurred prior to the date of termination. The CONSULTANT shall promptly submit its invoice for final payment and reimbursement and the invoice shall comply with the provisions of Paragraph 5.1 of this Project Agreement. Under no circumstances shall the CITY make any payment to the CONSULTANT for services which have not been performed.

6.3 **Assignment upon Termination.** Upon termination of this Project Agreement, a copy of all of the CONSULTANT's work product shall become the property of the CITY and the CONSULTANT shall, within ten (10) working days of receipt of written direction from the CITY, transfer to either the CITY or its authorized designee, a copy of all work product in its possession, including but not limited to designs, specifications, drawings, studies, reports and all other documents and data in the possession of the CONSULTANT pertaining to this Project Agreement. Further, upon the CITY'S request, the CONSULTANT shall assign its rights, title and interest under any subcontractor's agreements to the CITY.

6.4 **Suspension for Convenience**. The CITY shall have the right at any time to direct the CONSULTANT to suspend its performance, or any designated part thereof, for any reason whatsoever or without reason, for a cumulative period of up to thirty (30) calendar days. If any such suspension is directed by the CITY, the CONSULTANT shall immediately comply with same. In the event the CITY directs a suspension of performance as provided for herein through no fault of the CONSULTANT, the CITY shall pay to the CONSULTANT its reasonable costs, actually incurred and paid, of demobilization and remobilization, as full compensation for any such suspension.

SECION 7. INCORPORATION OF TERMS AND CONDTIONS OF CONTINUING SERVICE AGREEMENT

7.1 This Project Agreement incorporates the terms and conditions set forth in the Continuing Services Agreement dated June 23, 2004 between the parties as though fully set forth herein. In the event that any terms or conditions of this Project Agreement conflict with the Continuing Services Agreement, the provisions of this specific Project Agreement shall prevail and apply.

[THE REST OF THIS PAGE INTENTIONALLY LEFT BLANK.]

ATTEST:

Diane Clavier
City Clerk

CITY OF MARATHON

By: Clyde Burnett
Clyde Burnett, City Manager

Date: 2/25/09

APPROVED AS TO FORM AND LEGALITY FOR THE USE AND RELIANCE OF THE CITY OF MARATHON, FLORIDA ONLY:

City Attorney

ATTEST: WEILER ENGINEERING CORPORATION

By:
Edward R. Castle, Vice President

Date: 3/4/09

Exhibit "1"

Project Description

Provide coastal engineering services in support of a coastal feasibility study of Sombrero Beach and the adjacent canals to the east (Tingler Island). This scope of work will provide baseline beach and nearshore conditions, develop project alternatives to address shoreline and canal stabilization, and identify a preferred project alternative.

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Exhibit "2"

Scope of Services and Project Schedule

Provide coastal engineering services in support of a coastal feasibility study of Sombrero Beach and the adjacent canals to the east (Tingler Island). This scope of work will provide baseline beach and nearshore conditions, develop project alternatives to address shoreline and canal stabilization, and identify a preferred project alternative.

Sombrero Beach has had sand placed on it in the past, and the beach is possibly losing sand to adjacent canals and channels, which has resulted in shoaling of the canals. This could be due to storm events or it could be a natural occurrence.

Note: Old aerials show a land mass between the canal and the beach. Naturally the land will form again with sediment deposited where it previously existed. The Department of Environmental Protection's (DEP) Bureau of Beaches and Coastal Systems (BBCS) has identified the need to conduct a feasibility study in their May 2008 Strategic Beach Management Plan.

The following is an excerpt from FDEP Bureau of Beaches and Coastal Systems:

FDEP BUREAU OF BEACHES AND COASTAL SYSTEMS
STRATEGIC BEACH MANAGEMENT PLAN FOR THE FLORIDA KEYS REGIONS
STRATEGIES FOR INLETS AND CRITICALLY ERODED BEACHES
MIDDLE KEYS SUBREGION

SOMBRERO BEACH, VACA KEY, MONROE COUNTY
This is a 0.3 mile segment of critically eroded beach at the southwestern tip of Vaca Key. Sombrero Beach is a City of Marathon public park. The beach is sheltered from east and southeast wave activity. This results in the net sediment transport along the beach to be easterly into an adjacent canal on Tingler Island. The park facilities sustained major damage from storm tide flooding and landward sediment transport during Hurricane Georges (1998). In 2005, Hurricanes Rita and Wilma combined to cause minor to moderate beach and dune erosion. Hurricane Wilma also damaged much of the park's infrastructure. Significant sand losses have occurred as a result of overwash and sediment transport into canals on Tingler Island. Private interests on Tingler Island have constructed impermeable docks and groins, which should partially mitigate the loss of material into adjacent canals from Sombrero Beach.
Strategy: *Conduct a feasibility study to determine environmentally acceptable erosion control alternatives.*

With the FDEP Beaches and Coastal Systems Strategy as a guide we have developed the following plan for a feasibility study:

Task: Conduct a feasibility study of Sombrero Beach and the adjacent canals (Tingler Island) to the east.

Identify the problem: Is sand migrating from Sombrero Beach into the adjacent canals and if so why?

Solution: Determine the preferred project alternative to prevent the canals from shoaling and control beach erosion.

In order to conduct a feasibility study of this area there are several subtasks that need to be completed. First, a determination must be made as to how and to what extent the "longshore drift" and circulating currents affect Sombrero Beach. This will be a complicated process requiring analysis of data and the use of a modeling program. Second, a determination must be made whether "migration" is mainly caused by storm events, by longshore drift, or a combination of the two. USACE modeling programs, which are interactive Windows based systems that include a comprehensive collection of coastal engineering design and analysis software will be used. These programs include products developed by or for the US Army Corps of Engineers Coastal and Hydraulics Laboratory. The US Army Corps of Engineers Jacksonville District Coastal Engineering and Design Section and DEP staff in Tallahassee indicate that this software is the only recognized software for federally funded projects.

The feasibility study proposed by Weiler Engineering includes the following tasks:

1) Map the beach and the sea bottom. Conduct a benthic and bathymetric survey including sea-grass mapping showing the type of sea-grass [i.e. Turtle-grass *(Thalassia testudinum),* Manatee-grass *(Syringodium filiforme),* Shoal-grass *(Halodule wrightii)*], density, and location using a sub-foot GPS system either by boat or offset and doing the same mapping for shoreline mangroves. Vegetation is the most environmentally responsible technique to stabilize a shoreline and/or sea bottom and will be considered as a possible alternative for prevention of shoaling in the canals.

2) Gather wave and current information using a wave meter to measure the velocity and direction of the currents in several locations over a lunar cycle and develop a model for normal drift using CEDAS. Current velocity data from the adjacent canal will be included in the study to determine if the normal drift is affected by the currents associated with the canals.

3) Study historical storm events including the magnitude and direction of the storms. This data will be input into the model to determine what the effects were in the past and model the possible impacts of future storm events.

4) Collect samples from the sand and sediment at the beach, on the sea bottom, and in the canal. Use this data to determine if the sand that is shoaling in the mouth of the canal is actually coming from the beach area. If the sand is coming from the beach, it will be determined if the sand can be dredged and used to re-nourish the beach. This will require a comprehensive sieve analysis including a report showing sieve number, diameter in mm, diameter in phi units, weight retained on sieve, weight percent retained on sieve, cumulative weight percent retained on sieve. All weights and percentages will be recorded to the nearest 0.01 gm. A table of mean, median (d50), standard deviation (sorting), silt percent, and carbonate content will be provided. The report will include frequency and cumulative frequency plots of each sample, the spreadsheet used, and a cumulative frequency curve of the composite. Sieve sizes to be used: 3/4", 5/8", 3.5, 4, 5, 7, 10, 14, 18, 25, 35, 45, 60, 80, 120, 170, and 230.

5) An alternative analysis and alternative Course of Action are part of the study as well as a major part of the permitting process. Weiler Engineering's Environmental Scientist is experienced with the permitting processes of both the federal and state regulatory agencies and will coordinate with both the Coastal Engineering section of the ACOE and DEP Beaches staff throughout the course of the study. The least environmentally damaging, most cost effective alternatives will be listed and considered.

6) Endangered species coordination will be an important part of this study. An Endangered Species Use Evaluation of the beach and canal will include manatee, sawfish, and sea turtles. State listed species including mangroves will be considered as well. Weiler Engineering will coordinate with the USFWS/FWCC/NMFS, USACOE and Sanctuary personnel to determine what concerns will be addressed. The Army Corps will conduct either a formal or informal Section 7 consultation with either the USFWS or NMFS, or both. Formal consultation would require the agency to issue a biological opinion as part of the permitting process. There are construction restrictions because of turtle nesting. There is a volunteer force of watchers that walk the beaches every day during the nesting season. The information collected by this group will be used in the evaluation. Pat Wells, Manager of John Pennekamp Coral Reef State Park, is the state's expert for all the turtle nesting programs in the Keys. Weiler Engineering will consult with Mr. Wells regarding sea turtle issues. Weiler Engineering will also consult with the City's turtle expert as well as USFWS and NMFS staff.

7) Determine the best alternative. Weiler Engineering will work with the City of Marathon and State and Federal government regulatory agencies to determine the best and most preferred alternative. If a structure such as a groin is to be considered, a monitoring plan will be necessary to determine actual shoreline impacts. CEDAS models will be used to predict shoreline impacts with post-project monitoring used to compare observed impact with predicted impacts.

Project Approach

Beach Erosion: Determining Erosion

Changes in shoreline position

Changes in shoreline through processes of accretion and erosion can be analyzed in a geographic information system (GIS) by measuring differences in past and present shoreline locations. Several resources are available for both extracting shoreline positions and quantifying shoreline change. Using GIS, we will examine existing conditions and available historical datae. Historic and current shorelines can be used as a basis for determining shoreline change rates. It is helpful when determining long-term shoreline change to have sequential historic shorelines dating as far back as possible to the most recent available shoreline. On large tracks of shorelines, lidar shoreline extraction is a method used to map shorelines. Lidar data provides the advantage of deriving a true datum-based shoreline (such as the mean high water line or specific elevation contours).

Note: LIDAR (Light Detection and Ranging) is an optical remote sensing technology that measures properties of scattered light to find range and/or other information of a distant target. The prevalent method to determine distance to an object or surface is to use laser pulses. The term laser radar is also in use but is misleading because it uses laser light and not the radiowaves that are the basis of conventional radar. Lidar technology is expensive. We will see if any lidar data is available and if not we will use a manual technique utilizing sub-foot GPS equipment.

Procedure will be as follows:

A) Establish a Baseline: The baseline is an arbitrary line that can be drawn either shoreward or landward of shorelines to serve as the origination point of transects used for calculations.

Cast Transects: Transects are cast either manually or using an automated system (ie. DSAS).

Calculate the Rate of Change: The rate of change can be determined by measuring the distance between the shoreline/transect intersection points. Linear regressions are common statistical analyses for determining shoreline change rates.

B) Wave Refraction Modeling

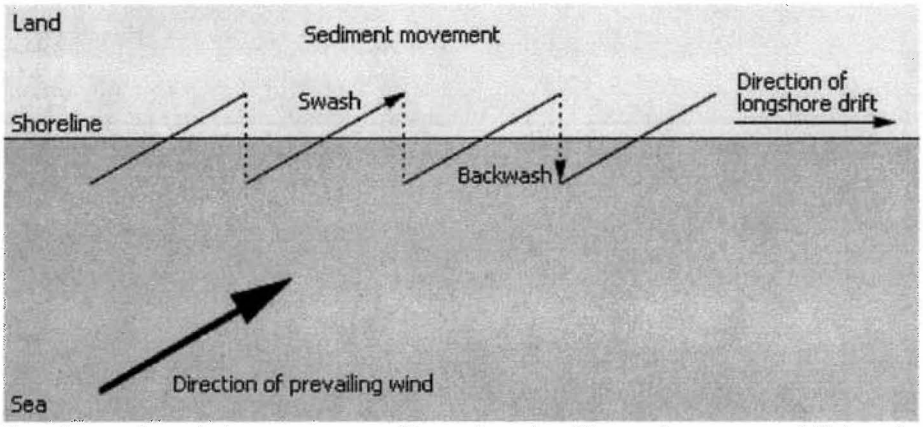
Using some of the ACOE modeling programs.

C) Litoral Transport or Longshore Drift:

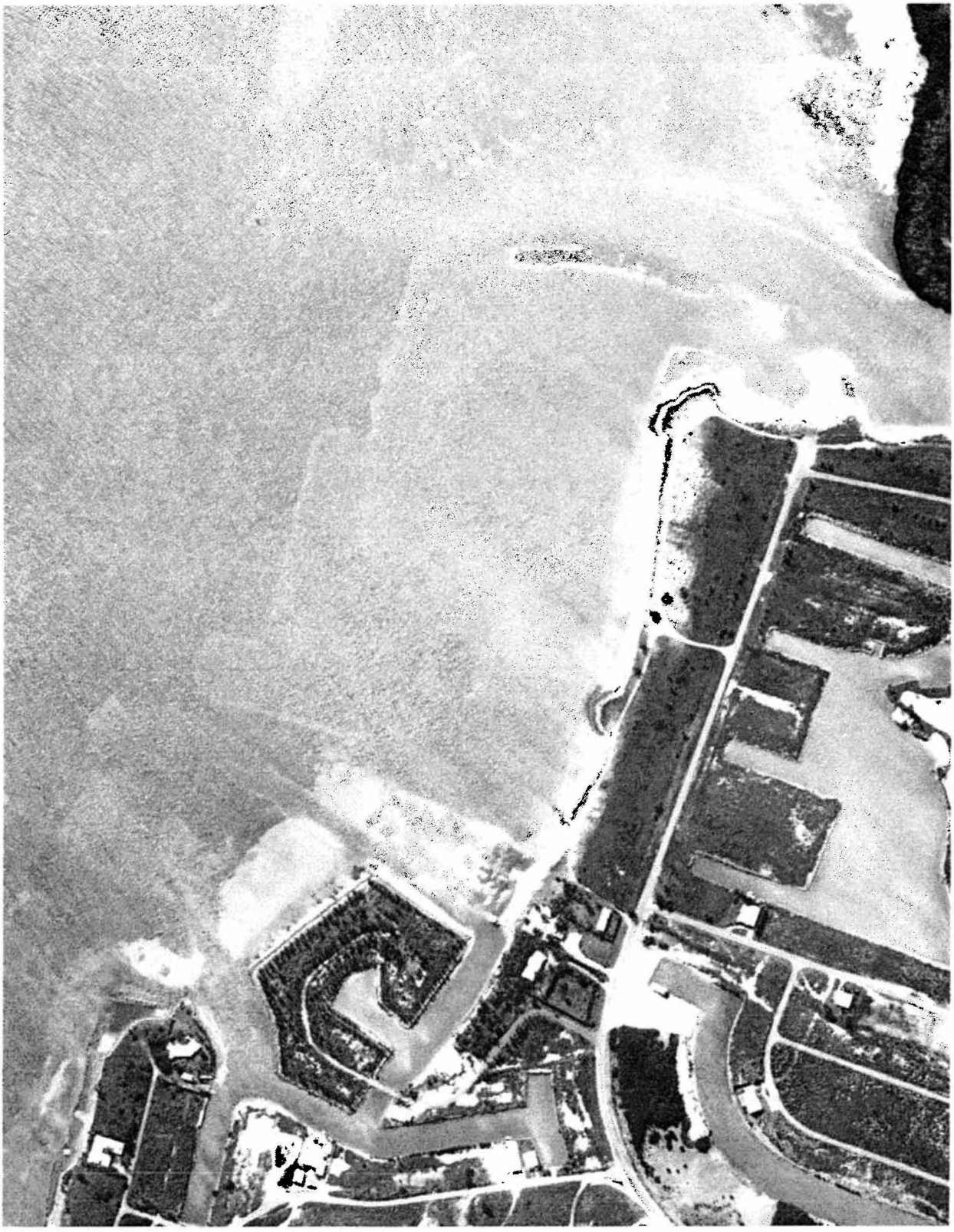
Longshore drift, sometimes known as shore drift or littoral drift, is a geological process by which sediments such as sand or other materials move along a beach shore. The US Army Corps of Engineers explains longshore drift as follows:

Longshore drifting is complemented by longshore "currents," which transport sediment through the water alongside the "beach." These currents are set in motion by the same oblique angle of entering waves that causes littoral drift and transport sediment in a similar "process". site:www.saj.usace.army.mil.

Longshore or littoral drift is the net movement of sand and other fine particles like shells along the coast line. The process occurs naturally and constantly on any shoreline where waves approach the shore obliquely at an angle other than 90° (the backwash leaves the shore at 90°). The effect of this is determined by factors such as the direction and fetch of the present wind and, in the long term, of the prevailing wind. Erosion on the beach works concurrently with longshore drift to straighten the overall shape of the beach by making it conform to the action of the waves. Any particles of sand that are not deposited parallel to the wave action are deposited in areas that receive the most pressure from incoming waves and wind. Beaches are continually shaped and shifted by long-shore drift.



Sombrero beach is more complicated and will require some additional modeling because of the adjacent canals/channels that are periodically dredged. Historical aerials show that these canals were much more defined when they were first dredged and that some land has been lost over the past decades (See FDOT 1963 aerial below)



1963 FDOT Aerial of Sombrero Beach

D) Development of a Sediment Budget

Sediment budget is a concept that applies to sandy and muddy shores. It is only one of three factors (sediment budget, sea level and wave energy) that control most land loss. Sediment budget refers to the balance between sediment added to and removed from the coastal system; in this respect the coastal sediment budget is like a bank account. When more material is added than is removed, there is a surplus of sediment and the shore builds seaward. On the other hand, when more material is removed than is added, there is a deficit in sediment supply and the shore retreats landward. Coastal erosion is a physical expression of a deficit in the sediment budget where nearshore processes remove more material from the shore than is added. Stated another way, coastal recession is the result of insufficient sediment supply compared to sediment removal.

Sediment budget also refers to the *sources* that deliver sediment to the coast and the places where it is temporarily or permanently stored. The storage sites are known as sediment *sinks*. To calculate the sediment budget for a coastal segment, one must identify all the sediment sources and sinks, and estimate how much sediment is being added to or taken from the beach each year.

Erosion along one stretch of sandy beach may be responsible for accretion or reduced erosion of a nearby beach in a downdrift direction if the sediment volume is sufficient and the available material is compatible with downdrift beaches. On the other hand, depletion of an updrift sediment source will initiate or accelerate retreat of downdrift beaches. The type of material eroded determines whether or not nearby beaches benefit from the erosion. For example, erosion of sandy beaches provides a ready source of sand for nourishment of downdrift beaches, whereas erosion of marshes and other muddy deposits usually does not contribute to the sand budget of adjacent beaches. Unfortunately, in the Florida Keys as compared to the rest of Florida's coastline there are not that many miles of beaches so erosion of one beach often doesn't contribut to the sand budget of another beach.

E) Currents and Tides, Traditional Control Structures, and Permitting

Currents Affecting Sombrero Beach:

Currents are very dynamic, and the Florida Current, the Gulf Stream, and the Loop Current are three dominant currents that affect the Florida Keys. The Florida Current results from the movement of water pushed from the Atlantic into the Caribbean Sea by the rotation of the Earth. Water flows northward through the Yucatán Channel into the Gulf of Mexico, where it is heated before entering the Florida Straits between the Florida Keys and Cuba. As it flows northward along the east coast of the United States, the Florida Current is often referred to imprecisely as the Gulf Stream. In fact, the Florida Current joins the Gulf Stream off the east coast of Florida. One of the primary currents that create the Gulf Stream is the Loop Current of the Gulf of

Mexico. Waters moving up from the Caribbean Sea past the Yucatan peninsula feed into the Gulf of Mexico. This current varies widely and can extend into the Mississippi delta or just barely venture north and east of the Dry Tortugas. This giant loop then moves water back out of the gulf and into the Florida Straits.. From there, it flows northwards along the Eastern Coast of the United States, crosses over the North Atlantic between 40 and 50 degrees Northern latitude, and enters the Norwegian Sea between the Faeroe Islands and Great Britain.

Tides and Circulation:

In the Florida Keys, water tidally fluctuates from the Florida Bay through the many cuts and natural channels into the Atlantic and visa versa. The Keys are a group of islands that reach over a hundred miles from Biscayne Bay to Key West. Henry Flagler connected many of these islands when he, in the process building the railroad and many bridges, filled in many of the natural cuts that separated the Atlantic from the Florida Bay. Hundreds of canals that drastically changed the natural circulation of the waters were dredged in and around these islands until the 1970s. Land was gained when the dredged material was placed adjacent to the canals and raised the elevation above sea level. Attached is a copy of a 1963 aerial showing Sombrero Beach and the adjacent canal separated by a more significant landmass.

Sand and Grain Size

Sand that is used for re-nourishment is carefully chosen to conform to specifications that FDEP beaches regulate. Weiler Engineering has experience working with sand mines and is able to ensure that the proper sand is recommended and utilized. This is important for turtle nesting as well as sediment movement/drift.

Beach Erosion Control Devices:

Groins: Groins are defined as wooden or concrete barriers built at right angles to a beach in order to block the movement of material along the beach caused by longshore drift. Groins are usually successful in protecting individual beaches, but because they prevent beach material from passing along the coast, this can mean that other beaches, starved of sand and shingle, are in danger of being eroded away by the waves. Since the referenced land mass was removed sometime between 1963 and the 1980s, perhaps a groin would prevent the natural tendency for the wave action to deposit land where it was previously.

Jetties: Jetties are structures used at inlets to stabilize the position of the navigation channel, to shield vessels from wave forces, and to control the movement of sand along the adjacent beaches so as to minimize the movement of sand into the channel. The sand transported into an inlet will interfere with navigation depth. Because of the longshore transport reversals common at many sites, jetties are often required on both sides of the inlet to achieve complete channel protection. Jetties are built from a variety of materials, e.g., timber, steel, concrete, and quarrystone. When

fully developed, the impounded sand extends well upward and outward toward the tip of the jetty.

Note: The jetty's major physical impact is the erosion of the downdrift beach. Before the installation of a jetty, nature supplies sand by intermittently transporting it across the inlet along the outer bar. The reduction or cessation of this sand transport due to the presence of a jetty leaves the downdrift beach with an inadequate natural supply of sand to replace that which is carried away by currents.

Breakwaters: Shore-connected breakwaters affect shorelines in much the same manner as jetties. Accretion occurs along the updrift junction of shore and structure and continues until longshore transport is deflected around the free end to the breakwater. Calm waters in the protected lee of the breakwater provide a depositional area that can rapidly shoal. Sediments trapped in the accretional area and terminal shoal are prevented from reaching downdrift beaches, and substantial erosion may result. Again, this will have to be evaluated, but constructing a groin, jetty, or breakwater may stop the shoaling pressure on the adjacent canal.

Regulations and Permitting

Any restoration activity, whether it is beach nourishment, dune restoration, dune construction, or shoreline stabilization requires federal, state, and local government permits and must comply with local comprehensive plans and ordinances. Weiler Engineering can do this in a timely manner, as their Environmental Scientist is very familiar with both Federal and State permitting requirements for both the State of Florida and the US Army Corps of Engineers (ACOE). A list of permitting requirements associated with the recommended Course of Action will be compiled.

Project Schedule

- Begin research of relevant existing data and coordination efforts with regulatory agencies upon execution of this Work Authorization
- Deploy current meter, initiate sediment sampling, seagrass mapping, mangrove mapping and bathymetric study within **30** days of notice to proceed.
- Collect current data for a tidal cycle , retrieving data and performing QA/QC checks on data throughout the period. Receive lab reports on sediment analyses. Mapping of seagrass, mangrove and bathymetric data will occur during this period as well.
- Begin modeling of current and wave action effects on sediment movement after completion of data collection, approximately **60** days after execution of Work Authorization.
- Complete modeling of the effects of normal tidal currents and storm events within **75** days of execution of Work Authorization. Models will include existing shoreline features and will examine the effects of possible alternatives to abate shoaling in the Tingler Island canals and related impacts on beach erosion.

- Draft report and recommended alternative with draft submitted to the City and regulatory agencies for comment within **90** days of execution of Work Authorization
- Final report and all deliverables submitted no later than **120** days after execution of Work Authorization.

Deliverables:

- Sea-grass mapping aerial and plan
- Mangrove mapping and plan
- Bathymetric survey
- Sand grain gradation report w/GPS coordinates
- CEDAS Modeling report-existing conditions/proposed conditions with coastal impacts
- Turtle nesting/Endangered species report/construction guidelines
- Feasibility Study with recommended Alternatives
- List of permitting requirements associated with recommended Alternatives

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EXHIBIT "3"

Payment Schedule

Research	$5500.00
Drafting	$2,250.00
Bathymetric mapping	$4,000.00
Seagrass mapping	$4,000.00
Mangrove mapping	$2,000.00
Sediment sampling	$3,200.00
Sediment Lab Analysis	$2,875.00
Current velocity measurement	$10,640.00
Data Analysis	$3,140.00
Numeric Models	$11,500.00
Report	$5750.00
Review and Edit	$640.00
Meetings	$1,820.00
Total	**$57,315.00**

Lump sum work with progress payment submitted monthly based on percentage completion of tasks.

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EXHIBIT "B"

PAGE 1 OF 2

CONSULTANT'S BILLING RATE

THE WEILER ENGINEERING CORPORATION

Principal	$ 125.00
Environmental Scientist	$ 125.00
Project Manager	$ 105.00
Professional Structural Engineer	$ 105.00
Registered Professional Engineer	$ 105.00
Professional Civil Engineer	$ 105.00
Professional Landscape Architect	$ 95.00
Registered Engineer Intern (E.I.T.)	$ 95.00
Senior Engineering Designer	$ 85.00
Construction Inspector	$ 65.00
Engineering Technician	$ 75.00
Clerical	$ 35.00

Reimbursable Expenses	
Blueprints	$ 2.30
Vellums	$ 10.00*(24 x 36 sheet)*
Mylars	$ 25.00*(24 x 36 sheet)*
Travel	Cost
(Travel outside of County)	
Overnight mail	Cost

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EXHIBIT "B"

PAGE 2 OF 2

GENERAL DESCRIPTION OF EMPLOYEE CATEGORIES

R. Jeff Weiler, P.E., President - Mr. Weiler is a Professional Engineer registered in the State of Florida. He is the President and Owner of The Weiler Engineering Corporation.

Edward R. Castle, P.E., Vice President - Wastewater Department Manager – Mr. Castle is a Professional Engineer registered in the State of Florida. He will be the Engineer in Responsible Charge for this project.

Rick Milloy, Environmental Scientist/Biologist – Environmental Consulting Department Manager – Mr. Milloy will be responsible for seagrass, bathymetric and benthic surveys and all permitting.

Todd Helt, GIS Manager – Mr. Helt will be responsible for all GIS data collection and post processing.

Michael Giardullo, E.I., Project Manager – Mr. Giardullo will be the primary designer and project manager for this project.

Serhiy Mashtakov, Senior Engineering Designer – Mr. Mashtakov will be the senior technician on this project.

Brett Moore, Coastal Engineer, Humiston and Moore Engineers – Mr. Moore and his associates will run the numeric models and report.

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