



2nd ANNUAL POST-CONSTRUCTION MONITORING REPORT

POST-CONSTRUCTION BATHYMETRY, SHORELINE, AND STRUCTURAL MONITORING

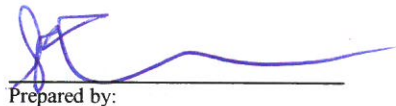
**MON LOUIS ISLAND RESTORATION PROJECT
USACE FINAL PERMIT# SAM-2014-01046-LET**

FOWL RIVER, MOBILE COUNTY, ALABAMA

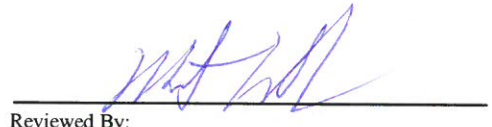
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TABLE OF CONTENTS

<u>Title</u>	<u>Page</u>
INTRODUCTION.....	1
CONSTRUCTION OVERVIEW	1
SURVEY CONTROLS & DATA PROCESSING	2
BACKGROUND - 2018 MONITORING SITE TOPOGRAPHY/BATHYMETRY	3
Marsh Elevation	3
Rock Dike Breakwater	4
Near-Shore Bathymetry Immediately Adjacent to Breakwater	5
Bathymetric Monitoring of Shoreline Change Transects.....	6
Post-Storm Monitoring	7
Open Water Dredge Material Placement Site / Borrow Area	7
Fowl River Navigation Channel	8
CURRENT MONITORING ACTIVITIES	
Bathymetric Monitoring of Shoreline Change Transects.....	8
FUTURE MONITORING ACTIVITIES	8
Bathymetric Monitoring of Shoreline Change Transects.....	8
Multi-Year Aerial Photo Analysis of Shoreline.....	8
Marsh Restoration Success Monitoring	9
REFERENCES CITED	10
APPENDIX	
Appendix A	Shoreline Change Monitoring Figures

INTRODUCTION

The Mon Louis Island Restoration Project was implemented by the Mobile Bay National Estuary Program (MBNEP) with funding from the National Fish and Wildlife Foundation Gulf Environmental Benefit Fund (NFWF-GEBCF). The restoration project included construction of an approximate 1,540-ft. continuous rock (rip-rap) dike breakwater (also referred to as the *rubble mound breakwater*), and 4 acres of tidal marsh along the bay side of the northern tip of Mon Louis Island (MLI) at the mouth of east Fowl River in Mobile County, Alabama. The project also included maintenance dredging of the Fowl River navigation channel with funding from the State of Alabama through the Deepwater Horizon Incident (DWHI) grant application program. The constructed breakwater/marsh system provides protection for approximately 8 acres of pre-existing tidal marsh restored during a previous project in 2005.

Project activities requiring approval from the U.S. Army Corps of Engineers (USACE) were authorized in Permit Number SAM-2014-01046-LET dated March 9, 2016. Among other conditions, the permit specifies the permittee perform various pre- and post-construction monitoring activities in accordance with the “*Proposed Bathymetry, Shoreline, and Structural Monitoring Plan, Mon Louis Island Marsh Restoration, Mobile Bay National Estuary Program*,” (version *DRAFT, 9-11-2015*) which was submitted to the USACE by Thompson Engineering on 9-11-2015. This report provides an update on post-construction monitoring activities required in the permit, as described in the *2015 Monitoring Plan*.

CONSTRUCTION OVERVIEW

Project construction began in July 2016, with the construction of the temporary access channel and rubble mound breakwater. Following completion of the rubble mound breakwater in September 2016, dredging was conducted at a nearby off-shore disposal area to provide fill-material for marsh creation on the site. The Fowl River Navigation Channel dredging was completed in October 2016.

Following completion of the marsh fill, the project was left to settle for several months, during which time, routine settlement monitoring was conducted. An additional topographic survey was performed on the marsh fill surface in late December 2016, when monitoring indicated the majority of the marsh settlement had occurred. The December 2016 topographic survey was then utilized to develop the final marsh grading and planting plan in January 2017. The final grading

plan included excavation (in the fill area) to create a tidal creek, and the construction of a minimal earthen berm on the east and west sides of the marsh fill. The berm, which was constructed with material from the tidal creek excavation, was created to provide short-term protection of the marsh fill prior to establishment of the permanent vegetative cover. Final marsh grading was performed in March and April 2017, and planting was completed in May 2017. Supplemental planting was performed in September 2017, following observation of some plant die-off.

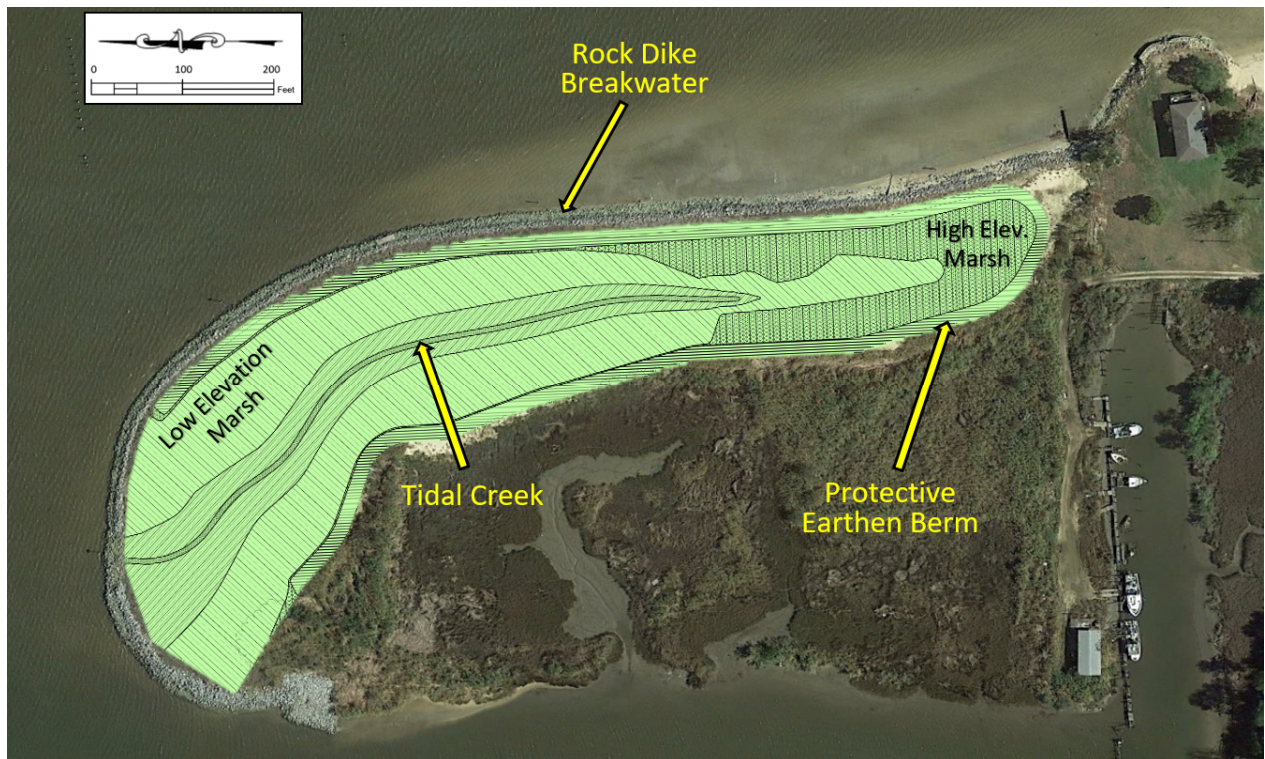


Figure 1. Constructed marsh and other site features.

SURVEY CONTROLS & DATA PROCESSING

Horizontal coordinates are referenced to Alabama State Plane Coordinate System, West zone (0102), established by Real Time Kinematic (RTK) GPS. Vertical datum is NAVD 88 established also by Real Time Kinematic GPS using 2009 geoid. Vertical control was tied to a temporary on-site benchmark previously established by Thompson Engineering.

The surveys were performed using both hydrographic (bathymetric) and topographic surveying techniques. Field survey data points were imported into AutoDesk Civil 3D, which was utilized to create a three-dimensional digital terrain model, allowing for data presentation as profile plots

for each transect. Additional specifics related to individual survey activities are found on the corresponding output figures found in Appendix A of this report.

BACKGROUND - 2018 MONITORING SITE TOPOGRAPHY/BATHYMETRY

Marsh Elevation

The Contractor provided an as-built marsh surface topographic survey, which was performed by Lawler and Co., on April 18, 2017, following completion of the final marsh grading activities. A subsequent marsh surface topographic survey was performed by Thompson Engineering in June 2018. For comparative purposes, 30 representative spot elevations were selected from the April 2017 survey and compared to the closest available spot elevation from the June 2018 survey. Appendix A of the 2018 monitoring report contains a figure depicting the location of the 30 elevation comparison points in the restored marsh area. The figure also contains a table comparing elevations at those points in 2017 and 2018.

Of these 30 points 18 (60%) points fell within one tenth of one foot (1.2 in.) of their closest relatable points and 25 (83%) fell within one quarter of one foot (3 in.) of their closest relatable points. The average of all 30 points from the 2018 survey was five one hundredths of a foot (0.6 in.) higher than the average of all 30 points from the 2017 survey. Potential sources of vertical error to consider include, relative positioning of comparative points, GPS error, and marsh surface survey instrument impacts.

A review of the data indicated very little change in marsh surface elevations. As described in the Post-Storm Monitoring section, erosion of the protective berm along the eastern side of the marsh (adjacent to the rock breakwater) during Tropical Storm Cindy caused a lowering in elevation at the berm location and a raising of surface elevations just to the west. It is possible wave action from this event and from Hurricane Nate also caused other minor shifts in fill material within the marsh. Generally, the survey data along with field observations did not indicated any appreciable changes in marsh surface elevations.

Per the 2015 Monitoring Plan, no future surveys are required for this task.

Rock Dike Breakwater

A post-construction survey of the breakwater was performed by Thompson Engineering in December 2016 following the initial marsh fill settlement period. The survey included transects of dike cross-sections at a spacing of 100 feet. A similar survey of the breakwater elevations was performed by Thompson Engineering again in June 2018. Visual surveys with photographic documentation (See Figures 2 and 3, dated August 9, 2018) were performed to document any mobilization or fracturing of rip-rap. A figure depicting the location of the breakwater transects, and additional figures comparing cross-sections at each station in both years surveyed was provided in Appendix B of the 2018 monitoring report.



Figure 2. Representative view of rock dike breakwater facing south (marsh on right)

A review of the comparative transects indicated some of the June 2018 transects are slightly lower than some of the December 2016 transects. This may indicate some slight settlement at these areas. Potential sources of vertical error to consider include, relative positioning of comparative cross-section survey lines, GPS error, and the large rock size. Because some of the

rip-rap pieces are three to four feet in diameter, the specific location a cross-section elevation shot is taken may result in different transect line shapes. Field observations did not indicate any displacement or fracturing of rip-rap, nor did they indicate any changes on overall cross-section.



Figure 3. Representative view of rock dike breakwater facing north (marsh on left)

Per the 2015 Monitoring Plan, no future surveys are required for this task.

Near-Shore Bathymetry Immediately Adjacent to Breakwater

As depicted in Appendix C of the 2018 monitoring report, a bathymetric survey of nearshore water bottoms (within 200 feet of the rock dike breakwater alignment) was performed in July 2016, prior to construction. A post-construction survey of this same area was performed in June 2018. These surveys were conducted from a boat using echo sounding equipment to find the water bottom relative to the water surface. Areas too shallow to access by boat were surveyed on foot with a pole mounted survey GPS unit, whereby the pole was placed on the mudline to find the water bottom. Potential sources of vertical error to consider for those portion of the survey

accessed on foot include GPS error, and mudline surface survey instrument impacts. Potential sources of vertical error to consider for those portion of the survey accessed by boat include echo sounding error, wave effects, and water level variations during the survey.

A review of the survey data indicated some near shore accretion may have occurred, in areas adjacent to the southern end of the rock dike breakwater. Survey data indicated possible accretion of 0.5 ft. to 1.0 ft. at varying locations south of approximate Station 8+00 and between 0.0 ft. to 0.5 ft. up-station from approximate Station 8+00. This accretion was potentially the result of sedimentation occurring during and shortly after placement of fill material, which was used to create the marsh. As coverage of marsh vegetation continues to stabilize those soils, the apparent accretion may decrease in the nearshore areas along the breakwater. No appreciable change in elevation was noted for portions of the transects lying further offshore. As expected, deeper 2018 elevations were observed at Stations 14+00 and 15+00, and are considered to be the direct result of dredging the Fowl River Navigation Channel.

Per the 2015 Monitoring Plan, no future surveys are required for this task.

Bathymetric Monitoring of Shoreline Change Transects

A series of bathymetric monitoring transects, extending 1,800-ft. offshore, were established to aid in the identification of potential changes to shorelines adjacent to, and south of the restoration project. The beginning of each transect located south of the proposed breakwater were fixed at the mean high water (MHW) line at the time of the pre-construction survey. Transects adjacent to the breakwater began at the point where the mean high water (MHW) line would be intersecting the proposed rubble mound breakwater.

A pre-construction bathymetric survey along the 1,800-ft. long transects, was performed in June 2016. The first post-construction survey along the transects was performed in June, 2018, following final construction. Survey methods and potential sources of error for this task were as described in the previous section, *Near-Shore Bathymetry Immediately Adjacent to Breakwater*.

In Appendix D of the 2018 monitoring report, a figure depicts the location of the 1,800-ft. long transects for profile comparison. Also provided were additional figures comparing profile views at each station in both years surveyed.

A review of the transects adjacent to the marsh restoration construction indicated no discernable bottom changes were observed. A review of the transects south of the marsh restoration construction did not yield any discernable changes.

Post-Storm Monitoring

In late June 2017, Tropical Storm Cindy traversed the northern Gulf of Mexico and created high water in Mobile Bay, sufficient to inundate the entire project site. East-northeast to southeasterly winds created significant waves at the project site. Peak sustained winds were in the range of 18 knots between 6-21-17 00:00 GMT and 6-22-17 00:00 GMT as indicated at NOAA/NOS/CO-OPS, Coast Guard Sector Mobile AL. A peak water level of +3.6 feet-NAVD88 was observed on 6-21-17 17:12 GMT and a peak water level of 3.8 feet-NAVD88 was observed on 6-22-17 14:00 GMT as indicated at NOAA/NOS/CO-OPS, East Fowl River Bridge, AL. A post-storm inspection revealed erosion of most of the bayside berm and some of the landside berm. Earthen material from the bayside berm was shifted and spread out just to the west of its original location. Where erosion was observed on the interior berm, earthen material primarily flattened out and spread in-place. The marsh plantings were observed to be in relatively good condition with little to no damage following this event. No damage to the rubble mound breakwater was observed following this event.

In early October 2017, Hurricane Nate traversed the northern Gulf of Mexico, and created high water in Mobile Bay sufficient to inundate the entire project site. East-southeast to southerly winds created significant waves at the project site. Peak sustained winds were in the range of 25 knots at approximately 10-8-17 07:00 GMT as indicated at NOAA/NOS/CO-OPS, Coast Guard Sector Mobile AL. A peak water level of +4.7 feet-NAVD88 was observed on 10-8-17 6:24 GMT as indicated at NOAA/NOS/CO-OPS, East Fowl River Bridge AL. A post-storm inspection revealed minor erosion along an approximate 10-ft. wide strip on the eastern side of the newly constructed marsh, adjacent to the rubble mound breakwater. Minimal plant damage was observed in this area following this event. No damage to the rubble mound breakwater was observed following this event.

Open Water Dredge Material Placement Site / Borrow Area

Monitoring of the open water dredge material placement site / borrow area was conducted and included a pre-construction/pre-borrow hydrographic survey and a survey conducted after re-filling of the borrow area. Results and data associated with this task were submitted to the USACE in the past.

Per the 2015 Monitoring Plan, no future surveys are required for this task.

Fowl River Navigation Channel

Monitoring of the Fowl River Navigation Channel was conducted and included one comprehensive pre-construction survey followed by post-dredge survey of acceptance sections outlined in the final dredging specifications. Results and data associated with this task were submitted to the USACE in the past.

Per the 2015 Monitoring Plan, no future surveys are required for this task.

CURRENT MONITORING ACTIVITIES

Bathymetric Monitoring of Shoreline Change Transects

A review of the transects (June 2016, June 2018, and October 2019) adjacent to and south of the marsh restoration construction indicates no discernable bottom changes were observed (Appendix A).

FUTURE MONITORING ACTIVITIES

Bathymetric Monitoring of Shoreline Change Transects

The 2015 Monitoring Plan calls for shoreline change monitoring (of 1,800-ft. long transects, as described in previous section) to be performed prior to construction to establish baseline conditions, post-construction, and yearly thereafter for an additional 4 years (i.e., 5 years total after construction). As the pre-construction, 2018, and 2019 post-construction surveys are complete, three additional annual surveys will be required (2020, 2021, 2022), unless specific marsh success criteria are met earlier.

Post-storm monitoring along transects will be performed after significant “storms,” occurring during the first 5 years after construction. A “storm” is defined as having sustained winds of 45 mph or greater at the project site and tropical in nature.

Multi-Year Aerial Photo Analysis of Shoreline

Potential changes to shorelines north of the Fowl River navigation channel, and shoreline areas adjacent to and south of the rock dike breakwater, will be evaluated utilizing existing or acquired aerial imagery to evaluate shoreline loss (or accretion) during the post-construction monitoring period. Shoreline change will be evaluated by comparing available (and suitably geo-referenced) pre-project baseline aerial imagery to imagery available post-project. All shoreline change data

will be compiled and presented in a report at the end of the five-year post-construction monitoring period.

Marsh Restoration Success Monitoring

The USACE permit specifies the permittee will implement the *Proposed Tidal Marsh Restoration Success Monitoring* (prepared by Barry A. Vittor & Associates, Inc., Version rev. 10-12-2015). The 2018 and 2019 post-construction annual inspection have been performed (reports dated December, 2018 and August, 2019).

REFERENCES CITED

Barry A. Vittor & Associates, Inc., 10-12-2015. Proposed *Tidal Marsh Restoration Success Monitoring*. (Draft Marsh Success Monitoring Plan incorporated into U.S. Army Corps of Engineers (USACE) Permit Number SAM-2014-01046-LET dated March 9, 2016.)

Barry A. Vittor & Associates, Inc., December, 2018. Mon Louis Island Restoration, 2018 Marsh Monitoring.

Barry A. Vittor & Associates, Inc., August, 2019. Mon Louis Island Restoration, 2019 Marsh Monitoring.

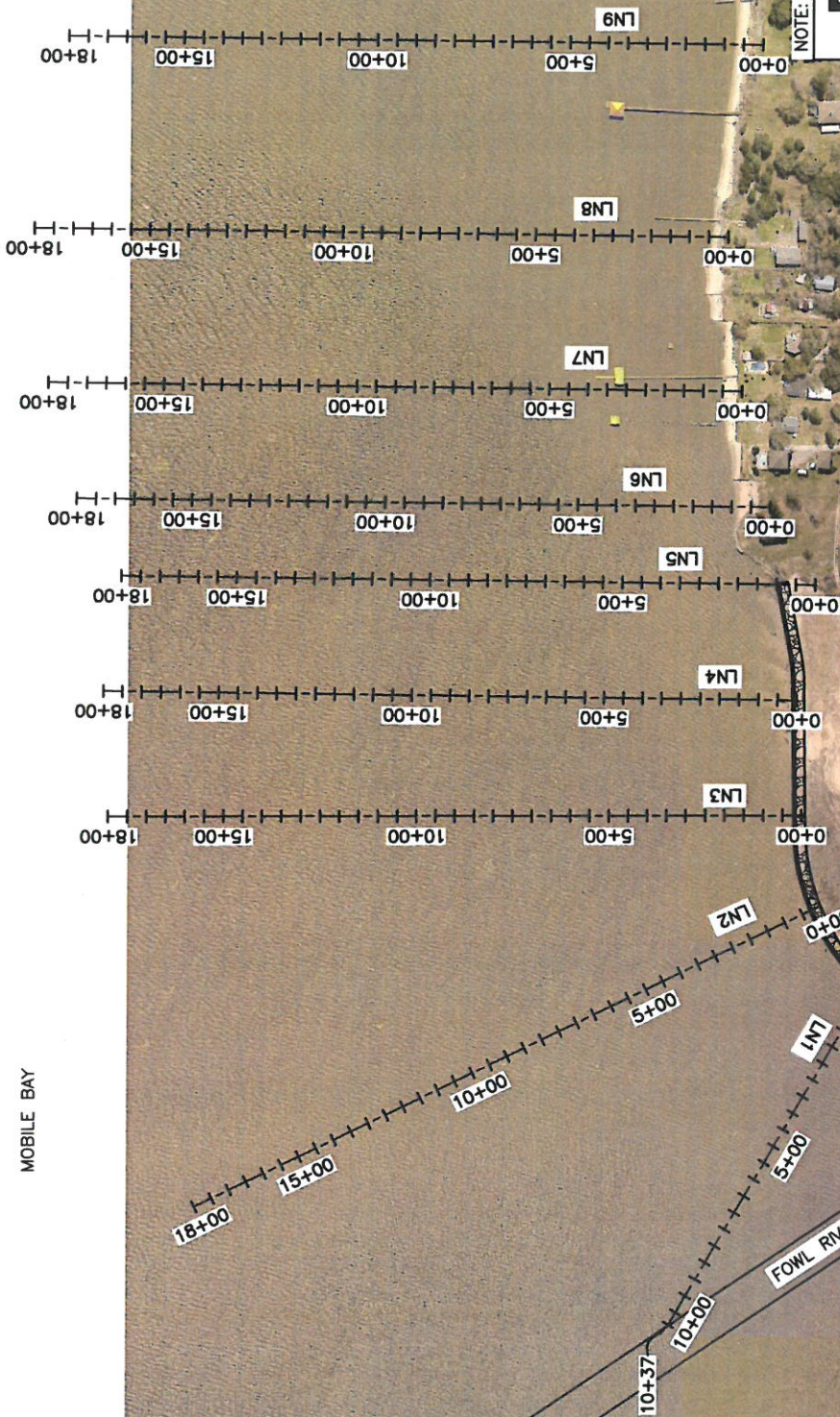
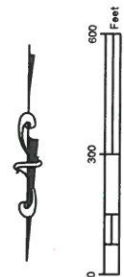
Thompson Engineering, Inc., 9-11-2015. *Proposed Bathymetry, Shoreline, and Structural Monitoring*. (Draft Monitoring Plan incorporated into U.S. Army Corps of Engineers (USACE) Permit Number SAM-2014-01046-LET dated March 9, 2016.)

Thompson Engineering, Inc., 8-24-2018. 1st Annual Post-construction Monitoring Report. Post-construction Bathymetry, Shoreline, and Structural Monitoring, Mon Louis Island Restoration Project.

APPENDIX A

Shoreline Change Monitoring Figures

MOBILE BAY



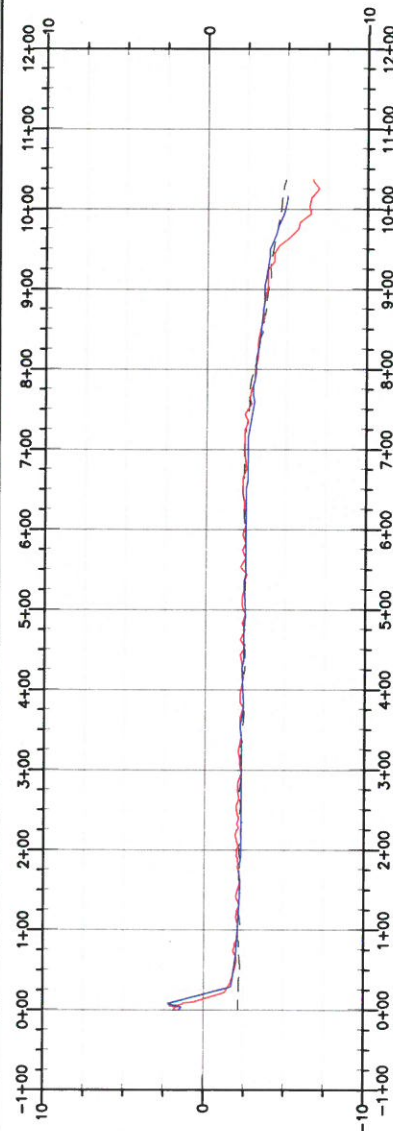
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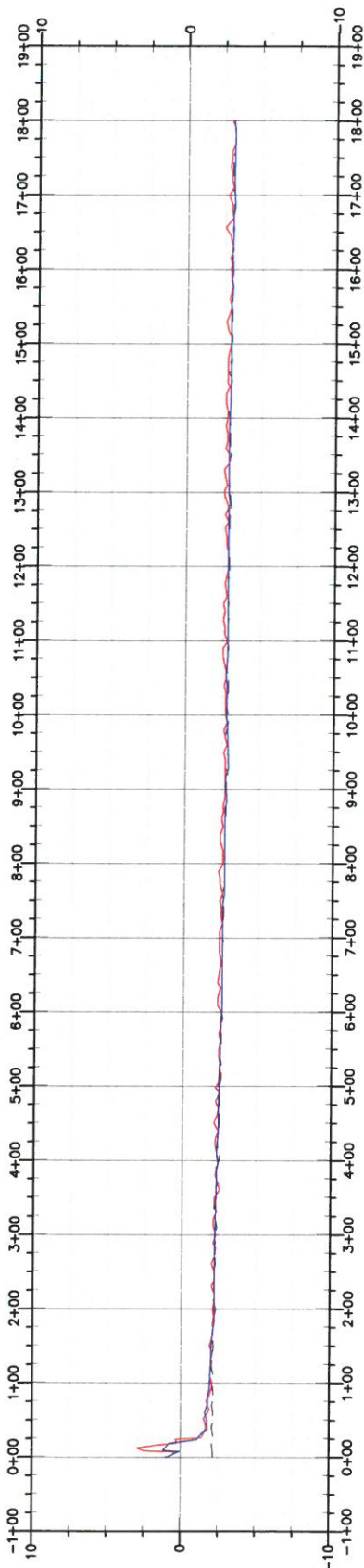
MOBILE BAY
NATIONAL ESTUARY PROGRAM
MOBILE, ALABAMA

SHORELINE CHANGE MONITORING
SHORELINE TO 1800 ft. BATHYMETRIC TRANSECTS
MON LOUI ISLAND RESTORATION PROJECT

PROJECT NO: 13-1101-0242
DATE: JULY 2018




LN1 PROFILE
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 VERT. SCALE: 1"=7.5'

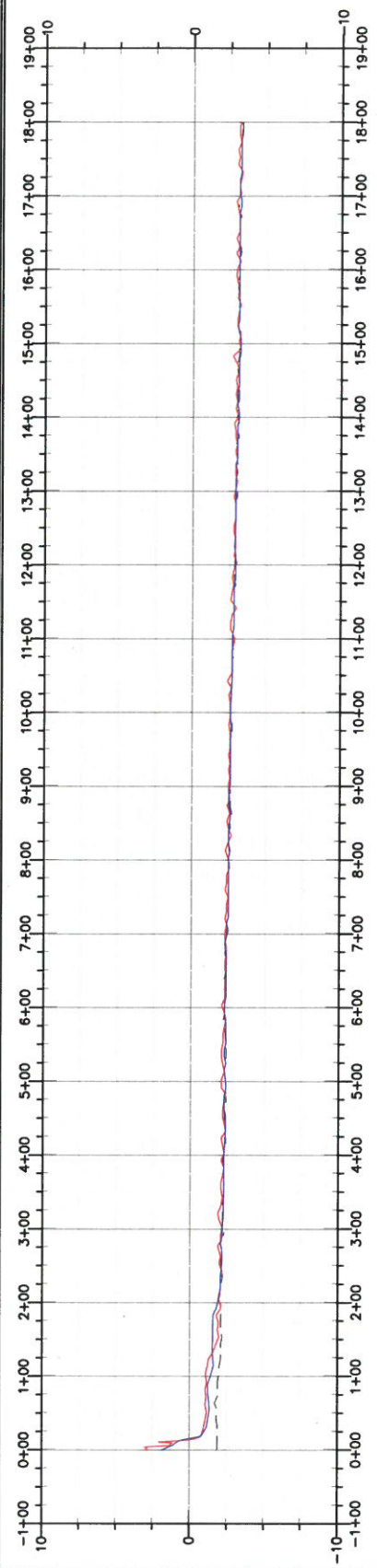


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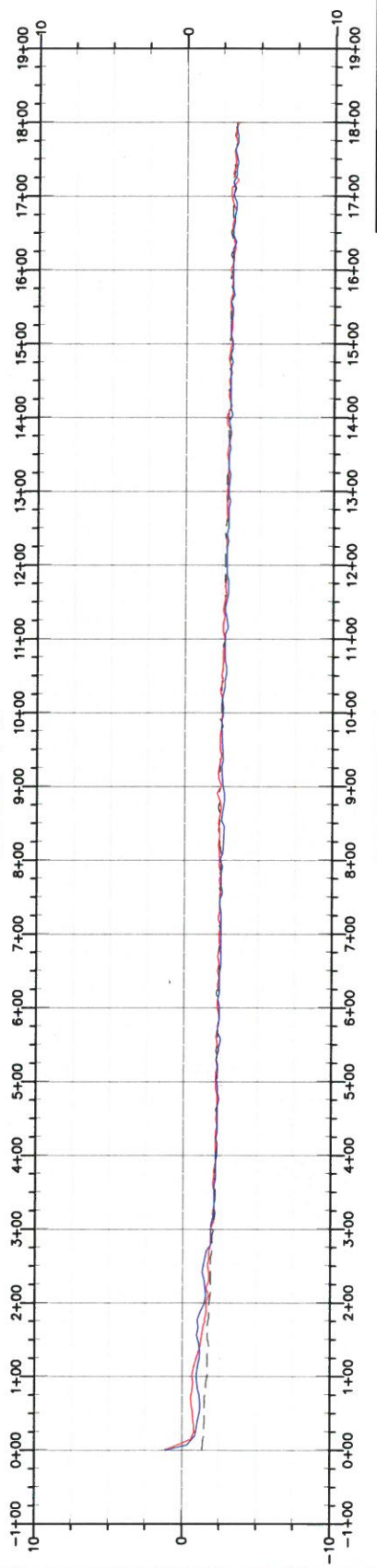
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- JUNE 2016
 - JUNE 2018
 - OCTOBER 2019

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 NAVD88.

	MOBILE BAY NATIONAL ESTUARY PROGRAM MOBILE, ALABAMA
	SHORELINE CHANGE MONITORING SHORELINE TO 1800-FT BATHYMETRIC PROFILES MON LOUIS ISLAND RESTORATION PROJECT
PROJECT NO: 13-1101-0242	DATE: OCTOBER 2019




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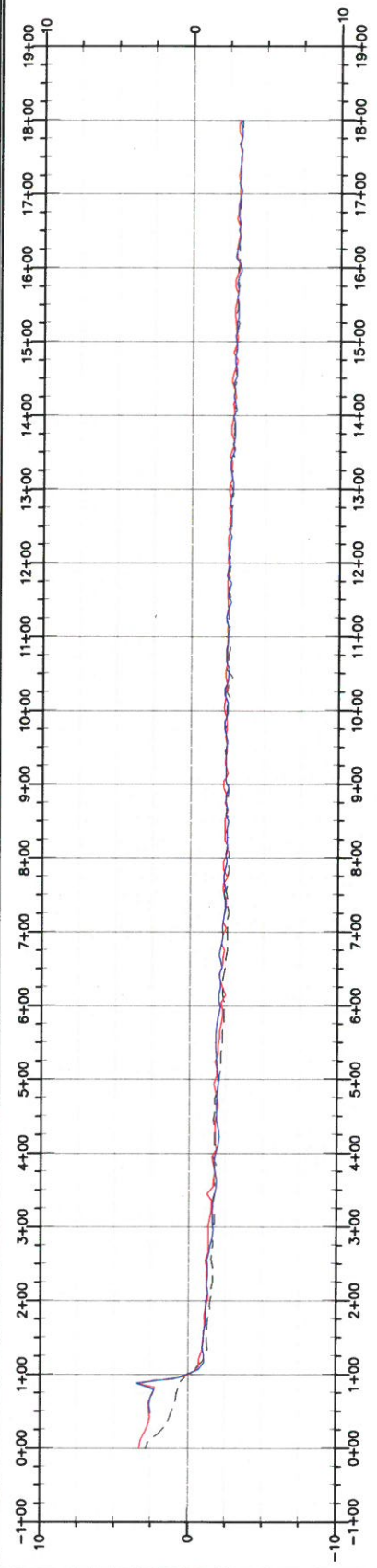


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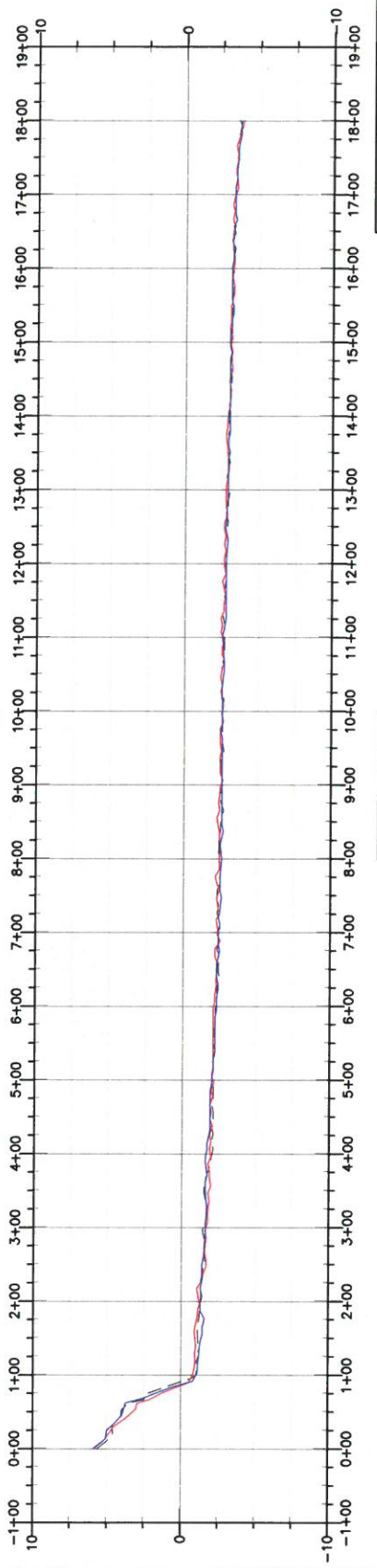
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 — JUNE 2018
 — OCTOBER 2019

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 FOOT NAD83. VERTICAL DATUM IS
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	SHORELINE CHANGE MONITORING SHORELINE TO 1800-FT BATHYMETRIC PROFILES MON LOUIS ISLAND RESTORATION PROJECT
PROJECT NO: 13-1101-0242	DATE: OCTOBER 2019




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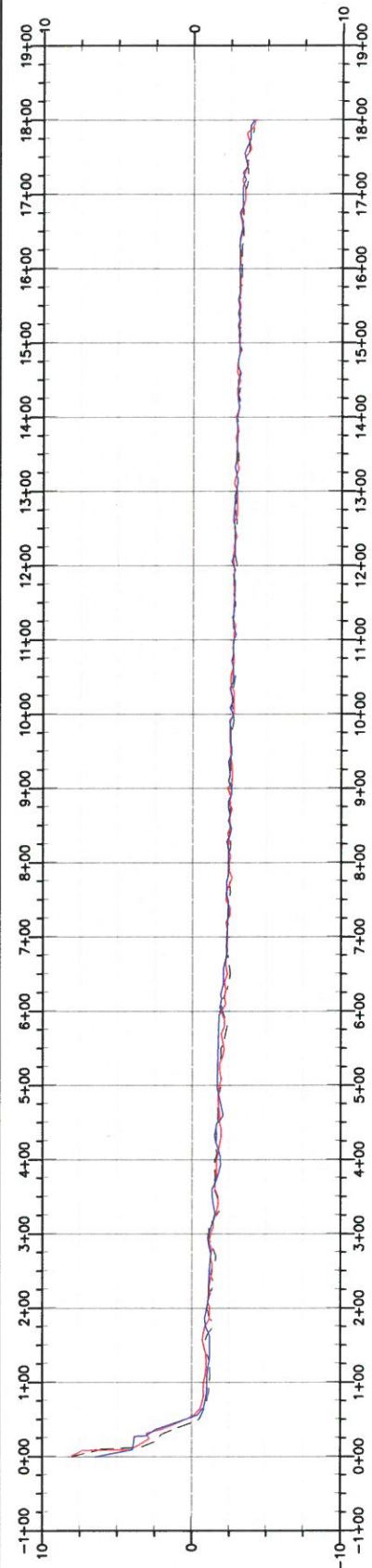


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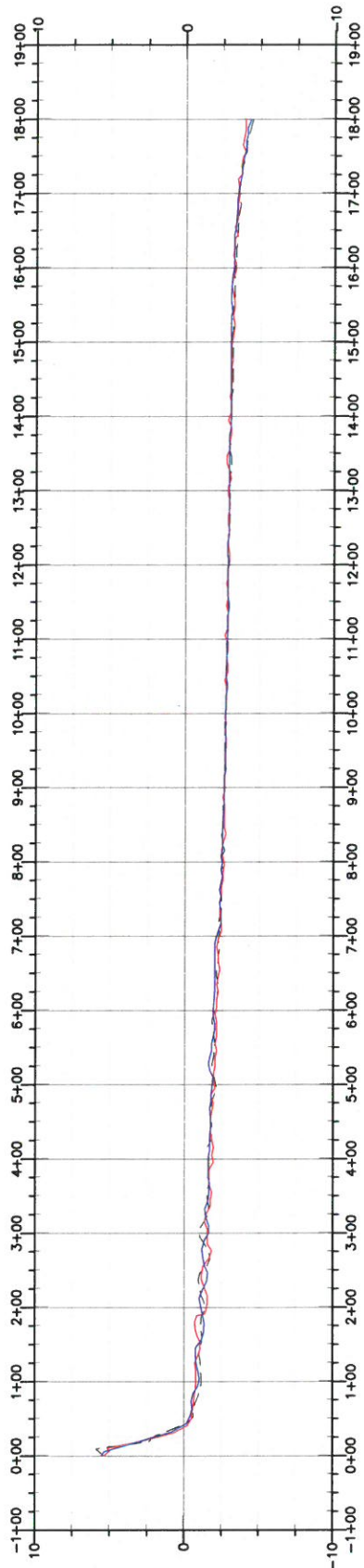
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PROJECT NO: 13-1101-0242	DATE: OCTOBER 2019



LN7 PROFILE

HORIZ. SCALE: 1"=150'
VERT. SCALE: 1"=7.5'



LEGEND

- JUNE 2016
- JUNE 2018
- OCTOBER 2019

LN8 PROFILE

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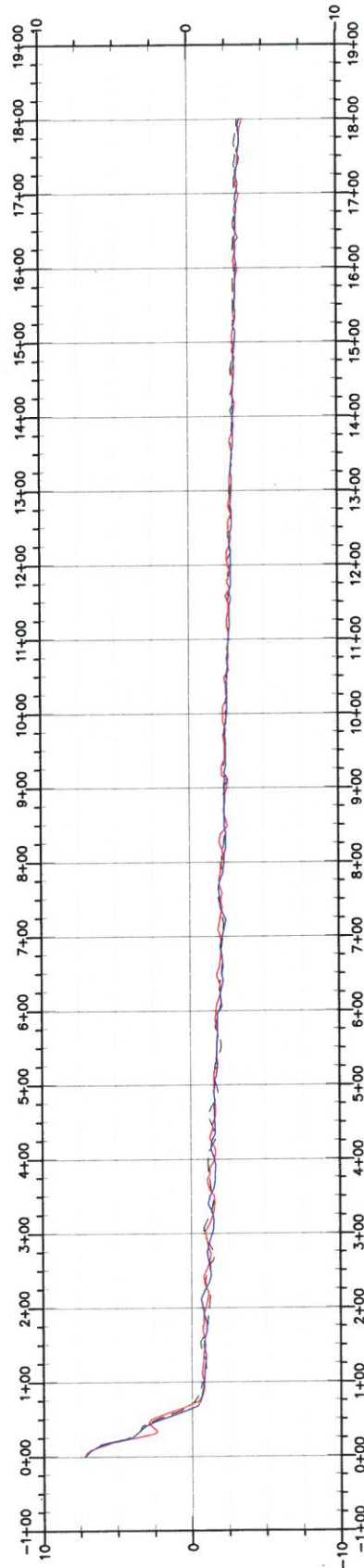
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SHORELINE CHANGE MONITORING

SHORELINE TO 1800-FT BATHYMETRIC PROFILES
MON LOUIS ISLAND RESTORATION PROJECT

PROJECT NO: 13-1101-0242


DATE: OCTOBER 2019



LN9 PROFILE
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- LEGEND**
- JUNE 2016
 - JUNE 2018
 - OCTOBER 2019

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