
Periodic Survey Evaluation: Ocean View Beach Fall 2018

Presented to:

City of Norfolk

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Prepared by:



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1. Executive Summary

The twenty-seventh consecutive twice-yearly survey of the Ocean View shoreline was conducted on November 5 - 8, 2018. The study area extends from the western end of Willoughby Spit to the western edge of Little Creek Inlet in East Ocean View. The periodic surveys are typically collected bi-annually in March/April and September/October to monitor the condition of the shoreline and the state of existing shore protection projects. The Federal coastal storm damage reduction project was constructed by Norfolk District U.S. Army Corps of Engineers (USACE) in mid-May 2017. This report documents the third monitoring survey following the initial adjustment period of the Federal Project, illustrating changes in the Federal Project beach and nearshore conditions approximately one and a half years post-construction.

A baseline and transect locations were established with the first survey in September 2005 and have been used for each subsequent survey. Shoreline changes at Mean High Water (MHW) and volumetric changes above 0 feet NAVD88 and -15 feet NAVD88 are calculated at each transect. Differences in the region above 0 feet NAVD88 are indicative of changes to the dune and subaerial beach berm, while the differences above -15 feet NAVD88 indicate changes in the nearshore zone. Comparison of yearly surveys (i.e. October 2017 to November 2018) eliminates seasonal variation of profiles in volumetric change analyses. Consecutive survey comparisons (fall to spring, and spring to fall) are useful to assess the direct impact of extreme events which have occurred during the six months between surveys. This report documents the data sources, methods, and results of a periodic surveying evaluation performed to compare the November 2018 survey data with previous surveys taken in October 2017 (fall to fall comparison) and April 2018 (most recent periodic survey comparison) in the Ocean View Beach area between Willoughby Spit and Little Creek Inlet.

Comparison	Parameter	Quantity
October 2017 vs. November 2018	Average Shoreline Change Rate at MHW (+0.98 ft NAVD88)	-8.47 ft/yr
	Cumulative Volume Change Rate Above 0 ft NAVD88	57,312 cy/yr
	Cumulative Volume Change Rate Above -15 ft NAVD88	108,507 cy/yr
April 2018 vs. November 2018	Average Shoreline Change at MHW (+0.98 ft NAVD88)	-4.73 ft
	Cumulative Volume Change Above 0 ft NAVD88	737 cy
	Cumulative Volume Change Above -15 ft NAVD88	117,491 cy

The Federal Willoughby and Vicinity Coastal Storm Damage Reduction Project (Federal Project) was constructed in March, April and May 2017. The Federal Project placed approximately 1.2 million cubic yards material on the Ocean View Beach. Chapter 7 of this Fall 2018 monitoring survey report evaluates the performance of the Federal Project and is intended to help the City and USACE to track project conditions and effectively plan for future renourishment needs.

The behavior in each of the shoreline reaches for the October 2017 to November 2018 and April 2018 to November 2018 periods are summarized in Table 1-1 and Table 1-2 respectively.

As illustrated in Table 1-1, the Ocean View shoreline has experienced overall retreat at MHW from October 2017 to November 2018 with a length-weighted average change rate of -8.47 ft/yr. The beach and dune above 0 feet NAVD88 gained sediment at a rate of 57,312 cy/yr from October 2017 to

November 2018. The beach and dune above -15 feet NAVD88 gained sediment at a rate of 108,507 cy/yr from October 2017 to November 2018.

From April 2018 to November 2018, the MHW shoreline retreated on average by -4.73 feet, as shown in Table 1-2. The volumetric change over the same period showed gain above 0 feet NAVD88 and loss above -15 feet NAVD88 of 737 cy and 117,491 cy, respectively.

Table 1-1: Regional Shoreline and Volume Change Statistics (October 2017 to November 2018)

Region	Average Shoreline Change	Average Volume Change Rate Above 0 ft NAVD88	Cumulative Volume Change Rate Above 0 ft NAVD88	Average Volume Change Rate Above -15 ft NAVD88	Cumulative Volume Change Rate Above -15 ft NAVD88
	(ft/yr)	(cy/ft/yr)	(cy/yr)	(cy/ft/yr)	(cy/yr)
Willoughby Spit (0+00 to 45+00)	-4.52	-0.25	-1,146	7.63	34,414
800 Block Breakwaters (45+25 to 87+62)	-14.62	0.06	257	1.76	7,983
West Ocean View (93+41 to 163+49)	-16.45	-0.61	-3,965	-1.71	-9,529
Central Ocean View Breakwaters (169+63 to 195+63)	-18.11	0.14	493	1.45	5,026
Central Ocean View (206+86 to 323+09)	3.97	4.57	57,214	5.45	68,217
East Ocean View (329+63 to 383+58)	-17.47	0.78	4,459	0.42	2,396
OVERALL	Weighted Avg (ft/yr)	Weighted Avg (cy/ft/yr)	Total (cy/yr)	Weighted Avg (cy/ft/yr)	Total (cy/yr)
	-8.47	1.48	57,312	2.74	108,507

Table 1-2: Regional Shoreline and Volume Change Statistics (April 2018 to November 2018)

Region	Average Shoreline Change	Average Volume Change Above 0 ft NAVD88	Cumulative Volume Change Above 0 ft NAVD88	Average Volume Change Above -15 ft NAVD88	Cumulative Volume Change Above -15 ft NAVD88
	(ft)	(cy/ft)	(cy)	(cy/ft)	(cy)
Willoughby Spit (0+00 to 45+00)	-2.95	-0.96	-4,341	8.39	37,874
800 Block Breakwaters (45+25 to 87+62)	-3.07	-0.60	-2,738	5.43	24,644
West Ocean View (93+41 to 163+49)	-7.02	-0.92	-7,023	2.10	15,976
Central Ocean View Breakwaters (169+63 to 195+63)	-18.71	-0.10	-361	0.81	2,802
Central Ocean View (206+86 to 323+09)	2.95	1.66	20,710	3.48	43,535
East Ocean View (329+63 to 383+58)	-12.72	-0.96	-5,509	-1.28	-7,339
OVERALL	Weighted Avg (ft)	Weighted Avg (cy/ft)	Total (cy)	Weighted Avg (cy/ft)	Total (cy)
	-4.73	0.02	737	3.06	117,491

2. Objective

The City of Norfolk, Virginia has maintained a program of periodic surveying of the Ocean View shoreline since 2005. The periodic surveying data collection dates are shown in Table 2-1. This report documents the data sources, methods, and results of a periodic surveying evaluation performed to compare the November 2018 survey data with previous surveys taken in October 2017 (fall to fall comparison) and April 2018 (most recent periodic survey comparison) in the Ocean View Beach area between Willoughby Spit and Little Creek Inlet.

Table 2-1: Surveyors and Collection Dates

Data Collection Date	Surveyor
September 2005	McKim & Creed
March 2006	McKim & Creed
October 2006	McKim & Creed
March 2007	McKim & Creed
October 2007	McKim & Creed
March 2008	McKim & Creed
October 2008	McKim & Creed
April 2009	McKim & Creed
October 2009	Geodynamics, LLC
March 2010	Geodynamics, LLC
October 2010	Geodynamics, LLC
April 2011	Geodynamics, LLC
October 2011	Geodynamics, LLC
March 2012	Geodynamics, LLC
September 2012	Geodynamics, LLC
April 2013	Geodynamics, LLC
October 2013	Geodynamics, LLC
March 2014	Geodynamics, LLC
October 2014	Geodynamics, LLC
April 2015	Geodynamics, LLC
October 2015	Geodynamics, LLC
May 2016	Geodynamics, LLC
October 2016	Geodynamics, LLC
February 2017	USACE (Great Lakes Dredge & Dock)
May 2017	USACE (Great Lakes Dredge & Dock)
May 2017	Geodynamics, LLC
October 2017	Geodynamics, LLC
April 2018	Geodynamics, LLC
November 2018	Geodynamics, LLC

3. Data Sources

Geodynamics, LLC, conducted the most recent survey of Ocean View Beach on November 5-8, 2018. The baseline and transects established for the September 2005 survey were used for the most recent survey. Figure 3-1 shows the location of the baseline, transects and the stationing applied by Geodynamics for the surveying. As shown in Figure 3-1, transects were stationed from west to east along the Ocean View shoreline. The survey data were provided in xyz and shapefile formats allowing for compatibility with multiple programs.

Geodynamics noted that typical vertical survey accuracy along the hydrographic portions of the profiles is approximately ± 1 cm. This ‘margin of error’, if applied over the entire length of the hydrographic profiles can potentially result in significant volumetric differences, in particular on the shallow-sloped and long profiles near Willoughby Spit. Therefore, volumetric changes discussed herein are analyzed with regard to potential volumetric margins of error.

On November 17, 2018, the Virginia Institute of Marine Science (VIMS) flew aerial photography of the Ocean View shoreline, georectified the images, and digitized the apparent MHW shoreline position from the images. The November 2018 aerial photos with the digitized shoreline positions from November 2018, April 2018, and October 2017 are shown in Appendix A. Since these photos cover a limited portion of area landward and seaward of the shoreline, a previous image (2009) is underlain for presentation purposes.



Figure 3-1: Survey Baseline and Transects

4. Methods

Survey comparisons and respective analysis were performed using a combination of Microsoft Excel, Golden Software Surfer, ESRI ArcGIS, and the USACE's Beach Morphology Analysis Package (BMAP). Surfer is a contouring and 3D surface mapping program utilized to create 3D surfaces for analysis. BMAP is a program developed by the USACE to analyze morphologic and dynamic properties of beach profiles.

The horizontal coordinate system used was Virginia South State Plane NAD 1983 (HARN), US Survey feet with a vertical datum of NAVD88. Individual profile plots showing the survey profile at each transect for each date are presented in Appendix B. From the profiles, shoreline changes and volumetric changes were then calculated at each transect for the following time periods:

1. October 2017 to November 2018 (Entire Shoreline)
2. April 2018 to November 2018 (Entire Shoreline)

First, the change in shoreline based on the survey profiles at mean high water (MHW) was calculated at each transect for each time period mentioned. MHW along Ocean View beaches is defined as +0.98 feet NAVD88 based on NOAA tidal benchmark at Sewells Point. The resulting value represents the shoreline change (feet) over the time period between surveys. The shoreline change rate (ft/yr) was then calculated by dividing by the amount of time between survey dates.

Representative volume changes were also calculated at each transect for all time periods. Volume changes were calculated for two different extents in order to better understand the processes occurring onshore and offshore of the Ocean View beach area. Calculations included volume changes above -15 feet NAVD88 and volume changes above 0 feet NAVD88. The results represent volume change per linear foot of shoreline (cy/ft) over the period of time between surveys. The volume change rate (cy/ft/yr) was then calculated by dividing by the amount of time between survey dates. In addition, the volume changes were converted to cumulative changes over the entire shoreline. This was done by applying the average end area method to the unit volume changes (cy/ft) and unit volume change rates (cy/ft/yr) computed at each transect and summing the total volume changes over the entire shoreline. The resulting value indicated the total loss or gain of material (cy) between surveys based on the applicable profile extents.

Volume changes calculated for portions of the profiles above 0 feet NAVD88 are representative of changes in the amount of material in the dune system and on the subaerial beach. These areas are highly influenced by the performance of coastal structures and the impact of storm activity. Volume changes calculated for portions of the profiles above -15 feet NAVD88 allow for the tracking of sand movement in the submerged active profile; removing profile data deeper than the -15 feet NAVD88 contour from the analysis reduces uncertainty that would be associated with hydrographic data beyond this depth.

5. Discussion of Periodic Surveying Evaluation

This section discusses differences observed between the noted surveys, overall shoreline trends, regional shoreline trends and comparison with the pre- and post-construction surveys of the Federal Project. The computed shoreline changes and volume changes at each individual transect for the time periods covered are tabulated in Appendix C.

5.1. Differences in Survey Coverage

Variation in profile positions between surveys taken as part of the ongoing program of periodic surveying of the Ocean View shoreline (October 2017, April 2018, and November 2018) were minimal in the topographic portion of the survey due to use of the same baseline and transects put in place for the initial survey in September 2005. Profile extents and alignment were virtually the same when comparing the survey data.

5.2. Key Events during the Reporting Period

Beach processes are greatly influenced by natural and engineering processes. This section describes key events that happened during the present reporting period which likely had an impact on shoreline position changes and profile volume gains and/or losses.

5.2.1. Storm Wave Events

Understanding of the wave climate immediately offshore of the Norfolk shoreline is vital for the design, monitoring, and understanding of projects along the shoreline and the behavior of the beach. The data used were collected from the City's AWAC (Acoustic Wave and Current) gage, which was deployed in 2006 directly offshore of the Norfolk Shoreline in approximately 23 feet of water. Wave data were collected throughout this survey period.

A summary of the observed conditions during this monitoring period yields the following general observations:

- The average significant wave height and peak period during this monitoring period (wave data available through October 31, 2018) was approximately 1.1 feet and 5.2 seconds.
- The largest significant wave height observed during this monitoring period was approximately 7.8 feet with a corresponding peak period of approximately 4.5 seconds and mean direction of 310 degrees (October 12, 2018).
- Waves approach from the northwest to southeast, with more than 79.4% approaching from 0 to 120 degrees North.

Thirty-six storm events occurred during October 2017 and October 2018 for which the significant wave height at the wave gauge exceeded 3.3 feet (1.0 meter). These events are shown in Figure 5-1 through Figure 5-36.

The overall trends remained consistent with prior measurement periods with waves during calm periods being predominantly swell traveling into the bay from the ocean and having longer wave periods and

lower wave heights. Typically, the larger wave height events are driven by northerly and northeasterly storm winds within the bay and tend to have shorter wave periods. There were 10 storm events identified during the spring 2018 to fall 2018 monitoring period, and, as observed in the prior measurement periods, the wind data indicate that for large and sustained wind events there is a corresponding increase in significant wave height. A summary of wave statistics by month from October 2017 through September 2018 is given in Table 5-1.

Table 5-1: Monthly Wave Statistics Summary

Wave Statistic	Oct-17	Nov-17	Dec-17	Jan-18	Feb-18	Mar-18
Average Significant Wave Height, H_s (ft)	1.3	1.4	1.2	1.4	1.1	1.9
Average Wave Period, T_m (s)	2.7	2.7	2.4	2.7	2.4	2.8
Average Peak Wave Period, T_p (s)	5.7	4.9	4.0	4.4	4.5	5.7
Maximum Observed Significant Wave Height, H_s (ft)	4.9	4.0	4.6	5.2	3.7	4.6
Maximum Observed Wave Height, H_{max} (ft)	8.3	7.1	8.0	9.6	5.8	9.7

Wave Statistic	Apr-18	May-18	Jun-18	Jul-18	Aug-18	Sep-18	Oct-18
Average Significant Wave Height, H_s (ft)	1.3	0.9	1.0	1.2	0.7	1.4	1.2
Average Wave Period, T_m (s)	2.5	2.3	2.4	2.5	2.2	2.8	2.6
Average Peak Wave Period, T_p (s)	4.2	4.3	4.7	5.0	4.4	5.9	5.5
Maximum Observed Significant Wave Height, H_s (ft)	4.6	2.6	3.7	5.1	2.7	5.1	7.8
Maximum Observed Wave Height, H_{max} (ft)	7.7	4.7	6.1	8.1	4.9	8.4	13.0

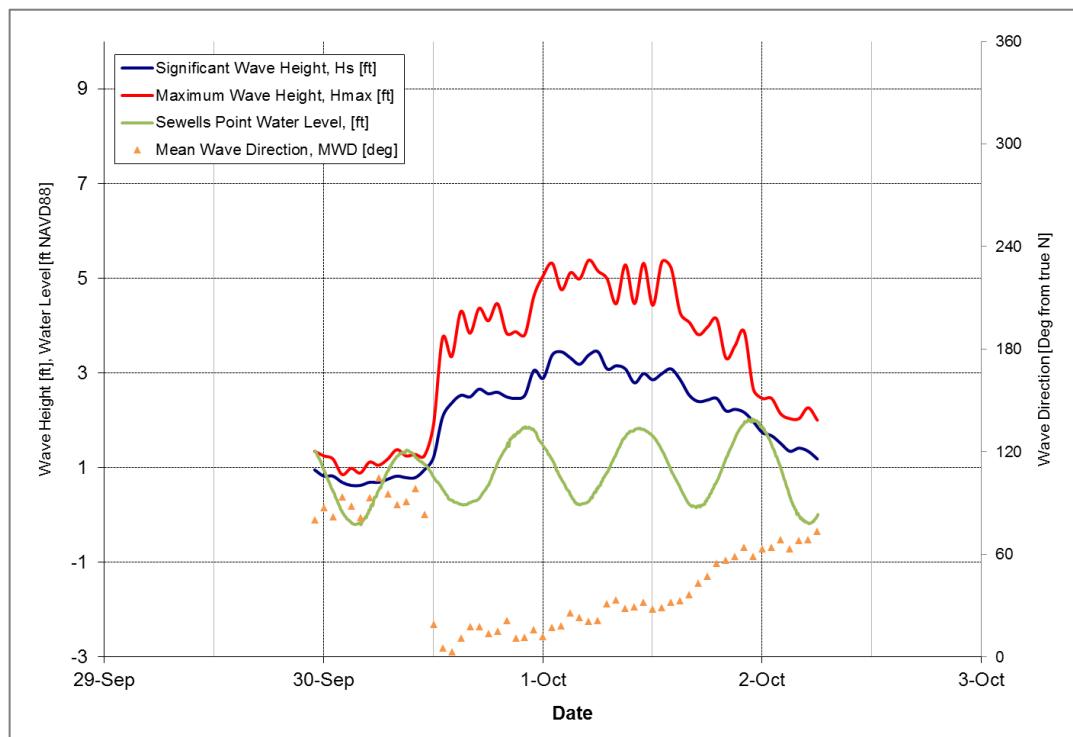


Figure 5-1: October 1, 2017 Storm

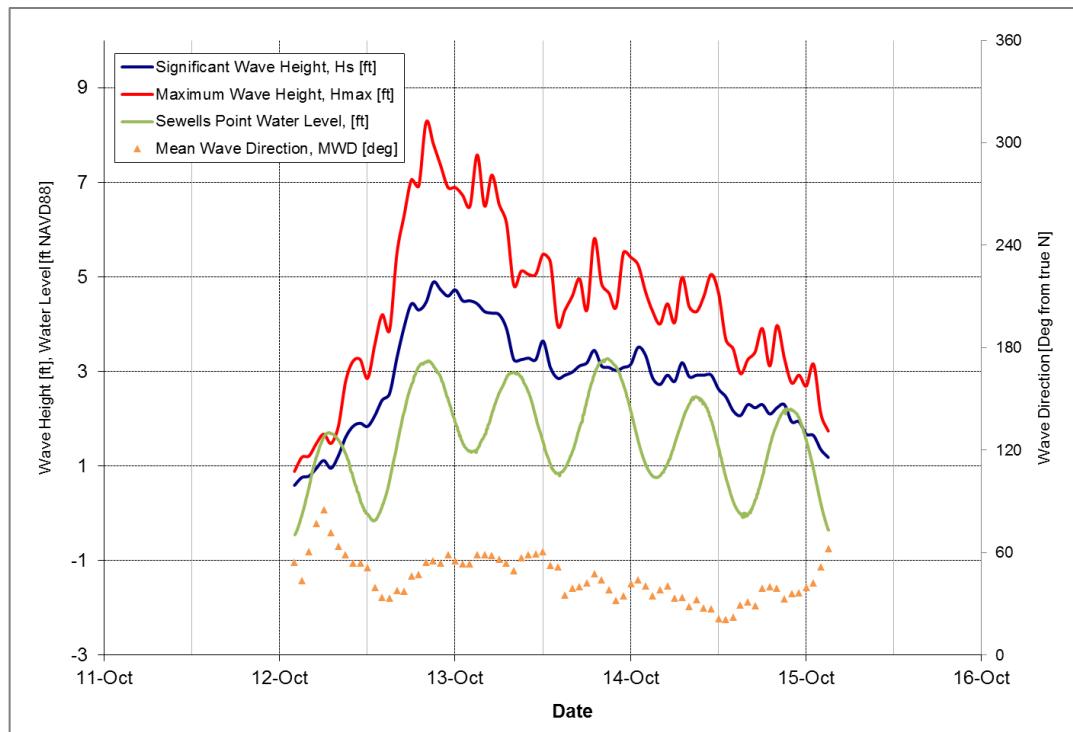


Figure 5-2: October 12, 2017 Storm

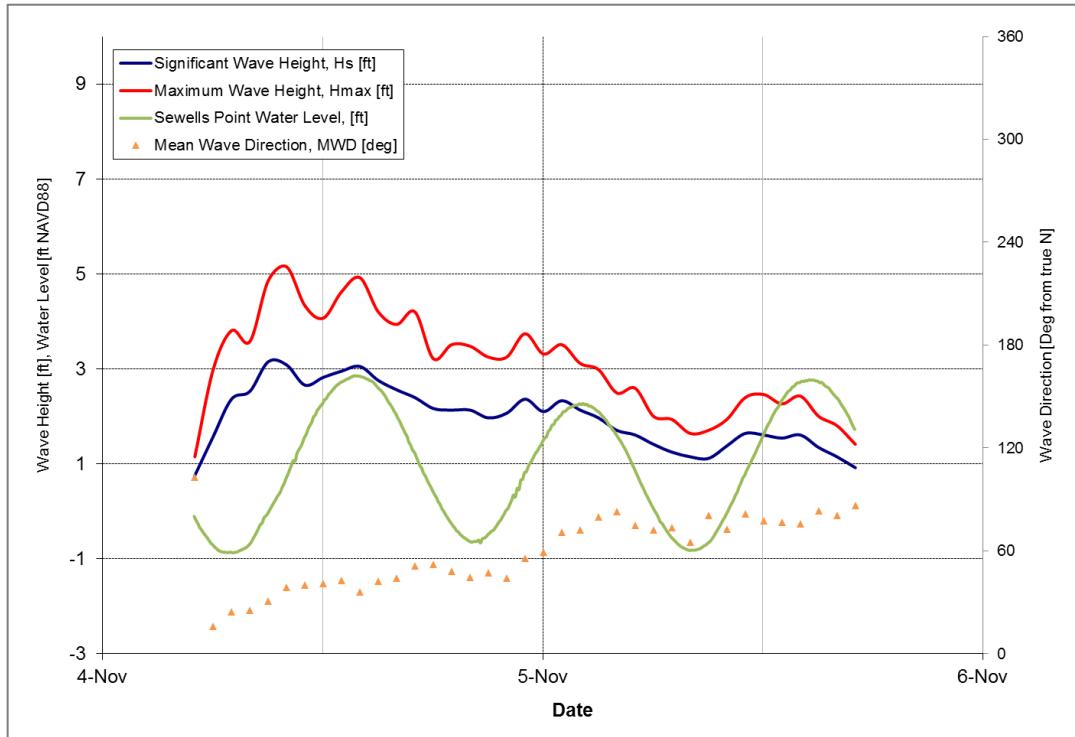


Figure 5-3: November 4, 2017 Storm

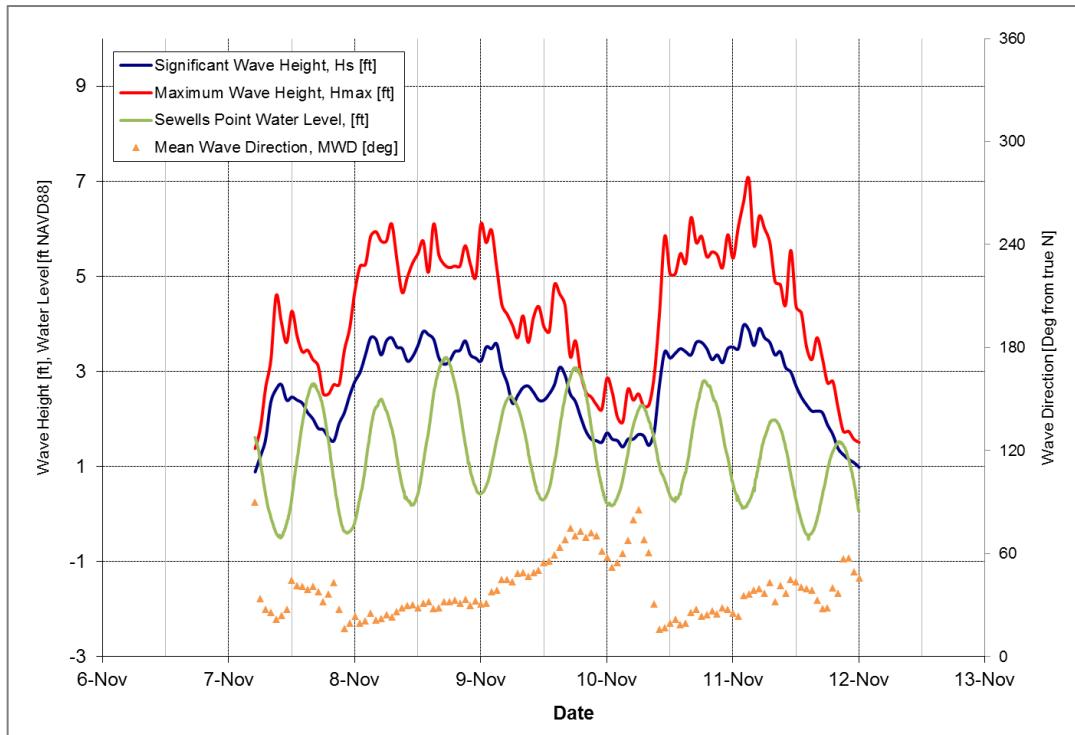


Figure 5-4: November 8, 2017 Storm

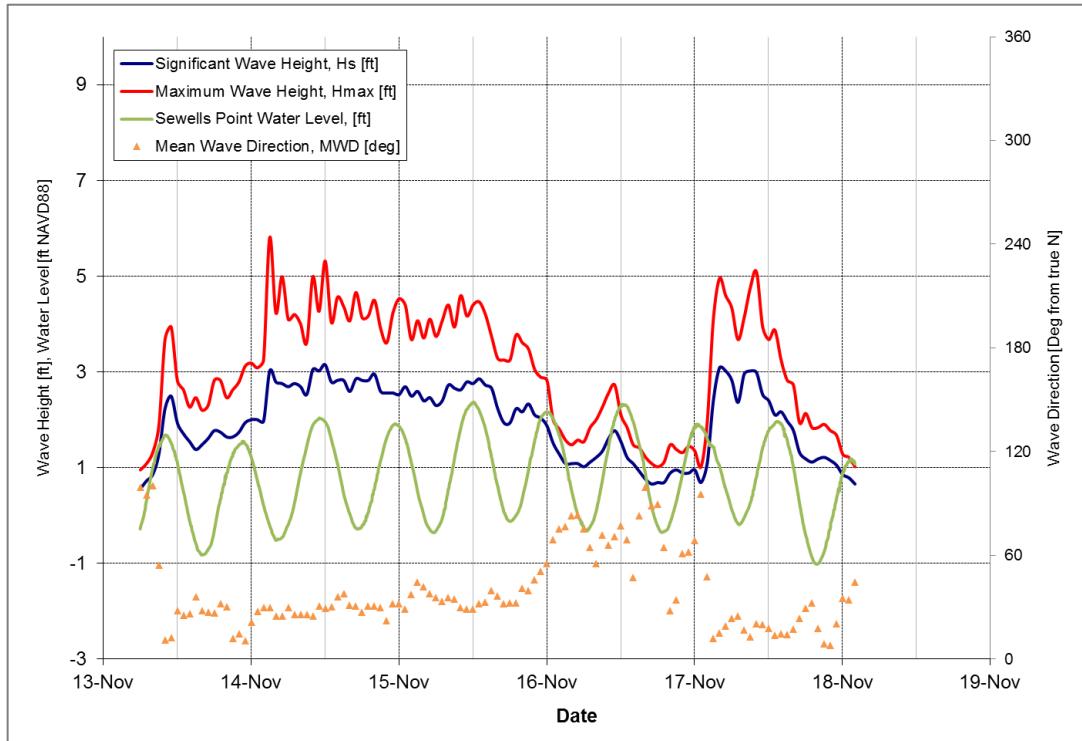


Figure 5-5: November 14, 2017 Storm

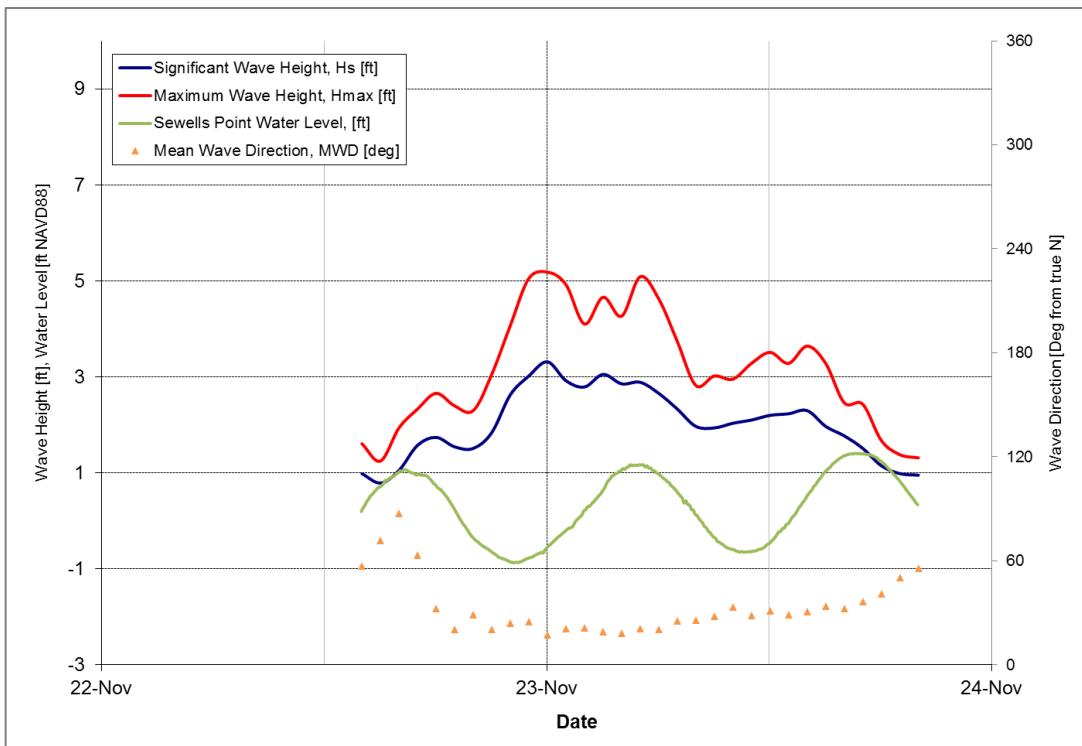


Figure 5-6: November 22, 2017 Storm

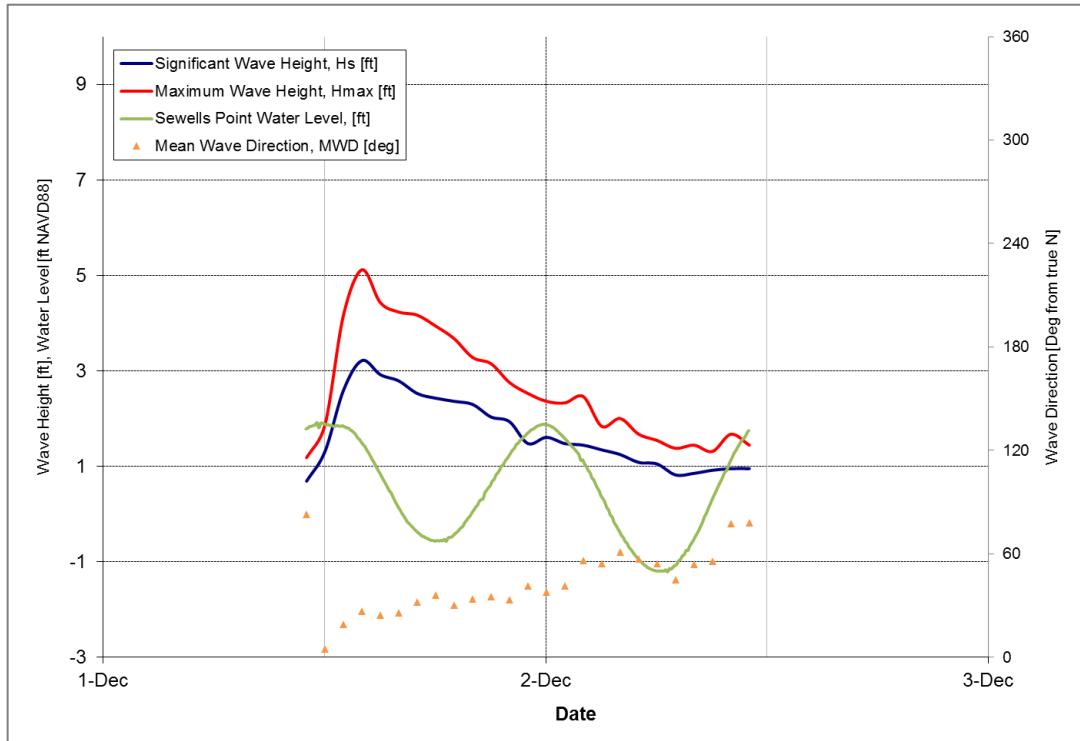


Figure 5-7: December 1, 2017 Storm

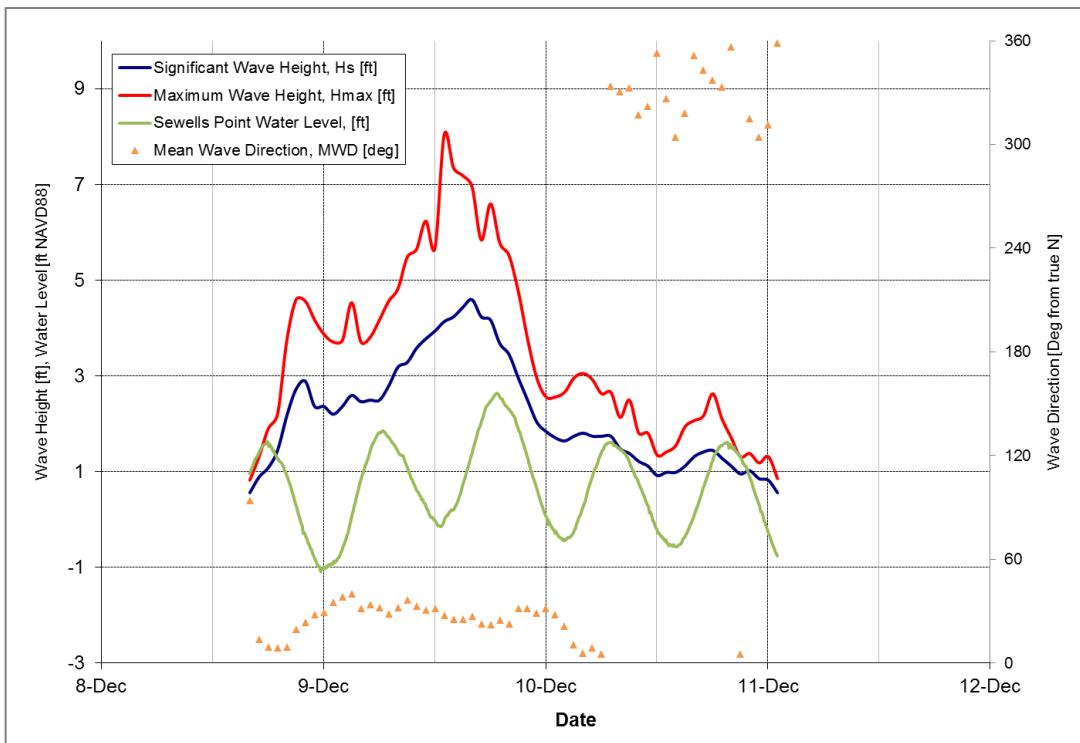


Figure 5-8: December 9, 2017 Storm

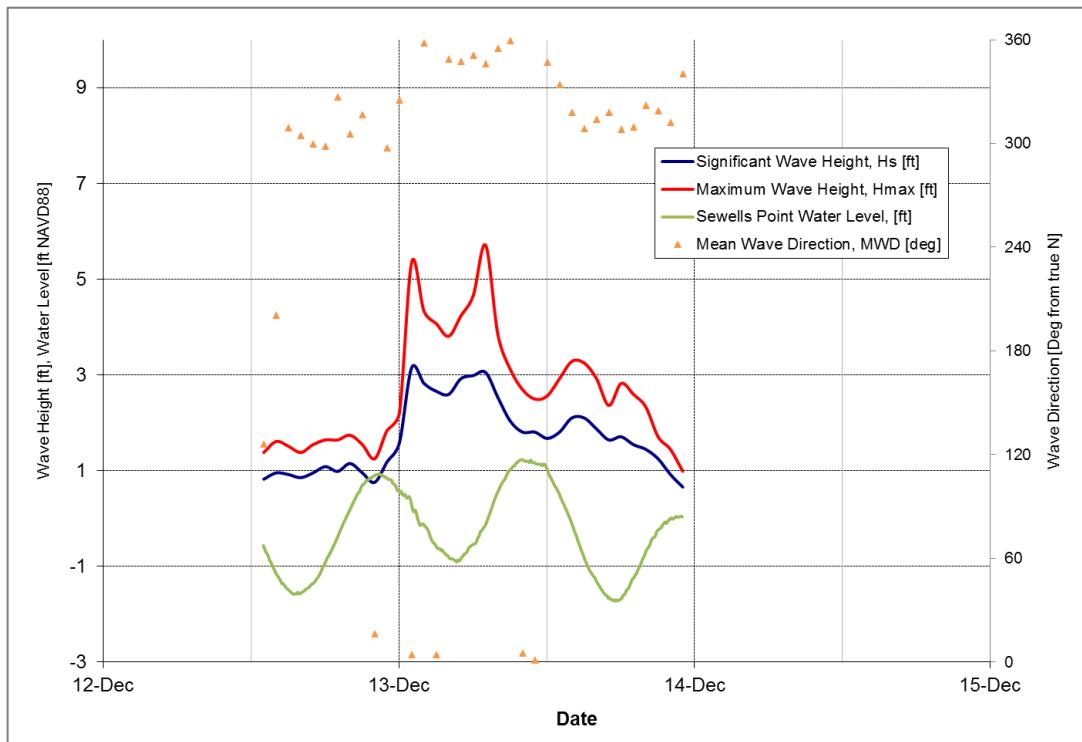


Figure 5-9: December 13, 2017 Storm

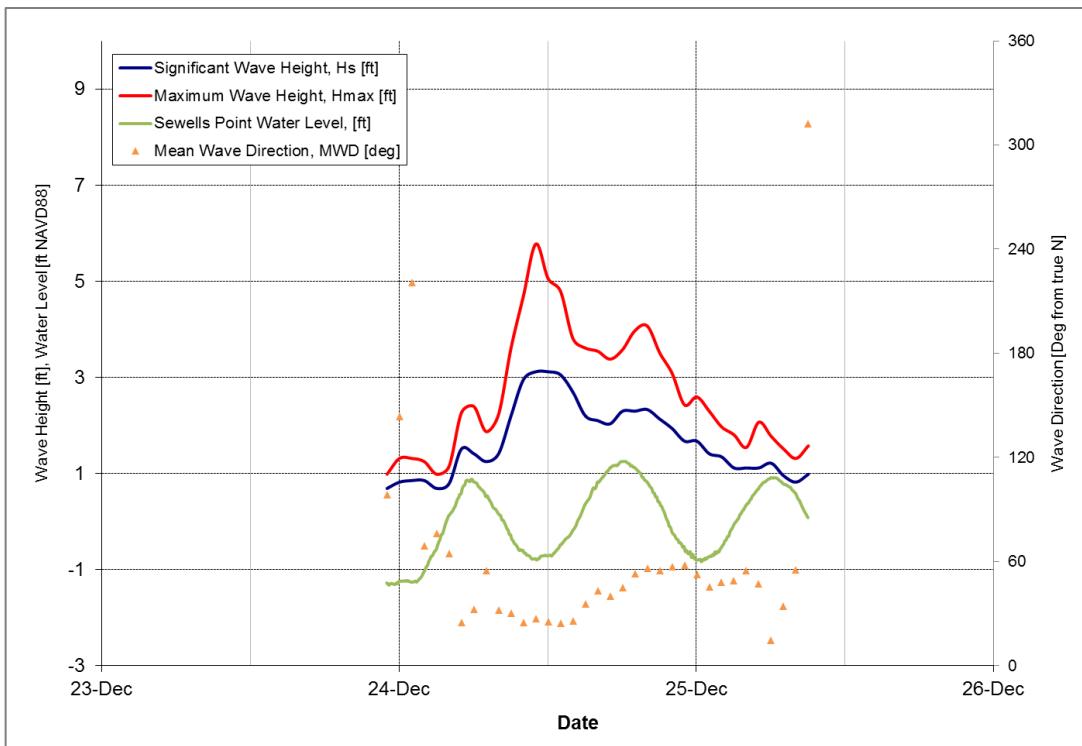


Figure 5-10: December 24, 2017 Storm

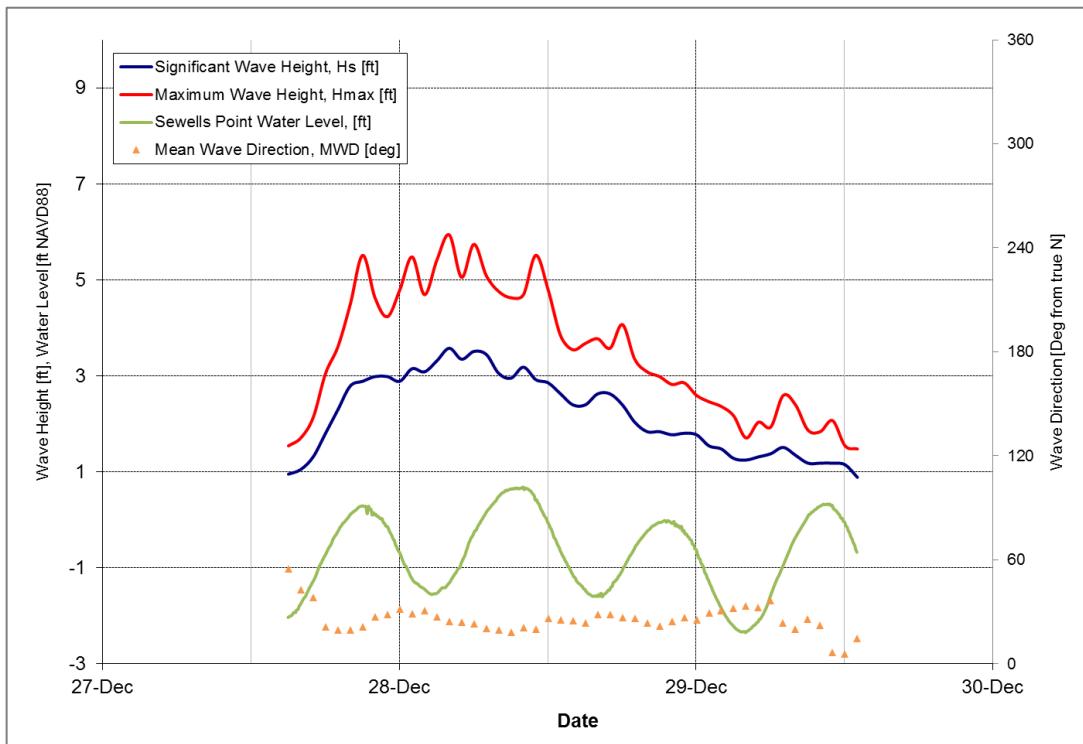


Figure 5-11: December 28, 2017 Storm

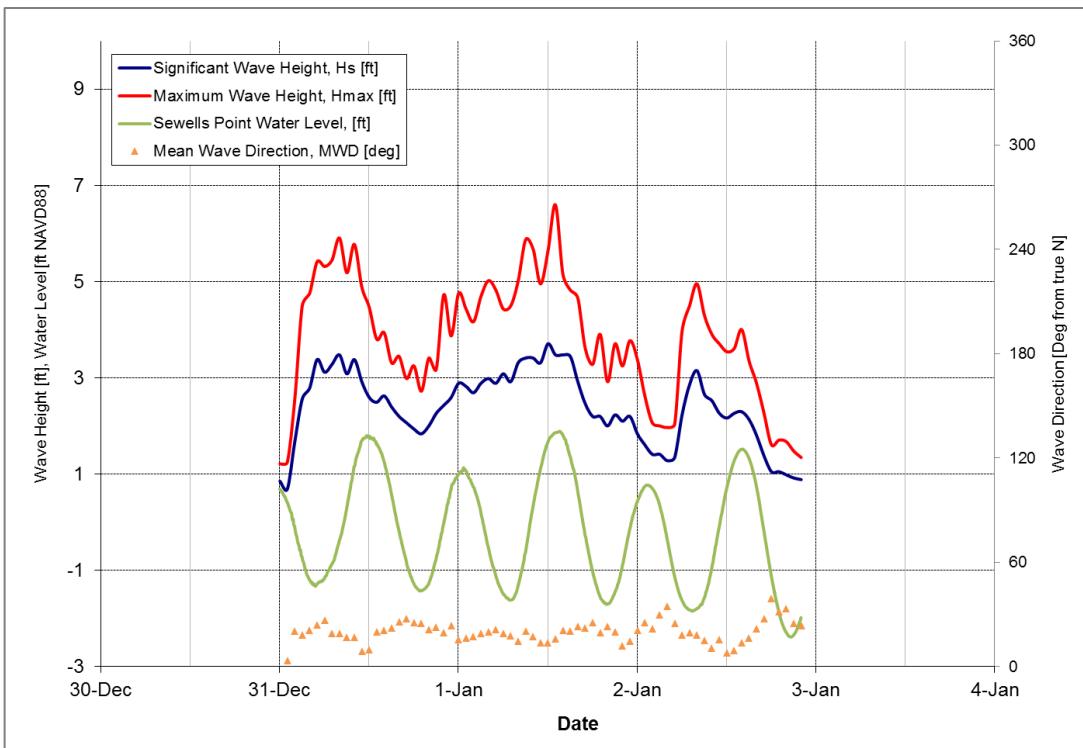


Figure 5-12: December 31, 2017 Storm

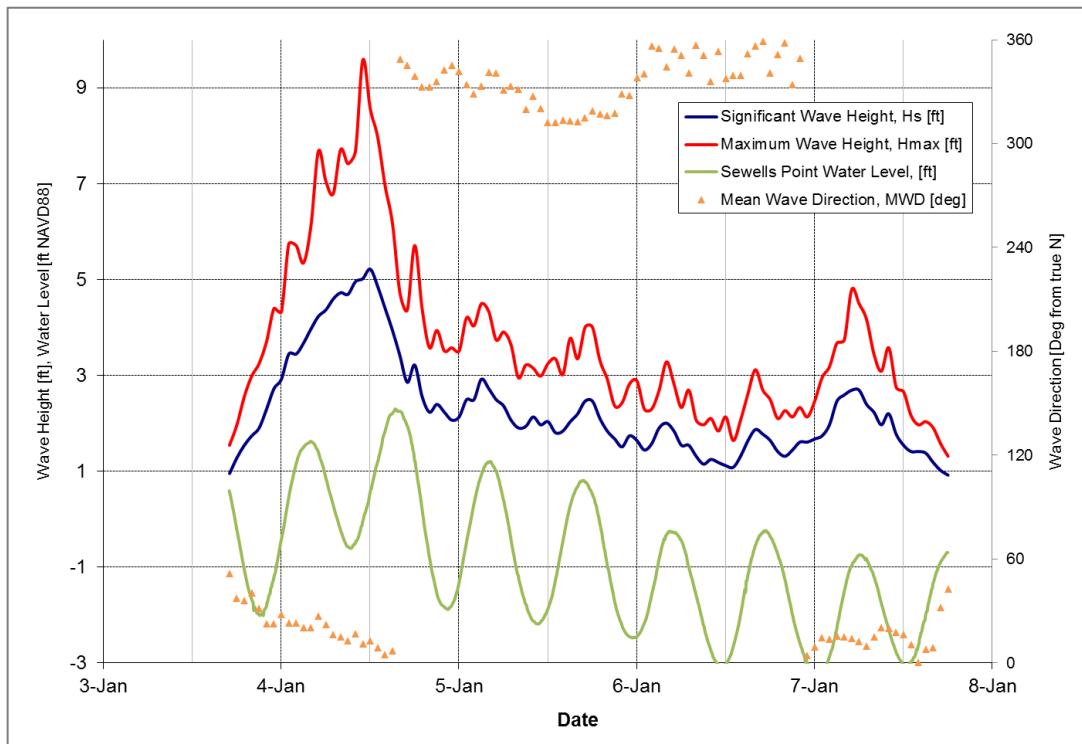


Figure 5-13: January 4, 2018 Storm

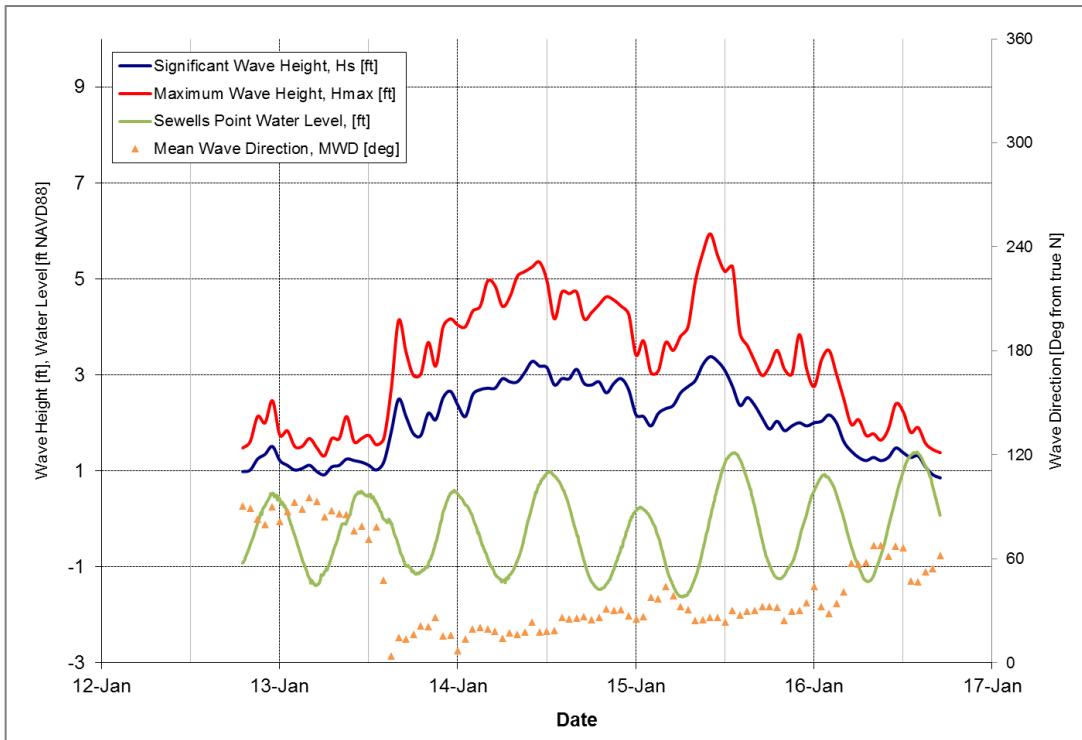


Figure 5-14: January 14, 2018 Storm

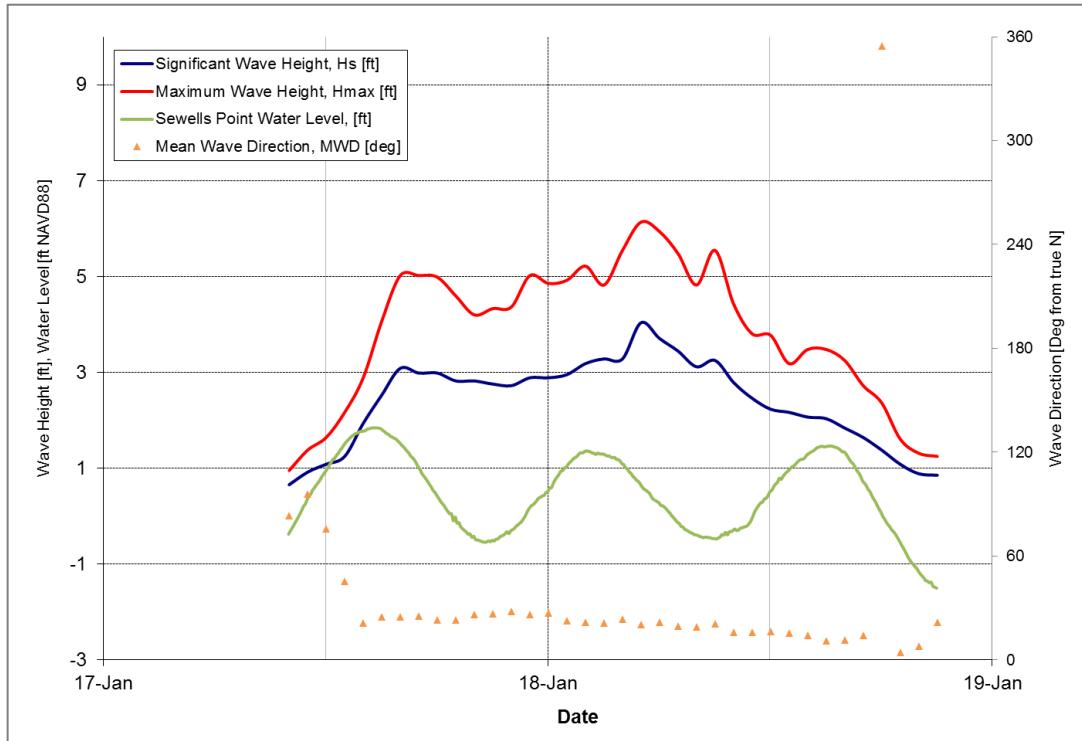


Figure 5-15: January 18, 2018 Storm

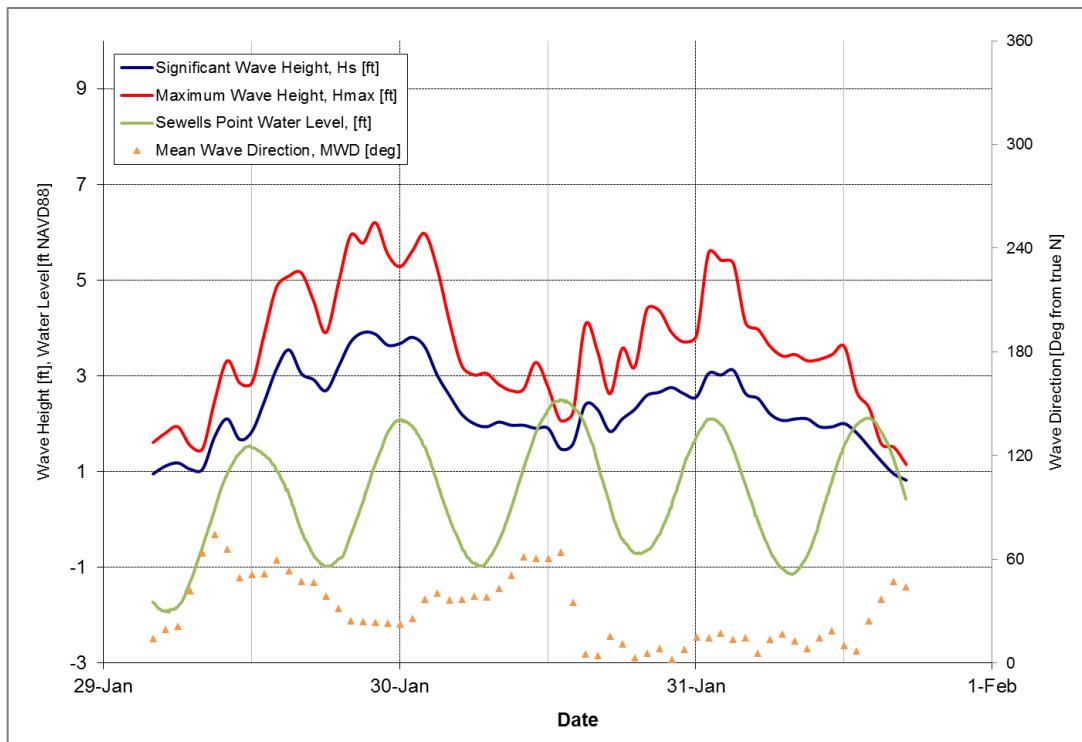


Figure 5-16: January 29, 2018 Storm

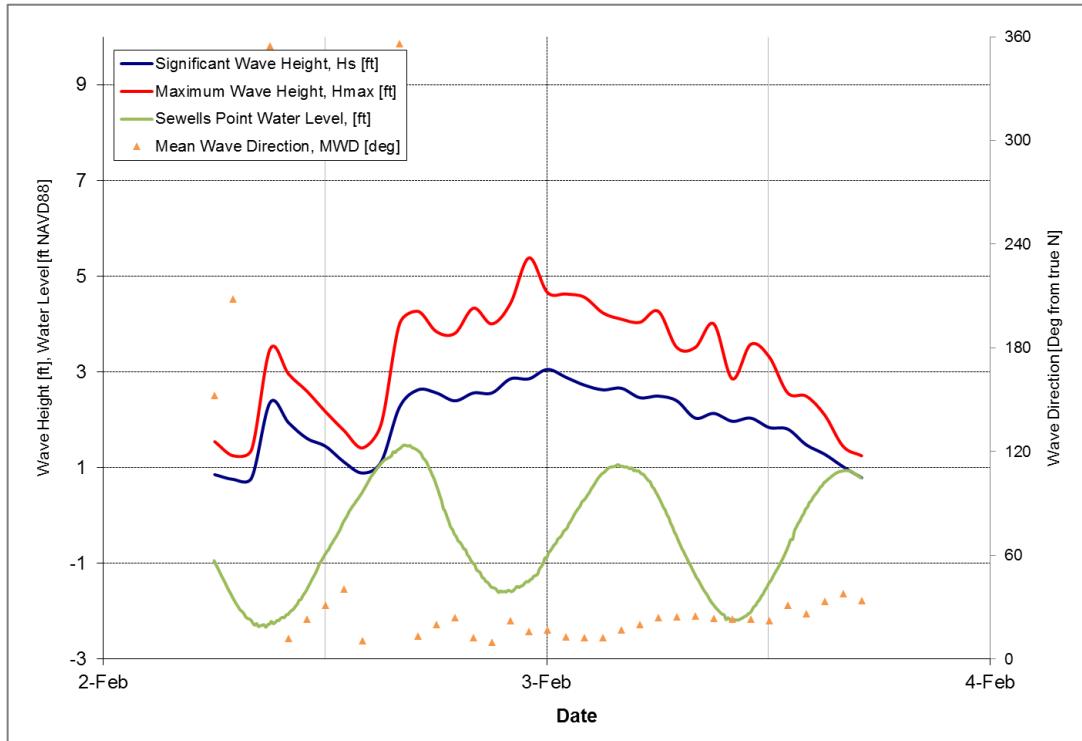


Figure 5-17: February 3, 2018 Storm

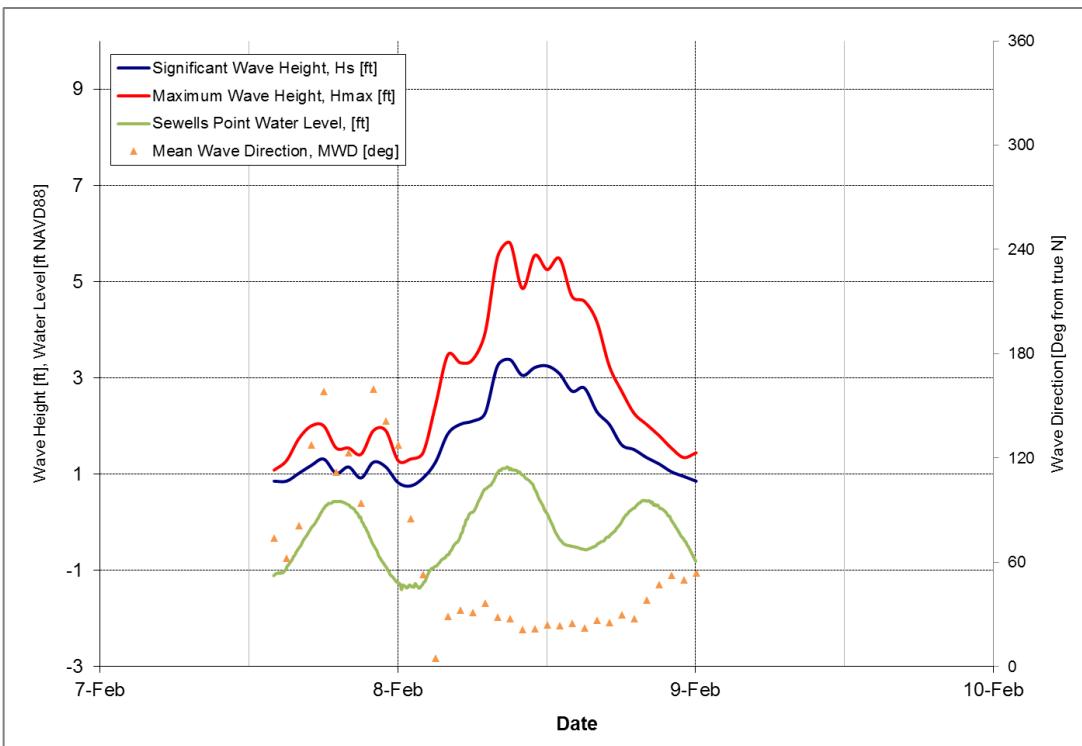


Figure 5-18: February 8, 2018 Storm

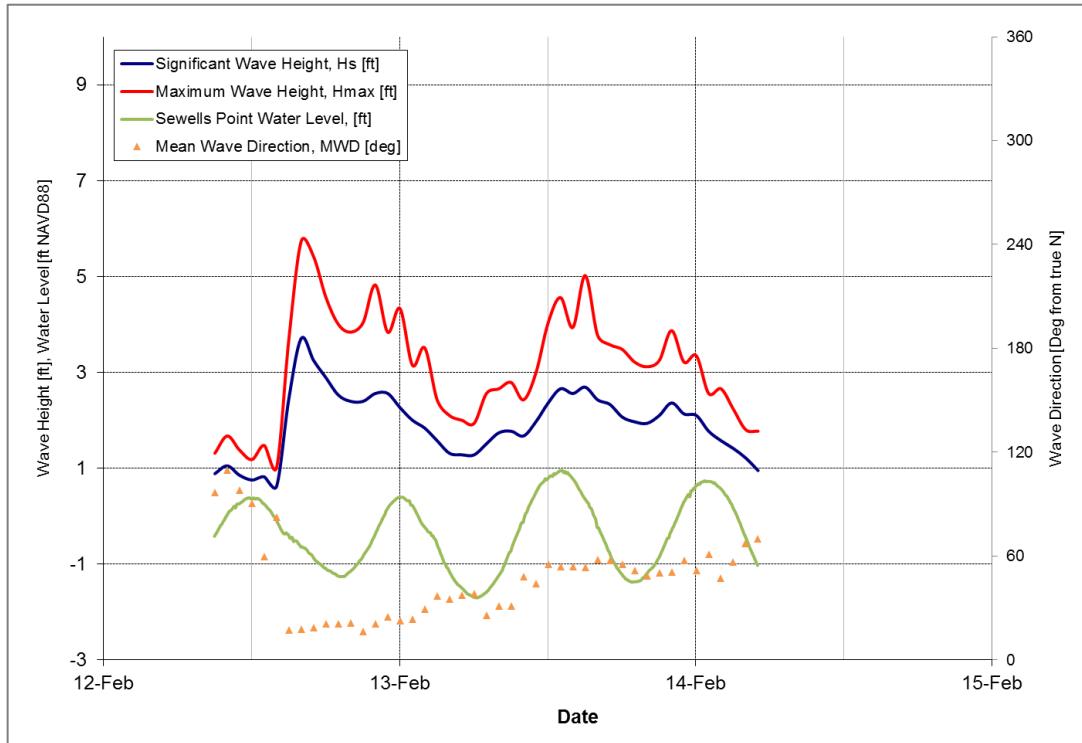


Figure 5-19: February 12, 2018 Storm

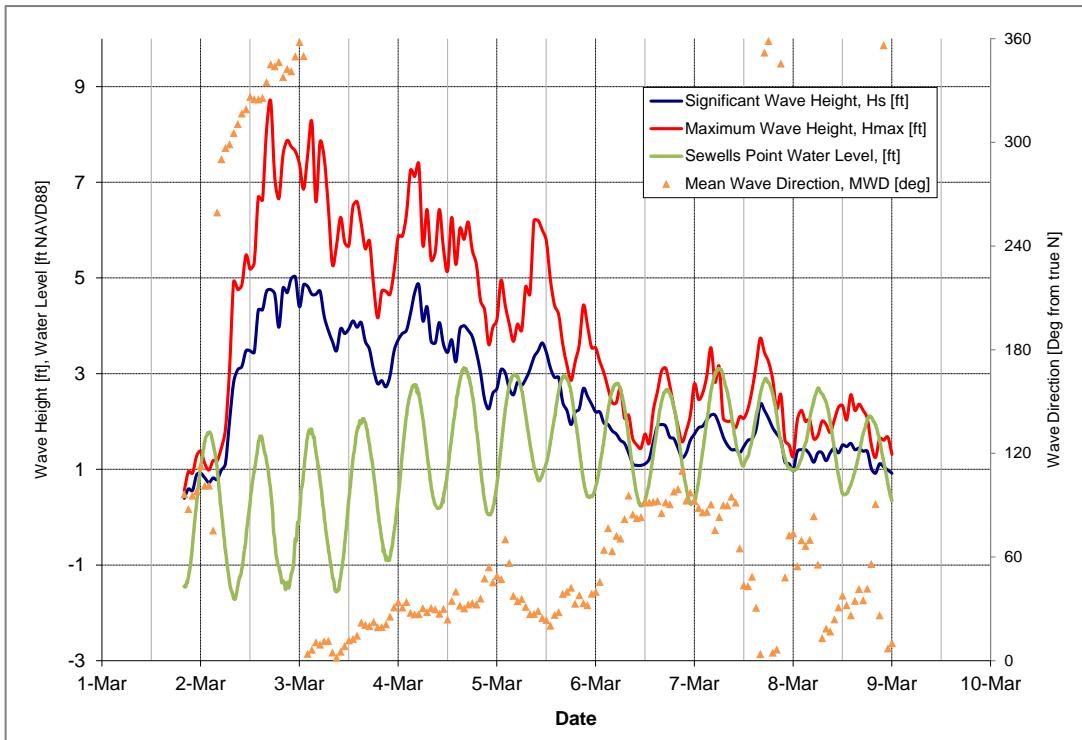


Figure 5-20: March 2, 2018 Storm

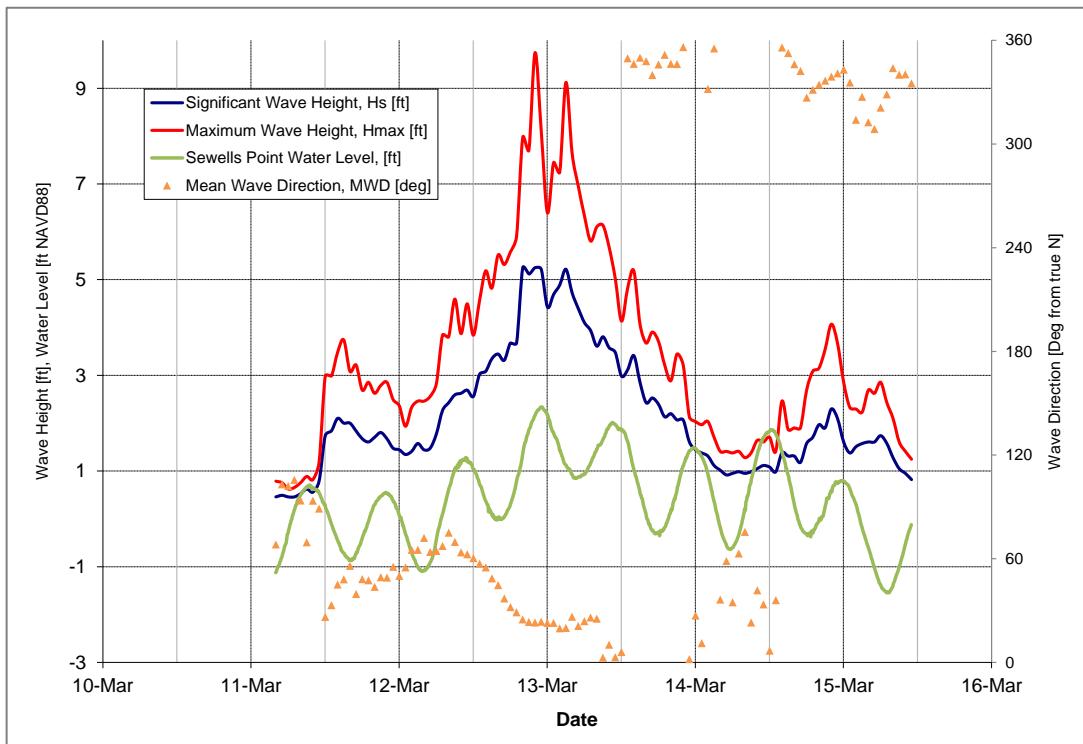


Figure 5-21: March 12, 2018 Storm

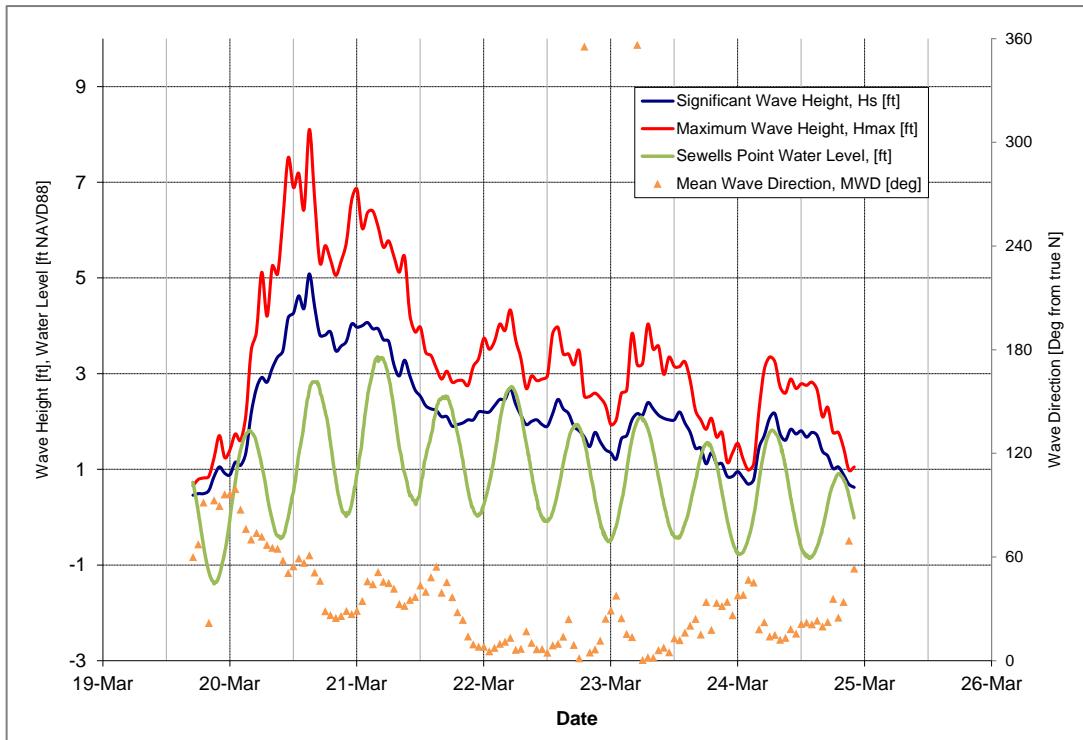


Figure 5-22: March 20, 2018 Storm

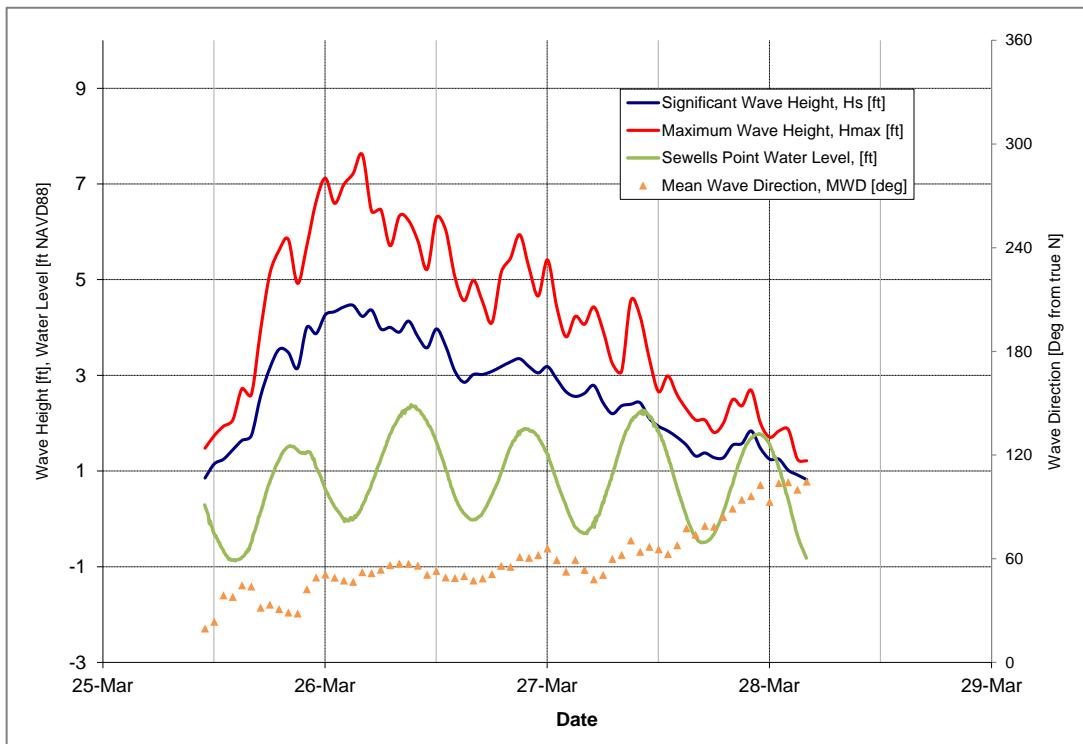


Figure 5-23: March 26, 2018 Storm

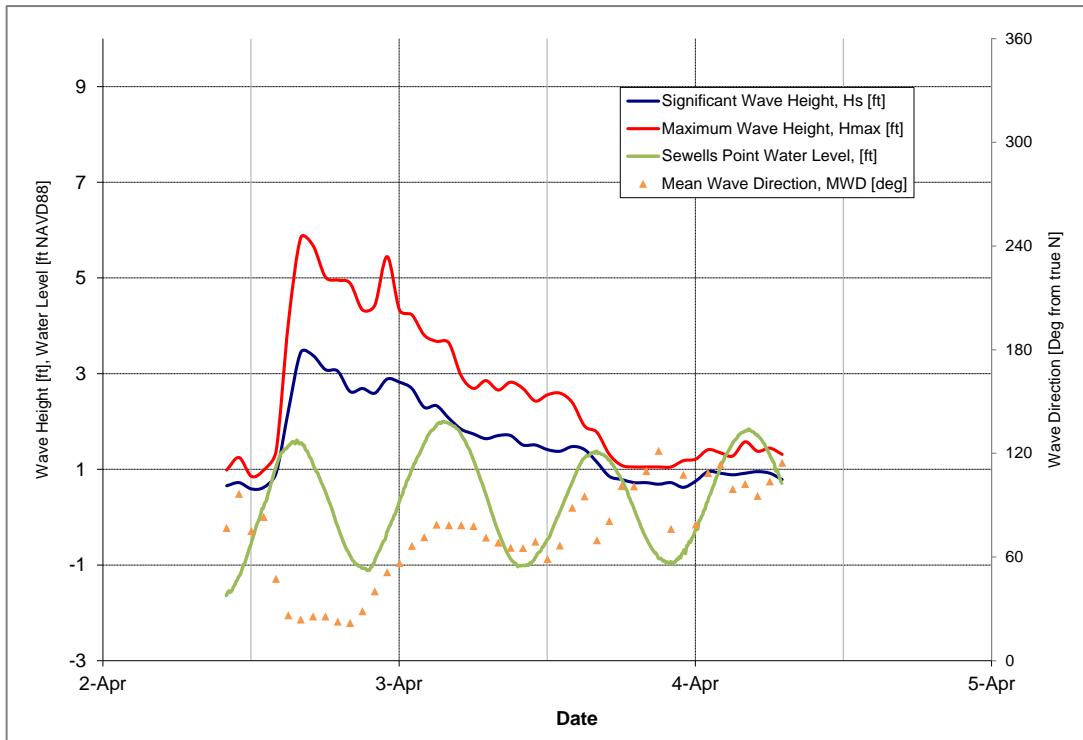


Figure 5-24: April 2, 2018 Storm

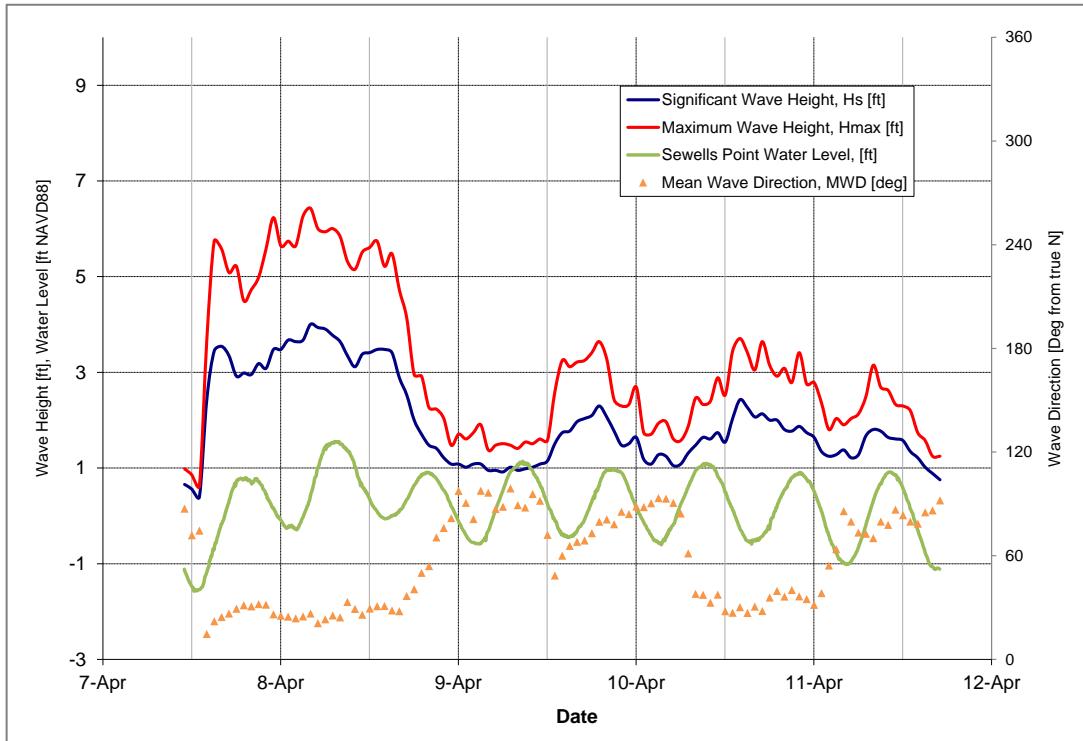


Figure 5-25: April 8, 2018 Storm

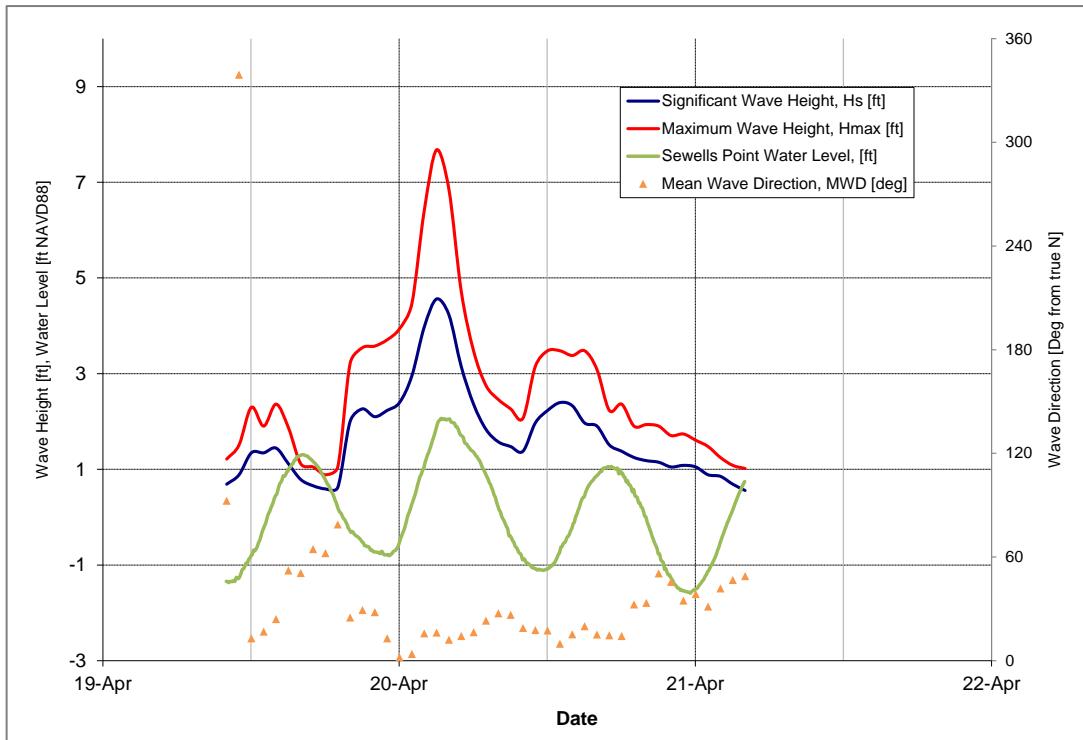


Figure 5-26: April 20, 2018 Storm

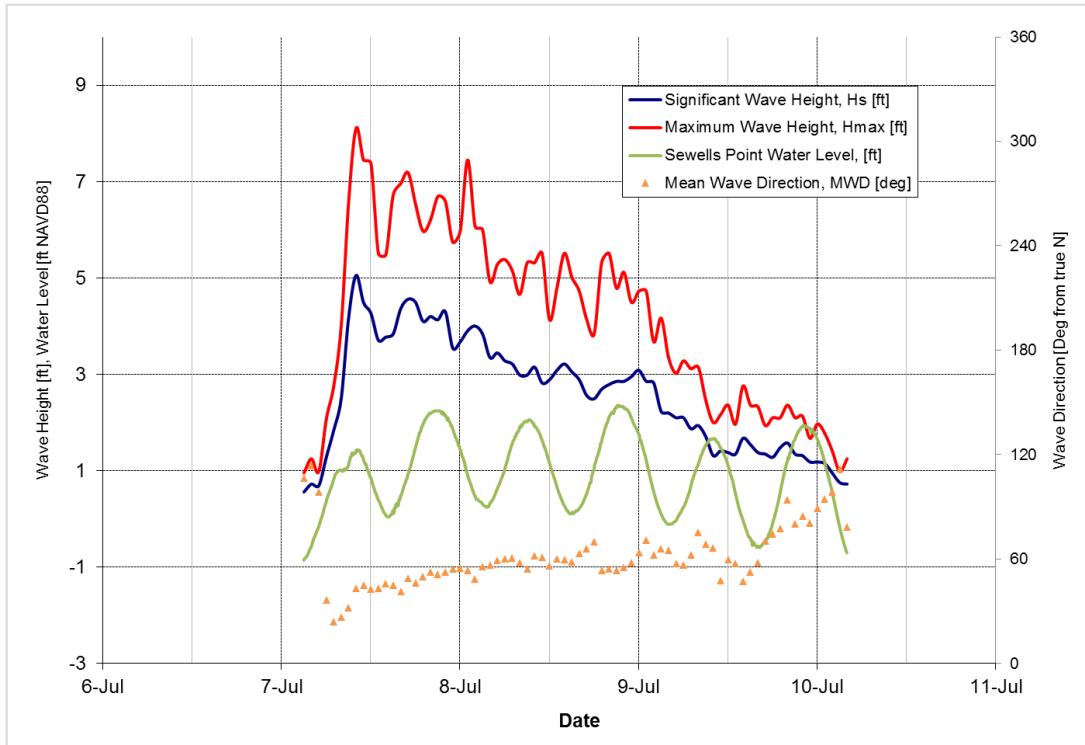


Figure 5-27: July 7, 2018 Storm

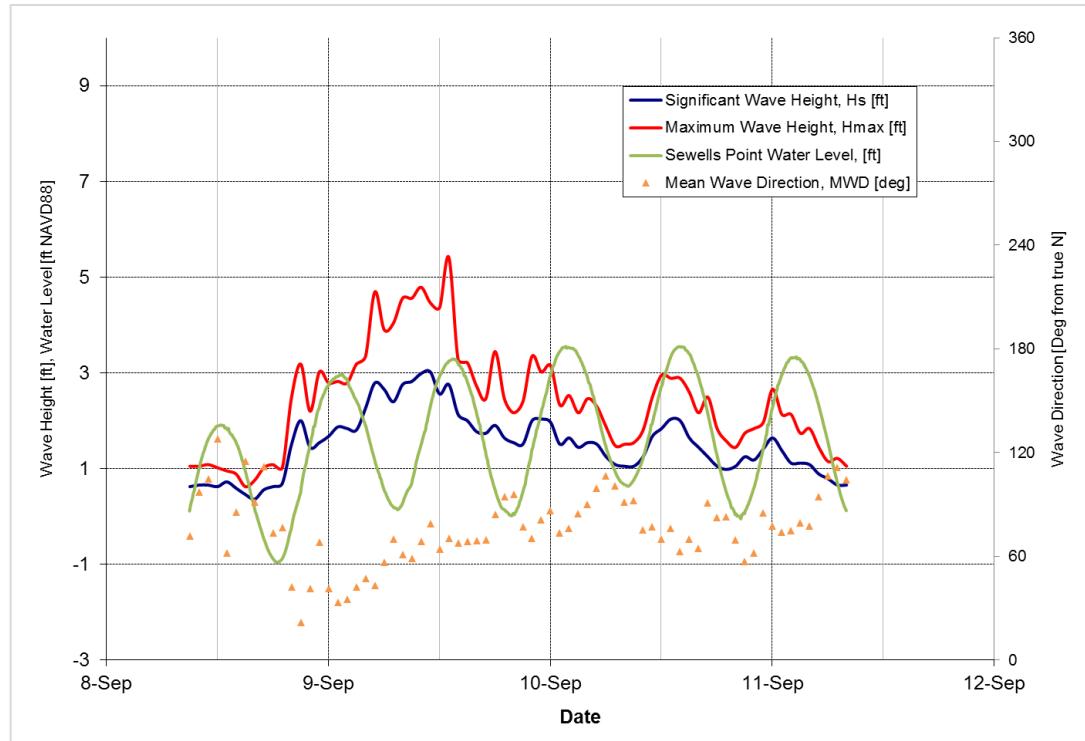


Figure 5-28: September 9, 2018 Storm

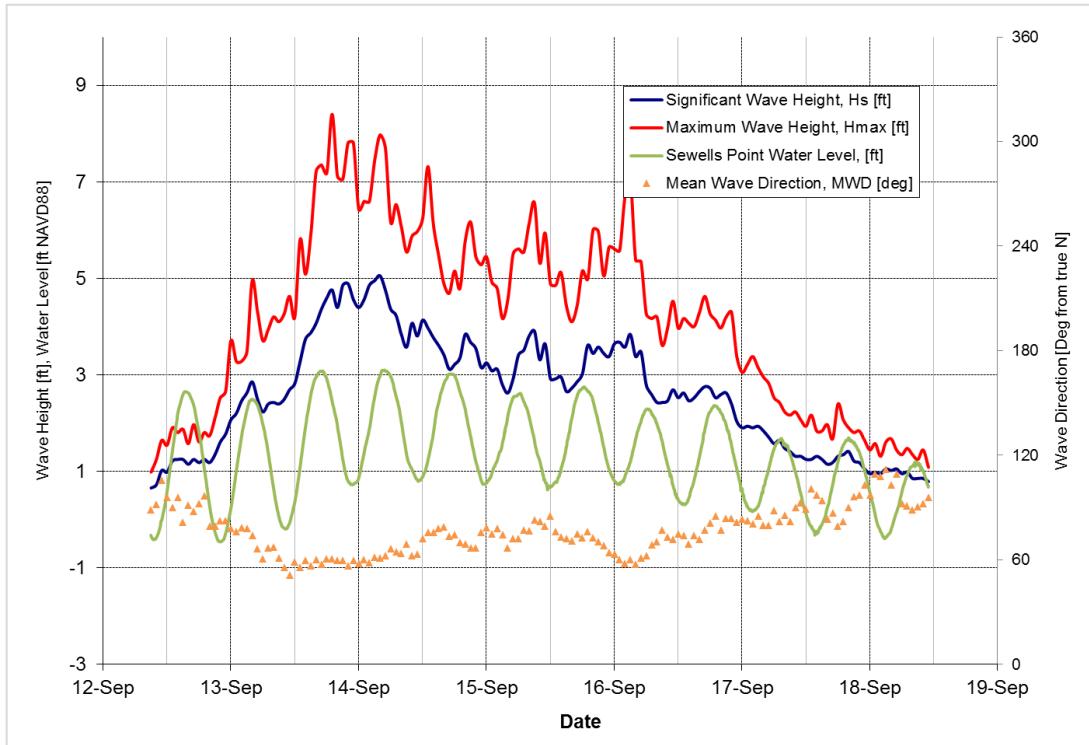


Figure 5-29: September 14, 2018 Storm

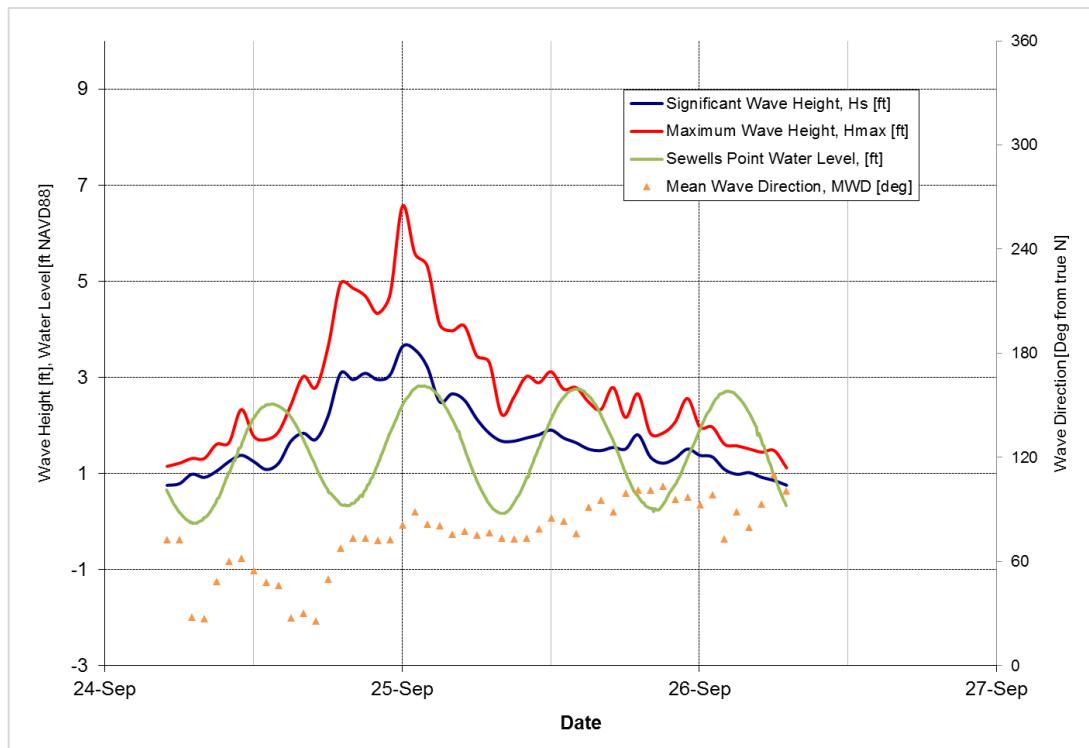


Figure 5-30: September 24, 2018 Storm

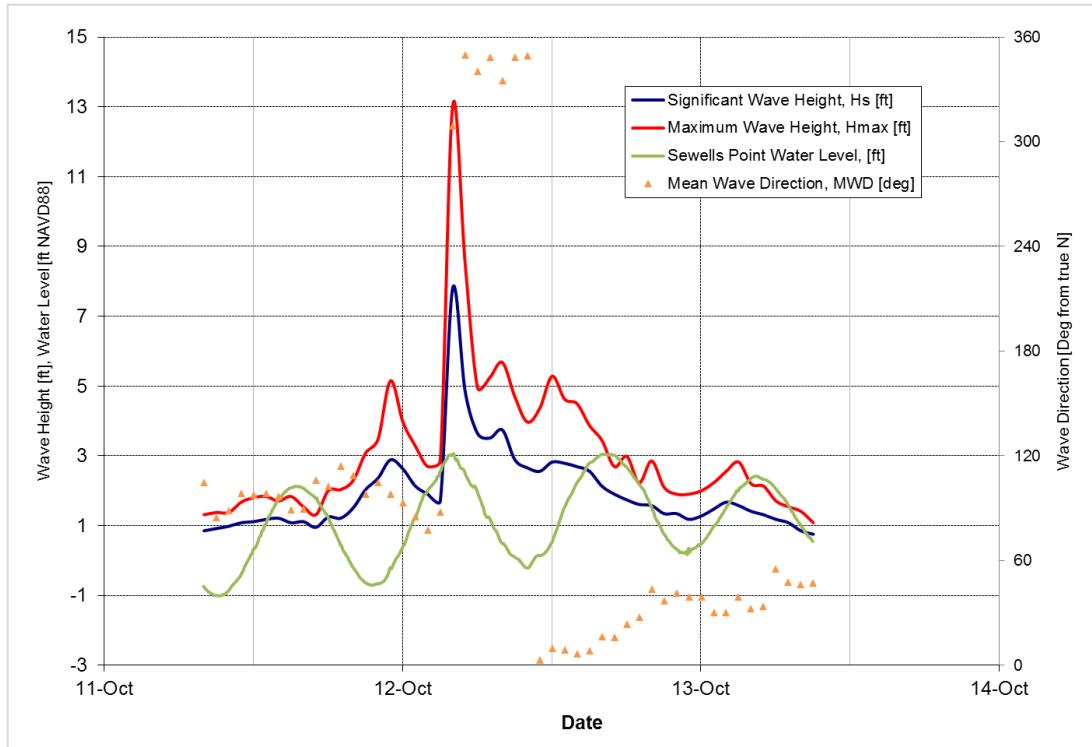


Figure 5-31: October 12, 2018 Storm

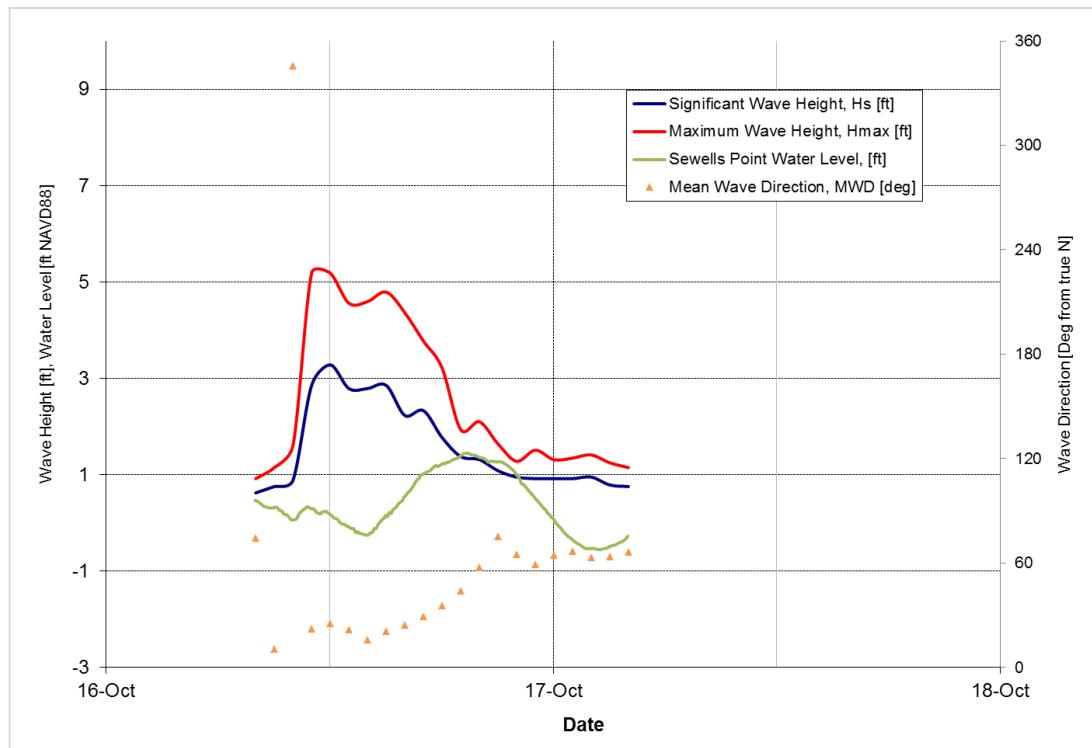


Figure 5-32: October 16, 2018 Storm

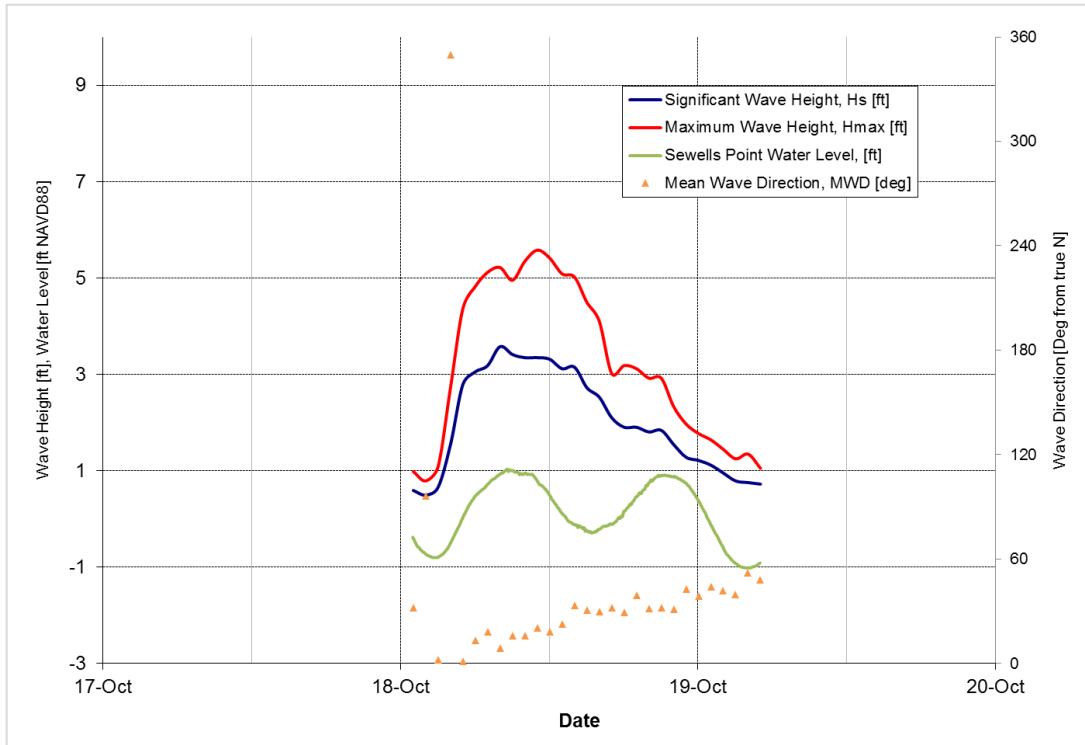


Figure 5-33: October 18, 2018 Storm

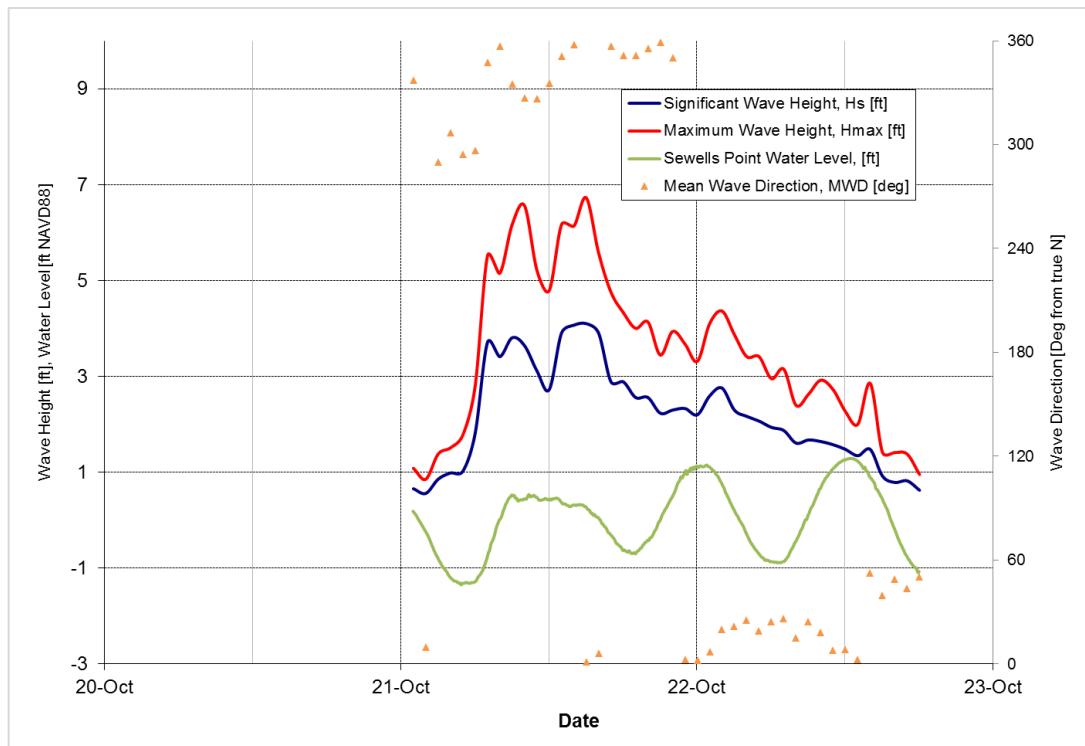


Figure 5-34: October 21, 2018 Storm

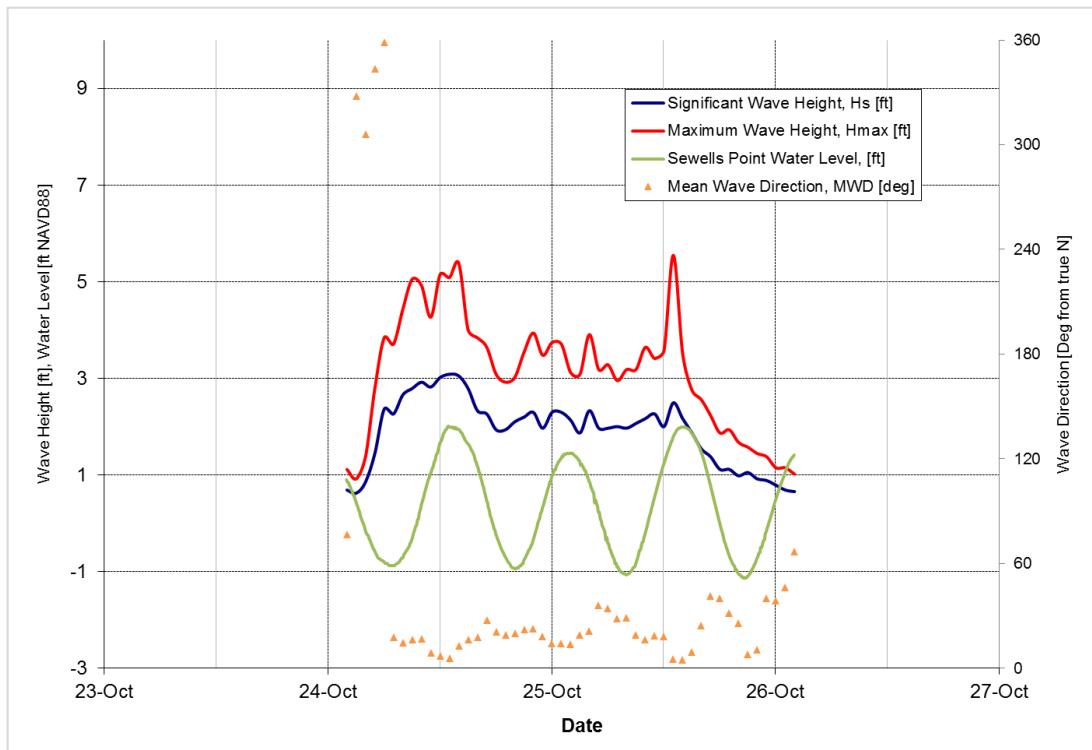


Figure 5-35: October 24, 2018 Storm

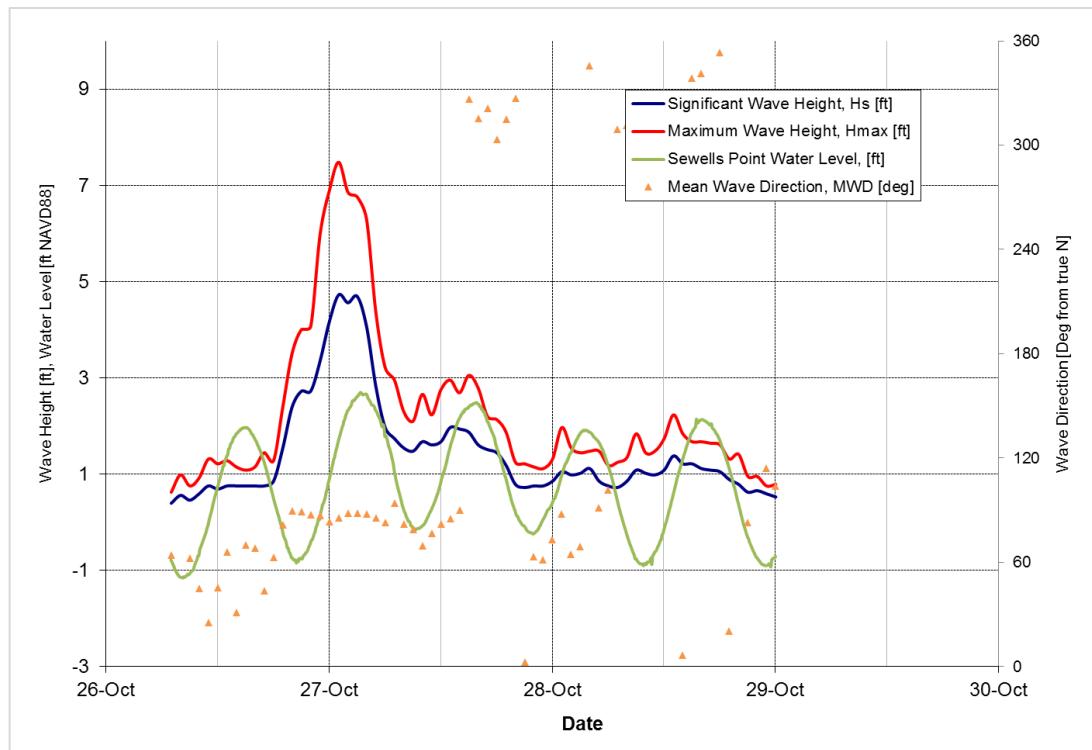


Figure 5-36: October 27, 2018 Storm

5.2.2. Engineering Activities

No significant coastal engineering activities occurred in the monitoring area during this six months' monitoring period.

The Federal Willoughby and Vicinity Coastal Storm Damage Reduction Project (Federal Project) was constructed in March, April and May 2017. The Federal Project placed approximately 1.2 million cubic yards of sand from the Thimble Shoals Auxiliary Channel along most of the Ocean View shoreline. An exception is that the Federal Project did not place sand between Warwick Avenue (station 206+86) and 1st Bay Street (station 274+53).

5.3. General Shoreline Trends

Key statistics were calculated to describe the shoreline and volume change trends over the entire shoreline as well as for each region of the shoreline as defined in Figure 3-1. The computed statistics include average shoreline change, average volume change, and cumulative volume change (e.g. total volume of material lost or gained along a section of shoreline). A summary of the resulting statistics for the October 2017 to November 2018 comparison are presented in Table 5-2. A summary of the resulting statistics for the April 2018 to November 2018 comparison are presented in Table 5-3.

As illustrated in Table 5-2, the Ocean View shoreline has experienced overall retreat at MHW during October 2017 and November 2018 with a length-weighted average change rate of -8.47 ft/yr. The beach and dune above 0 feet NAVD88 gained sediment at a rate of 57,312 cy/yr from October 2017 to November 2018. The beach and dune above -15 feet NAVD88 gained sediment at a rate of 108,507 cy/yr from October 2017 to November 2018.

From April 2018 to November 2018, the MHW shoreline retreated more slowly than in the first six months post-construction of the Federal Project, with an average shoreline change of -4.73 feet, as shown in Table 5-3. The volumetric change over the same period showed gains of 737 cy above 0 feet NAVD88, and gain of 117,491 cy above -15 feet NAVD88, respectively.

The Ocean View shoreline overall gain 117,491 cy above -15 feet NAVD88 between April 2018 and November 2018, and it had a net 108,507 cy gain of sand volume above -15 feet NAVD88 over the year between October 2017 and November 2018. These overall trends and the behavior of the system are better understood by looking at patterns of change on a reach-by-reach basis, as discussed in more detail in the following section.

Table 5-2: Regional Shoreline and Volume Change Statistics (October 2017 to November 2018)

Region	Average Shoreline Change	Average Volume Change Rate Above 0 ft NAVD88	Cumulative Volume Change Rate Above 0 ft NAVD88	Average Volume Change Rate Above -15 ft NAVD88	Cumulative Volume Change Rate Above -15 ft NAVD88
	(ft/yr)	(cy/ft/yr)	(cy/yr)	(cy/ft/yr)	(cy/yr)
Willoughby Spit (0+00 to 45+00)	-4.52	-0.25	-1,146	7.63	34,414
800 Block Breakwaters (45+25 to 87+62)	-14.62	0.06	257	1.76	7,983
West Ocean View (93+41 to 163+49)	-16.45	-0.61	-3,965	-1.71	-9,529
Central Ocean View Breakwaters (169+63 to 195+63)	-18.11	0.14	493	1.45	5,026
Central Ocean View (206+86 to 323+09)	3.97	4.57	57,214	5.45	68,217
East Ocean View (329+63 to 383+58)	-17.47	0.78	4,459	0.42	2,396
OVERALL	Weighted Avg (ft/yr)	Weighted Avg (cy/ft/yr)	Total (cy/yr)	Weighted Avg (cy/ft/yr)	Total (cy/yr)
	-8.47	1.48	57,312	2.74	108,507

Table 5-3: Regional Shoreline and Volume Change Statistics (April 2018 to November 2018)

Region	Average Shoreline Change	Average Volume Change Above 0 ft NAVD88	Cumulative Volume Change Above 0 ft NAVD88	Average Volume Change Above -15 ft NAVD88	Cumulative Volume Change Above -15 ft NAVD88
	(ft)	(cy/ft)	(cy)	(cy/ft)	(cy)
Willoughby Spit (0+00 to 45+00)	-2.95	-0.96	-4,341	8.39	37,874
800 Block Breakwaters (45+25 to 87+62)	-3.07	-0.60	-2,738	5.43	24,644
West Ocean View (93+41 to 163+49)	-7.02	-0.92	-7,023	2.10	15,976
Central Ocean View Breakwaters (169+63 to 195+63)	-18.71	-0.10	-361	0.81	2,802
Central Ocean View (206+86 to 323+09)	2.95	1.66	20,710	3.48	43,535
East Ocean View (329+63 to 383+58)	-12.72	-0.96	-5,509	-1.28	-7,339
OVERALL	Weighted Avg (ft)	Weighted Avg (cy/ft)	Total (cy)	Weighted Avg (cy/ft)	Total (cy)
	-4.73	0.02	737	3.06	117,491

5.4. Regional Shoreline Trends

Regional shoreline trends are discussed below for the defined regions between Willoughby Spit and Little Creek Inlet (see Figure 3-1). A summary of the information in Table 5-2 and Table 5-3 has been created for each region of study.

Figure 5-37 through Figure 5-40, following the discussion of regional shoreline trends, present the shoreline and volume change at each transect within the defined regions.

5.4.1. Willoughby Spit

The western end of the Willoughby Spit region has, since regular monitoring started in 2005, been a relatively stable and accreting region. The eastern end of this region contained an erosional hot spot that was studied in 2010, and that study recommended improvements to manage erosion rates. Prior to December 2012, coastal structures in this region included two offshore breakwaters, a rock terminal groin, and several timber groins. Construction of the Willoughby Spit Shoreline Improvement Project was completed by December 2013, and it included sand nourishment, the removal of the existing timber groin field, relocation of a prior existing breakwater in the 800 Block breakwater field, and addition of seven new detached breakwaters connecting the 800 Block breakwaters with the two prior existing Willoughby Spit breakwaters. A summary of average shoreline and volume change rates for the Willoughby Spit region between October 2017 and November 2018 and between April 2018 and November 2018 are presented in Table 5-4.

Table 5-4: Average Shoreline and Volume Change Rates for Willoughby Spit

Region	Average Shoreline Change	Average Volume Change Above 0 ft NAVD88	Cumulative Volume Change Above 0 ft NAVD88	Average Volume Change Above -15 ft NAVD88	Cumulative Volume Change Above -15 ft NAVD88
October 2017 vs. November 2018 Comparison					
Willoughby Spit (0+00 to 45+00)	(ft/yr)	(cy/ft/yr)	(cy/yr)	(cy/ft/yr)	(cy/yr)
	-4.52	-0.25	-1,146	7.63	34,414
April 2018 vs. November 2018 Comparison					
Willoughby Spit (0+00 to 45+00)	(ft)	(cy/ft)	(cy)	(cy/ft)	(cy)
	-2.95	-0.96	-4,341	8.39	37,874

On average, this region lost volume in the beach and dune above 0 feet NAVD88 over the seasonal comparison (April 2018 - November 2018). Willoughby Spit lost volume in the beach above 0 feet NAVD88 over the yearly comparison (October 2017 - November 2018). This region gained volume in the subaerial beach and in the submerged profile over the seasonal comparison (April 2018 - November 2018) and gained volume over the yearly comparison (October 2017 – November 2018). For the yearly comparison, the MHW shoreline lost at a rate of -0.25 ft/yr while loss volume above 0 feet and gaining volume above -15 feet NAVD88 at a rate of -1,146 cy/yr and 34,414 cy/yr, respectively. The seasonal comparison showed loss of the MHW shoreline of -2.95 feet on average and a cumulative sediment loss of -4,341 cy above 0 feet and gain of 37,874 cy above -15 feet NAVD88, respectively. The breakwaters that were part of the 2013 shoreline improvement project that connected to the previously existing 800 Block breakwaters have continued to provide stability to the majority of the Willoughby Spit reach as shown in Figure 5-37 and Figure 5-39. As an exception, at the transition between the two sets of breakwaters, from approximately 11th View Street to 12th View Street along Toler Place, has experienced significantly greater shoreline retreat than adjacent areas in the Willoughby Spit segment. The design and permitting of modifications to that transition area is underway, with construction of the breakwater modifications expected to be completed during 2019.

5.4.2. 800 Block Breakwaters

The 800 Block Breakwaters region (Sta 45+25 to Sta 87+62) is characterized by a field of eight breakwaters. The easternmost breakwater was relocated in February 2006 along with removal of a pre-existing groin spur and toe extension. This relocated breakwater was placed further offshore to mitigate an excessive salient / tombolo formation, caused by the prior structural configuration that had impaired natural sediment transport to the west. In conjunction with the 2013 Willoughby Spit shoreline improvement project, the second easternmost breakwater in the 800 Block set was also relocated further offshore to enhance natural sediment transport in the region. A summary of average shoreline and volume change rates for the 800 Block Breakwaters region between October 2017 and November 2018 and between April 2018 and November 2018 are presented in Table 5-5.

Table 5-5: Average Shoreline and Volume Change Rates for 800 Block Breakwaters

Region	Average Shoreline Change	Average Volume Change Above 0 ft NAVD88	Cumulative Volume Change Above 0 ft NAVD88	Average Volume Change Above -15 ft NAVD88	Cumulative Volume Change Above -15 ft NAVD88
October 2017 vs. November 2018 Comparison					
	(ft/yr)	(cy/ft/yr)	(cy/yr)	(cy/ft/yr)	(cy/yr)
800 Block Breakwaters (45+25 to 87+62)	-14.62	0.06	257	1.76	7,983
April 2018 vs. November 2018 Comparison					
	(ft)	(cy/ft)	(cy)	(cy/ft)	(cy)
800 Block Breakwaters (45+25 to 87+62)	-3.07	-0.60	-2,738	5.43	24,644

The 800 Block region gained volume over the seasonal comparison (April 2018 - November 2018) and over the yearly comparison (October 2017 - November 2018). Over the past year, there has been retreat of the MHW shoreline of -14.62 ft/yr as well as an overall volume gain above 0 feet NAVD88 of 257 cy/yr and overall volume gain above -15 ft NAVD88 of 7,983 cy/yr, respectively. The seasonal comparison showed there was retreat of the MHW shoreline of -3.07 feet with a loss of sediment volume above 0 feet NAVD88 and a gain of sediment volume above -15 feet NAVD88 of -2,738 cy and 24,644 cy, respectively.

5.4.3. West Ocean View

The West Ocean View area (Sta 93+41 to Sta 163+49), between the 800 Block and Central Ocean View breakwaters, was historically characterized by a series of timber groins. The 2013 West Ocean View Shoreline Improvement Project included the removal of all timber groins located between the Ocean View Fishing Pier and Station 141+98, the reconstruction of a rock groin at station 129+17, and 73,600 cy of sand nourishment placed in front of Sarah Constant Beach Park. A summary of average shoreline and volume change rates for the West Ocean View region between October 2017 and November 2018 and between April 2018 and November 2018 are presented in Table 5-6.

Table 5-6: Average Shoreline and Volume Change Rates for West Ocean View

Region	Average Shoreline Change	Average Volume Change Above 0 ft NAVD88	Cumulative Volume Change Above 0 ft NAVD88	Average Volume Change Above -15 ft NAVD88	Cumulative Volume Change Above -15 ft NAVD88
October 2017 vs. November 2018 Comparison					
	(ft/yr)	(cy/ft/yr)	(cy/yr)	(cy/ft/yr)	(cy/yr)
West Ocean View (93+41 to 163+49)	-16.45	-0.61	-3,965	-1.71	-9,529
April 2018 vs. November 2018 Comparison					
	(ft)	(cy/ft)	(cy)	(cy/ft)	(cy)
West Ocean View (93+41 to 163+49)	-7.02	-0.92	-7,023	2.10	15,976

This region had loss over the yearly comparison (October 2017 - November 2018) with retreat of the MHW shoreline at a rate of -16.45 ft/yr, and a volume loss above 0 feet NAVD88 of -3,965 cy/yr and a volume loss above -15 feet NAVD88 of -9,529 cy/yr respectively. The seasonal comparison (April 2018 - November 2018) showed a retreat of the MHW shoreline of -7.02 feet, a loss of material above 0 feet NAVD88 of -7,023 cy and a gain of material above -15 feet NAVD88 of 15,976 cy.

5.4.4. Central Ocean View Breakwaters

The Central Ocean View Breakwaters region covers the four offshore breakwaters at Central Ocean View and approximately 800 feet westward (Sta 169+63 to Sta 195+63). A summary of average shoreline and volume change rates for the Central Ocean View Breakwaters region between October 2017 and November 2018 and between April 2018 and November 2018 are presented in Table 5-7.

Table 5-7: Average Shoreline and Volume Change Rates for Central Ocean View Breakwaters

Region	Average Shoreline Change	Average Volume Change Above 0 ft NAVD88	Cumulative Volume Change Above 0 ft NAVD88	Average Volume Change Above -15 ft NAVD88	Cumulative Volume Change Above -15 ft NAVD88
October 2017 vs. November 2018 Comparison					
	(ft/yr)	(cy/ft/yr)	(cy/yr)	(cy/ft/yr)	(cy/yr)
Central Ocean View Breakwaters (169+63 to 195+63)	-18.11	0.14	493	1.45	5,026
April 2018 vs. November 2018 Comparison					
	(ft)	(cy/ft)	(cy)	(cy/ft)	(cy)
Central Ocean View Breakwaters (169+63 to 195+63)	-18.71	-0.10	-361	0.81	2,802

This region experienced overall volume gain over the yearly comparison (October 2017 - November 2018) and volume gain seasonal comparison (April 2018 – November 2018) above -15 feet NAVD88. The yearly comparison showed retreat of the MHW shoreline at an average rate of -18.11 ft/yr and an overall volume gain above 0 feet NAVD88 and above -15 feet NAVD88 at a rate of 493 cy/yr and 5,026 cy/yr, respectively. The seasonal comparison indicated retreat of the MHW shoreline at an average rate of -18.71 ft and a loss of material above 0 feet NAVD88 and a gain of -15 feet NAVD88 of -361 cy and 2,802 cy respectively.

5.4.5. Central Ocean View

Central Ocean View (Sta 206+86 to Sta 323+09) is historically a stable region with slight accretion despite the absence of engineering interventions (e.g. beach fill or structures). A summary of average shoreline and volume change rates for the Central Ocean View region between October 2017 and November 2018 and between April 2018 and November 2018 are presented in Table 5-8.

Table 5-8: Average Shoreline and Volume Change Rates for Central Ocean View

Region	Average Shoreline Change	Average Volume Change Above 0 ft NAVD88	Cumulative Volume Change Above 0 ft NAVD88	Average Volume Change Above -15 ft NAVD88	Cumulative Volume Change Above -15 ft NAVD88
October 2017 vs. November 2018 Comparison					
Central Ocean View (206+86 to 323+09)	(ft/yr)	(cy/ft/yr)	(cy/yr)	(cy/ft/yr)	(cy/yr)
April 2018 vs. November 2018 Comparison					
Central Ocean View (206+86 to 323+09)	(ft)	(cy/ft)	(cy)	(cy/ft)	(cy)

As shown in Table 5-8, the yearly comparison (October 2017 - November 2018) for the Central Ocean View region showed volume gain above 0 feet NAVD88 and above -15 feet NAVD88. The seasonal comparison (April 2018 - November 2018) also indicated volume gains above 0 feet NAVD88 and above -15 feet NAVD88 of 20,710 cy and 43,535 cy, respectively. The average yearly shoreline gain rate was 3.97 ft/yr with an average of 2.95 ft of gain occurring over the reach during the current survey period.

5.4.6. East Ocean View

The East Ocean View region (Sta 329+63 to Sta 383+58) is characterized by 15 breakwaters of which the 5 westernmost were built in August 2009. In March 2009, prior to the breakwater construction, a beach renourishment project added approximately 196,000 cy of material to the beach. Table 5-9 summarizes average shoreline and volume change rates for the East Ocean View region between October 2017 and November 2018 and between April 2018 and November 2018.

Table 5-9: Average Shoreline and Volume Change Rates for East Ocean View

Region	Average Shoreline Change	Average Volume Change Above 0 ft NAVD88	Cumulative Volume Change Above 0 ft NAVD88	Average Volume Change Above -15 ft NAVD88	Cumulative Volume Change Above -15 ft NAVD88
October 2017 vs. November 2018 Comparison					
East Ocean View (329+63 to 383+58)	(ft/yr)	(cy/ft/yr)	(cy/yr)	(cy/ft/yr)	(cy/yr)
April 2018 vs. November 2018 Comparison					
East Ocean View (329+63 to 383+58)	(ft)	(cy/ft)	(cy)	(cy/ft)	(cy)

This region is normally characterized by a consistent erosional pattern due to sediment movement along the shoreline from east to west with no external sand source due to the terminal groin at Little Creek Inlet. East Ocean View experienced volume gain over the yearly (October 2017 – November 2018) comparison and volume loss over the seasonal (April 2018 – November 2018) comparison. The yearly comparison showed an overall retreat of the MHW shoreline at a rate of -17.47 ft/yr and an overall volume gain above 0 feet NAVD88 and overall volume gain above -15 feet NAVD88 at a rate of 4,459 cy/yr and 2,396 cy/yr respectively. The seasonal comparison showed a MHW shoreline retreat of -12.72 feet, and loss of material above 0 feet NAVD88 and -15 feet NAVD88 of -5,509 cy and -7,339 cy respectively.

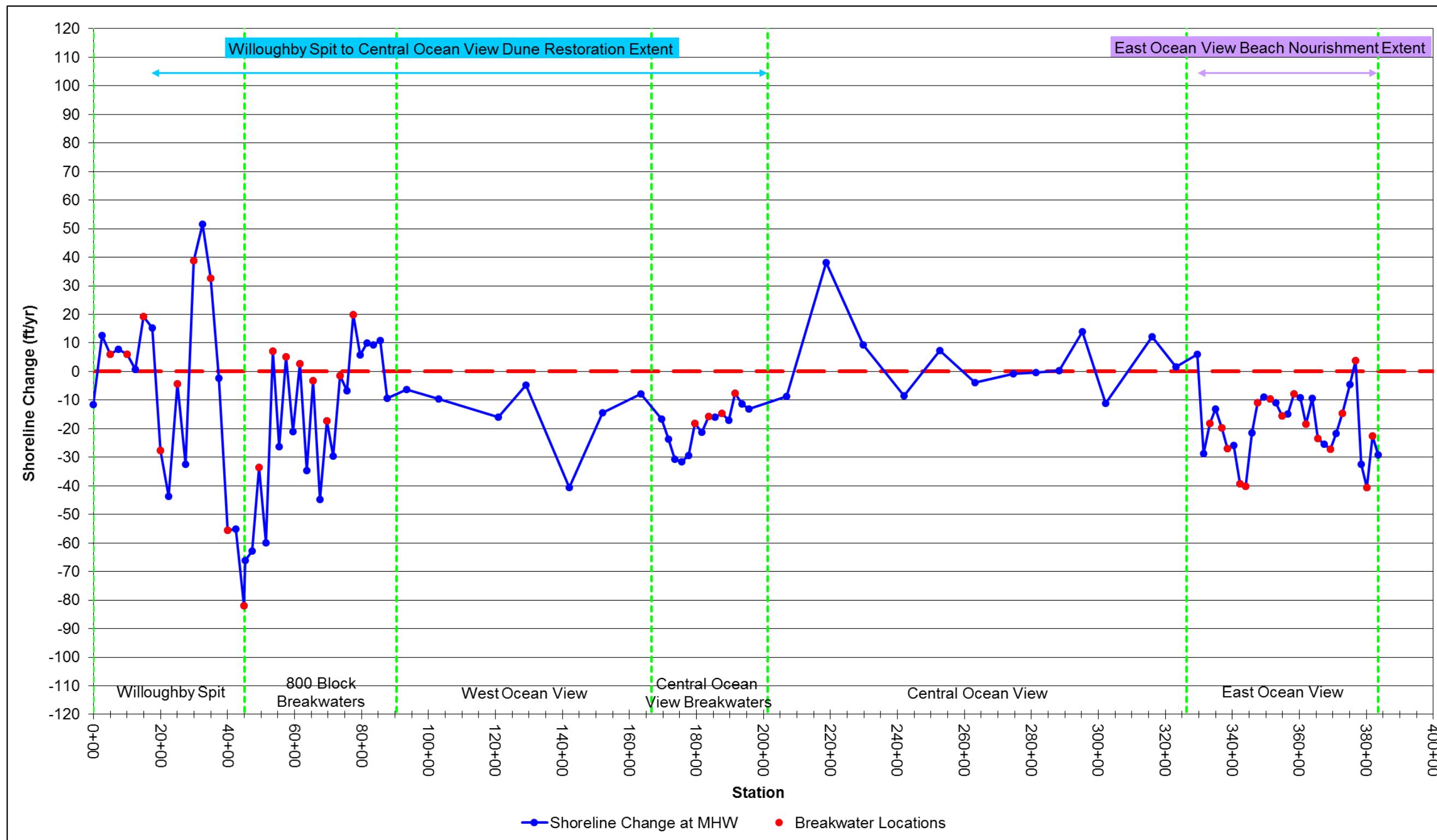


Figure 5-37: Shoreline Change Rate (ft/yr) at Mean High Water (+0.98 ft NAVD88) for October 2017 to November 2018 (Note: Positive = Accretion, Negative = Erosion)

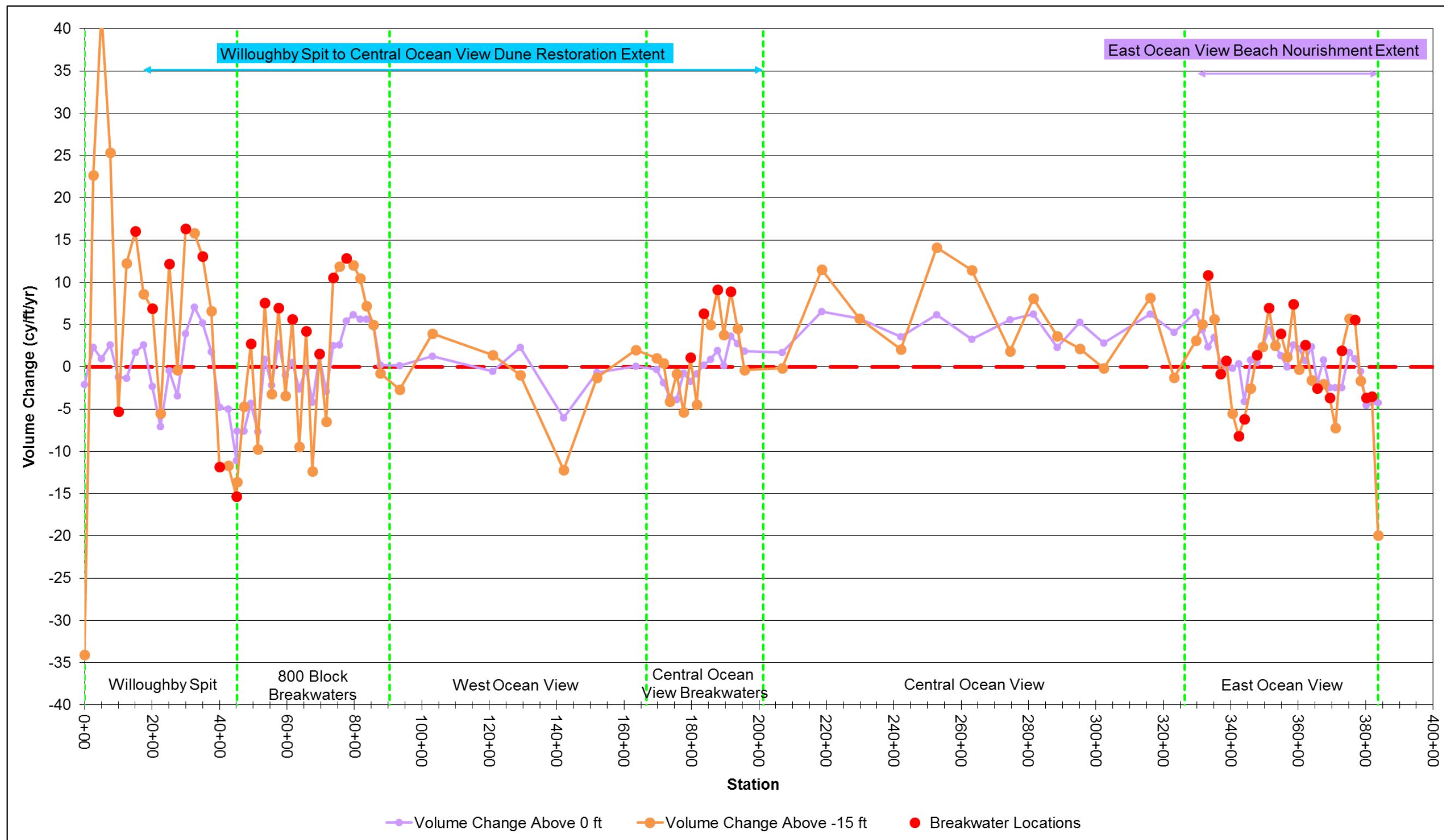


Figure 5-38: Volume Change Rate above 0 ft NAVD88 and -15 ft NAVD88 (cy/ft/yr) for October 2017 to November 2018 (Note: Positive = Accretion, Negative = Erosion)

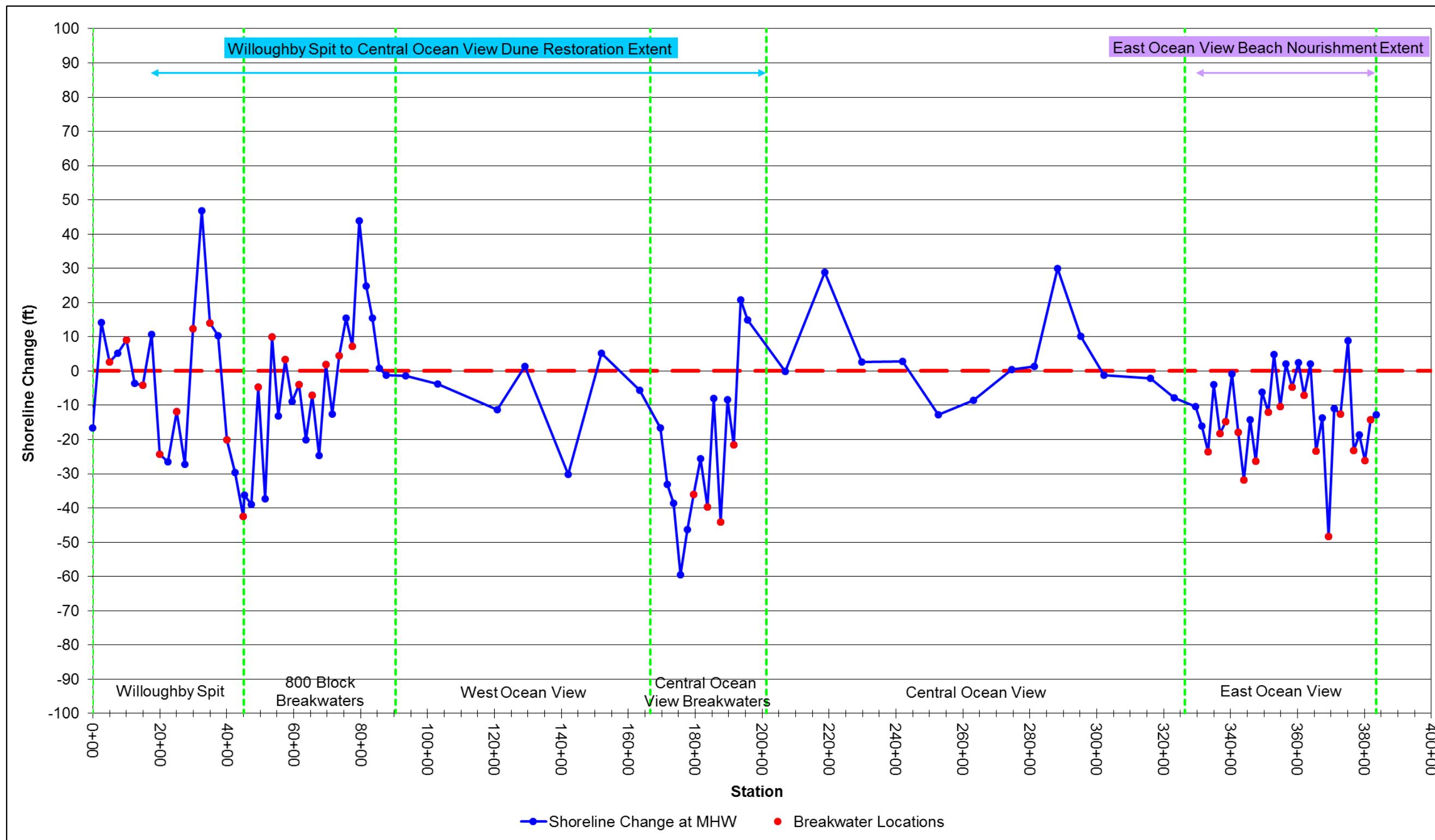


Figure 5-39: Shoreline Change (ft) at Mean High Water (+0.98 ft NAVD88) for April 2018 to November 2018 (Note: Positive = Accretion, Negative = Erosion)

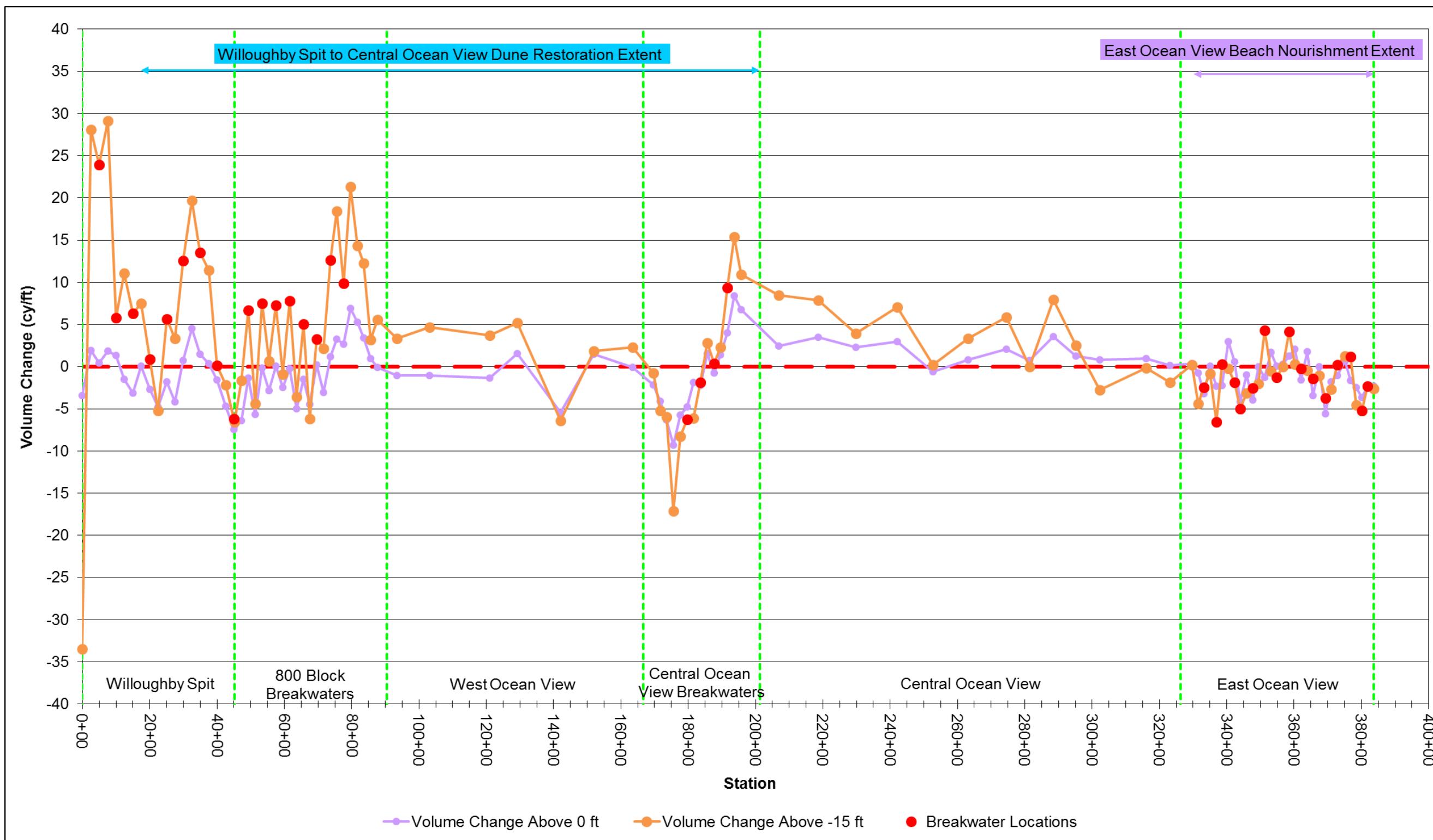


Figure 5-40: Volume Change Above 0 ft NAVD88 and -15 ft NAVD88 (cy/ft) for April 2018 to November 2018 (Note: Positive = Accretion, Negative = Erosion)

6. Bed Elevations Immediately West of the Willoughby Spit Terminal Groin

The 2012 design and subsequent construction of the Willoughby Spit Shoreline Improvement projects included elevation of the crest of the terminal groin, along with excavation of sand from the area immediately west of the terminal groin. The excavated sand was used as beach fill borrow material in other reaches of the project to pre-fill the newly constructed Willoughby Spit breakwaters field.

Prior to the 2012 project, a resident had expressed concerns to the City about sand accretion at their pier and boat dock adjacent to the terminal groin. The crest of the terminal groin was raised, and the sand between the groin and the pier was excavated, in order to mitigate some of the potential for sand to migrate over the groin and into the vicinity of the pier.

While this area west of the terminal groin has not historically been part of the regular periodic survey coverage, the past two surveys have included vessel tracks, as shown in Figure 6-1, to evaluate the depths near the pier. The left and right panels of Figure 6-1 show the April 2018 and November 2018 survey point depths, respectively, between the terminal groin and the pier and the relatively deeper waters near the Hampton Roads Bridge Tunnel. In both surveys, depths near the pier were deeper than -4.0 feet NAVD88, which is approximately 2.5 feet deeper than local Mean Low Water (MLW). Bed elevations were consistently at or deeper than this elevation from the pier to the deeper water at the end of the spit.

In addition, no significant change in bed elevation is seen between the April 2018 and November 2018 survey data. Thus, the surveys indicate that the depths between the terminal groin and the pier are presently relatively stable.

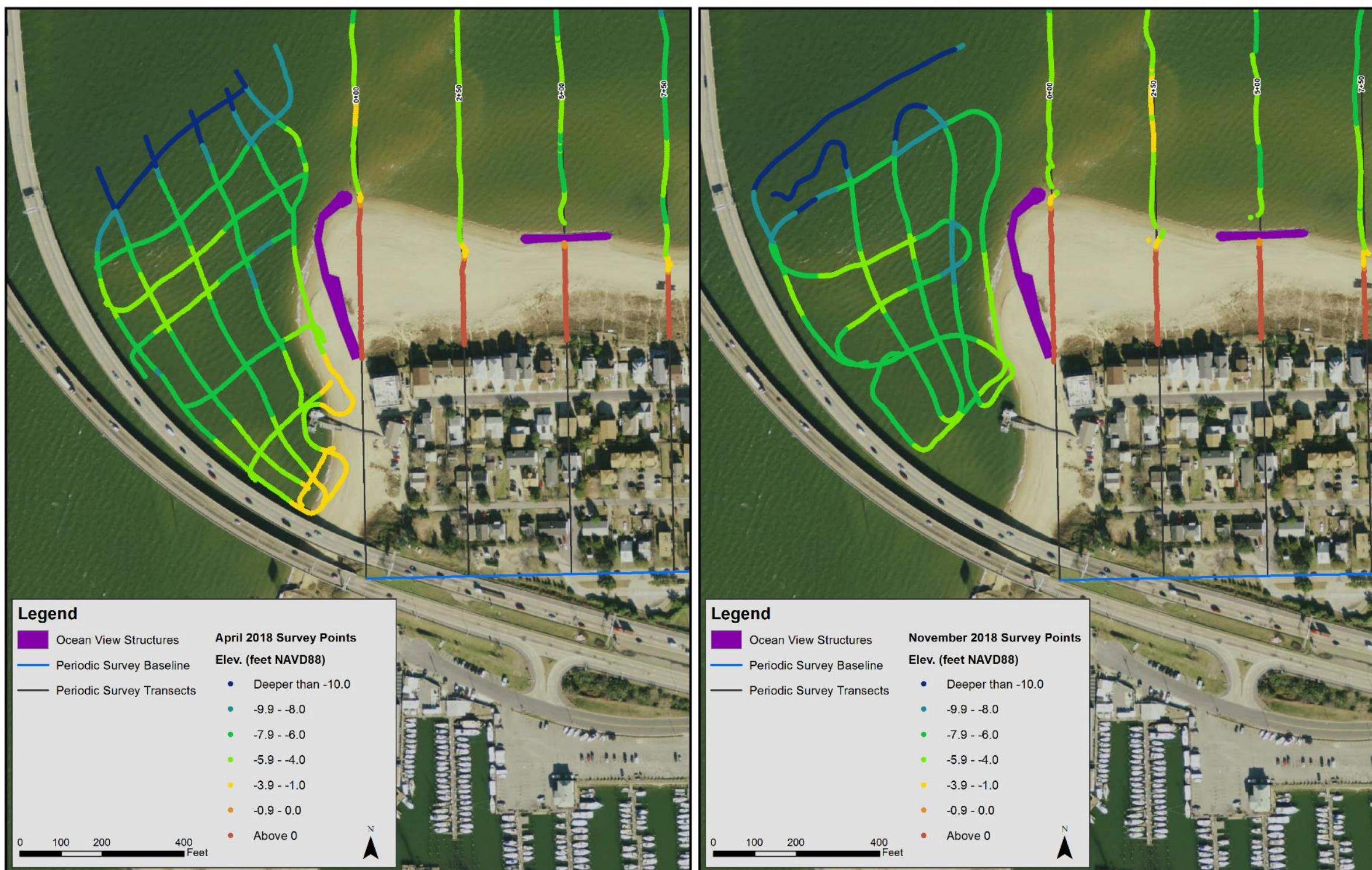


Figure 6-1: Spring 2018 and Fall 2018 Survey Depths West of the Willoughby Spit Terminal Groin

7. Federal Coastal Storm Damage Reduction Project

7.1. Initial Construction of the Federal Project

The initial nourishment of the Federal Willoughby and Vicinity Coastal Storm Damage Reduction Project (Federal Project) was constructed in March, April and May 2017. The Federal Project placed approximately 1.2 million cubic yards of sand from the Thimble Shoals Auxiliary Channel along most of the Ocean View shoreline. An exception is that the Federal Project did not place sand between Warwick Avenue (station 206+86) and 1st Bay Street (station 274+53). The Spring 2017 survey (done in late May 2017 after all of the Federal Project beach fill had been placed) captured the project's beach and nearshore condition very soon after construction was completed. The volume gains from October 2016 to May 2017 associated with Federal Project construction, and the initial readjustment of the Federal project post-construction, were discussed in the prior reports for Fall 2017 and Spring 2017 monitoring periods.

7.2. Shoreline and Beach Berm Contour Changes Relative to the May 2017 Post-Construction Condition of the Federal Project

7.2.1. Shoreline Change

The most recent Fall 2018 periodic survey documents the continued evolution of the Federal Project through background erosion / accretion due to coastal processes from October 2017 through November 2018. Figure 7-1 shows the position of the Mean Higher High Water (MHHW) contour line extracted from Digital Elevation Models (DEMs) of surveys from October 2016 (approximately six months pre-construction), May 2017 (post-construction), October 2017 (approximately five months post-construction), April 2018 (11 months post-construction), and November 2018 (18 months post-construction).

The movement of the shoreline is consistent with the shoreline changes tabulated by Ocean View region earlier in this report (Table 1-2). The chart in Figure 7-1 shows shoreline position rather than shoreline change rate as a means of illustrating the beach planform remaining in the project relative to its construction design. The chart illustrates that the MHHW contour changed less in both the seven months from April 2018 to November 2018 and over the year from October 2017 to November 2018, compared to the changes observed in the first year post-construction (May 2017 to April 2018). This is consistent with typical expectations of a beach nourishment project's evolution.

The median shoreline change rate from October 2017 to November 2018 among the 106 transects (without any length-weighting) was approximately -12 ft/yr, with 80% of transects having change rates between +11 ft/yr and -39 ft/yr. Over the more recent seven months from April 2018 to November 2018, the median shoreline change rate was -16 ft/yr with 80% limits of +19 ft/yr and -61 ft/yr. Thus, the survey data indicate that the shoreline changed more quickly during the Spring 2018 to Fall 2018 period than it did over the past year as a whole.

Shoreline advance continued to occur in Central Ocean View between stations 263+22 and 274+53 post-construction of the Federal Project, though at a slower rate than in the first year post-construction.

From May 2017 to November 2018, the shoreline in this reach advanced approximately 16 feet, most likely due to continued migration of sand transported into this segment of Central Ocean View from the adjacent areas that were directly nourished as part of the Federal Project.

7.2.2. Berm Contour Change

The Federal Project authorized beach template is not defined by the shoreline position, but by the beach width (seaward of the dune toe) at or above a beach berm elevation of +3.5 feet NAVD88. Figure 7-2 shows the position of the most bayward +3.5 ft NAVD88 elevation contour (representing the authorized Federal beach berm elevation) as extracted from the October 2016, May 2017, October 2017, April 2018, and November 2018 survey DEMs. The median berm contour change post-construction of the Federal project, through November 2018, is approximately -13 feet, with 80% of the stations exhibiting change between +35 feet and -49 feet.

Significant berm retreat is seen from stations 40+00 to 51+41, in the vicinity of 11th View street from midway along Toler Place to the 800 Block breakwaters. This area is the subject of current design work by the City to modify the breakwater field and provide additional shoreline stability in the transition area between the 800 Block Breakwaters and the Willoughby Spit breakwaters.

Between stations 171+63 and 179+63 adjacent to the east end of the Central Ocean View Breakwaters, the 3.5 ft berm contour has continued to retreat since Federal Project construction. While the net average post-construction change rate is approximately -29 ft/yr in this area, the +3.5 ft contour has retreated at approximately -67 ft/yr since April 2018. Beach and Nearshore Elevation Changes Relative to the May 2017 Post-Construction Condition of the Federal Project

The map plots in Appendix E shows areas of elevation change between the dates indicated in the map Legends. Elevation gains (accretion) are shown in green shades, and elevation losses (erosion) are shown in yellow to red shades. The three sets of maps (four pages for each set) were prepared by subtracting elevations in each grid cell within survey Digital Elevation Models (DEMs) between survey dates April 2018 to November 2018 and October 2017 to April 2018. Though it is outside of the annual monitoring period of this report, the October 2016 to May 2017 set is kept in the Appendix to illustrate the magnitude of the May 2017 Federal Project beach nourishment to give context to post-construction changes.

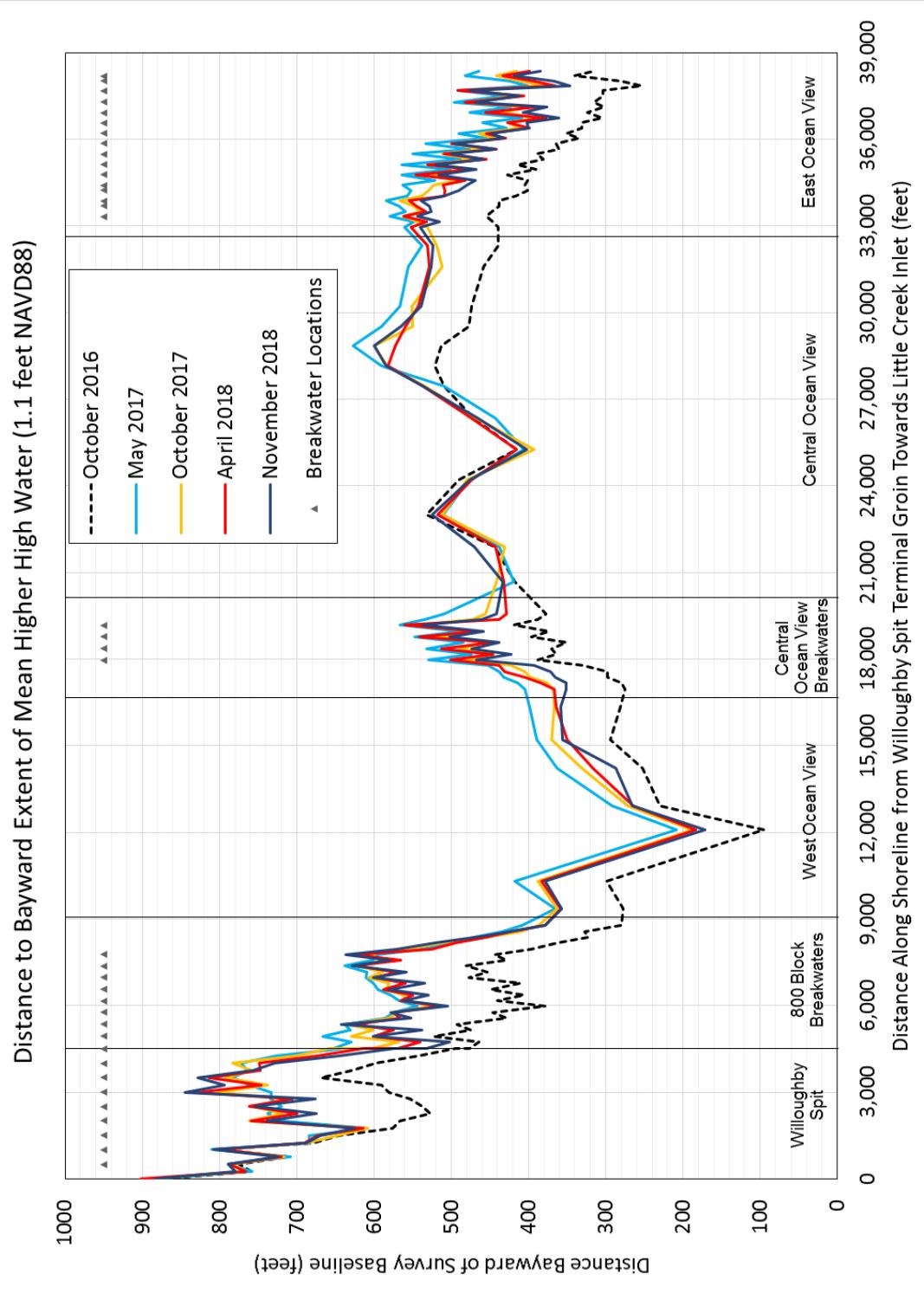


Figure 7-1: Position of the Mean Higher High Water (+1.1 ft NAVD88) Contour Relative to Pre- and Post-Construction of the Federal Project

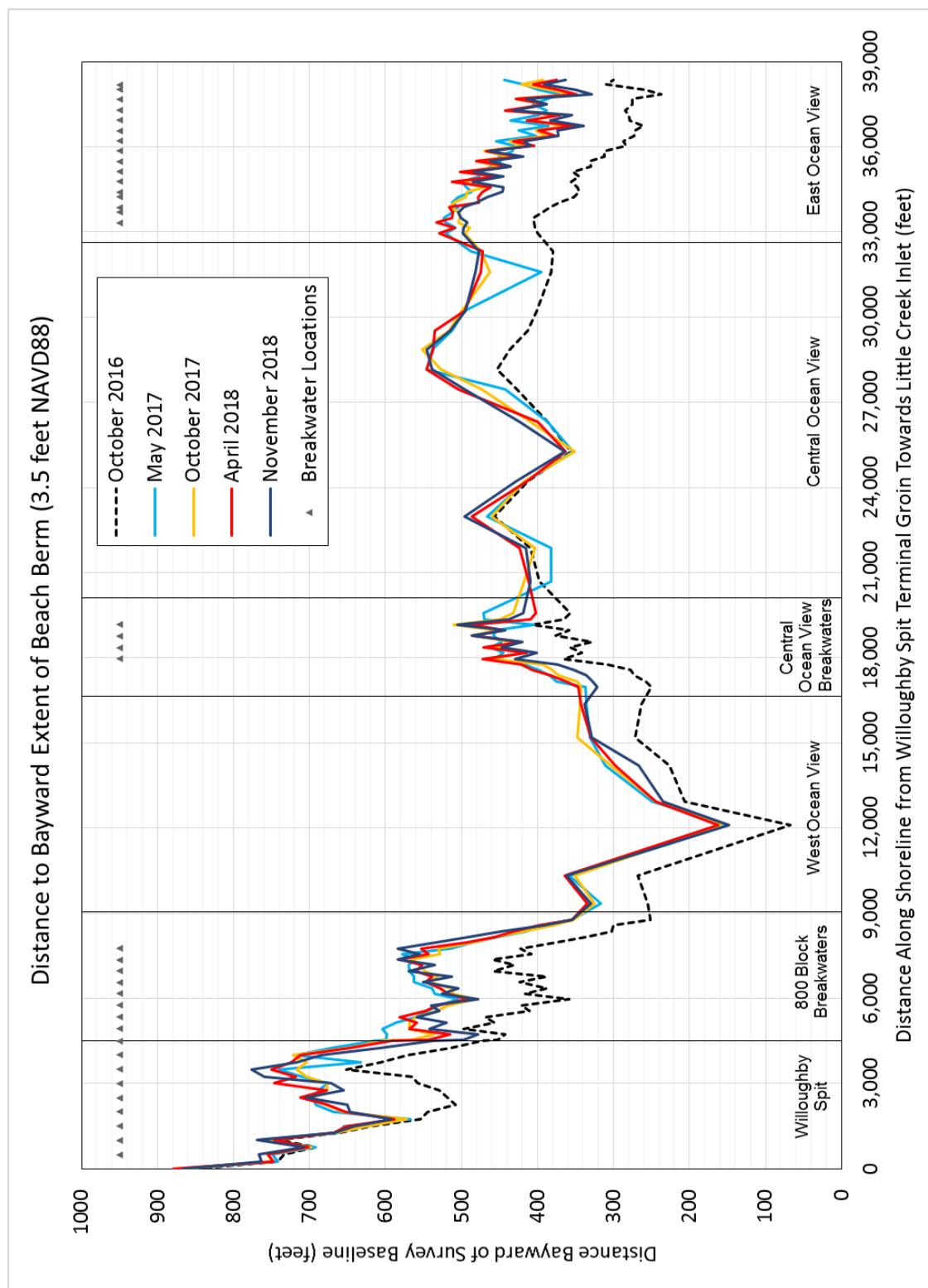


Figure 7-2: Position of the Bayward Extent of the +3.5 ft NAVD88 Beach Berm Contour Relative to Pre- and Post-Construction of the Federal Project

7.3. Federal Project Status Relative to a Renourishment Threshold

The USACE Federal Project design studies established a threshold criteria for renourishment of the Federal Project. The published documents presently available relative to the Federal Project do not define a particular shoreline or beach berm position in physical space that represents such a threshold condition. Instead, the threshold is discussed in the Federal Project's authorizing documents state that [renourishment] would occur when the berm has eroded to a width of 30 feet, which is half of the authorized beach berm width of 60 feet at an elevation of +3.5 feet NAVD88.

For survey stations that are within the limits of the Federal Project's initial construction, the Appendix B survey comparison profiles include a representation of the authorized USACE Design Template (dashed black line), indicating the beach fill outline to achieve a berm width of 60 feet fronting the October 2016 pre-Federal Project monitoring survey data. A USACE Nourishment Threshold is also shown, indicating a berm and slope position 30 feet landward of the authorized 60 ft wide berm. The template outlines provide a way to visually assess the current status of the beach berm with respect to the authorized design and nourishment criteria.

For example, at station 32+50, on page 13 of Appendix B, the survey profiles indicate that the berm edge is approximately 150 feet bayward of the USACE Design Template and that the berm advanced significantly between April 2018 and November 2018. Further east at station 45+00, the November 2018 profile shows that the beach has retreated landward of the USACE Design Template and is nearing the Nourishment Threshold.

It is difficult to find a single statistic that conveys the status of the beach morphology and berm width at each transect station in a graphical or tabular form. Instead, it is recommended that City and USACE staff review the profiles in Appendix B to track the progression of the Federal Project toward an eventual nourishment need. To assist with this review, the map panels in Appendix F and Table 7-1 below summarizes characteristics of the November 2018 survey profiles with respect to the USACE Design Template and the Nourishment Threshold. The map panels in Appendix F also show color shading representing the beach and nearshore elevation change from immediately post-construction of the Federal Project (May 2017) to November 2018.

Table 7-1: Beach Berm Status Relative to the Federal Project Design Template and Nourishment Threshold

Transect Stations	Location Description	Status of the Beach Based on November 2018 Survey Profiles
0+00 to 17+50	Terminal groin to 14 th View Street	Outside the limits of initial Federal Project construction.
20+00 to 42+50	14 th View Street to east of 12 th View Street, midway along Toler Place	Beach berm edge remains significantly bayward of the USACE Design Template.
45+00 to 51+41	Midway along Toler Place to the 800 Block Breakwaters	Berm edge is at or landward of the Design Template. The berm edge remains bayward of the Nourishment Threshold, while lower contours of the beach slope have retreated landward of the Nourishment Threshold. The rate of retreat of this segment from October 2017 to November 2018 decreased from the rate indicated between May 2017 and April 2018.
53+46 to 87+62	800 Block Breakwaters and eastward adjacent area	Berm edge remains moderately to significantly bayward of the Design Template.
93+41 to 120+93	Vicinity of the Ocean View Fishing Pier	Berm edge remains bayward of the Design Template, while the lower contours of the beach slope have retreated landward approximately to the Nourishment Threshold. This appears to be related to the beach adopting a steeper profile than the USACE Design Template assumes, and the wave-reducing function provided by the beach berm remains in place bayward of the Design Template.
129+17 to 141+98	Ocean View Beach Park and adjacent westward area; bulkhead and revetment present at the back of the beach	Berm edge has retreated to a position approaching the Nourishment Threshold.
152+01 to 177+63	From Ocean View Beach Park to west end of the Central Ocean View Breakwaters	Berm edge remains bayward of the Design Template, while the lower contours of the beach slope have retreated landward approximately to the Nourishment Threshold. Significant retreat observed between April 2018 and November 2018.
179+63 to 195+63	Central Ocean View Breakwaters and adjacent eastward reach to Atlans Street	Berm edge remains bayward of the Design Template within the breakwater field. Reasonable variations in profile observed between stations at breakwaters vs. stations in gaps between breakwaters.
206+86 to 263+22	Central Ocean View between Warwick Avenue and Inlet Road	Outside the limits of initial Federal Project construction. Beach profile stable to slightly accretional over the past year.
274+53 to 331+43	1 st Bay Street to west end of the Bay Oaks Breakwaters	Berm edge remains bayward of the Design Template.
333+23 to 383+58	Bay Oaks Breakwaters and East Ocean View Breakwaters to Little Creek Inlet	Berm edge remains moderately to significantly bayward of the Design Template. Reasonable variations in profile observed between stations at breakwaters vs. stations in gaps between breakwaters.

8. Summary

Comprehensive periodic surveying of the entire Ocean View shoreline began with an initial survey in September 2005. The most recent survey was completed in November 2018. The beach and bathymetric surveys performed by Geodynamics utilized baseline and transect positions established in September 2005 which are used for all periodic surveys. For this periodic evaluation, the November 2018 survey was compared with both the prior year and prior six months' surveys (November 2018 compared to October 2017 and April 2018, respectively). The surveys were used to compute shoreline change at MHW and volume change above 0 feet NAVD88 and above -15 feet NAVD88.

Key statistics were computed for defined regions along Ocean View and the entire shoreline for the time period between the October 2017 and November 2018 surveys and between the April 2018 and November 2018 surveys.

Comparison	Parameter	Quantity
October 2017 vs. November 2018	Average Shoreline Change Rate at MHW (+0.98 ft NAVD88)	-8.47 ft/yr
	Cumulative Volume Change Rate Above 0 ft NAVD88	57,312 cy/yr
	Cumulative Volume Change Rate Above -15 ft NAVD88	108,507 cy/yr
April 2018 vs. November 2018	Average Shoreline Change at MHW (+0.98 ft NAVD88)	-4.73 ft
	Cumulative Volume Change Above 0 ft NAVD88	737 cy
	Cumulative Volume Change Above -15 ft NAVD88	117,491 cy

The average shoreline change rate for the entire shoreline at MHW between the October 2017 and November 2018 surveys was -8.47 ft/yr shoreline retreat, and the cumulative volume changes above 0 feet NAVD88 and -15 feet NAVD88 were approximately 57,312 cy/yr and 108,507 cy/yr, respectively.

The average shoreline change for the entire shoreline at MHW between the April 2018 and November 2018 surveys was -4.73 ft, and the cumulative volume changes above 0 feet NAVD88 and -15 feet NAVD88 were approximately 737 cy and 117,491 cy, respectively.

Areas of greater shoreline retreat (compared to average rates along Ocean View as a whole) include: between 11th View Street and the 800 Block Breakwaters; adjacent to the west and east ends of the Central Ocean View Breakwaters; and west of the Bay Oaks Breakwaters in East Ocean View. Shoreline change rates varied widely on a transect by transect basis. The median shoreline change among the 106 transects (without any length-weighting) was approximately -29 feet, with 90% of transects having change between +112 and -66 feet. For greater benefit in using future monitoring reports to track the performance and remaining "service life" of the Federal Project, it is recommended to establish a fixed line in space that can be plotted on charts similar to Figure 7-1 and Figure 7-2. This line should be developed in collaboration with USACE Norfolk District.

This is the twenty-seventh periodic survey report completed to date, and the twenty-seventh evaluation of a consistent survey period utilizing beach and bathymetric surveys. As noted, there are inevitable margins of error associated with the survey data that may reduce the accuracy of volumetric change analyses. Therefore, it is essential to thoroughly review the beach and bathymetric profiles using various analytical techniques and general engineering judgment to assure that results are not falsely interpreted. Comparison of surveys taken at the same season of the year (i.e. October 2017 to November 2018) mitigates seasonal variation of profiles in volumetric change analyses. Consecutive

spring-fall or fall-spring survey comparisons are useful to assess the direct impact of extreme events which may occur during the approximate six month period between surveys.

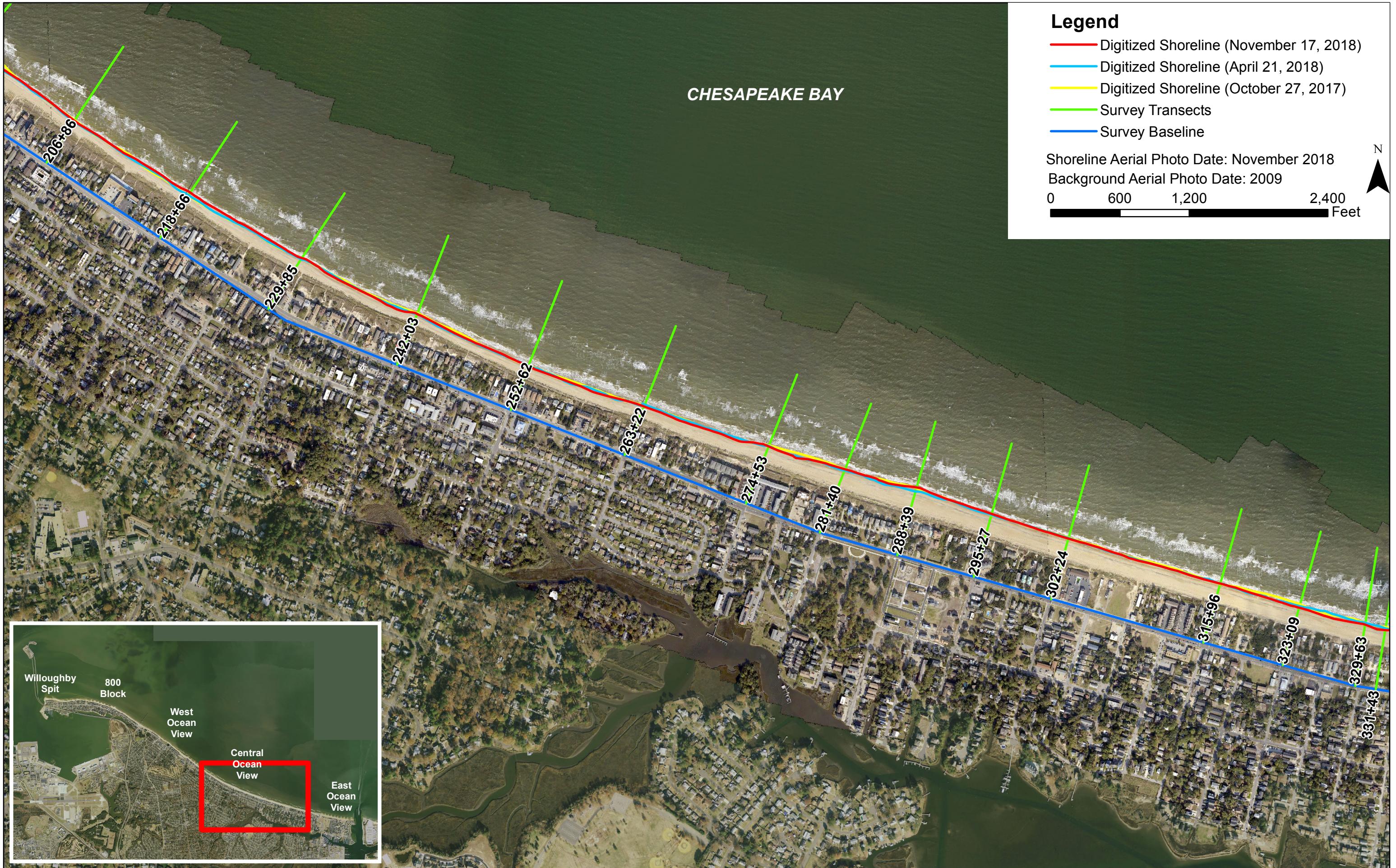
Future periodic survey evaluations will continue to track changes in and the condition of the Federal Project, to assist the City to manage these beaches and coordinate with USACE regarding Federal Project maintenance.

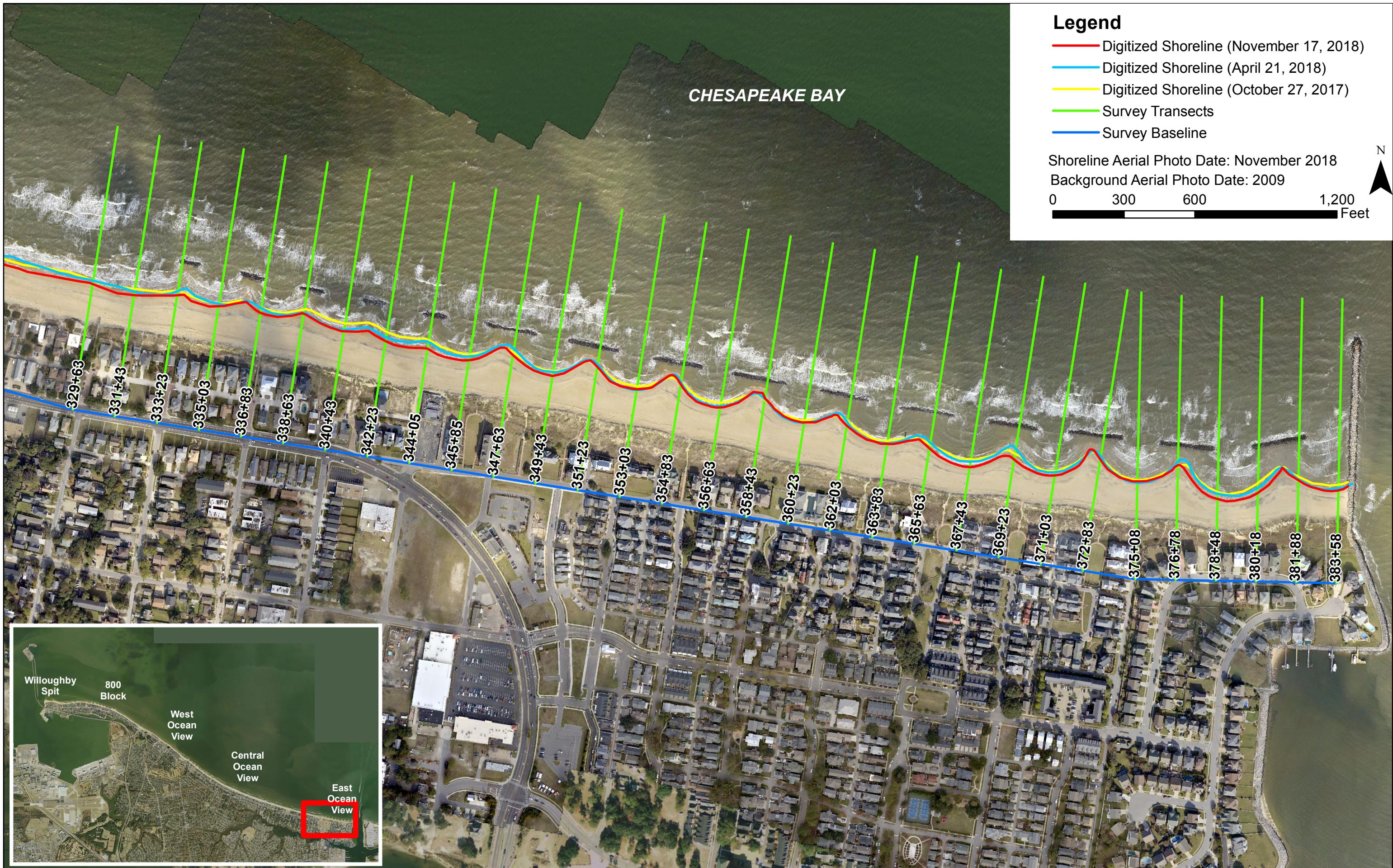


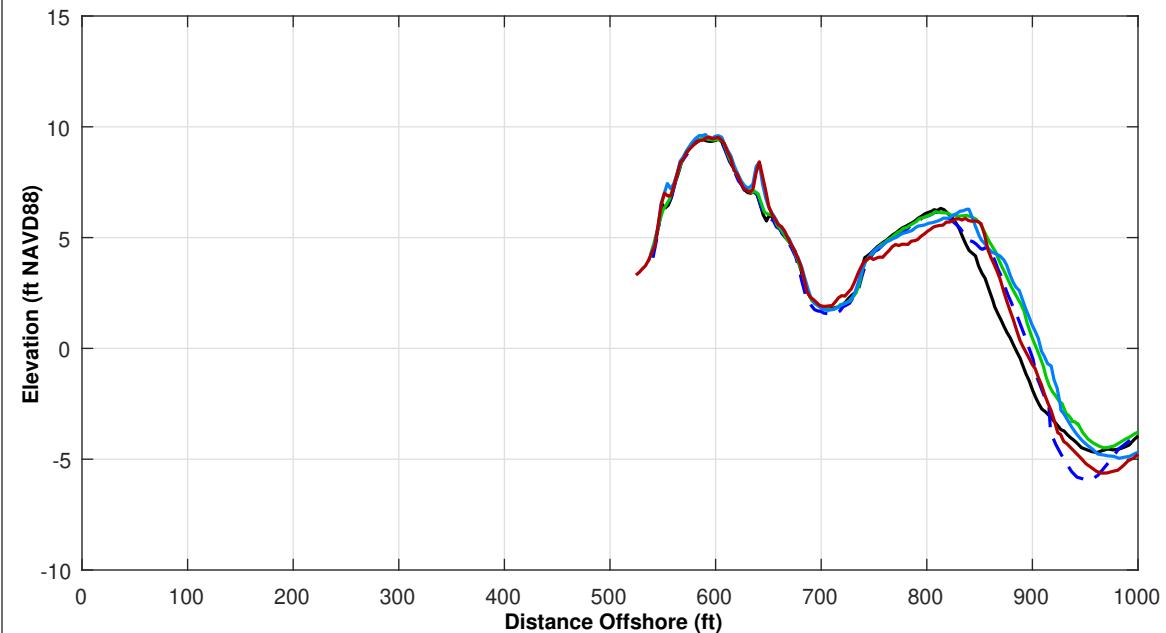
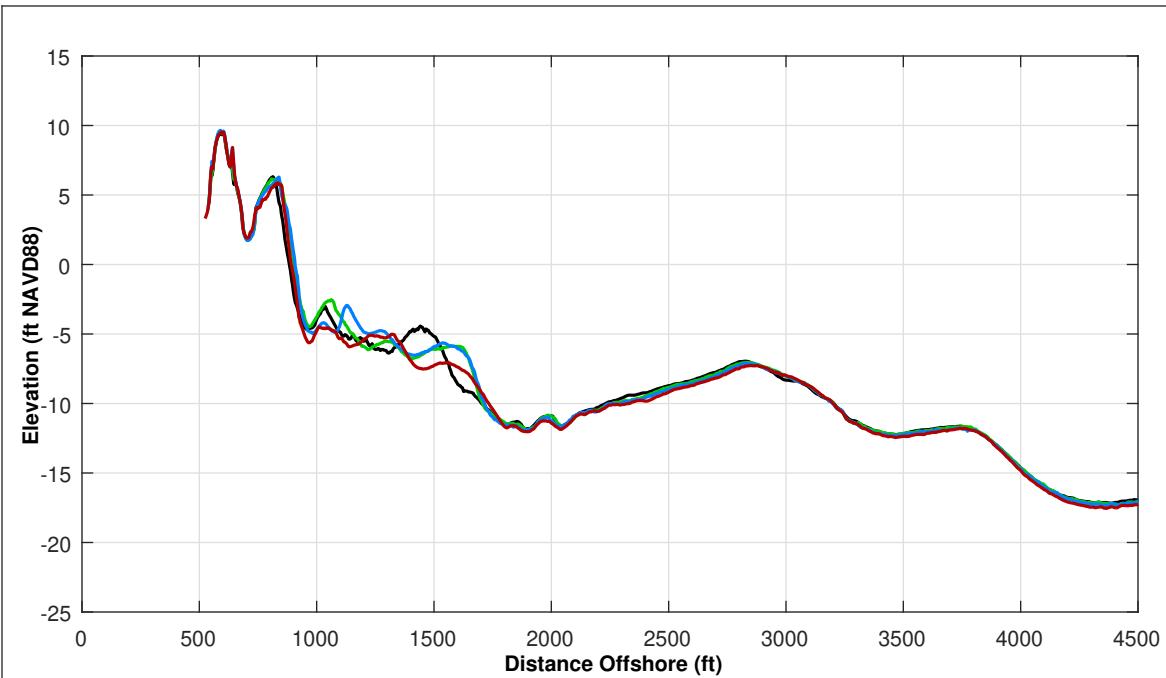








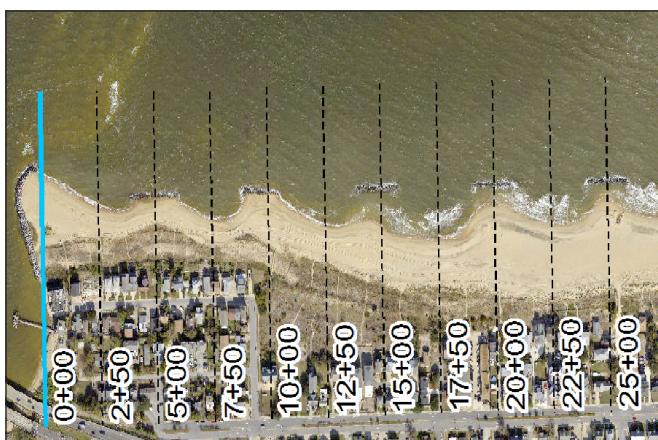


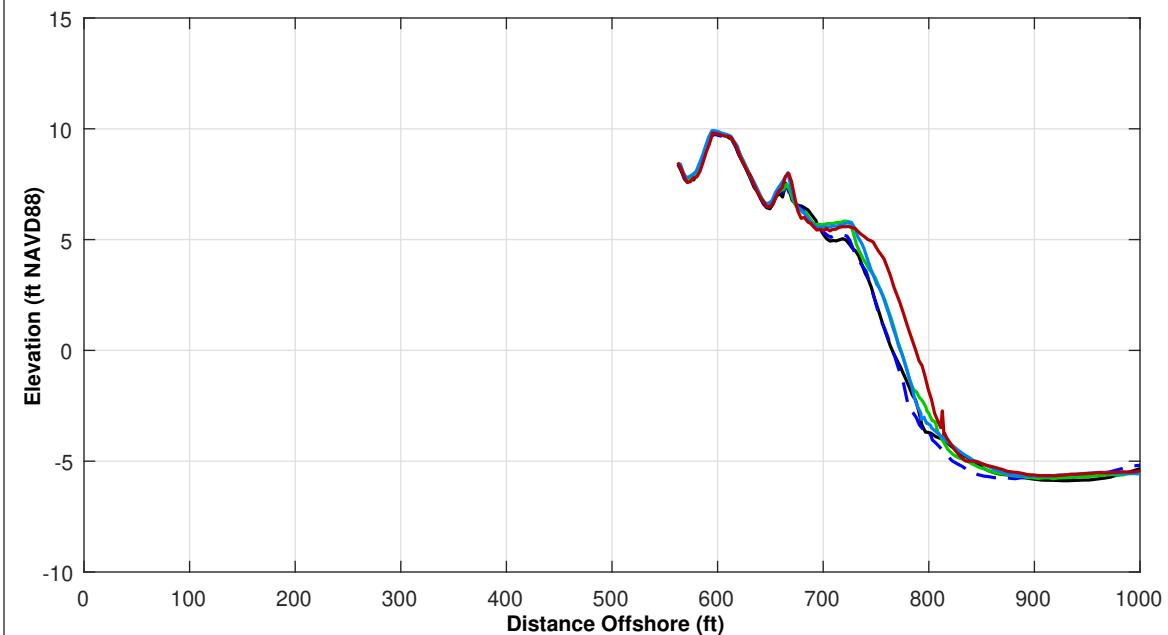
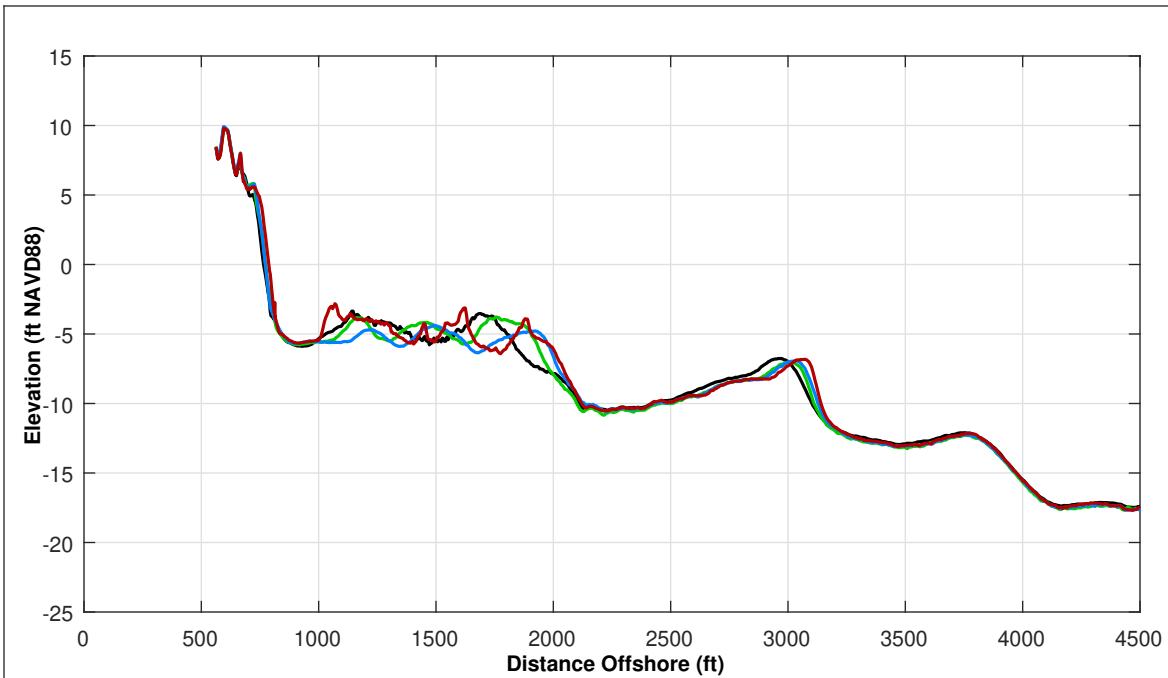


Survey Transect 0+00	NOV 2018 - OCT 2017	NOV 2018 - APR 2018
Shoreline Change at MHW (0.98 ft NAVD88)	-12.19 ft	-16.52 ft
Volume Change Above -15 ft NAVD88	-36.00 cy/ft	-33.46 cy/ft
Volume Change Above 0 ft NAVD88	-2.24 cy/ft	-3.40 cy/ft
Distance from USACE Design Template @ 3.5 feet NAVD88:		
LEGEND: NOV 2018 — NOV 2018 APR 2018 — APR 2018 OCT 2017 — OCT 2017 MAY 2017 — MAY 2017 OCT 2016 — OCT 2016		

Notes:

1. Station From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward and Seaward Of The Breakwater.



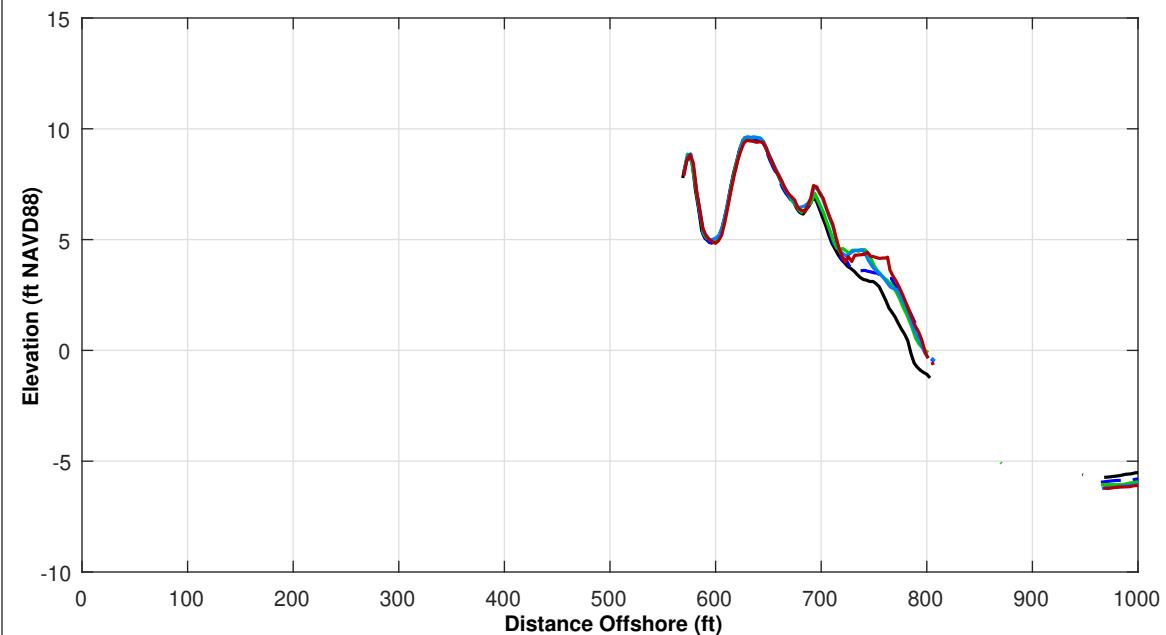
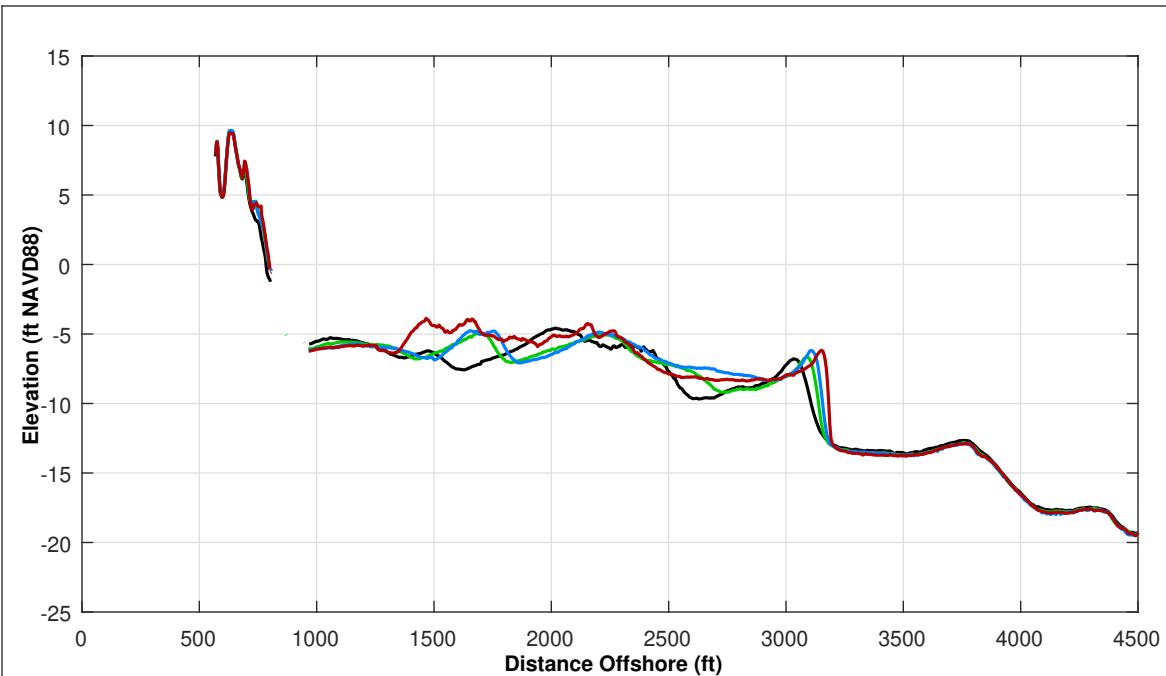


Survey Transect 2+50	NOV 2018 - OCT 2017	NOV 2018 - APR 2018
Shoreline Change at MHW (0.98 ft NAVD88)	13.38 ft	14.27 ft
Volume Change Above -15 ft NAVD88	23.94 cy/ft	28.11 cy/ft
Volume Change Above 0 ft NAVD88	2.41 cy/ft	1.91 cy/ft
Distance from USACE Design Template @ 3.5 feet NAVD88:		
LEGEND: NOV 2018 — NOV 2018 APR 2018 — APR 2018 OCT 2017 — OCT 2017 MAY 2017 — MAY 2017 OCT 2016 — OCT 2016		

Notes:

1. Station From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward and Seaward Of The Breakwater.



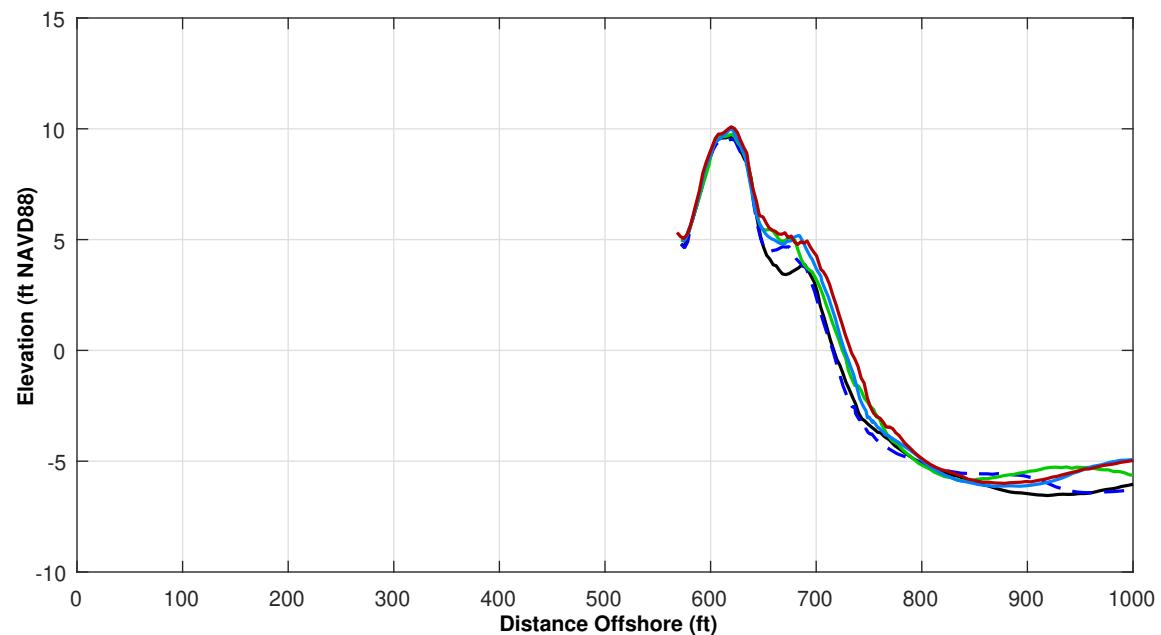
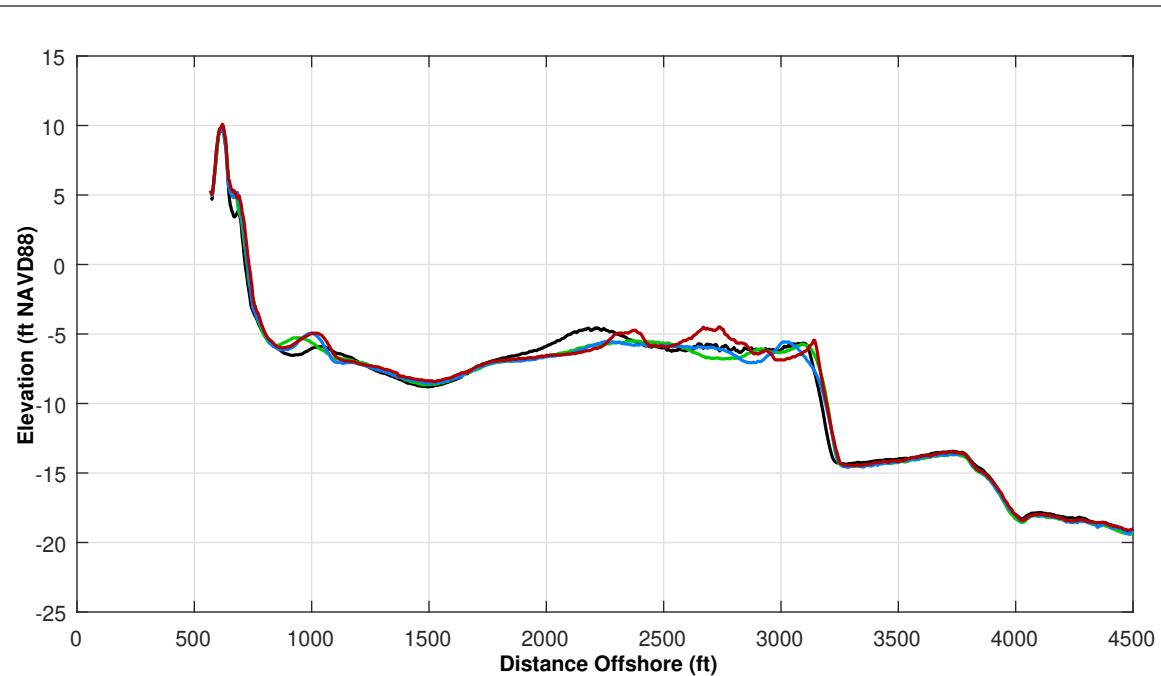


Survey Transect 5+00	NOV 2018 - OCT 2017	NOV 2018 - APR 2018
Shoreline Change at MHW (0.98 ft NAVD88)	6.30 ft	2.70 ft
Volume Change Above -15 ft NAVD88	44.31 cy/ft	23.94 cy/ft
Volume Change Above 0 ft NAVD88	1.04 cy/ft	0.44 cy/ft
Distance from USACE Design Template @ 3.5 feet NAVD88:		
LEGEND: NOV 2018 — NOV 2018 APR 2018 — APR 2018 OCT 2017 — OCT 2017 MAY 2017 — MAY 2017 OCT 2016 — OCT 2016		

Notes:

1. Station From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward and Seaward Of The Breakwater.





Survey Transect 7+50	NOV 2018 - OCT 2017	NOV 2018 - APR 2018
Shoreline Change at MHW (0.98 ft NAVD88)	8.33 ft	5.13 ft
Volume Change Above -15 ft NAVD88	26.84 cy/ft	29.14 cy/ft
Volume Change Above 0 ft NAVD88	2.77 cy/ft	1.87 cy/ft
Distance from USACE Design Template @ 3.5 feet NAVD88:		

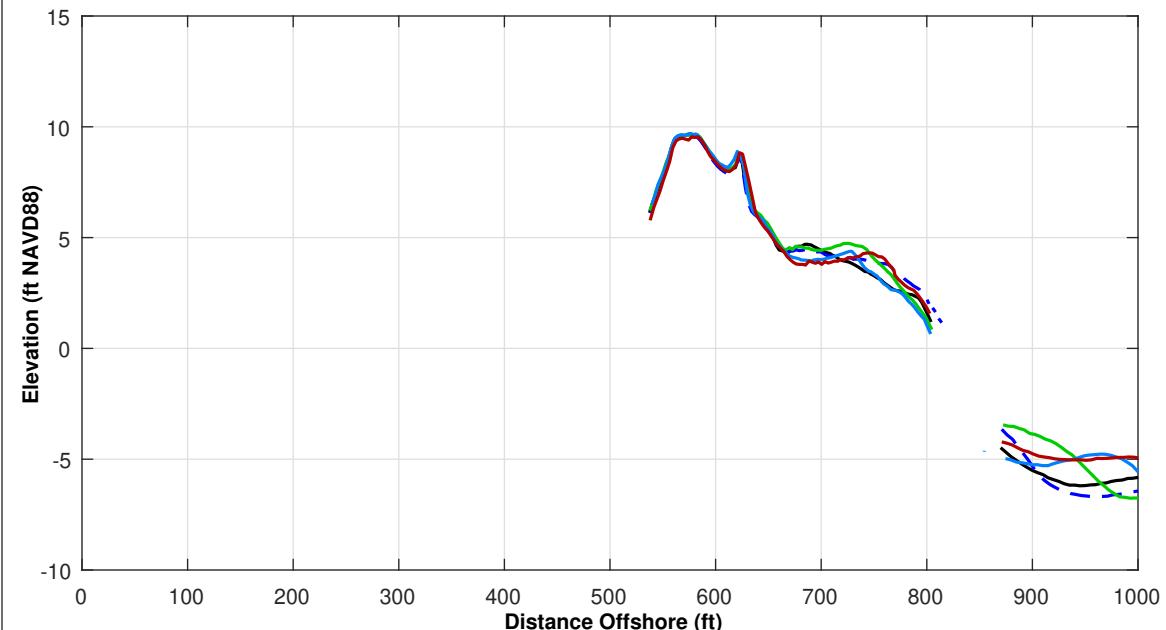
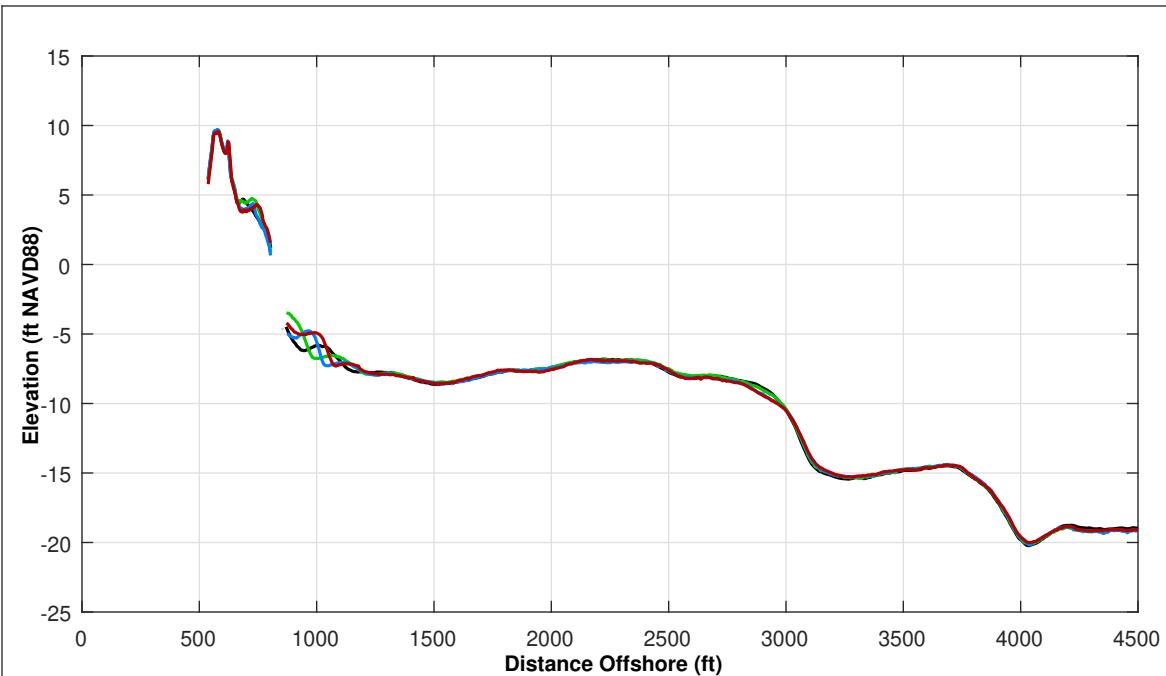
LEGEND:

NOV 2018 — NOV 2018
APR 2018 — APR 2018
OCT 2017 — OCT 2017
MAY 2017 — MAY 2017
OCT 2016 — OCT 2016

Notes:

1. Station From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward and Seaward Of The Breakwater.





Survey Transect 10+00	NOV 2018 - OCT 2017	NOV 2018 - APR 2018
Shoreline Change at MHW (0.98 ft NAVD88)	6.30 ft	9.15 ft
Volume Change Above -15 ft NAVD88	-5.58 cy/ft	5.78 cy/ft
Volume Change Above 0 ft NAVD88	-1.29 cy/ft	1.36 cy/ft
Distance from USACE Design Template @ 3.5 feet NAVD88:		

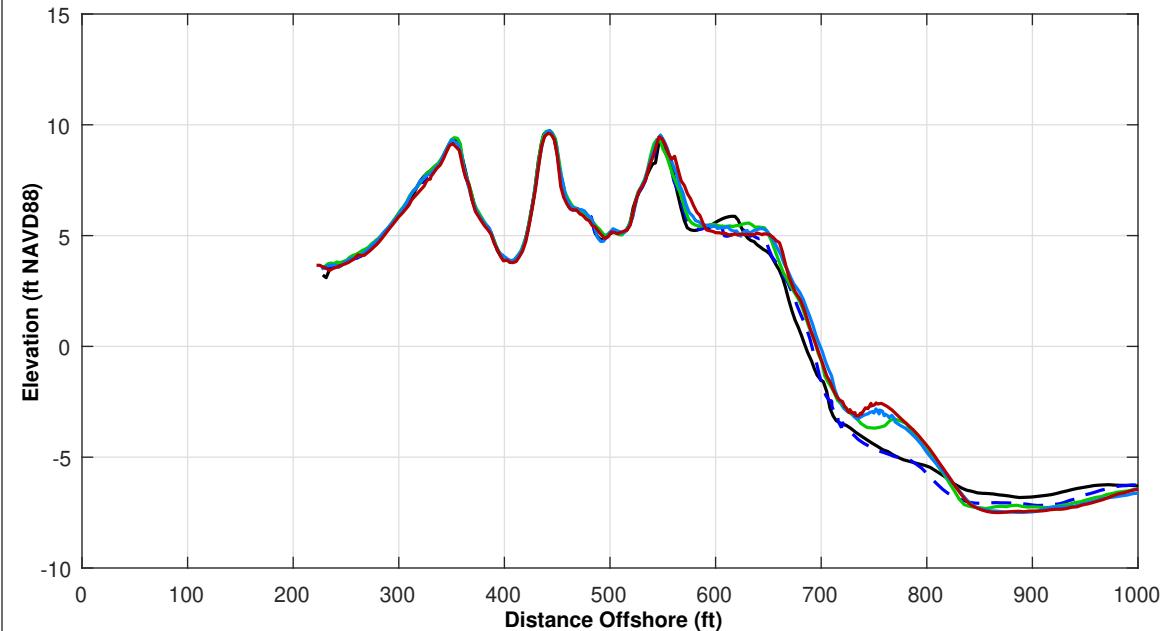
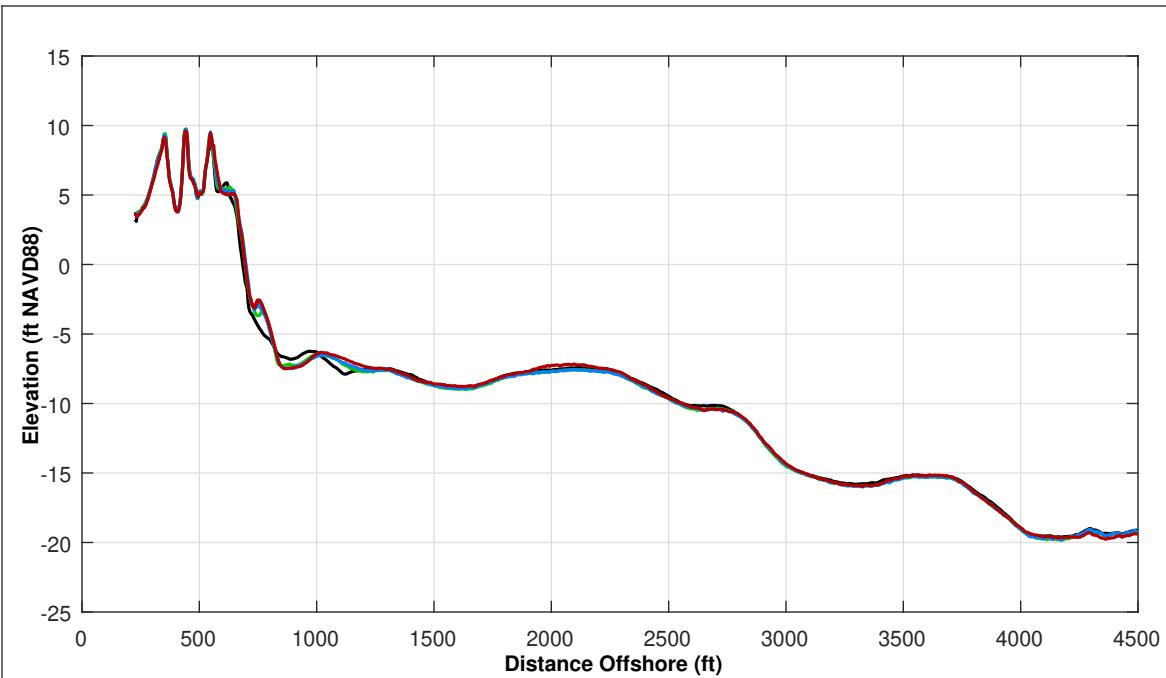
LEGEND:

NOV 2018 — NOV 2018
APR 2018 — APR 2018
OCT 2017 — OCT 2017
MAY 2017 — MAY 2017
OCT 2016 — OCT 2016

Notes:

1. Station From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward and Seaward Of The Breakwater.





Survey Transect 12+50	NOV 2018 - OCT 2017	NOV 2018 - APR 2018
Shoreline Change at MHW (0.98 ft NAVD88)	0.77 ft	-3.55 ft
Volume Change Above -15 ft NAVD88	12.99 cy/ft	11.05 cy/ft
Volume Change Above 0 ft NAVD88	-1.40 cy/ft	-1.50 cy/ft
Distance from USACE Design Template @ 3.5 feet NAVD88:		

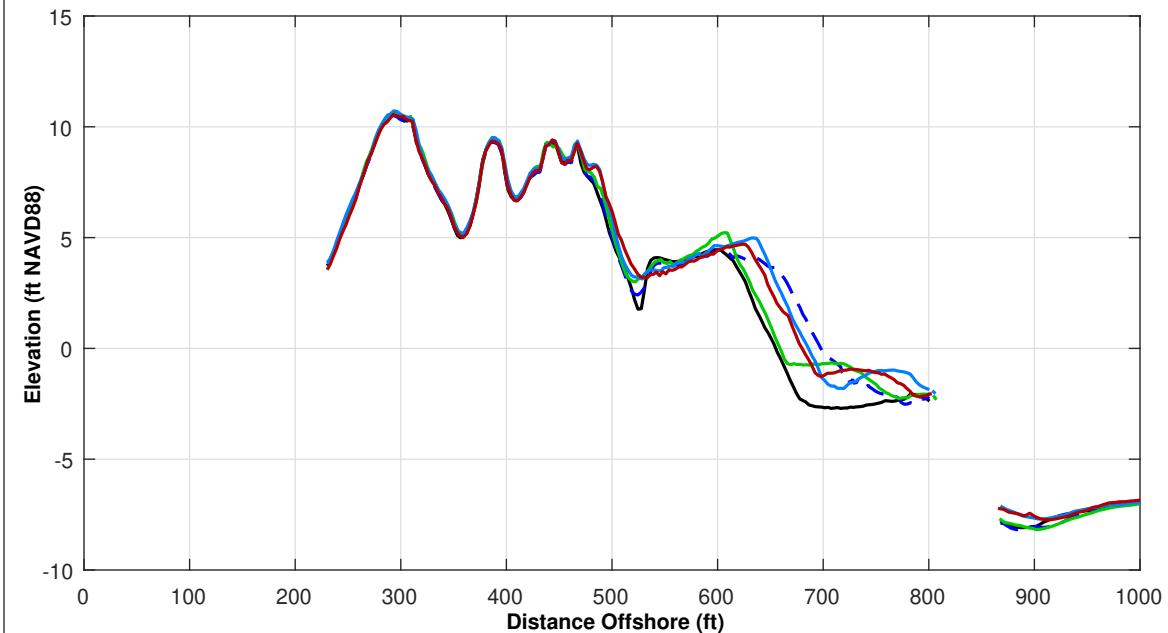
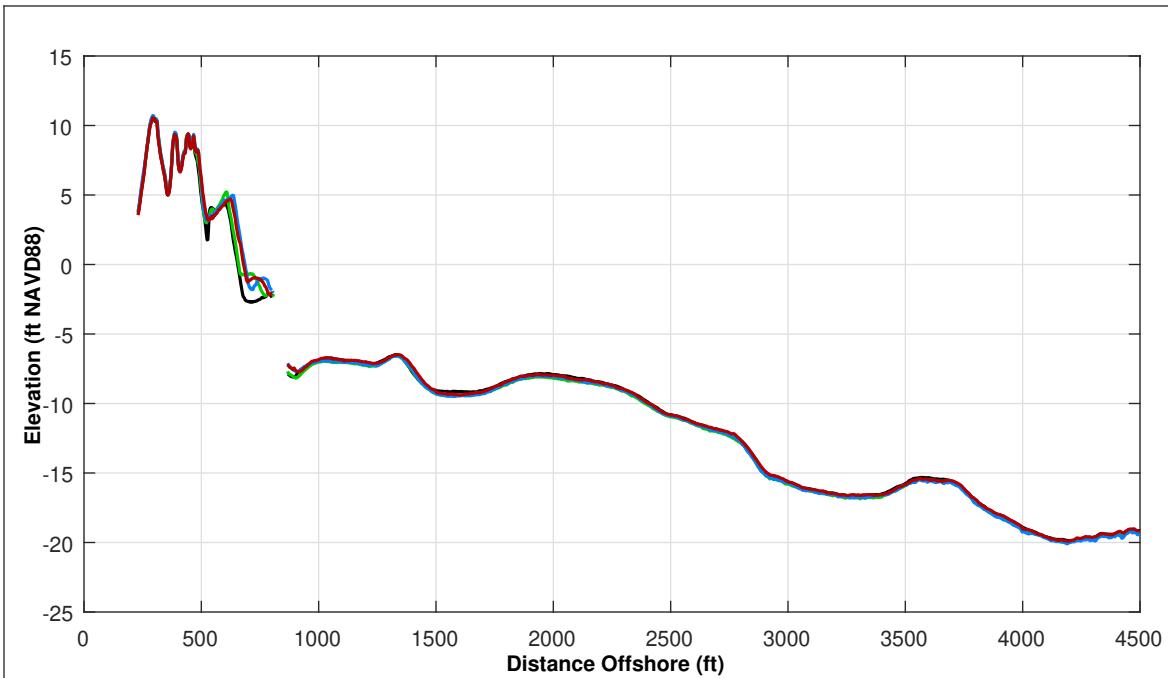
LEGEND:

NOV 2018 — NOV 2018
APR 2018 — APR 2018
OCT 2017 — OCT 2017
MAY 2017 — OCT 2016

Notes:

1. Station From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward and Seaward Of The Breakwater.





Survey Transect 15+00	NOV 2018 - OCT 2017	NOV 2018 - APR 2018
Shoreline Change at MHW (0.98 ft NAVD88)	20.31 ft	-4.05 ft
Volume Change Above -15 ft NAVD88	16.95 cy/ft	6.30 cy/ft
Volume Change Above 0 ft NAVD88	1.81 cy/ft	-3.11 cy/ft
Distance from USACE Design Template @ 3.5 feet NAVD88:		

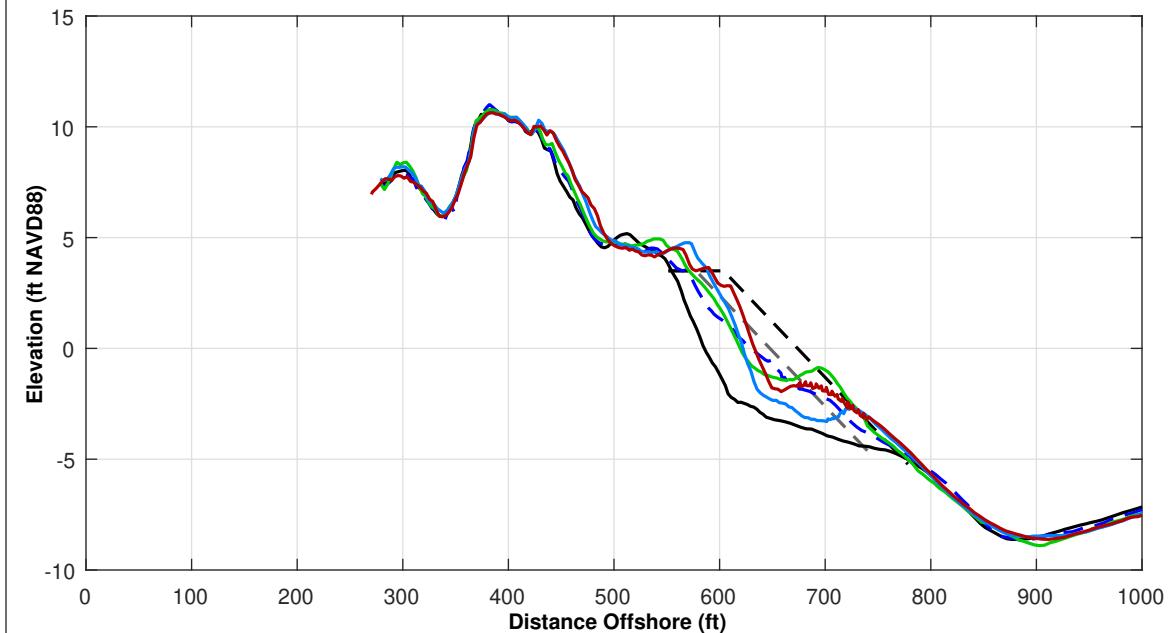
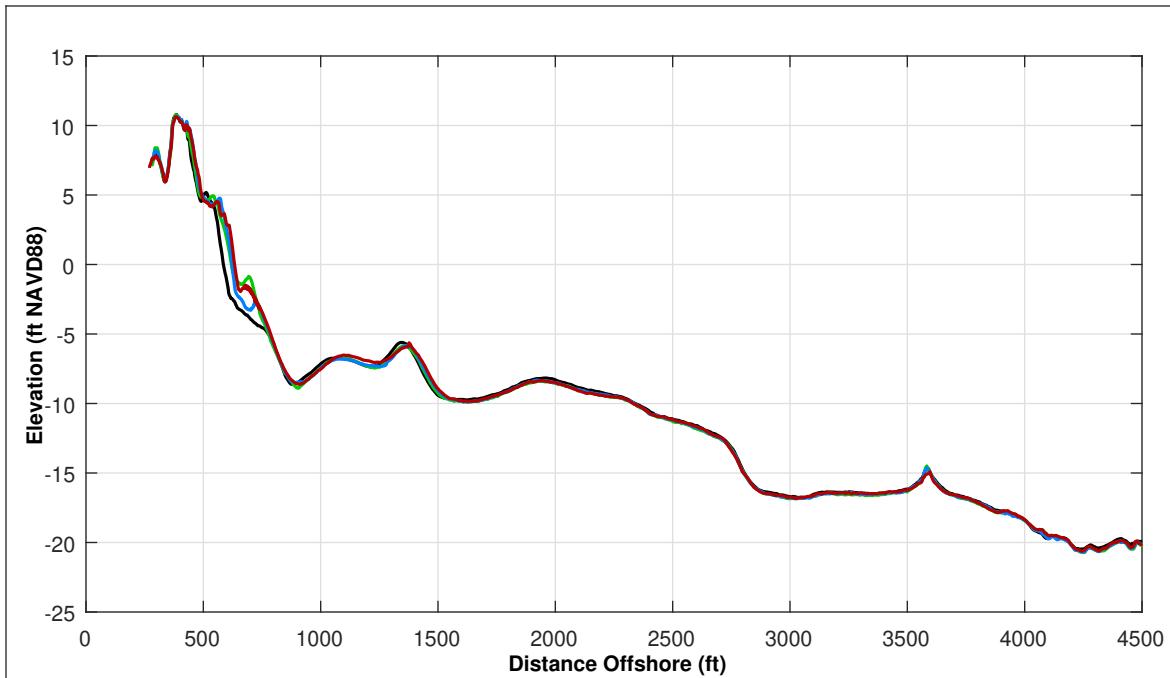
LEGEND:

NOV 2018 — NOV 2018
APR 2018 — APR 2018
OCT 2017 — OCT 2017
MAY 2017 — MAY 2017
OCT 2016 — OCT 2016

Notes:

1. Station From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward and Seaward Of The Breakwater.





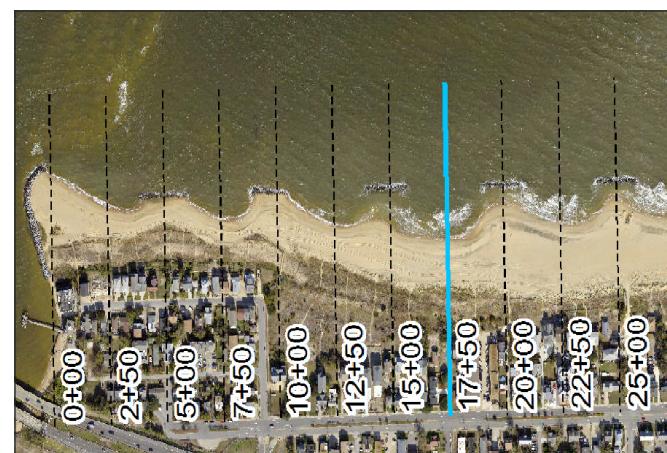
Survey Transect 17+50	NOV 2018 - OCT 2017	NOV 2018 - APR 2018
Shoreline Change at MHW (0.98 ft NAVD88)	16.08 ft	10.62 ft
Volume Change Above -15 ft NAVD88	9.10 cy/ft	7.54 cy/ft
Volume Change Above 0 ft NAVD88	2.77 cy/ft	0.04 cy/ft
Distance from USACE Design Template @ 3.5 feet NAVD88:		

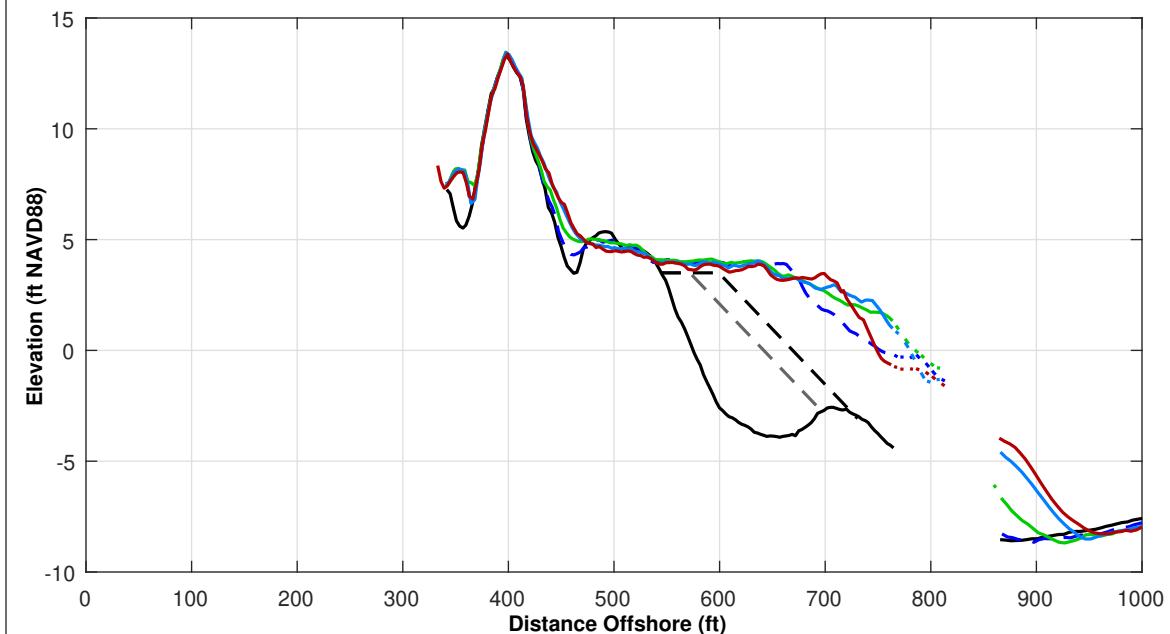
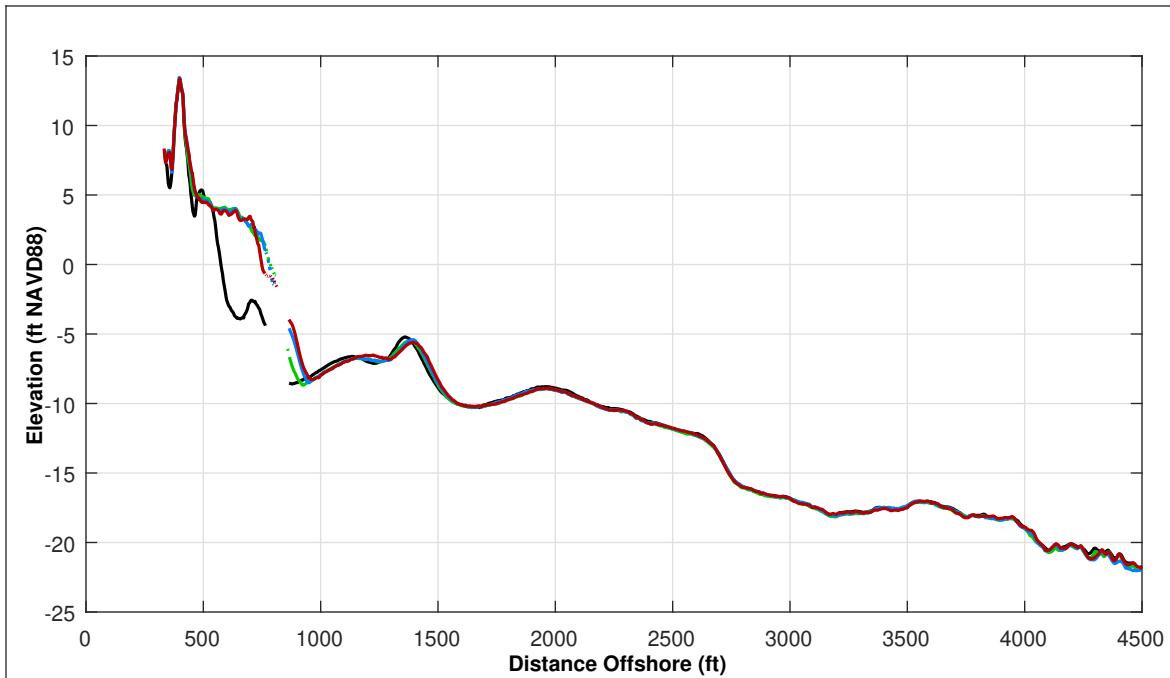
LEGEND:

NOV 2018	MAY 2017
APR 2018	OCT 2016
OCT 2017	USACE Design Template
	USACE Nourishment Threshold

Notes:

1. Station From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward and Seaward Of The Breakwater.





Survey Transect 20+00	NOV 2018 - OCT 2017	NOV 2018 - APR 2018
Shoreline Change at MHW (0.98 ft NAVD88)	-29.24 ft	-24.23 ft
Volume Change Above -15 ft NAVD88	7.31 cy/ft	0.87 cy/ft
Volume Change Above 0 ft NAVD88	-2.46 cy/ft	-2.67 cy/ft

Distance from USACE Design Template @ 3.5 feet NAVD88:

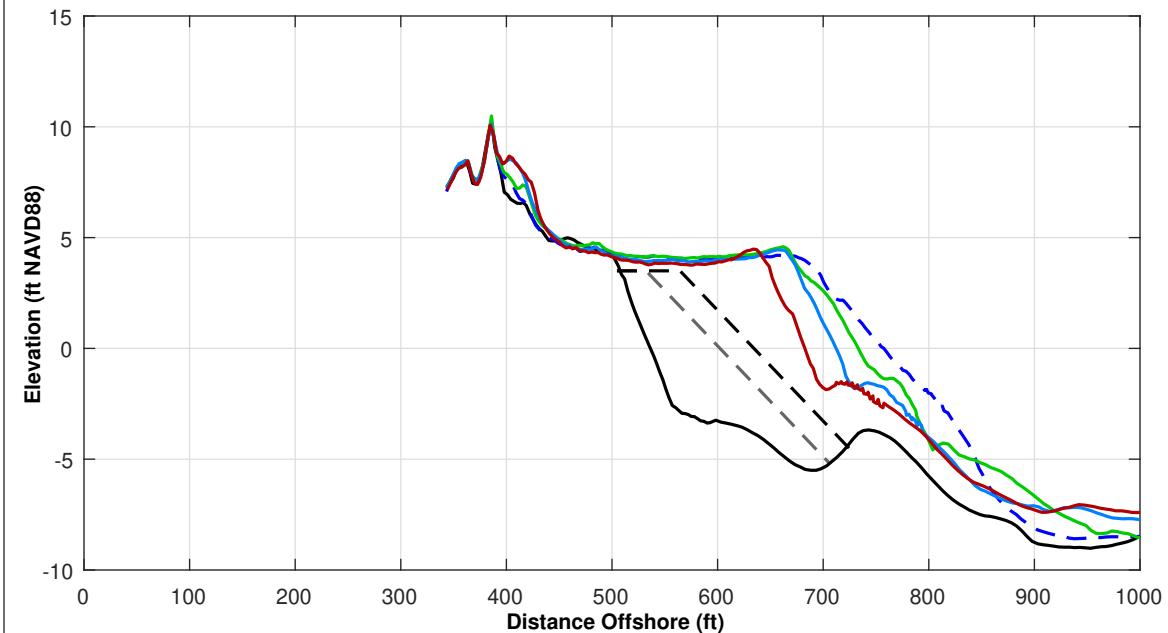
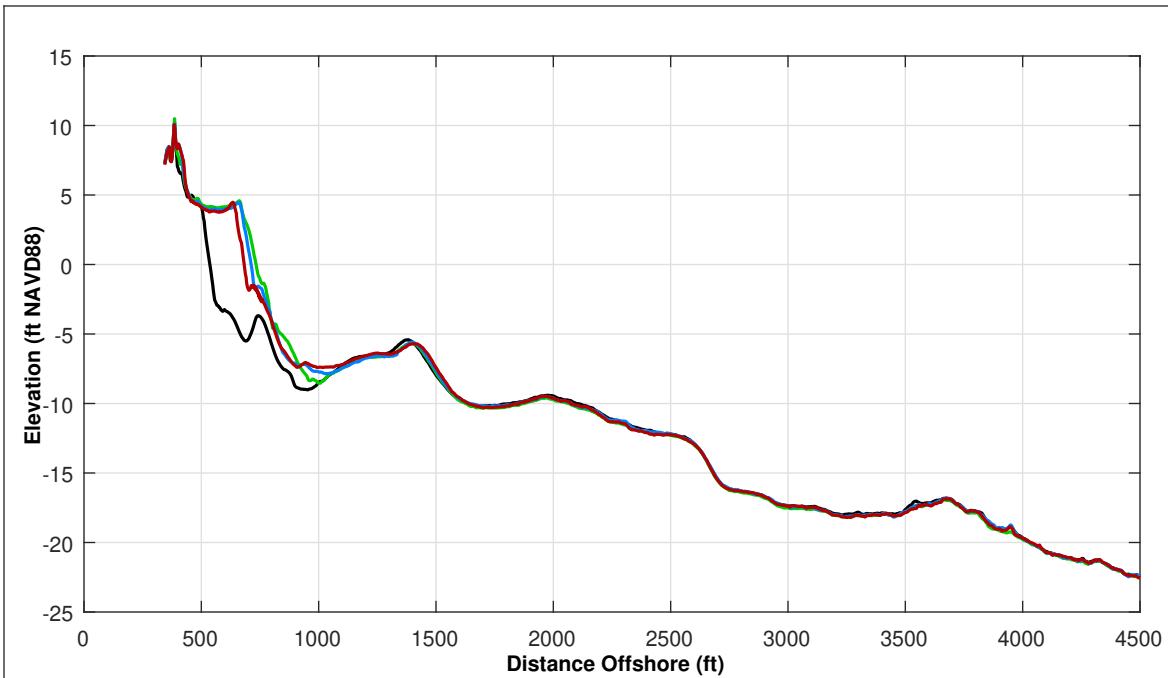
LEGEND:

- MAY 2017
- NOV 2018
- OCT 2016
- APR 2018
- OCT 2017
- USACE Design Template
- USACE Nourishment Threshold

Notes:

1. Station From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward and Seaward Of The Breakwater.

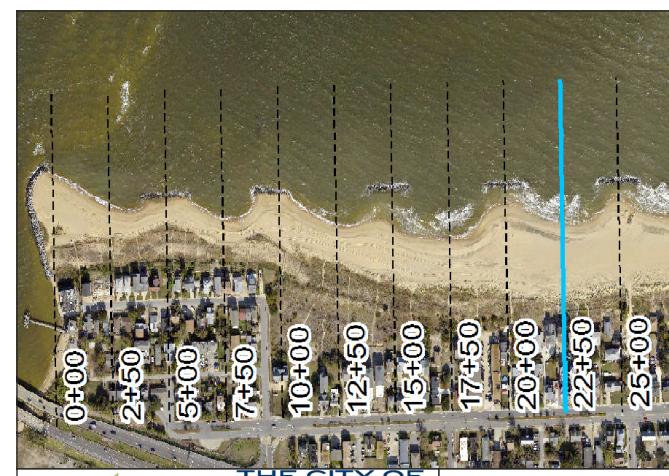


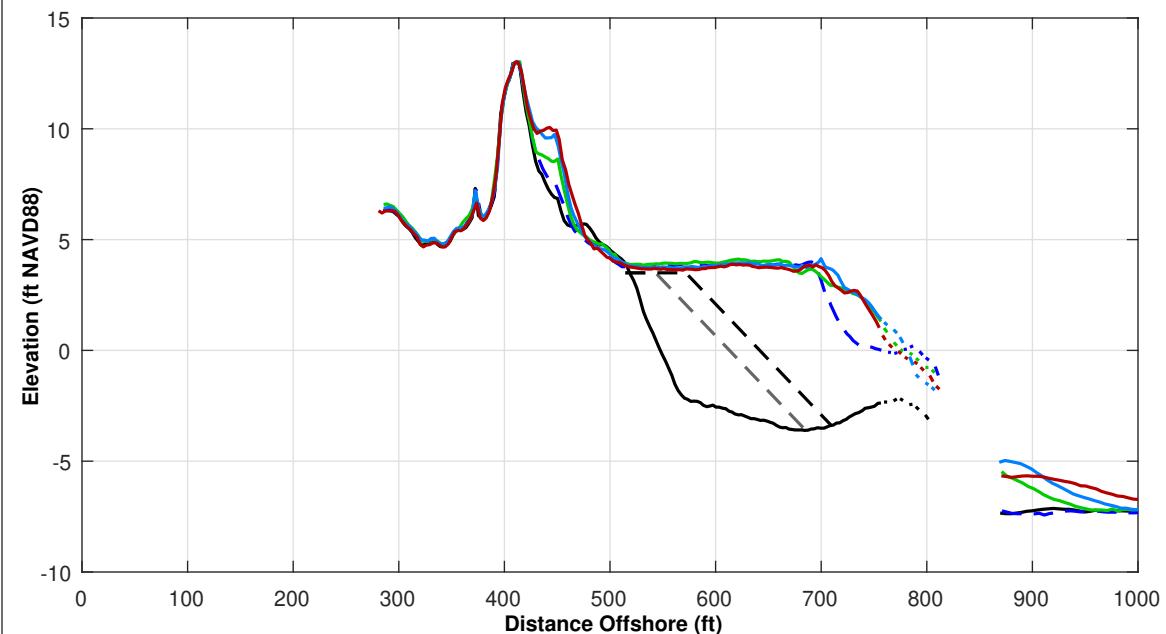
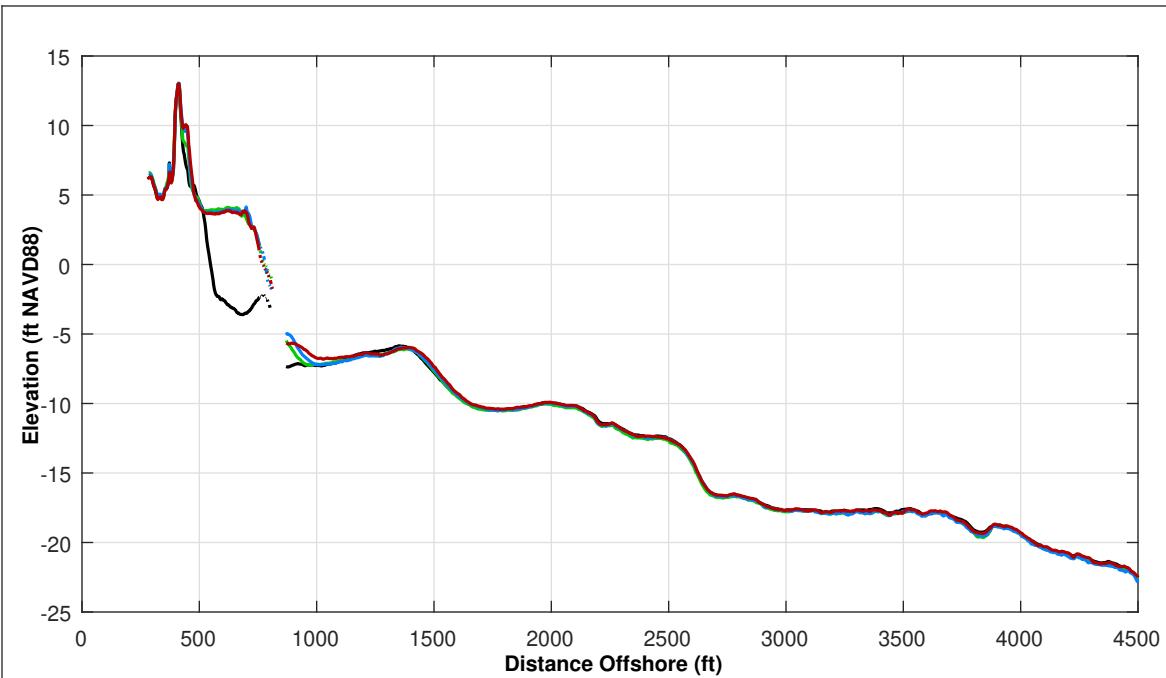


Survey Transect 22+50	NOV 2018 - OCT 2017	NOV 2018 - APR 2018
Shoreline Change at MHW (0.98 ft NAVD88)	-46.29 ft	-26.56 ft
Volume Change Above -15 ft NAVD88	-5.82 cy/ft	-5.25 cy/ft
Volume Change Above 0 ft NAVD88	-7.47 cy/ft	-4.76 cy/ft
Distance from USACE Design Template @ 3.5 feet NAVD88:		
LEGEND: NOV 2018 — MAY 2017 APR 2018 — OCT 2016 OCT 2017 — USACE Design Template USACE Nourishment Threshold — USACE Nourishment Threshold		

Notes:

1. Station From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward and Seaward Of The Breakwater.

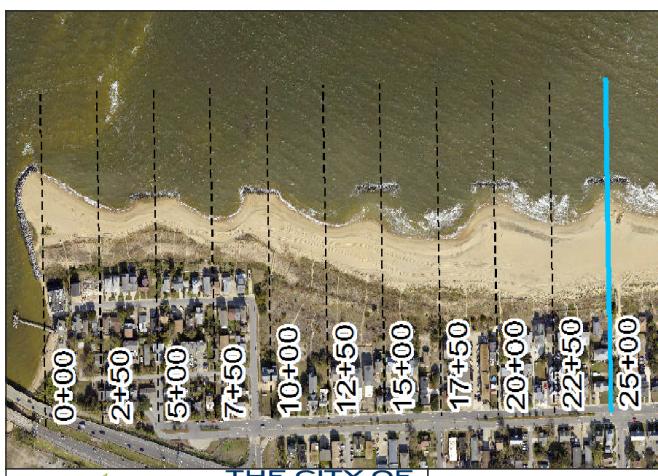


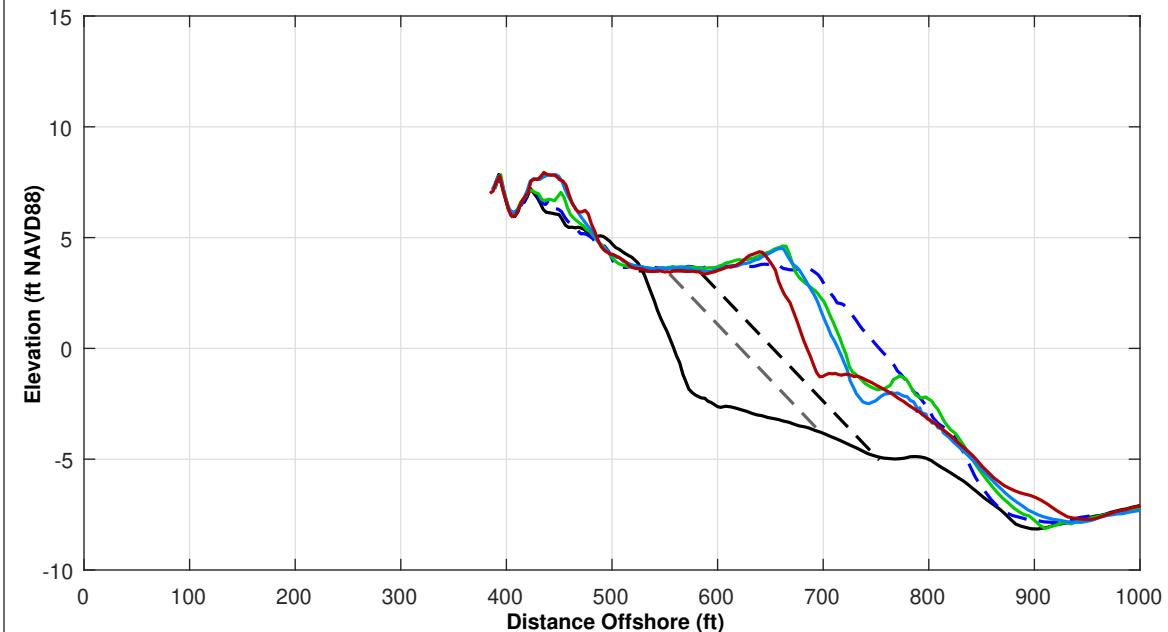
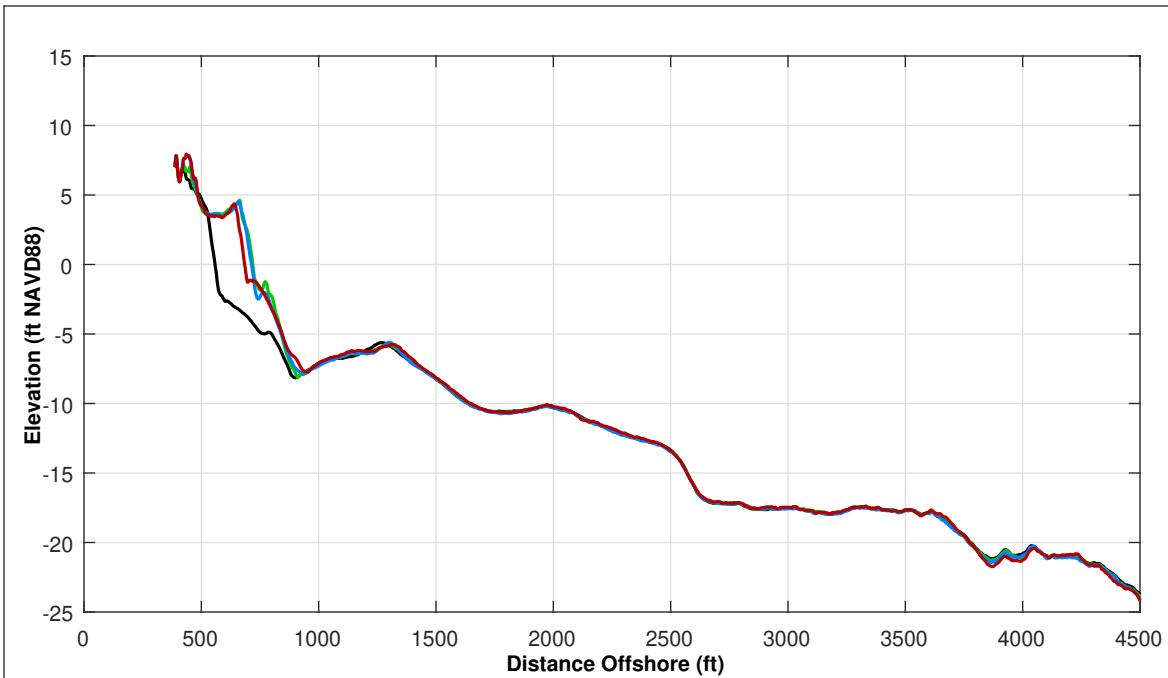


Survey Transect 25+00	NOV 2018 - OCT 2017	NOV 2018 - APR 2018
Shoreline Change at MHW (0.98 ft NAVD88)	-4.57 ft	-11.90 ft
Volume Change Above -15 ft NAVD88	12.88 cy/ft	5.62 cy/ft
Volume Change Above 0 ft NAVD88	-0.50 cy/ft	-1.79 cy/ft
Distance from USACE Design Template @ 3.5 feet NAVD88:		
LEGEND: MAY 2017 NOV 2018 — APR 2018 — OCT 2016 — USACE Design Template - - - OCT 2017 - - - USACE Nourishment Threshold - - - - - -		

Notes:

1. Station From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward and Seaward Of The Breakwater.



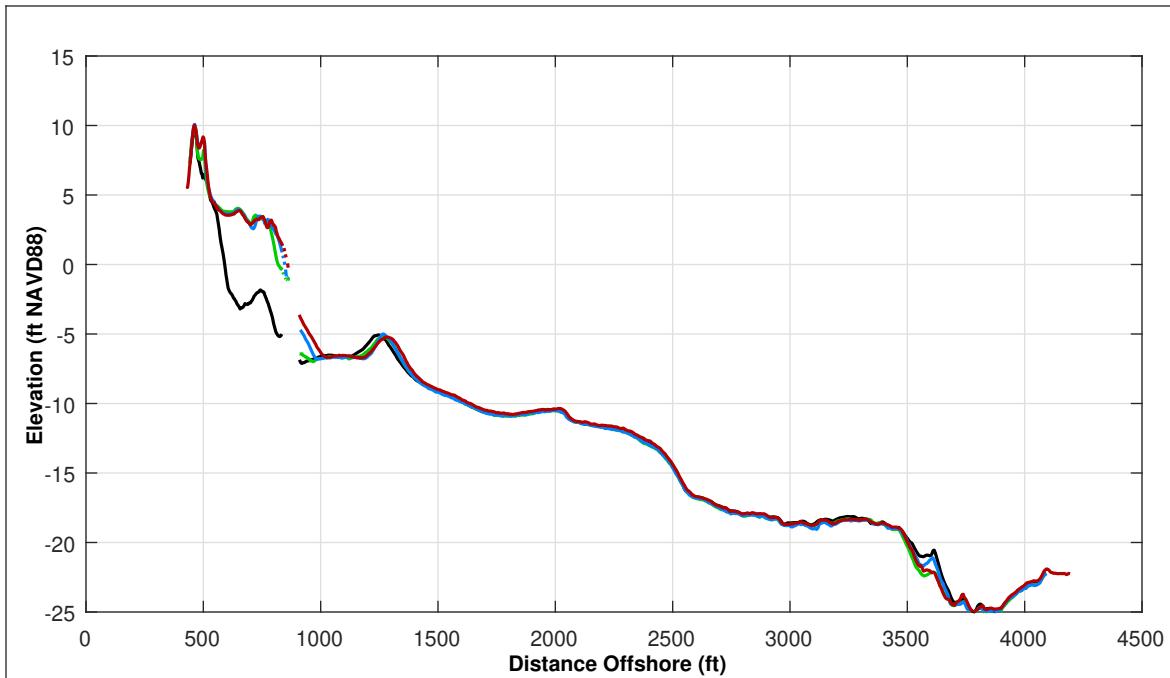


Survey Transect 27+50	NOV 2018 - OCT 2017	NOV 2018 - APR 2018
Shoreline Change at MHW (0.98 ft NAVD88)	-34.22 ft	-27.19 ft
Volume Change Above -15 ft NAVD88	-0.40 cy/ft	3.30 cy/ft
Volume Change Above 0 ft NAVD88	-3.61 cy/ft	-4.16 cy/ft
Distance from USACE Design Template @ 3.5 feet NAVD88:		
LEGEND: MAY 2017 NOV 2018 — APR 2018 — OCT 2016 — USACE Design Template - - - OCT 2017 — USACE Nourishment Threshold - - -		

Notes:

1. Station From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward and Seaward Of The Breakwater.

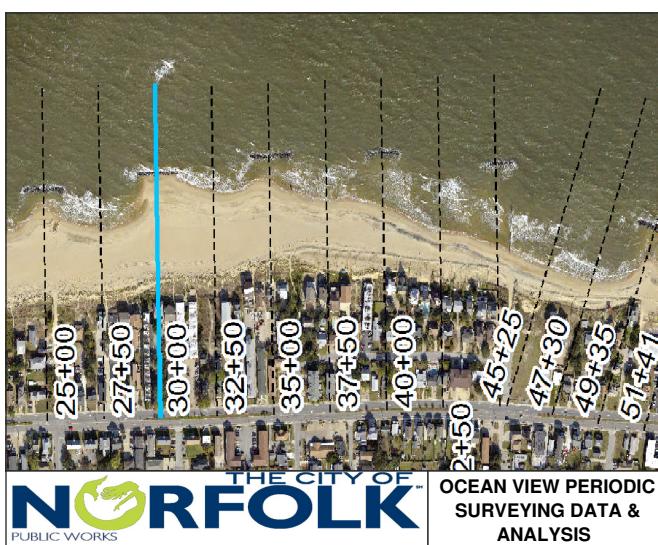


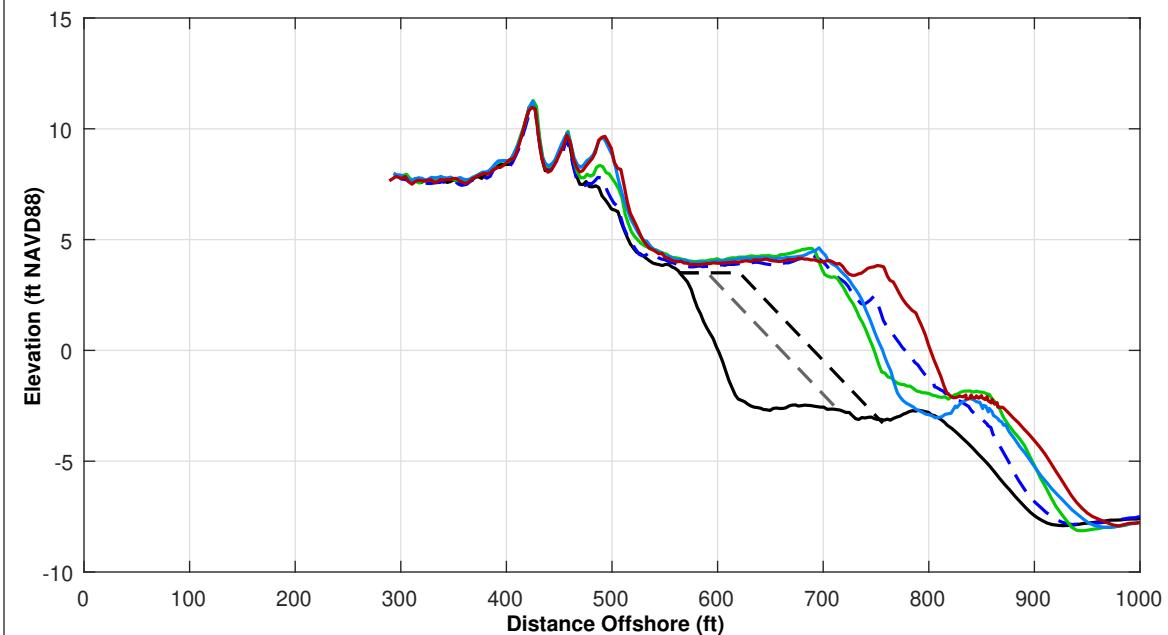
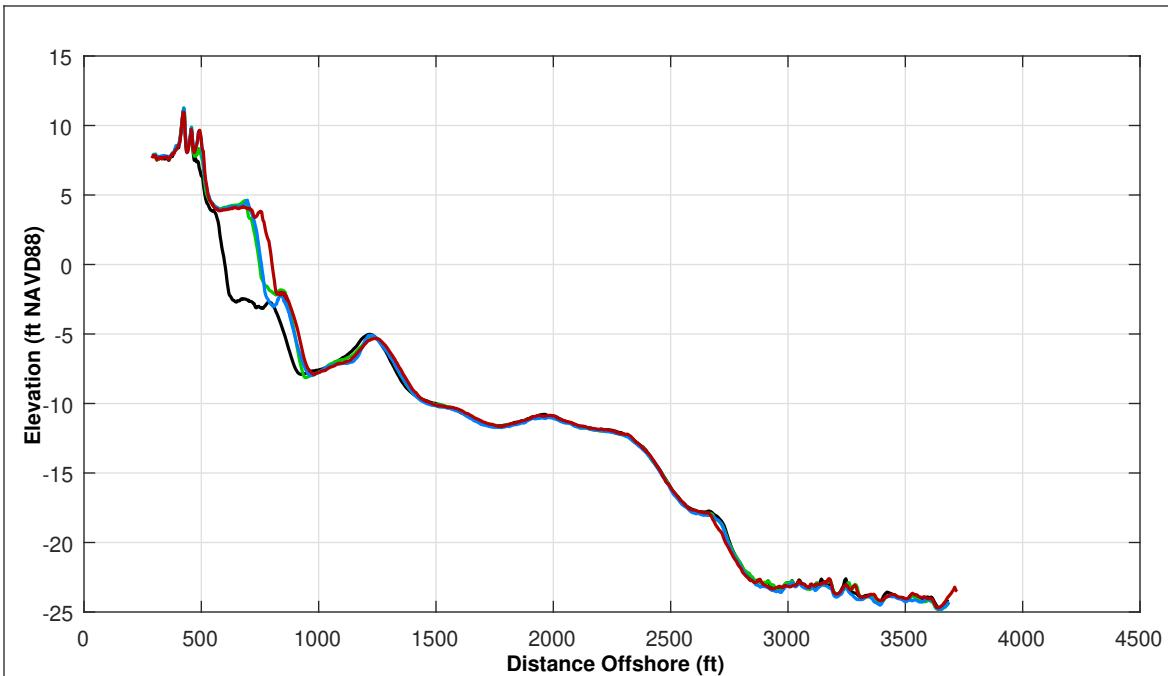


Survey Transect 30+00	NOV 2018 - OCT 2017	NOV 2018 - APR 2018
Shoreline Change at MHW (0.98 ft NAVD88)	40.93 ft	12.39 ft
Volume Change Above -15 ft NAVD88	17.25 cy/ft	12.56 cy/ft
Volume Change Above 0 ft NAVD88	4.15 cy/ft	0.76 cy/ft
Distance from USACE Design Template @ 3.5 feet NAVD88:		
LEGEND: MAY 2017 NOV 2018 — OCT 2016 — APR 2018 — OCT 2017 — USACE Design Template USACE Nourishment Threshold		

Notes:

1. Station From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward and Seaward Of The Breakwater.



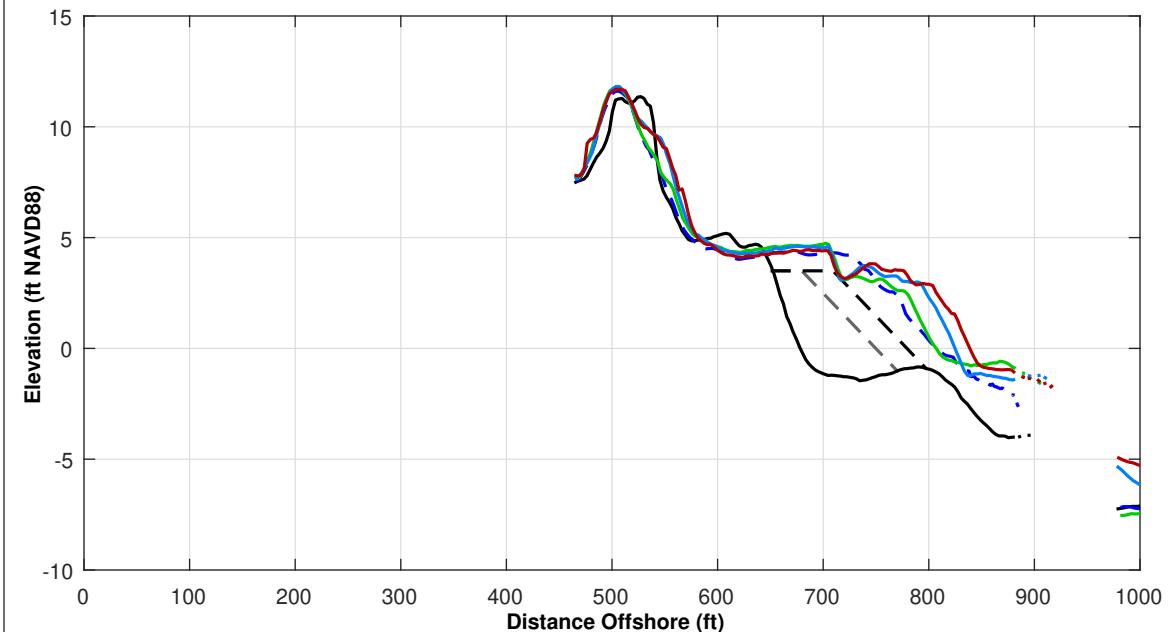
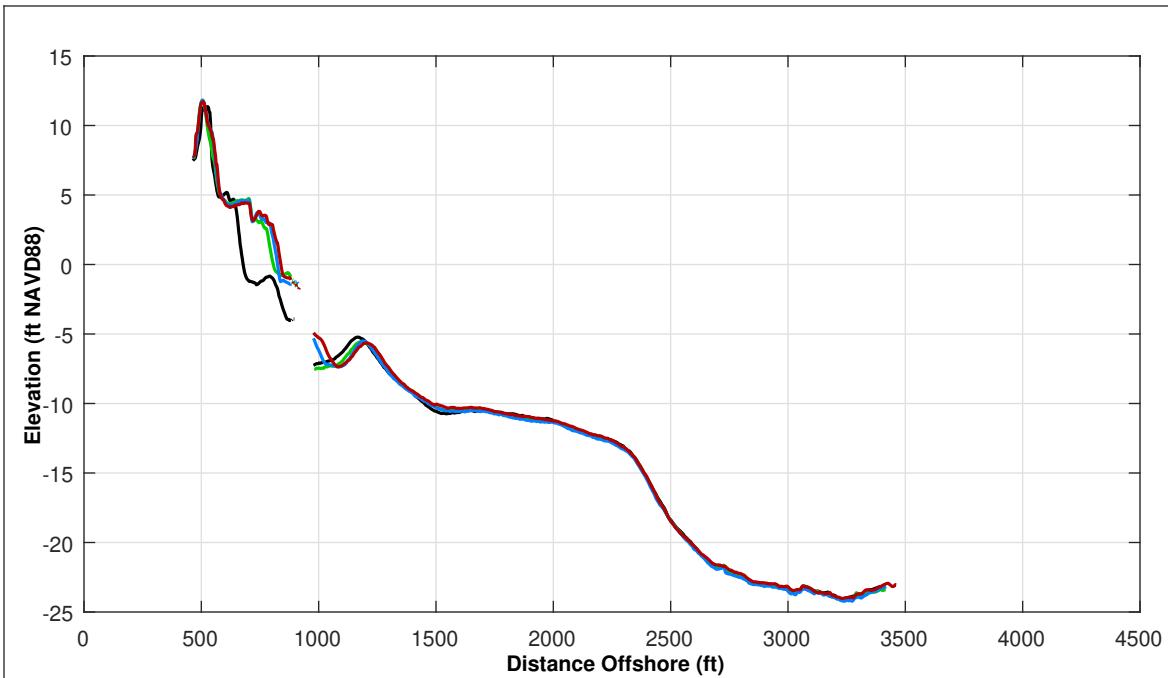


Survey Transect 32+50	NOV 2018 - OCT 2017	NOV 2018 - APR 2018
Shoreline Change at MHW (0.98 ft NAVD88)	54.46 ft	46.76 ft
Volume Change Above -15 ft NAVD88	16.77 cy/ft	19.70 cy/ft
Volume Change Above 0 ft NAVD88	7.48 cy/ft	4.50 cy/ft
Distance from USACE Design Template @ 3.5 feet NAVD88:		
LEGEND: NOV 2018 — MAY 2017 APR 2018 — OCT 2016 OCT 2017 — USACE Design Template USACE Nourishment Threshold — USACE Nourishment Threshold		

Notes:

1. Station From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward and Seaward Of The Breakwater.



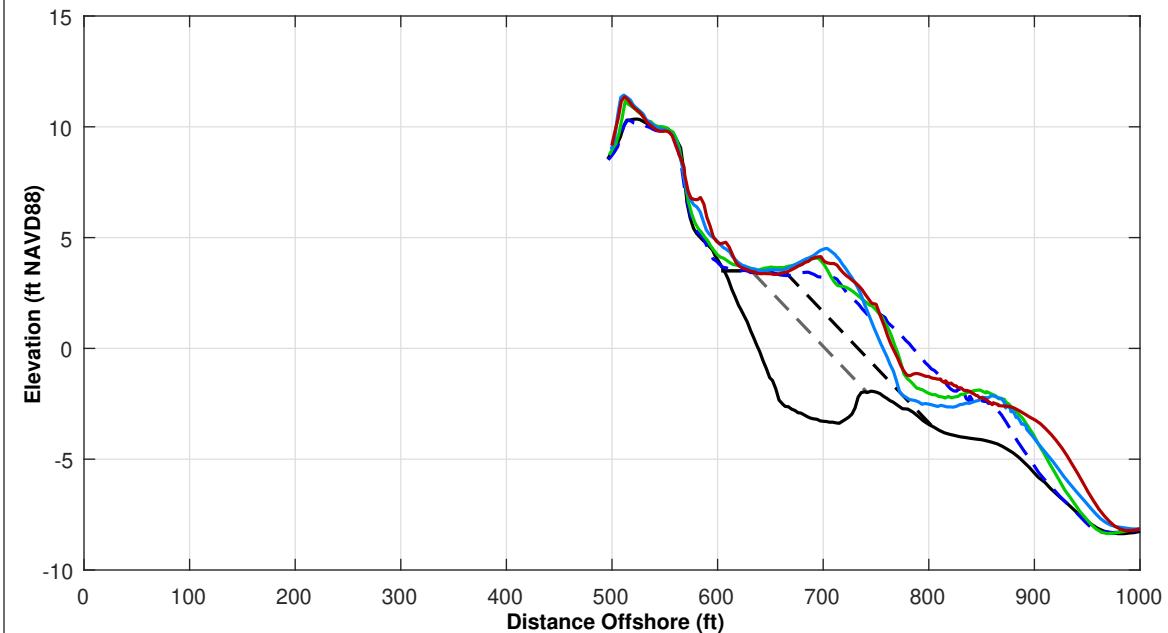
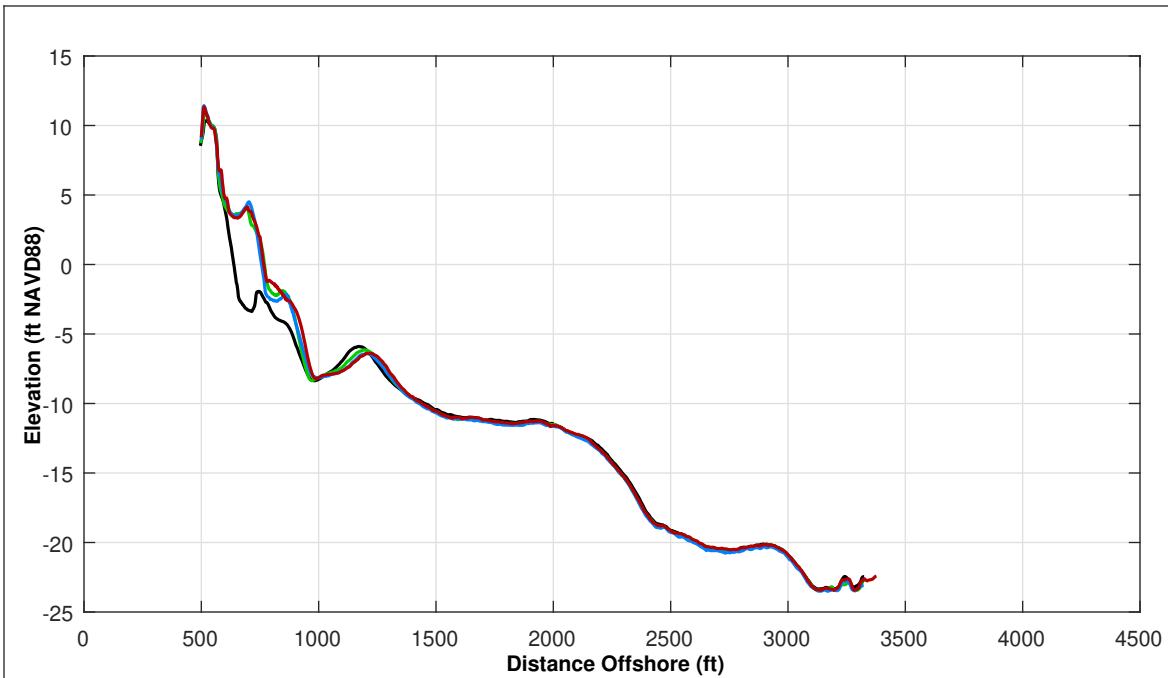


Survey Transect 35+00	NOV 2018 - OCT 2017	NOV 2018 - APR 2018
Shoreline Change at MHW (0.98 ft NAVD88)	34.53 ft	14.01 ft
Volume Change Above -15 ft NAVD88	13.82 cy/ft	13.53 cy/ft
Volume Change Above 0 ft NAVD88	5.47 cy/ft	1.48 cy/ft
Distance from USACE Design Template @ 3.5 feet NAVD88:		
LEGEND: NOV 2018 — MAY 2017 APR 2018 — OCT 2016 OCT 2017 — USACE Design Template USACE Nourishment Threshold — USACE Nourishment Threshold		

Notes:

1. Station From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward and Seaward Of The Breakwater.



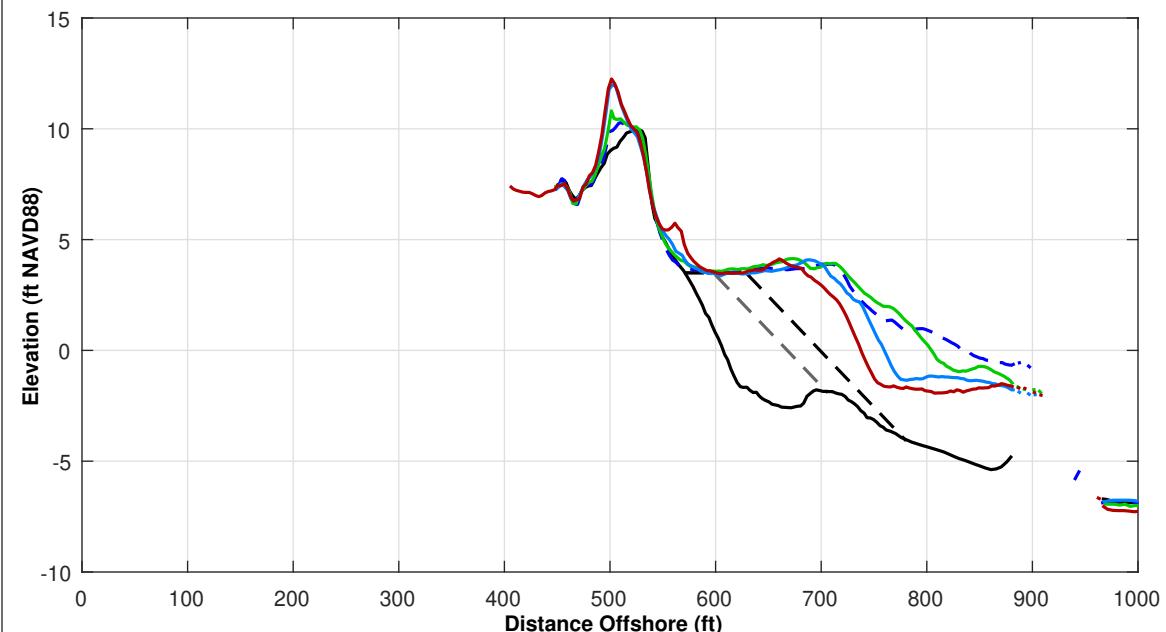
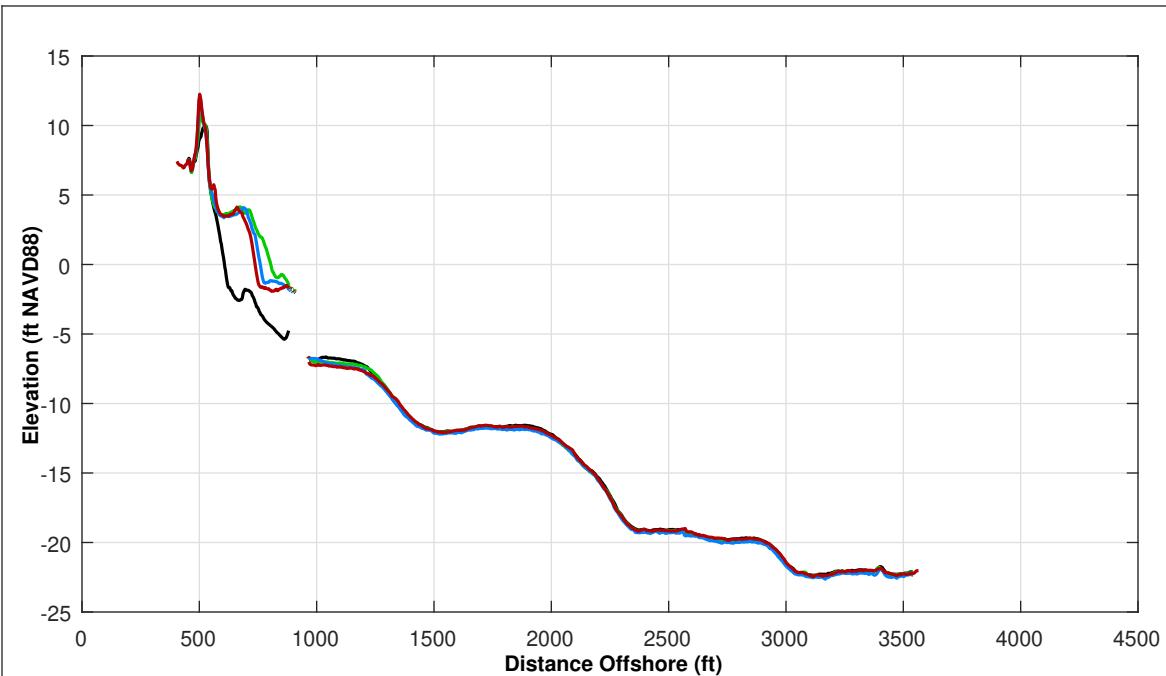


Survey Transect 37+50	NOV 2018 - OCT 2017	NOV 2018 - APR 2018
Shoreline Change at MHW (0.98 ft NAVD88)	-2.51 ft	10.40 ft
Volume Change Above -15 ft NAVD88	6.96 cy/ft	11.46 cy/ft
Volume Change Above 0 ft NAVD88	1.90 cy/ft	0.33 cy/ft
Distance from USACE Design Template @ 3.5 feet NAVD88:		
LEGEND: NOV 2018 — MAY 2017 APR 2018 — OCT 2016 OCT 2017 — USACE Design Template USACE Nourishment Threshold — — —		

Notes:

1. Station From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward and Seaward Of The Breakwater.





Survey Transect 40+00	NOV 2018 - OCT 2017	NOV 2018 - APR 2018
Shoreline Change at MHW (0.98 ft NAVD88)	-58.87 ft	-20.10 ft
Volume Change Above -15 ft NAVD88	-12.51 cy/ft	0.14 cy/ft
Volume Change Above 0 ft NAVD88	-5.03 cy/ft	-1.56 cy/ft

Distance from USACE Design Template @ 3.5 feet NAVD88:

LEGEND:

- MAY 2017
- NOV 2018
- OCT 2016
- APR 2018
- USACE Design Template
- OCT 2017
- USACE Nourishment Threshold

Notes:

1. Station From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward and Seaward Of The Breakwater.

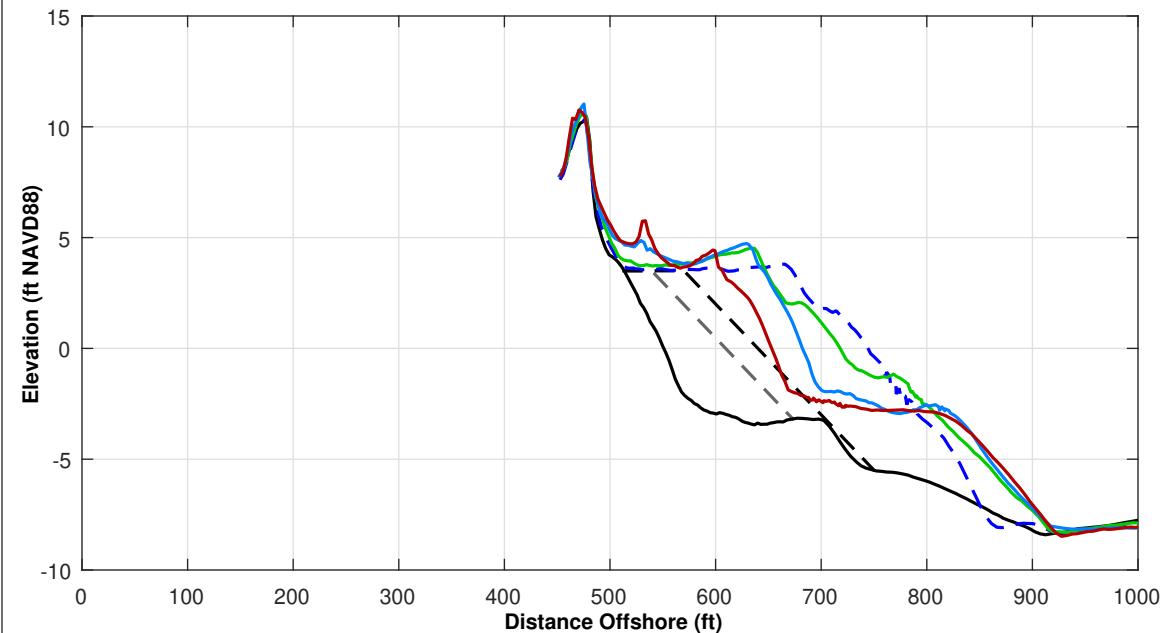
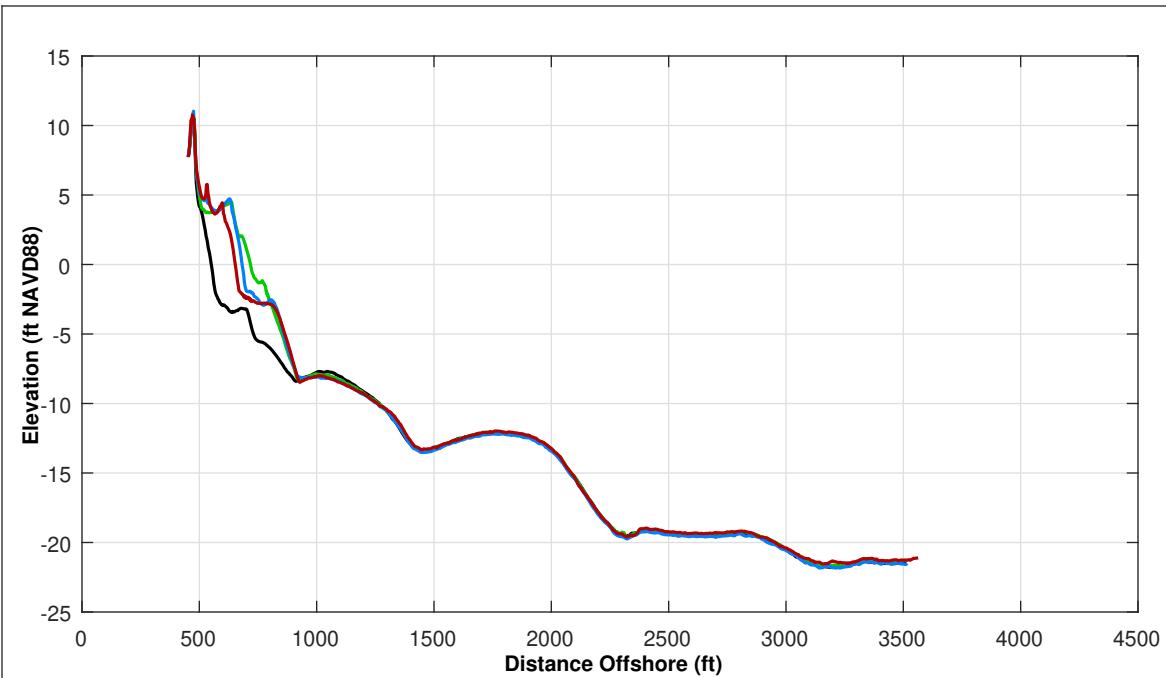


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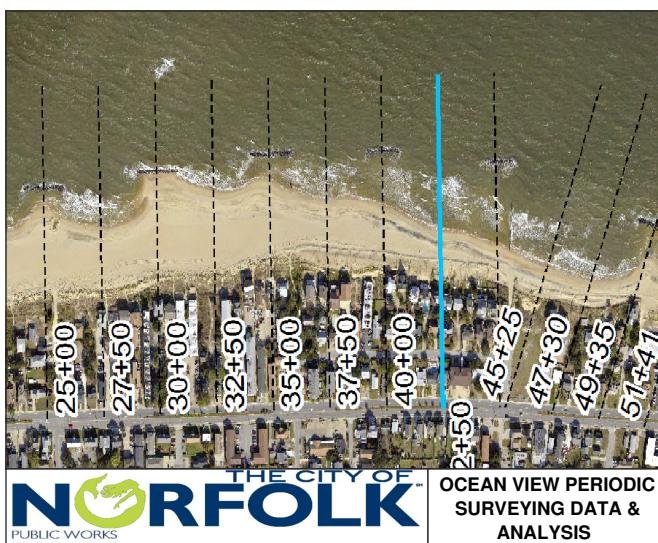
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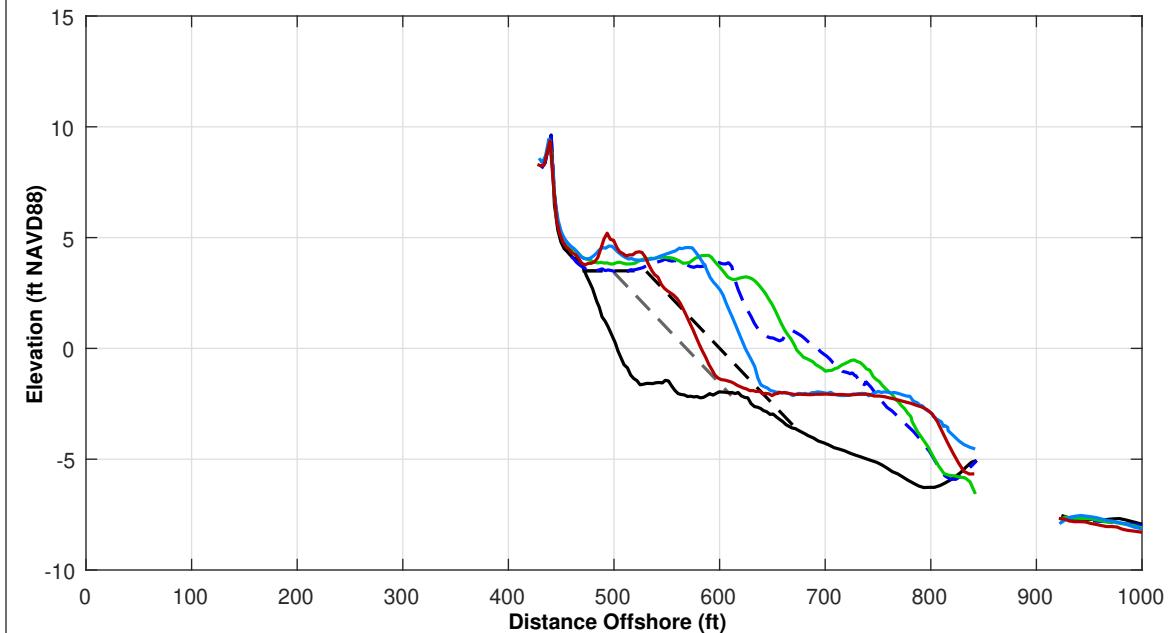
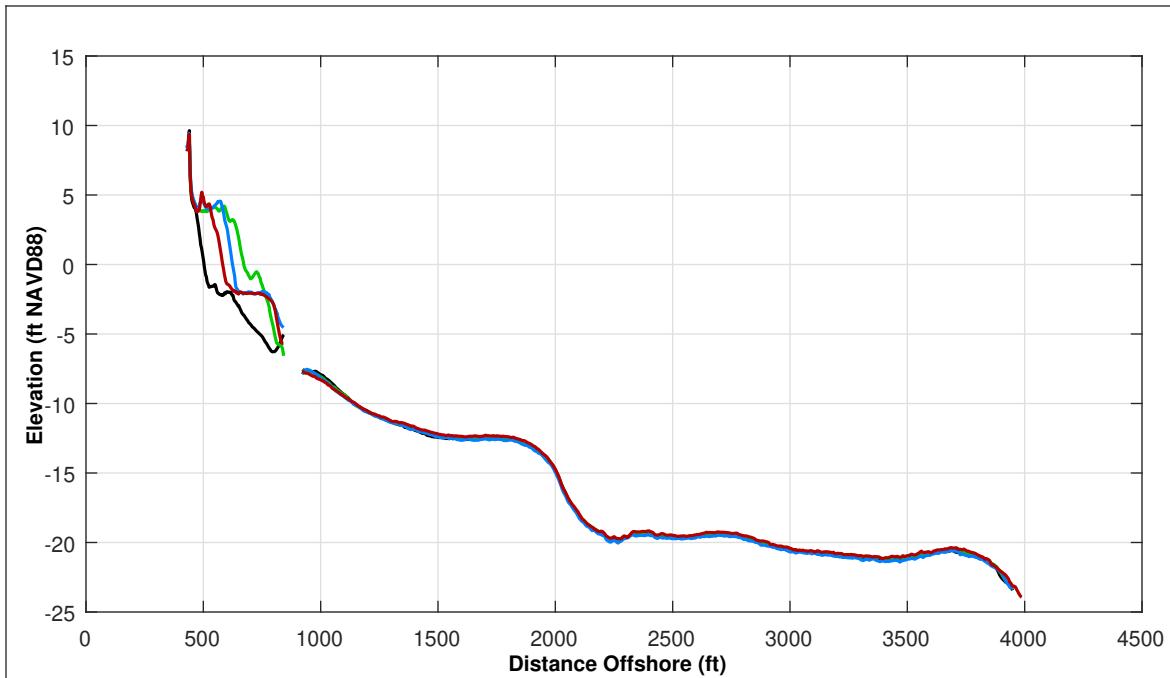


Survey Transect 42+50	NOV 2018 - OCT 2017	NOV 2018 - APR 2018
Shoreline Change at MHW (0.98 ft NAVD88)	-58.23 ft	-29.56 ft
Volume Change Above -15 ft NAVD88	-12.32 cy/ft	-2.16 cy/ft
Volume Change Above 0 ft NAVD88	-5.29 cy/ft	-4.70 cy/ft
Distance from USACE Design Template @ 3.5 feet NAVD88:		
LEGEND: NOV 2018 — NOV 2018 APR 2018 — APR 2018 MAY 2017 — MAY 2017 OCT 2016 — OCT 2016 USACE Design Template — USACE Design Template OCT 2017 — OCT 2017 USACE Nourishment Threshold — USACE Nourishment Threshold		

Notes:

1. Station From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward and Seaward Of The Breakwater.



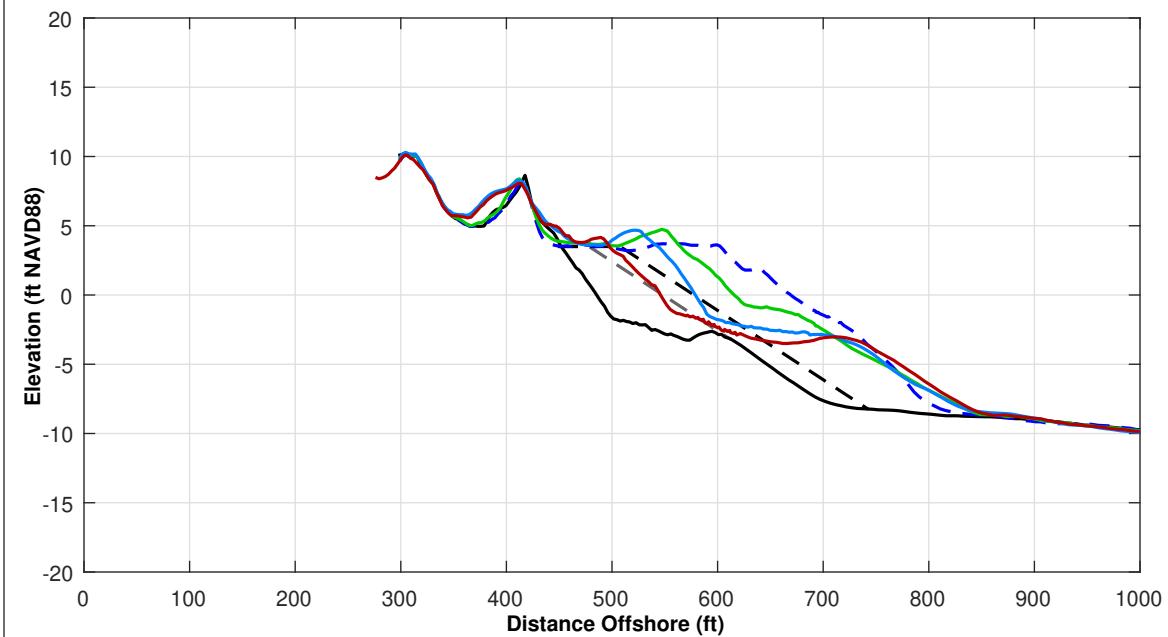
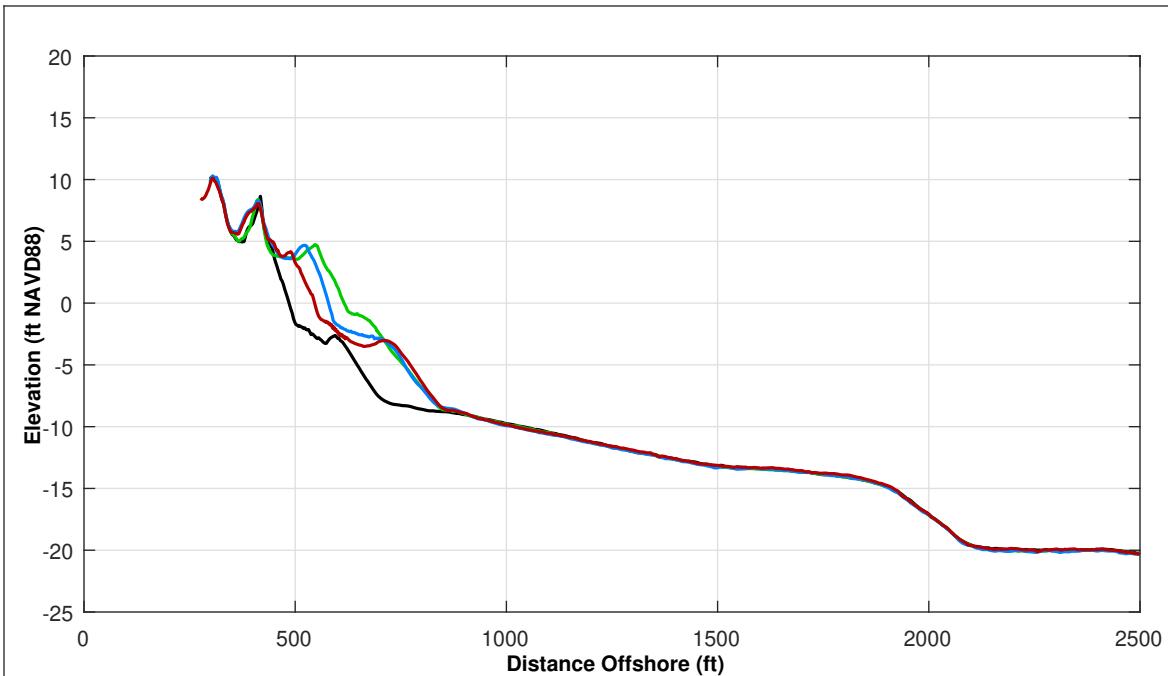


Survey Transect 45+00	NOV 2018 - OCT 2017	NOV 2018 - APR 2018
Shoreline Change at MHW (0.98 ft NAVD88)	-86.58 ft	-42.38 ft
Volume Change Above -15 ft NAVD88	-16.23 cy/ft	-6.17 cy/ft
Volume Change Above 0 ft NAVD88	-11.74 cy/ft	-7.47 cy/ft
Distance from USACE Design Template @ 3.5 feet NAVD88:		
LEGEND: NOV 2018 — NOV 2018 APR 2018 — APR 2018 MAY 2017 — MAY 2017 OCT 2016 — OCT 2016 USACE Design Template — USACE Design Template OCT 2017 — OCT 2017 USACE Nourishment Threshold — USACE Nourishment Threshold		

Notes:

1. Station From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward and Seaward Of The Breakwater.



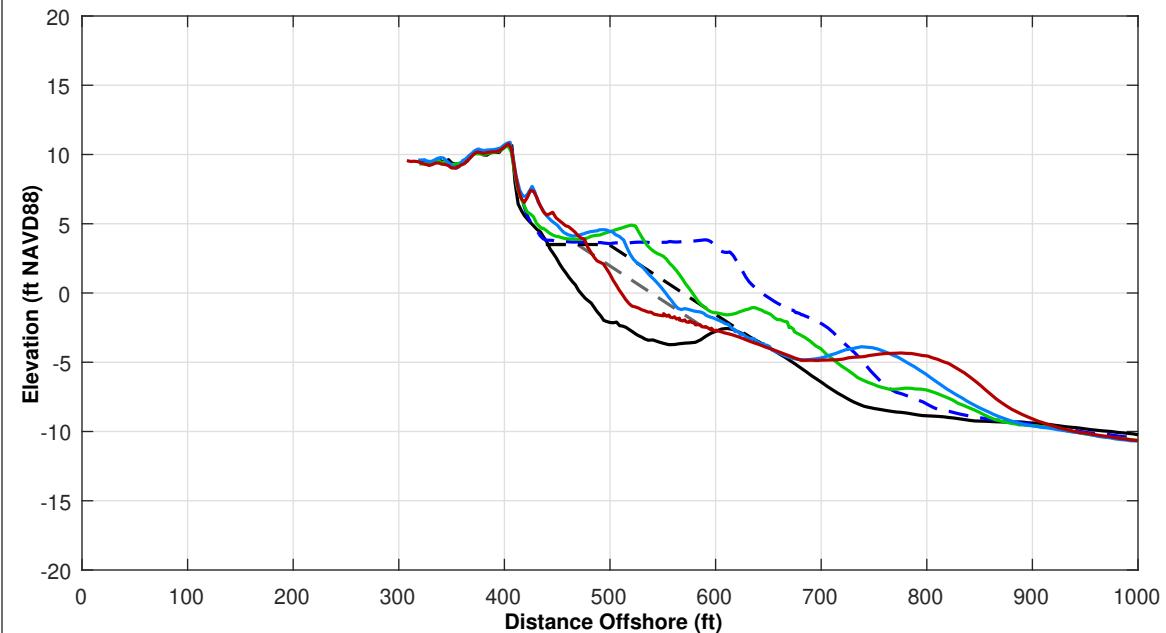
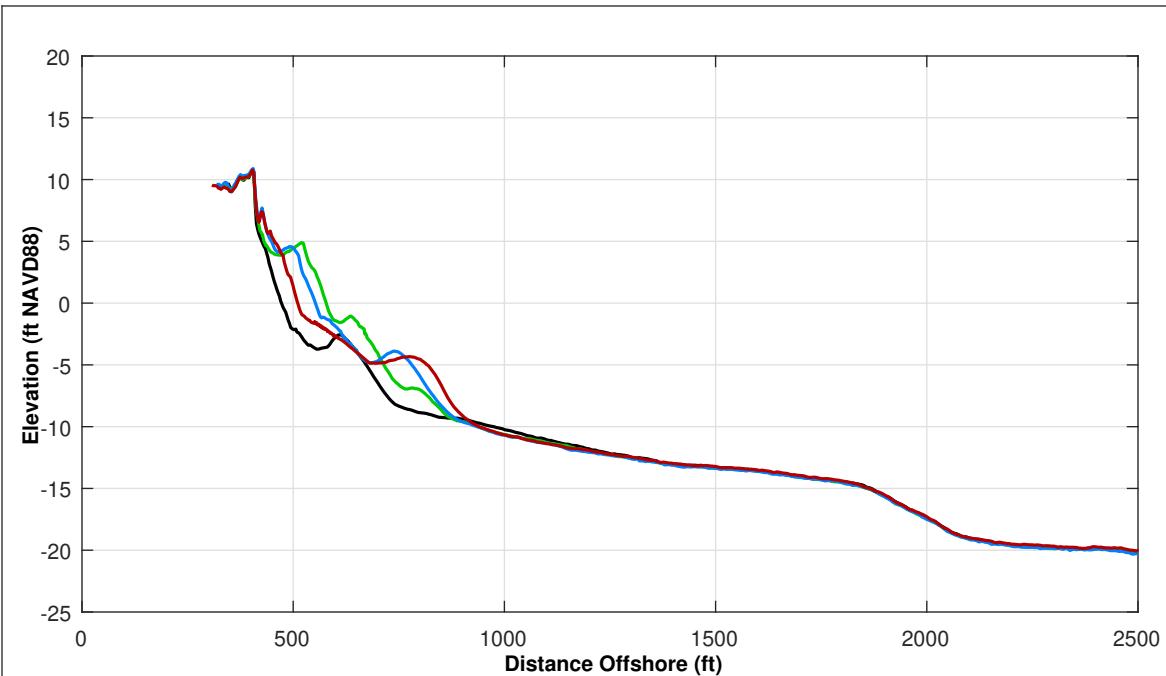


Survey Transect 45+25	NOV 2018 - OCT 2017	NOV 2018 - APR 2018
Shoreline Change at MHW (0.98 ft NAVD88)	-69.95 ft	-36.18 ft
Volume Change Above -15 ft NAVD88	-14.40 cy/ft	-6.53 cy/ft
Volume Change Above 0 ft NAVD88	-8.02 cy/ft	-7.02 cy/ft
Distance from USACE Design Template @ 3.5 feet NAVD88:		
LEGEND: NOV 2018 — MAY 2017 APR 2018 — OCT 2016 OCT 2017 — USACE Design Template USACE Nourishment Threshold — USACE Nourishment Threshold		

Notes:

1. Station From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward and Seaward Of The Breakwater.



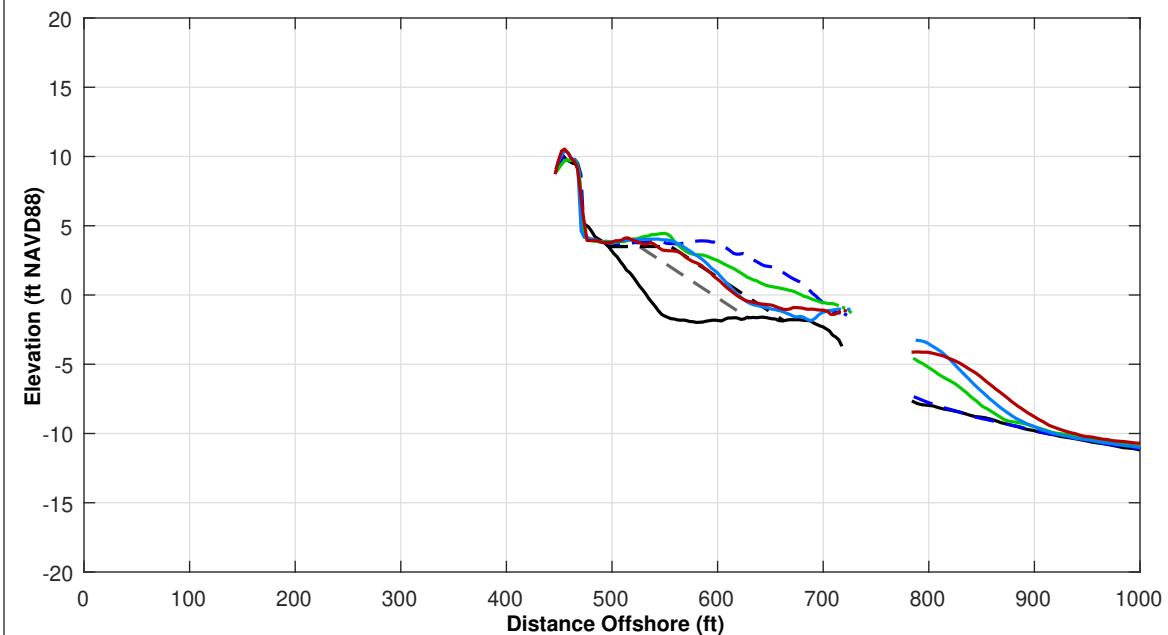
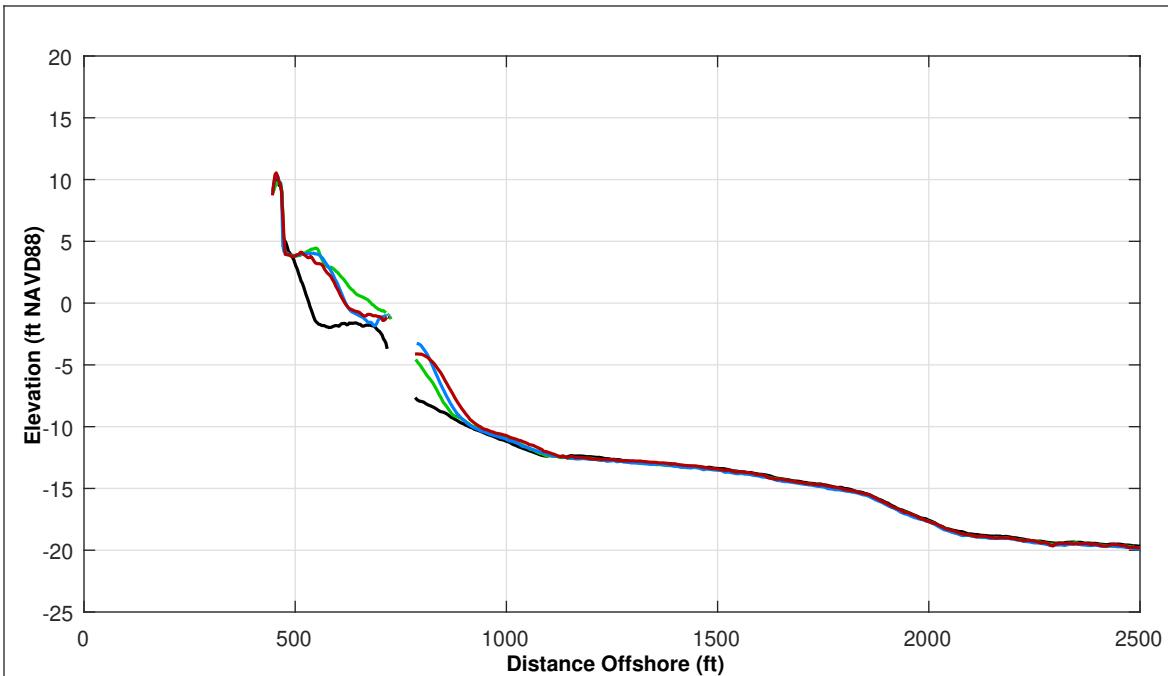


Survey Transect 47+30	NOV 2018 - OCT 2017	NOV 2018 - APR 2018
Shoreline Change at MHW (0.98 ft NAVD88)	-66.34 ft	-39.06 ft
Volume Change Above -15 ft NAVD88	-4.97 cy/ft	-1.62 cy/ft
Volume Change Above 0 ft NAVD88	-8.02 cy/ft	-6.39 cy/ft
Distance from USACE Design Template @ 3.5 feet NAVD88:		
LEGEND: NOV 2018 — NOV 2018 APR 2018 — APR 2018 MAY 2017 — MAY 2017 OCT 2016 — OCT 2016 USACE Design Template — USACE Design Template OCT 2017 — OCT 2017 USACE Nourishment Threshold — USACE Nourishment Threshold		

Notes:

1. Station From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward and Seaward Of The Breakwater.





Survey Transect 49+35	NOV 2018 - OCT 2017	NOV 2018 - APR 2018
Shoreline Change at MHW (0.98 ft NAVD88)	-35.51 ft	-4.75 ft
Volume Change Above -15 ft NAVD88	2.87 cy/ft	6.66 cy/ft
Volume Change Above 0 ft NAVD88	-4.56 cy/ft	-1.31 cy/ft

Distance from USACE Design Template @ 3.5 feet NAVD88:

LEGEND:

- MAY 2017
- NOV 2018
- OCT 2016
- APR 2018
- USACE Design Template
- OCT 2017
- USACE Nourishment Threshold

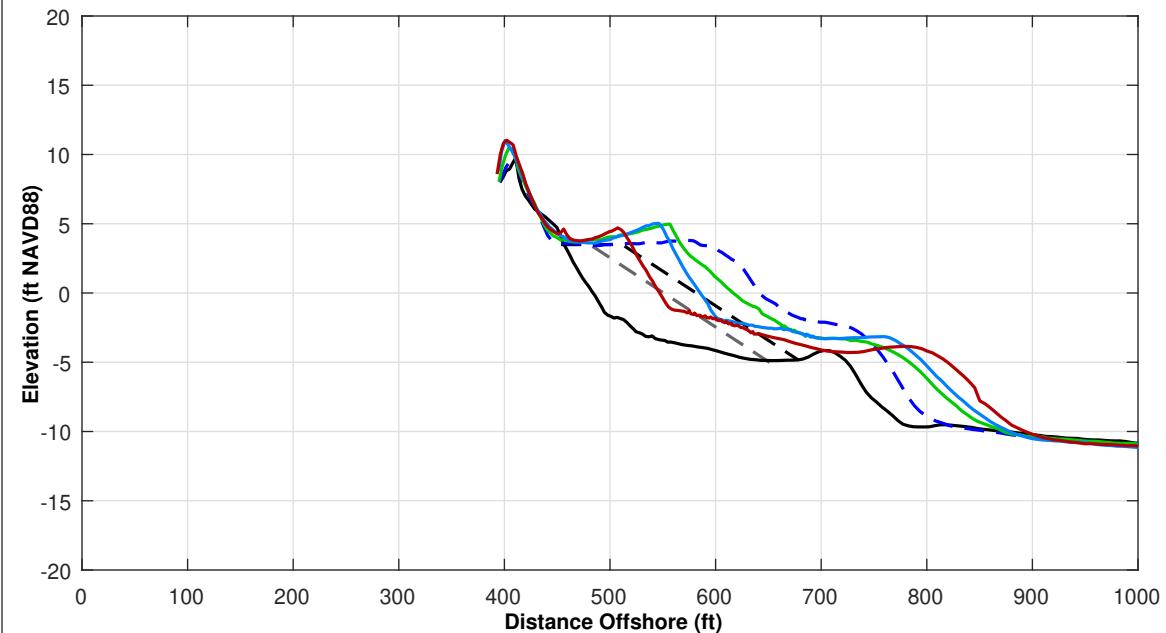
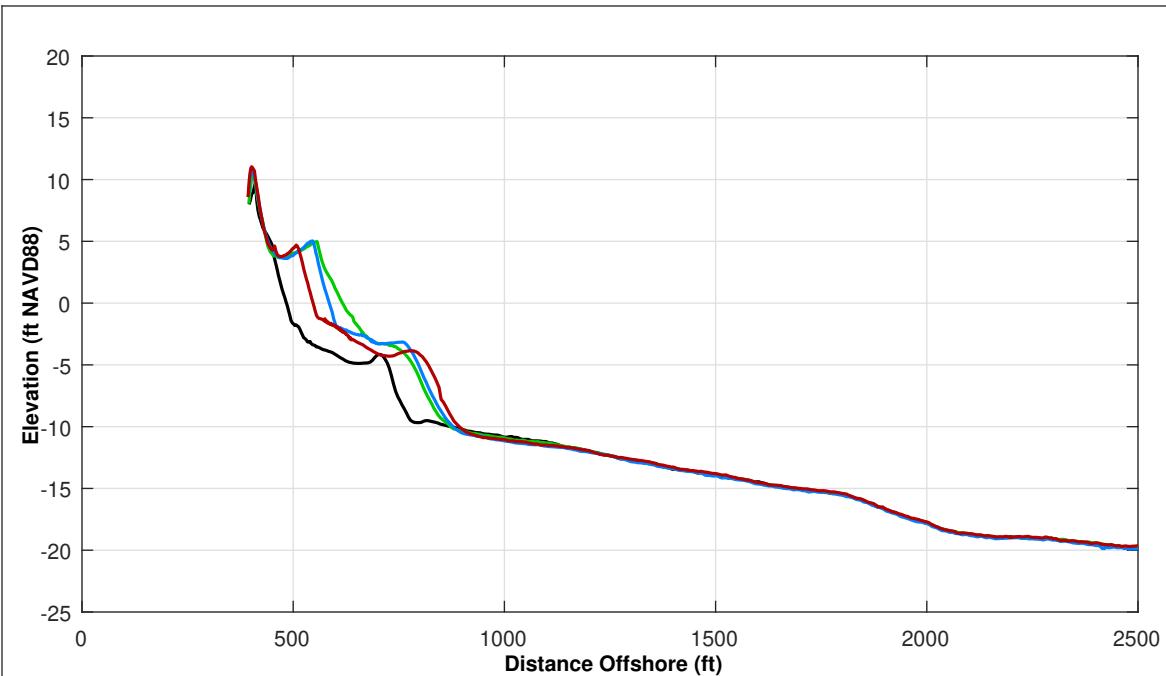
Notes:

1. Station From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward and Seaward Of The Breakwater.



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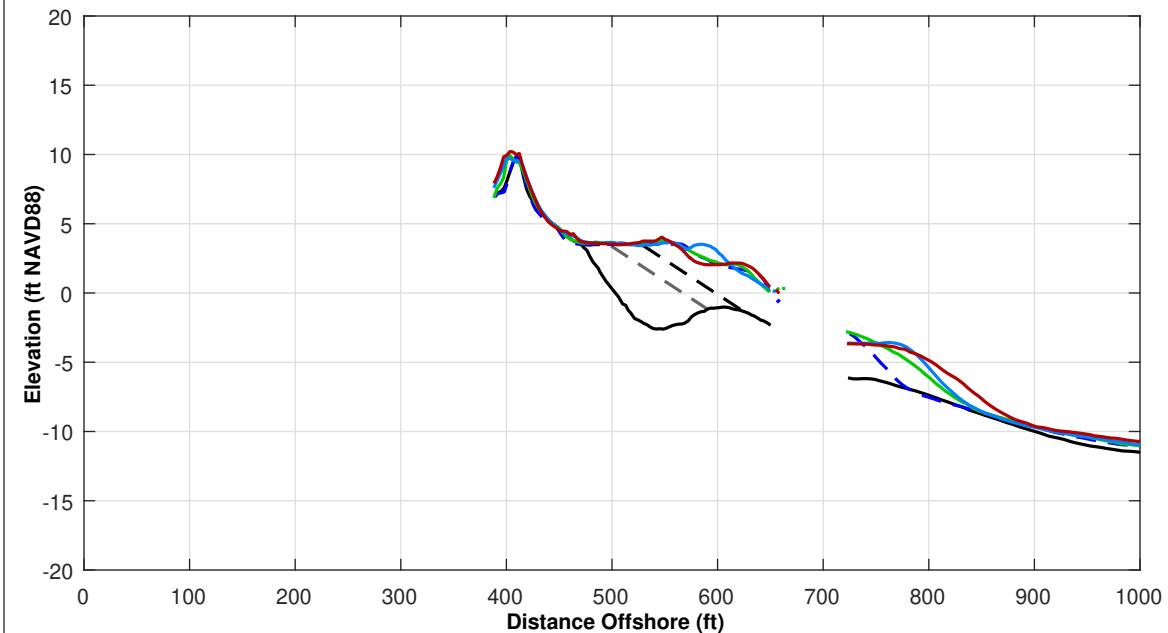
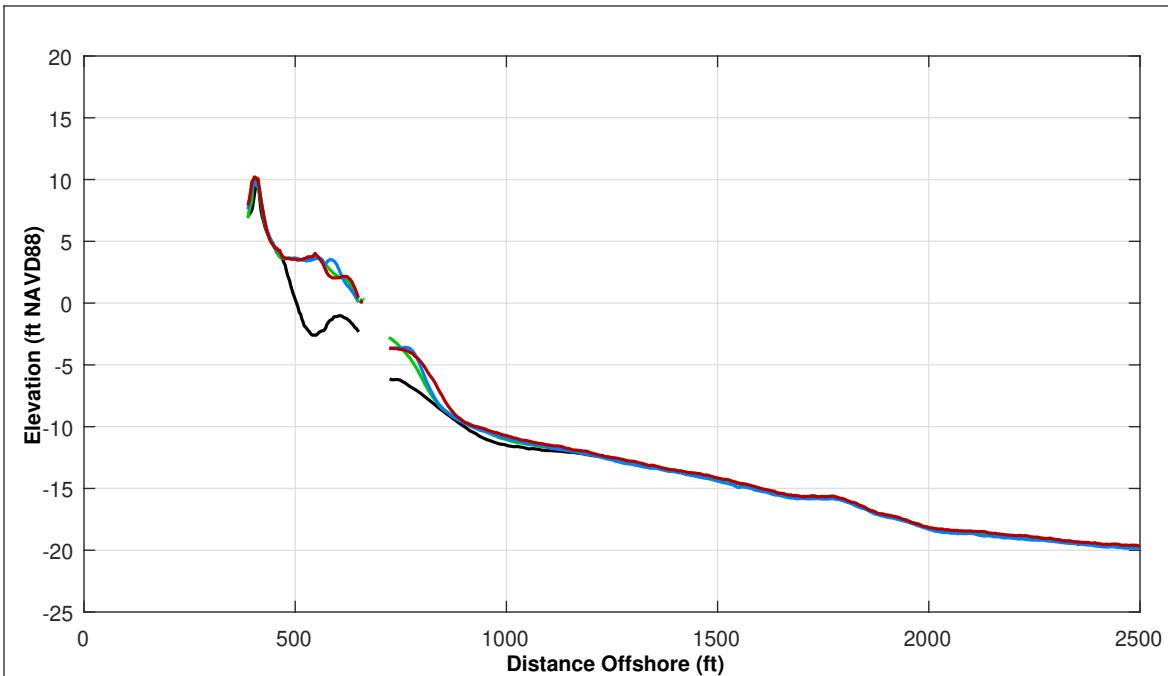


Survey Transect 51+41	NOV 2018 - OCT 2017	NOV 2018 - APR 2018
Shoreline Change at MHW (0.98 ft NAVD88)	-63.35 ft	-37.29 ft
Volume Change Above -15 ft NAVD88	-10.30 cy/ft	-4.41 cy/ft
Volume Change Above 0 ft NAVD88	-8.10 cy/ft	-5.65 cy/ft
Distance from USACE Design Template @ 3.5 feet NAVD88:		
LEGEND: NOV 2018 — MAY 2017 APR 2018 — OCT 2016 OCT 2017 — USACE Design Template USACE Nourishment Threshold — USACE Nourishment Threshold		

Notes:

1. Station From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward and Seaward Of The Breakwater.





Survey Transect 53+46	NOV 2018 - OCT 2017	NOV 2018 - APR 2018
Shoreline Change at MHW (0.98 ft NAVD88)	7.44 ft	9.93 ft
Volume Change Above -15 ft NAVD88	8.03 cy/ft	7.51 cy/ft
Volume Change Above 0 ft NAVD88	0.93 cy/ft	-0.18 cy/ft
Distance from USACE Design Template @ 3.5 feet NAVD88:		

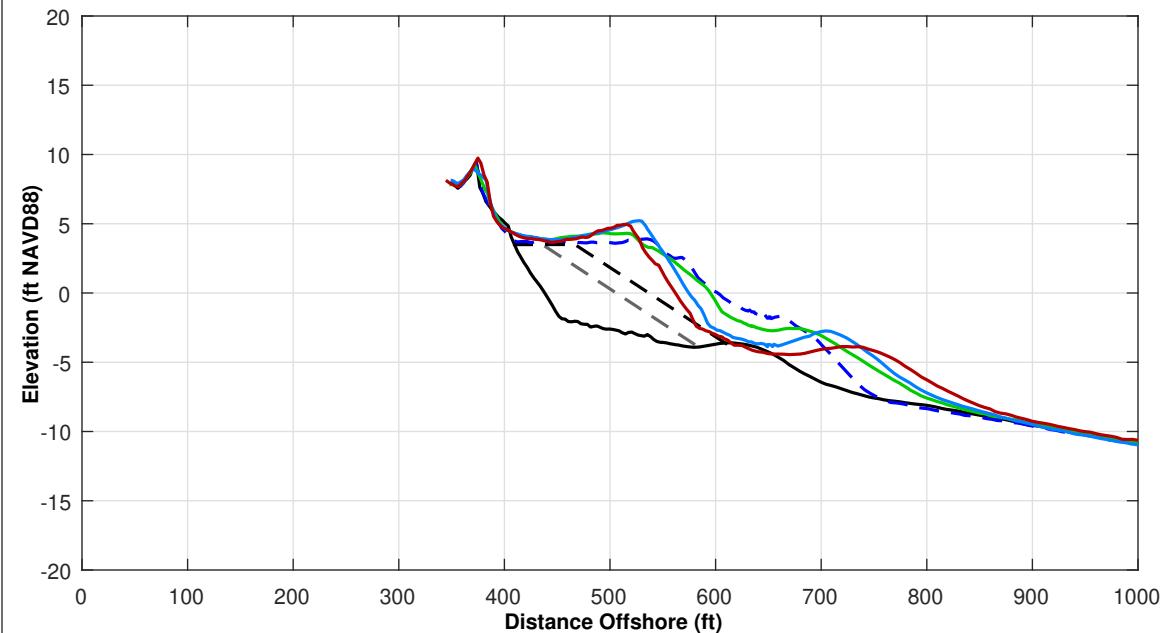
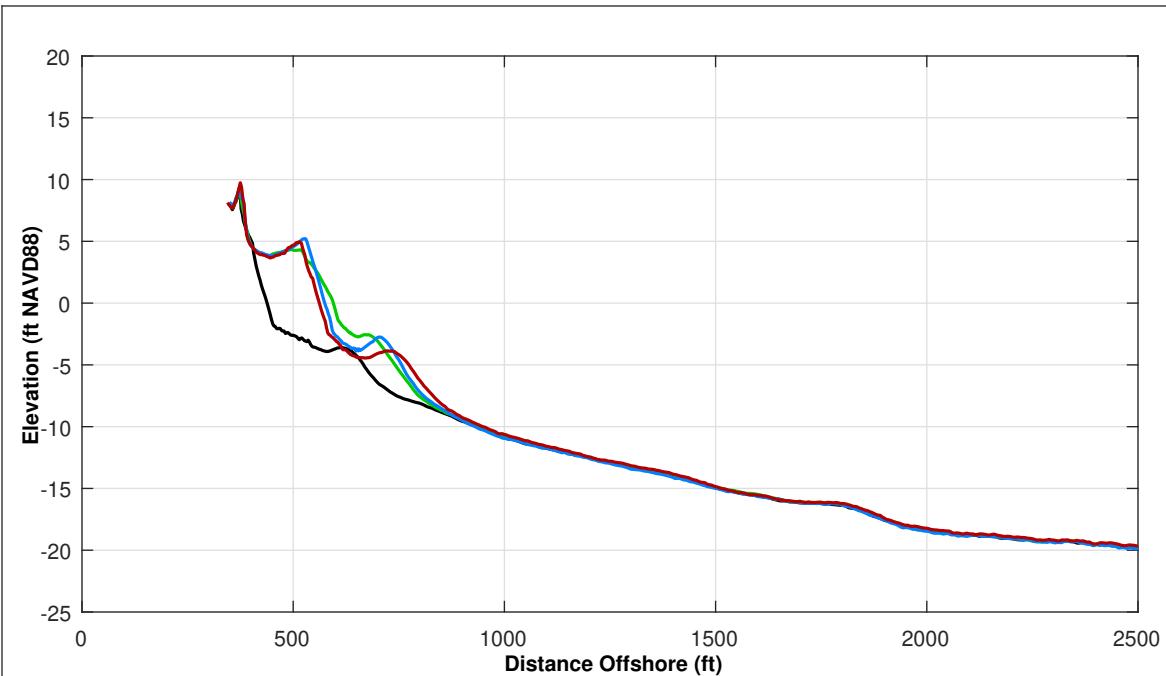
LEGEND:

NOV 2018	MAY 2017
APR 2018	OCT 2016
OCT 2017	USACE Design Template
	USACE Nourishment Threshold

Notes:

1. Station From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward and Seaward Of The Breakwater.



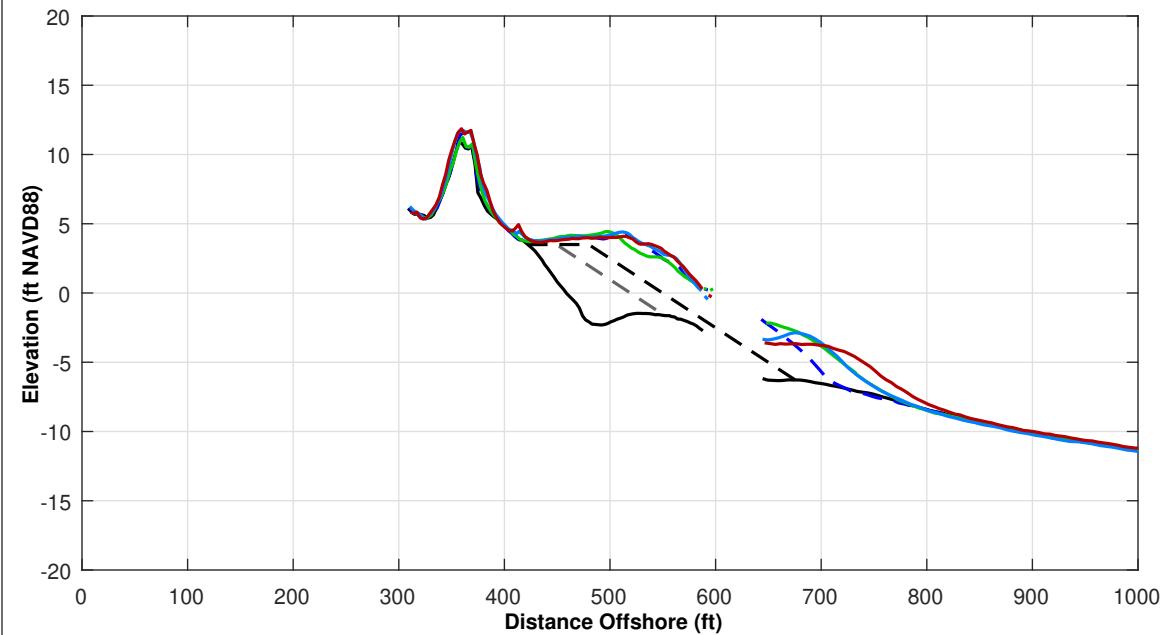
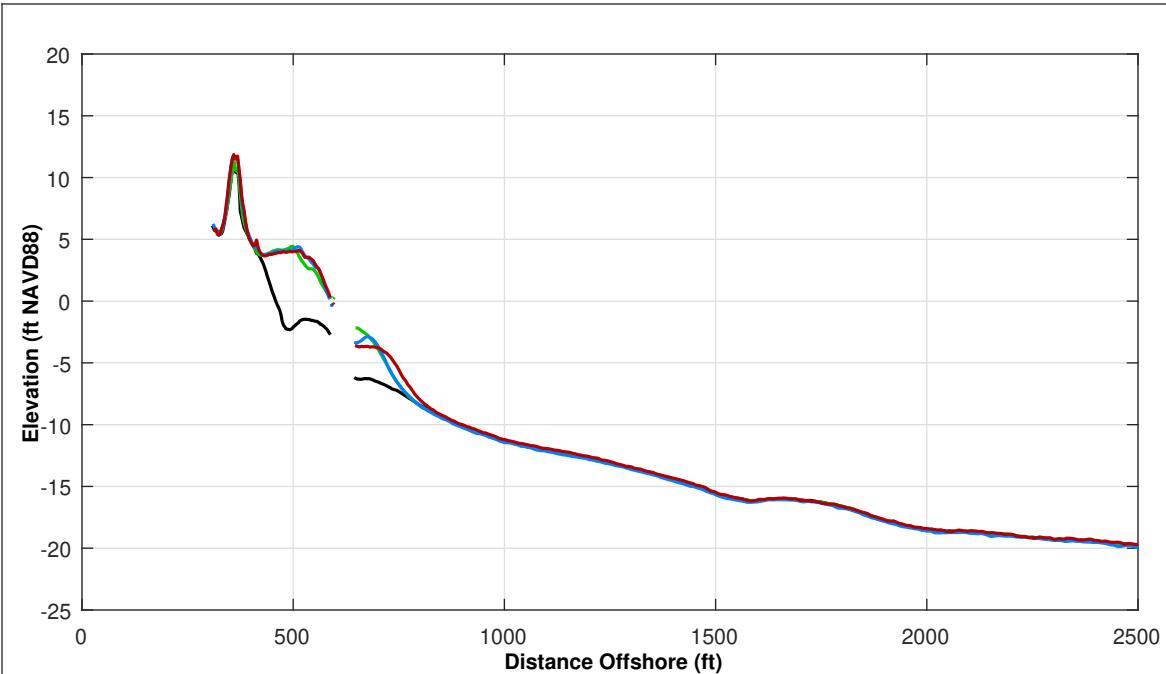


Survey Transect 55+51	NOV 2018 - OCT 2017	NOV 2018 - APR 2018
Shoreline Change at MHW (0.98 ft NAVD88)	-27.85 ft	-13.18 ft
Volume Change Above -15 ft NAVD88	-3.38 cy/ft	0.66 cy/ft
Volume Change Above 0 ft NAVD88	-2.26 cy/ft	-2.83 cy/ft
Distance from USACE Design Template @ 3.5 feet NAVD88:		
LEGEND: NOV 2018 — NOV 2018 APR 2018 — APR 2018 OCT 2017 — OCT 2017 USACE Design Template - - - - - USACE Nourishment Threshold - - - - -		

Notes:

1. Station From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward and Seaward Of The Breakwater.



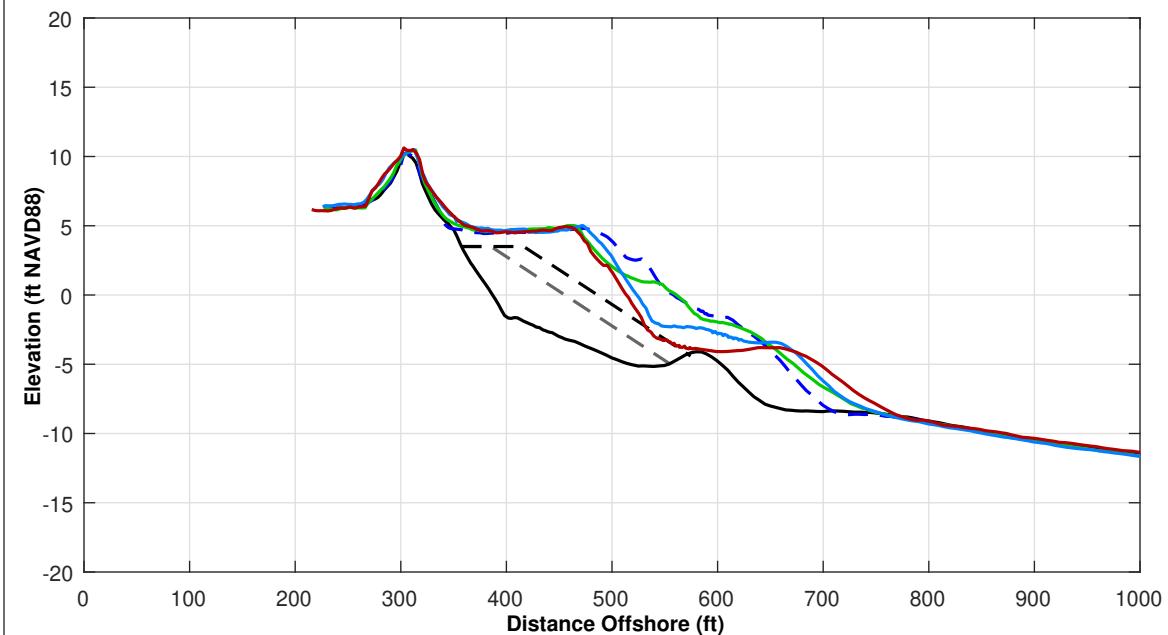
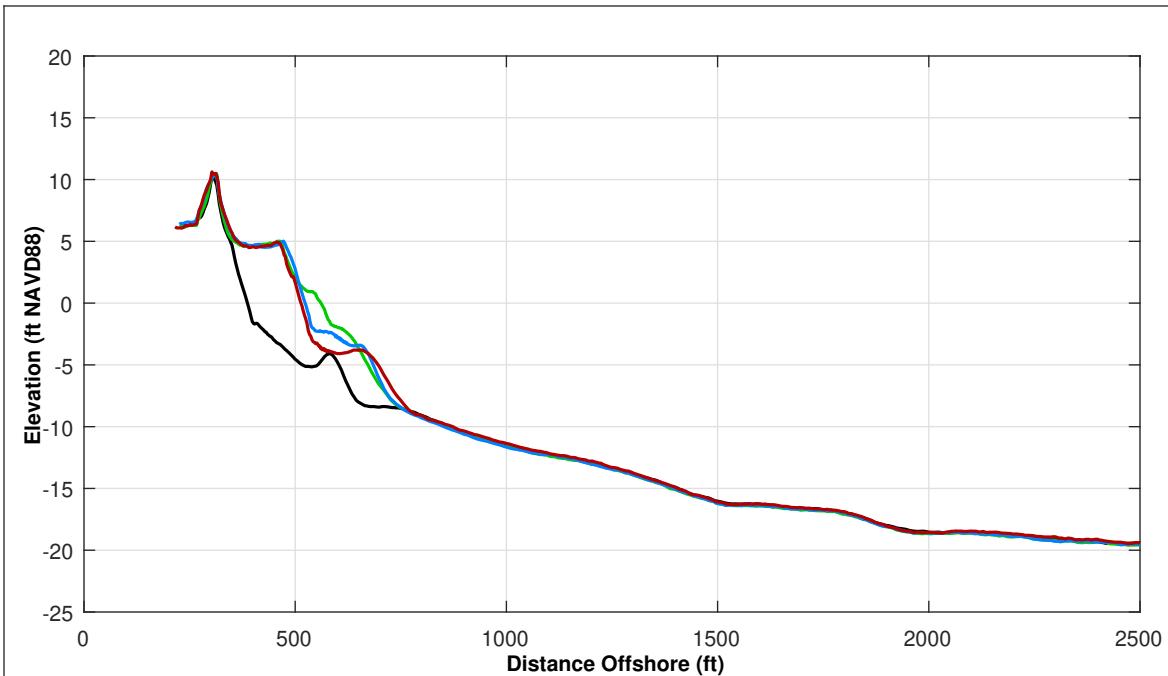


Survey Transect 57+57	NOV 2018 - OCT 2017	NOV 2018 - APR 2018
Shoreline Change at MHW (0.98 ft NAVD88)	5.35 ft	3.34 ft
Volume Change Above -15 ft NAVD88	7.41 cy/ft	7.32 cy/ft
Volume Change Above 0 ft NAVD88	2.88 cy/ft	0.07 cy/ft
Distance from USACE Design Template @ 3.5 feet NAVD88:		
LEGEND: NOV 2018 — MAY 2017 APR 2018 — OCT 2016 OCT 2017 — USACE Design Template USACE Nourishment Threshold — USACE Nourishment Threshold		

Notes:

1. Station From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward and Seaward Of The Breakwater.





Survey Transect 59+62	NOV 2018 - OCT 2017	NOV 2018 - APR 2018
Shoreline Change at MHW (0.98 ft NAVD88)	-22.26 ft	-8.97 ft
Volume Change Above -15 ft NAVD88	-3.62 cy/ft	-0.90 cy/ft
Volume Change Above 0 ft NAVD88	-1.00 cy/ft	-2.46 cy/ft

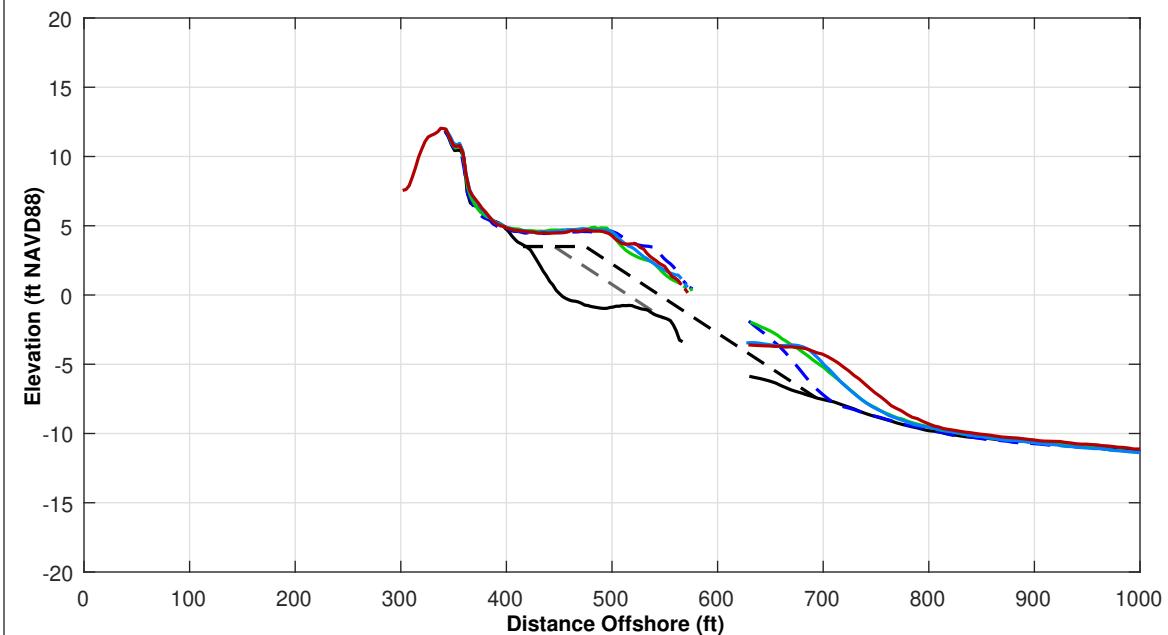
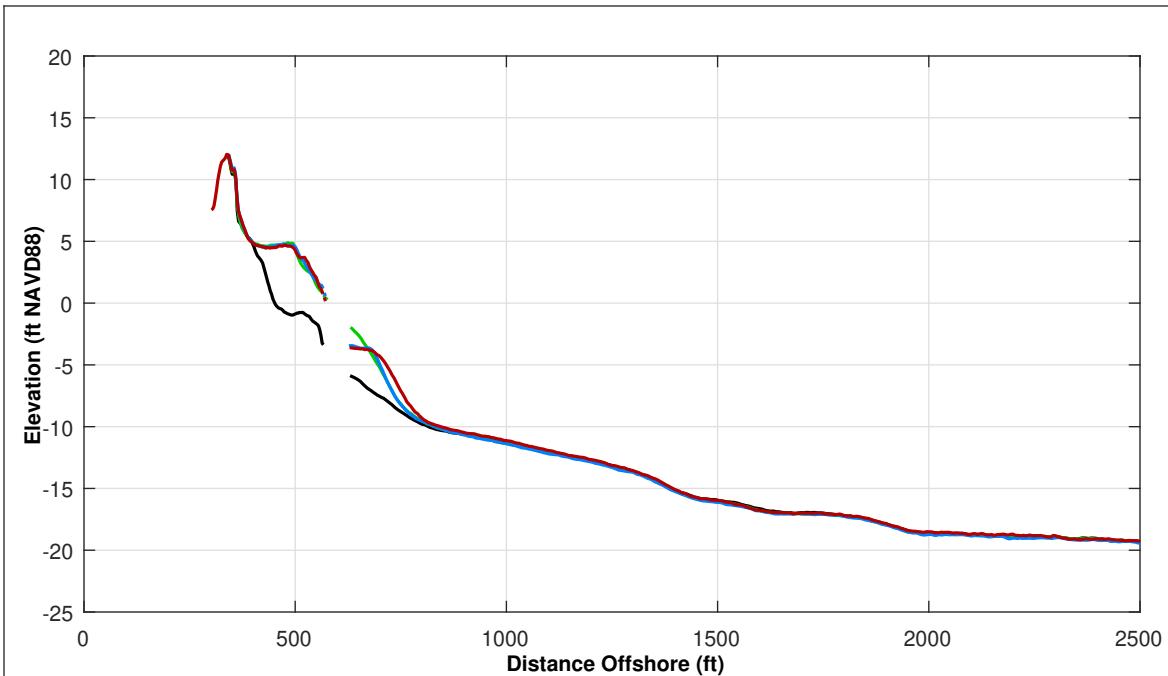
Distance from USACE Design Template
@ 3.5 feet NAVD88:

LEGEND:	MAY 2017	OCT 2016	USACE Design Template	USACE Nourishment Threshold
NOV 2018	—	—	—	—
APR 2018	—	—	—	—
OCT 2017	—	—	—	—

Notes:

1. Station From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward and Seaward Of The Breakwater.





Survey Transect 61+62	NOV 2018 - OCT 2017	NOV 2018 - APR 2018
Shoreline Change at MHW (0.98 ft NAVD88)	2.88 ft	-4.04 ft
Volume Change Above -15 ft NAVD88	5.94 cy/ft	7.82 cy/ft
Volume Change Above 0 ft NAVD88	0.58 cy/ft	-0.26 cy/ft
Distance from USACE Design Template @ 3.5 feet NAVD88:		

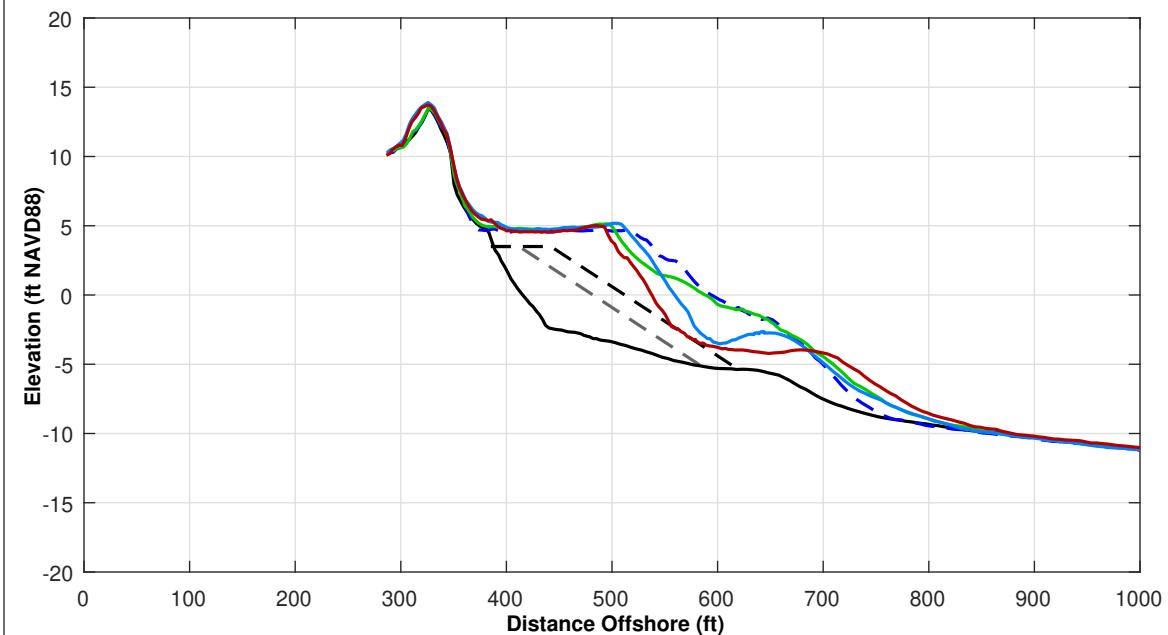
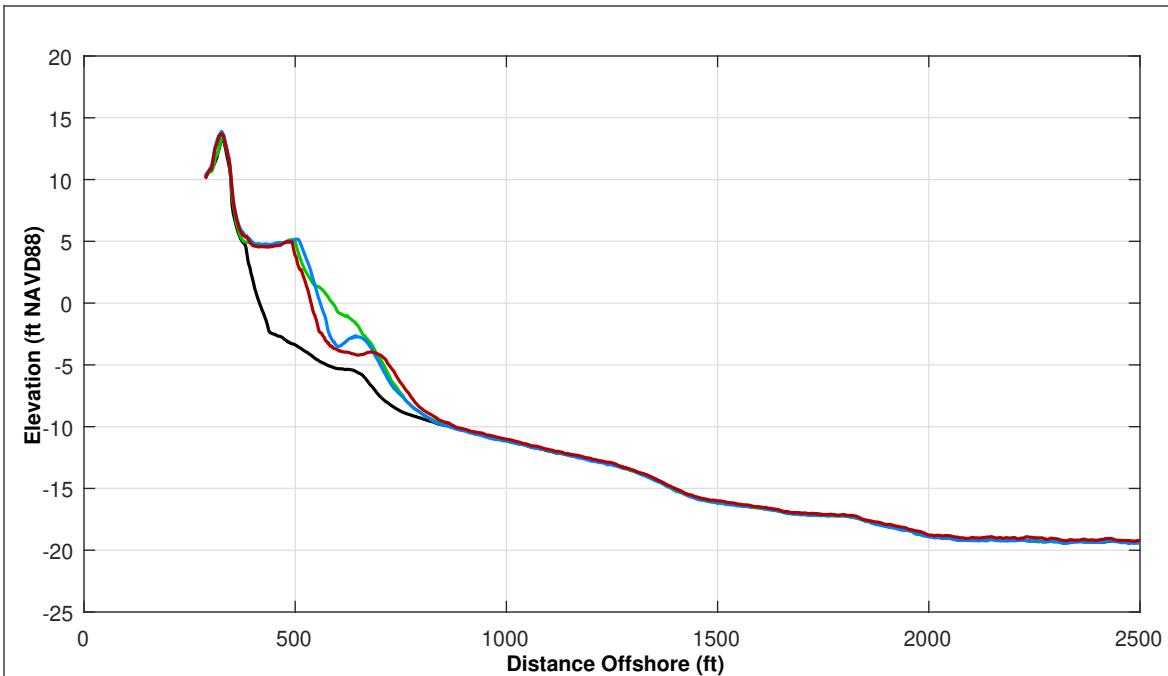
LEGEND:

NOV 2018	MAY 2017
APR 2018	OCT 2016
OCT 2017	USACE Design Template
	USACE Nourishment Threshold

Notes:

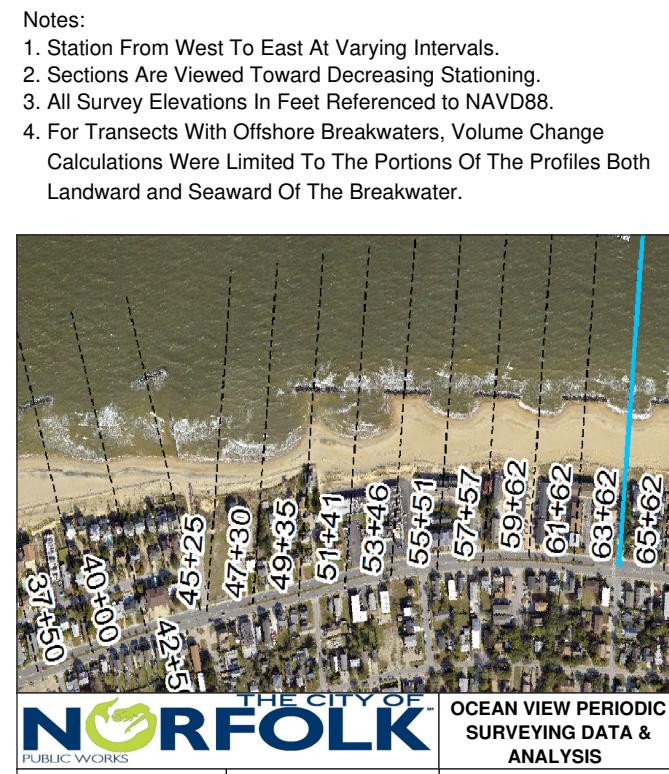
1. Station From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward and Seaward Of The Breakwater.

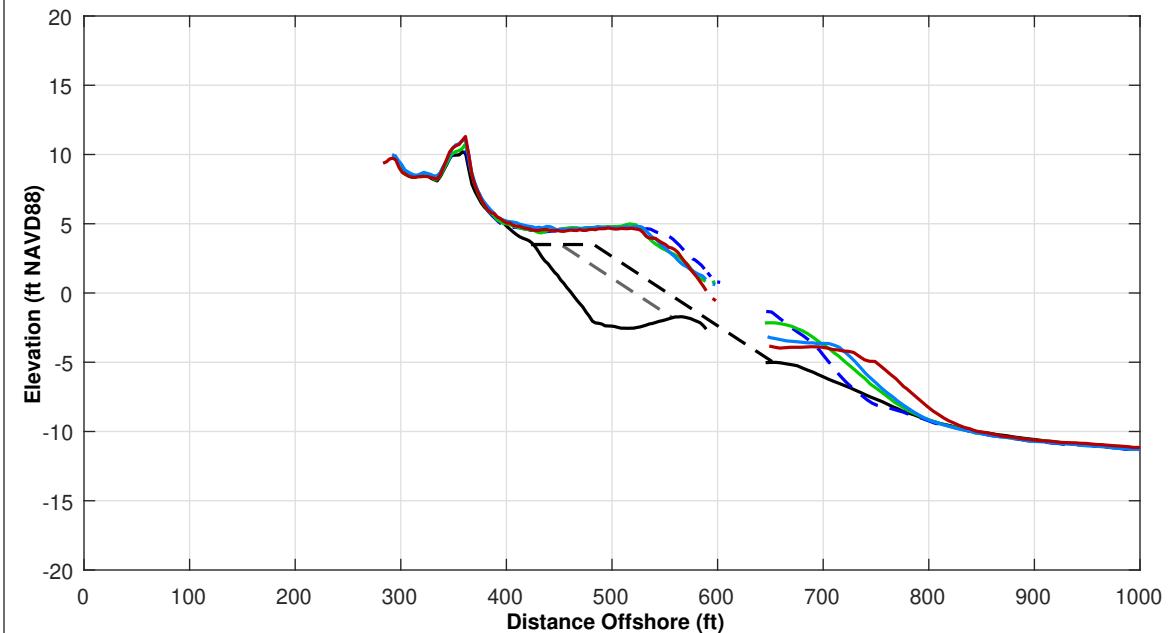
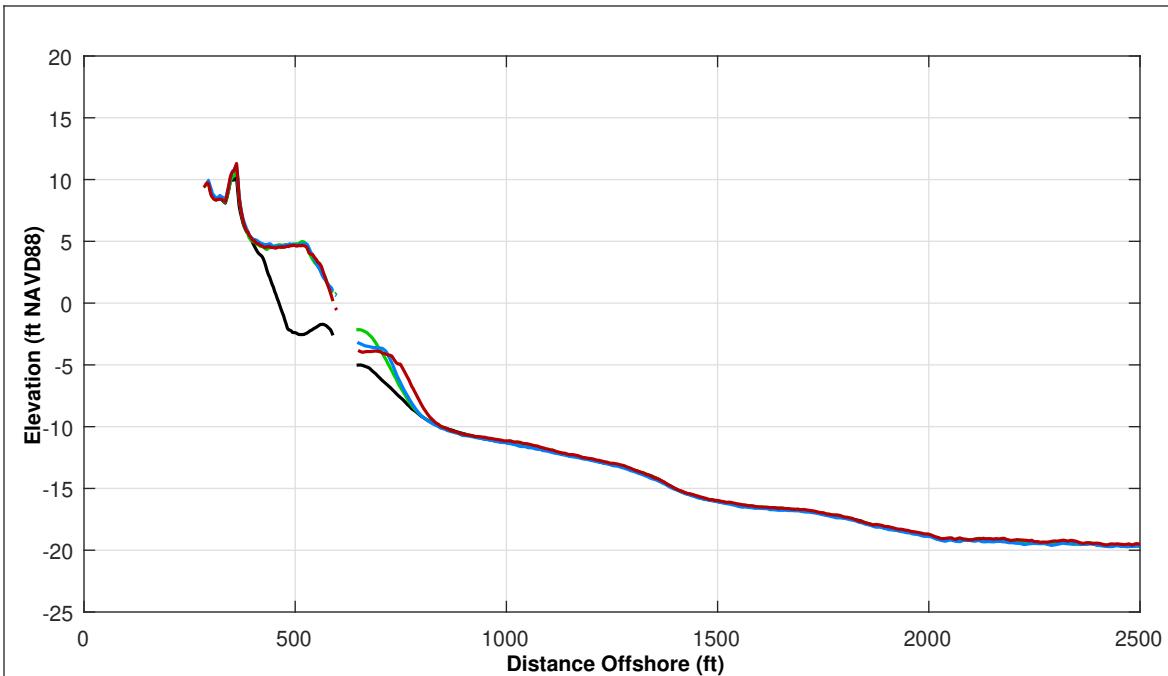




Survey Transect	NOV 2018 - OCT 2017	NOV 2018 - APR 2018
63+62		
Shoreline Change at MHW (0.98 ft NAVD88)	-36.63 ft	-20.12 ft
Volume Change Above -15 ft NAVD88	-9.99 cy/ft	-3.54 cy/ft
Volume Change Above 0 ft NAVD88	-2.77 cy/ft	-4.99 cy/ft
Distance from USACE Design Template @ 3.5 feet NAVD88:		

LEGEND:	MAY 2017	OCT 2016	USACE Design Template	USACE Nourishment Threshold
NOV 2018	—	—	—	—
APR 2018	—	—	—	—
OCT 2017	—	—	—	—





Survey Transect 65+62	NOV 2018 - OCT 2017	NOV 2018 - APR 2018
Shoreline Change at MHW (0.98 ft NAVD88)	-3.46 ft	-7.04 ft
Volume Change Above -15 ft NAVD88	4.45 cy/ft	5.01 cy/ft
Volume Change Above 0 ft NAVD88	-0.26 cy/ft	-1.48 cy/ft

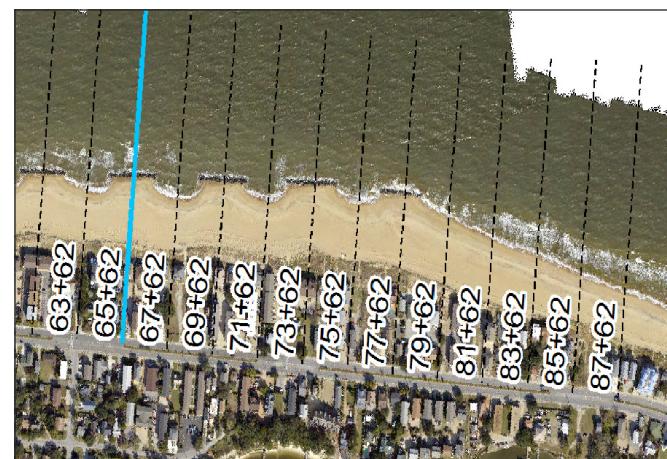
Distance from USACE Design Template
@ 3.5 feet NAVD88:

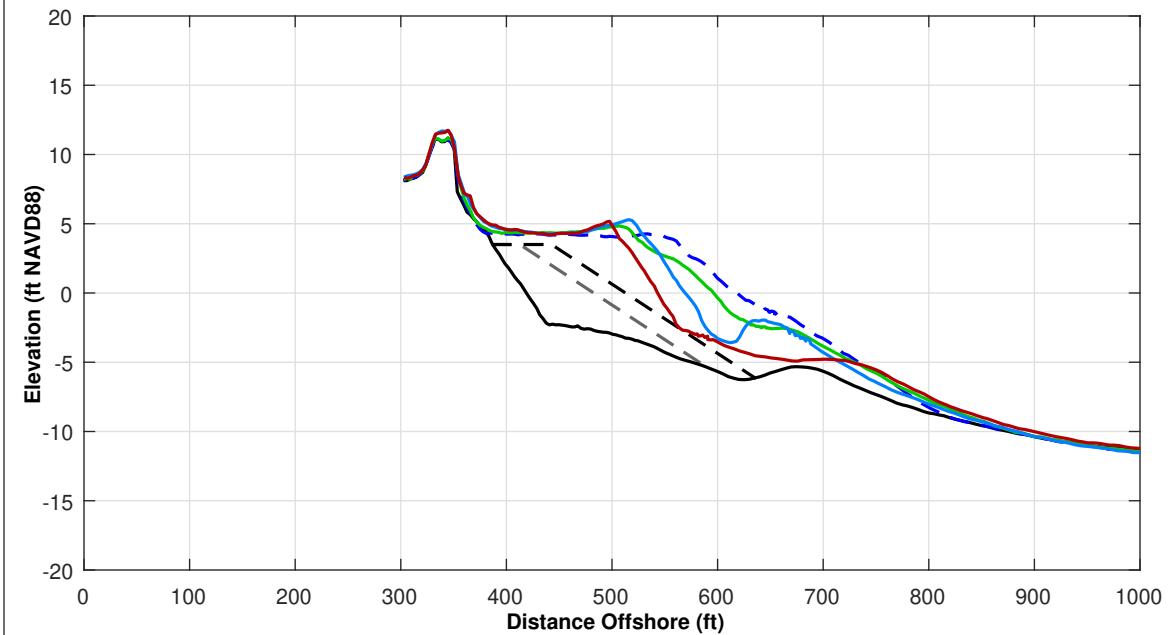
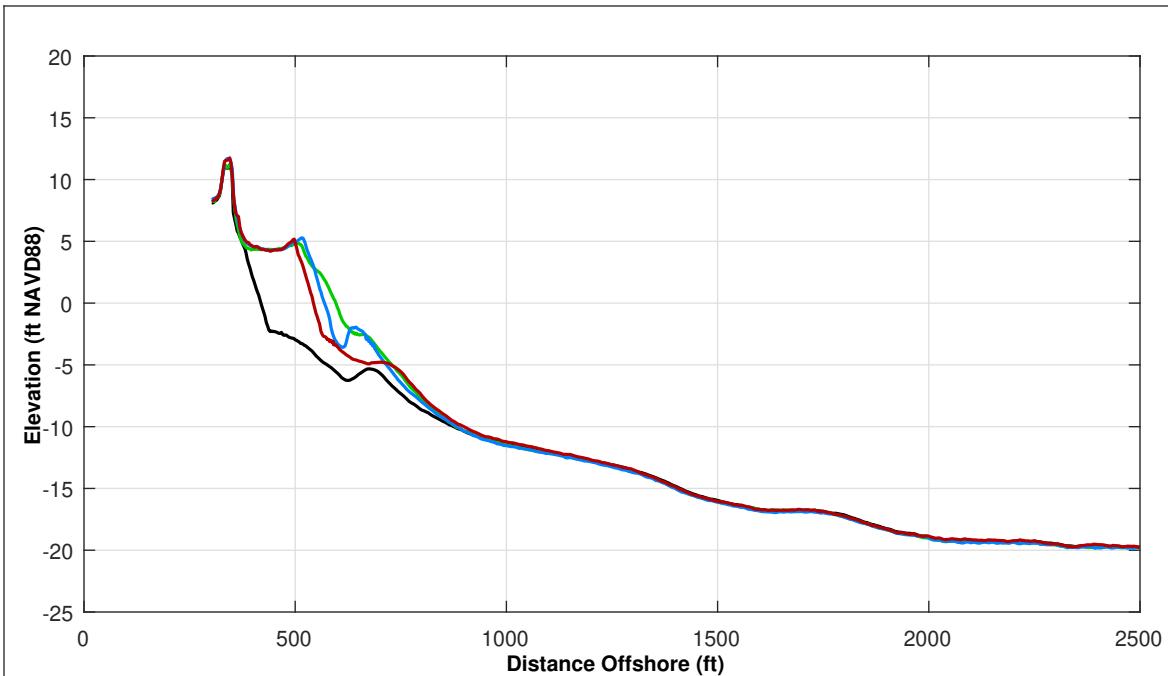
LEGEND:

NOV 2018	MAY 2017
APR 2018	OCT 2016
OCT 2017	USACE Design Template
	USACE Nourishment Threshold

Notes:

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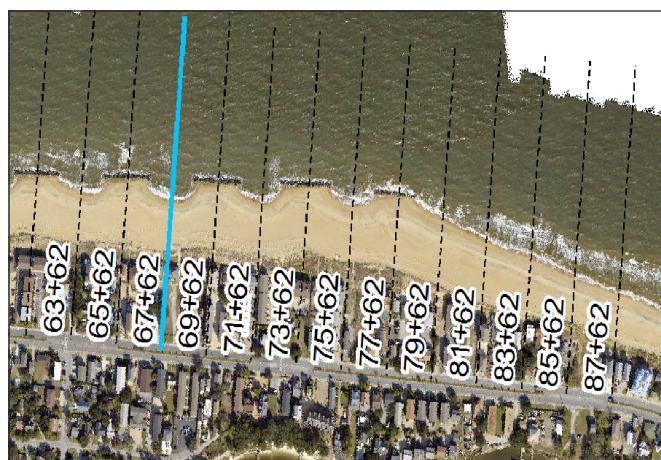


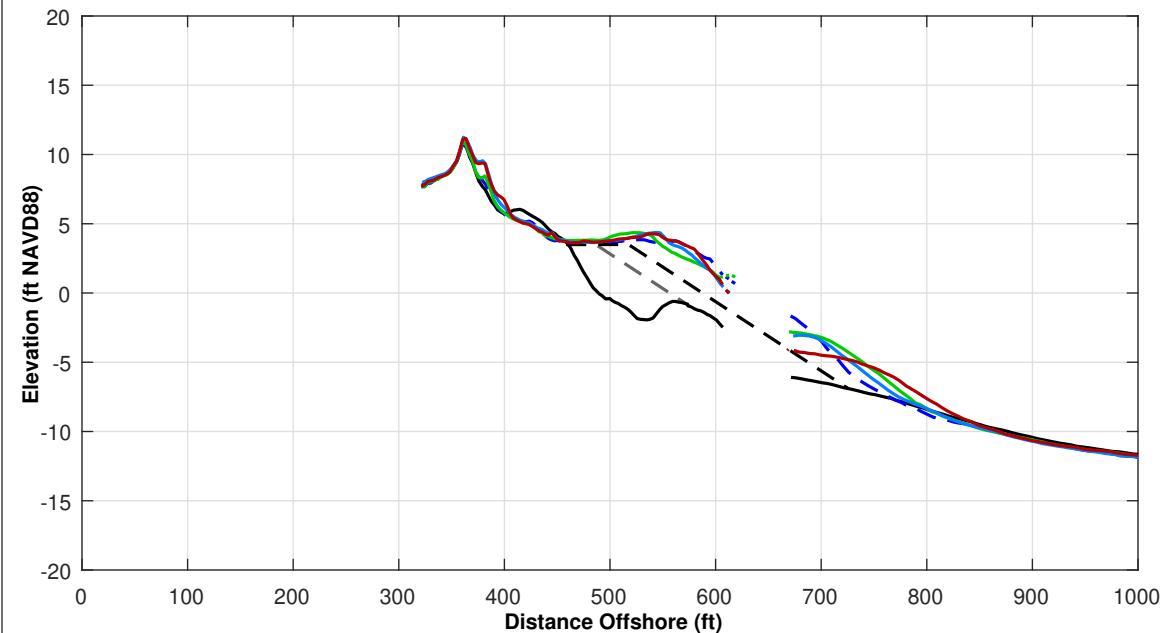
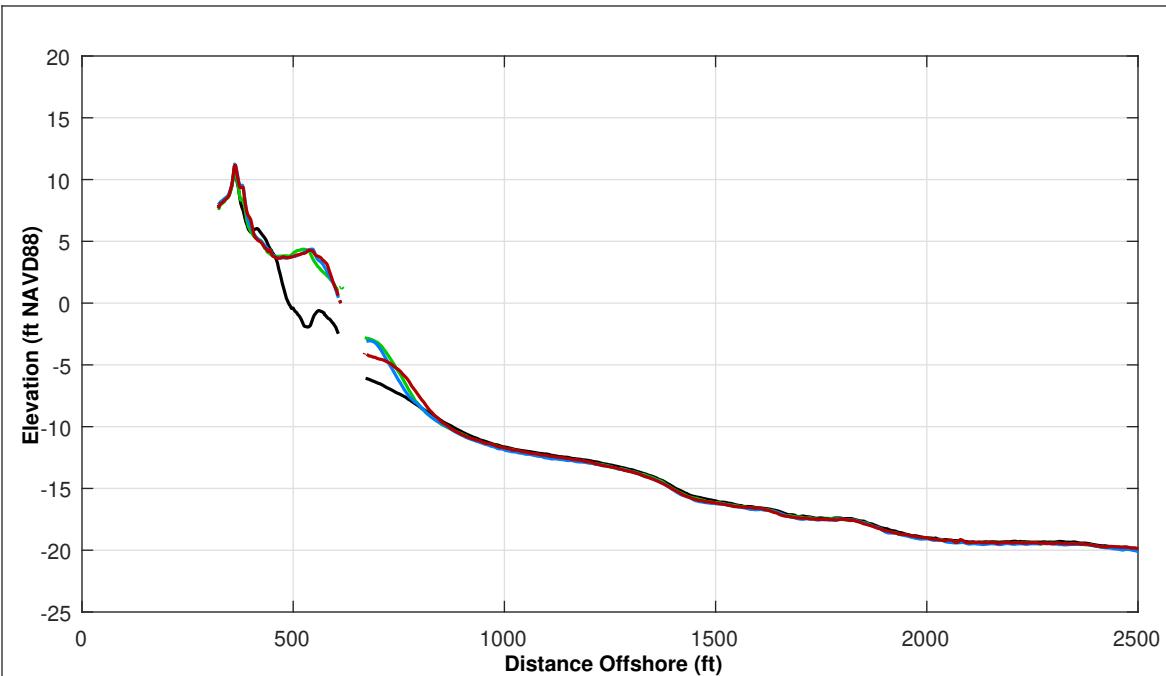


Survey Transect 67+62	NOV 2018 - OCT 2017	NOV 2018 - APR 2018
Shoreline Change at MHW (0.98 ft NAVD88)	-47.27 ft	-24.61 ft
Volume Change Above -15 ft NAVD88	-13.10 cy/ft	-6.16 cy/ft
Volume Change Above 0 ft NAVD88	-4.40 cy/ft	-4.51 cy/ft
Distance from USACE Design Template @ 3.5 feet NAVD88:		
LEGEND: NOV 2018 — MAY 2017 OCT 2016 — OCT 2016 USACE Design Template — USACE Design Template OCT 2017 — USACE Nourishment Threshold		

Notes:

1. Station From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward and Seaward Of The Breakwater.

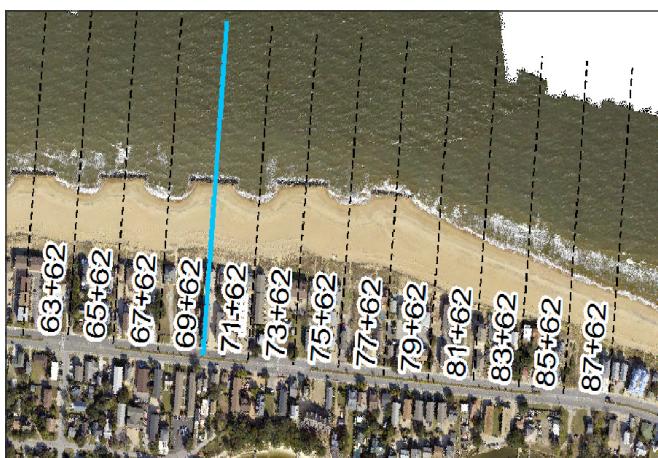


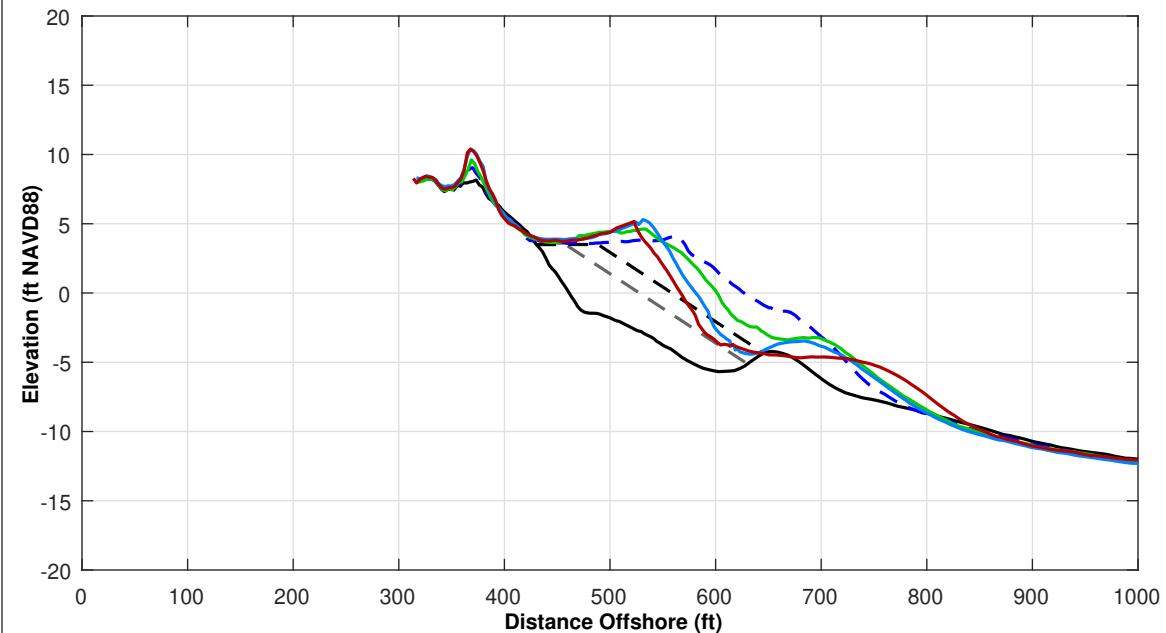
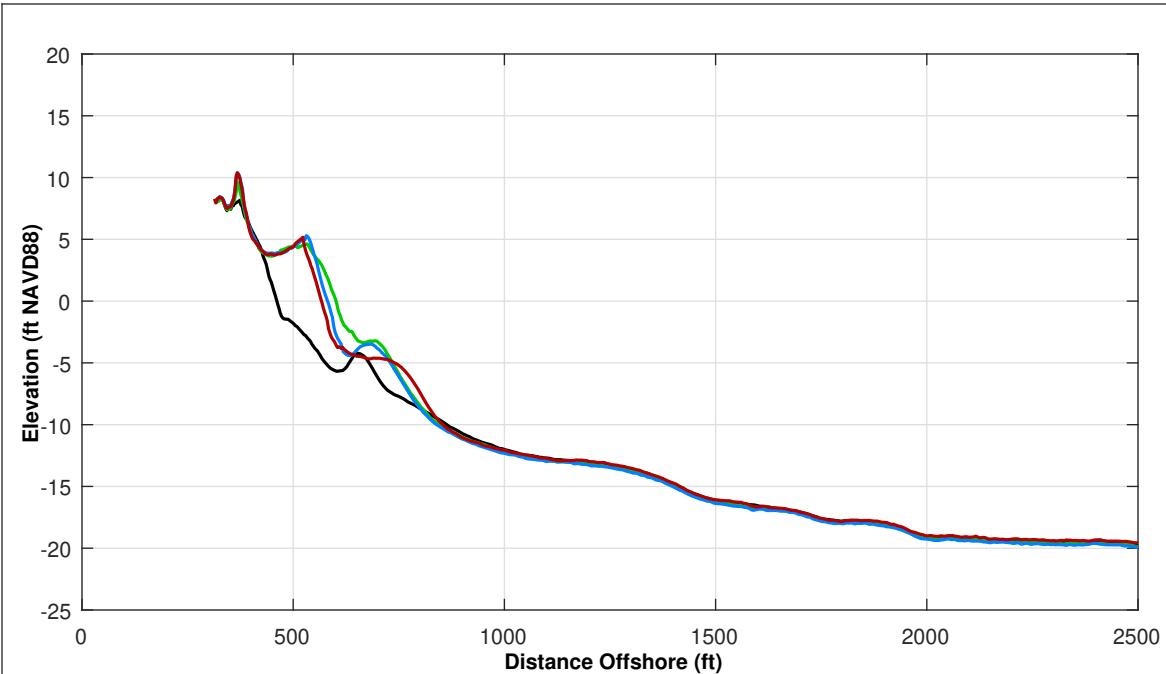


Survey Transect 69+62	NOV 2018 - OCT 2017	NOV 2018 - APR 2018
Shoreline Change at MHW (0.98 ft NAVD88)	-18.29 ft	1.93 ft
Volume Change Above -15 ft NAVD88	1.65 cy/ft	3.30 cy/ft
Volume Change Above 0 ft NAVD88	1.22 cy/ft	0.23 cy/ft
Distance from USACE Design Template @ 3.5 feet NAVD88:		
LEGEND: NOV 2018 — MAY 2017 APR 2018 — OCT 2016 OCT 2017 — USACE Design Template USACE Nourishment Threshold		

Notes:

1. Station From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward and Seaward Of The Breakwater.

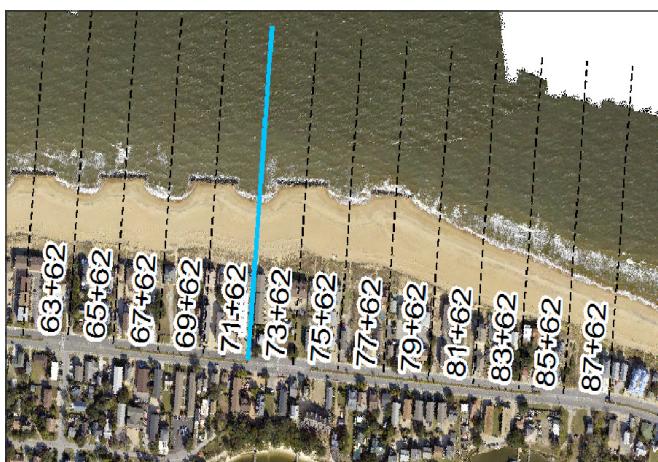


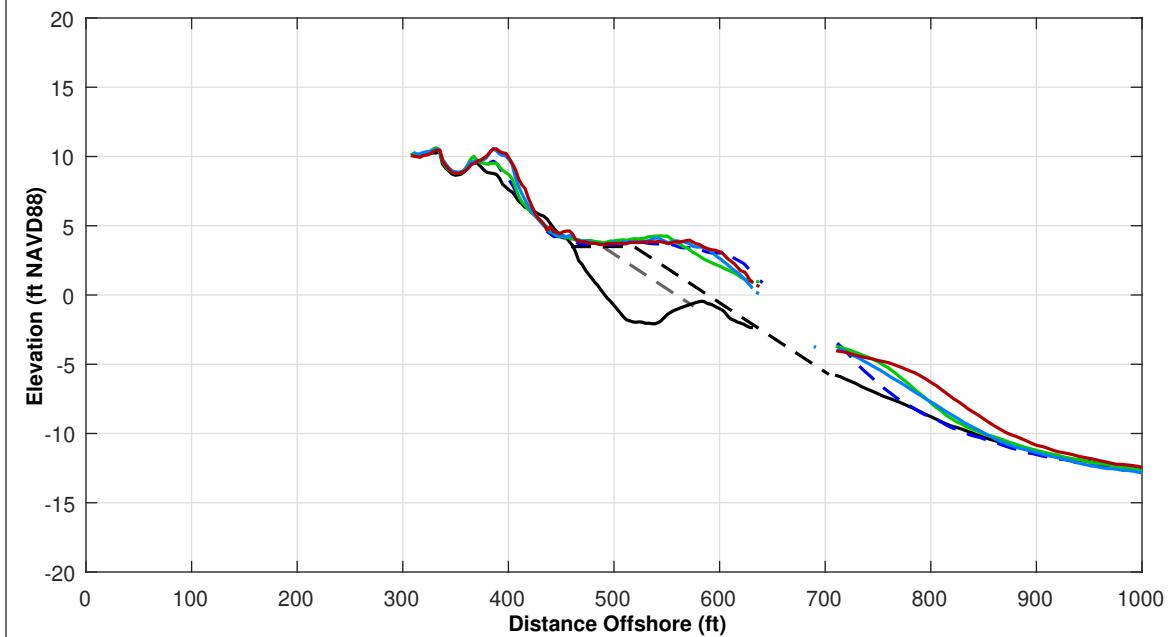
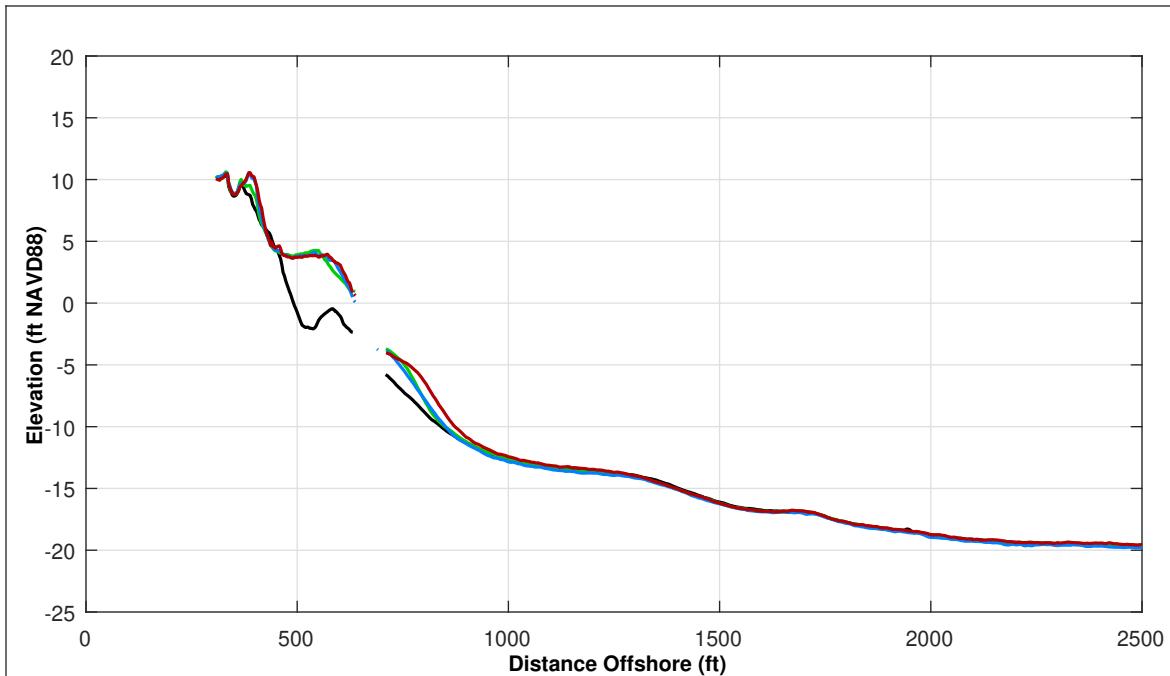


Survey Transect 71+62	NOV 2018 - OCT 2017	NOV 2018 - APR 2018
Shoreline Change at MHW (0.98 ft NAVD88)	-31.35 ft	-12.65 ft
Volume Change Above -15 ft NAVD88	-6.88 cy/ft	2.12 cy/ft
Volume Change Above 0 ft NAVD88	-3.07 cy/ft	-3.06 cy/ft
Distance from USACE Design Template @ 3.5 feet NAVD88:		
LEGEND: NOV 2018 — MAY 2017 OCT 2016 — OCT 2016 USACE Design Template — USACE Design Template OCT 2017 — USACE Nourishment Threshold		

Notes:

1. Station From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward and Seaward Of The Breakwater.





Survey Transect 73+62	NOV 2018 - OCT 2017	NOV 2018 - APR 2018
Shoreline Change at MHW (0.98 ft NAVD88)	-1.48 ft	4.39 ft
Volume Change Above -15 ft NAVD88	11.17 cy/ft	12.60 cy/ft
Volume Change Above 0 ft NAVD88	2.67 cy/ft	1.21 cy/ft

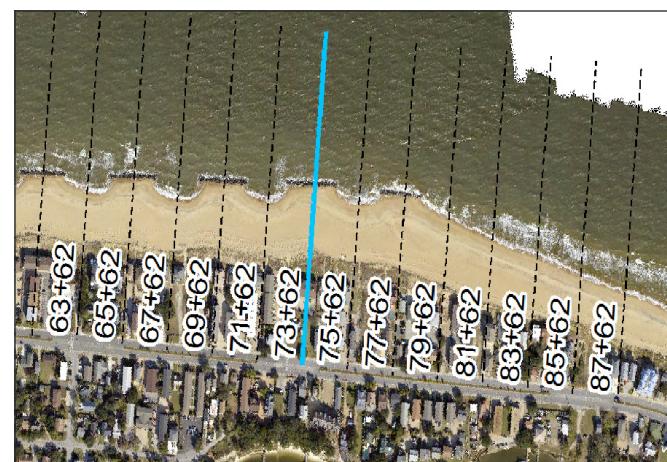
Distance from USACE Design Template
@ 3.5 feet NAVD88:

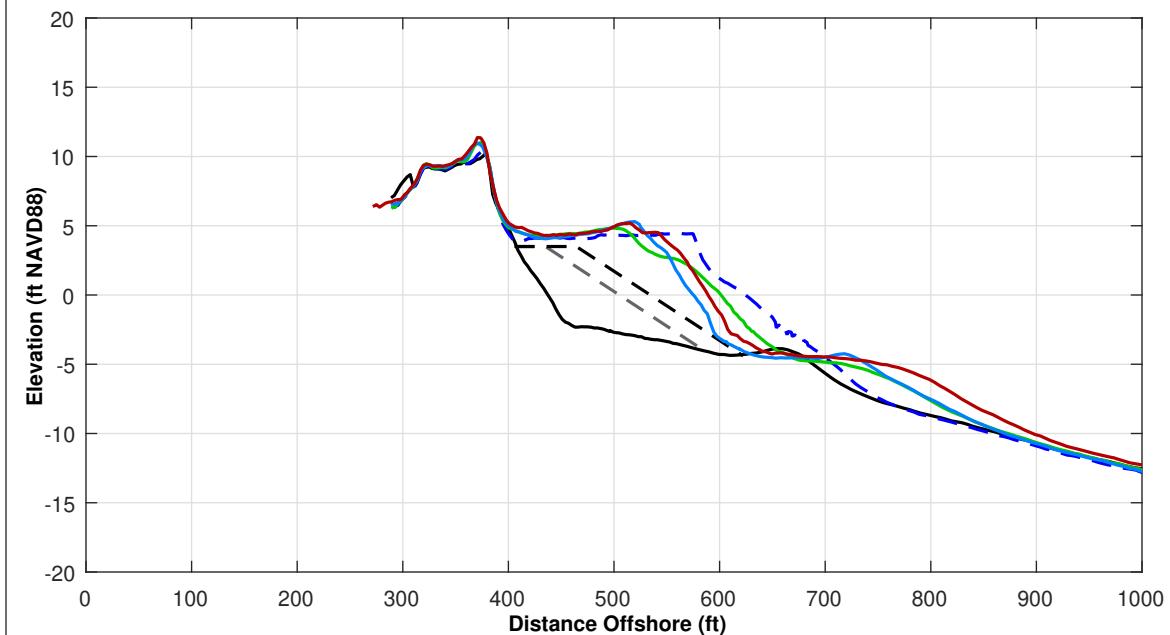
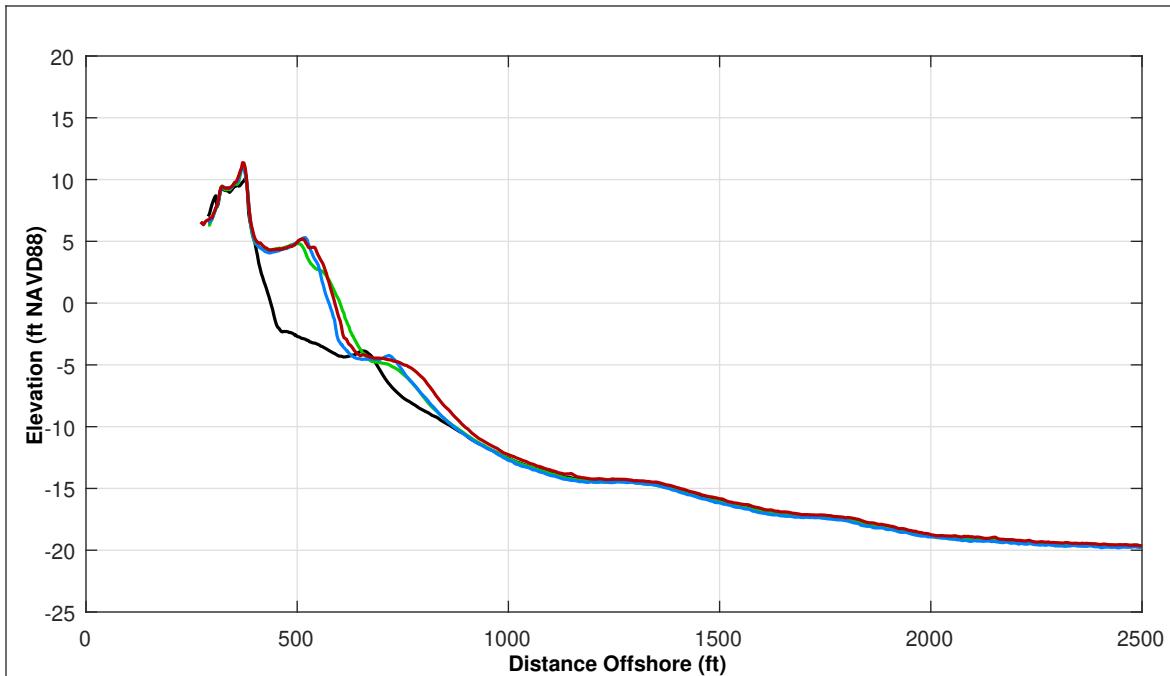
LEGEND:

NOV 2018	MAY 2017
APR 2018	OCT 2016
OCT 2017	USACE Design Template
	USACE Nourishment Threshold

Notes:

1. Station From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward and Seaward Of The Breakwater.

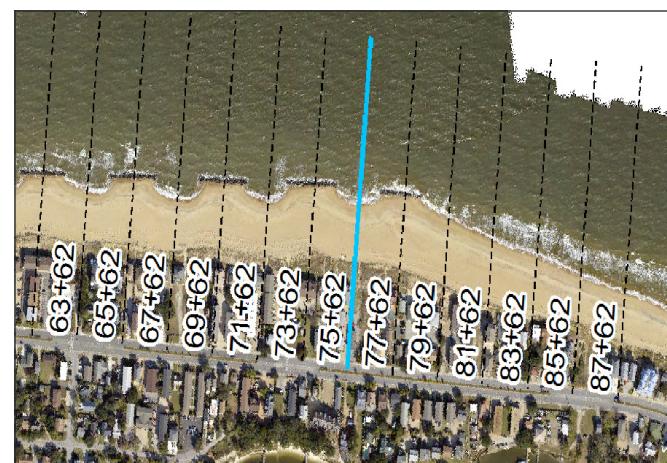


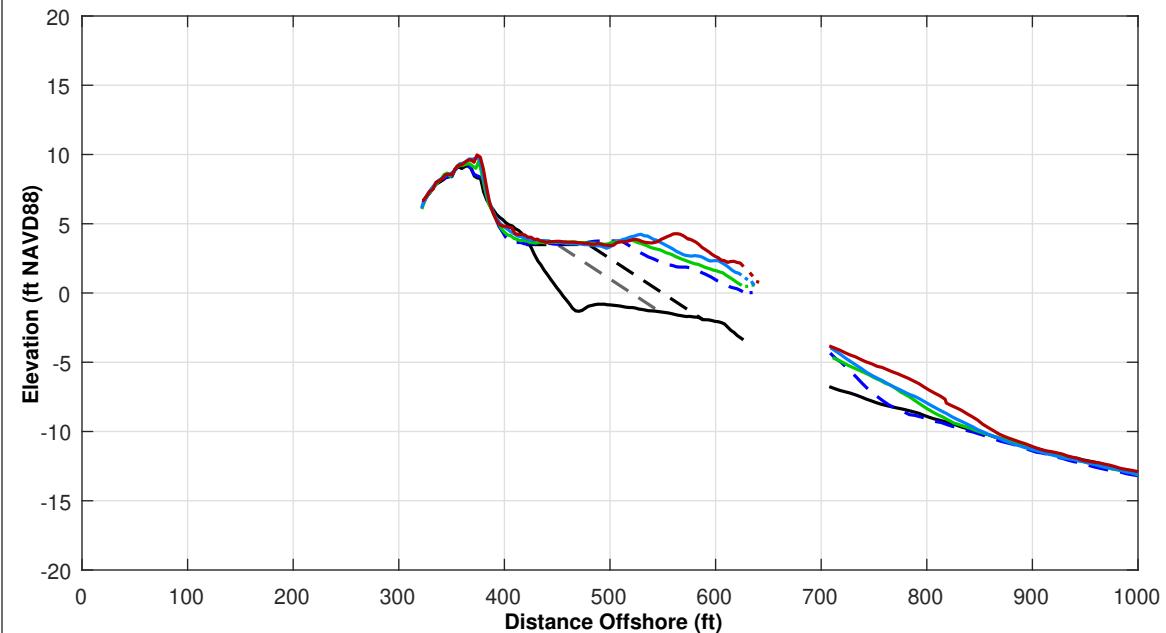
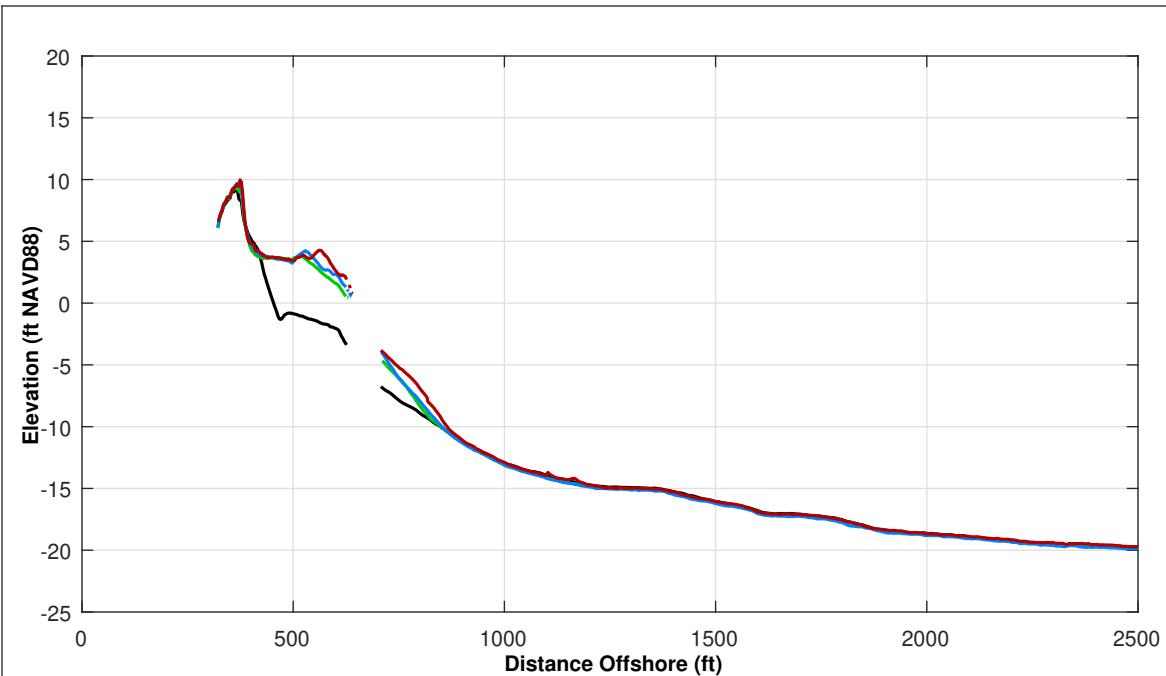


Survey Transect 75+62	NOV 2018 - OCT 2017	NOV 2018 - APR 2018
Shoreline Change at MHW (0.98 ft NAVD88)	-7.10 ft	15.49 ft
Volume Change Above -15 ft NAVD88	12.60 cy/ft	18.40 cy/ft
Volume Change Above 0 ft NAVD88	2.72 cy/ft	3.29 cy/ft
Distance from USACE Design Template @ 3.5 feet NAVD88:		
LEGEND: NOV 2018 — MAY 2017 OCT 2016 — OCT 2016 APR 2018 — USACE Design Template OCT 2017 — USACE Nourishment Threshold		

Notes:

1. Station From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward and Seaward Of The Breakwater.

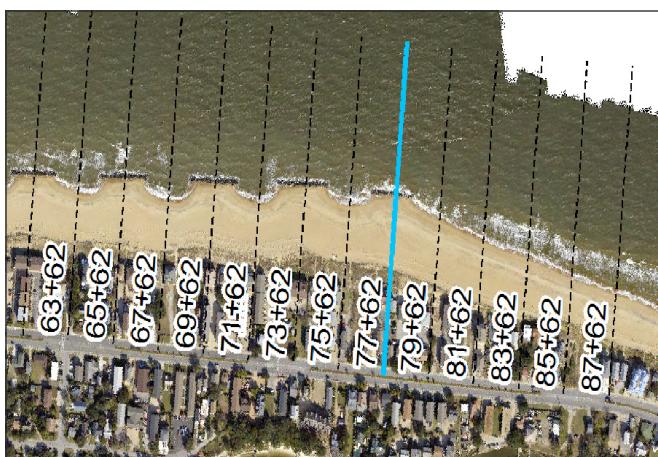


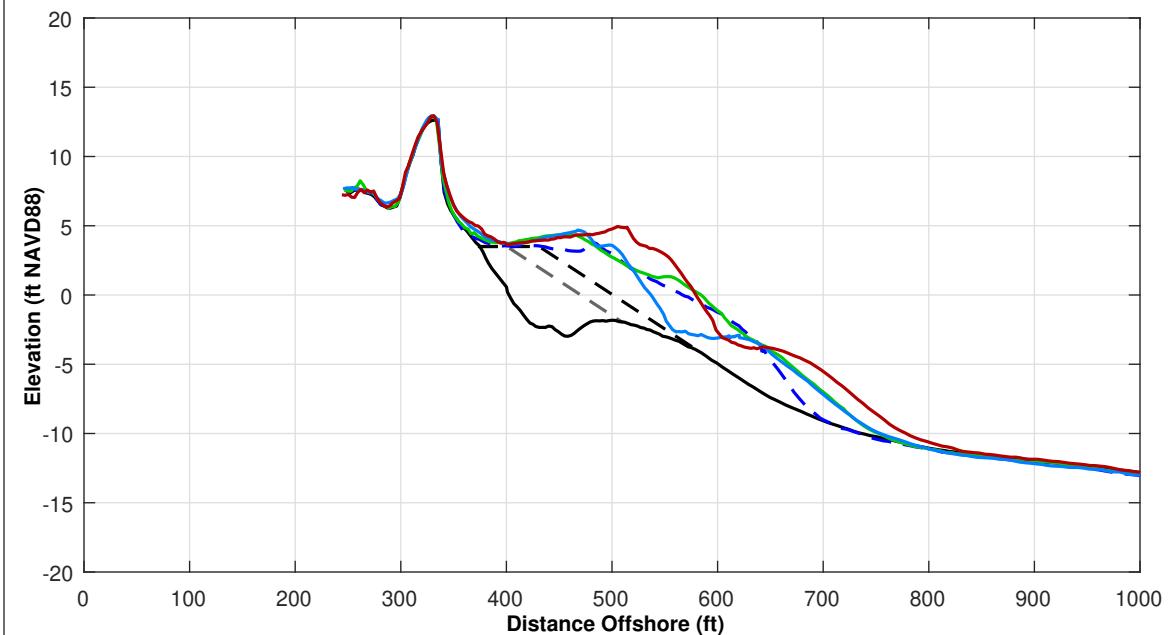
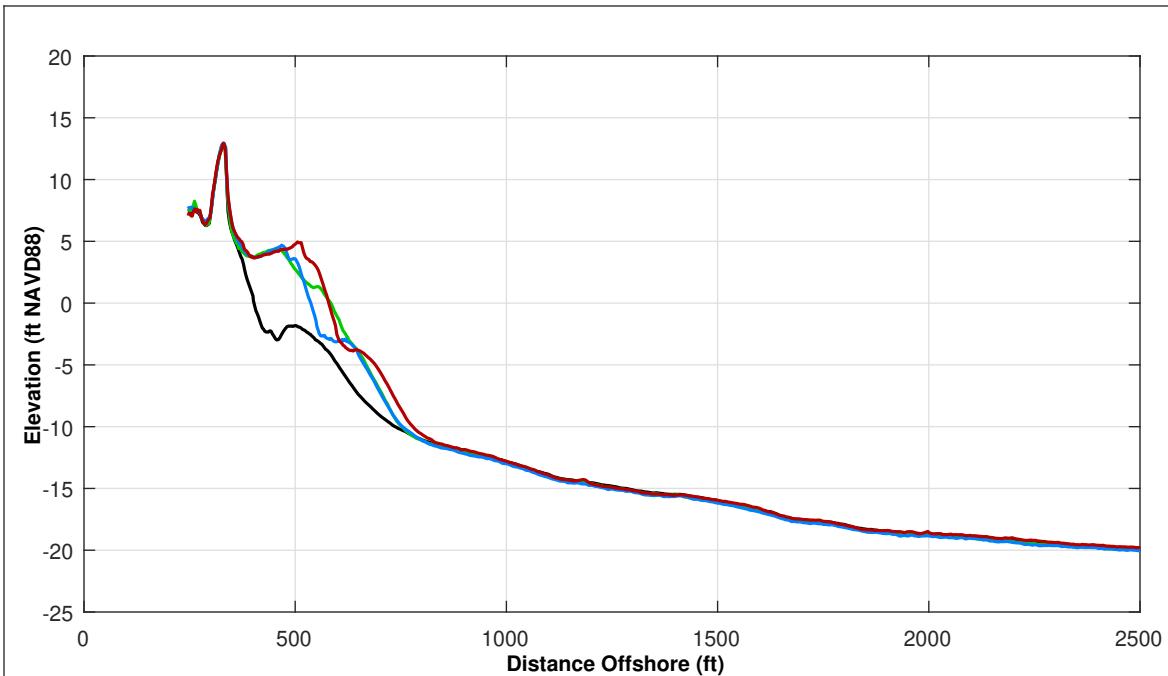


Survey Transect 77+62	NOV 2018 - OCT 2017	NOV 2018 - APR 2018
Shoreline Change at MHW (0.98 ft NAVD88)	21.00 ft	7.26 ft
Volume Change Above -15 ft NAVD88	13.61 cy/ft	9.85 cy/ft
Volume Change Above 0 ft NAVD88	5.71 cy/ft	2.64 cy/ft
Distance from USACE Design Template @ 3.5 feet NAVD88:		
LEGEND: NOV 2018 — MAY 2017 OCT 2016 — OCT 2016 USACE Design Template — USACE Design Template OCT 2017 — USACE Nourishment Threshold		

Notes:

1. Station From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward and Seaward Of The Breakwater.





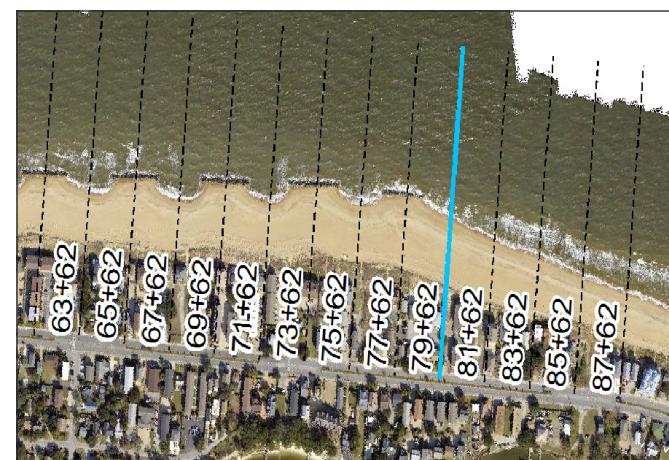
Survey Transect 79+62	NOV 2018 - OCT 2017	NOV 2018 - APR 2018
Shoreline Change at MHW (0.98 ft NAVD88)	6.21 ft	43.86 ft
Volume Change Above -15 ft NAVD88	12.71 cy/ft	21.31 cy/ft
Volume Change Above 0 ft NAVD88	6.55 cy/ft	6.92 cy/ft

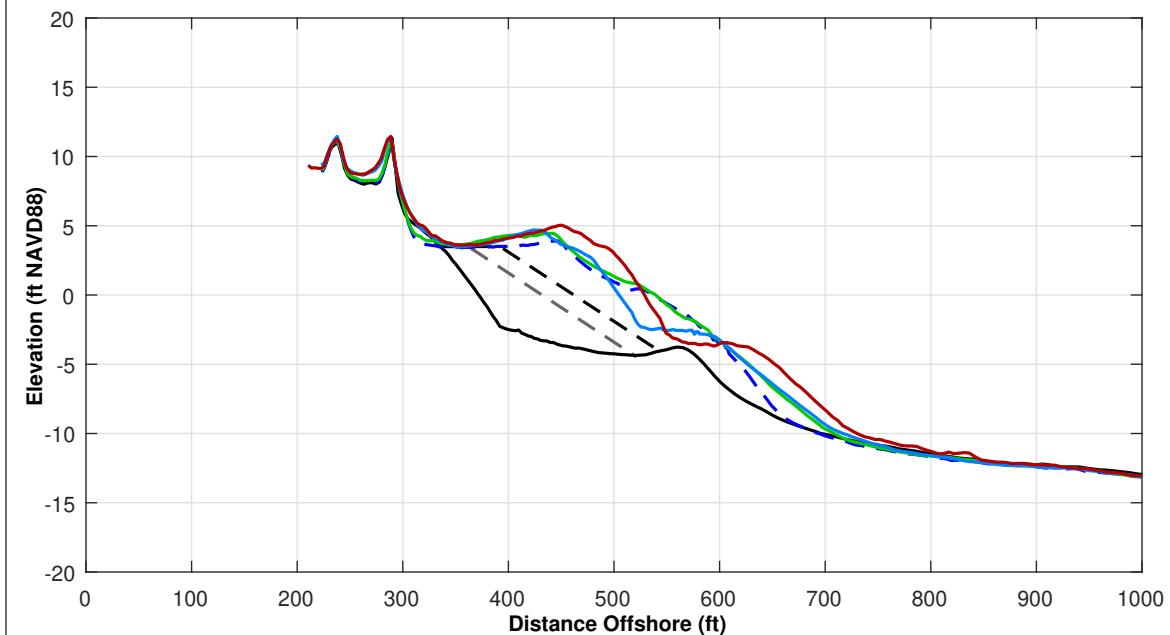
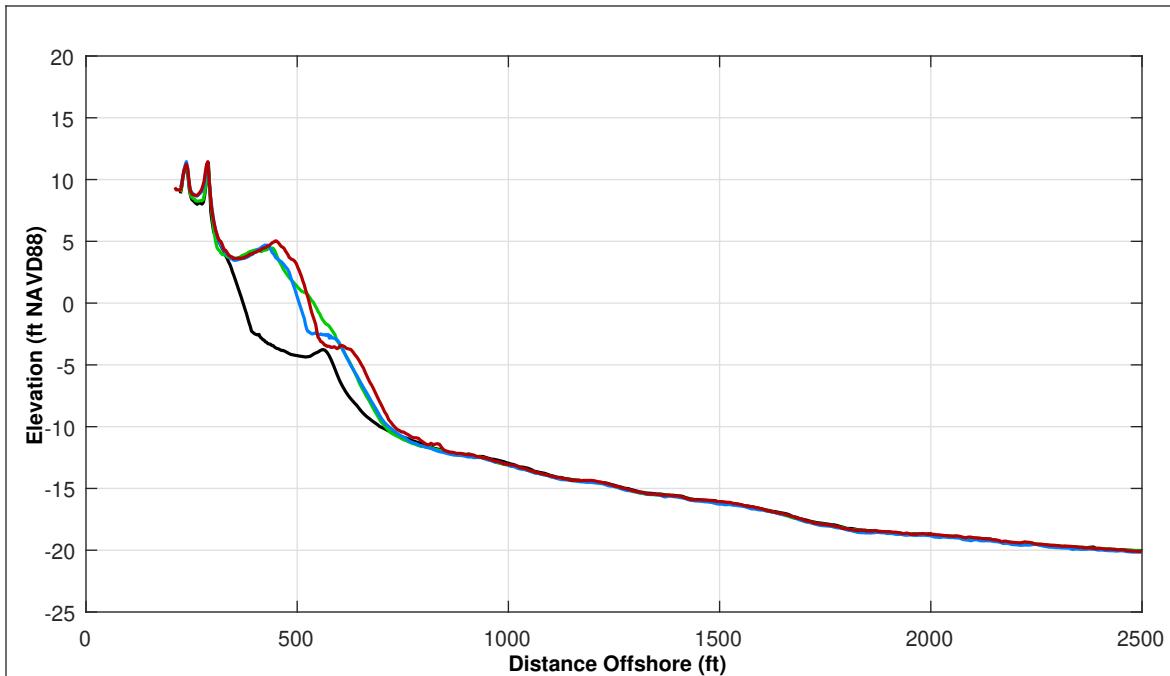
Distance from USACE Design Template @ 3.5 feet NAVD88:
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LEGEND:

Notes:

1. Station From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward and Seaward Of The Breakwater.

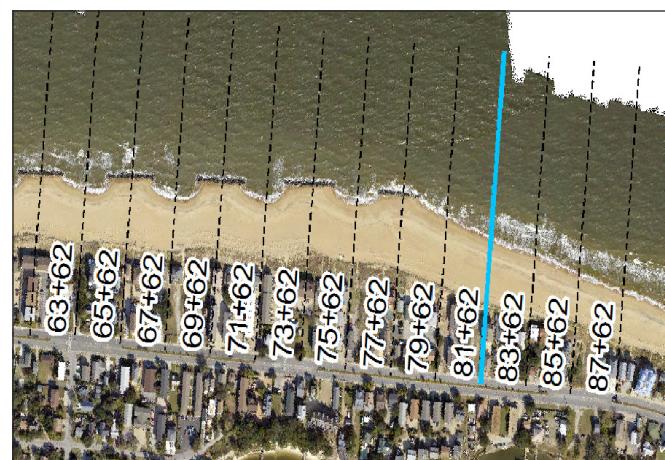


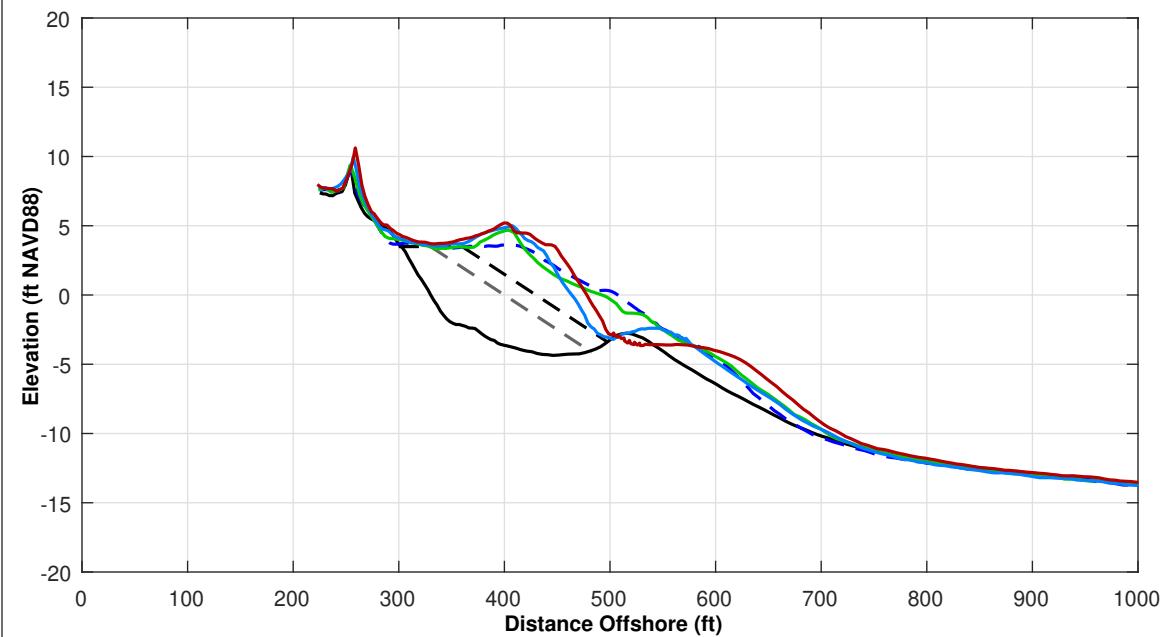
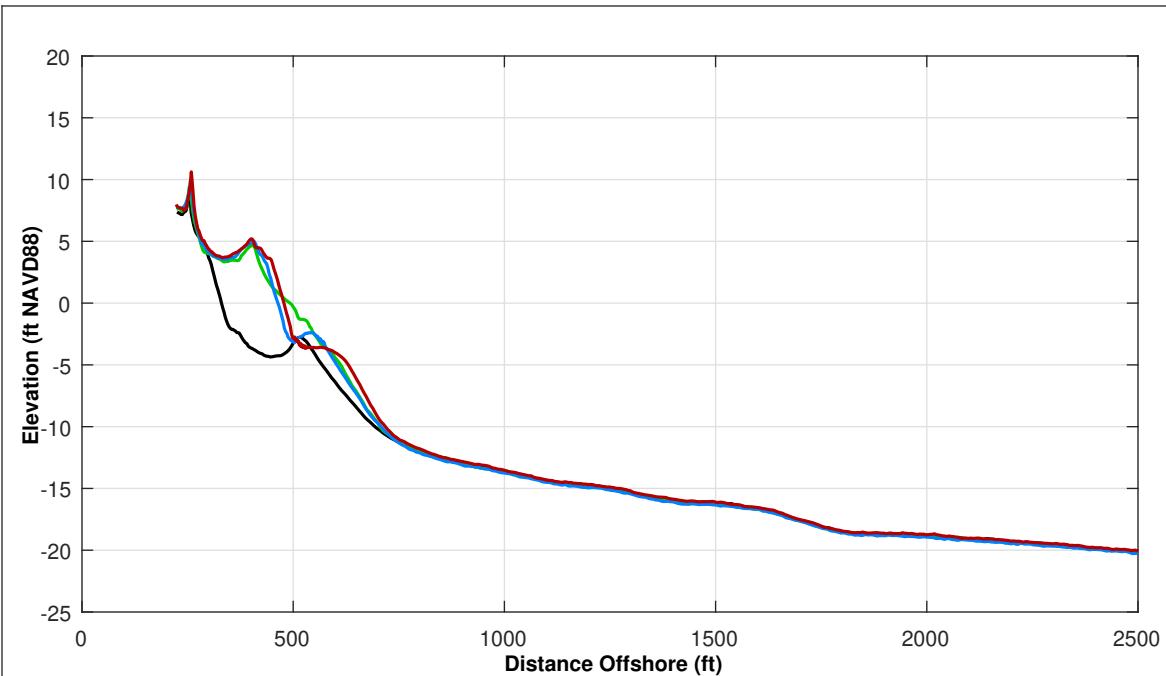


Survey Transect 81+62	NOV 2018 - OCT 2017	NOV 2018 - APR 2018
Shoreline Change at MHW (0.98 ft NAVD88)	10.47 ft	24.80 ft
Volume Change Above -15 ft NAVD88	11.05 cy/ft	14.32 cy/ft
Volume Change Above 0 ft NAVD88	5.98 cy/ft	5.27 cy/ft
Distance from USACE Design Template @ 3.5 feet NAVD88:		
LEGEND:		
NOV 2018	MAY 2017	---
APR 2018	OCT 2016	—
OCT 2017	USACE Design Template	—
	USACE Nourishment Threshold	—

Notes:

1. Station From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward and Seaward Of The Breakwater.





Survey Transect 83+62	NOV 2018 - OCT 2017	NOV 2018 - APR 2018
Shoreline Change at MHW (0.98 ft NAVD88)	9.87 ft	15.46 ft
Volume Change Above -15 ft NAVD88	7.65 cy/ft	12.27 cy/ft
Volume Change Above 0 ft NAVD88	5.96 cy/ft	3.42 cy/ft

Distance from USACE Design Template @ 3.5 feet NAVD88:

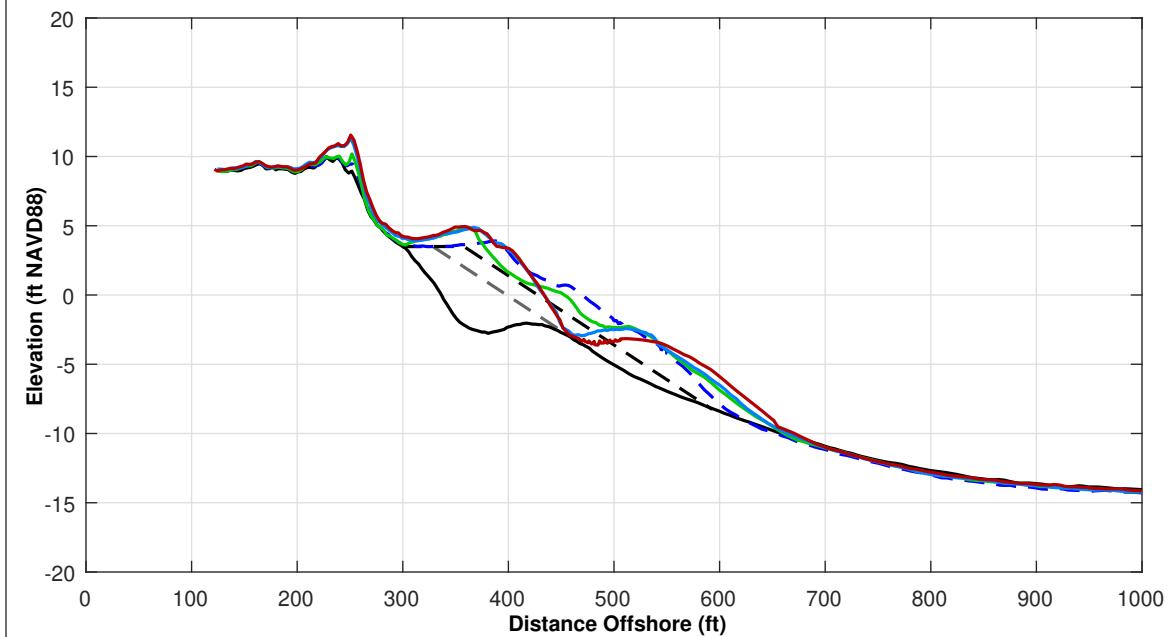
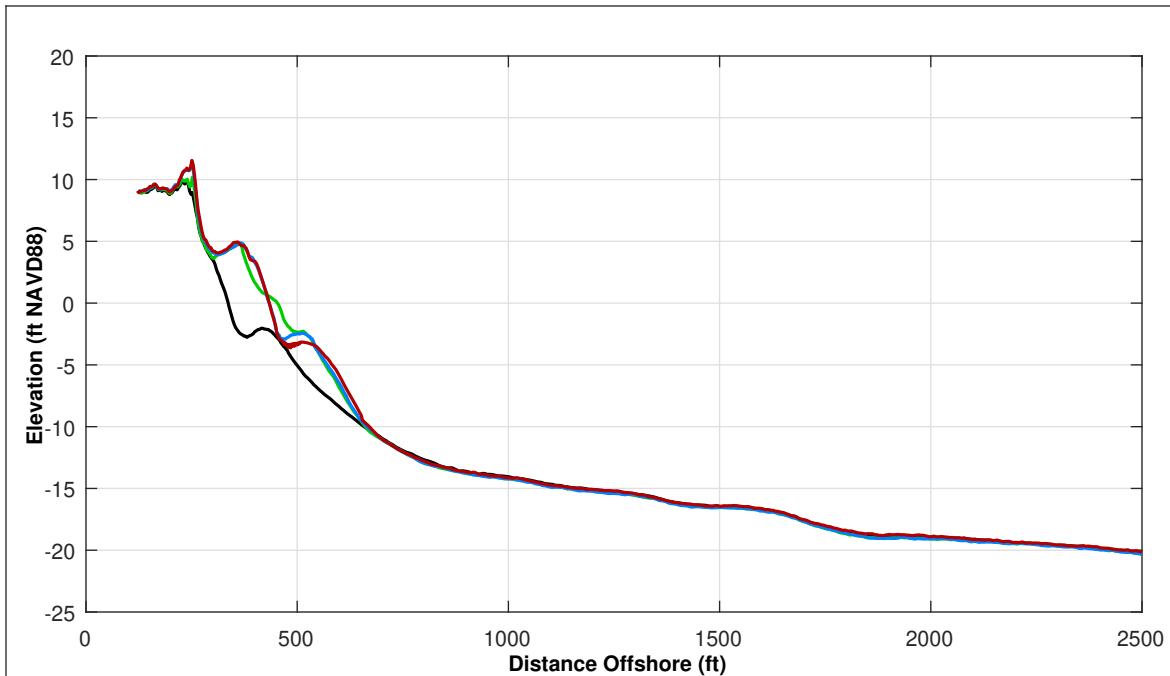
LEGEND:

- MAY 2017
- NOV 2018
- OCT 2016
- APR 2018
- USACE Design Template
- OCT 2017
- USACE Nourishment Threshold

Notes:

1. Station From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward and Seaward Of The Breakwater.





Survey Transect 85+62	NOV 2018 - OCT 2017	NOV 2018 - APR 2018
Shoreline Change at MHW (0.98 ft NAVD88)	11.53 ft	0.88 ft
Volume Change Above -15 ft NAVD88	5.24 cy/ft	3.18 cy/ft
Volume Change Above 0 ft NAVD88	5.36 cy/ft	0.96 cy/ft
Distance from USACE Design Template @ 3.5 feet NAVD88:		

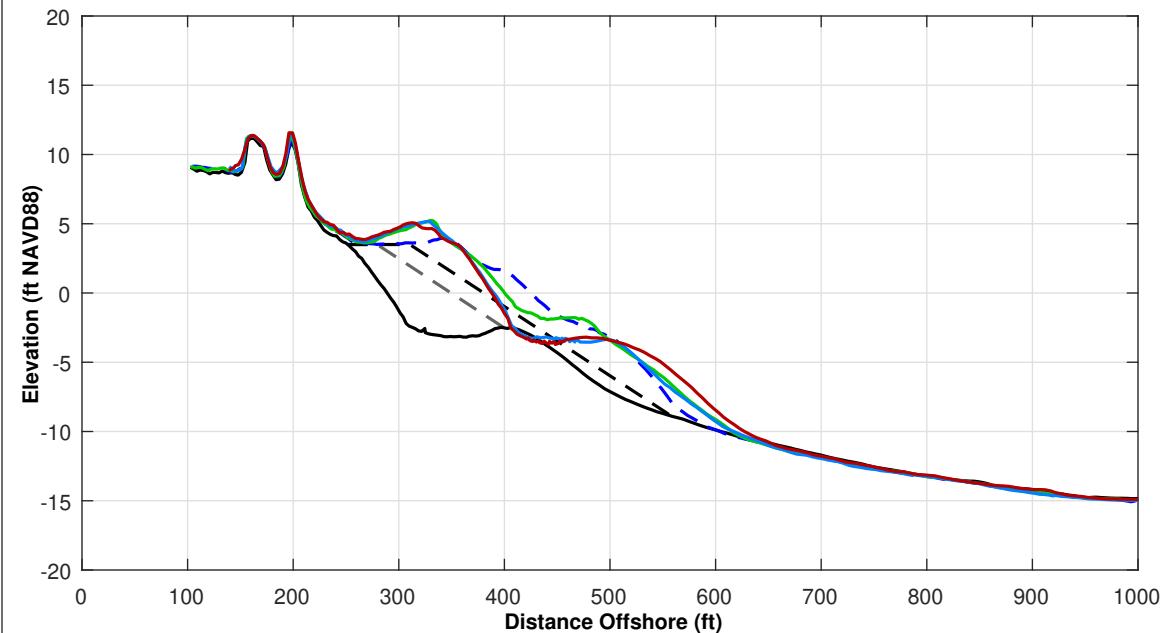
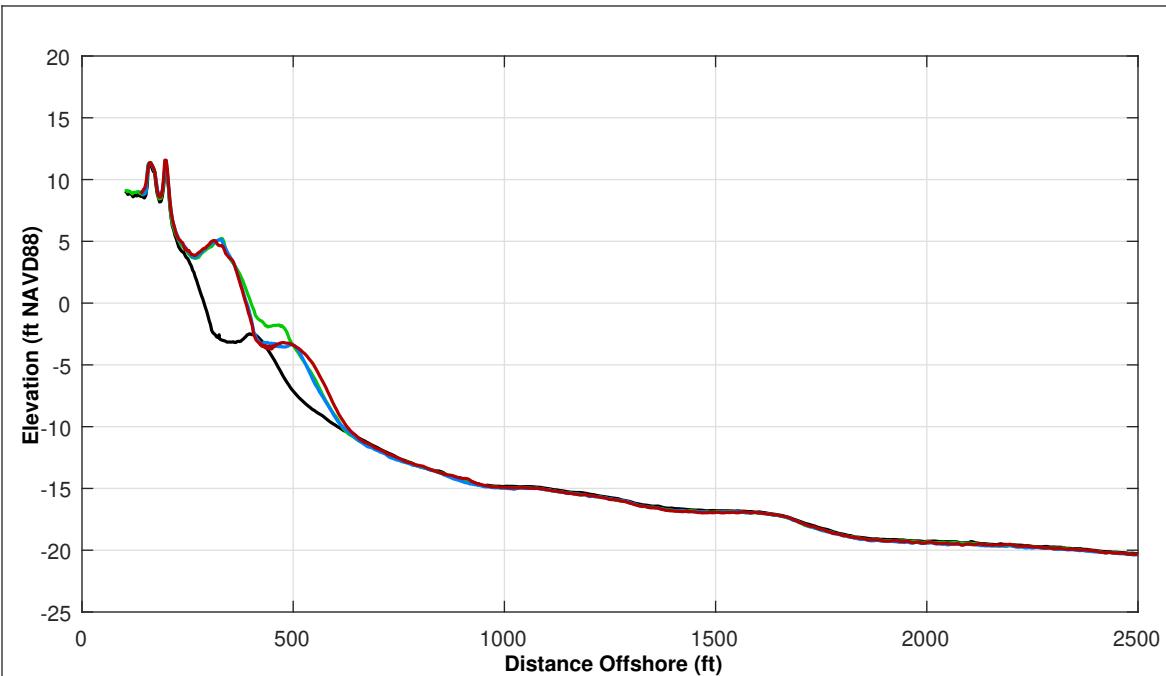
LEGEND:

NOV 2018	MAY 2017
OCT 2016	OCT 2016
USACE Design Template	USACE Design Template
OCT 2017	USACE Nourishment Threshold

Notes:

1. Station From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward and Seaward Of The Breakwater.





Survey Transect 87+62	NOV 2018 - OCT 2017	NOV 2018 - APR 2018
Shoreline Change at MHW (0.98 ft NAVD88)	-9.99 ft	-1.19 ft
Volume Change Above -15 ft NAVD88	-0.80 cy/ft	5.59 cy/ft
Volume Change Above 0 ft NAVD88	0.20 cy/ft	-0.05 cy/ft
Distance from USACE Design Template @ 3.5 feet NAVD88:		

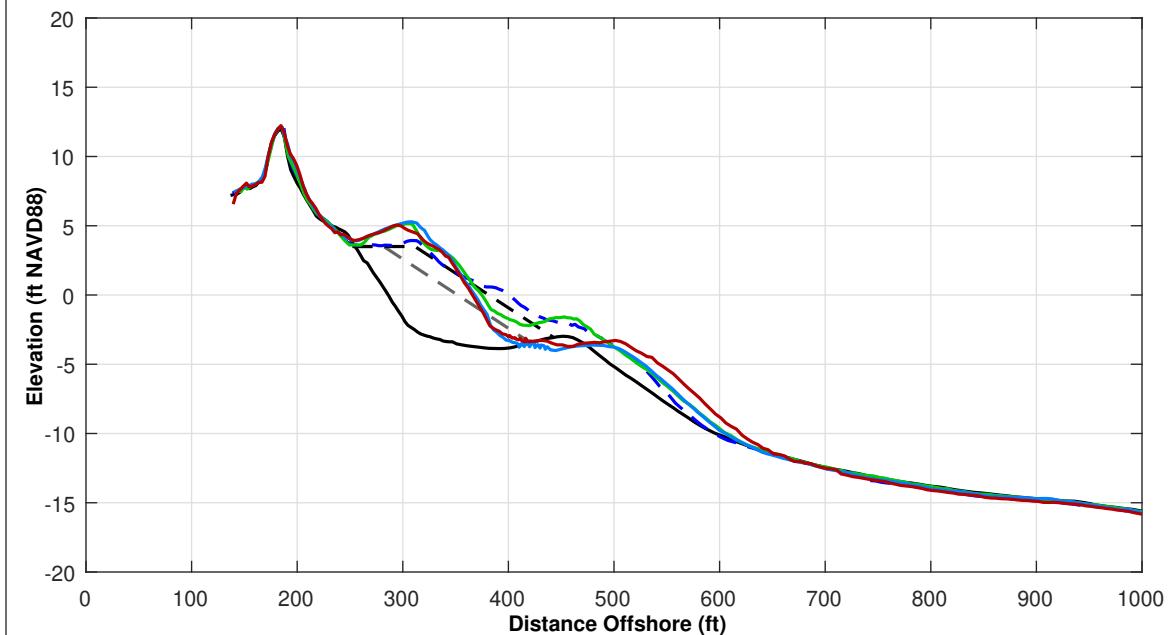
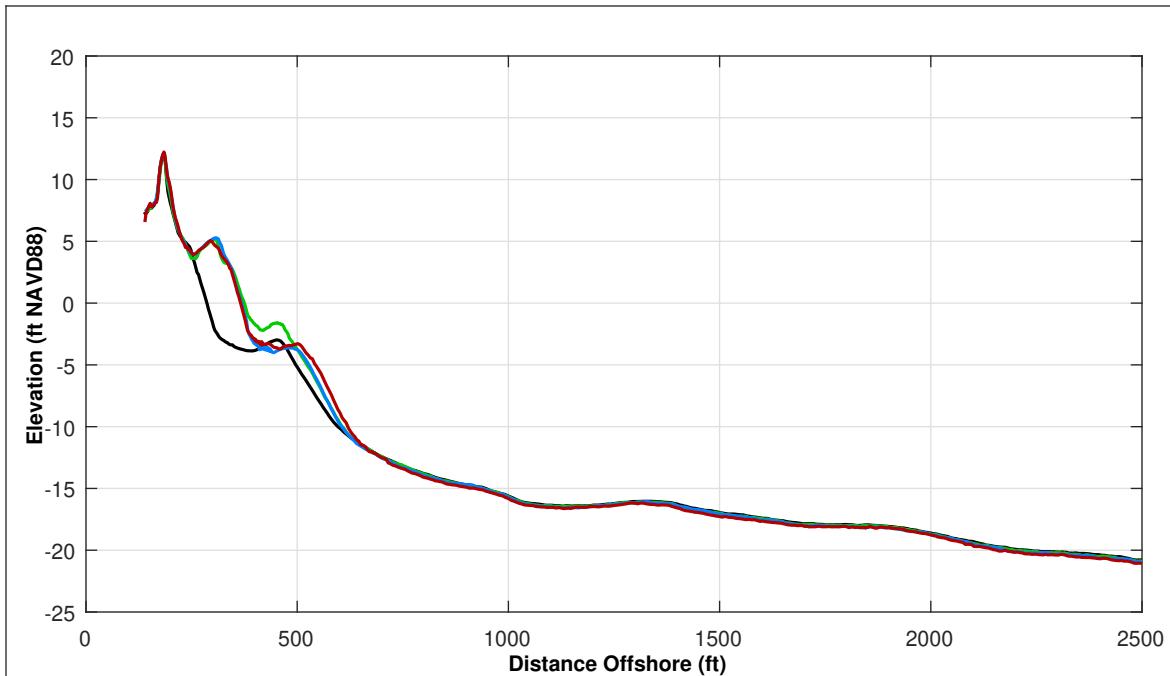
LEGEND:

NOV 2018	MAY 2017
APR 2018	OCT 2016
OCT 2017	USACE Design Template
	USACE Nourishment Threshold

Notes:

1. Station From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward and Seaward Of The Breakwater.





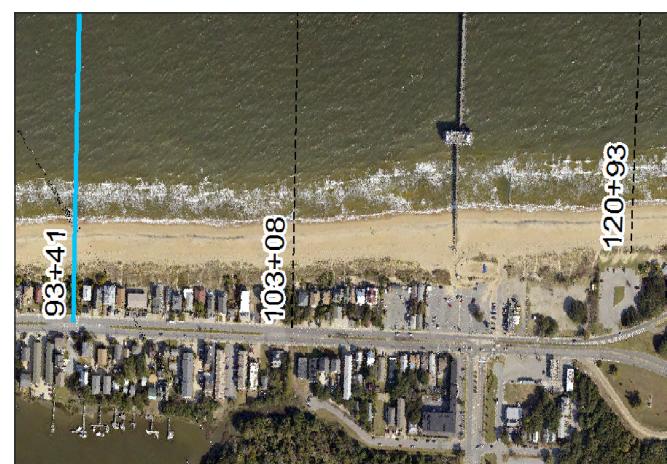
Survey Transect 93+41	NOV 2018 - OCT 2017	NOV 2018 - APR 2018
Shoreline Change at MHW (0.98 ft NAVD88)	-6.67 ft	-1.32 ft
Volume Change Above -15 ft NAVD88	-2.88 cy/ft	3.31 cy/ft
Volume Change Above 0 ft NAVD88	0.15 cy/ft	-1.03 cy/ft
Distance from USACE Design Template @ 3.5 feet NAVD88:		

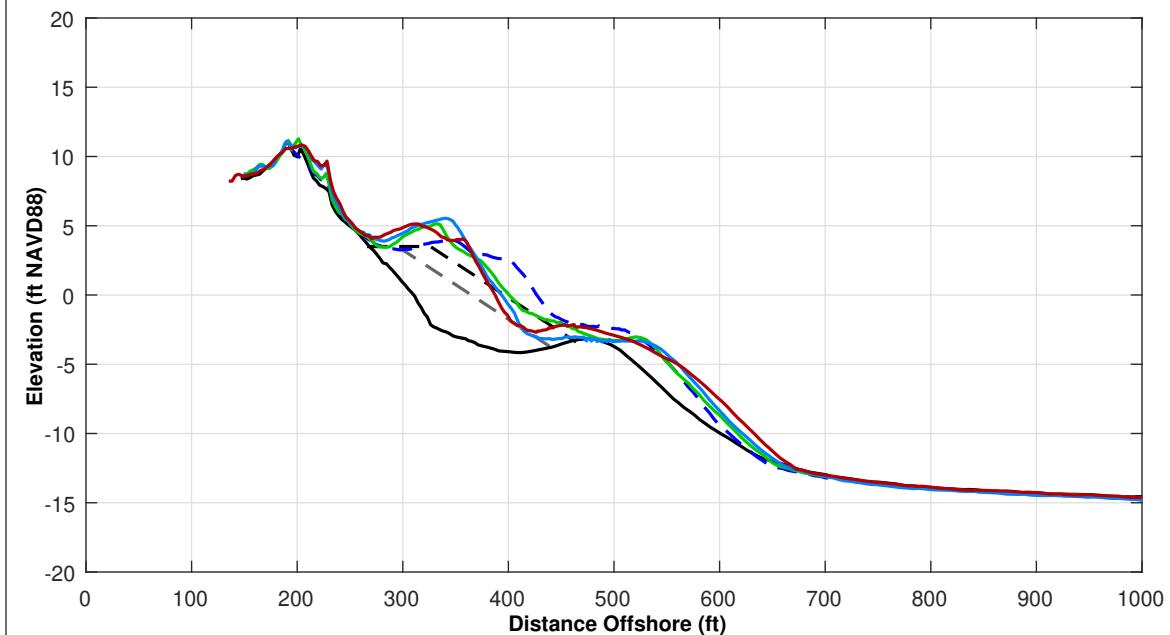
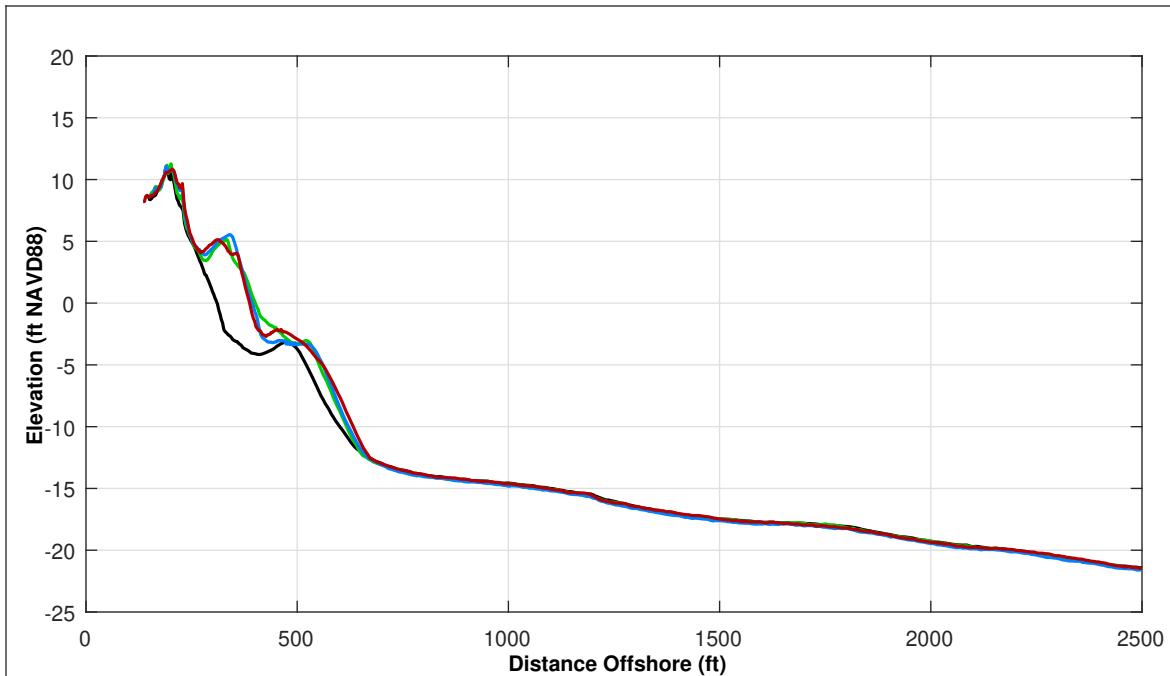
LEGEND:

NOV 2018	MAY 2017
APR 2018	OCT 2016
OCT 2017	USACE Design Template
	USACE Nourishment Threshold

Notes:

1. Station From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward and Seaward Of The Breakwater.

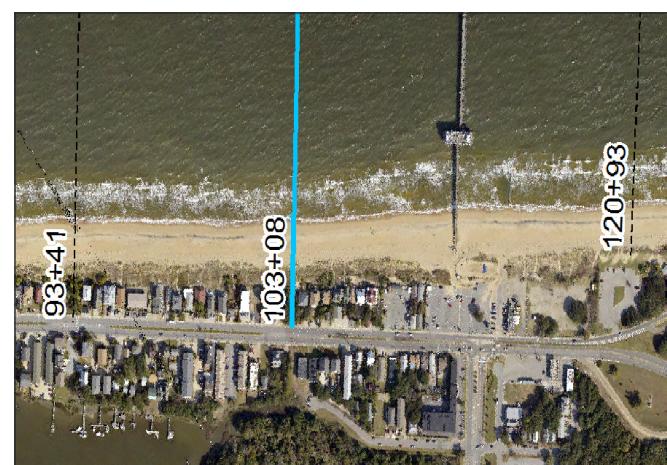


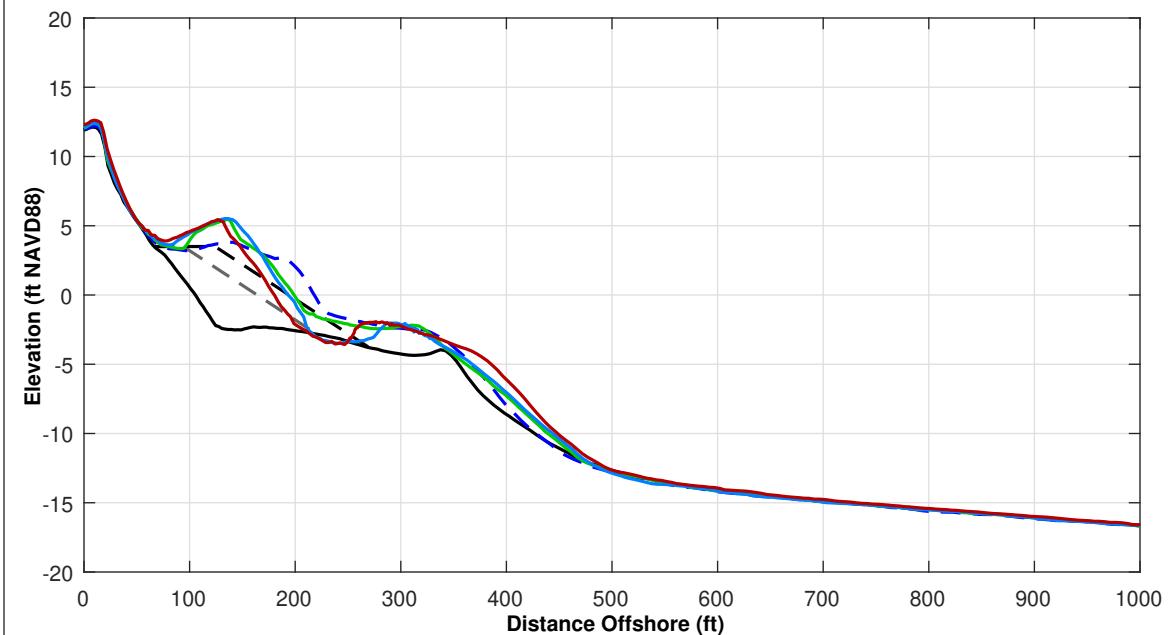
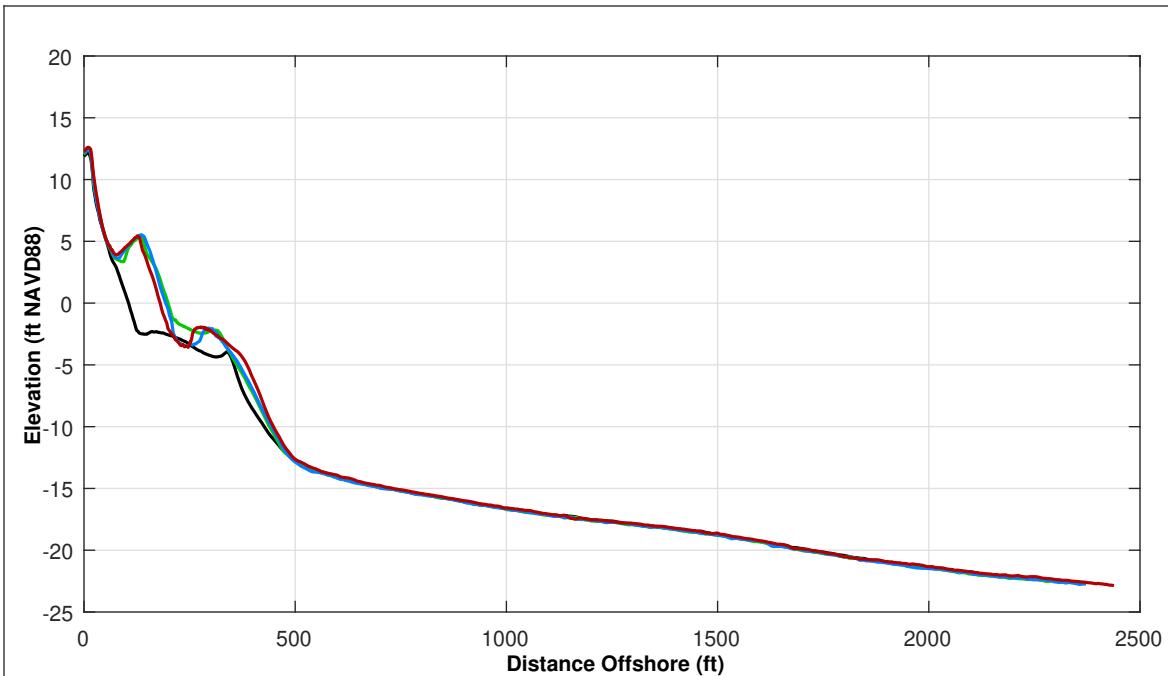


Survey Transect 103+08	NOV 2018 - OCT 2017	NOV 2018 - APR 2018
Shoreline Change at MHW (0.98 ft NAVD88)	-10.19 ft	-3.77 ft
Volume Change Above -15 ft NAVD88	4.13 cy/ft	4.70 cy/ft
Volume Change Above 0 ft NAVD88	1.32 cy/ft	-1.03 cy/ft
Distance from USACE Design Template @ 3.5 feet NAVD88:		
LEGEND: NOV 2018 — NOV 2018 APR 2018 — APR 2018 MAY 2017 — MAY 2017 OCT 2016 — OCT 2016 USACE Design Template — USACE Design Template OCT 2017 — OCT 2017 USACE Nourishment Threshold — USACE Nourishment Threshold		

Notes:

1. Station From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward and Seaward Of The Breakwater.

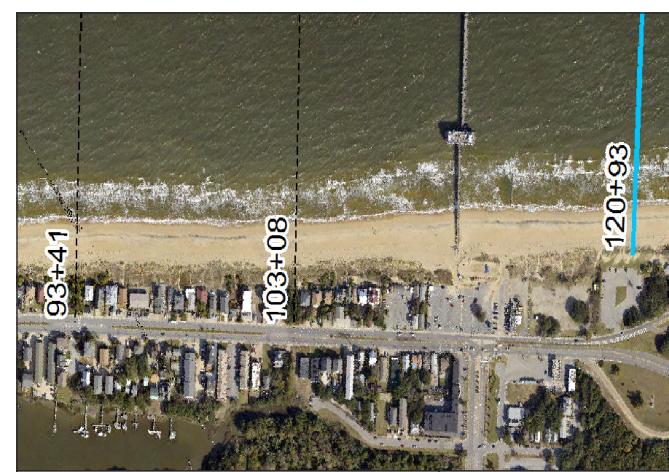


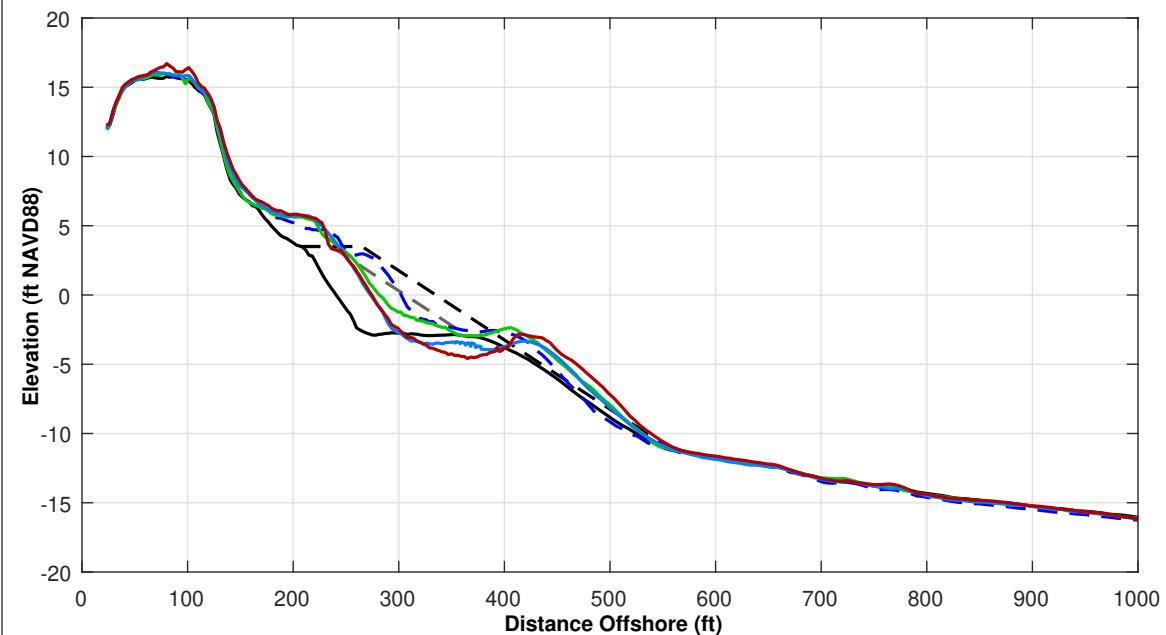
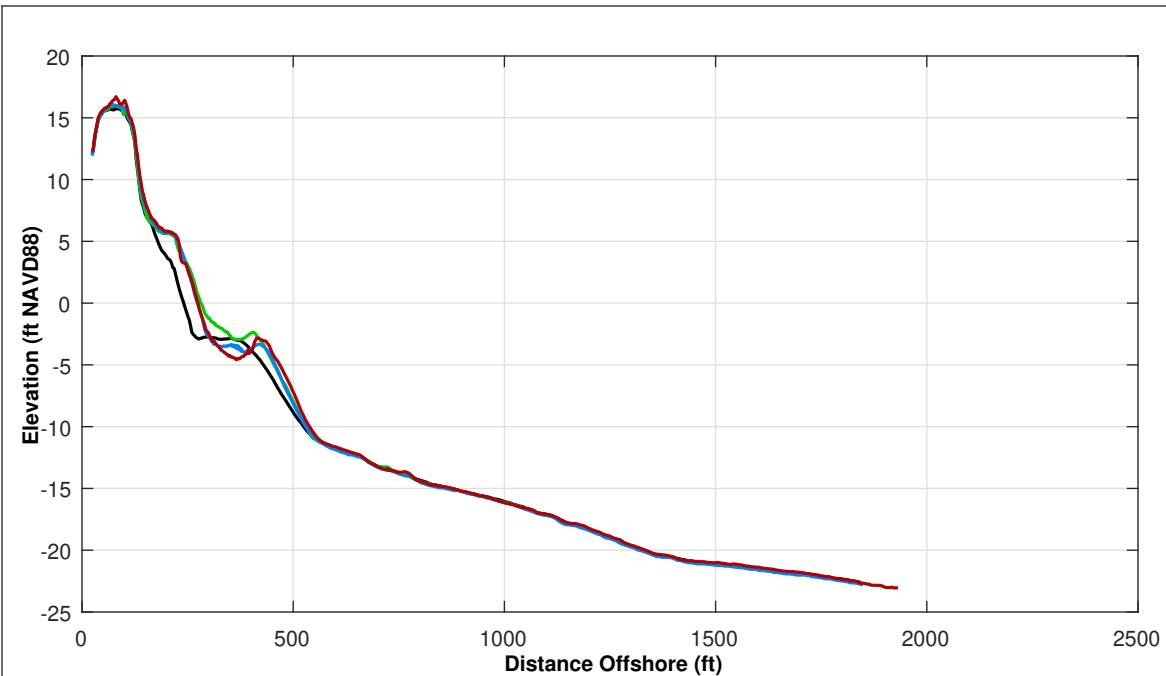


Survey Transect 120+93	NOV 2018 - OCT 2017	NOV 2018 - APR 2018
Shoreline Change at MHW (0.98 ft NAVD88)	-16.94 ft	-11.27 ft
Volume Change Above -15 ft NAVD88	1.48 cy/ft	3.69 cy/ft
Volume Change Above 0 ft NAVD88	-0.53 cy/ft	-1.36 cy/ft
Distance from USACE Design Template @ 3.5 feet NAVD88:		
LEGEND: MAY 2017 (Blue dashed line) NOV 2018 (Red solid line) OCT 2016 (Black dashed line) APR 2018 (Blue solid line) USACE Design Template (Green solid line) OCT 2017 (Green solid line) USACE Nourishment Threshold (Black dashed line)		

Notes:

1. Station From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward and Seaward Of The Breakwater.



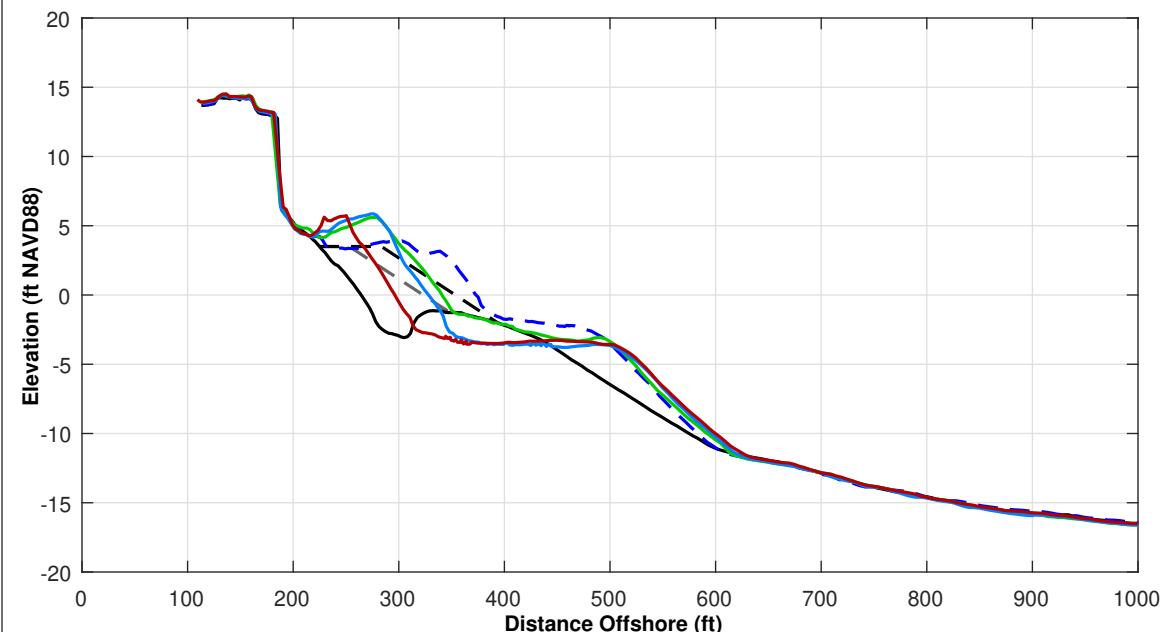
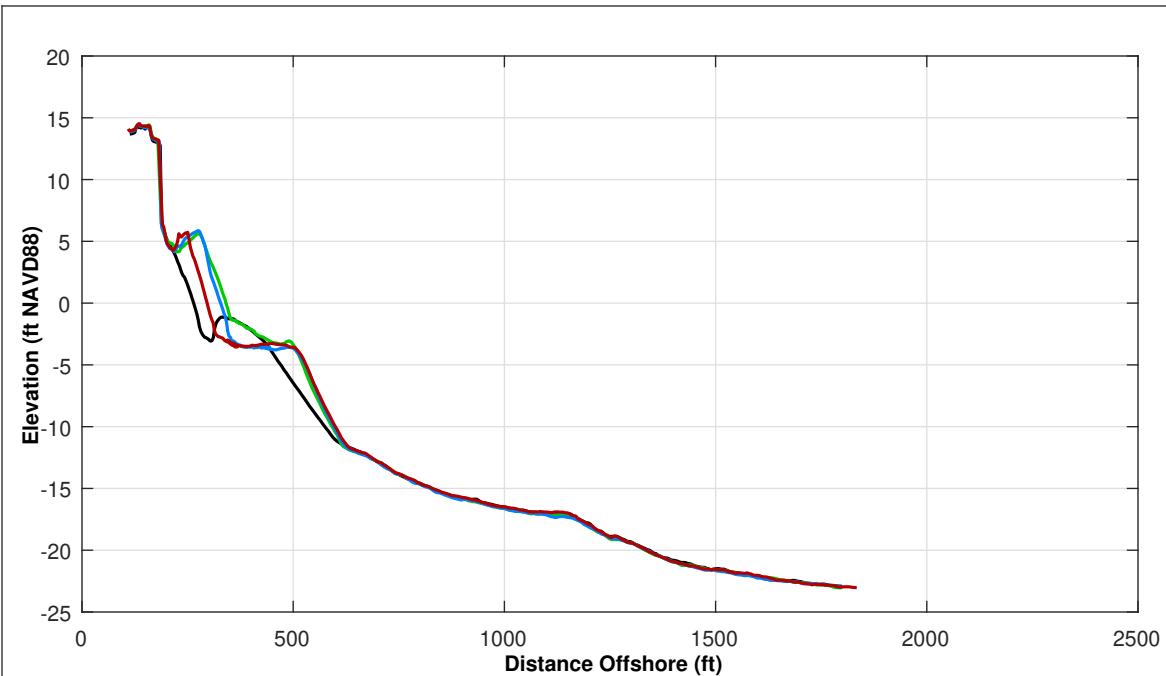


Survey Transect 129+17	NOV 2018 - OCT 2017	NOV 2018 - APR 2018
Shoreline Change at MHW (0.98 ft NAVD88)	-5.08 ft	1.39 ft
Volume Change Above -15 ft NAVD88	-1.03 cy/ft	5.22 cy/ft
Volume Change Above 0 ft NAVD88	2.44 cy/ft	1.52 cy/ft
Distance from USACE Design Template @ 3.5 feet NAVD88:		
LEGEND: NOV 2018 — MAY 2017 APR 2018 — OCT 2016 OCT 2017 — USACE Design Template USACE Nourishment Threshold — USACE Nourishment Threshold		

Notes:

1. Station From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward and Seaward Of The Breakwater.





Survey Transect 141+98	NOV 2018 - OCT 2017	NOV 2018 - APR 2018
Shoreline Change at MHW (0.98 ft NAVD88)	-42.96 ft	-30.19 ft
Volume Change Above -15 ft NAVD88	-12.93 cy/ft	-6.42 cy/ft
Volume Change Above 0 ft NAVD88	-6.40 cy/ft	-5.40 cy/ft

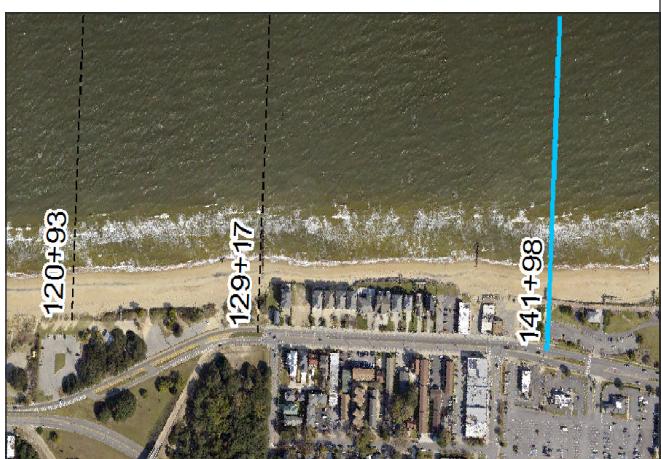
Distance from USACE Design Template @ 3.5 feet NAVD88:

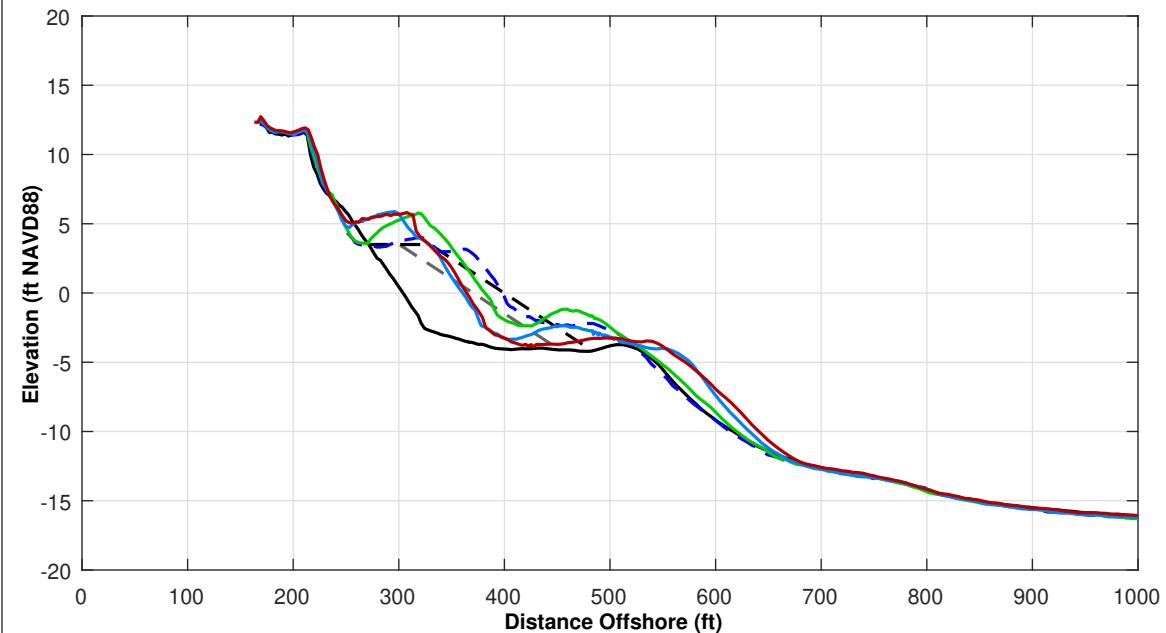
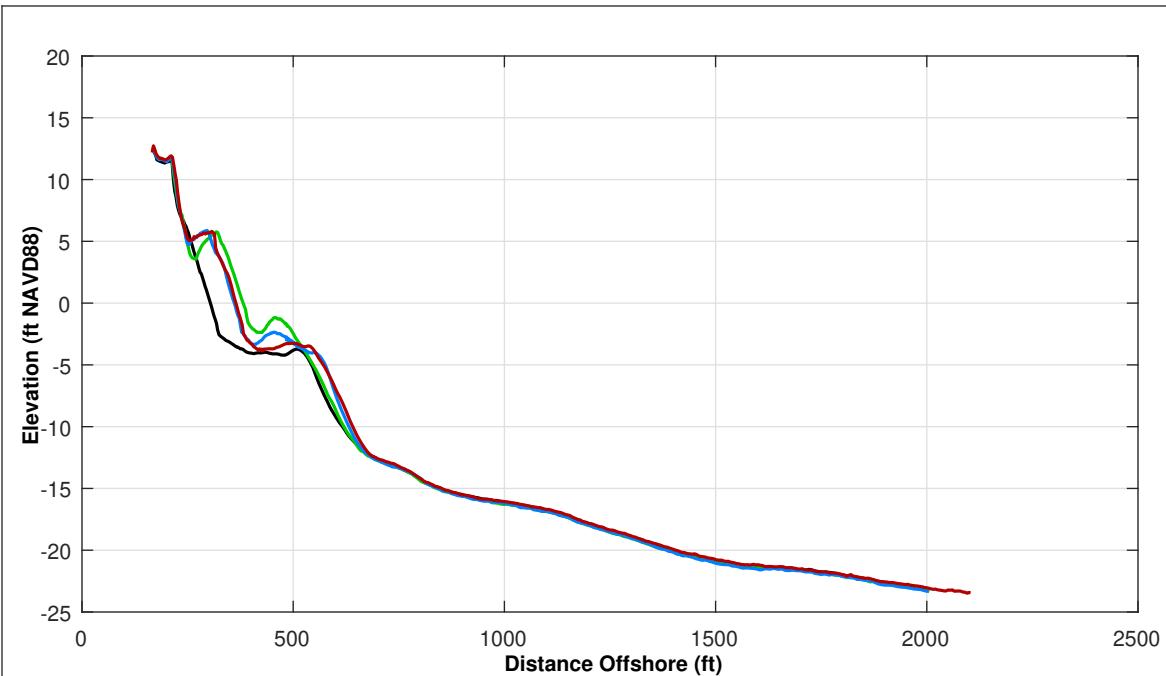
LEGEND:

- MAY 2017
- NOV 2018
- APR 2018
- OCT 2016
- USACE Design Template
- OCT 2017
- USACE Nourishment Threshold

Notes:

1. Station From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward and Seaward Of The Breakwater.

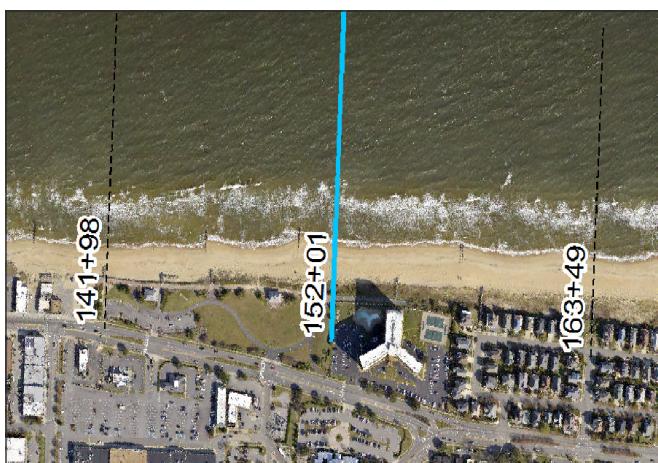


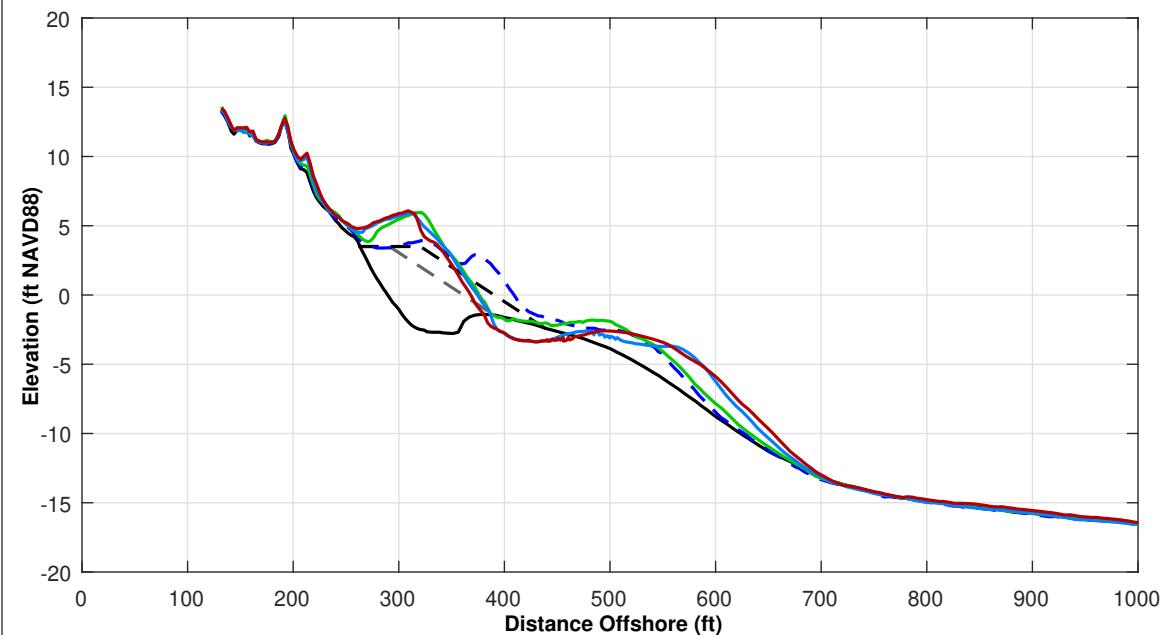
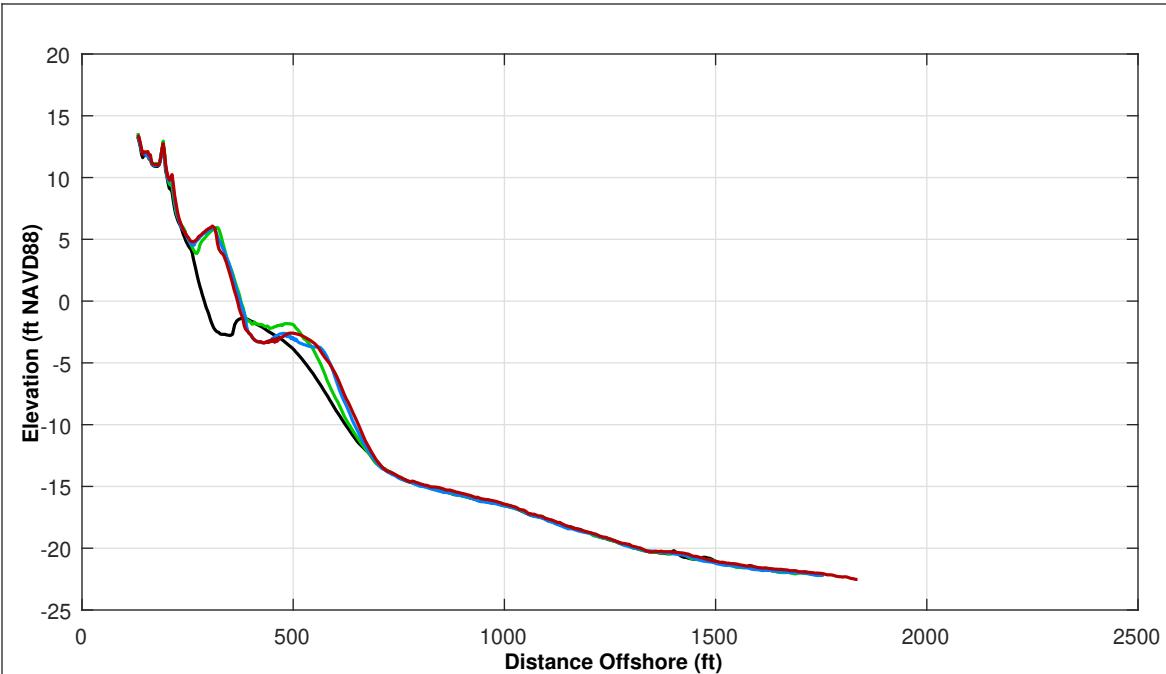


Survey Transect 152+01	NOV 2018 - OCT 2017	NOV 2018 - APR 2018
Shoreline Change at MHW (0.98 ft NAVD88)	-15.26 ft	5.14 ft
Volume Change Above -15 ft NAVD88	-1.36 cy/ft	1.81 cy/ft
Volume Change Above 0 ft NAVD88	-0.70 cy/ft	1.51 cy/ft
Distance from USACE Design Template @ 3.5 feet NAVD88:		
LEGEND: NOV 2018 — NOV 2018 OCT 2016 — OCT 2016 USACE Design Template — USACE Design Template OCT 2017 — OCT 2017 USACE Nourishment Threshold — USACE Nourishment Threshold		

Notes:

1. Station From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward and Seaward Of The Breakwater.

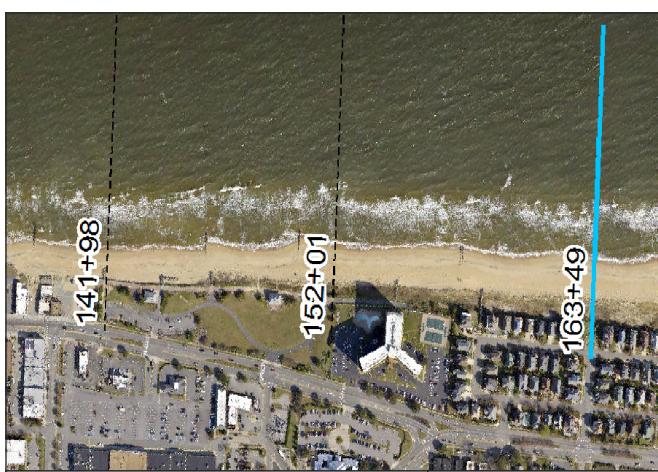


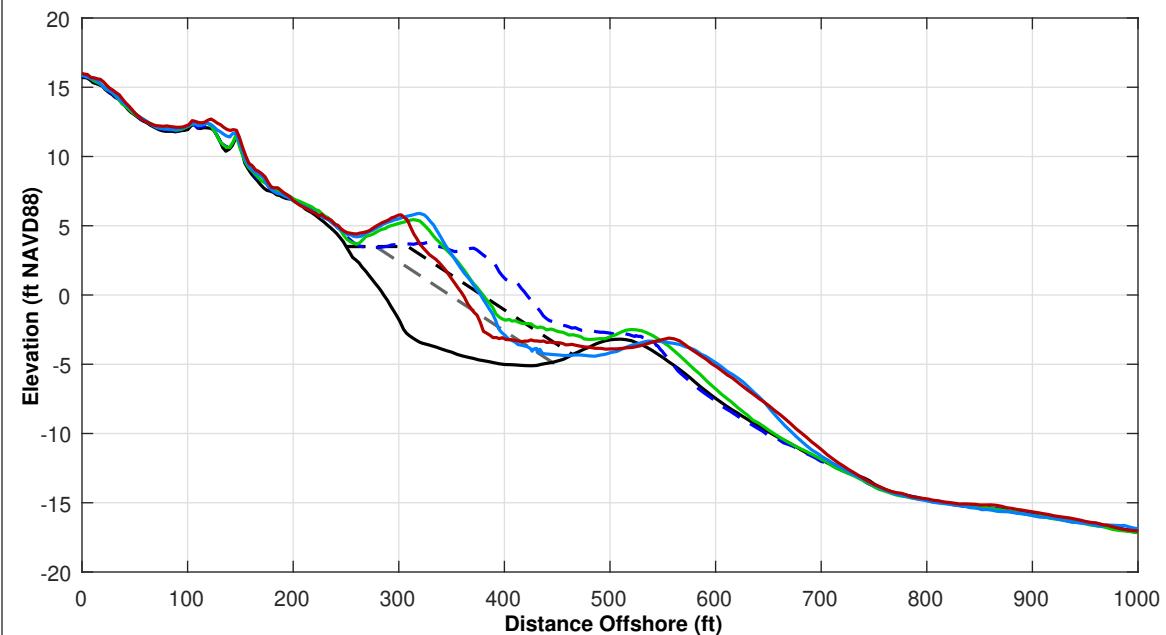
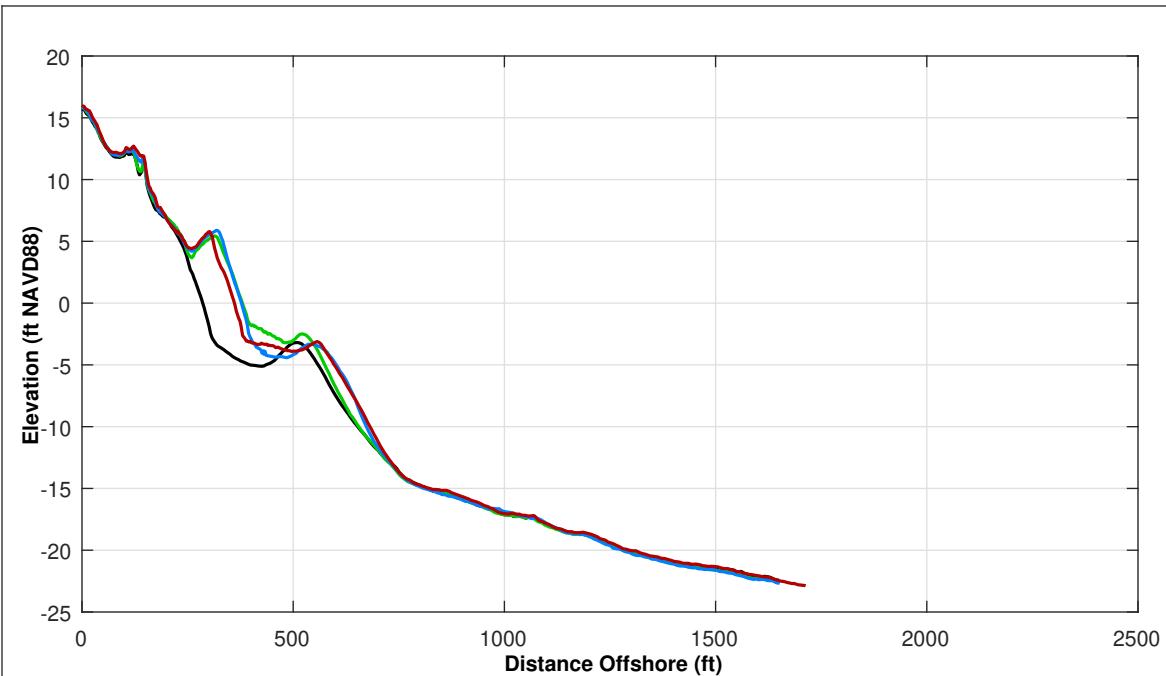


Survey Transect 163+49	NOV 2018 - OCT 2017	NOV 2018 - APR 2018
Shoreline Change at MHW (0.98 ft NAVD88)	-8.25 ft	-5.63 ft
Volume Change Above -15 ft NAVD88	2.09 cy/ft	2.31 cy/ft
Volume Change Above 0 ft NAVD88	0.05 cy/ft	-0.11 cy/ft
Distance from USACE Design Template @ 3.5 feet NAVD88:		
LEGEND: MAY 2017 (blue dashed line) NOV 2018 (red solid line) OCT 2016 (black dashed line) APR 2018 (blue solid line) USACE Design Template (black dashed line) OCT 2017 (green solid line) USACE Nourishment Threshold (black dashed line)		

Notes:

1. Station From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward and Seaward Of The Breakwater.



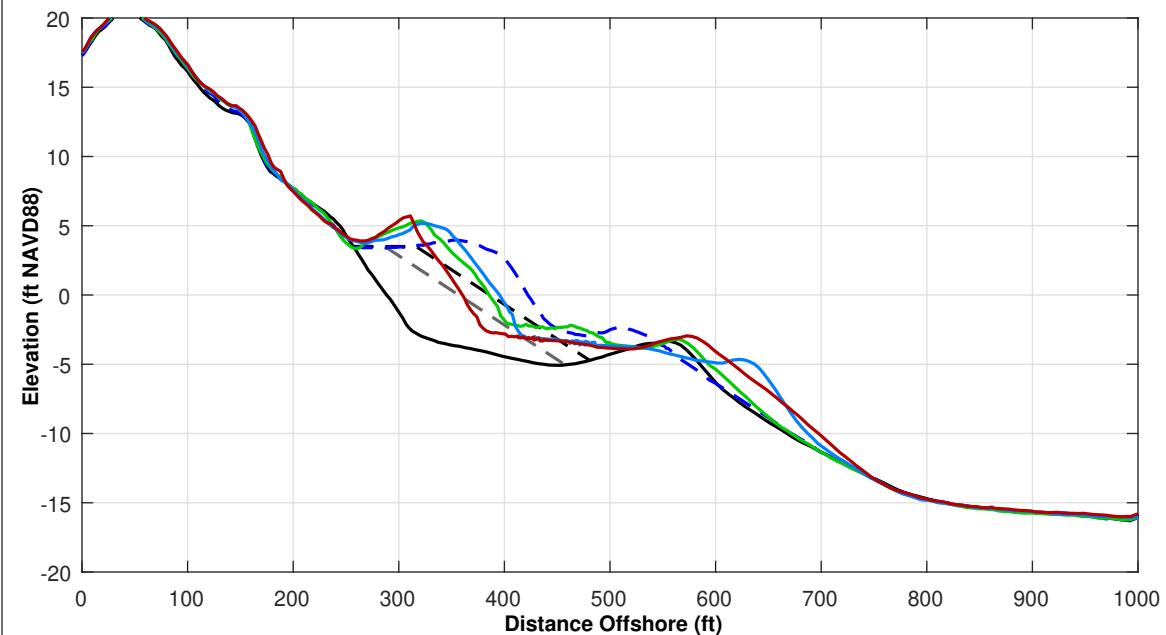
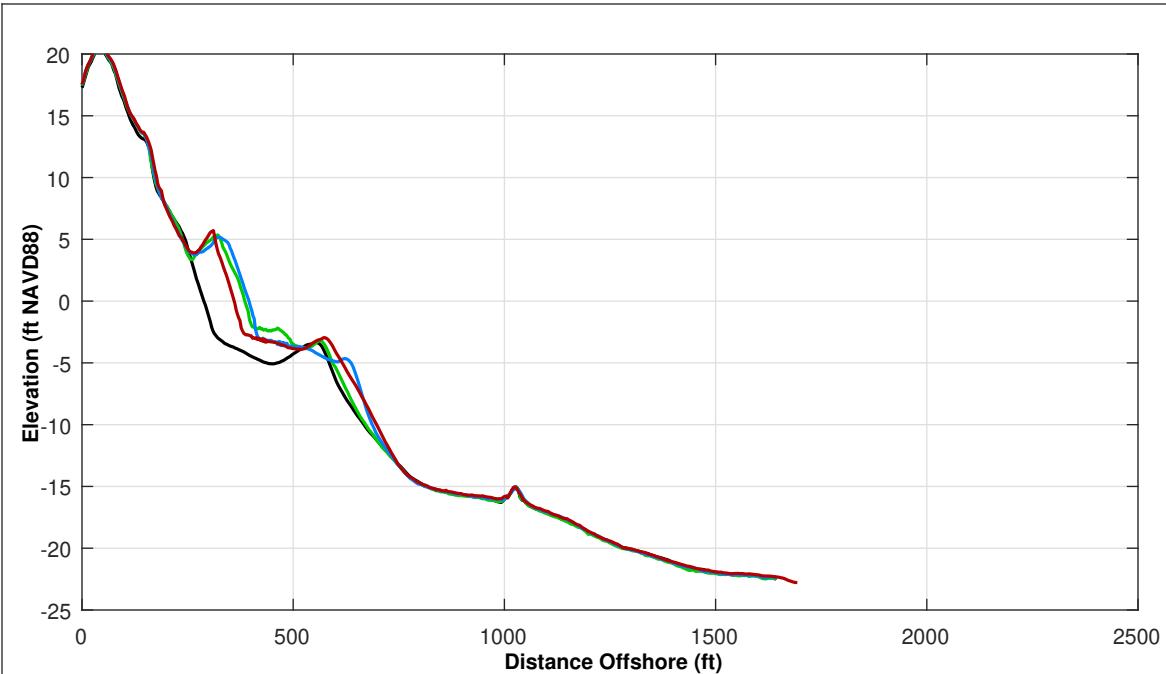


Survey Transect 169+63	NOV 2018 - OCT 2017	NOV 2018 - APR 2018
Shoreline Change at MHW (0.98 ft NAVD88)	-17.53 ft	-16.63 ft
Volume Change Above -15 ft NAVD88	1.07 cy/ft	-0.77 cy/ft
Volume Change Above 0 ft NAVD88	-0.36 cy/ft	-2.18 cy/ft
Distance from USACE Design Template @ 3.5 feet NAVD88:		
LEGEND:		
NOV 2018	MAY 2017	---
APR 2018	OCT 2016	—
OCT 2017	USACE Design Template	—
	USACE Nourishment Threshold	—

Notes:

1. Station From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward and Seaward Of The Breakwater.

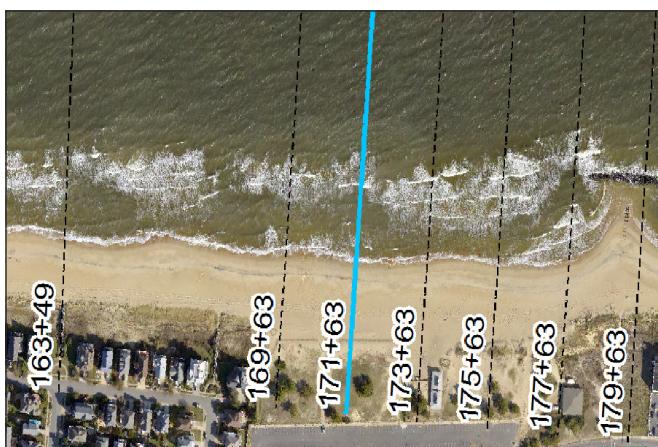


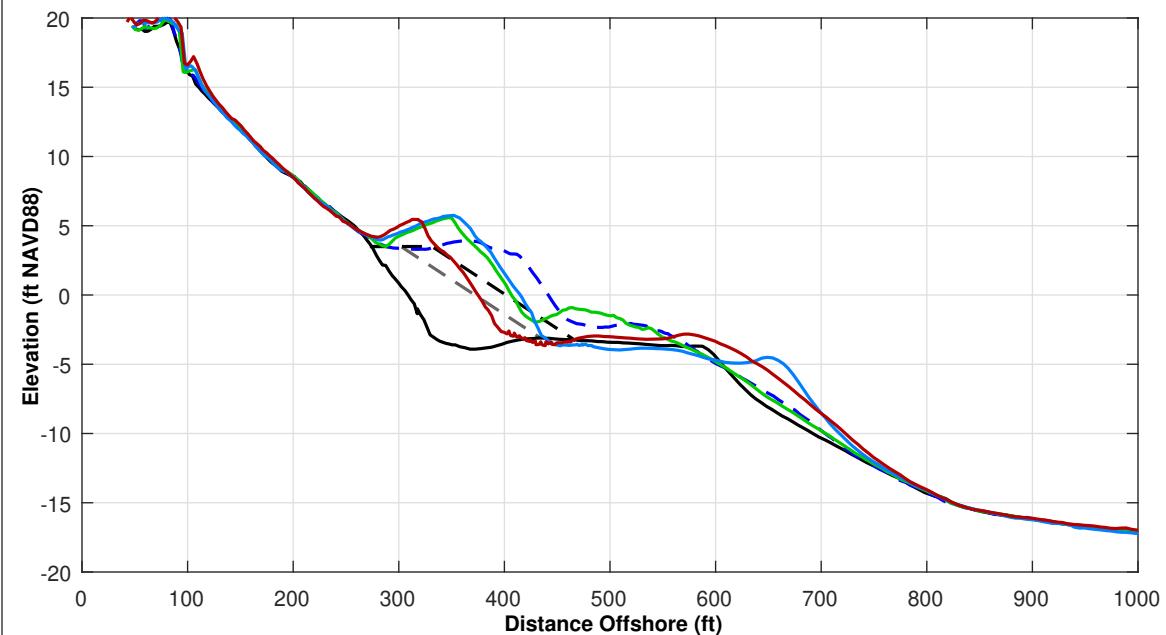
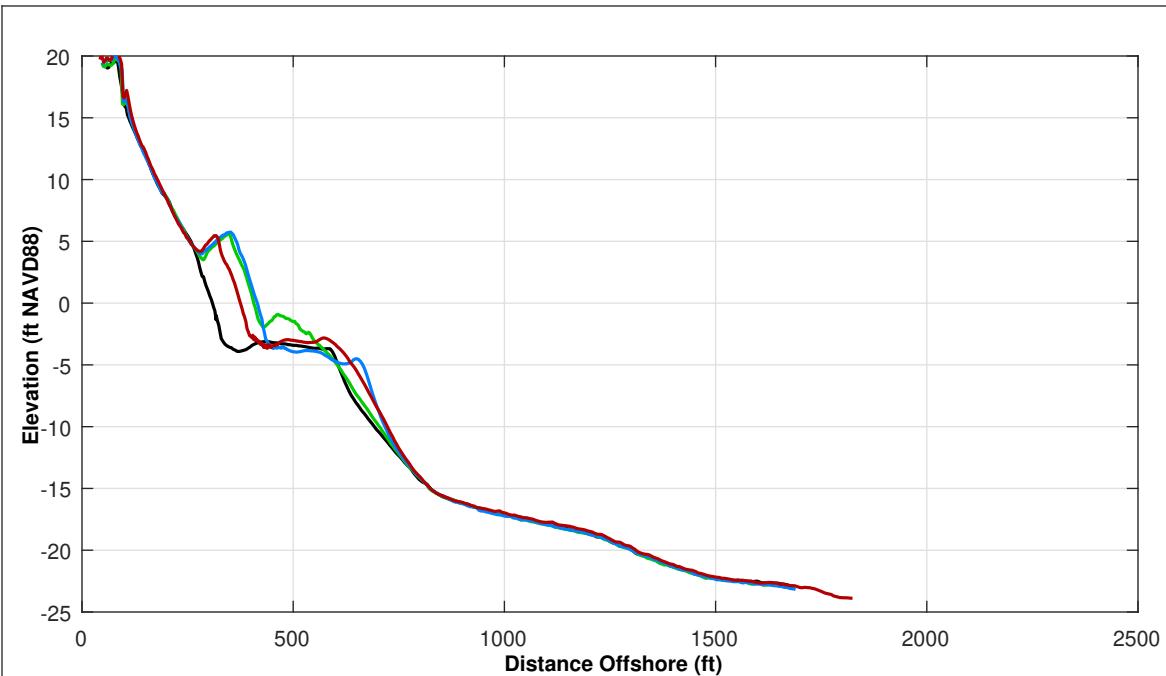


Survey Transect 171+63	NOV 2018 - OCT 2017	NOV 2018 - APR 2018
Shoreline Change at MHW (0.98 ft NAVD88)	-24.93 ft	-33.17 ft
Volume Change Above -15 ft NAVD88	0.46 cy/ft	-5.21 cy/ft
Volume Change Above 0 ft NAVD88	-1.94 cy/ft	-4.07 cy/ft
Distance from USACE Design Template @ 3.5 feet NAVD88:		
LEGEND: NOV 2018 — NOV 2018 APR 2018 — APR 2018 MAY 2017 — MAY 2017 OCT 2016 — OCT 2016 USACE Design Template — USACE Design Template USACE Nourishment Threshold — USACE Nourishment Threshold		

Notes:

1. Station From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward and Seaward Of The Breakwater.





Survey Transect 173+63	NOV 2018 - OCT 2017	NOV 2018 - APR 2018
Shoreline Change at MHW (0.98 ft NAVD88)	-32.52 ft	-38.62 ft
Volume Change Above -15 ft NAVD88	-4.34 cy/ft	-5.96 cy/ft
Volume Change Above 0 ft NAVD88	-3.80 cy/ft	-6.31 cy/ft

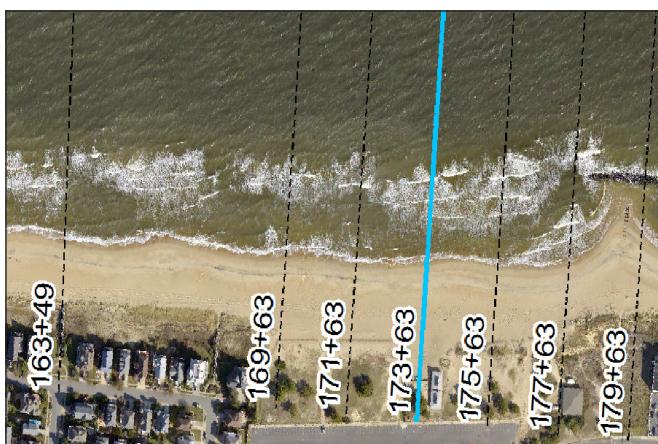
Distance from USACE Design Template @ 3.5 feet NAVD88:

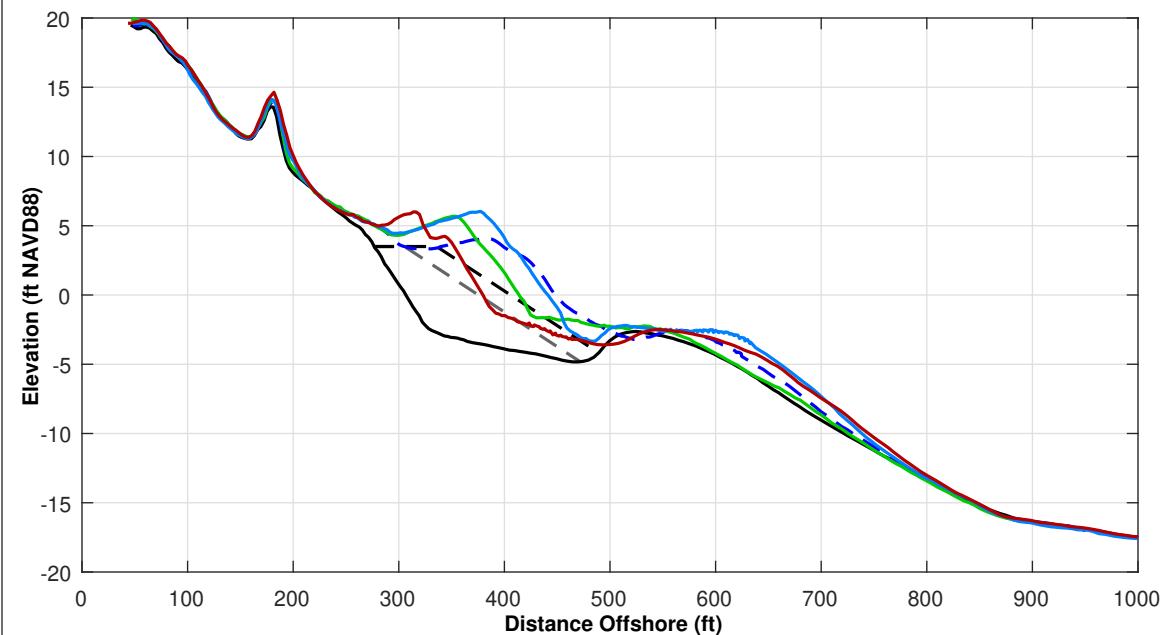
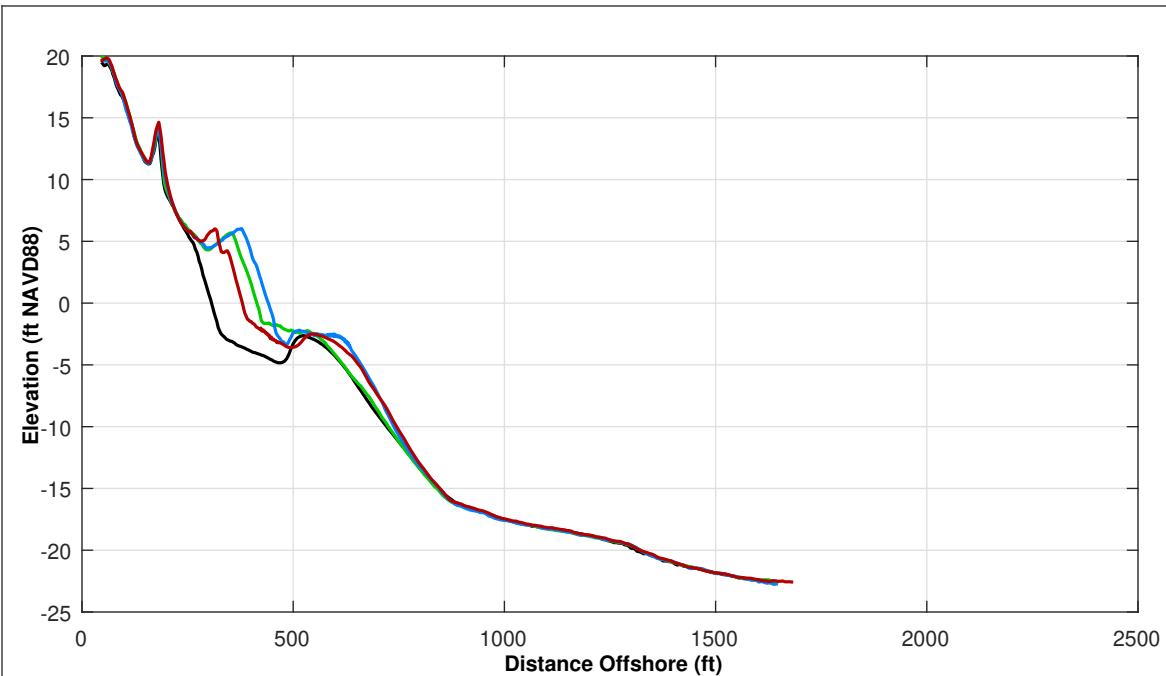
LEGEND:

- NOV 2018 — NOV 2018
- APR 2018 — APR 2018
- MAY 2017 — MAY 2017
- OCT 2016 — OCT 2016
- USACE Design Template — USACE Design Template
- USACE Nourishment Threshold — USACE Nourishment Threshold

Notes:

1. Station From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward and Seaward Of The Breakwater.

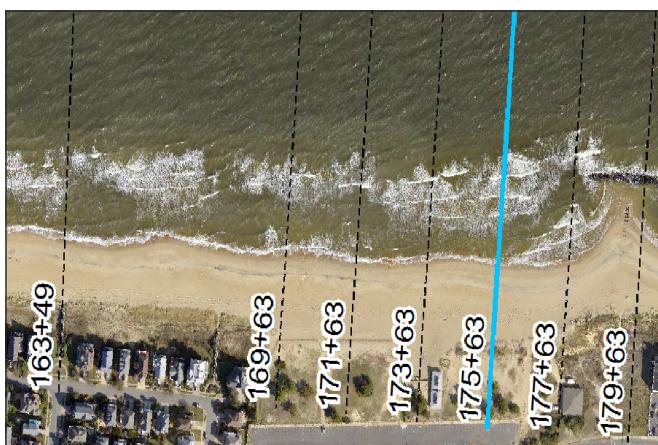


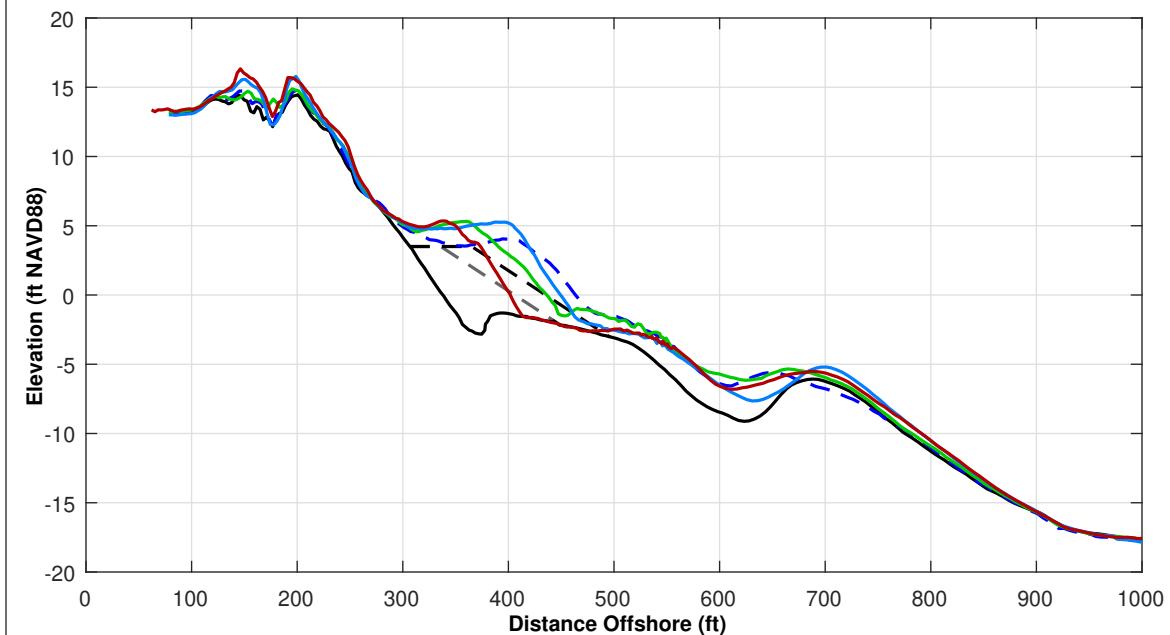
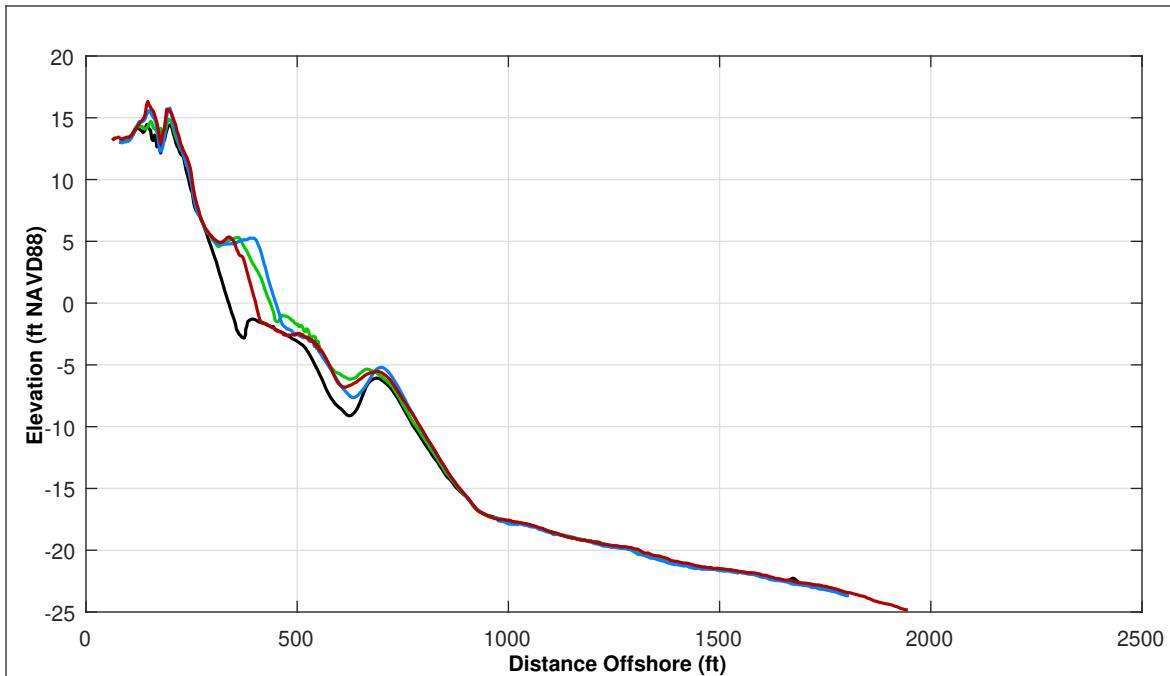


Survey Transect 175+63	NOV 2018 - OCT 2017	NOV 2018 - APR 2018
Shoreline Change at MHW (0.98 ft NAVD88)	-33.43 ft	-59.44 ft
Volume Change Above -15 ft NAVD88	-0.87 cy/ft	-17.09 cy/ft
Volume Change Above 0 ft NAVD88	-4.07 cy/ft	-9.31 cy/ft

Notes:

1. Station From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward and Seaward Of The Breakwater.

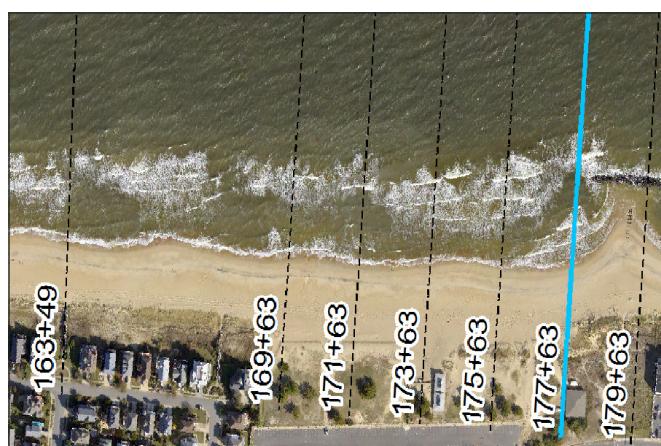


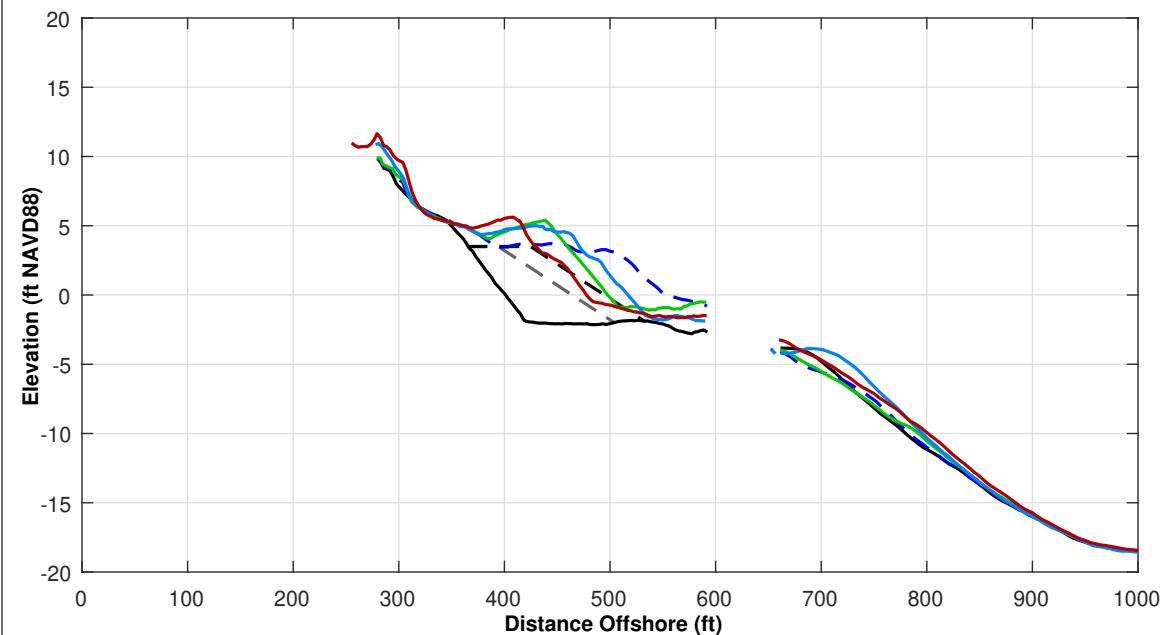
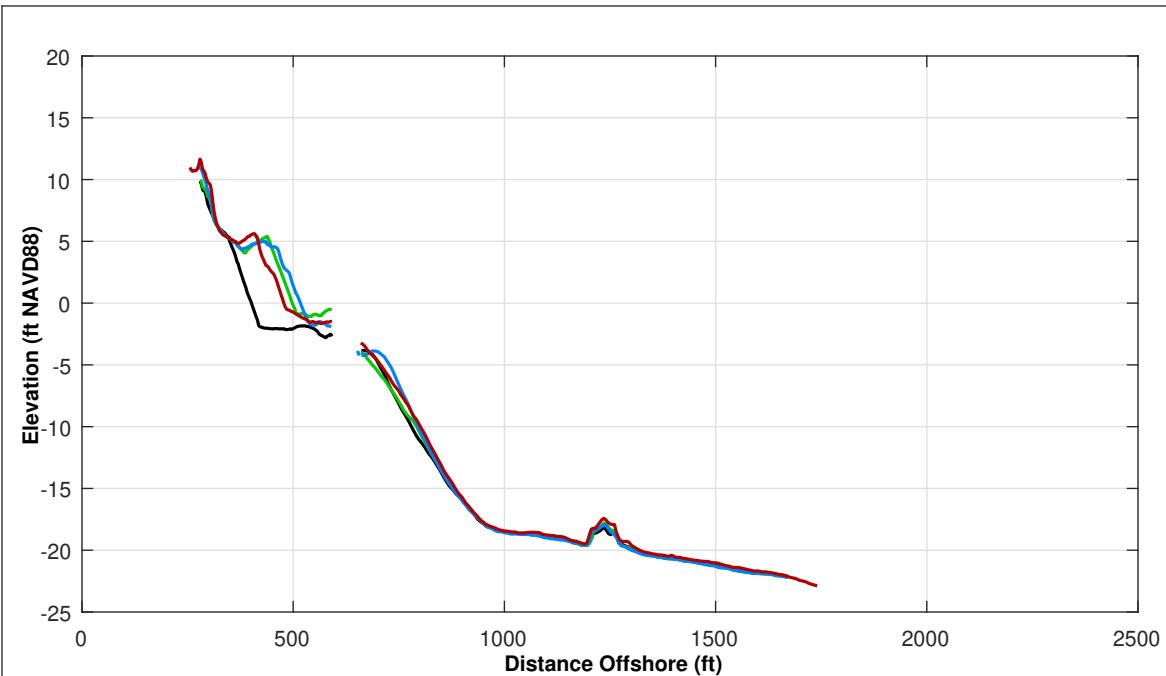


Survey Transect 177+63	NOV 2018 - OCT 2017	NOV 2018 - APR 2018
Shoreline Change at MHW (0.98 ft NAVD88)	-31.14 ft	-46.33 ft
Volume Change Above -15 ft NAVD88	-5.71 cy/ft	-8.29 cy/ft
Volume Change Above 0 ft NAVD88	-0.81 cy/ft	-5.75 cy/ft

Notes:

1. Station From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward and Seaward Of The Breakwater.

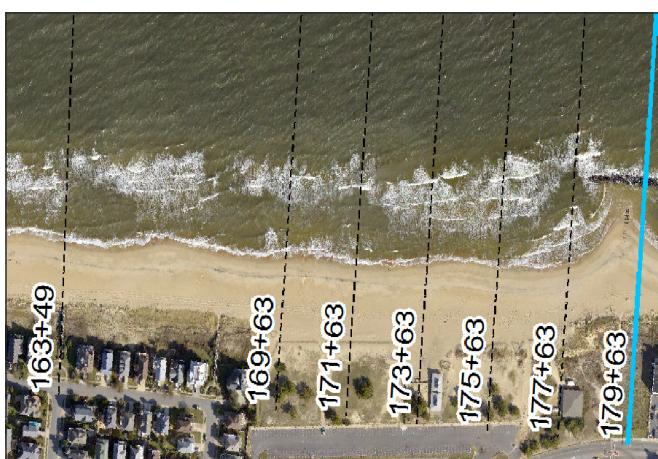


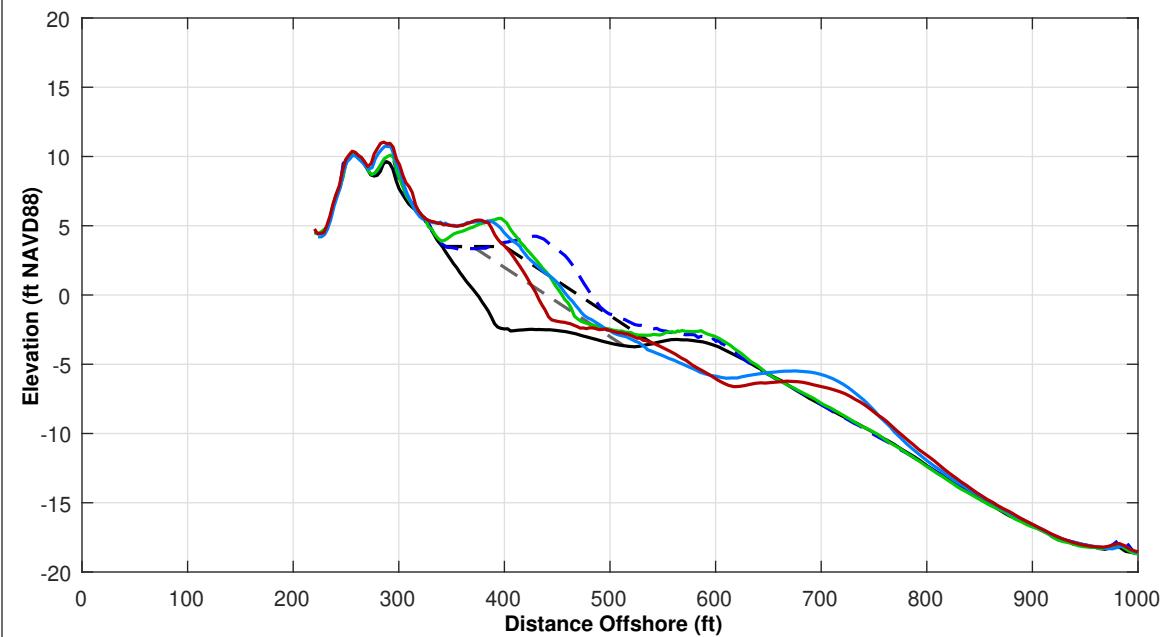
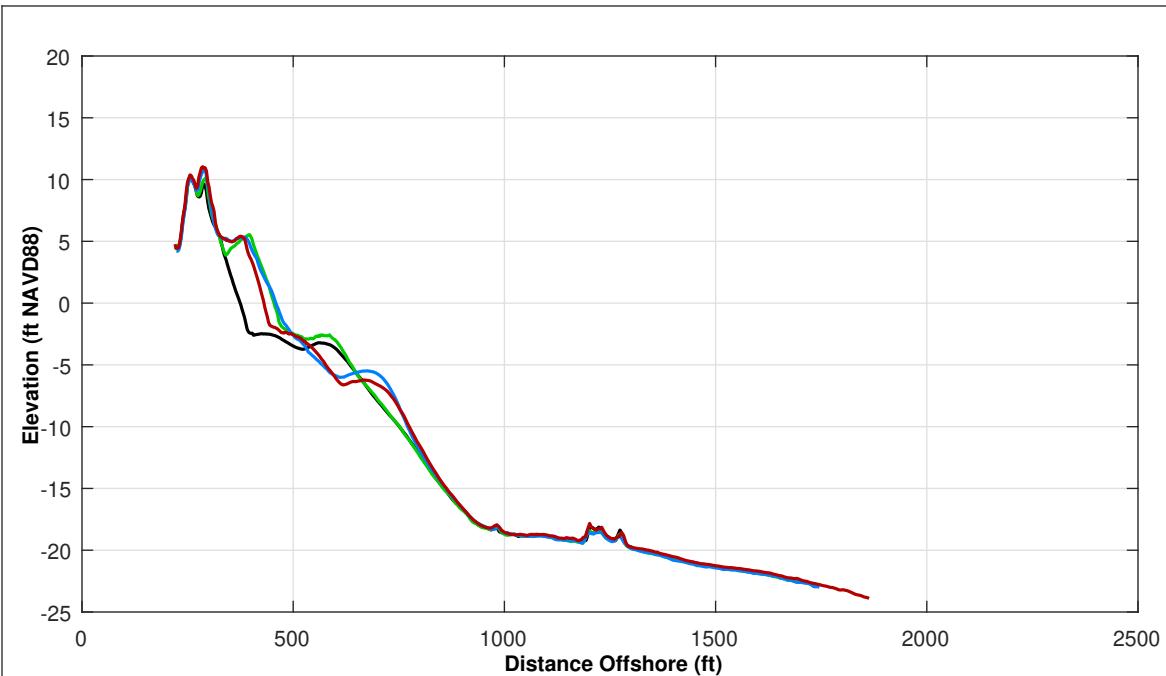


Survey Transect 179+63	NOV 2018 - OCT 2017	NOV 2018 - APR 2018
Shoreline Change at MHW (0.98 ft NAVD88)	-19.21 ft	-36.01 ft
Volume Change Above -15 ft NAVD88	1.14 cy/ft	-6.25 cy/ft
Volume Change Above 0 ft NAVD88	-1.79 cy/ft	-4.76 cy/ft
Distance from USACE Design Template @ 3.5 feet NAVD88:		
LEGEND: NOV 2018 — MAY 2017 APR 2018 — OCT 2016 OCT 2017 — USACE Design Template USACE Nourishment Threshold — USACE Nourishment Threshold		

Notes:

1. Station From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward and Seaward Of The Breakwater.





Survey Transect 181+63	NOV 2018 - OCT 2017	NOV 2018 - APR 2018
Shoreline Change at MHW (0.98 ft NAVD88)	-22.52 ft	-25.59 ft
Volume Change Above -15 ft NAVD88	-4.73 cy/ft	-6.08 cy/ft
Volume Change Above 0 ft NAVD88	-0.84 cy/ft	-1.87 cy/ft

Distance from USACE Design Template @ 3.5 feet NAVD88:

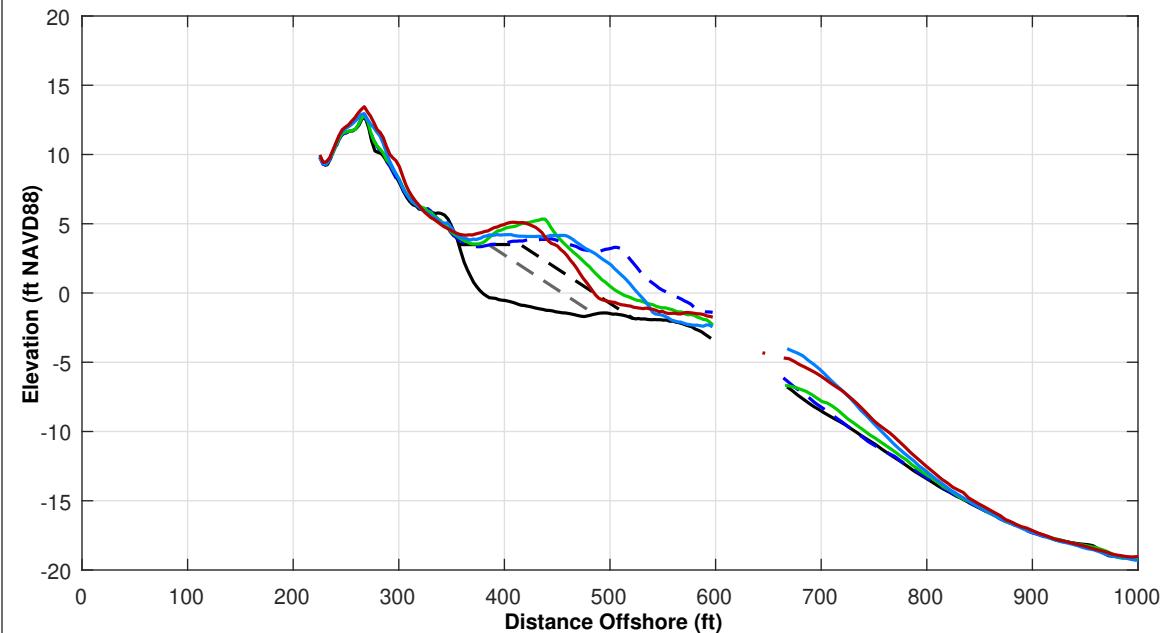
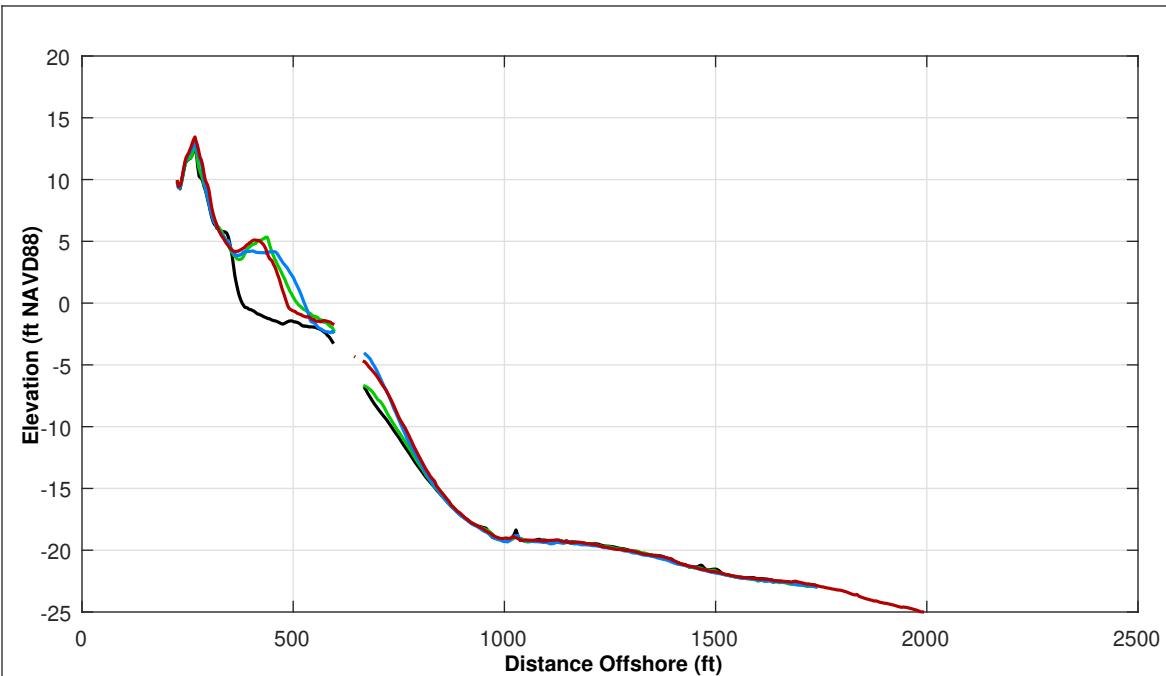
LEGEND:

- MAY 2017
- NOV 2018
- OCT 2016
- APR 2018
- OCT 2017
- USACE Design Template
- USACE Nourishment Threshold

Notes:

1. Station From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward and Seaward Of The Breakwater.



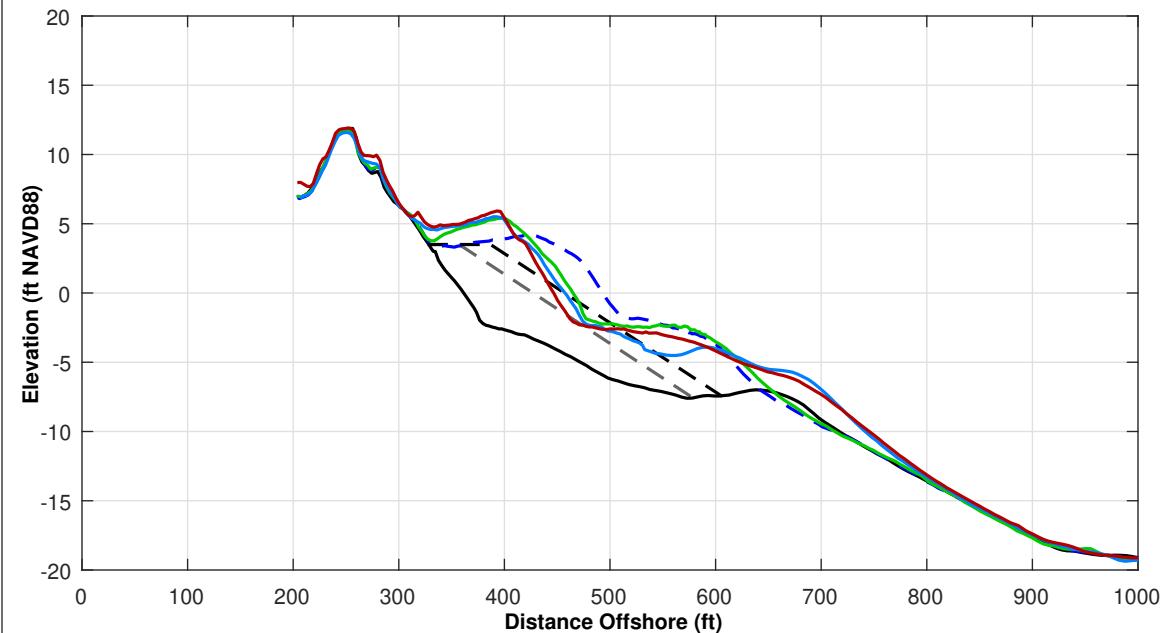
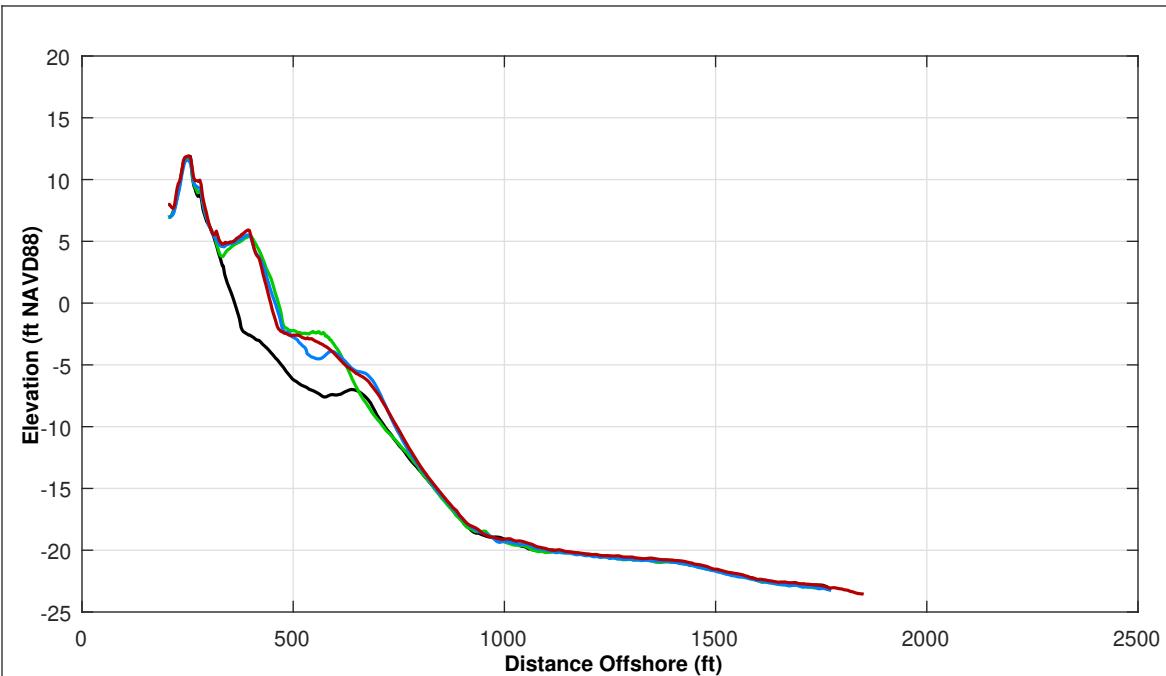


Survey Transect 183+63	NOV 2018 - OCT 2017	NOV 2018 - APR 2018
Shoreline Change at MHW (0.98 ft NAVD88)	-16.60 ft	-39.69 ft
Volume Change Above -15 ft NAVD88	6.64 cy/ft	-1.84 cy/ft
Volume Change Above 0 ft NAVD88	0.20 cy/ft	-2.23 cy/ft
Distance from USACE Design Template @ 3.5 feet NAVD88:		
LEGEND: NOV 2018 — NOV 2018 APR 2018 — APR 2018 MAY 2017 — MAY 2017 OCT 2016 — OCT 2016 USACE Design Template — USACE Design Template USACE Nourishment Threshold — USACE Nourishment Threshold		

Notes:

1. Station From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward and Seaward Of The Breakwater.





Survey Transect 185+63	NOV 2018 - OCT 2017	NOV 2018 - APR 2018
Shoreline Change at MHW (0.98 ft NAVD88)	-16.92 ft	-8.01 ft
Volume Change Above -15 ft NAVD88	5.28 cy/ft	2.85 cy/ft
Volume Change Above 0 ft NAVD88	0.93 cy/ft	1.53 cy/ft

Distance from USACE Design Template @ 3.5 feet NAVD88:

LEGEND:

- MAY 2017 (Blue dashed line)
- NOV 2018 (Red solid line)
- OCT 2016 (Black solid line)
- APR 2018 (Blue solid line)
- USACE Design Template (Black dashed line)
- OCT 2017 (Green solid line)
- USACE Nourishment Threshold (Dashed line)

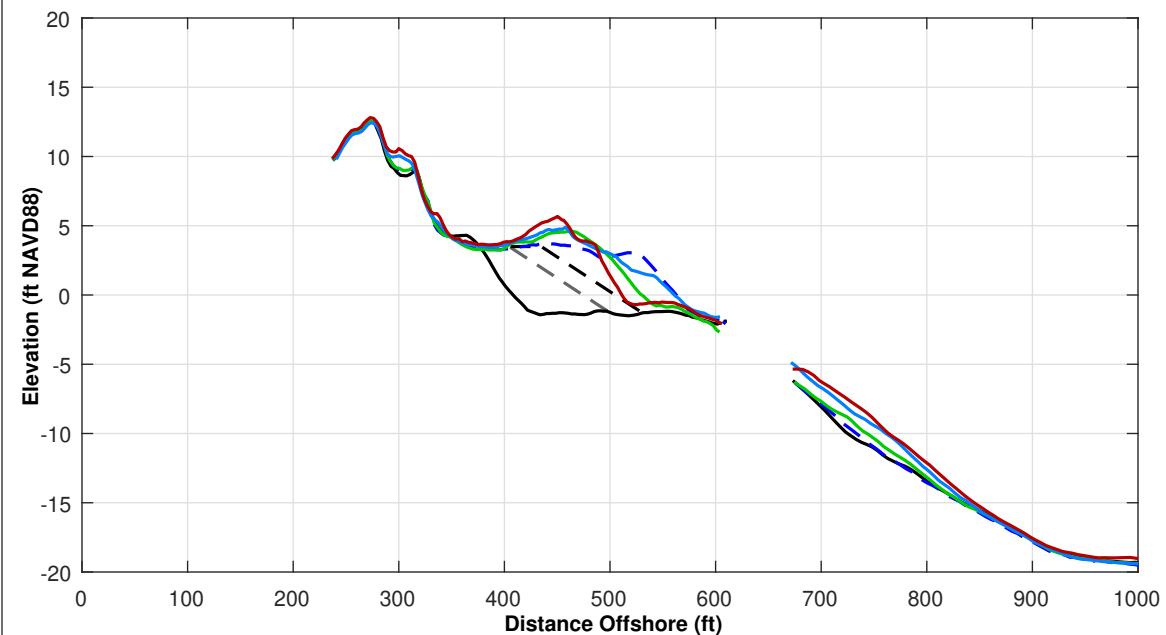
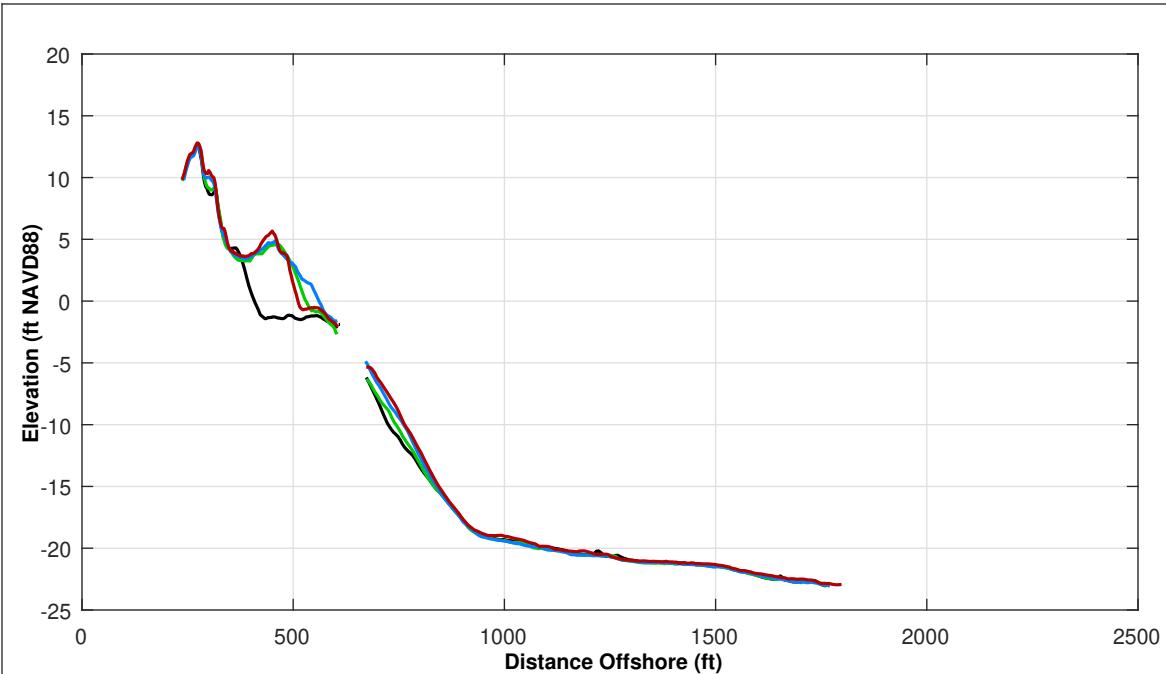
Notes:

1. Station From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward and Seaward Of The Breakwater.



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Survey Transect 187+63	NOV 2018 - OCT 2017	NOV 2018 - APR 2018
Shoreline Change at MHW (0.98 ft NAVD88)	-15.59 ft	-44.14 ft
Volume Change Above -15 ft NAVD88	9.69 cy/ft	0.35 cy/ft
Volume Change Above 0 ft NAVD88	2.05 cy/ft	-0.73 cy/ft
Distance from USACE Design Template @ 3.5 feet NAVD88:		
LEGEND: NOV 2018 — NOV 2018 APR 2018 — APR 2018 OCT 2016 — OCT 2016 OCT 2017 — OCT 2017 USACE Design Template — USACE Design Template USACE Nourishment Threshold — USACE Nourishment Threshold		

Notes:

1. Station From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward and Seaward Of The Breakwater.



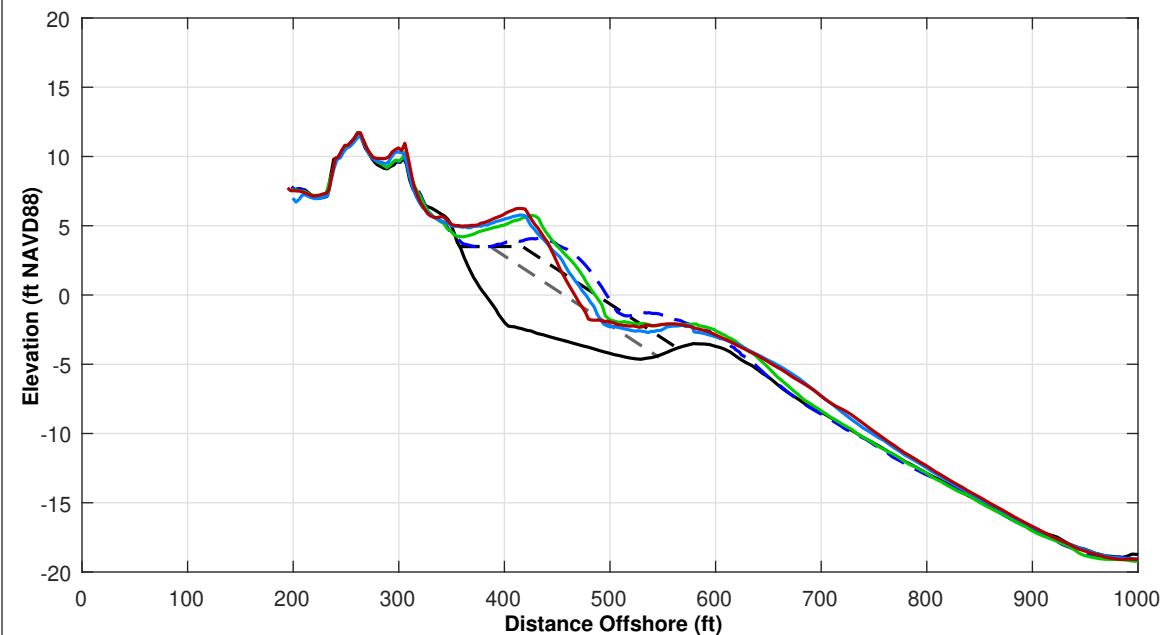
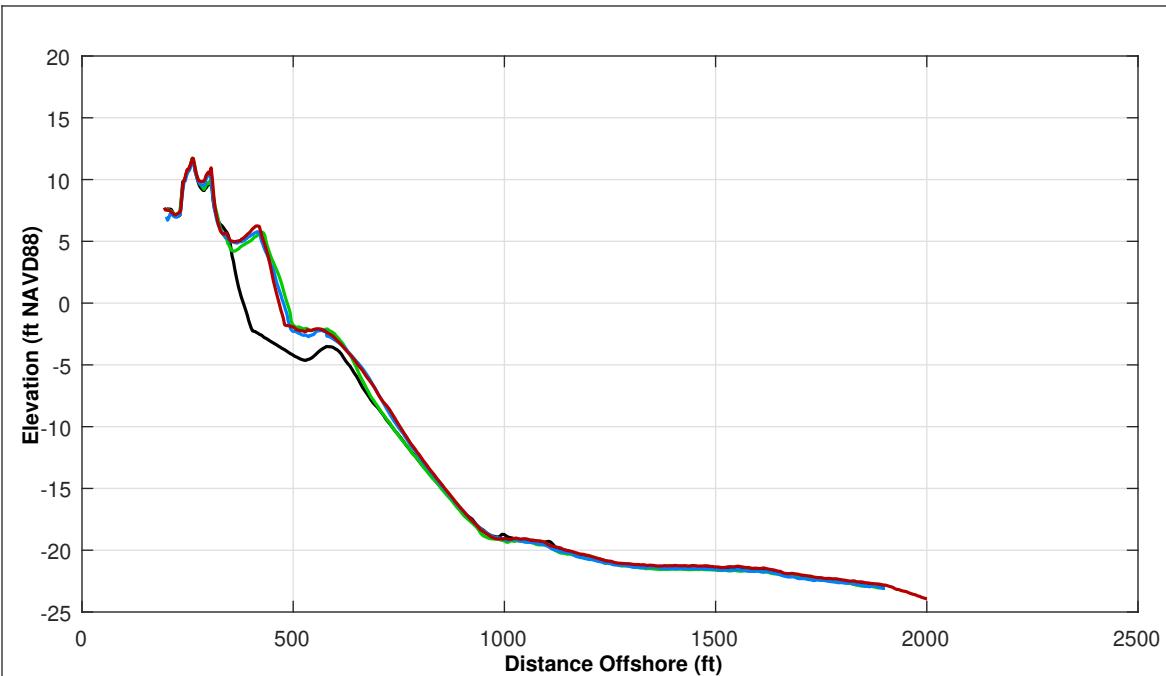
NORFOLK
THE CITY OF
PUBLIC WORKS

ST 187+63

OCEAN VIEW PERIODIC
SURVEYING DATA &
ANALYSIS

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Fall 2018



Survey Transect 189+63	NOV 2018 - OCT 2017	NOV 2018 - APR 2018
Shoreline Change at MHW (0.98 ft NAVD88)	-18.08 ft	-8.36 ft
Volume Change Above -15 ft NAVD88	3.96 cy/ft	2.32 cy/ft
Volume Change Above 0 ft NAVD88	0.16 cy/ft	1.44 cy/ft

Distance from USACE Design Template @ 3.5 feet NAVD88:

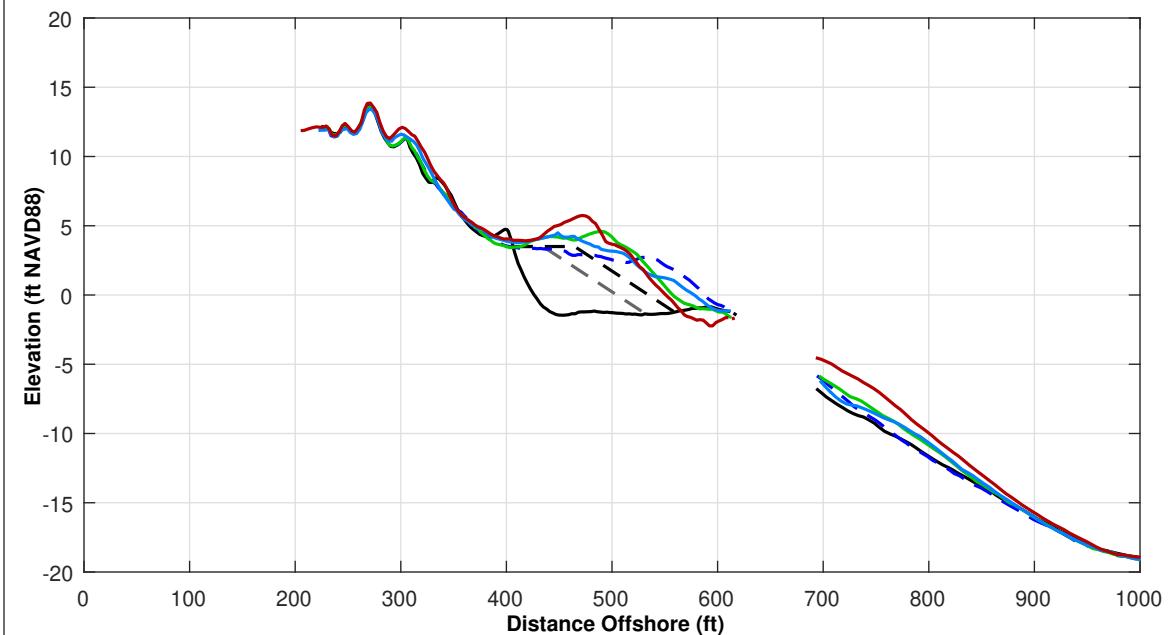
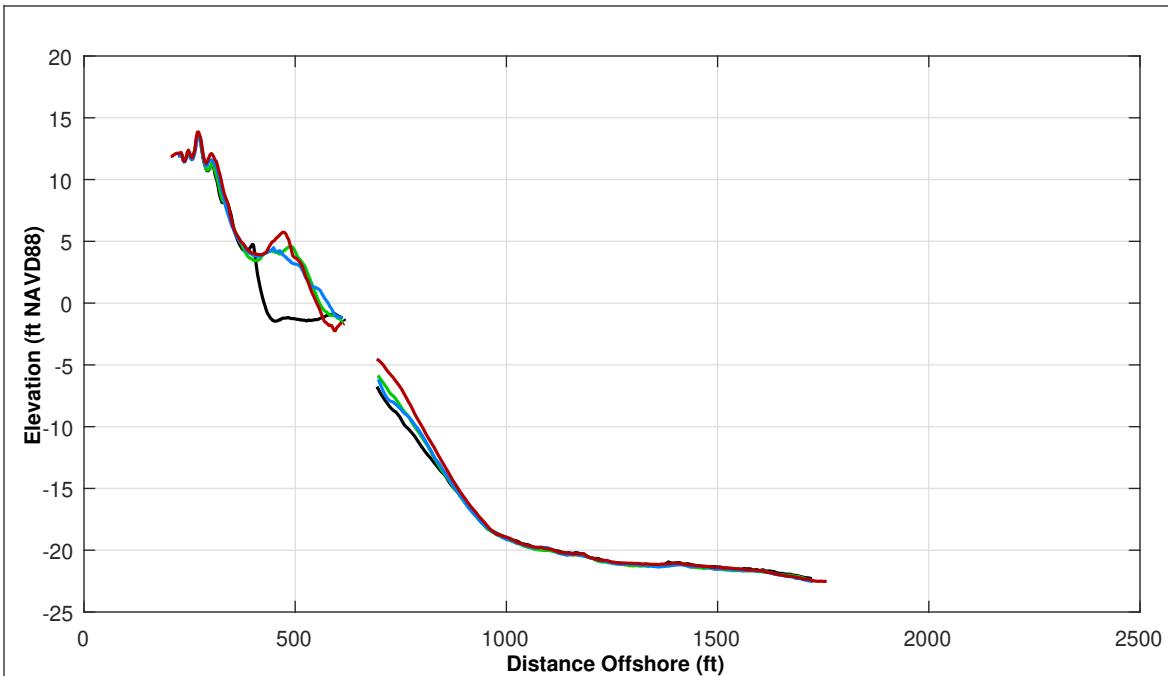
LEGEND:

- NOV 2018 (Red solid line)
- APR 2018 (Blue solid line)
- OCT 2016 (Black solid line)
- OCT 2017 (Green solid line)
- USACE Design Template (Black dashed line)
- USACE Nourishment Threshold (Dashed line)

Notes:

1. Station From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward and Seaward Of The Breakwater.



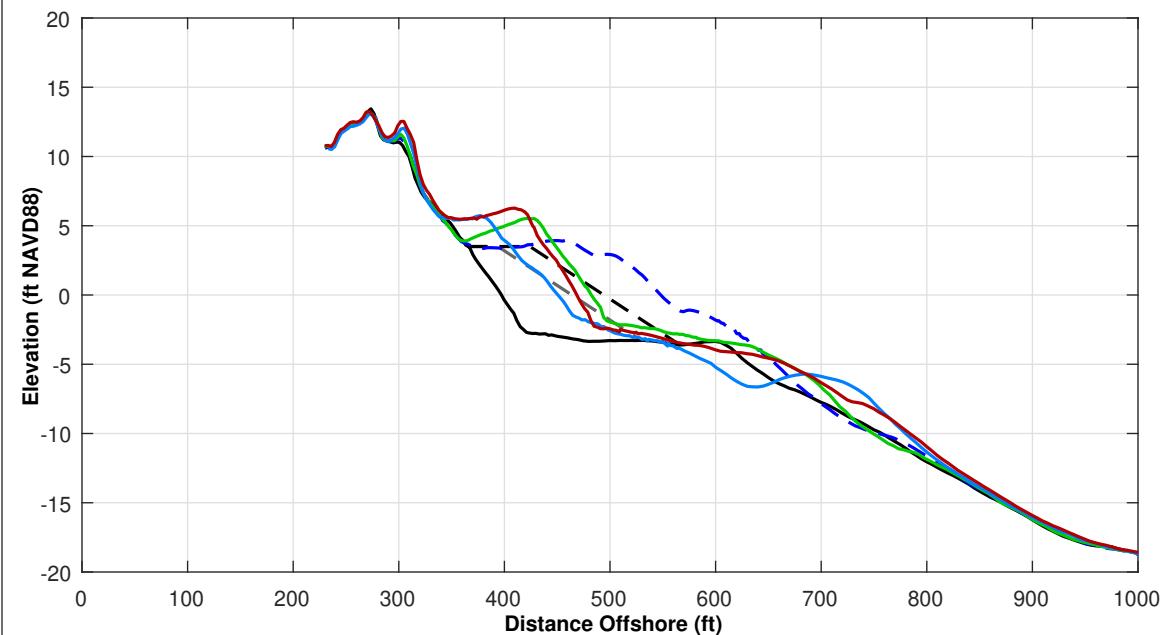
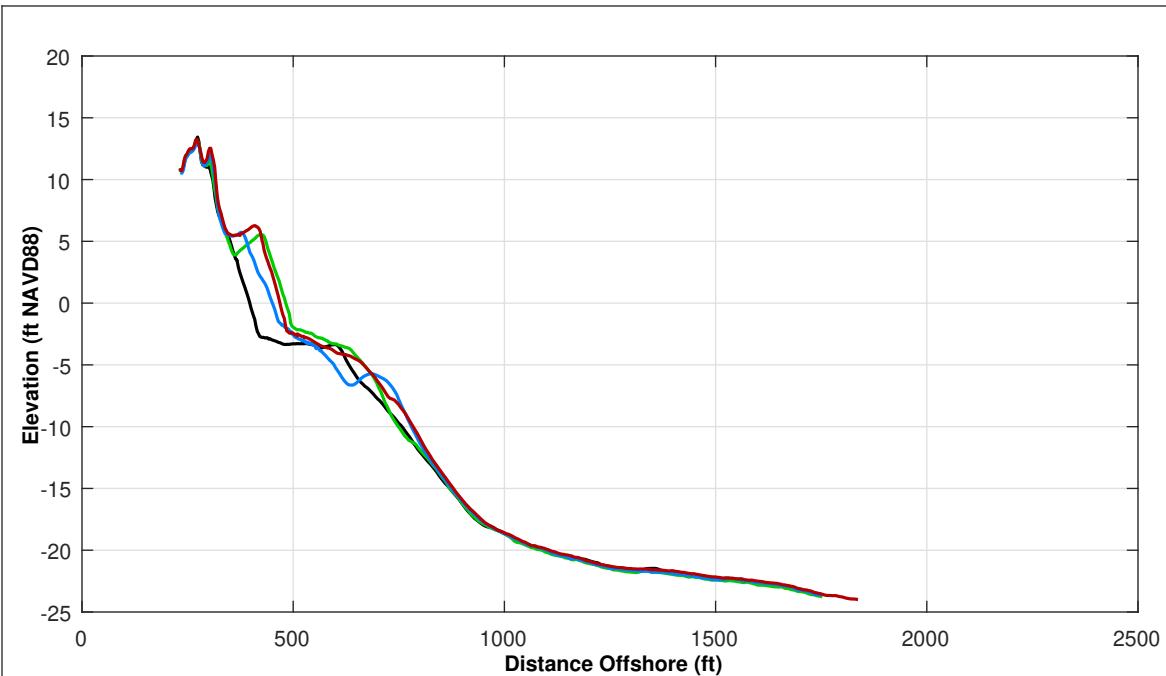


Survey Transect 191+63	NOV 2018 - OCT 2017	NOV 2018 - APR 2018
Shoreline Change at MHW (0.98 ft NAVD88)	-7.94 ft	-21.49 ft
Volume Change Above -15 ft NAVD88	9.41 cy/ft	9.36 cy/ft
Volume Change Above 0 ft NAVD88	3.85 cy/ft	3.98 cy/ft
Distance from USACE Design Template @ 3.5 feet NAVD88:		
LEGEND:		
NOV 2018	MAY 2017	---
APR 2018	OCT 2016	—
OCT 2017	USACE Design Template	— - -
	USACE Nourishment Threshold	— - - -

Notes:

1. Station From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward and Seaward Of The Breakwater.



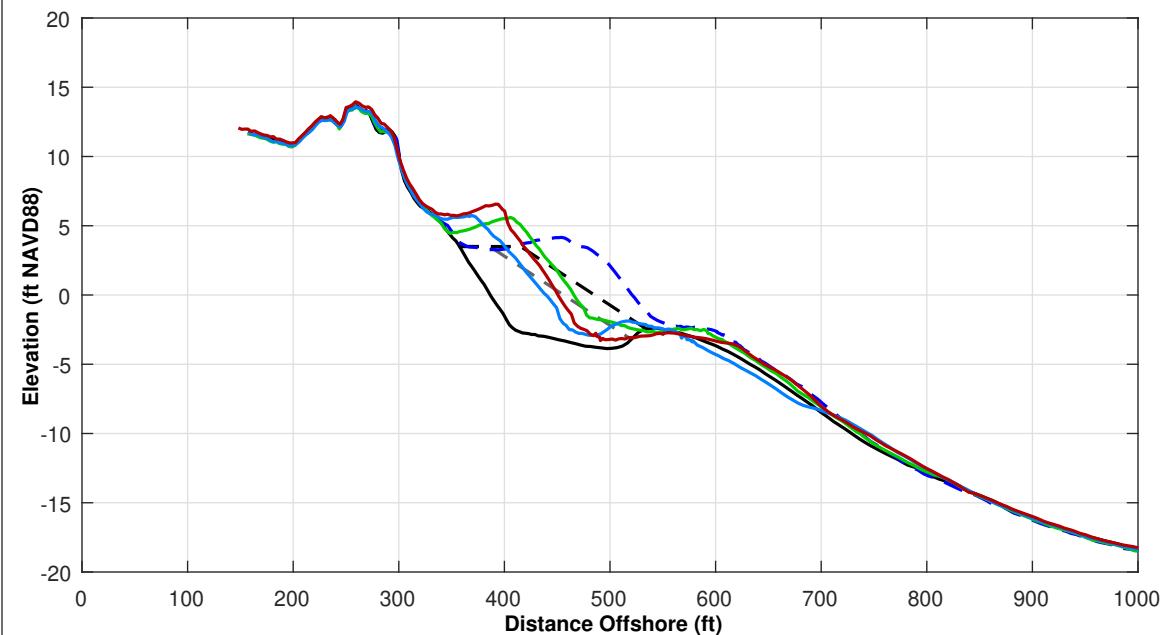
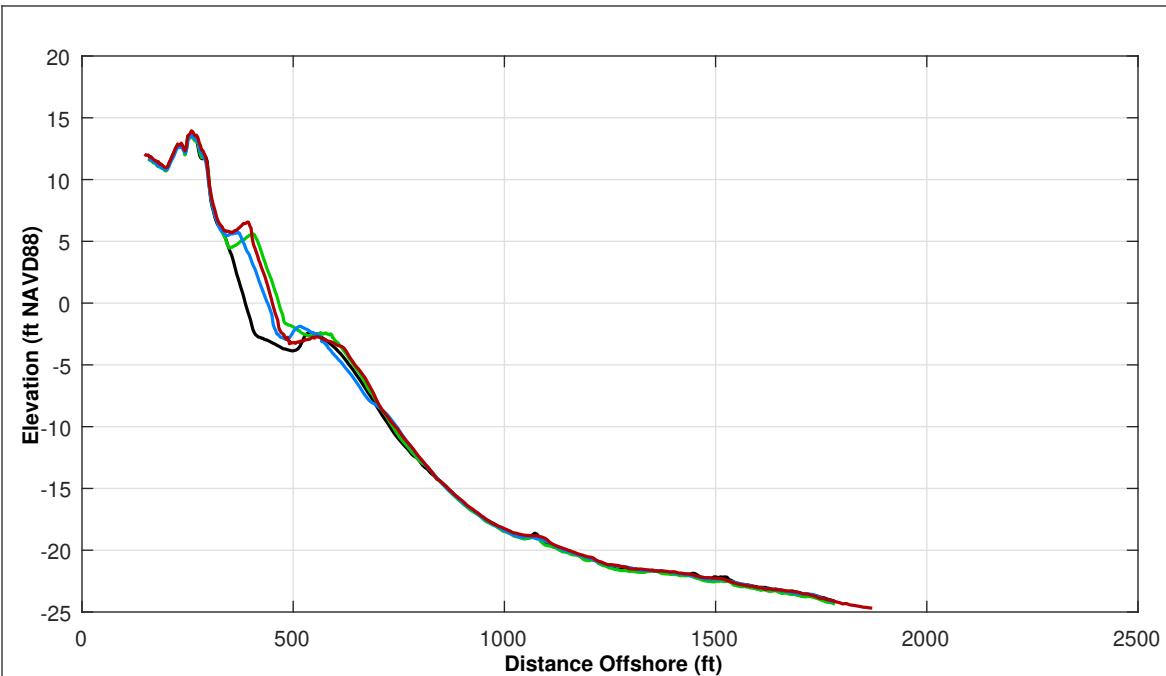


Survey Transect 193+63	NOV 2018 - OCT 2017	NOV 2018 - APR 2018
Shoreline Change at MHW (0.98 ft NAVD88)	-11.95 ft	20.79 ft
Volume Change Above -15 ft NAVD88	4.75 cy/ft	15.36 cy/ft
Volume Change Above 0 ft NAVD88	2.92 cy/ft	8.36 cy/ft
Distance from USACE Design Template @ 3.5 feet NAVD88:		
LEGEND: NOV 2018 — NOV 2017 APR 2018 — OCT 2016 OCT 2017 — USACE Design Template USACE Nourishment Threshold — USACE Nourishment Threshold		

Notes:

1. Station From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward and Seaward Of The Breakwater.



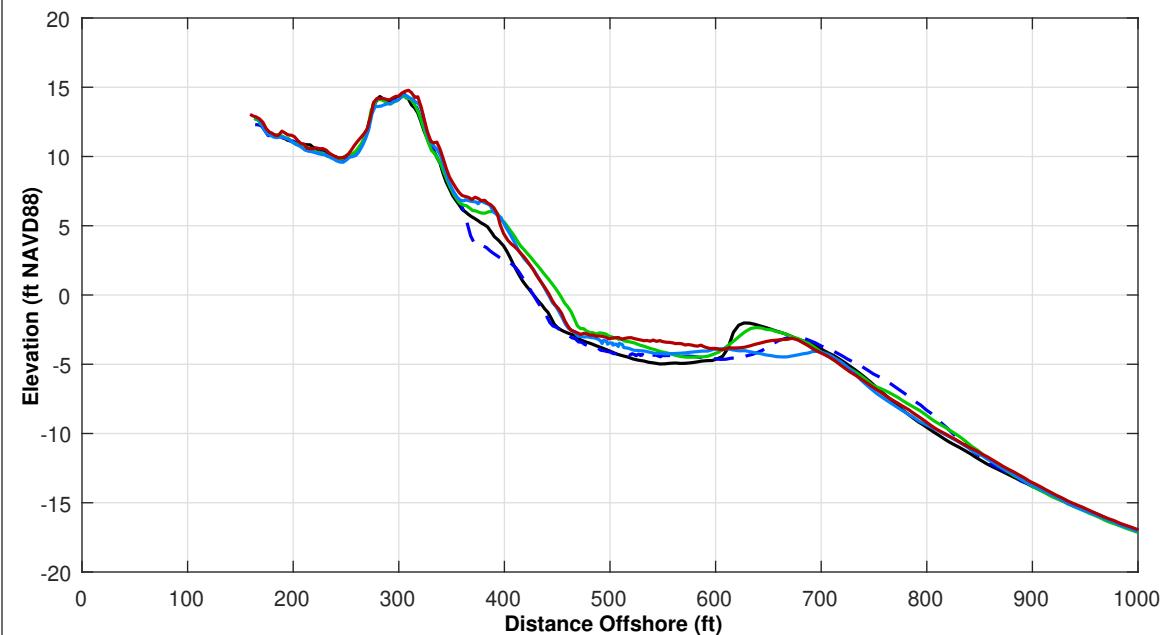
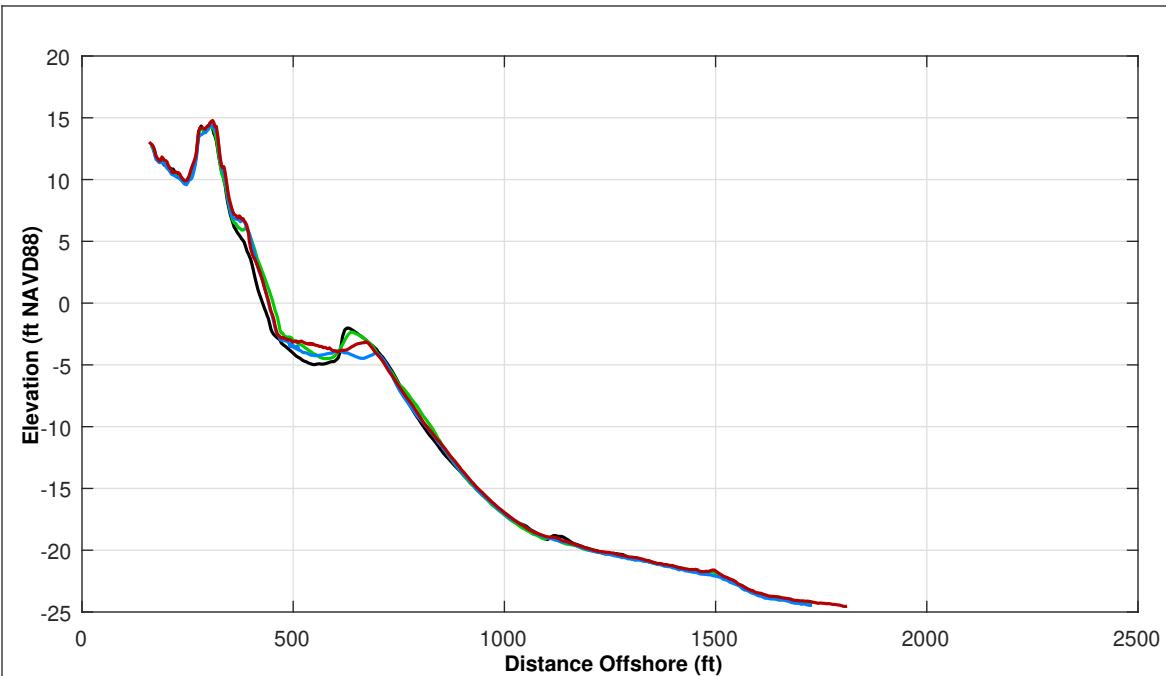


Survey Transect 195+63	NOV 2018 - OCT 2017	NOV 2018 - APR 2018
Shoreline Change at MHW (0.98 ft NAVD88)	-13.79 ft	14.96 ft
Volume Change Above -15 ft NAVD88	-0.40 cy/ft	10.90 cy/ft
Volume Change Above 0 ft NAVD88	1.96 cy/ft	6.76 cy/ft
Distance from USACE Design Template @ 3.5 feet NAVD88:		
LEGEND: NOV 2018 — MAY 2017 APR 2018 — OCT 2016 OCT 2017 — USACE Design Template USACE Nourishment Threshold —		

Notes:

1. Station From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward and Seaward Of The Breakwater.

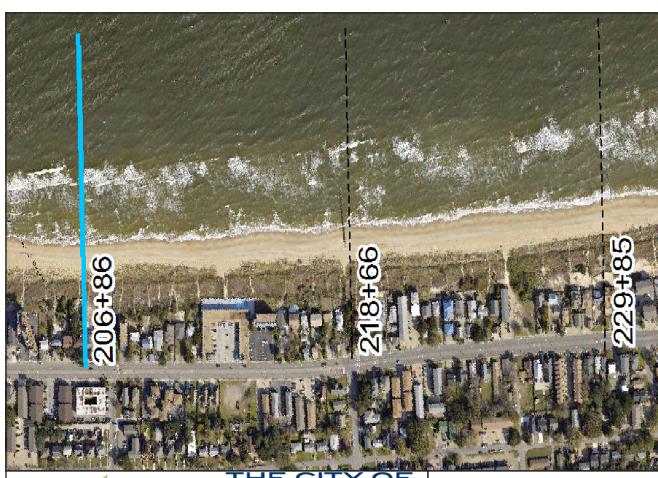


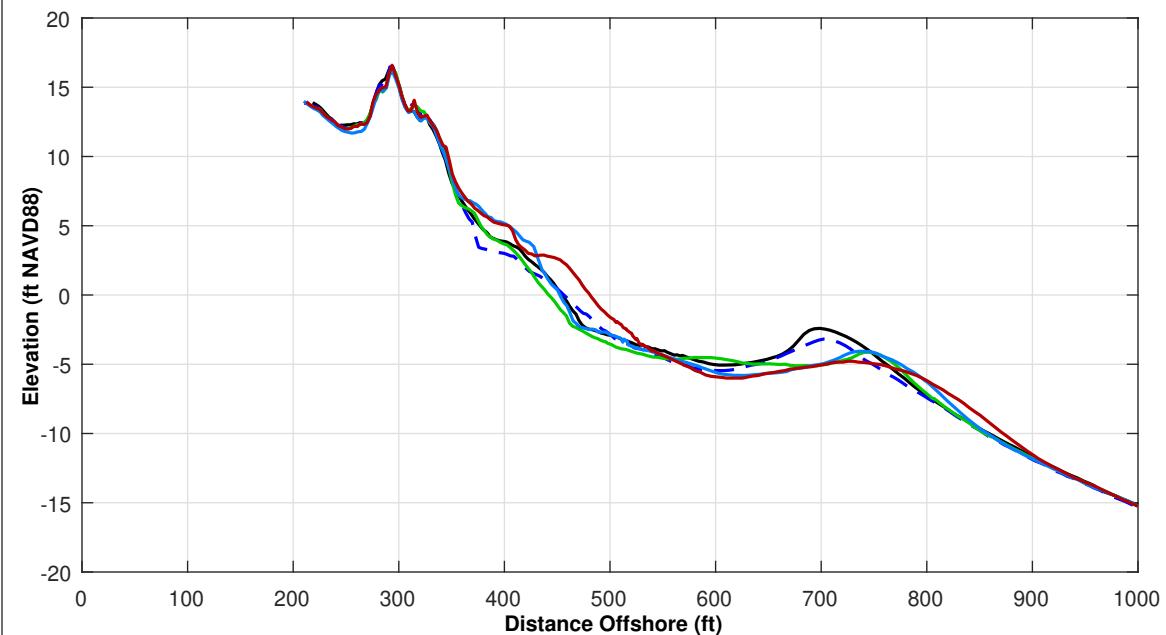
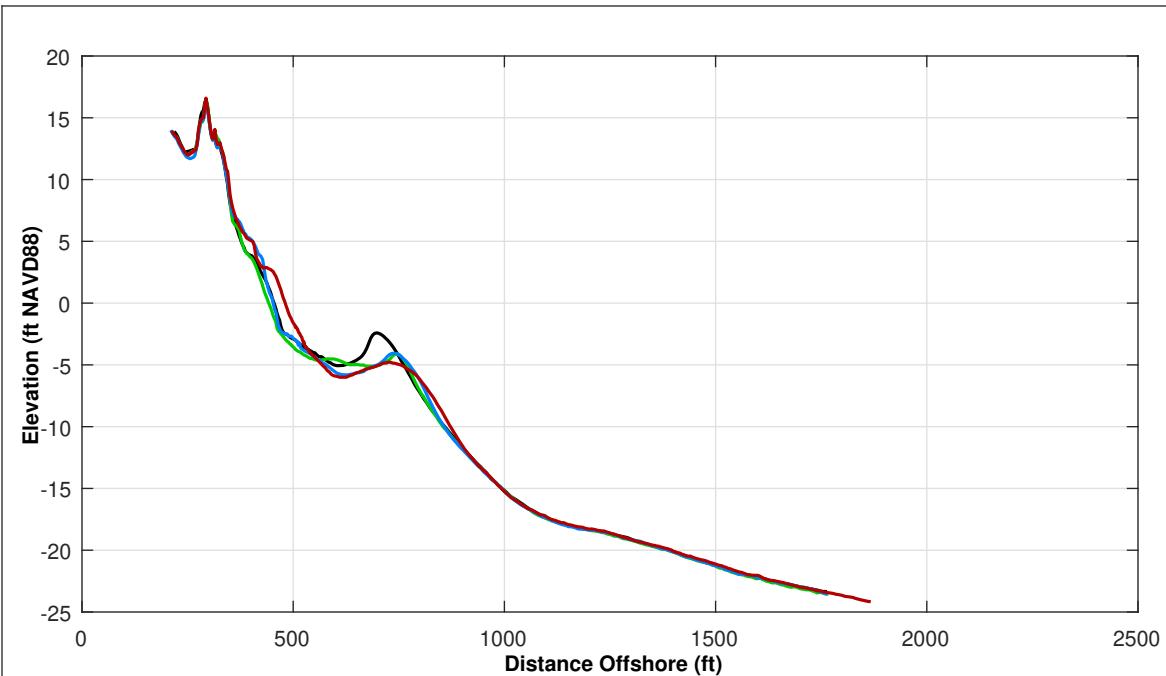


Survey Transect 206+86	NOV 2018 - OCT 2017	NOV 2018 - APR 2018
Shoreline Change at MHW (0.98 ft NAVD88)	-9.14 ft	-0.11 ft
Volume Change Above -15 ft NAVD88	-0.19 cy/ft	8.45 cy/ft
Volume Change Above 0 ft NAVD88	1.83 cy/ft	2.46 cy/ft
Distance from USACE Design Template @ 3.5 feet NAVD88:		
LEGEND:		
NOV 2018	—	MAY 2017
APR 2018	—	OCT 2016
OCT 2017	—	—

Notes:

1. Station From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward and Seaward Of The Breakwater.

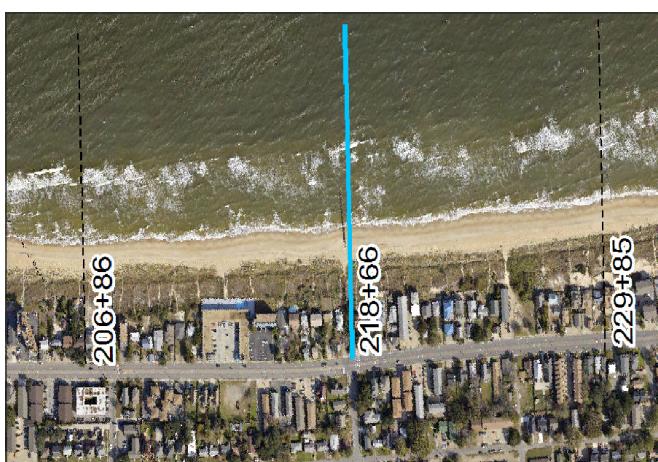


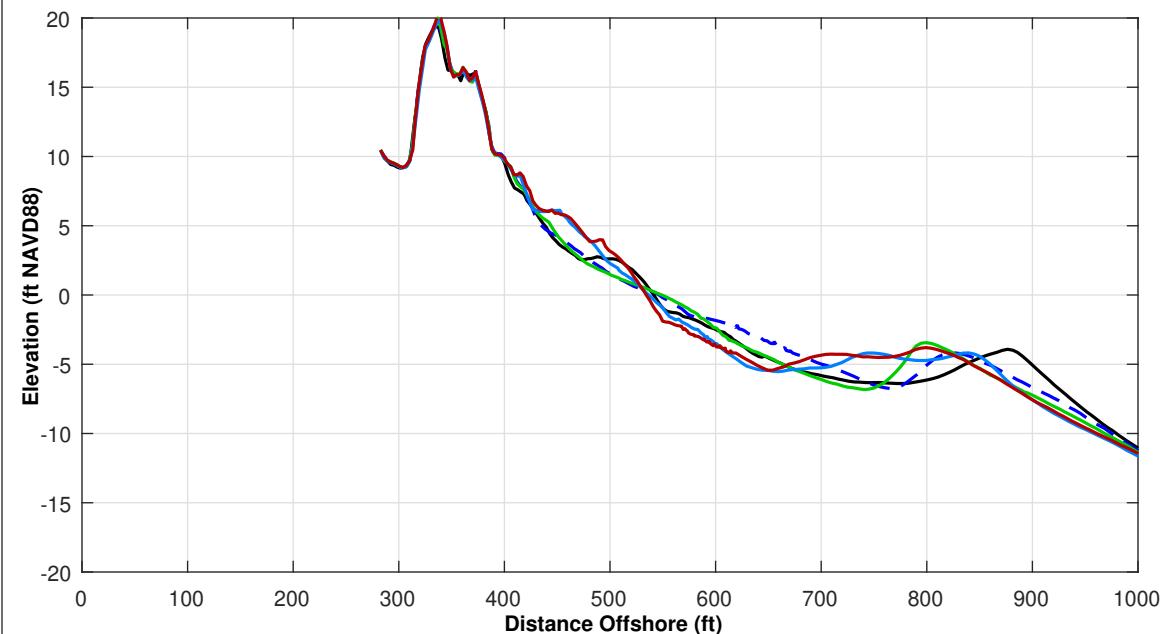
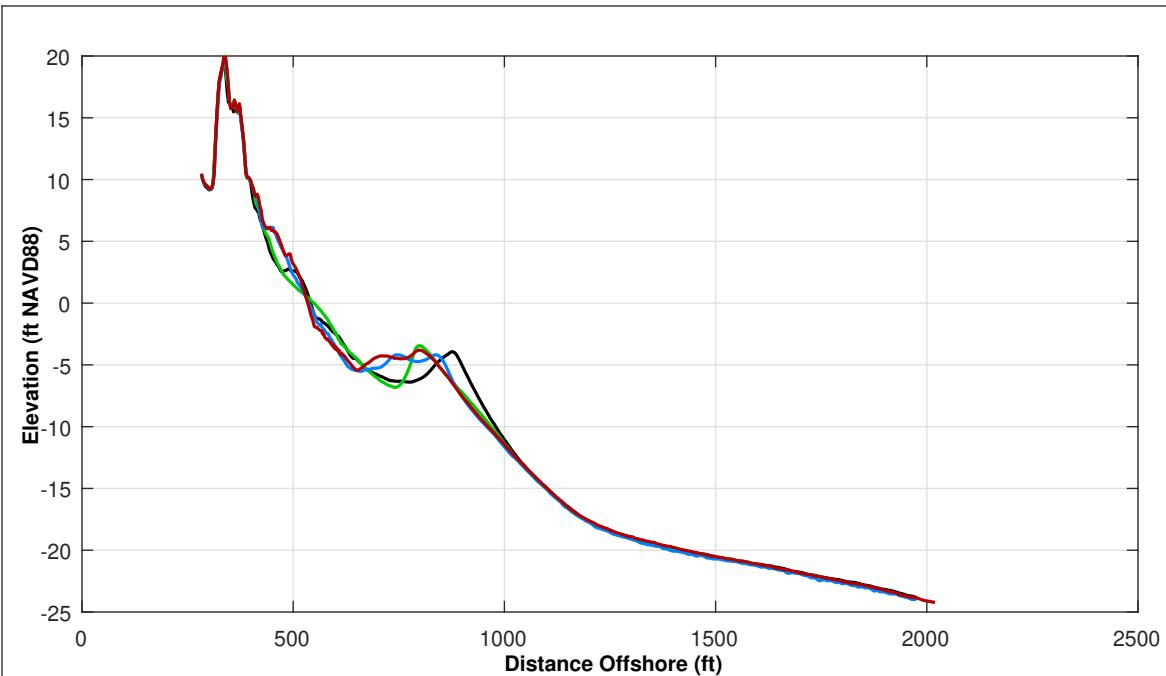


Survey Transect 218+66	NOV 2018 - OCT 2017	NOV 2018 - APR 2018
Shoreline Change at MHW (0.98 ft NAVD88)	40.34 ft	28.94 ft
Volume Change Above -15 ft NAVD88	12.16 cy/ft	7.85 cy/ft
Volume Change Above 0 ft NAVD88	6.87 cy/ft	3.45 cy/ft
Distance from USACE Design Template @ 3.5 feet NAVD88:		
LEGEND: NOV 2018 — NOV 2018 APR 2018 — APR 2018 OCT 2017 — OCT 2017 MAY 2017 — MAY 2017 OCT 2016 — OCT 2016		

Notes:

1. Station From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward and Seaward Of The Breakwater.



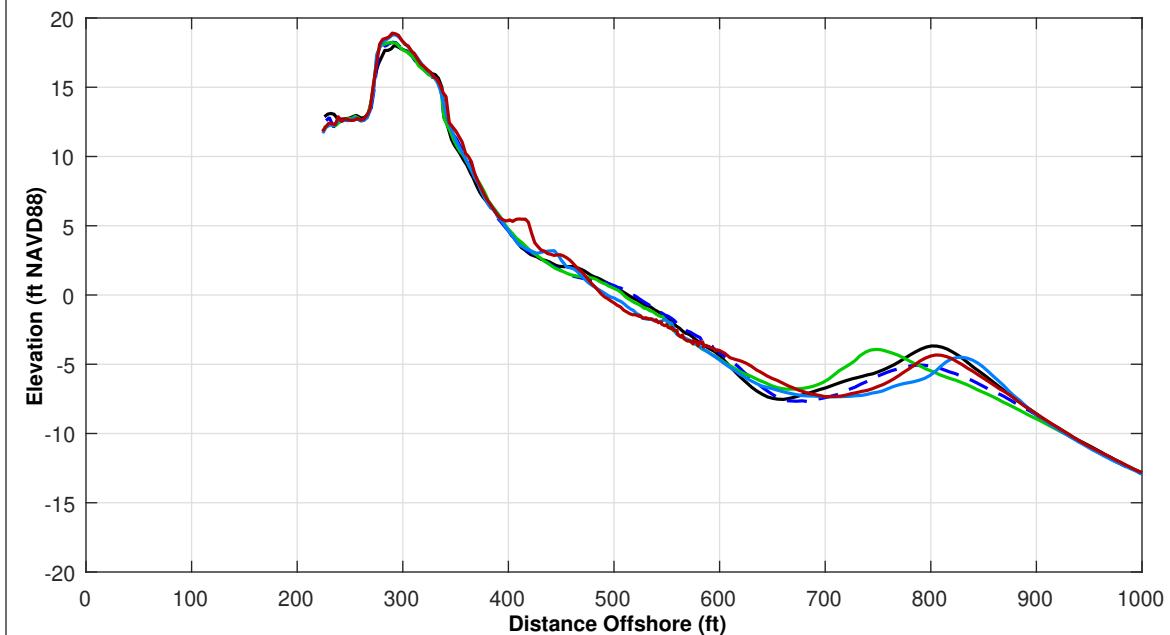
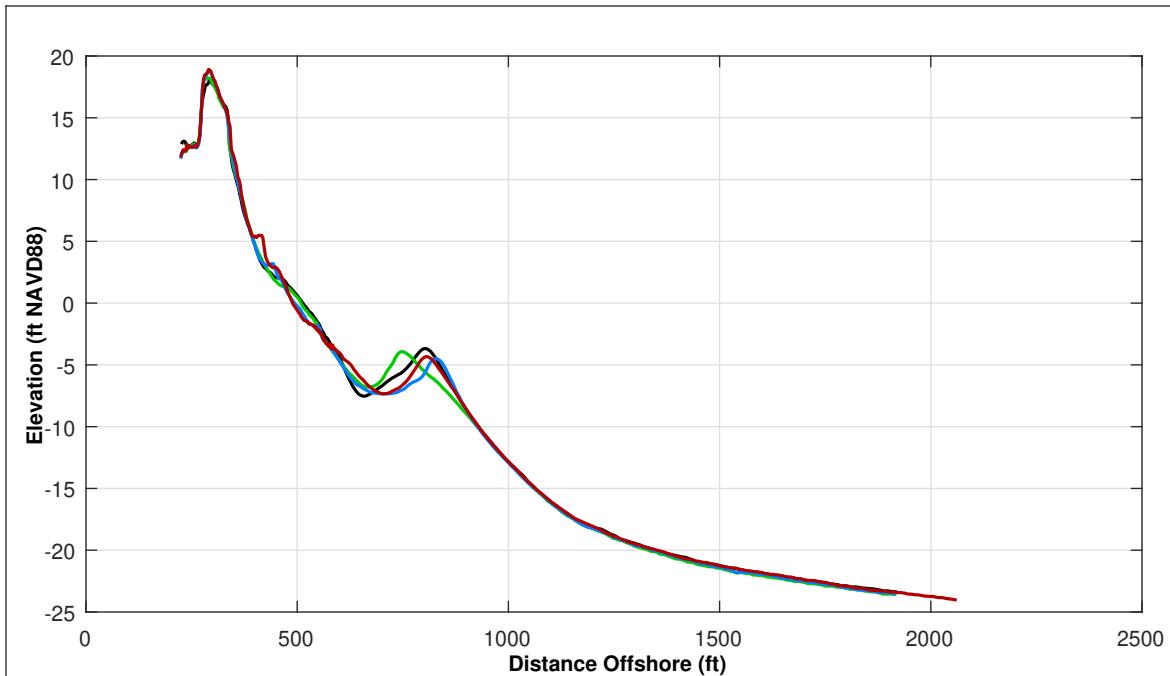


Survey Transect 229+85	NOV 2018 - OCT 2017	NOV 2018 - APR 2018
Shoreline Change at MHW (0.98 ft NAVD88)	9.86 ft	2.59 ft
Volume Change Above -15 ft NAVD88	6.01 cy/ft	3.96 cy/ft
Volume Change Above 0 ft NAVD88	6.08 cy/ft	2.27 cy/ft
Distance from USACE Design Template @ 3.5 feet NAVD88:		
LEGEND: NOV 2018 — APR 2018 — OCT 2017 — MAY 2017 OCT 2016 —		

Notes:

1. Station From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward and Seaward Of The Breakwater.



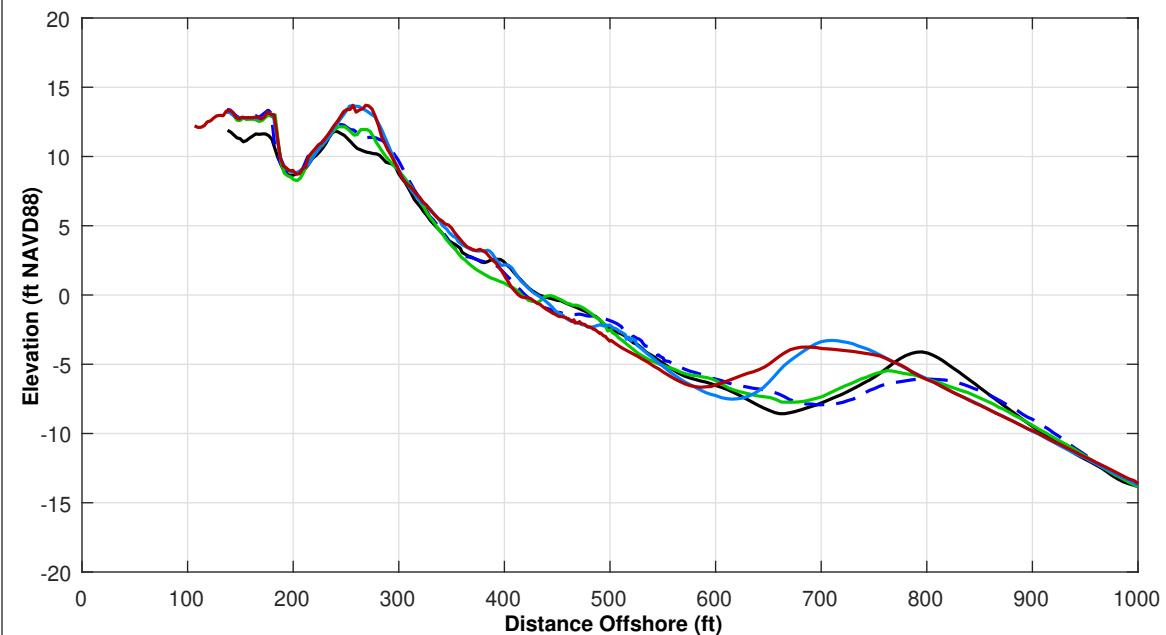
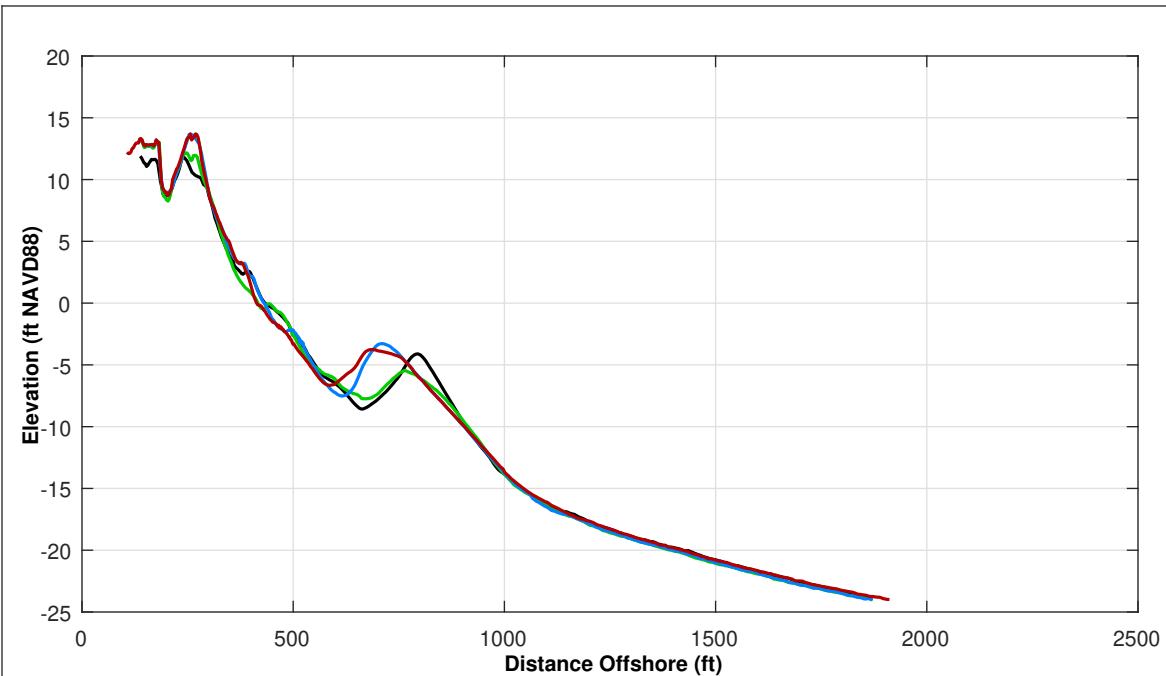


Survey Transect 242+03	NOV 2018 - OCT 2017	NOV 2018 - APR 2018
Shoreline Change at MHW (0.98 ft NAVD88)	-9.07 ft	2.76 ft
Volume Change Above -15 ft NAVD88	2.18 cy/ft	7.03 cy/ft
Volume Change Above 0 ft NAVD88	3.80 cy/ft	2.99 cy/ft
Distance from USACE Design Template @ 3.5 feet NAVD88:		
LEGEND: NOV 2018 — NOV 2018 APR 2018 — APR 2018 OCT 2017 — OCT 2017 MAY 2017 — MAY 2017 OCT 2016 — OCT 2016		

Notes:

1. Station From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward and Seaward Of The Breakwater.

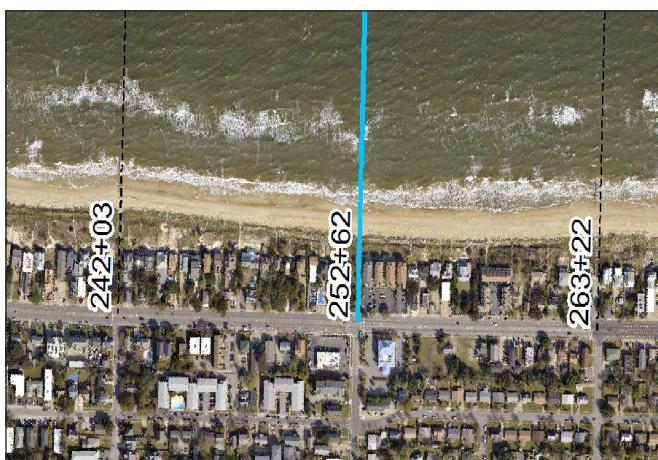


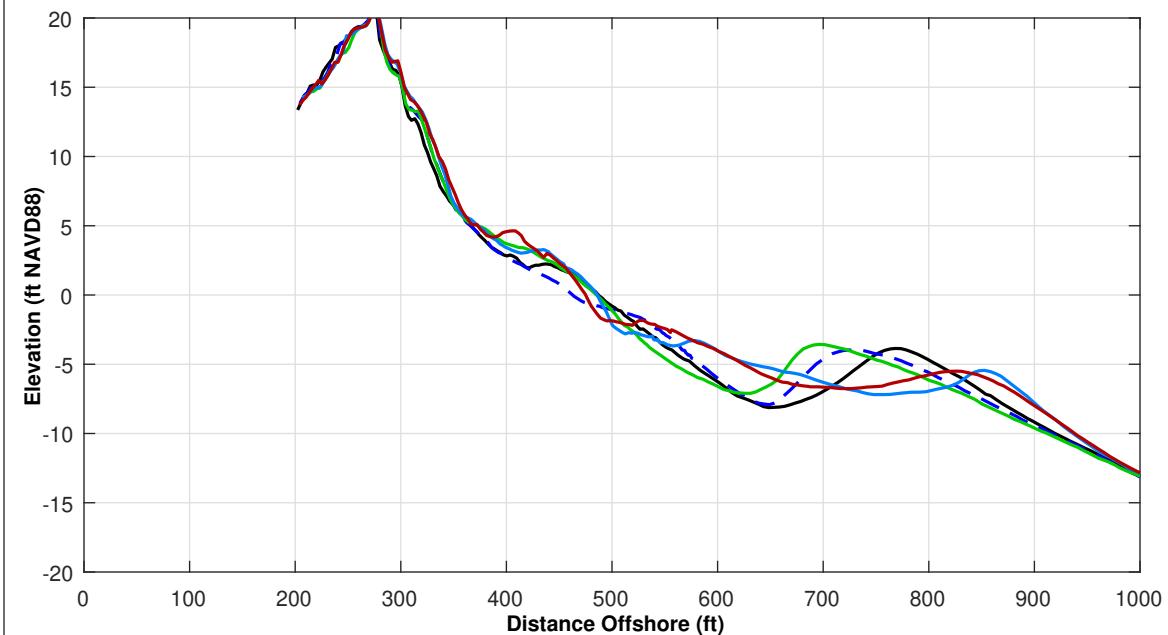
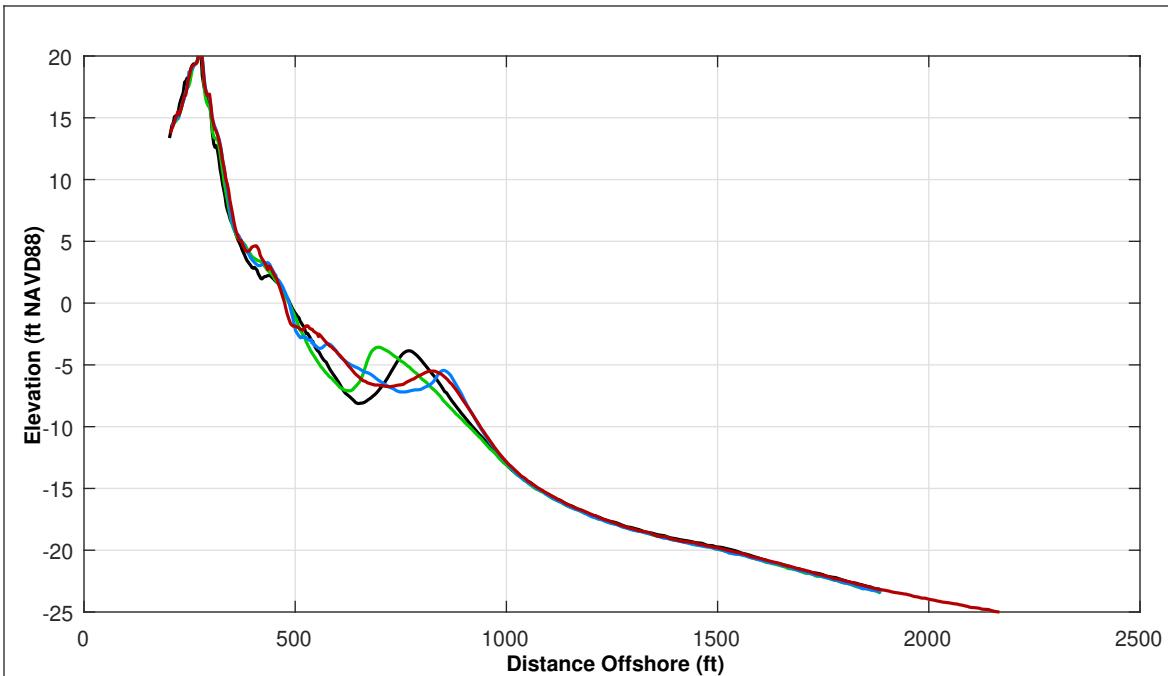


Survey Transect 252+62	NOV 2018 - OCT 2017	NOV 2018 - APR 2018
Shoreline Change at MHW (0.98 ft NAVD88)	7.78 ft	-12.67 ft
Volume Change Above -15 ft NAVD88	14.91 cy/ft	0.22 cy/ft
Volume Change Above 0 ft NAVD88	6.51 cy/ft	-0.58 cy/ft
Distance from USACE Design Template @ 3.5 feet NAVD88:		
LEGEND: NOV 2018 — NOV 2018 APR 2018 — APR 2018 OCT 2017 — OCT 2017 MAY 2017 — MAY 2017 OCT 2016 — OCT 2016		

Notes:

1. Station From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward and Seaward Of The Breakwater.



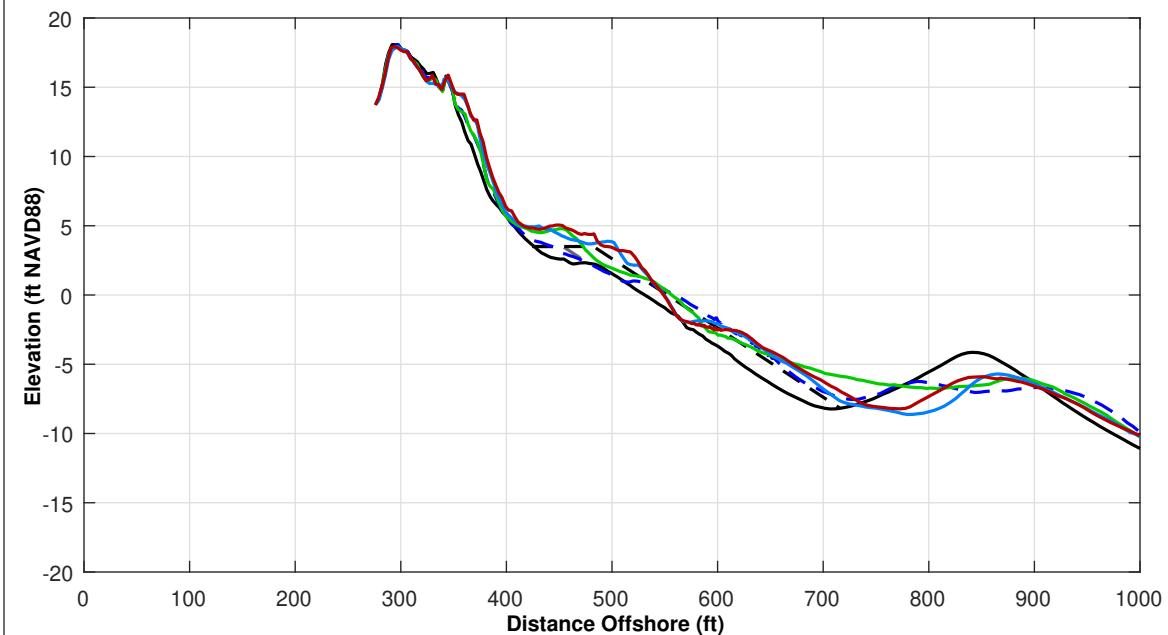
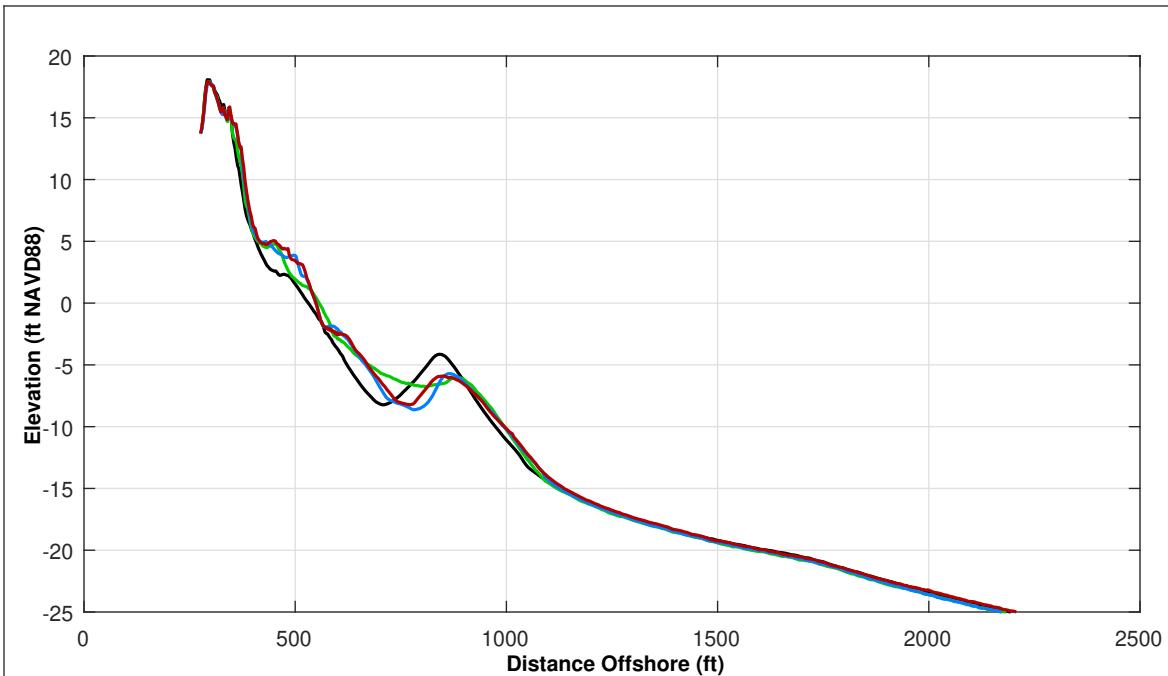


Survey Transect 263+22	NOV 2018 - OCT 2017	NOV 2018 - APR 2018
Shoreline Change at MHW (0.98 ft NAVD88)	-4.17 ft	-8.57 ft
Volume Change Above -15 ft NAVD88	12.13 cy/ft	3.37 cy/ft
Volume Change Above 0 ft NAVD88	3.48 cy/ft	0.83 cy/ft
Distance from USACE Design Template @ 3.5 feet NAVD88:		
LEGEND: NOV 2018 — NOV 2018 APR 2018 — APR 2018 OCT 2017 — OCT 2017 MAY 2017 — MAY 2017 OCT 2016 — OCT 2016		

Notes:

1. Station From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward and Seaward Of The Breakwater.



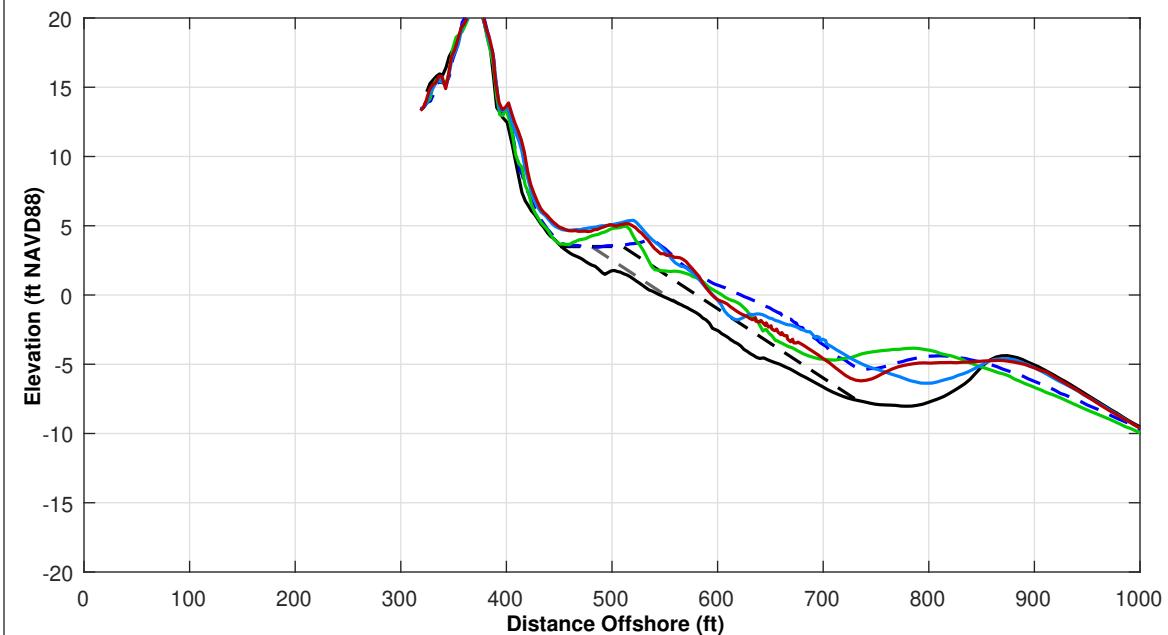
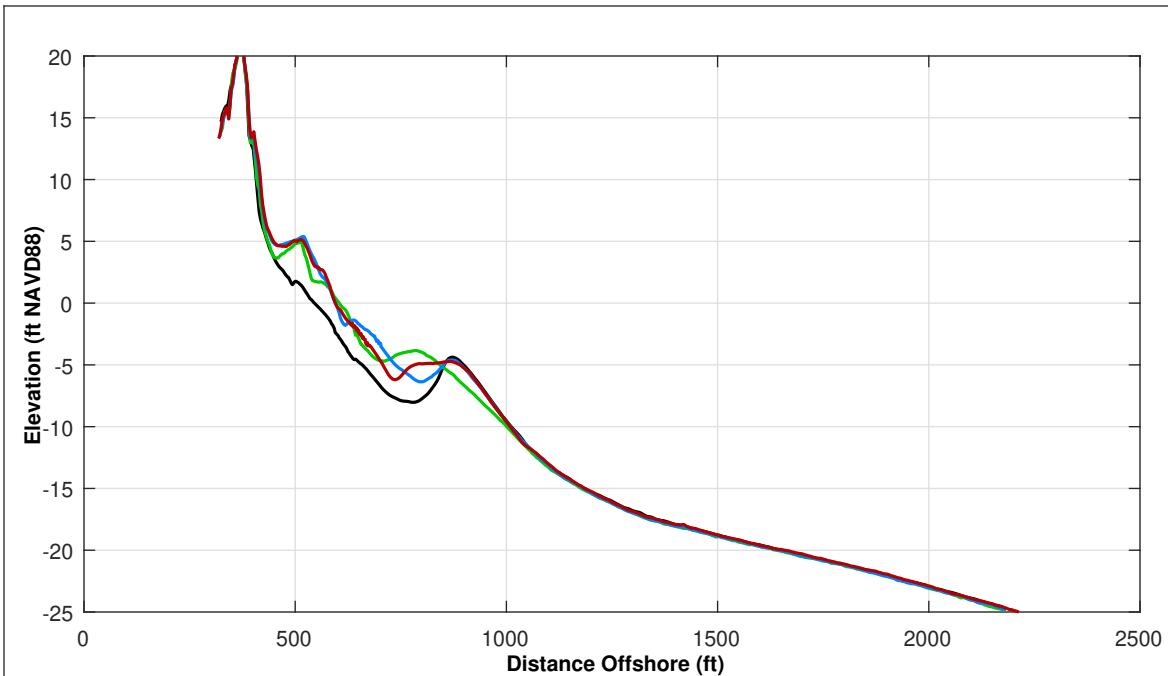


Survey Transect 274+53	NOV 2018 - OCT 2017	NOV 2018 - APR 2018
Shoreline Change at MHW (0.98 ft NAVD88)	-0.73 ft	0.44 ft
Volume Change Above -15 ft NAVD88	1.98 cy/ft	5.84 cy/ft
Volume Change Above 0 ft NAVD88	5.90 cy/ft	2.04 cy/ft

Notes:

1. Station From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward and Seaward Of The Breakwater.



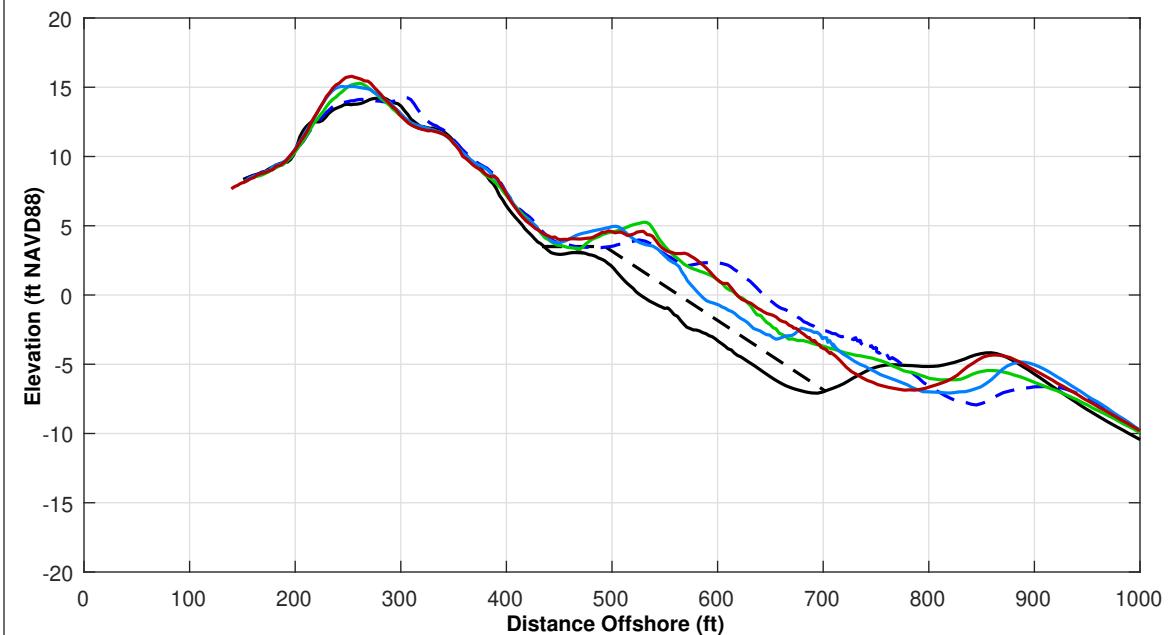
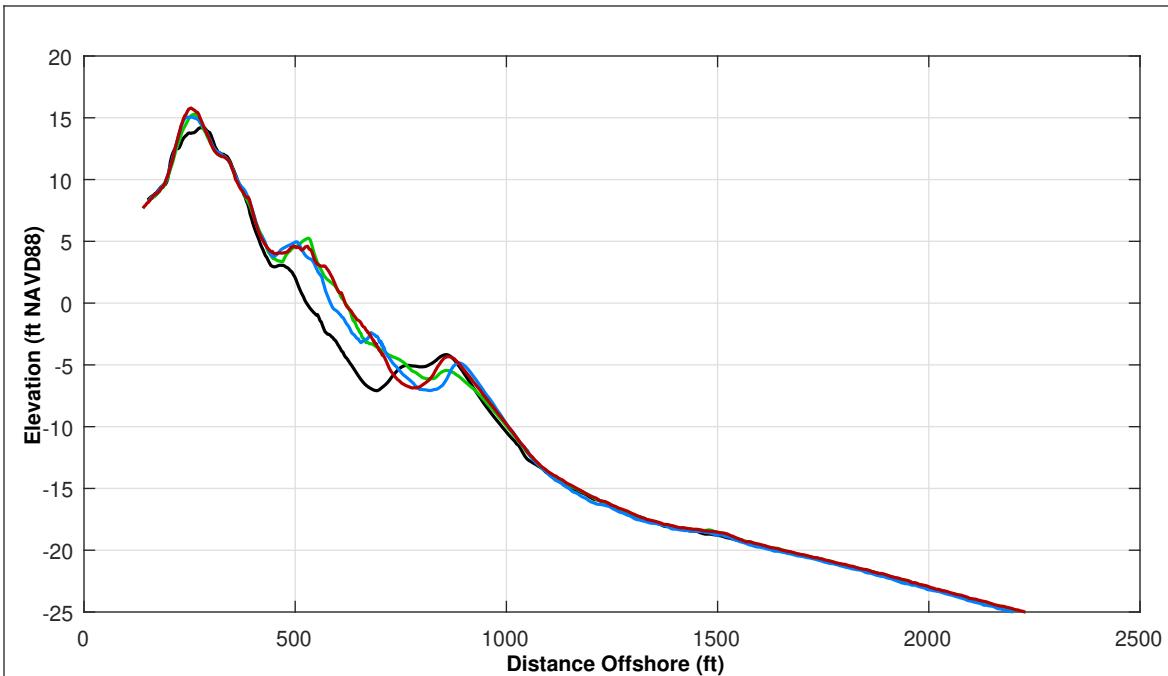


Survey Transect 281+40	NOV 2018 - OCT 2017	NOV 2018 - APR 2018
Shoreline Change at MHW (0.98 ft NAVD88)	-0.47 ft	1.32 ft
Volume Change Above -15 ft NAVD88	8.58 cy/ft	-0.01 cy/ft
Volume Change Above 0 ft NAVD88	6.60 cy/ft	0.71 cy/ft
Distance from USACE Design Template @ 3.5 feet NAVD88:		
LEGEND: NOV 2018 — NOV 2018 APR 2018 — APR 2018 MAY 2017 — MAY 2017 OCT 2016 — OCT 2016 USACE Design Template — USACE Design Template USACE Nourishment Threshold — USACE Nourishment Threshold		

Notes:

1. Station From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward and Seaward Of The Breakwater.



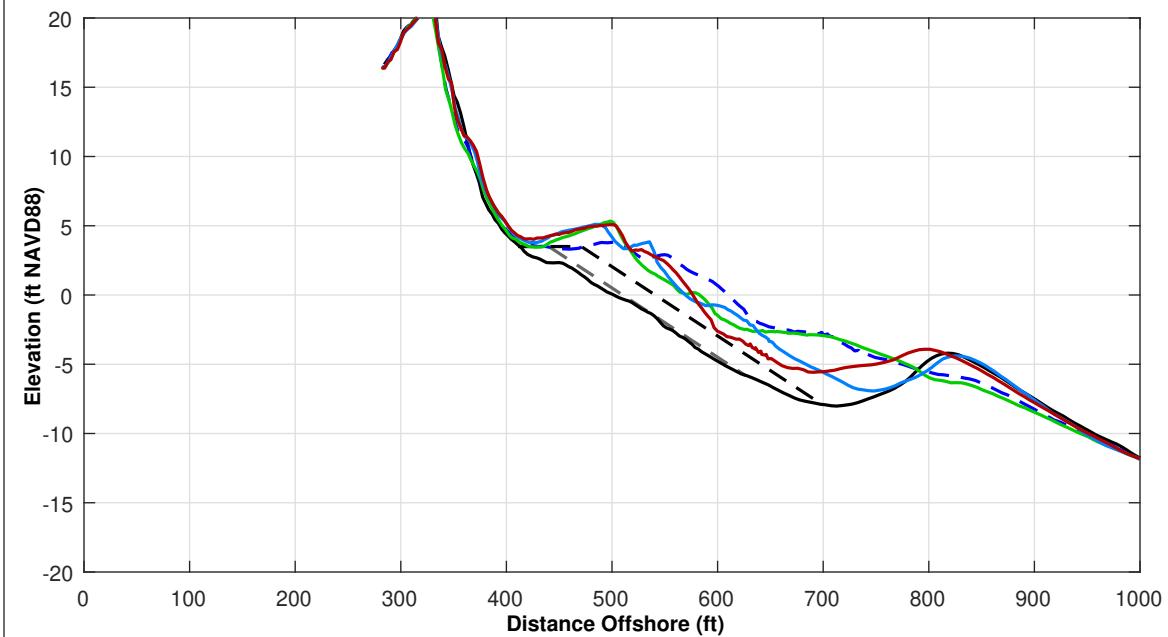
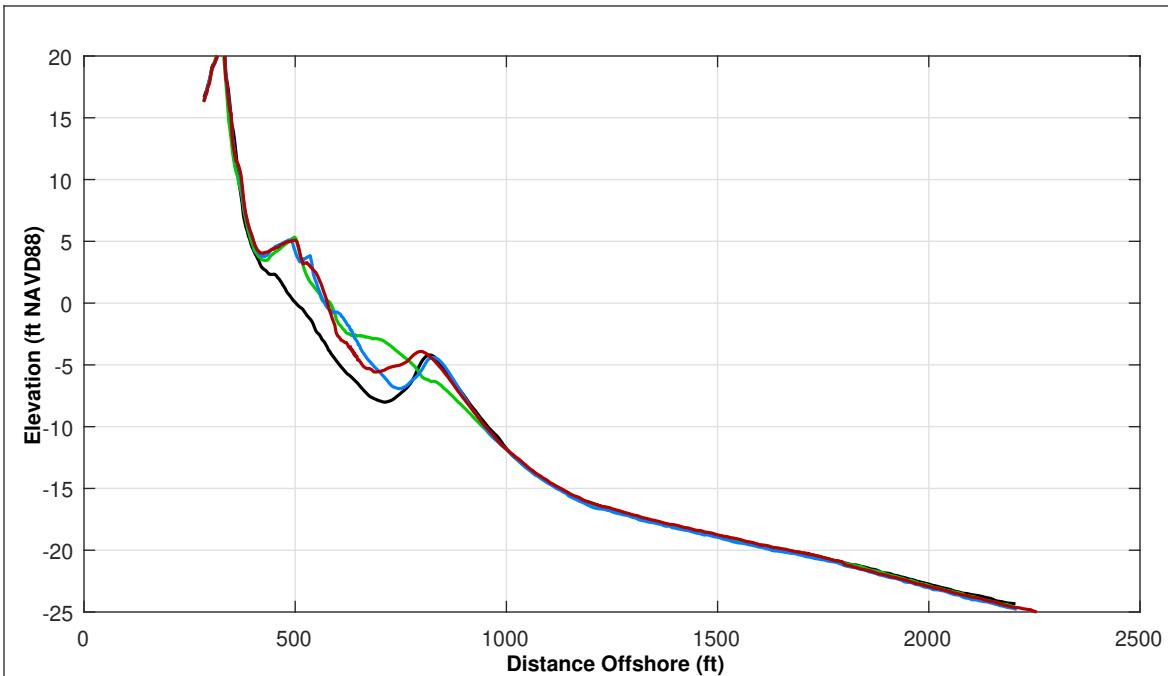


Survey Transect 288+39	NOV 2018 - OCT 2017	NOV 2018 - APR 2018
Shoreline Change at MHW (0.98 ft NAVD88)	0.36 ft	29.95 ft
Volume Change Above -15 ft NAVD88	3.81 cy/ft	7.95 cy/ft
Volume Change Above 0 ft NAVD88	2.42 cy/ft	3.54 cy/ft
Distance from USACE Design Template @ 3.5 feet NAVD88:		
LEGEND: NOV 2018 — NOV 2018 APR 2018 — APR 2018 MAY 2017 — MAY 2017 OCT 2016 — OCT 2016 USACE Design Template — USACE Design Template OCT 2017 — OCT 2017 USACE Nourishment Threshold — USACE Nourishment Threshold		

Notes:

1. Station From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward and Seaward Of The Breakwater.



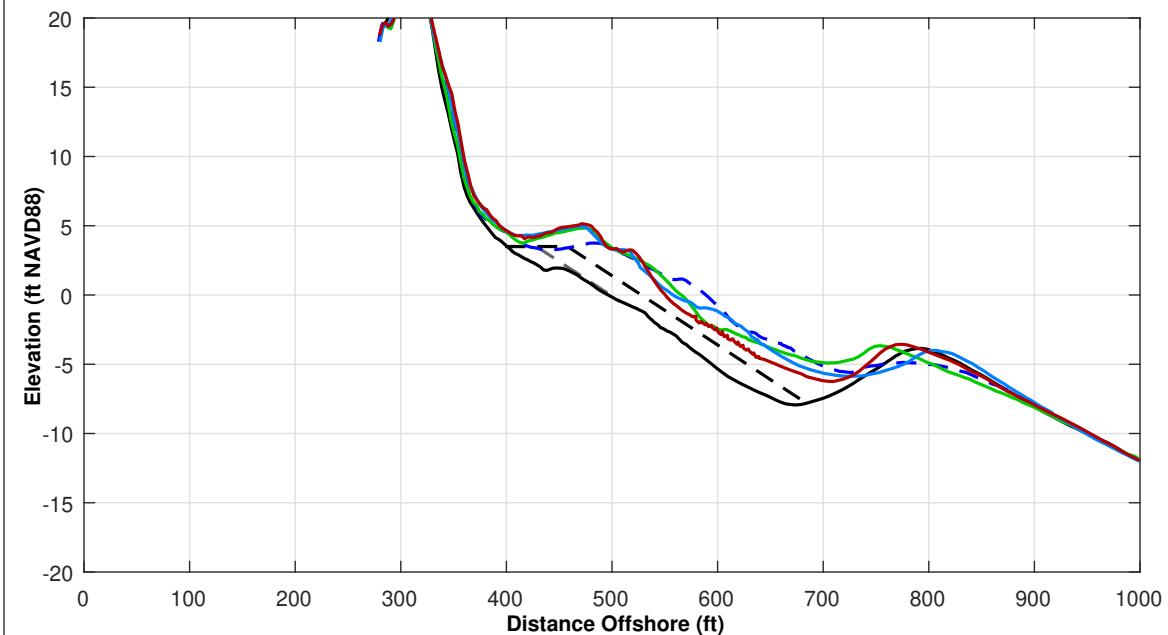
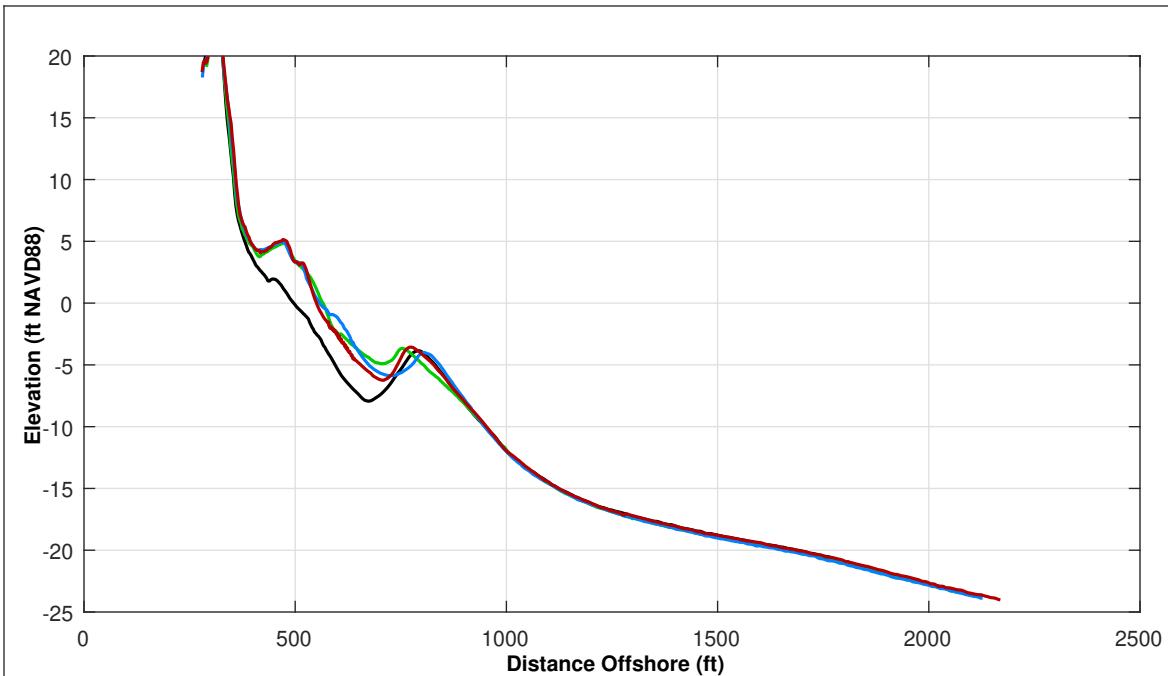


Survey Transect 295+27	NOV 2018 - OCT 2017	NOV 2018 - APR 2018
Shoreline Change at MHW (0.98 ft NAVD88)	14.81 ft	10.07 ft
Volume Change Above -15 ft NAVD88	2.25 cy/ft	2.50 cy/ft
Volume Change Above 0 ft NAVD88	5.55 cy/ft	1.26 cy/ft
Distance from USACE Design Template @ 3.5 feet NAVD88:		
LEGEND: NOV 2018 — NOV 2018 APR 2018 — APR 2018 MAY 2017 — MAY 2017 OCT 2016 — OCT 2016 USACE Design Template — USACE Design Template USACE Nourishment Threshold — USACE Nourishment Threshold		

Notes:

1. Station From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward and Seaward Of The Breakwater.



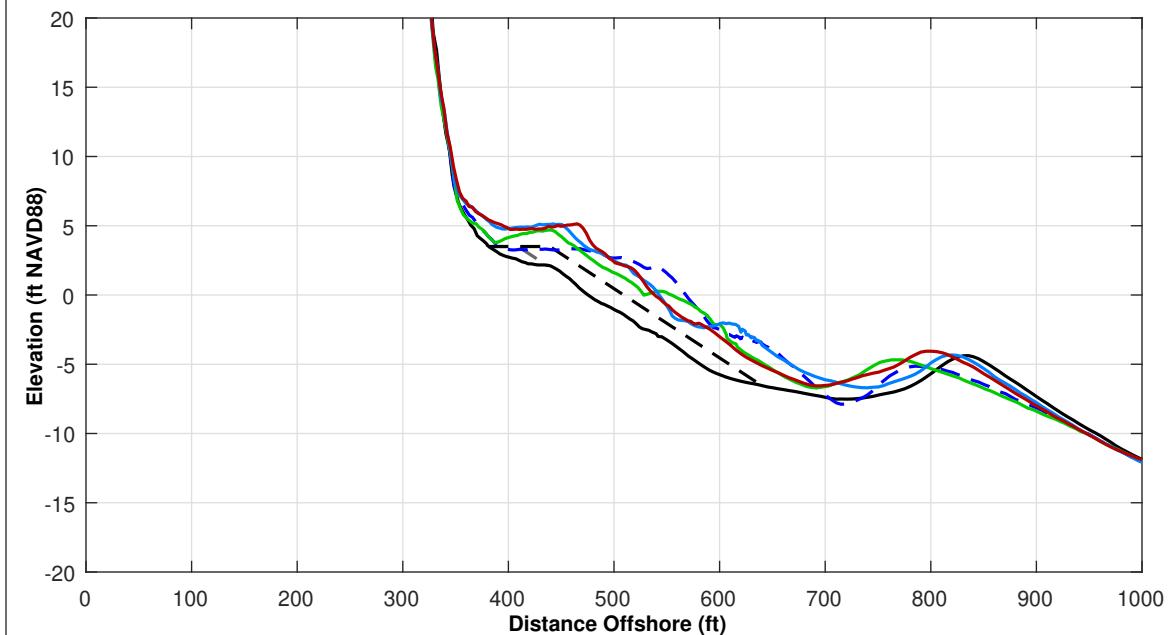
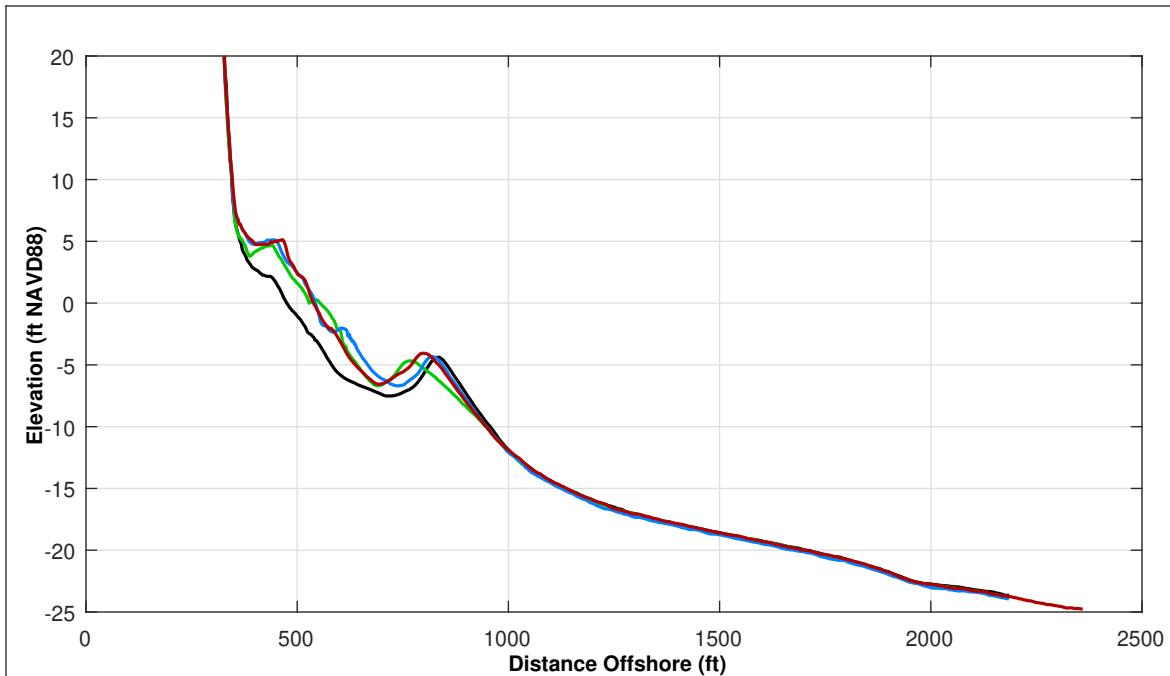


Survey Transect 302+24	NOV 2018 - OCT 2017	NOV 2018 - APR 2018
Shoreline Change at MHW (0.98 ft NAVD88)	-11.86 ft	-1.17 ft
Volume Change Above -15 ft NAVD88	-0.20 cy/ft	-2.75 cy/ft
Volume Change Above 0 ft NAVD88	2.98 cy/ft	0.78 cy/ft

Notes:

1. Station From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward and Seaward Of The Breakwater.



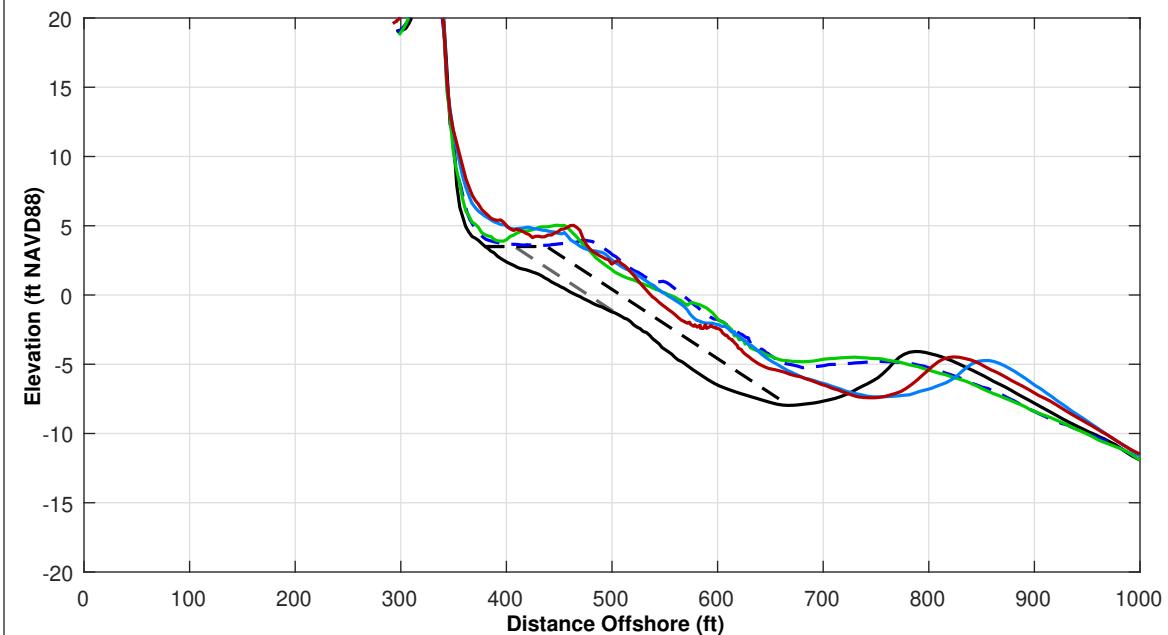
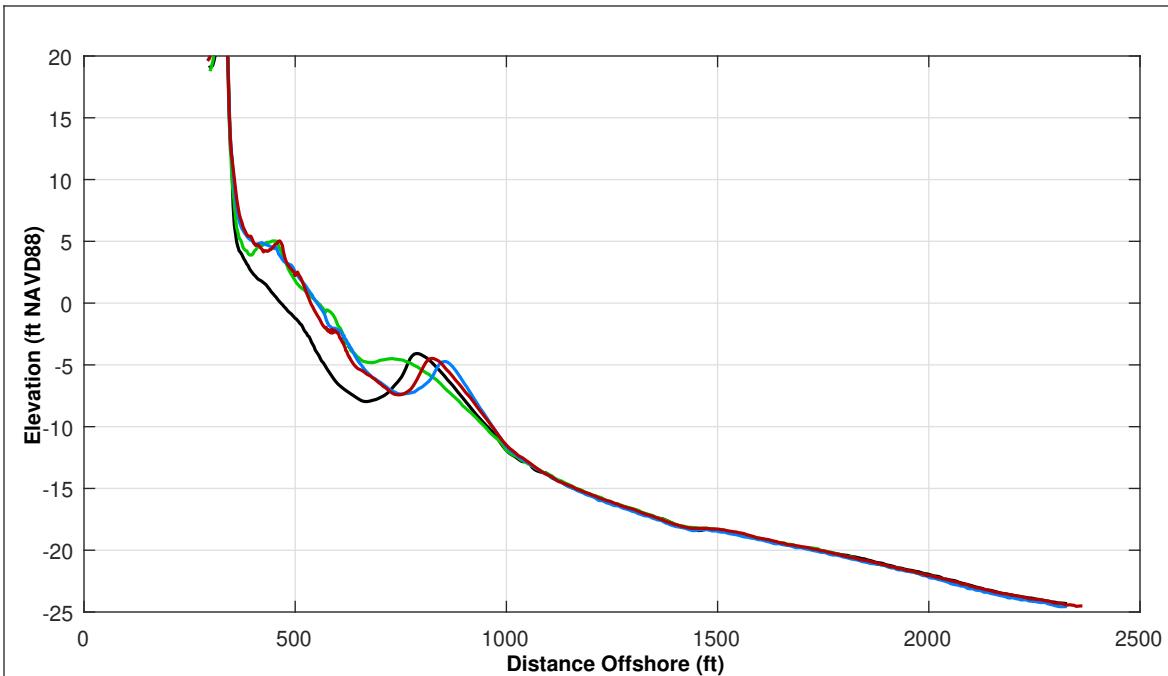


Survey Transect 315+96	NOV 2018 - OCT 2017	NOV 2018 - APR 2018
Shoreline Change at MHW (0.98 ft NAVD88)	12.86 ft	-2.09 ft
Volume Change Above -15 ft NAVD88	8.61 cy/ft	-0.18 cy/ft
Volume Change Above 0 ft NAVD88	6.60 cy/ft	0.95 cy/ft
Distance from USACE Design Template @ 3.5 feet NAVD88:		
LEGEND: NOV 2018 — NOV 2018 APR 2018 — APR 2018 MAY 2017 — MAY 2017 OCT 2016 — OCT 2016 USACE Design Template — USACE Design Template USACE Nourishment Threshold — USACE Nourishment Threshold		

Notes:

1. Station From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward and Seaward Of The Breakwater.





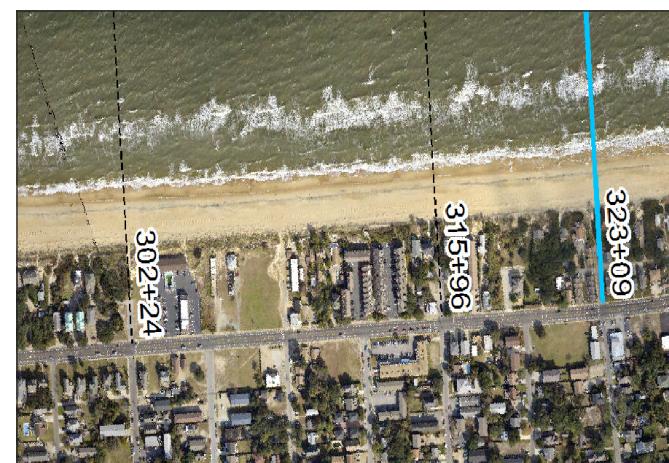
Survey Transect 323+09	NOV 2018 - OCT 2017	NOV 2018 - APR 2018
Shoreline Change at MHW (0.98 ft NAVD88)	ft	ft
Volume Change Above -15 ft NAVD88	cy/ft	cy/ft
Volume Change Above 0 ft NAVD88	cy/ft	cy/ft
Distance from USACE Design Template @ 3.5 feet NAVD88:		

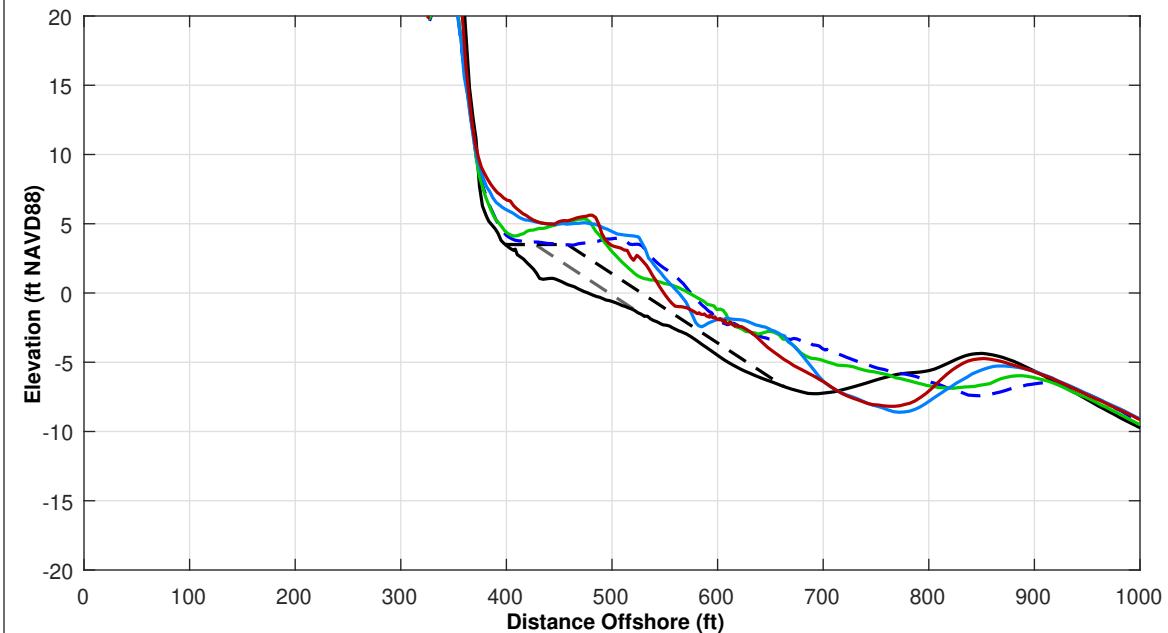
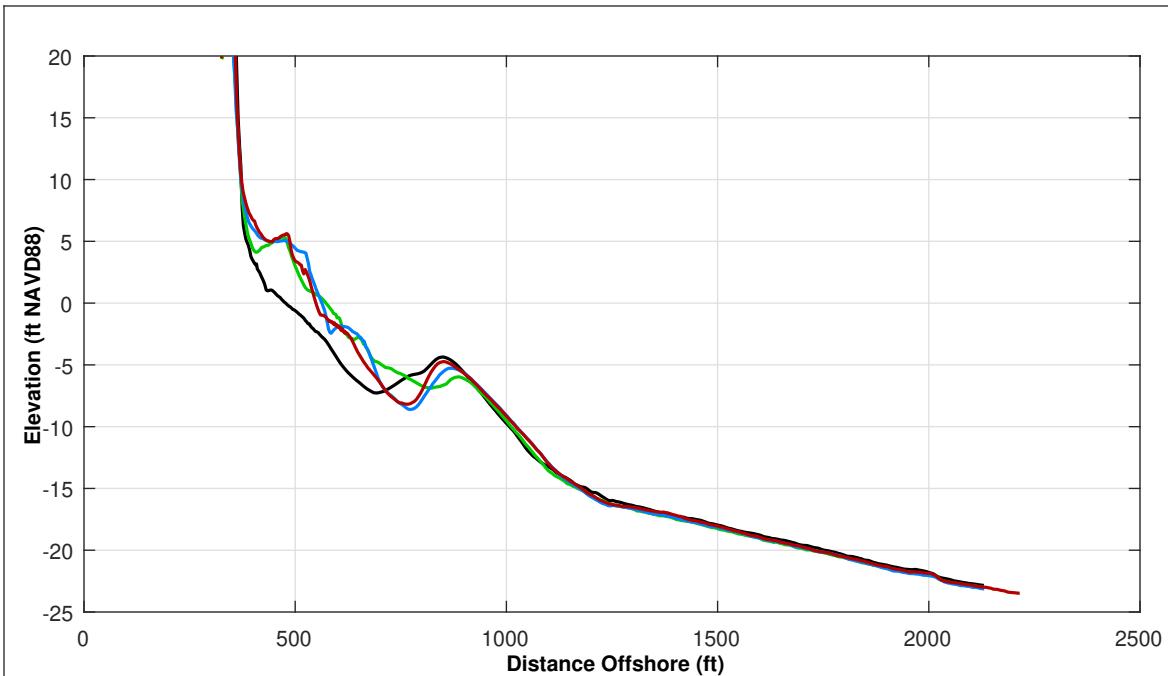
LEGEND:

NOV 2018	MAY 2017
APR 2018	OCT 2016
OCT 2017	USACE Design Template
USACE Nourishment Threshold	USACE Nourishment Threshold

Notes:

1. Station From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward and Seaward Of The Breakwater.



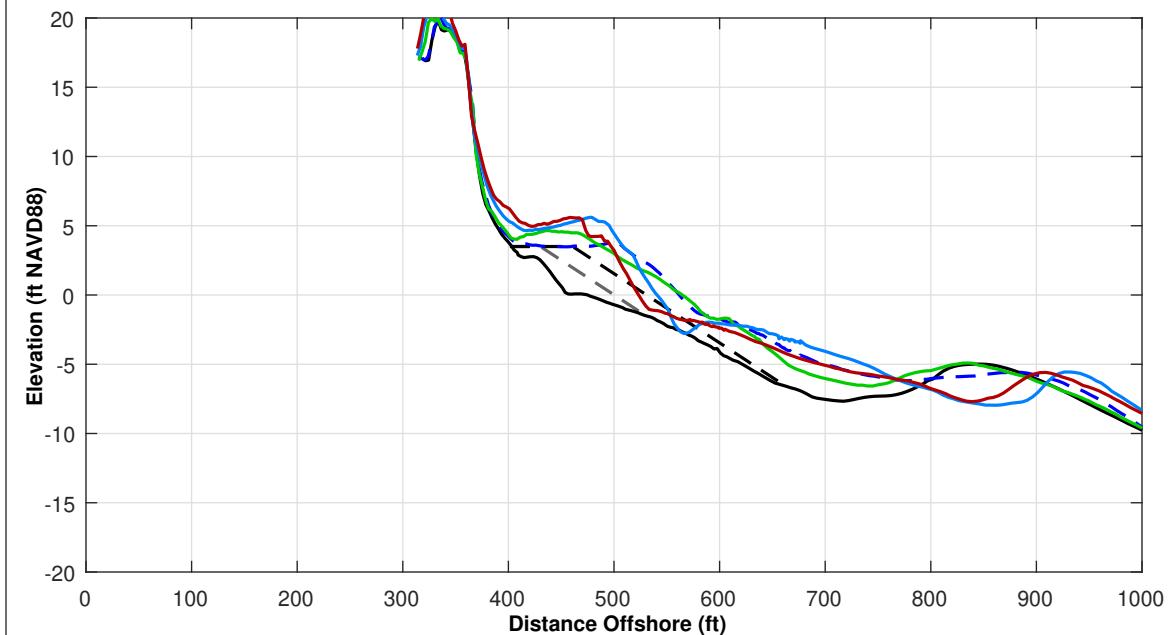
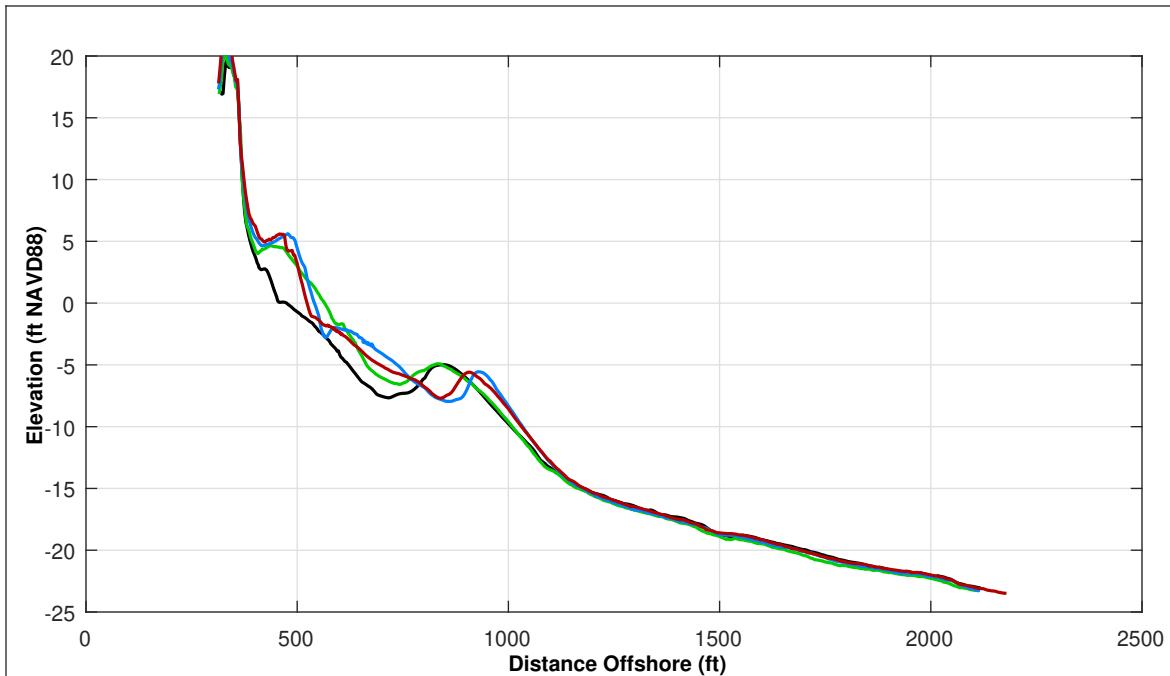


Survey Transect 329+63	NOV 2018 - OCT 2017	NOV 2018 - APR 2018
Shoreline Change at MHW (0.98 ft NAVD88)	6.36 ft	-10.39 ft
Volume Change Above -15 ft NAVD88	3.33 cy/ft	0.21 cy/ft
Volume Change Above 0 ft NAVD88	6.87 cy/ft	0.35 cy/ft
Distance from USACE Design Template @ 3.5 feet NAVD88:		
LEGEND: NOV 2018 — NOV 2018 APR 2018 — APR 2018 MAY 2017 — MAY 2017 OCT 2016 — OCT 2016 USACE Design Template - - - - - USACE Nourishment Threshold - - - - -		

Notes:

1. Station From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward and Seaward Of The Breakwater.

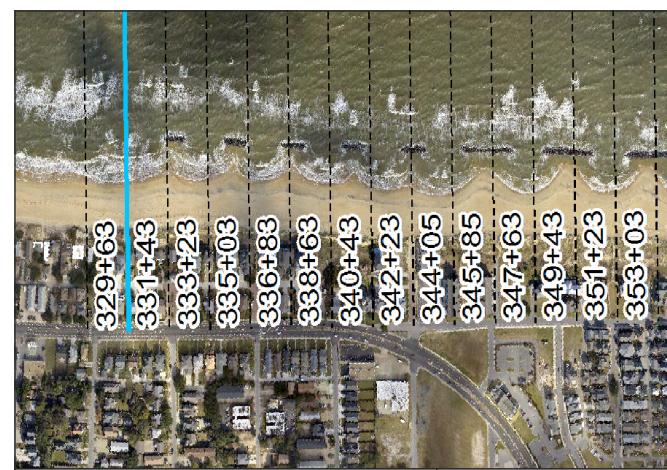


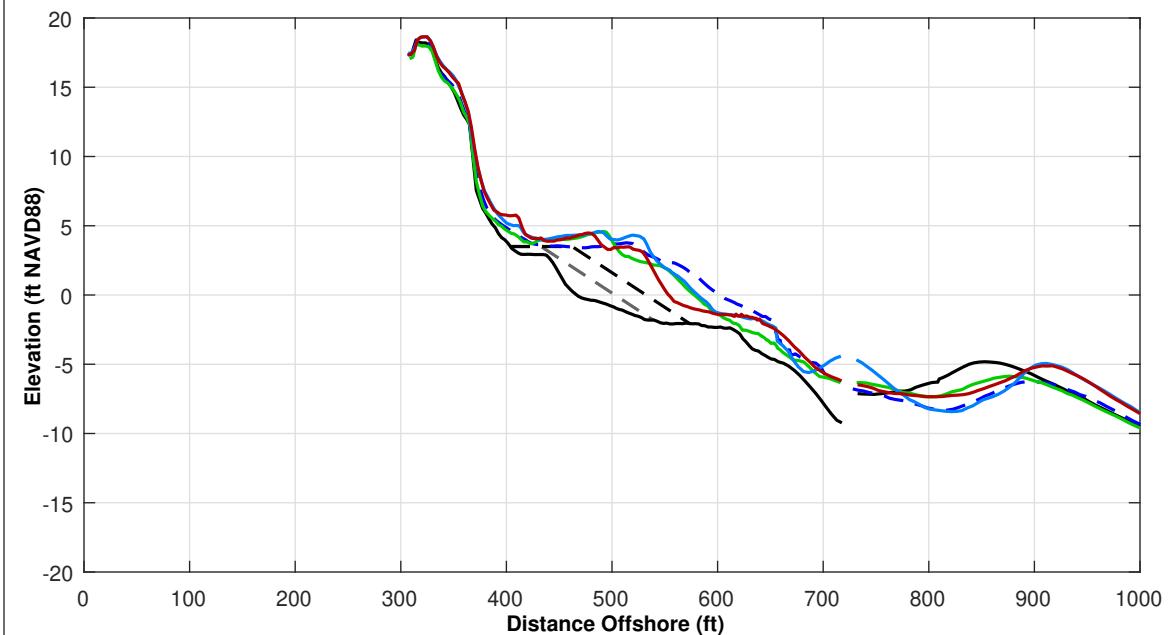
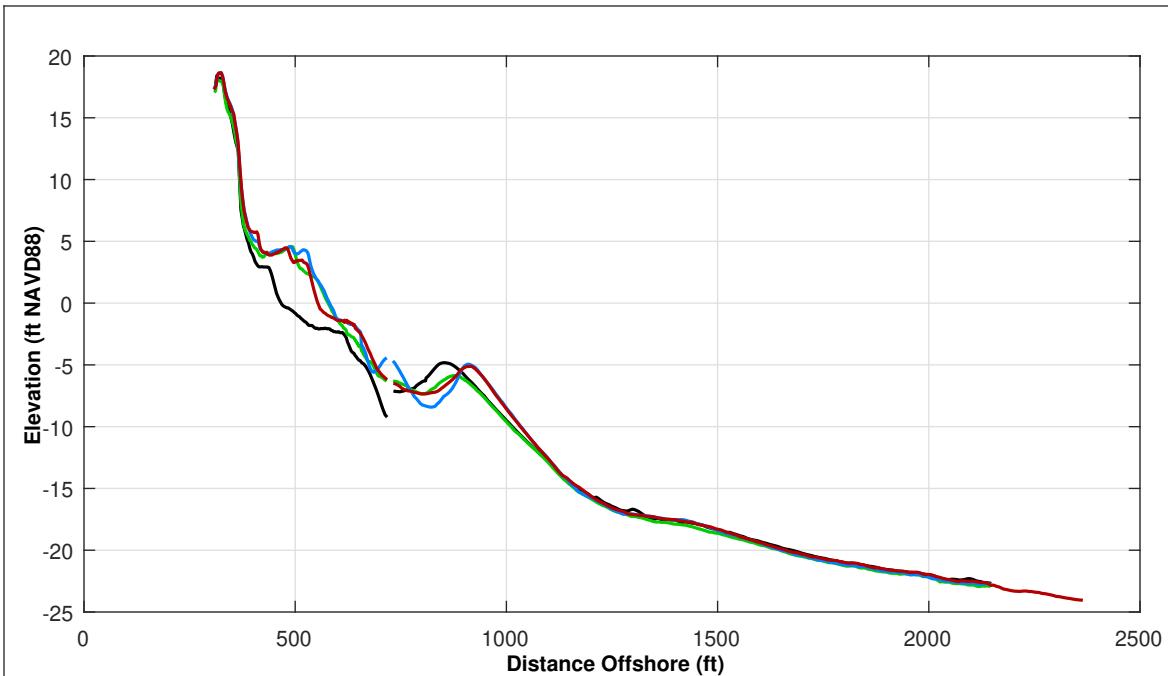


Survey Transect 331+43	NOV 2018 - OCT 2017	NOV 2018 - APR 2018
Shoreline Change at MHW (0.98 ft NAVD88)	-30.35 ft	-16.08 ft
Volume Change Above -15 ft NAVD88	5.33 cy/ft	-4.37 cy/ft
Volume Change Above 0 ft NAVD88	4.66 cy/ft	-0.72 cy/ft
Distance from USACE Design Template @ 3.5 feet NAVD88:		
LEGEND: NOV 2018 — MAY 2017 APR 2018 — OCT 2016 OCT 2017 — USACE Design Template USACE Nourishment Threshold —		

Notes:

1. Station From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward and Seaward Of The Breakwater.



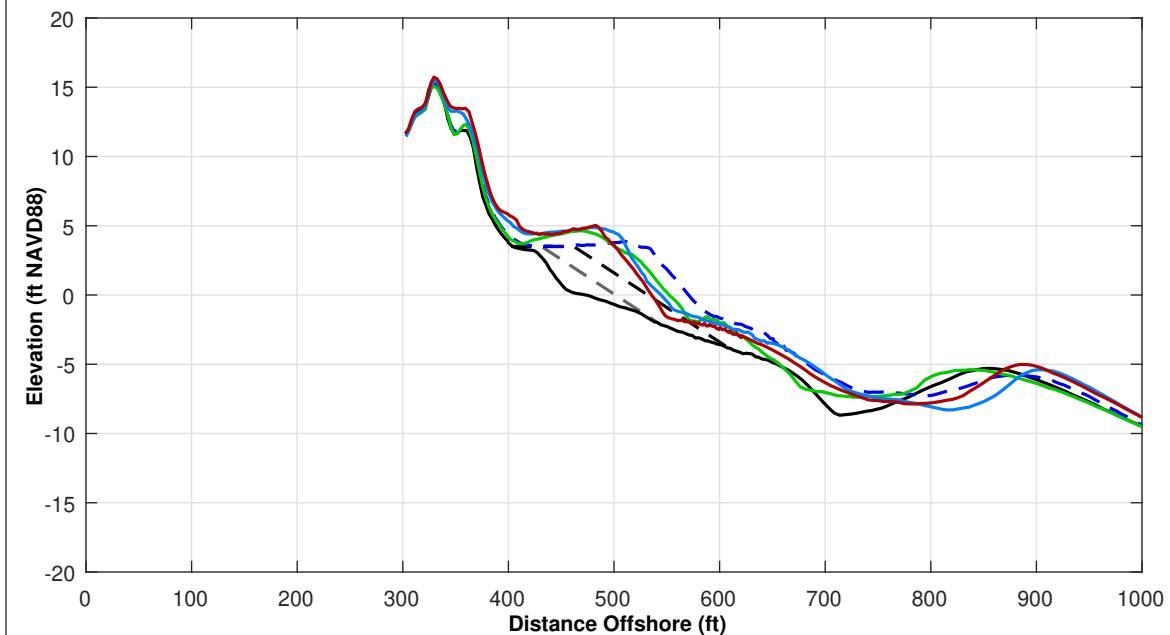
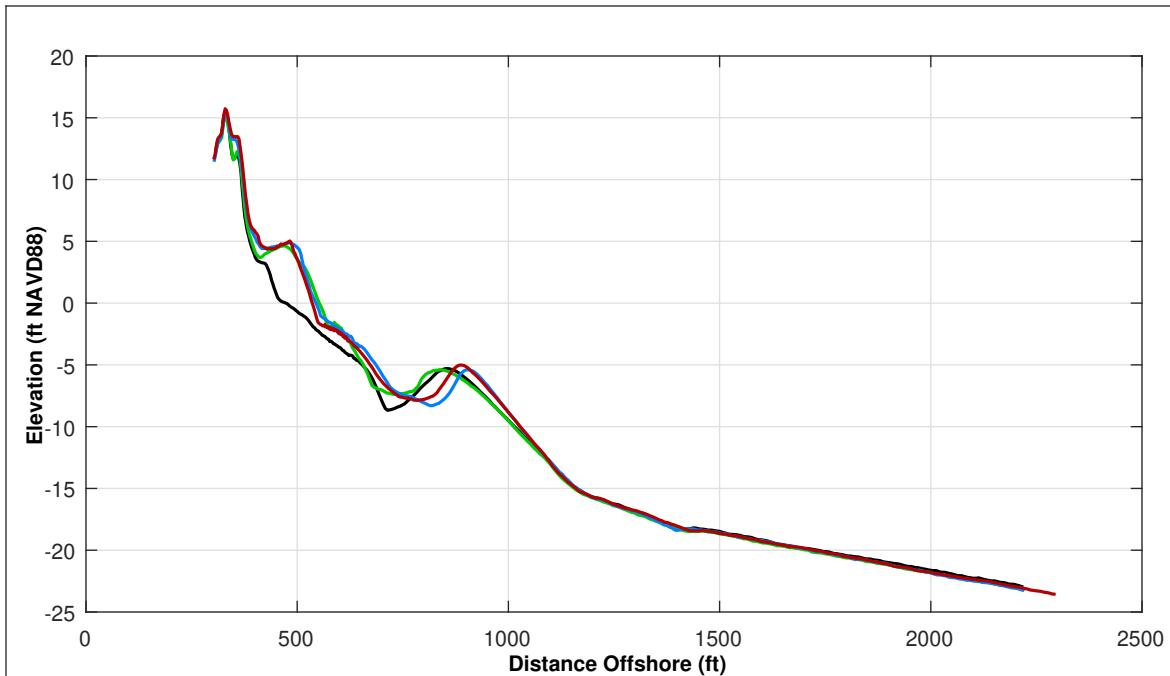


Survey Transect 333+23	NOV 2018 - OCT 2017	NOV 2018 - APR 2018
Shoreline Change at MHW (0.98 ft NAVD88)	-19.32 ft	-23.54 ft
Volume Change Above -15 ft NAVD88	11.48 cy/ft	-2.44 cy/ft
Volume Change Above 0 ft NAVD88	2.50 cy/ft	-3.21 cy/ft
Distance from USACE Design Template @ 3.5 feet NAVD88:		
LEGEND: NOV 2018 — NOV 2018 APR 2018 — APR 2018 MAY 2017 — MAY 2017 OCT 2016 — OCT 2016 USACE Design Template — USACE Design Template USACE Nourishment Threshold — USACE Nourishment Threshold		

Notes:

1. Station From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward and Seaward Of The Breakwater.



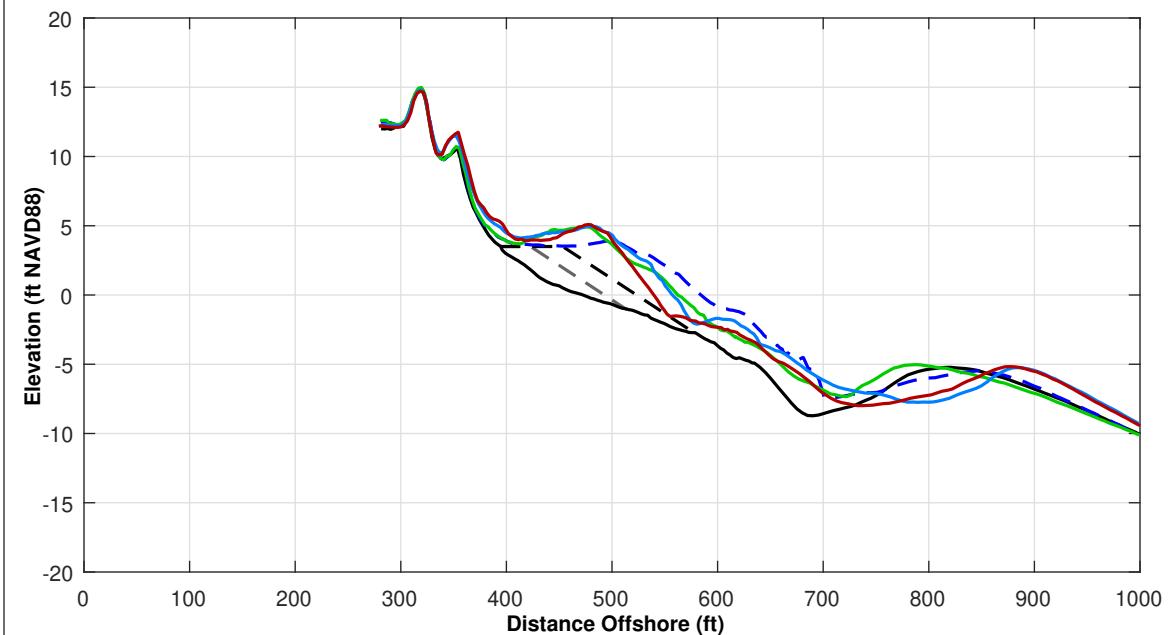
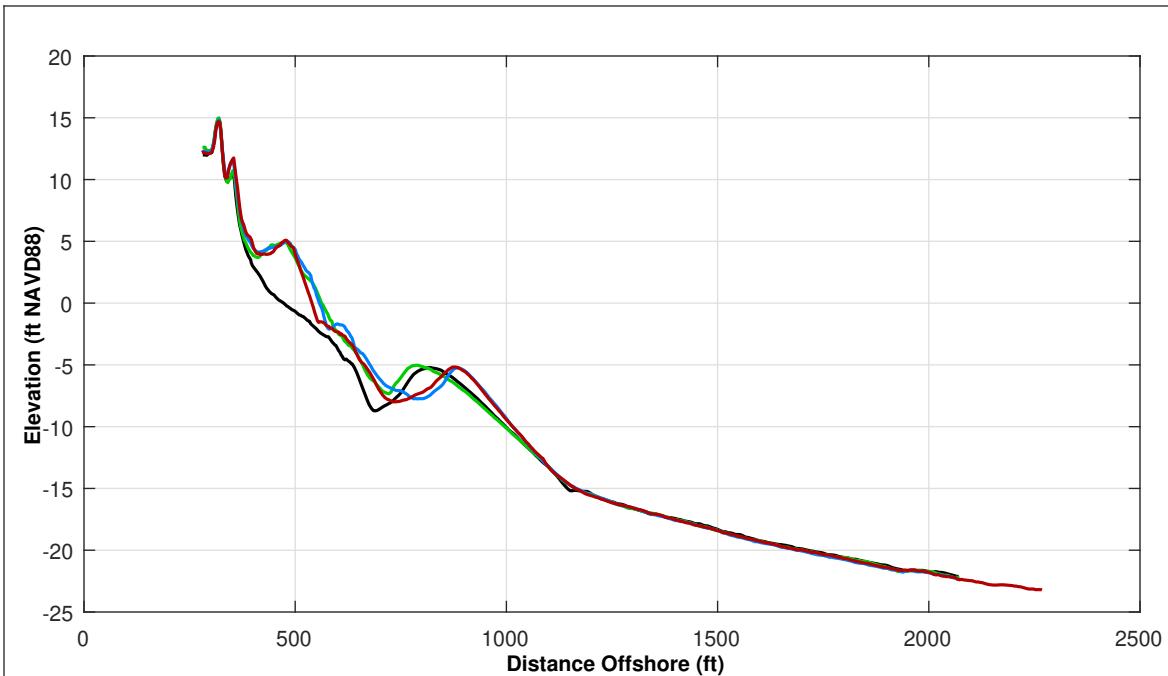


Survey Transect 335+03	NOV 2018 - OCT 2017	NOV 2018 - APR 2018
Shoreline Change at MHW (0.98 ft NAVD88)	-13.81 ft	-4.03 ft
Volume Change Above -15 ft NAVD88	5.95 cy/ft	-0.86 cy/ft
Volume Change Above 0 ft NAVD88	3.69 cy/ft	0.08 cy/ft
Distance from USACE Design Template @ 3.5 feet NAVD88:		
LEGEND: NOV 2018 — MAY 2017 APR 2018 — OCT 2016 OCT 2017 — USACE Design Template USACE Nourishment Threshold — USACE Nourishment Threshold		

Notes:

1. Station From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
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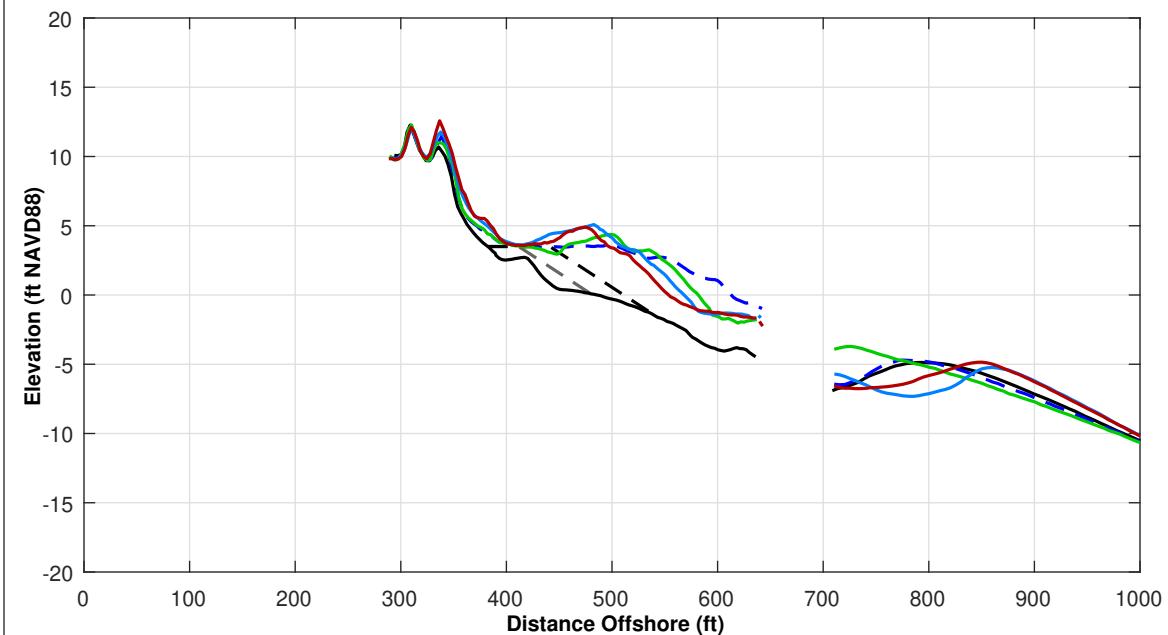
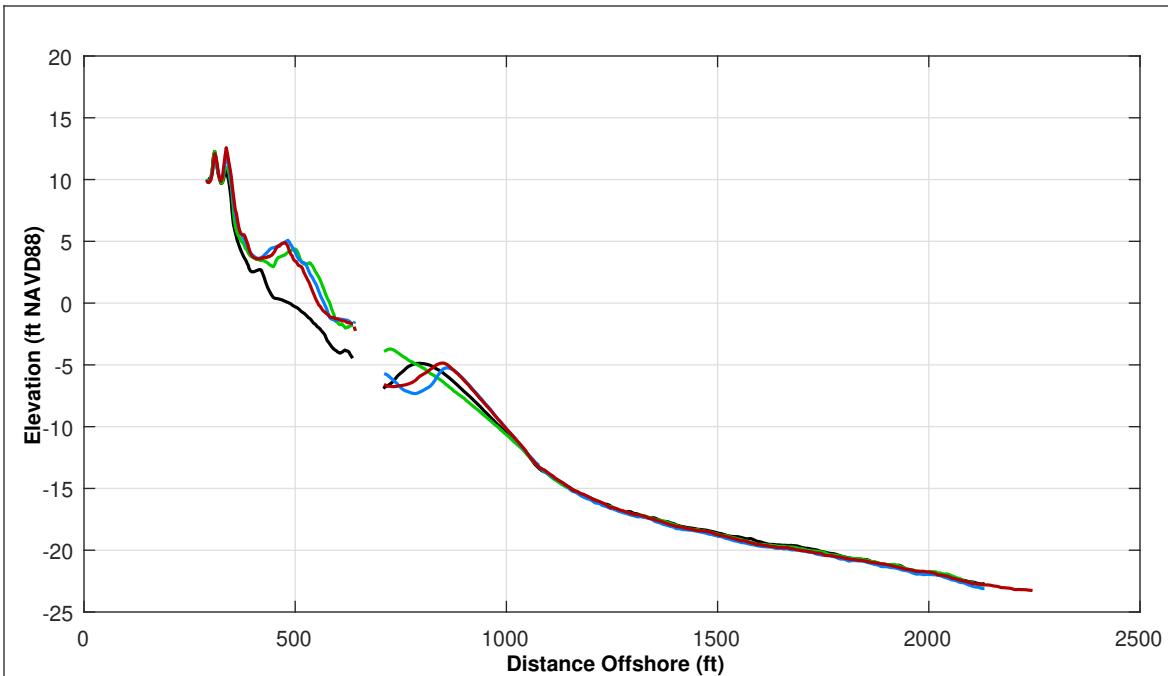


Survey Transect 336+83	NOV 2018 - OCT 2017	NOV 2018 - APR 2018
Shoreline Change at MHW (0.98 ft NAVD88)	-20.92 ft	-18.31 ft
Volume Change Above -15 ft NAVD88	-0.91 cy/ft	-6.56 cy/ft
Volume Change Above 0 ft NAVD88	0.49 cy/ft	-2.28 cy/ft
Distance from USACE Design Template @ 3.5 feet NAVD88:		
LEGEND: NOV 2018 — NOV 2018 APR 2018 — APR 2018 MAY 2017 — MAY 2017 OCT 2016 — OCT 2016 USACE Design Template — USACE Design Template USACE Nourishment Threshold — USACE Nourishment Threshold		

Notes:

1. Station From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward and Seaward Of The Breakwater.



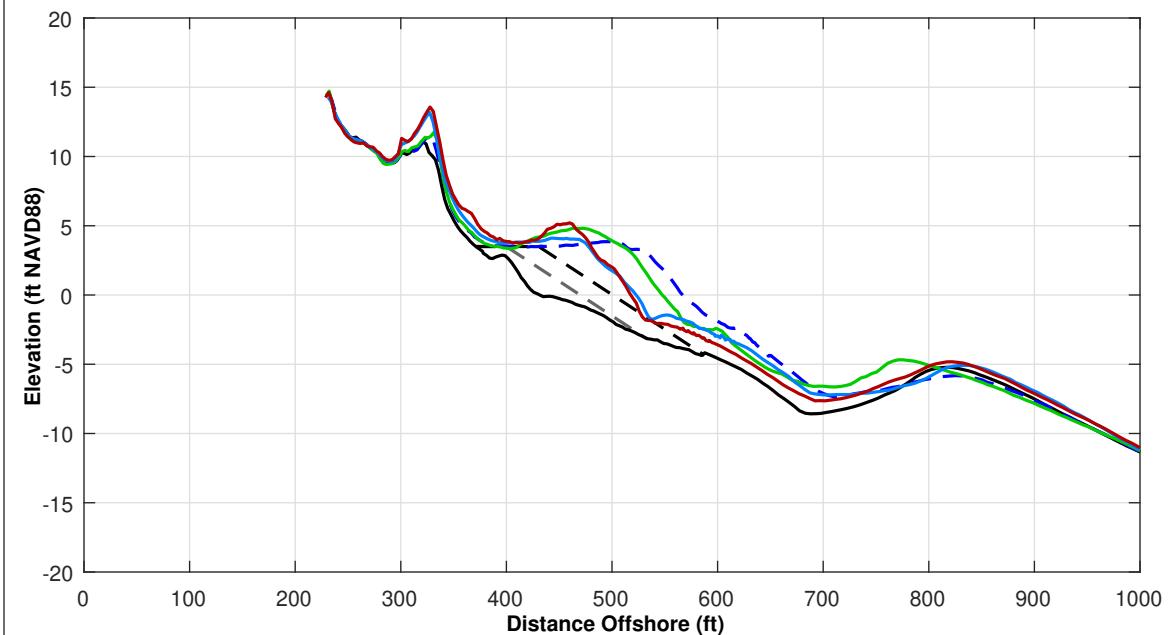
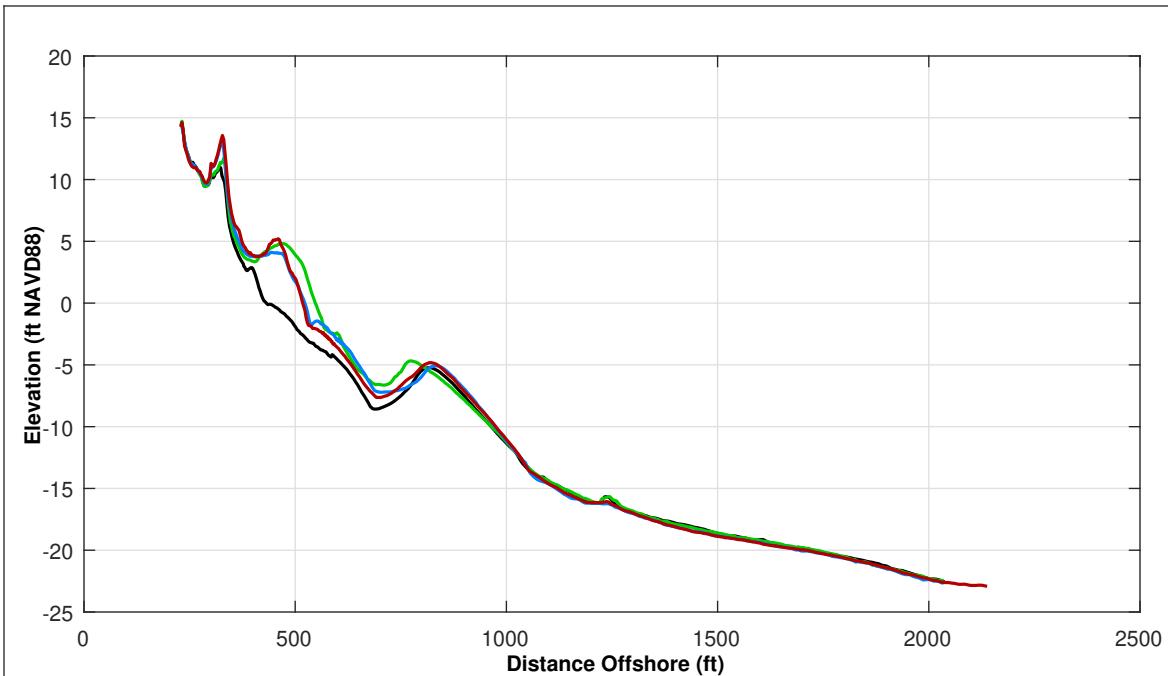


Survey Transect 338+63	NOV 2018 - OCT 2017	NOV 2018 - APR 2018
Shoreline Change at MHW (0.98 ft NAVD88)	-28.55 ft	-14.69 ft
Volume Change Above -15 ft NAVD88	0.77 cy/ft	0.29 cy/ft
Volume Change Above 0 ft NAVD88	-0.16 cy/ft	-2.26 cy/ft
Distance from USACE Design Template @ 3.5 feet NAVD88:		
LEGEND: NOV 2018 — NOV 2018 APR 2018 — APR 2018 OCT 2016 — OCT 2016 MAY 2017 — MAY 2017 USACE Design Template — USACE Design Template USACE Nourishment Threshold — USACE Nourishment Threshold		

Notes:

1. Station From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward and Seaward Of The Breakwater.

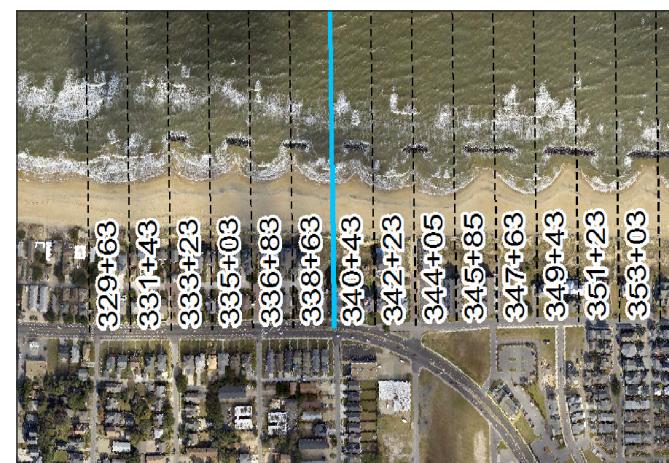


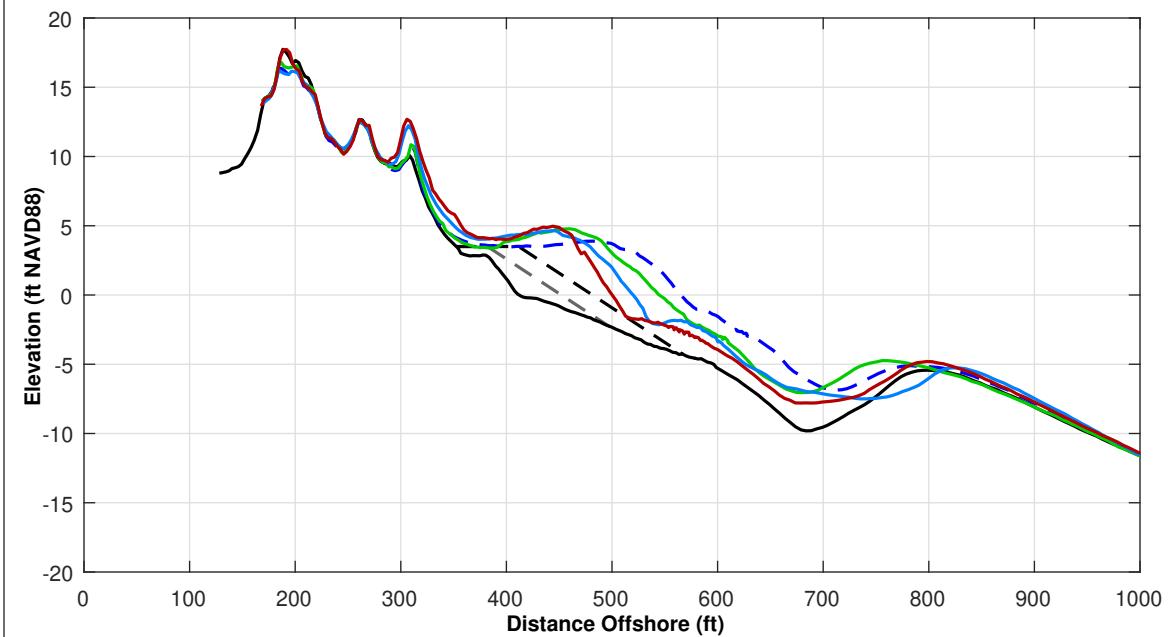
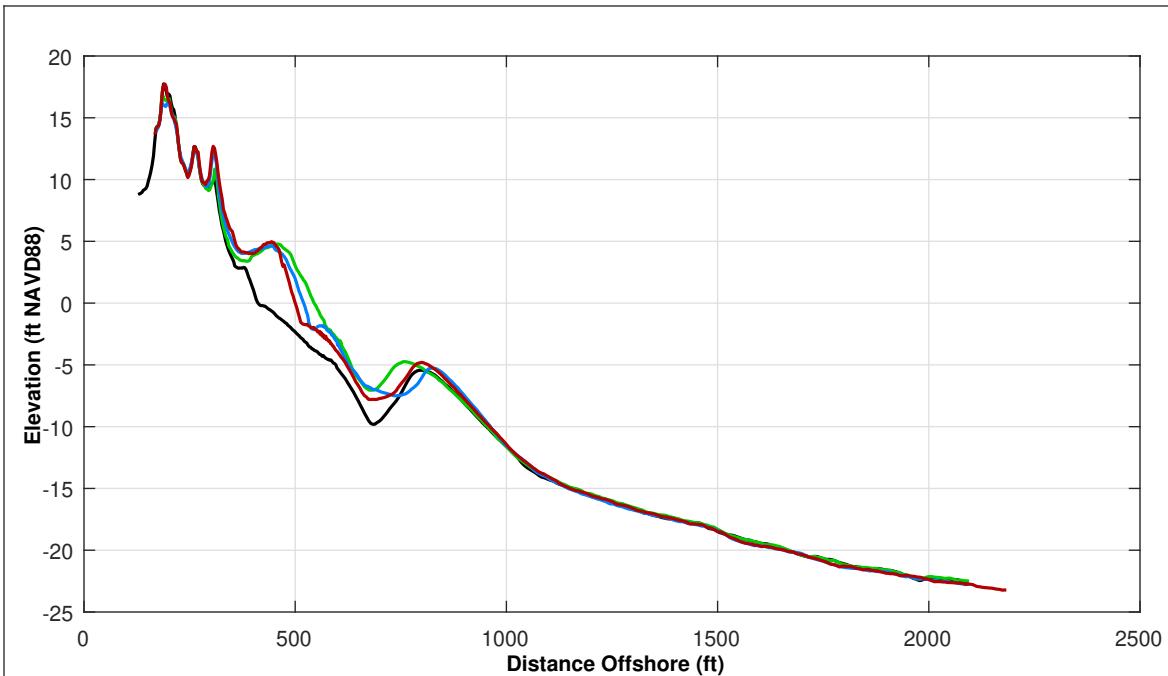


Survey Transect 340+43	NOV 2018 - OCT 2017	NOV 2018 - APR 2018
Shoreline Change at MHW (0.98 ft NAVD88)	-27.44 ft	-0.90 ft
Volume Change Above -15 ft NAVD88	-5.80 cy/ft	-0.21 cy/ft
Volume Change Above 0 ft NAVD88	-0.16 cy/ft	2.96 cy/ft
Distance from USACE Design Template @ 3.5 feet NAVD88:		
LEGEND: NOV 2018 — NOV 2017 APR 2018 — OCT 2016 MAY 2017 — USACE Design Template OCT 2017 — USACE Nourishment Threshold		

Notes:

1. Station From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
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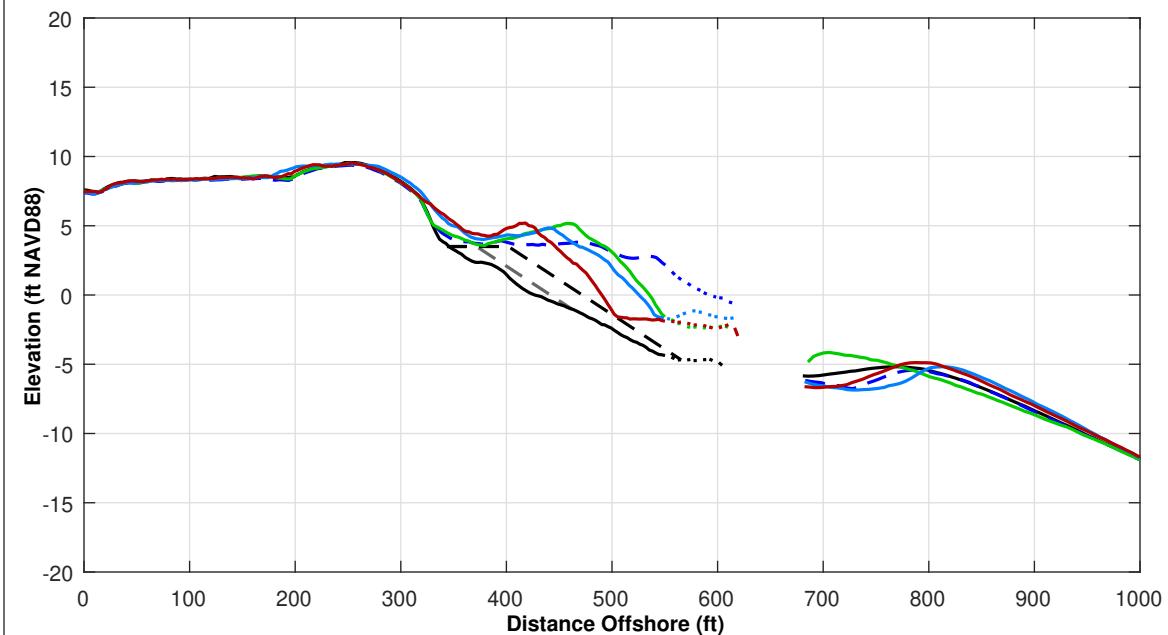
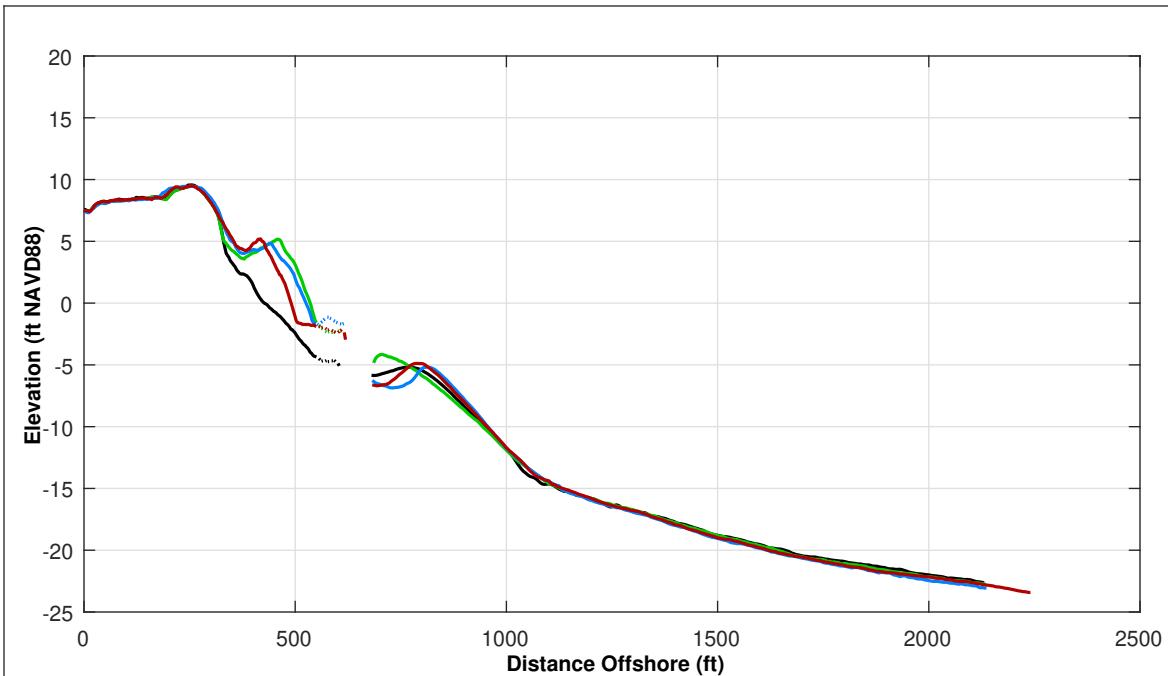


Survey Transect 342+23	NOV 2018 - OCT 2017	NOV 2018 - APR 2018
Shoreline Change at MHW (0.98 ft NAVD88)	-41.47 ft	-17.82 ft
Volume Change Above -15 ft NAVD88	-8.62 cy/ft	-1.87 cy/ft
Volume Change Above 0 ft NAVD88	0.35 cy/ft	0.55 cy/ft
Distance from USACE Design Template @ 3.5 feet NAVD88:		
LEGEND: NOV 2018 — NOV 2018 APR 2018 — APR 2018 OCT 2016 — OCT 2016 OCT 2017 — OCT 2017 USACE Design Template — USACE Design Template USACE Nourishment Threshold — USACE Nourishment Threshold		

Notes:

1. Station From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward and Seaward Of The Breakwater.



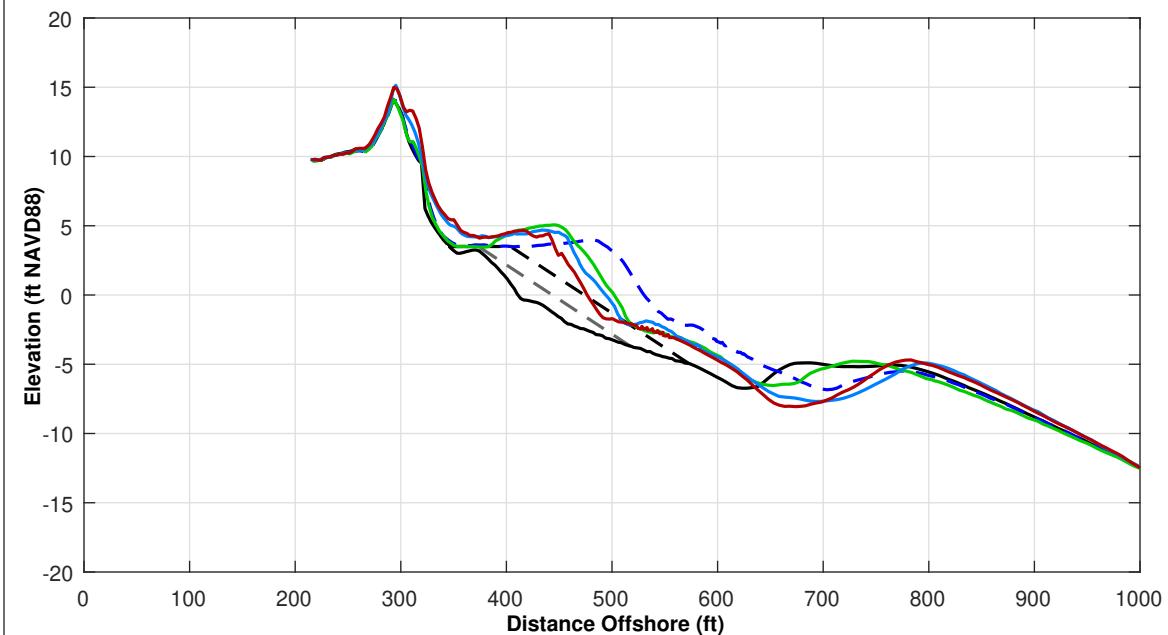
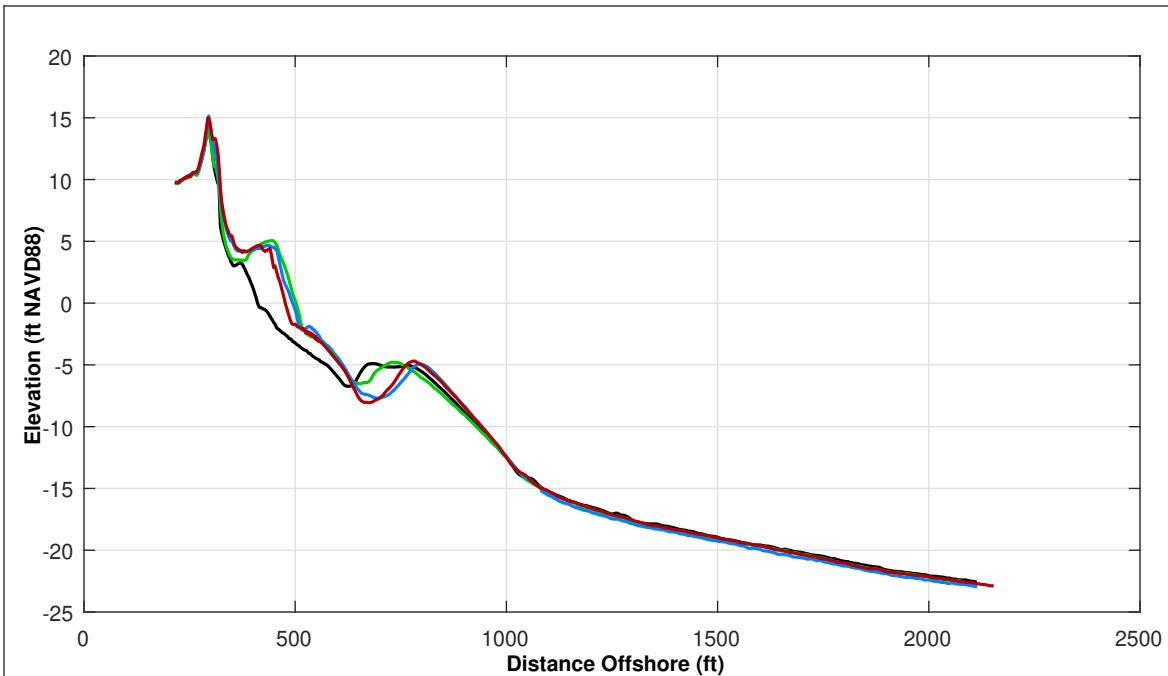


Survey Transect 344+05	NOV 2018 - OCT 2017	NOV 2018 - APR 2018
Shoreline Change at MHW (0.98 ft NAVD88)	-42.59 ft	-31.87 ft
Volume Change Above -15 ft NAVD88	-6.54 cy/ft	-5.00 cy/ft
Volume Change Above 0 ft NAVD88	-4.30 cy/ft	-4.16 cy/ft
Distance from USACE Design Template @ 3.5 feet NAVD88:		
LEGEND: NOV 2018 — NOV 2018 APR 2018 — APR 2018 OCT 2016 — OCT 2016 OCT 2017 — OCT 2017 USACE Design Template — USACE Design Template USACE Nourishment Threshold — USACE Nourishment Threshold		

Notes:

1. Station From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward and Seaward Of The Breakwater.



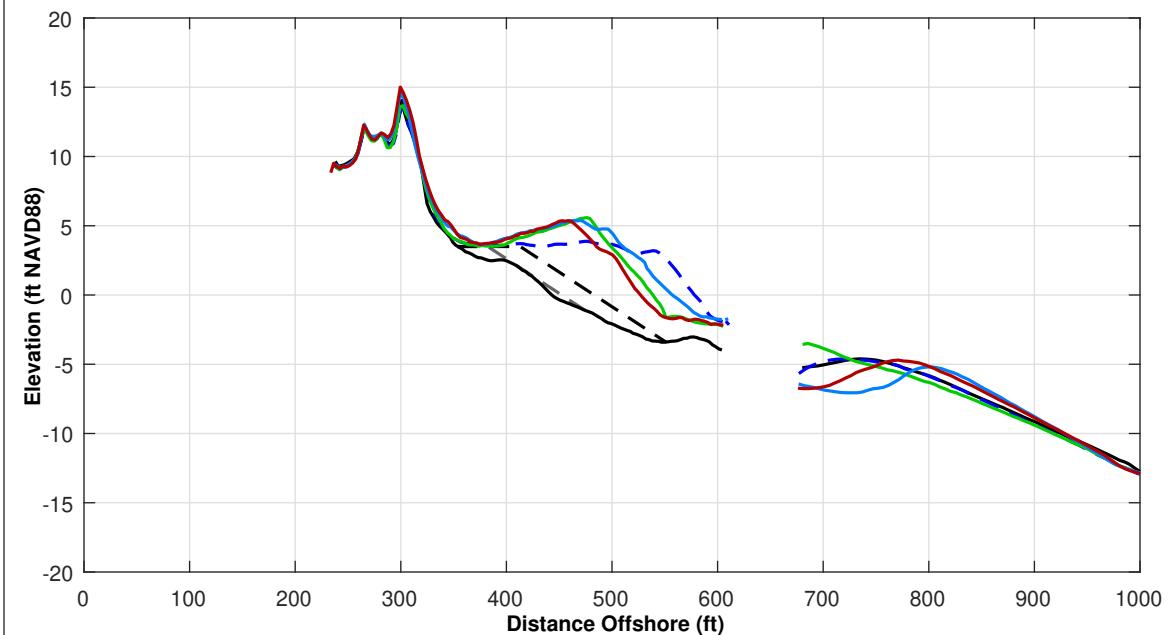
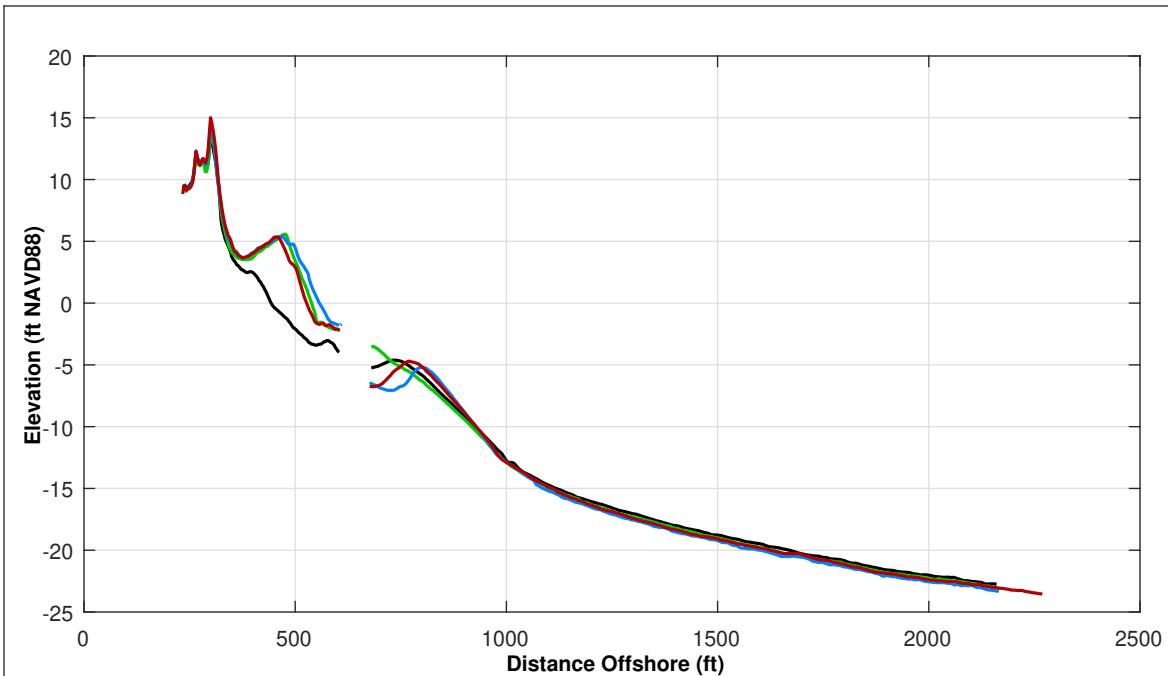


Survey Transect 345+85	NOV 2018 - OCT 2017	NOV 2018 - APR 2018
Shoreline Change at MHW (0.98 ft NAVD88)	-22.75 ft	-14.23 ft
Volume Change Above -15 ft NAVD88	-2.68 cy/ft	-3.11 cy/ft
Volume Change Above 0 ft NAVD88	0.86 cy/ft	-0.95 cy/ft
Distance from USACE Design Template @ 3.5 feet NAVD88:		
LEGEND: MAY 2017 NOV 2018 — OCT 2016 — APR 2018 — USACE Design Template - - - OCT 2017 — USACE Nourishment Threshold - - -		

Notes:

1. Station From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward and Seaward Of The Breakwater.



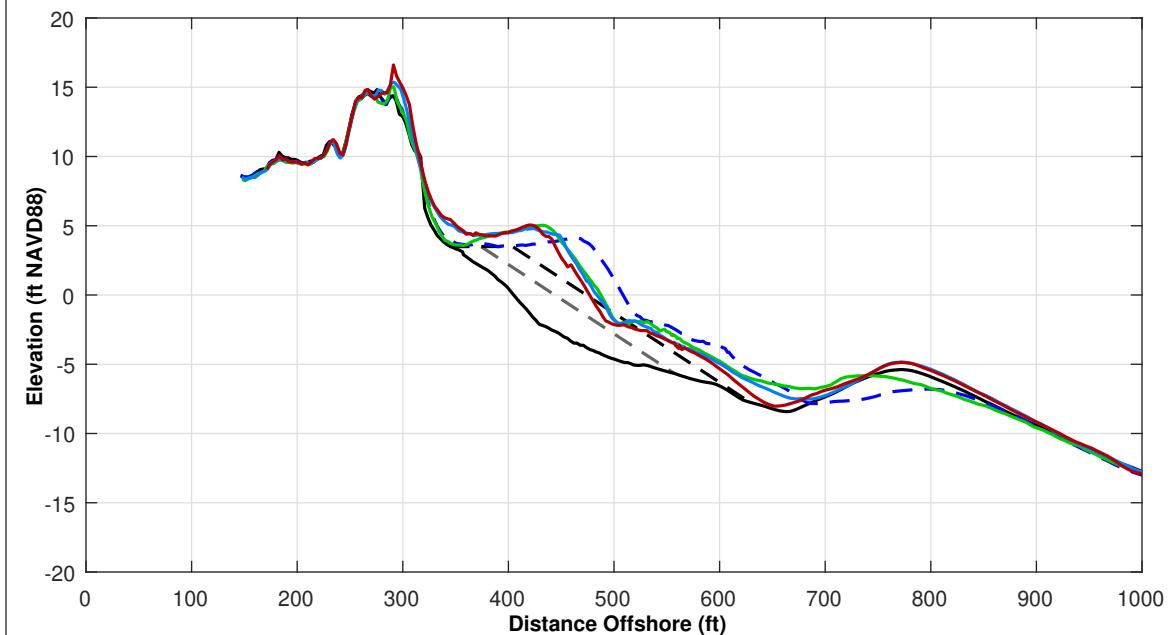
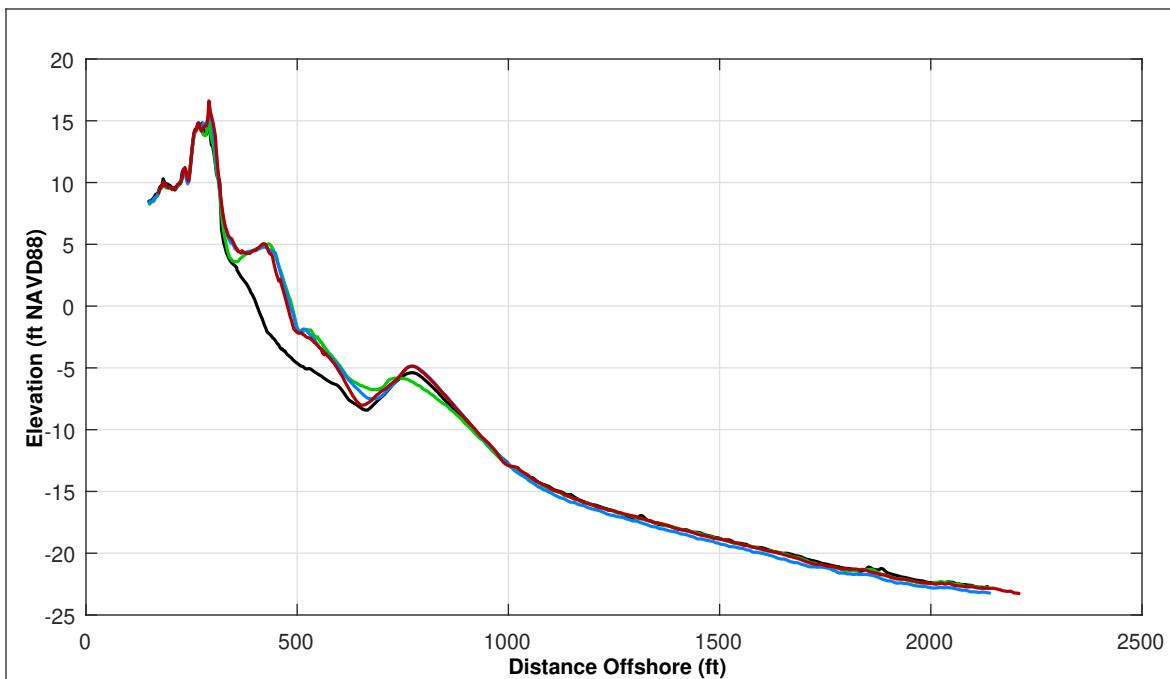


Survey Transect 347+63	NOV 2018 - OCT 2017	NOV 2018 - APR 2018
Shoreline Change at MHW (0.98 ft NAVD88)	-11.61 ft	-26.37 ft
Volume Change Above -15 ft NAVD88	1.49 cy/ft	-2.54 cy/ft
Volume Change Above 0 ft NAVD88	0.55 cy/ft	-3.97 cy/ft
Distance from USACE Design Template @ 3.5 feet NAVD88:		
LEGEND: NOV 2018 — NOV 2018 APR 2018 — APR 2018 OCT 2017 — OCT 2017 USACE Design Template — USACE Design Template USACE Nourishment Threshold — USACE Nourishment Threshold		

Notes:

1. Station From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward and Seaward Of The Breakwater.



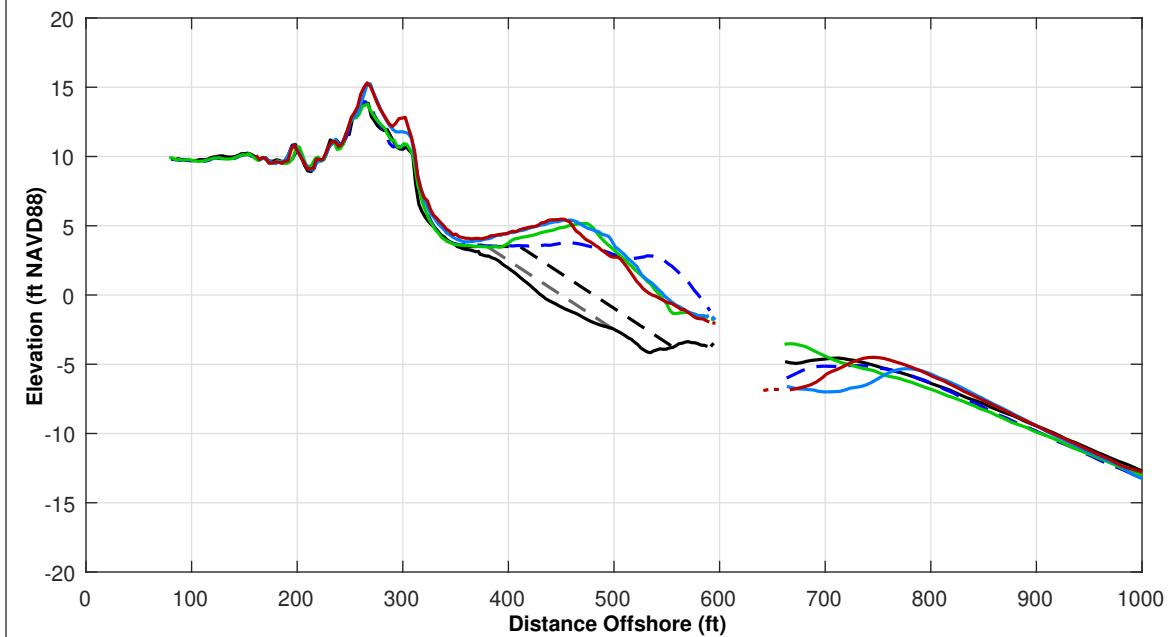
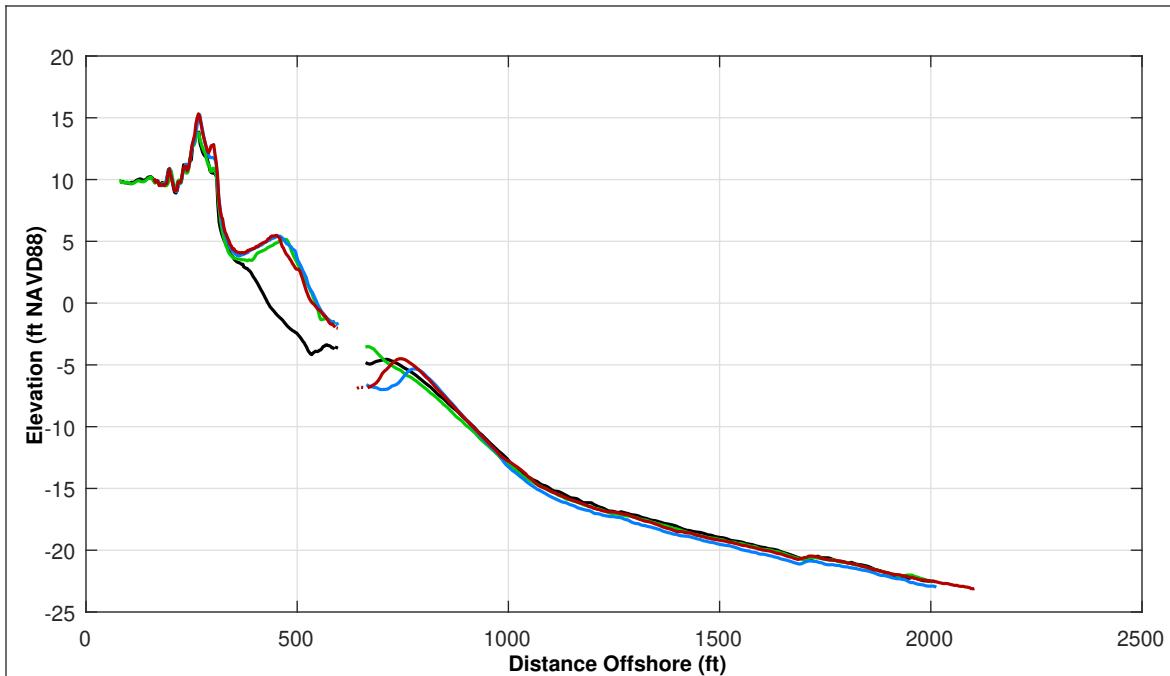


Survey Transect 349+43	NOV 2018 - OCT 2017	NOV 2018 - APR 2018
Shoreline Change at MHW (0.98 ft NAVD88)	-9.36 ft	-6.24 ft
Volume Change Above -15 ft NAVD88	2.54 cy/ft	-1.99 cy/ft
Volume Change Above 0 ft NAVD88	2.51 cy/ft	0.00 cy/ft
Distance from USACE Design Template @ 3.5 feet NAVD88:		
LEGEND: MAY 2017 NOV 2018 — OCT 2016 APR 2018 — USACE Design Template OCT 2017 — USACE Nourishment Threshold		

Notes:

1. Station From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward and Seaward Of The Breakwater.



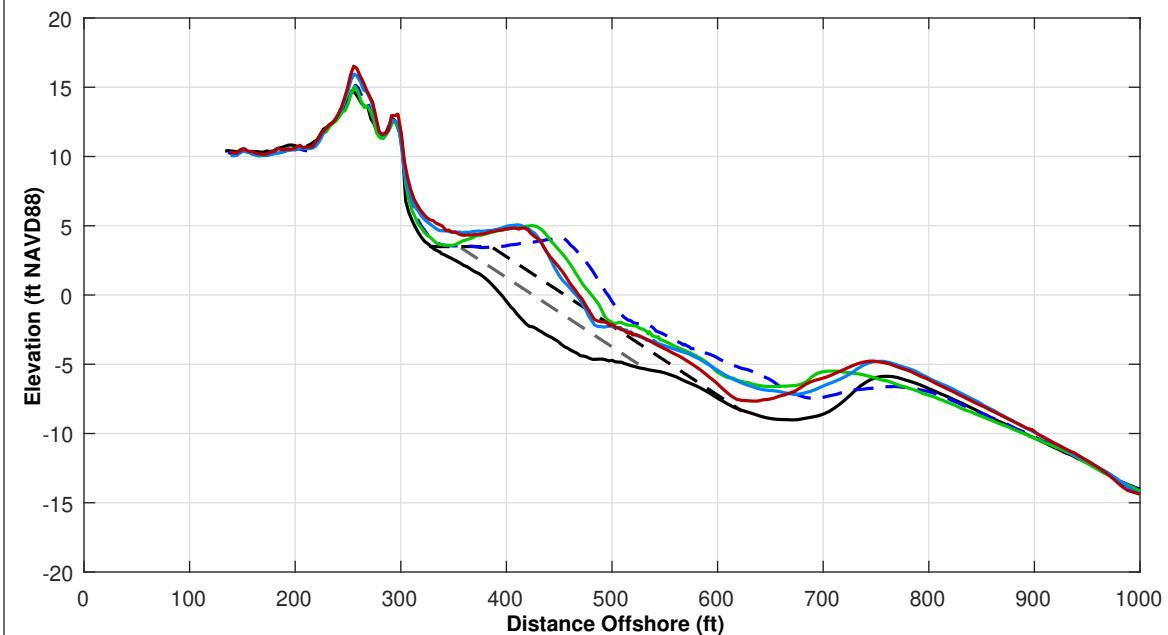
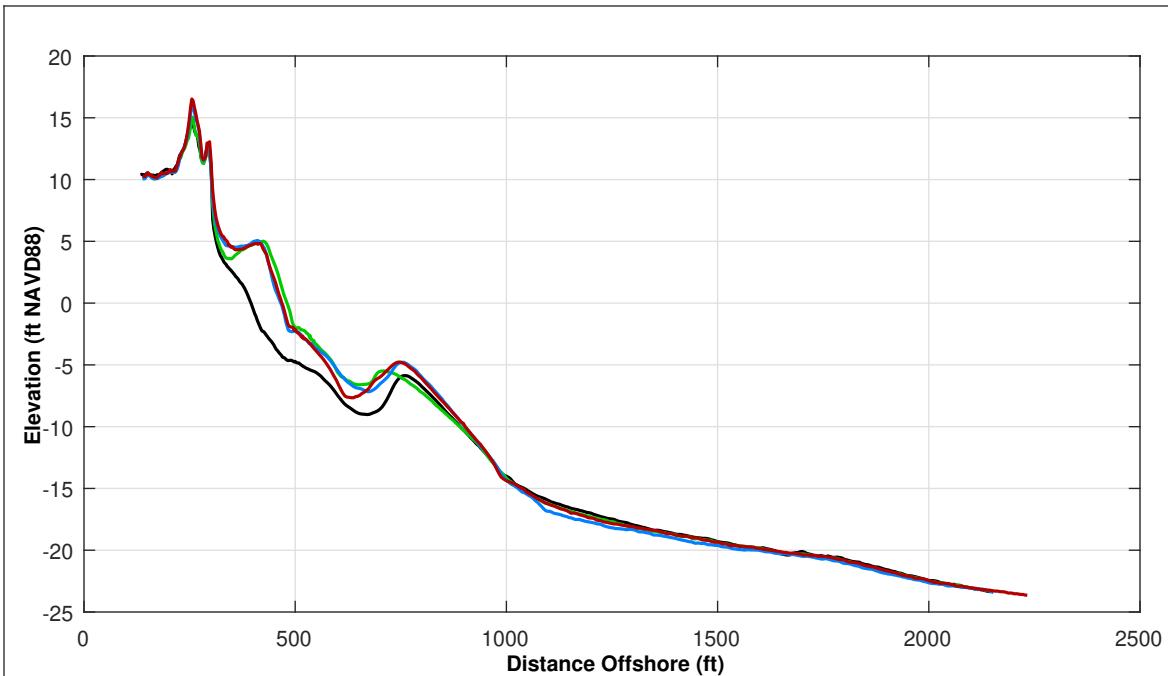


Survey Transect 351+23	NOV 2018 - OCT 2017	NOV 2018 - APR 2018
Shoreline Change at MHW (0.98 ft NAVD88)	-10.12 ft	-12.02 ft
Volume Change Above -15 ft NAVD88	7.41 cy/ft	4.32 cy/ft
Volume Change Above 0 ft NAVD88	4.62 cy/ft	-1.30 cy/ft
Distance from USACE Design Template @ 3.5 feet NAVD88:		
LEGEND: MAY 2017 NOV 2018 — APR 2018 — OCT 2017 — USACE Design Template - - - USACE Nourishment Threshold - - -		

Notes:

1. Station From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward and Seaward Of The Breakwater.





Survey Transect 353+03	NOV 2018 - OCT 2017	NOV 2018 - APR 2018
Shoreline Change at MHW (0.98 ft NAVD88)	-11.60 ft	4.88 ft
Volume Change Above -15 ft NAVD88	2.65 cy/ft	-0.51 cy/ft
Volume Change Above 0 ft NAVD88	2.72 cy/ft	1.72 cy/ft

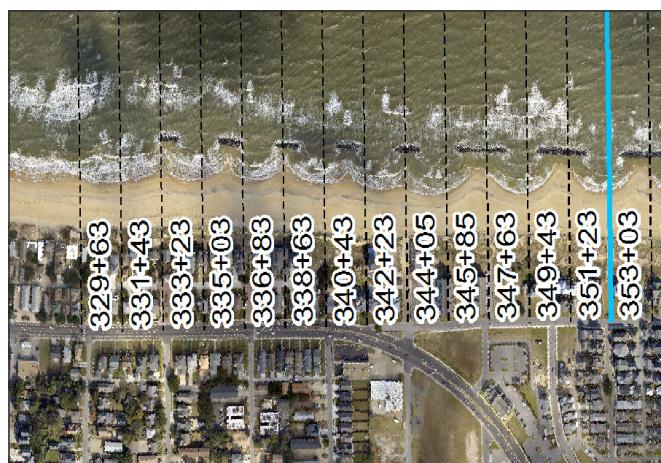
Distance from USACE Design Template @ 3.5 feet NAVD88:

LEGEND:

- MAY 2017
- NOV 2018
- OCT 2016
- APR 2018
- USACE Design Template
- OCT 2017
- USACE Nourishment Threshold

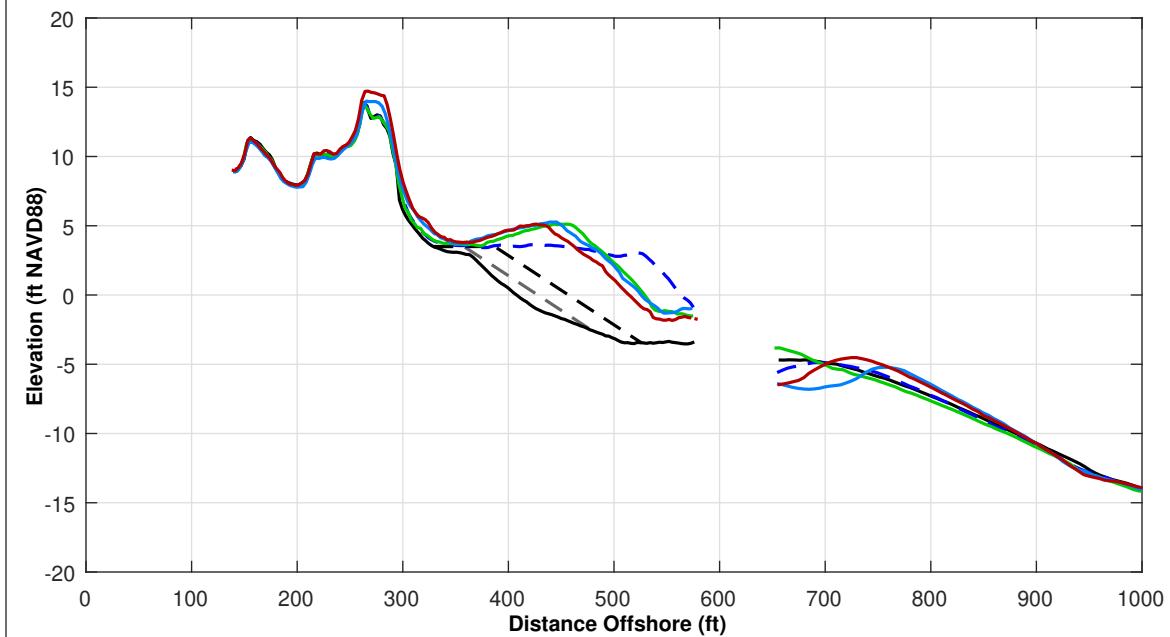
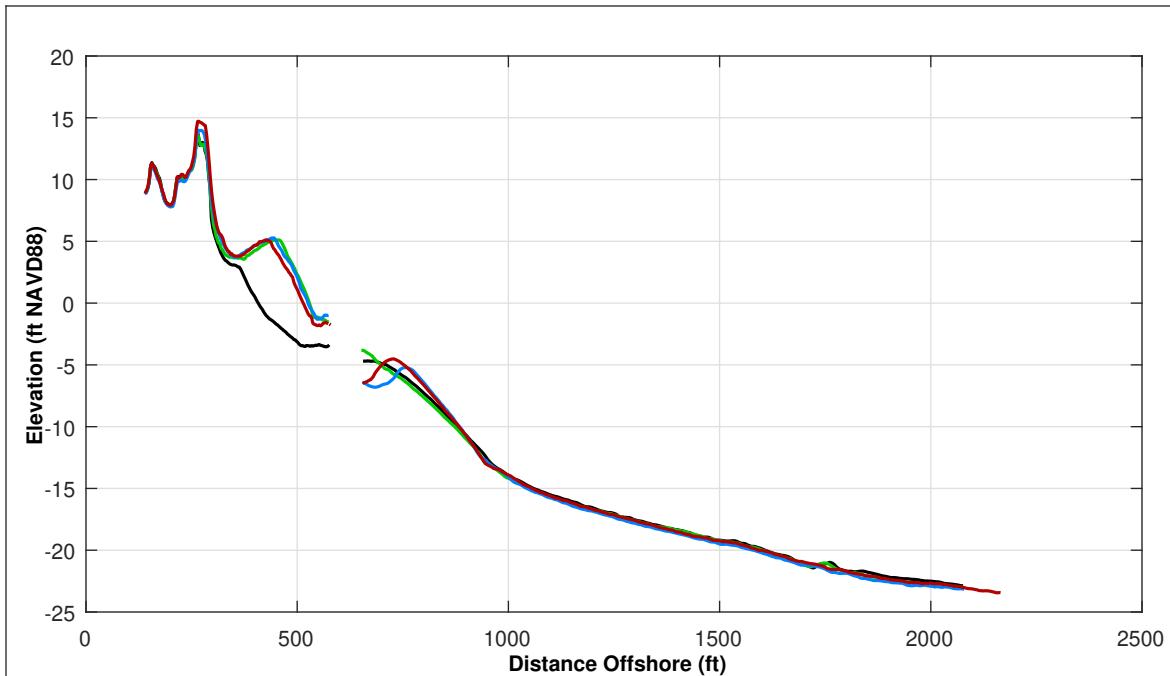
Notes:

1. Station From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward and Seaward Of The Breakwater.



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Survey Transect 354+83	NOV 2018 - OCT 2017	NOV 2018 - APR 2018
Shoreline Change at MHW (0.98 ft NAVD88)	-16.39 ft	-10.35 ft
Volume Change Above -15 ft NAVD88	4.13 cy/ft	-1.29 cy/ft
Volume Change Above 0 ft NAVD88	1.44 cy/ft	0.08 cy/ft

Distance from USACE Design Template @ 3.5 feet NAVD88:

LEGEND:

- NOV 2018 (Red solid line)
- OCT 2016 (Blue solid line)
- APR 2018 (Green solid line)
- OCT 2017 (Black solid line)
- USACE Design Template (Blue dashed line)
- USACE Nourishment Threshold (Black dashed line)

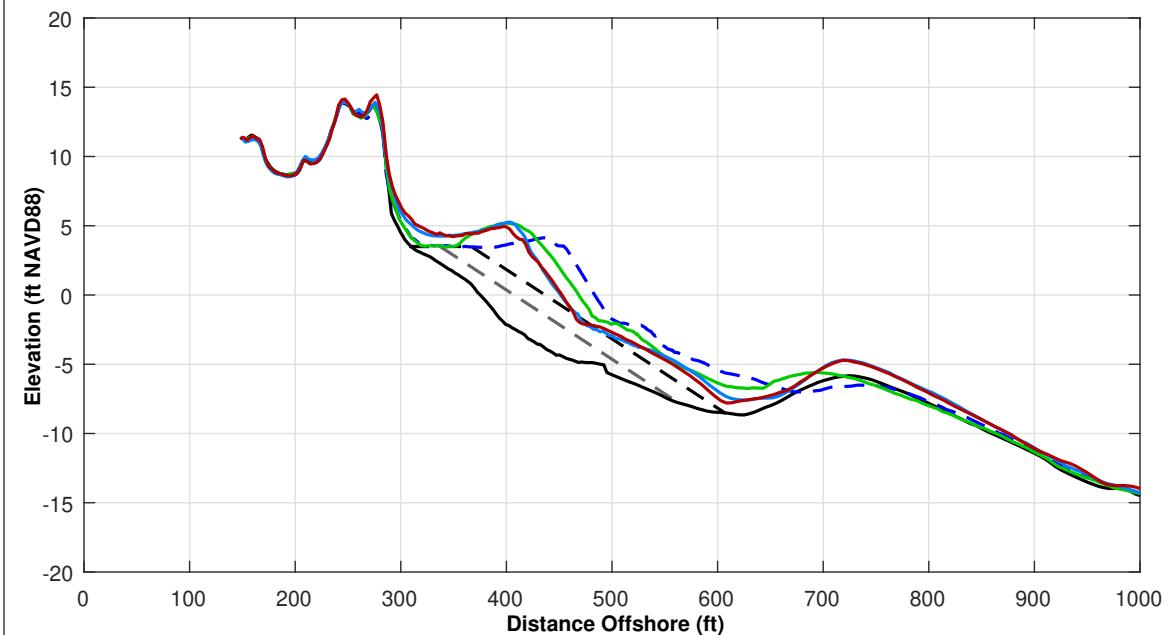
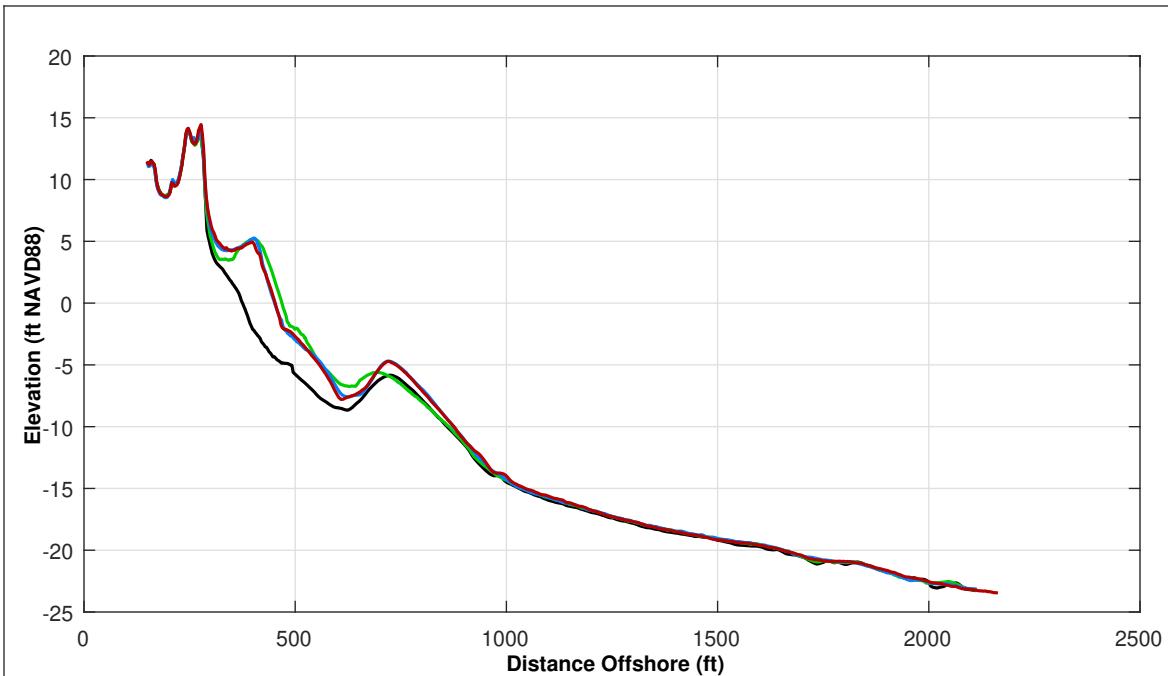
Notes:

1. Station From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward and Seaward Of The Breakwater.



NORFOLK
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OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS

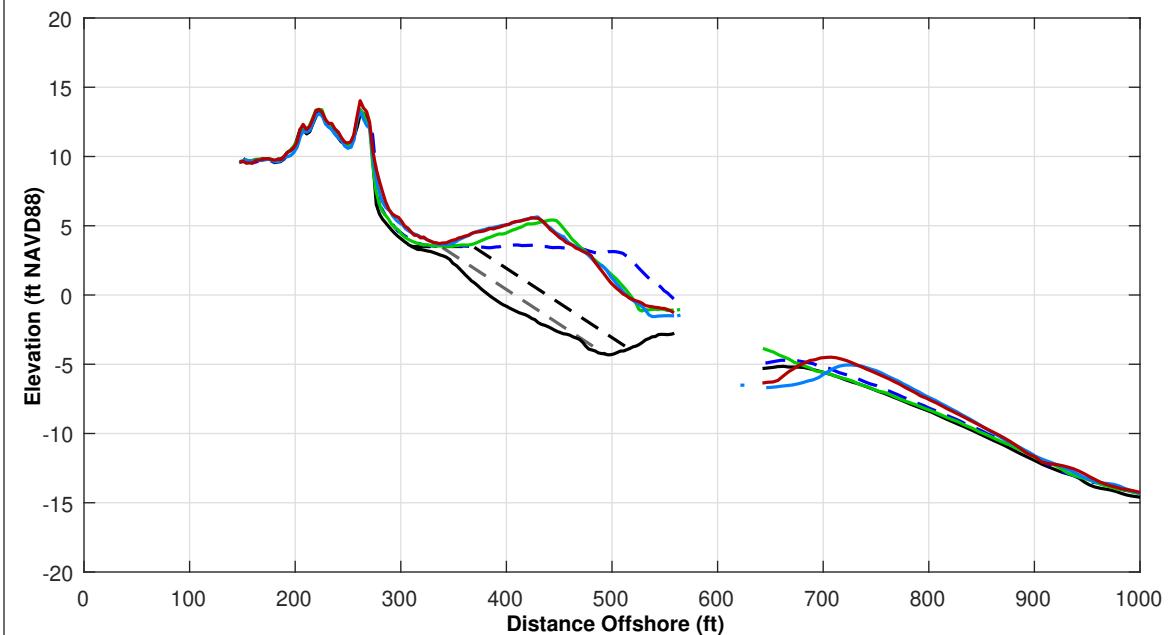
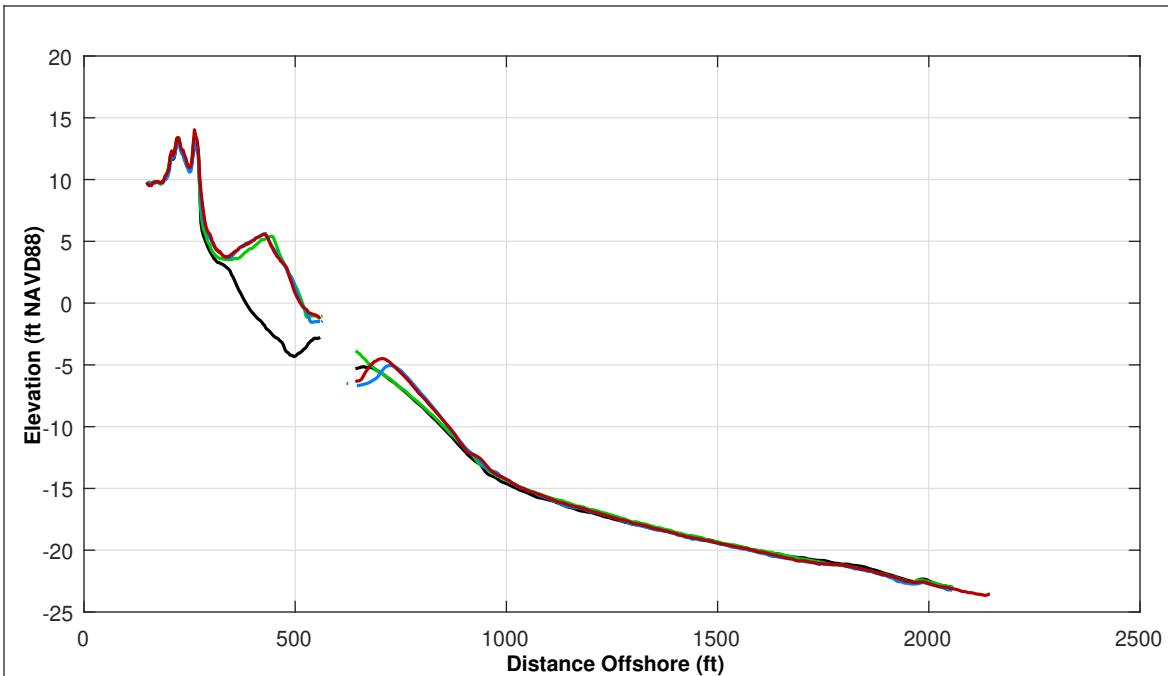


Survey Transect 356+63	NOV 2018 - OCT 2017	NOV 2018 - APR 2018
Shoreline Change at MHW (0.98 ft NAVD88)	-15.77 ft	2.18 ft
Volume Change Above -15 ft NAVD88	1.25 cy/ft	-0.04 cy/ft
Volume Change Above 0 ft NAVD88	-0.02 cy/ft	0.29 cy/ft
Distance from USACE Design Template @ 3.5 feet NAVD88:		
LEGEND: NOV 2018 — NOV 2018 APR 2018 — APR 2018 MAY 2017 — MAY 2017 OCT 2016 — OCT 2016 USACE Design Template — USACE Design Template OCT 2017 — OCT 2017 USACE Nourishment Threshold — USACE Nourishment Threshold		

Notes:

1. Station From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward and Seaward Of The Breakwater.



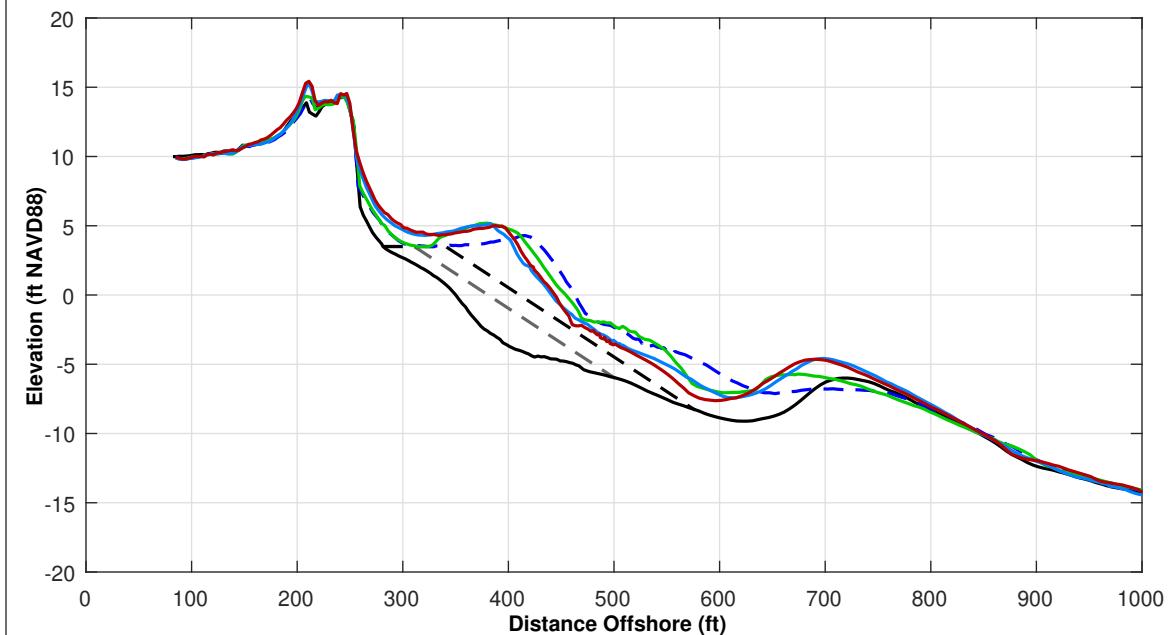
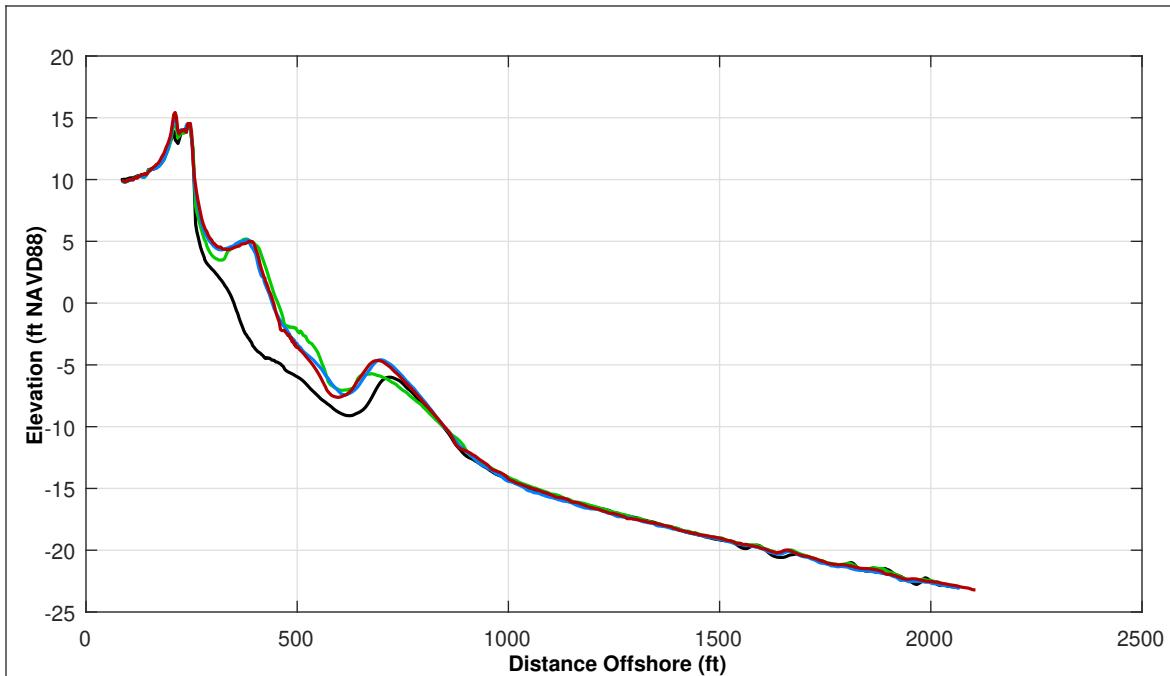


Survey Transect 358+43	NOV 2018 - OCT 2017	NOV 2018 - APR 2018
Shoreline Change at MHW (0.98 ft NAVD88)	-8.36 ft	-4.71 ft
Volume Change Above -15 ft NAVD88	7.88 cy/ft	4.17 cy/ft
Volume Change Above 0 ft NAVD88	2.71 cy/ft	1.26 cy/ft
Distance from USACE Design Template @ 3.5 feet NAVD88:		
LEGEND: NOV 2018 — NOV 2018 APR 2018 — APR 2018 MAY 2017 — MAY 2017 OCT 2016 — OCT 2016 USACE Design Template - - - - - USACE Nourishment Threshold - - - - -		

Notes:

1. Station From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward and Seaward Of The Breakwater.

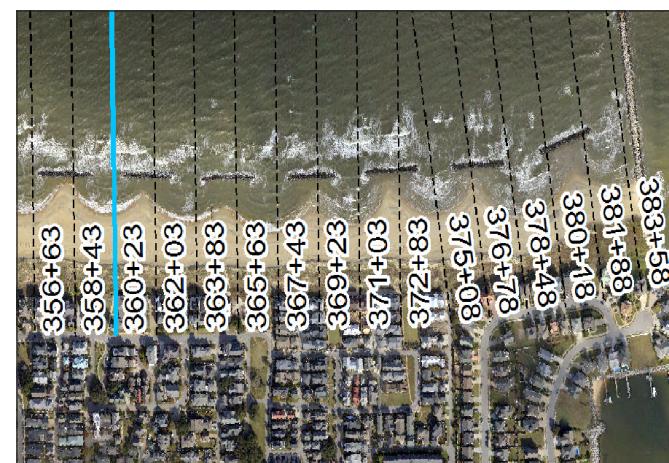


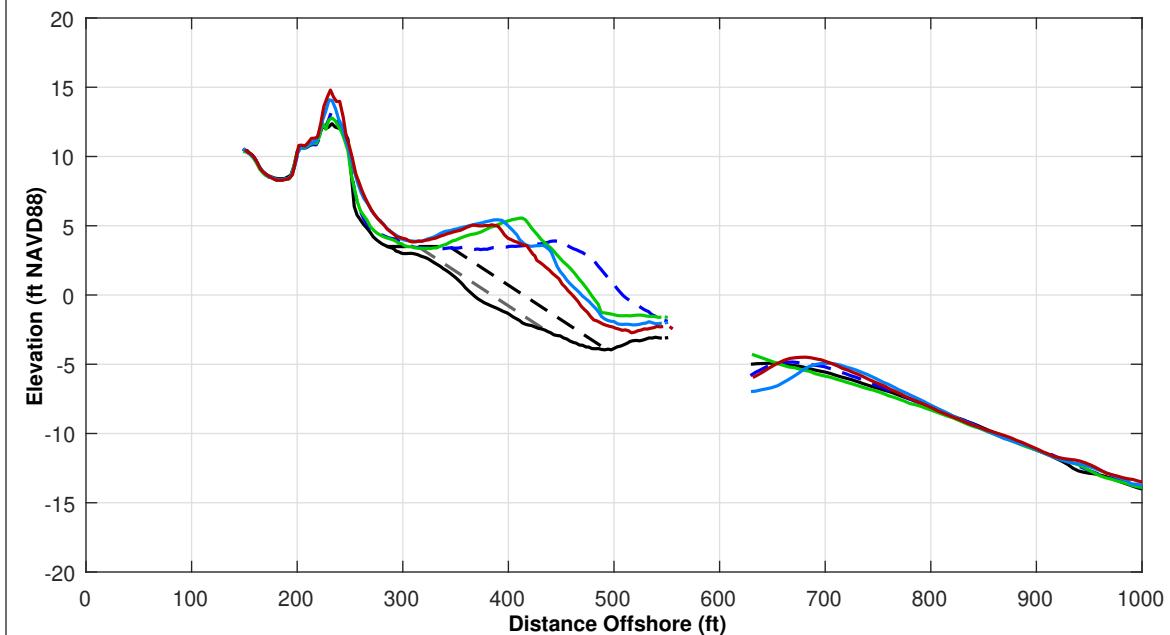
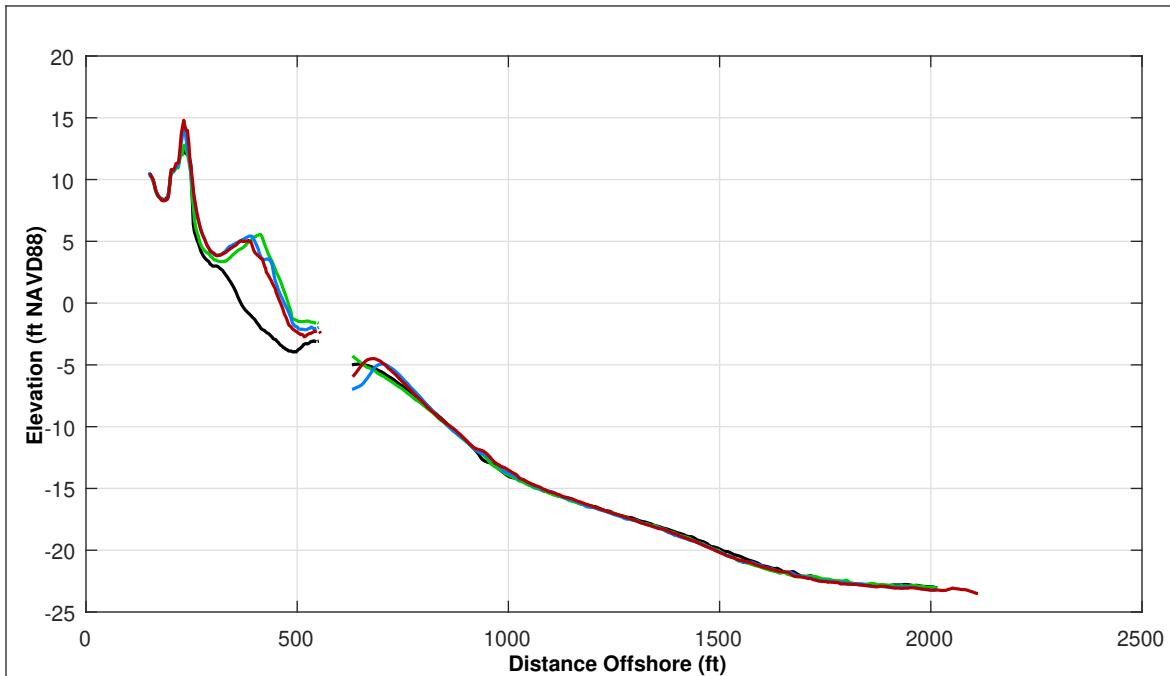


Survey Transect 360+23	NOV 2018 - OCT 2017	NOV 2018 - APR 2018
Shoreline Change at MHW (0.98 ft NAVD88)	-9.60 ft	2.55 ft
Volume Change Above -15 ft NAVD88	-0.34 cy/ft	0.25 cy/ft
Volume Change Above 0 ft NAVD88	2.29 cy/ft	2.07 cy/ft
Distance from USACE Design Template @ 3.5 feet NAVD88:		
LEGEND: NOV 2018 — NOV 2018 APR 2018 — APR 2018 MAY 2017 — MAY 2017 OCT 2016 — OCT 2016 USACE Design Template — USACE Design Template OCT 2017 — OCT 2017 USACE Nourishment Threshold — USACE Nourishment Threshold		

Notes:

1. Station From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward and Seaward Of The Breakwater.

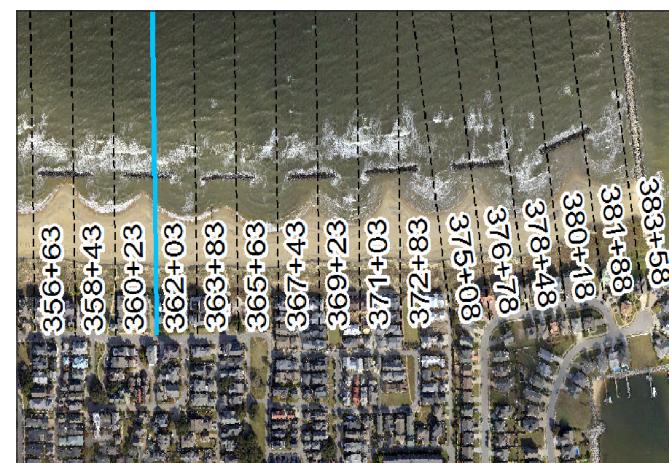


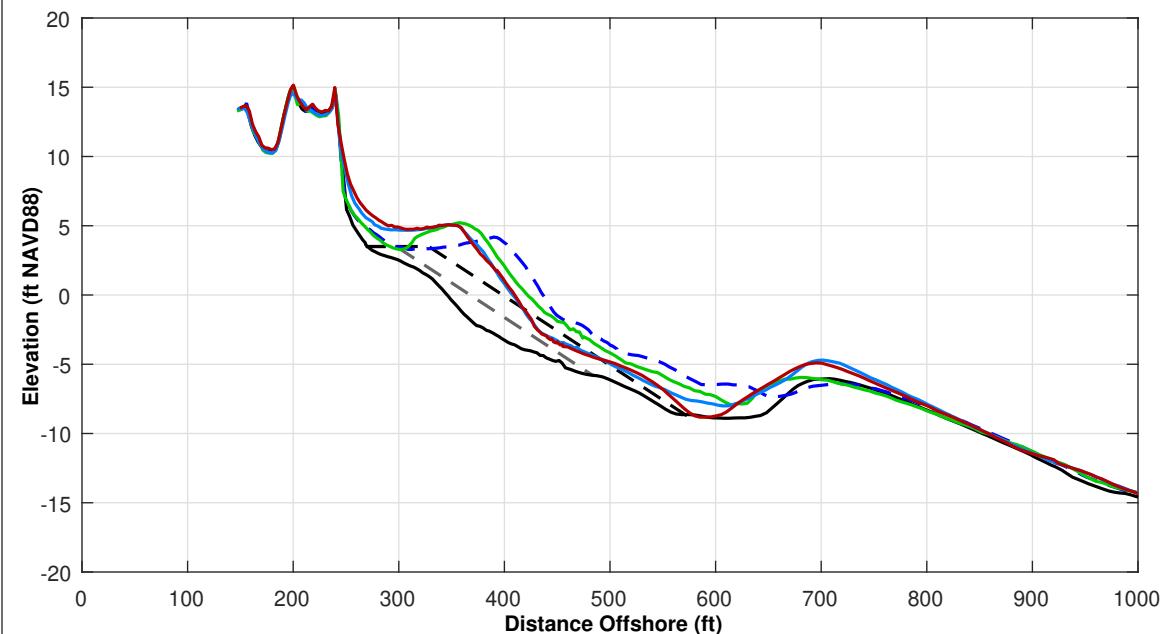
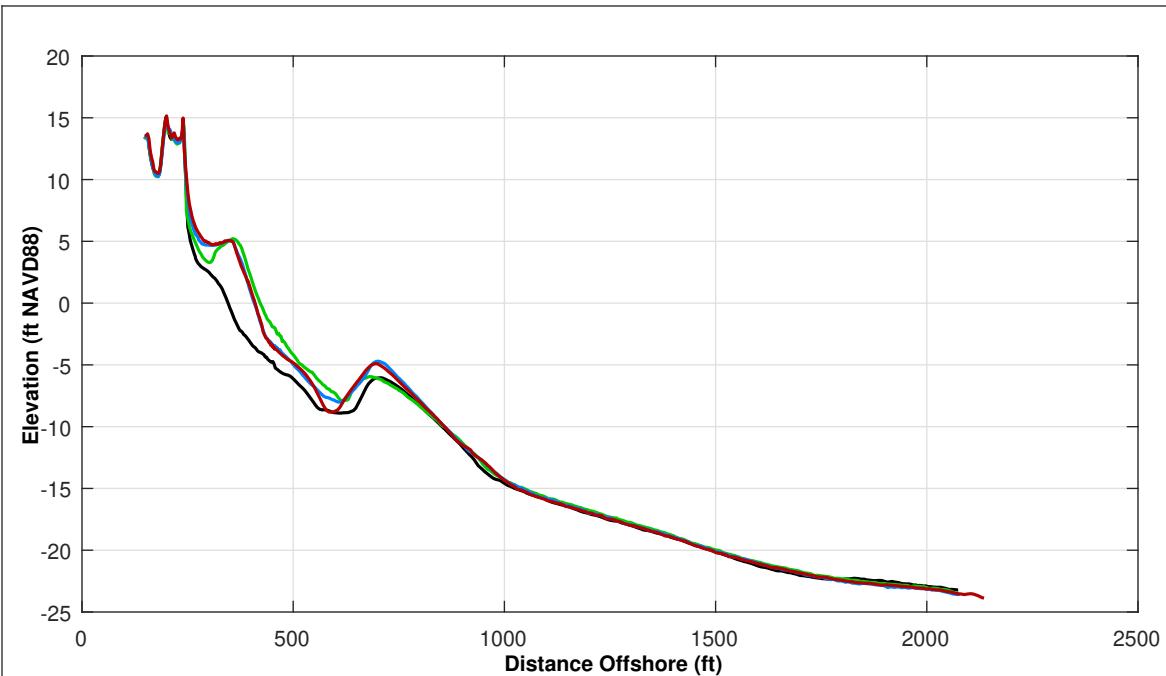


Survey Transect 362+03	NOV 2018 - OCT 2017	NOV 2018 - APR 2018
Shoreline Change at MHW (0.98 ft NAVD88)	-19.45 ft	-7.06 ft
Volume Change Above -15 ft NAVD88	2.73 cy/ft	-0.24 cy/ft
Volume Change Above 0 ft NAVD88	0.74 cy/ft	-1.56 cy/ft
Distance from USACE Design Template @ 3.5 feet NAVD88:		
LEGEND: NOV 2018 — NOV 2018 OCT 2016 — OCT 2016 USACE Design Template - - - - - OCT 2017 — OCT 2017 USACE Nourishment Threshold - - - - -		

Notes:

1. Station From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward and Seaward Of The Breakwater.

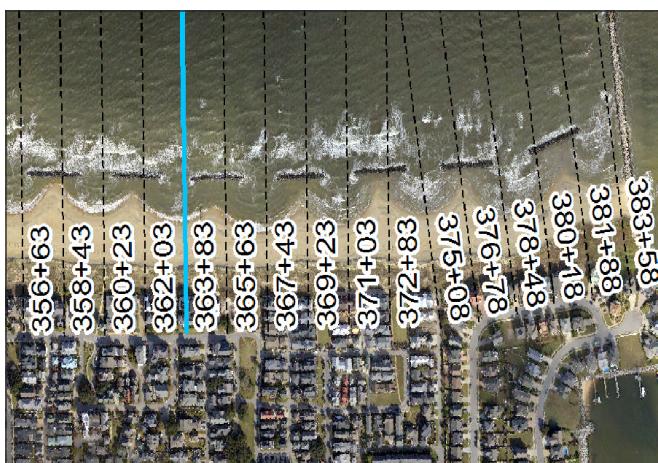


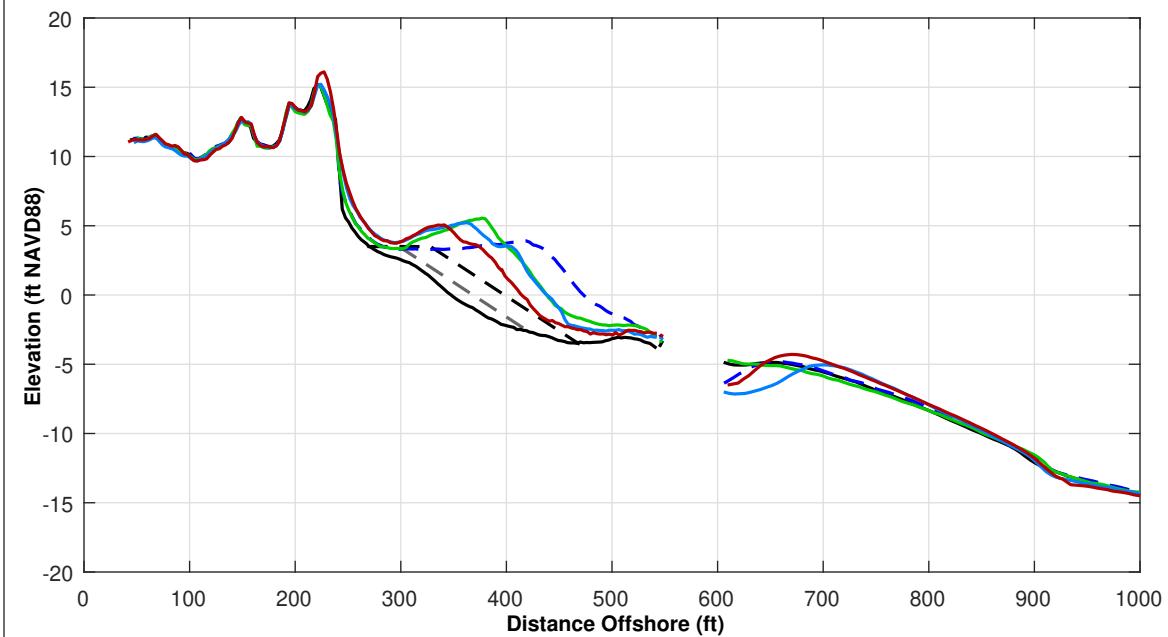
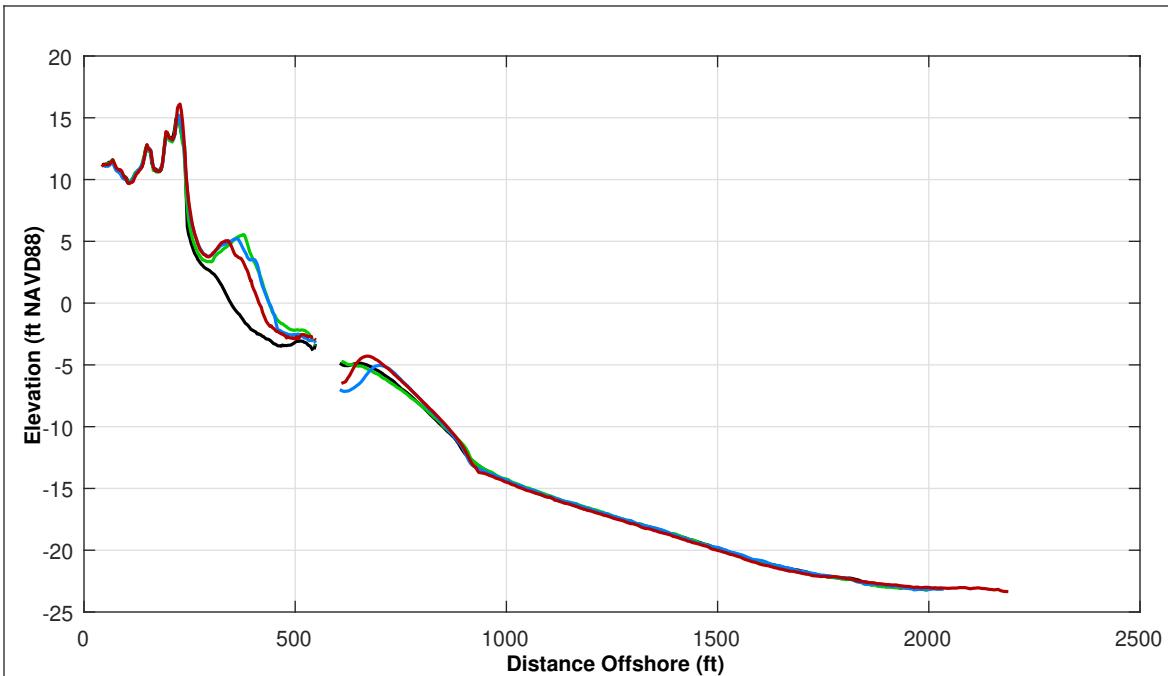


Survey Transect 363+83	NOV 2018 - OCT 2017	NOV 2018 - APR 2018
Shoreline Change at MHW (0.98 ft NAVD88)	-10.01 ft	2.14 ft
Volume Change Above -15 ft NAVD88	-1.69 cy/ft	-0.44 cy/ft
Volume Change Above 0 ft NAVD88	2.50 cy/ft	1.77 cy/ft

Notes:

1. Station From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward and Seaward Of The Breakwater.

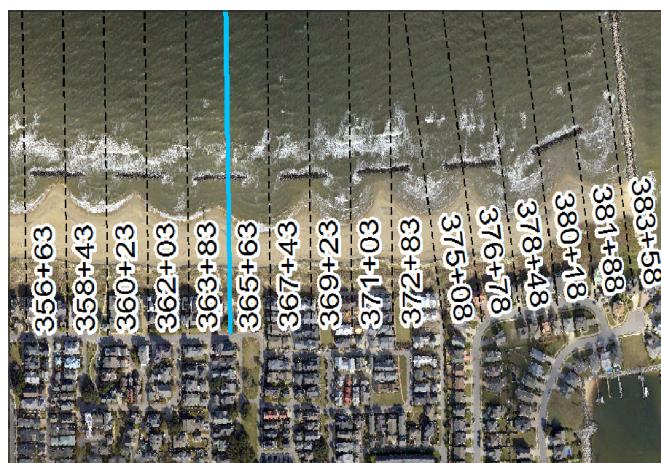


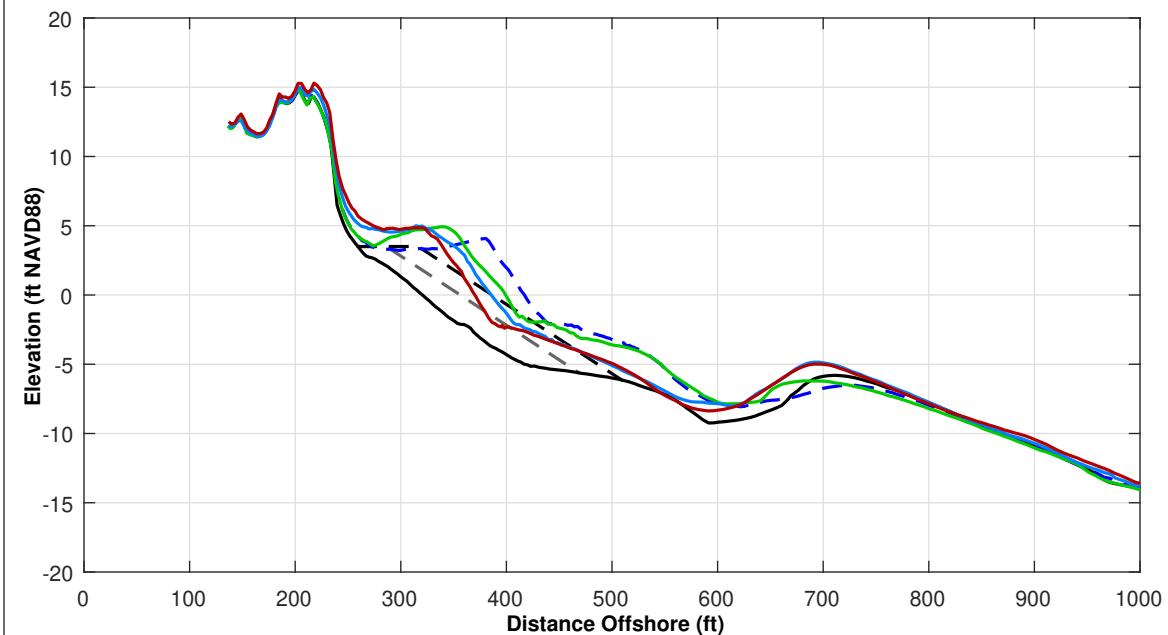
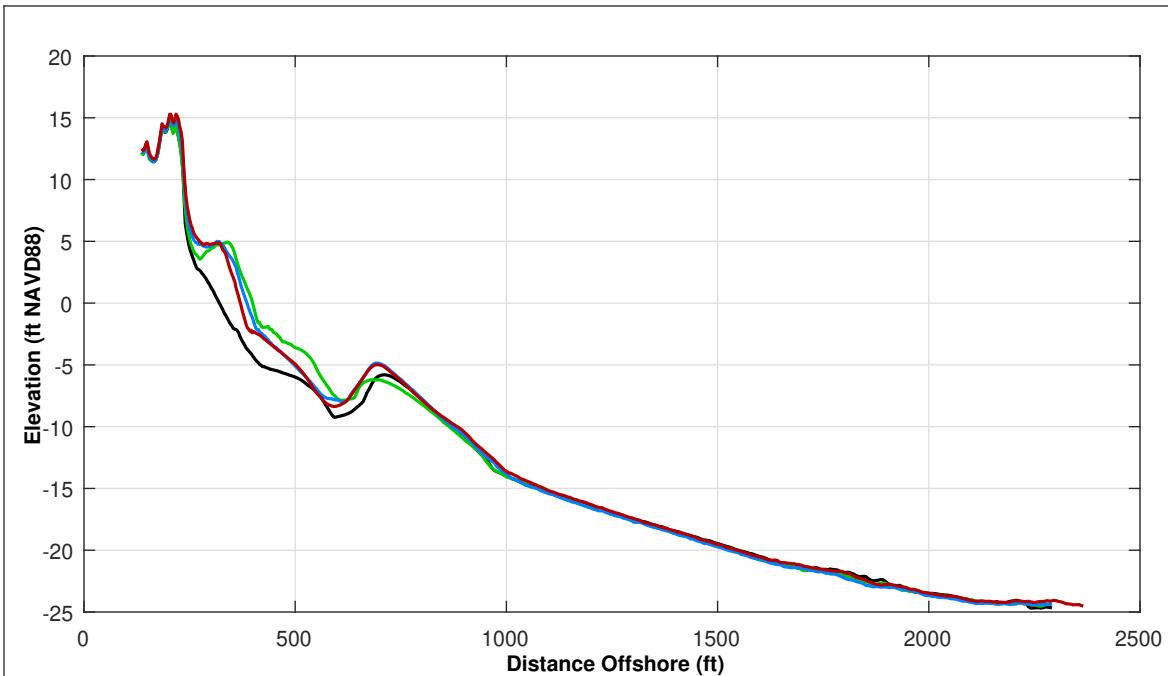


Survey Transect 365+63	NOV 2018 - OCT 2017	NOV 2018 - APR 2018
Shoreline Change at MHW (0.98 ft NAVD88)	-24.80 ft	-23.30 ft
Volume Change Above -15 ft NAVD88	-2.71 cy/ft	-1.42 cy/ft
Volume Change Above 0 ft NAVD88	-2.04 cy/ft	-3.43 cy/ft
Distance from USACE Design Template @ 3.5 feet NAVD88:		
LEGEND: NOV 2018 — NOV 2018 APR 2018 — APR 2018 MAY 2017 — MAY 2017 OCT 2016 — OCT 2016 USACE Design Template - - - - - OCT 2017 — OCT 2017 USACE Nourishment Threshold - - - - -		

Notes:

1. Station From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward and Seaward Of The Breakwater.

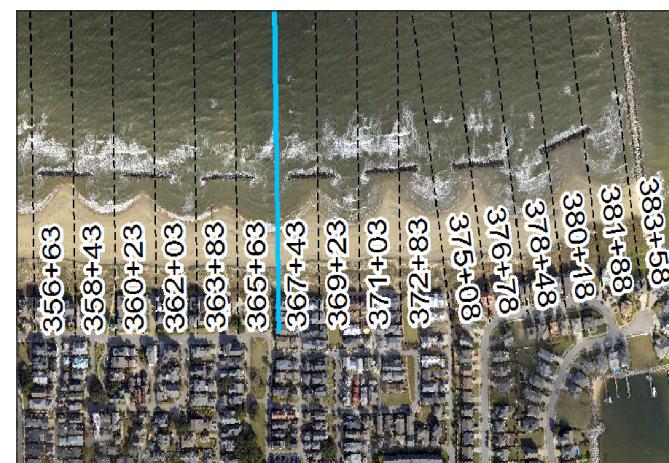


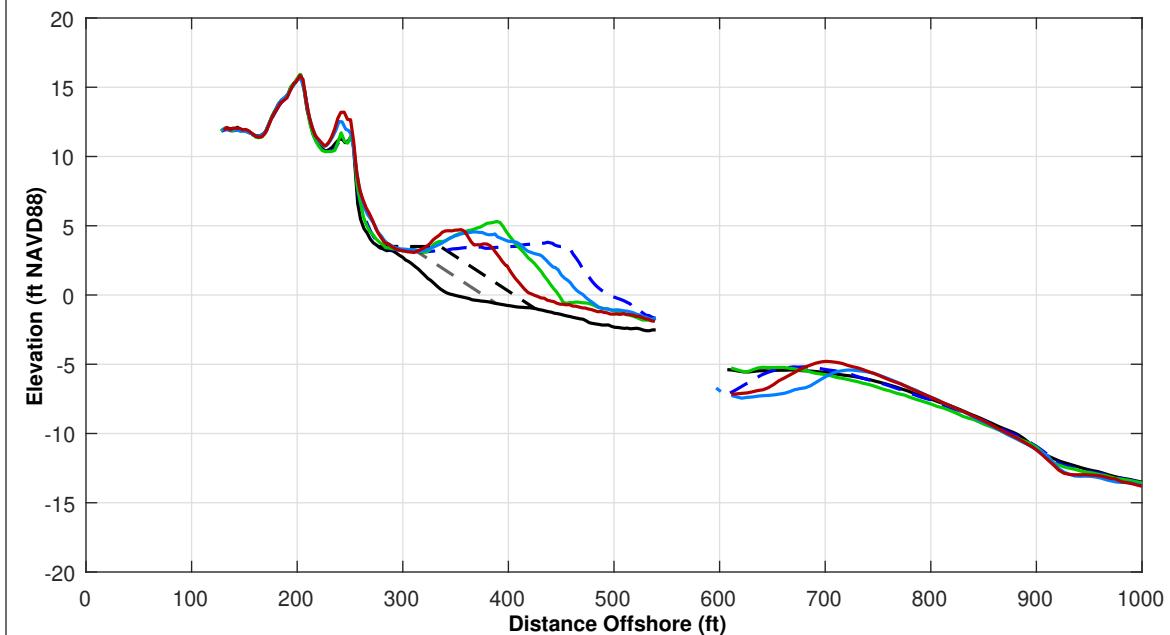
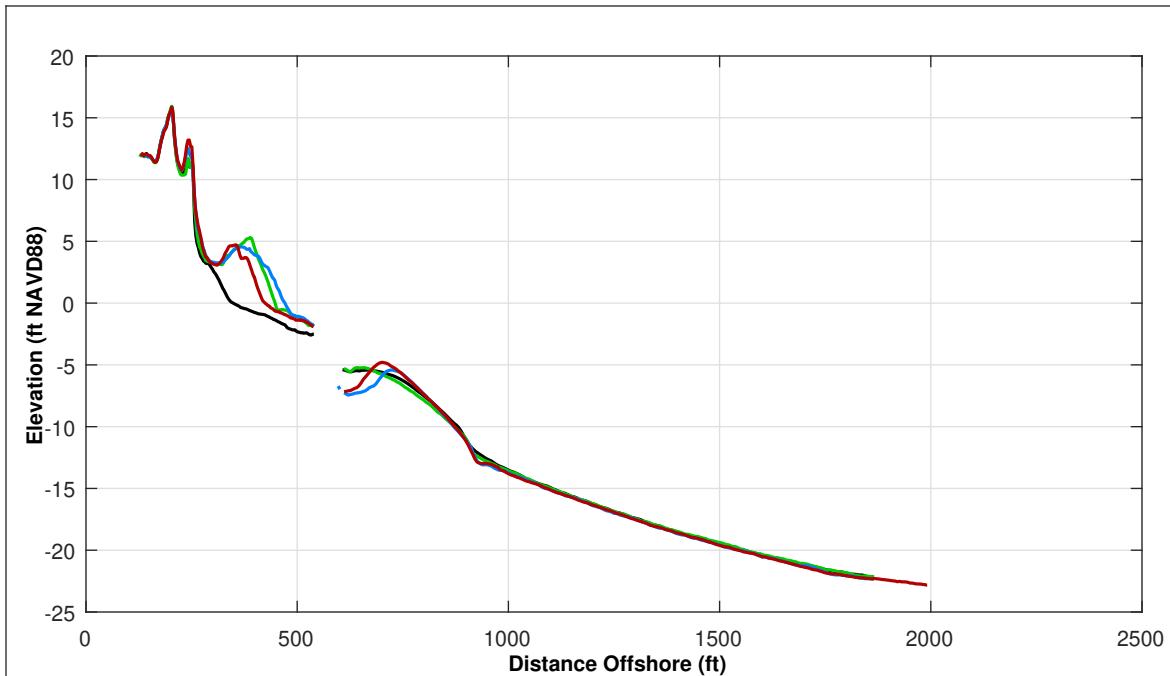


Survey Transect 367+43	NOV 2018 - OCT 2017	NOV 2018 - APR 2018
Shoreline Change at MHW (0.98 ft NAVD88)	-26.78 ft	-13.62 ft
Volume Change Above -15 ft NAVD88	-2.17 cy/ft	-1.03 cy/ft
Volume Change Above 0 ft NAVD88	0.88 cy/ft	0.02 cy/ft
Distance from USACE Design Template @ 3.5 feet NAVD88:		
LEGEND: NOV 2018 — NOV 2018 APR 2018 — APR 2018 MAY 2017 — MAY 2017 OCT 2016 — OCT 2016 USACE Design Template — Dashed Blue USACE Nourishment Threshold — Dashed Green		

Notes:

1. Station From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward and Seaward Of The Breakwater.

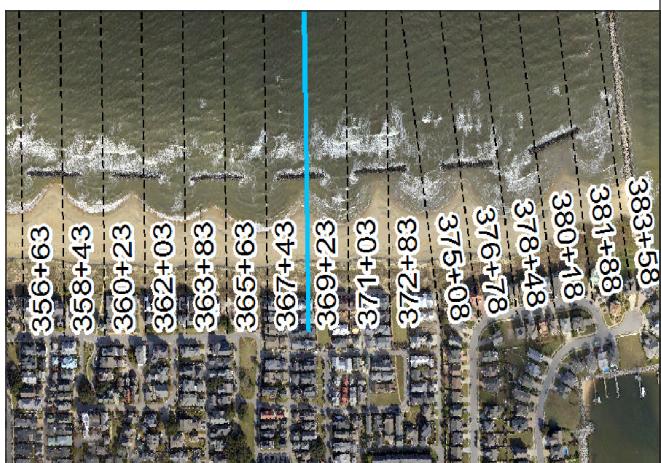


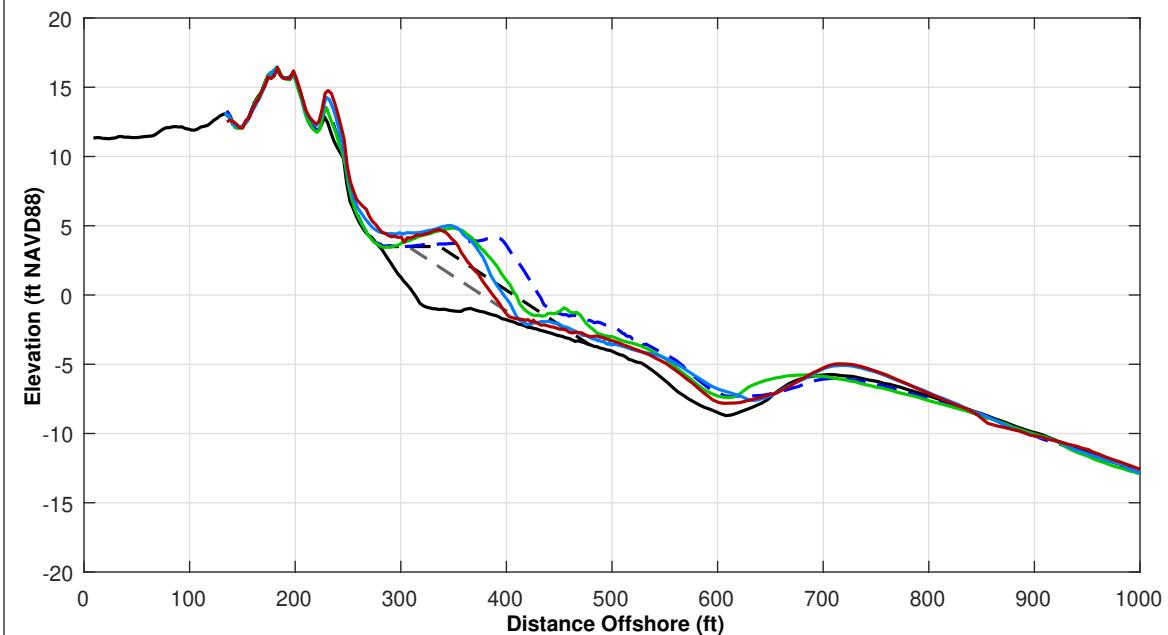
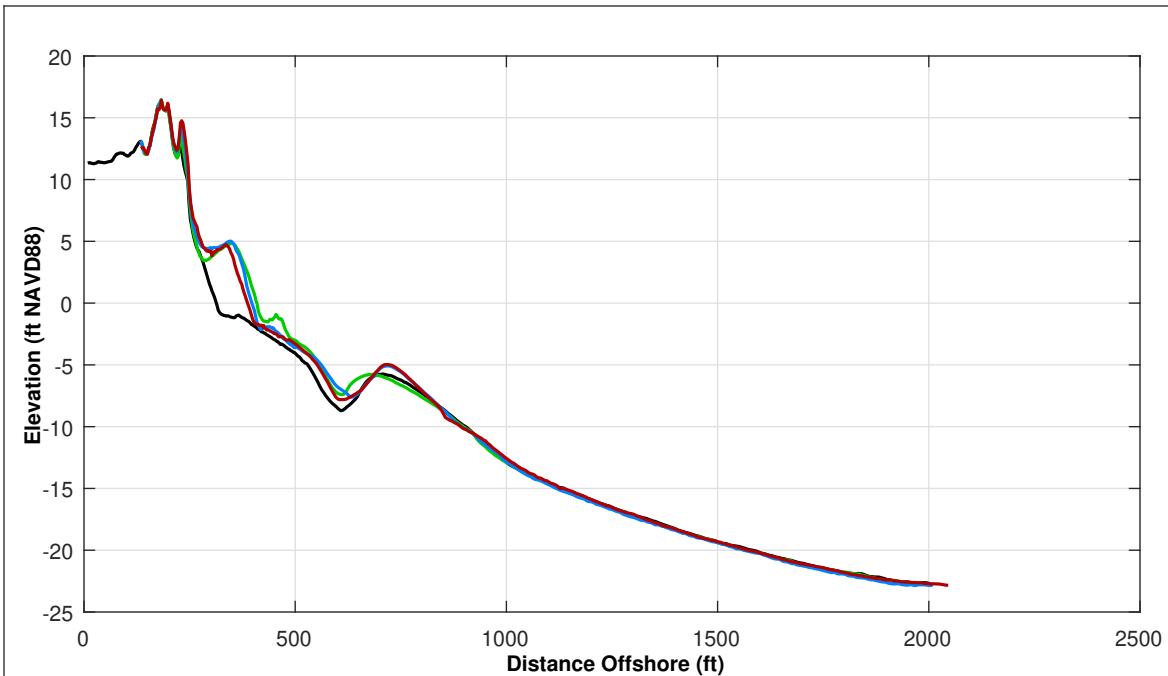


Survey Transect 369+23	NOV 2018 - OCT 2017	NOV 2018 - APR 2018
Shoreline Change at MHW (0.98 ft NAVD88)	-28.79 ft	-48.28 ft
Volume Change Above -15 ft NAVD88	-3.83 cy/ft	-3.74 cy/ft
Volume Change Above 0 ft NAVD88	-2.57 cy/ft	-5.58 cy/ft
Distance from USACE Design Template @ 3.5 feet NAVD88:		
LEGEND: MAY 2017 NOV 2018 OCT 2016 APR 2018 USACE Design Template USACE Nourishment Threshold		

Notes:

1. Station From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward and Seaward Of The Breakwater.

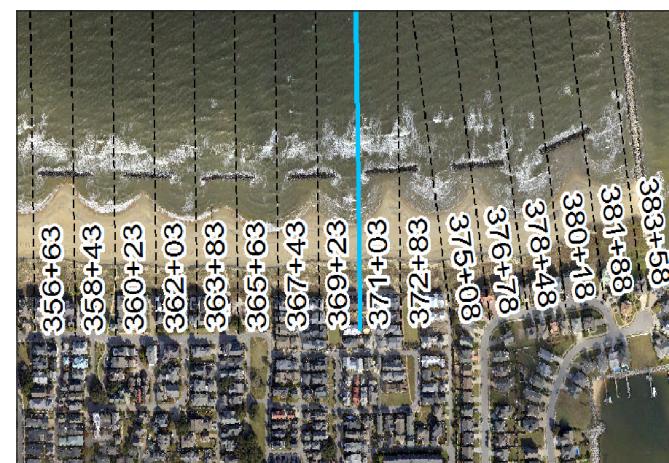


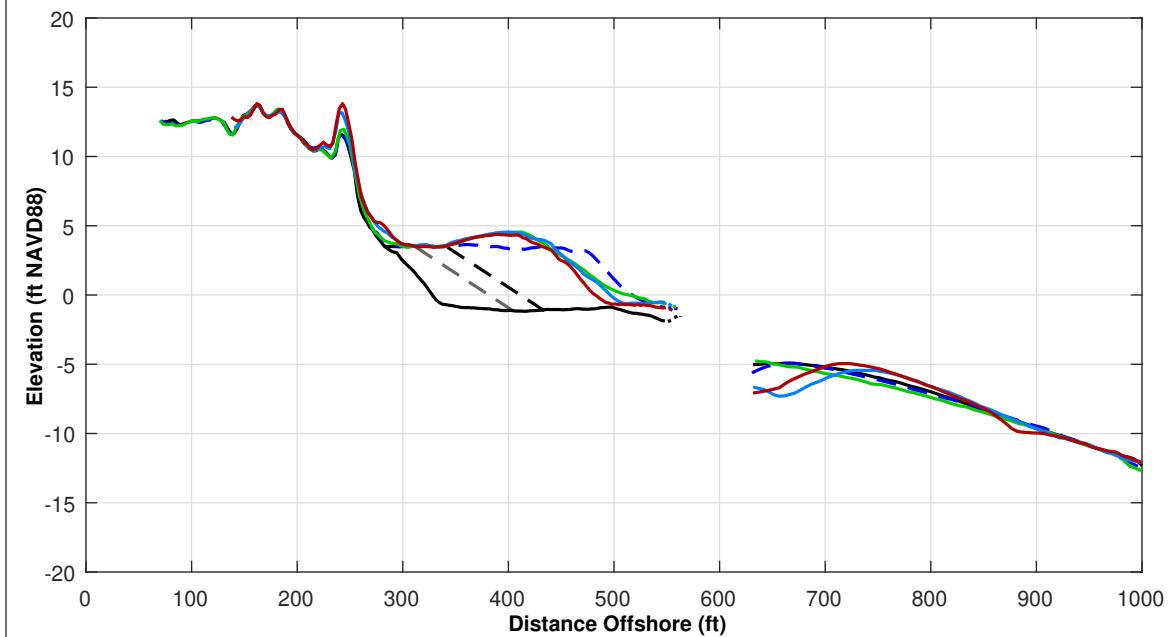
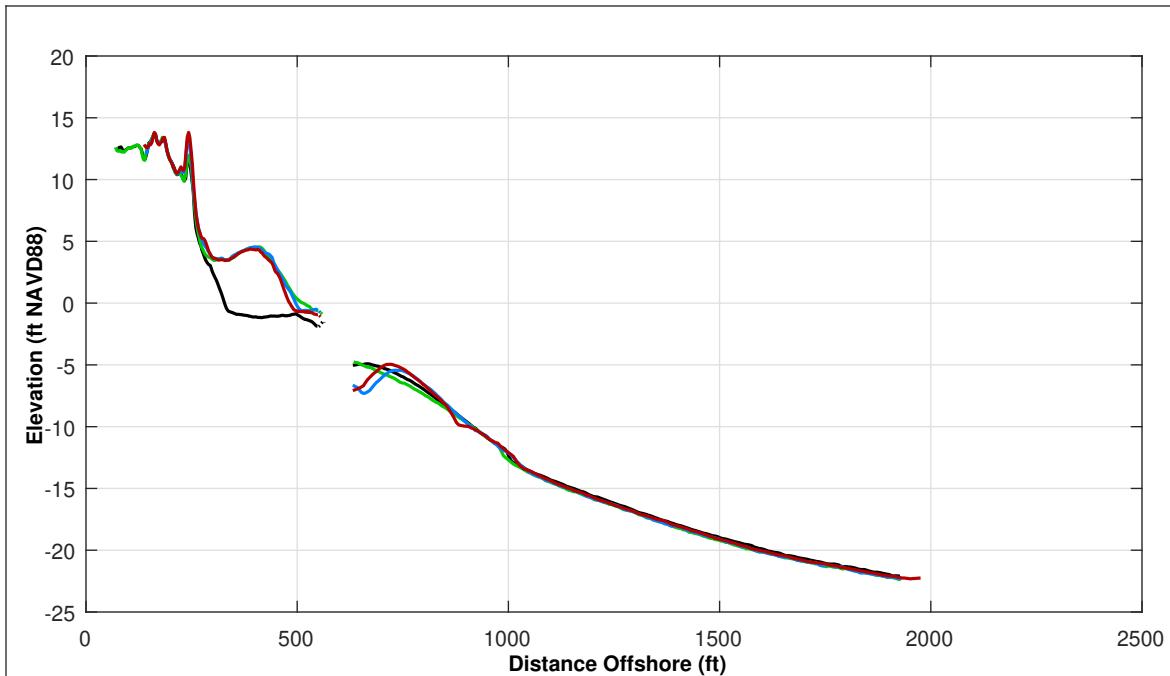


Survey Transect 371+03	NOV 2018 - OCT 2017	NOV 2018 - APR 2018
Shoreline Change at MHW (0.98 ft NAVD88)	ft	ft
Volume Change Above -15 ft NAVD88	cy/ft	cy/ft
Volume Change Above 0 ft NAVD88	cy/ft	cy/ft
Distance from USACE Design Template @ 3.5 feet NAVD88:		

Notes:

1. Station From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward and Seaward Of The Breakwater.



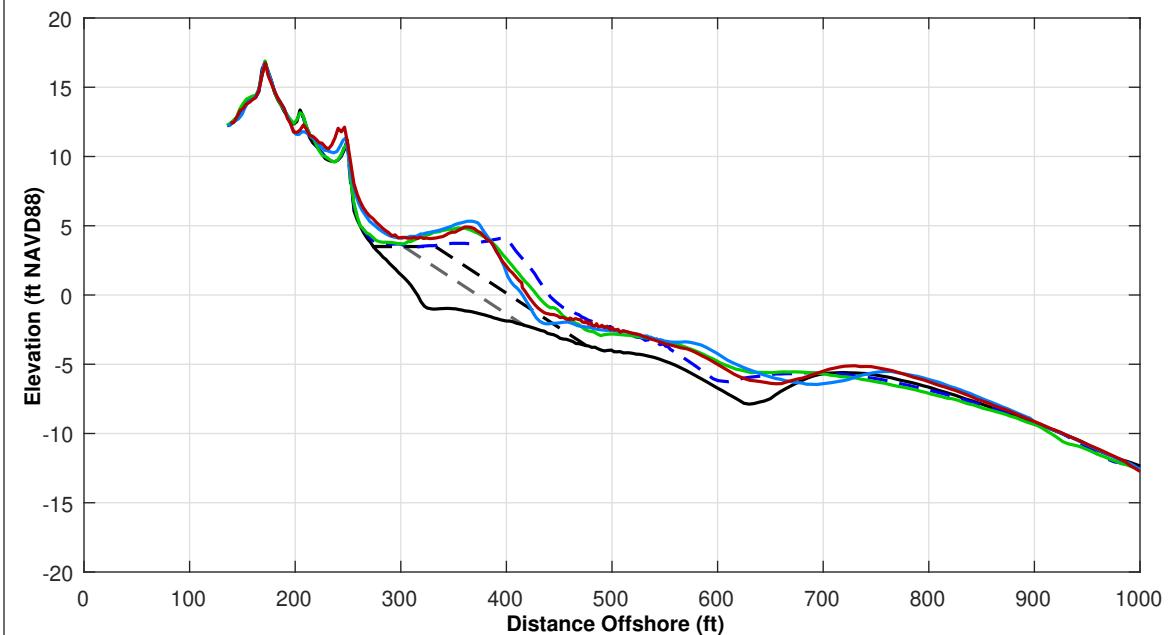
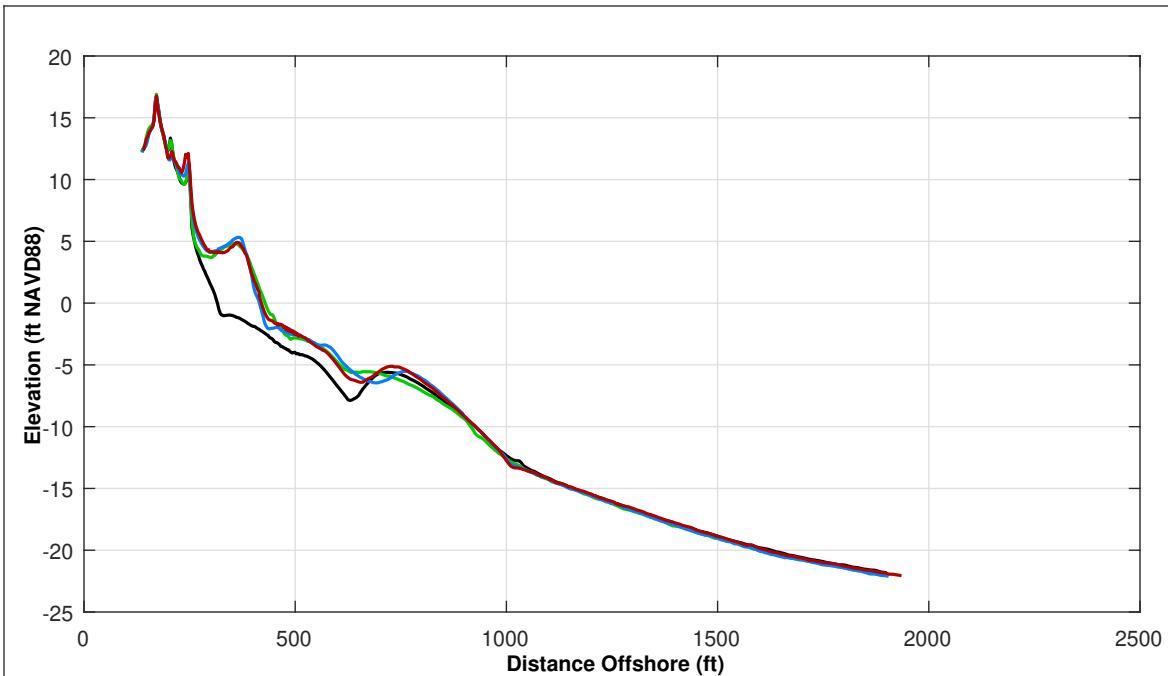


Survey Transect 372+83	NOV 2018 - OCT 2017	NOV 2018 - APR 2018
Shoreline Change at MHW (0.98 ft NAVD88)	-15.40 ft	-12.50 ft
Volume Change Above -15 ft NAVD88	2.04 cy/ft	0.21 cy/ft
Volume Change Above 0 ft NAVD88	-2.60 cy/ft	-1.02 cy/ft
Distance from USACE Design Template @ 3.5 feet NAVD88:		
LEGEND: MAY 2017 NOV 2018 — APR 2018 — OCT 2016 — USACE Design Template — OCT 2017 — USACE Nourishment Threshold —		

Notes:

1. Station From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward and Seaward Of The Breakwater.

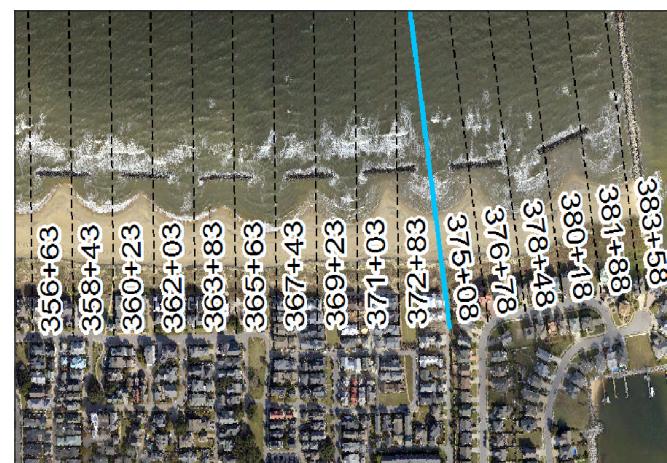


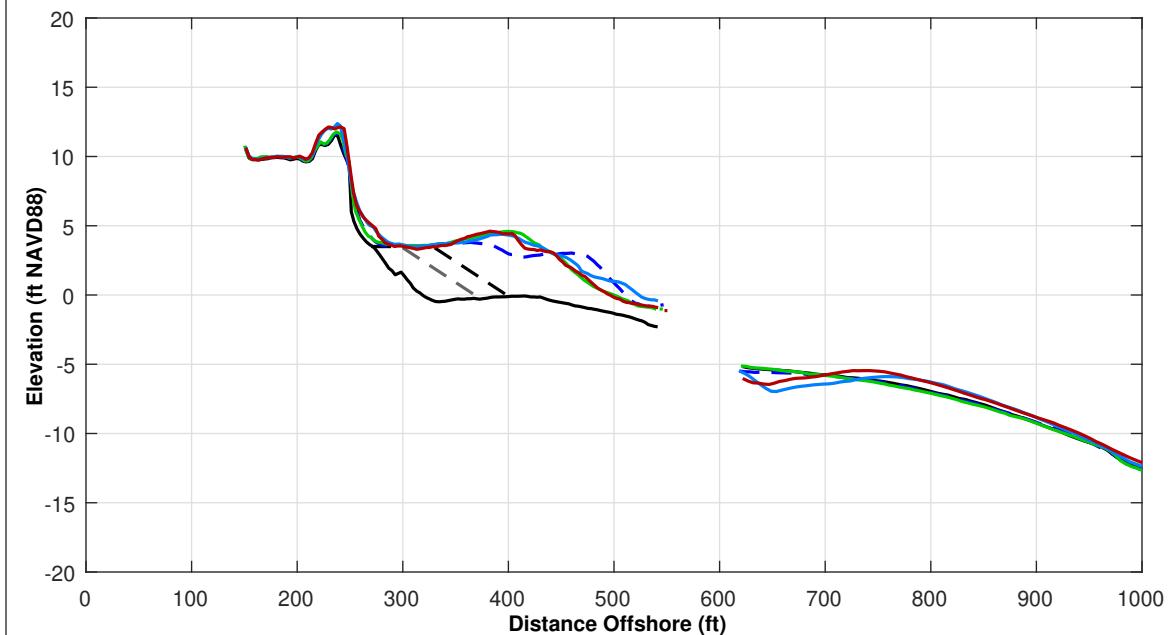
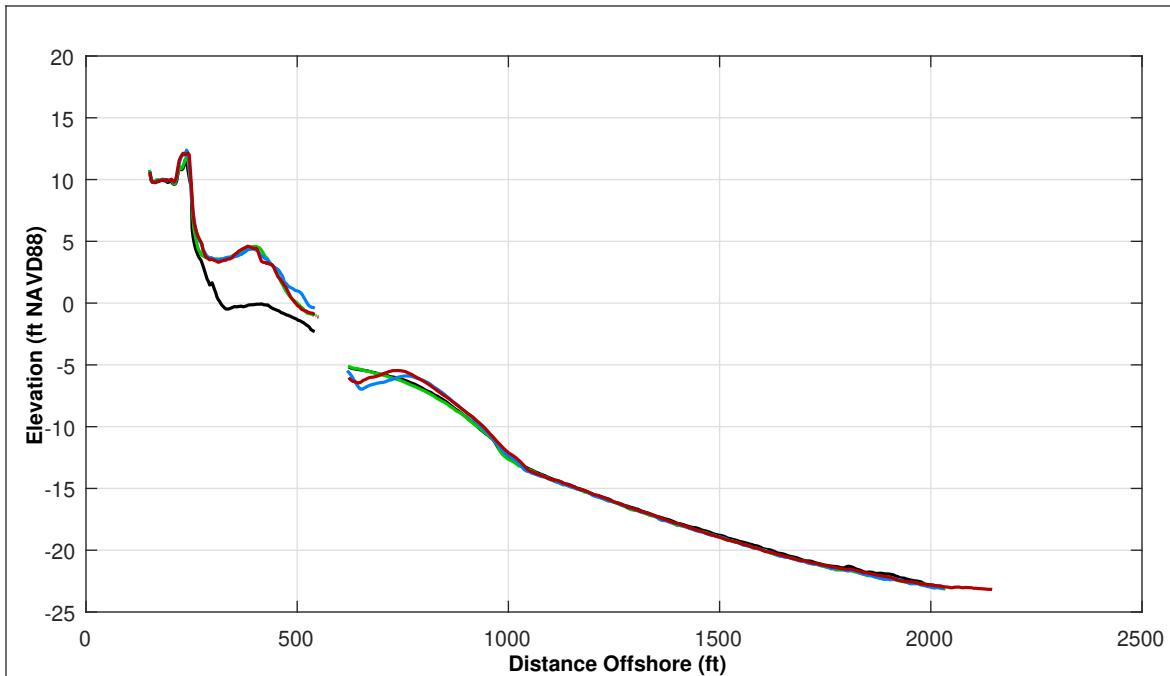


Survey Transect 375+08	NOV 2018 - OCT 2017	NOV 2018 - APR 2018
Shoreline Change at MHW (0.98 ft NAVD88)	-4.77 ft	8.92 ft
Volume Change Above -15 ft NAVD88	6.07 cy/ft	1.27 cy/ft
Volume Change Above 0 ft NAVD88	1.77 cy/ft	0.69 cy/ft
Distance from USACE Design Template @ 3.5 feet NAVD88:		
LEGEND: MAY 2017 NOV 2018 — OCT 2016 — APR 2018 — USACE Design Template — OCT 2017 — USACE Nourishment Threshold —		

Notes:

1. Station From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward and Seaward Of The Breakwater.

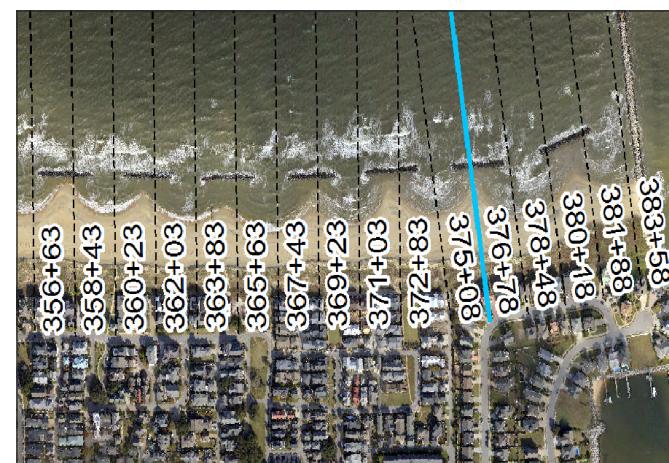


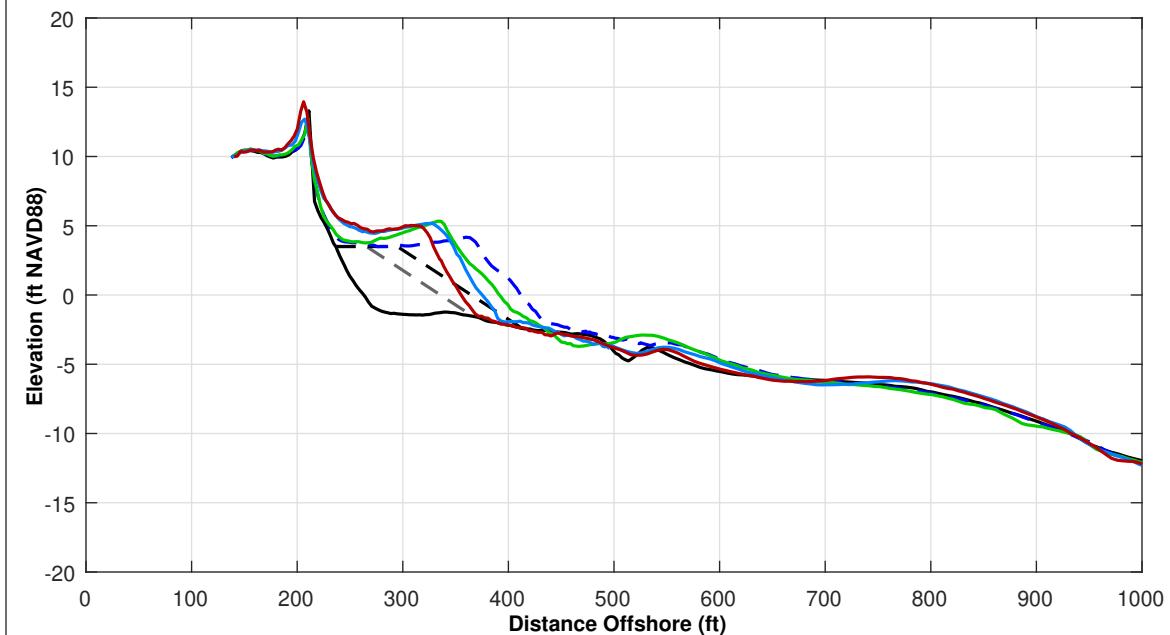
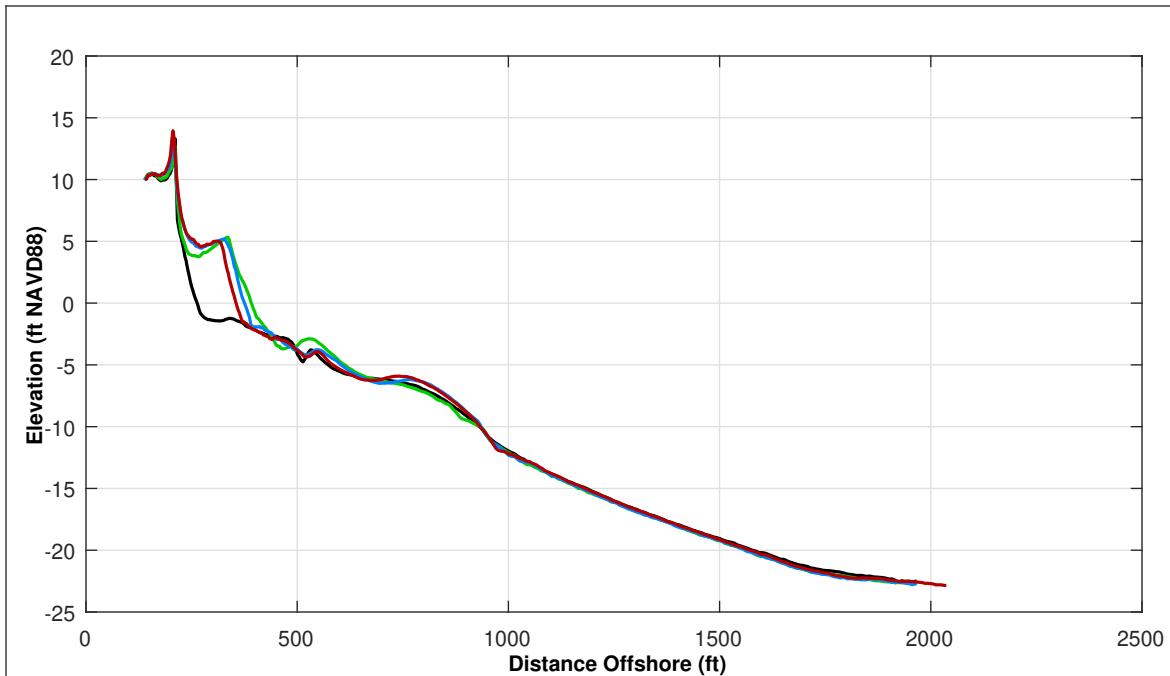


Survey Transect 376+78	NOV 2018 - OCT 2017	NOV 2018 - APR 2018
Shoreline Change at MHW (0.98 ft NAVD88)	4.00 ft	-23.18 ft
Volume Change Above -15 ft NAVD88	5.88 cy/ft	1.21 cy/ft
Volume Change Above 0 ft NAVD88	1.00 cy/ft	-1.63 cy/ft
Distance from USACE Design Template @ 3.5 feet NAVD88:		
LEGEND: NOV 2018 — NOV 2018 APR 2018 — APR 2018 MAY 2017 — MAY 2017 OCT 2016 — OCT 2016 OCT 2017 — OCT 2017 USACE Design Template - - - - - USACE Nourishment Threshold - - - - -		

Notes:

1. Station From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward and Seaward Of The Breakwater.

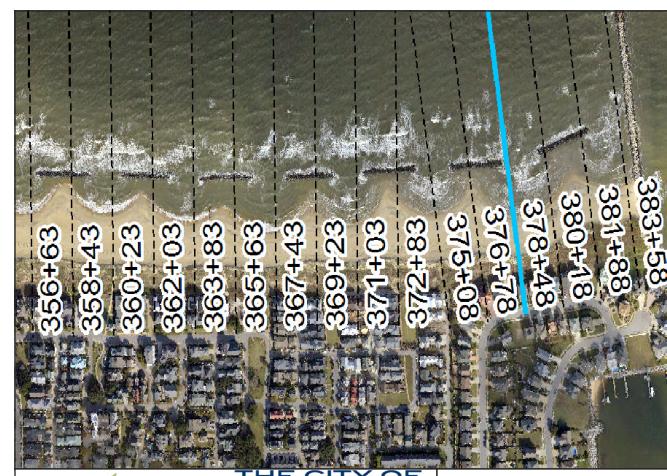


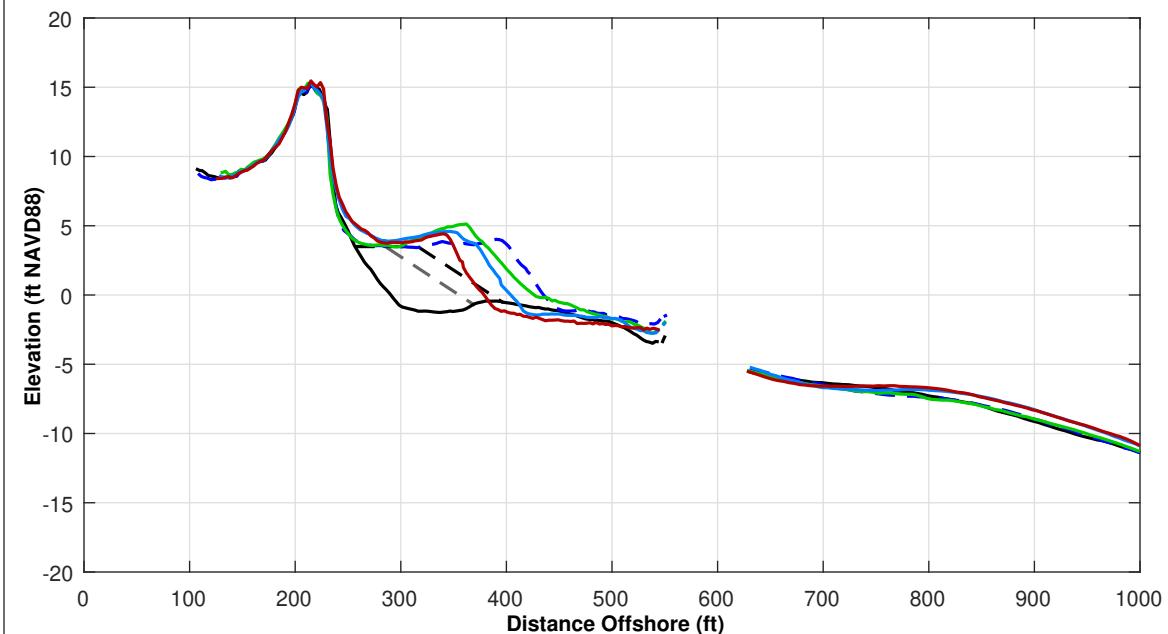
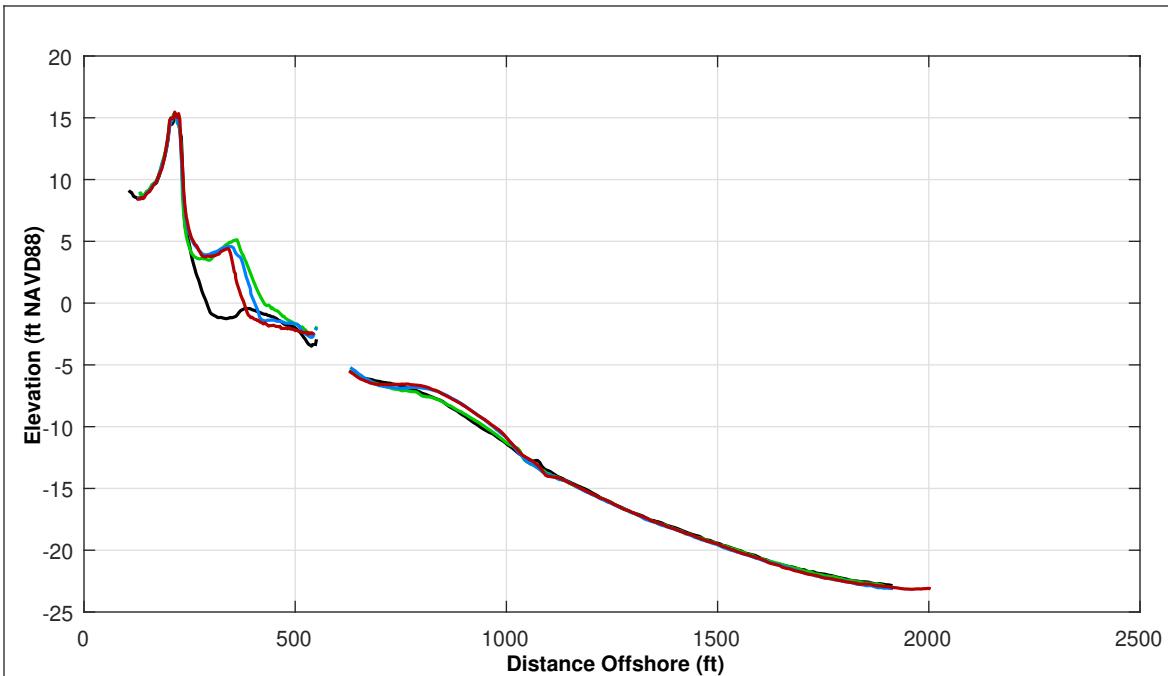


Survey Transect 378+48	NOV 2018 - OCT 2017	NOV 2018 - APR 2018
Shoreline Change at MHW (0.98 ft NAVD88)	-34.37 ft	-18.67 ft
Volume Change Above -15 ft NAVD88	-1.75 cy/ft	-4.56 cy/ft
Volume Change Above 0 ft NAVD88	-0.54 cy/ft	-2.46 cy/ft
Distance from USACE Design Template @ 3.5 feet NAVD88:		
LEGEND: NOV 2018 — NOV 2018 APR 2018 — APR 2018 MAY 2017 — MAY 2017 OCT 2016 — OCT 2016 USACE Design Template — USACE Design Template USACE Nourishment Threshold — USACE Nourishment Threshold		

Notes:

1. Station From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward and Seaward Of The Breakwater.

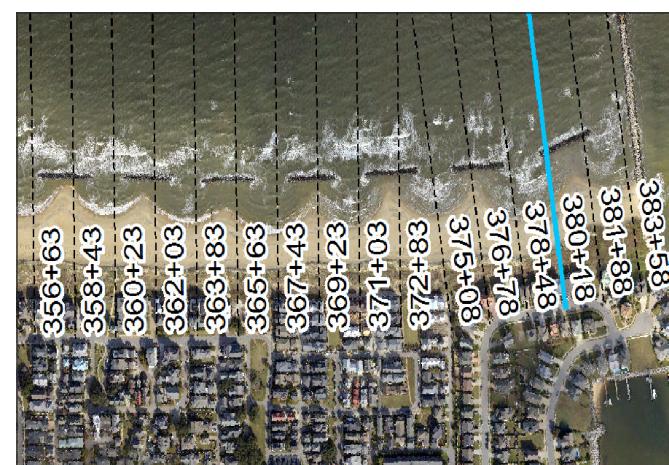


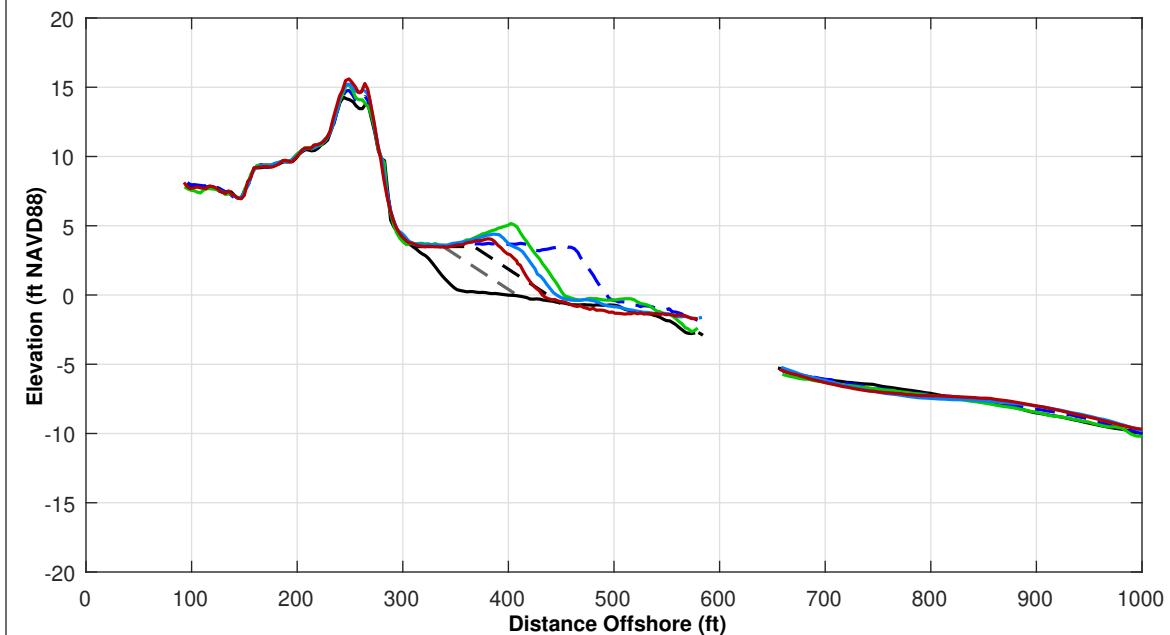
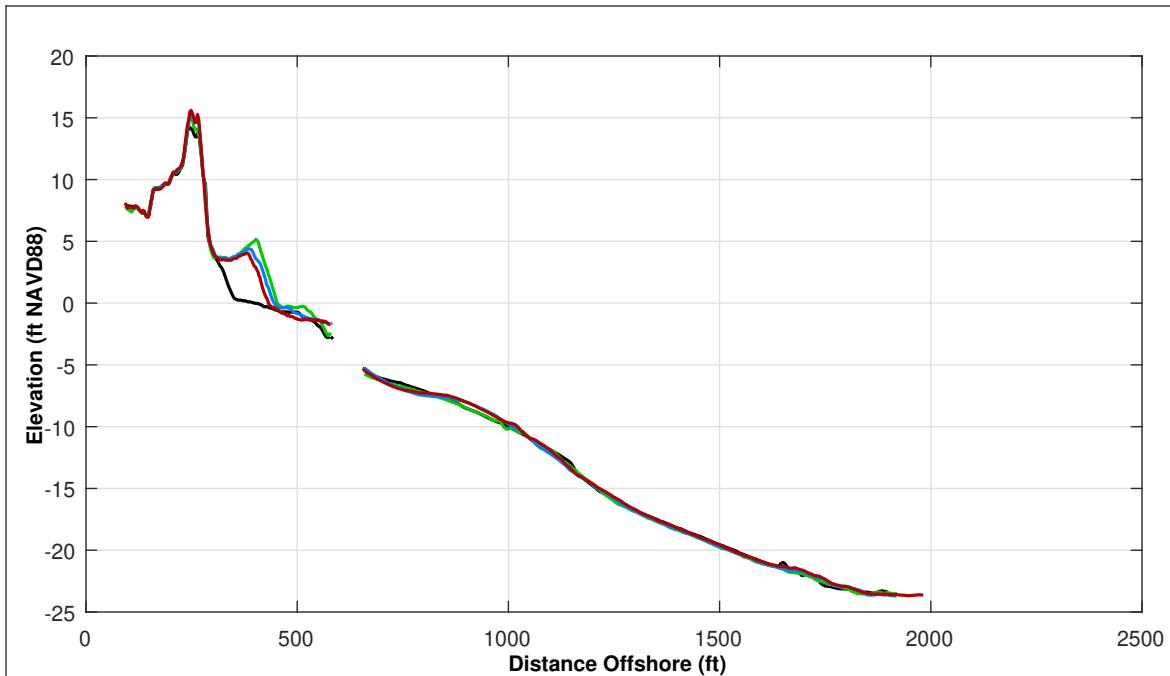


Survey Transect 380+18	NOV 2018 - OCT 2017	NOV 2018 - APR 2018
Shoreline Change at MHW (0.98 ft NAVD88)	-42.96 ft	-26.12 ft
Volume Change Above -15 ft NAVD88	-3.89 cy/ft	-5.24 cy/ft
Volume Change Above 0 ft NAVD88	-4.80 cy/ft	-3.67 cy/ft
Distance from USACE Design Template @ 3.5 feet NAVD88:		
LEGEND: MAY 2017 NOV 2018 — OCT 2016 — APR 2018 — USACE Design Template — OCT 2017 — USACE Nourishment Threshold —		

Notes:

1. Station From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward and Seaward Of The Breakwater.



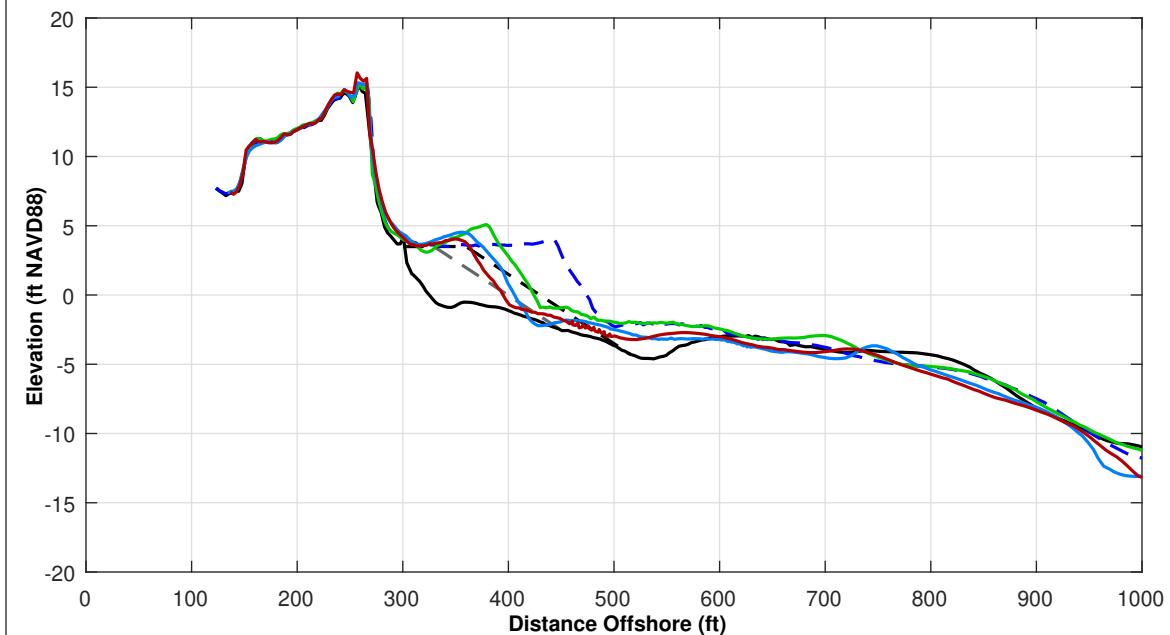
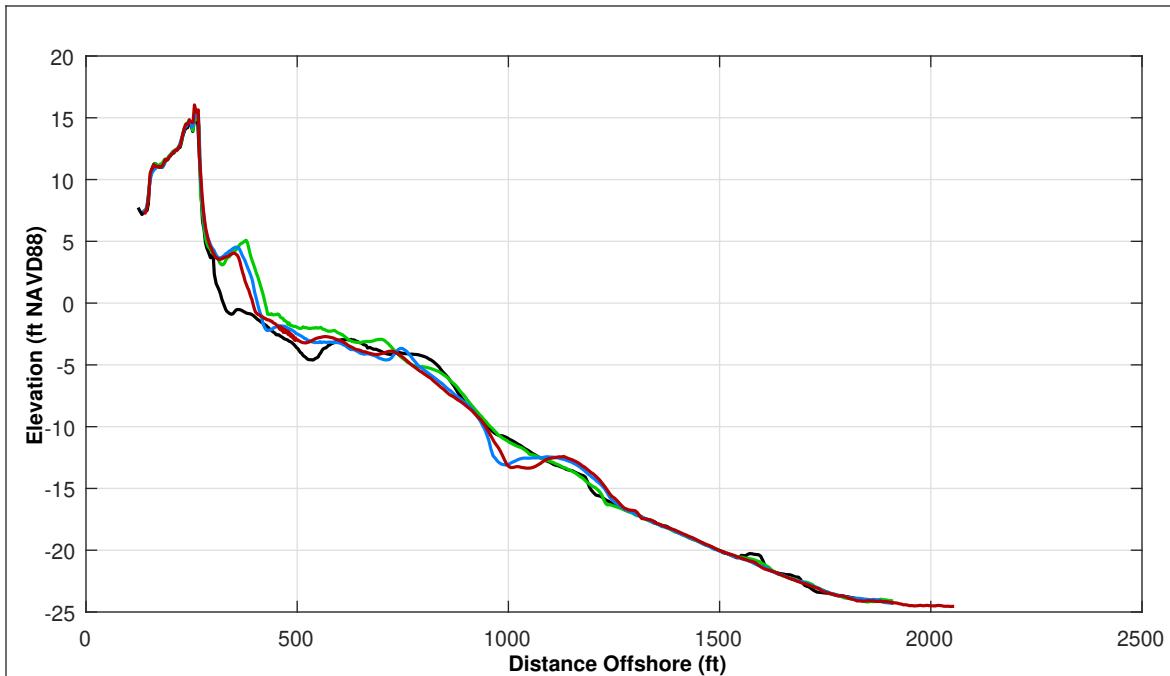


Survey Transect 381+88	NOV 2018 - OCT 2017	NOV 2018 - APR 2018
Shoreline Change at MHW (0.98 ft NAVD88)	-23.96 ft	-14.14 ft
Volume Change Above -15 ft NAVD88	-3.71 cy/ft	-2.33 cy/ft
Volume Change Above 0 ft NAVD88	-4.38 cy/ft	-2.36 cy/ft
Distance from USACE Design Template @ 3.5 feet NAVD88:		
LEGEND: NOV 2018 — NOV 2018 APR 2018 — APR 2018 MAY 2017 — MAY 2017 OCT 2016 — OCT 2016 USACE Design Template — USACE Design Template USACE Nourishment Threshold — USACE Nourishment Threshold		

Notes:

1. Station From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward and Seaward Of The Breakwater.





Survey Transect	NOV 2018 - OCT 2017	NOV 2018 - APR 2018
Shoreline Change at MHW (0.98 ft NAVD88)	-30.87 ft	-12.67 ft
Volume Change Above -15 ft NAVD88	-21.07 cy/ft	-2.63 cy/ft
Volume Change Above 0 ft NAVD88	-4.49 cy/ft	-2.35 cy/ft
Distance from USACE Design Template @ 3.5 feet NAVD88:		

Notes:

1. Station From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward and Seaward Of The Breakwater.



**Table C-1. Summary of Shoreline Change and Volume Change
(October 2017 to November 2018)**

NOTES:

1. Positive changes indicate accretion or gain in volume along the profile and negative changes indicate erosion or loss of volume along the profile.
2. MHW assumed at +0.98 ft-NAVD88.
3. Shoreline Change and Volume Change is calculated for the period between surveys from October 16, 2017 to November 6, 2018.

Transect Number (Station)	Old Survey Date	New Survey Date	Shoreline Change Rate at MHW (ft/yr)	Volume Change Rate Above 0 ft NAVD88 (cy/ft/yr)	Volume Change Rate Above -15 ft NAVD88 (cy/ft/yr)
0+00	10/16/2017	11/6/2018	-11.53	-2.12	-34.04
2+50	10/16/2017	11/6/2018	12.65	2.28	22.64
5+00	10/16/2017	11/6/2018	5.96	0.98	41.90
7+50	10/16/2017	11/6/2018	7.88	2.62	25.38
10+00	10/16/2017	11/6/2018	5.96	-1.22	-5.27
12+50	10/16/2017	11/6/2018	0.73	-1.33	12.29
15+00	10/16/2017	11/6/2018	19.21	1.71	16.03
17+50	10/16/2017	11/6/2018	15.21	2.61	8.60
20+00	10/16/2017	11/6/2018	-27.65	-2.32	6.92
22+50	10/16/2017	11/6/2018	-43.77	-7.07	-5.51
25+00	10/16/2017	11/6/2018	-4.32	-0.47	12.18
27+50	10/16/2017	11/6/2018	-32.36	-3.41	-0.38
30+00	10/16/2017	11/6/2018	38.70	3.93	16.31
32+50	10/16/2017	11/6/2018	51.50	7.07	15.86
35+00	10/16/2017	11/6/2018	32.65	5.17	13.07
37+50	10/16/2017	11/6/2018	-2.37	1.79	6.59
40+00	10/16/2017	11/6/2018	-55.67	-4.75	-11.83
42+50	10/16/2017	11/6/2018	-55.06	-5.00	-11.65
45+00	10/16/2017	11/6/2018	-81.87	-11.10	-15.35
45+25	10/16/2017	11/6/2018	-66.14	-7.59	-13.61
47+30	10/16/2017	11/6/2018	-62.73	-7.59	-4.70
49+35	10/16/2017	11/6/2018	-33.58	-4.31	2.71
51+41	10/16/2017	11/6/2018	-59.90	-7.66	-9.74
53+46	10/16/2017	11/6/2018	7.04	0.88	7.59
55+51	10/16/2017	11/6/2018	-26.33	-2.14	-3.20
57+57	10/16/2017	11/6/2018	5.06	2.72	7.01
59+62	10/16/2017	11/6/2018	-21.05	-0.94	-3.43
61+62	10/16/2017	11/6/2018	2.72	0.55	5.62
63+62	10/16/2017	11/6/2018	-34.64	-2.62	-9.45
65+62	10/16/2017	11/6/2018	-3.27	-0.25	4.21
67+62	10/16/2017	11/6/2018	-44.70	-4.16	-12.38
69+62	10/16/2017	11/6/2018	-17.29	1.16	1.56
71+62	10/16/2017	11/6/2018	-29.64	-2.90	-6.51
73+62	10/16/2017	11/6/2018	-1.40	2.52	10.56
75+62	10/16/2017	11/6/2018	-6.71	2.57	11.91
77+62	10/16/2017	11/6/2018	19.86	5.40	12.87
79+62	10/16/2017	11/6/2018	5.87	6.19	12.02
81+62	10/16/2017	11/6/2018	9.90	5.65	10.45
83+62	10/16/2017	11/6/2018	9.33	5.64	7.23
85+62	10/16/2017	11/6/2018	10.90	5.07	4.95
87+62	10/16/2017	11/6/2018	-9.45	0.19	-0.76

**Table C-1. Summary of Shoreline Change and Volume Change
(October 2017 to November 2018) Cont.**

1. Positive changes indicate accretion or gain in volume along the profile and negative changes indicate erosion or loss of volume along the profile.
2. MHW assumed at +0.98 ft-NAVD88.
3. Shoreline Change and Volume Change is calculated for the period between surveys from October 16, 2017 to November 6, 2018.

Transect Number (Station)	Old Survey Date	New Survey Date	Shoreline Change Rate at MHW (ft/yr)	Volume Change Rate Above 0 ft NAVD88 (cy/ft/yr)	Volume Change Rate Above -15 ft NAVD88 (cy/ft/yr)
93+41	10/16/2017	11/6/2018	-6.31	0.14	-2.72
103+08	10/16/2017	11/6/2018	-9.64	1.25	3.90
120+93	10/16/2017	11/6/2018	-16.02	-0.50	1.40
129+17	10/16/2017	11/6/2018	-4.80	2.31	-0.98
141+98	10/16/2017	11/6/2018	-40.62	-6.05	-12.22
152+01	10/16/2017	11/6/2018	-14.43	-0.66	-1.28
163+49	10/16/2017	11/6/2018	-7.80	0.05	1.98
169+63	10/16/2017	11/6/2018	-16.58	-0.34	1.02
171+63	10/16/2017	11/6/2018	-23.57	-1.84	0.43
173+63	10/16/2017	11/6/2018	-30.75	-3.59	-4.10
175+63	10/16/2017	11/6/2018	-31.61	-3.85	-0.82
177+63	10/16/2017	11/6/2018	-29.45	-0.77	-5.40
179+63	10/16/2017	11/6/2018	-18.16	-1.69	1.08
181+63	10/16/2017	11/6/2018	-21.29	-0.79	-4.47
183+63	10/16/2017	11/6/2018	-15.70	0.19	6.28
185+63	10/16/2017	11/6/2018	-16.00	0.88	4.99
187+63	10/16/2017	11/6/2018	-14.74	1.94	9.16
189+63	10/16/2017	11/6/2018	-17.10	0.15	3.75
191+63	10/16/2017	11/6/2018	-7.51	3.64	8.90
193+63	10/16/2017	11/6/2018	-11.30	2.76	4.49
195+63	10/16/2017	11/6/2018	-13.04	1.85	-0.37
206+86	10/16/2017	11/6/2018	-8.64	1.73	-0.18
218+66	10/16/2017	11/6/2018	38.15	6.50	11.50
229+85	10/16/2017	11/6/2018	9.32	5.75	5.68
242+03	10/16/2017	11/6/2018	-8.58	3.59	2.06
252+62	10/16/2017	11/6/2018	7.36	6.16	14.10
263+22	10/16/2017	11/6/2018	-3.94	3.29	11.47
274+53	10/16/2017	11/6/2018	-0.69	5.58	1.87
281+40	10/16/2017	11/6/2018	-0.44	6.24	8.11
288+39	10/16/2017	11/6/2018	0.34	2.28	3.61
295+27	10/16/2017	11/6/2018	14.00	5.25	2.12
302+24	10/16/2017	11/6/2018	-11.21	2.82	-0.19
315+96	10/16/2017	11/6/2018	12.16	6.24	8.14
323+09	10/16/2017	11/6/2018	1.64	4.09	-1.28
329+63	10/16/2017	11/6/2018	6.01	6.50	3.15
331+43	10/16/2017	11/6/2018	-28.70	4.41	5.04
333+23	10/16/2017	11/6/2018	-18.27	2.36	10.86
335+03	10/16/2017	11/6/2018	-13.06	3.49	5.62
336+83	10/16/2017	11/6/2018	-19.78	0.46	-0.86
338+63	10/16/2017	11/6/2018	-27.00	-0.15	0.73
340+43	10/16/2017	11/6/2018	-25.95	-0.16	-5.48
342+23	10/16/2017	11/6/2018	-39.21	0.33	-8.15

**Table C-1. Summary of Shoreline Change and Volume Change
(October 2017 to November 2018) Cont.**

NOTES:

1. Positive changes indicate accretion or gain in volume along the profile and negative changes indicate erosion or loss of volume along the profile.
2. MHW assumed at +0.98 ft-NAVD88.
3. Shoreline Change and Volume Change is calculated for the period between surveys from October 16, 2017 to November 6, 2018.

Transect Number (Station)	Old Survey Date	New Survey Date	Shoreline Change Rate at MHW (ft/yr)	Volume Change Rate Above 0 ft NAVD88 (cy/ft/yr)	Volume Change Rate Above -15 ft NAVD88 (cy/ft/yr)
344+05	10/16/2017	11/6/2018	-40.27	-4.07	-6.19
345+85	10/16/2017	11/6/2018	-21.51	0.81	-2.54
347+63	10/16/2017	11/6/2018	-10.98	0.52	1.41
349+43	10/16/2017	11/6/2018	-8.85	2.37	2.40
351+23	10/16/2017	11/6/2018	-9.57	4.36	7.01
353+03	10/16/2017	11/6/2018	-10.97	2.57	2.50
354+83	10/16/2017	11/6/2018	-15.50	1.36	3.91
356+63	10/16/2017	11/6/2018	-14.91	-0.02	1.18
358+43	10/16/2017	11/6/2018	-7.91	2.56	7.45
360+23	10/16/2017	11/6/2018	-9.08	2.16	-0.32
362+03	10/16/2017	11/6/2018	-18.39	0.70	2.58
363+83	10/16/2017	11/6/2018	-9.47	2.36	-1.59
365+63	10/16/2017	11/6/2018	-23.45	-1.93	-2.57
367+43	10/16/2017	11/6/2018	-25.32	0.83	-2.05
369+23	10/16/2017	11/6/2018	-27.22	-2.43	-3.62
371+03	10/16/2017	11/6/2018	-21.78	-2.43	-7.19
372+83	10/16/2017	11/6/2018	-14.56	-2.46	1.93
375+08	10/16/2017	11/6/2018	-4.51	1.67	5.74
376+78	10/16/2017	11/6/2018	3.78	0.95	5.56
378+48	10/16/2017	11/6/2018	-32.50	-0.51	-1.65
380+18	10/16/2017	11/6/2018	-40.62	-4.54	-3.68
381+88	10/16/2017	11/6/2018	-22.66	-4.14	-3.51
383+58	10/16/2017	11/6/2018	-29.19	-4.25	-19.92

**Table C-2. Summary of Shoreline Change and Volume Change
(April 2018 to November 2018)**

NOTES:

1. Positive changes indicate accretion or gain in volume along the profile and negative changes indicate erosion or loss of volume along the profile.
2. MHW assumed at +0.98 ft-NAVD88.
3. Shoreline Change and Volume Change is calculated for the period between surveys from April 11, 2018 to November 6, 2018.

Transect Number (Station)	Old Survey Date	New Survey Date	Shoreline Change at MHW (ft)	Volume Change Above 0 ft NAVD88 (cy/ft)	Volume Change Above -15 ft NAVD88 (cy/ft)
0+00	4/11/2018	11/6/2018	-16.52	-3.40	-33.46
2+50	4/11/2018	11/6/2018	14.27	1.91	28.11
5+00	4/11/2018	11/6/2018	2.70	0.44	23.94
7+50	4/11/2018	11/6/2018	5.13	1.87	29.14
10+00	4/11/2018	11/6/2018	9.15	1.36	5.78
12+50	4/11/2018	11/6/2018	-3.55	-1.50	11.05
15+00	4/11/2018	11/6/2018	-4.05	-3.11	6.30
17+50	4/11/2018	11/6/2018	10.62	0.04	7.54
20+00	4/11/2018	11/6/2018	-24.23	-2.67	0.87
22+50	4/11/2018	11/6/2018	-26.56	-4.76	-5.25
25+00	4/11/2018	11/6/2018	-11.90	-1.79	5.62
27+50	4/11/2018	11/6/2018	-27.19	-4.16	3.30
30+00	4/11/2018	11/6/2018	12.39	0.76	12.56
32+50	4/11/2018	11/6/2018	46.76	4.50	19.70
35+00	4/11/2018	11/6/2018	14.01	1.48	13.53
37+50	4/11/2018	11/6/2018	10.40	0.33	11.46
40+00	4/11/2018	11/6/2018	-20.10	-1.56	0.14
42+50	4/11/2018	11/6/2018	-29.56	-4.70	-2.16
45+00	4/11/2018	11/6/2018	-42.38	-7.47	-6.17
45+25	4/11/2018	11/6/2018	-36.18	-7.02	-6.53
47+30	4/11/2018	11/6/2018	-39.06	-6.39	-1.62
49+35	4/11/2018	11/6/2018	-4.75	-1.31	6.66
51+41	4/11/2018	11/6/2018	-37.29	-5.65	-4.41
53+46	4/11/2018	11/6/2018	9.93	-0.18	7.51
55+51	4/11/2018	11/6/2018	-13.18	-2.83	0.66
57+57	4/11/2018	11/6/2018	3.34	0.07	7.32
59+62	4/11/2018	11/6/2018	-8.97	-2.46	-0.90
61+62	4/11/2018	11/6/2018	-4.04	-0.26	7.82
63+62	4/11/2018	11/6/2018	-20.12	-4.99	-3.54
65+62	4/11/2018	11/6/2018	-7.04	-1.48	5.01
67+62	4/11/2018	11/6/2018	-24.61	-4.51	-6.16
69+62	4/11/2018	11/6/2018	1.93	0.23	3.30
71+62	4/11/2018	11/6/2018	-12.65	-3.06	2.12
73+62	4/11/2018	11/6/2018	4.39	1.21	12.60
75+62	4/11/2018	11/6/2018	15.49	3.29	18.40
77+62	4/11/2018	11/6/2018	7.26	2.64	9.85
79+62	4/11/2018	11/6/2018	43.86	6.92	21.31
81+62	4/11/2018	11/6/2018	24.80	5.27	14.32
83+62	4/11/2018	11/6/2018	15.46	3.42	12.27
85+62	4/11/2018	11/6/2018	0.88	0.96	3.18
87+62	4/11/2018	11/6/2018	-1.19	-0.05	5.59

**Table C-2. Summary of Shoreline Change and Volume Change
(April 2018 to November 2018) Cont.**

1. Positive changes indicate accretion or gain in volume along the profile and negative changes indicate erosion or loss of volume along the profile.
2. MHW assumed at +0.98 ft-NAVD88.
3. Shoreline Change and Volume Change is calculated for the period between surveys from April 11, 2018 to November 6, 2018.

Transect Number (Station)	Old Survey Date	New Survey Date	Shoreline Change at MHW (ft)	Volume Change Above 0 ft NAVD88 (cy/ft)	Volume Change Above -15 ft NAVD88 (cy/ft)
93+41	4/11/2018	11/6/2018	-1.32	-1.03	3.31
103+08	4/11/2018	11/6/2018	-3.77	-1.03	4.70
120+93	4/11/2018	11/6/2018	-11.27	-1.36	3.69
129+17	4/11/2018	11/6/2018	1.39	1.52	5.22
141+98	4/11/2018	11/6/2018	-30.19	-5.40	-6.42
152+01	4/11/2018	11/6/2018	5.14	1.51	1.81
163+49	4/11/2018	11/6/2018	-5.63	-0.11	2.31
169+63	4/11/2018	11/6/2018	-16.63	-2.18	-0.77
171+63	4/11/2018	11/6/2018	-33.17	-4.07	-5.21
173+63	4/11/2018	11/6/2018	-38.62	-6.31	-5.96
175+63	4/11/2018	11/6/2018	-59.44	-9.31	-17.09
177+63	4/11/2018	11/6/2018	-46.33	-5.75	-8.29
179+63	4/11/2018	11/6/2018	-36.01	-4.76	-6.25
181+63	4/11/2018	11/6/2018	-25.59	-1.87	-6.08
183+63	4/11/2018	11/6/2018	-39.69	-2.23	-1.84
185+63	4/11/2018	11/6/2018	-8.01	1.53	2.85
187+63	4/11/2018	11/6/2018	-44.14	-0.73	0.35
189+63	4/11/2018	11/6/2018	-8.36	1.44	2.32
191+63	4/11/2018	11/6/2018	-21.49	3.98	9.36
193+63	4/11/2018	11/6/2018	20.79	8.36	15.36
195+63	4/11/2018	11/6/2018	14.96	6.76	10.90
206+86	4/11/2018	11/6/2018	-0.11	2.46	8.45
218+66	4/11/2018	11/6/2018	28.94	3.45	7.85
229+85	4/11/2018	11/6/2018	2.59	2.27	3.96
242+03	4/11/2018	11/6/2018	2.76	2.99	7.03
252+62	4/11/2018	11/6/2018	-12.67	-0.58	0.22
263+22	4/11/2018	11/6/2018	-8.57	0.83	3.37
274+53	4/11/2018	11/6/2018	0.44	2.04	5.84
281+40	4/11/2018	11/6/2018	1.32	0.71	-0.01
288+39	4/11/2018	11/6/2018	29.95	3.54	7.95
295+27	4/11/2018	11/6/2018	10.07	1.26	2.50
302+24	4/11/2018	11/6/2018	-1.17	0.78	-2.75
315+96	4/11/2018	11/6/2018	-2.09	0.95	-0.18
323+09	4/11/2018	11/6/2018	-7.72	0.15	-1.89
329+63	4/11/2018	11/6/2018	-10.39	0.35	0.21
331+43	4/11/2018	11/6/2018	-16.08	-0.72	-4.37
333+23	4/11/2018	11/6/2018	-23.54	-3.21	-2.44
335+03	4/11/2018	11/6/2018	-4.03	0.08	-0.86
336+83	4/11/2018	11/6/2018	-18.31	-2.28	-6.56
338+63	4/11/2018	11/6/2018	-14.69	-2.26	0.29
340+43	4/11/2018	11/6/2018	-0.90	2.96	-0.21

**Table C-2. Summary of Shoreline Change and Volume Change
(April 2018 to November 2018) Cont.**

NOTES:

1. Positive changes indicate accretion or gain in volume along the profile and negative changes indicate erosion or loss of volume along the profile.
2. MHW assumed at +0.98 ft-NAVD88.
3. Shoreline Change and Volume Change is calculated for the period between surveys from April 11, 2018 to November 6, 2018.

Transect Number (Station)	Old Survey Date	New Survey Date	Shoreline Change at MHW (ft)	Volume Change Above 0 ft NAVD88 (cy/ft)	Volume Change Above -15 ft NAVD88 (cy/ft)
342+23	4/11/2018	11/6/2018	-17.82	0.55	-1.87
344+05	4/11/2018	11/6/2018	-31.87	-4.16	-5.00
345+85	4/11/2018	11/6/2018	-14.23	-0.95	-3.11
347+63	4/11/2018	11/6/2018	-26.37	-3.97	-2.54
349+43	4/11/2018	11/6/2018	-6.24	0.00	-1.99
351+23	4/11/2018	11/6/2018	-12.02	-1.30	4.32
353+03	4/11/2018	11/6/2018	4.88	1.72	-0.51
354+83	4/11/2018	11/6/2018	-10.35	0.08	-1.29
356+63	4/11/2018	11/6/2018	2.18	0.29	-0.04
358+43	4/11/2018	11/6/2018	-4.71	1.26	4.17
360+23	4/11/2018	11/6/2018	2.55	2.07	0.25
362+03	4/11/2018	11/6/2018	-7.06	-1.56	-0.24
363+83	4/11/2018	11/6/2018	2.14	1.77	-0.44
365+63	4/11/2018	11/6/2018	-23.30	-3.43	-1.42
367+43	4/11/2018	11/6/2018	-13.62	0.02	-1.03
369+23	4/11/2018	11/6/2018	-48.28	-5.58	-3.74
371+03	4/11/2018	11/6/2018	-10.87	-1.77	-2.69
372+83	4/11/2018	11/6/2018	-12.50	-1.02	0.21
375+08	4/11/2018	11/6/2018	8.92	0.69	1.27
376+78	4/11/2018	11/6/2018	-23.18	-1.63	1.21
378+48	4/11/2018	11/6/2018	-18.67	-2.46	-4.56
380+18	4/11/2018	11/6/2018	-26.12	-3.67	-5.24
381+88	4/11/2018	11/6/2018	-14.14	-2.36	-2.33
383+58	4/11/2018	11/6/2018	-12.67	-2.35	-2.63

ENGINEERING ACTIVITIES LOG AND LOG OF SURVEYS FOR ENTIRE OCEAN VIEW SHORELINE

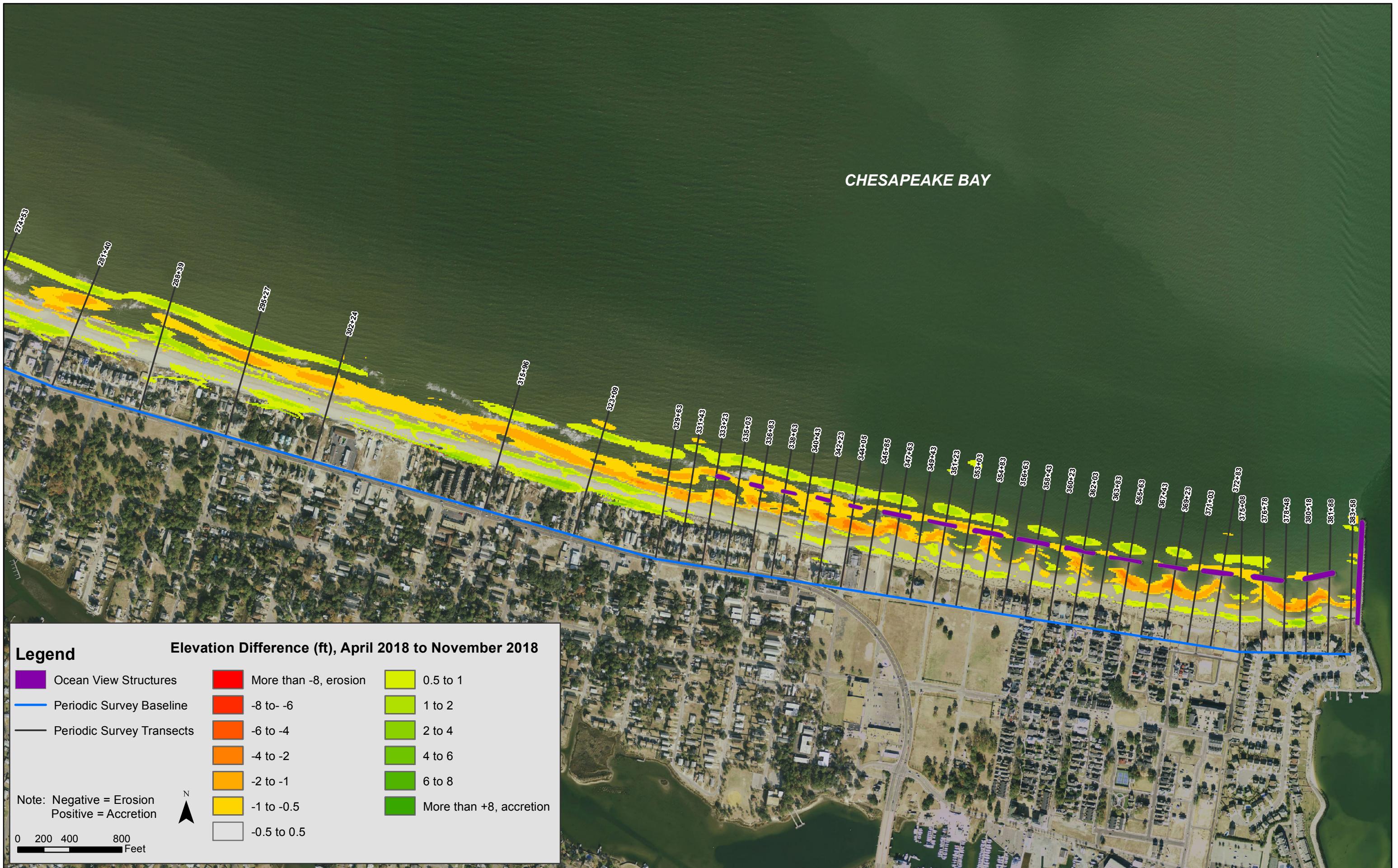
No	Date	Project Type	Location	Description	Vol (cy)	Extent (ft)	Unit Vol (cy/ft)	Sand Source
1	1920-1937	Groin Construction	Willoughby Spit Shoreline	62 groins built by private property owners				
2	Dec 1926-Jan 1928	Jetty Construction	Little Creek Inlet	East Jetty Construction				
3	Dec 1926-Nov 1928	Jetty Construction	Little Creek Inlet	West Jetty Construction				
4	1938	Groin Construction	Between Willoughby Spit and Chesapeake Blvd.	37 timber groins built by City of Norfolk				
5	1953	Beach Nourishment	18th Bay St to 27th Bay St (East Ocean View)	Beach Nourishment	1,260,000	3,000	420	
6	1953	Beach Nourishment	27th Bay St to West Jetty (East Ocean View)	Beach Nourishment	500,000	1,800	278	
7	1960	Beach Nourishment	East End Parking Lot to West Jetty (East Ocean View)	Beach Nourishment	159,000	900	177	
8	1962	Beach Nourishment	Terminal Groin to 9th View St (Willoughby Spit)	Beach Nourishment	176,000	6,900	25	
9	1981	Groin reconstruction	Willoughby Spit area	5 timber groins were reconstructed				
10	1982	Beach Nourishment	East Ocean View	Beach Nourishment	400,000			Pretty Lake
11	1983	Groin Removal	Ocean View Park area	3 groins removed				
12	1983	Groin Construction	Western end of Willoughby Spit	5 groins built by the City of Norfolk				
13	Jan-Apr 1984	Beach Nourishment	Terminal Groin to 5th View St (Willoughby Spit)	Beach Nourishment	537,500	11,000	49	Navy Piers
14	Aug-Nov 1984	Beach Nourishment	21st Bay St to East End Parking Lot (East Ocean View)	Beach Nourishment	400,000	3,000	133	Pretty Lake
15	1985	Beach Nourishment	6th View St to Sarah Constant Shrine Park	Beach Nourishment	50,000			Navy's Willoughby project site
16	1987	Beach Nourishment	5th View St to Mason Creek	Beach Nourishment	50,000	2,000	25	Truck Haul
17	1988	Beach Access Construction	Willoughby and Ocean View	19 pedestrian beach access ways constructed				
18	Spring 1988	Dune Repair	Willoughby Beach	used 10,000 cy of accretion from terminal groin				
19	June, 1989	Dune Repair	Willoughby Beach	used 25,000 cy of accretion from terminal groin				
20	1989	Beach Nourishment	21st Bay St to East End Parking Lot (East Ocean View)	Beach Nourishment	133,000	3,000	44	Cape Henry Channel
21	1990	Breakwater Construction	Western end of Willoughby Spit-Lea View Ave.	2 near shore breakwaters				
22	1990	Terminal Groin Reconstruction	Western end of Willoughby Spit-Lea View Ave.	Original wooden groin raised and extended using rock				
23	1990	Beach Nourishment	Willoughby Spit-Near Terminal Groin	Beach Nourishment	100,000			West of Terminal Groin
24	1990-1991	Dune Stabilization/repair	Various Locations	dune vegetation planting,sand fence construction, elevated public access way, cross-over structures, and timber roads for vehicles				
25	1995	Beach Nourishment	Willoughby Spit	Beach Nourishment	240,000			15th View
26	December, 1995	Beach Nourishment	13th View St to 12 View St (in 4 groin pockets)	Beach Nourishment	4,000			15th View
27	December, 1995	Beach Nourishment	Critical Area 1: 8th View St to 7th View St	Beach Nourishment	30,000	1,000	30	15th View
28	March, 1997	Terminal Groin (trunk) Elevated	Willoughby Spit	terminal groin (trunk) elevated +4 ft				
29	Jan 1997- April 1997	Breakwater Construction	Critical Area 1: Worth St to 8th View	nearshore breakwaters 1-4 constructed				
30	December 1997 - March 1998	Breakwater Construction	Critical Area 1: Worth St to 8th View	nearshore breakwaters 5-7 constructed				
31	October 1998 City Survey		Entire Ocean View Shoreline					
32	December, 1998	Beach Nourishment	Critical Area 1: East of 8th View St-near site of future groin spur	Beach Nourishment	500	175	3	
33	October 1999 City Survey		Entire Ocean View Shoreline					
34	1999	Breakwater Construction	Critical Area 2: Just east of Community Beach	4 nearshore breakwaters constructed				
35	November-December 1999	Groin Spur Construction	Critical Area 1: Worth St to 8th View	groin spur construction				
36	December, 1999	Beach Nourishment	Center of COV breakwaters	Beach Nourishment	4,000			
37	December, 1999	Beach Nourishment	Critical Area 1: East of 8th View St-leeward of newly constructed groin spur	Beach Nourishment	1,000	200	5	15th View
38	July 2000 City Survey		From Approx. 9th View St to Little Creek Inlet					
39	August, 2000	Breakwater Construction	Critical Area 3: 21st Bay to Little Creek Inlet	nearshore breakwaters 2,3,4 constructed				
40	October 2000 City Survey		From Approx. 12th View St to Little Creek Inlet					
41	July, 2001	Beach Nourishment	Critical Area 1: Worth St to 8th View	Beach Nourishment	500			Truck Haul
42	September, 2001	Beach Nourishment	Critical Area 1: East of 8th View St-between breakwater 7 and groin spur	Beach Nourishment	2,000	300	7	15th View
43	October 2001 City Survey		Entire Ocean View Shoreline					
44	November, 2001	Breakwater Construction	Critical Area 3: 21st Bay to Little Creek Inlet	nearshore breakwaters 1,5,6,7 constructed				
45	March - April, 2002	Breakwater Work	Critical Area 1: breakwater 7	work on toe extensions				
46	May, 2002	Beach Nourishment	Critical Area 1: East of 8th View St-between breakwater 7 and groin spur	Beach Nourishment	3,438	300	11	15th View
47	June, 2002	Groin Removal	Critical Area 1: Worth St to 8th View	Removal of timber groin channalward of rock spur				
48	July 2002 City Survey		Entire Ocean View Shoreline - excluding approx. Sherwood Pl. to Warwick Ave.					
49	October 2002 City Survey		Entire Ocean View Shoreline - minimal survey data (no beach or bathymetric survey points)					
50	March 2003 City Survey		East Ocean View Shoreline (19th Bay to Little Creek Inlet)					
51	April 2003 City Survey		East Ocean View Shoreline (17th Bay to Little Creek Inlet)					
52	June 2003 Waterway Survey		East Ocean View Shoreline (17th Bay to Little Creek Inlet)					
53	September, 2003	Beach Nourishment	Critical Area 1: West of 8th View St beach access	Beach Nourishment	1,100	350	3	15th View

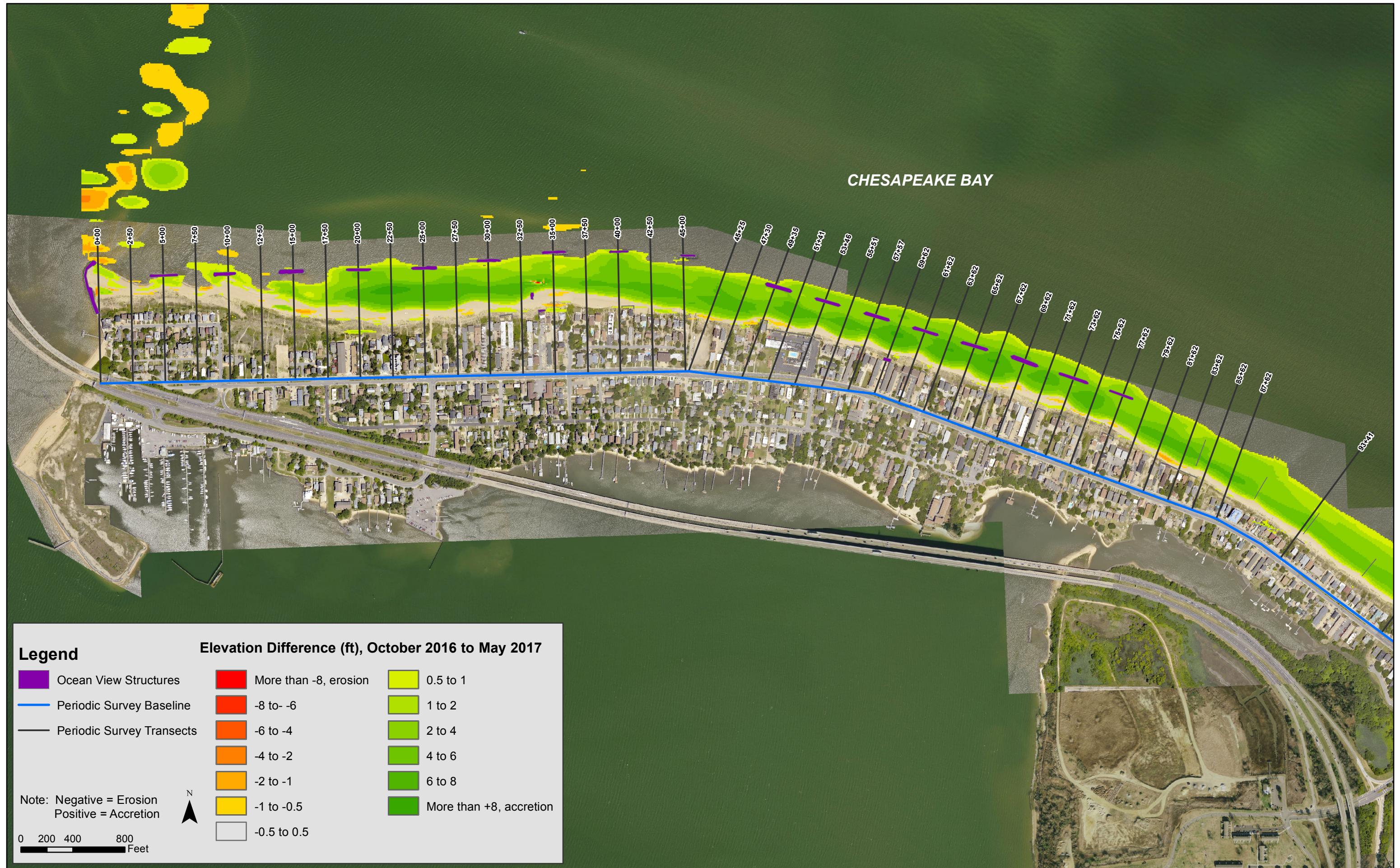
No	Date	Project Type	Location	Description	Vol (cy)	Extent (ft)	Unit Vol (cy/ft)	Sand Source
54	October 2003 Waterway Survey		Post-Isabel Survey - East Ocean View Shoreline (17th Bay to Little Creek Inlet)					
55	October, 2003	Beach Nourishment	Critical Area 3: 19th Bay St	Beach Nourishment	6,000	545	11	upland sand trucked in
56	October, 2003	Beach Nourishment	Critical Area 3: East of 30th Bay St	Beach Nourishment	1,000	150	7	upland sand trucked in
57	December, 2003	Beach Nourishment	Critical Area 3: 17th Bay St to Little Creek Inlet	Beach Nourishment	359,000	5,280	68	Thimble Shoal Channel
58	December, 2003	Beach Nourishment	Critical Area 1: 9th View St to 7th View St (+400 ft)	Beach Nourishment	39,800	1,260	32	
59	Nov-Dec 2003 Post-Fill Survey		East OceanView Shoreline (17th Bay to Little Inlet Creek)					
60	Feb-April, 2004 Waterway Survey		From Approx. Willoughby Spit to 17th Bay St					
61	August, 2004	Beach Nourishment	13th View to 11th View, Behind Western 4 Breakwaters at 800 Block, 1200' East of dogleg	Beach Nourishment	37,000	4,950	7	Truck Haul
62	January-March, 2005	Dune Restoration	Willoughby Spit to Central Ocean View (14th View St to Warwick Ave)	Willoughby Spit to Central Ocean View Dune Restoration Project	504,329	18,300	28	Thimble Shoal Channel
63	January-March 2005 Post-Fill Survey		Willoughby Spit to Warwick Ave.					
64	September 2005 McKim & Creed Periodic Survey		Entire Ocean View Shoreline					
65	January-February, 2006	Groin Spur & Toe Extension Removal	Critical Area 1: East of 8th View	groin spur removal				
66	January-February, 2006	Breakwater Construction	Critical Area 1: East of 8th View	nearshore breakwater 8 constructed				
67	January-February, 2006	Breakwater Construction	Critical Area 3: 29th Bay to Little Creek Inlet	nearshore breakwaters 8, 9, & 10 constructed				
68	March 2006 McKim & Creed Periodic Survey		Entire Ocean View Shoreline					
69	October 2006 McKim & Creed Periodic Survey		Entire Ocean View Shoreline					
70	March 2007 McKim & Creed Periodic Survey		Entire Ocean View Shoreline					
71	October 2007 McKim & Creed Periodic Survey		Entire Ocean View Shoreline					
72	March 2008 McKim & Creed Periodic Survey		Entire Ocean View Shoreline					
73	October 2008 McKim & Creed Periodic Survey		Entire Ocean View Shoreline					
74	March, 2009	Beach Nourishment	East Ocean View and Bay Oaks	Beach Nourishment	196,000			
75	April 2009 McKim & Creed Periodic Survey		Entire Ocean View Shoreline					
76	August-October, 2009	Breakwater Construction	Bay Oaks	5 Nearshore Breakwaters Constructed				
77	October 2009 Geodynamics Periodic Survey		Entire Ocean View Shoreline					
78	November-December 2009 Post-Storm Survey		Entire Ocean View Shoreline					
79	March 2010 Geodynamics Periodic Survey		Entire Ocean View Shoreline					
80	April, 2010	Dune Restoration	Willoughby Spit and 800 Block	Dune restoration using sediment from terminal groin and 800 block breakwaters				
81	October 2010 Geodynamics Periodic Survey		Entire Ocean View Shoreline					
82	April 2011 Geodynamics Periodic Survey		Entire Ocean View Shoreline					
83	October 2011 Geodynamics Periodic Survey		Entire Ocean View Shoreline					
84	March 2012 Geodynamics Periodic Survey		Entire Ocean View Shoreline					
85	October 2012 Geodynamics Periodic Survey		Entire Ocean View Shoreline					
86	January-May, 2013	Breakwater Construction	Willoughby Spit	7 Nearshore Breakwaters Constructed				
87	January-May, 2013	Dune Restoration/Beach Nourishment	Willoughby Spit	Dune Restoration at Lea View Ave and Beach Nourishment from 11th View to 13th View	35,000			Willoughby Spit / Truck Haul
87	January-May, 2013	Breakwater Relocation	800 Block	Breakwater 7 moved further offshore				
88	April 2013 Geodynamics Periodic Survey		Entire Ocean View Shoreline					
89	May-October, 2013	Timber Groin Removal	West Ocean View	7 Timber Groins removed east of the Pier				
90	October, 2013	Rock Groin Construction	West Ocean View	Rock Groin Constructed between Sarah Constant Shrine Park and the 200 Block				
91	October 2013 Geodynamics Periodic Survey		Entire Ocean View Shoreline					
92	November 2013	Beach Nourishment	West Ocean View	Beach Nourishment	73,600			Truck Haul
93	March 2014 Geodynamics Periodic Survey		Entire Ocean View Shoreline					
94	October 2014 Geodynamics Periodic Survey		Entire Ocean View Shoreline					
95	April 2015 Geodynamics Periodic Survey		Entire Ocean View Shoreline					
96	October 2015 Geodynamics Periodic Survey		Entire Ocean View Shoreline					
97	January-February 2016	Beach Nourishment	Toler Place (between 11th View and 12th View Streets)	Emergency nourishemnt placed above MHW	16,400			Willoughby Spit
98	February 2016	Beach Nourishment	Adjacent to Terminal Groin	Emergency nourishemnt placed above MHW	1,500			Truck Haul Upland Source
99	May 2016 Geodynamics Periodic Survey		Entire Ocean View Shoreline					
100	October 2016 Geodynamics Periodic Survey		Entire Ocean View Shoreline					
101	February 2017 Federal Project Pre-Construction Survey (by GLDD)		Entire Ocean View Shoreline					
102	March-May 2017	Beach Nourishment	14th View Street to Warwick Avenue, and 1st Bay Street to Little Creek Inlet	Initial Construction of the Federal Project by USACE	1,200,358		variable	Thimble Shoal Aux. Channel
103	May 2017 Federal Project Post-Construction Survey (by GLDD)		Entire Ocean View Shoreline					
104	May 2017 Geodynamics Periodic Survey		Entire Ocean View Shoreline					
105	October 2017 Geodynamics Periodic Survey		Entire Ocean View Shoreline					
106	April 2018 Geodynamics Periodic Survey		Entire Ocean View Shoreline					
107	November 2018 Geodynamics Periodic Survey		Entire Ocean View Shoreline					

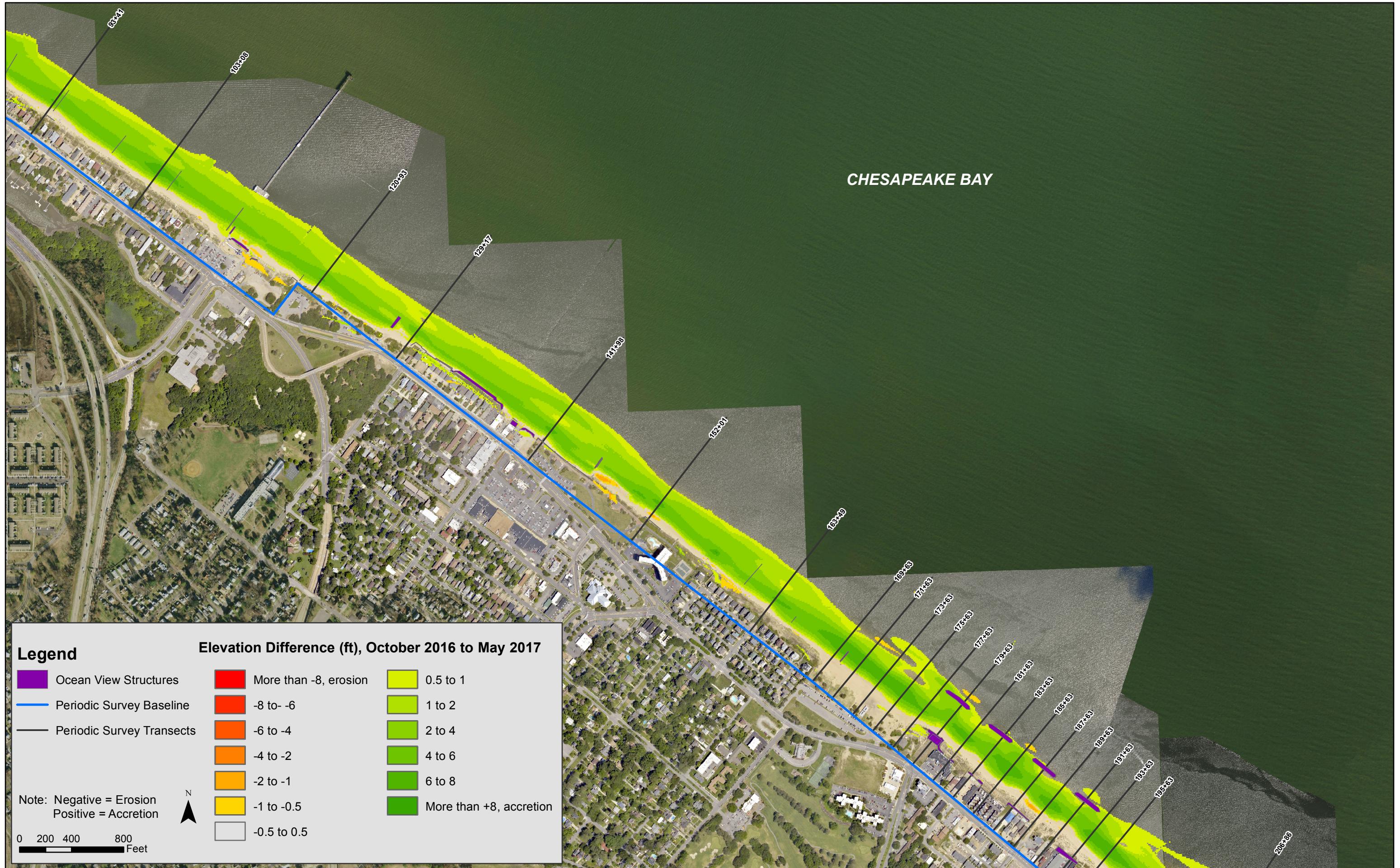


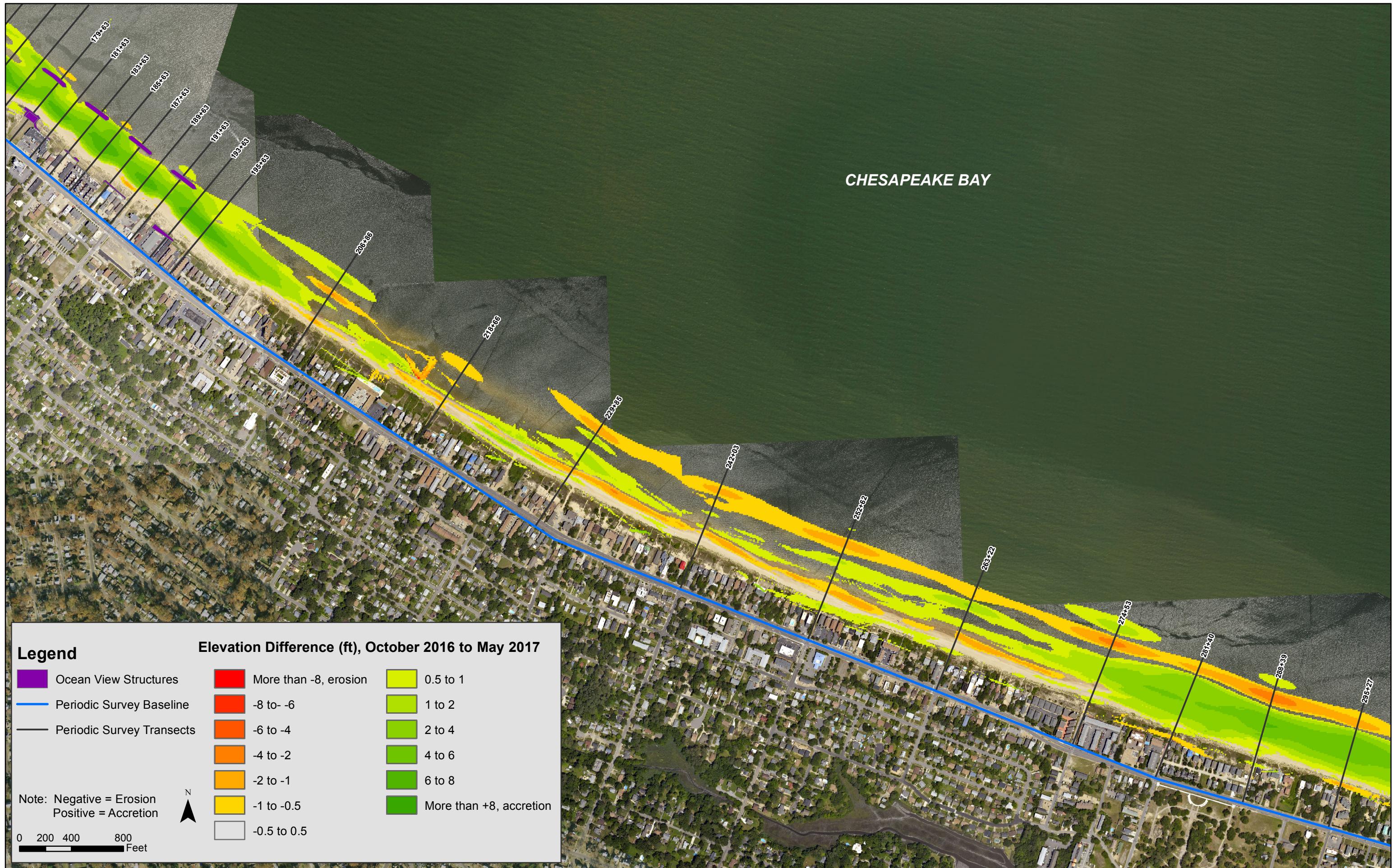


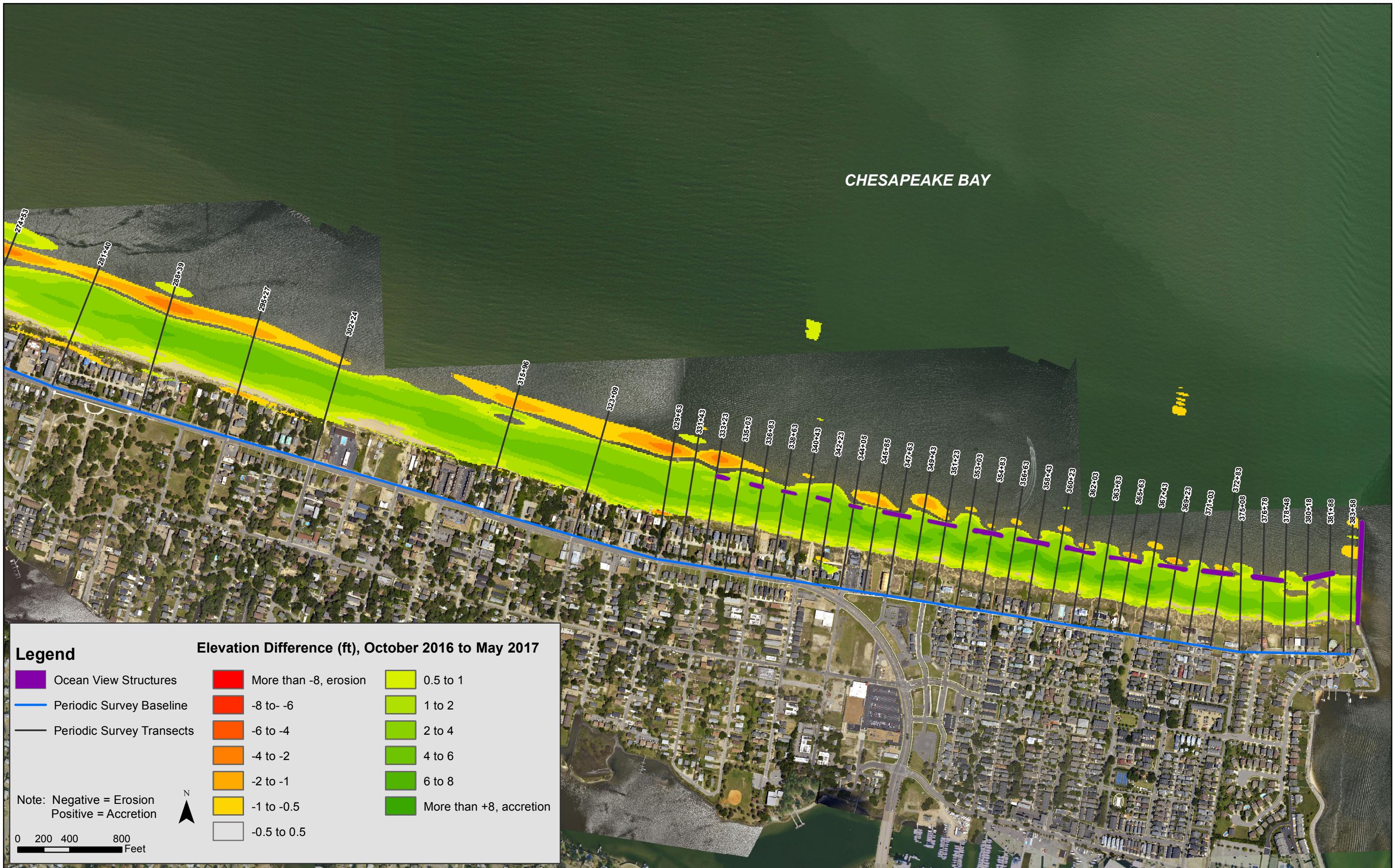


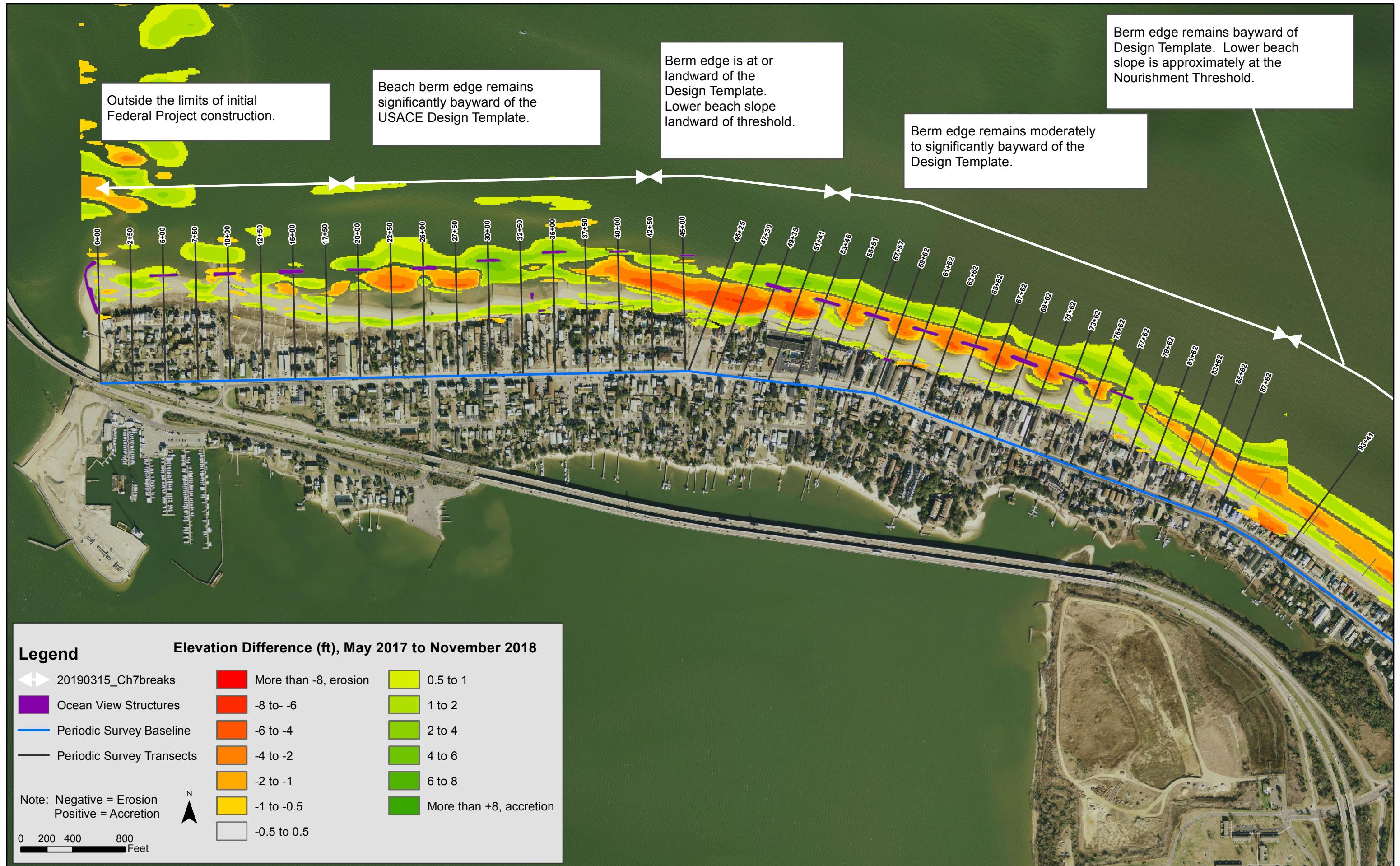


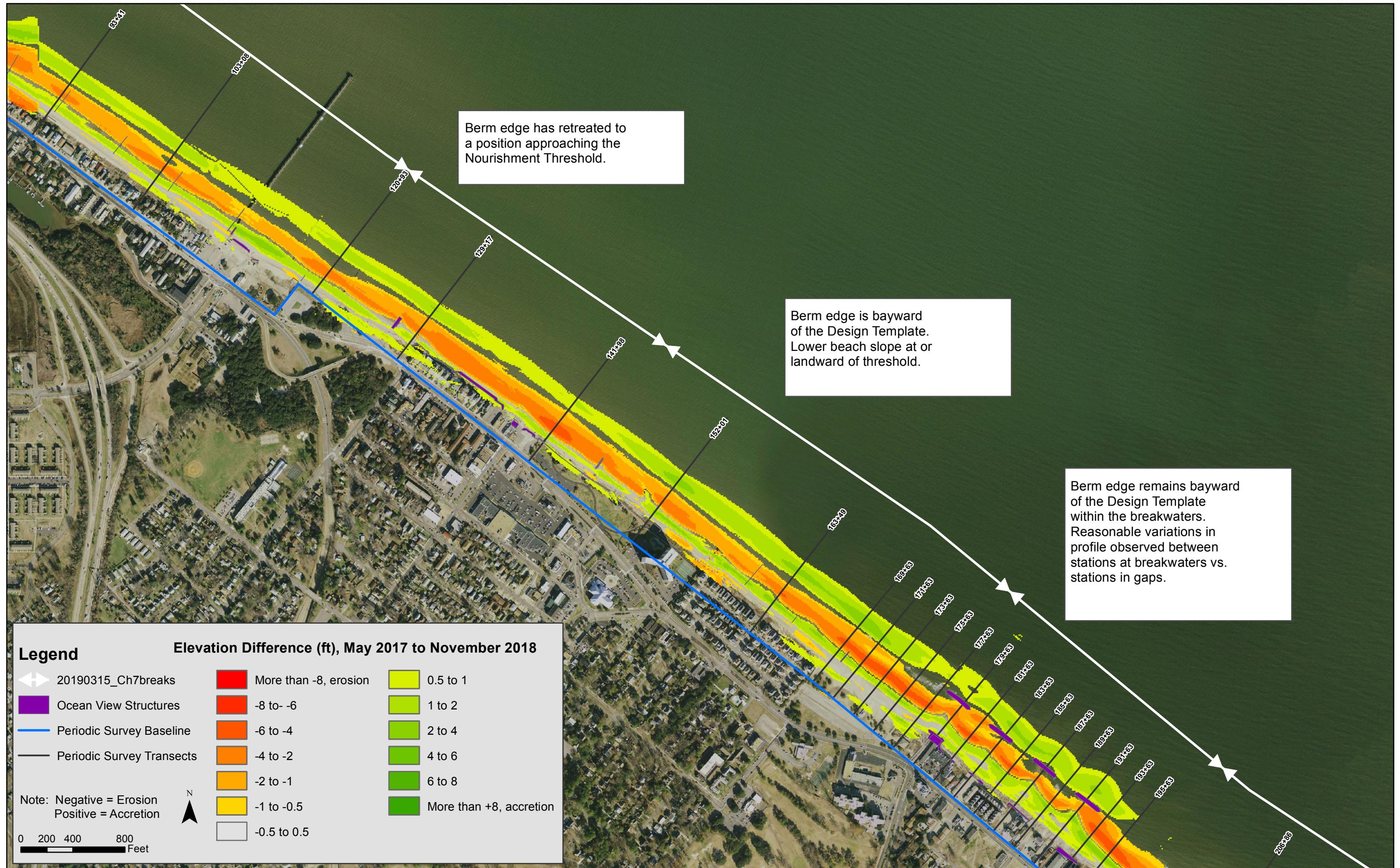














Berm edge remains bayward of the Design Template.

Berm edge remains bayward of the Design Template within the breakwaters. Reasonable variations in profile observed between stations at breakwaters vs. stations in gaps.

