

COLLIER CREEK MODELING OUTLINE COLLIER COUNTY, FL

It is the intent of the County to conduct a modeling study based on the results of the Collier Creek Feasibility Study (CB&I, 2015). The initial dredging project in Collier Creek lasted approximately 7 years before maintenance dredging was needed. The last dredging project only lasted 2 years before hazardous navigation conditions appeared. Currently, safe boating is threatened during monthly high tides by severe currents and turbulence. The two primary modeling objectives of this project are to improve navigability in the inlet and to manage coastal sediments so that periodic dredging events will have a project life of at least 4 years.

The area of concern is the entrance to Collier Creek, which meets the Marco River on the north side of Marco Island in Collier County, Florida, and will focus on the area from monument H-14 (near the easternmost T-groin) east to H-16, and cross sections C-1 to C-11. The creek entrance is flanked to the east by the Ville de Marco West condominium (VDMW) and to the west by a terminal jetty on Marco Point, the eastern end of Hideaway Beach. This creek is used by local boaters to access Collier Bay, residences and the Esplanade Shoppes on Smokehouse Bay.

Services requested under an awarded contract may include but are not limited to the following:

- Conduct wave, current and tidal measurements in the throat of the inlet and offshore using a pair of ADCPs.
- Coordinate with FDEP State Lands and FDEP Beaches, Inlets & Ports (BIPS) about permit and land use feasibility.
- Calibrate the hydrodynamics based on ADCP measurements and calibrate the morphology changes between two different periods, one of the periods containing the December 2014 channel survey. The calibration should be sufficient for comparing alternatives. This survey was taken near the time of the latest complaints.
- Conduct three dimensional modeling of five or more alternatives using the calibrated model based on results of ADCP measurements. The alternatives analysis should examine both the hydrodynamic performance within the inlet and sediment transport from the adjacent Hideaway Beach as compared to the period containing the December 2014 survey condition. Performance of each alternative should be optimized, except the first one listed below.
 - December 2012 permitted plan with jetty relocation.
 - Enlarge Entrance Channel to Equilibrium Cross Section
 - Move Terminal Jetty West
 - Adjust Terminal Jetty: raise, lengthen, sand tighten and move west
 - Streamline the flow in Collier Creek
 - Remove the jetty on the west side of the inlet.
- Based on modeling results and environmental constraints, identify a location other than Hideaway Beach, its borrow areas and the Marco-Capri Pass Disposal Area, for economical long term dredge disposal and sand stockpiling.
- Prior to the start of modeling production runs, conduct a meeting with the County to review data collected and data proposed for use in modeling, including the time period, survey data and modeling parameters proposed for use in modeling, and a sediment budget.
- Conduct 2 meetings with the County and local stakeholders to discuss the initial results of the modeling and the final plan.
- Recommend a final plan with a detailed description suitable for preparing permits, plans, and specification. Identify what portions of the plan can be implemented without a new permit.

- Develop a sediment management plan that promotes longevity for the navigation project and minimize sediment transport from Hideaway beach into the inlet.
- Based on the model results, describe lessons learned for future consideration.
- To the maximum extent practical in modeling, use historic monitoring and construction surveys, NOAA and LiDAR data sets.
- Conduct a survey of selected profiles from the project area containing cross sections C-1 to C-11 and beach profiles H-14 to H-16 (CB&I, 2015).
- Determine if sand deposited in 2016 Hideaway Beach shoal dredging and placement in erosional area/scour area approximately 200 ft. west of Collier Creek jetty has been or will be eroded and deposited into Collier Creek. Document the impacts. Investigate the fate of the 1,800 cy of material placed on Hideaway Beach.
- Calculate an optimized calibration to address the amount of sand that can be placed on Hideaway Beaches without negative impact to the navigation through Collier Creek.
- Final modeling result are subject to third party peer review
- Highlight the modelers qualifications in successful projects/designs

A familiarity with the past and current permits for Collier Creek and the adjacent Hideaway Beach, along with the 2015 feasibility study is essential to the project. Several findings were identified in the 2015 feasibility study and are summarized as follows:

1. The entrance to Collier Creek has narrowed since 2005, when the terminal jetty was installed.
2. Infilling is occurring in Collier Creek.
3. Collier Creek experiences turbulent flow and strong currents around peak tides.
4. Too much sand is being transported to the creek, shortening the time between dredging events and causing further constriction of the inlet's width.
5. If the jetty cannot be moved west or modified, removal may be the best alternative.

A combination of the engineering alternatives presented in the feasibility study may provide the best results for this area. Based on the engineering analysis conducted for this feasibility study, it is recommended that the entrance to Collier Creek be widened 20 to 60 feet depending on location and that sand management practices be changed to reduce the amount of sand arriving at the terminal jetty and entering the creek. Widening of Collier Creek would be accomplished by relocating the terminal jetty further west; if the State Lands Department objects to the relocation of the terminal jetty, removal may accomplish some of the same goal. Improvements to the jetty structure can be implemented to make it more sand tight and further delay sand transport into the creek.

A model that performs waves, hydrodynamic and morphological simulations in the vicinity of Collier Creek in 3D is essential in order to evaluate the impact of the channel dredging and sediment transport from the adjacent beaches. A 3D model is specifically designed to model complex interactions between offshore and inlet bathymetry, structures, waves, tides, winds currents, sediment transport, erosion and deposition. Prior to making permanent changes to the inlet, a 3D model calibrated with ADCP data collection is essential to create and study the 3D flow field and identify what is causing the severe turbulence and currents.

The model will be setup in three dimensional (3D) mode and calibrated with existing bathymetry data, along with the locally measured water levels, currents and waves. This includes the development of a model computational grid, interpolation of the bathymetry, waves, hydrodynamic and morphological calibration, and production runs of the simulation alternatives

The modeling will be calibrated to existing conditions (December 2014 survey), which represents a time of severe turbulence and currents, and then compare that condition to 5 or more alternatives. One alternative shall be the inlet and jetty plan approved in the 2012 permit. To the maximum extent practical, the modeling set up will use existing surveys including construction and monitoring surveys of Collier Creek and Hideaway Beach, 2010 LiDAR Survey, 2015 LiDAR survey when available and NOAA bathymetry.

As part of the modeling effort, a sediment budget will be developed based on a time period containing the December 2014 survey, when turbidity was known to be severe. The sediment budget will be used in the morphology calibration for the years selected and cover just the project area sufficient to define the sediment by passing into the inlet.