
MEMORANDUM – COASTAL ENGINEERING REVIEW**Ocean City Inlet Navigation Improvements – 2D Model Report Review
TAR 21414**

16 November 2022

INTRODUCTION AND TAR

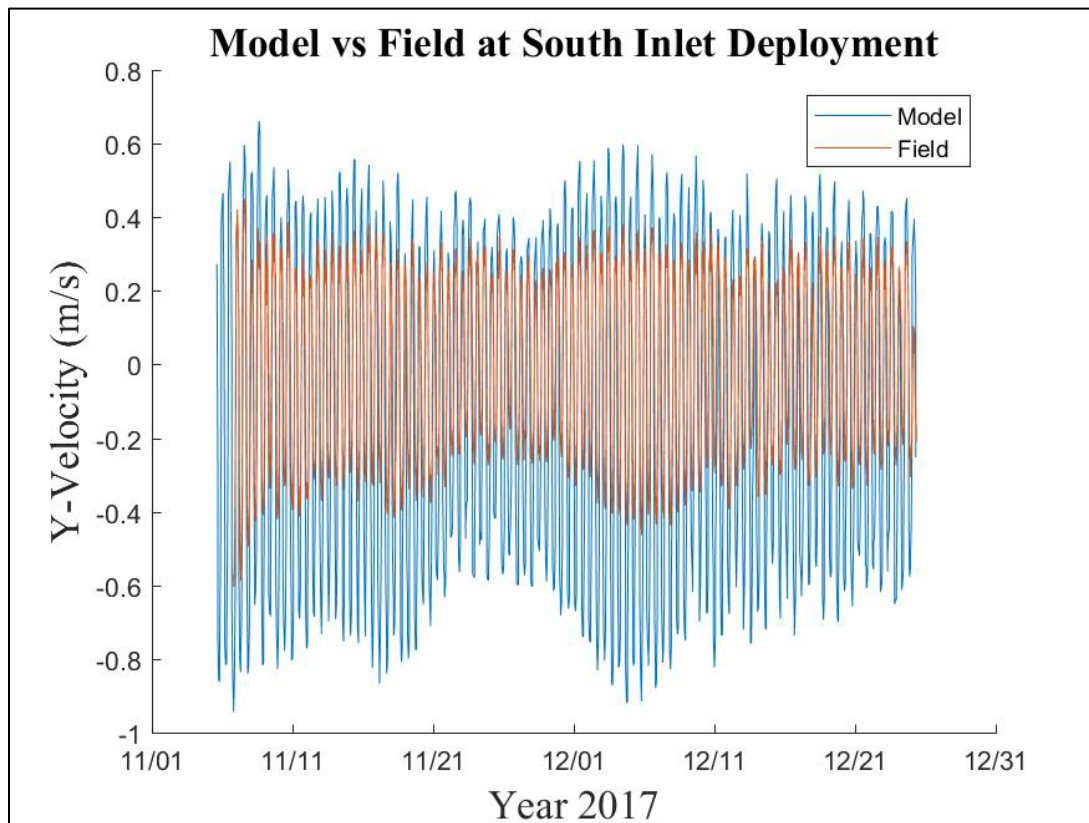
The US Army Corps of Engineers (USACE) has prepared the *Ocean City Harbor and Inlet and Sinepuxent Bay Project, Section 107 Inlet Navigation Improvements, Environmental Assessment* (draft EA) to analyze proposed changes to the navigation channel at Ocean City Inlet (draft EA; USACE – Baltimore District 2022). USACE has also prepared a modeling report, *Ocean City Inlet and Scour Hole 2D Numerical Modeling of Hydrodynamics and Sediment Transport* (modeling report; USACE Engineer Research and Development Center 2022) to analyze the effectiveness of the proposed changes and potential impacts. The National Park Service has requested an in-depth technical review of the modeling report. The National Park Service also seeks to better understand the impacts the proposed project will have on northern Assateague Island and recommendations for post-construction monitoring to document actual effects of the project on park resources. The modeling report presents information on the numerical model setup, validation, and results that USACE used to present their understanding of existing and expected conditions related to the proposed project.

USACE had requested comments from the National Park Service by early May 2022 so that USACE could issue the environmental assessment for public review by late May 2022. Given the short time for review, an initial review in May 2022 was conducted by EA to provide a list of questions for USACE to help the National Park Service better understand USACE's modeling and analysis and impacts to park resources. These questions were provided to the National Park Service for review and forwarding to USACE in May 2022 and are copied below for reference.

The National Park Service additionally requested recommendations for a beach monitoring program for ASIS resources, which can in turn be provided to USACE as a recommendation for post-construction monitoring to verify the numerical model studies. These are provided following the initial questions list.

INITIAL QUESTIONS FOR USACE**Questions on the Ocean City Inlet and Scour Hole 2D Numerical Modeling of Hydrodynamics and Sediment Transport**

- Figure 20 on page 23 shows the modeled results from the South Inlet gage ranging from 1.5 to 2 times the magnitude of the measured data (refer to reproduction below). This seems excessive, but there is no explanation for this variation of the model vs. field information at the location. Can this be explained?



- Page 70 states the noted modeled erosion is a function of sea level rise (SLR) and not of the proposed project. As the model has identified erosion effects with the modeled SLR on Assateague Island, what would be the recommended treatment to prevent this erosion from occurring on park property?
- What is the comparison of the 'with' and 'without' project for the 2075 SLR scenario? All the comparisons within this section of the report are of the base year conditions to SLR, the comparison between no-project and with project for SLR should also be made to confirm that the erosion is independent of the project. This analysis of the year 2075 with and without project should not require any additional model runs, just the text comparison of the already completed simulations.
- The report describes overall lengths and areas of erosion/sedimentation, however yearly volume accruals are not presented. These values would be vital to inform maintenance dredging operations/frequency and should be added to the report.
- Please confirm that the source of the 2075 SLR projection is the Department of the Army guidance document EP 1100-2-1 Procedures to Evaluate Sea Level Change: Impacts, Responses and Adaptation. If so, please provide reasoning and justification for its use as the document has an expiration date noted of 2019.

**Questions on the Ocean City Harbor and Inlet and Sinepuxent Bay Project, Section 107 Inlet
Navigation Improvements, Environmental Assessment, dated February 22, 2022**

- From page 1 of the executive summary, “Destruction of benthos would occur in the realigned channel inlet area to be dredged. Previous USACE documents have assessed impacts of maintenance dredging, and thus this EA does not assess future channel maintenance dredging.” Can the effects of the maintenance plan for the projects be described/confirmed with the newly modelled sedimentation rates? Additionally, can the specific USACE documents be referenced?
- Page 8 references funding shortfalls (both from USACE and the National Park Service per comments from Chris Spaur) that have limited maintenance dredging operations – how will the new shipping channel alignment change maintenance operations and will the lower funding availability be able to address the changed needs of the system?
- Page 15 references another numerical modeling report of the alternatives as report ERDC/CHL LR-21-6. Has the National Park Service had a chance to review this report as well? It uses different models (CSTORM-MS) to determine surge and flood impacts from the structures. This model could be the basis for the decision to not use a 3-D model for the sediment transport and should be reviewed to confirm.
- Page 15 makes the assertion that a longer duration model period for sediment transport is unnecessary because “it was not anticipated that substantial further environmental changes would occur.” This statement should be further explained in the text. More specifically the following questions should be considered and addressed as needed; is this assumption based upon the maintenance program? Have sensitivity tests been done on the model platform to detail that one year is sufficient to predict future impacts? Does the sediment movement show signs of reaching equilibrium when examined on a month-to-month basis? How does the sediment transport react to a major storm event when it has built up (or eroded) as shown in the sediment transport model when the surge storm events are run? And how does any of this change if budget shortfalls and vessel availability continue to hamper the sand bypass project?
- Page 24–25 Section 2.4.3 Project Monitoring and Performance — this section is incomplete and does not present the plan for post-construction monitoring.
- Will an analysis of the cumulative impacts of the proposed work be completed?

BEACH MONITORING RECOMMENDATIONS

Beach monitoring is a useful and practical tool to verify post-construction impacts and compliance for a dynamic system such as ASIS. When performed correctly, such monitoring activities can provide accurate data to quantify the beach erosion/accretion that is occurring at each beach profile location.

Monitoring options that could be implemented at Assateague Island to document the impact of plan implementation include deploying photographic loggers, the use of sophisticated laser scanning survey equipment, or the collection of beach transect elevations and horizontal coordinates. Photographic loggers collect periodic imagery to capture a visual record of any changes at the site and thus provide a qualitative analysis of the impacts. This method is not recommended for a post navigation channel modification

project due to the variability in photograph interpretation. Sophisticated laser scanning survey equipment and beach transect monitoring are the best options for potential use at this site.

General practices that should be followed regardless of method are as follows.

- Beach profile transects should be perpendicular to the shoreline.
- Transects should be spaced to represent the area of change to be calculated.
- Azimuth associated with each transect should be noted.
- If possible, measurements should be taken around low tide.
- Transects should extend below the waterline and have a defined end point.
- The time should be recorded for all water edge/in water measurements.
- Elevation measurements should be recorded at a relatively consistent interval.
- Additional elevation measurements should be taken at points of inflection and features of interest (i.e., slope changes, wrack lines, etc.).

As noted above, sophisticated laser scanning and beach transect monitoring are recommended for monitoring changes to Assateague Island as a result of the channel modifications proposed for Ocean City Harbor and Inlet and Sinepuxent Bay. Several specific methods for each type of monitoring are described below. These methods are based on standards developed by USACE (EM 1110-1-1005 dated 2007 and EM 1110-2-1003 dated 2013), each with variations in level of accuracy, level-of-effort, and associated equipment rental/purchase costs.

Beach Transect Monitoring Methods

Survey terrestrial profiles with a laser level – This option does not require use of special software, can be taught to new staff relatively quickly, and does not require purchase of expensive equipment. This method is the least costly and easiest to implement at a large scale. However, the overall accuracy of the monitoring data is less than the other methods.

Survey terrestrial transects with a total station – This requires the use of expensive equipment, which can either be purchased or rented, and requires training of field staff in total station operation. The total station method is a detailed system of monitoring which requires moving the system along the beach and recalibrating each time. This can take time and the recalibration can be complex in some cases and may lead to data loss if not done correctly.

Laser Scanning Methods

Survey terrestrial profiles with Real-Time Network Global Navigation Satellite System (RTN-GNSS) equipment (Recommended method) – This requires recurring equipment rental or the purchase of specialized equipment, and appropriate training to operate the equipment. This method provides better data quality than a laser level, and a more user-friendly system than the total station survey method.

Survey offshore profiles with Real-Time Network Global Navigation Satellite System (RTN-GNSS) equipment – Depending on the defined endpoint for each transect, deeper water than is safe for wading may be encountered. The offshore portion of a transect can be measured using RTN-GNSS equipment mounted to a vessel. This method requires the highest level of training of all listed, as well as licensure and skill to maneuver a vessel effectively.

LIDAR – Light Detection and Ranging (LIDAR) technology measures the amount of time it takes a laser to reflect from an object. The benefits of using LIDAR for survey work are numerous and include the ability to collect large amounts of data with very detailed resolution. Additionally, there is limited impact to the site as the equipment is not required to physically touch the surveyed area. This method has several drawbacks that should be considered and are detailed below.

LIDAR relies on the reflection of laser light to determine the distance from the collection device to the survey surface. One disadvantage of this method is its inability to penetrate the water surface to gather subsurface information reliably. Additionally, any obstruction between the survey surface and the collection device will register as a surface, for example any vegetation of sufficient size to reflect a laser beam will be registered by the equipment. In areas where dune grasses or wetlands are present, this may cause an error of +/- several feet in the LIDAR survey surface within vegetation zones. While tree canopies typically cause this error, dense grasses can also result in significant error in the LIDAR data collection. This error may be somewhat mitigated by “ground truthing,” a practice where horizontal and vertical coordinates are collected by standard survey methods to provide a regional correction factor for the presence of the vegetation and can reduce the error in many cases from +/- several feet to closer to +/- a foot. However, it should be noted that ground truthing does not provide the fine detailed resolution that LIDAR does, with the correction factors from a single point being applied over large areas.

The errors which can arise during LIDAR data collection can be compounded when the data is used for design purposes. Small errors in surface elevation multiply over the entire area, potentially leading to significant errors in volume calculations. These volume calculations are critical in monitoring for erosion at a site such as ASIS. Additionally, licensed surveyors are shifting their approval approach from signing off on the full survey to only endorsing the control and check points for the data collection. This change in approach is due to recognition by the professional surveying community of the level of accuracy attainable by LIDAR data collection isn't the same as traditional survey methods.

Imagery Options

Satellite imagery – The ability of the federal government to use satellite imagery presents a unique opportunity to leverage new technologies for monitoring applications. Possible inclement weather, poor resolution, and variable time (and thus tidal elevation) can affect historical satellite imagery which may present difficulties in data processing for monitoring or erosion tracking purposes. Future scheduled recurring image collection efforts at a monitoring location would allow proactive selection of days and times where the tide is as low as practically possible and would provide additional image collection which can be used to compensate for the unpredictability of cloud cover and other meteorological factors which may have affected existing imagery resolution.

Using LIDAR and Imagery to Supplement Surveys – While the discussion of LIDAR and satellite imagery so far has explained the difficulties in relying on this technology solely, neither tool should be discounted as they can provide significant supplemental data. Satellite imagery over the seasons can provide insights into the evolving vegetation and ecosystem as the sediment reaches equilibrium, and analysis of any collected LIDAR data can provide shoreline elevation information when compared to NOAA water level buoy data. These supplemental analyses may provide earlier detection of ecological issues and should be leveraged whenever possible. Historic imagery information can provide a baseline for the system at ASIS, ensuring that the erosion rates before the proposed USACE project are understood and then compared to the evolving system after construction.

MONITORING RECOMMENDATION

The RTN-GNSS method is recommended to be implemented annually for a five-year period after construction. To capture the most available data, it is recommended to schedule this survey up to quarterly during extreme low tides in either the spring or the fall, allowing the largest possible portion of the beach to be captured. This method uses an RTN-GNSS rover unit and a virtual reference station network. While the initial setup can be complex, the single setup allows for the completion of all profile surveys with relative ease. It is critical to verify that the RTN-GNSS unit is working properly by comparing the X, Y, and Z output against a known benchmark before performing any measurements. The required materials list and step-by-step method for implementation are provided in Attachment 1.

Figure 1 is taken from the draft EA and shows the proposed project. With the modifications to the breakwater and the installation of a new jetty to the northeast, a robust monitoring plan will be needed to ensure early detection of problems. The draft EA suggests monitoring an area 3,280 feet (1 kilometer) long from the jetty south along the bay side of the island. Monitoring of the actual breakwater and adjacent land is also recommended. In reviewing historical aerial imagery, this recommendation matches the range of historic impact from the oceanside jetty. Figure 2 presents the recommended beach monitoring survey transects running south from the newly constructed jetty approximately 3,300 ft (1.01 km) with transect spacing approximately 50 feet (15 meters) to 100 feet (30 meters) apart. This spacing range is close enough to capture small shifts in sedimentation rate. The sediment transport model report shows the northernmost section of the island immediately behind the proposed breakwater structure as having the most significant change in sedimentation patterns. For this reason, this area is included in the recommended survey transects to verify the breakwater functions as expected. Additionally, monitoring in this region will verify there is no loss of the newly constructed dune features either from loss of fine material through the constructed jetty or from wind erosion. This proposed plan should be considered an initial survey regime, with the ability to add additional transects if significant impacts are observed towards the southern limits of the survey area. This plan may require adjustments as the system progresses towards equilibrium.

Figure 1: Proposed USACE alterations to the north shore of Assateague Island.

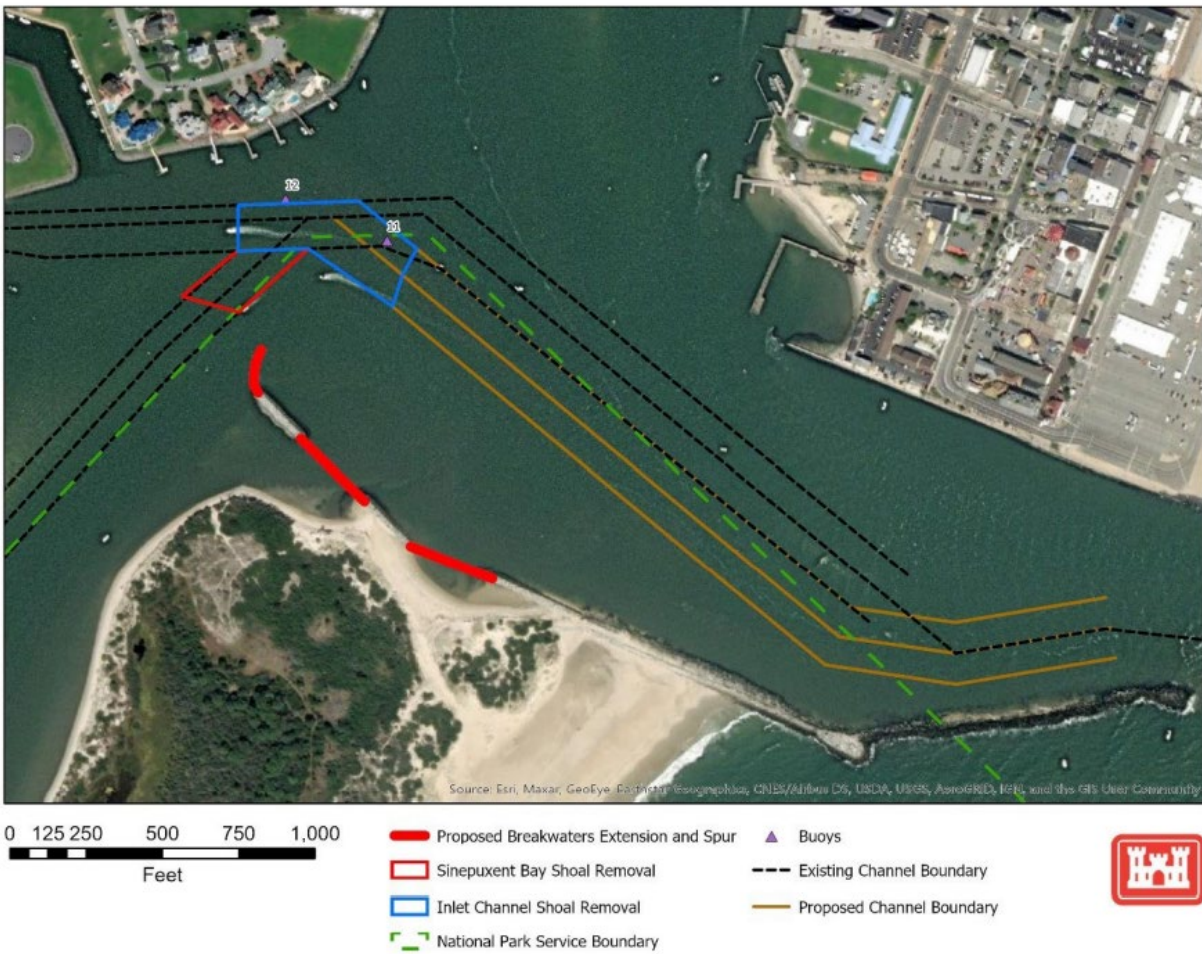


Figure 2: Proposed beach monitoring survey transect layout along the northern shore of ASIS.



REFERENCES

United States Army Corps of Engineers

- 2007 Engineering Manual 1110-1-1005 *Control and Topographic Surveying*.
- 2013 Engineering Manual 1110-2-1003 *Hydrographic Surveying*.
- 2022 Ocean City Harbor and Inlet & Sinepuxent Bay Project Worcester County, Maryland Inlet Navigation Improvements Draft Environmental Assessment. US Army Corps of Engineers, Baltimore District. Available online:
https://www.nab.usace.army.mil/Portals/63/1_OC_DRAFT-EA_MAY2022.pdf. Accessed:
August 31 2022.

United States Army Corps of Engineers – Baltimore District

- 2022 *Ocean City Harbor and Inlet & Sinepuxent Bay Project Worcester County, Maryland Inlet Navigation Improvements Draft Environmental Assessment*.

United States Army Corps of Engineers Engineer Research and Development Center

- 2022 *Ocean City Inlet and Scour Hole 2D Numerical Modeling of Hydrodynamics and Sediment Transport*.

ATTACHMENT 1

Required Materials:

- RTN-GNSS rover
- Rover controller/data collector
- Rover rod (3.28 ft; 2-meter)
- Wide base topo shoe
- Measuring tape (sized based on maximum expected beach width)
- Line level
- Survey pins
- Standard compass
- Batteries (include spares)
- Camera (with at least 12-megapixel resolution)
- Data sheets
- Tide charts

RTN GNSS Step-by-Step Method:

1. Complete the relevant information on the data sheet for the transect (date, time, transect ID, etc.).
Note: each transect will have its own data sheet to help eliminate possible confusion/user error.
2. Locate the start of the transect to be measured by finding the correct reference benchmark.
3. Use the compass to align to the azimuth associated with the reference benchmark/transect.
4. With the general transect line direction now known, it is advisable to take photographs from the starting point down the length and parallel to the shore in both directions. Additionally, photographs should be taken of the reference benchmark and of any interesting features along the transect with notes added about each to the data sheet. A photograph should also be taken from the waterline looking back up the transect to the reference benchmark as well.
5. When the initial setup is complete, begin readying the RTN Rover. Next, attach the RTN rover unit to the top of the rover rod and attach the controller/data collector to the rover rod as well. Turn on both the RTN rover unit and the controller/data collector and connect to the virtual reference station network.
6. In the controller/data collector point ID field, add the transect ID name. The points should automatically name themselves with the transect ID followed by an ascending point number for each subsequent measurement along the transect. Begin recording measurements, which should be collected no further than every 13 ft (4 meters) for constant slopes. Data points should be collected at all slope changes and at any other notable features along the transect down to the waterline. The distance of each point from the dune high point should be recorded on the data

sheet. For measuring the distance, the measuring tape and line level should be used to help ensure the measuring tape is level in the horizontal plane. Alternatively, the use of a digital range finder that can find horizontal distance can be used. Each point should be recorded using at least a 3-second occupation time

7. The first measurement to be recorded is at the reference benchmark. Using the controller/data collector, record the measurement at the reference benchmark. As a failsafe, the measurement should also be recorded on the data sheet for the transect in case the controller/data collector file becomes corrupted. Compare this recorded elevation with the previously recorded elevation(s) at the reference benchmark to ensure the equipment is working properly. Note, the RTN rover can have trouble with signal near large obstructions, such as buildings and heavy vegetation. Also, care should be taken to keep the rover rod plumb when recording measurements. An example of the setup (a) and field measurement process (b) is shown in Figure A-1. Continue measure along the transect and when the water line is reached, measure additional points at the distance interval or relevant features/slope changes. The practicality and number of water points that can be measured will vary from transect to transect. Note the time associated with the waterline and in-water measurements.
8. When finished with the measurements, ensure the controller/data collector has saved the transect data, the data sheet has been completed, and all necessary photographs have been taken before moving to the next transect location.
9. Lastly, when finished profiling for the day, export the project file transect data from the controller/data collector and save it on a local hard drive and/or computer. Take the raw exported file for the day and import the data into the template spreadsheet format for processing. The spreadsheet will then process the measured data and produce beach profile plots for each transect.

Figure A-1: RTN Rover and Controller/Data Collector Setup – Example of a typical RTN rover and controller/data collector setup (a) and field use of the equipment by EA personnel in a beach environment (b).

