Periodic Survey Evaluation: Ocean View Beach

Presented to:

City of Norfolk

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1. Executive Summary

In April 2015 Geodynamics, LLC conducted the twentieth survey of the Ocean View shoreline. The study area extends from the western end of Willoughby Spit to the western edge of the Little Creek Inlet in East Ocean View. The periodic surveys are collected bi-annually in March/April and September/October to assess the condition of the shoreline and the state of existing shore protection projects. A baseline and transects 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 seasonal surveys (i.e. March 2014 to April 2015) eliminates seasonal variation of profiles in volumetric change analyses. Consecutive survey comparisons are useful to assess the direct impact of extreme events which may occur during the six month period between surveys. This report documents the data sources, methods, and results of a periodic surveying evaluation performed to compare the April 2015 survey data with previous surveys taken in March 2014 (spring to spring comparison) and October 2014 (most recent periodic survey comparison) in the Ocean View Beach area between Willoughby Spit and Little Creek Inlet.

Comparison	Parameter	Quantity
March 2014 vs. April 2015	Average Shoreline Change Rate at MHW (+0.98 ft NAVD88)	5.34 ft/yr
	Cumulative Volume Change Rate Above 0 ft NAVD88	69,285 cy/yr
	Cumulative Volume Change Rate Above -15 ft NAVD88	49,538 cy/yr
October 2014 vs. April 2015	Average Shoreline Change at MHW (+0.98 ft NAVD88)	0.65 ft
	Cumulative Volume Change Above 0 ft NAVD88	17,049 cy
	Cumulative Volume Change Above -15 ft NAVD88	94,234 cy

The Ocean View region experienced an overall gain in material above 0 feet NAVD88 and -15 feet NAVD88 over the past year (March 2014 to April 2015). The average MHW shoreline change over the past year shows accretion over the entire beach. Over the most recent survey period (October 2014 to April 2015), there was a slight overall accretion of the average MHW shoreline. The Ocean View shoreline also experienced a gain in material above 0 feet NAVD88 and above -15 feet NAVD88 during this period. This indicates material was transported from above the closure depth to the subaerial beach, which is typical during a quiescent wave climate and confirmed by the profiles in Appendix B.

While the shoreline showed overall volume gain for the year, there was variability within the various regions. The Willoughby Spit region is still equilibrating from the Willoughby Spit Shoreline Improvement Project, which finished construction in December 2013. The nourishment placed at the eastern end of this reach has continued moving westward and is staying in the nearshore system due to the seven newly constructed breakwaters. Overall, this reach experienced accretion of the MHW shoreline, and volumetric gains above both 0 feet NAVD88 and -15 feet NAVD88 over the past year and over the most recent survey period.

The 800 Block region has remained fairly stable over the most recent monitoring cycle with a slight erosion of the MHW shoreline, and a slight volumetric gain above 0 feet NAVD88 and -15 feet NAVD88. During the yearly period, there was an erosion of the MHW shoreline and volumetric loss

above 0 feet NAVD88 and -15 feet NAVD88. The tombolo located at the realigned breakwater has remained detached allowing sand to transport freely through this reach.

The West Ocean View region was characterized by the shoreline improvement project was completed in April 2014. Station 129+17 was removed from analysis between March 2014 and April 2015 for this report because it could not be surveyed due to the presence of construction equipment. The October 2014 to April 2015 analysis includes Station 129+17 in the calculations and the effects of the shoreline improvement project can be seen. The yearly analysis shows overall accretion of the MHW shoreline and volumetric gains above both 0 feet NAVD88 and -15 feet NAVD88. The seasonal comparison shows erosion of the MHW shoreline as well as volumetric loss above both 0 feet NAVD88 and -15 feet NAVD88 which is due to the continued equilibration of the shoreline improvement project.

The Central Ocean View Breakwaters region continues to show gains in the MHW shoreline position and volumetric gains above 0 feet NAVD88 and -15 feet NAVD88 over the past year and current survey period.

Typically a very stable region, Central Ocean View has experienced accretion of the MHW shoreline and a volumetric gain above 0 feet NAVD88 and -15 feet NAVD88 over the past year. The most recent survey period showed slightly less accretion of the MHW shoreline and less volume gain above 0 feet NAVD88; however, more volume gain above -15 feet NAVD88.

Due to the normal direction of sediment movement, there is an erosion of the MHW shoreline and minor volumetric losses above both 0 feet NAVD88 and -15 feet NAVD88 in the East Ocean View region over the entire year. During the most recent survey period, this region remained fairly stable. There was minimal volume gain above 0 feet NAVD88 and -15 feet NAVD88 with a slight erosion of the MHW shoreline. The Bay Oaks breakwaters are continuing to perform well, trapping sediment and eliminating the hotspot at this location. The east end of the region, adjacent to the jetty, is more erosive than most areas west in this region due to the lack of a sediment source.

In addition to regional assessments, comparison of the April 2015 survey was made against post-fill surveys from the East Ocean View beach nourishment and Willoughby Spit to Central Ocean View dune restoration which took place in March 2009 and January-March 2005 respectively.

Comparison	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
East Ocean View Nourishment vs. April 2015 Comparison	-106.34 ft	-18.84 cy/ft	-98,049 cy	-33.70 cy/ft	-174,691 cy
Central Ocean View Nourishment vs. April 2015 Comparison	-25.86 ft	-10.03 cy/ft	-184,326 cy	-5.82 cy/ft	-103,117 cy

Since the East Ocean View Nourishment project in 2009, roughly 87% of the placed material above 0 feet NAVD88 has been lost. Since the Central Ocean View Nourishment project in 2005, roughly 57% of the placed material above 0 feet NAVD88 has been lost. The Willoughby Spit Shoreline Improvement Project has alleviated a majority of the areas of concern in this reach. The West Ocean View Shoreline Improvement Project completed construction and has alleviated the hotspot between

the 200 Block and Sarah Constant Shrine Park. Future surveys will show the performance of this project. East Ocean View will need renourishment in the next 1-2 years.

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 October 2014 survey data with previous surveys taken in October 2013 (fall to fall comparison) and March 2014 (most recent periodic survey comparison) in the Ocean View Beach area between Willoughby Spit and Little Creek Inlet. In addition, comparison of the most recent survey (October 2014) was made to pre-fill and post-fill surveys from the Central Ocean View beach nourishment project that took place in January-March 2005 and the most recent East Ocean View beach nourishment project which took place in March 2009.

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

3. Data Sources

Geodynamics, LLC, conducted the most recent survey of Ocean View Beach in April 2015. 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 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 and long profiles near Willoughby Spit. Therefore, volumetric changes discussed herein are analyzed with regard to potential volumetric margins of error.

Also in April 2015, the Virginia Institute of Marine Science (VIMS) flew aerial photography of the Ocean View shoreline, georectified the images, and digitized a shoreline position from the images. The April 2015 aerial photos with the digitized shoreline positions from April 2015, October 2014, and March 2014 are presented 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.

Pre- and post-fill survey data from the East Ocean View beach nourishment, collected in June 2003 and March 2009, respectively, were used as baseline data for assessing the current state of that nourishment project. Similarly, pre- and post-fill survey data from the Willoughby Spit to Central Ocean View dune restoration were utilized; these surveys were collected in December 2004 – February 2005 and March 2005, respectively. Pre-fill and post-fill data were available in xyz format from previous studies of these projects by Moffatt & Nichol.

Figure 3-1: Survey Baseline and Transects

4. Methods

Survey comparisons and respective analysis were performed using a combination of Autodesk Civil 3D 2014 (Civil 3D), Microsoft Excel (Excel), Surfer and the USACE's Beach Morphology Analysis Package (BMAP). Civil 3D is an AutoCAD based program which allows the user to create and analyze Digital Terrain Models (DTMs). 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.

All pertinent survey data were imported into Civil 3D in xyz format. The horizontal coordinate system used was Virginia South State Plane NAD 1983 (HARN), US Survey feet with a vertical datum of NAVD88. DTMs were created for each set of survey data, and a beach profile was extracted at each survey transect in station-elevation format. Individual profile plates showing the extracted profile at each transect for each date are presented in Appendix B. From the profiles, shoreline change and volumetric change were then calculated at each transect for the following time periods:

1. March 2014 to April 2015 (Entire Shoreline)
2. October 2014 to April 2015 (Entire Shoreline)
3. March 2009 (East Ocean View post-fill) to April 2015 (Sta 329+63 through Sta 383+58)
4. March 2005 (Central Ocean View post-fill) to April 2015 (Sta 15+00 through Sta 195+63)
5. December 2004-February 2005 (Central Ocean View pre-fill) to April 2015 (Sta 15+00 through Sta 195+63)
6. June 2003 (East Ocean View pre-fill) to April 2015 (Sta 329+63 through Sta 383+58)

First, the change in shoreline based on the profiles extracted from Civil 3D 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 change above -15 feet NAVD88 and volume change 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 offshore while reducing the amount of uncertainty 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 the East Ocean View and Central Ocean View nourishment projects. 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 Comparisons

Profile variations in the surveys taken as part of the ongoing program of periodic surveying of the Ocean View shoreline (March 2014, October 2014, and April 2015) 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. The only discrepancy which impacted calculations was the vertical margin of error in the hydrographic portion of the survey as mentioned in Section 3.

The pre-fill and post-fill surveys taken for the East Ocean View and Central Ocean View nourishment projects did not use the same baseline and transects or cover the same extents as the periodic surveys. Therefore, the profiles extracted from the DTMs in Civil 3D at the periodic surveying transects are interpolations between the actual pre- and post-fill data points. In addition, the surveys did not extend as far offshore as the periodic surveys, limiting computations and the ability to track the offshore movement of sand.

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 reporting period which likely had an impact on the changes in shoreline position as well as profile volume gains and losses.

5.2.1. Storm 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. The dates that the wave data were collected during this survey period were between March 3, 2015 and April 21, 2015. No data was collected from October 3, 2014 through March 2, 2015 due to instrument malfunction.

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

- The average significant wave height and peak period over this measurement period was approximately 1.1 feet and 4.7 seconds.
- The typical direction of the waves was from the northwest to southeast.

- The largest significant wave height observed during this deployment was approximately 4.1 feet with a corresponding peak period of approximately 4.4 seconds and mean direction of 26 degrees (March 6, 2015).

The overall wave climate was quiescent, which is typical during this period for this region. No storm events occurred during this time where significant wave heights reached or exceeded 5 feet (1.5 m). However, four events occurred during this period for which the significant wave height reached or exceeded 3.3 feet (1.0 meter). These events occurred on March 5, 2015, March 17, 2015, March 27, 2015, and April 1, 2011 and are shown in, Figure 5-1 through Figure 5-4.

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 storm winds within the bay and tend to have shorter wave periods. There were four storm events during this 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 during this deployment is given in Table 5-1.

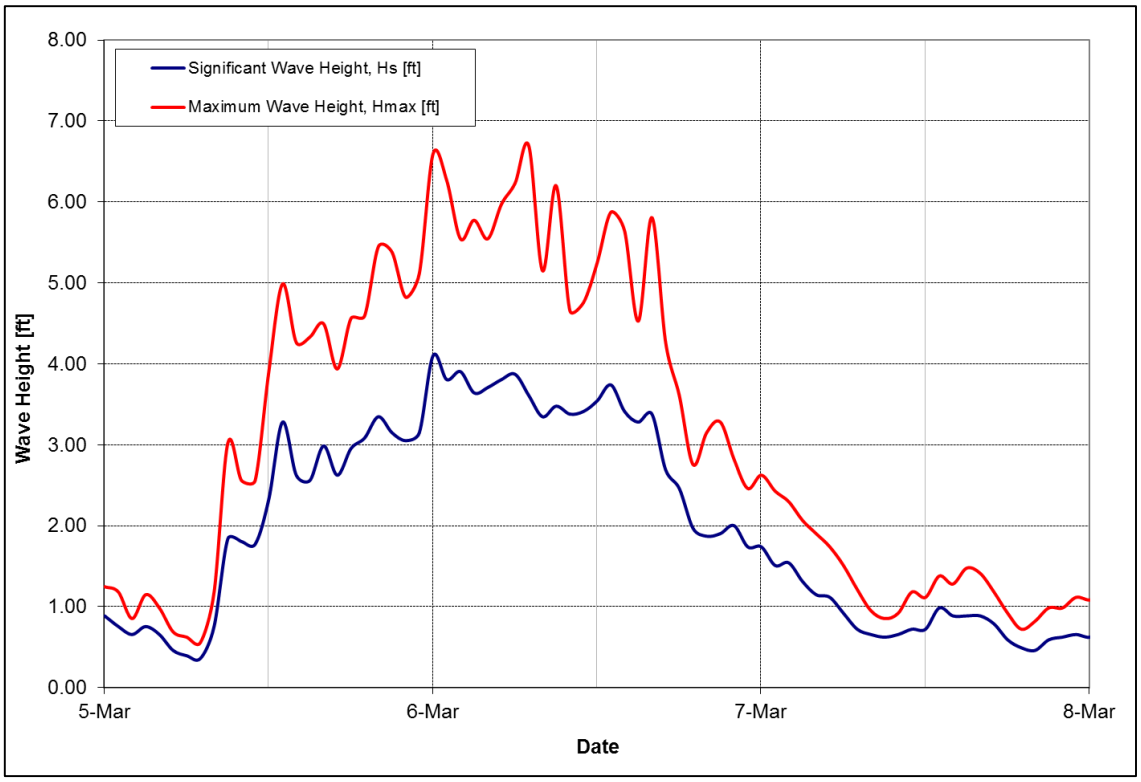


Figure 5-1: March 5, 2015 Storm

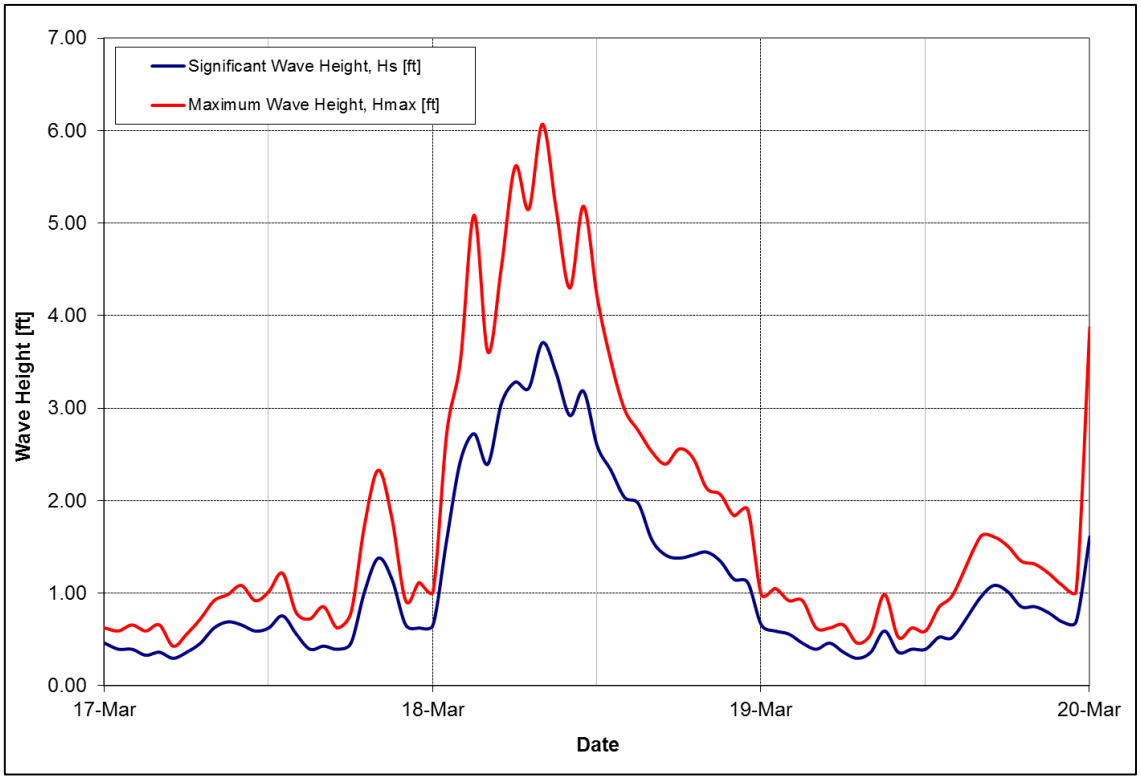


Figure 5-2: March 17, 2015 Storm

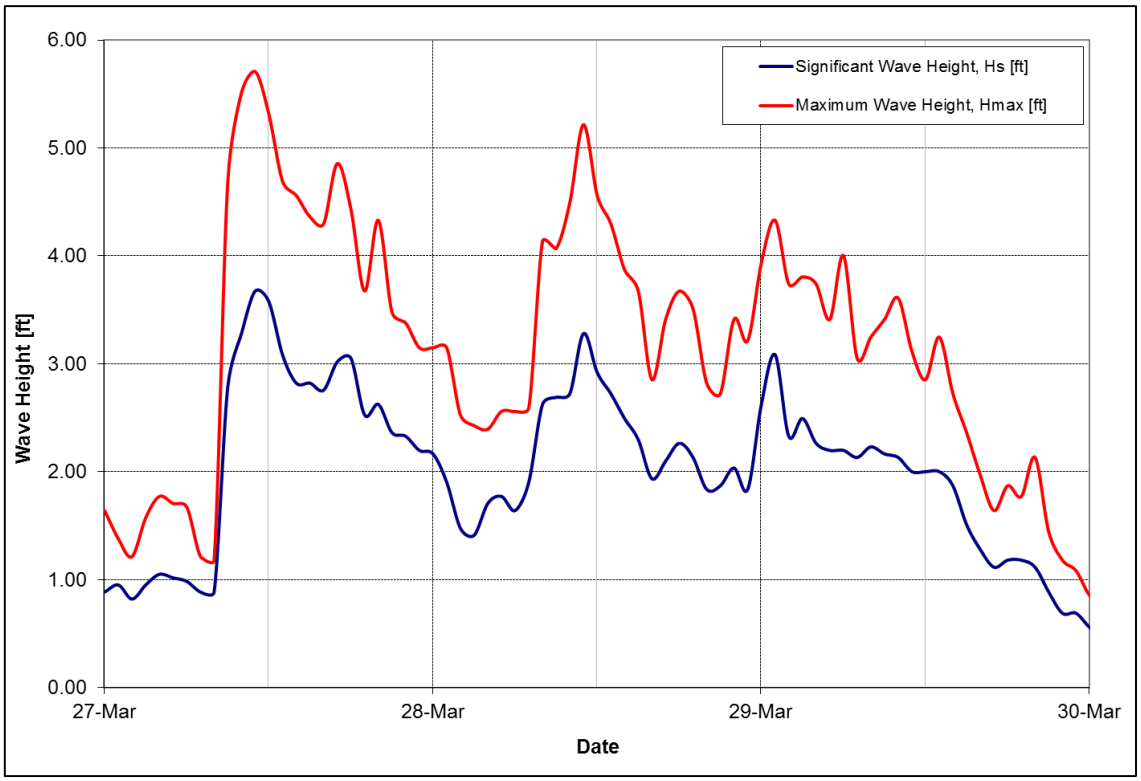


Figure 5-3: March 27, 2015 Storm

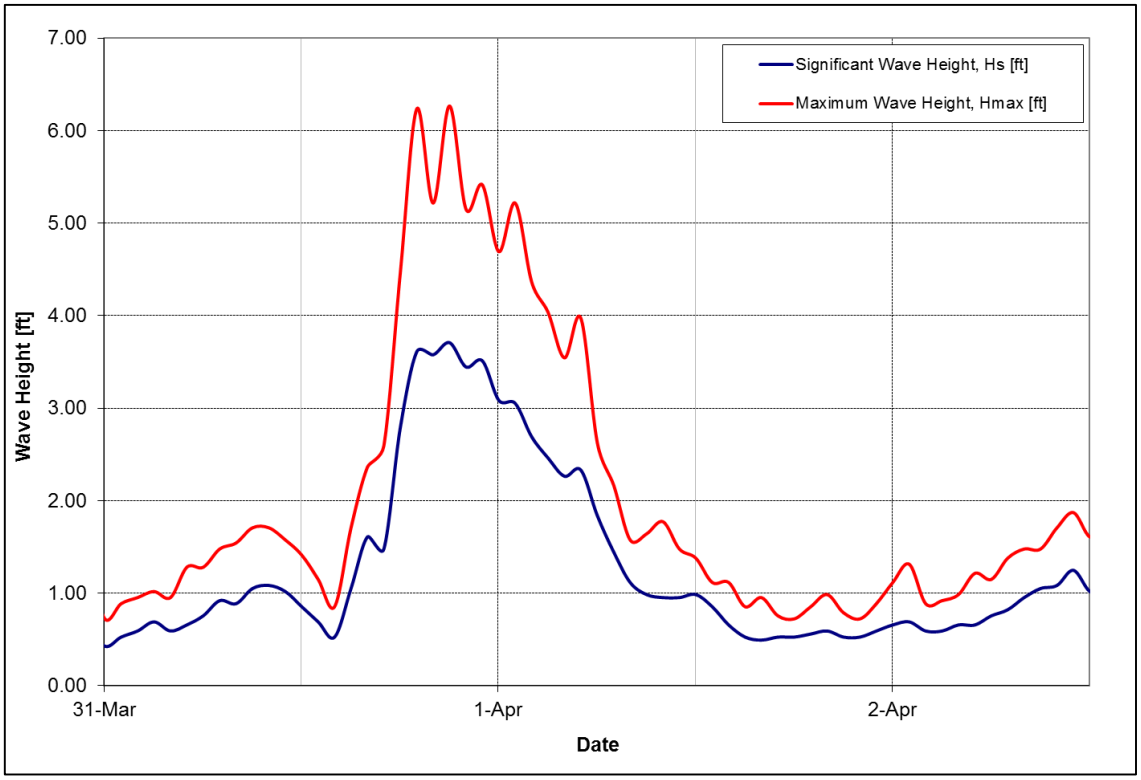


Figure 5-4: April 1, 2015 Storm

Table 5-1: Monthly Wave Statistics Summary

Wave Statistic	Mar-14	Apr-14
Average Significant Wave Height, H_s (ft)	1.18	1.10
Average Wave Period, T_m (s)	2.57	2.65
Average Peak Wave Period, T_p (s)	4.61	4.74
Maximum Observed Significant Wave Height, H_s (ft)	4.10	3.71
Maximum Observed Wave Height, H_{max} (ft)	6.69	6.27

5.2.2. Engineering Activities

No new engineering activities took place along the Ocean View Shoreline over the most recent monitoring period (October 2014 – April 2015). Construction of the West Ocean View Shoreline Improvement Project was completed during the previous monitoring period (October 2013 – March 2014). See Section 5.7 for a detailed analysis of this project.

5.3. General Shoreline Trends

Key statistics were calculated to describe the average shoreline and volume changes 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 March 2014 to April 2015 comparison are presented in Table 5-2. A summary of the resulting statistics for the October 2014 to April 2015 comparison are presented in Table 5-3. Evaluation of the computed statistics took into account volume changes computed for portions of the profile above 0 feet NAVD88 and above -15 feet NAVD88 in order to better understand onshore and offshore processes.

According to Table 5-2, the Ocean View shoreline has experienced overall gains at MHW over the past year with a change rate of 1.51 feet per year. While the beach gained a significant amount of material above 0 feet NAVD88, the gain above -15 ft NAVD88 was minor with a change rate of 12,759 cy/yr overall. The overall MHW shoreline showed accretion over the most recent survey of 4.41 ft, as shown in Table 5-3. The volumetric change over the past survey showed gains above 0 ft NAVD88 and loss above -15 ft NAVD88.

While the overall trends over the past year show shoreline accretion and volumetric gain of the system, patterns vary within each region of the shoreline as defined in Figure 3-1. The calculated statistics with respect to each region will be discussed in more detail in the following section.

Table 5-2: Regional Shoreline and Volume Change Statistics (March 2014 to April 2015)

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)	6.98	2.29	11,188	1.31	8,089
800 Block Breakwaters (45+25 to 87+62)	-3.17	-0.30	-788	-3.23	-13,733
West Ocean View (93+41 to 163+49)	2.12	1.02	11,031	3.66	32,243
Central Ocean View Breakwaters (169+63 to 195+63)	3.65	1.21	3,970	3.53	9,527
Central Ocean View (206+86 to 323+09)	15.89	3.87	47,480	2.27	31,768
East Ocean View (329+63 to 383+58)	-6.97	-0.77	-3,595	-3.35	-18,356
OVERALL	Weighted Avg (ft/yr)	Weighted Avg (cy/ft/yr)	Total (cy/yr)	Weighted Avg (cy/ft/yr)	Total (cy/yr)
	5.34	1.69	69,285	1.06	49,538

Table 5-3: Regional Shoreline and Volume Change Statistics (October 2014 to April 2015)

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)	1.98	0.76	3,607	4.42	21,619
800 Block Breakwaters (45+25 to 87+62)	-0.75	-0.02	93	0.81	4,475
West Ocean View (93+41 to 163+49)	-6.43	-1.07	-7,299	-0.21	-278
Central Ocean View Breakwaters (169+63 to 195+63)	4.48	0.90	2,164	5.27	12,814
Central Ocean View (206+86 to 323+09)	5.93	1.40	17,633	3.68	45,080
East Ocean View (329+63 to 383+58)	-3.72	0.02	851	1.68	10,524
OVERALL	Weighted Avg (ft)	Weighted Avg (cy/ft)	Total (cy)	Weighted Avg (cy/ft)	Total (cy)
	0.65	0.41	17,049	2.50	94,234

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 5-5 through Figure 5-8, 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 Willoughby Spit region (Sta 0+00 to Sta 45+00) previously included two offshore breakwaters, timber groins and has historically been a stable and accreting region. This region is still continuing to adjust due to the completion of the Willoughby Spit Shoreline Improvement Project in December 2013, which included the removal of the existing groin field and connected the 800 Block breakwater field with the existing Willoughby Spit breakwaters by adding seven new breakwaters. A summary of average shoreline and volume change rates for the Willoughby Spit region between March 2014 and April 2015 and between October 2014 and April 2015 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
March 2014 vs. April 2015 Comparison					
	(ft/yr)	(cy/ft/yr)	(cy/yr)	(cy/ft/yr)	(cy/yr)
Willoughby Spit (0+00 to 45+00)	6.98	2.29	11,188	1.31	8,089
October 2014 vs. April 2015 Comparison					
	(ft)	(cy/ft)	(cy)	(cy/ft)	(cy)
Willoughby Spit (0+00 to 45+00)	1.98	0.76	3,607	4.42	21,619

The information shown in Table 5-4 is still influenced by the recent Willoughby Spit Shoreline Improvement Project on this region over the last year. The nourishment that was placed along the

eastern end of the reach has continued to equilibrate moving to the west as shown in Figure 5-6 over the past year. This region was on average accretional over the seasonal (October 2014 - April 2015) and yearly (March 2014 - April 2015) comparisons. For the yearly comparison, the MHW shoreline accreted at a rate of 6.98 ft/yr and gained sediment above 0 ft NAVD88 and -15 ft NAVD88 at a rate of 11,188 cy/yr and 8,089 cy/yr respectively. The seasonal comparison showed an accretion of the MHW shoreline of 1.98 feet on average and a cumulative sediment gain above 0 feet NAVD88 and -15 feet NAVD88 of 3,607 cy and 21,619 cy respectively. This reach now has a total of 9 nearshore breakwaters, which connects the two existing breakwaters near the terminal groin to the 800 block breakwater field. The shoreline improvement project has continued to perform as designed, holding the sand in the system as it moves west through the reach as shown in Figure 5-6 and Figure 5-8. This correlates well to the accretion of the MHW shoreline in the western section of the reach and the erosion of the MHW shoreline in the eastern section of the reach as shown in Figure 5-5 and Figure 5-7.

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 the pre-existing groin spur and toe extension. This new breakwater was built further offshore since the previous structural configuration caused the beach to fill out and impair natural sediment transport to the west. In conjunction with the Willoughby Spit Project, the second easternmost breakwater, has been 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 March 2014 and April 2015 and between October 2014 and April 2015 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
March 2014 vs. April 2015 Comparison					
	(ft/yr)	(cy/ft/yr)	(cy/yr)	(cy/ft/yr)	(cy/yr)
800 Block Breakwaters (45+25 to 87+62)	-3.17	-0.30	-788	-3.23	-13,733
October 2014 vs. April 2015 Comparison					
	(ft)	(cy/ft)	(cy)	(cy/ft)	(cy)
800 Block Breakwaters (45+25 to 87+62)	-0.75	0.02	93	0.81	4,475

The 800 block was predominately erosional over the seasonal (October 2014 - April 2015) and predominately accretional over the yearly (March 2014 - April 2015) comparisons. For the yearly comparison, there has been an erosion of the MHW shoreline of -3.17 ft/yr as well as a minimal overall volume loss above 0 ft NAVD88 and -15 ft NAVD88 of 788 cy/yr and -13,733 cy/yr. The seasonal comparison showed this region remained relatively stable on average. There was a slight erosion of the MHW shoreline of -0.75 feet and a minimal gain of sediment above 0 feet NAVD88 and -15 feet NAVD88 of 93 cy and 4,475 respectively. Across the reach, there were gains located in the central section with losses located on the eastern and western end as shown in Figure 5-6. The majority of the loss above -15 ft NAVD88 is located in the western end of the reach, as shown in Figure 5-6. This was most likely due to the continued equilibration of the nourishment placed from the Willoughby Spit Shoreline Improvement Project as well as the end effects on both ends of the breakwater field in this

reach. Also, the MHW shoreline located behind the realigned breakwater has continued to accrete as shown in Figure 5-7; however, a tombolo has not formed at this point as can be seen in the profile plot in Appendix B.

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, is characterized by a series of timber groins. The 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 the rock groin at station 129+17, and 73,600 cy of nourishment placed in front of Sarah Shrine Constant Park. A summary of average shoreline and volume change rates for the West Ocean View region March 2014 and April 2015 and between October 2014 and April 2015 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
March 2014 vs. April 2015 Comparison					
	(ft/yr)	(cy/ft/yr)	(cy/yr)	(cy/ft/yr)	(cy/yr)
West Ocean View (93+41 to 163+49)	2.12	1.02	11,031	3.66	32,243
October 2014 vs. April 2015 Comparison					
	(ft)	(cy/ft)	(cy)	(cy/ft)	(cy)
West Ocean View (93+41 to 163+49)	-6.43	-1.07	-7,299	-0.21	-278

The changes within this region were controlled by the West Ocean View Shoreline Improvement Project, which completed construction in April 2014. At the time of the March 2014 survey, there was construction equipment located at Station 129+17; therefore, no data were recorded at this station. This station was removed from analysis for the survey comparison between March 2014 and April 2015; therefore, the calculated shoreline and volume change does not account for the entire nourishment placed for the project. This region was predominately accretional over the yearly (March 2014 - April 2015) comparisons and erosional over the seasonal (October 2014 - April 2015) comparison. The yearly survey comparison showed accretion of the MHW shoreline at a rate of 2.12 ft/yr, and a volume gain above 0 feet NAVD88 and -15 feet NAVD88 at a rate of 11,031 cy/yr and 32,243 cy/yr respectively. The seasonal comparison showed an erosion of the MHW shoreline of -6.43 feet and a slight loss of material above 0 feet NAVD88 and -15 feet NAVD88 of -7,299 cy and -278 cy respectively. Figure 5-7 and Figure 5-8 show the effects of the West Ocean View Shoreline Improvement Project on the MHW shoreline and volume change above 0 ft NAVD88 and -15 ft NAVD88 respectively. As expected, the majority of the volume loss and shoreline erosion occurred within the project extents. There were localized gains in sediment volume and accretion of the MHW shoreline directly east and west of the project due to the spreading of the nourishment.

5.4.4. Central Ocean View Breakwaters

The Central Ocean View breakwater 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 March 2014 and April 2015 and between October 2014 and April 2015 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
March 2014 vs. April 2015 Comparison					
	(ft/yr)	(cy/ft/yr)	(cy/yr)	(cy/ft/yr)	(cy/yr)
Central Ocean View Breakwaters (169+63 to 195+63)	3.65	1.21	3,970	3.53	9,527
October 2014 vs. April 2015 Comparison					
	(ft)	(cy/ft)	(cy)	(cy/ft)	(cy)
Central Ocean View Breakwaters (169+63 to 195+63)	4.48	0.90	2,164	5.27	12,814

The Central Ocean View Breakwaters reach has continued to be fairly stable. This region was on average accretional over the yearly (March 2014 - April 2015) and seasonal (October 2014 - April 2015) comparisons. The yearly comparison showed an overall accretion of the MHW shoreline at a rate of 3.65 ft/yr and an overall volume gain above 0 feet NAVD88 and -15 feet NAVD88 at a rate of 3,970 cy/yr and 9,527 cy/yr respectively. The seasonal comparison showed an accretion of the MHW shoreline of 4.48 feet and a gain of material above 0 feet NAVD88 and -15 feet NAVD88 of 2,164 cy and 12,814 cy respectively. The end effects of the breakwaters in this region are evident in Figure 5-6Figure 5-7 and Figure 5-8 Overall, this reach has continued to fare well over the past few monitoring periods.

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 March 2014 and April 2015 and between October 2014 and April 2015 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
March 2014 vs. April 2015 Comparison					
	(ft/yr)	(cy/ft/yr)	(cy/yr)	(cy/ft/yr)	(cy/yr)
Central Ocean View (206+86 to 323+09)	15.89	3.87	47,480	2.27	31,768
October 2014 vs. April 2015 Comparison					
	(ft)	(cy/ft)	(cy)	(cy/ft)	(cy)
Central Ocean View (206+86 to 323+09)	5.93	1.40	17,633	3.68	45,080

As shown in Table 5-8, Central Ocean View region was on average accretional over the yearly (March 2014 - April 2015) and seasonal (October 2014 - April 2015) comparisons. The yearly comparison showed a significant accretion of the MHW shoreline at a rate of 15.89 ft/yr and an overall volume gain above 0 feet NAVD88 and -15 feet NAVD88 at a rate of 47,480 cy/yr and 31,768 cy/yr respectively. The seasonal comparison showed an accretion of the MHW shoreline of 5.93 feet and a

gain of material above 0 feet NAVD88 and -15 feet NAVD88 of 17,633 cy and 45,080 cy respectively. Figure 5-6Figure 5-7 and Figure 5-8 shows the dune and subaerial beach change has predominately gained material over the entire region. The berm growth noted in the previous report has migrated down in elevation and seaward as can be seen in Appendix B. This correlates to an overall accretion of the MHW shoreline as shown in Figure 5-5 and Figure 5-7.

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 of 2009. Prior to the breakwater construction, a beach renourishment project took place in March 2009, adding approximately 196,000 cy of material to the beach. A summary of average shoreline and volume change rates for the East Ocean View region between March 2014 and April 2015 and between October 2014 and April 2015 are presented in Table 5-9.

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
March 2014 vs. April 2015 Comparison					
	(ft/yr)	(cy/ft/yr)	(cy/yr)	(cy/ft/yr)	(cy/yr)
East Ocean View (329+63 to 383+58)	-6.97	-0.77	-3,595	-3.35	-18,356
October 2014 vs. April 2015 Comparison					
	(ft)	(cy/ft)	(cy)	(cy/ft)	(cy)
East Ocean View (329+63 to 383+58)	-3.72	0.02	851	1.68	10,524

This region is normally characterized by a consistent erosional pattern due to sediment movement along the shoreline from east to west with no sand source due to the terminal groin at Little Creek Inlet. East Ocean View was erosional over the yearly (March 2014 - April 2015) comparison and predominately accretional over the seasonal (October 2014 - April 2015) comparison. The yearly comparison showed an overall erosion of the MHW shoreline at a rate of -6.97 ft/yr and an overall volume loss above 0 feet NAVD88 and -15 feet NAVD88 at a rate of -3,595 cy/yr and -18,356 cy/yr respectively. The seasonal comparison remained fairly stable showing an erosion of the MHW shoreline of -3.72 feet and a minimal gain of material above 0 feet NAVD88 and -15 feet NAVD88 of 851 cy and 10,524 cy respectively. It is important to note that at new beach access was opened through the dune at Station 344+05, which can be seen in Figure 5-6. Since this feature occurs over one transect, it does not significantly affect the overall results for this reach. The Bay Oaks breakwaters have continued to be very successful at retaining sand that may be eroding from the beach and eliminating the previous hotspot. Typically, the east end of the region, adjacent to the jetty, is more erosive than most areas west in this region due to the lack of a sediment source and the littoral sediment movement in this region going from east to west. Also, this region has a fairly steady pattern of accretion on the profiles behind the breakwaters and erosion on the profiles between the breakwaters. This indicates the influence of the breakwaters on decreasing the wave heights and retaining sediment along the shore.

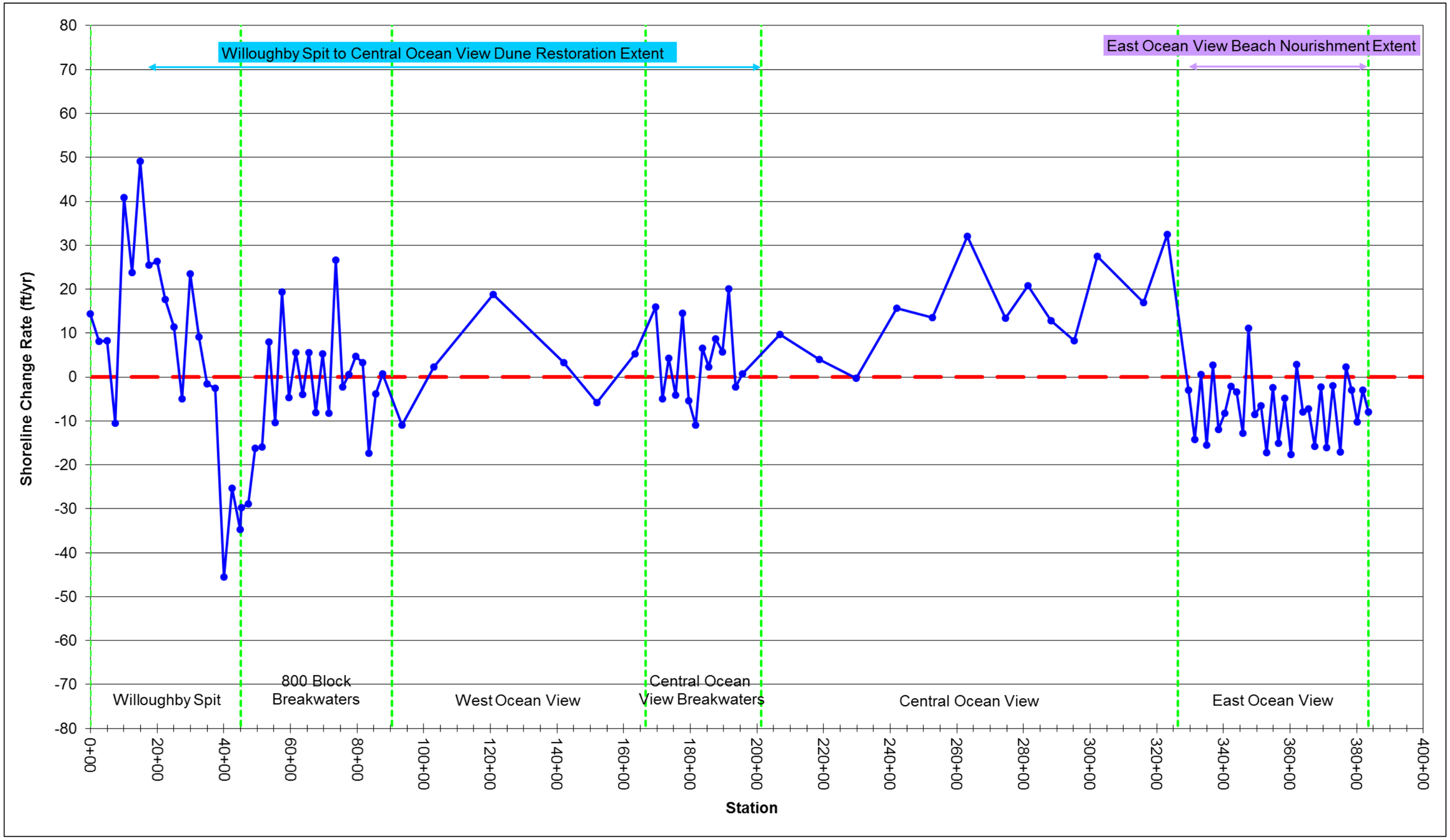


Figure 5-5: Shoreline Change Rate (ft/yr) at Mean High Water (+0.98 ft NAVD88) for March 2014 to April 2015 (Note: Positive = Accretion, Negative = Erosion)

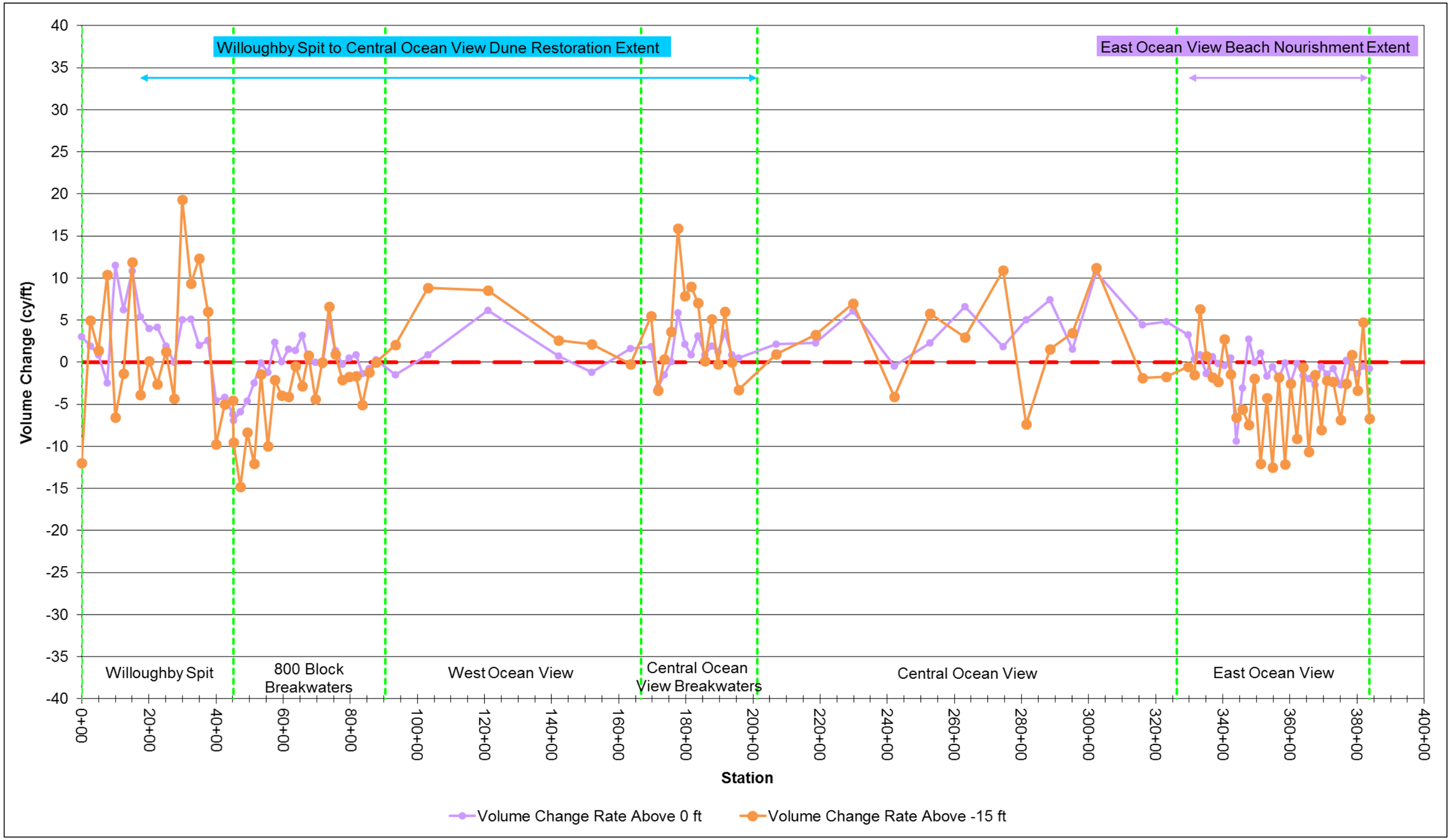


Figure 5-6: Volume Change Above 0 ft NAVD88 and -15 ft NAVD88 (cy/ft) for March 2014 to April 2015 (Note: Positive = Accretion, Negative = Erosion)

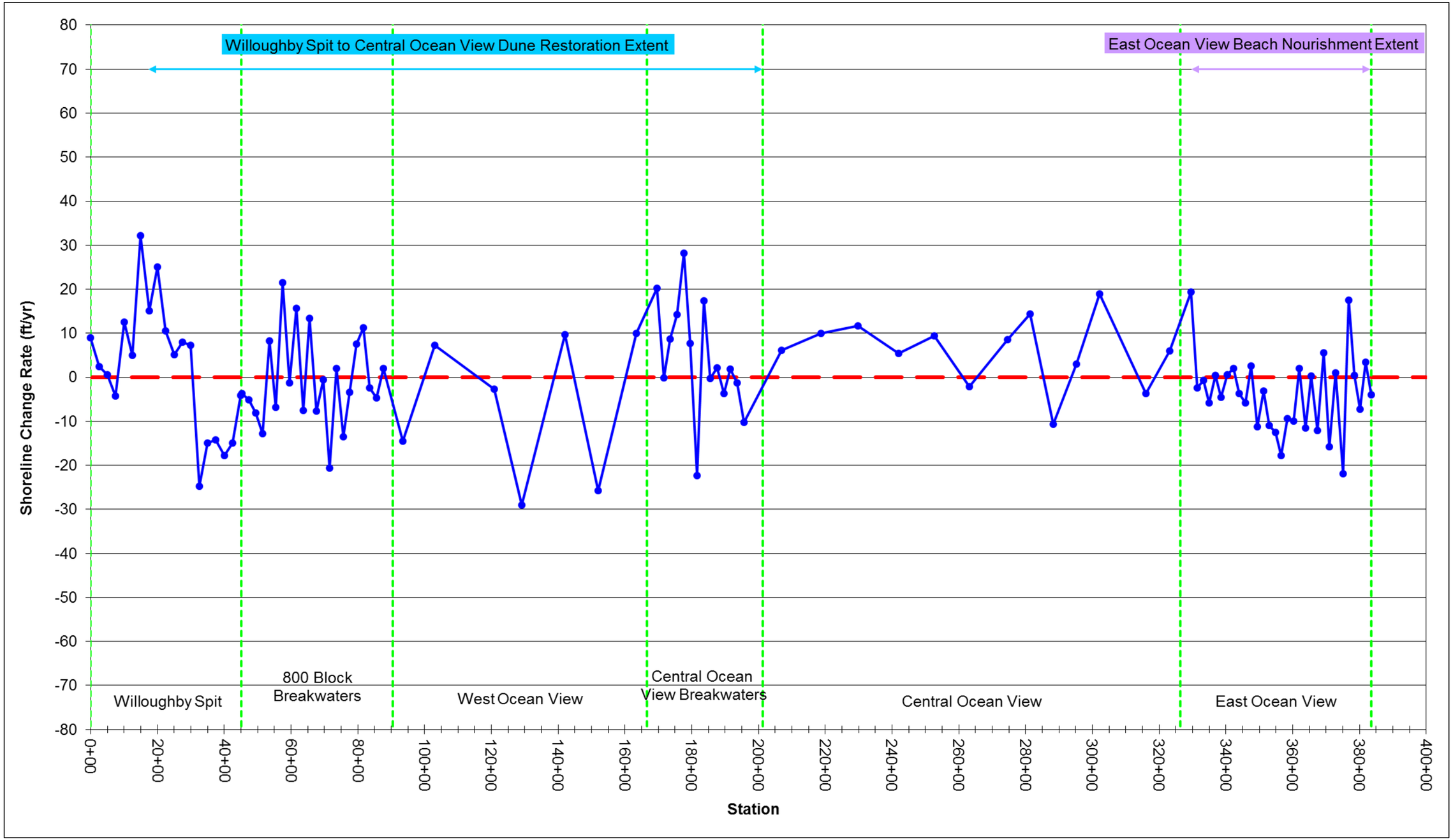


Figure 5-7: Shoreline Change (ft) at Mean High Water (+0.98 ft NAVD88) for October 2014 to April 2015 (Note: Positive = Accretion, Negative = Erosion)

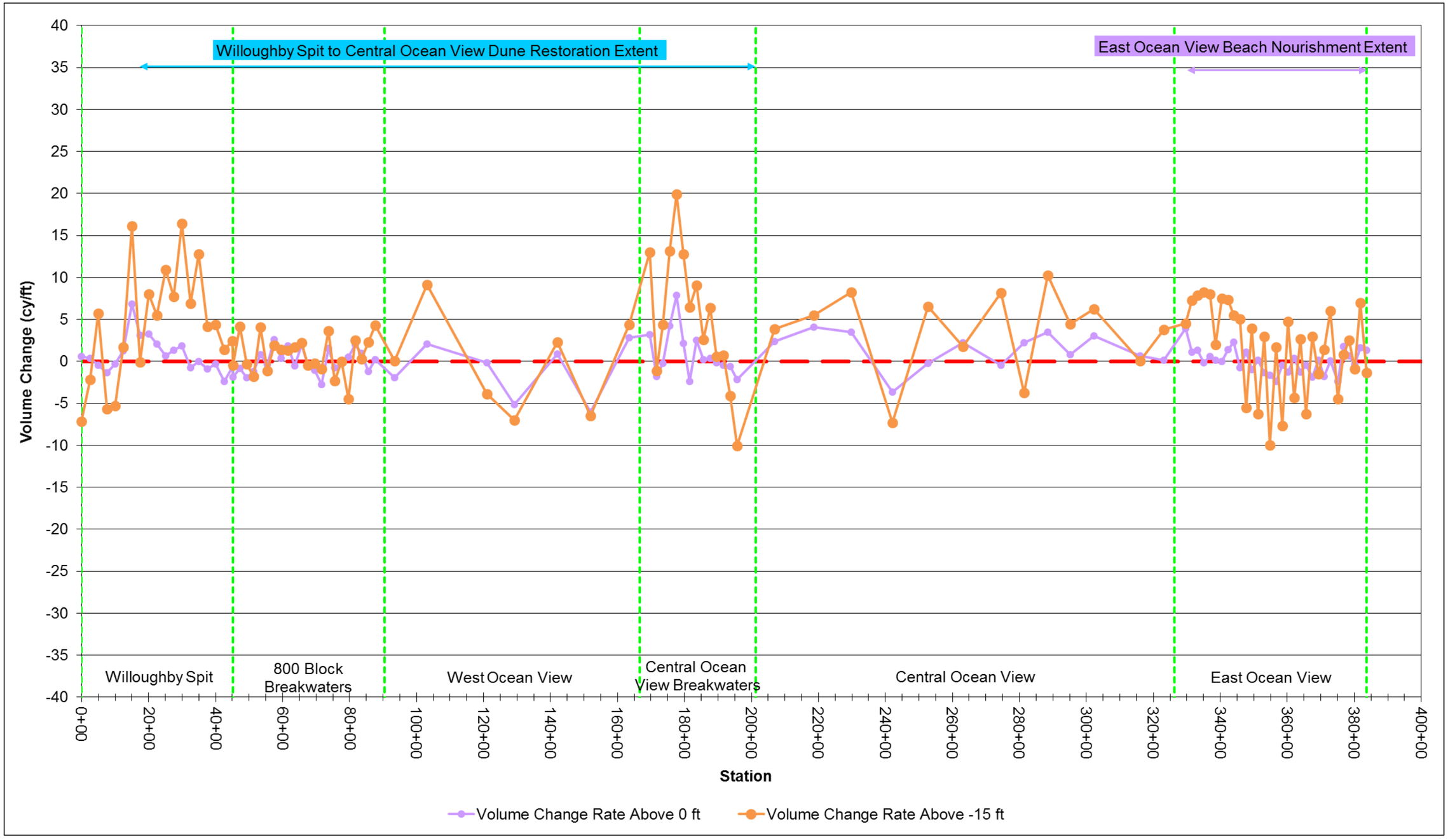


Figure 5-8: Volume Change Above 0 ft NAVD88 and -15 ft NAVD88 (cy/ft) for October 2014 to April 2015 (Note: Positive = Accretion, Negative = Erosion)

5.5. East Ocean View Beach Nourishment Project (2009)

An initial beach nourishment project took place along the East Ocean View shoreline in November 2003. Approximately 359,000 cy of material was placed on the beach between Station 329+63 and Station 383+58. More recently, the East Ocean View shoreline was renourished with approximately 196,000 cy of material in March 2009. The most recent periodic survey, taken in October 2014, was compared to the post-fill survey taken in March 2009. Table 5-10 presents the shoreline and volume change statistics comparing the two surveys.

Table 5-10: Overall Shoreline and Volume Change Statistics – East Ocean View Nourishment Project (March 2009 Post-Fill – April 2015 Comparison)

Region		Average Shoreline Change (ft)	Average Volume Change Above 0 ft NAVD88 (cy/ft)	Cumulative Volume Change Above 0 ft NAVD88 (cy)	Average Volume Change Above -15 ft NAVD88 (cy/ft)	Cumulative Volume Change Above -15 ft NAVD88 (cy)
East Ocean View (329+63 to 383+58)	Rate per Year	-17.46	-3.09	-16,099	-5.53	-28,683
	Total	-106.34	-18.84	-98,049	-33.70	-174,691

Results indicate that the East Ocean View shoreline has remained fairly constant at MHW. Roughly 98,000 cy of material has been lost above 0 feet NAVD88, or approximately 87% of the 113,000 cy originally placed above 0 feet NAVD88. This was a slight increase from the previous survey period where the percentage loss was 85%, which indicates there was not significant loss of additional sediment over the most recent survey period. This loss of sediment is the result of the expected erosion due to design life of the nourishment project combined with storm activity. Previous experience from the 2003 nourishment project indicates that the design life of projects in this area is limited to 4-5 years due to storm impact and lack of sediment source to the east. Therefore, it is anticipated that renourishment will be needed within the next year.

Figure 5-9 shows areas of elevation change between the post-fill survey and the April 2015 survey. As depicted in the figure, there has been erosion of the beach face and nearshore in-between the breakwaters with some of that sediment being trapped behind each of the breakwaters. The magnitude of the loss is much larger to the east, which is to be expected since this shoreline is cut off from a sediment source by the jetty. Some of the sediment eroded from the beach face and nearshore appears to be caught offshore in the vicinity of the Bay Oaks breakwaters. At Station 329+63, there seems to be some slight end effects from the Bay Oaks breakwaters. These breakwaters have continued to be very successful eliminating the previous hotspot and providing a transition into the Central Ocean View region. There has also been an increase in the dune area, which may partially be attributed to the annual dune planting project providing a mechanism for sand accumulation.

In addition, the April 2015 MHW shoreline was compared to the MHW shoreline from June 2003, before the first nourishment project in November 2003, as another way to measure the amount of protection being supplied by the March 2009 nourishment project. Areas where the current shoreline is within 20 feet of the June 2003 shoreline need to be targeted for nourishment. Figure 5-10 shows the MHW shoreline position difference between the June 2003 pre-fill and April 2015 shorelines. As can be seen, the MHW shoreline at all stations along the East Ocean View Breakwaters have retreated within 20 feet of the pre-fill shoreline with a majority receding beyond the pre-fill shoreline position.

Half of the stations within the Bay Oaks Breakwaters have remained outside of the 20 foot buffer for the pre-fill shoreline; however, they have receded closer to this mark. Two new station (338+63 and 345+85) has receded within 20 feet of the pre-fill shoreline. Two stations (331+43 and 347+63) that have receded beyond the pre-fill shoreline mark have remain fairly stable and no new stations have receded beyond this mark. As for the East Ocean View Breakwaters, only stations five stations (349+43, 372+83, 376+78, 378+48, and 380+18) remain within 20 feet of the prefill shoreline. The remaining fifteen stations are beyond the pre-fill shoreline, five of which have receded beyond this mark over the previous monitoring period. These stations are as follows: Station 356+63, 360+23, 367+43, 371+03 and 375+08. One station (376+78) that was previously beyond the pre-fill shoreline has accreted outside of this region; however, remains within 20 feet of the pre-fill shoreline. It will be important to monitor this portion of shoreline for planning purposes of future nourishment projects.

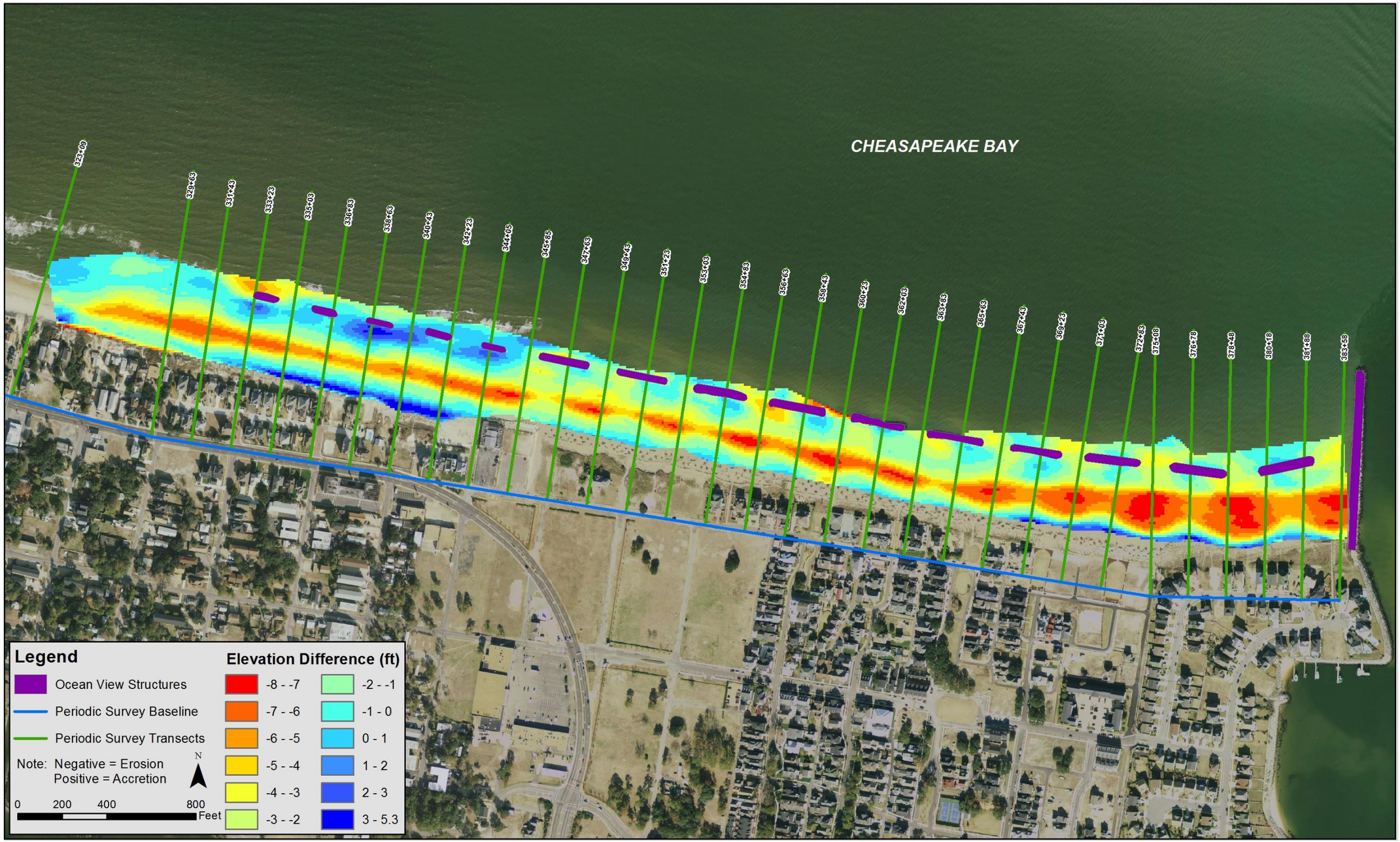


Figure 5-9: Net Volume Change Since the East Ocean View Nourishment Project (March 2009)

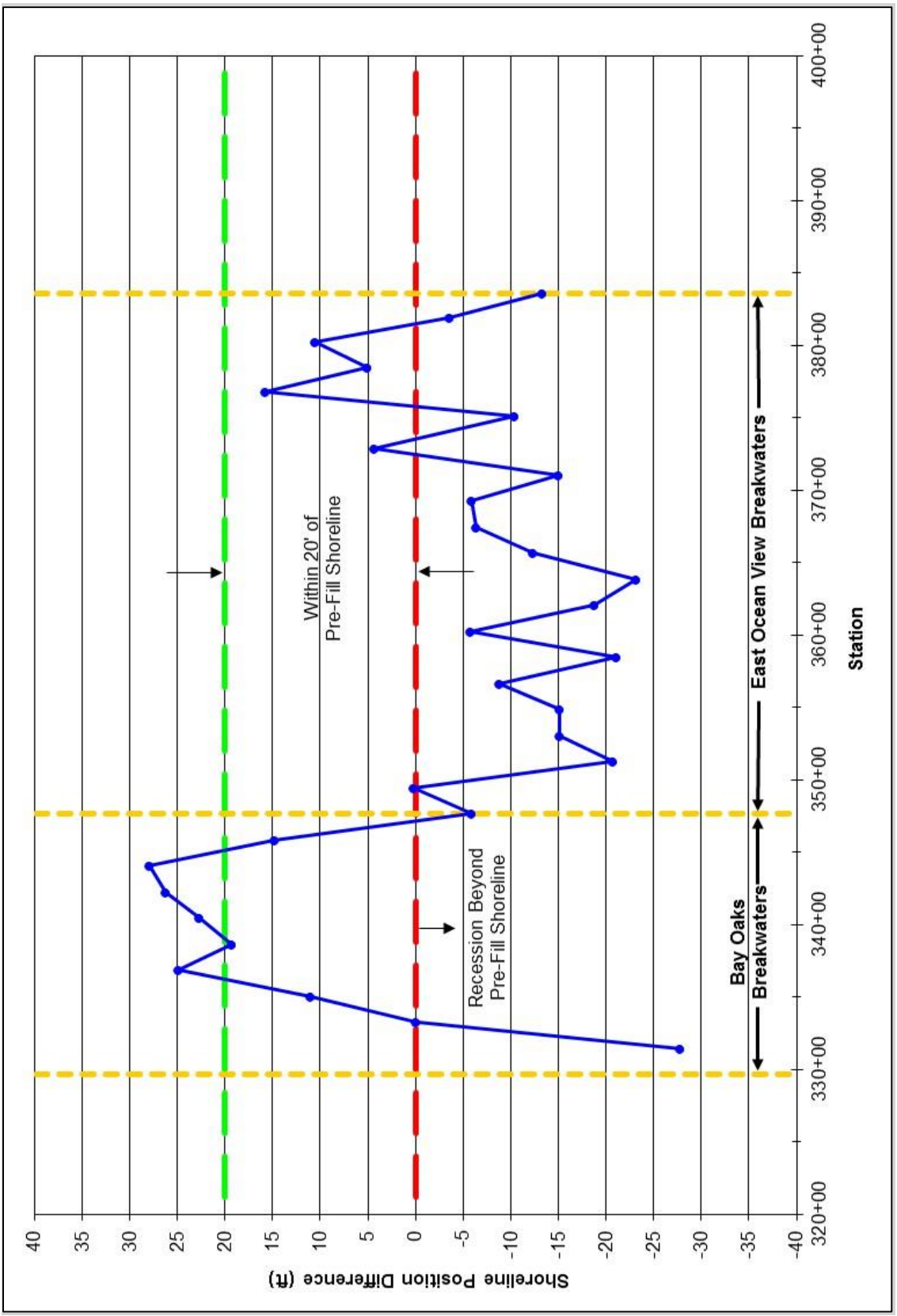


Figure 5-10: Shoreline Position Difference (ft) at MHW Between 2003 Pre-Fill and April 2015 Shorelines for East Ocean View

5.6. Central Ocean View Dune Restoration Project (2005)

The most recent periodic survey, taken in April 2015, was also compared to the post-fill survey taken in March 2005 after completion of the Willoughby Spit to Central Ocean View Dune Restoration project. A total of 504,300 cy of sand was placed from Station 15+00 to Station 195+63. Table 5-11 presents the shoreline and volume change statistics comparing the two surveys.

Table 5-11: Regional and Overall Shoreline and Volume Change Statistics for Central Ocean View Nourishment Project (March 2005 Post-Fill – April 2015 Comparison)

Region		Average Shoreline Change (ft)	Average Volume Change Above 0 ft NAVD88 (cy/ft)	Cumulative Volume Change Above 0 ft NAVD88 (cy)	Average Volume Change Above -15 ft NAVD88 (cy/ft)	Cumulative Volume Change Above -15 ft NAVD88 (cy)
Willoughby Spit (0+00 to 45+00)	Rate per Year	0.47	-0.60	-1,647	-0.27	-502
	Total	4.70	-6.07	-16,647	-2.75	-5,073
800 Block Breakwaters (45+25 to 87+62)	Rate per Year	-5.28	-1.11	-4,777	-1.70	-7,315
	Total	-53.40	-11.19	-48,280	-17.21	-73,929
West Ocean View (93+41 to 163+49)	Rate per Year	-3.19	-1.53	-11,745	-0.89	-6,161
	Total	-32.21	-15.43	-118,704	-9.03	-62,266
Central Ocean View Breakwaters (169+63 to 195+63)	Rate per Year	-0.35	-0.03	-69	1.32	3,775
	Total	-3.53	-0.27	-695	13.34	38,150
OVERALL		Weighted Average	Total	Weighted Average	Total	Weighted Average
Rate per Year		-2.56	-0.99	-18,238	-0.58	-10,203
Total		-25.86	-10.03	-184,326	-5.82	-103,117

It is important to consider changes above the 0 feet contour since the project was primarily a dune restoration, placing the majority of sand above the intertidal zone. Table 5-11 shows that there has been significant loss of material in the dune system and subaerial beach above 0 feet NAVD88 since the project was completed. Roughly 184,300 cy of material has been lost above 0 feet NAVD88, or approximately 57% of the 320,700 cy originally placed above 0 feet NAVD88 which remained fairly stable when compared to the previous monitoring period (October 2014), which was 57%. The influence of the Willoughby Spit and West Ocean View Shoreline Improvement Projects have helped keep this region relatively stable.

Figure 5-11 shows areas of elevation change between the post-fill survey and the April 2015 survey. As depicted in the figure, there has been erosion of the beach face and nearshore in-between the Willoughby Spit breakwaters, the 800 Block breakwaters, and the Central Ocean View breakwaters. These losses are less in the Central Ocean View breakwaters than in the 800 Block breakwaters and Willoughby Spit breakwaters. The losses due to the end effects from the 800 Block breakwaters can also be seen between Stations 42+50 and 47+30.

In addition, the April 2015 MHW shoreline was compared to the pre-fill MHW shoreline as another way to measure the amount of protection still being supplied by the January-March 2005 nourishment (dune restoration) project. The design life of the nourishment project was outlined in the M&N

Willoughby Spit to Central Ocean View Dune Restoration Project Performance Analysis from October 2004. The study anticipated a project design life of 5 to 6 years with no major storm activity and 2 to 3 years at hot spot areas if there were impacts to this reach of shoreline from storms. The nourishment project is in its tenth year and has been impacted by several storms since its construction, e.g. October 2006 and November 2009 nor'easters, and Hurricane Irene in August 2011. Areas where the current shoreline is within 20 feet of the pre-fill shoreline need to be targeted for nourishment. Figure 5-12 shows the MHW shoreline position difference between the pre-fill and April 2015 shorelines. As can be seen, the sections of the Willoughby Spit to Central Ocean View MHW shoreline come within 20 feet of the pre-fill shoreline in many locations and has even receded past the pre-fill shoreline. Within the Willoughby Spit region, some stations that were below the pre-fill shoreline have accreted beyond this mark; however, there were some stations that were greater than 20 feet beyond the pre-fill shoreline that have eroded within 20 feet of the pre-fill shoreline. Areas of concern include the shoreline to the west of the 800 Block breakwater field as well as portions of the breakwater field itself which include Stations 42+50 through 55+51. The breakwaters are most likely inhibiting the transport of sand to the western portion of the field and shoreline beyond. Overall, a majority of stations between Station 0+00 and 40+00 are beyond the pre-fill shoreline. The western end of the West Ocean View shoreline remains an area of concern with Stations 81+62 through 152+01 showing recession either beyond the pre-fill shoreline or within 20 feet of the pre-fill shoreline with the exception of Station 120+93. This is most likely due to the equilibration of the West Ocean View shoreline improvement project. The eastern end of West Ocean View starting at Station 163+49, as well as the entire Central Ocean View Breakwaters reach remain stable. This shoreline historically has suffered significant impacts from the November 2009 nor'easter which were further exacerbated by Hurricane Irene in August 2011. Targeted nourishment projects should continue to be planned for problem areas in the future.

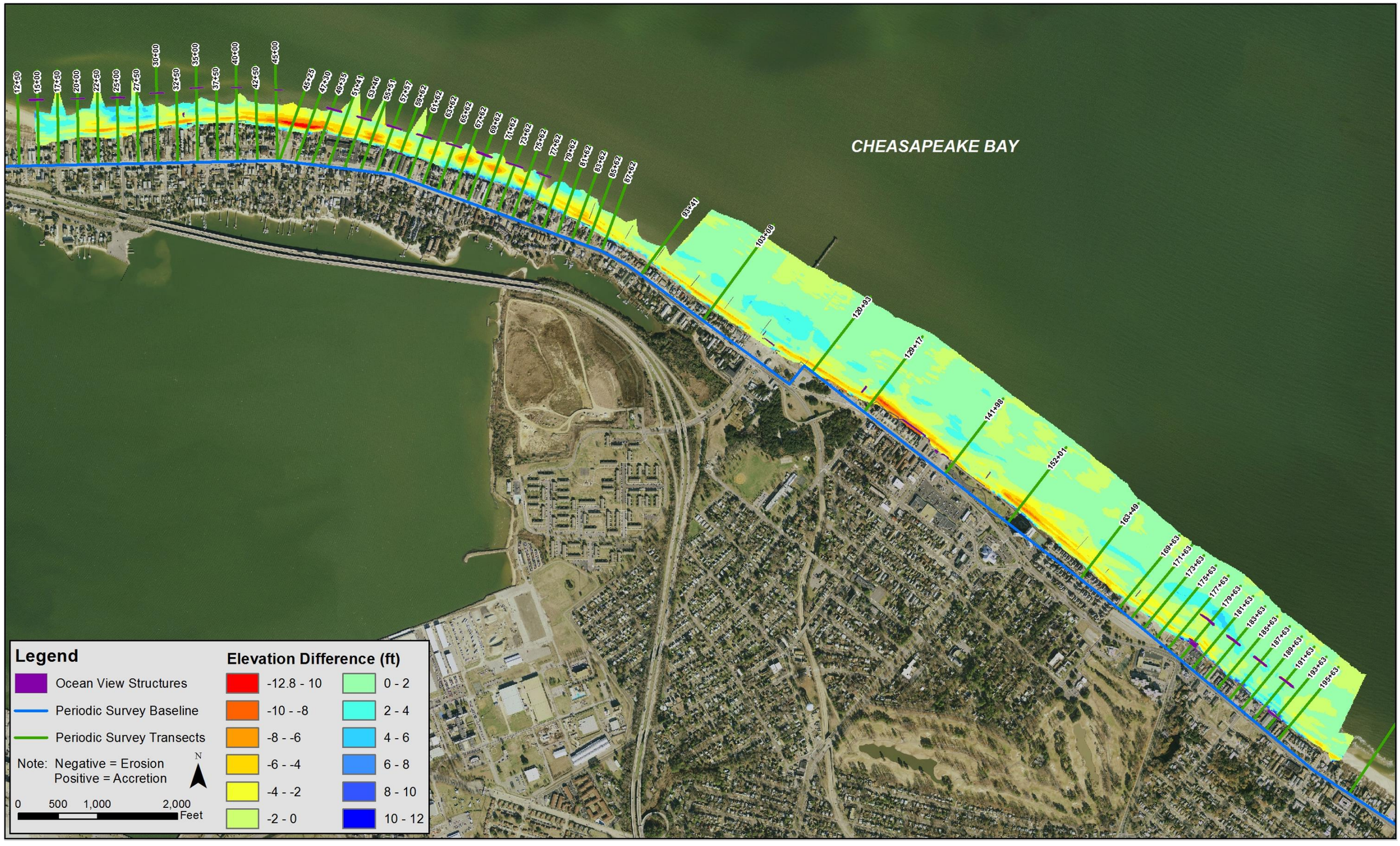


Figure 5-11: Net Volume Change Since the Willoughby Spit to Central Ocean View Dune Restoration Project (March 2005)

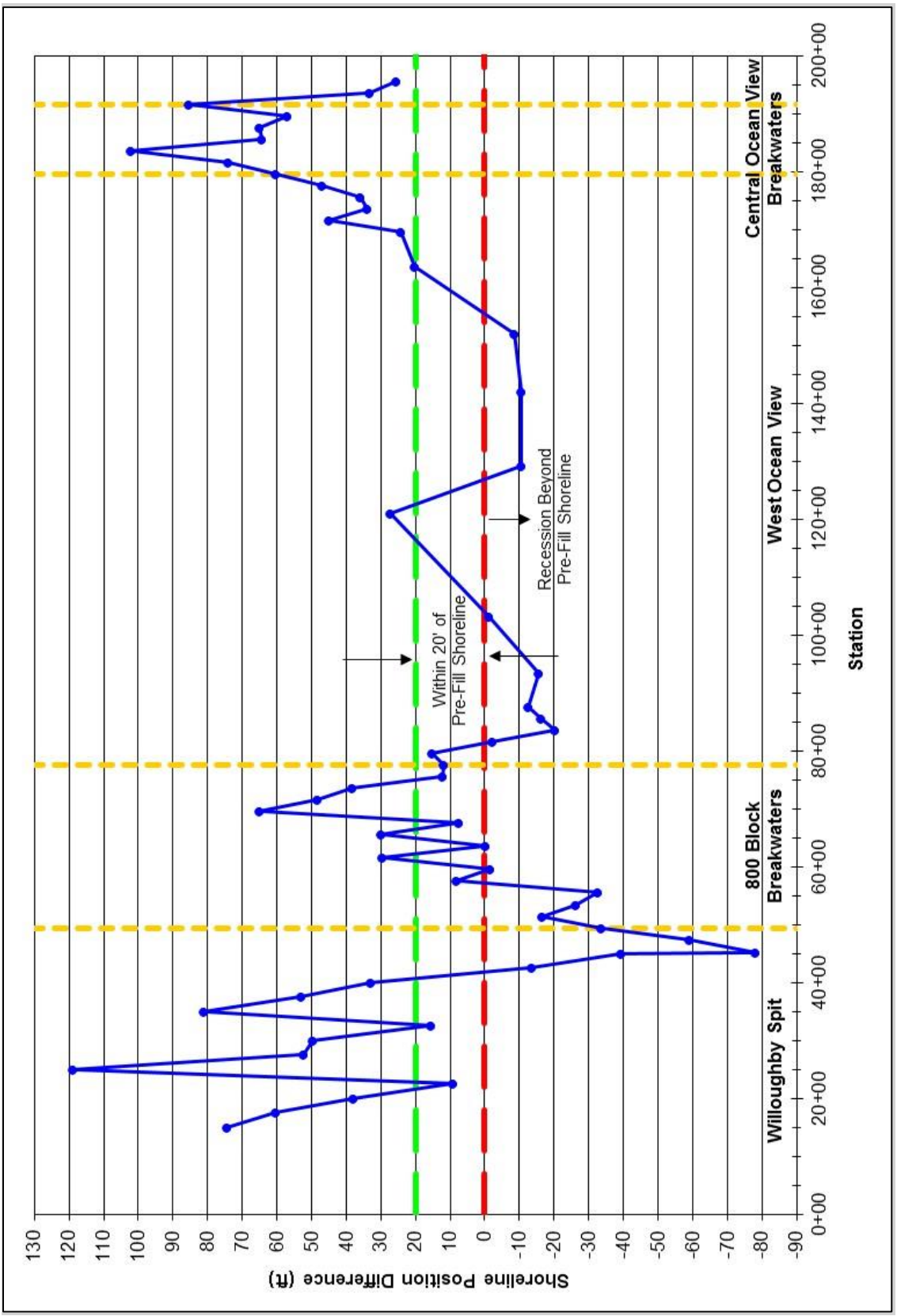


Figure 5-12: Shoreline Position Difference (ft) at MHW Between 2003 Pre-Fill and April 2015 Shorelines for Central Ocean View

5.7. West Ocean View Shoreline Improvement Project (2013)

The most recent periodic survey, taken in April 2015, was also compared to the October 2013 survey prior to the completion of the West Ocean View Shoreline Improvement Project. A total of 73,600 cy of sand was placed from Station 103+08 to Station 152+01.

Table 5-12: Overall Shoreline and Volume Change Statistics for West Ocean View shoreline Improvement Project (October 2013 – April 2015 Comparison)

Region		Average Shoreline Change (ft)	Average Volume Change Above 0 ft NAVD88 (cy/ft)	Cumulative Volume Change Above 0 ft NAVD88 (cy)	Average Volume Change Above -15 ft NAVD88 (cy/ft)	Cumulative Volume Change Above -15 ft NAVD88 (cy)
West Ocean View (103+08 to 152+01)	Rate per Year	4.62	1.50	11,758	5.07	30,952
	Total	5.03	1.64	10,811	5.51	33,666

Construction of the West Ocean View Shoreline Improvement Project was completed during the previous monitoring period. This project included the removal of the existing groin field east of the pier, reconstruction of a groin in between the 200 Block and Sarah Constant Shrine Park, and a 73,600 cy nourishment project, as shown in Figure 5-13**.** The new groin was designed to be shorter and tighter than the previous groins, helping to maintain the beach width in front of the 200 Block adequately for vehicle access. The 73,600 cy nourishment project added 30 feet of berm width in front of Sarah Constant Shrine Park, on the dowdrift side of the groin.

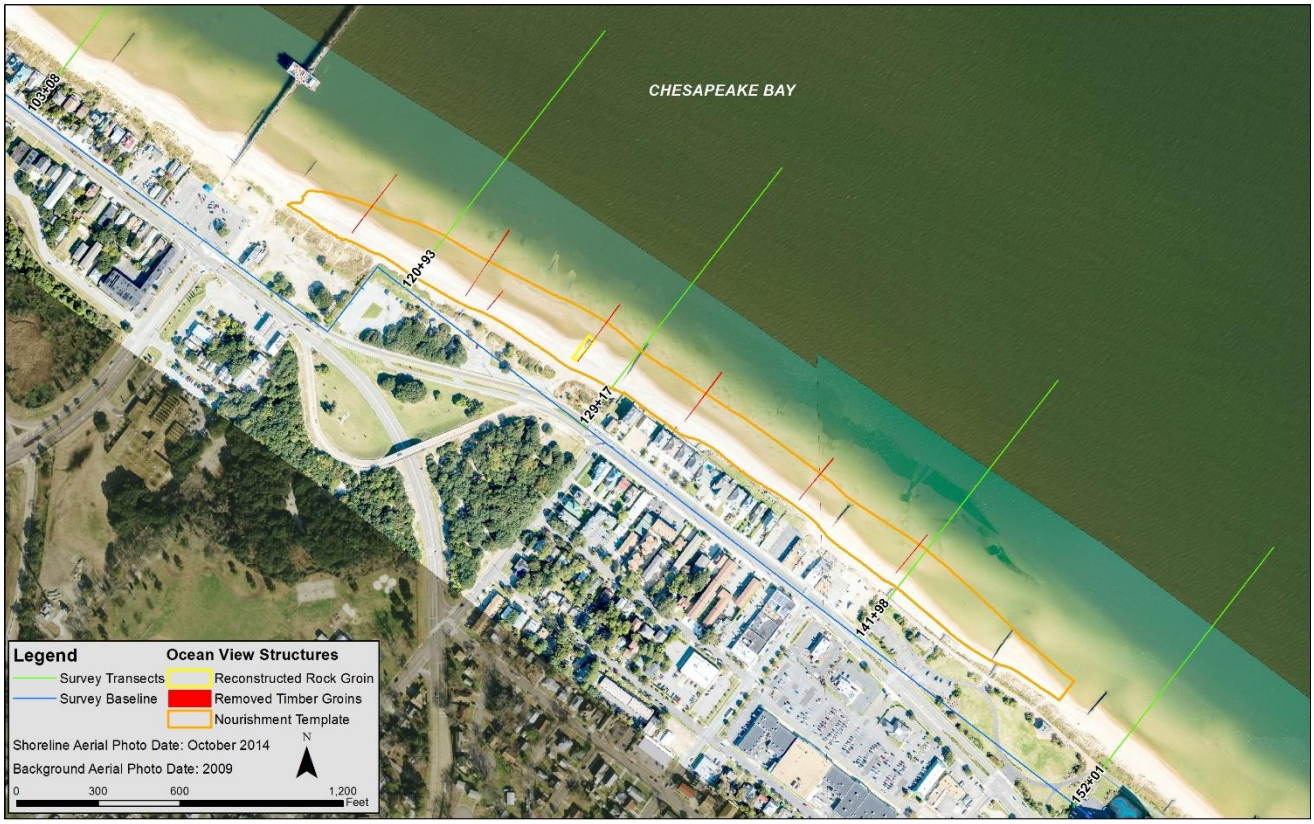


Figure 5-13: West Ocean View Shoreline Improvement Project Area

West Ocean View has continued to equilibrate from this project during the current monitoring period. A majority of the material placed within this subreach was placed above -3 ft NAVD88; therefore, the volume change above -15 ft NAVD88 was examined to capture as much of the remaining material as possible. Roughly 33,700 cy of material is remaining above -15 feet NAVD88, or approximately 46% of the 73,600 cy originally placed above -15 feet NAVD88.

In addition, the April 2015 MHW shoreline was compared to the MHW shoreline from October 2013, before the shoreline improvement project was completed in April 2014, as another way to measure the amount of protection being supplied by this nourishment project. Areas where the current shoreline is within 10 feet of the October 2013 shoreline need to be targeted for nourishment. Figure 5-14 shows the MHW shoreline position difference between the October 2013 and April 2015 shorelines. As can be seen, the MHW shoreline at all transects along the project area are greater than 10 feet of the pre-fill shoreline. Station 120+93 is the only location that has remained greater than 10 feet from the October 2013 shoreline. All stations remain beyond the October 2013 shoreline except for Station 152+01; however, a majority of the stations are within 10 feet of the October 2013 shoreline. Station 103+08 that was previously beyond the October 2013 shoreline has accreted and is now within 10 feet of the shoreline. This is an indication that the nourishment is equilibrating and positively affecting areas outside of the template. This area will continue to be monitored for further recession in the coming survey period and for future nourishment projects.

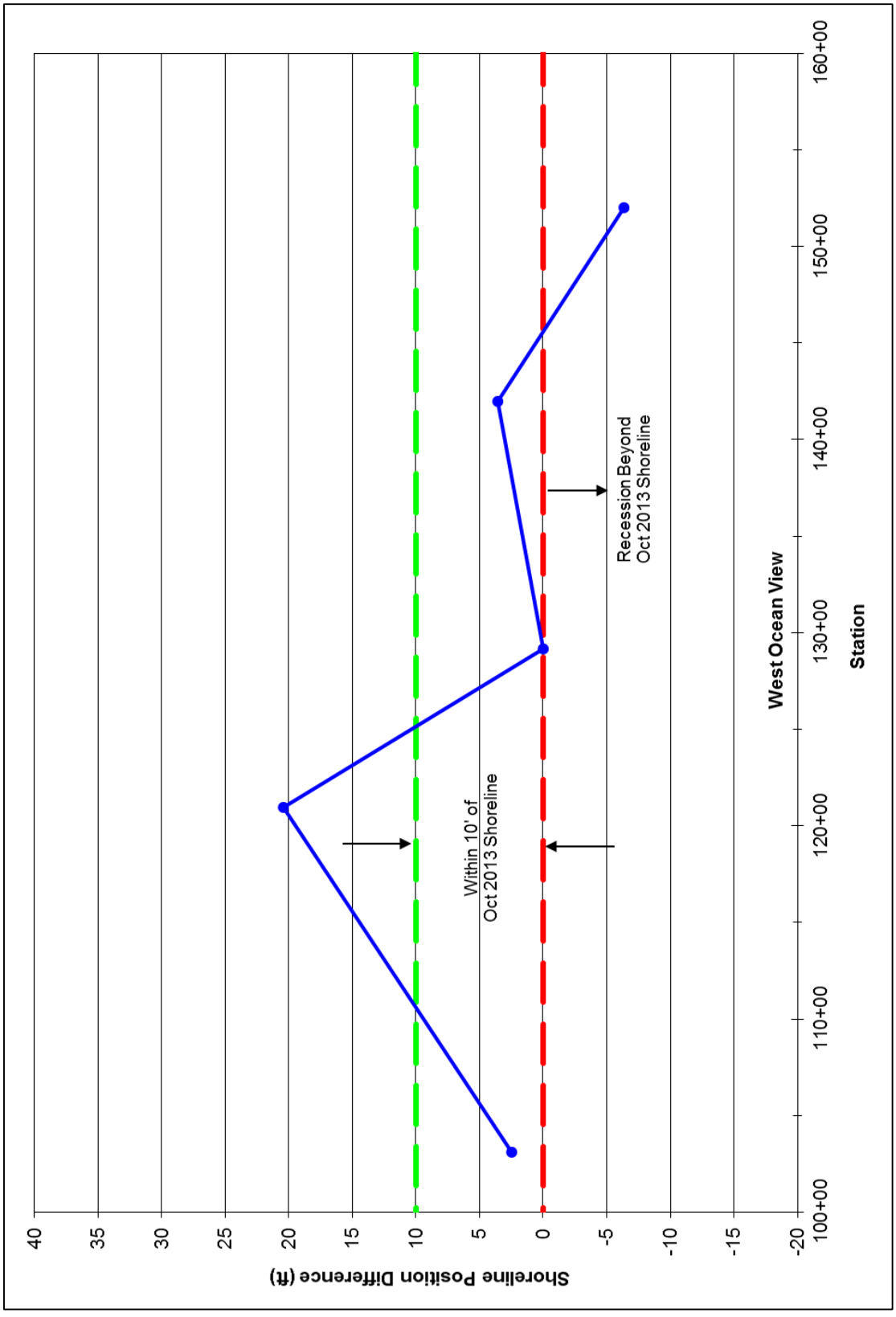


Figure 5-14: Shoreline Position Difference (ft) at MHW Between October 2013 and April 2015 Shorelines for West Ocean View

6. 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 April 2015. Subsequent surveys are planned to be conducted and evaluated every six months, in March/April and September/October. 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 April 2015 survey was compared with both the October 2014 and March 2014 surveys. The surveys were used to compute shoreline change at MHW and volume change above 0 feet NAVD88 and above -15 feet NAVD88.

In addition, the most recent survey in April 2015 was compared to pre- and post-fill surveys taken after the East Ocean View beach nourishment and Willoughby Spit to Central Ocean View dune restoration projects in March 2009 and January-March 2005 respectively. This was done to quantify the amount of material loss since the projects were completed and condition of the shoreline with respect to pre-fill conditions.

Key statistics were computed for defined regions along Ocean View and the entire shoreline for the time period between both the March 2014 and April 2015 surveys and the October 2014 and April 2015 surveys.

Comparison	Parameter	Quantity
March 2014 vs. April 2015	Average Shoreline Change Rate at MHW (+0.98 ft NAVD88)	5.34 ft/yr
	Cumulative Volume Change Rate Above 0 ft NAVD88	69,285 cy/yr
	Cumulative Volume Change Rate Above -15 ft NAVD88	49,538 cy/yr
October 2014 vs. April 2015	Average Shoreline Change at MHW (+0.98 ft NAVD88)	0.65 ft
	Cumulative Volume Change Above 0 ft NAVD88	17,049 cy
	Cumulative Volume Change Above -15 ft NAVD88	94,234 cy

The average shoreline change rate for the entire shoreline at MHW between the March 2014 and April 2015 surveys was 5.34 ft/yr, and the cumulative volume change above 0 feet NAVD88 and -15 feet NAVD88 was 69,285 cy/yr and 49,538 cy/yr. This indicates an overall volumetric gain in the dune and subaerial beach as well as a gain to the entire system over the past year. This gain is primarily due to the West Ocean View Shoreline Improvement Project which placed 73,600 cy within the West Ocean View region as well as a quiescent wave climate. The most recent period of comparison (October 2014 - April 2015) depicts an overall gain at the MHW line of 0.65 feet. The cumulative volume gain above 0 feet NAVD88 indicates a sediment gain to the subaerial beach of 17,049 cy. There was also a gain of sediment in the nearshore system above -15 feet NAVD88 of 94,234 cy.

Willoughby Spit

The Willoughby Spit region is still equilibrating from the Willoughby Spit Shoreline Improvement Project, which finished construction in December 2013. The nourishment placed at the eastern end of this reach has continued moving westward and is staying in the nearshore system due to the seven newly constructed breakwaters. Overall, this reach experienced accretion of the MHW shoreline, and

volumetric gains above both 0 feet NAVD88 and -15 feet NAVD88 over the past year and over the most recent survey period.

800 Block Breakwaters

The 800 Block region has remained fairly stable over the most recent monitoring cycle with a slight erosion of the MHW shoreline, and a slight volumetric gain above 0 feet NAVD88 and -15 feet NAVD88. During the yearly period, there was an erosion of the MHW shoreline and volumetric loss above 0 feet NAVD88 and -15 feet NAVD88. The tombolo located at the realigned breakwater has remained detached allowing sand to transport freely through this reach.

West Ocean View

The West Ocean View region was characterized by the shoreline improvement project was completed in April 2014. Station 129+17 was removed from analysis between March 2014 and April 2015 for this report because it could not be surveyed due to the presence of construction equipment. The October 2014 to April 2015 analysis includes Station 129+17 in the calculations and the effects of the shoreline improvement project can be seen. The yearly analysis shows overall accretion of the MHW shoreline and volumetric gains above both 0 feet NAVD88 and -15 feet NAVD88. The seasonal comparison shows erosion of the MHW shoreline as well as volumetric loss above both 0 feet NAVD88 and -15 feet NAVD88 which is due to the continued equilibration of the shoreline improvement project.

Central Ocean View Breakwaters

The Central Ocean View Breakwaters region continues to show gains in the MHW shoreline position and volumetric gains above 0 feet NAVD88 and -15 feet NAVD88 over the past year and current survey period.

Central Ocean View

Typically a very stable region, Central Ocean View has experienced accretion of the MHW shoreline and a volumetric gain above 0 feet NAVD88 and -15 feet NAVD88 over the past year. The most recent survey period showed slightly less accretion of the MHW shoreline and less volume gain above 0 feet NAVD88; however, more volume gain above -15 feet NAVD88.

East Ocean View

Due to the normal direction of sediment movement, there is an erosion of the MHW shoreline and minor volumetric losses above both 0 feet NAVD88 and -15 feet NAVD88 in the East Ocean View region over the entire year. During the most recent survey period, this region remained fairly stable. There was minimal volume gain above 0 feet NAVD88 and -15 feet NAVD88 with a slight erosion of the MHW shoreline. The Bay Oaks breakwaters are continuing to perform well, trapping sediment and eliminating the hotspot at this location. The east end of the region, adjacent to the jetty, is more erosive than most areas west in this region due to the lack of a sediment source.

In addition to regional assessments, comparison of the April 2015 survey was made against post-fill surveys from the East Ocean View beach nourishment and Willoughby Spit to Central Ocean View dune restoration which took place in March 2009 and January-March 2005 respectively.

Comparison	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
East Ocean View Nourishment vs. April 2015 Comparison	-106.34 ft	-18.84 cy/ft	-98,049 cy	-33.70 cy/ft	-174,691 cy
Central Ocean View Nourishment vs. April 2015 Comparison	-25.86 ft	-10.03 cy/ft	-184,326 cy	-5.82 cy/ft	-103,117 cy

The approximately 98,000 cy volumetric loss above 0 feet NAVD88 from the East Ocean View project is roughly 87% of the original amount placed in this dune and subaerial beach area while the approximately 184,300 cy loss above 0 feet NAVD88 in the Central Ocean View project area is roughly 57% of the original amount placed above 0 feet NAVD88. Due to storm impacts and background erosion that has occurred, as anticipated, over the projects' design life, there are areas in both of these shoreline regions that should be targeted for nourishment. The completed Willoughby Spit project and the West Ocean View project have alleviated the concerns with these hot spots and have provided additional protection in vulnerable areas; however, there are still other areas that may require nourishment to provide adequate storm protection. The East Ocean View project may also require a renourishment in the next 1 to 2 years.

As another measure of the protection being supplied by the East Ocean View and Central Ocean View nourishment projects, the projects' pre-fill and April 2015 MHW shoreline positions were compared. Areas where the current shoreline has receded beyond or eroded within 20 feet of the pre-fill shoreline may need to be targeted for immediate nourishment. Results of this analysis indicate that the East Ocean View nourishment project has provided ample shoreline protection for the majority of the shoreline with only slight end effects immediately west of the most recently constructed breakwaters; however, the November 2009 Nor'easter and Hurricane Irene have impacted the design life with all of the stations within the East Ocean View Breakwaters receding to within 20 feet of the pre-fill shoreline or beyond the pre-fill shoreline. Again, renourishment of this area will be required in the next 1 to 2 years. The Willoughby Spit to Central Ocean View shoreline has improved from the recent shoreline improvement projects that have been constructed; however, there continues to be various problem spots. The eastern section of the shoreline in the Willoughby Spit groin field and the majority of the shoreline behind the 800 Block breakwaters has eroded to within 20 feet of the pre-fill shoreline or receded beyond the pre-fill shoreline. This project had an anticipated design life of 5 to 6 years, with no storm activity, with hot spot areas anticipated to require nourishment after 2 to 3 years if storm activity impacted this region. The project is at the end of the anticipated design life and has been impacted by storm activity. As the Willoughby Spit and West Ocean View shorelines equilibrate, these areas of concern in this reach should continue to improve. Targeted nourishment projects should continue to be planned for problem areas in the future.

This is the twentieth periodic survey report completed to date, and nineteenth 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 yearly surveys (i.e. March 2014 to April 2015) eliminates seasonal variation of profiles in volumetric change analyses. Consecutive survey comparisons are useful to assess the direct impact of extreme events which may occur during the six month period between surveys. Future periodic survey evaluations will continue to improve on analysis techniques so that the rich survey data sets are best utilized.

Appendix A: Aerial Photography and Digitized Shorelines

CHESAPEAKE BAY

0+00
2+50
5+00
7+50
10+00
12+50
15+00
17+50
20+00
22+50
25+00
27+50
30+00
32+50
35+00
37+50
40+00
42+50
45+00

Legend

- Digitized Shoreline (April 12, 2015)
- Digitized Shoreline (October 17, 2014)
- Digitized Shoreline (April 6, 2014)
- Survey Transects
- Survey Baseline

Shoreline Aerial Photo Date: April 2015

Background Aerial Photo Date: 2009

0 250 500 1,000 Feet

N

CHESAPEAKE BAY

45+25
47+30
49+35
51+41
53+46
55+51
57+57
59+62
61+62
63+62
65+62
67+62
69+62
71+62
73+62
75+62
77+62
79+62
81+62
83+62
85+62
87+62

Legend

- Digitized Shoreline (April 12, 2015)
- Digitized Shoreline (October 17, 2014)
- Digitized Shoreline (April 6, 2014)
- Survey Transects
- Survey Baseline

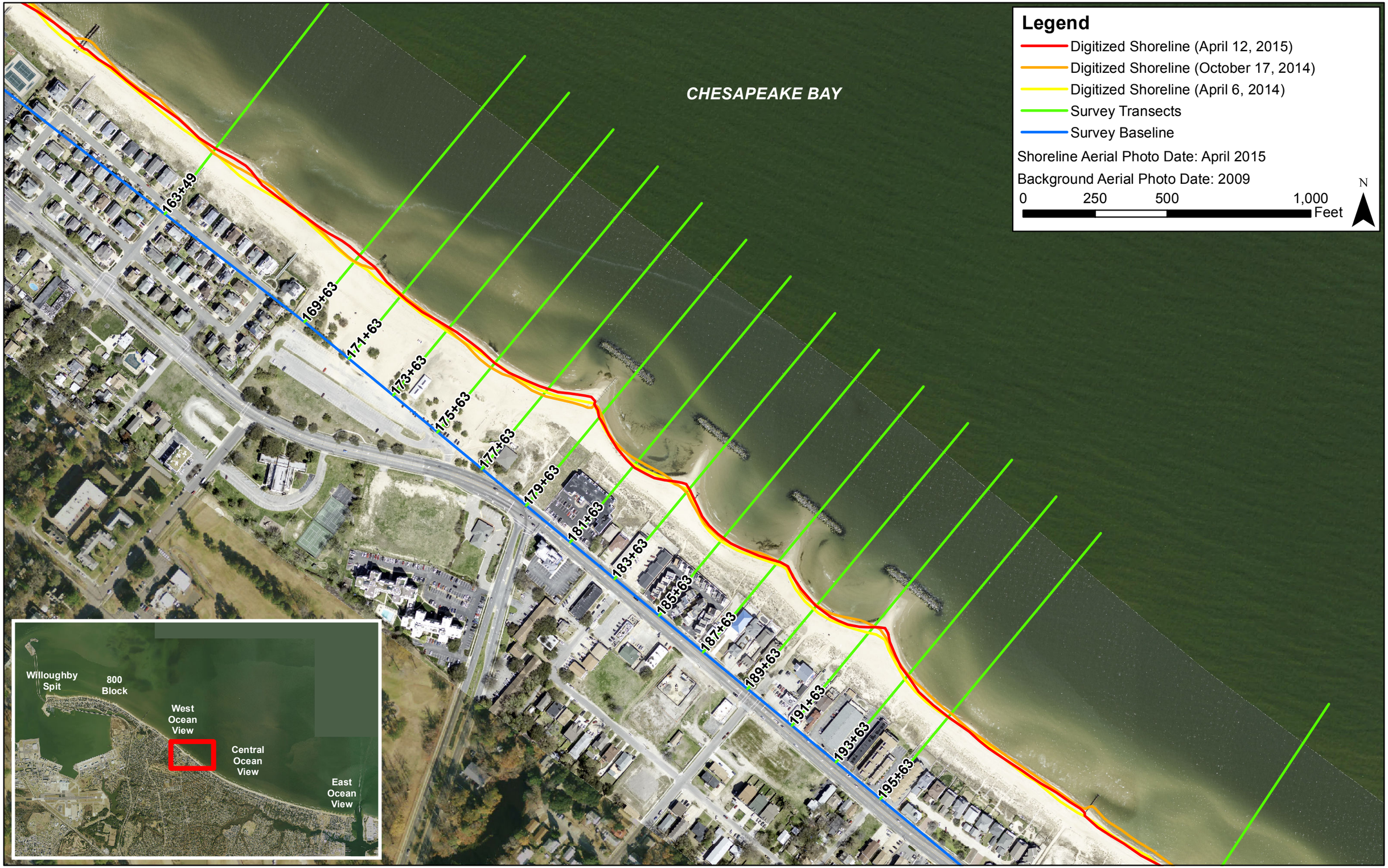
Shoreline Aerial Photo Date: April 2015

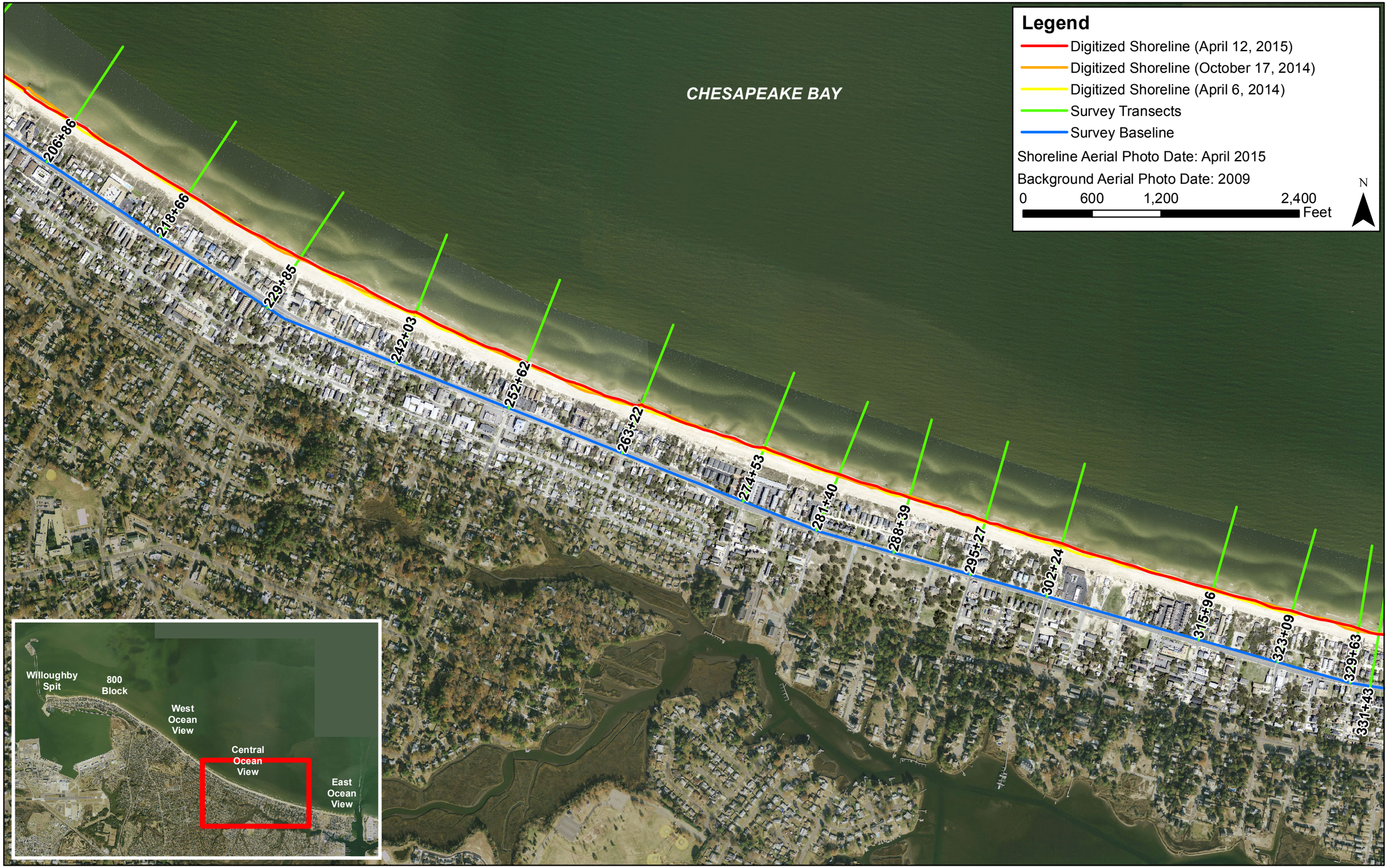
Background Aerial Photo Date: 2009

0 250 500 1,000 Feet

N


CHESAPEAKE BAY
93+41
103+08
120+93
129+17
141+98
152+01
163+49
Legend
Digitized Shoreline (April 12, 2015)
Digitized Shoreline (October 17, 2014)
Digitized Shoreline (April 6, 2014)
Survey Transects
Survey Baseline
Shoreline Aerial Photo Date: April 2015
Background Aerial Photo Date: 2009
0
375
750
1,500
Feet
N
Willoughby Spit
800 Block
West Ocean View
Central Ocean View
East Ocean View


CHESAPEAKE BAY
Legend
Digitized Shoreline (April 12, 2015)
Digitized Shoreline (October 17, 2014)
Digitized Shoreline (April 6, 2014)
Survey Transects
Survey Baseline
Shoreline Aerial Photo Date: April 2015
Background Aerial Photo Date: 2009
0
250
500
1,000
Feet
N
163+49
169+63
171+63
173+63
175+63
177+63
179+63
181+63
183+63
185+63
187+63
189+63
191+63
193+63
195+63
Willoughby Spit
800 Block
West Ocean View
Central Ocean View
East Ocean View


CHESAPEAKE BAY
206+86
218+66
229+85
242+03
252+62
263+22
274+53
281+40
288+39
295+27
302+24
315+96
323+09
329+63
331+43
Legend
Digitized Shoreline (April 12, 2015)
Digitized Shoreline (October 17, 2014)
Digitized Shoreline (April 6, 2014)
Survey Transects
Survey Baseline
Shoreline Aerial Photo Date: April 2015
Background Aerial Photo Date: 2009
0
600
1,200
2,400
Feet
N
Willoughby Spit
800 Block
West Ocean View
Central Ocean View
East Ocean View

CHESAPEAKE BAY

Legend

- Digitized Shoreline (April 12, 2015)
- Digitized Shoreline (October 17, 2014)
- Digitized Shoreline (April 6, 2014)
- Survey Transects
- Survey Baseline

Shoreline Aerial Photo Date: April 2015

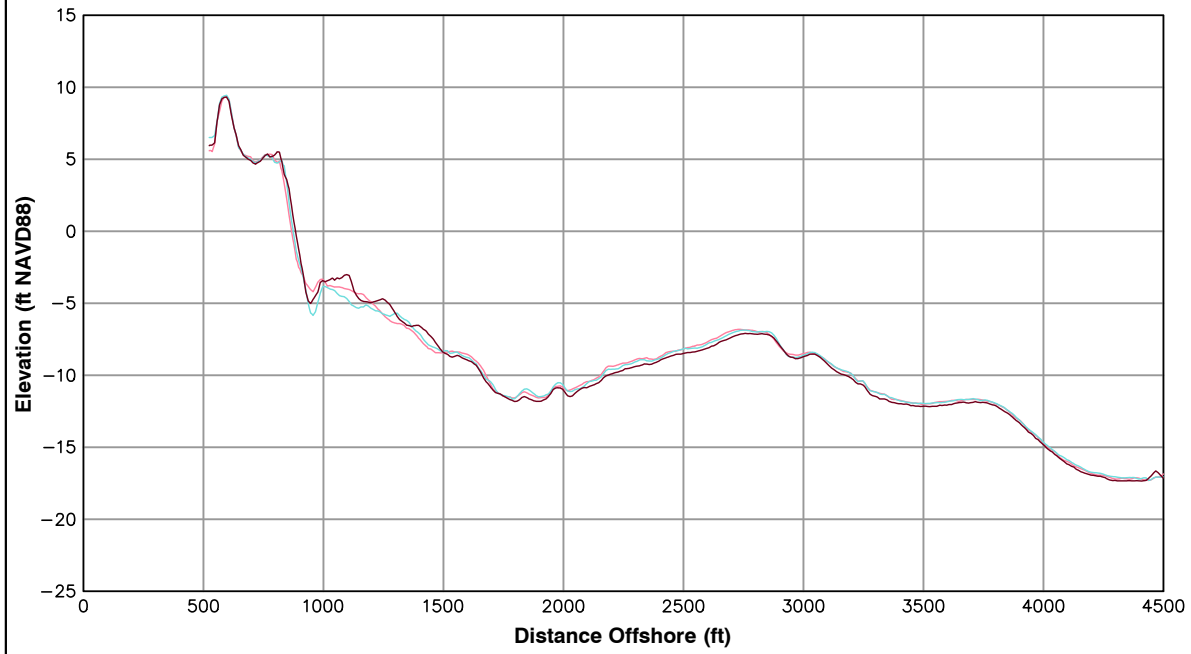
Background Aerial Photo Date: 2009

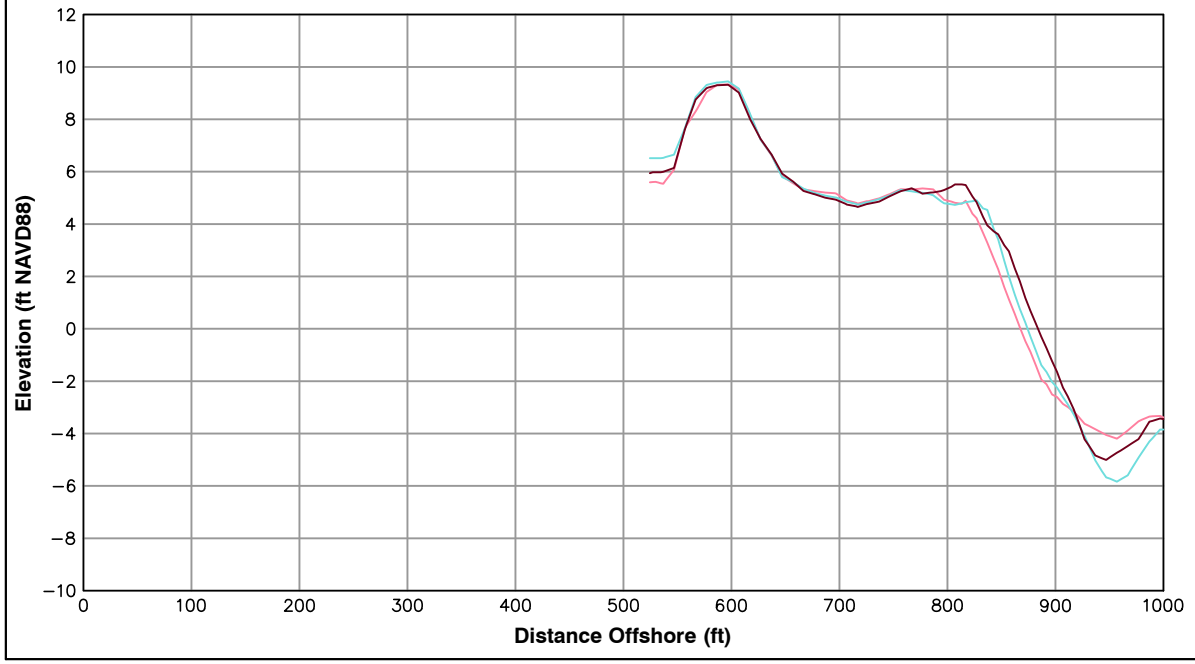
0 300 600 1,200 Feet

N

329+63 331+43 333+23 335+03 336+83 338+63 340+43 342+23 344+05 345+85 347+63 349+43 351+23 353+03 354+83 356+63 358+43 360+23 362+03 363+83 365+63 367+43 369+23 371+03 372+83 375+08 376+78 378+48 380+18 381+88 383+58

Appendix B: Survey Comparison Plots





Survey Transect 0+00	April 2015 - March 2014	April 2015 - October 2014
Shoreline Change at MHW (0.98 ft NAVD88)	14.41 ft/yr	8.93 ft
Volume Change Above -15 ft NAVD88	-11.00 cy/ft/yr	-7.14 cy/ft
Volume Change Above 0 ft NAVD88	2.78 cy/ft/yr	0.56 cy/ft

LEGEND:
- 2015 APR
- 2014 OCT
- 2014 MAR

Notes:
1. Stationing From West To East At Varying Intervals.
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3. All Survey Elevations In Feet Referenced to NAVD88.
4. Survey Comparison Made To March 2014 and October 2014.
5. 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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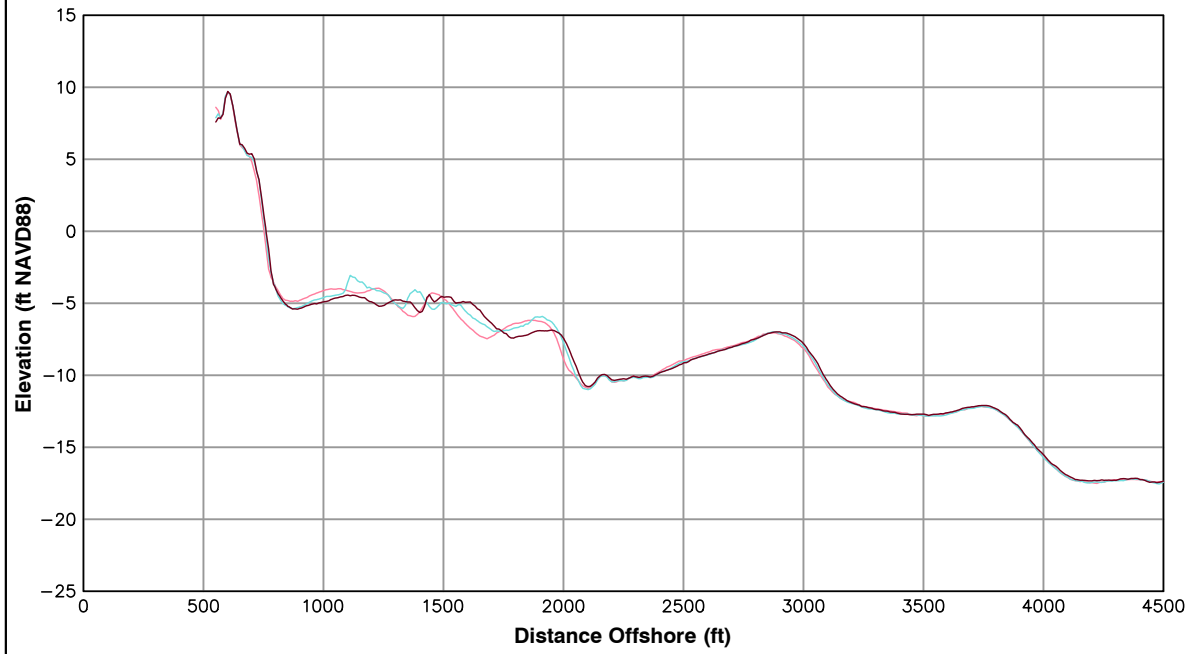
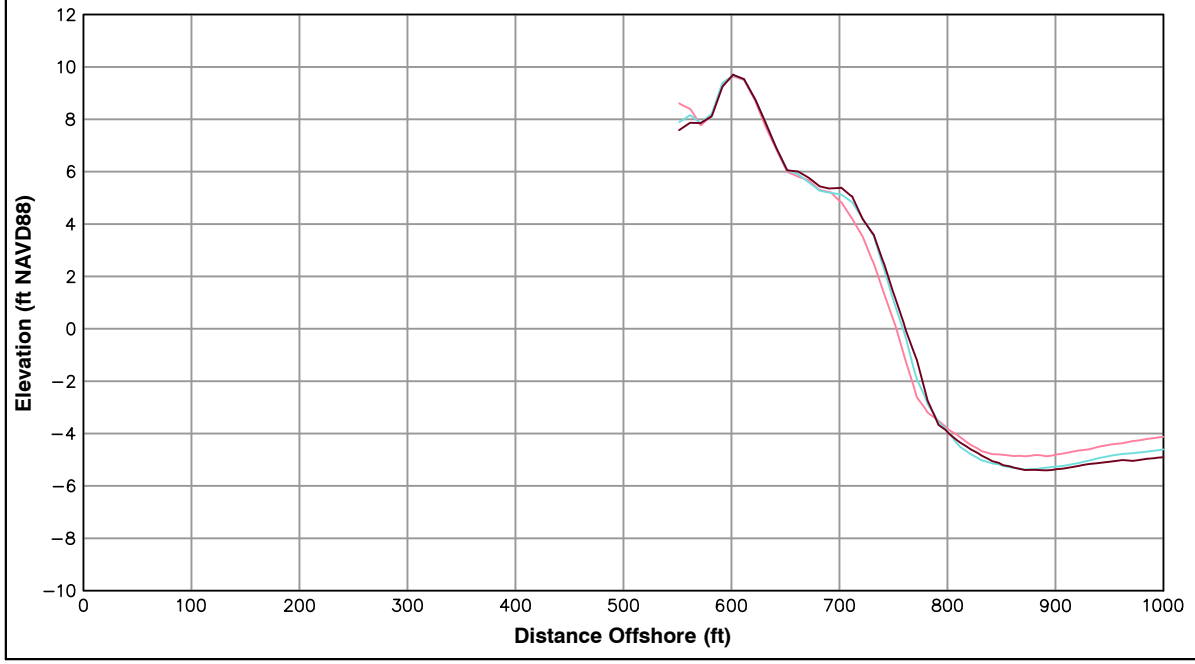
ST 0+00	Pg 1 of 106	Spring 2015





Survey Transect 2+50	April 2015 - March 2014	April 2015 - October 2014
Shoreline Change at MHW (0.98 ft NAVD88)	8.06 ft/yr	2.41 ft
Volume Change Above -15 ft NAVD88	4.55 cy/ft/yr	-2.15 cy/ft
Volume Change Above 0 ft NAVD88	1.80 cy/ft/yr	0.39 cy/ft

LEGEND:
- 2015 APR
- 2014 OCT
- 2014 MAR

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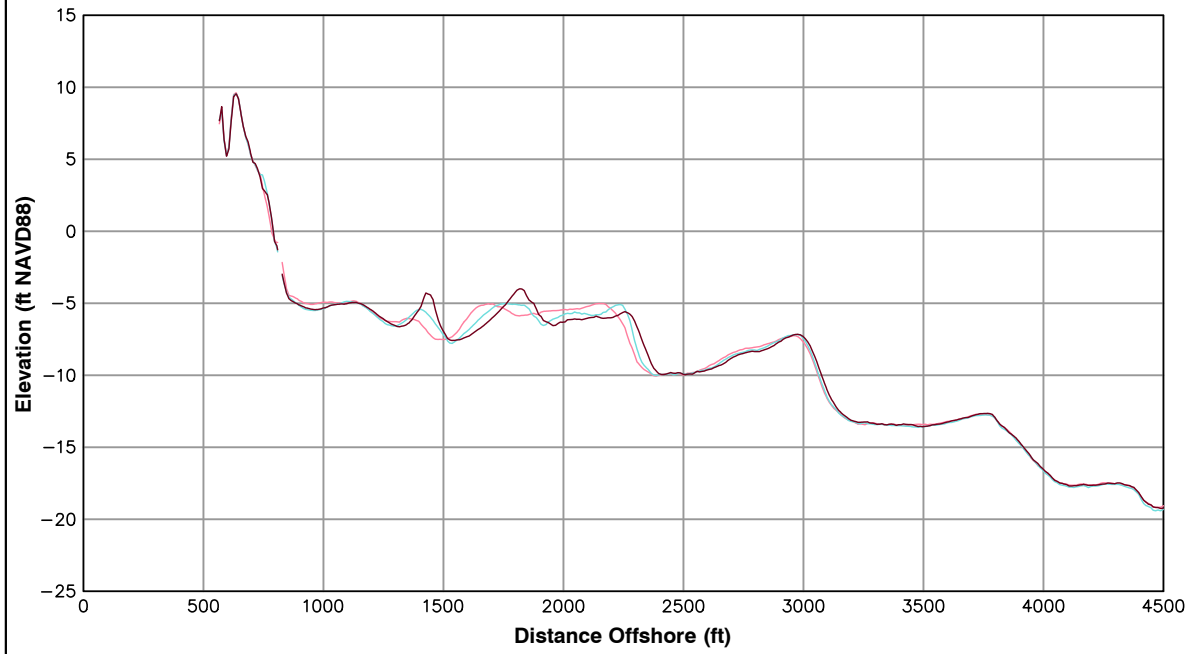

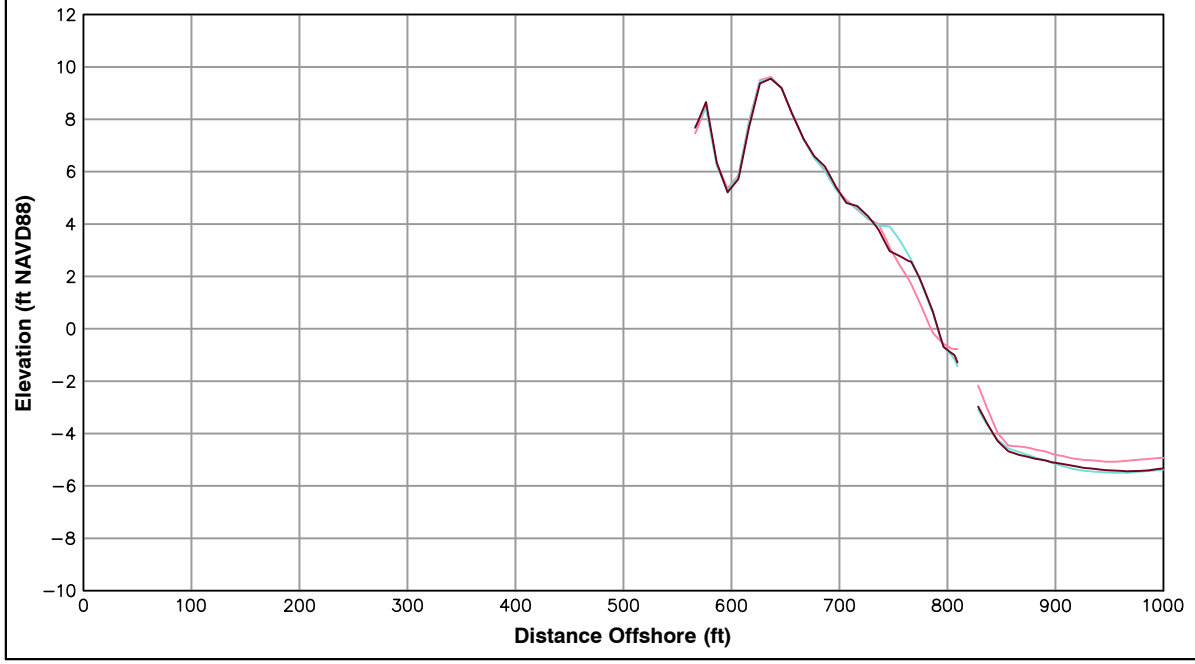

Survey Transect 5+00	April 2015 - March 2014	April 2015 - October 2014
Shoreline Change at MHW (0.98 ft NAVD88)	8.29 ft/yr	0.61 ft
Volume Change Above -15 ft NAVD88	1.28 cy/ft/yr	5.75 cy/ft
Volume Change Above 0 ft NAVD88	0.80 cy/ft/yr	-0.48 cy/ft

LEGEND:
- 2015 APR
- 2014 OCT
- 2014 MAR

Notes:
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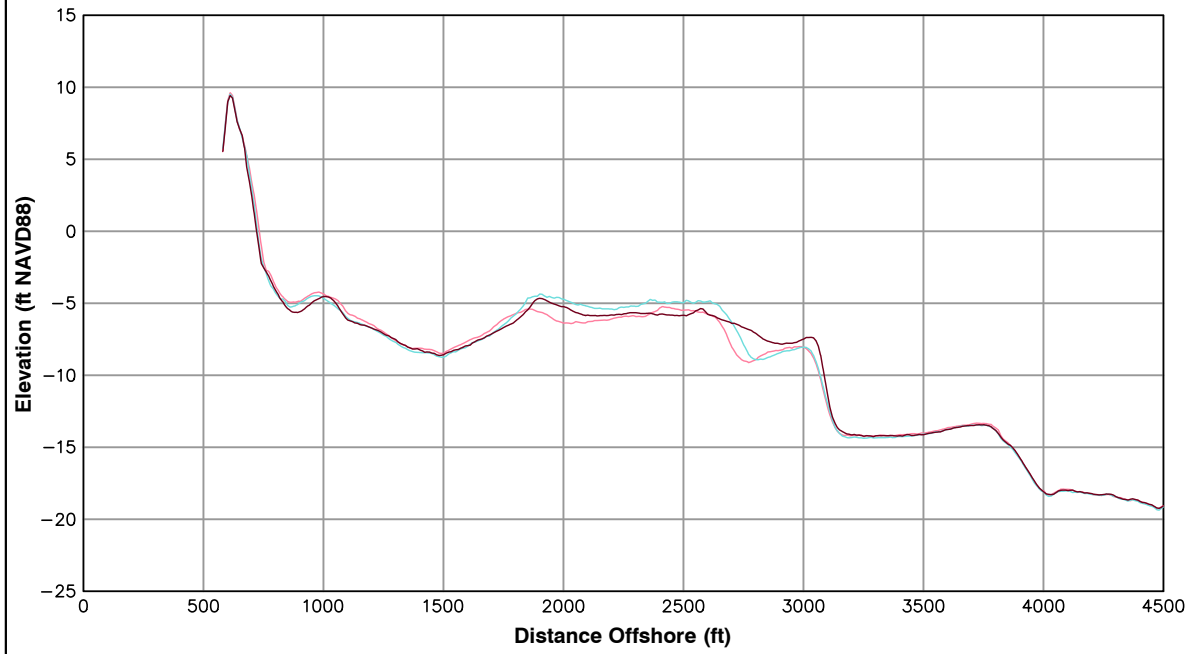

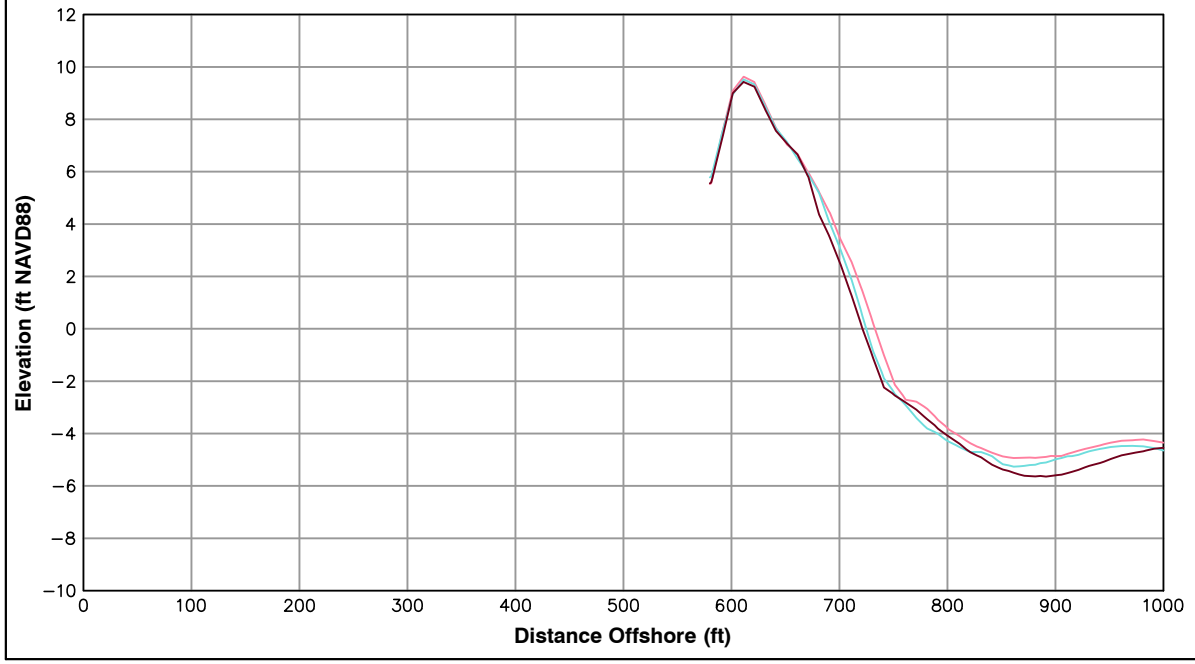

Survey Transect 7+50	April 2015 - March 2014	April 2015 - October 2014
Shoreline Change at MHW (0.98 ft NAVD88)	-10.58 ft/yr	-4.26 ft
Volume Change Above -15 ft NAVD88	9.58 cy/ft/yr	-5.66 cy/ft
Volume Change Above 0 ft NAVD88	-2.29 cy/ft/yr	-1.32 cy/ft

LEGEND:
- 2015 APR
- 2014 OCT
- 2014 MAR

Notes:
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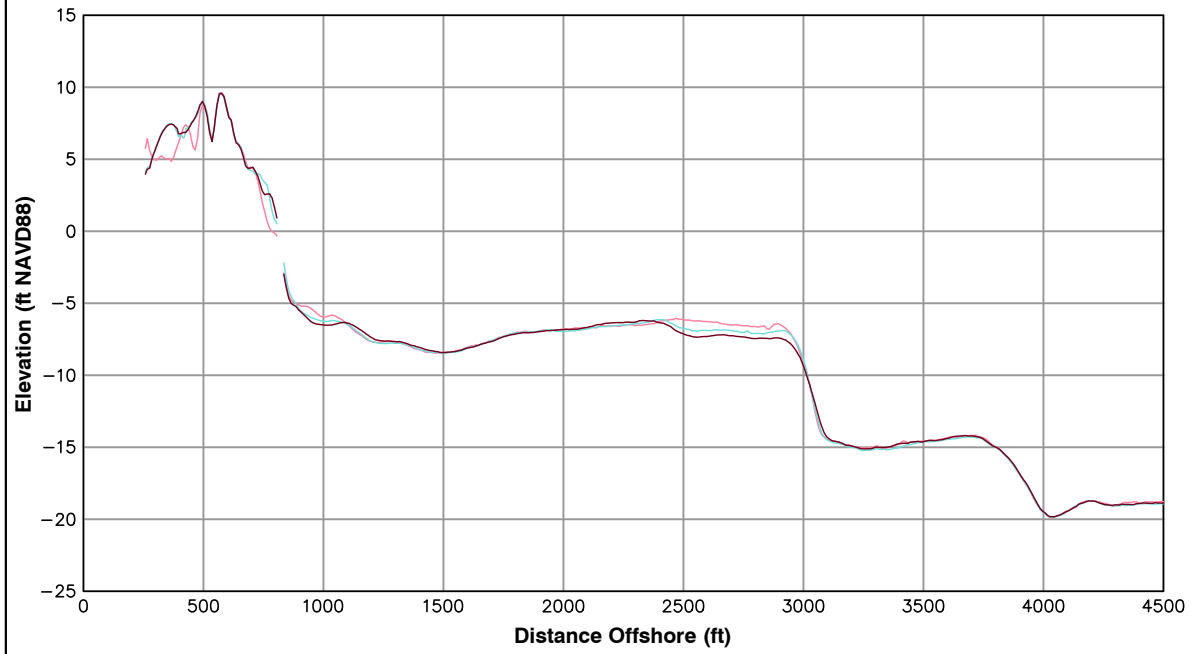
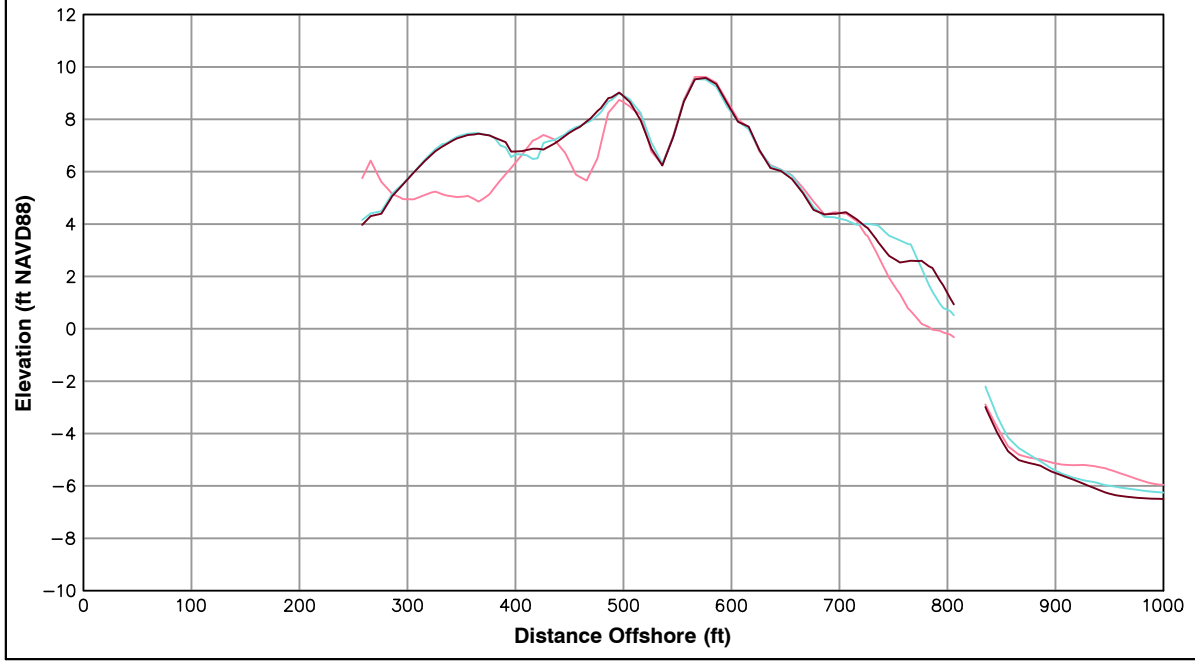
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 10+00	April 2015 - March 2014	April 2015 - October 2014
Shoreline Change at MHW (0.98 ft NAVD88)	40.89 ft/yr	12.57 ft
Volume Change Above -15 ft NAVD88	-6.04 cy/ft/yr	-5.26 cy/ft
Volume Change Above 0 ft NAVD88	10.58 cy/ft/yr	-0.29 cy/ft

LEGEND:
- 2015 APR
- 2014 OCT
- 2014 MAR

Notes:
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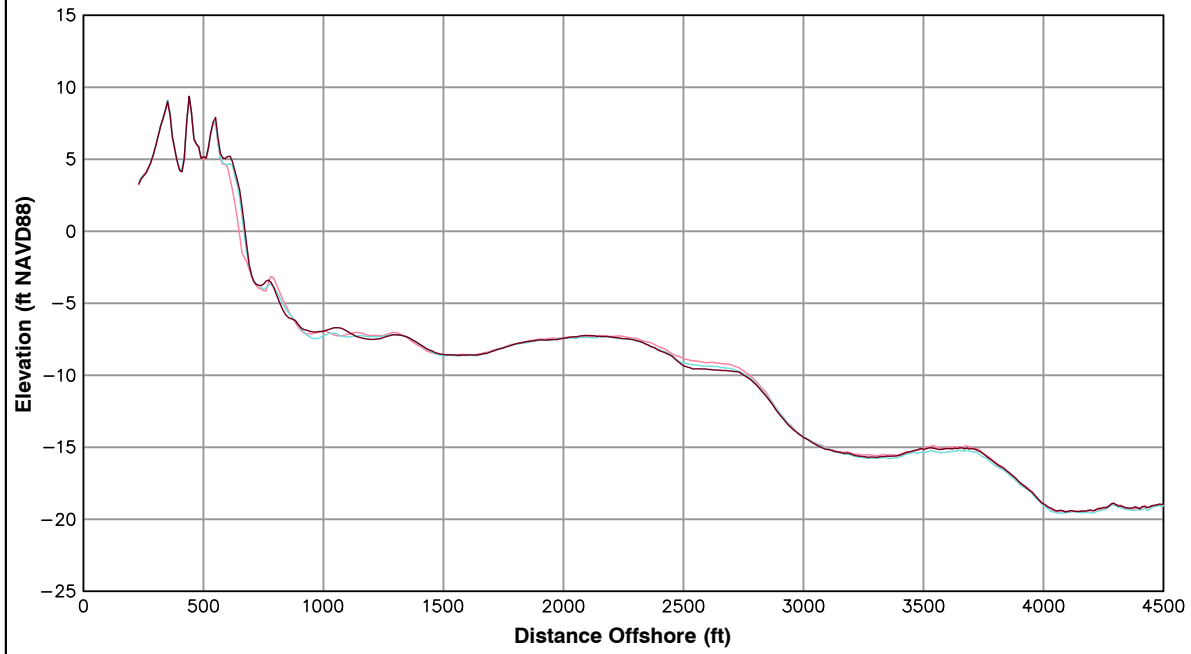
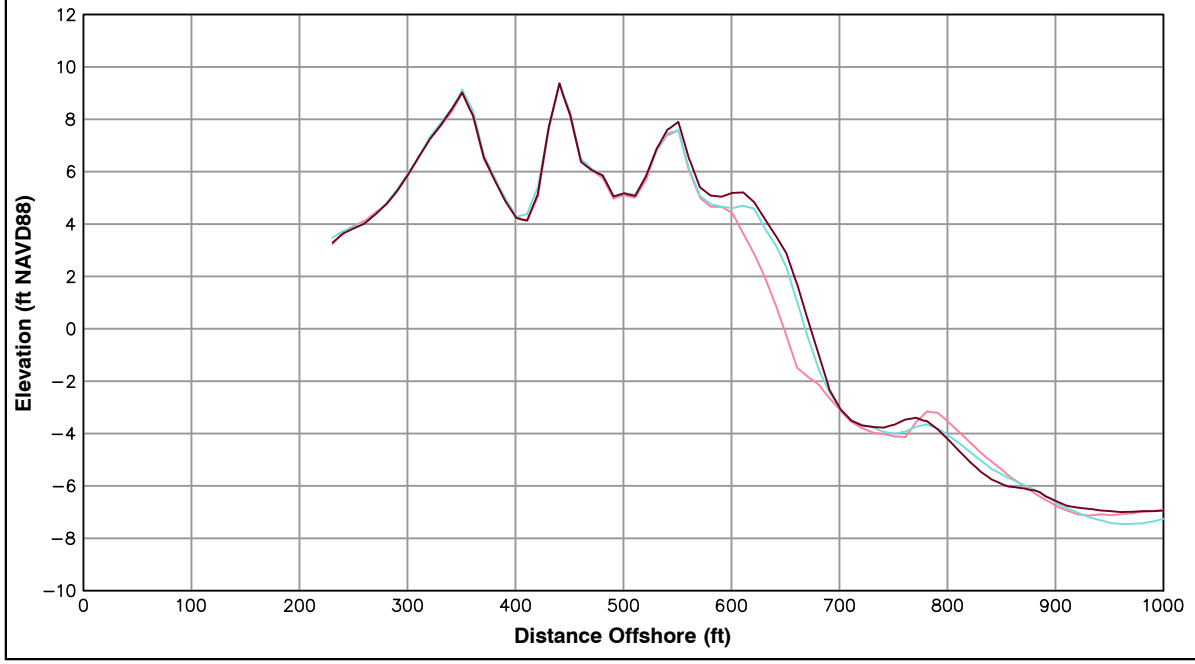
City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS

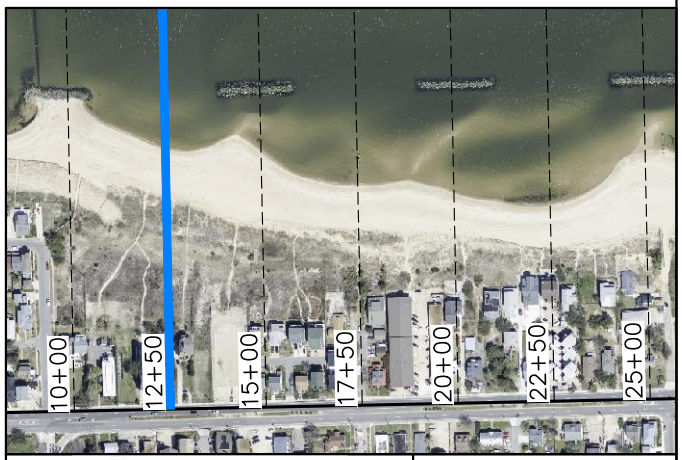




Survey Transect 12+50	April 2015 - March 2014	April 2015 - October 2014
Shoreline Change at MHW (0.98 ft NAVD88)	23.81 ft/yr	4.93 ft
Volume Change Above -15 ft NAVD88	-1.21 cy/ft/yr	1.67 cy/ft
Volume Change Above 0 ft NAVD88	5.74 cy/ft/yr	1.28 cy/ft

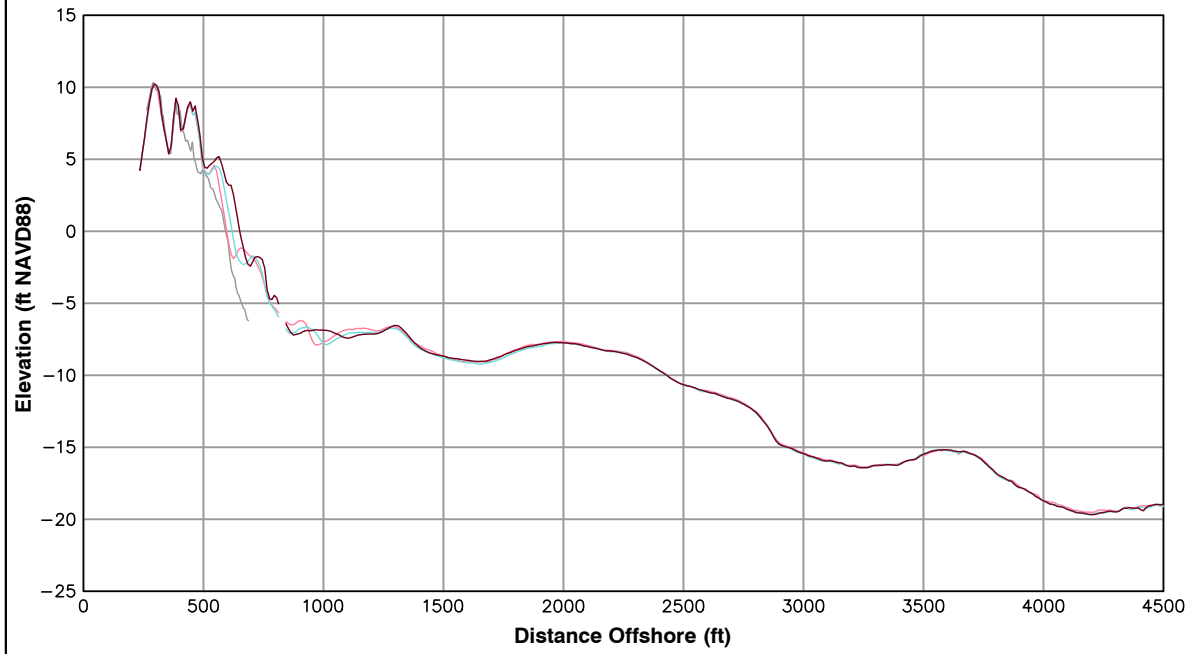
LEGEND:
- 2015 APR
- 2014 OCT
- 2014 MAR

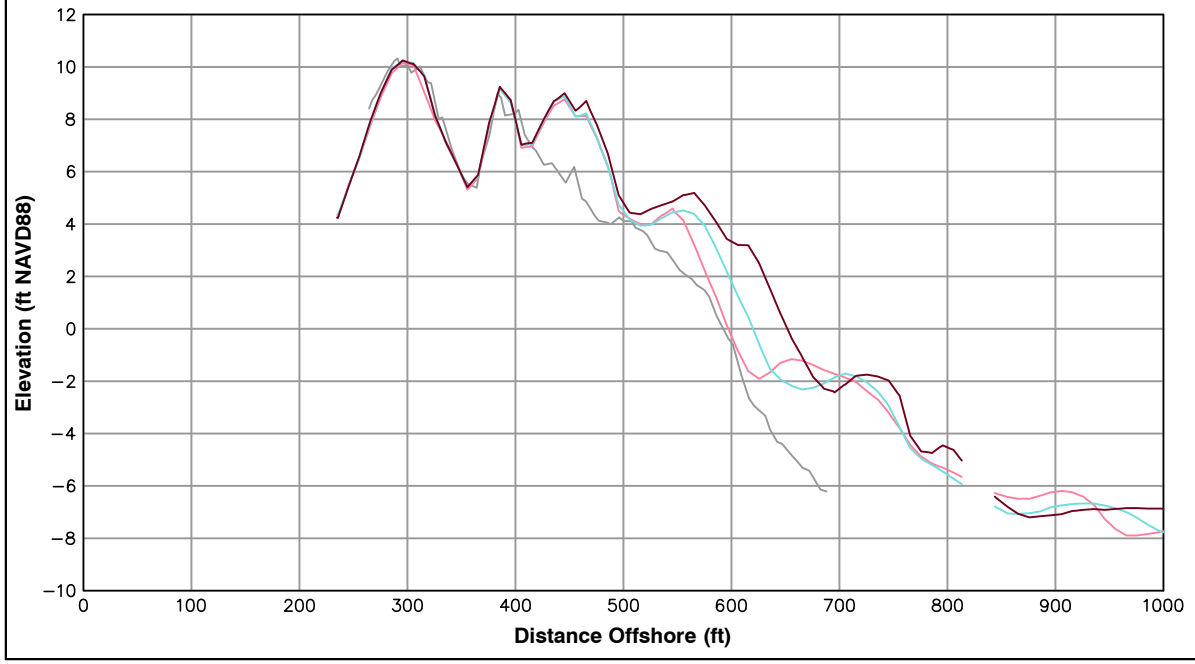
Notes:
1. Stationing From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. Survey Comparison Made To March 2014 and October 2014.
5. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward And Seaward Of The Breakwater.



City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 15+00	April 2015 - March 2014	April 2015 - October 2014
Shoreline Change at MHW (0.98 ft NAVD88)	49.14 ft/yr	32.12 ft
Volume Change Above -15 ft NAVD88	10.96 cy/ft/yr	16.16 cy/ft
Volume Change Above 0 ft NAVD88	9.96 cy/ft/yr	6.84 cy/ft

LEGEND:
- 2015 APR
- 2014 OCT
- 2014 MAR
- POST-FILL

Notes:
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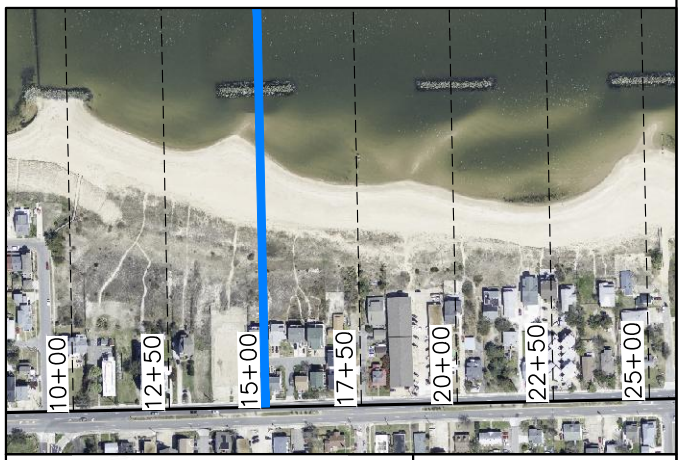

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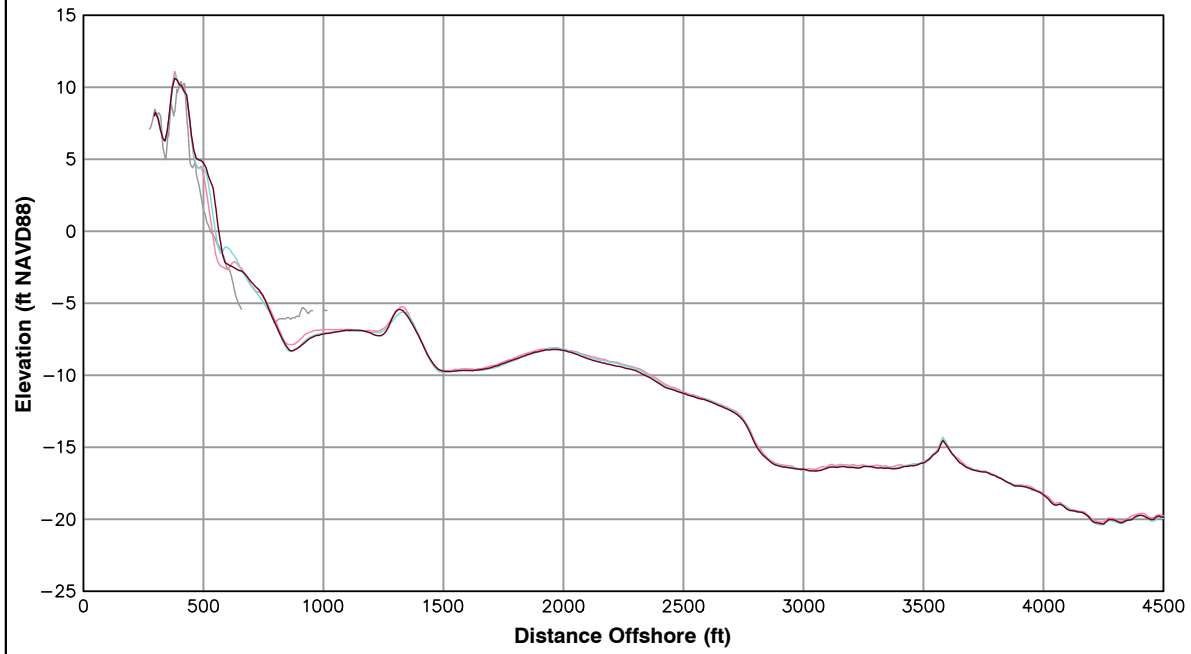
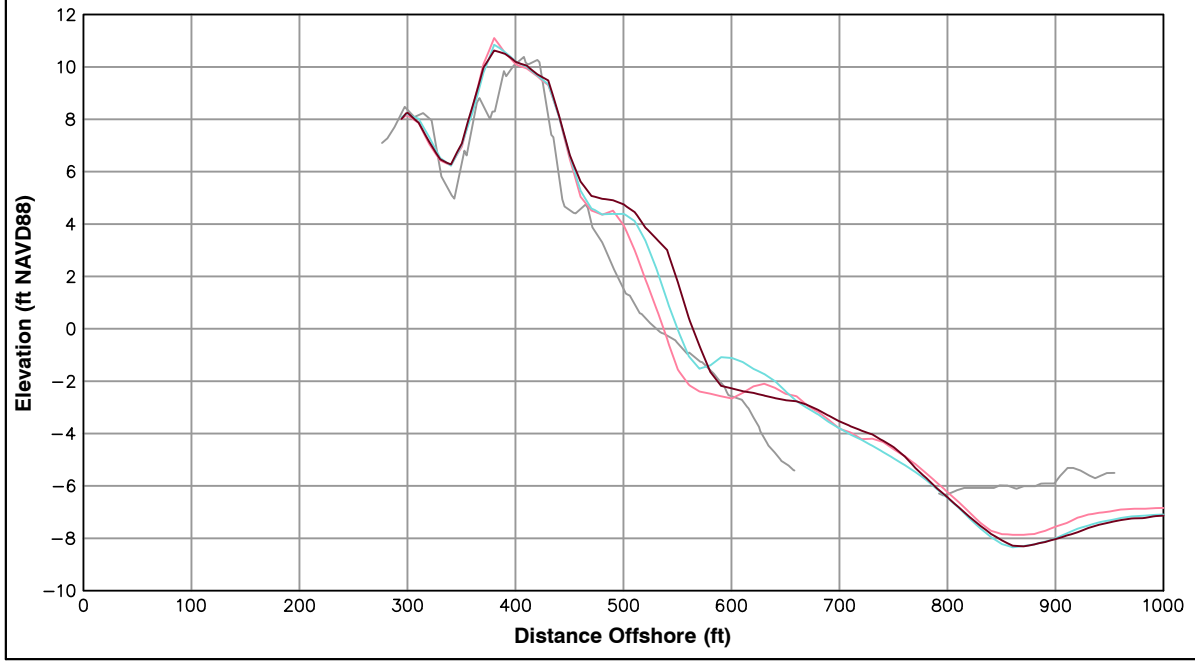
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 17+50	April 2015 - March 2014	April 2015 - October 2014
Shoreline Change at MHW (0.98 ft NAVD88)	25.44 ft/yr	15.08 ft
Volume Change Above -15 ft NAVD88	-3.59 cy/ft/yr	-0.10 cy/ft
Volume Change Above 0 ft NAVD88	5.00 cy/ft/yr	3.15 cy/ft

LEGEND:
- 2015 APR
- 2014 OCT
- 2014 MAR
- POST-FILL

Notes:
1. Stationing From West To East At Varying Intervals.
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3. All Survey Elevations In Feet Referenced to NAVD88.
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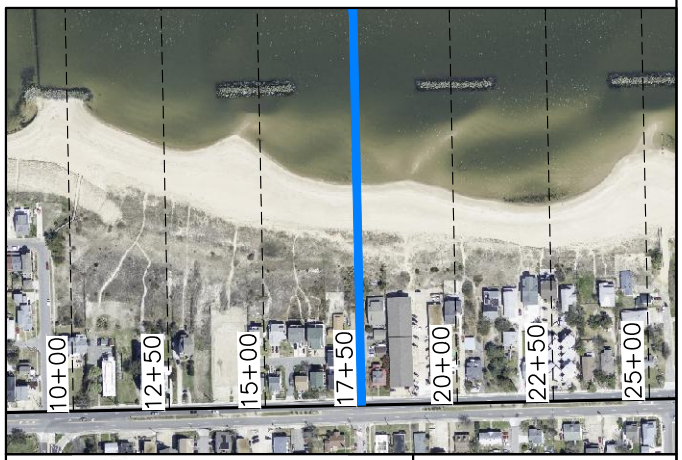
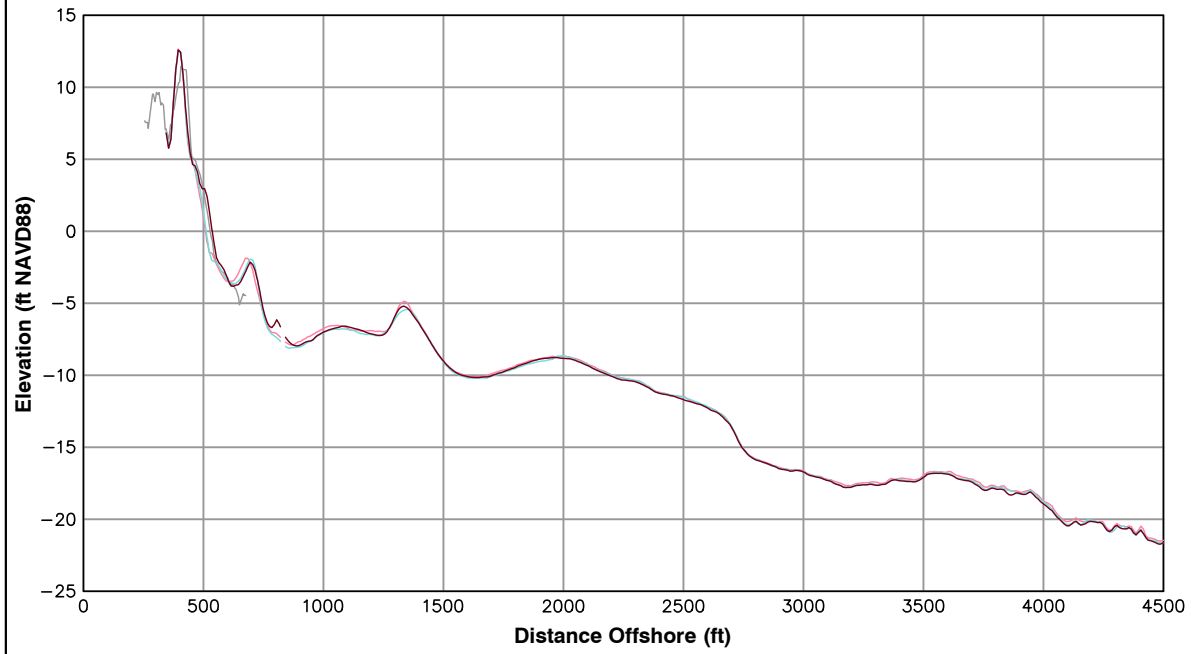
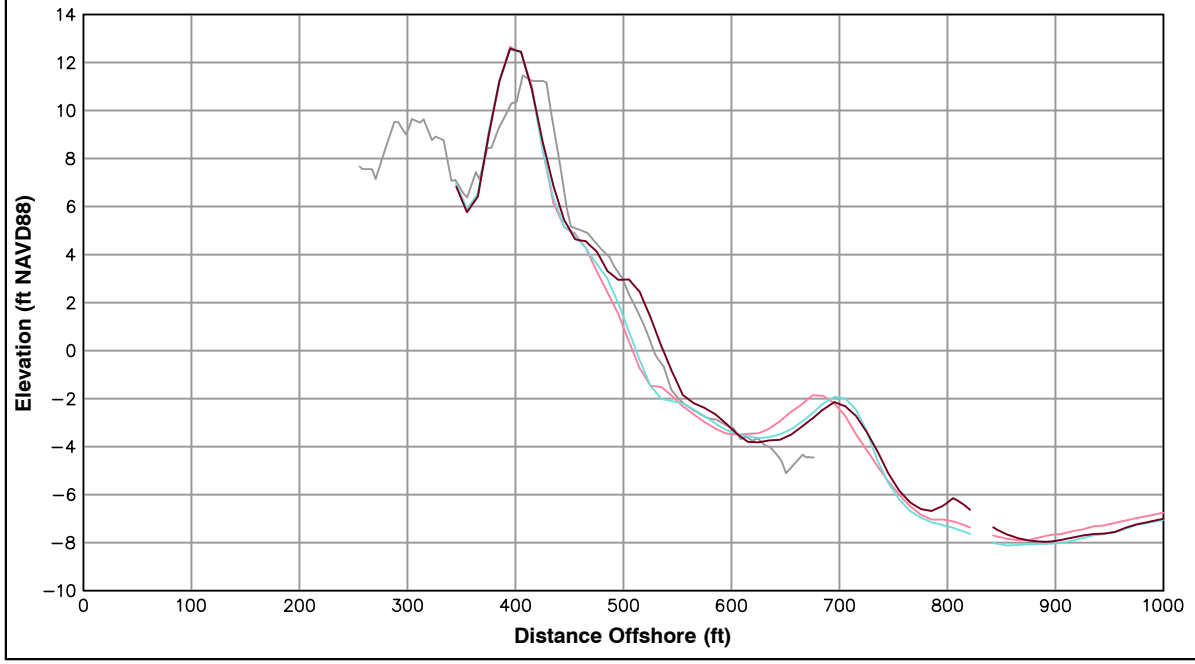
5. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward And Seaward Of The Breakwater.



City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 20+00	April 2015 - March 2014	April 2015 - October 2014
Shoreline Change at MHW (0.98 ft NAVD88)	26.27 ft/yr	25.01 ft
Volume Change Above -15 ft NAVD88	0.16 cy/ft/yr	8.02 cy/ft
Volume Change Above 0 ft NAVD88	3.71 cy/ft/yr	3.28 cy/ft

LEGEND:
- 2015 APR
- 2014 OCT
- 2014 MAR
- POST-FILL

Notes:
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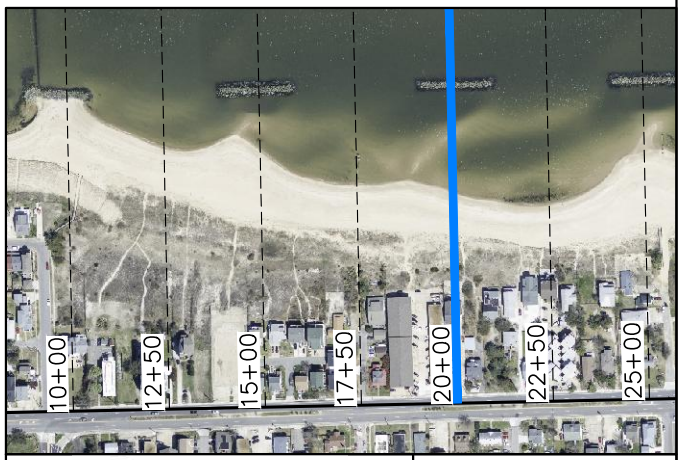
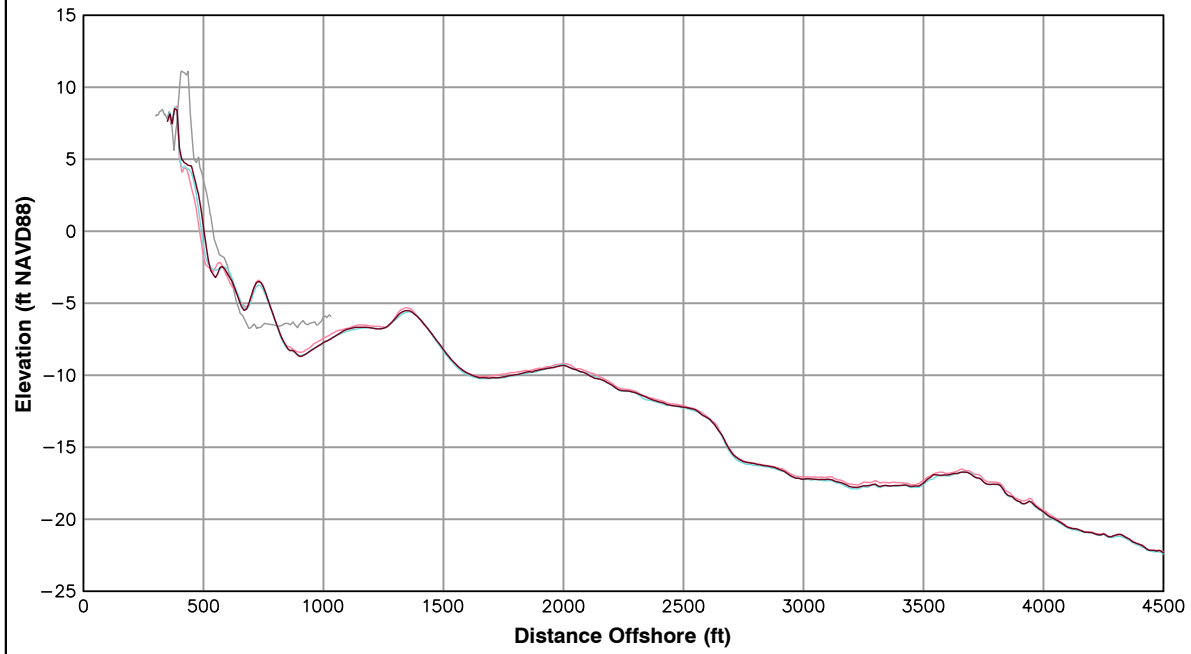
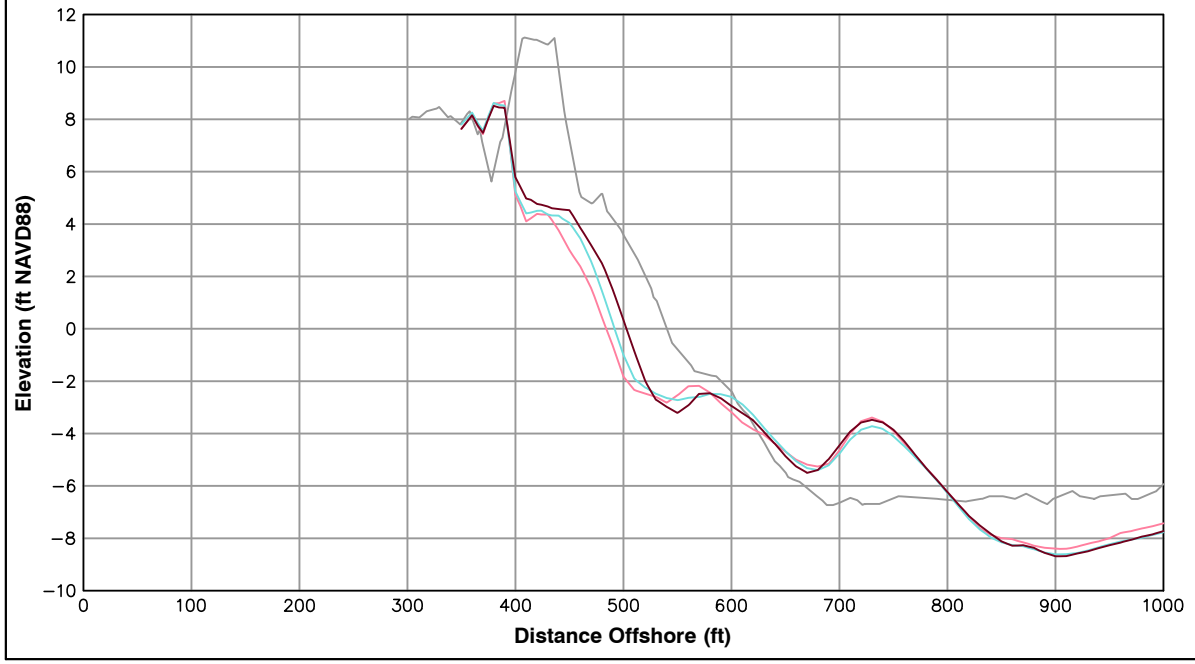


City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS

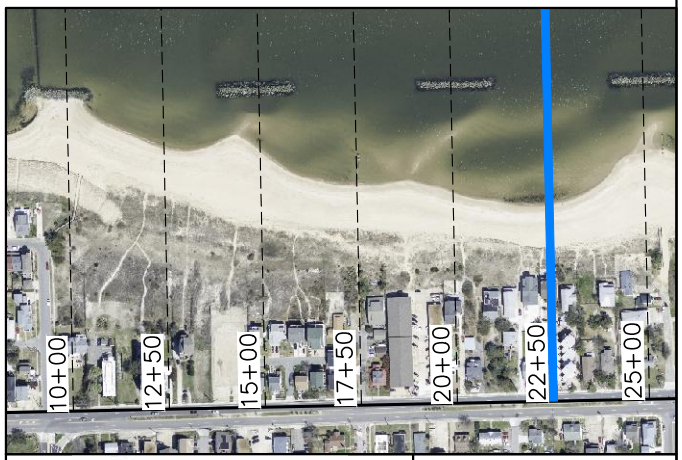




Survey Transect 22+50	April 2015 - March 2014	April 2015 - October 2014
Shoreline Change at MHW (0.98 ft NAVD88)	17.66 ft/yr	10.57 ft
Volume Change Above -15 ft NAVD88	-2.43 cy/ft/yr	5.52 cy/ft
Volume Change Above 0 ft NAVD88	3.85 cy/ft/yr	2.07 cy/ft

LEGEND:
- 2015 APR
- 2014 OCT
- 2014 MAR
- POST-FILL

Notes:
1. Stationing From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. Survey Comparison Made To March 2014 and October 2014.
5. 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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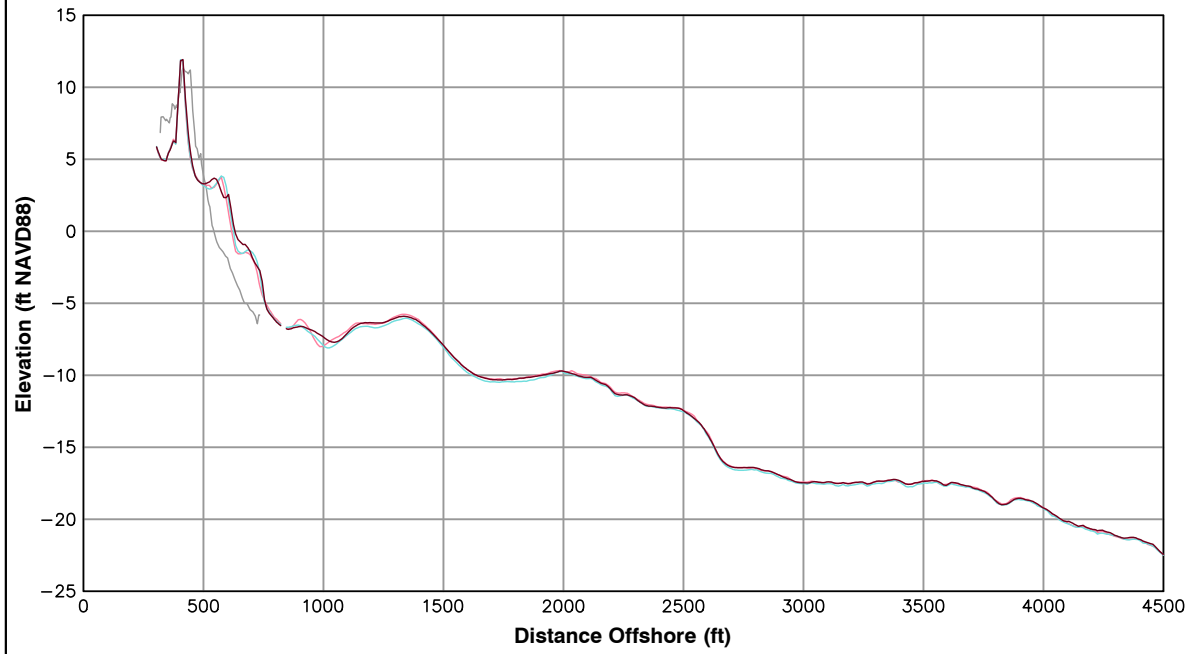
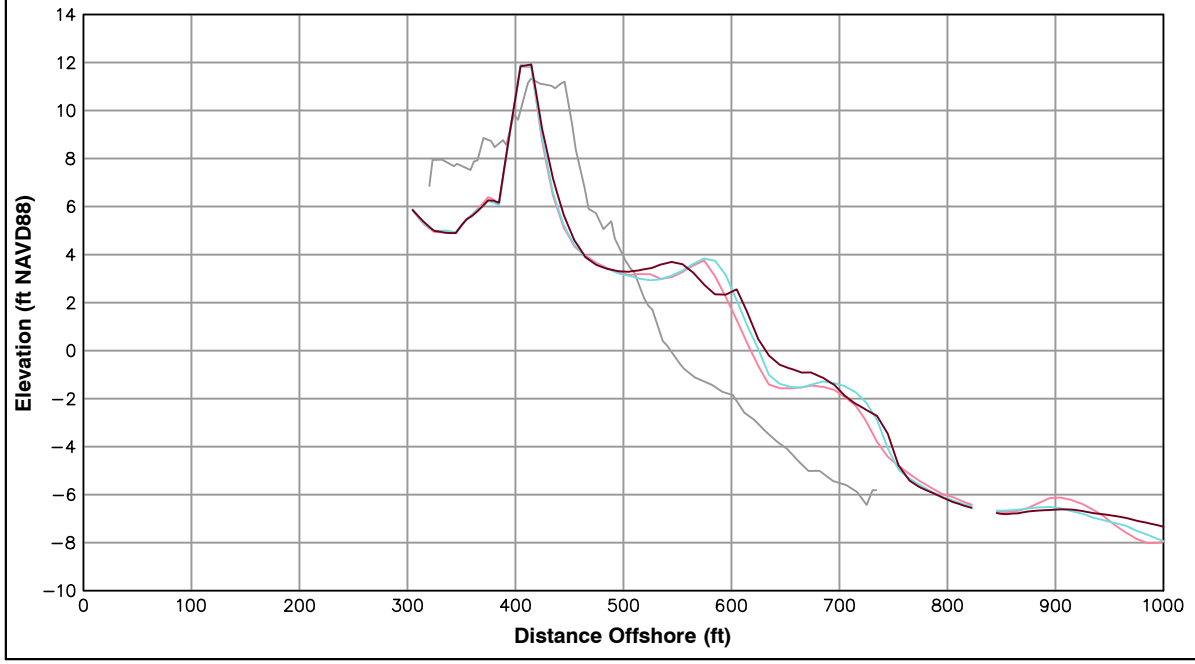
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 25+00	April 2015 - March 2014	April 2015 - October 2014
Shoreline Change at MHW (0.98 ft NAVD88)	11.43 ft/yr	5.07 ft
Volume Change Above -15 ft NAVD88	1.14 cy/ft/yr	10.92 cy/ft
Volume Change Above 0 ft NAVD88	1.76 cy/ft/yr	0.69 cy/ft

LEGEND:
- 2015 APR
- 2014 OCT
- 2014 MAR
- POST-FILL

Notes:
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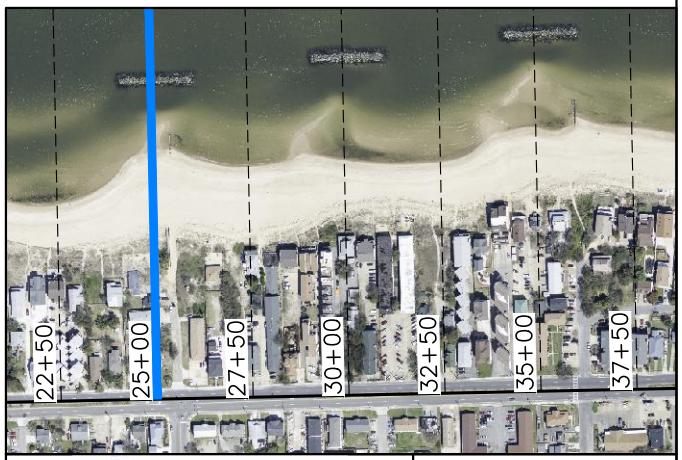

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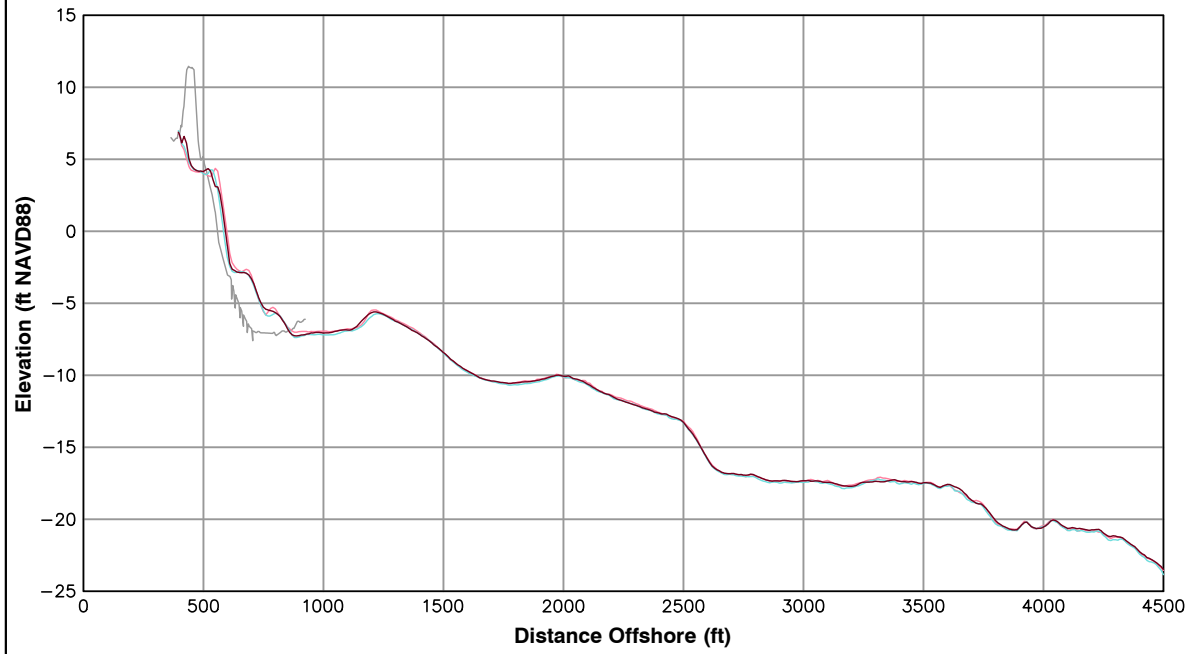
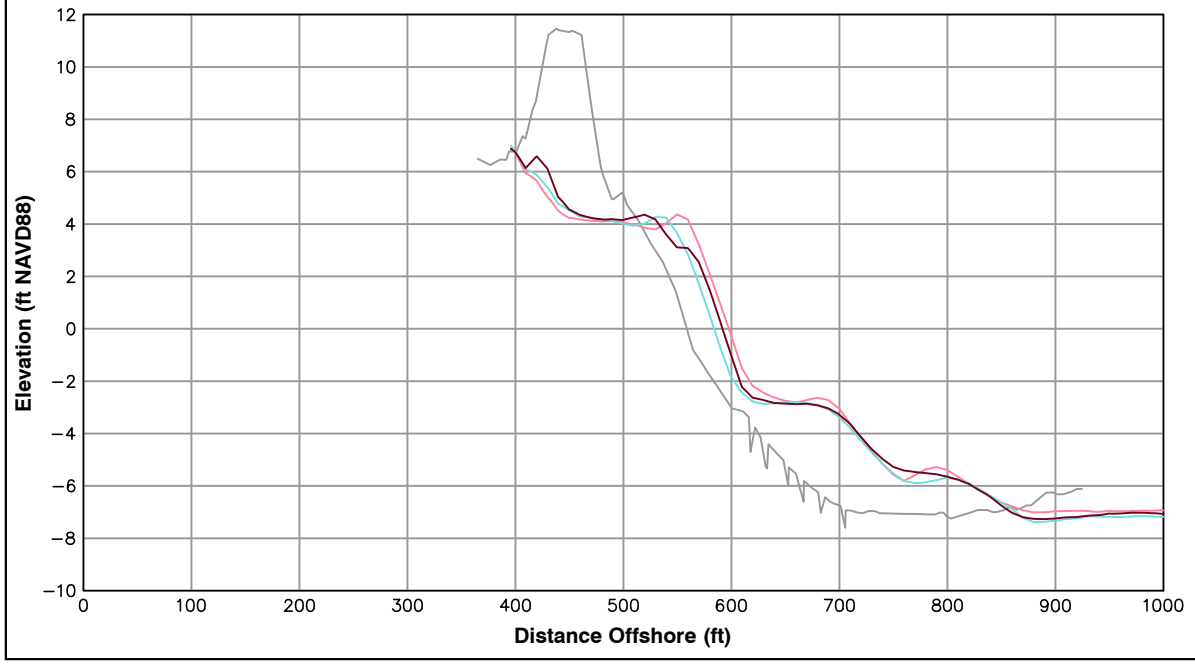
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 27+50	April 2015 - March 2014	April 2015 - October 2014
Shoreline Change at MHW (0.98 ft NAVD88)	-5.02 ft/yr	7.94 ft
Volume Change Above -15 ft NAVD88	-3.96 cy/ft/yr	7.72 cy/ft
Volume Change Above 0 ft NAVD88	0.00 cy/ft/yr	1.36 cy/ft

LEGEND:
- 2015 APR
- 2014 OCT
- 2014 MAR
- POST-FILL

Notes:
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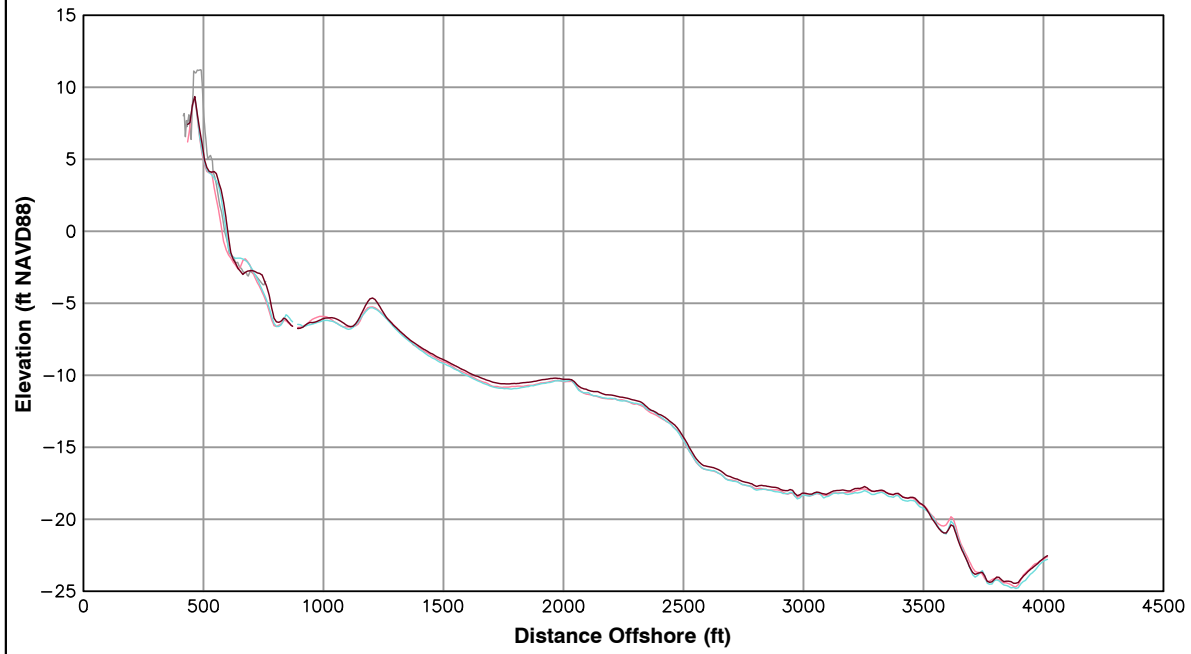
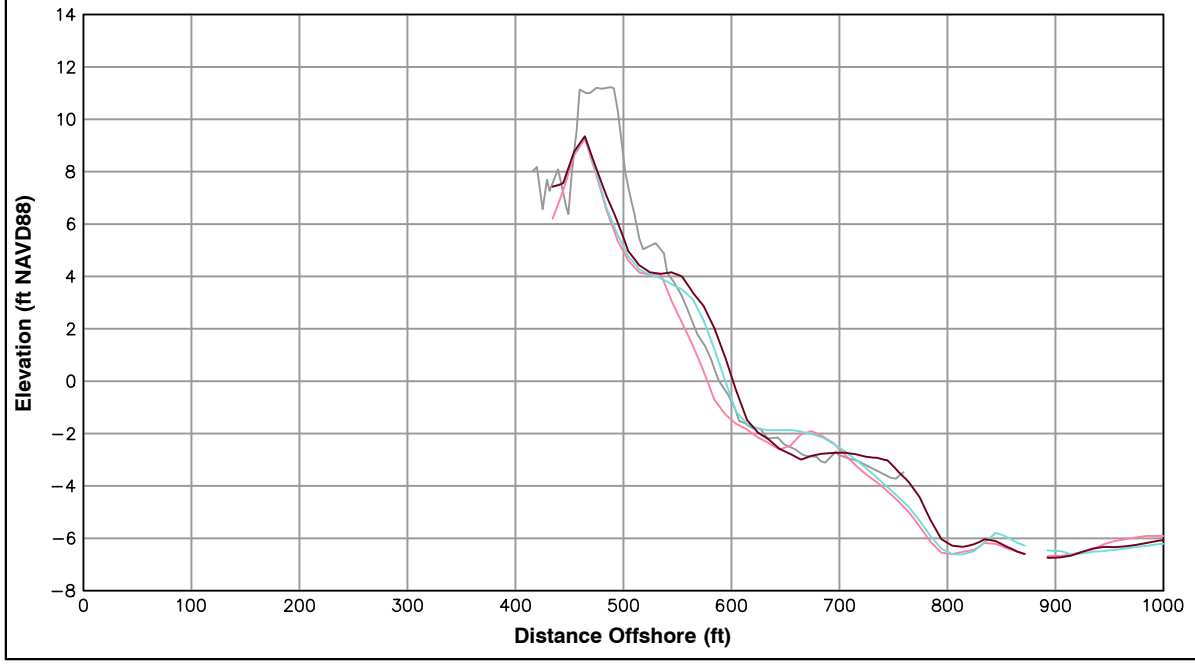
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 30+00	April 2015 - March 2014	April 2015 - October 2014
Shoreline Change at MHW (0.98 ft NAVD88)	23.45 ft/yr	7.34 ft
Volume Change Above -15 ft NAVD88	17.79 cy/ft/yr	16.39 cy/ft
Volume Change Above 0 ft NAVD88	4.64 cy/ft/yr	1.88 cy/ft

LEGEND:
- 2015 APR
- 2014 OCT
- 2014 MAR
- POST-FILL

Notes:
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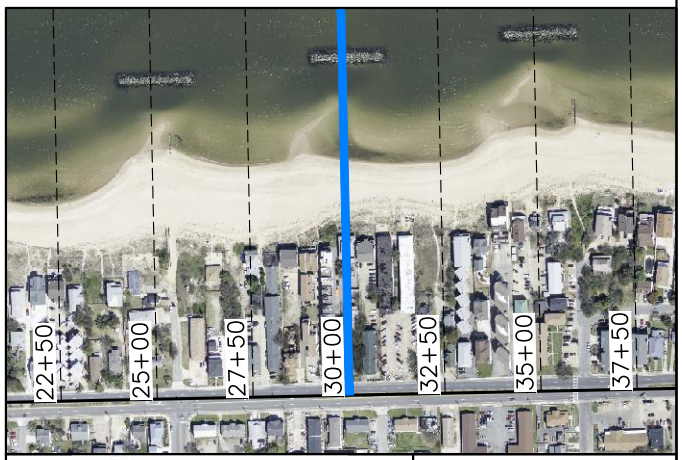

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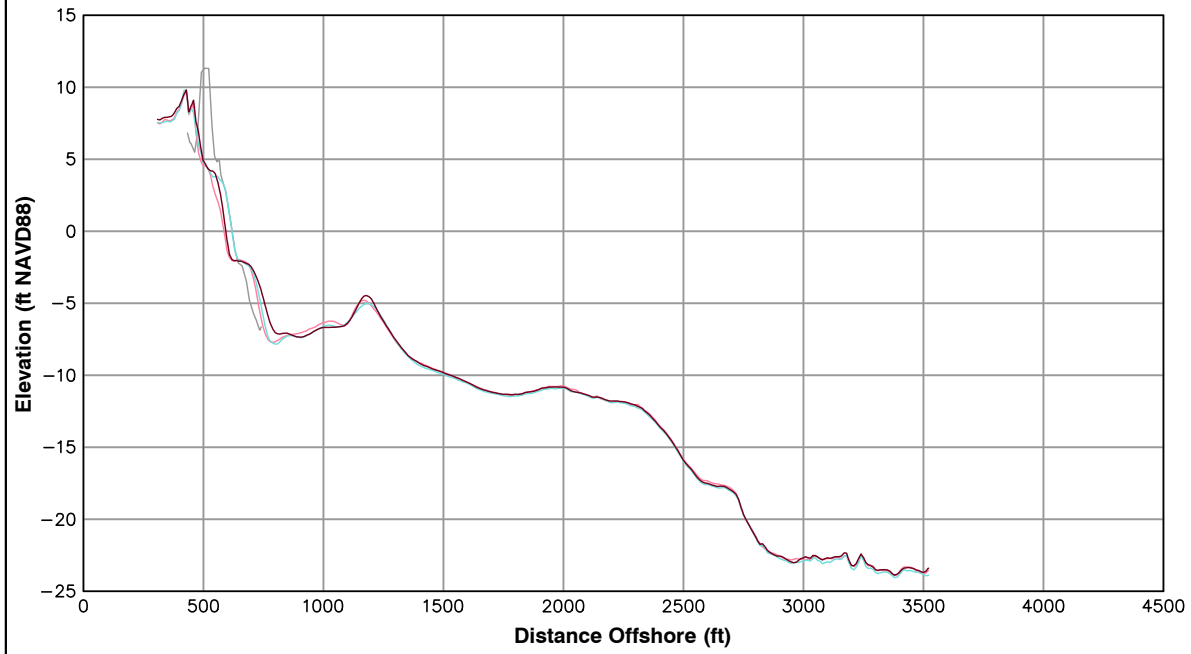
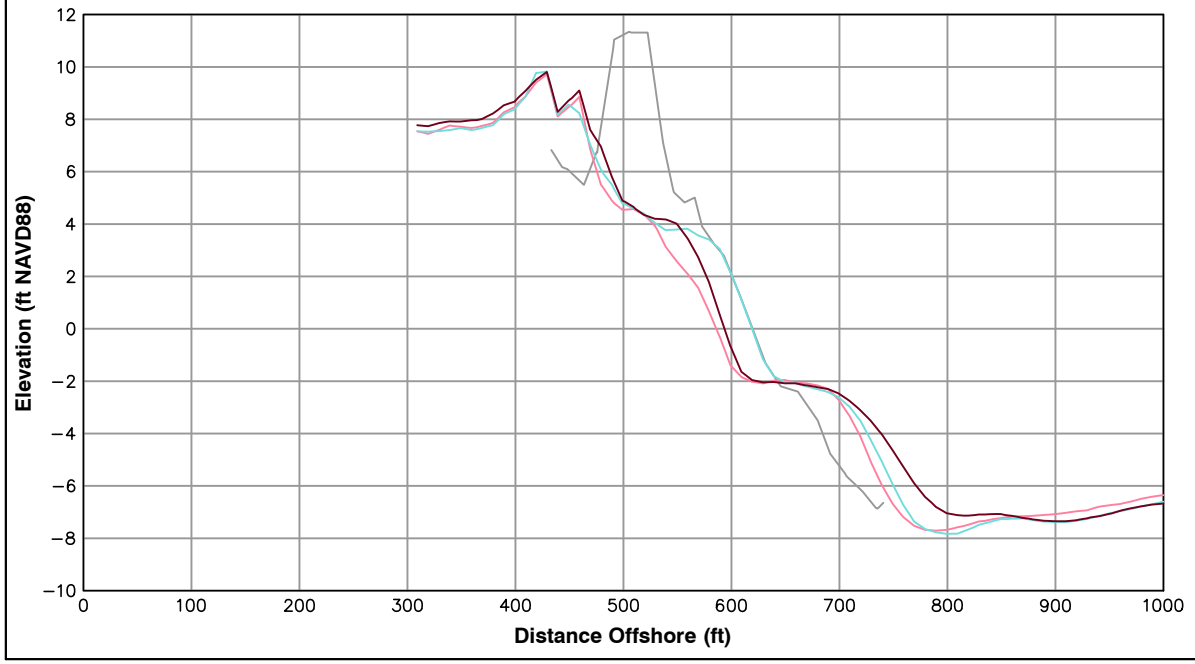
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 32+50	April 2015 - March 2014	April 2015 - October 2014
Shoreline Change at MHW (0.98 ft NAVD88)	9.06 ft/yr	-24.79 ft
Volume Change Above -15 ft NAVD88	8.61 cy/ft/yr	6.93 cy/ft
Volume Change Above 0 ft NAVD88	4.73 cy/ft/yr	-0.73 cy/ft

LEGEND:
- 2015 APR
- 2014 OCT
- 2014 MAR
- POST-FILL

Notes:
1. Stationing From West To East At Varying Intervals.
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5. 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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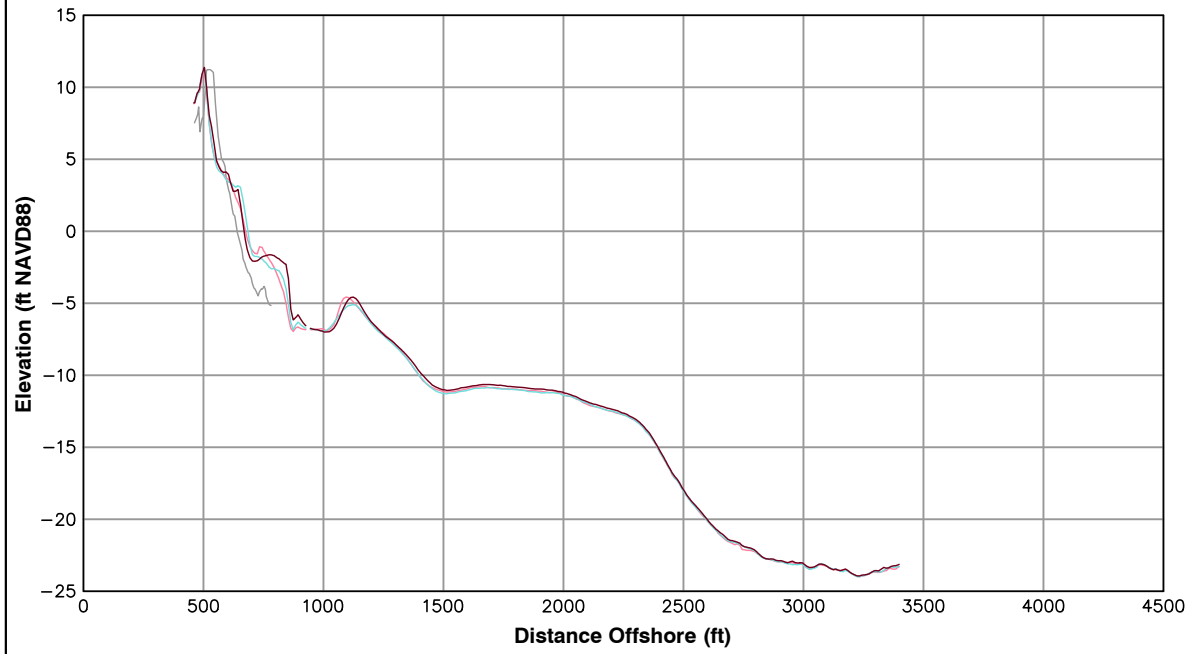
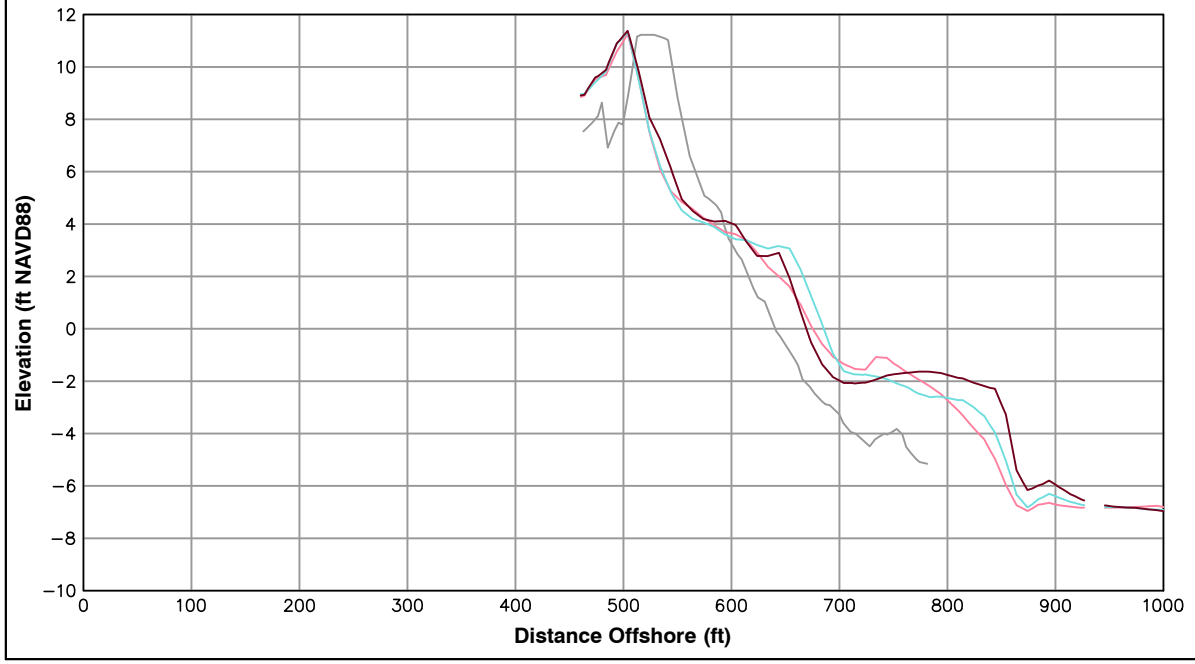
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 35+00	April 2015 - March 2014	April 2015 - October 2014
Shoreline Change at MHW (0.98 ft NAVD88)	-1.49 ft/yr	-14.94 ft
Volume Change Above -15 ft NAVD88	11.33 cy/ft/yr	12.79 cy/ft
Volume Change Above 0 ft NAVD88	1.86 cy/ft/yr	-0.02 cy/ft

LEGEND:
- 2015 APR
- 2014 OCT
- 2014 MAR
- POST-FILL

Notes:
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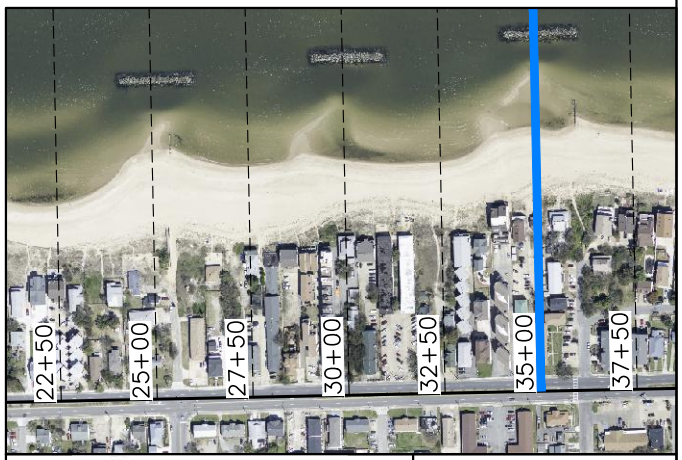

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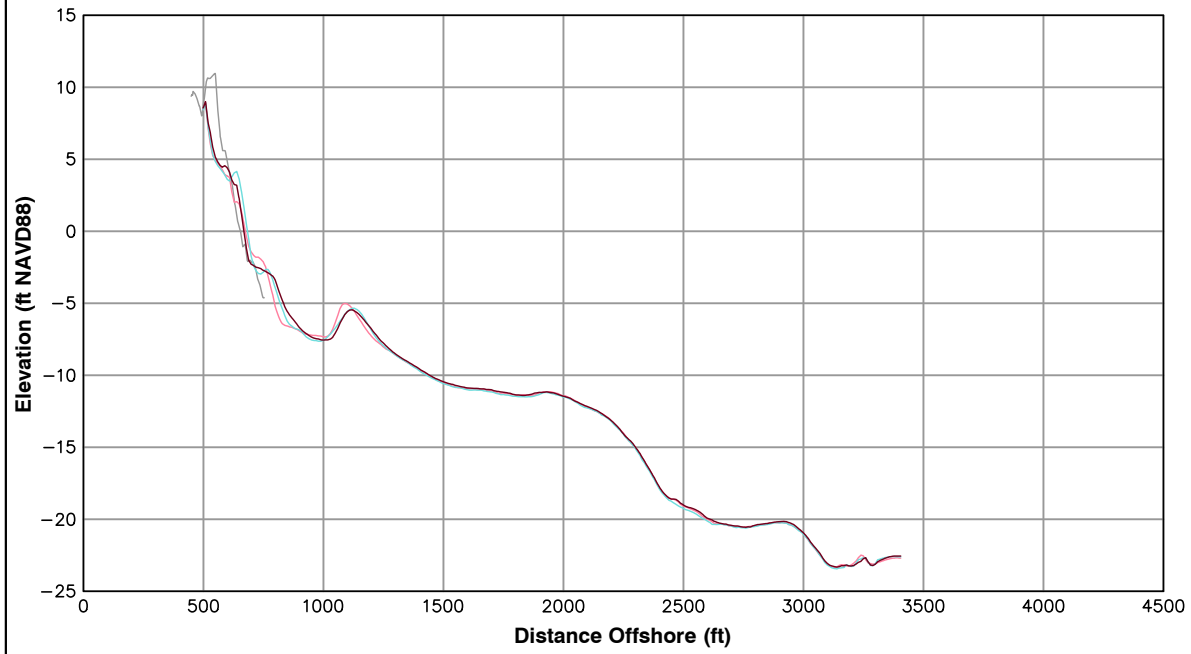
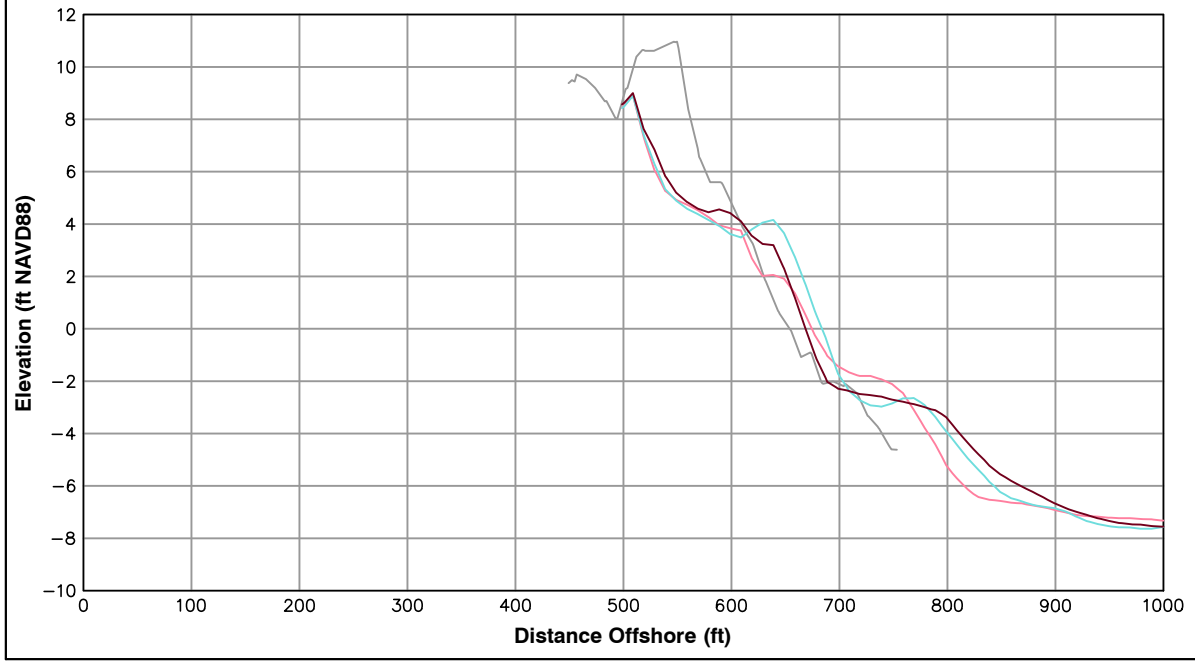
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 37+50	April 2015 - March 2014	April 2015 - October 2014
Shoreline Change at MHW (0.98 ft NAVD88)	-2.61 ft/yr	-14.26 ft
Volume Change Above -15 ft NAVD88	5.52 cy/ft/yr	4.17 cy/ft
Volume Change Above 0 ft NAVD88	2.37 cy/ft/yr	-0.90 cy/ft

LEGEND:

- 2015 APR
- 2014 OCT
- 2014 MAR
- POST-FILL

Notes:

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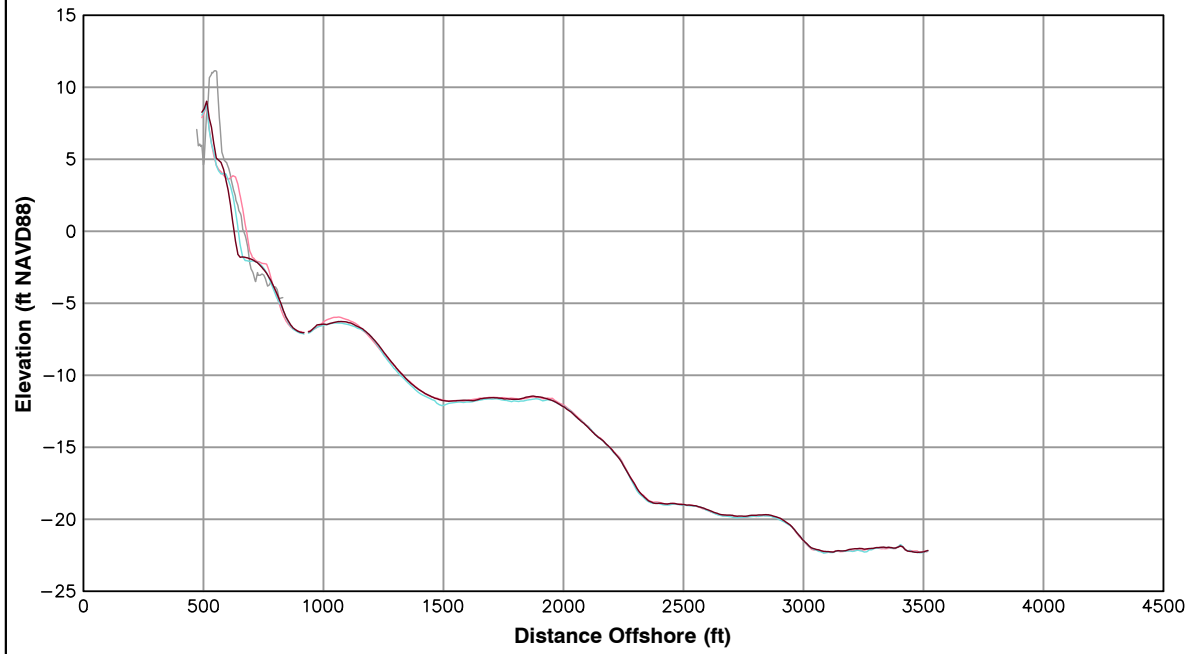
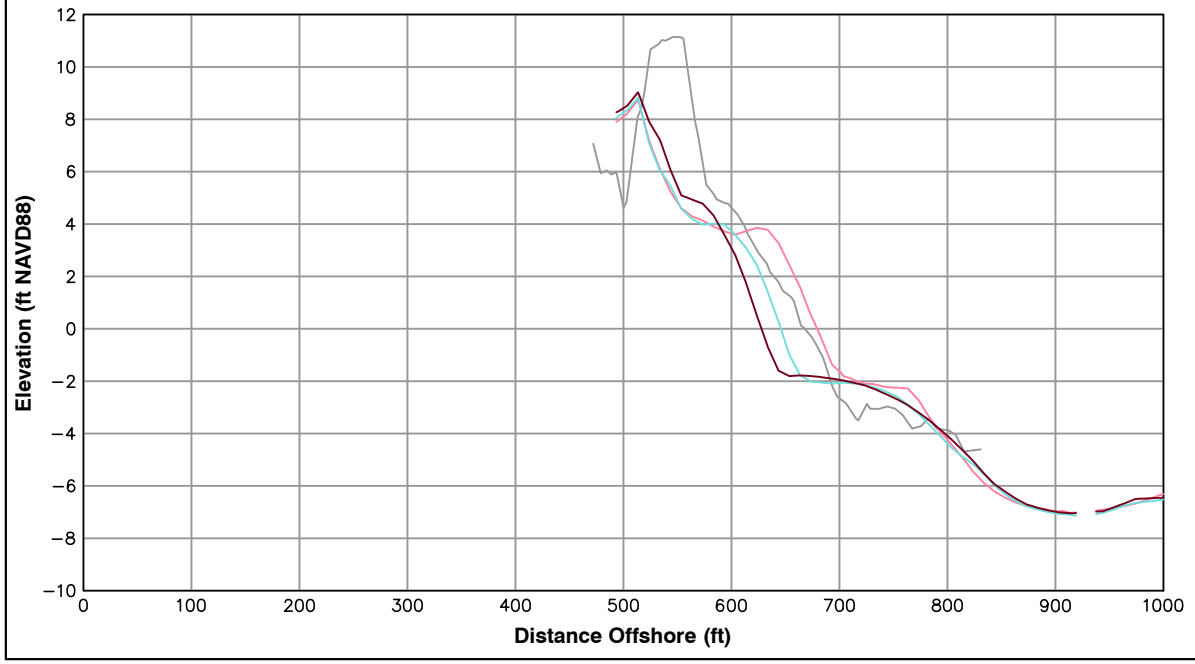
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 40+00	April 2015 - March 2014	April 2015 - October 2014
Shoreline Change at MHW (0.98 ft NAVD88)	-45.47 ft/yr	-17.72 ft
Volume Change Above -15 ft NAVD88	-8.96 cy/ft/yr	4.41 cy/ft
Volume Change Above 0 ft NAVD88	-4.18 cy/ft/yr	-0.28 cy/ft

LEGEND:
- 2015 APR
- 2014 OCT
- 2014 MAR
- POST-FILL

Notes:
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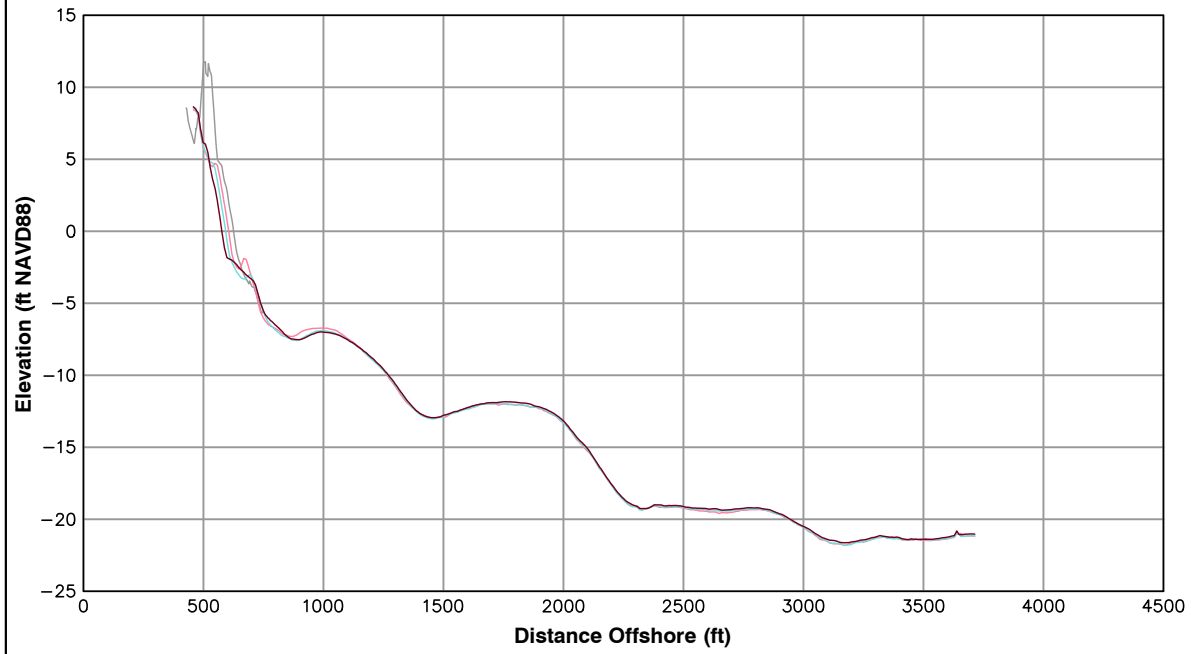
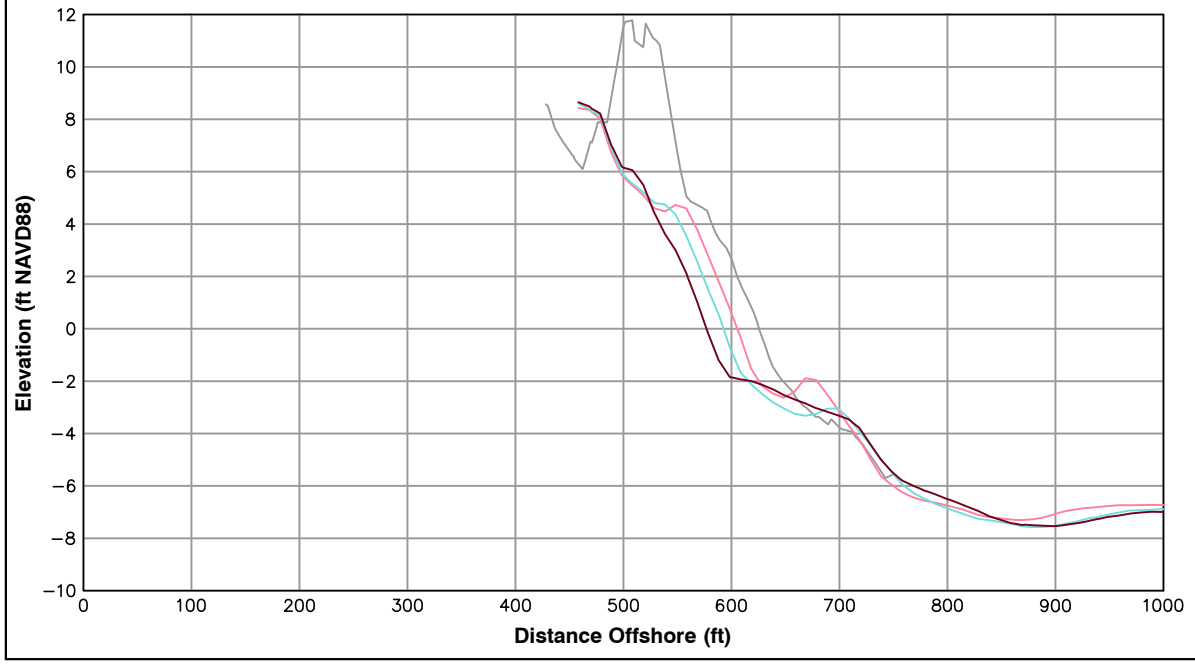
5. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward And Seaward Of The Breakwater.

City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 42+50	April 2015 - March 2014	April 2015 - October 2014
Shoreline Change at MHW (0.98 ft NAVD88)	-25.32 ft/yr	-14.93 ft
Volume Change Above -15 ft NAVD88	-4.59 cy/ft/yr	1.40 cy/ft
Volume Change Above 0 ft NAVD88	-3.84 cy/ft/yr	-2.38 cy/ft

LEGEND:
- 2015 APR
- 2014 OCT
- 2014 MAR
- POST-FILL

Notes:
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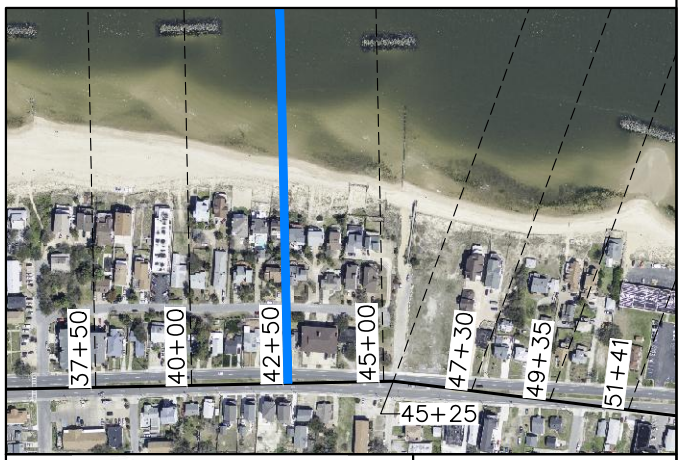
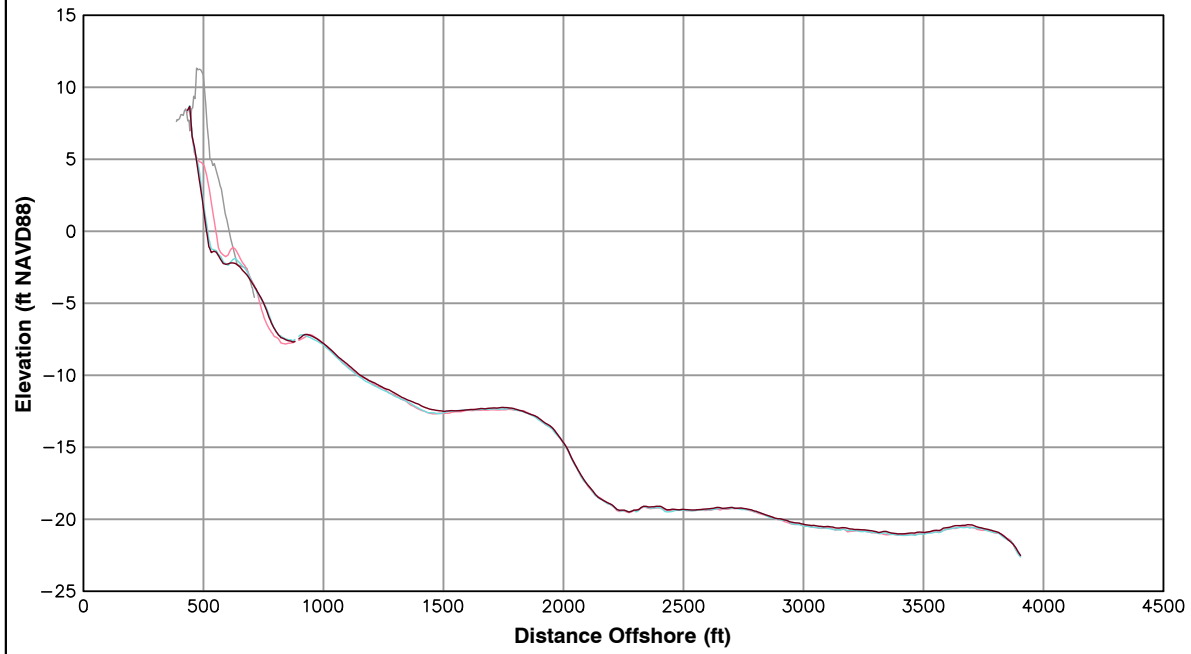
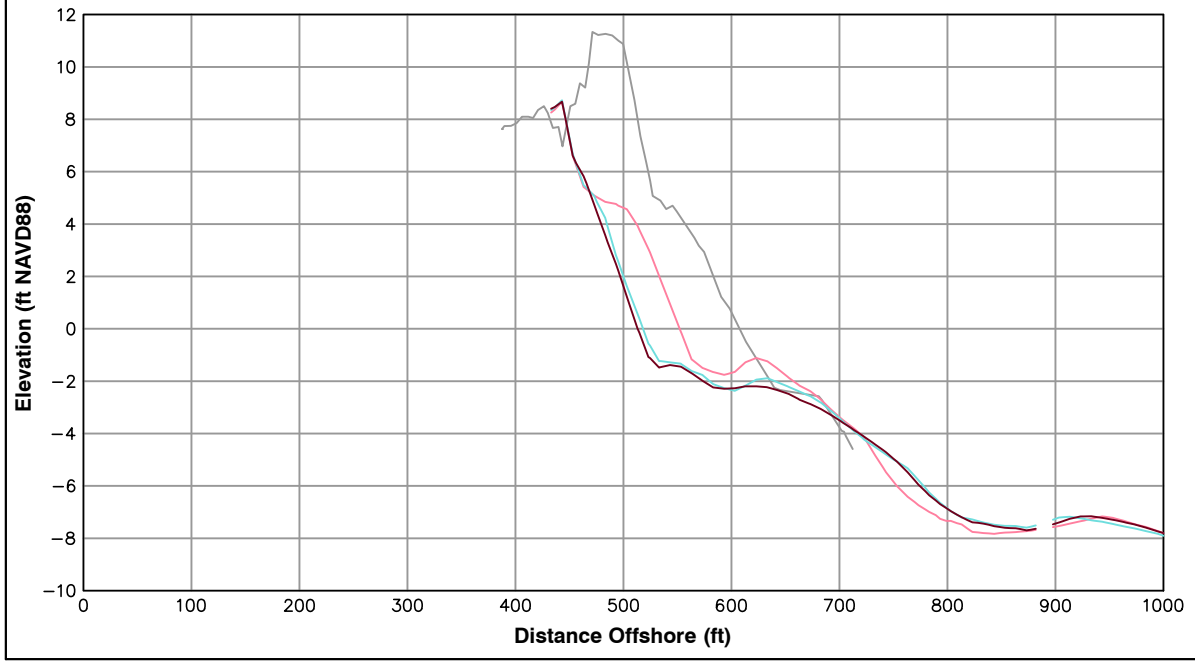


City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 45+00	April 2015 - March 2014	April 2015 - October 2014
Shoreline Change at MHW (0.98 ft NAVD88)	-34.70 ft/yr	-4.12 ft
Volume Change Above -15 ft NAVD88	-4.17 cy/ft/yr	2.48 cy/ft
Volume Change Above 0 ft NAVD88	-5.67 cy/ft/yr	-0.70 cy/ft

LEGEND:
- 2015 APR
- 2014 OCT
- 2014 MAR
- POST-FILL

Notes:
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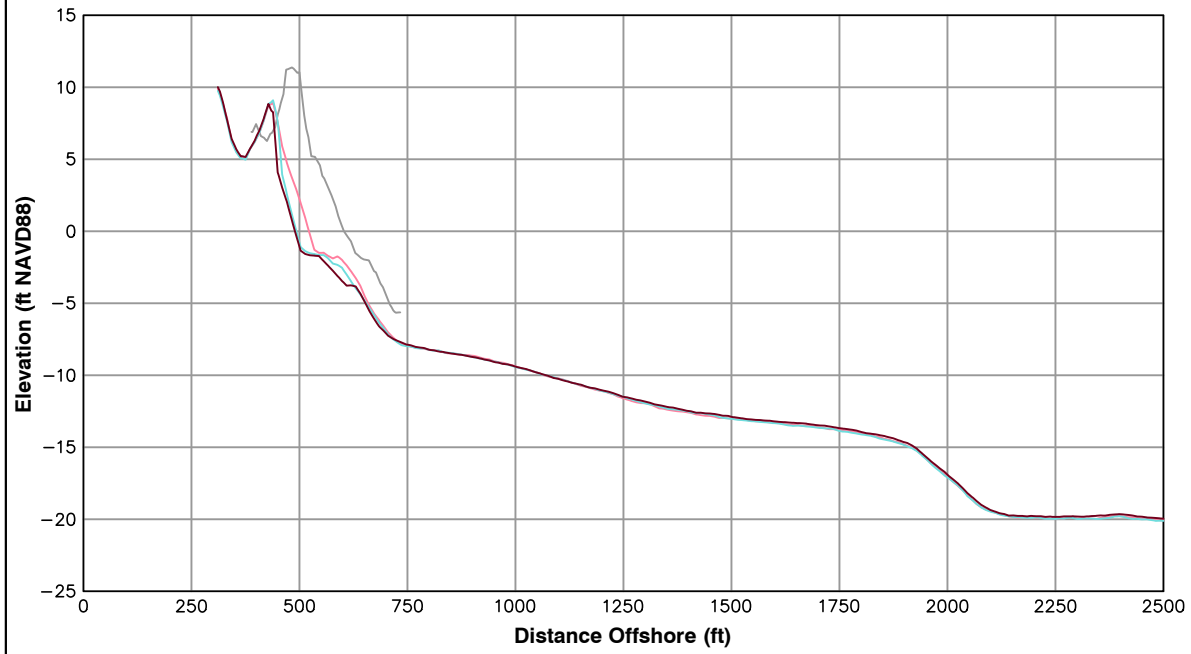
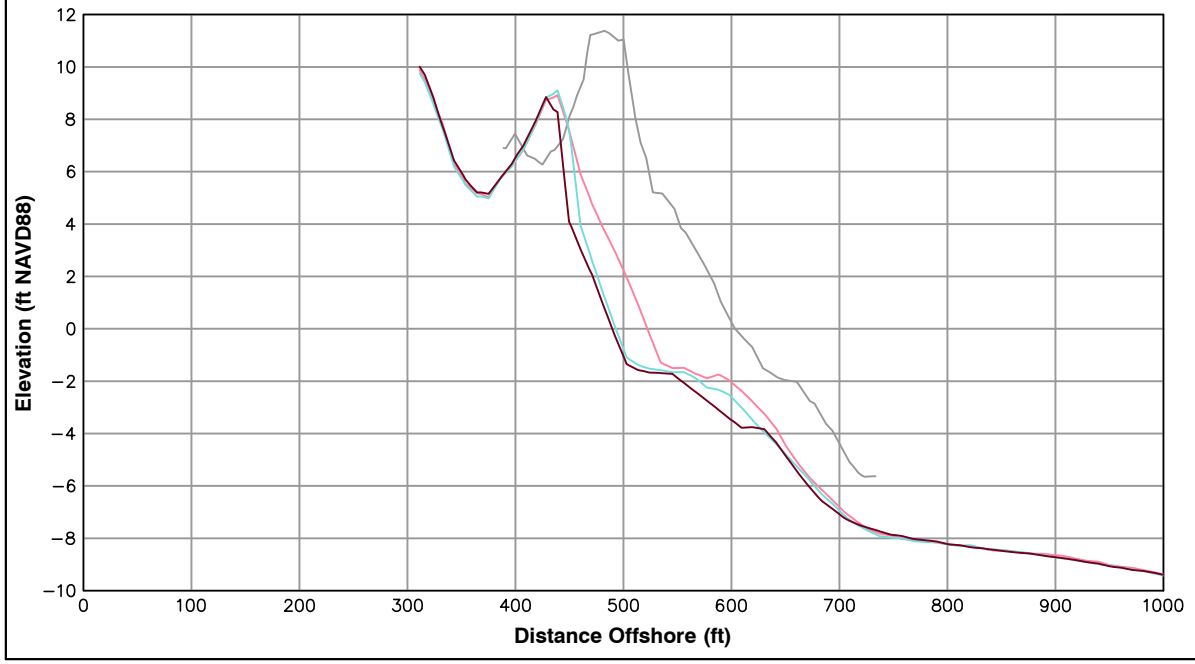
City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 45+25	April 2015 - March 2014	April 2015 - October 2014
Shoreline Change at MHW (0.98 ft NAVD88)	-29.70 ft/yr	-3.67 ft
Volume Change Above -15 ft NAVD88	-8.79 cy/ft/yr	-0.42 cy/ft
Volume Change Above 0 ft NAVD88	-6.36 cy/ft/yr	-1.90 cy/ft

LEGEND:
- 2015 APR
- 2014 OCT
- 2014 MAR
- POST-FILL

Notes:
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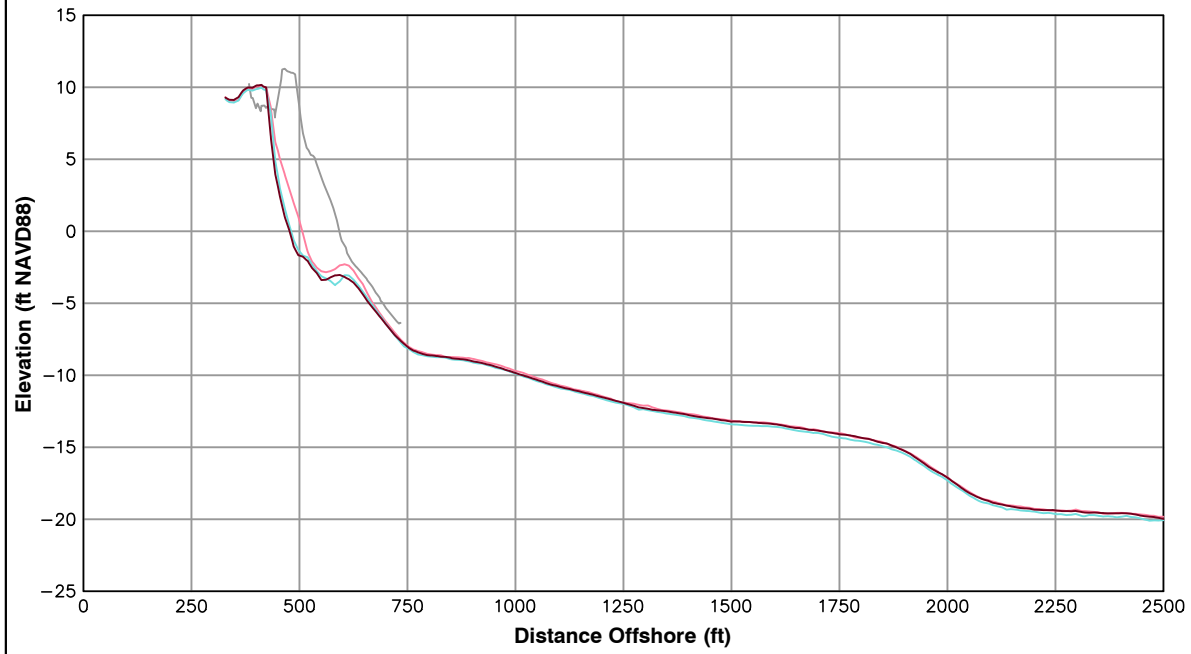
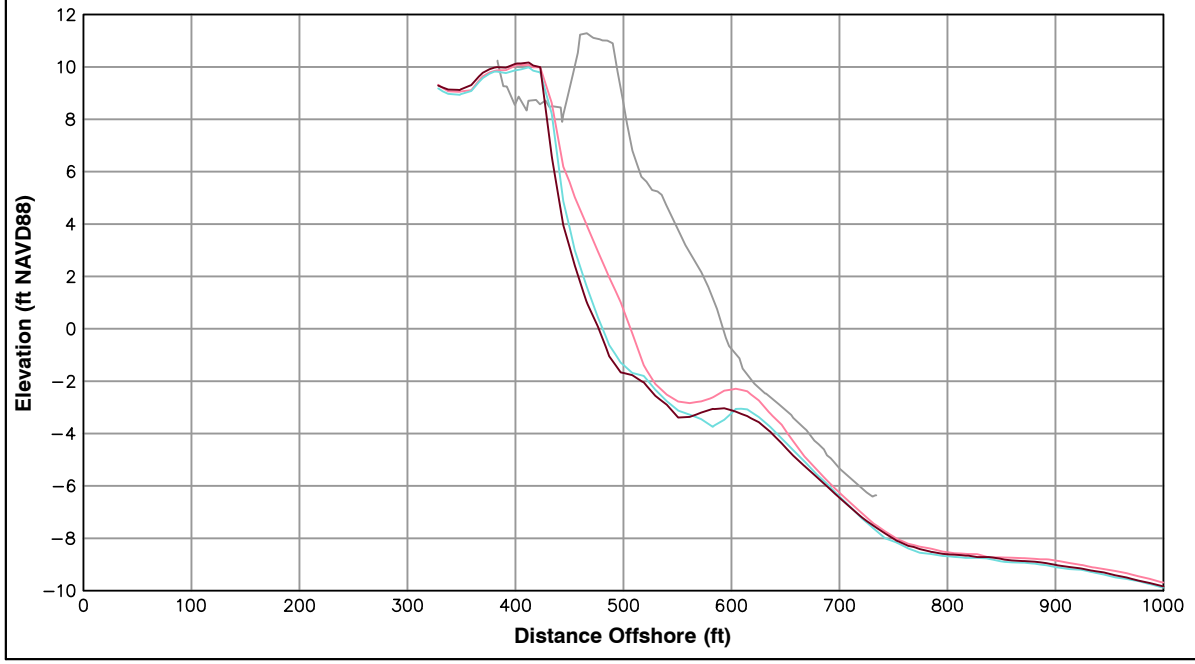
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 47+30	April 2015 - March 2014	April 2015 - October 2014
Shoreline Change at MHW (0.98 ft NAVD88)	-28.85 ft/yr	-5.15 ft
Volume Change Above -15 ft NAVD88	-13.64 cy/ft/yr	4.13 cy/ft
Volume Change Above 0 ft NAVD88	-5.38 cy/ft/yr	-0.86 cy/ft

LEGEND:
- 2015 APR
- 2014 OCT
- 2014 MAR
- POST-FILL

Notes:
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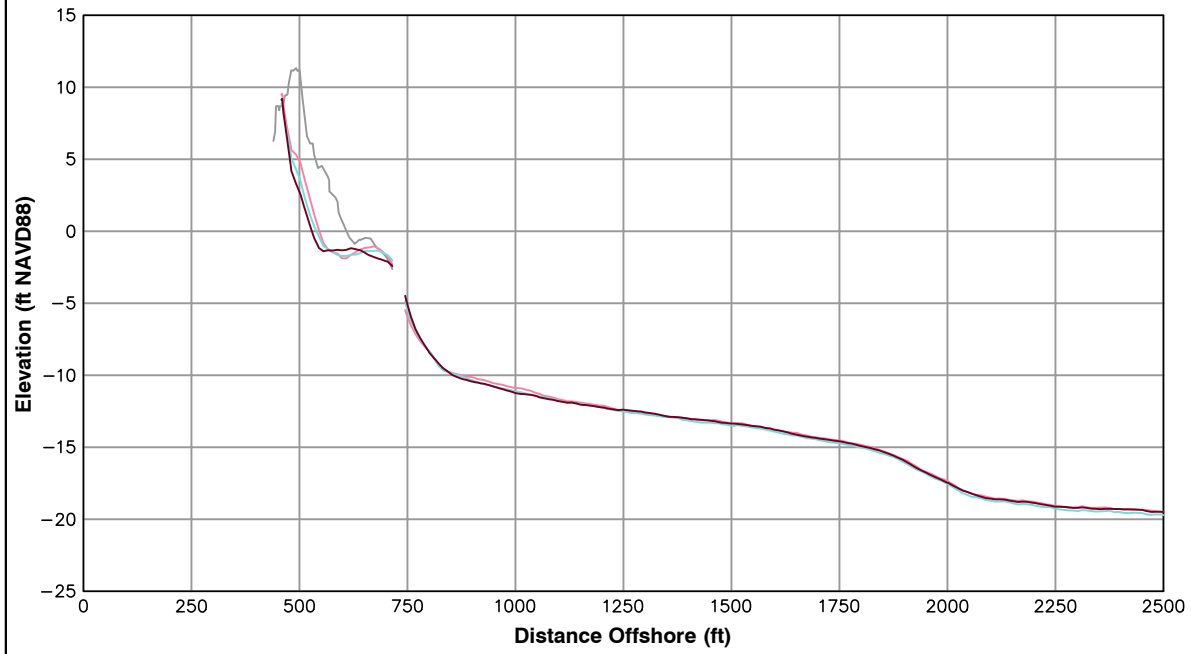
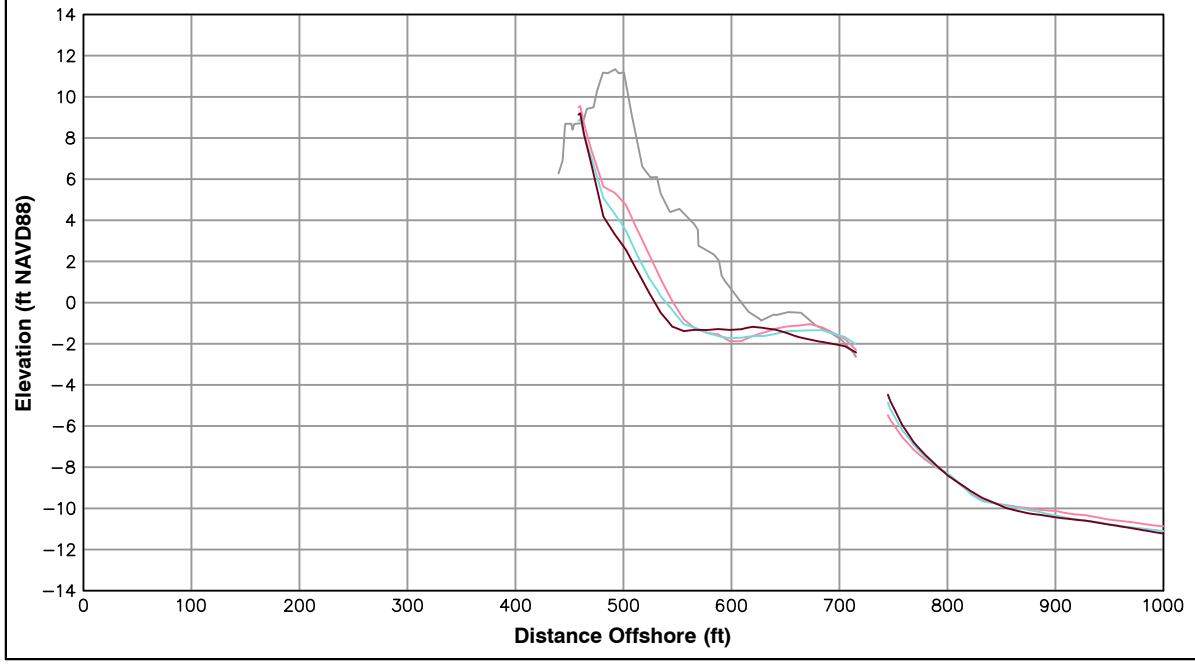
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 49+35	April 2015 - March 2014	April 2015 - October 2014
Shoreline Change at MHW (0.98 ft NAVD88)	-16.18 ft/yr	-8.03 ft
Volume Change Above -15 ft NAVD88	-7.63 cy/ft/yr	-0.29 cy/ft
Volume Change Above 0 ft NAVD88	-4.26 cy/ft/yr	-1.91 cy/ft

LEGEND:
- 2015 APR
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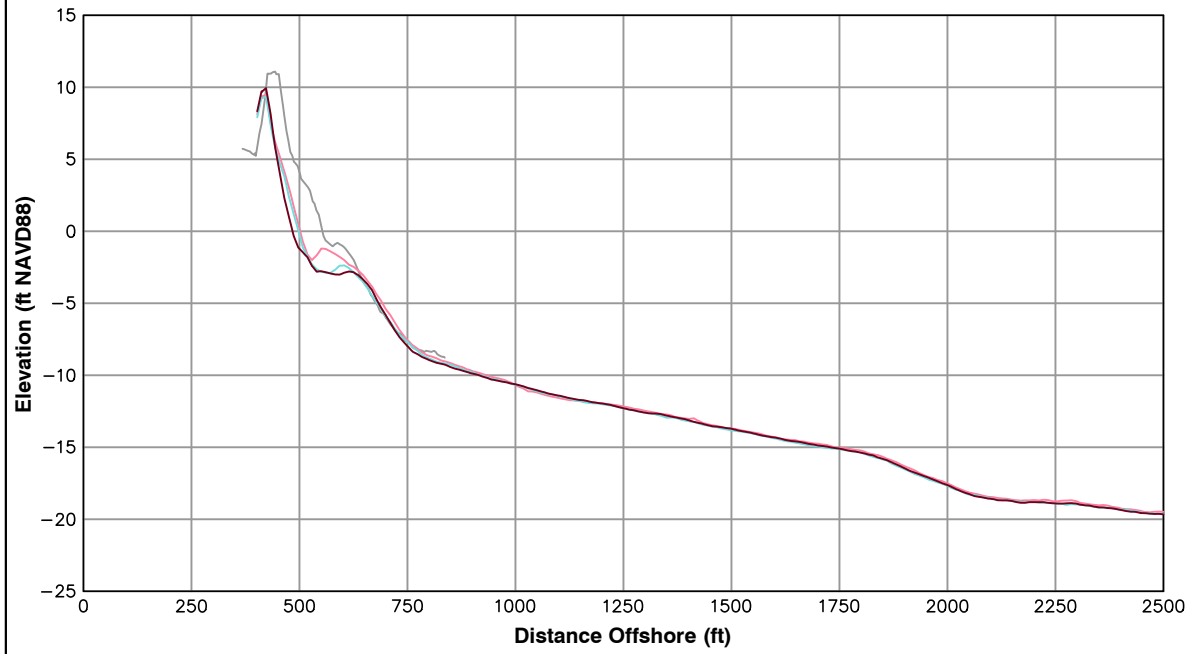
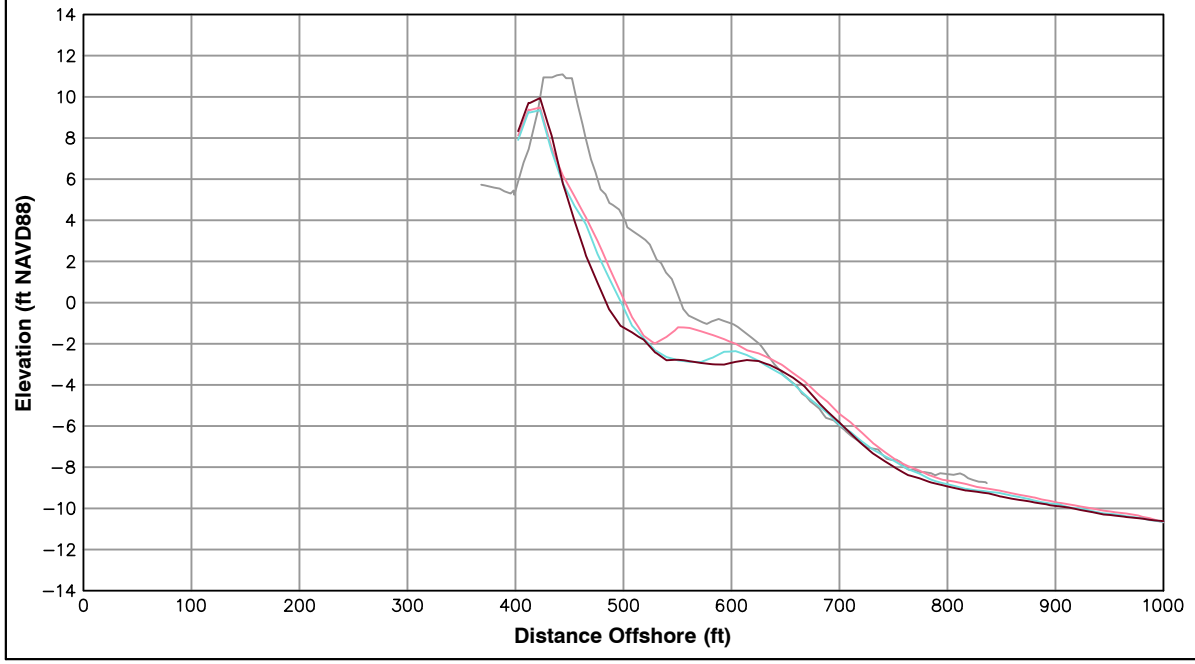
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 51+41	April 2015 - March 2014	April 2015 - October 2014
Shoreline Change at MHW (0.98 ft NAVD88)	-15.89 ft/yr	-12.80 ft
Volume Change Above -15 ft NAVD88	-11.07 cy/ft/yr	-1.76 cy/ft
Volume Change Above 0 ft NAVD88	-2.26 cy/ft/yr	-1.20 cy/ft

LEGEND:
- 2015 APR
- 2014 OCT
- 2014 MAR
- POST-FILL

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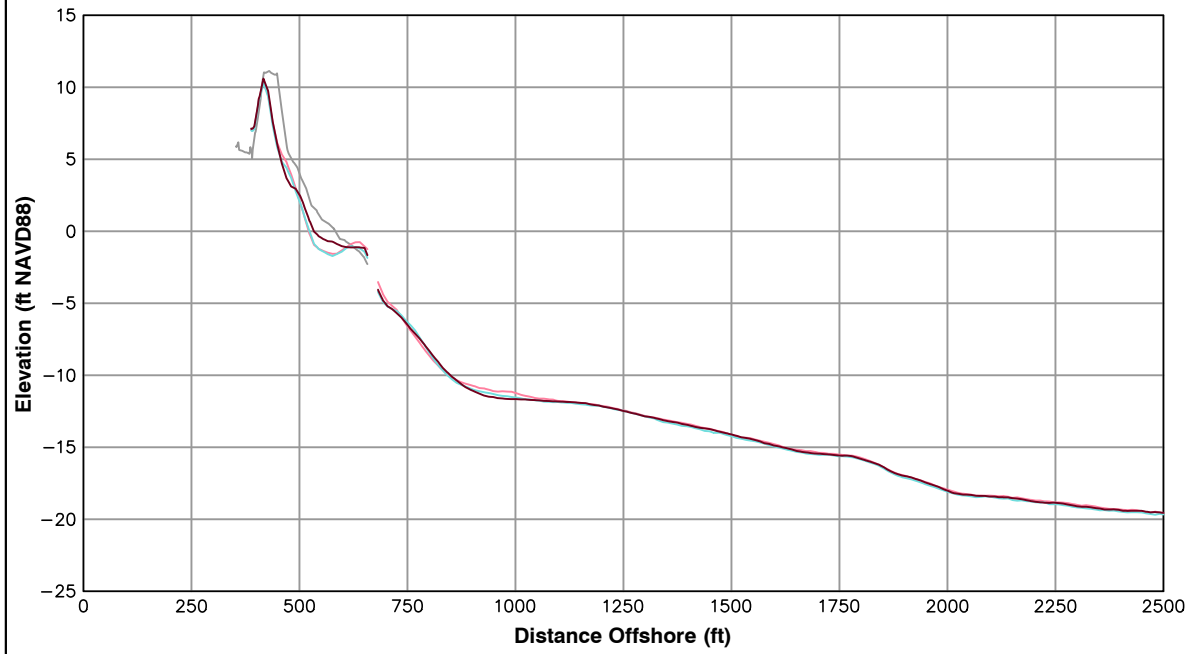
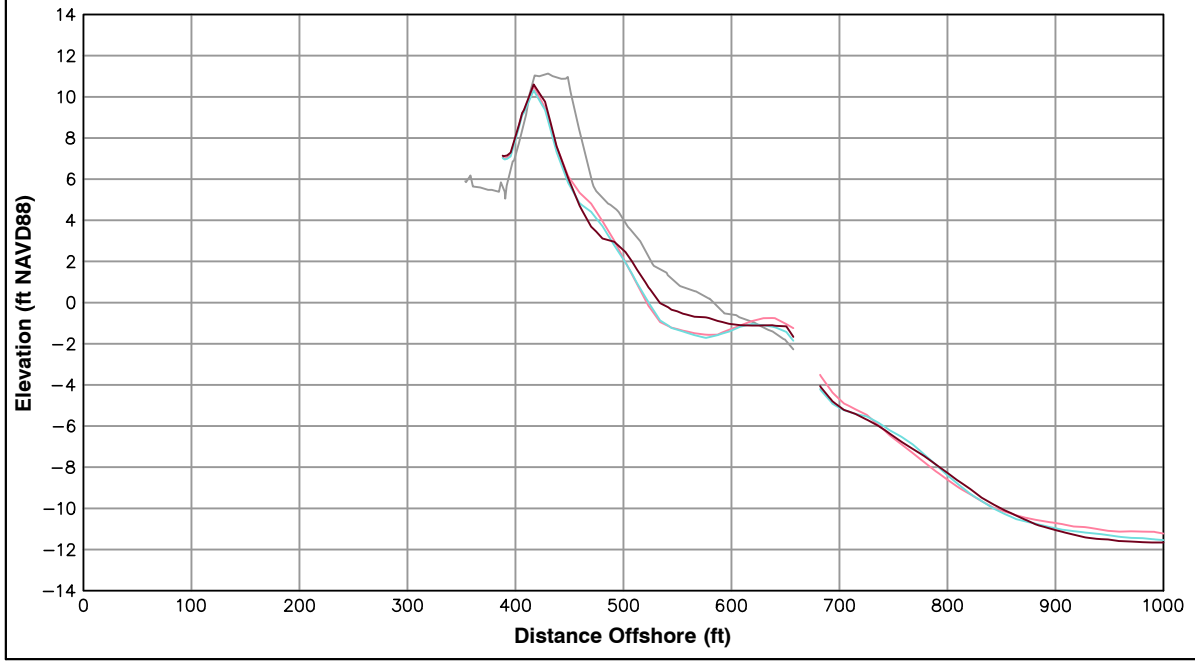
City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





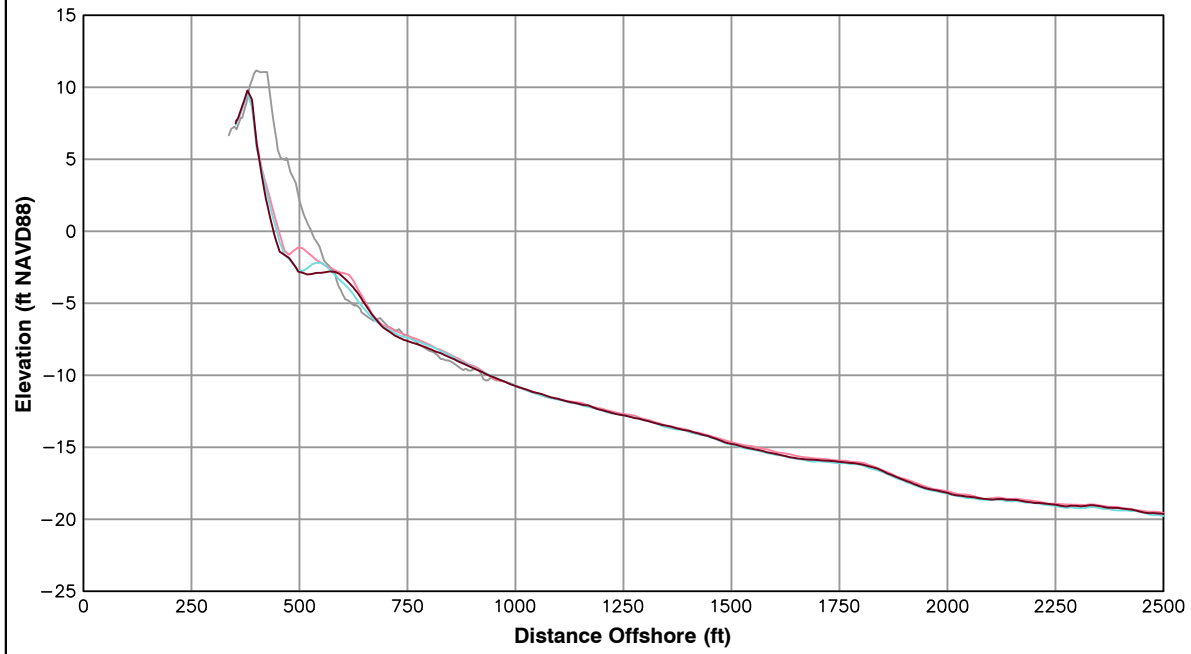
Survey Transect 53+46	April 2015 - March 2014	April 2015 - October 2014
Shoreline Change at MHW (0.98 ft NAVD88)	8.00 ft/yr	8.23 ft
Volume Change Above -15 ft NAVD88	-1.29 cy/ft/yr	4.12 cy/ft
Volume Change Above 0 ft NAVD88	-0.07 cy/ft/yr	0.84 cy/ft

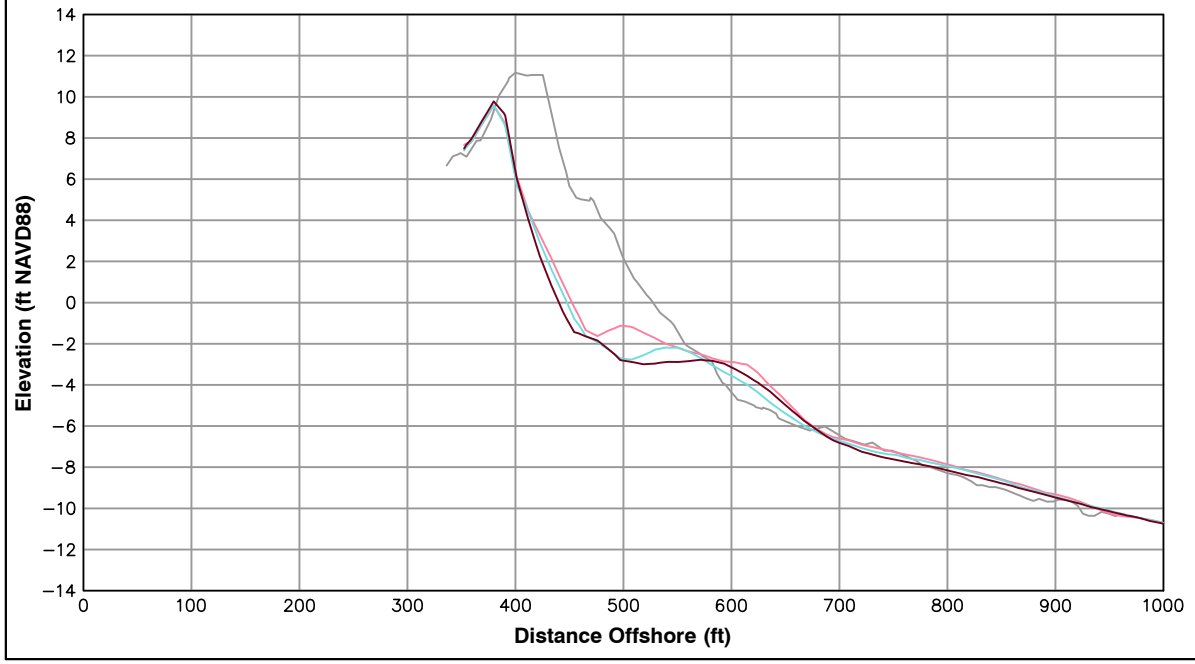
LEGEND:
- 2015 APR
- 2014 OCT
- 2014 MAR
- POST-FILL

Notes:
1. Stationing From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. Survey Comparison Made To March 2014 and October 2014.
5. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward And Seaward Of The Breakwater.

City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 55+51	April 2015 - March 2014	April 2015 - October 2014
Shoreline Change at MHW (0.98 ft NAVD88)	-10.38 ft/yr	-6.87 ft
Volume Change Above -15 ft NAVD88	-9.14 cy/ft/yr	-1.13 cy/ft
Volume Change Above 0 ft NAVD88	-1.09 cy/ft/yr	-0.40 cy/ft

LEGEND:
- 2015 APR
- 2014 OCT
- 2014 MAR
- POST-FILL

Notes:
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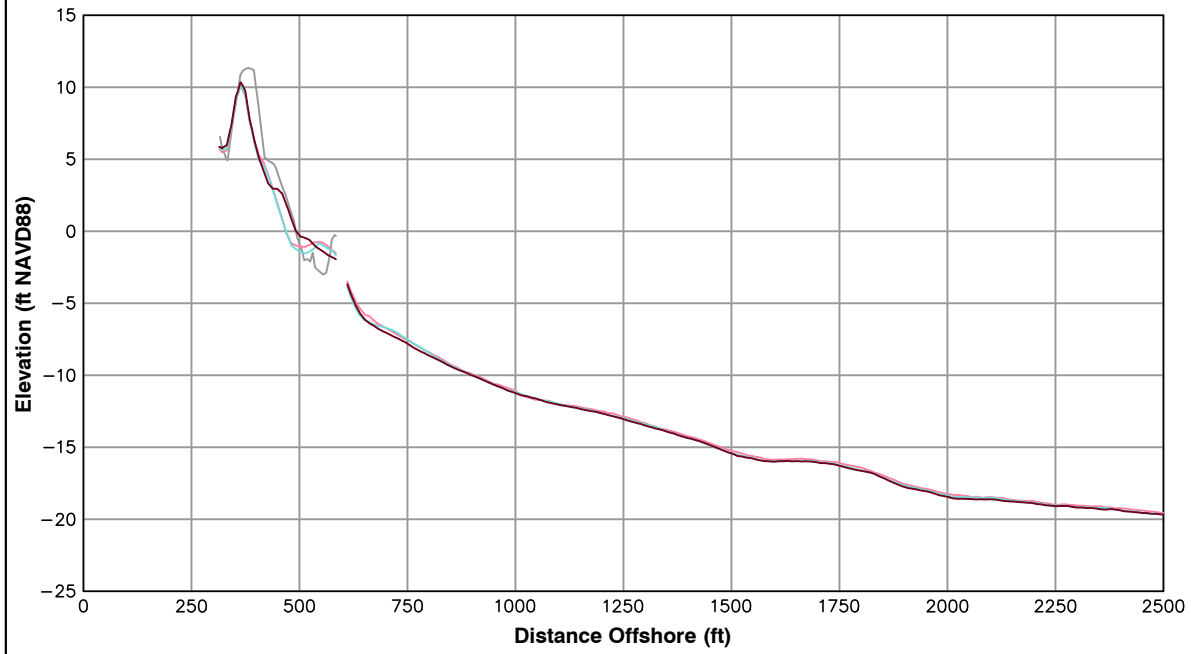
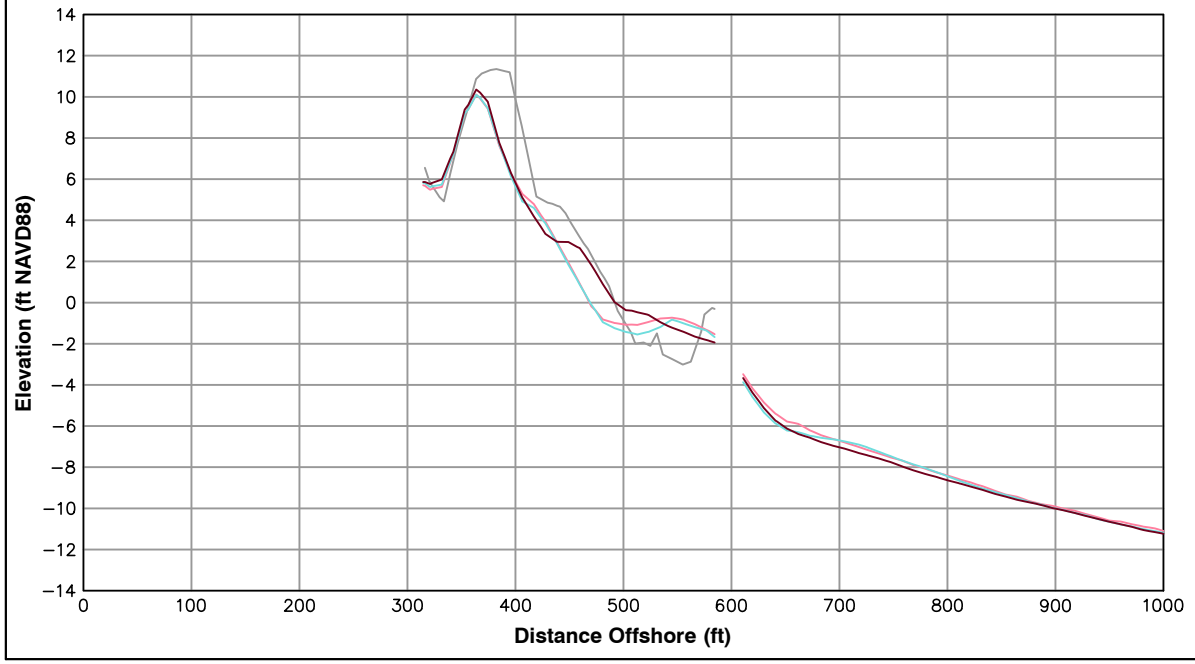
City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 57+57	April 2015 - March 2014	April 2015 - October 2014
Shoreline Change at MHW (0.98 ft NAVD88)	19.37 ft/yr	21.54 ft
Volume Change Above -15 ft NAVD88	-1.91 cy/ft/yr	1.95 cy/ft
Volume Change Above 0 ft NAVD88	2.15 cy/ft/yr	2.57 cy/ft

LEGEND:
- 2015 APR
- 2014 OCT
- 2014 MAR
- POST-FILL

Notes:
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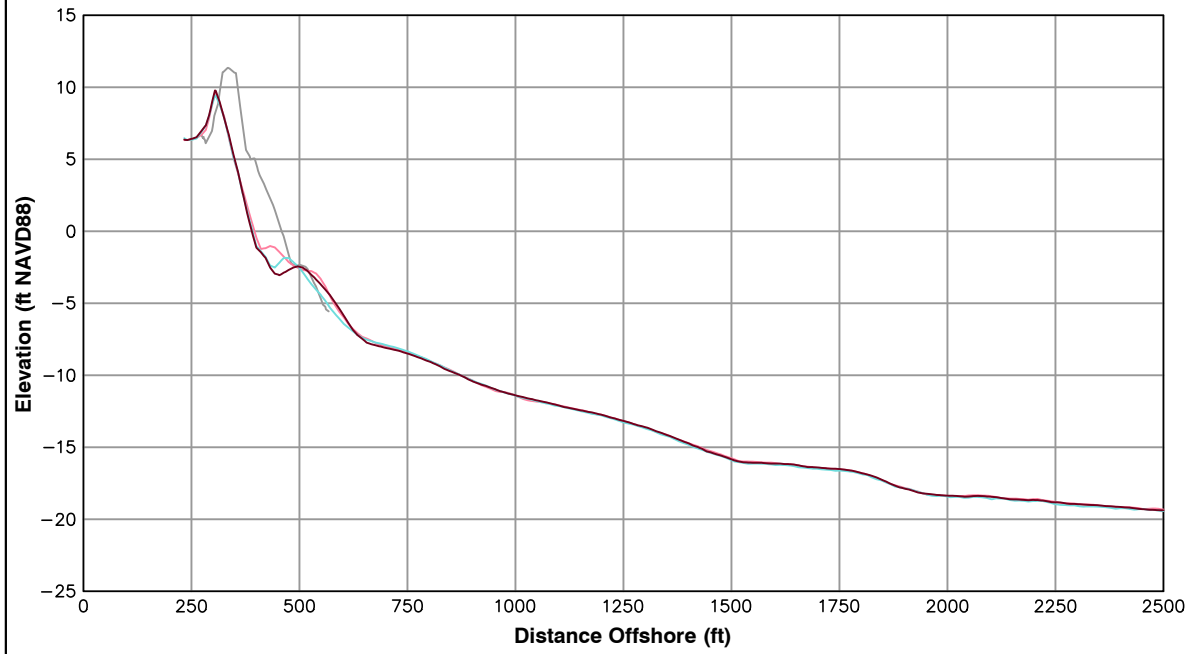
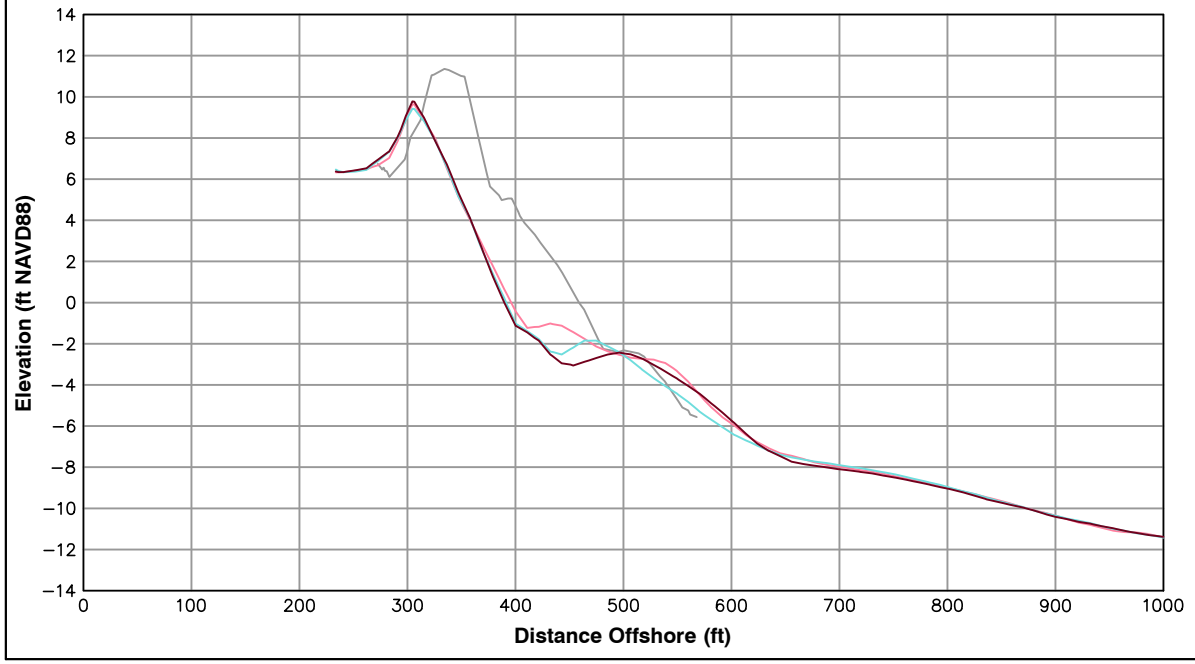
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 59+62	April 2015 - March 2014	April 2015 - October 2014
Shoreline Change at MHW (0.98 ft NAVD88)	-4.73 ft/yr	-1.31 ft
Volume Change Above -15 ft NAVD88	-3.66 cy/ft/yr	1.44 cy/ft
Volume Change Above 0 ft NAVD88	0.09 cy/ft/yr	0.36 cy/ft

LEGEND:
- 2015 APR
- 2014 OCT
- 2014 MAR
- POST-FILL

Notes:
1. Stationing From West To East At Varying Intervals.
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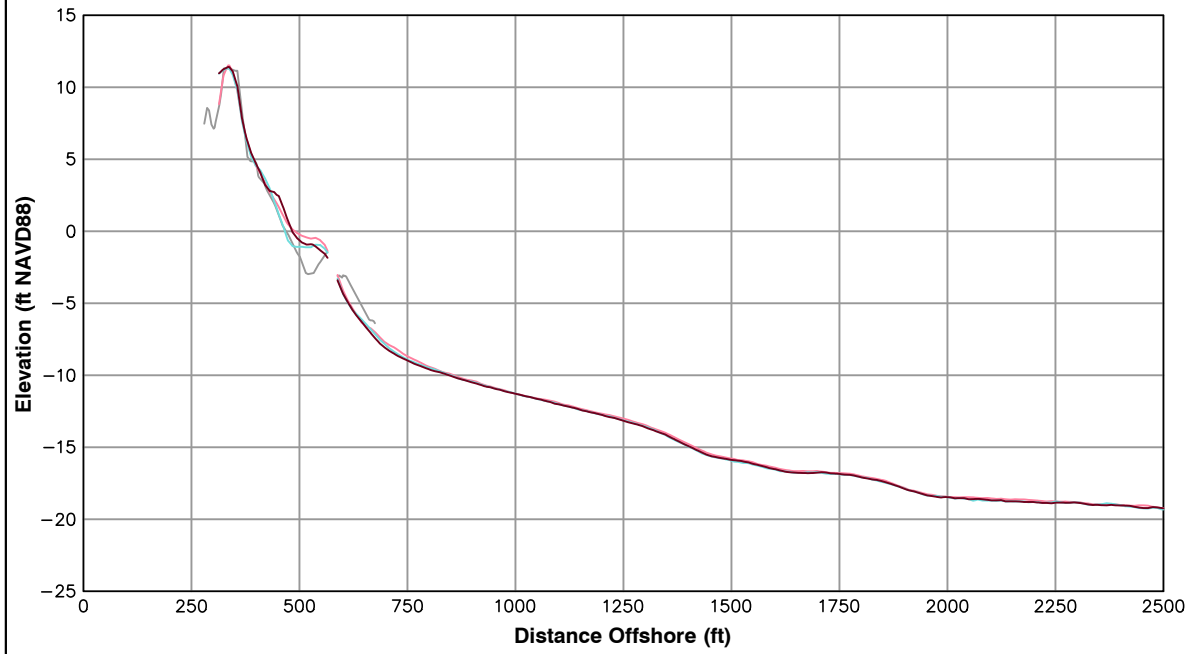
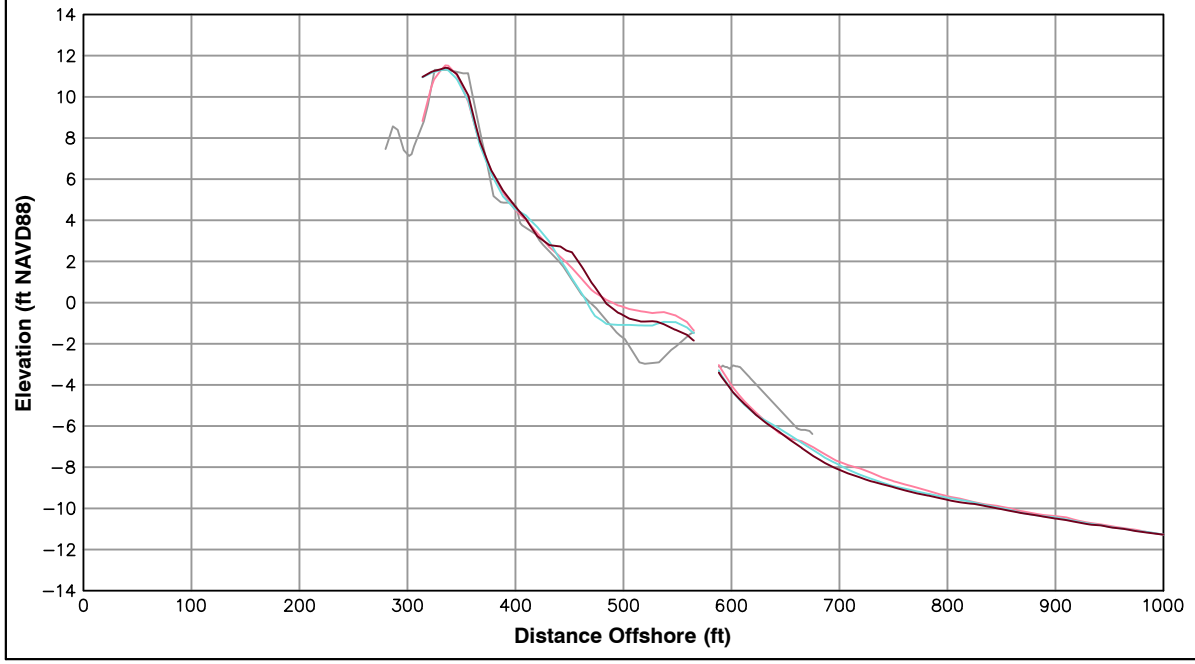
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 61+62	April 2015 - March 2014	April 2015 - October 2014
Shoreline Change at MHW (0.98 ft NAVD88)	5.60 ft/yr	15.62 ft
Volume Change Above -15 ft NAVD88	-3.74 cy/ft/yr	1.32 cy/ft
Volume Change Above 0 ft NAVD88	1.46 cy/ft/yr	1.84 cy/ft

LEGEND:
- 2015 APR
- 2014 OCT
- 2014 MAR
- POST-FILL

Notes:
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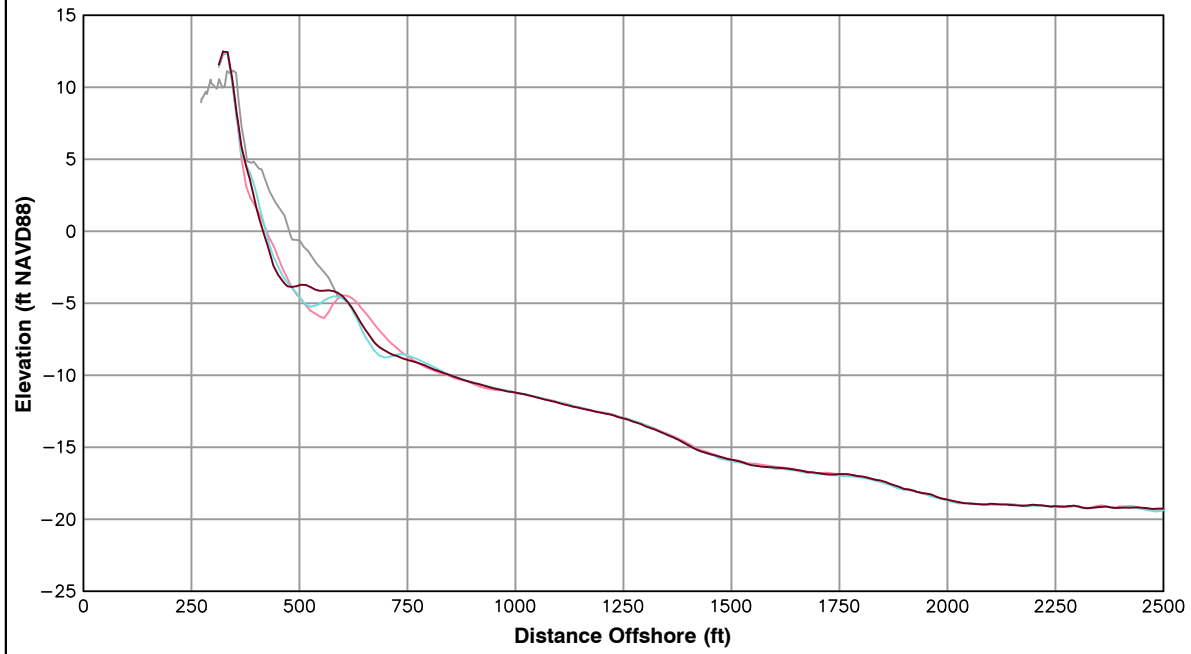
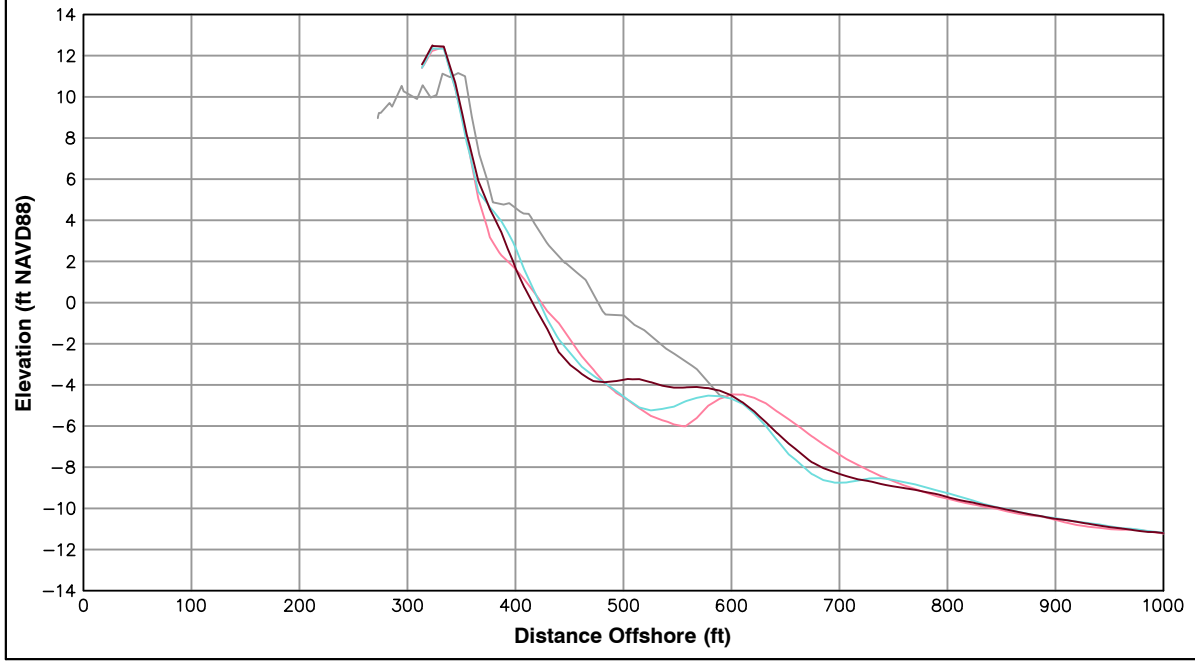
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 63+62	April 2015 - March 2014	April 2015 - October 2014
Shoreline Change at MHW (0.98 ft NAVD88)	-3.95 ft/yr	-7.60 ft
Volume Change Above -15 ft NAVD88	-0.43 cy/ft/yr	1.68 cy/ft
Volume Change Above 0 ft NAVD88	1.31 cy/ft/yr	-0.53 cy/ft

LEGEND:
- 2015 APR
- 2014 OCT
- 2014 MAR
- POST-FILL

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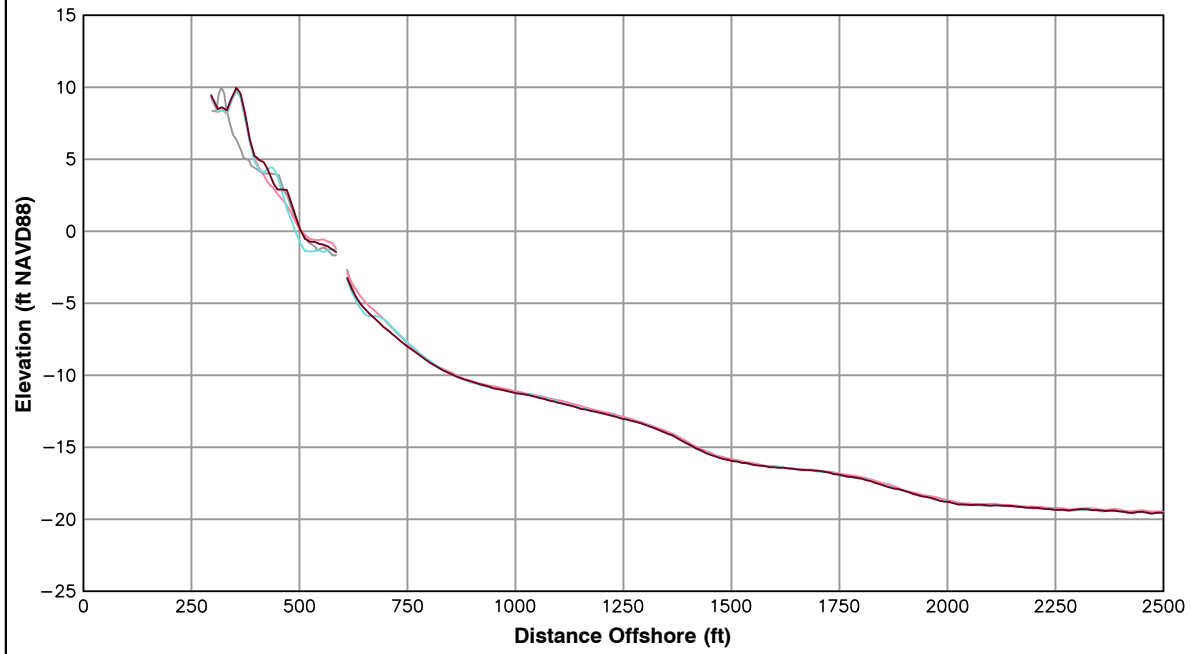
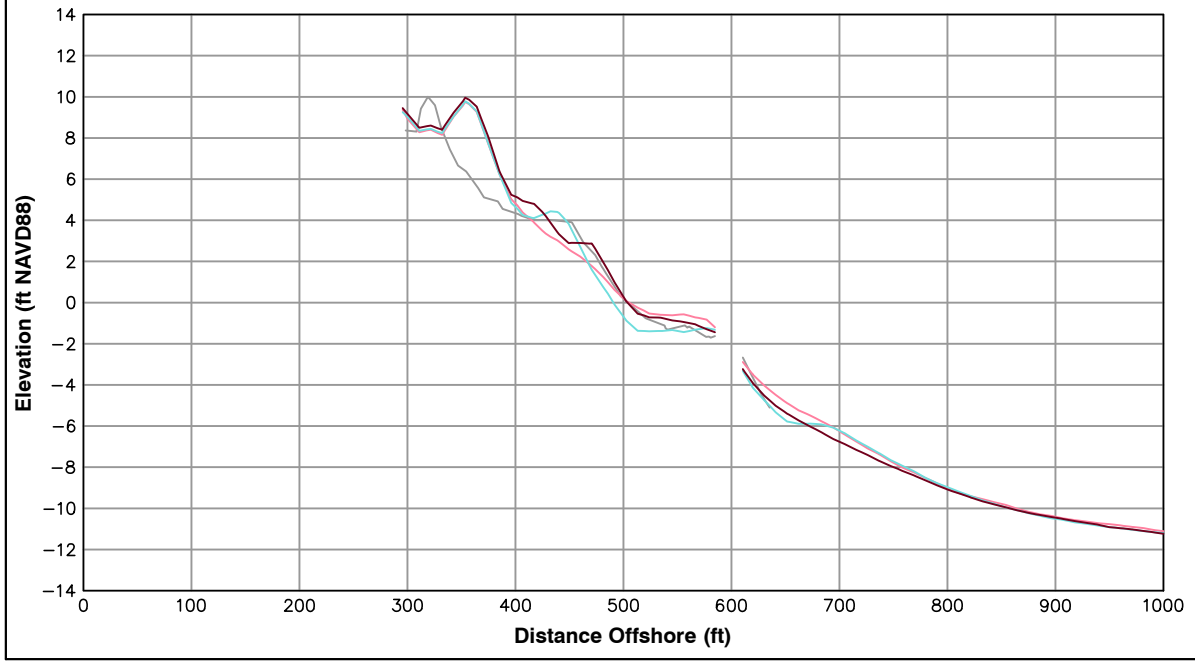
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 65+62	April 2015 - March 2014	April 2015 - October 2014
Shoreline Change at MHW (0.98 ft NAVD88)	5.59 ft/yr	13.44 ft
Volume Change Above -15 ft NAVD88	-2.63 cy/ft/yr	2.19 cy/ft
Volume Change Above 0 ft NAVD88	2.92 cy/ft/yr	1.99 cy/ft

LEGEND:
- 2015 APR
- 2014 OCT
- 2014 MAR
- POST-FILL

Notes:
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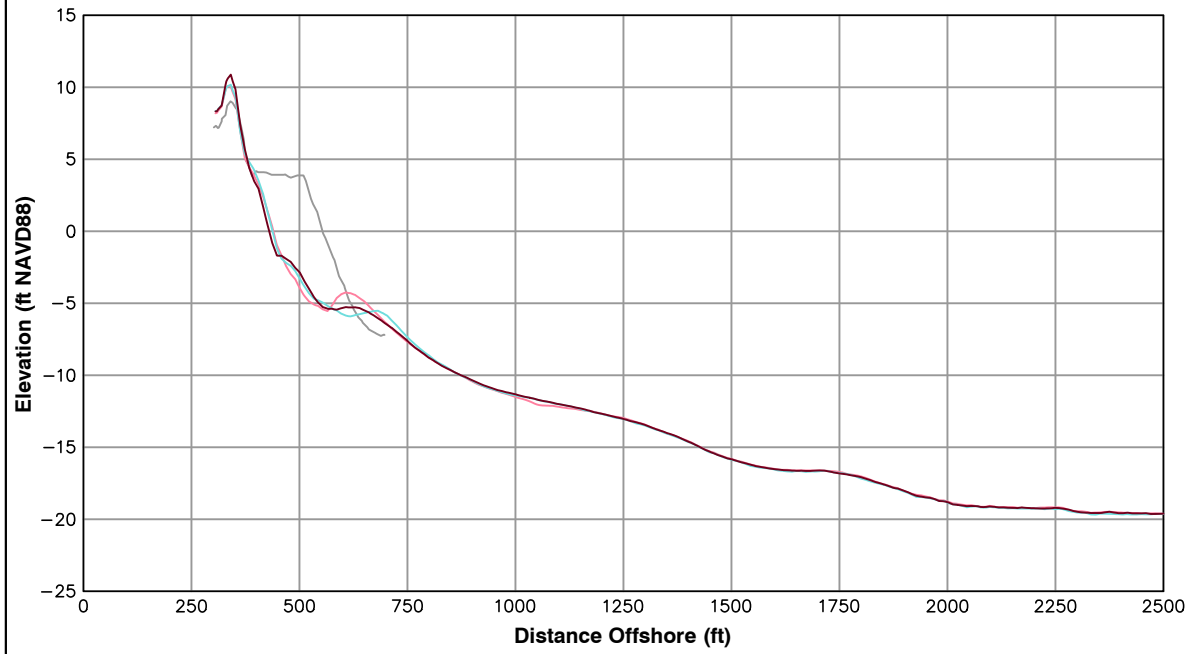
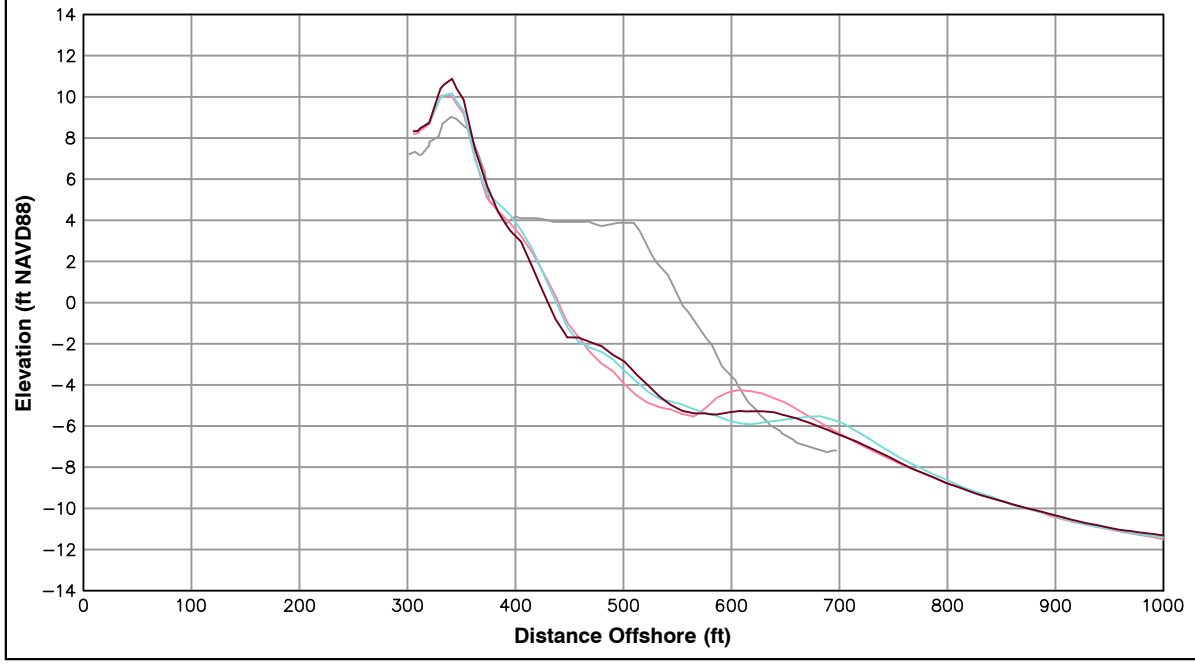
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 67+62	April 2015 - March 2014	April 2015 - October 2014
Shoreline Change at MHW (0.98 ft NAVD88)	-8.06 ft/yr	-7.63 ft
Volume Change Above -15 ft NAVD88	0.74 cy/ft/yr	-0.43 cy/ft
Volume Change Above 0 ft NAVD88	0.15 cy/ft/yr	-0.49 cy/ft

LEGEND:
- 2015 APR
- 2014 OCT
- 2014 MAR
- POST-FILL

Notes:
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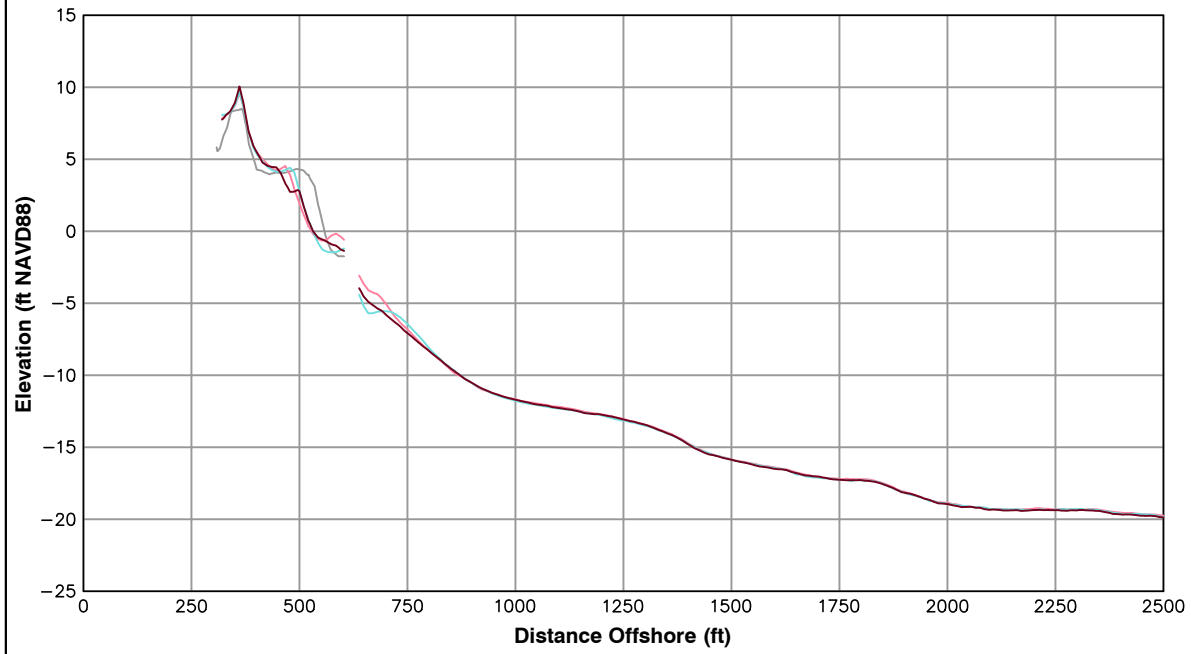
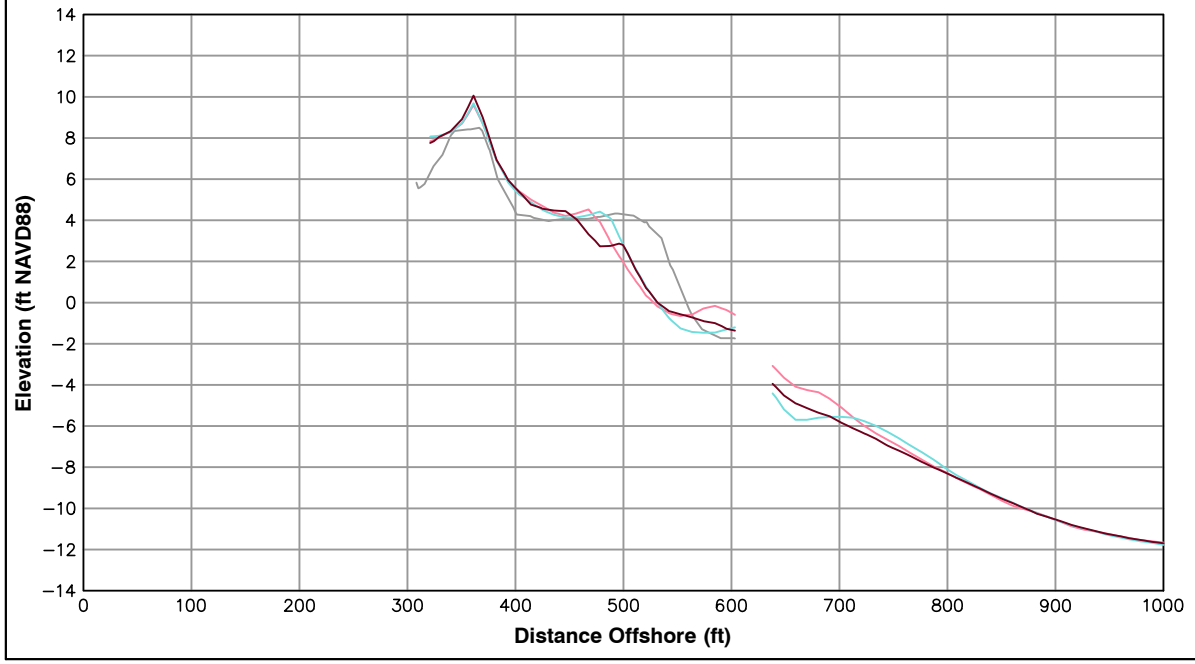
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 69+62	April 2015 - March 2014	April 2015 - October 2014
Shoreline Change at MHW (0.98 ft NAVD88)	5.27 ft/yr	-0.59 ft
Volume Change Above -15 ft NAVD88	-4.04 cy/ft/yr	-0.25 cy/ft
Volume Change Above 0 ft NAVD88	0.02 cy/ft/yr	-1.02 cy/ft

LEGEND:
- 2015 APR
- 2014 OCT
- 2014 MAR
- POST-FILL

Notes:
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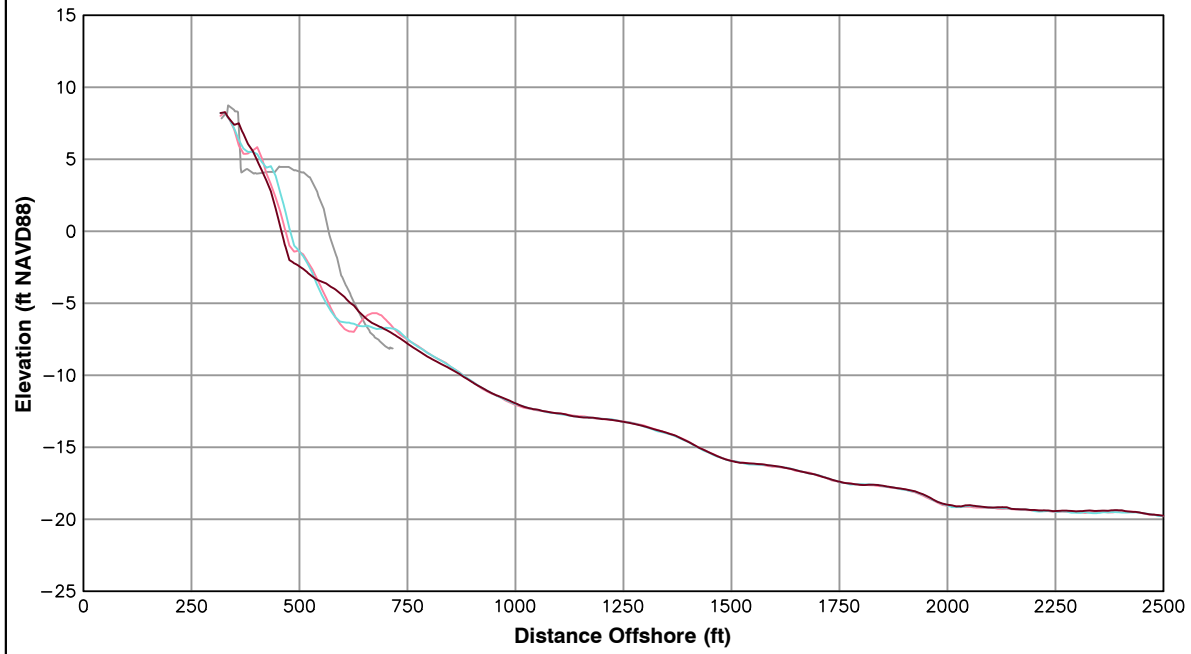
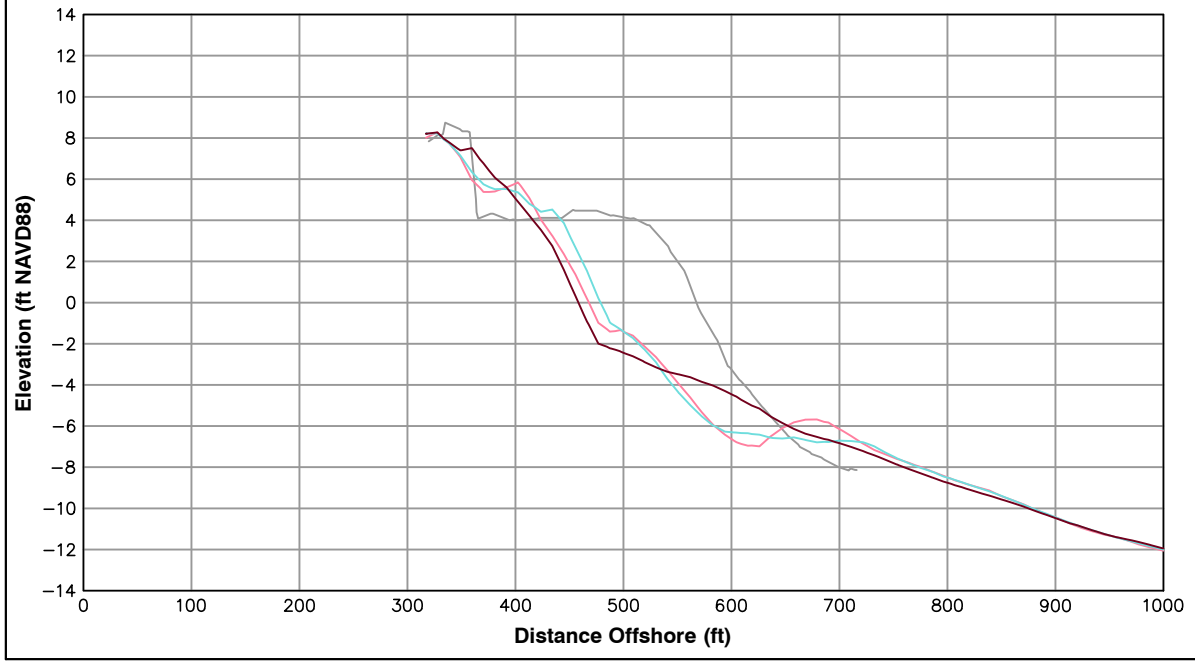
City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 71+62	April 2015 - March 2014	April 2015 - October 2014
Shoreline Change at MHW (0.98 ft NAVD88)	-8.29 ft/yr	-20.68 ft
Volume Change Above -15 ft NAVD88	0.00 cy/ft/yr	-0.87 cy/ft
Volume Change Above 0 ft NAVD88	-0.29 cy/ft/yr	-2.75 cy/ft

LEGEND:
- 2015 APR
- 2014 OCT
- 2014 MAR
- POST-FILL

Notes:
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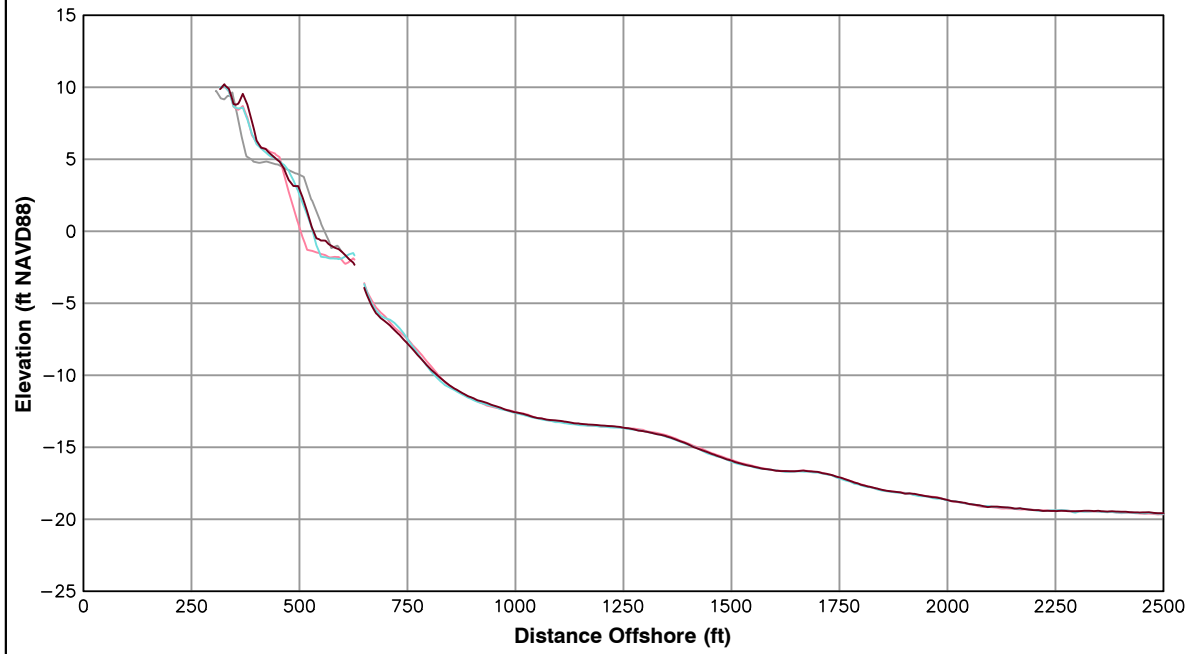
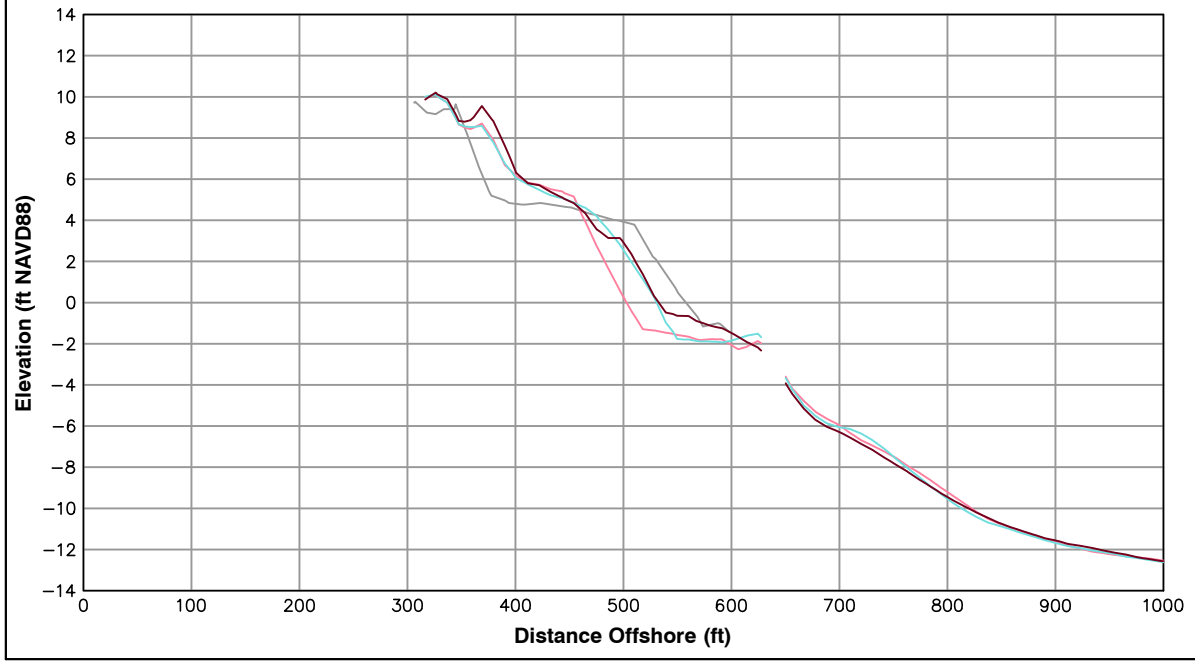
City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 73+62	April 2015 - March 2014	April 2015 - October 2014
Shoreline Change at MHW (0.98 ft NAVD88)	26.67 ft/yr	1.98 ft
Volume Change Above -15 ft NAVD88	6.11 cy/ft/yr	3.65 cy/ft
Volume Change Above 0 ft NAVD88	4.42 cy/ft/yr	1.55 cy/ft

LEGEND:
- 2015 APR
- 2014 OCT
- 2014 MAR
- POST-FILL

Notes:
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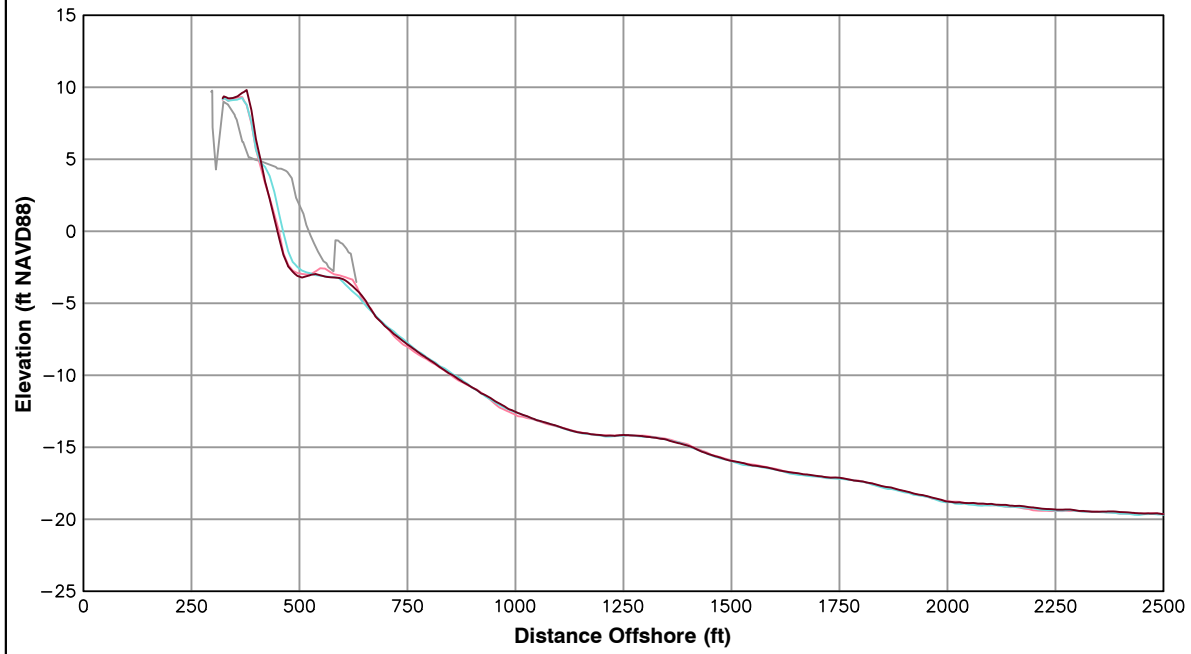
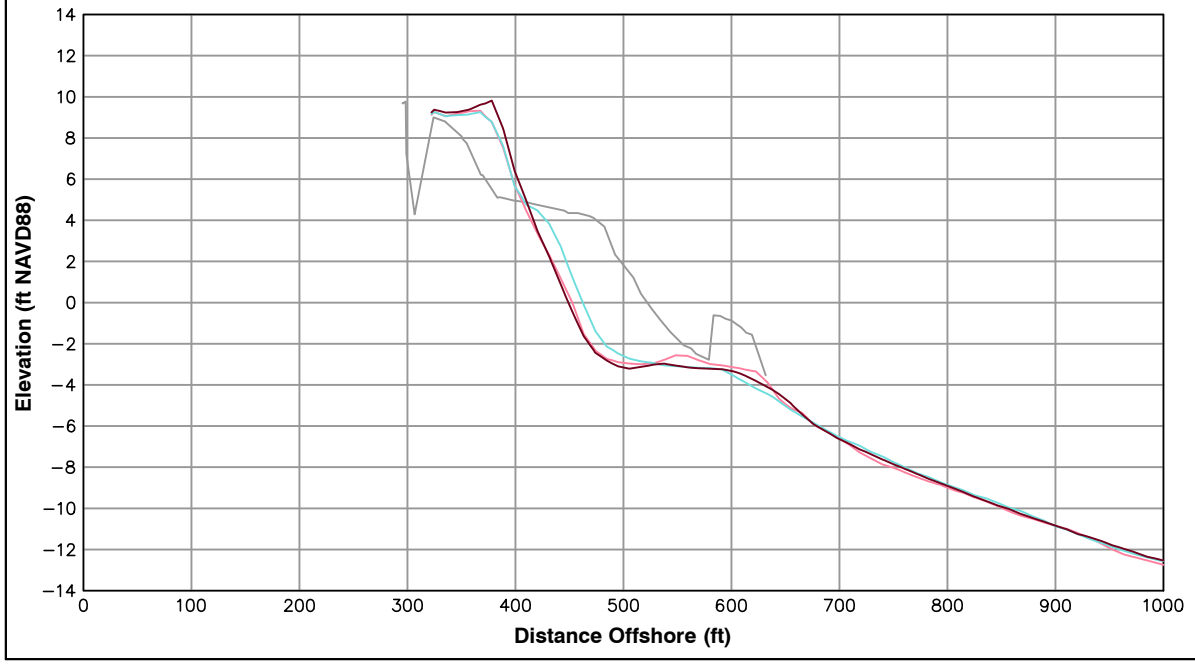
City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 75+62	April 2015 - March 2014	April 2015 - October 2014
Shoreline Change at MHW (0.98 ft NAVD88)	-2.28 ft/yr	-13.44 ft
Volume Change Above -15 ft NAVD88	0.89 cy/ft/yr	-0.79 cy/ft
Volume Change Above 0 ft NAVD88	1.26 cy/ft/yr	-0.79 cy/ft

LEGEND:
- 2015 APR
- 2014 OCT
- 2014 MAR
- POST-FILL

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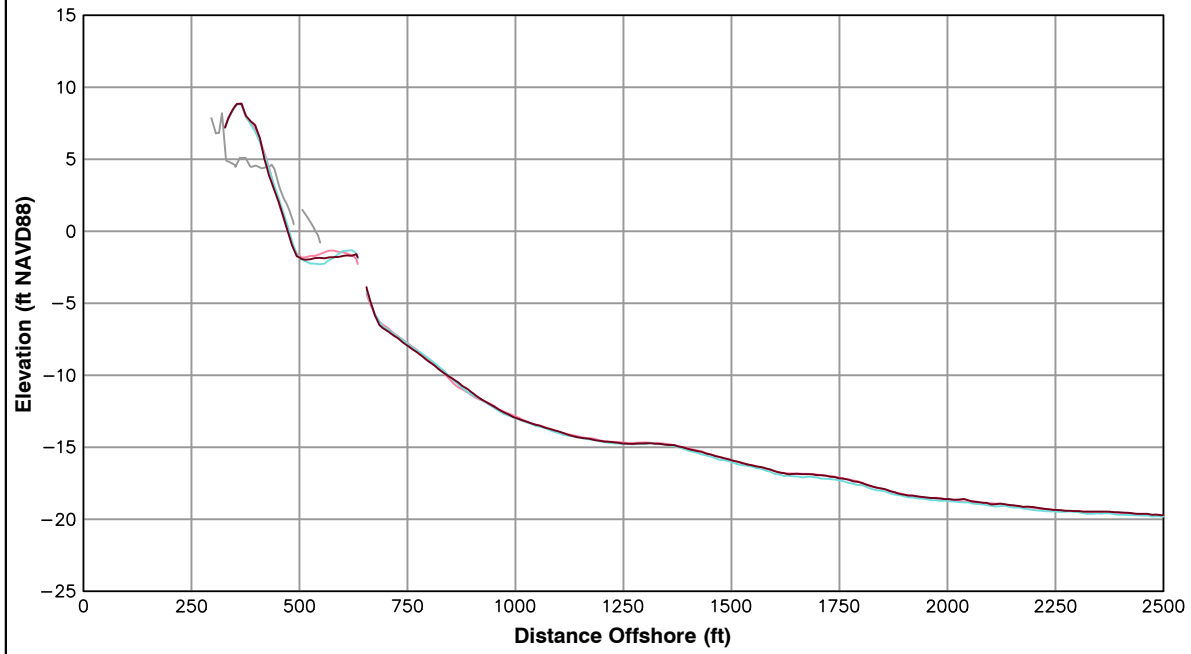
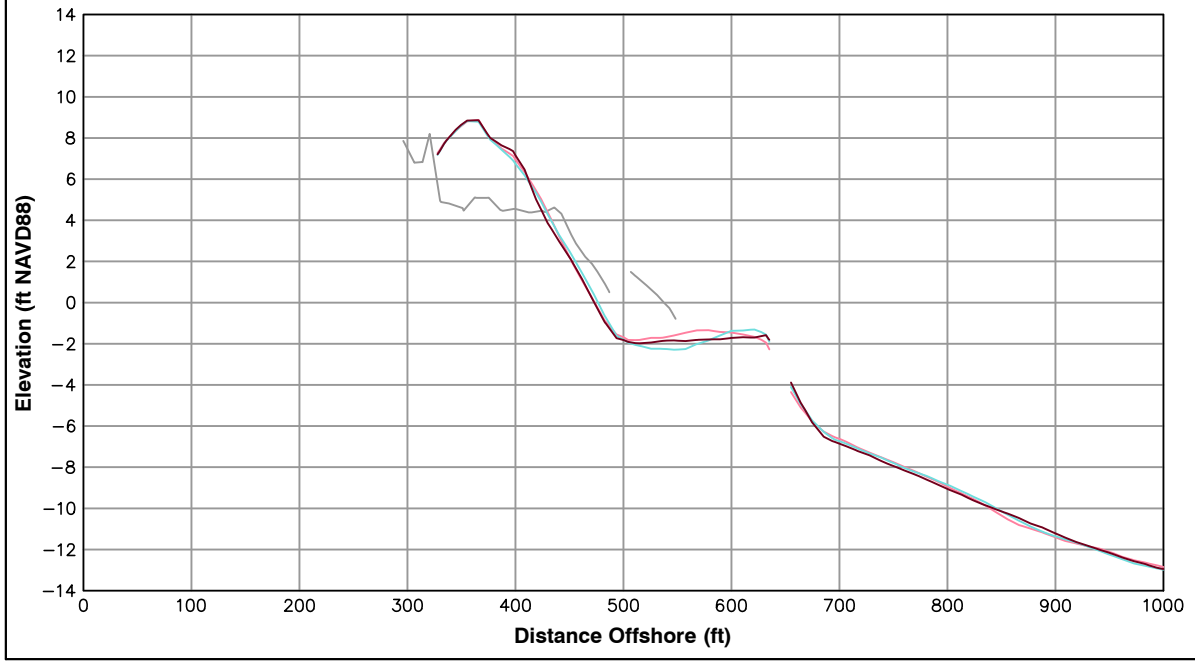
City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 77+62	April 2015 - March 2014	April 2015 - October 2014
Shoreline Change at MHW (0.98 ft NAVD88)	0.55 ft/yr	-3.38 ft
Volume Change Above -15 ft NAVD88	-1.95 cy/ft/yr	0.01 cy/ft
Volume Change Above 0 ft NAVD88	-0.21 cy/ft/yr	-0.29 cy/ft

LEGEND:
- 2015 APR
- 2014 OCT
- 2014 MAR
- POST-FILL

Notes:
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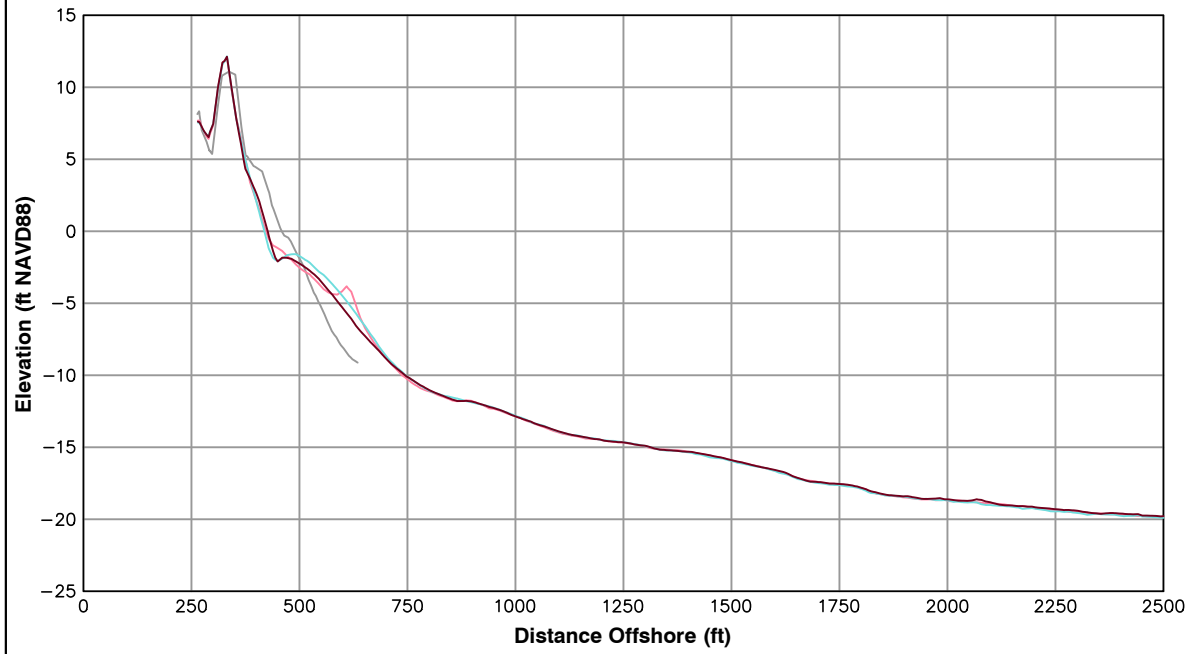

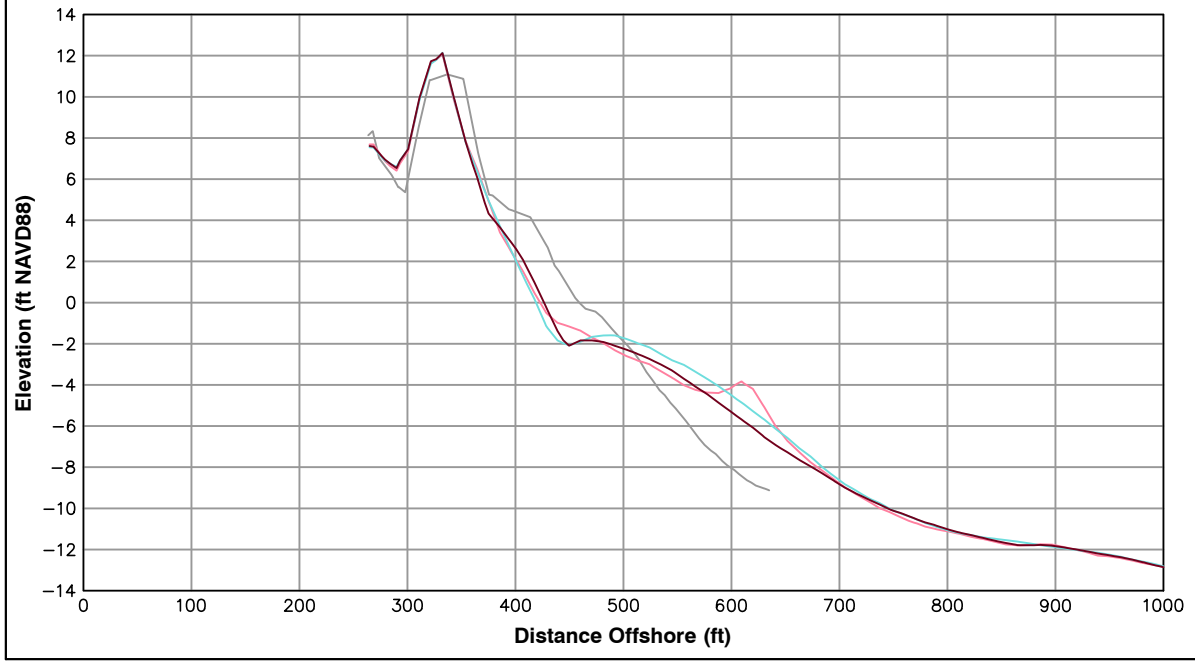

Survey Transect 79+62	April 2015 - March 2014	April 2015 - October 2014
Shoreline Change at MHW (0.98 ft NAVD88)	4.70 ft/yr	7.59 ft
Volume Change Above -15 ft NAVD88	-1.59 cy/ft/yr	-4.50 cy/ft
Volume Change Above 0 ft NAVD88	0.44 cy/ft/yr	0.51 cy/ft

LEGEND:
- 2015 APR
- 2014 OCT
- 2014 MAR
- POST-FILL

Notes:
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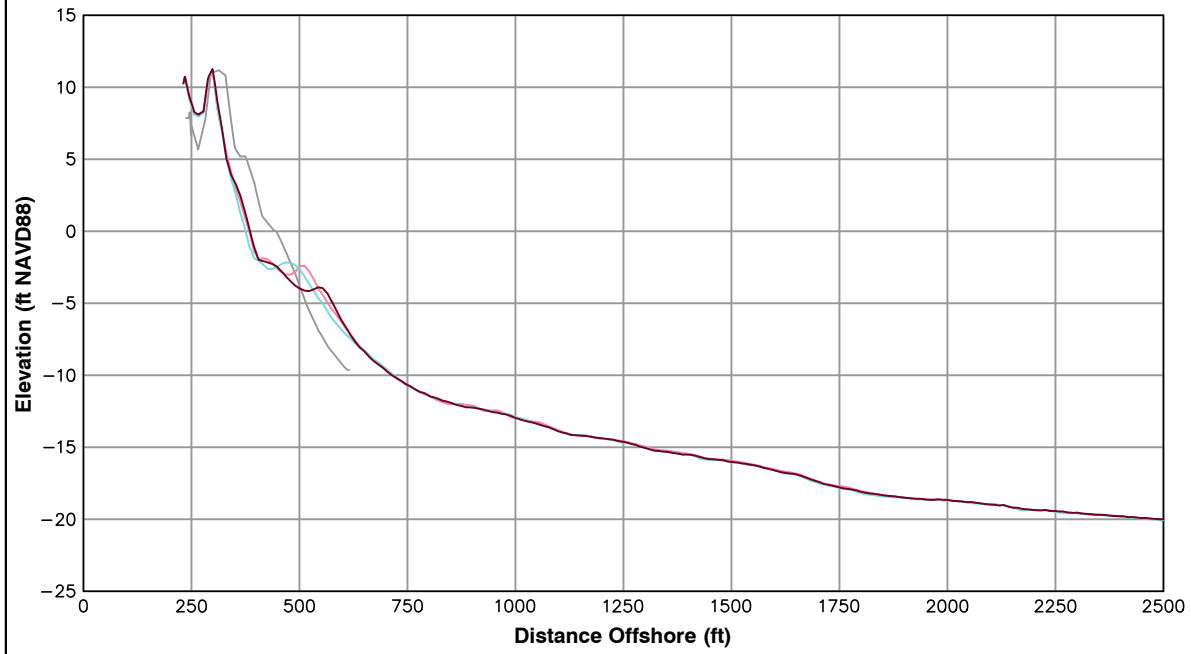

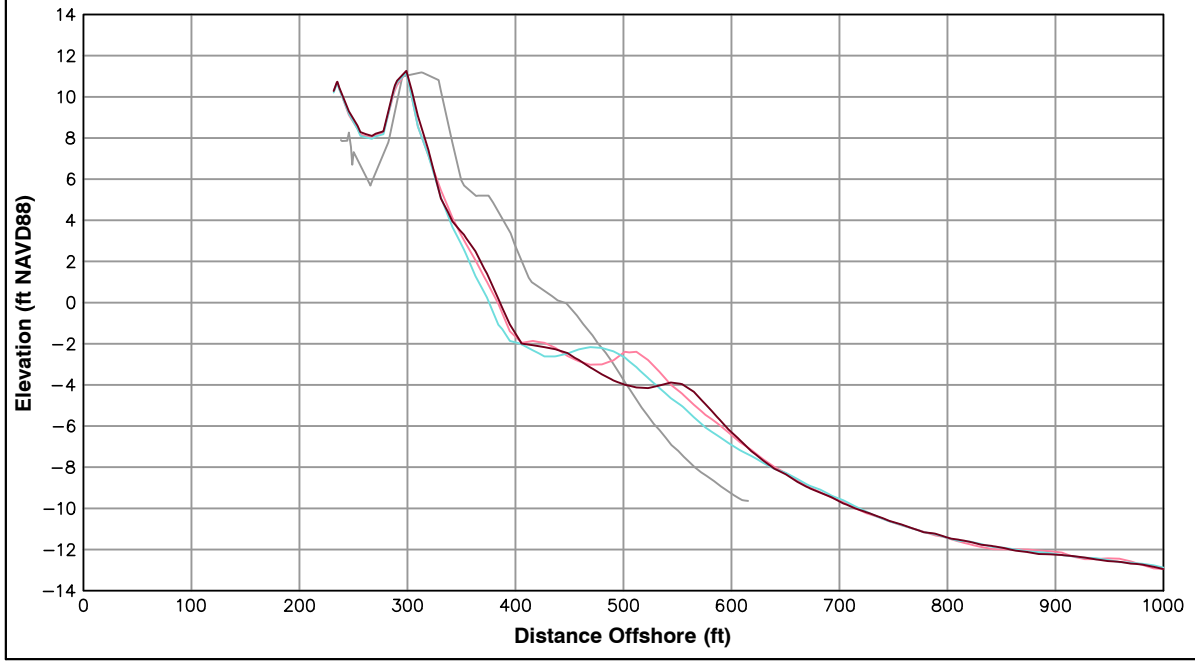

Survey Transect 81+62	April 2015 - March 2014	April 2015 - October 2014
Shoreline Change at MHW (0.98 ft NAVD88)	3.23 ft/yr	11.22 ft
Volume Change Above -15 ft NAVD88	-1.54 cy/ft/yr	2.50 cy/ft
Volume Change Above 0 ft NAVD88	0.80 cy/ft/yr	2.01 cy/ft

LEGEND:
- 2015 APR
- 2014 OCT
- 2014 MAR
- POST-FILL

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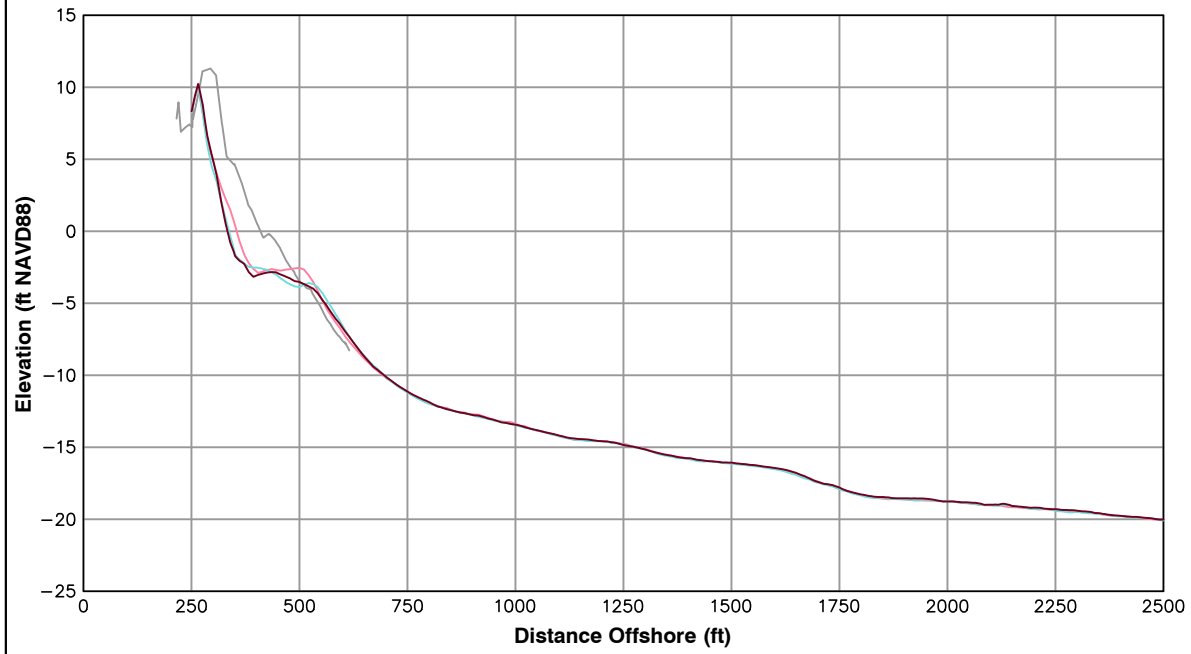
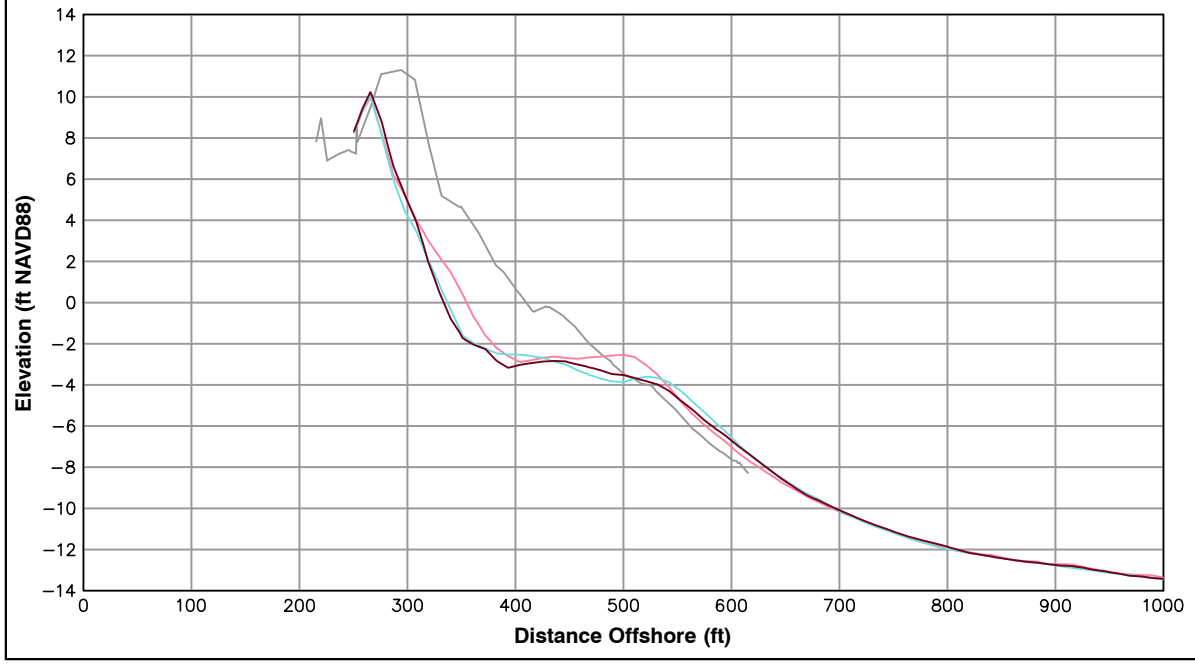
City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 83+62	April 2015 - March 2014	April 2015 - October 2014
Shoreline Change at MHW (0.98 ft NAVD88)	-17.41 ft/yr	-2.35 ft
Volume Change Above -15 ft NAVD88	-4.66 cy/ft/yr	0.28 cy/ft
Volume Change Above 0 ft NAVD88	-1.22 cy/ft/yr	0.93 cy/ft

LEGEND:
- 2015 APR
- 2014 OCT
- 2014 MAR
- POST-FILL

Notes:
1. Stationing From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
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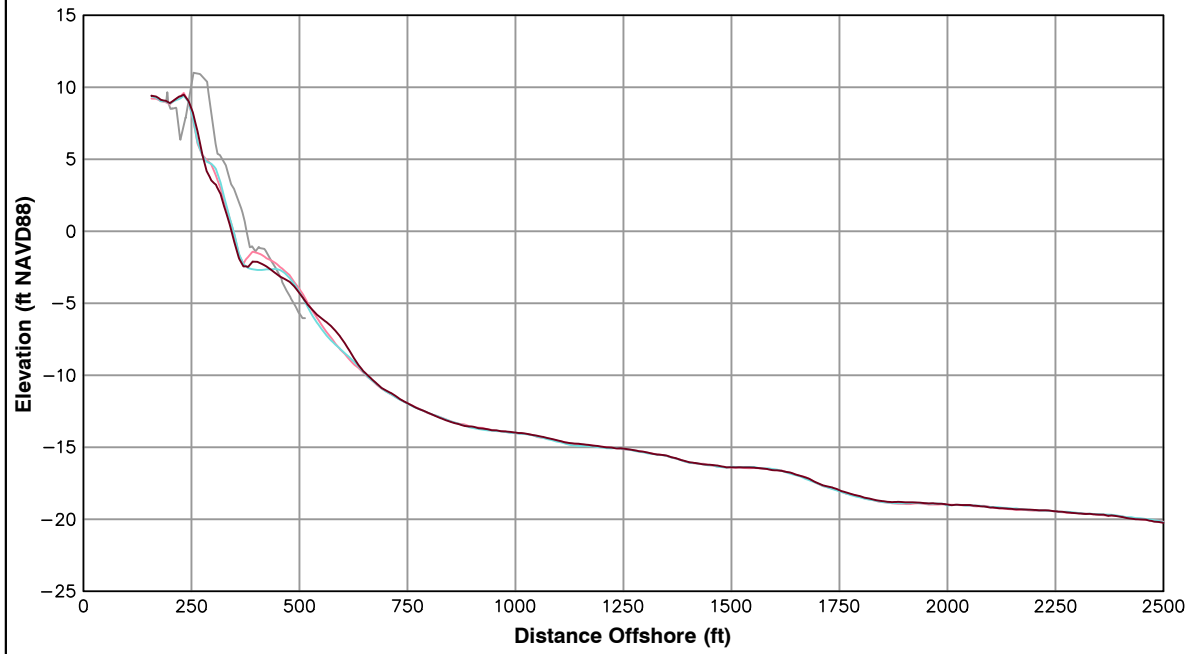
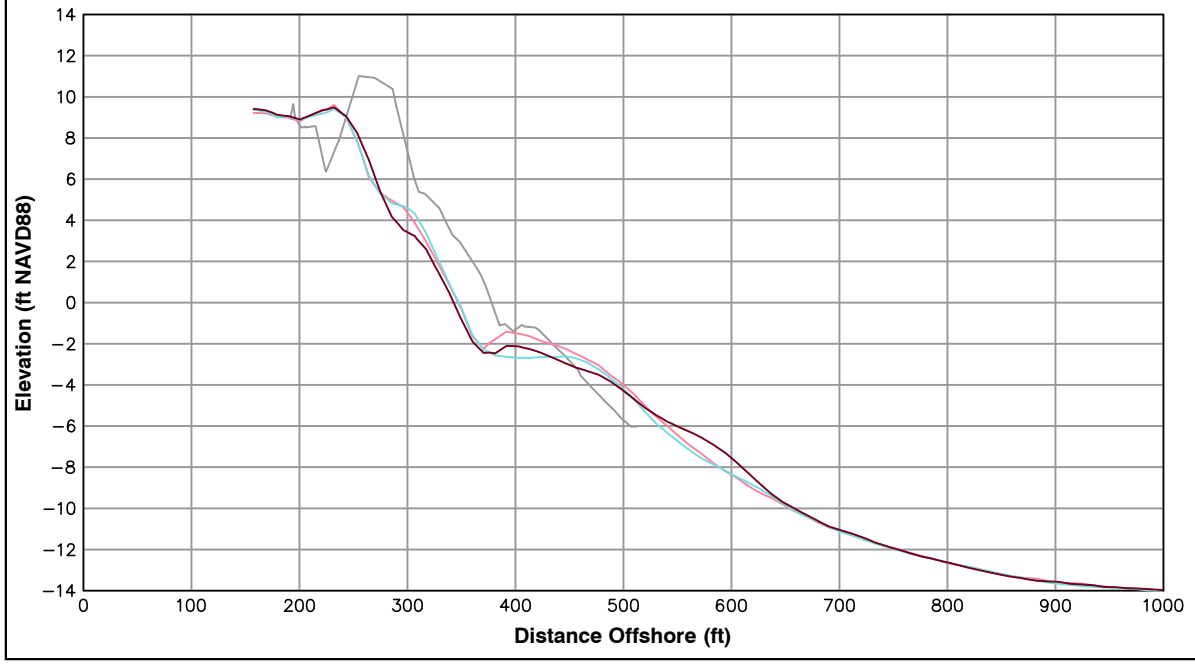
5. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward And Seaward Of The Breakwater.

City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 85+62	April 2015 - March 2014	April 2015 - October 2014
Shoreline Change at MHW (0.98 ft NAVD88)	-3.80 ft/yr	-4.61 ft
Volume Change Above -15 ft NAVD88	-1.10 cy/ft/yr	2.29 cy/ft
Volume Change Above 0 ft NAVD88	-0.70 cy/ft/yr	-1.17 cy/ft

LEGEND:
- 2015 APR
- 2014 OCT
- 2014 MAR
- POST-FILL

Notes:
1. Stationing From West To East At Varying Intervals.
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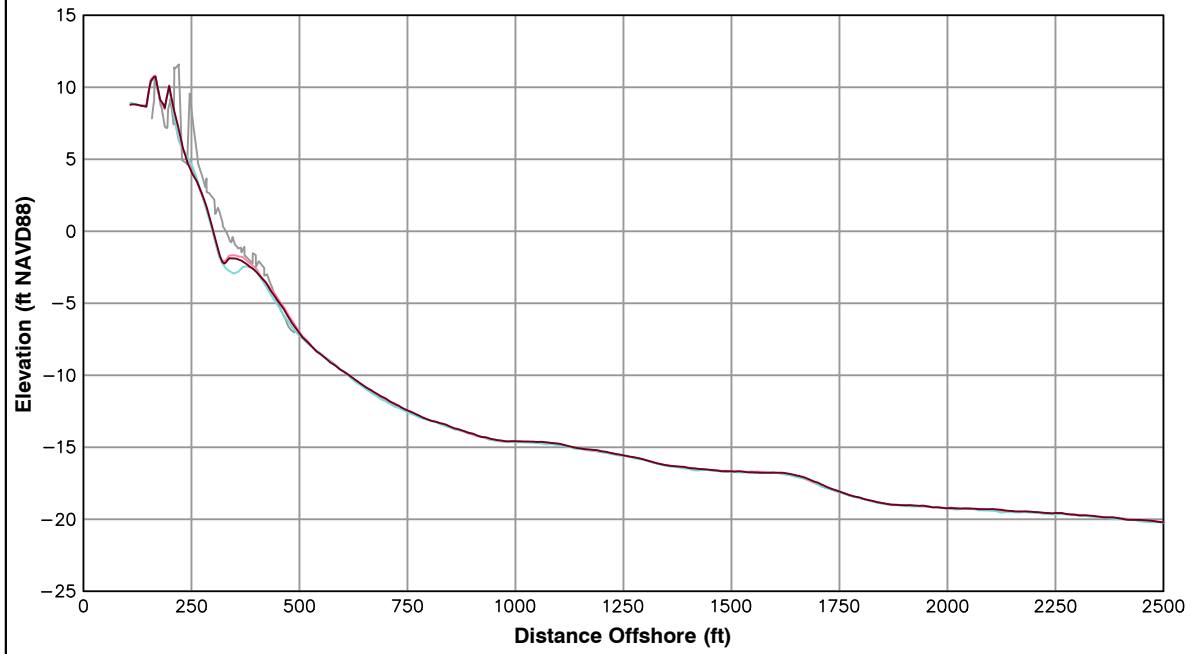
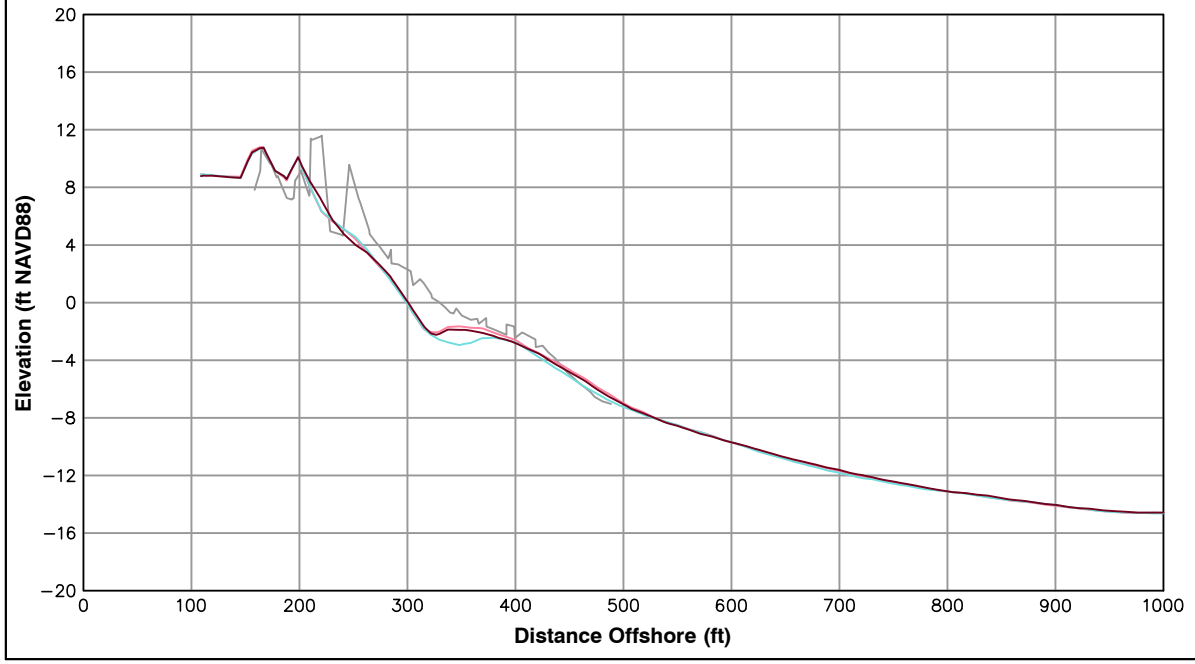
City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 87+62	April 2015 - March 2014	April 2015 - October 2014
Shoreline Change at MHW (0.98 ft NAVD88)	0.79 ft/yr	2.07 ft
Volume Change Above -15 ft NAVD88	-0.04 cy/ft/yr	4.31 cy/ft
Volume Change Above 0 ft NAVD88	0.24 cy/ft/yr	0.20 cy/ft

LEGEND:
- 2015 APR
- 2014 OCT
- 2014 MAR
- POST-FILL

Notes:
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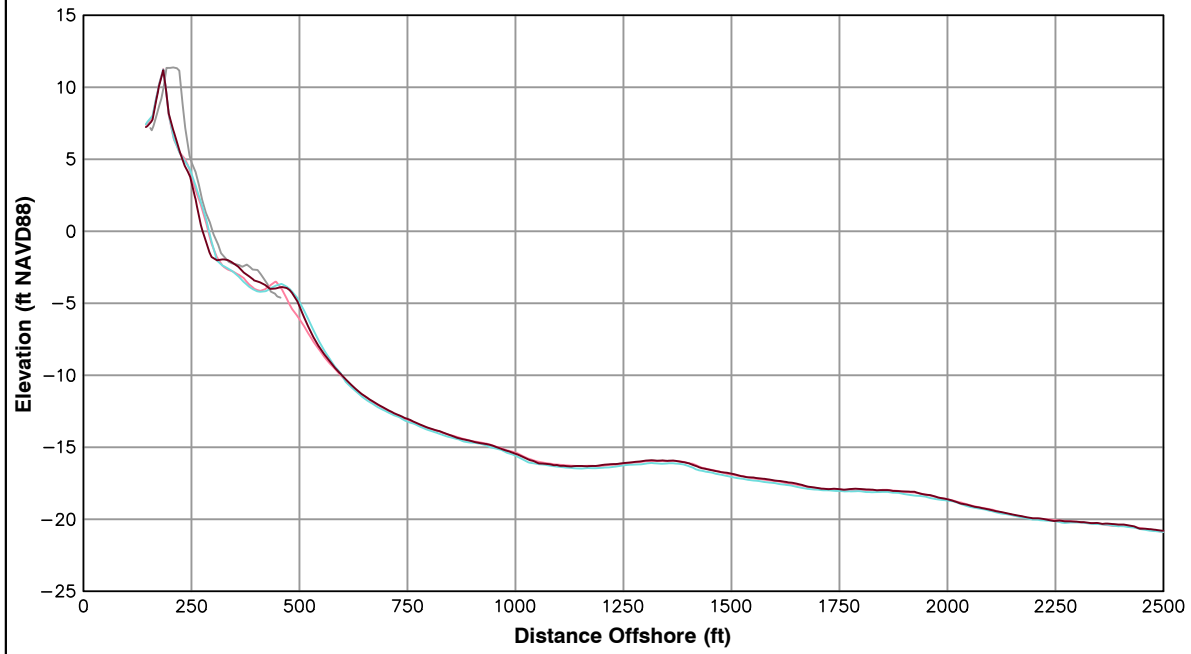
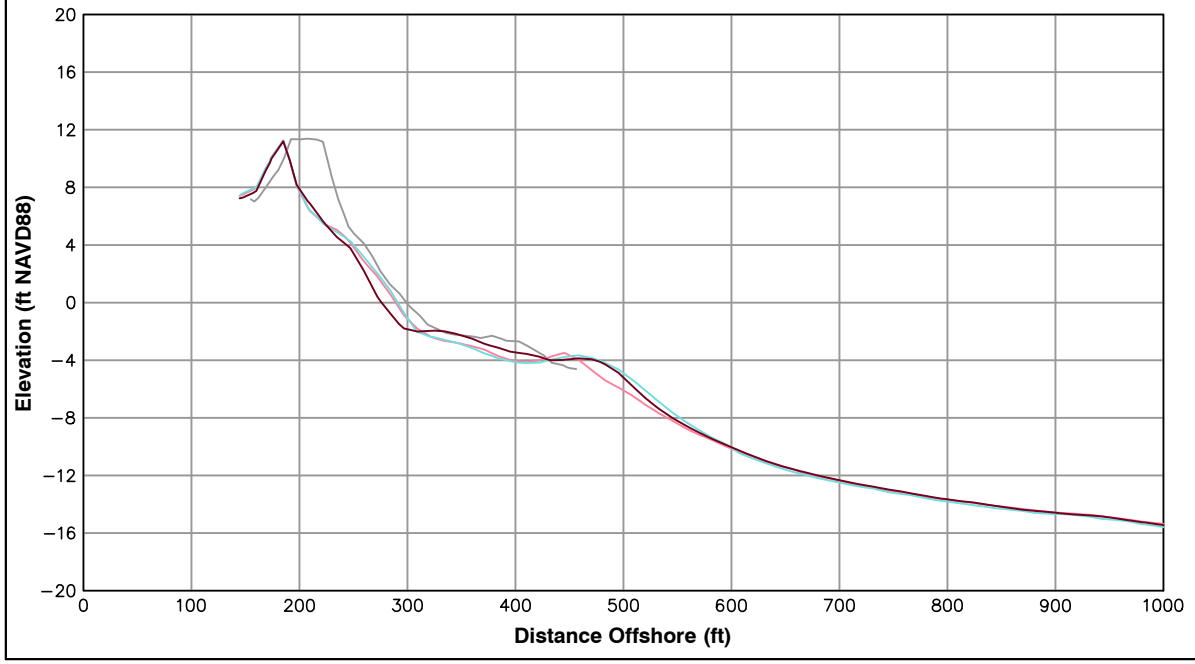
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 93+41	April 2015 - March 2014	April 2015 - October 2014
Shoreline Change at MHW (0.98 ft NAVD88)	-10.99 ft/yr	-14.50 ft
Volume Change Above -15 ft NAVD88	1.91 cy/ft/yr	0.09 cy/ft
Volume Change Above 0 ft NAVD88	-1.39 cy/ft/yr	-1.92 cy/ft

LEGEND:
- 2015 APR
- 2014 OCT
- 2014 MAR
- POST-FILL

Notes:
1. Stationing From West To East At Varying Intervals.
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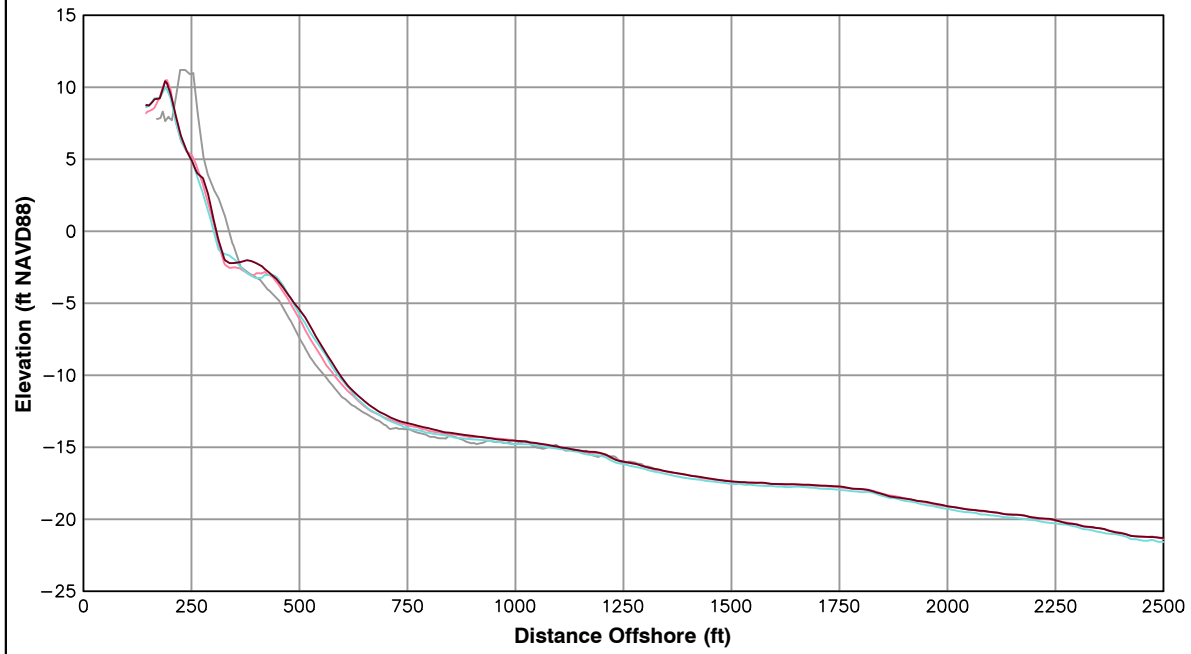
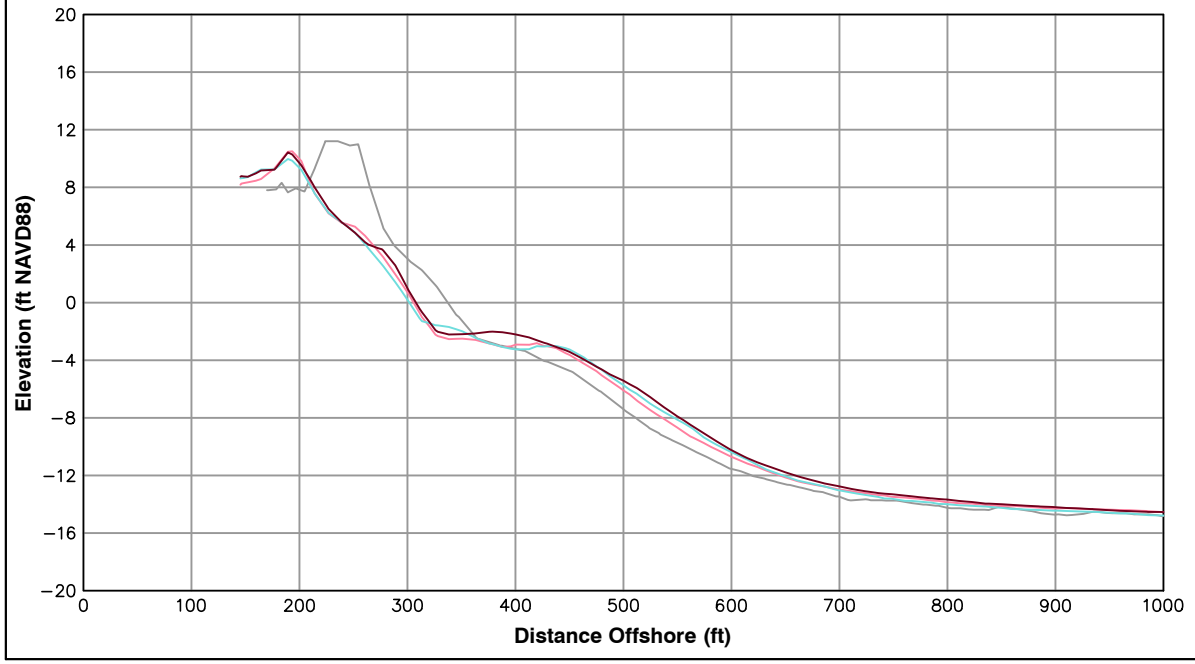
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 103+08	April 2015 - March 2014	April 2015 - October 2014
Shoreline Change at MHW (0.98 ft NAVD88)	2.25 ft/yr	7.25 ft
Volume Change Above -15 ft NAVD88	8.10 cy/ft/yr	9.13 cy/ft
Volume Change Above 0 ft NAVD88	0.79 cy/ft/yr	2.07 cy/ft

LEGEND:
- 2015 APR
- 2014 OCT
- 2014 MAR
- POST-FILL

Notes:
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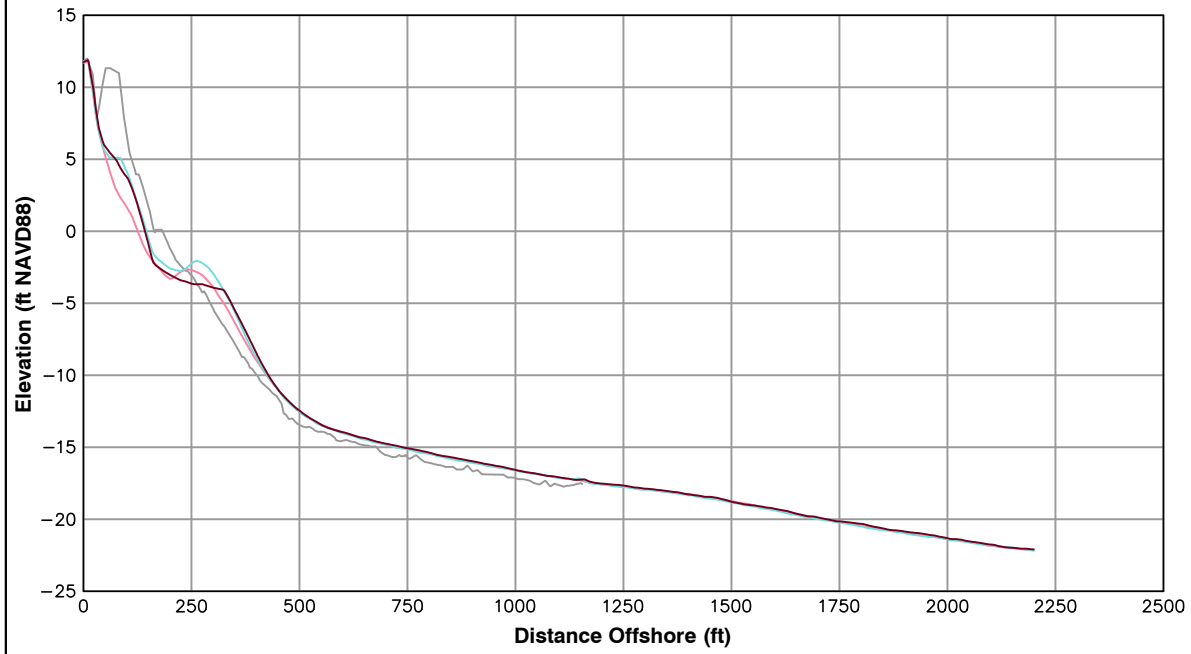
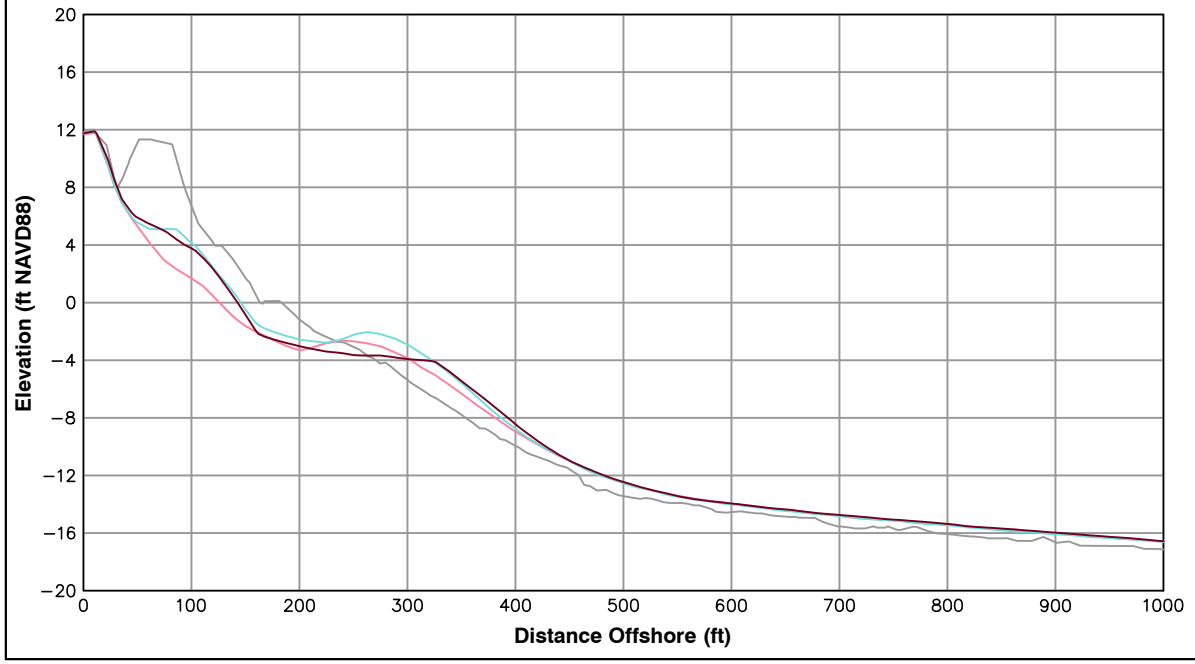
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 120+93	April 2015 - March 2014	April 2015 - October 2014
Shoreline Change at MHW (0.98 ft NAVD88)	18.78 ft/yr	-2.74 ft
Volume Change Above -15 ft NAVD88	7.82 cy/ft/yr	-3.90 cy/ft
Volume Change Above 0 ft NAVD88	5.66 cy/ft/yr	-0.18 cy/ft

LEGEND:
- 2015 APR
- 2014 OCT
- 2014 MAR
- POST-FILL

Notes:
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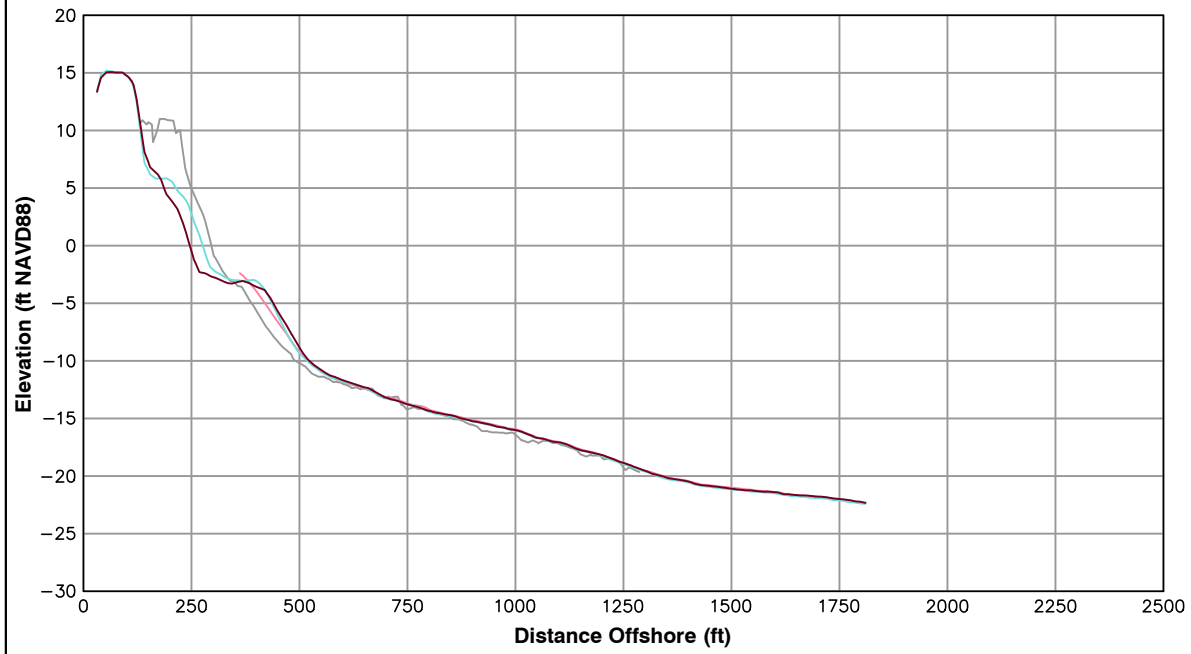
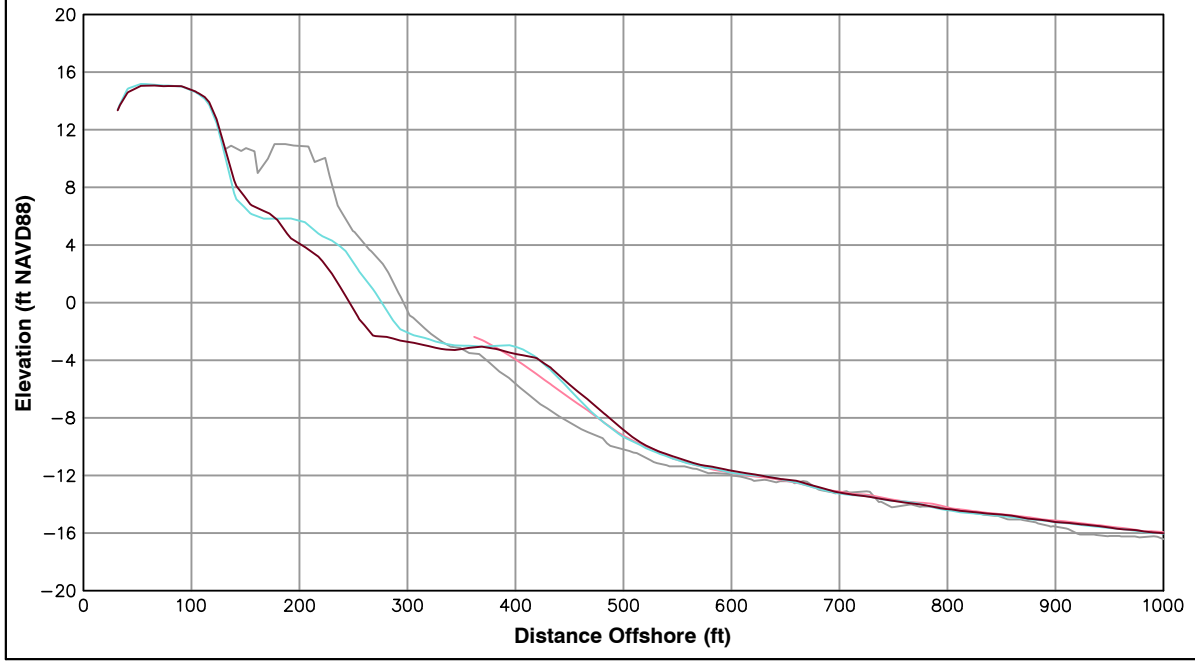
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 129+17	April 2015 - March 2014	April 2015 - October 2014
Shoreline Change at MHW (0.98 ft NAVD88)	- ft/yr	-29.04 ft
Volume Change Above -15 ft NAVD88	- cy/ft/yr	-6.97 cy/ft
Volume Change Above 0 ft NAVD88	- cy/ft/yr	-5.12 cy/ft

LEGEND:
- 2015 APR
- 2014 OCT
- 2014 MAR
- POST-FILL

Notes:
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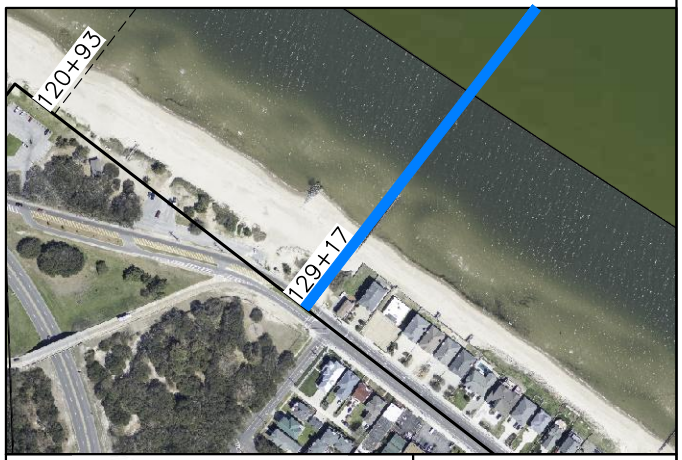

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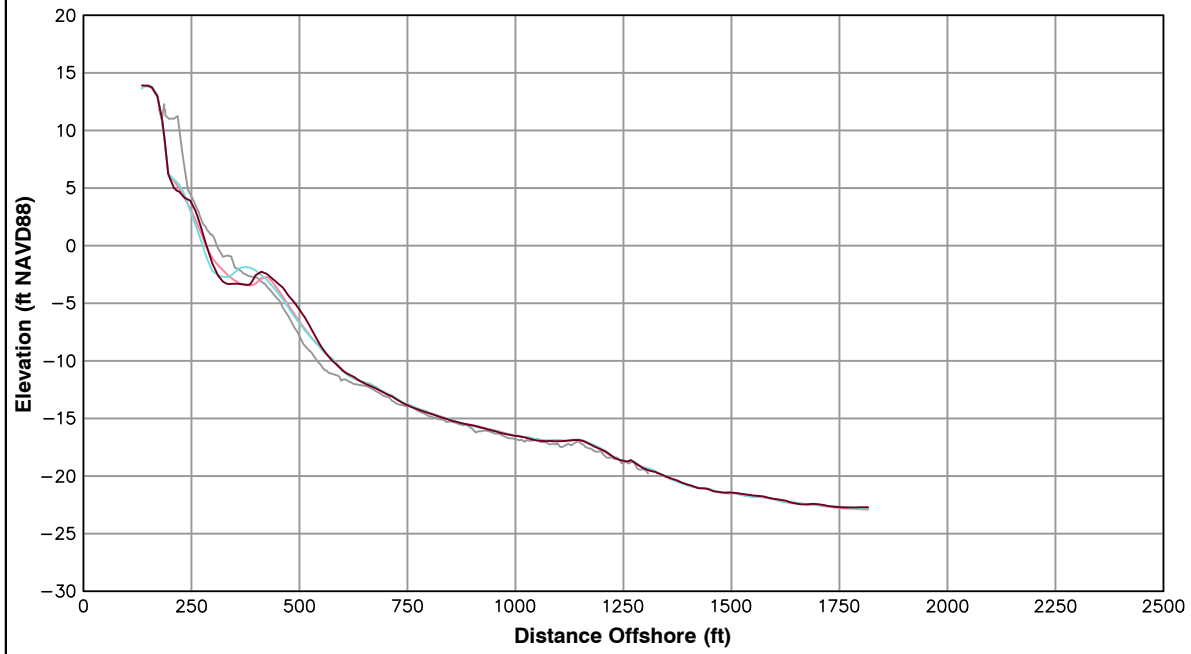
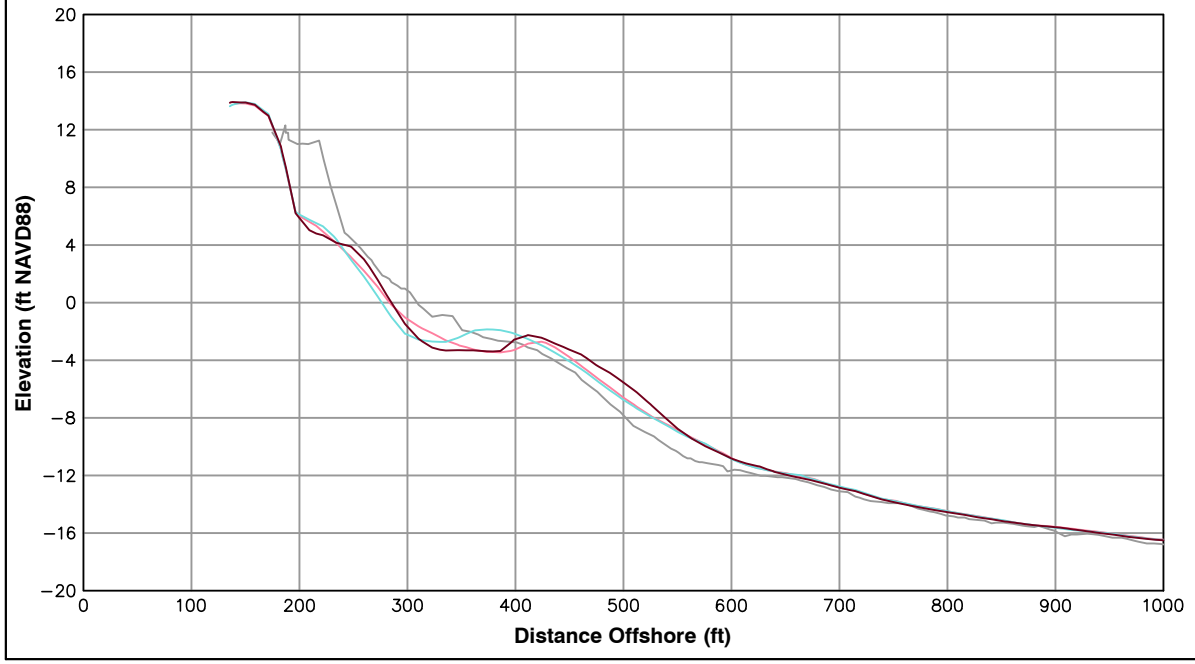
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 141+98	April 2015 - March 2014	April 2015 - October 2014
Shoreline Change at MHW (0.98 ft NAVD88)	3.27 ft/yr	9.76 ft
Volume Change Above -15 ft NAVD88	2.40 cy/ft/yr	2.32 cy/ft
Volume Change Above 0 ft NAVD88	0.67 cy/ft/yr	0.87 cy/ft

LEGEND:
- 2015 APR
- 2014 OCT
- 2014 MAR
- POST-FILL

Notes:
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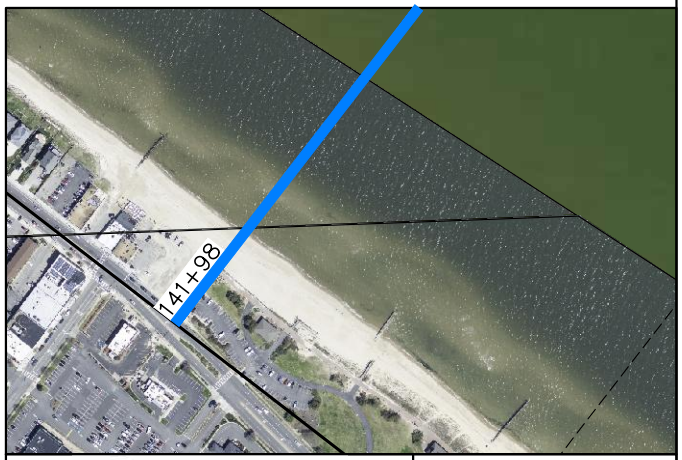

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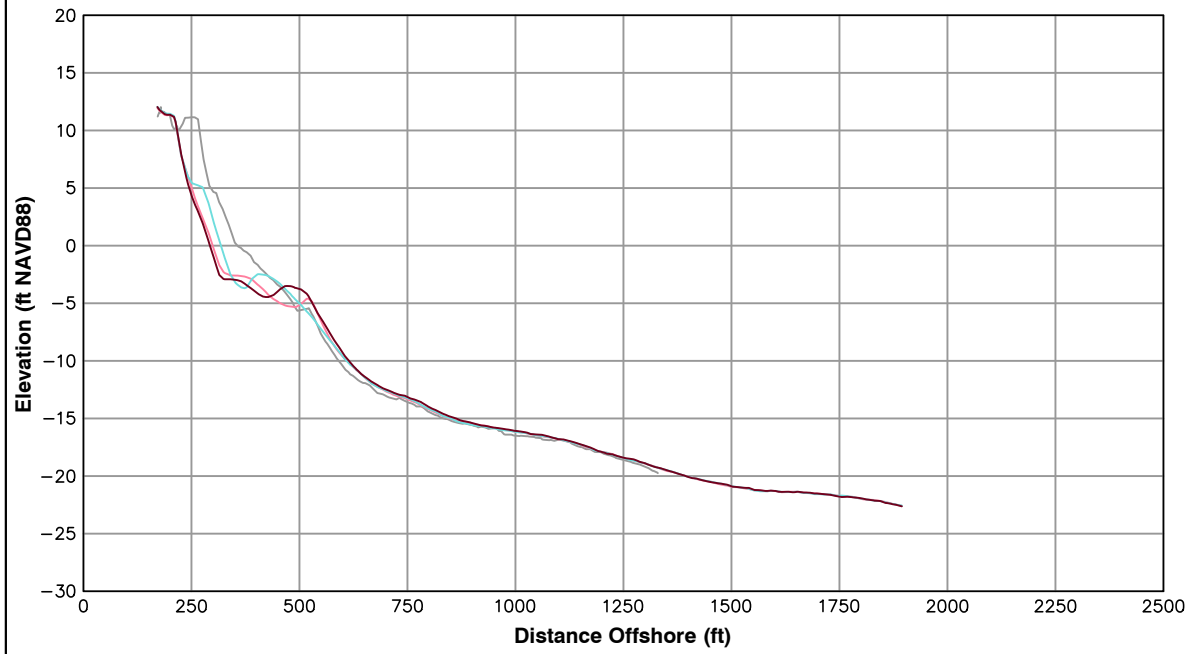
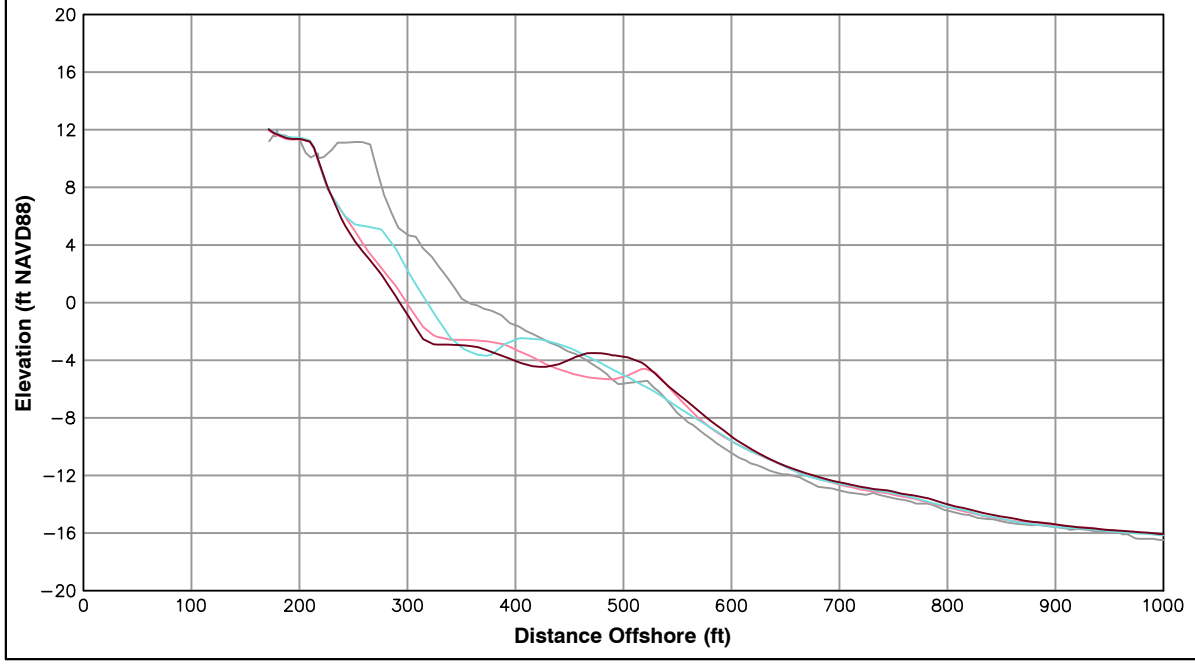
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 152+01	April 2015 - March 2014	April 2015 - October 2014
Shoreline Change at MHW (0.98 ft NAVD88)	-5.82 ft/yr	-25.69 ft
Volume Change Above -15 ft NAVD88	1.97 cy/ft/yr	-6.48 cy/ft
Volume Change Above 0 ft NAVD88	-1.10 cy/ft/yr	-6.04 cy/ft

LEGEND:
- 2015 APR
- 2014 OCT
- 2014 MAR
- POST-FILL

Notes:
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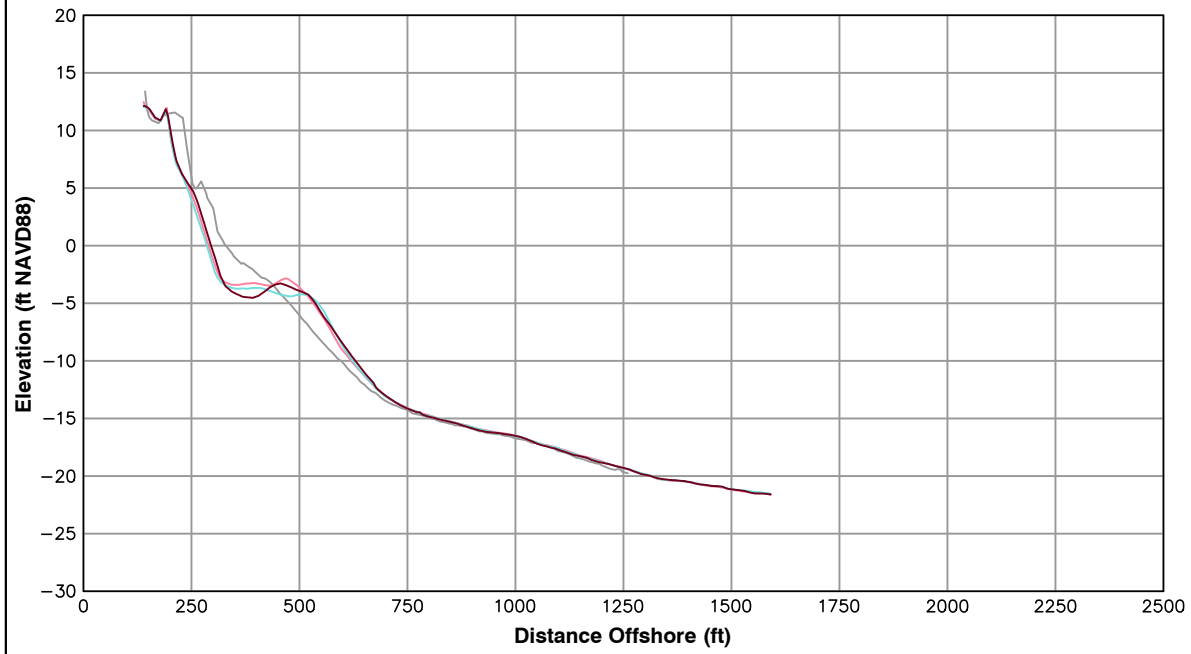
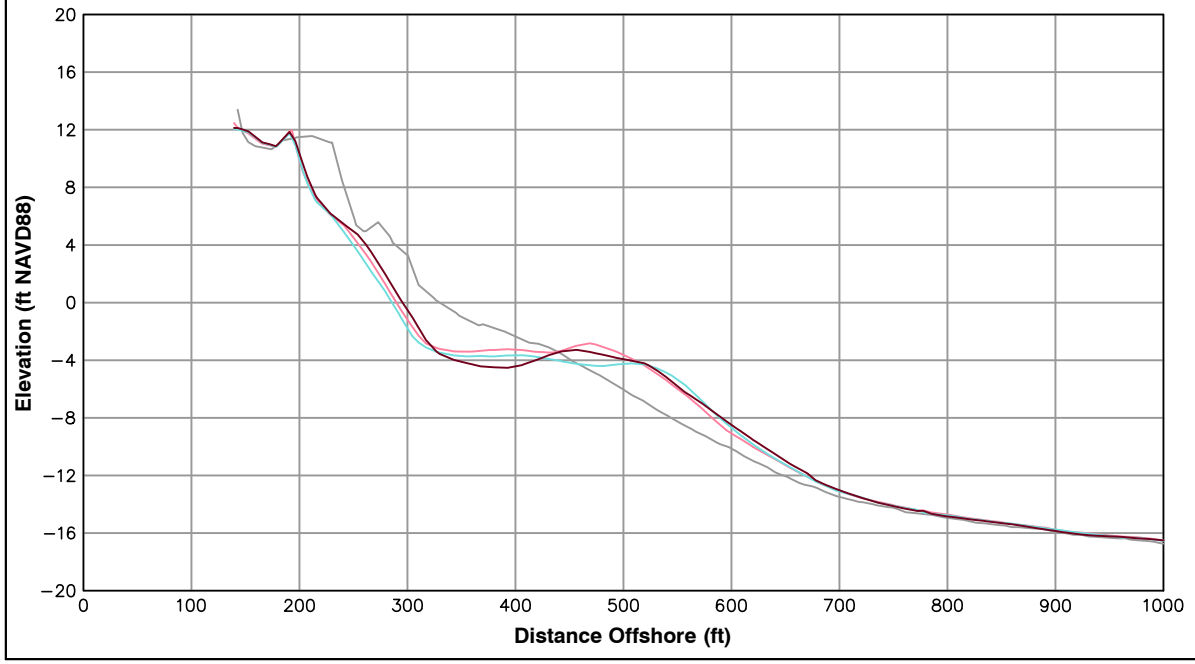
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 163+49	April 2015 - March 2014	April 2015 - October 2014
Shoreline Change at MHW (0.98 ft NAVD88)	5.22 ft/yr	9.93 ft
Volume Change Above -15 ft NAVD88	-0.21 cy/ft/yr	4.35 cy/ft
Volume Change Above 0 ft NAVD88	1.47 cy/ft/yr	2.80 cy/ft

LEGEND:
- 2015 APR
- 2014 OCT
- 2014 MAR
- POST-FILL

Notes:
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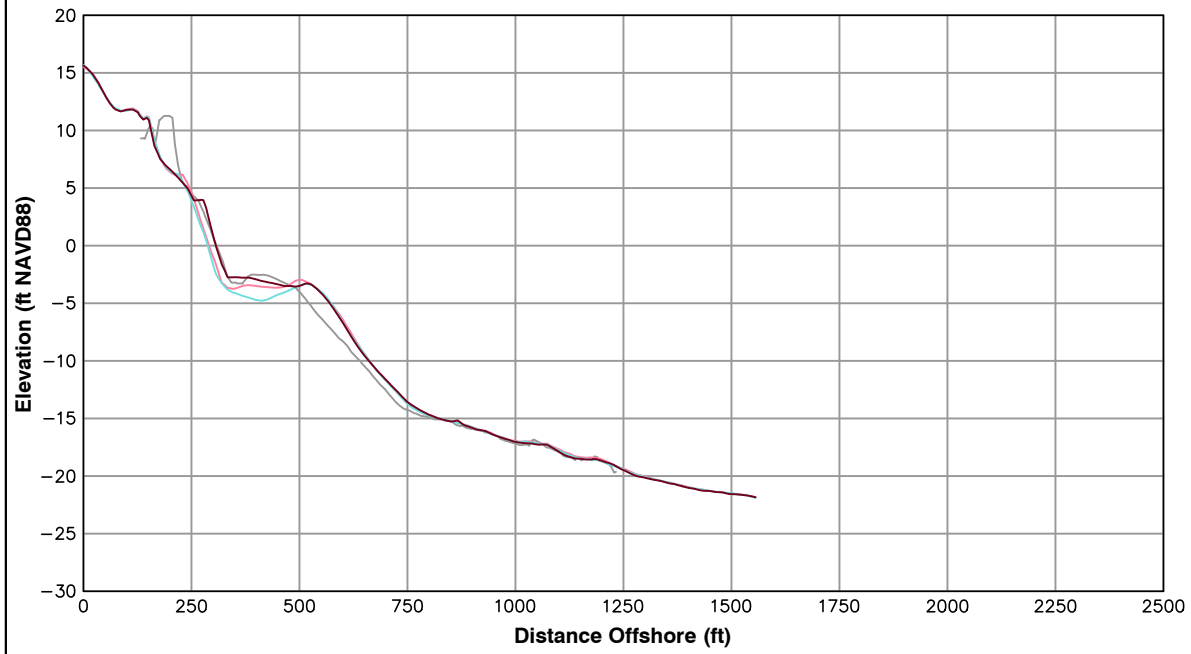
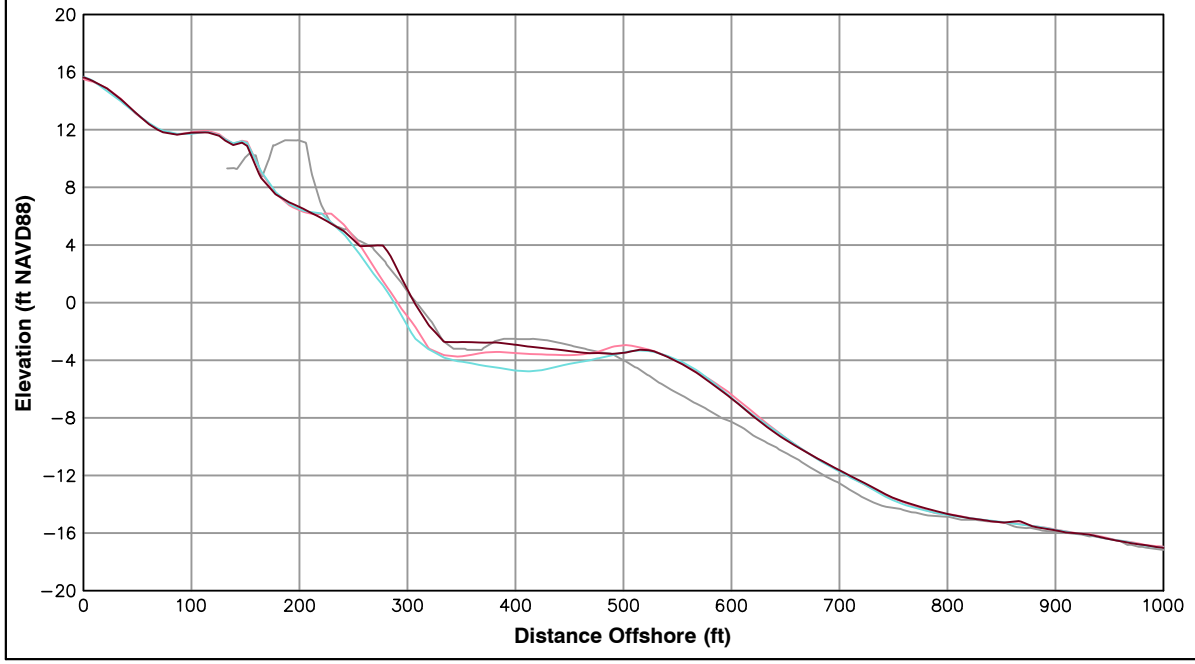
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 169+63	April 2015 - March 2014	April 2015 - October 2014
Shoreline Change at MHW (0.98 ft NAVD88)	15.99 ft/yr	20.18 ft
Volume Change Above -15 ft NAVD88	5.08 cy/ft/yr	13.00 cy/ft
Volume Change Above 0 ft NAVD88	1.72 cy/ft/yr	3.15 cy/ft

LEGEND:
- 2015 APR
- 2014 OCT
- 2014 MAR
- POST-FILL

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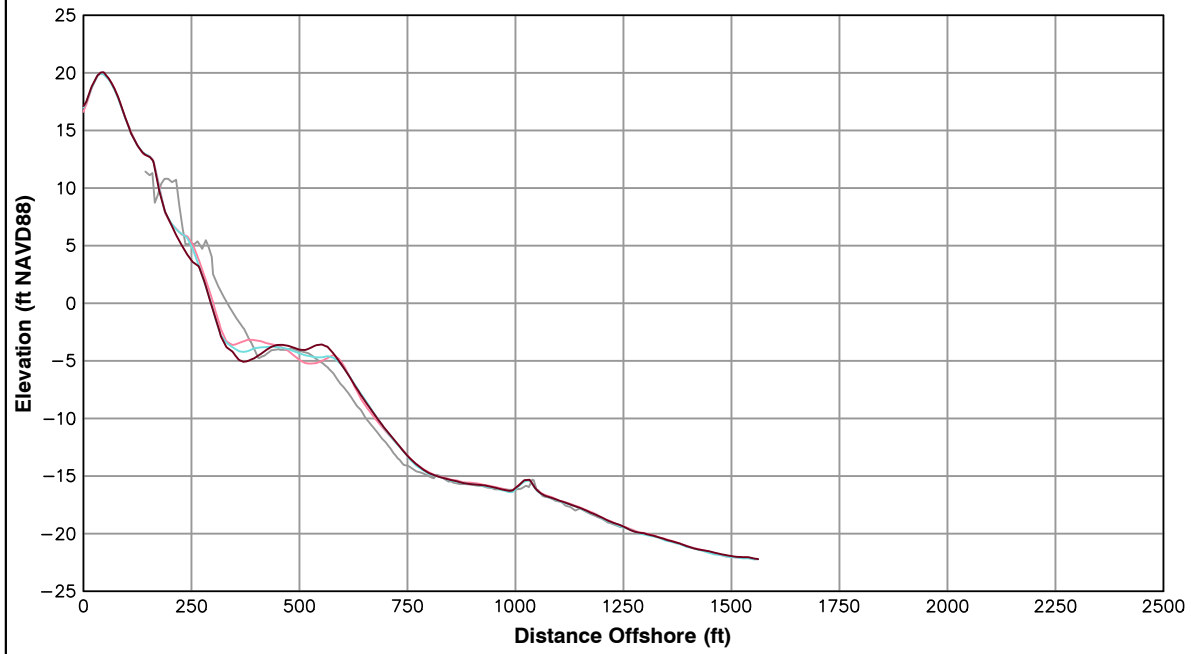
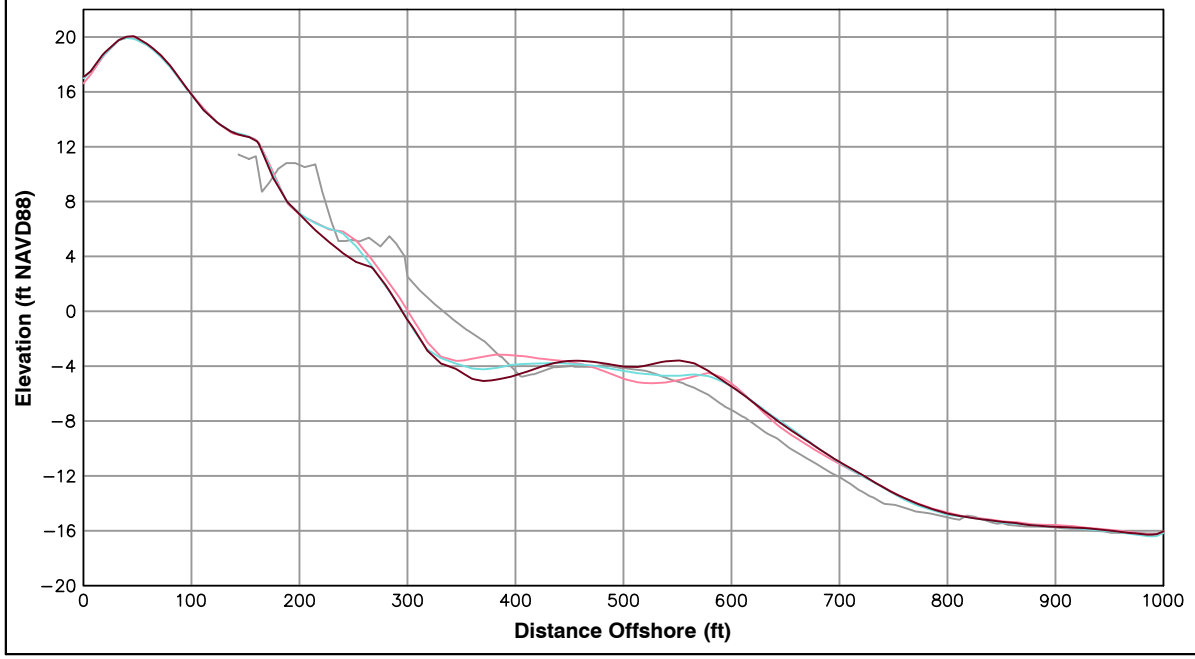
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 171+63	April 2015 - March 2014	April 2015 - October 2014
Shoreline Change at MHW (0.98 ft NAVD88)	-4.95 ft/yr	-0.10 ft
Volume Change Above -15 ft NAVD88	-3.10 cy/ft/yr	-1.16 cy/ft
Volume Change Above 0 ft NAVD88	-2.71 cy/ft/yr	-1.80 cy/ft

LEGEND:
- 2015 APR
- 2014 OCT
- 2014 MAR
- POST-FILL

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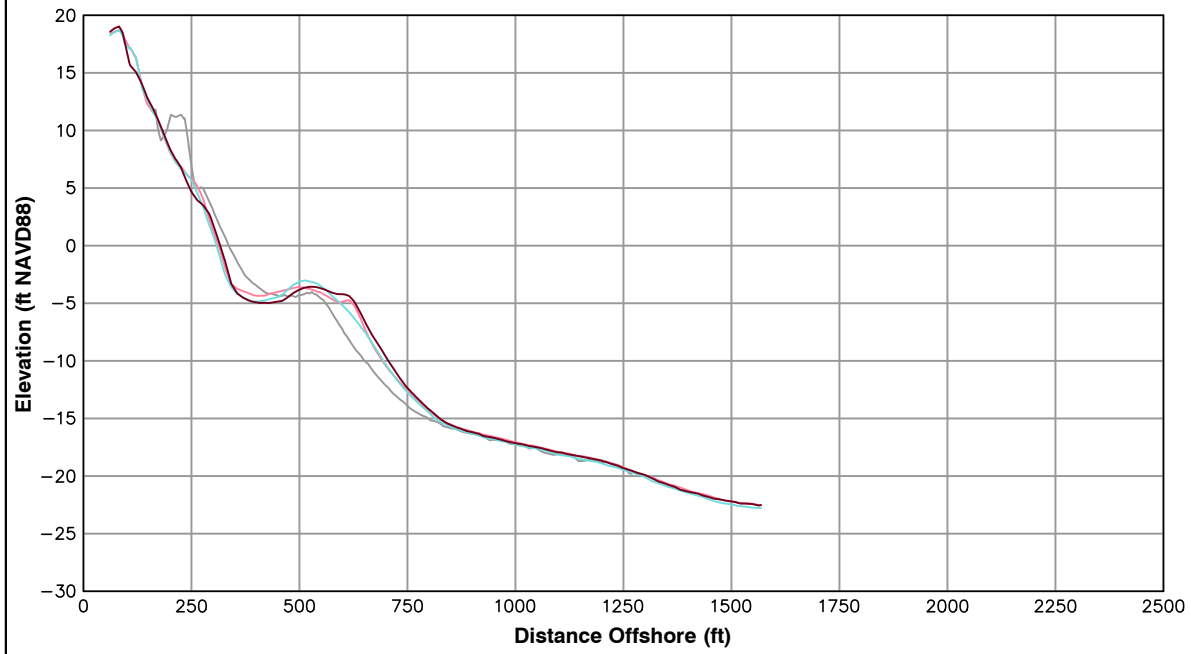
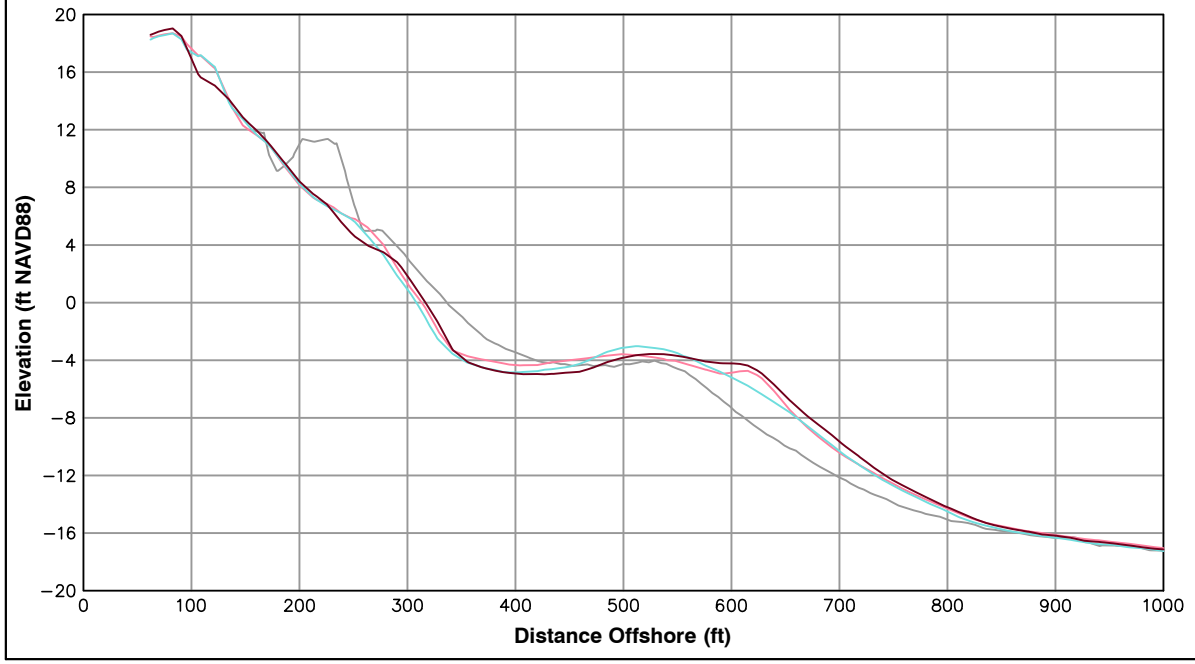
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 173+63	April 2015 - March 2014	April 2015 - October 2014
Shoreline Change at MHW (0.98 ft NAVD88)	4.32 ft/yr	8.66 ft
Volume Change Above -15 ft NAVD88	0.32 cy/ft/yr	4.41 cy/ft
Volume Change Above 0 ft NAVD88	-1.38 cy/ft/yr	-0.26 cy/ft

LEGEND:
- 2015 APR
- 2014 OCT
- 2014 MAR
- POST-FILL

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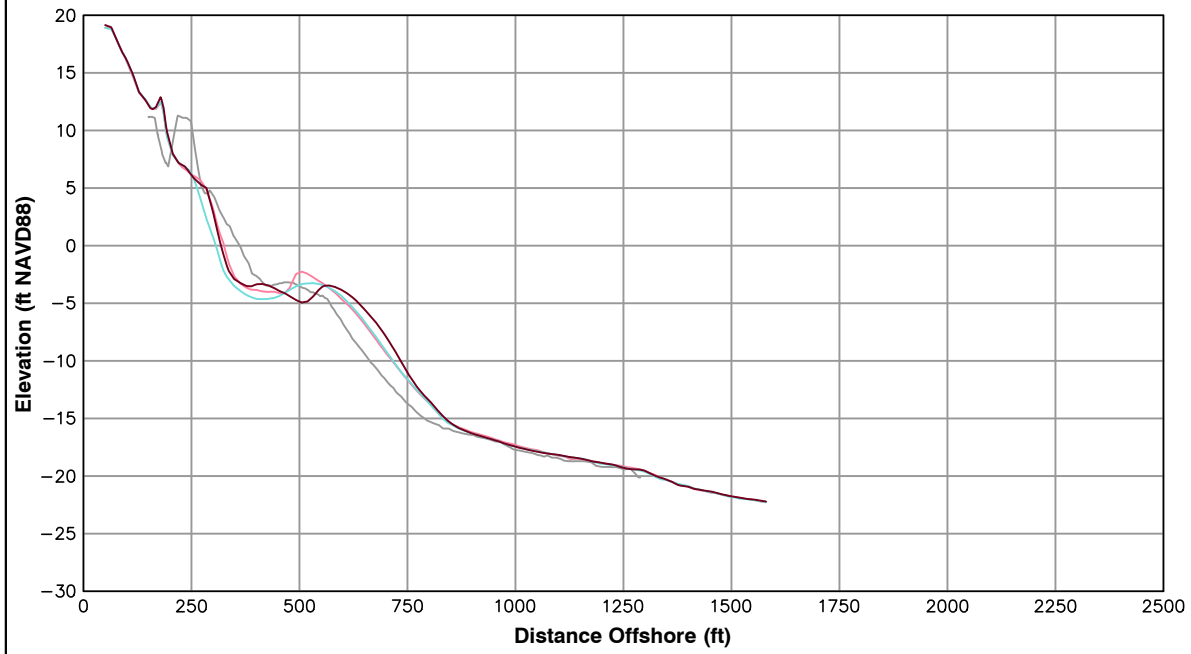
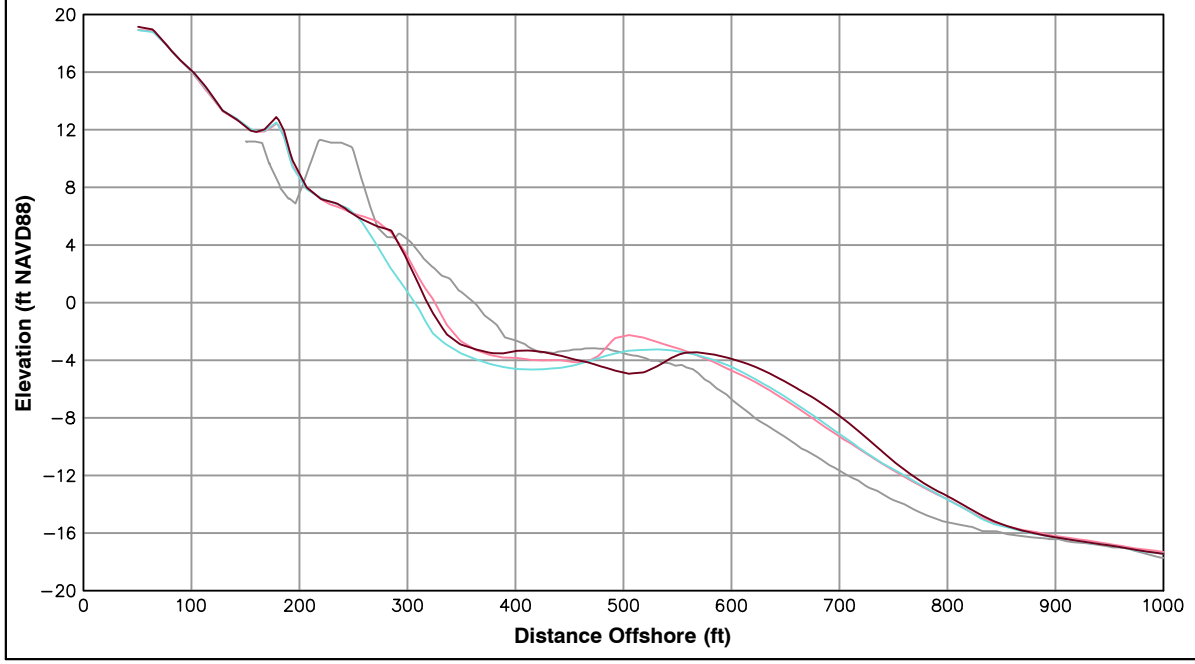
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 175+63	April 2015 - March 2014	April 2015 - October 2014
Shoreline Change at MHW (0.98 ft NAVD88)	-4.13 ft/yr	14.30 ft
Volume Change Above -15 ft NAVD88	3.33 cy/ft/yr	13.17 cy/ft
Volume Change Above 0 ft NAVD88	0.09 cy/ft/yr	4.25 cy/ft

LEGEND:
- 2015 APR
- 2014 OCT
- 2014 MAR
- POST-FILL

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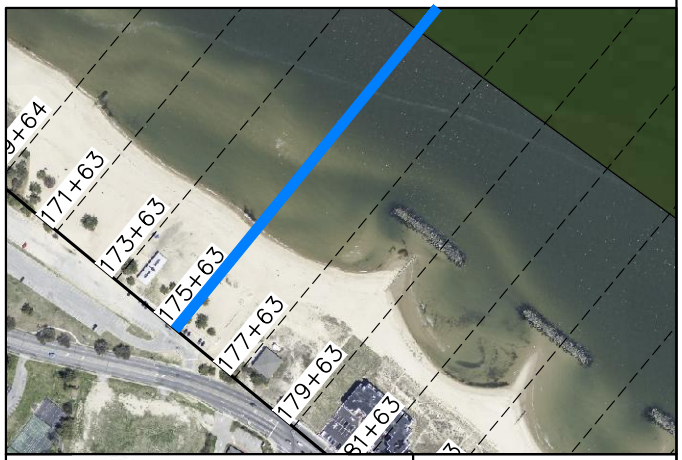
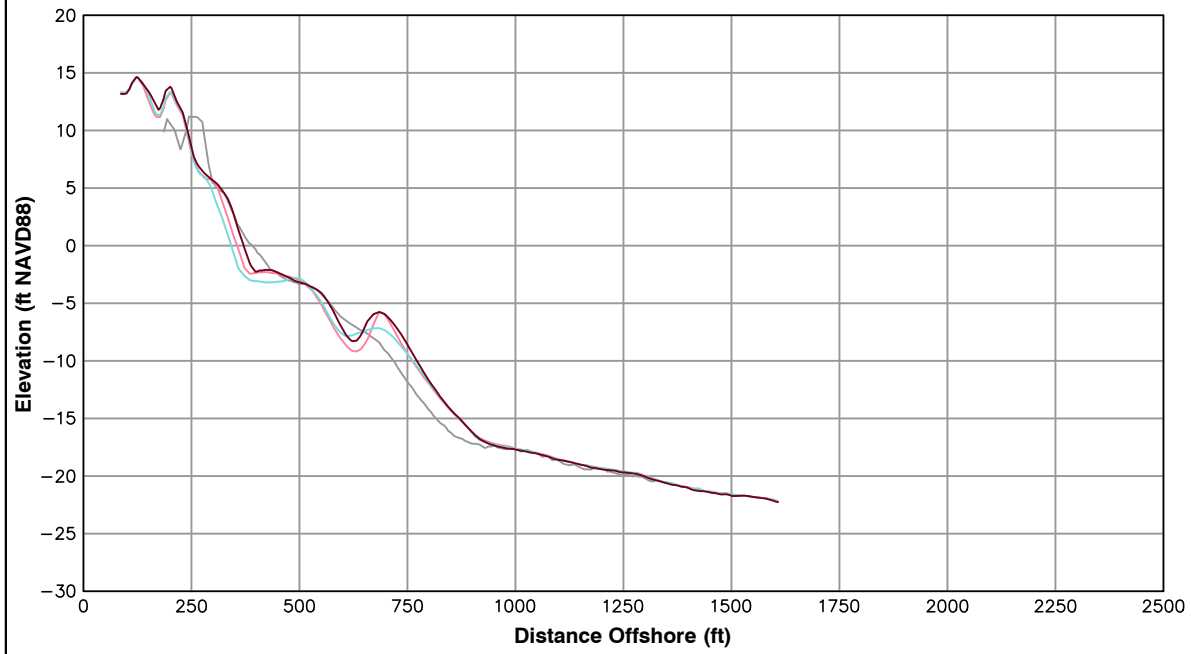
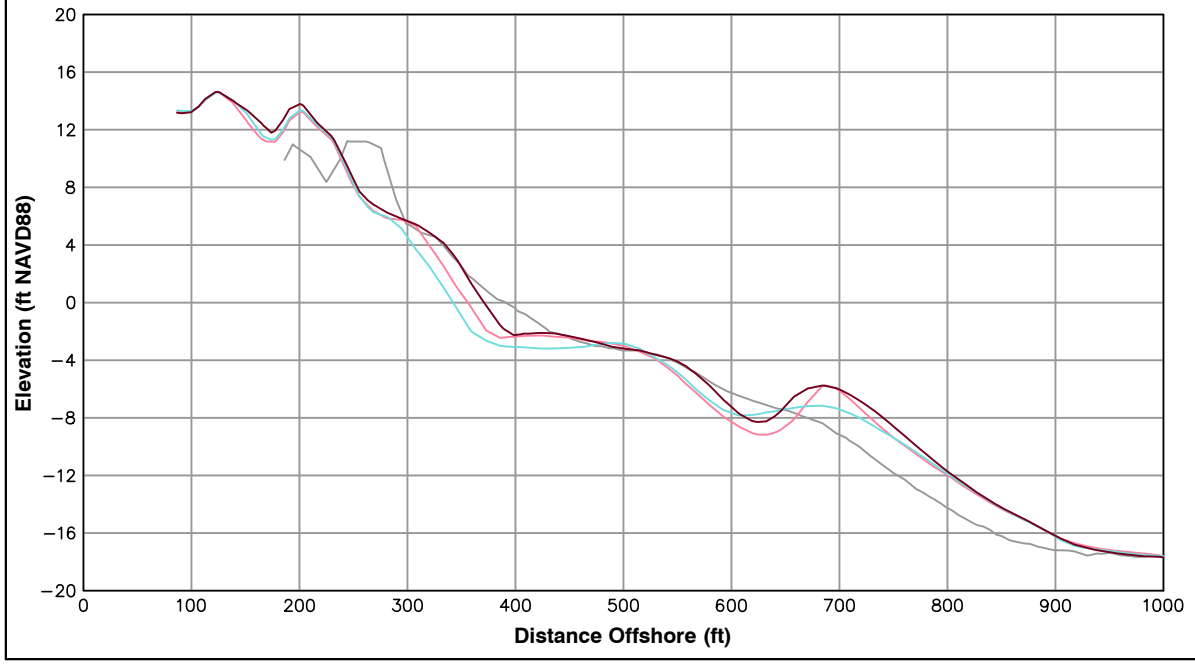


City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS

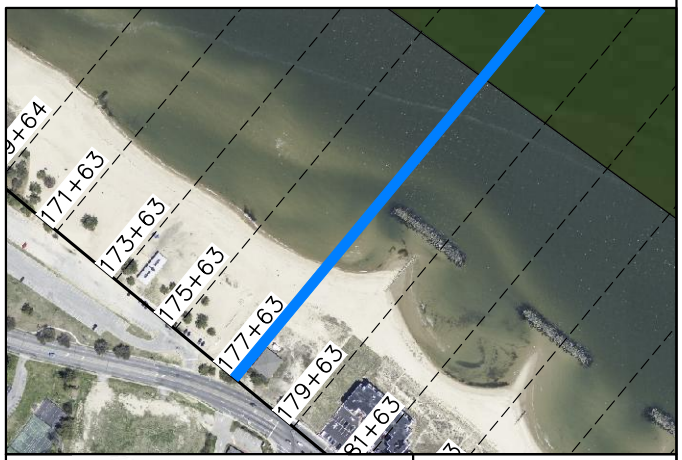




Survey Transect 177+63	April 2015 - March 2014	April 2015 - October 2014
Shoreline Change at MHW (0.98 ft NAVD88)	14.50 ft/yr	28.19 ft
Volume Change Above -15 ft NAVD88	14.59 cy/ft/yr	19.89 cy/ft
Volume Change Above 0 ft NAVD88	5.41 cy/ft/yr	7.84 cy/ft

LEGEND:
- 2015 APR
- 2014 OCT
- 2014 MAR
- POST-FILL

Notes:
1. Stationing From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. Survey Comparison Made To March 2014 and October 2014.
5. 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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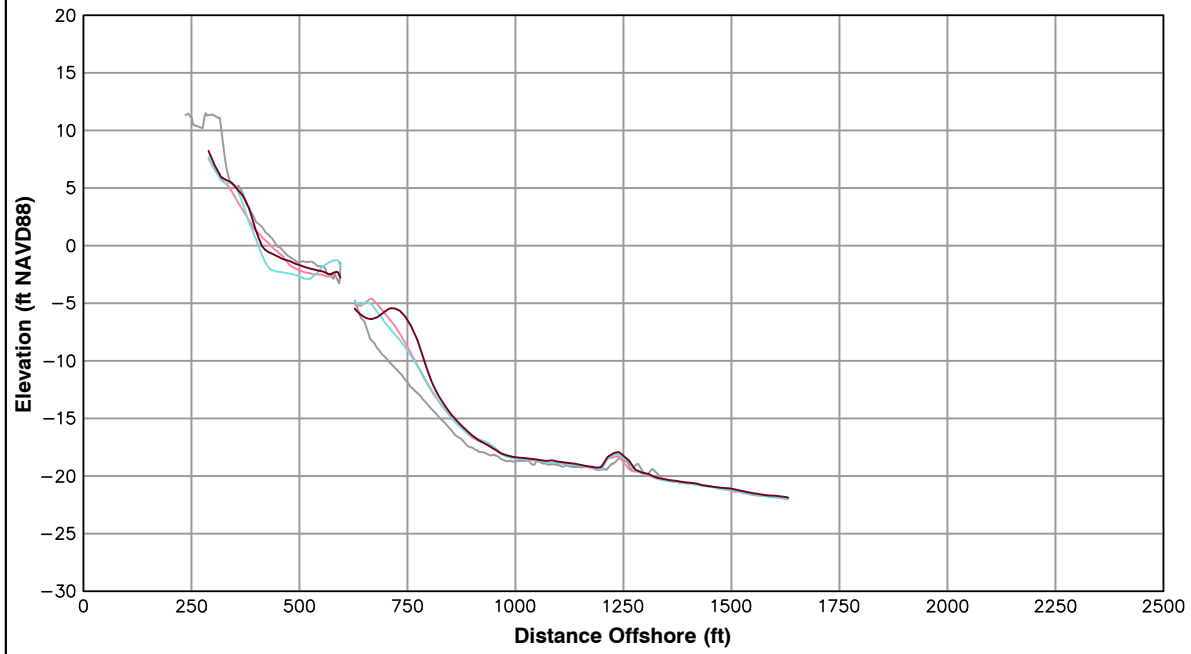
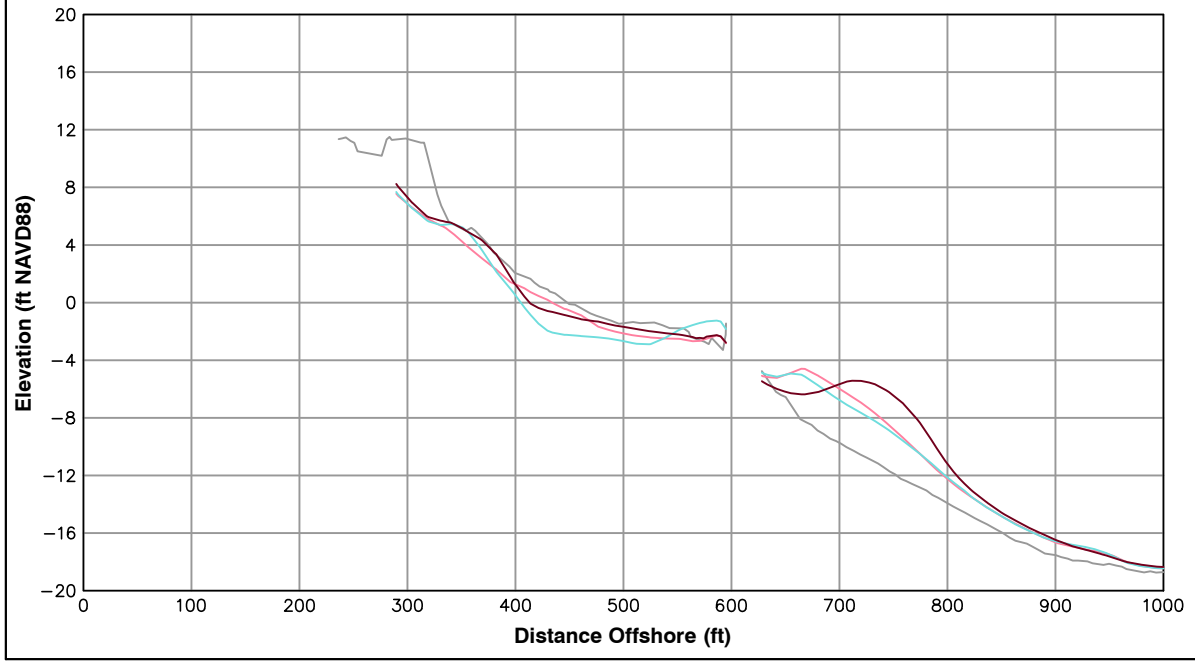
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 179+63	April 2015 - March 2014	April 2015 - October 2014
Shoreline Change at MHW (0.98 ft NAVD88)	-5.34 ft/yr	7.63 ft
Volume Change Above -15 ft NAVD88	7.23 cy/ft/yr	12.81 cy/ft
Volume Change Above 0 ft NAVD88	1.99 cy/ft/yr	2.14 cy/ft

LEGEND:
- 2015 APR
- 2014 OCT
- 2014 MAR
- POST-FILL

Notes:
1. Stationing From West To East At Varying Intervals.
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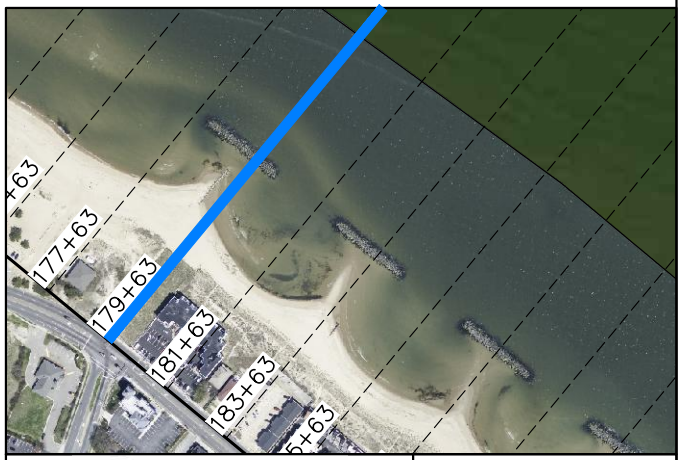

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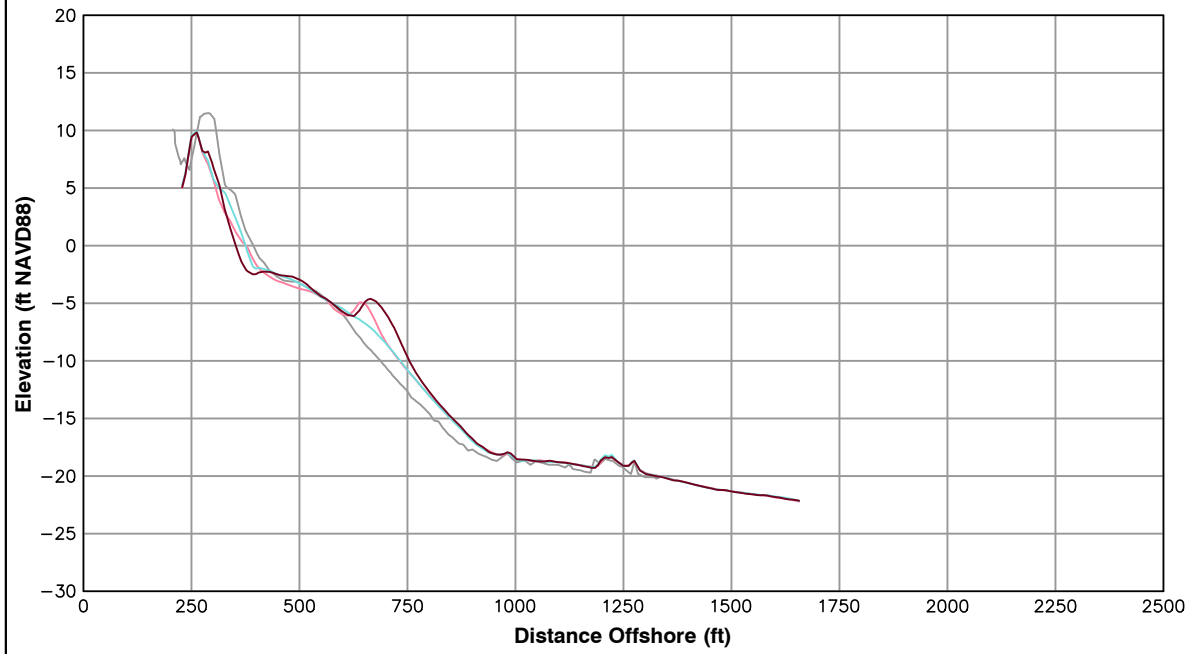
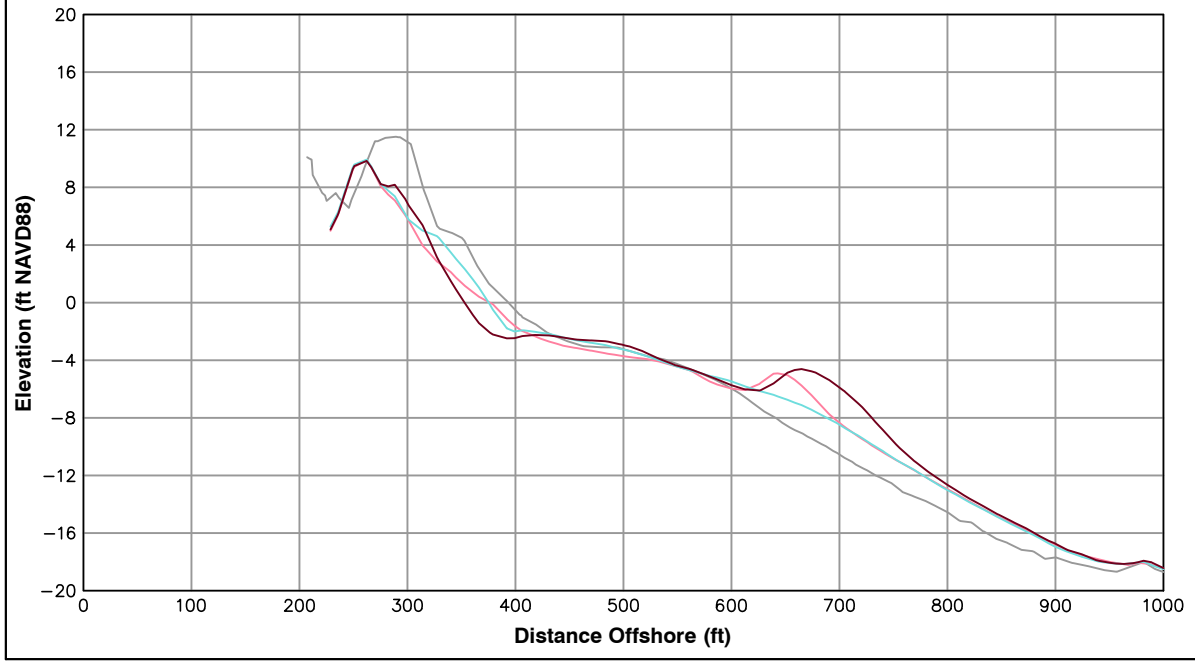
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 181+63	April 2015 - March 2014	April 2015 - October 2014
Shoreline Change at MHW (0.98 ft NAVD88)	-10.92 ft/yr	-22.28 ft
Volume Change Above -15 ft NAVD88	8.24 cy/ft/yr	6.43 cy/ft
Volume Change Above 0 ft NAVD88	0.83 cy/ft/yr	-2.38 cy/ft

LEGEND:
- 2015 APR
- 2014 OCT
- 2014 MAR
- POST-FILL

Notes:
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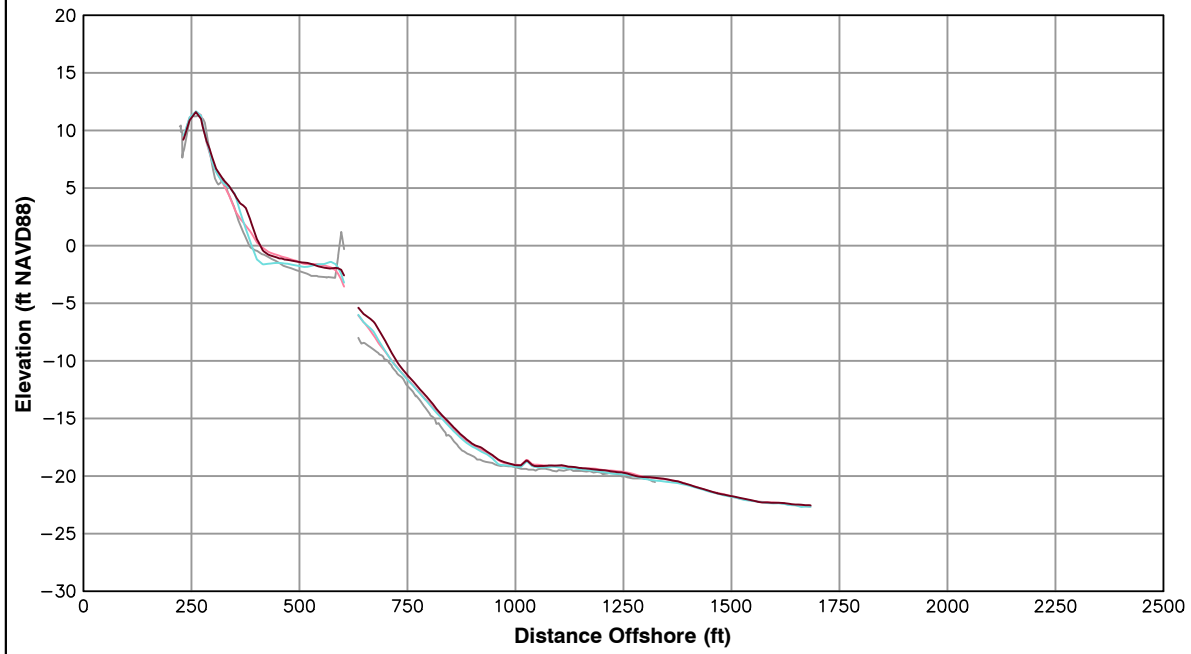
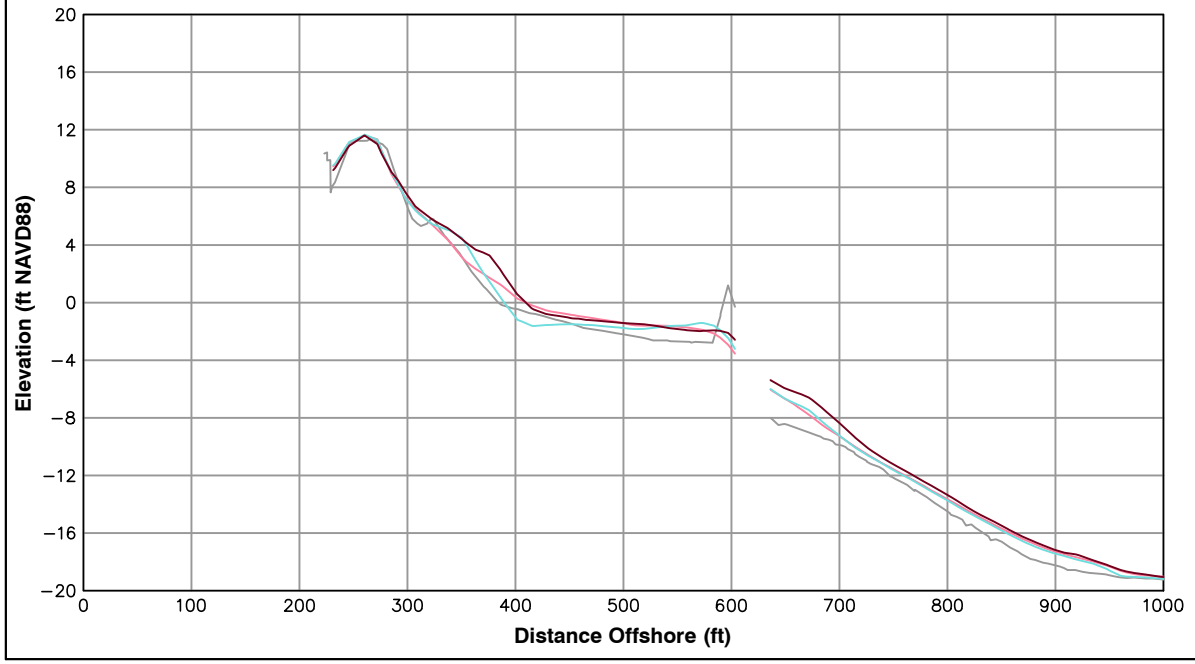
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 183+63	April 2015 - March 2014	April 2015 - October 2014
Shoreline Change at MHW (0.98 ft NAVD88)	6.57 ft/yr	17.44 ft
Volume Change Above -15 ft NAVD88	6.52 cy/ft/yr	9.09 cy/ft
Volume Change Above 0 ft NAVD88	2.88 cy/ft/yr	2.50 cy/ft

LEGEND:
- 2015 APR
- 2014 OCT
- 2014 MAR
- POST-FILL

Notes:
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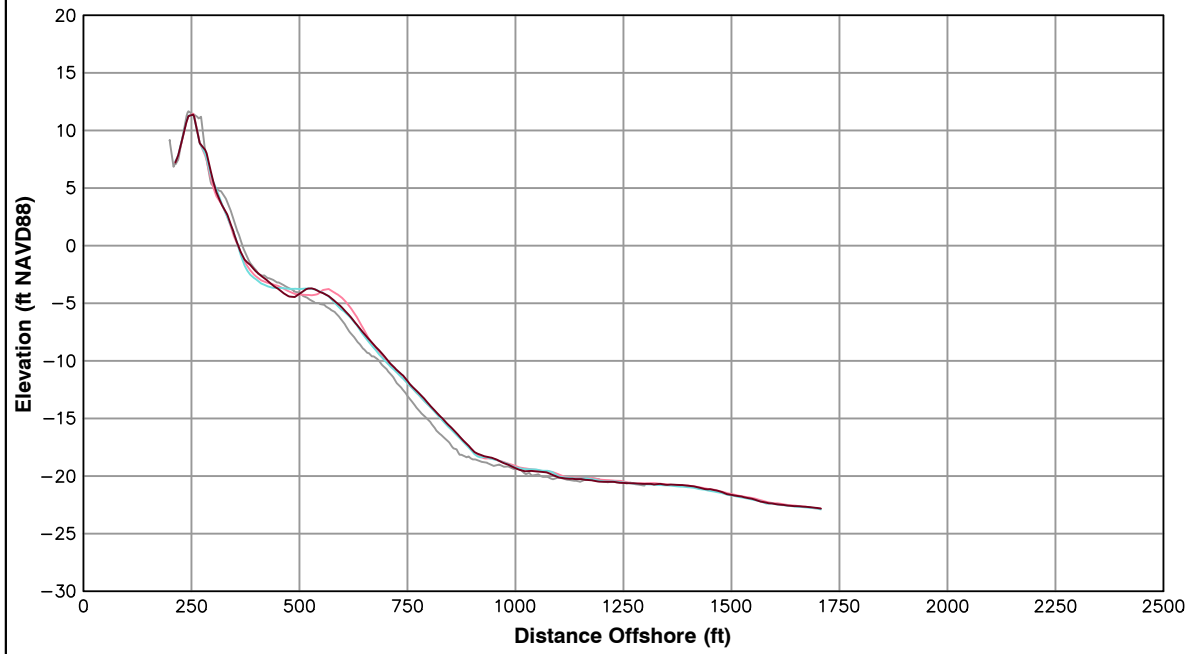
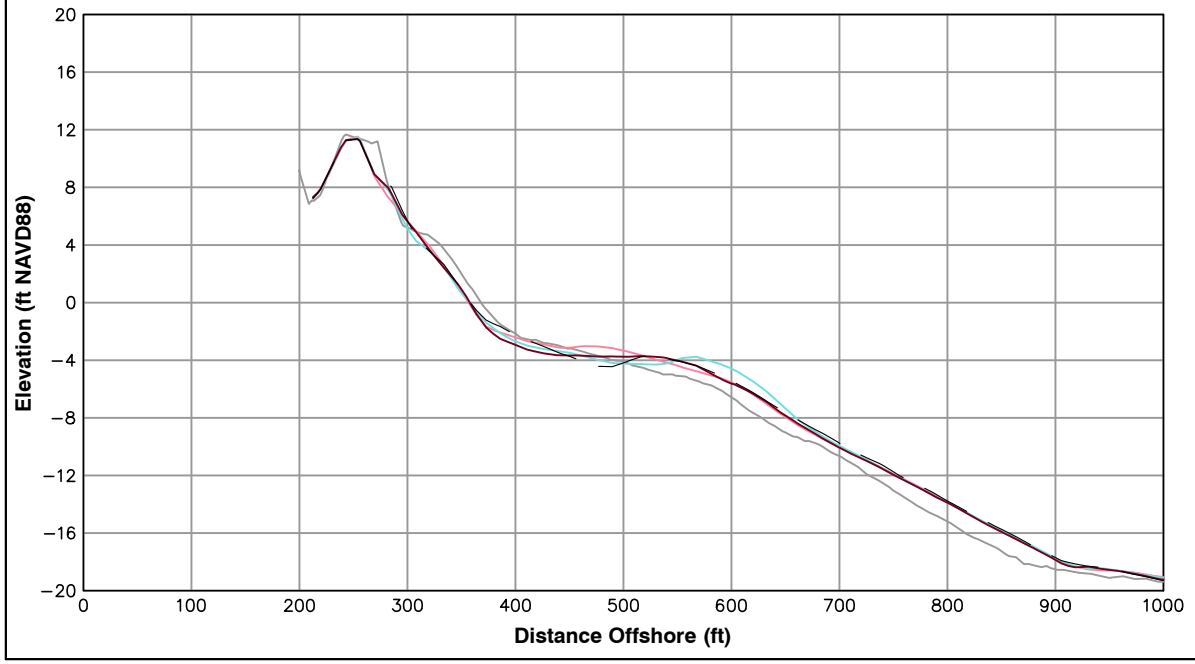
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 185+63	April 2015 - March 2014	April 2015 - October 2014
Shoreline Change at MHW (0.98 ft NAVD88)	2.22 ft/yr	-0.25 ft
Volume Change Above -15 ft NAVD88	0.11 cy/ft/yr	2.62 cy/ft
Volume Change Above 0 ft NAVD88	0.80 cy/ft/yr	0.21 cy/ft

LEGEND:
- 2015 APR
- 2014 OCT
- 2014 MAR
- POST-FILL

Notes:
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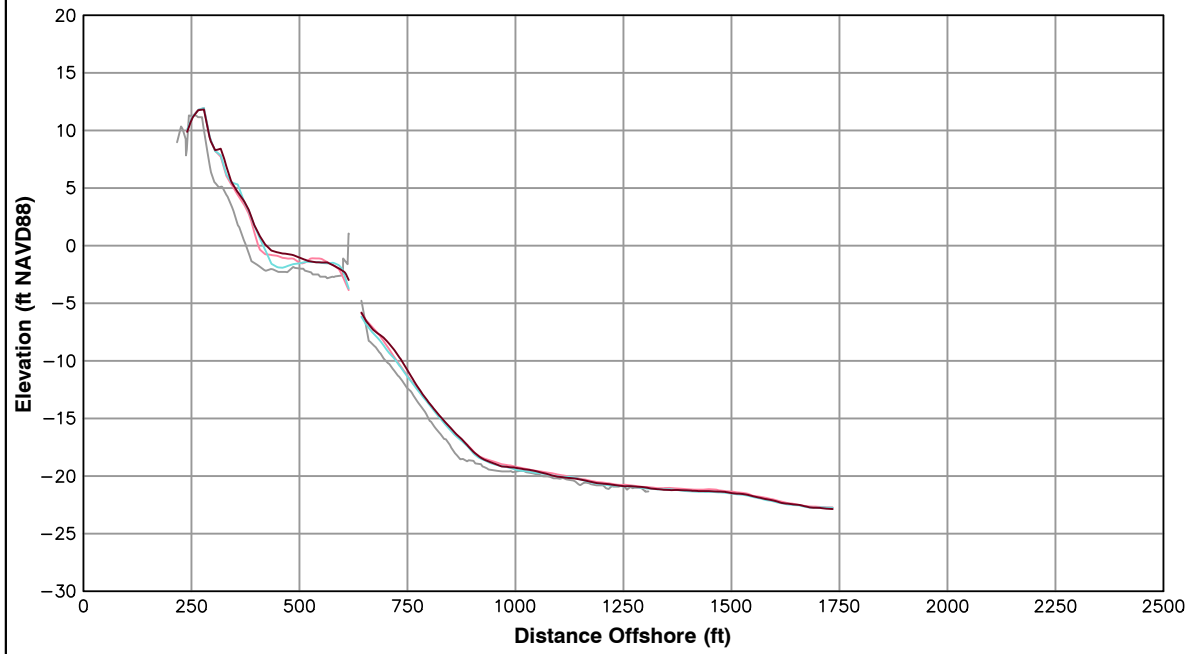
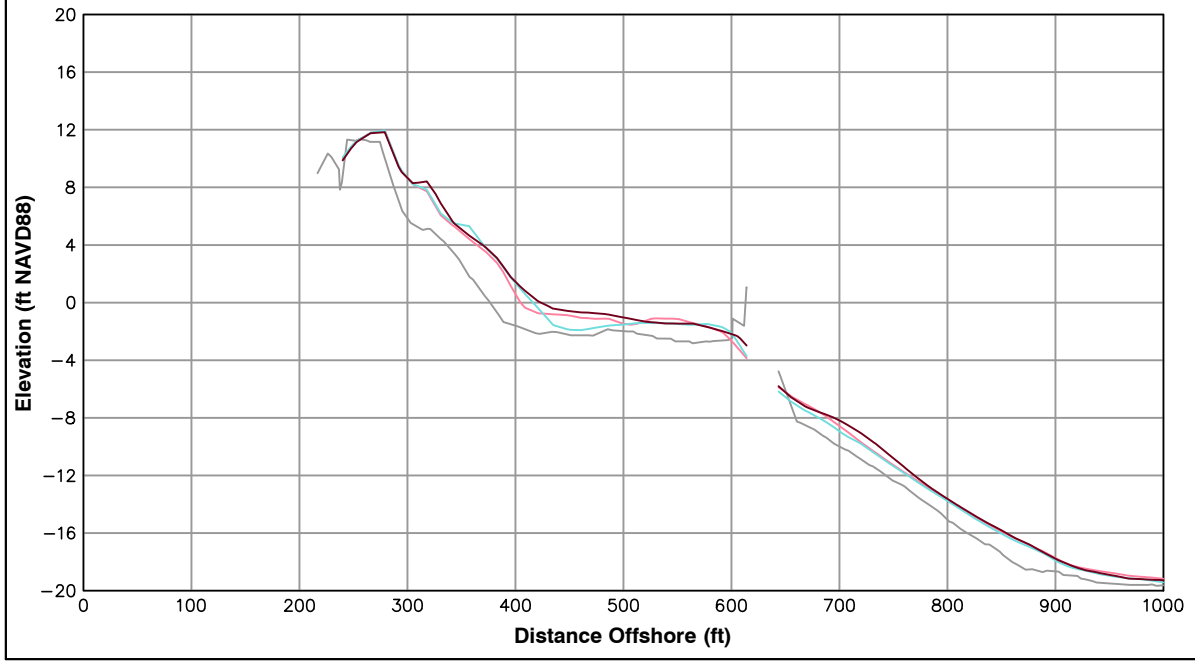
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 187+63	April 2015 - March 2014	April 2015 - October 2014
Shoreline Change at MHW (0.98 ft NAVD88)	8.66 ft/yr	2.15 ft
Volume Change Above -15 ft NAVD88	4.73 cy/ft/yr	6.41 cy/ft
Volume Change Above 0 ft NAVD88	1.75 cy/ft/yr	0.34 cy/ft

LEGEND:
- 2015 APR
- 2014 OCT
- 2014 MAR
- POST-FILL

Notes:
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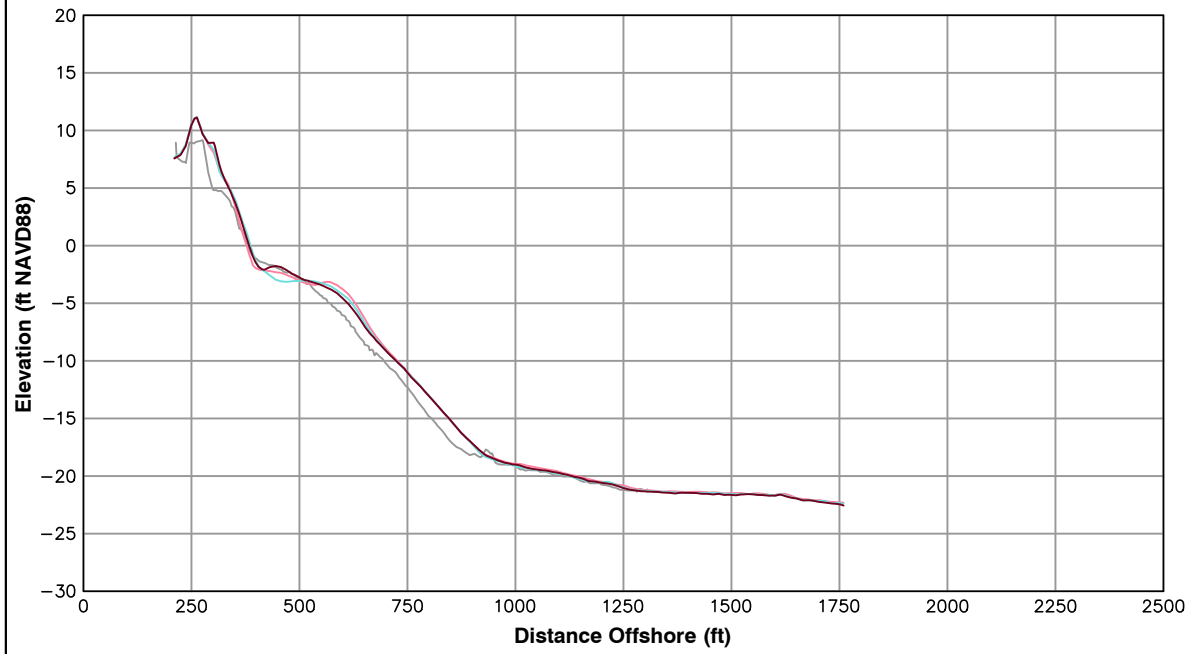
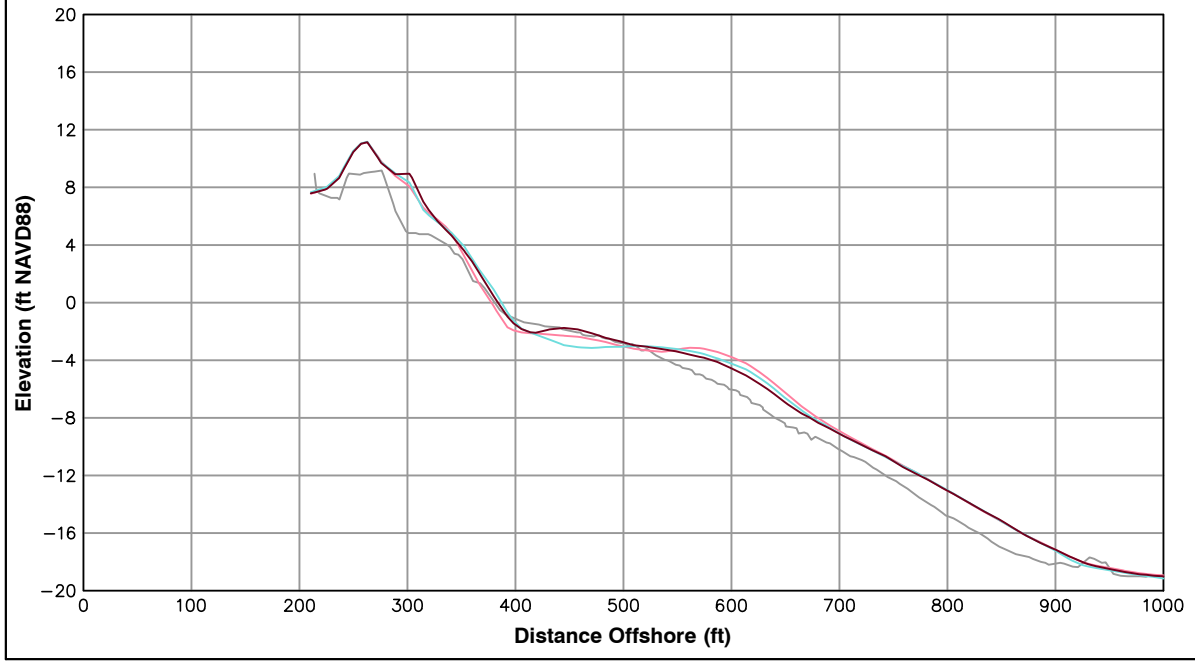
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 189+63	April 2015 - March 2014	April 2015 - October 2014
Shoreline Change at MHW (0.98 ft NAVD88)	5.67 ft/yr	-3.63 ft
Volume Change Above -15 ft NAVD88	-0.19 cy/ft/yr	0.56 cy/ft
Volume Change Above 0 ft NAVD88	1.13 cy/ft/yr	-0.17 cy/ft

LEGEND:
- 2015 APR
- 2014 OCT
- 2014 MAR
- POST-FILL

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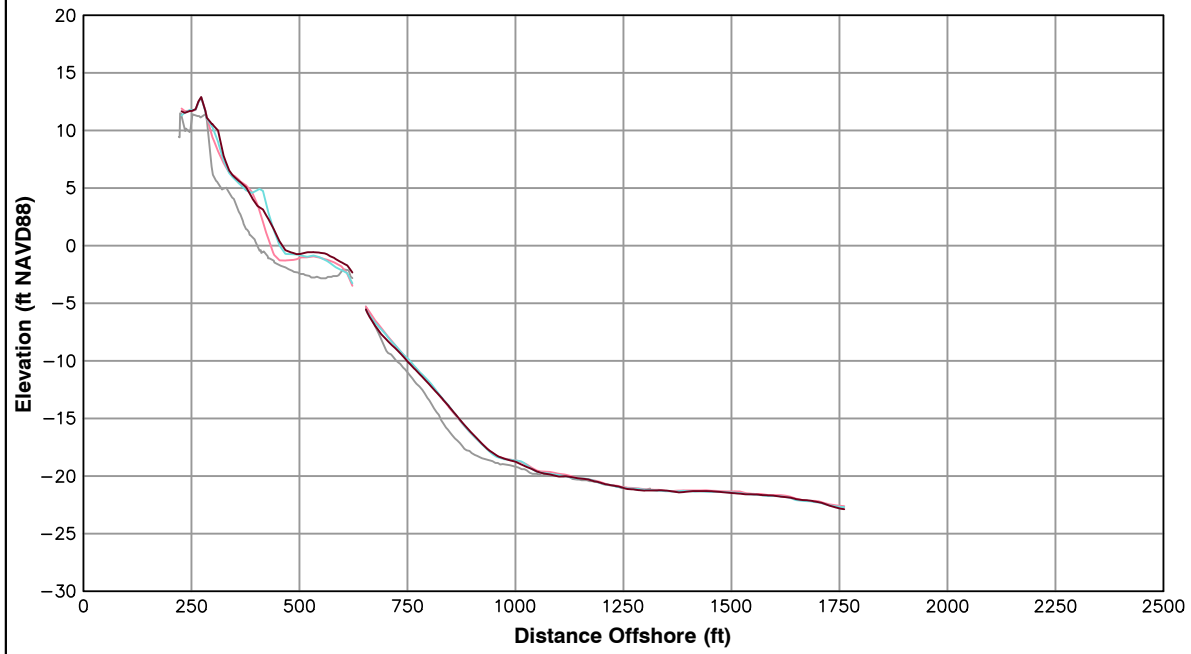
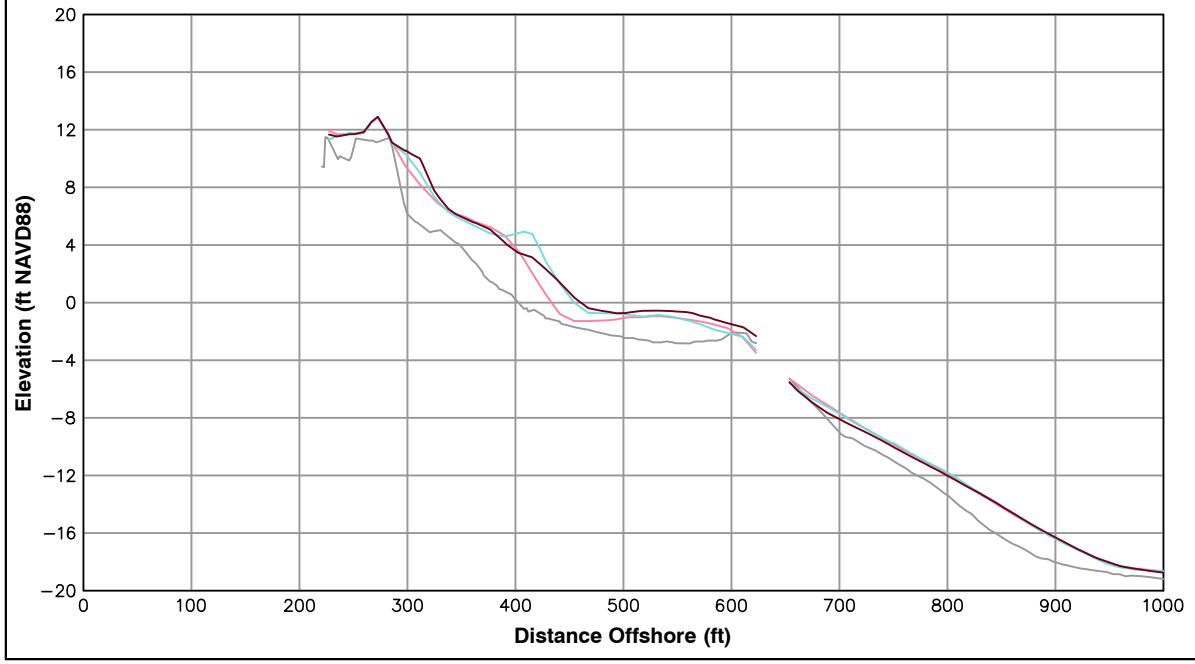
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 191+63	April 2015 - March 2014	April 2015 - October 2014
Shoreline Change at MHW (0.98 ft NAVD88)	20.02 ft/yr	1.92 ft
Volume Change Above -15 ft NAVD88	5.56 cy/ft/yr	0.70 cy/ft
Volume Change Above 0 ft NAVD88	3.18 cy/ft/yr	-0.45 cy/ft

LEGEND:
- 2015 APR
- 2014 OCT
- 2014 MAR
- POST-FILL

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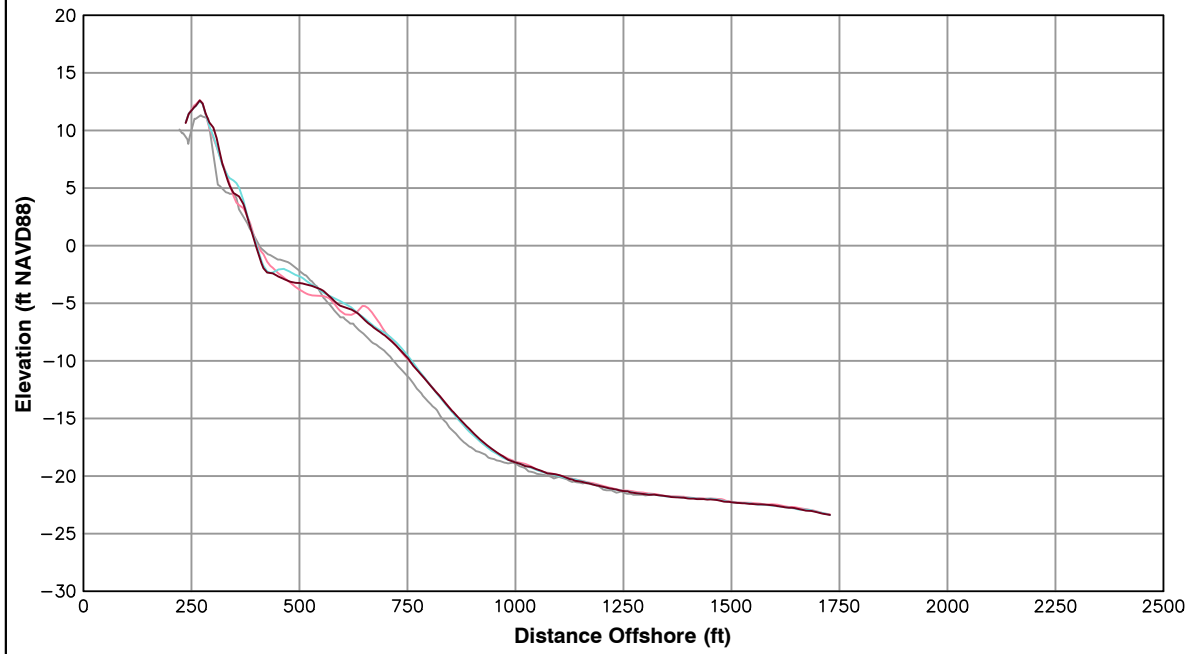
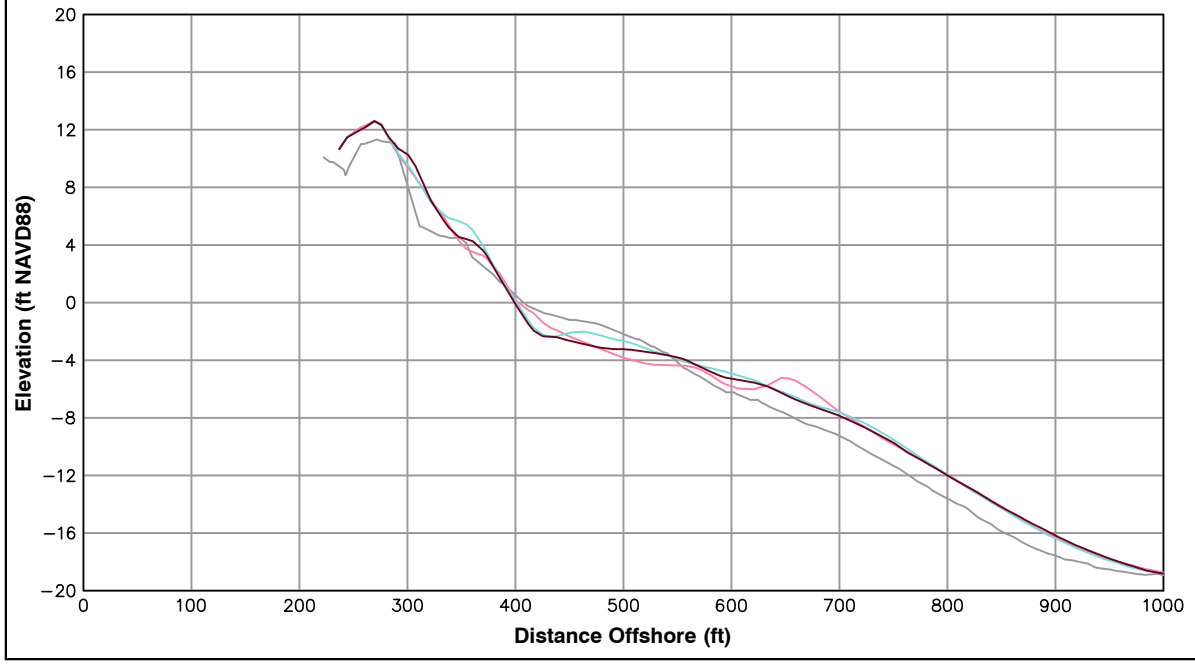
City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 193+63	April 2015 - March 2014	April 2015 - October 2014
Shoreline Change at MHW (0.98 ft NAVD88)	-2.32 ft/yr	-1.20 ft
Volume Change Above -15 ft NAVD88	-0.04 cy/ft/yr	-4.13 cy/ft
Volume Change Above 0 ft NAVD88	0.82 cy/ft/yr	-0.60 cy/ft

LEGEND:
- 2015 APR
- 2014 OCT
- 2014 MAR
- POST-FILL

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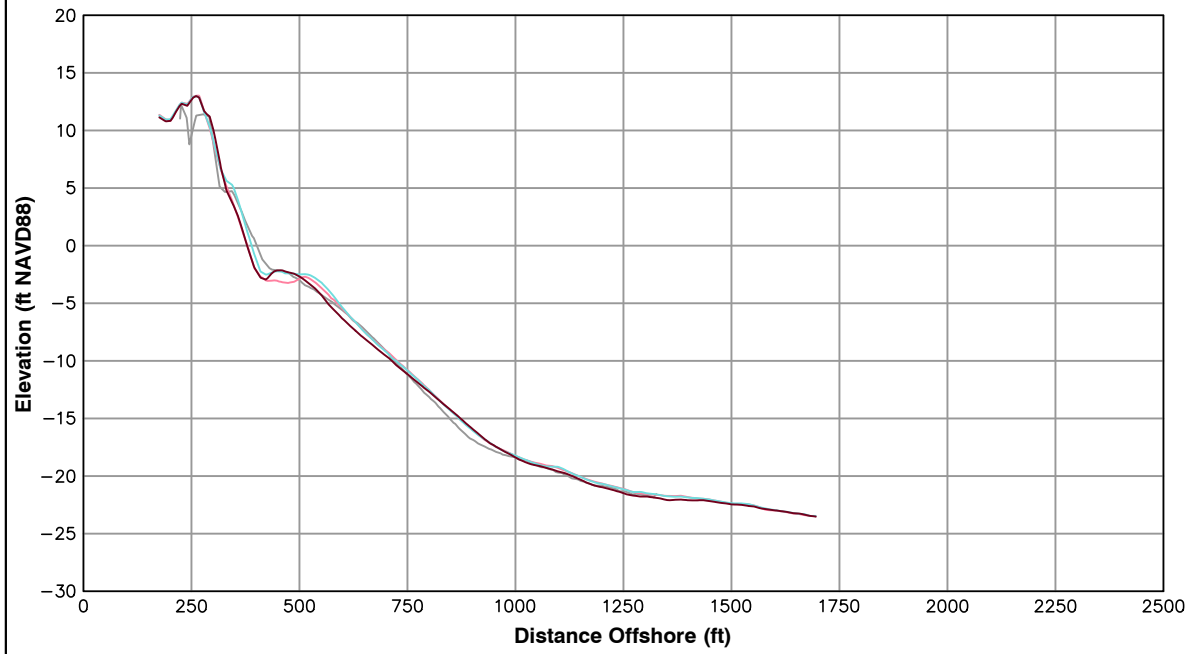
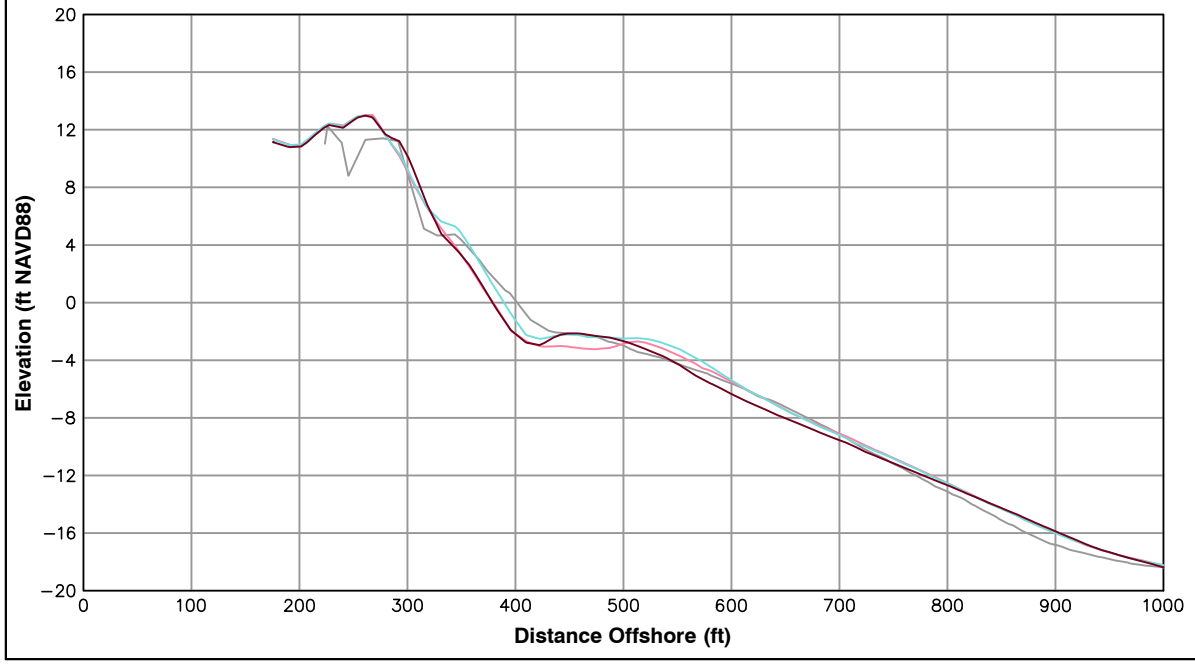
City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 195+63	April 2015 - March 2014	April 2015 - October 2014
Shoreline Change at MHW (0.98 ft NAVD88)	0.75 ft/yr	-10.23 ft
Volume Change Above -15 ft NAVD88	-3.02 cy/ft/yr	-10.03 cy/ft
Volume Change Above 0 ft NAVD88	0.47 cy/ft/yr	-2.18 cy/ft

LEGEND:
- 2015 APR
- 2014 OCT
- 2014 MAR
- POST-FILL

Notes:
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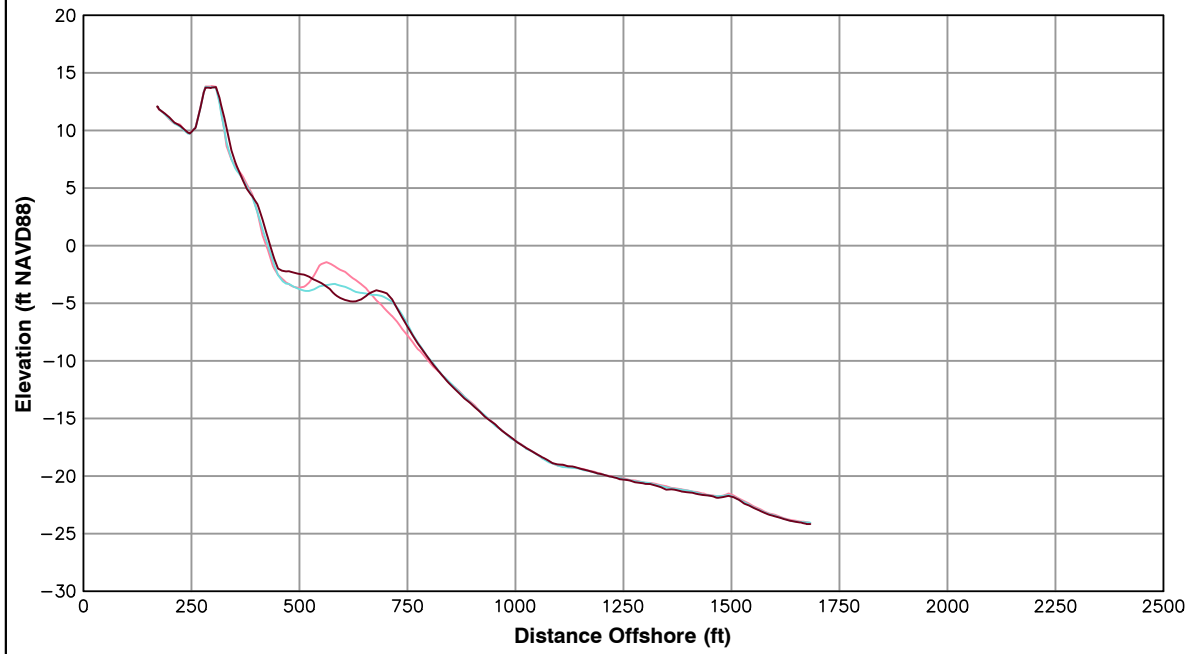
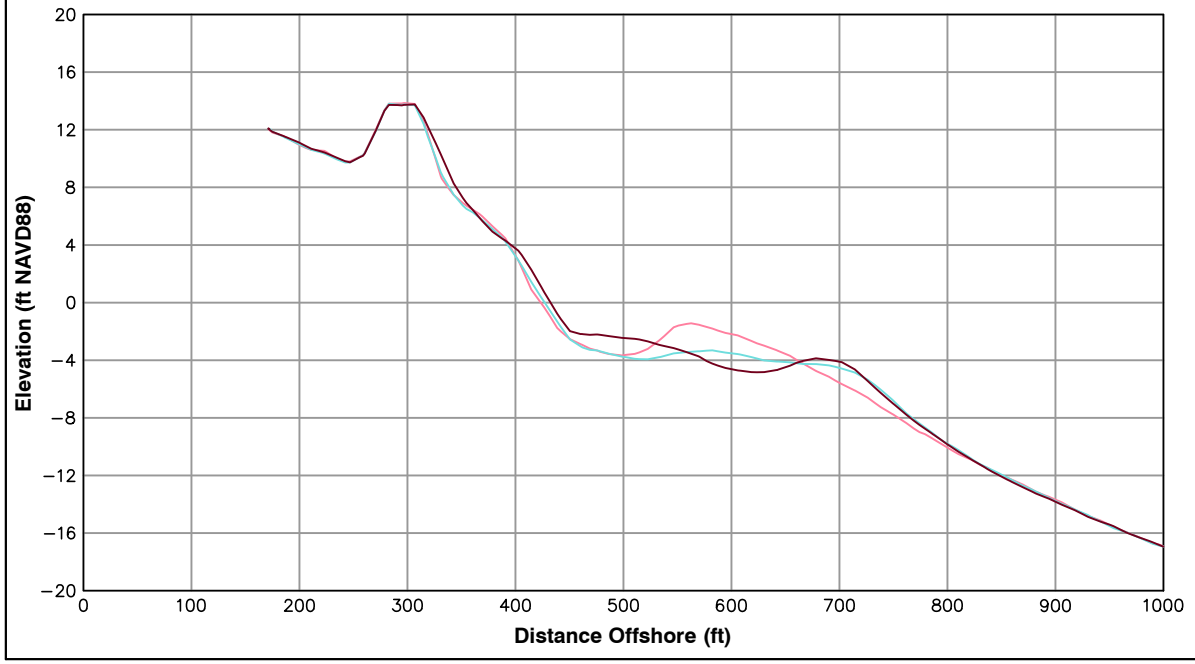
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 206+86	April 2015 - March 2014	April 2015 - October 2014
Shoreline Change at MHW (0.98 ft NAVD88)	9.63 ft/yr	6.12 ft
Volume Change Above -15 ft NAVD88	0.90 cy/ft/yr	3.89 cy/ft
Volume Change Above 0 ft NAVD88	1.95 cy/ft/yr	2.40 cy/ft

LEGEND:
2015 APR
2014 OCT
2014 MAR

Notes:
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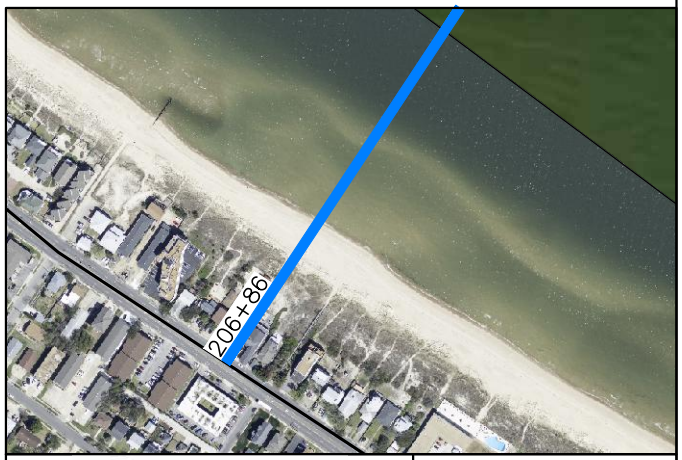

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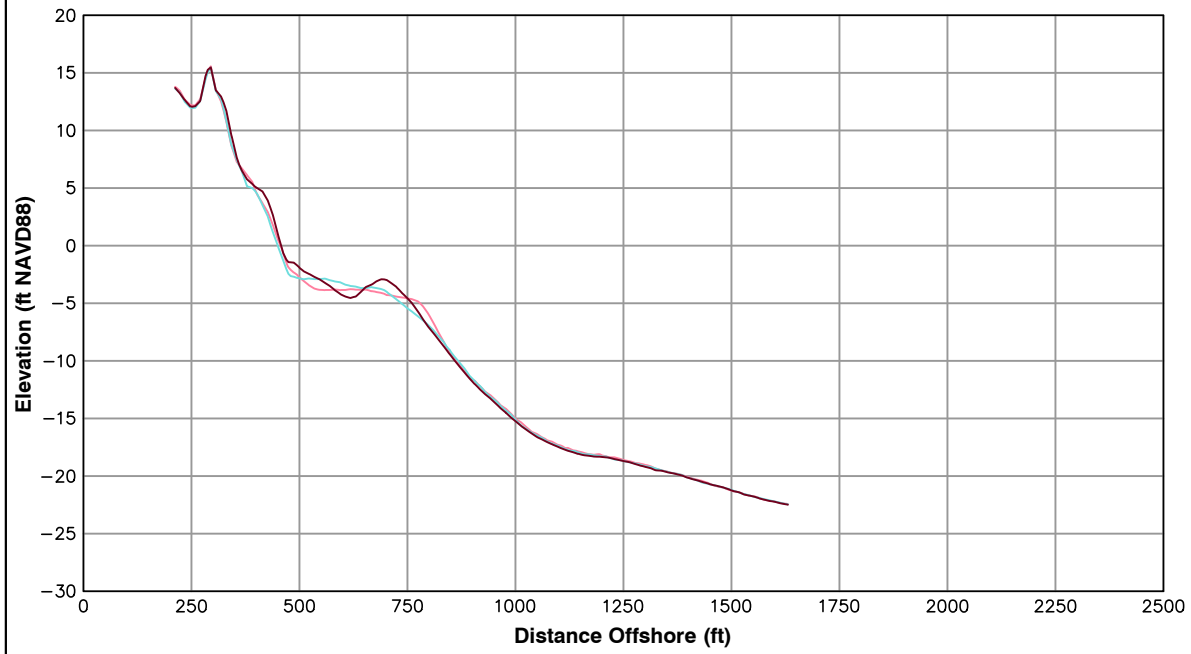
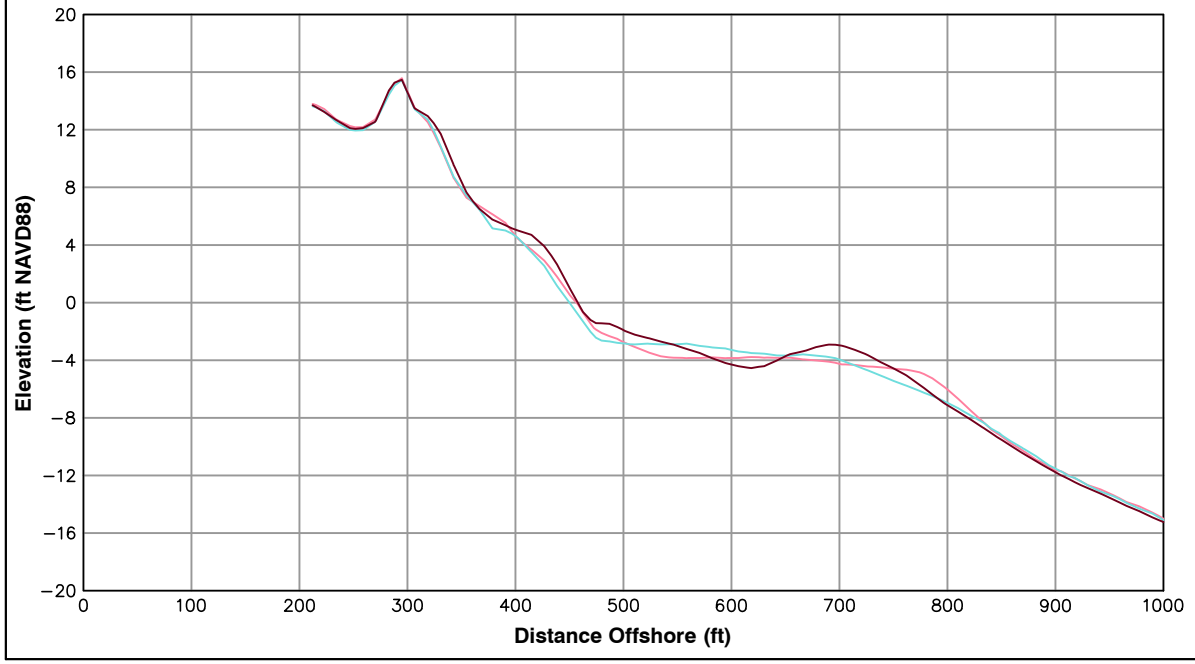
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 218+66	April 2015 - March 2014	April 2015 - October 2014
Shoreline Change at MHW (0.98 ft NAVD88)	3.93 ft/yr	10.03 ft
Volume Change Above -15 ft NAVD88	3.03 cy/ft/yr	5.46 cy/ft
Volume Change Above 0 ft NAVD88	2.09 cy/ft/yr	4.11 cy/ft

LEGEND:
- 2015 APR
- 2014 OCT
- 2014 MAR

Notes:
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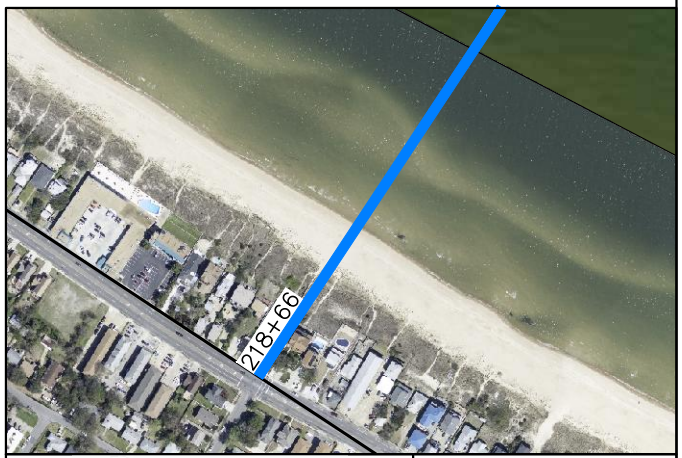

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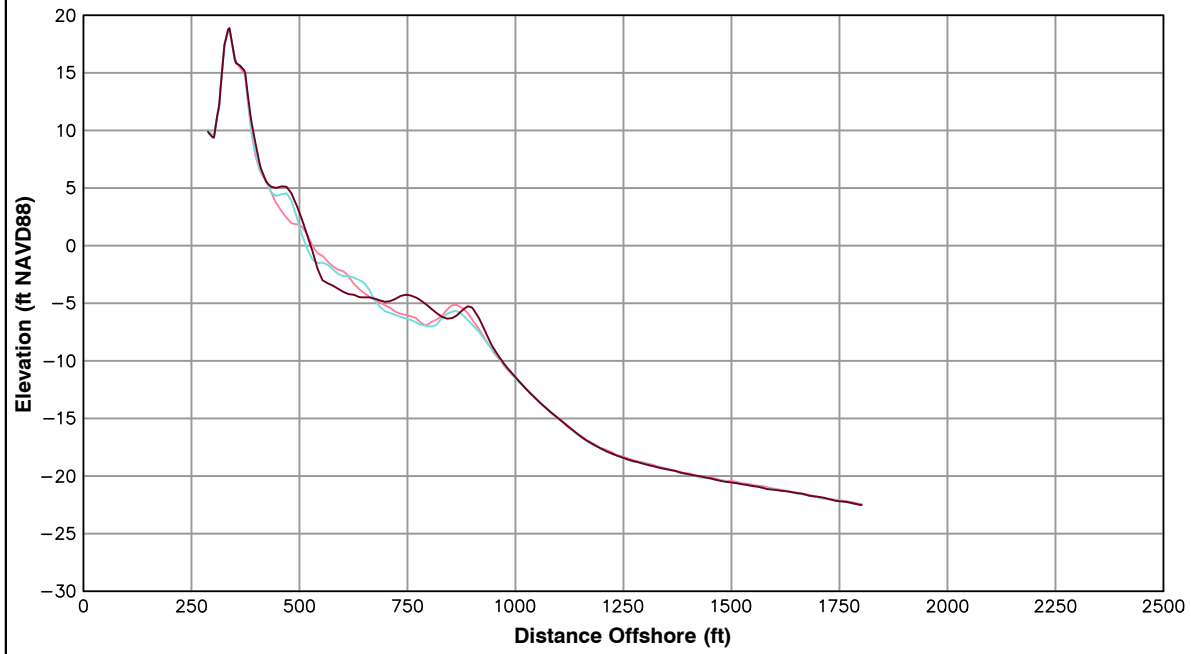
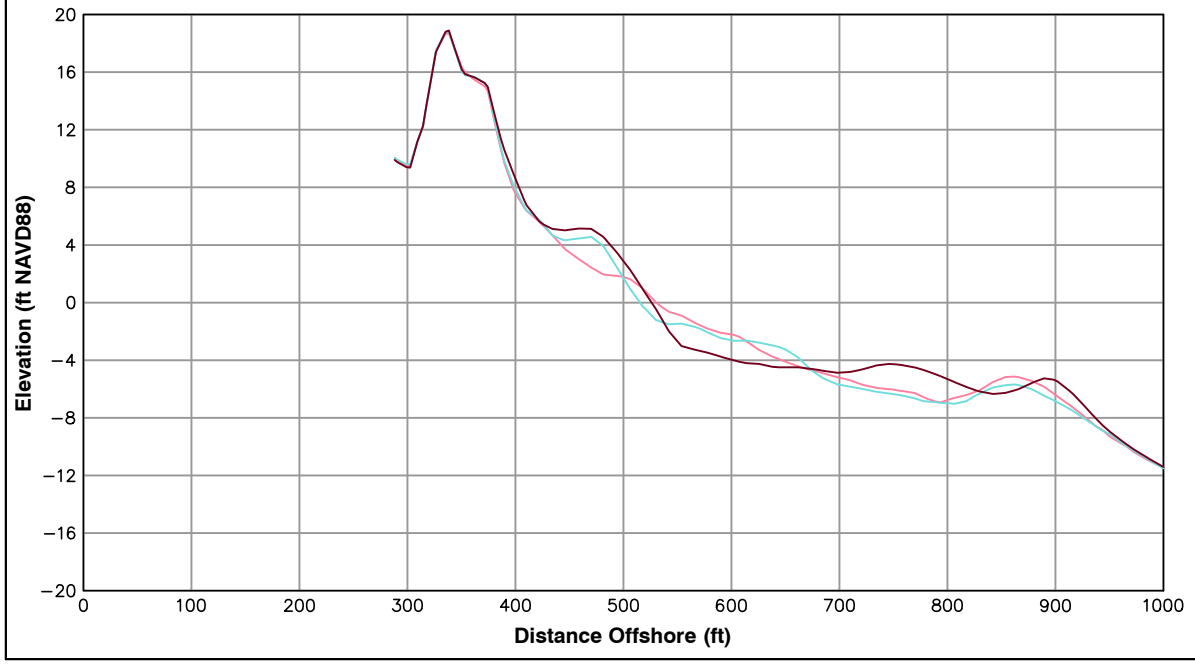
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 229+85	April 2015 - March 2014	April 2015 - October 2014
Shoreline Change at MHW (0.98 ft NAVD88)	-0.23 ft/yr	11.61 ft
Volume Change Above -15 ft NAVD88	6.42 cy/ft/yr	8.23 cy/ft
Volume Change Above 0 ft NAVD88	5.57 cy/ft/yr	3.47 cy/ft

LEGEND:
2015 APR
2014 OCT
2014 MAR

Notes:
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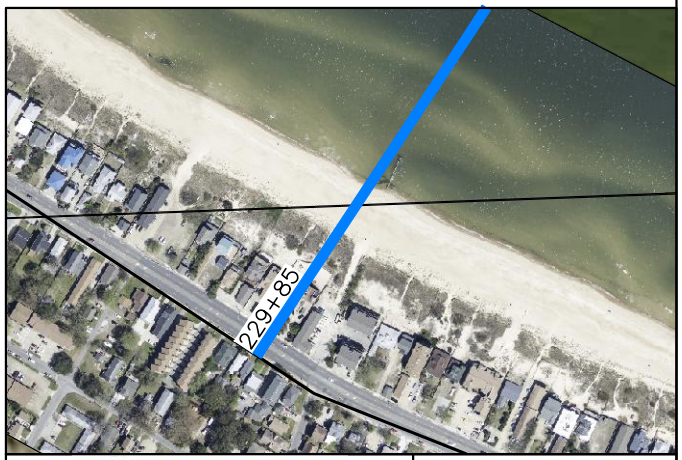

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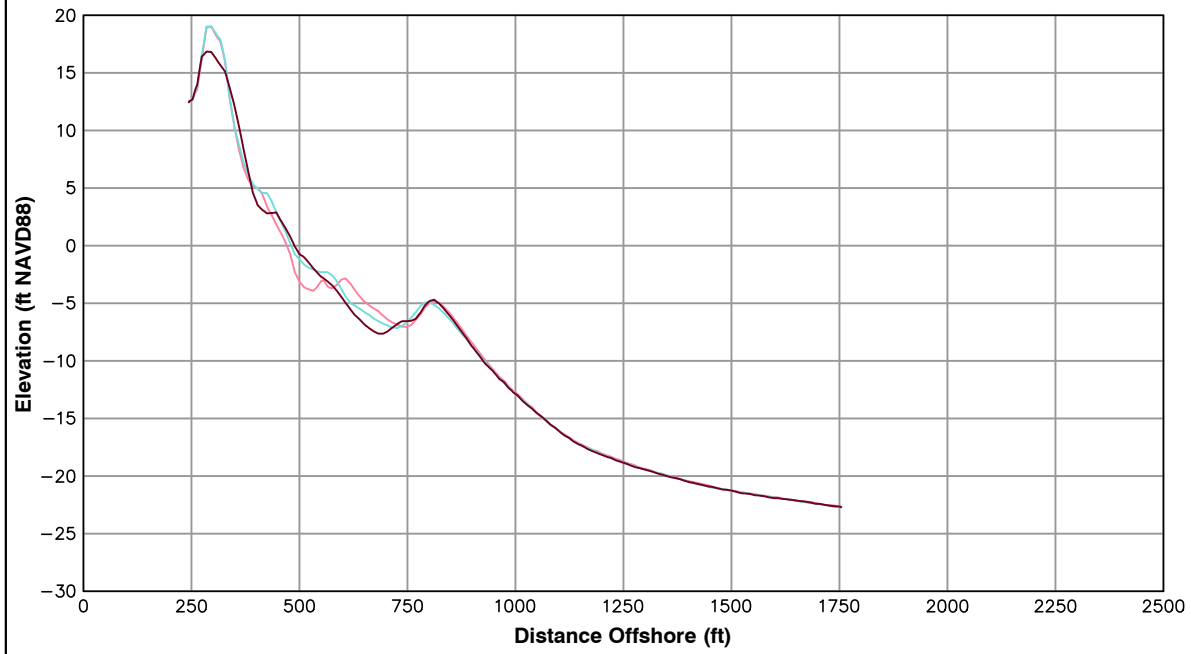
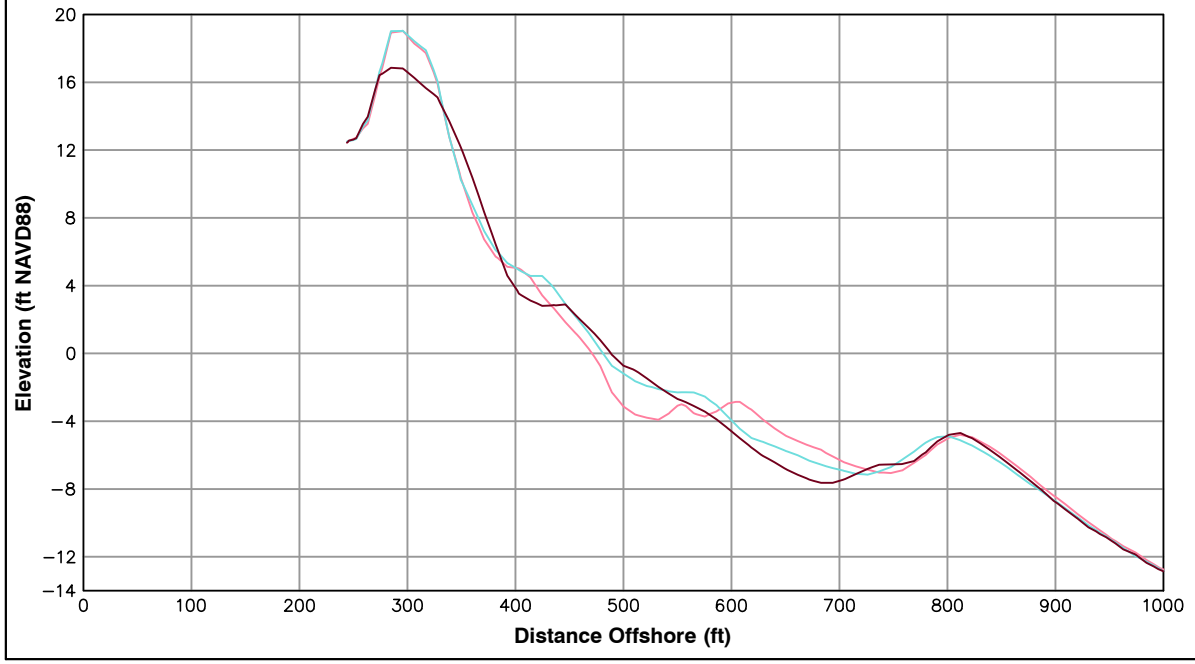
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 242+03	April 2015 - March 2014	April 2015 - October 2014
Shoreline Change at MHW (0.98 ft NAVD88)	15.60 ft/yr	5.44 ft
Volume Change Above -15 ft NAVD88	-3.79 cy/ft/yr	-7.29 cy/ft
Volume Change Above 0 ft NAVD88	-0.42 cy/ft/yr	-3.64 cy/ft

LEGEND:
- 2015 APR
- 2014 OCT
- 2014 MAR

Notes:
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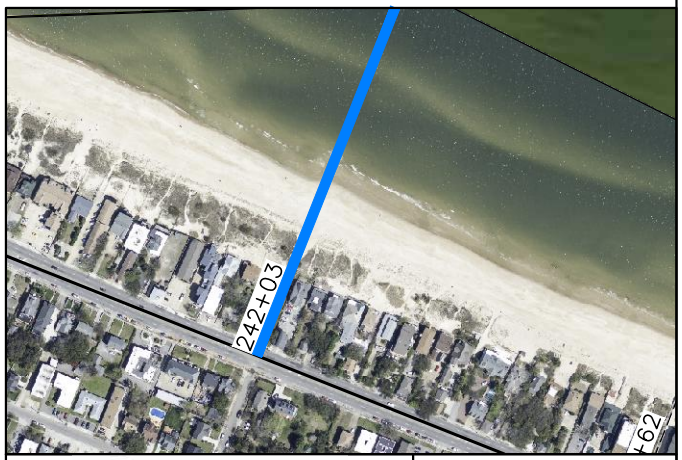
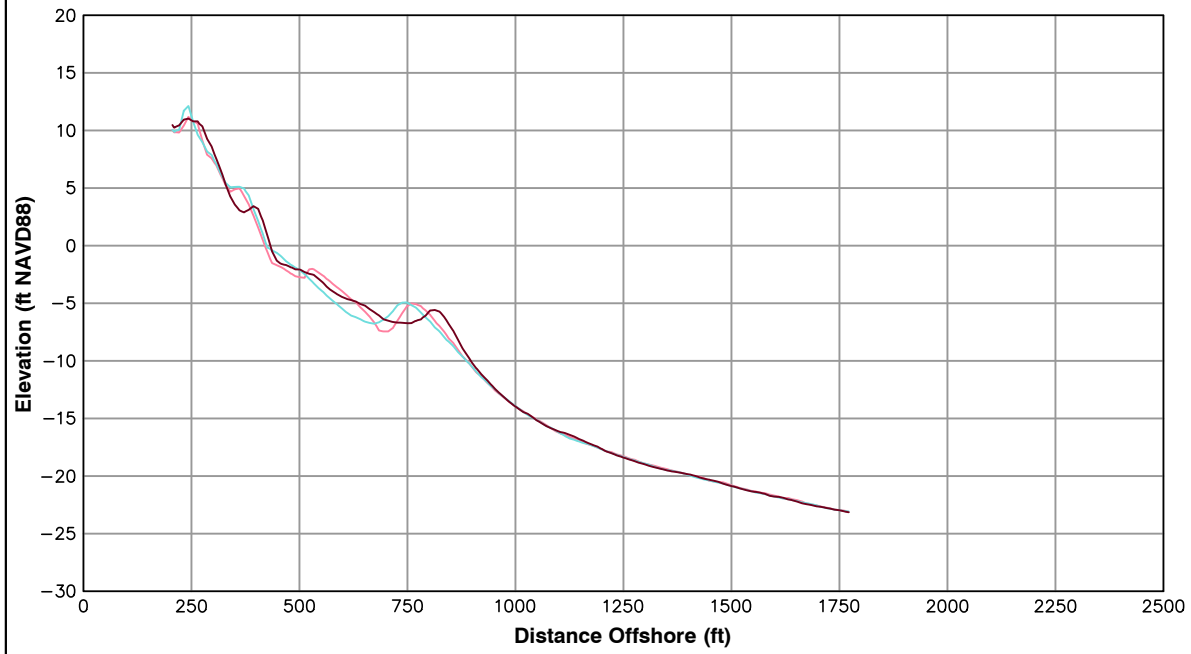
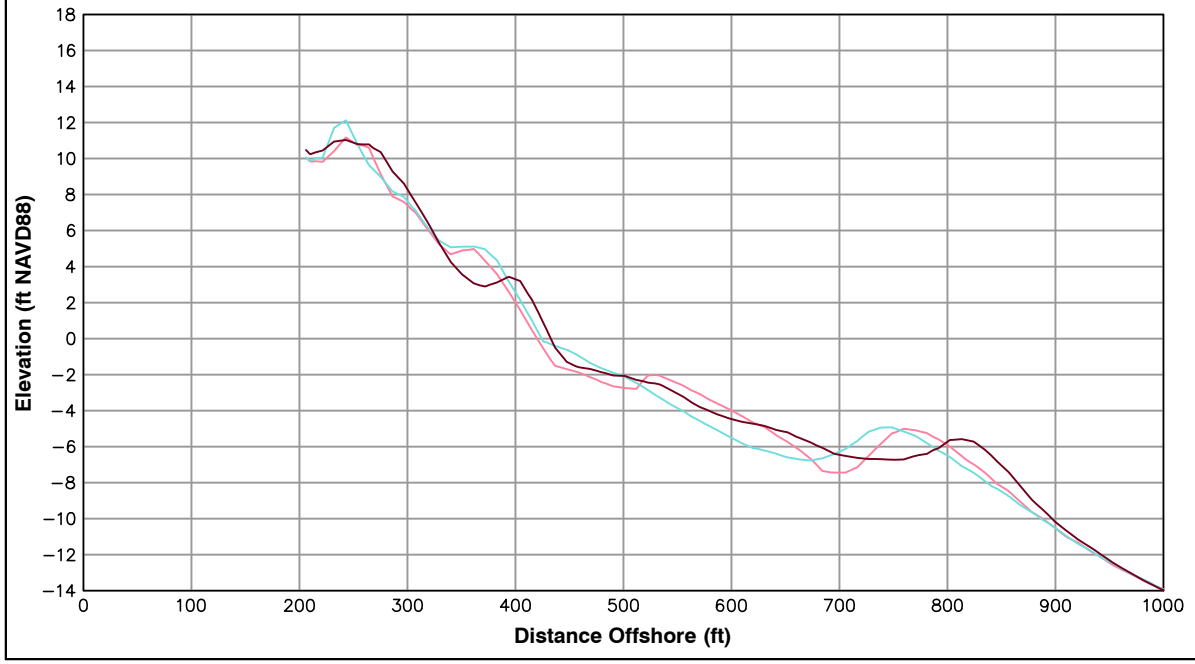


City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 252+62	April 2015 - March 2014	April 2015 - October 2014
Shoreline Change at MHW (0.98 ft NAVD88)	13.48 ft/yr	9.41 ft
Volume Change Above -15 ft NAVD88	5.32 cy/ft/yr	6.53 cy/ft
Volume Change Above 0 ft NAVD88	2.09 cy/ft/yr	-0.21 cy/ft

LEGEND:
- 2015 APR
- 2014 OCT
- 2014 MAR

Notes:
1. Stationing From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. Survey Comparison Made To March 2014 and October 2014.
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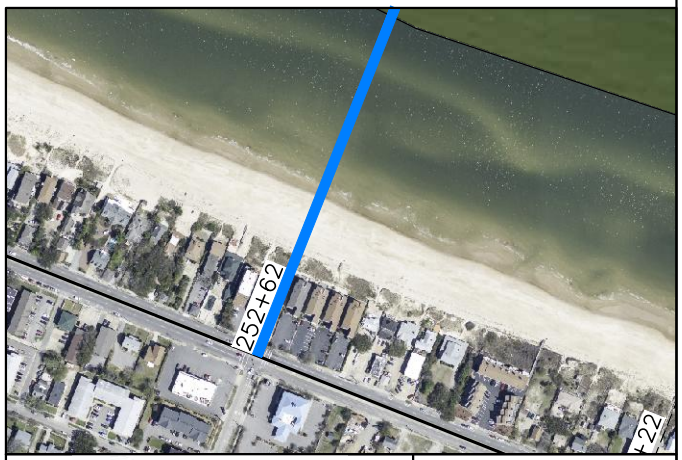

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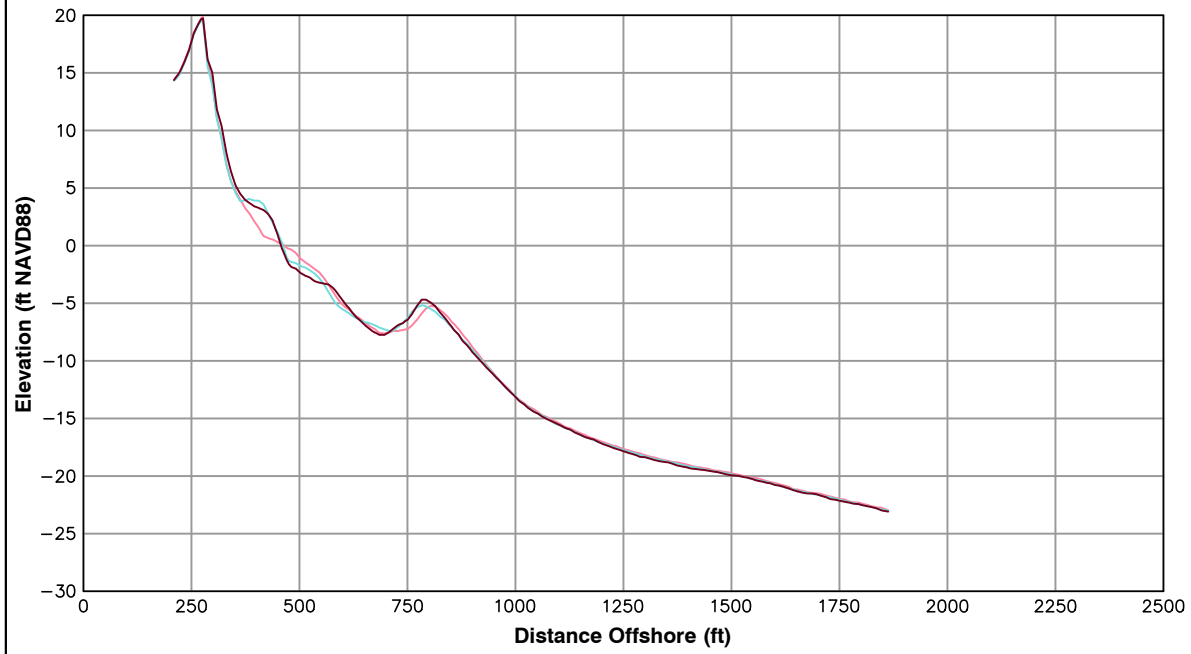
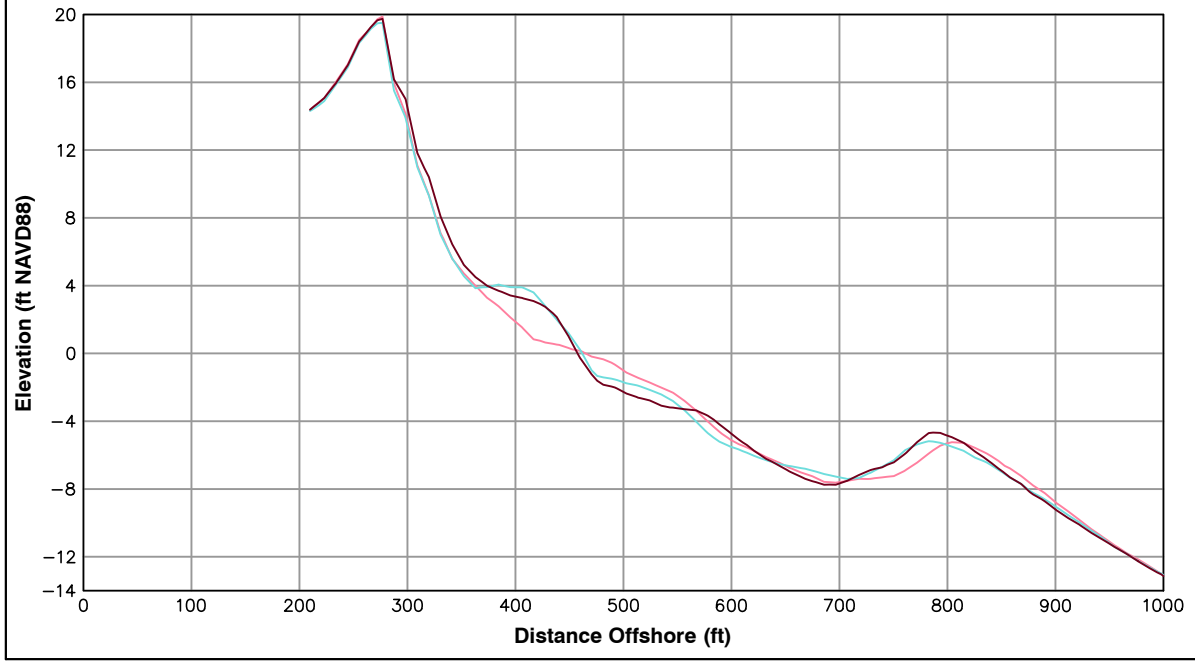
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 263+22	April 2015 - March 2014	April 2015 - October 2014
Shoreline Change at MHW (0.98 ft NAVD88)	32.07 ft/yr	-2.07 ft
Volume Change Above -15 ft NAVD88	2.70 cy/ft/yr	1.78 cy/ft
Volume Change Above 0 ft NAVD88	6.06 cy/ft/yr	2.26 cy/ft

LEGEND:
- 2015 APR
- 2014 OCT
- 2014 MAR

Notes:
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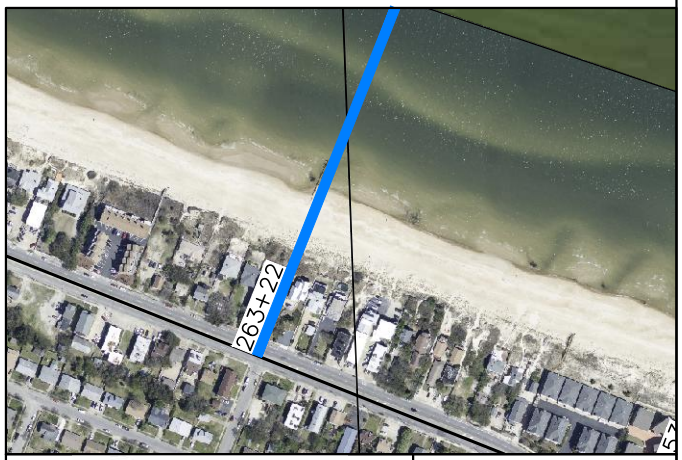

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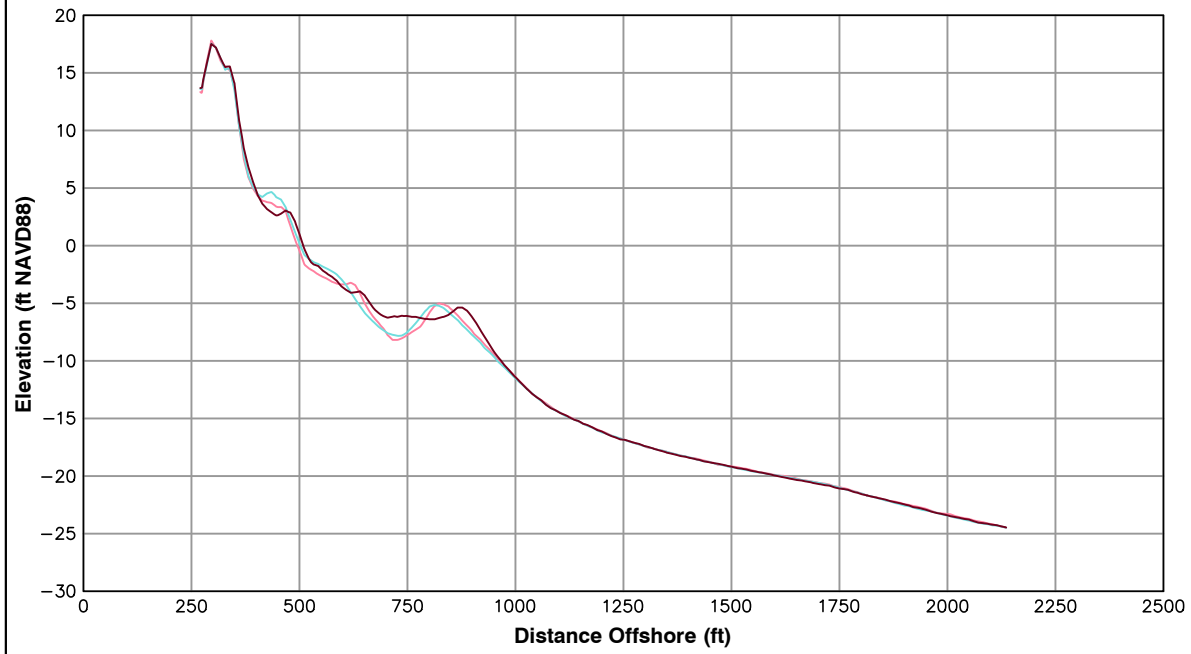
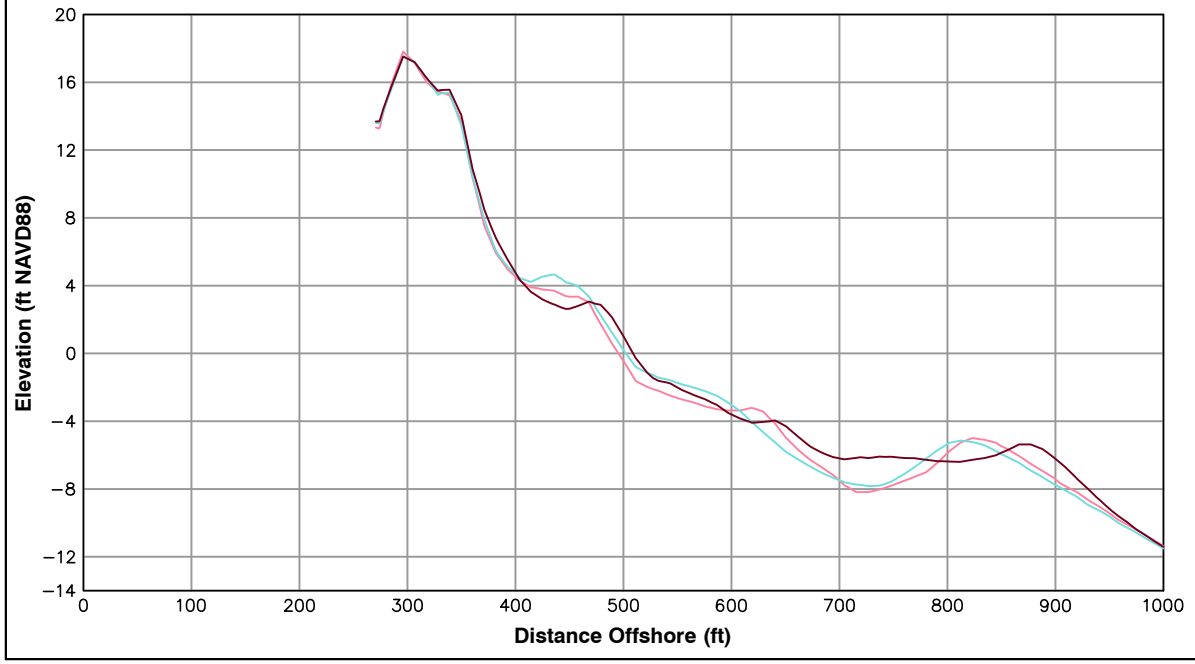
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 274+53	April 2015 - March 2014	April 2015 - October 2014
Shoreline Change at MHW (0.98 ft NAVD88)	13.45 ft/yr	8.49 ft
Volume Change Above -15 ft NAVD88	10.03 cy/ft/yr	8.16 cy/ft
Volume Change Above 0 ft NAVD88	1.70 cy/ft/yr	-0.43 cy/ft

LEGEND:
2015 APR
2014 OCT
2014 MAR

Notes:
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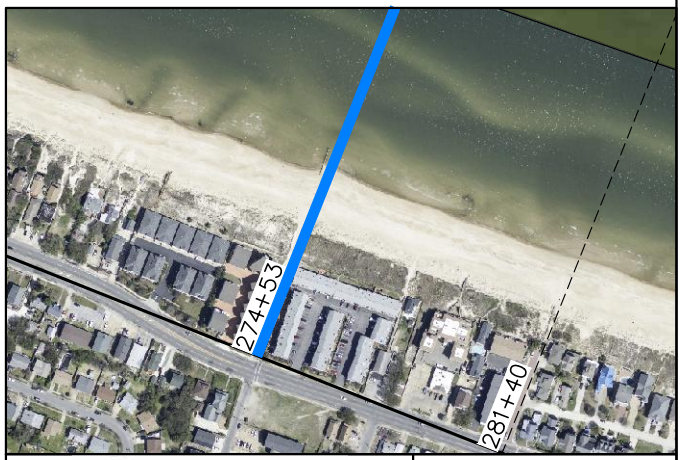

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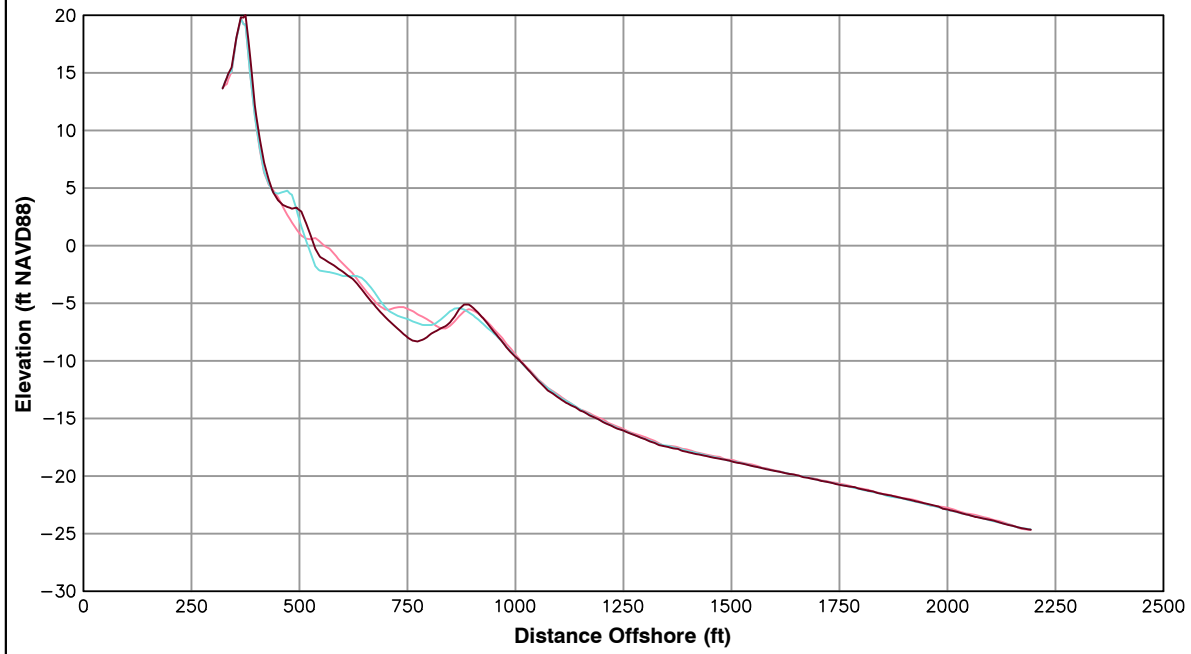
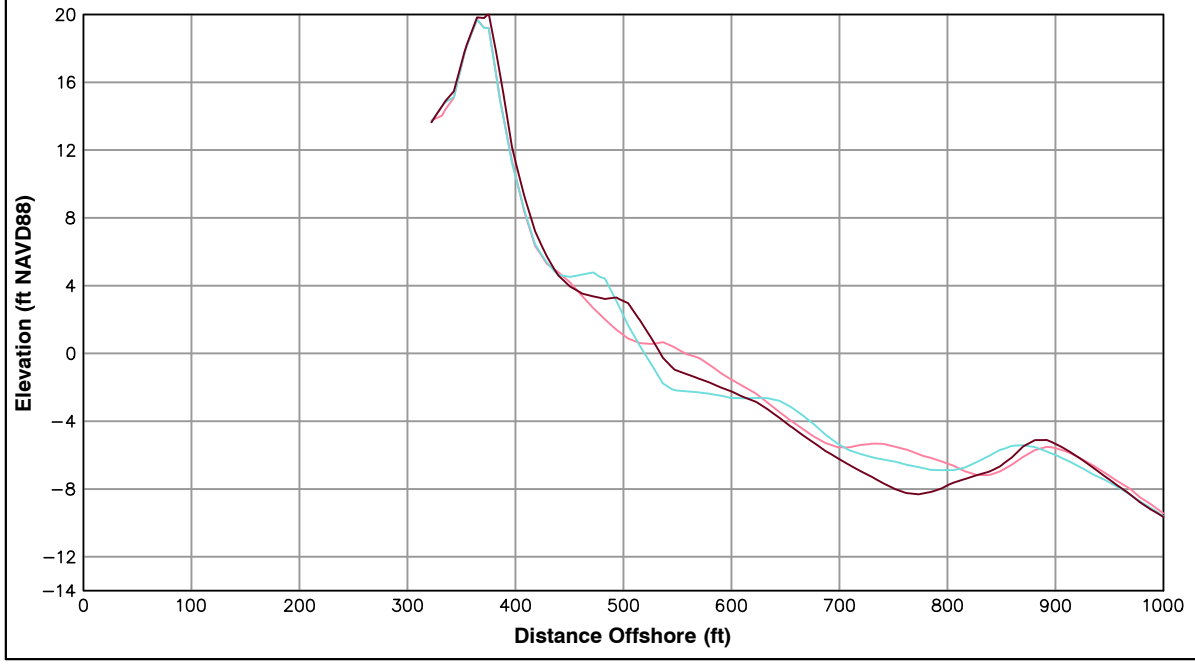
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 281+40	April 2015 - March 2014	April 2015 - October 2014
Shoreline Change at MHW (0.98 ft NAVD88)	20.73 ft/yr	14.44 ft
Volume Change Above -15 ft NAVD88	-6.79 cy/ft/yr	-3.74 cy/ft
Volume Change Above 0 ft NAVD88	4.61 cy/ft/yr	2.18 cy/ft

LEGEND:
- 2015 APR
- 2014 OCT
- 2014 MAR

Notes:
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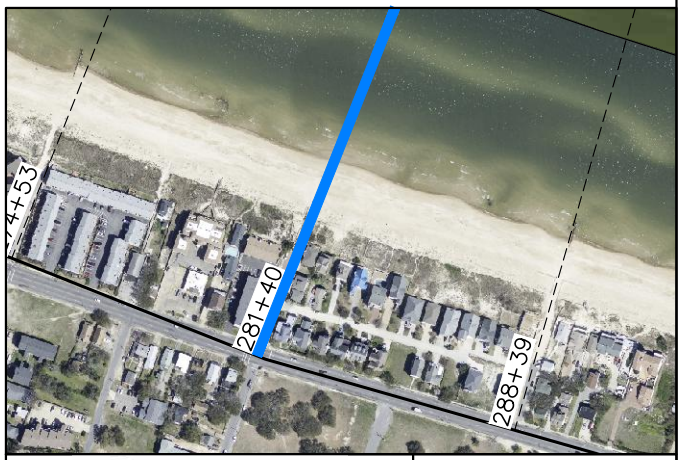

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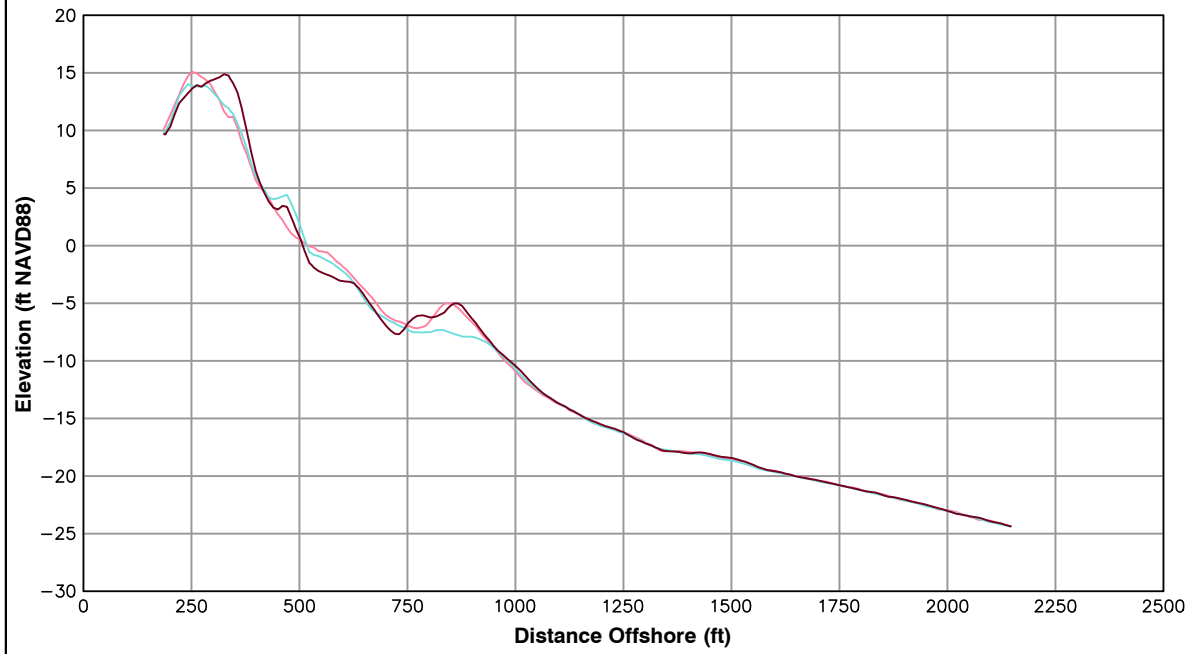
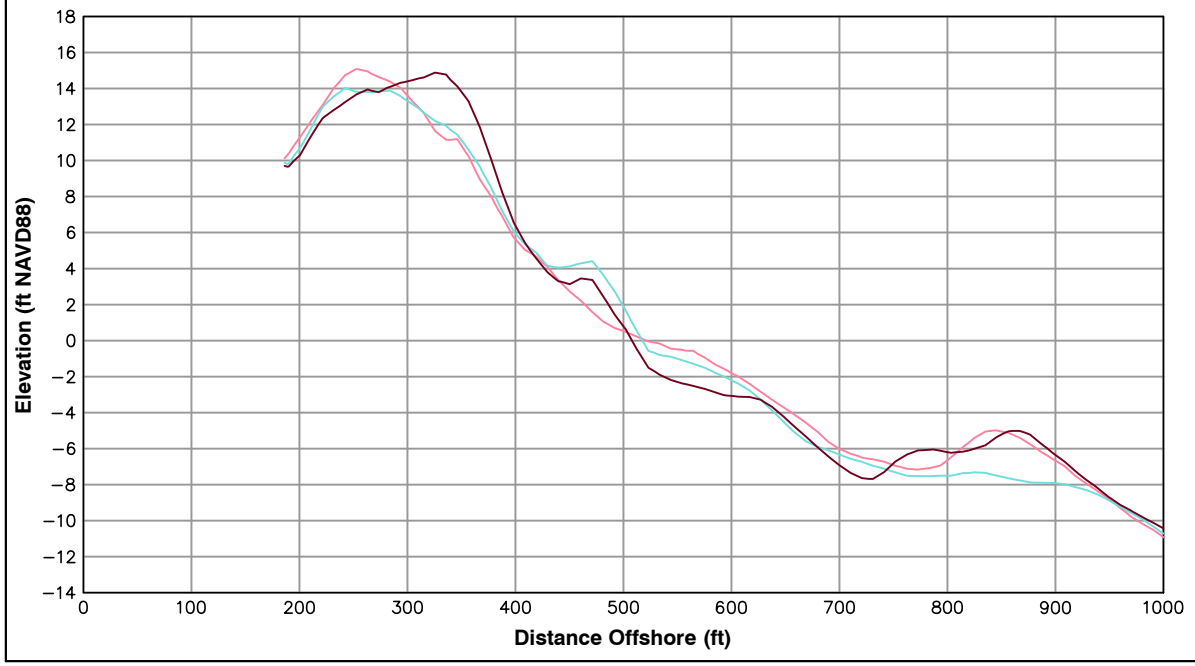
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 288+39	April 2015 - March 2014	April 2015 - October 2014
Shoreline Change at MHW (0.98 ft NAVD88)	12.86 ft/yr	-10.67 ft
Volume Change Above -15 ft NAVD88	1.43 cy/ft/yr	10.26 cy/ft
Volume Change Above 0 ft NAVD88	6.85 cy/ft/yr	3.48 cy/ft

LEGEND:
- 2015 APR
- 2014 OCT
- 2014 MAR

Notes:
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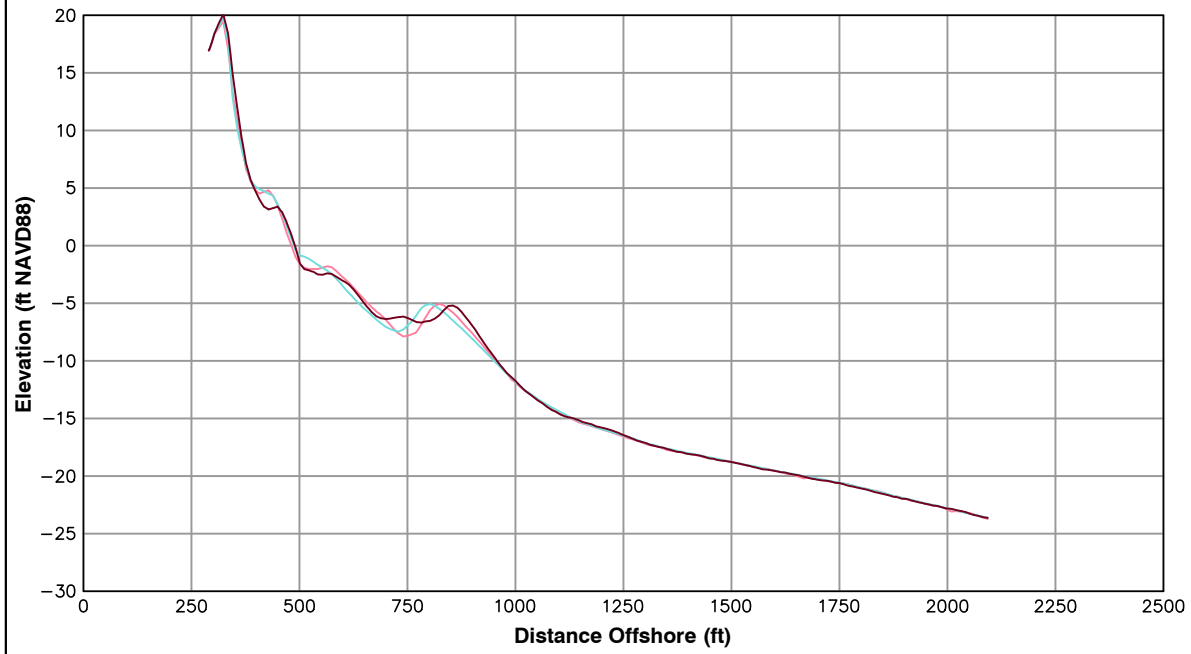
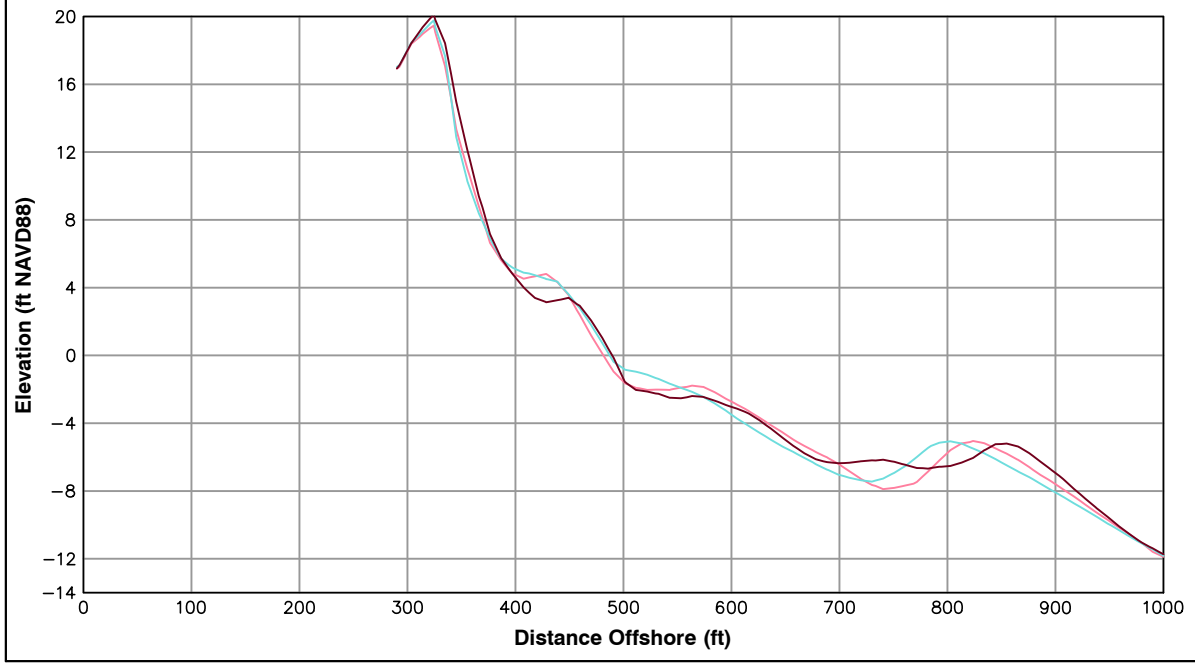
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 295+27	April 2015 - March 2014	April 2015 - October 2014
Shoreline Change at MHW (0.98 ft NAVD88)	8.23 ft/yr	2.97 ft
Volume Change Above -15 ft NAVD88	3.22 cy/ft/yr	4.44 cy/ft
Volume Change Above 0 ft NAVD88	1.43 cy/ft/yr	0.79 cy/ft

LEGEND:
- 2015 APR
- 2014 OCT
- 2014 MAR

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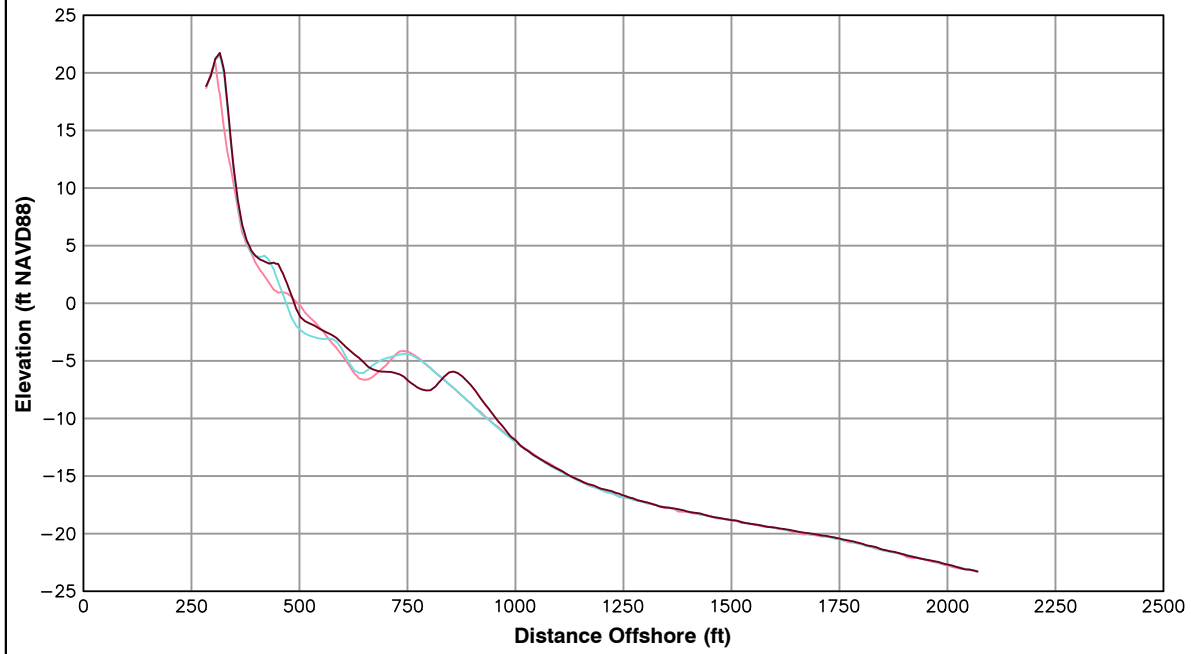
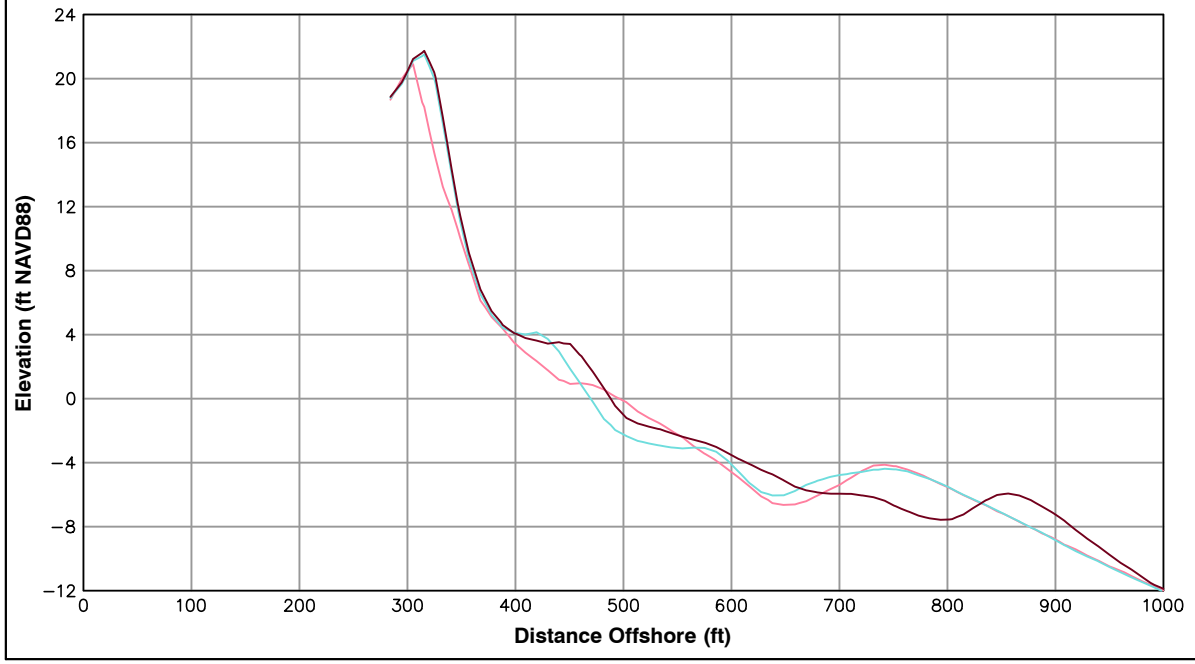
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 302+24	April 2015 - March 2014	April 2015 - October 2014
Shoreline Change at MHW (0.98 ft NAVD88)	27.43 ft/yr	18.99 ft
Volume Change Above -15 ft NAVD88	10.35 cy/ft/yr	6.21 cy/ft
Volume Change Above 0 ft NAVD88	9.84 cy/ft/yr	3.00 cy/ft

LEGEND:
- 2015 APR
- 2014 OCT
- 2014 MAR

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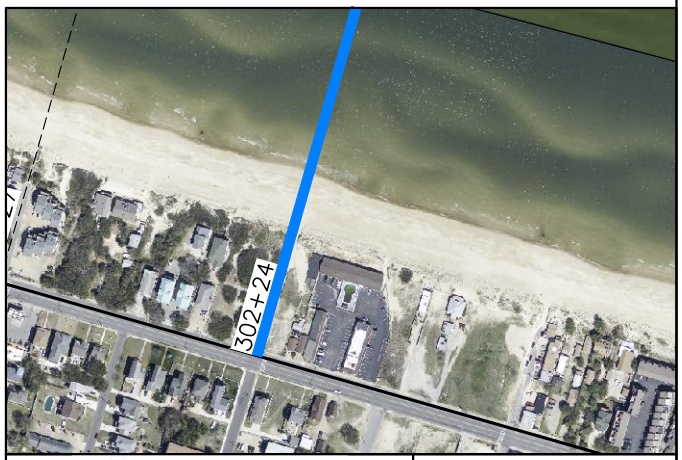

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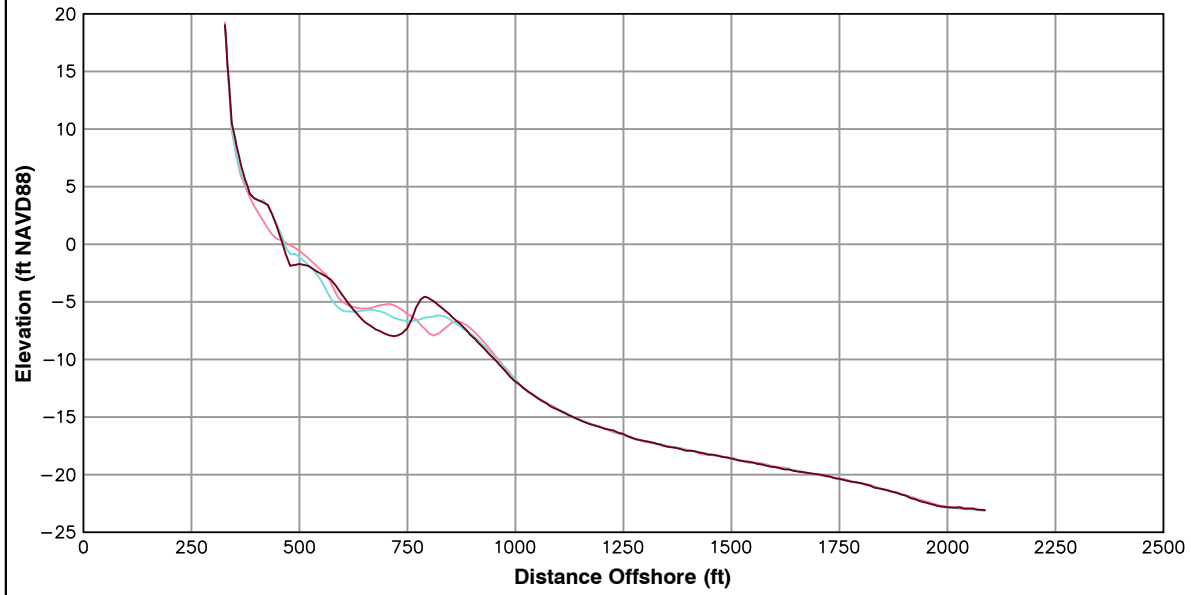
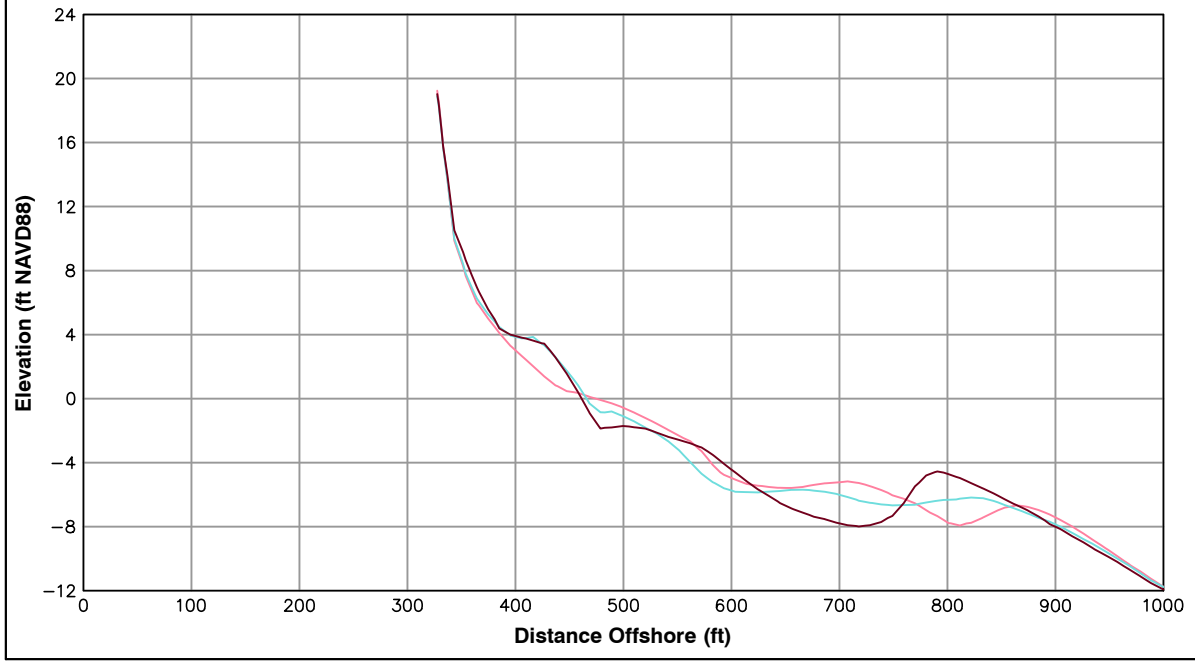
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 315+96	April 2015 - March 2014	April 2015 - October 2014
Shoreline Change at MHW (0.98 ft NAVD88)	16.97 ft/yr	-3.62 ft
Volume Change Above -15 ft NAVD88	-1.71 cy/ft/yr	0.09 cy/ft
Volume Change Above 0 ft NAVD88	4.08 cy/ft/yr	0.68 cy/ft

LEGEND:
- 2015 APR
- 2014 OCT
- 2014 MAR

Notes:
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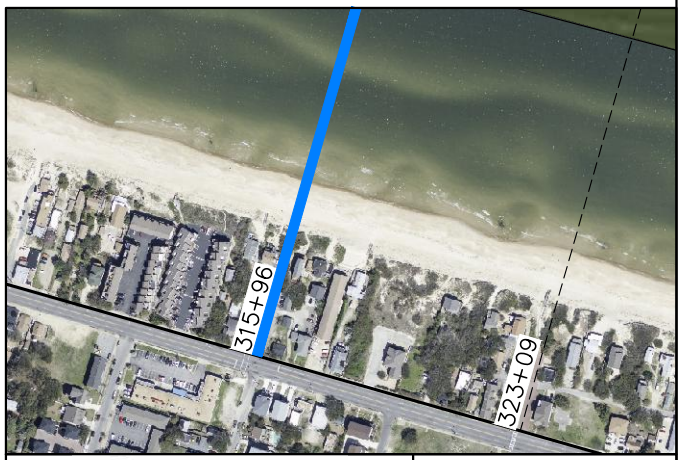

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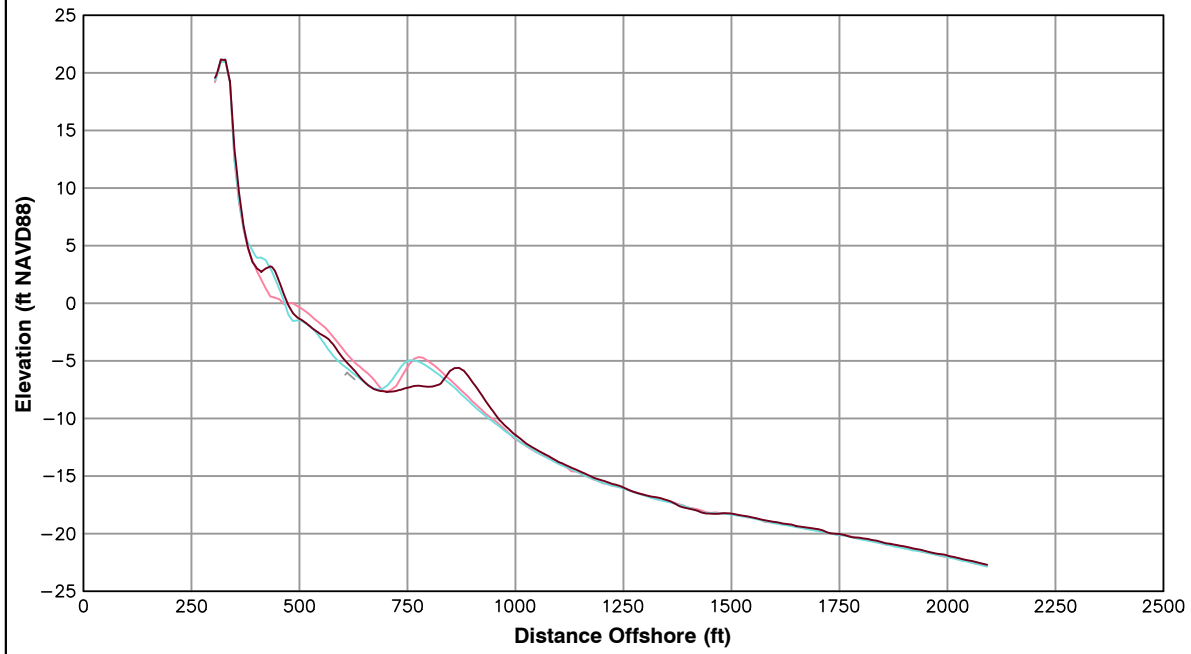
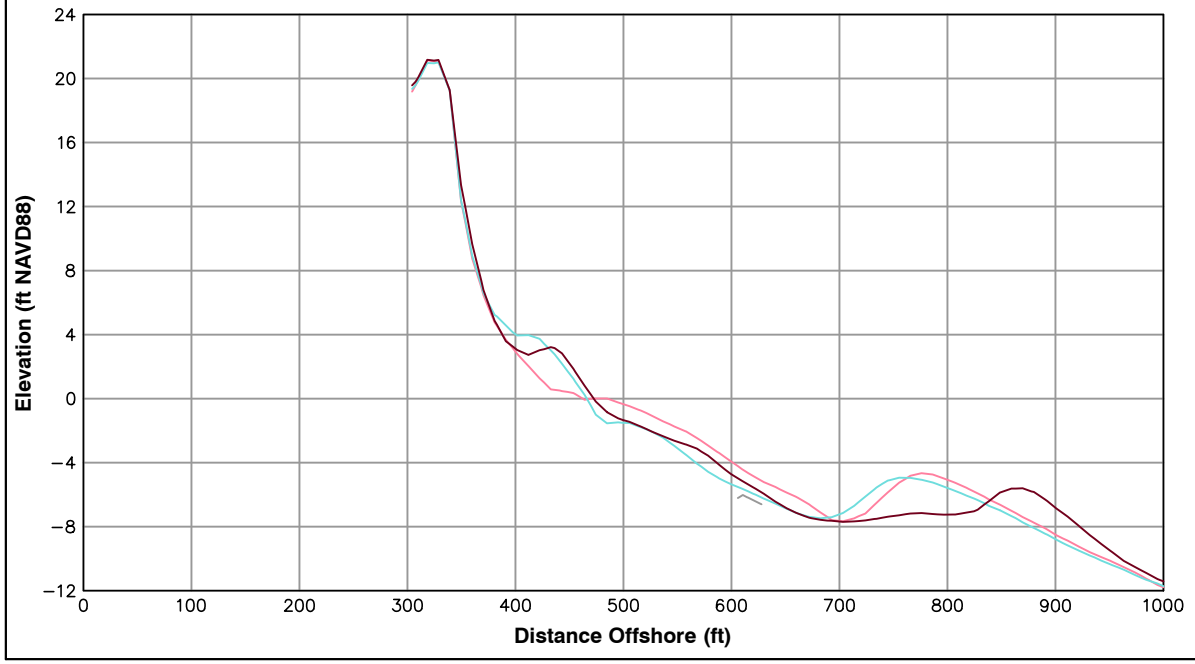
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 323+09	April 2015 - March 2014	April 2015 - October 2014
Shoreline Change at MHW (0.98 ft NAVD88)	32.45 ft/yr	6.00 ft
Volume Change Above -15 ft NAVD88	-1.59 cy/ft/yr	3.80 cy/ft
Volume Change Above 0 ft NAVD88	4.43 cy/ft/yr	0.11 cy/ft

LEGEND:
- 2015 APR
- 2014 OCT
- 2014 MAR

Notes:
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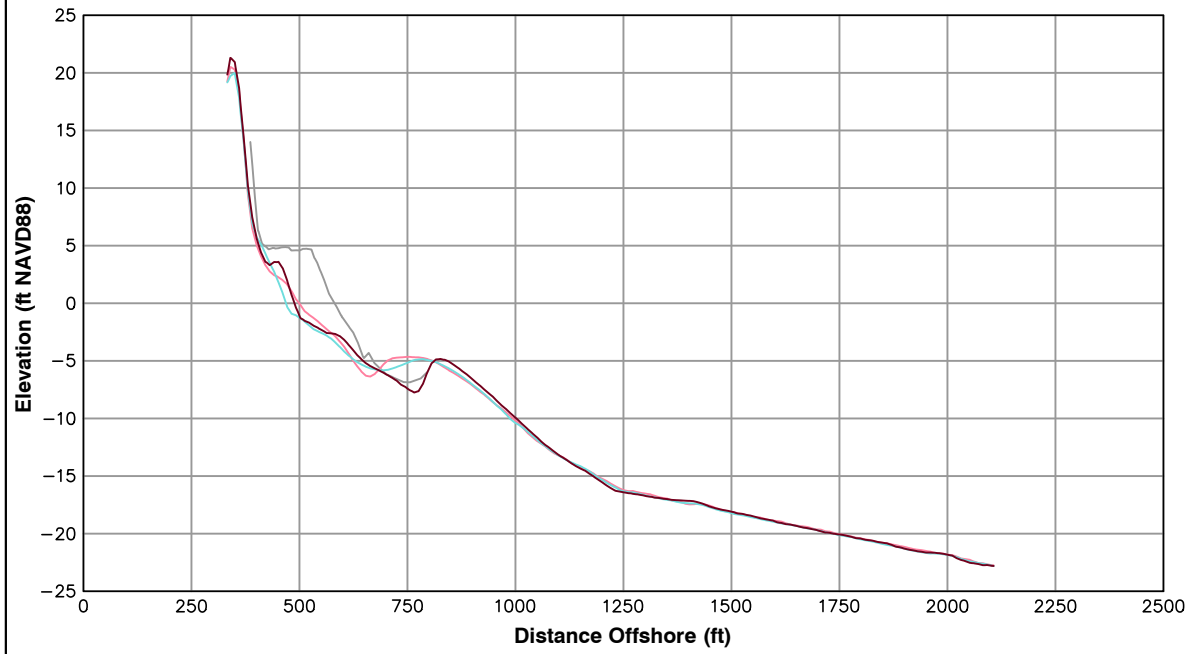
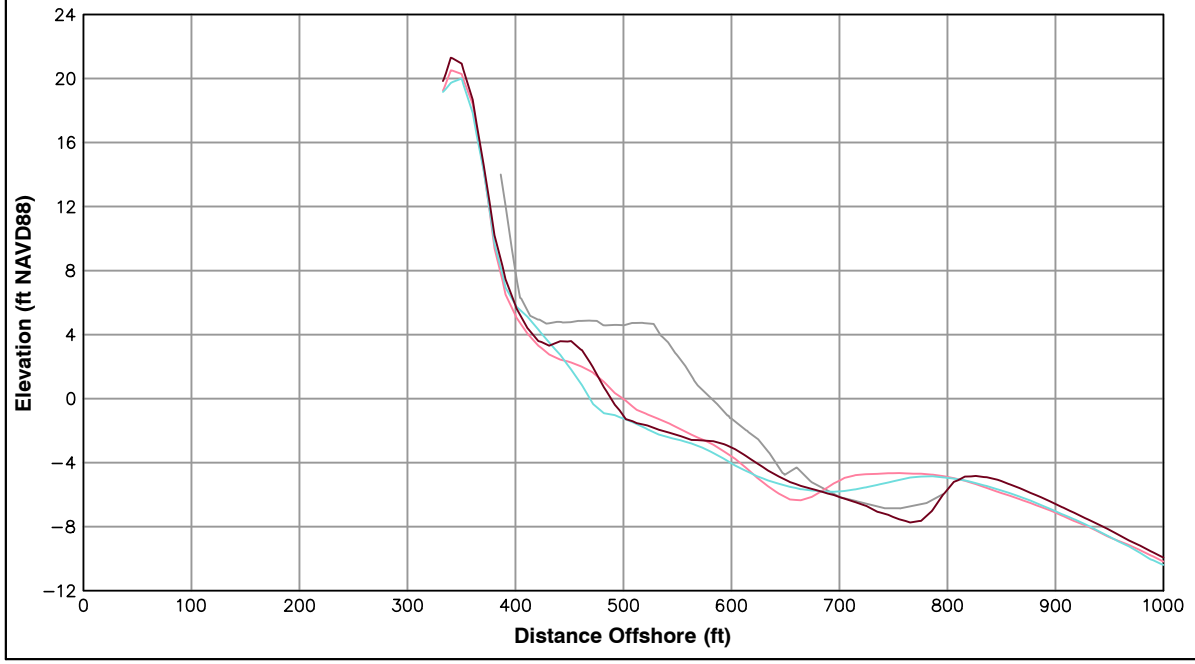
City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 329+63	April 2015 - March 2014	April 2015 - October 2014
Shoreline Change at MHW (0.98 ft NAVD88)	-2.92 ft/yr	19.42 ft
Volume Change Above -15 ft NAVD88	-0.50 cy/ft/yr	4.51 cy/ft
Volume Change Above 0 ft NAVD88	3.00 cy/ft/yr	3.94 cy/ft

LEGEND:
- 2015 APR
- 2014 OCT
- 2014 MAR
- POST-FILL

Notes:
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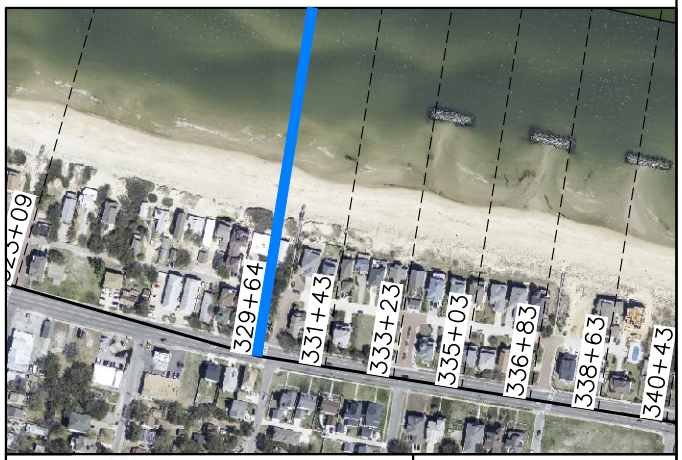

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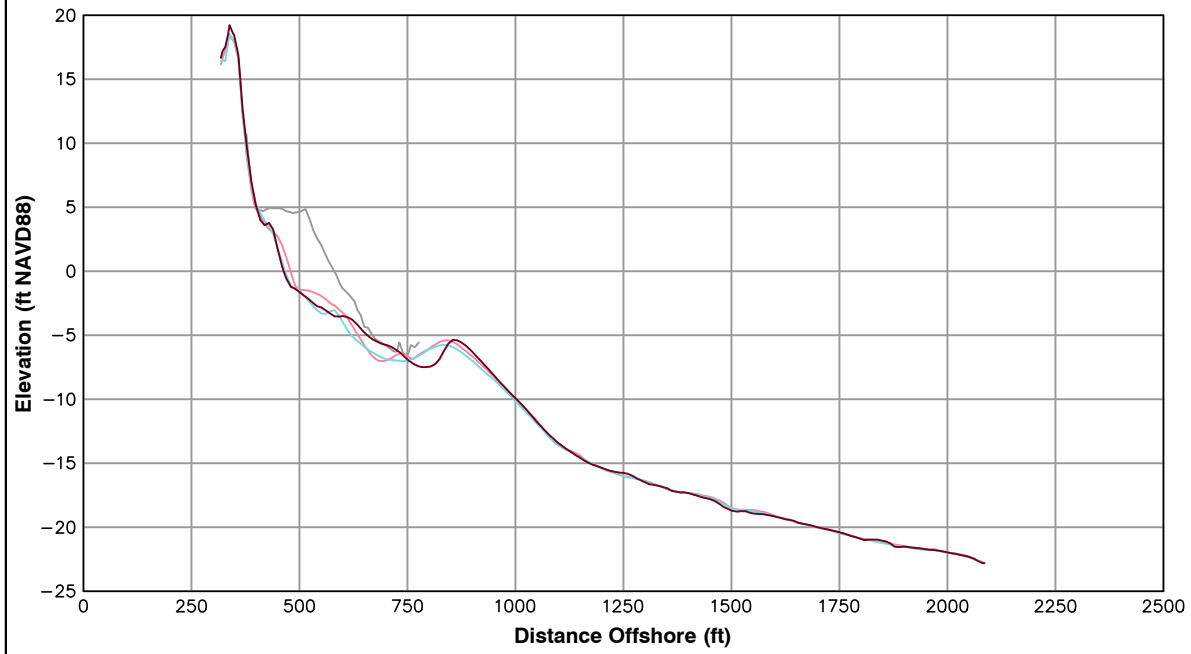
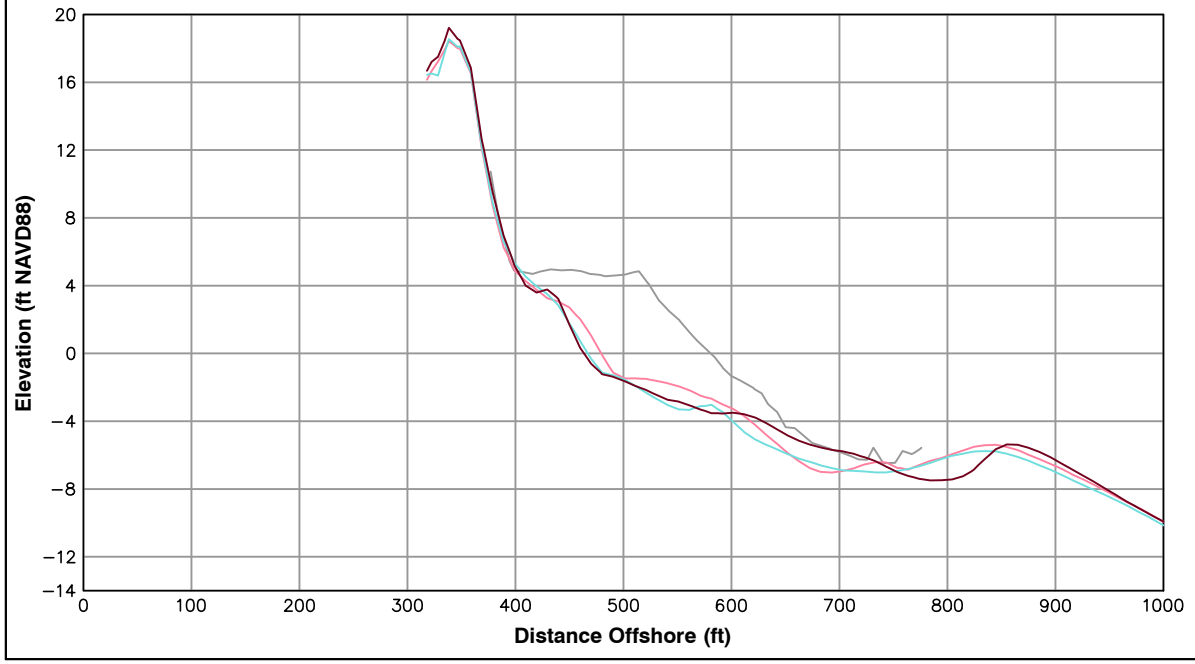
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 331+43	April 2015 - March 2014	April 2015 - October 2014
Shoreline Change at MHW (0.98 ft NAVD88)	-14.18 ft/yr	-2.37 ft
Volume Change Above -15 ft NAVD88	-1.40 cy/ft/yr	7.31 cy/ft
Volume Change Above 0 ft NAVD88	0.32 cy/ft/yr	1.14 cy/ft

LEGEND:
- 2015 APR
- 2014 OCT
- 2014 MAR
- POST-FILL

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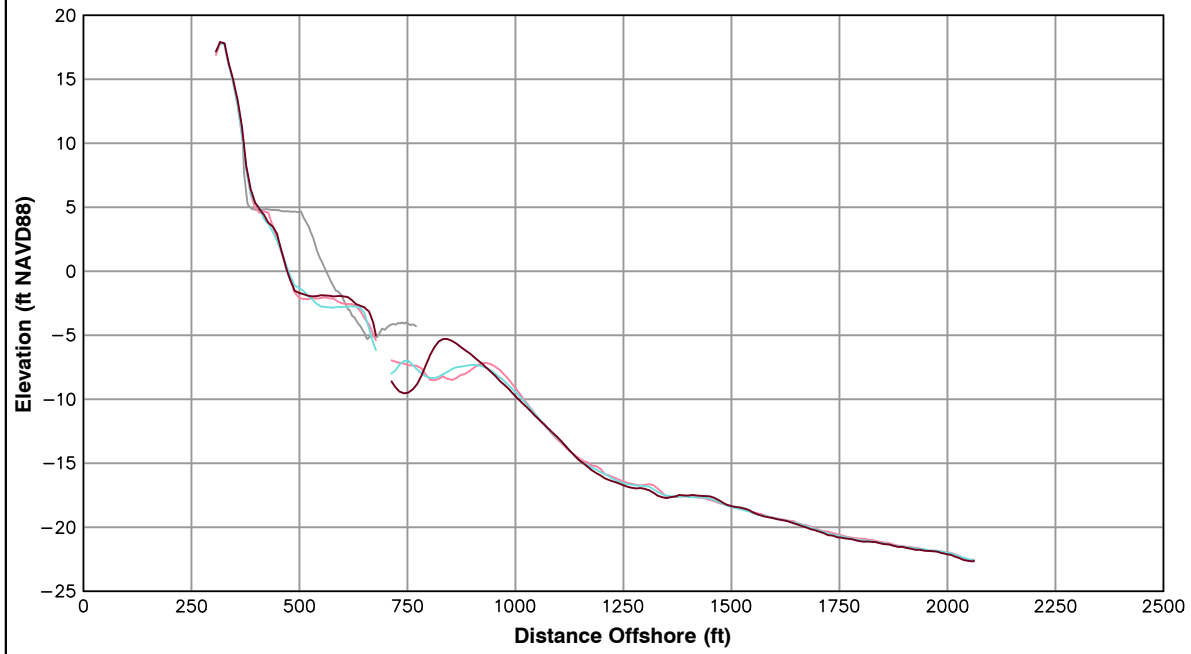
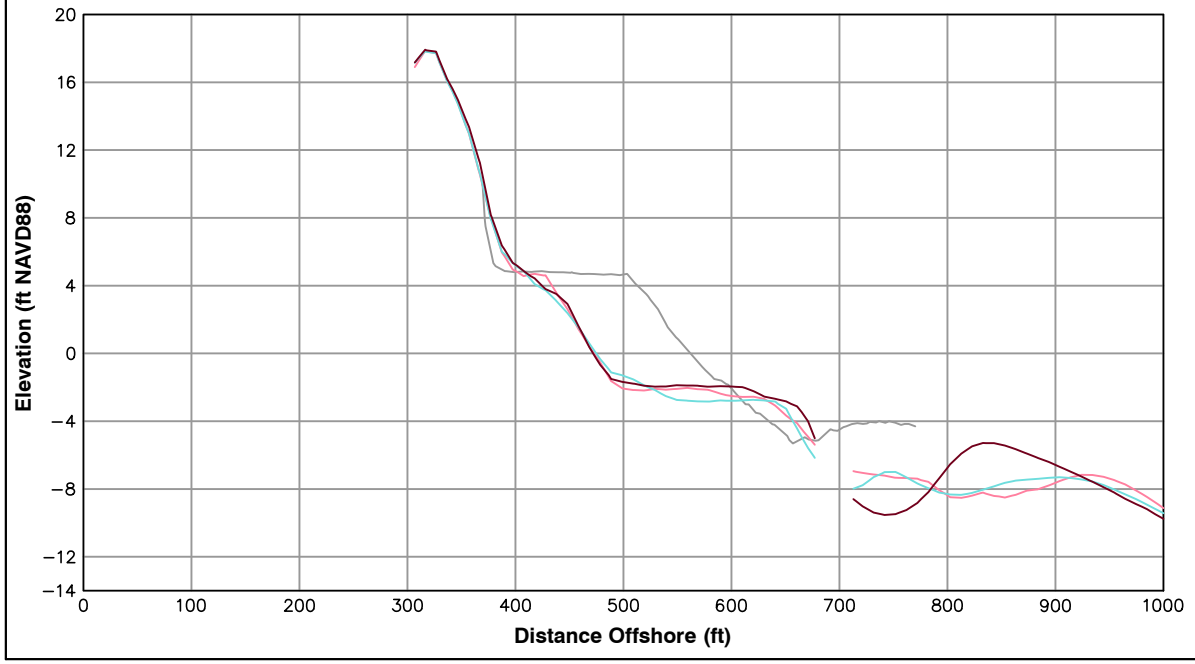
City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 333+23	April 2015 - March 2014	April 2015 - October 2014
Shoreline Change at MHW (0.98 ft NAVD88)	0.61 ft/yr	-0.77 ft
Volume Change Above -15 ft NAVD88	5.77 cy/ft/yr	7.87 cy/ft
Volume Change Above 0 ft NAVD88	0.79 cy/ft/yr	1.29 cy/ft

LEGEND:
- 2015 APR
- 2014 OCT
- 2014 MAR
- POST-FILL

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City of Norfolk

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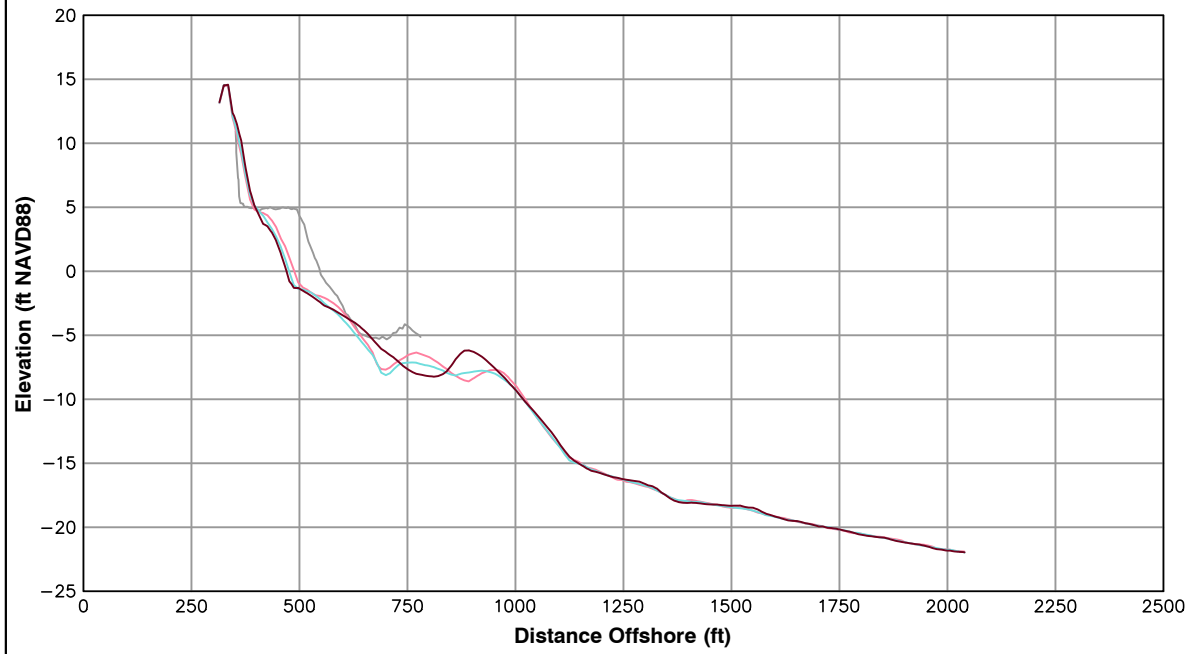

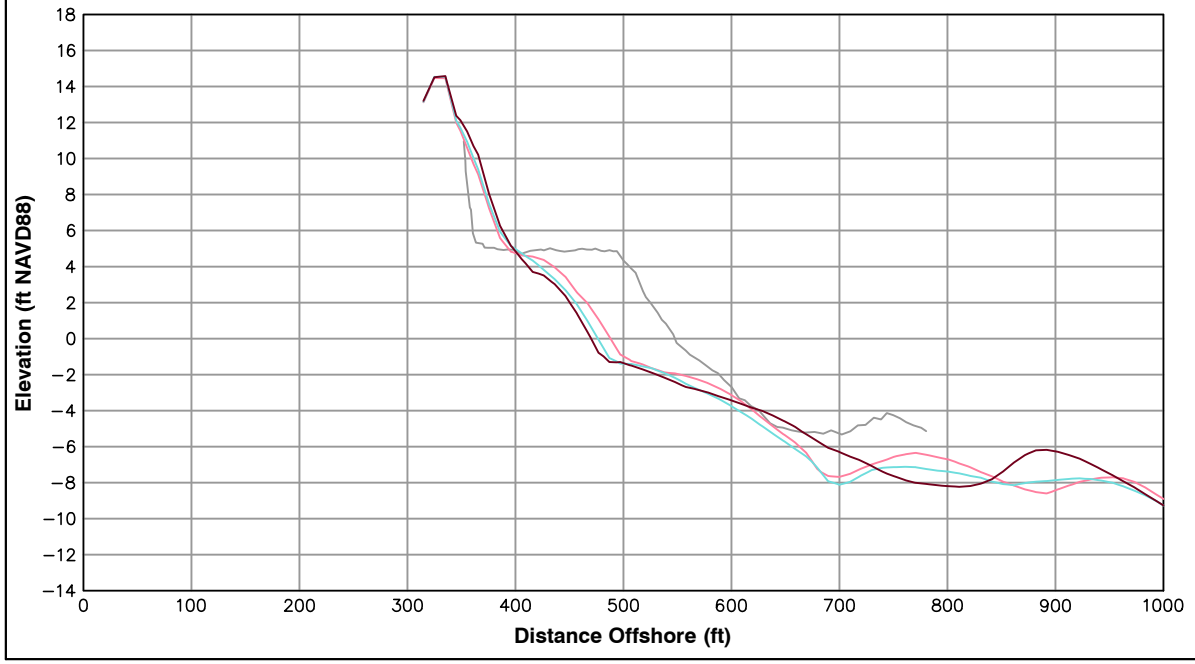

Survey Transect 335+03	April 2015 - March 2014	April 2015 - October 2014
Shoreline Change at MHW (0.98 ft NAVD88)	-15.54 ft/yr	-5.87 ft
Volume Change Above -15 ft NAVD88	0.64 cy/ft/yr	8.26 cy/ft
Volume Change Above 0 ft NAVD88	-1.23 cy/ft/yr	-0.19 cy/ft

LEGEND:
- 2015 APR
- 2014 OCT
- 2014 MAR
- POST-FILL

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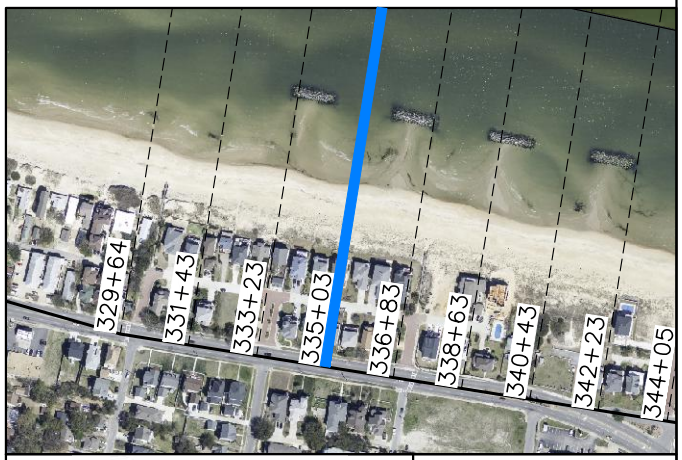
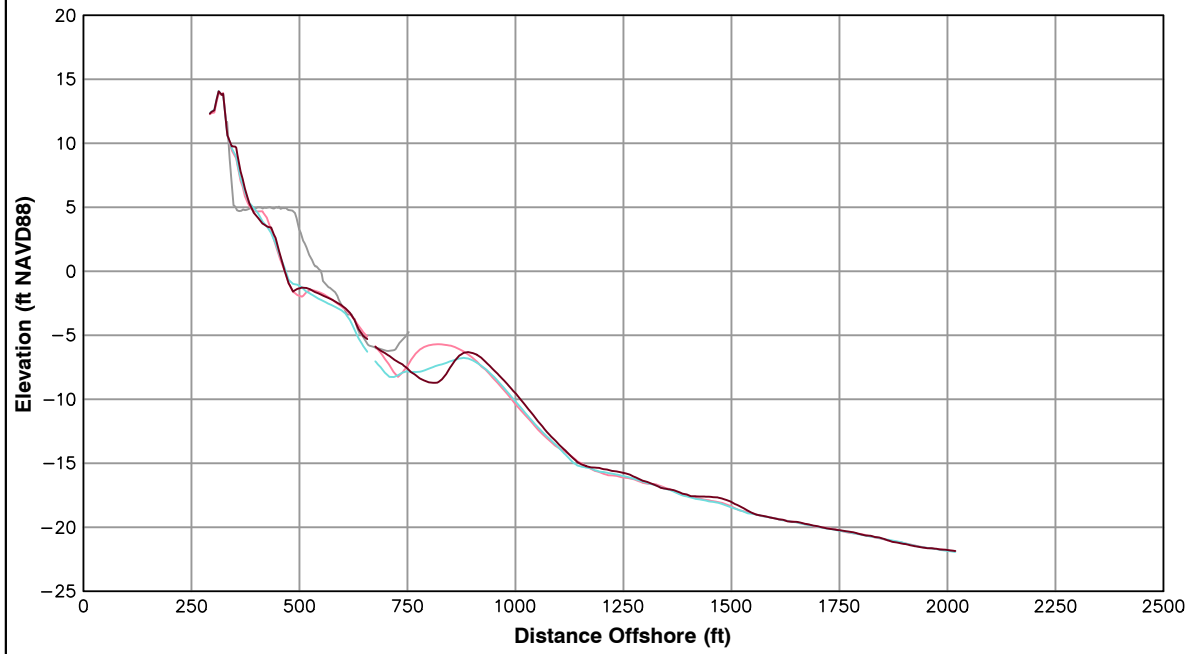
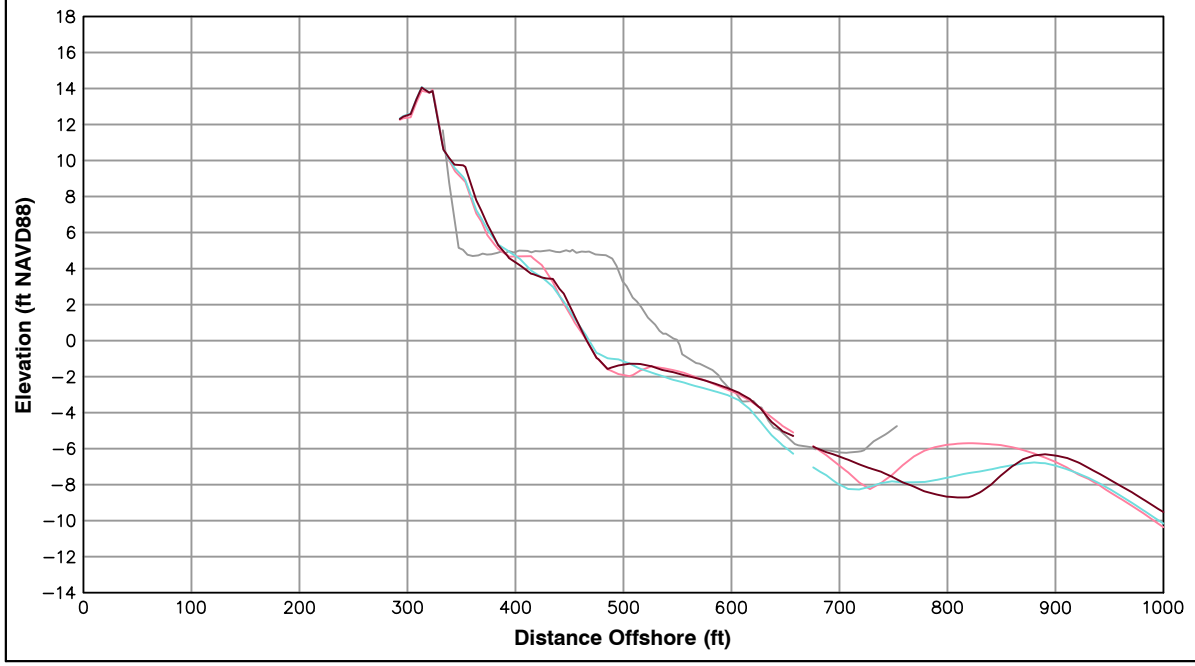


City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





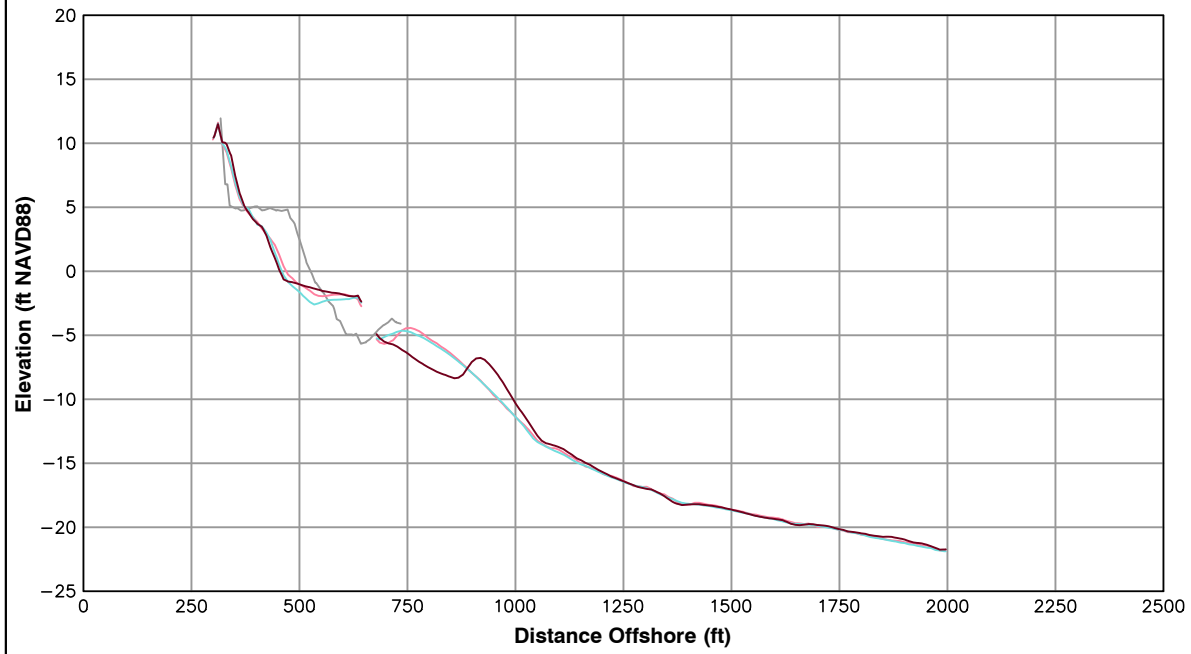
Survey Transect 336+83	April 2015 - March 2014	April 2015 - October 2014
Shoreline Change at MHW (0.98 ft NAVD88)	2.66 ft/yr	0.38 ft
Volume Change Above -15 ft NAVD88	-1.62 cy/ft/yr	8.03 cy/ft
Volume Change Above 0 ft NAVD88	0.60 cy/ft/yr	0.59 cy/ft

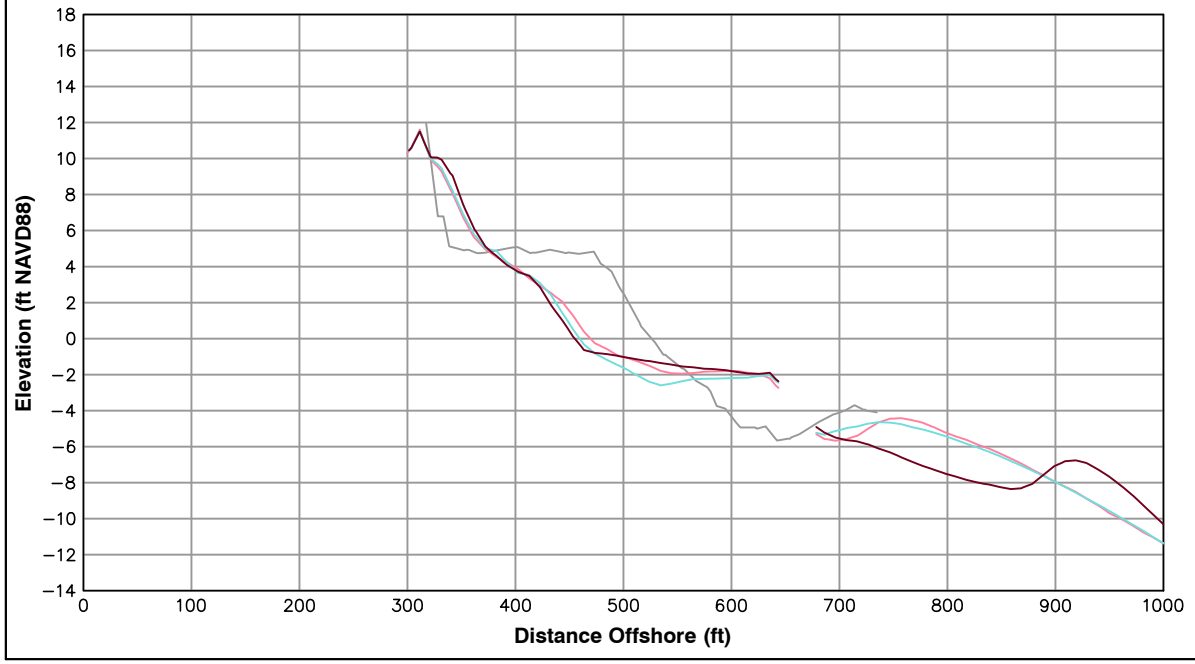
LEGEND:
- 2015 APR
- 2014 OCT
- 2014 MAR
- POST-FILL

Notes:
1. Stationing From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. Survey Comparison Made To March 2014 and October 2014.
5. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward And Seaward Of The Breakwater.

City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 338+63	April 2015 - March 2014	April 2015 - October 2014
Shoreline Change at MHW (0.98 ft NAVD88)	-11.96 ft/yr	-4.56 ft
Volume Change Above -15 ft NAVD88	-2.12 cy/ft/yr	1.97 cy/ft
Volume Change Above 0 ft NAVD88	-0.12 cy/ft/yr	0.13 cy/ft

LEGEND:
- 2015 APR
- 2014 OCT
- 2014 MAR
- POST-FILL

Notes:
1. Stationing From West To East At Varying Intervals.
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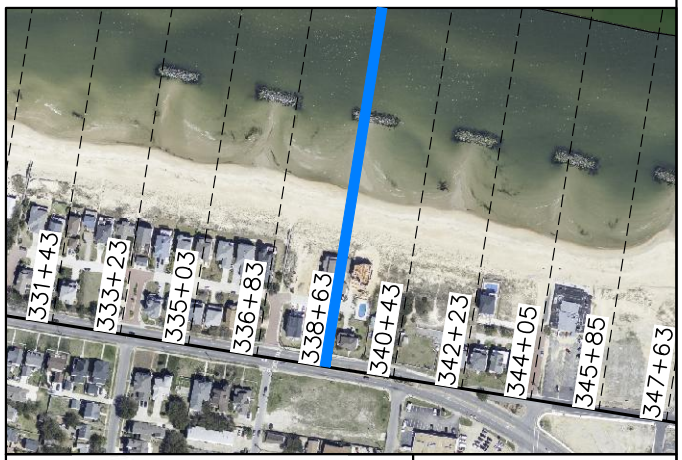
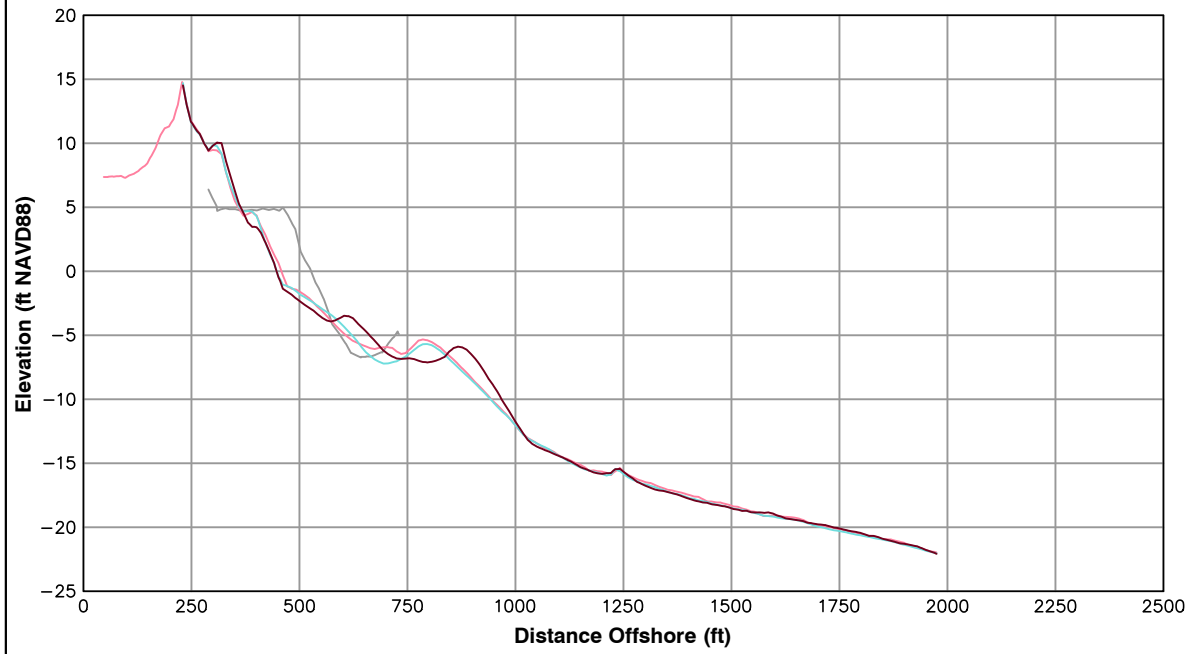
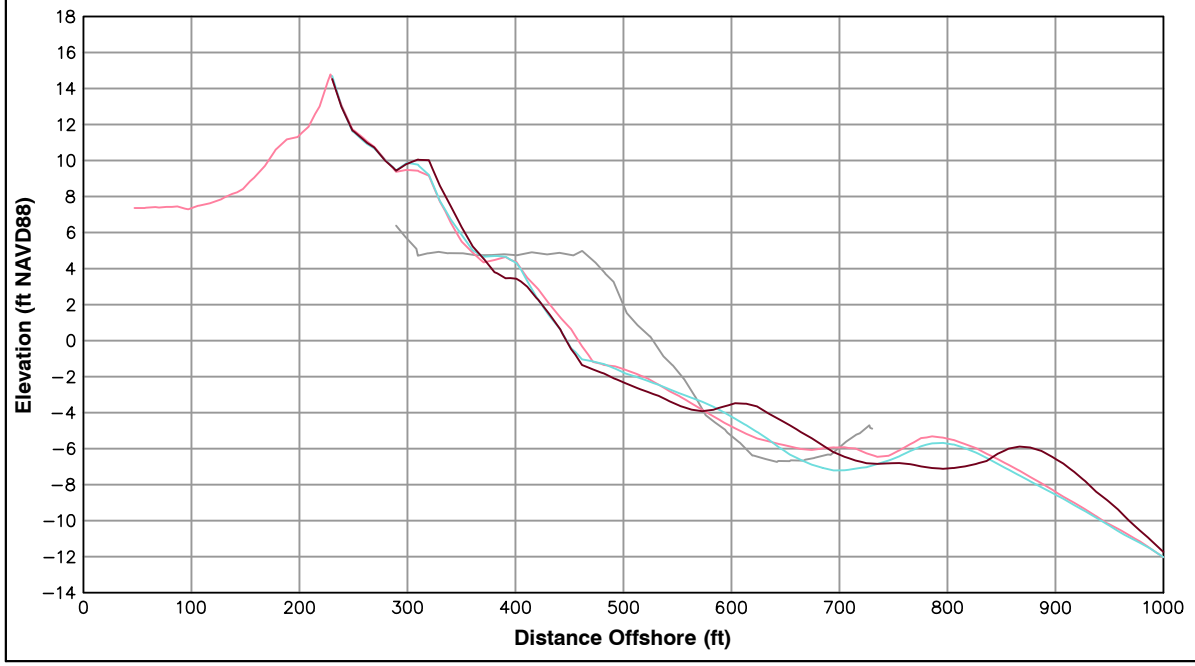


City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 340+43	April 2015 - March 2014	April 2015 - October 2014
Shoreline Change at MHW (0.98 ft NAVD88)	-8.28 ft/yr	0.54 ft
Volume Change Above -15 ft NAVD88	2.53 cy/ft/yr	7.53 cy/ft
Volume Change Above 0 ft NAVD88	-0.34 cy/ft/yr	0.00 cy/ft

LEGEND:
- 2015 APR
- 2014 OCT
- 2014 MAR
- POST-FILL

Notes:
1. Stationing From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. Survey Comparison Made To March 2014 and October 2014.
5. 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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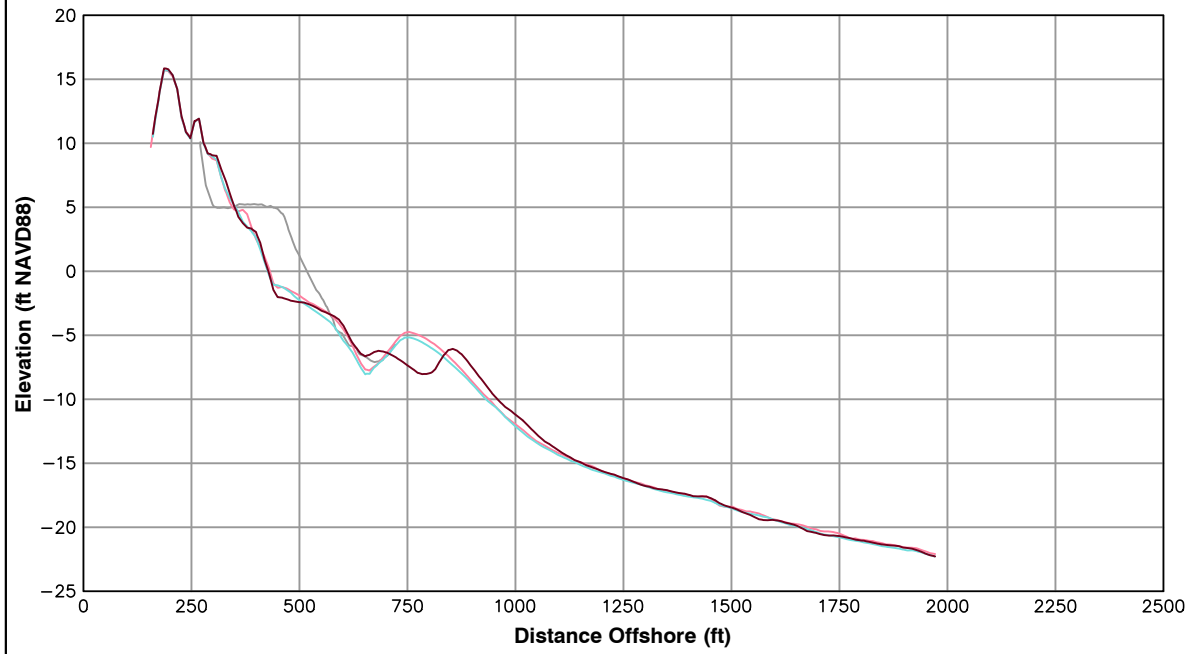
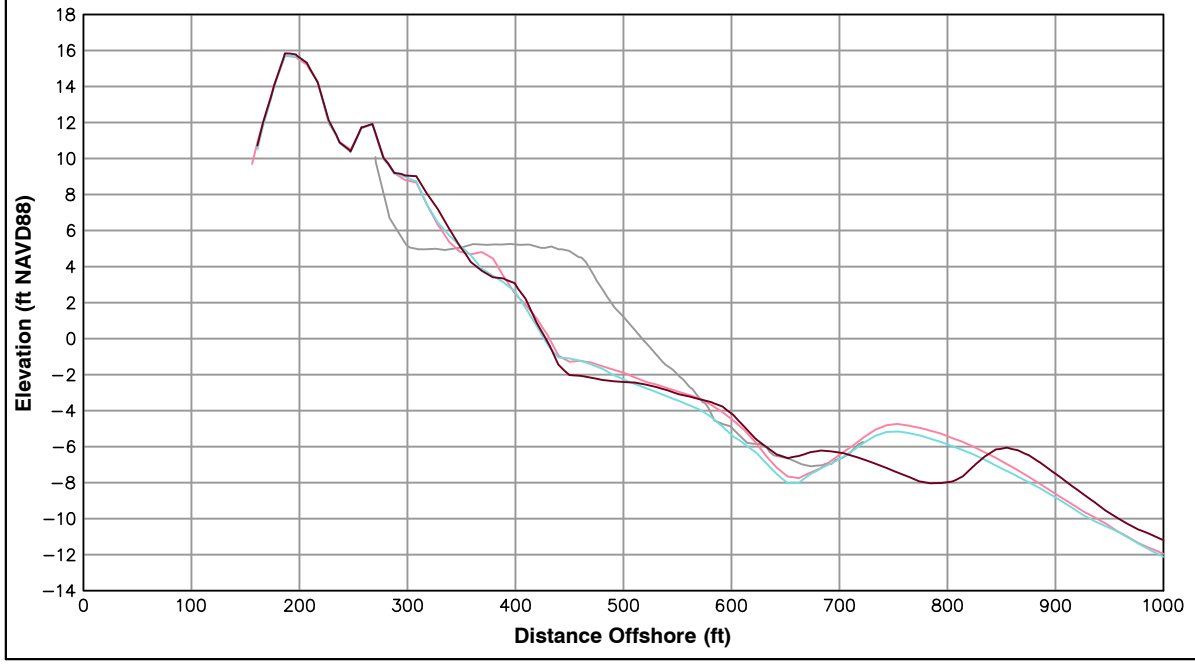
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





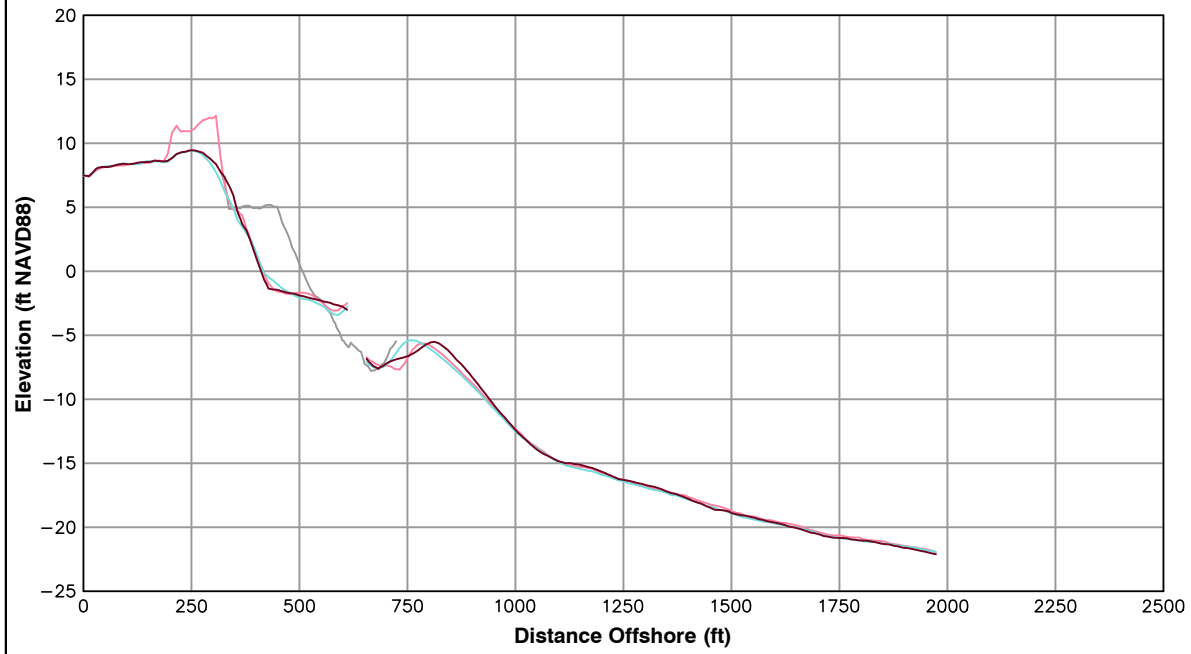
Survey Transect 342+23	April 2015 - March 2014	April 2015 - October 2014
Shoreline Change at MHW (0.98 ft NAVD88)	-2.11 ft/yr	1.99 ft
Volume Change Above -15 ft NAVD88	-1.27 cy/ft/yr	7.33 cy/ft
Volume Change Above 0 ft NAVD88	0.44 cy/ft/yr	1.40 cy/ft

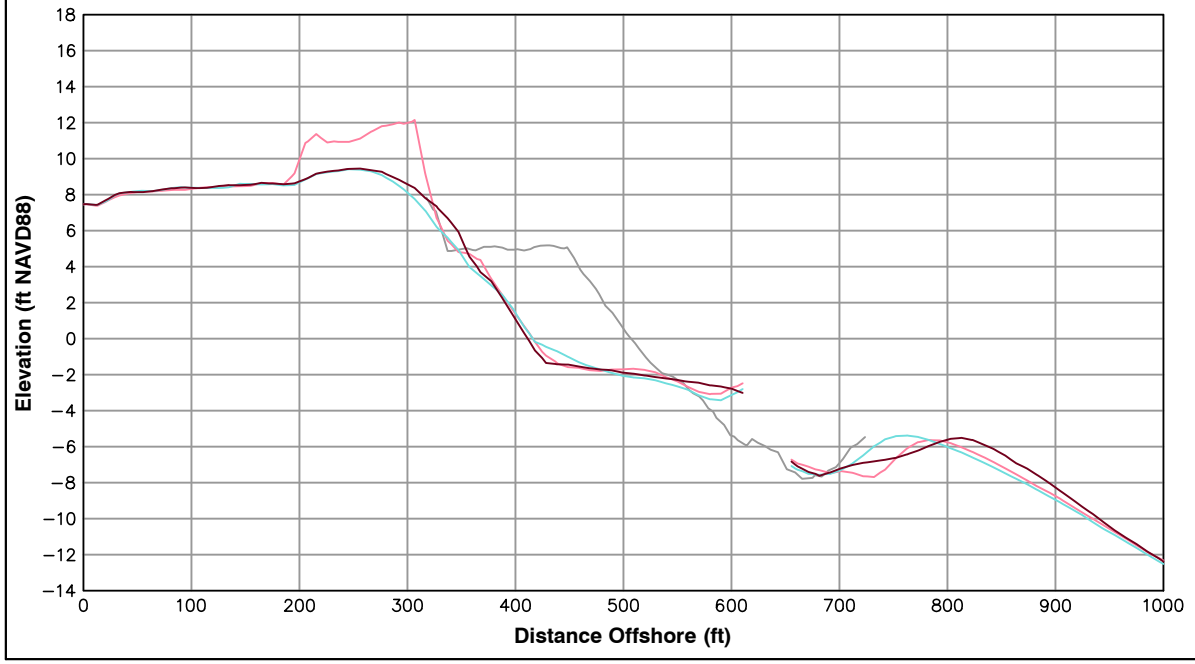
LEGEND:
- 2015 APR
- 2014 OCT
- 2014 MAR
- POST-FILL

Notes:
1. Stationing From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. Survey Comparison Made To March 2014 and October 2014.
5. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward And Seaward Of The Breakwater.

City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 344+05	April 2015 - March 2014	April 2015 - October 2014
Shoreline Change at MHW (0.98 ft NAVD88)	-3.40 ft/yr	-3.70 ft
Volume Change Above -15 ft NAVD88	-6.02 cy/ft/yr	5.47 cy/ft
Volume Change Above 0 ft NAVD88	-8.61 cy/ft/yr	2.28 cy/ft

LEGEND:
- 2015 APR
- 2014 OCT
- 2014 MAR
- POST-FILL

Notes:
1. Stationing From West To East At Varying Intervals.
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5. 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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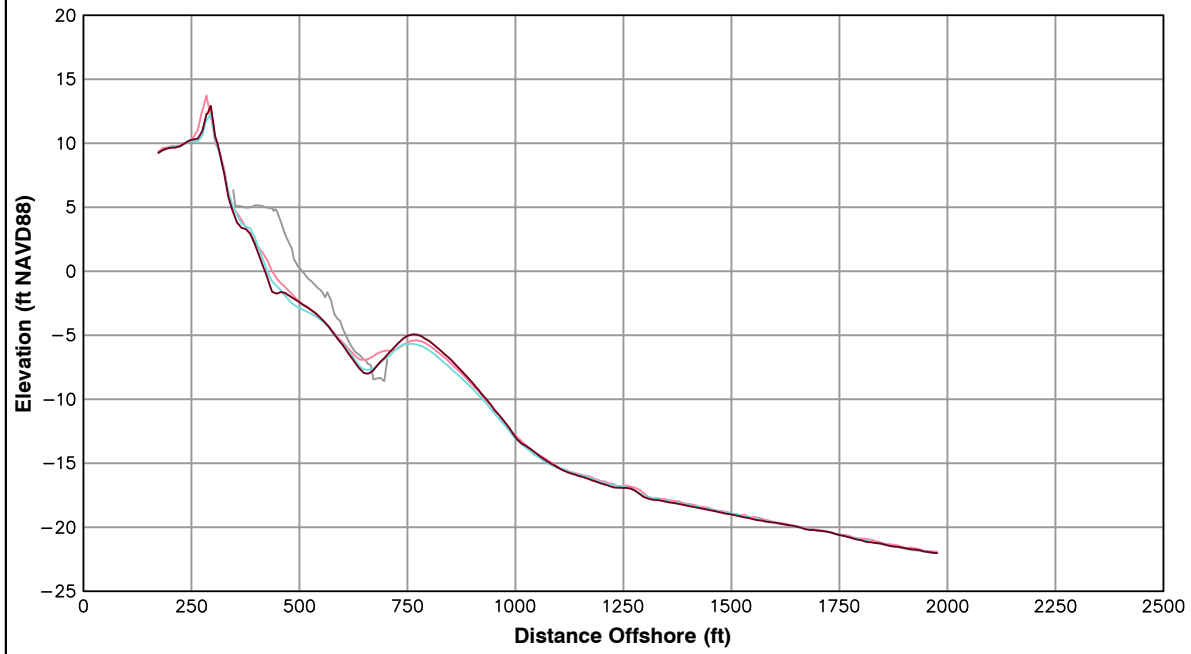
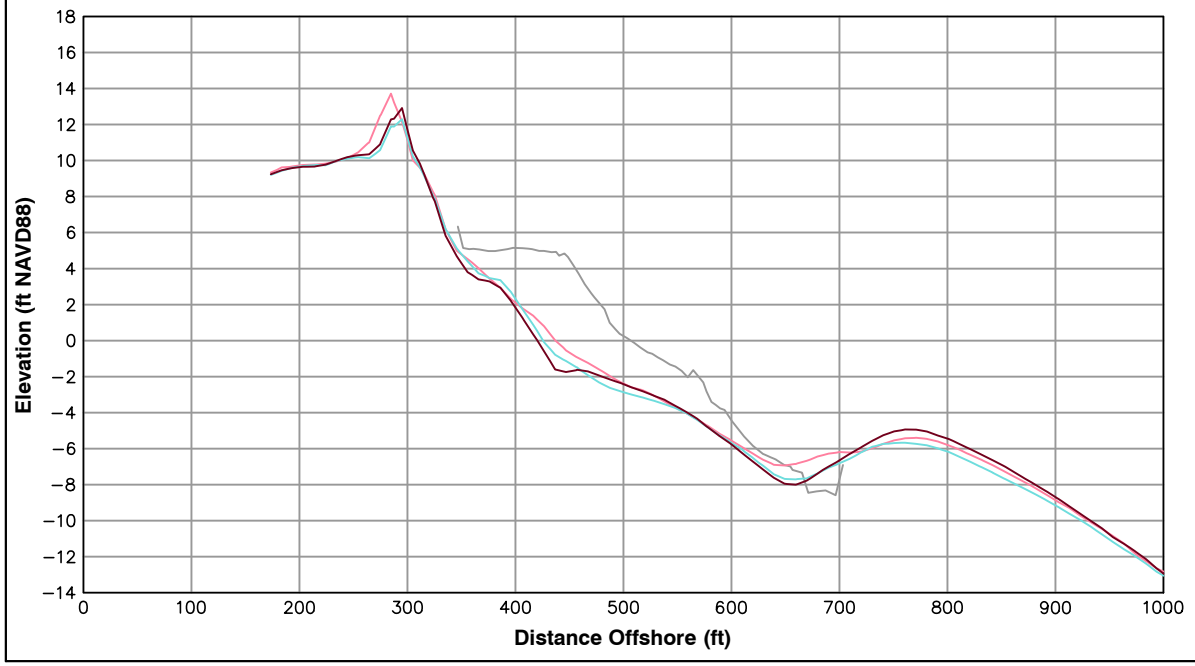
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 345+85	April 2015 - March 2014	April 2015 - October 2014
Shoreline Change at MHW (0.98 ft NAVD88)	-12.76 ft/yr	-5.80 ft
Volume Change Above -15 ft NAVD88	-5.15 cy/ft/yr	5.03 cy/ft
Volume Change Above 0 ft NAVD88	-2.81 cy/ft/yr	-0.74 cy/ft

LEGEND:
- 2015 APR
- 2014 OCT
- 2014 MAR
- POST-FILL

Notes:
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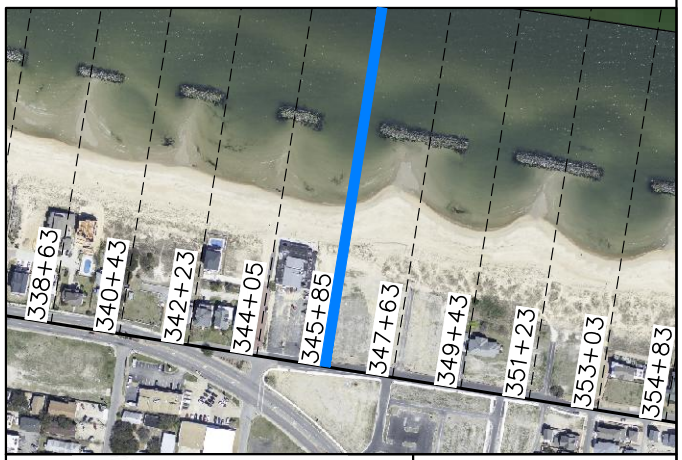

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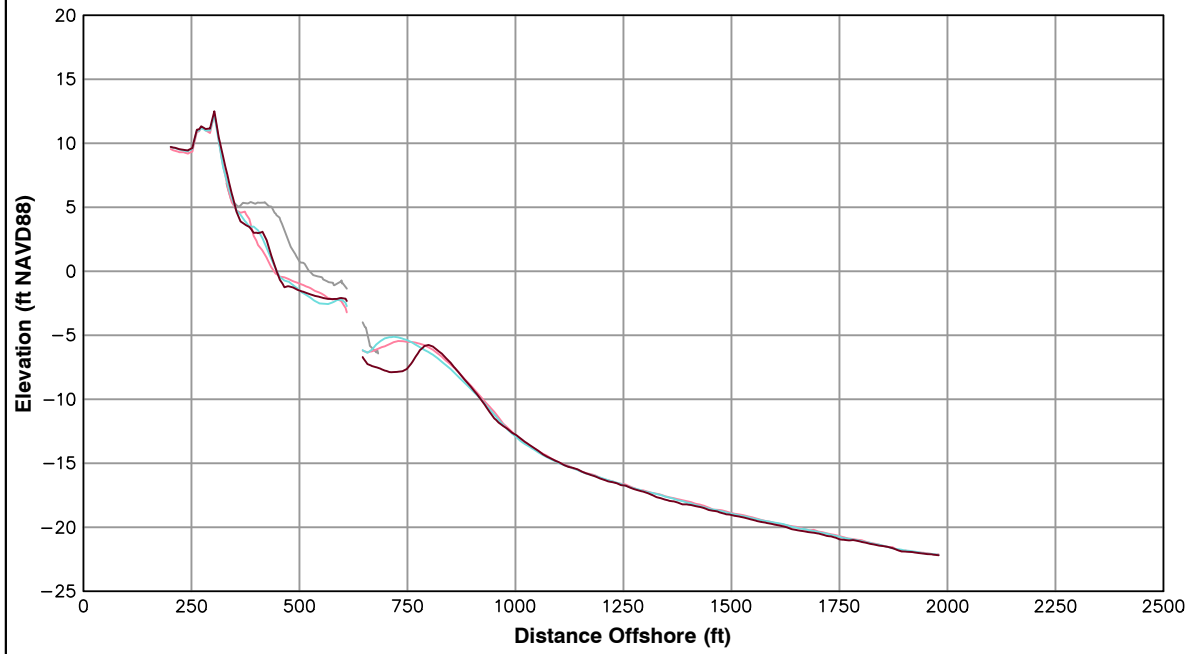
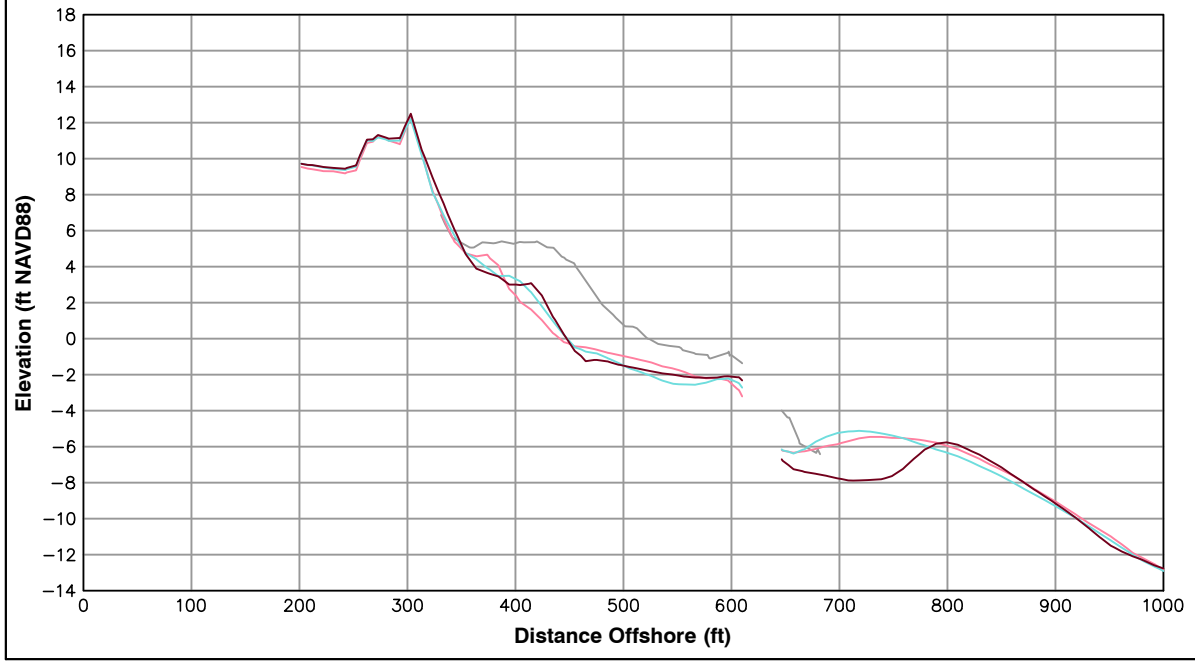
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 347+63	April 2015 - March 2014	April 2015 - October 2014
Shoreline Change at MHW (0.98 ft NAVD88)	11.16 ft/yr	2.61 ft
Volume Change Above -15 ft NAVD88	-6.84 cy/ft/yr	-5.49 cy/ft
Volume Change Above 0 ft NAVD88	2.53 cy/ft/yr	1.07 cy/ft

LEGEND:
- 2015 APR
- 2014 OCT
- 2014 MAR
- POST-FILL

Notes:
1. Stationing From West To East At Varying Intervals.
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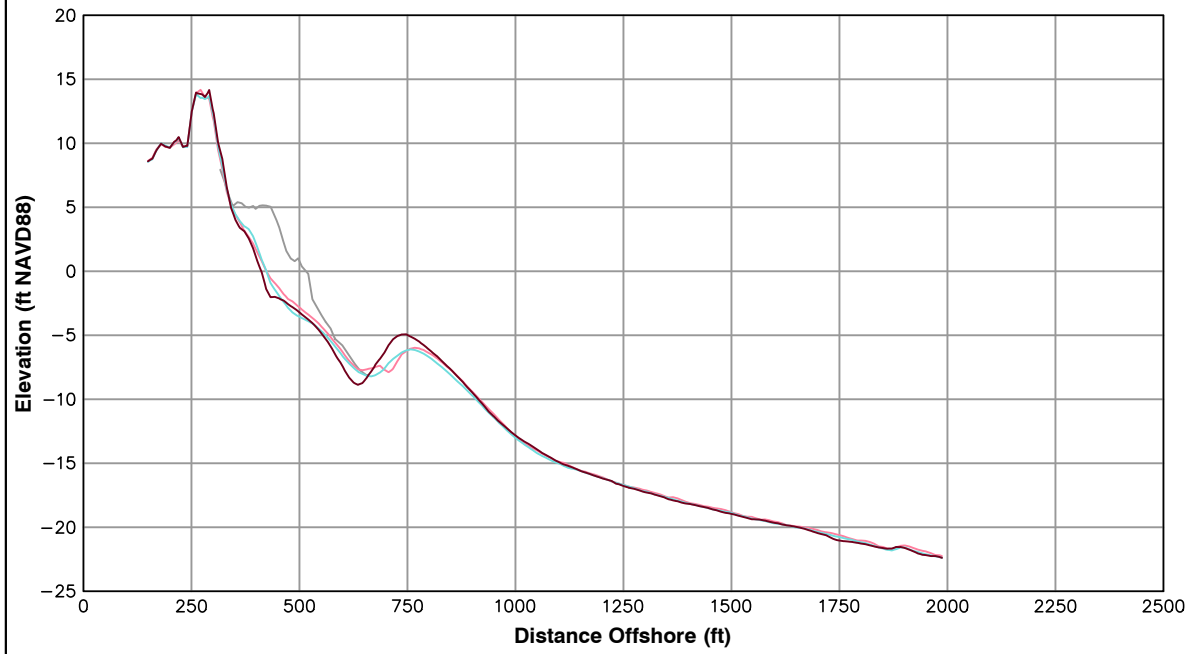
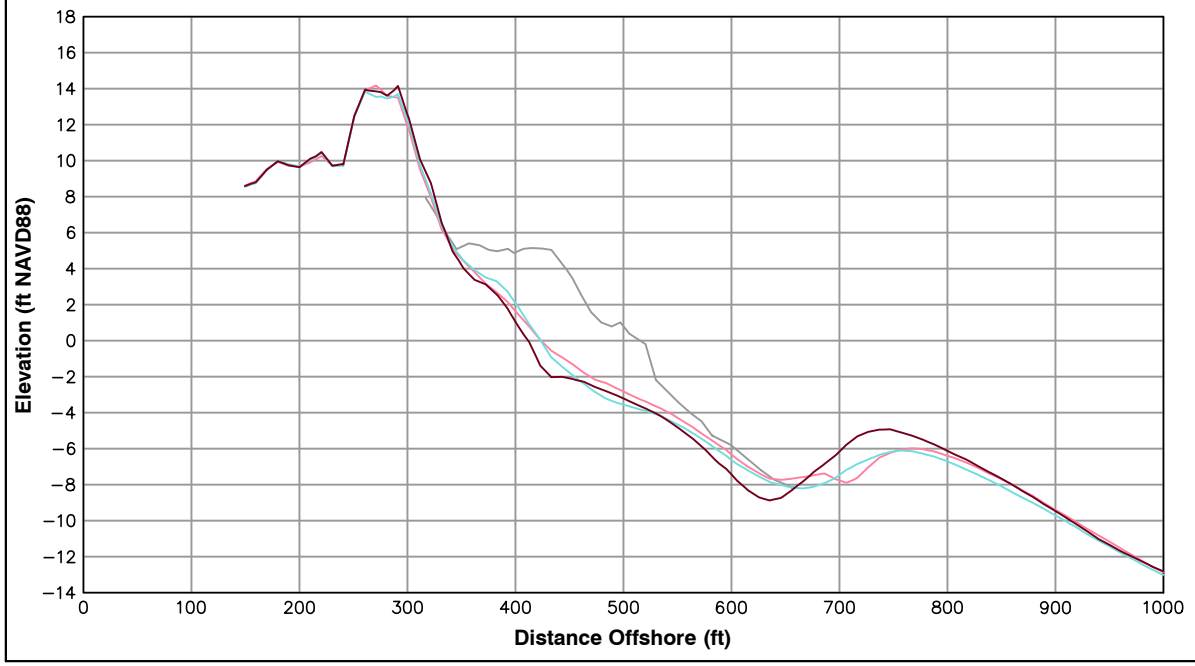
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 349+43	April 2015 - March 2014	April 2015 - October 2014
Shoreline Change at MHW (0.98 ft NAVD88)	-8.47 ft/yr	-11.27 ft
Volume Change Above -15 ft NAVD88	-1.78 cy/ft/yr	3.95 cy/ft
Volume Change Above 0 ft NAVD88	0.01 cy/ft/yr	-1.01 cy/ft

LEGEND:
- 2015 APR
- 2014 OCT
- 2014 MAR
- POST-FILL

Notes:
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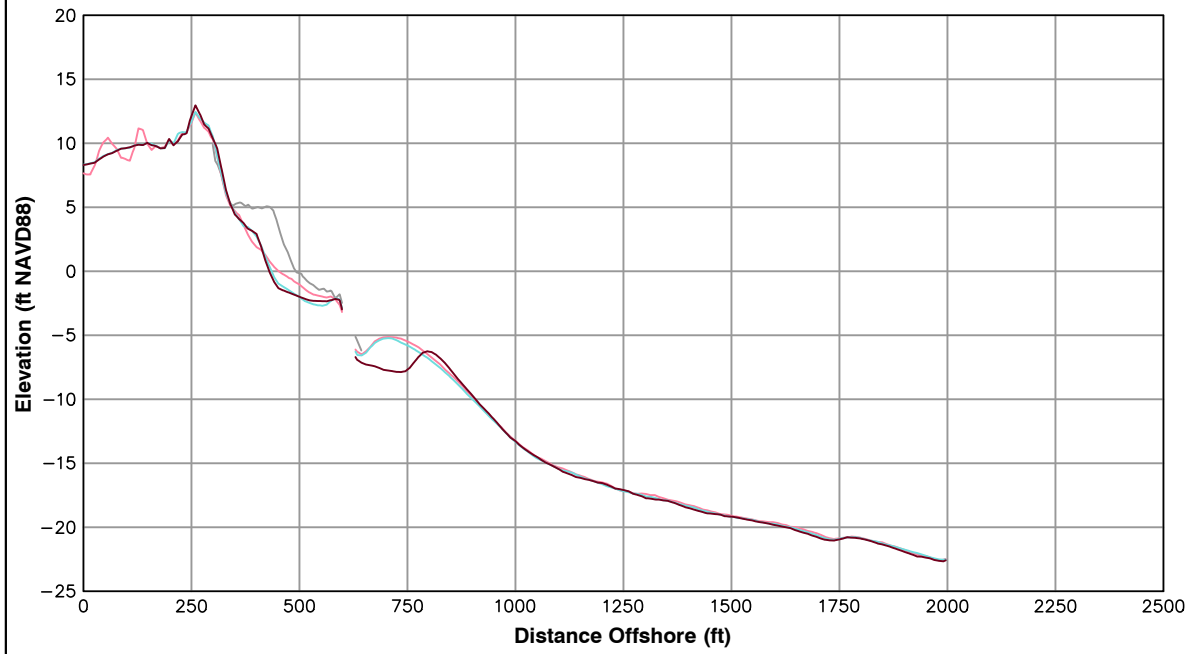
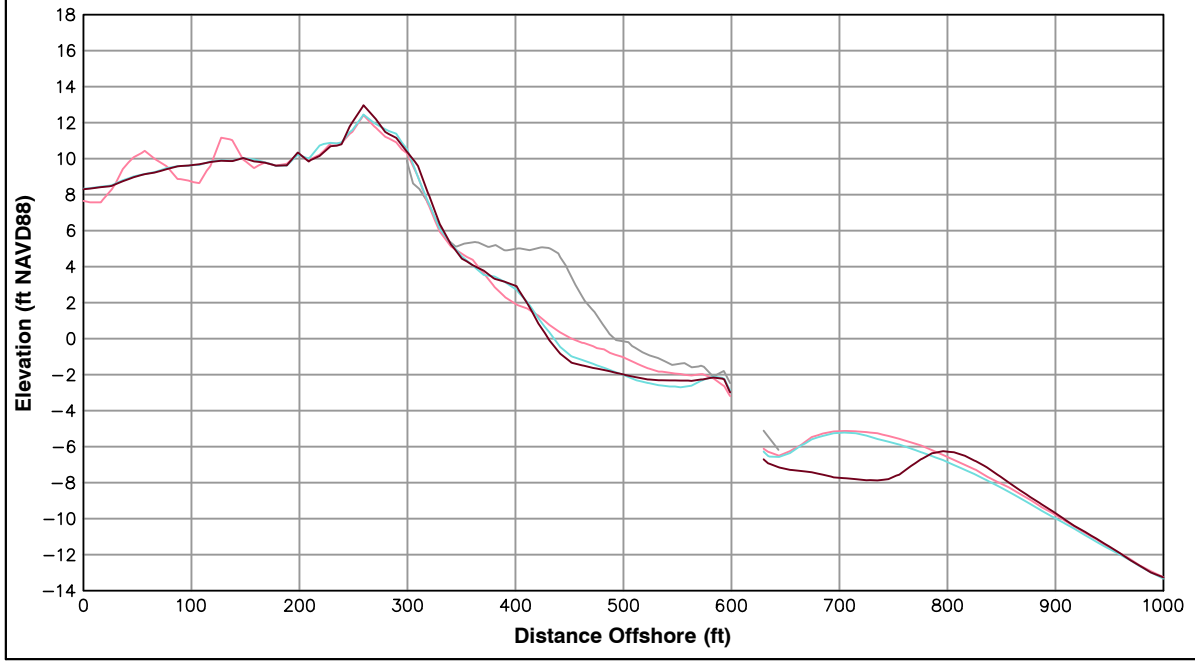
City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 351+23	April 2015 - March 2014	April 2015 - October 2014
Shoreline Change at MHW (0.98 ft NAVD88)	-6.58 ft/yr	-3.19 ft
Volume Change Above -15 ft NAVD88	-11.10 cy/ft/yr	-6.25 cy/ft
Volume Change Above 0 ft NAVD88	1.00 cy/ft/yr	0.13 cy/ft

LEGEND:
- 2015 APR
- 2014 OCT
- 2014 MAR
- POST-FILL

Notes:
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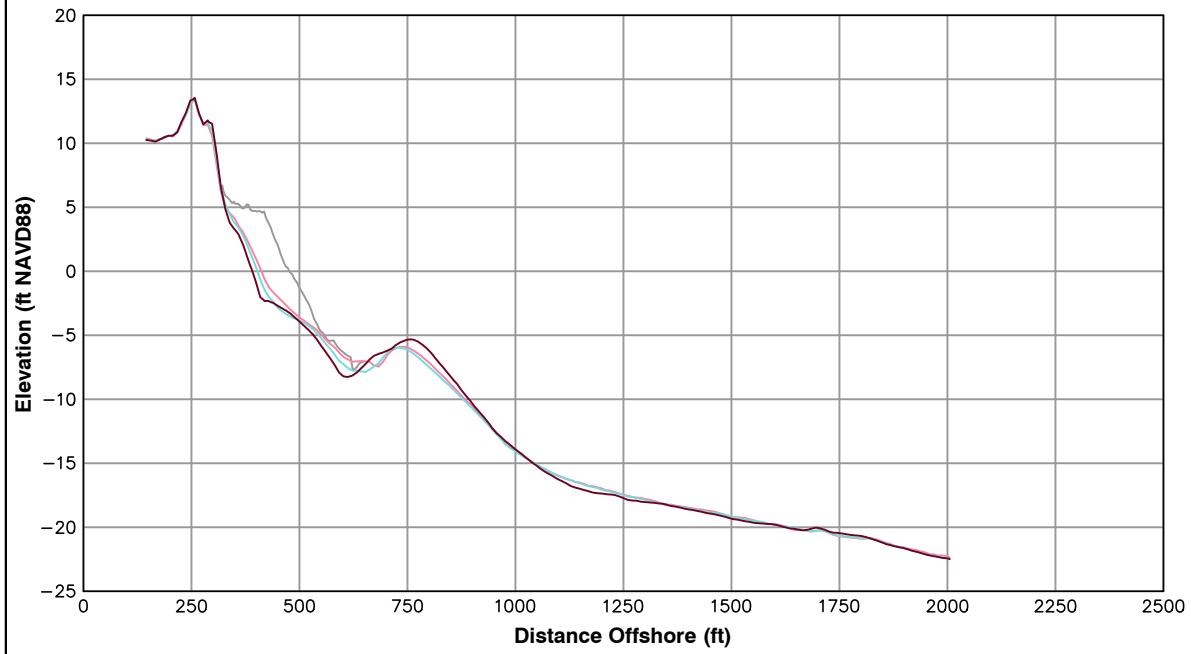
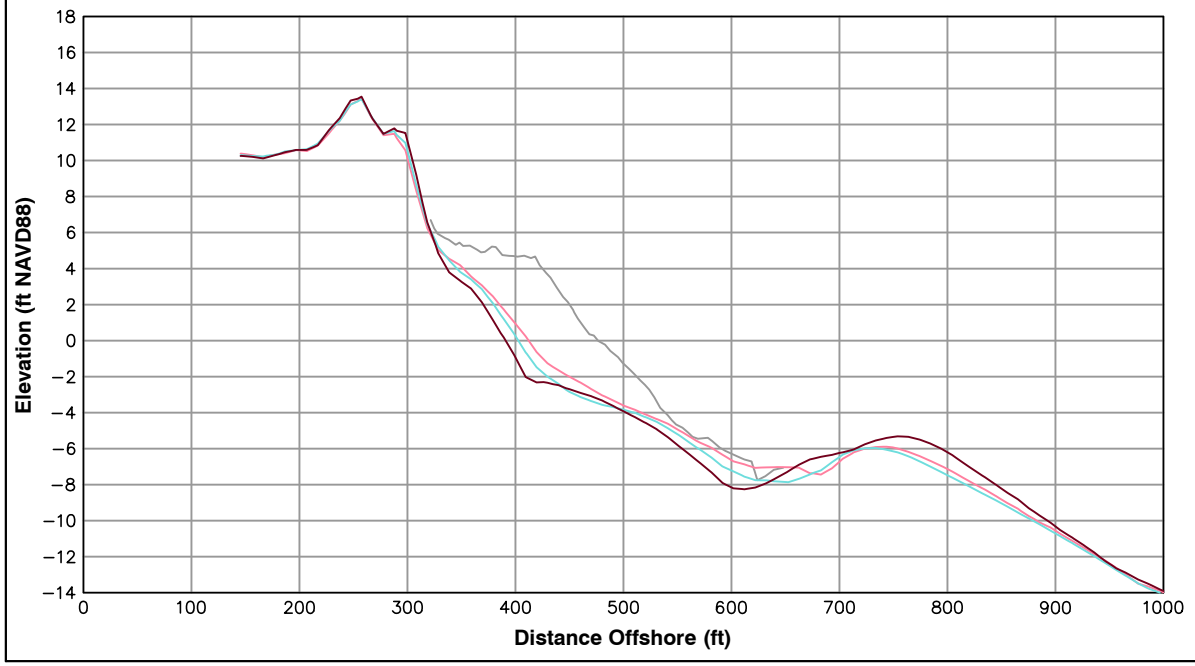
City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 353+03	April 2015 - March 2014	April 2015 - October 2014
Shoreline Change at MHW (0.98 ft NAVD88)	-17.26 ft/yr	-10.99 ft
Volume Change Above -15 ft NAVD88	-3.94 cy/ft/yr	2.98 cy/ft
Volume Change Above 0 ft NAVD88	-1.52 cy/ft/yr	-1.31 cy/ft

LEGEND:
- 2015 APR
- 2014 OCT
- 2014 MAR
- POST-FILL

Notes:
1. Stationing From West To East At Varying Intervals.
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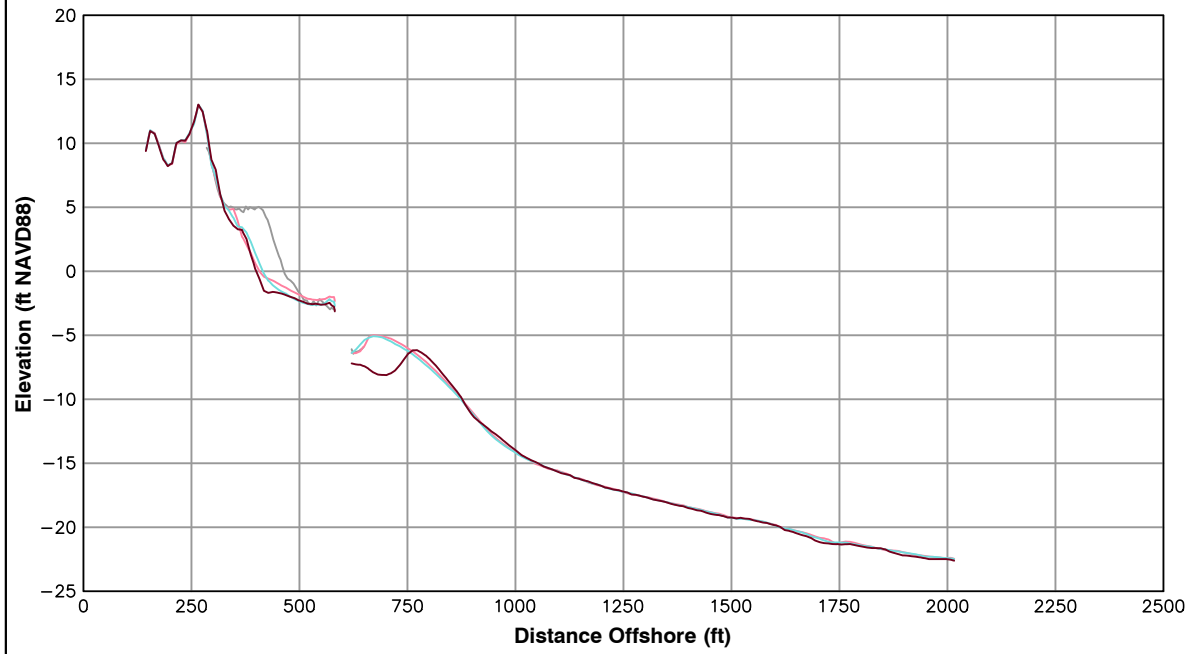
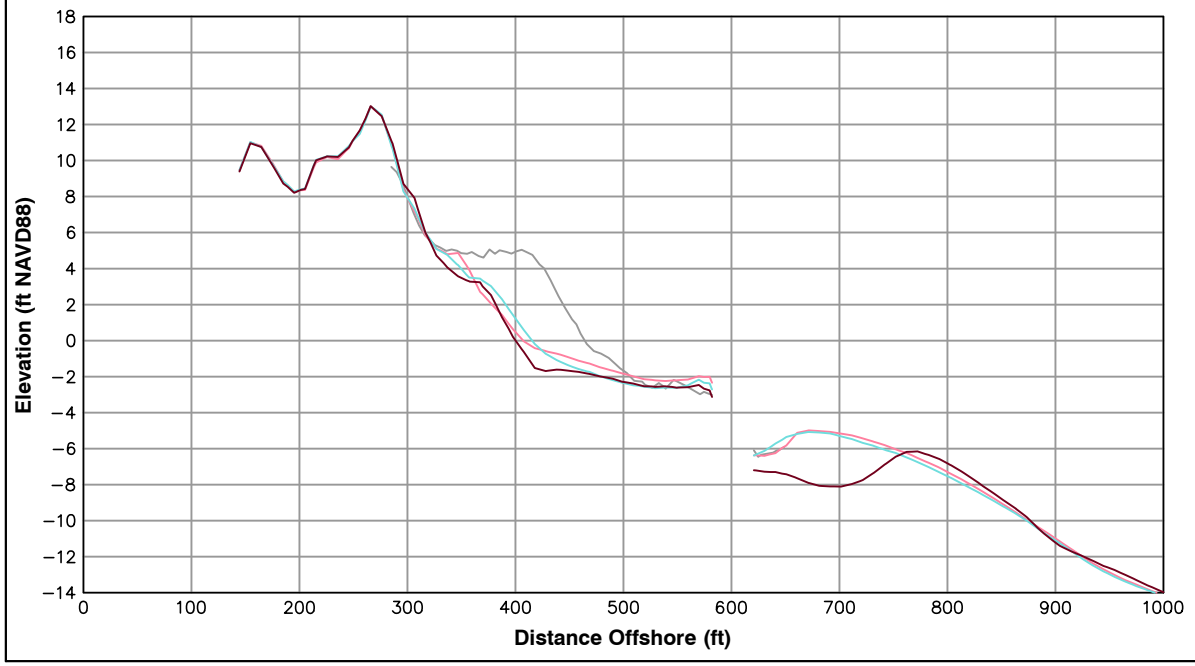
City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 354+83	April 2015 - March 2014	April 2015 - October 2014
Shoreline Change at MHW (0.98 ft NAVD88)	-2.37 ft/yr	-12.48 ft
Volume Change Above -15 ft NAVD88	-11.47 cy/ft/yr	-9.94 cy/ft
Volume Change Above 0 ft NAVD88	-0.47 cy/ft/yr	-1.68 cy/ft

LEGEND:
- 2015 APR
- 2014 OCT
- 2014 MAR
- POST-FILL

Notes:
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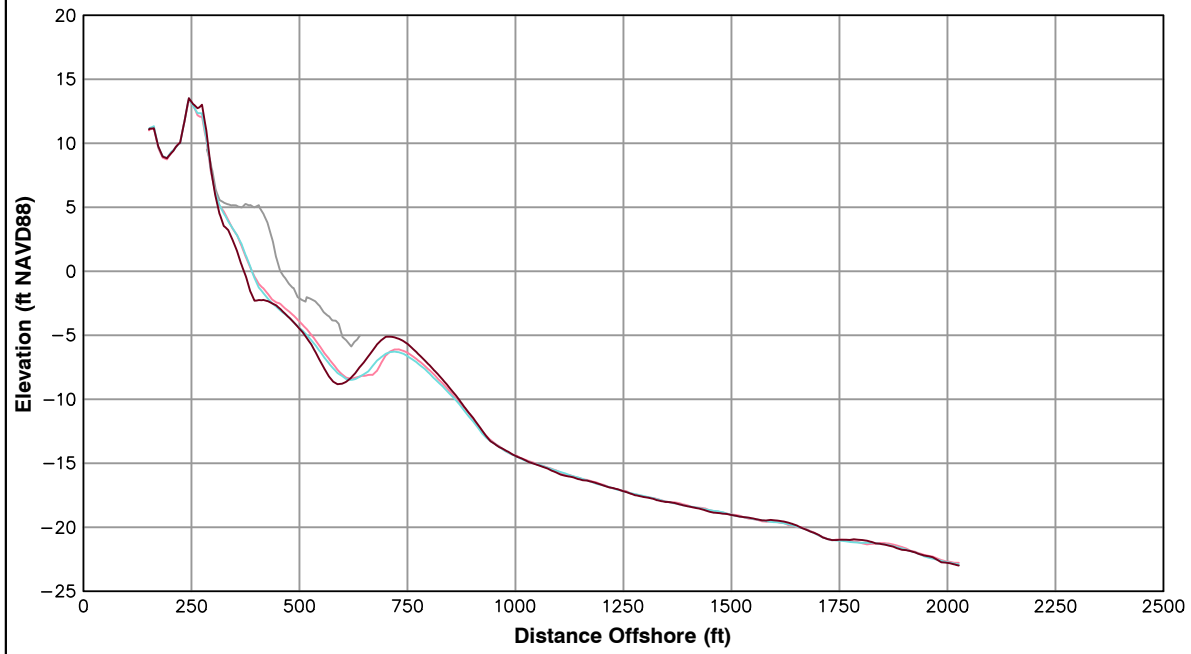
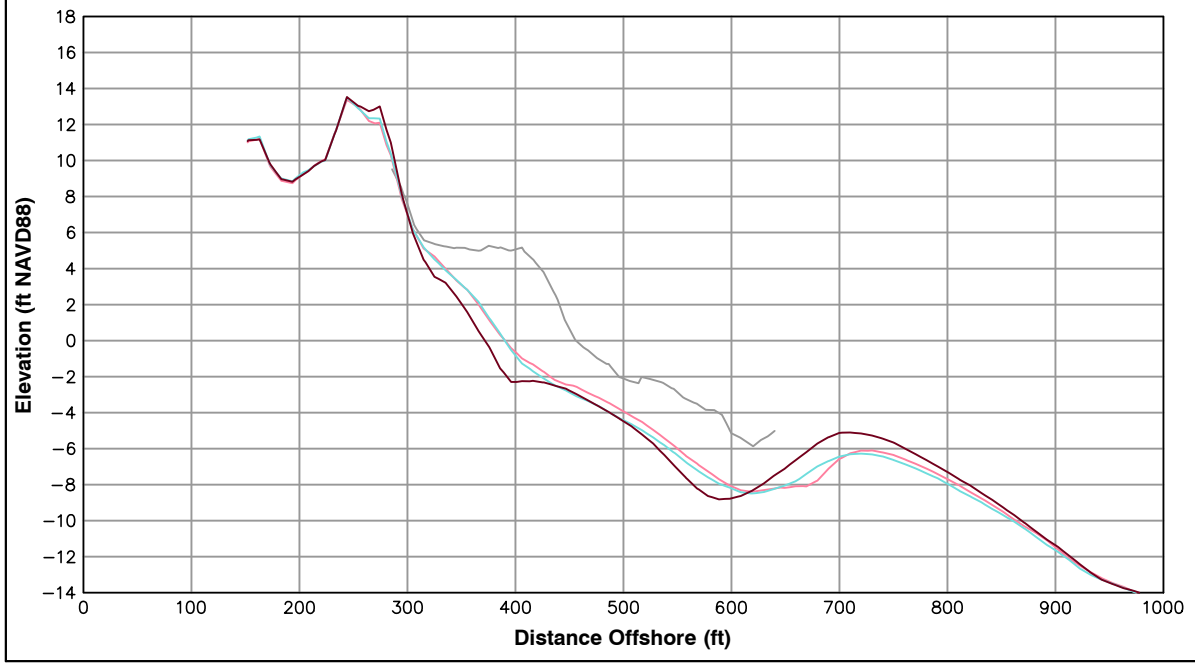
City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 356+63	April 2015 - March 2014	April 2015 - October 2014
Shoreline Change at MHW (0.98 ft NAVD88)	-15.03 ft/yr	-17.71 ft
Volume Change Above -15 ft NAVD88	-1.66 cy/ft/yr	1.70 cy/ft
Volume Change Above 0 ft NAVD88	-1.68 cy/ft/yr	-2.36 cy/ft

LEGEND:
- 2015 APR
- 2014 OCT
- 2014 MAR
- POST-FILL

Notes:
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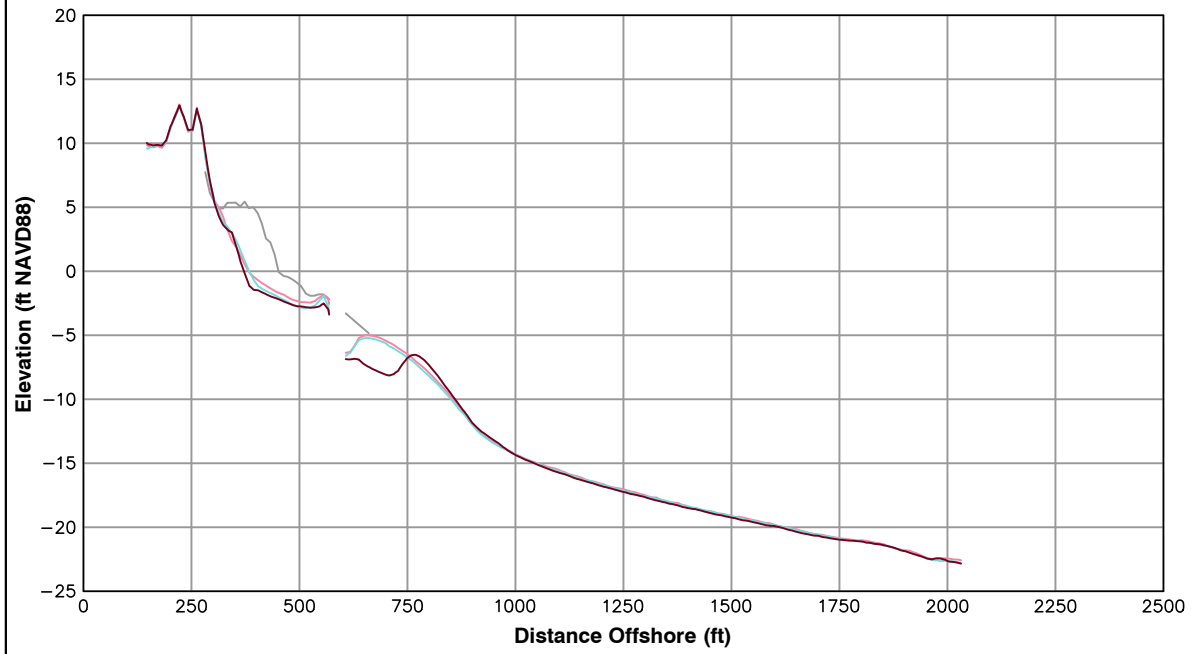
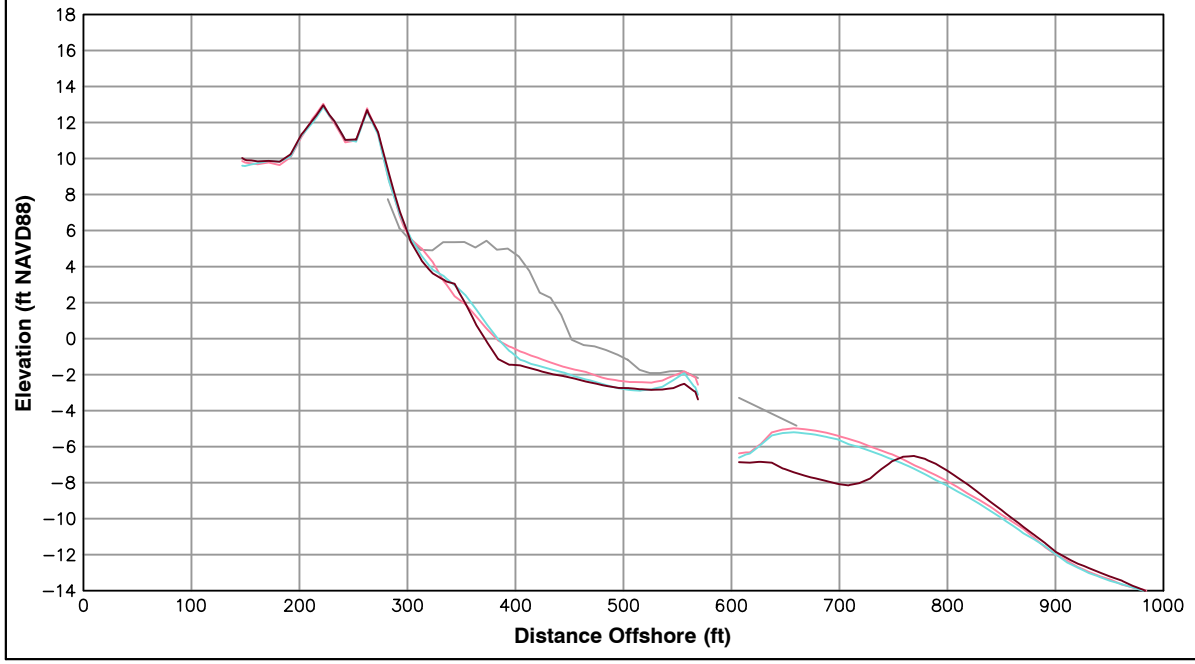
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 358+43	April 2015 - March 2014	April 2015 - October 2014
Shoreline Change at MHW (0.98 ft NAVD88)	-4.85 ft/yr	-9.34 ft
Volume Change Above -15 ft NAVD88	-11.13 cy/ft/yr	-7.70 cy/ft
Volume Change Above 0 ft NAVD88	-0.05 cy/ft/yr	-0.47 cy/ft

LEGEND:
- 2015 APR
- 2014 OCT
- 2014 MAR
- POST-FILL

Notes:
1. Stationing From West To East At Varying Intervals.
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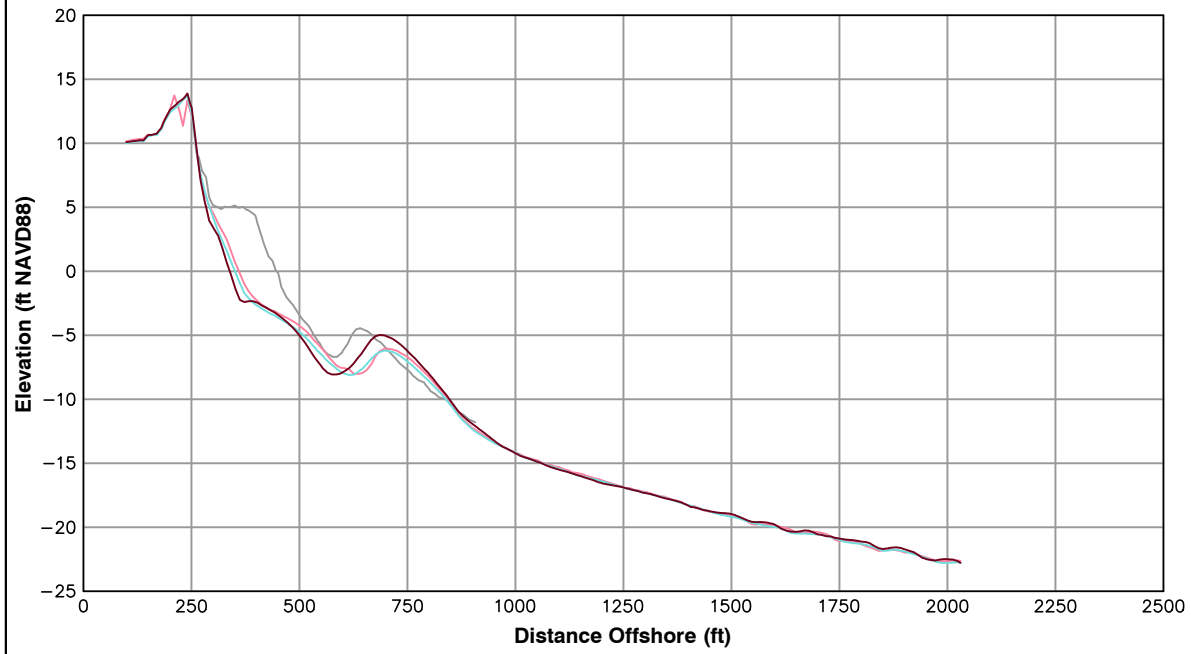
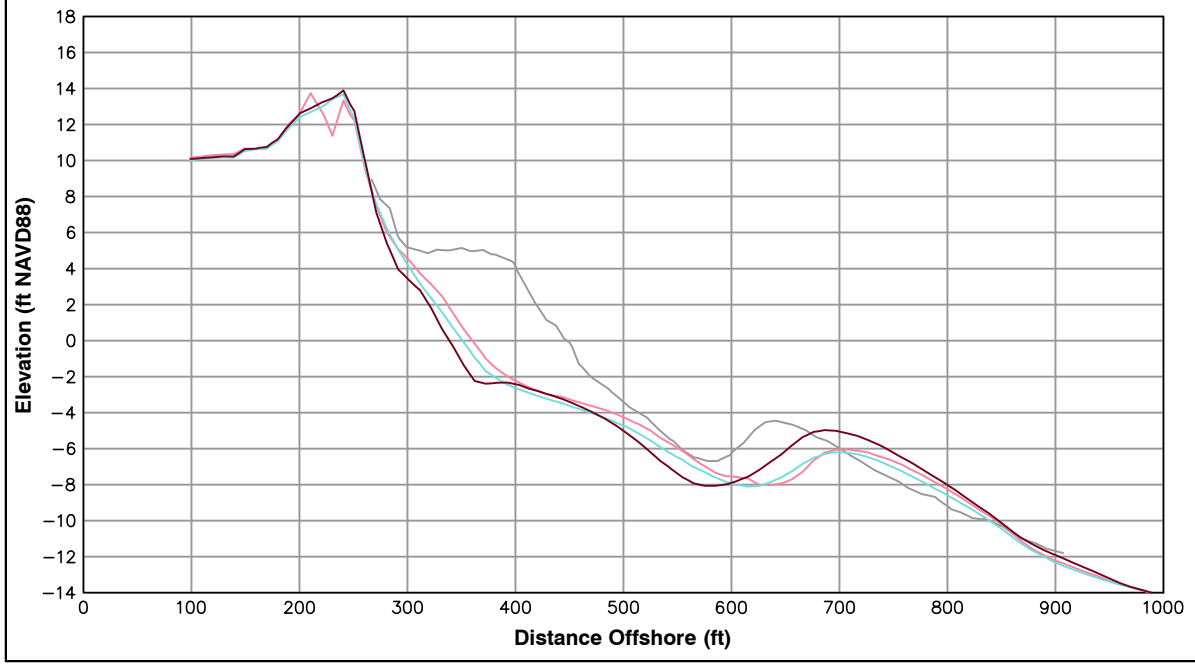
City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 360+23	April 2015 - March 2014	April 2015 - October 2014
Shoreline Change at MHW (0.98 ft NAVD88)	-17.58 ft/yr	-10.00 ft
Volume Change Above -15 ft NAVD88	-2.35 cy/ft/yr	4.78 cy/ft
Volume Change Above 0 ft NAVD88	-2.29 cy/ft/yr	-1.24 cy/ft

LEGEND:
- 2015 APR
- 2014 OCT
- 2014 MAR
- POST-FILL

Notes:
1. Stationing From West To East At Varying Intervals.
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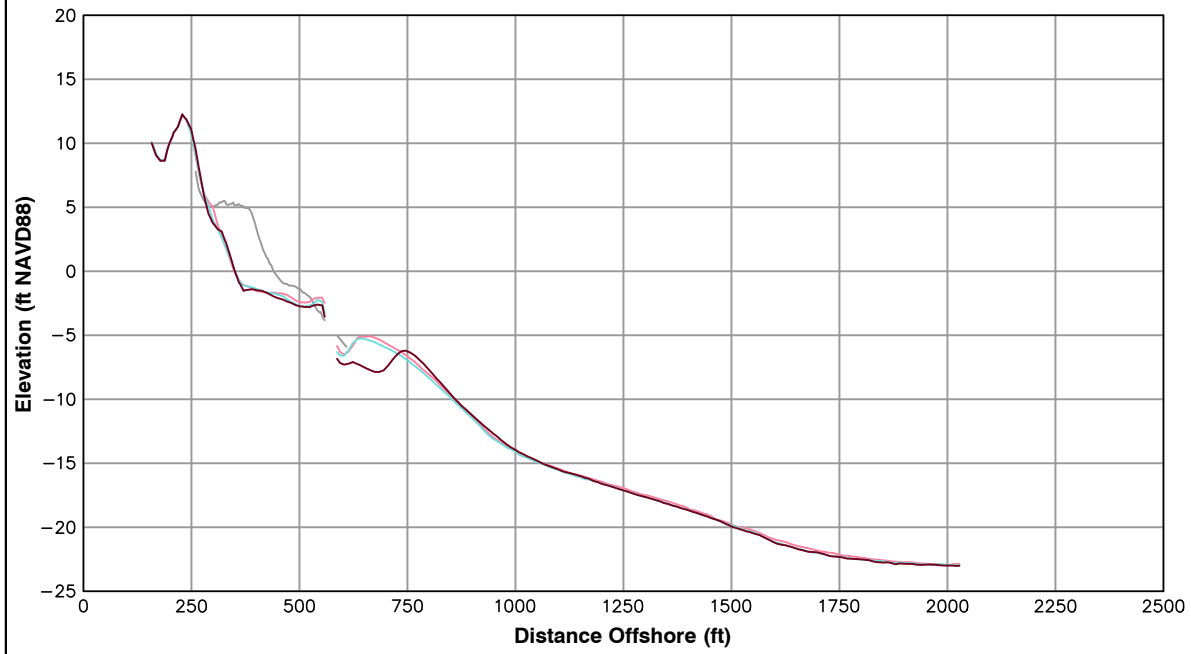
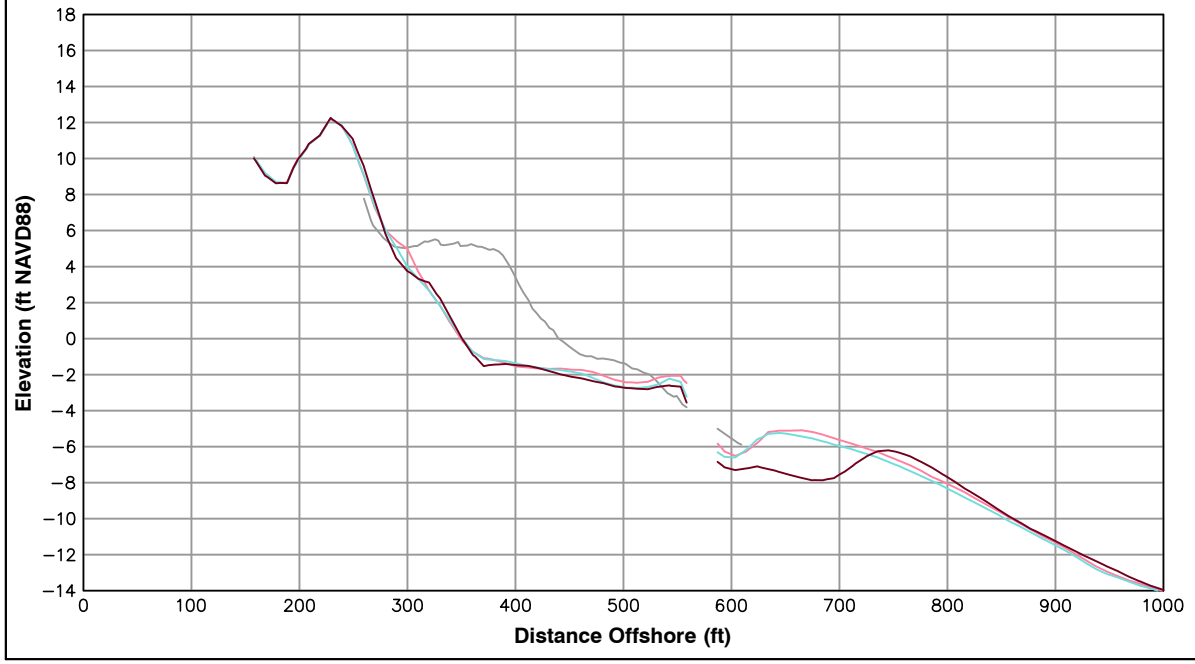
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 362+03	April 2015 - March 2014	April 2015 - October 2014
Shoreline Change at MHW (0.98 ft NAVD88)	2.87 ft/yr	1.94 ft
Volume Change Above -15 ft NAVD88	-8.37 cy/ft/yr	-4.35 cy/ft
Volume Change Above 0 ft NAVD88	-0.15 cy/ft/yr	0.38 cy/ft

LEGEND:
- 2015 APR
- 2014 OCT
- 2014 MAR
- POST-FILL

Notes:
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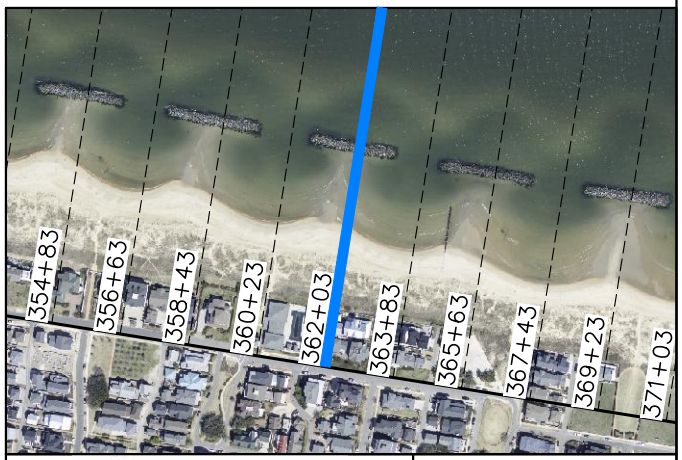

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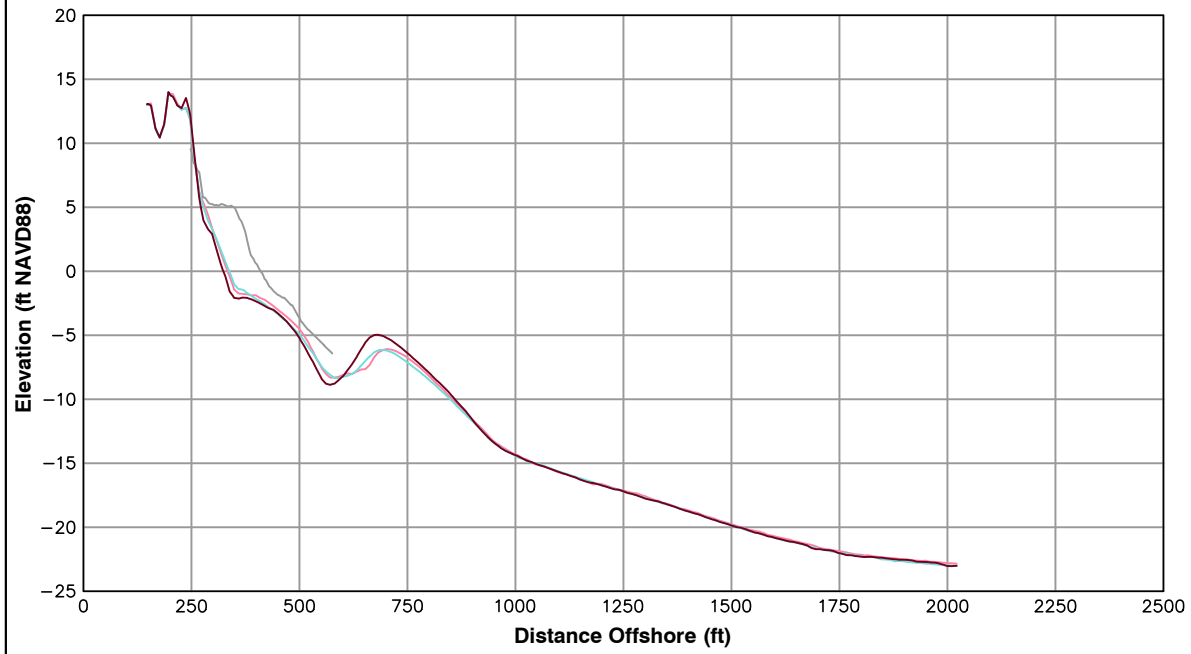

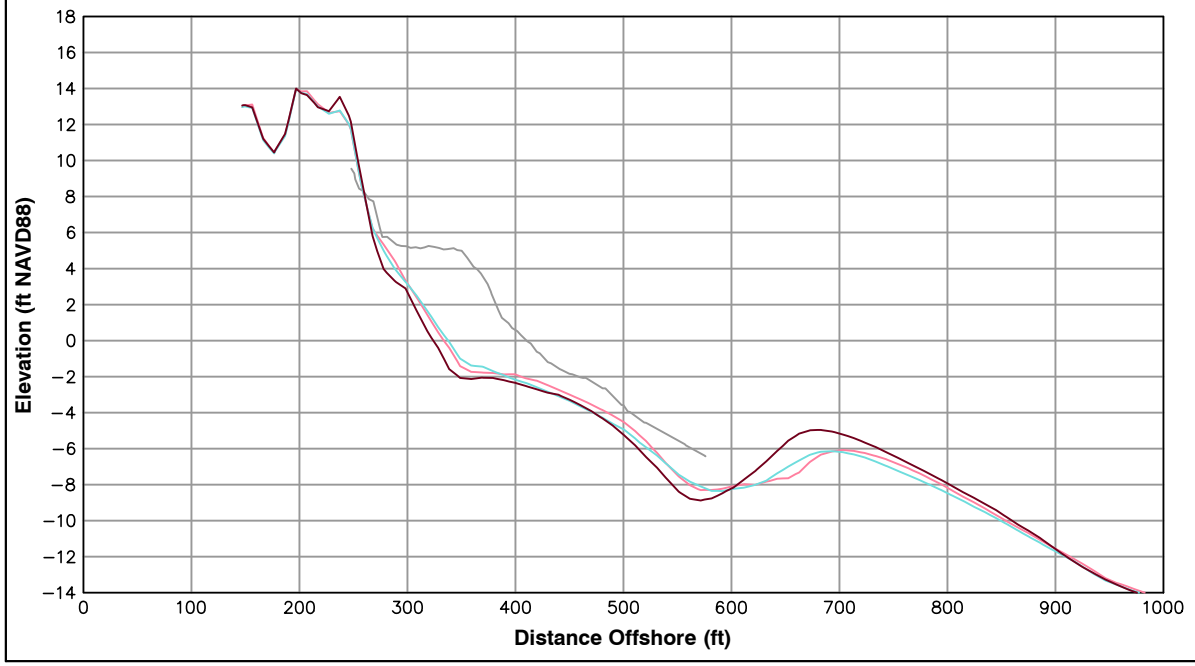

Survey Transect 363+83	April 2015 - March 2014	April 2015 - October 2014
Shoreline Change at MHW (0.98 ft NAVD88)	-7.93 ft/yr	-11.46 ft
Volume Change Above -15 ft NAVD88	-0.56 cy/ft/yr	2.70 cy/ft
Volume Change Above 0 ft NAVD88	-1.48 cy/ft/yr	-1.28 cy/ft

LEGEND:
- 2015 APR
- 2014 OCT
- 2014 MAR
- POST-FILL

Notes:
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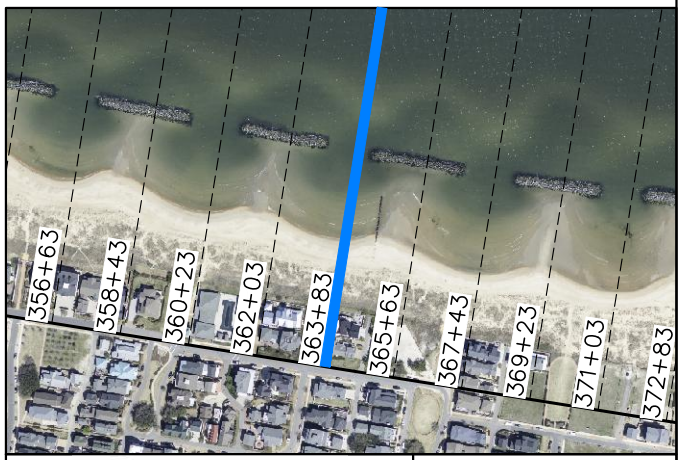

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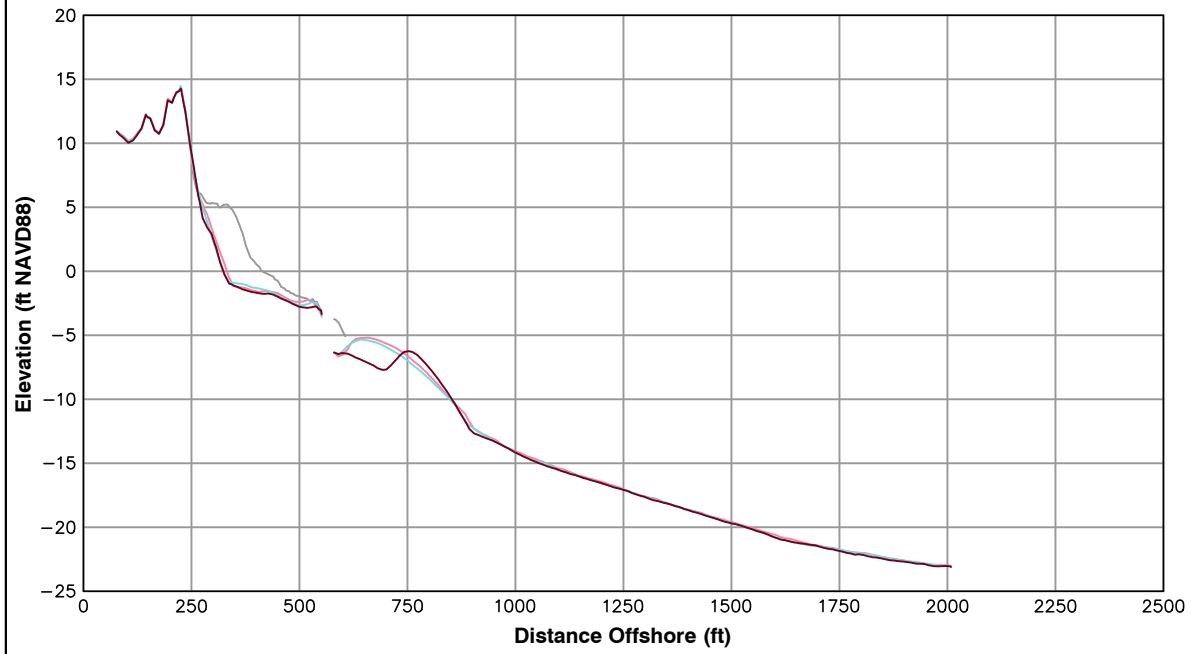
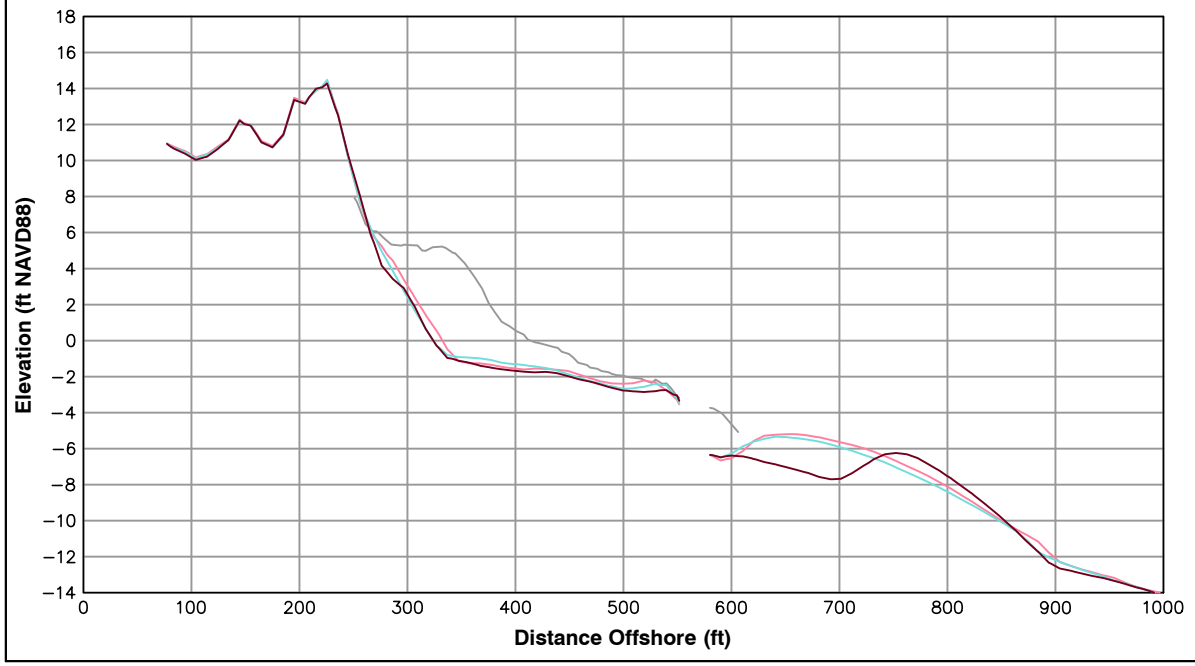
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 365+63	April 2015 - March 2014	April 2015 - October 2014
Shoreline Change at MHW (0.98 ft NAVD88)	-7.19 ft/yr	0.36 ft
Volume Change Above -15 ft NAVD88	-9.80 cy/ft/yr	-6.24 cy/ft
Volume Change Above 0 ft NAVD88	-1.81 cy/ft/yr	-0.47 cy/ft

LEGEND:
- 2015 APR
- 2014 OCT
- 2014 MAR
- POST-FILL

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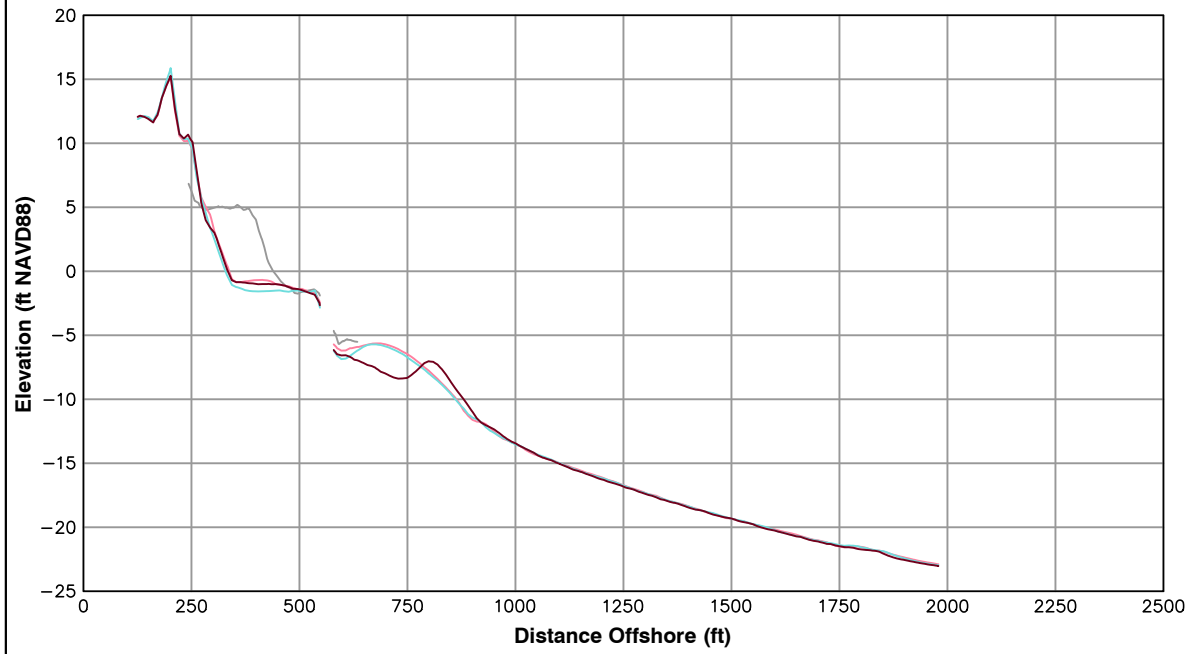
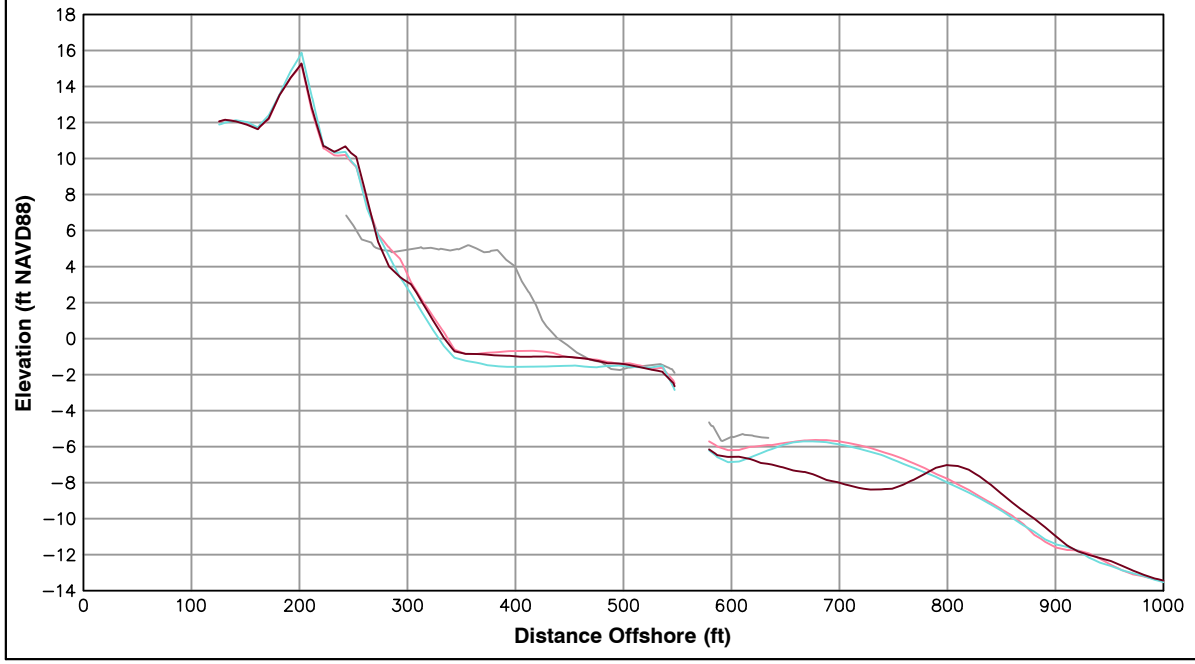
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 369+23	April 2015 - March 2014	April 2015 - October 2014
Shoreline Change at MHW (0.98 ft NAVD88)	-2.30 ft/yr	5.57 ft
Volume Change Above -15 ft NAVD88	-7.42 cy/ft/yr	-1.49 cy/ft
Volume Change Above 0 ft NAVD88	-0.47 cy/ft/yr	0.11 cy/ft

LEGEND:
- 2015 APR
- 2014 OCT
- 2014 MAR
- POST-FILL

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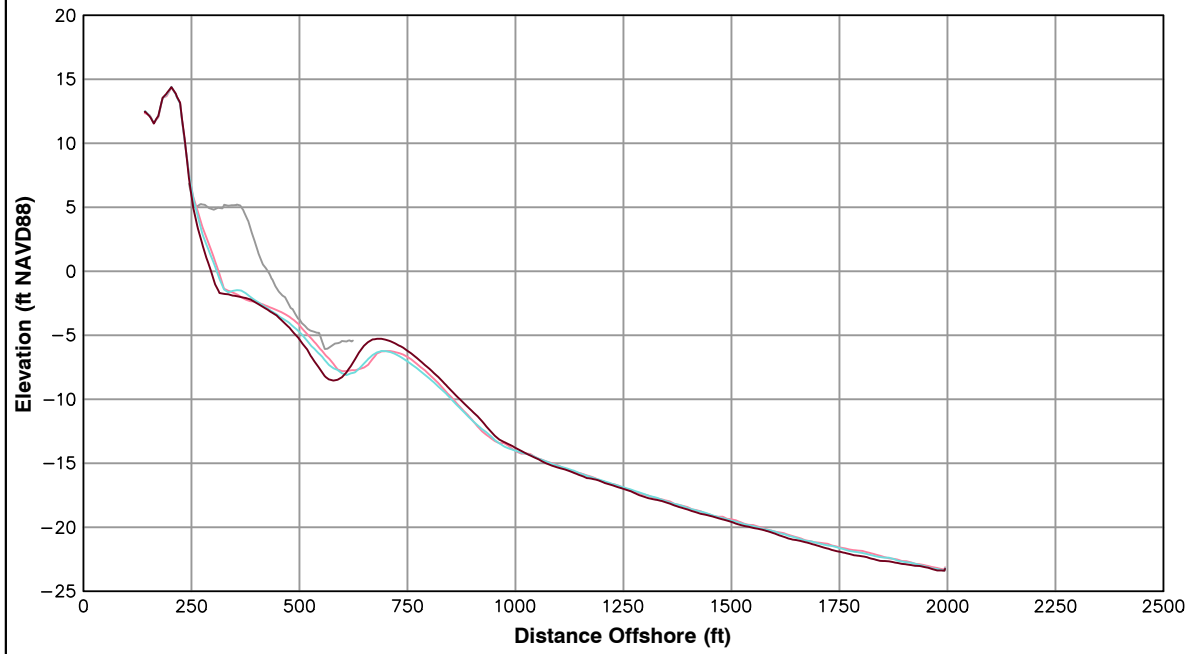
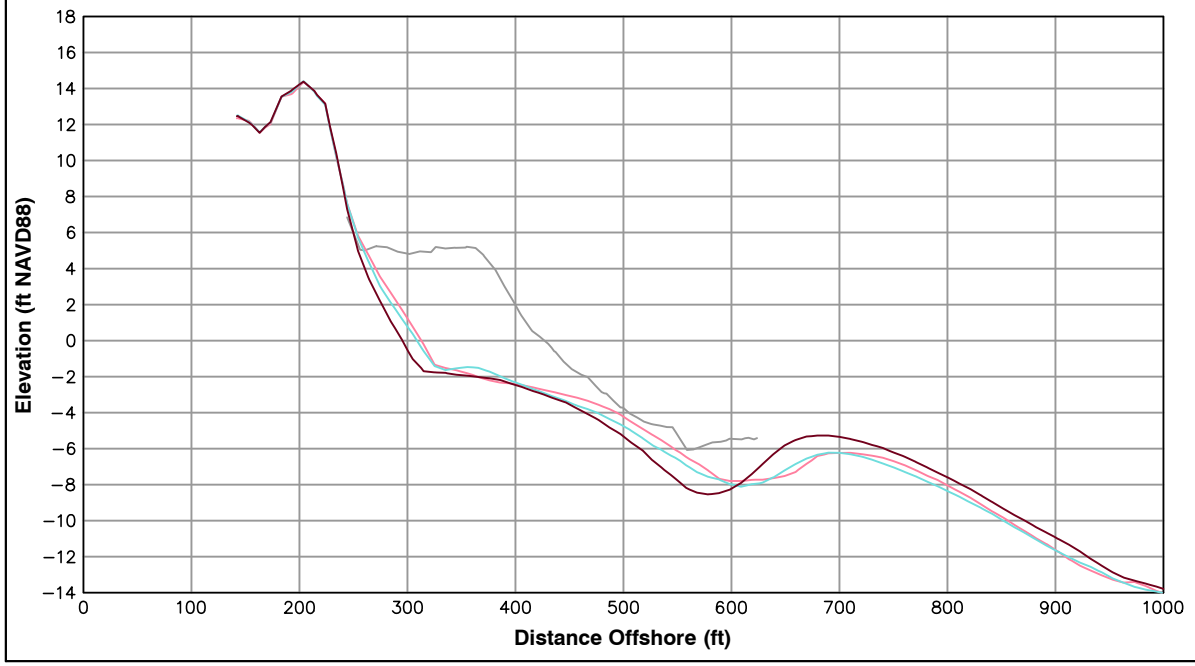
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 367+43	April 2015 - March 2014	April 2015 - October 2014
Shoreline Change at MHW (0.98 ft NAVD88)	-15.81 ft/yr	-12.09 ft
Volume Change Above -15 ft NAVD88	-1.37 cy/ft/yr	2.95 cy/ft
Volume Change Above 0 ft NAVD88	-2.50 cy/ft/yr	-1.87 cy/ft

LEGEND:
- 2015 APR
- 2014 OCT
- 2014 MAR
- POST-FILL

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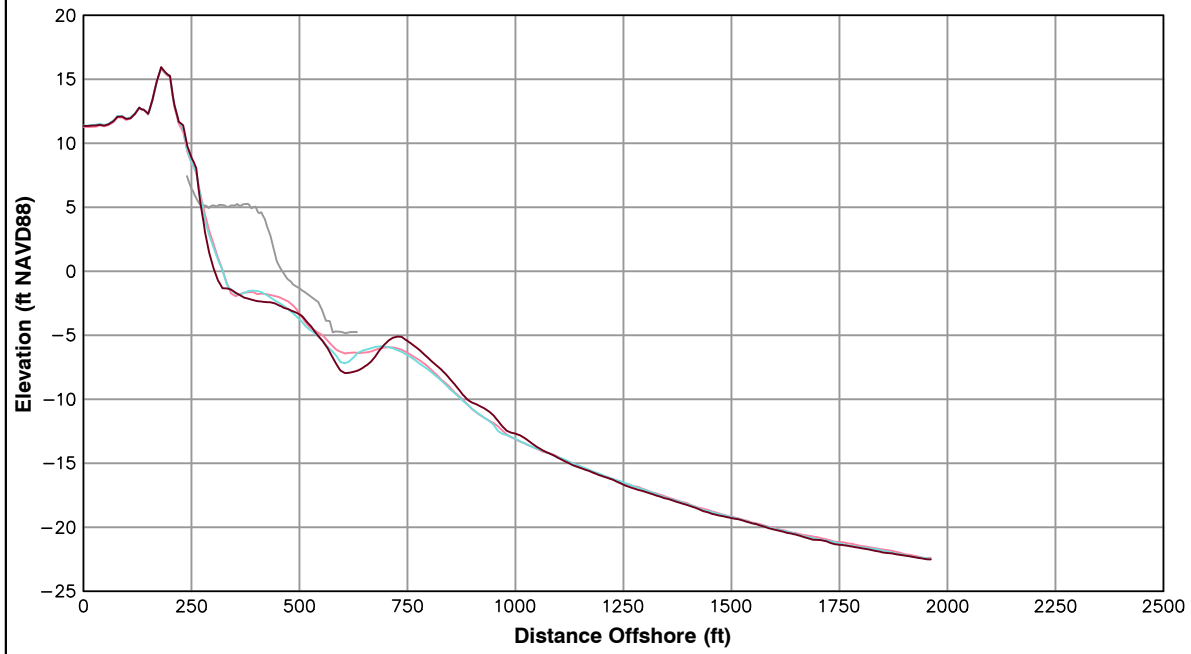
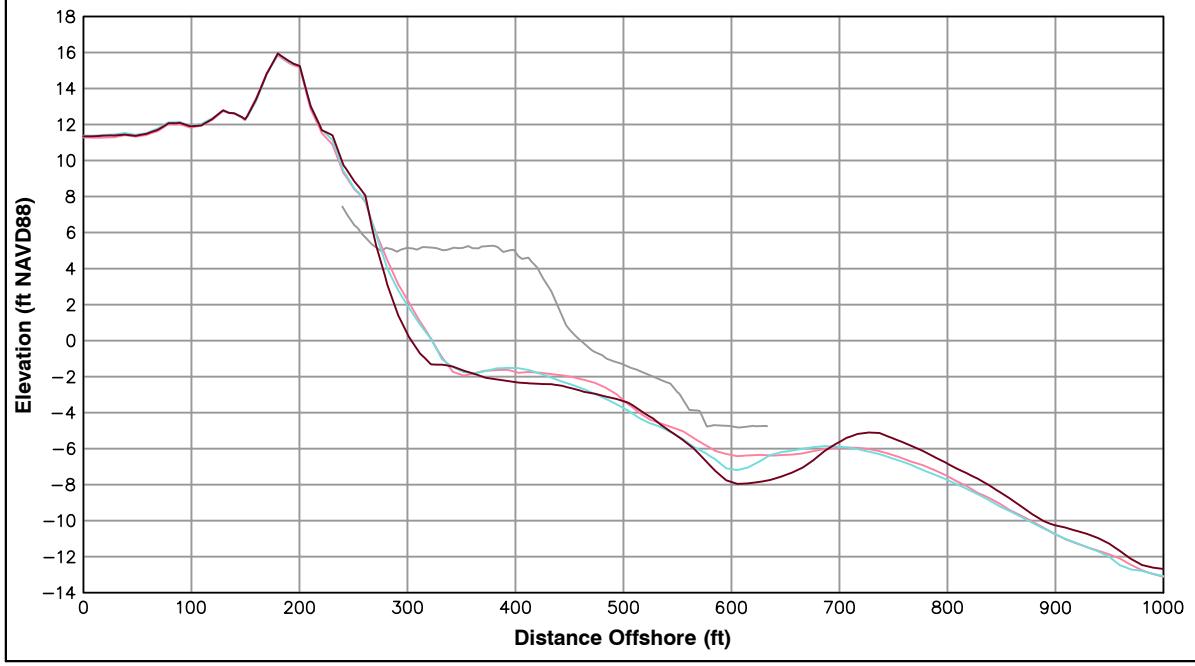
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 371+03	April 2015 - March 2014	April 2015 - October 2014
Shoreline Change at MHW (0.98 ft NAVD88)	-16.05 ft/yr	-15.74 ft
Volume Change Above -15 ft NAVD88	-1.98 cy/ft/yr	1.37 cy/ft
Volume Change Above 0 ft NAVD88	-1.31 cy/ft/yr	-1.77 cy/ft

LEGEND:
- 2015 APR
- 2014 OCT
- 2014 MAR
- POST-FILL

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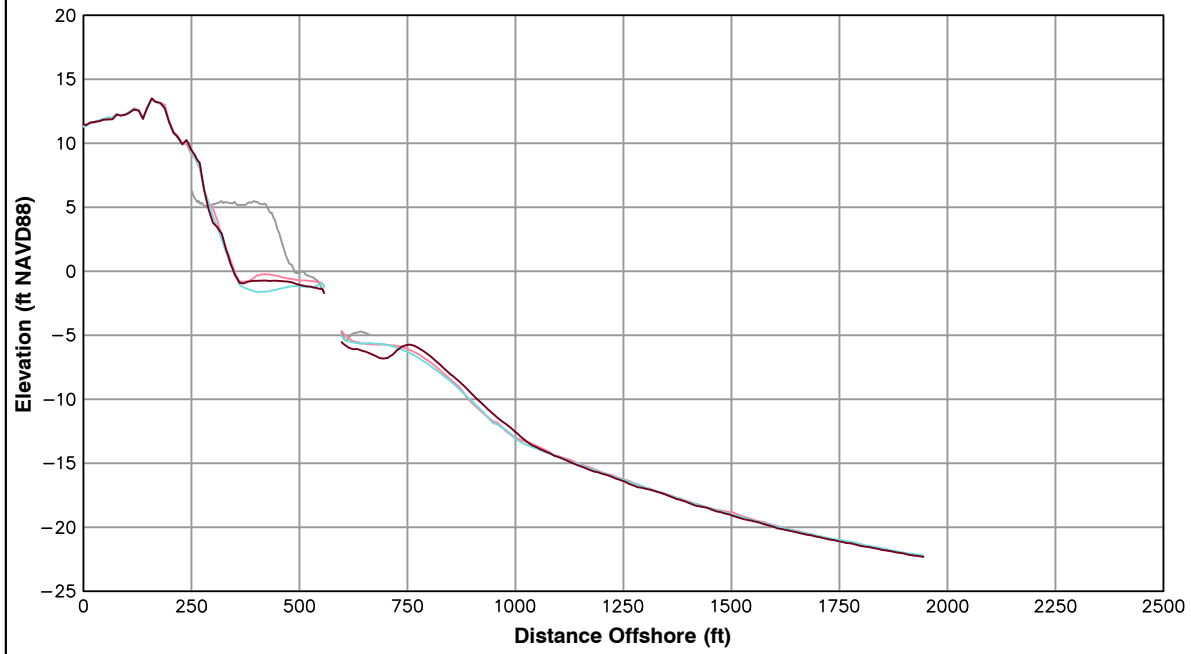
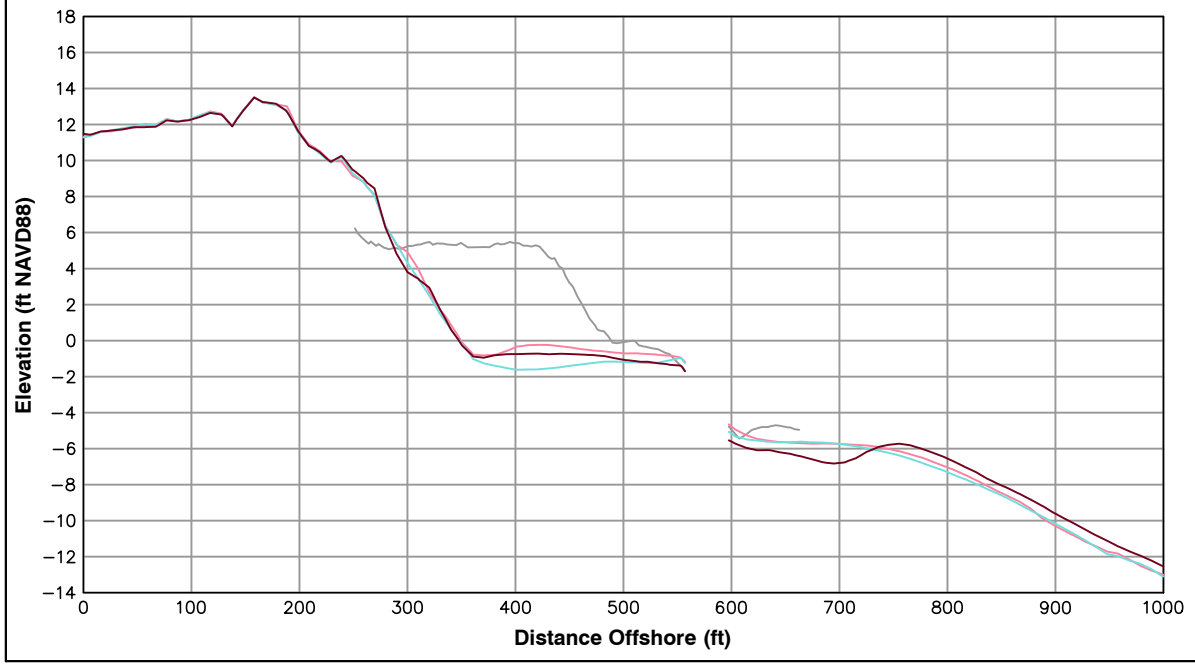
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 372+83	April 2015 - March 2014	April 2015 - October 2014
Shoreline Change at MHW (0.98 ft NAVD88)	-1.94 ft/yr	1.03 ft
Volume Change Above -15 ft NAVD88	-2.15 cy/ft/yr	6.04 cy/ft
Volume Change Above 0 ft NAVD88	-0.69 cy/ft/yr	0.04 cy/ft

LEGEND:
- 2015 APR
- 2014 OCT
- 2014 MAR
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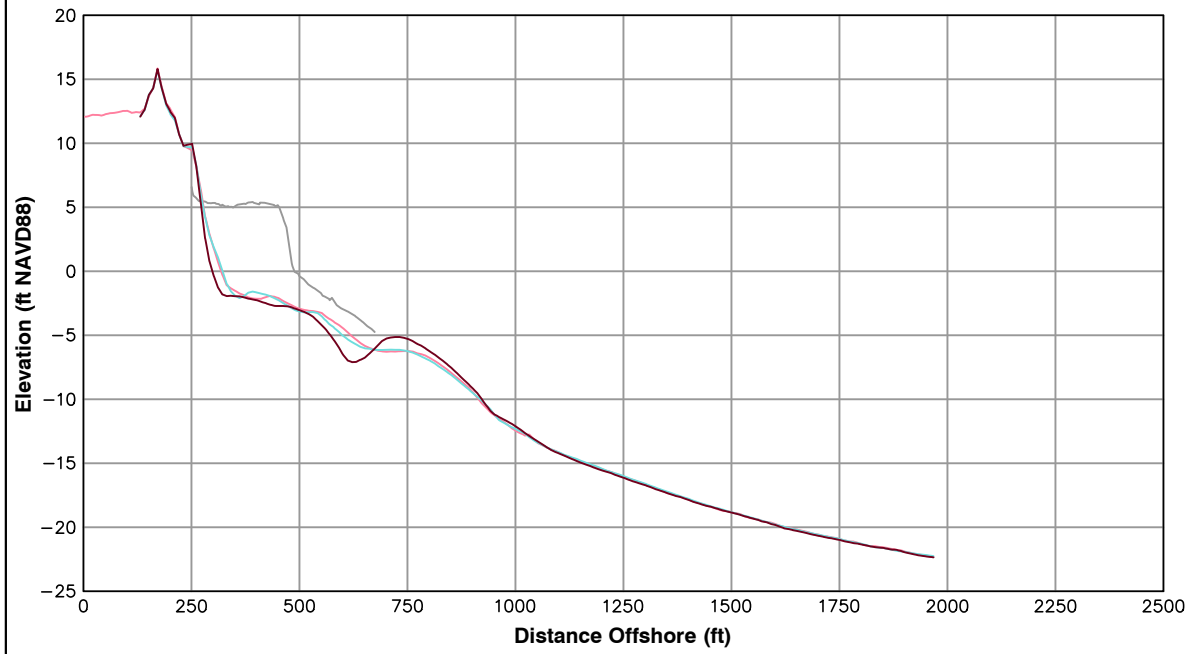
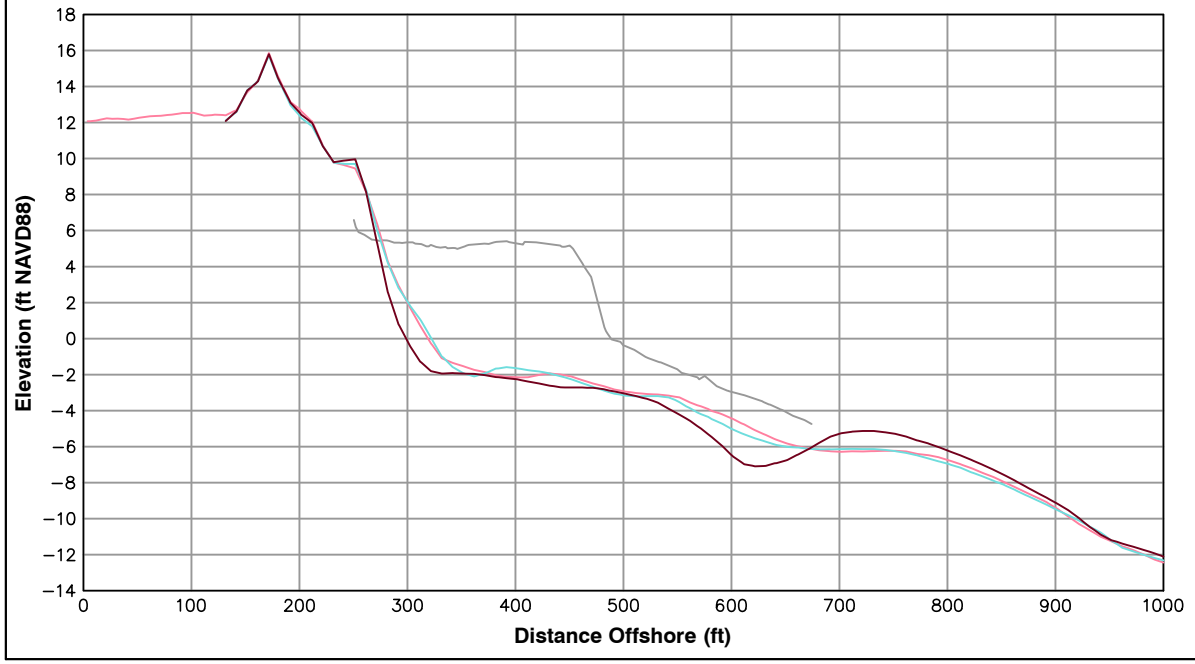
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 375+08	April 2015 - March 2014	April 2015 - October 2014
Shoreline Change at MHW (0.98 ft NAVD88)	-17.10 ft/yr	-21.94 ft
Volume Change Above -15 ft NAVD88	-6.31 cy/ft/yr	-4.47 cy/ft
Volume Change Above 0 ft NAVD88	-2.49 cy/ft/yr	-2.41 cy/ft

LEGEND:
- 2015 APR
- 2014 OCT
- 2014 MAR
- POST-FILL

Notes:
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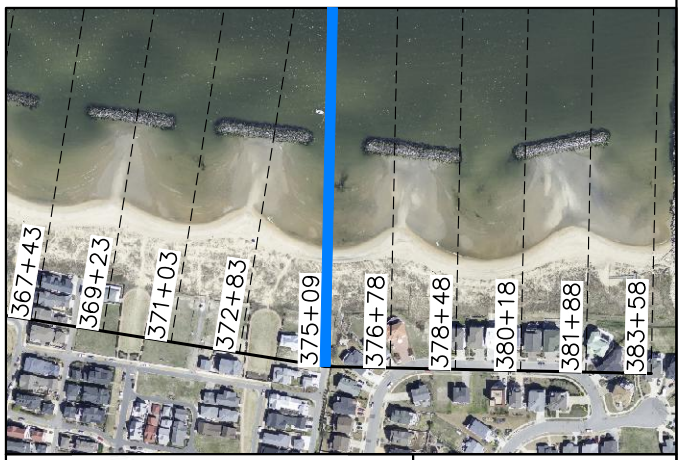

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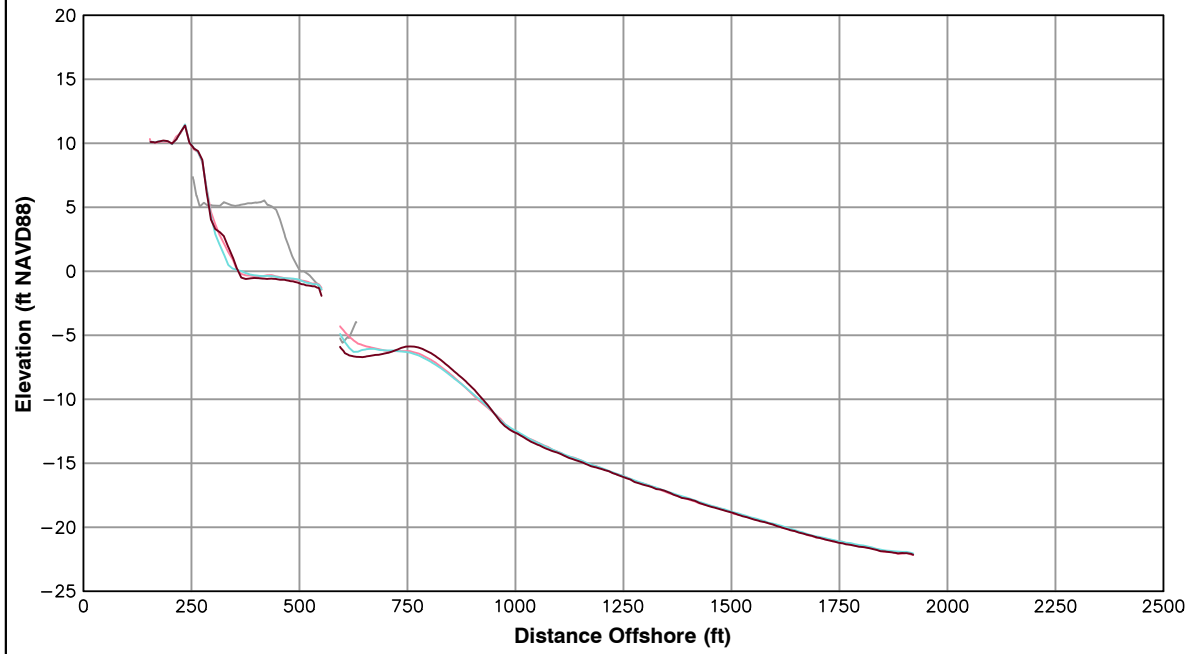
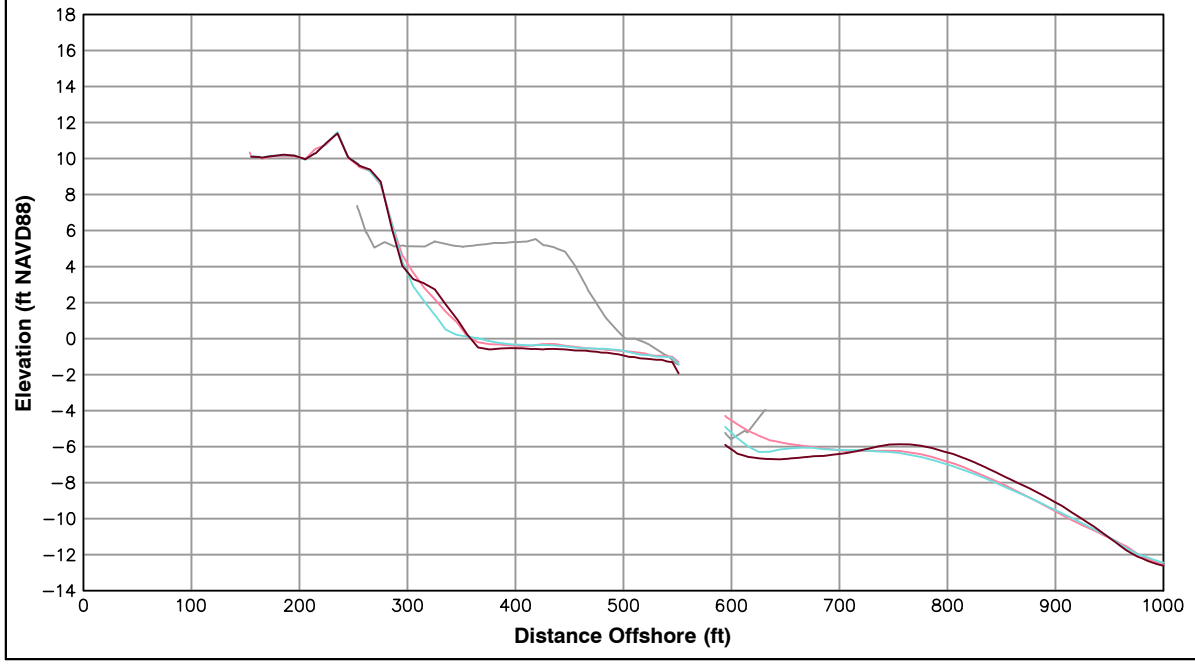
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 376+78	April 2015 - March 2014	April 2015 - October 2014
Shoreline Change at MHW (0.98 ft NAVD88)	2.27 ft/yr	17.45 ft
Volume Change Above -15 ft NAVD88	-2.33 cy/ft/yr	0.85 cy/ft
Volume Change Above 0 ft NAVD88	0.18 cy/ft/yr	1.76 cy/ft

LEGEND:
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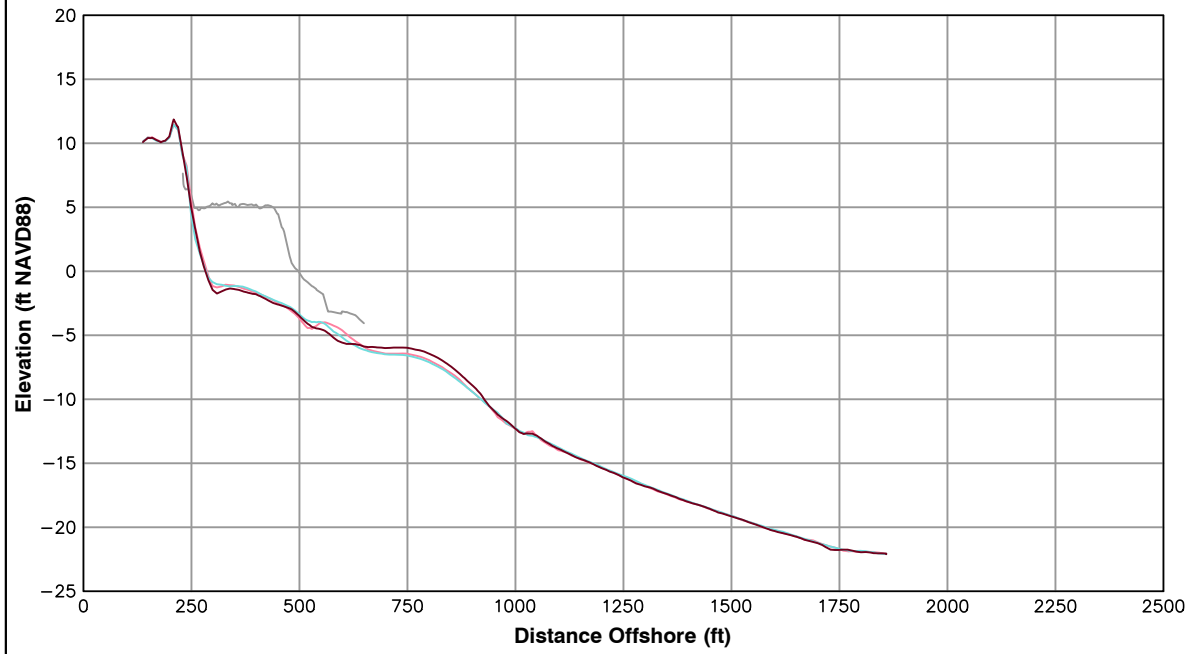
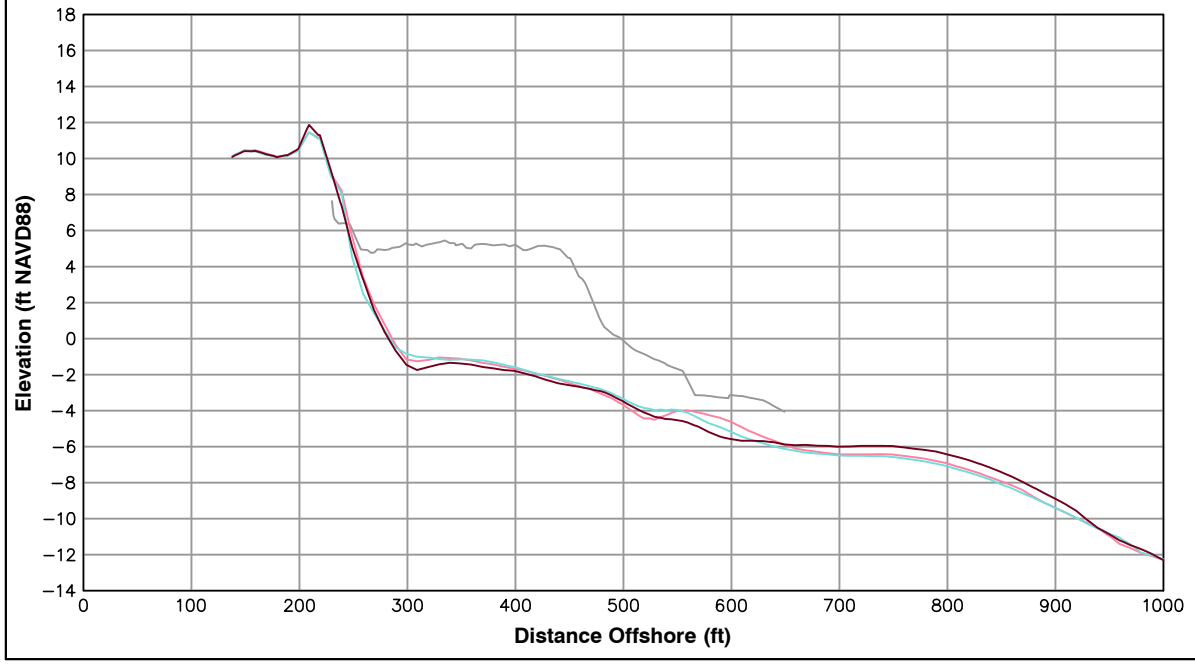
City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 378+48	April 2015 - March 2014	April 2015 - October 2014
Shoreline Change at MHW (0.98 ft NAVD88)	-2.95 ft/yr	0.46 ft
Volume Change Above -15 ft NAVD88	0.81 cy/ft/yr	2.48 cy/ft
Volume Change Above 0 ft NAVD88	-0.54 cy/ft/yr	0.67 cy/ft

LEGEND:
- 2015 APR
- 2014 OCT
- 2014 MAR
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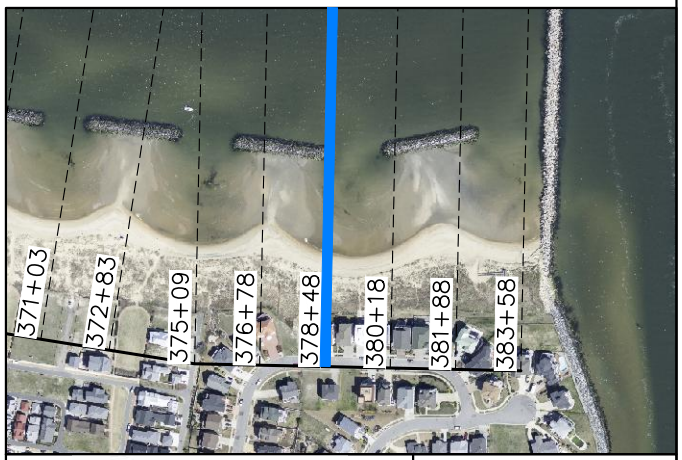

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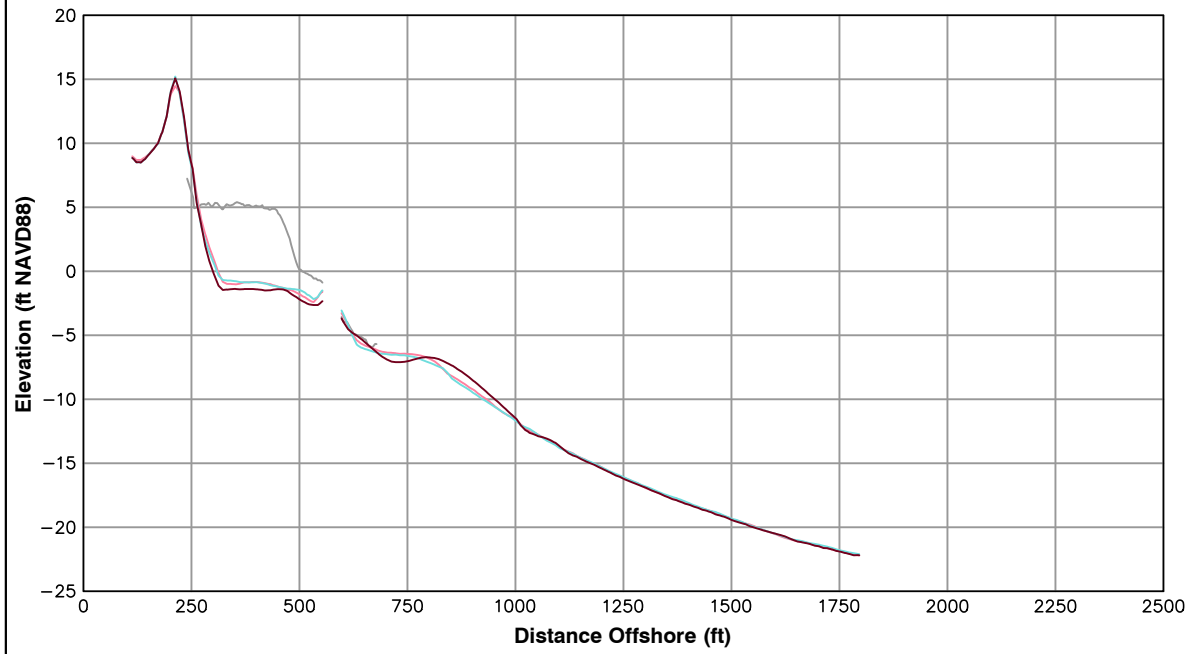
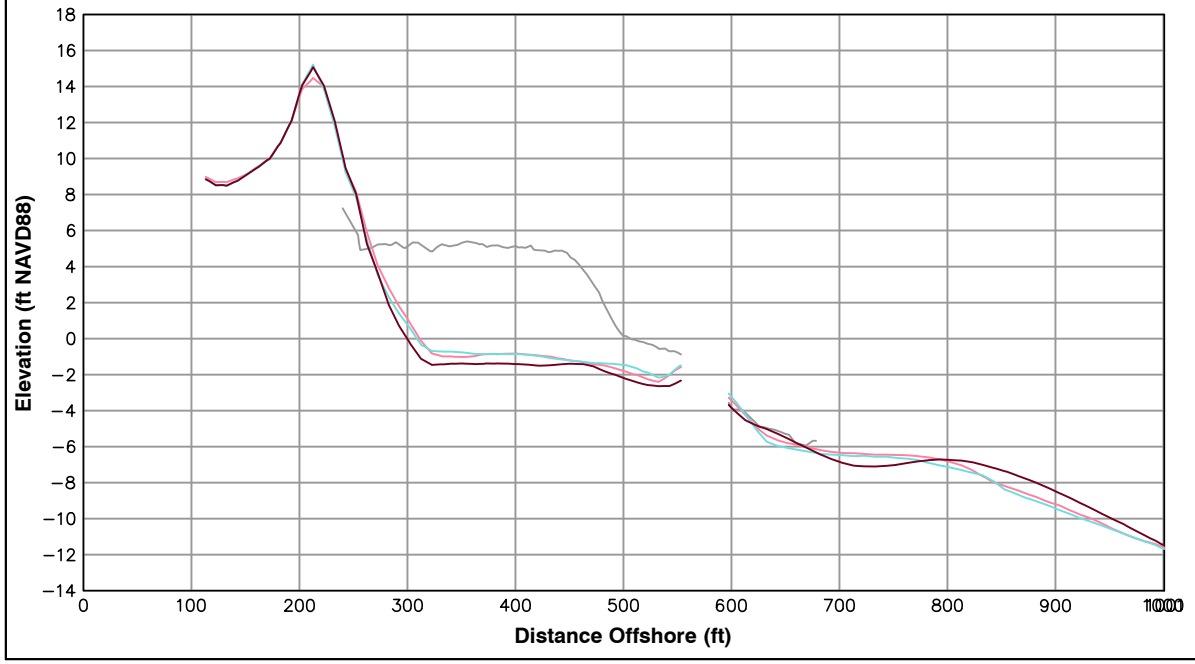
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 380+18	April 2015 - March 2014	April 2015 - October 2014
Shoreline Change at MHW (0.98 ft NAVD88)	-10.21 ft/yr	-7.30 ft
Volume Change Above -15 ft NAVD88	-3.08 cy/ft/yr	-0.91 cy/ft
Volume Change Above 0 ft NAVD88	-1.23 cy/ft/yr	-0.40 cy/ft

LEGEND:
- 2015 APR
- 2014 OCT
- 2014 MAR
- POST-FILL

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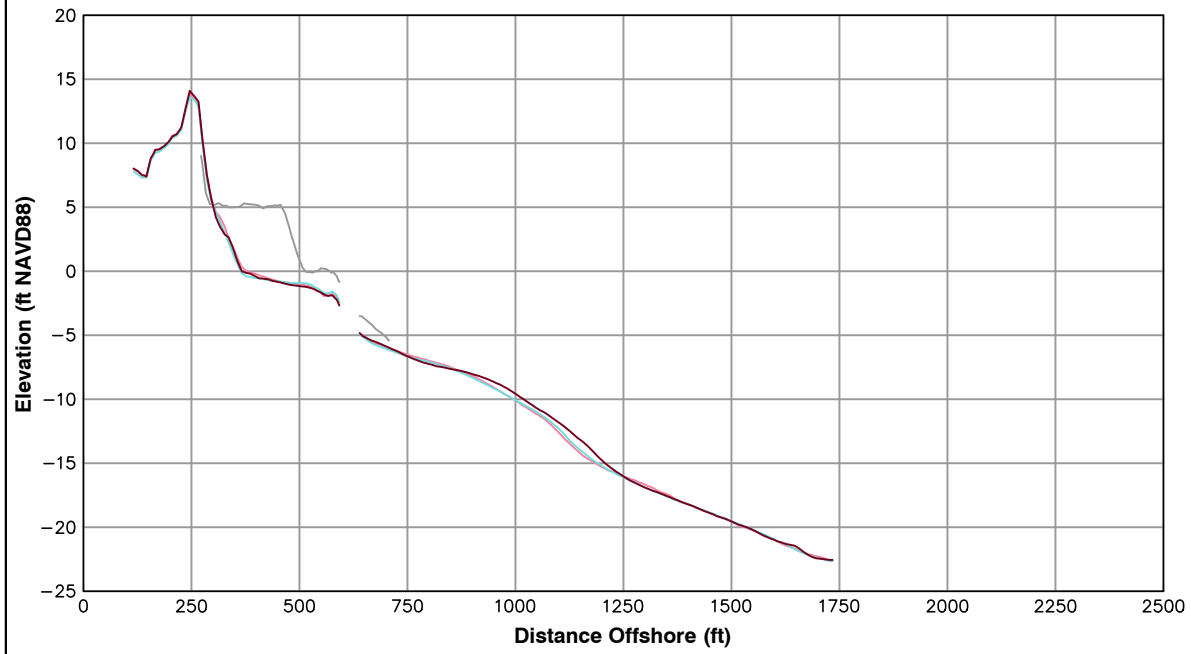

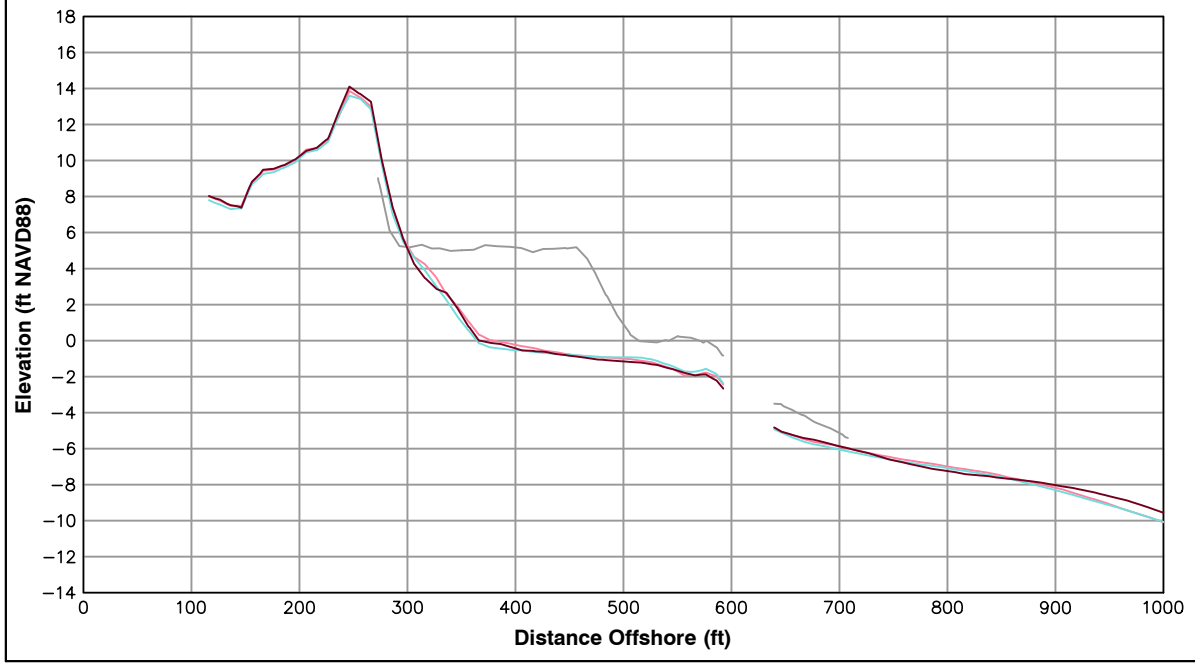

Survey Transect 381+88	April 2015 - March 2014	April 2015 - October 2014
Shoreline Change at MHW (0.98 ft NAVD88)	-3.02 ft/yr	3.47 ft
Volume Change Above -15 ft NAVD88	4.40 cy/ft/yr	7.01 cy/ft
Volume Change Above 0 ft NAVD88	-0.41 cy/ft/yr	1.60 cy/ft

LEGEND:
- 2015 APR
- 2014 OCT
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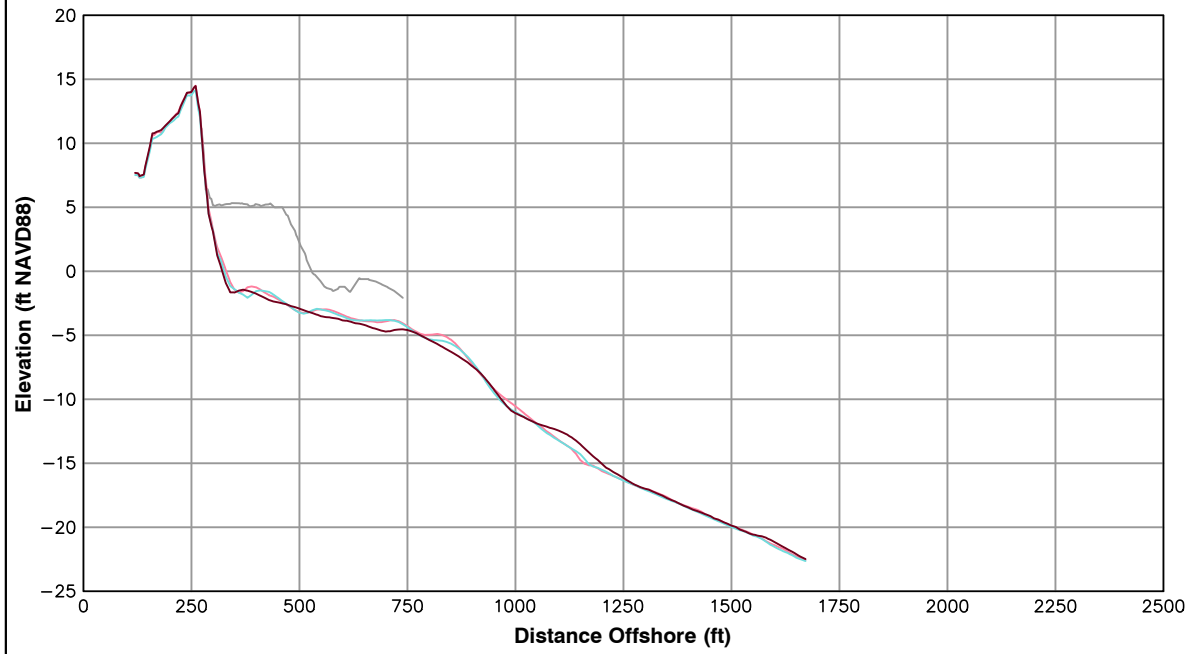

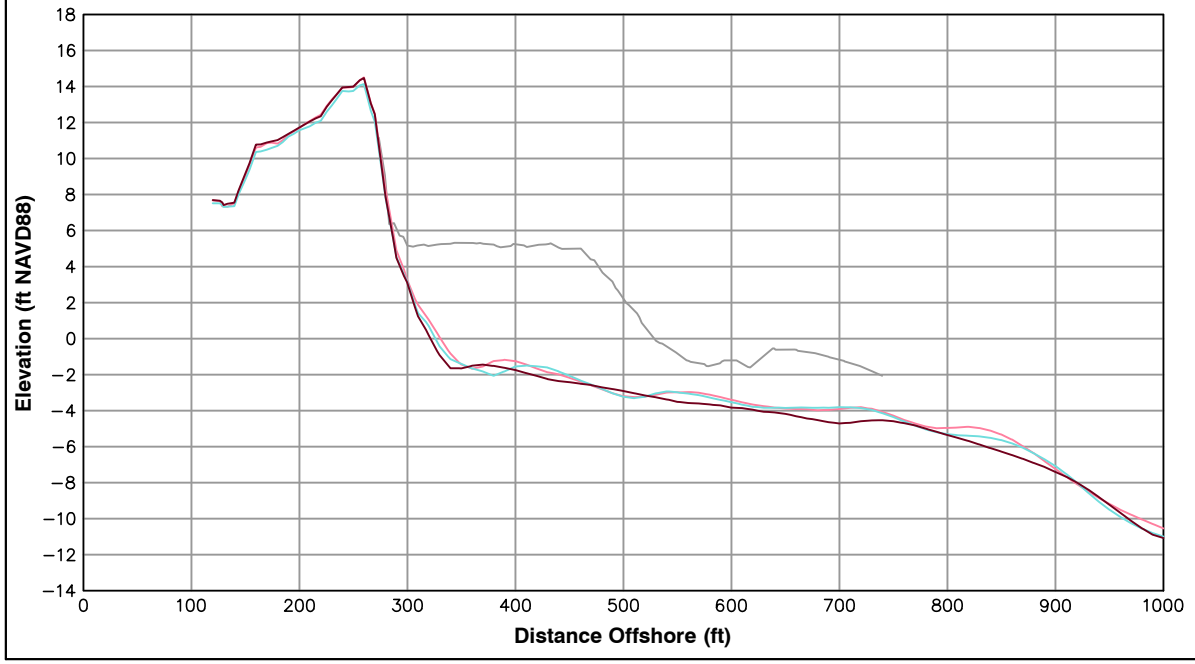

Survey Transect 383+58	April 2015 - March 2014	April 2015 - October 2014
Shoreline Change at MHW (0.98 ft NAVD88)	-7.91 ft/yr	-4.00 ft
Volume Change Above -15 ft NAVD88	-6.13 cy/ft/yr	-1.32 cy/ft
Volume Change Above 0 ft NAVD88	-0.70 cy/ft/yr	1.30 cy/ft

LEGEND:
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OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS

Appendix C: Summary of Shoreline Change and Volume Change Tables

Table C-1. Summary of Shoreline Change and Volume Change (March 2014 to April 2015)

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 March 20, 2014 to April 21, 2015.

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	3/20/2014	4/21/2015	14.41	2.78	-11.00
2+50	3/20/2014	4/21/2015	8.06	1.80	4.55
5+00	3/20/2014	4/21/2015	8.29	0.80	1.28
7+50	3/20/2014	4/21/2015	-10.58	-2.29	9.58
10+00	3/20/2014	4/21/2015	40.89	10.58	-6.04
12+50	3/20/2014	4/21/2015	23.81	5.74	-1.21
15+00	3/20/2014	4/21/2015	49.14	9.96	10.96
17+50	3/20/2014	4/21/2015	25.44	5.00	-3.59
20+00	3/20/2014	4/21/2015	26.27	3.71	0.16
22+50	3/20/2014	4/21/2015	17.66	3.85	-2.43
25+00	3/20/2014	4/21/2015	11.43	1.76	1.14
27+50	3/20/2014	4/21/2015	-5.02	0.00	-3.96
30+00	3/20/2014	4/21/2015	23.45	4.64	17.79
32+50	3/20/2014	4/21/2015	9.06	4.73	8.61
35+00	3/20/2014	4/21/2015	-1.49	1.86	11.33
37+50	3/20/2014	4/21/2015	-2.61	2.37	5.52
40+00	3/20/2014	4/21/2015	-45.47	-4.18	-8.96
42+50	3/20/2014	4/21/2015	-25.32	-3.84	-4.59
45+00	3/20/2014	4/21/2015	-34.70	-5.67	-4.17
45+25	3/20/2014	4/21/2015	-29.70	-6.36	-8.79
47+30	3/20/2014	4/21/2015	-28.85	-5.38	-13.64
49+35	3/20/2014	4/21/2015	-16.18	-4.26	-7.63
51+41	3/20/2014	4/21/2015	-15.89	-2.26	-11.07
53+46	3/20/2014	4/21/2015	8.00	-0.07	-1.29
55+51	3/20/2014	4/21/2015	-10.38	-1.09	-9.14
57+57	3/20/2014	4/21/2015	19.37	2.15	-1.91
59+62	3/20/2014	4/21/2015	-4.73	0.09	-3.66
61+62	3/20/2014	4/21/2015	5.60	1.46	-3.74
63+62	3/20/2014	4/21/2015	-3.95	1.31	-0.43
65+62	3/20/2014	4/21/2015	5.59	2.92	-2.63
67+62	3/20/2014	4/21/2015	-8.06	0.15	0.74
69+62	3/20/2014	4/21/2015	5.27	0.02	-4.04
71+62	3/20/2014	4/21/2015	-8.29	-0.29	0.00
73+62	3/20/2014	4/21/2015	26.67	4.42	6.11
75+62	3/20/2014	4/21/2015	-2.28	1.26	0.89
77+62	3/20/2014	4/21/2015	0.55	-0.21	-1.95
79+62	3/20/2014	4/21/2015	4.70	0.44	-1.59
81+62	3/20/2014	4/21/2015	3.23	0.80	-1.54
83+62	3/20/2014	4/21/2015	-17.41	-1.22	-4.66
85+62	3/20/2014	4/21/2015	-3.80	-0.70	-1.10
87+62	3/20/2014	4/21/2015	0.79	0.24	-0.04

Table C-1. Summary of Shoreline Change and Volume Change (March 2014 to April 2015) 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 March 20, 2014 to April 21, 2015.

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	3/20/2014	4/21/2015	-10.99	-1.39	1.91
103+08	3/20/2014	4/21/2015	2.25	0.79	8.10
120+93	3/20/2014	4/21/2015	18.78	5.66	7.82
129+17	3/20/2014	4/21/2015	-	-	-
141+98	3/20/2014	4/21/2015	3.27	0.67	2.40
152+01	3/20/2014	4/21/2015	-5.82	-1.10	1.97
163+49	3/20/2014	4/21/2015	5.22	1.47	-0.21
169+63	3/20/2014	4/21/2015	15.99	1.72	5.08
171+63	3/20/2014	4/21/2015	-4.95	-2.71	-3.10
173+63	3/20/2014	4/21/2015	4.32	-1.38	0.32
175+63	3/20/2014	4/21/2015	-4.13	0.09	3.33
177+63	3/20/2014	4/21/2015	14.50	5.41	14.59
179+63	3/20/2014	4/21/2015	-5.34	1.99	7.23
181+63	3/20/2014	4/21/2015	-10.92	0.83	8.24
183+63	3/20/2014	4/21/2015	6.57	2.88	6.52
185+63	3/20/2014	4/21/2015	2.22	0.80	0.11
187+63	3/20/2014	4/21/2015	8.66	1.75	4.73
189+63	3/20/2014	4/21/2015	5.67	1.13	-0.19
191+63	3/20/2014	4/21/2015	20.02	3.18	5.56
193+63	3/20/2014	4/21/2015	-2.32	0.82	-0.04
195+63	3/20/2014	4/21/2015	0.75	0.47	-3.02
206+86	3/20/2014	4/21/2015	9.63	1.95	0.90
218+66	3/20/2014	4/21/2015	3.93	2.09	3.03
229+85	3/20/2014	4/21/2015	-0.23	5.57	6.42
242+03	3/20/2014	4/21/2015	15.60	-0.42	-3.79
252+62	3/20/2014	4/21/2015	13.48	2.09	5.32
263+22	3/20/2014	4/21/2015	32.07	6.06	2.70
274+53	3/20/2014	4/21/2015	13.45	1.70	10.03
281+40	3/20/2014	4/21/2015	20.73	4.61	-6.79
288+39	3/20/2014	4/21/2015	12.86	6.85	1.43
295+27	3/20/2014	4/21/2015	8.23	1.43	3.22
302+24	3/20/2014	4/21/2015	27.43	9.84	10.35
315+96	3/20/2014	4/21/2015	16.97	4.08	-1.71
323+09	3/20/2014	4/21/2015	32.45	4.43	-1.59
329+63	3/20/2014	4/21/2015	-2.92	3.00	-0.50
331+43	3/20/2014	4/21/2015	-14.18	0.32	-1.40
333+23	3/20/2014	4/21/2015	0.61	0.79	5.77
335+03	3/20/2014	4/21/2015	-15.54	-1.23	0.64
336+83	3/20/2014	4/21/2015	2.66	0.60	-1.62
338+63	3/20/2014	4/21/2015	-11.96	-0.12	-2.12
340+43	3/20/2014	4/21/2015	-8.28	-0.34	2.53
342+23	3/20/2014	4/21/2015	-2.11	0.44	-1.27

Table C-1. Summary of Shoreline Change and Volume Change (March 2014 to April 2015) 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 March 20, 2014 to April 21, 2015.

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	3/20/2014	4/21/2015	-3.40	-8.61	-6.02
345+85	3/20/2014	4/21/2015	-12.76	-2.81	-5.15
347+63	3/20/2014	4/21/2015	11.16	2.53	-6.84
349+43	3/20/2014	4/21/2015	-8.47	0.01	-1.78
351+23	3/20/2014	4/21/2015	-6.58	1.00	-11.10
353+03	3/20/2014	4/21/2015	-17.26	-1.52	-3.94
354+83	3/20/2014	4/21/2015	-2.37	-0.47	-11.47
356+63	3/20/2014	4/21/2015	-15.03	-1.68	-1.66
358+43	3/20/2014	4/21/2015	-4.85	-0.05	-11.13
360+23	3/20/2014	4/21/2015	-17.58	-2.29	-2.35
362+03	3/20/2014	4/21/2015	2.87	-0.15	-8.37
363+83	3/20/2014	4/21/2015	-7.93	-1.48	-0.56
365+63	3/20/2014	4/21/2015	-7.19	-1.81	-9.80
367+43	3/20/2014	4/21/2015	-15.81	-2.50	-1.37
369+23	3/20/2014	4/21/2015	-2.30	-0.47	-7.42
371+03	3/20/2014	4/21/2015	-16.05	-1.31	-1.98
372+83	3/20/2014	4/21/2015	-1.94	-0.69	-2.15
375+08	3/20/2014	4/21/2015	-17.10	-2.49	-6.31
376+78	3/20/2014	4/21/2015	2.27	0.18	-2.33
378+48	3/20/2014	4/21/2015	-2.95	-0.54	0.81
380+18	3/20/2014	4/21/2015	-10.21	-1.23	-3.08
381+88	3/20/2014	4/21/2015	-3.02	-0.41	4.40
383+58	3/20/2014	4/21/2015	-7.91	-0.70	-6.13

Table C-2. Summary of Shoreline Change and Volume Change (October 2014 to April 2015)

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 7, 2014 to April 21, 2015.*

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	10/7/2014	4/21/2015	8.93	0.56	-7.14
2+50	10/7/2014	4/21/2015	2.41	0.39	-2.15
5+00	10/7/2014	4/21/2015	0.61	-0.48	5.75
7+50	10/7/2014	4/21/2015	-4.26	-1.32	-5.66
10+00	10/7/2014	4/21/2015	12.57	-0.29	-5.26
12+50	10/7/2014	4/21/2015	4.93	1.28	1.67
15+00	10/7/2014	4/21/2015	32.12	6.84	16.16
17+50	10/7/2014	4/21/2015	15.08	3.15	-0.10
20+00	10/7/2014	4/21/2015	25.01	3.28	8.02
22+50	10/7/2014	4/21/2015	10.57	2.07	5.52
25+00	10/7/2014	4/21/2015	5.07	0.69	10.92
27+50	10/7/2014	4/21/2015	7.94	1.36	7.72
30+00	10/7/2014	4/21/2015	7.34	1.88	16.39
32+50	10/7/2014	4/21/2015	-24.79	-0.73	6.93
35+00	10/7/2014	4/21/2015	-14.94	-0.02	12.79
37+50	10/7/2014	4/21/2015	-14.26	-0.90	4.17
40+00	10/7/2014	4/21/2015	-17.72	-0.28	4.41
42+50	10/7/2014	4/21/2015	-14.93	-2.38	1.40
45+00	10/7/2014	4/21/2015	-4.12	-0.70	2.48
45+25	10/7/2014	4/21/2015	-3.67	-1.90	-0.42
47+30	10/7/2014	4/21/2015	-5.15	-0.86	4.13
49+35	10/7/2014	4/21/2015	-8.03	-1.91	-0.29
51+41	10/7/2014	4/21/2015	-12.80	-1.20	-1.76
53+46	10/7/2014	4/21/2015	8.23	0.84	4.12
55+51	10/7/2014	4/21/2015	-6.87	-0.40	-1.13
57+57	10/7/2014	4/21/2015	21.54	2.57	1.95
59+62	10/7/2014	4/21/2015	-1.31	0.36	1.44
61+62	10/7/2014	4/21/2015	15.62	1.84	1.32
63+62	10/7/2014	4/21/2015	-7.60	-0.53	1.68
65+62	10/7/2014	4/21/2015	13.44	1.99	2.19
67+62	10/7/2014	4/21/2015	-7.63	-0.49	-0.43
69+62	10/7/2014	4/21/2015	-0.59	-1.02	-0.25
71+62	10/7/2014	4/21/2015	-20.68	-2.75	-0.87
73+62	10/7/2014	4/21/2015	1.98	1.55	3.65
75+62	10/7/2014	4/21/2015	-13.44	-0.79	-2.30
77+62	10/7/2014	4/21/2015	-3.38	-0.29	0.01
79+62	10/7/2014	4/21/2015	7.59	0.51	-4.50
81+62	10/7/2014	4/21/2015	11.22	2.01	2.50
83+62	10/7/2014	4/21/2015	-2.35	0.93	0.28
85+62	10/7/2014	4/21/2015	-4.61	-1.17	2.29
87+62	10/7/2014	4/21/2015	2.07	0.20	4.31

Table C-2. Summary of Shoreline Change and Volume Change (October 2014 to April 2015) 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 7, 2014 to April 21, 2015.

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	10/7/2014	4/21/2015	-14.50	-1.92	0.09
103+08	10/7/2014	4/21/2015	7.25	2.07	9.13
120+93	10/7/2014	4/21/2015	-2.74	-0.18	-3.90
129+17	10/7/2014	4/21/2015	-29.04	-5.12	-6.97
141+98	10/7/2014	4/21/2015	9.76	0.87	2.32
152+01	10/7/2014	4/21/2015	-25.69	-6.04	-6.48
163+49	10/7/2014	4/21/2015	9.93	2.80	4.35
169+63	10/7/2014	4/21/2015	20.18	3.15	13.00
171+63	10/7/2014	4/21/2015	-0.10	-1.80	-1.16
173+63	10/7/2014	4/21/2015	8.66	-0.26	4.41
175+63	10/7/2014	4/21/2015	14.30	4.25	13.17
177+63	10/7/2014	4/21/2015	28.19	7.84	19.89
179+63	10/7/2014	4/21/2015	7.63	2.14	12.81
181+63	10/7/2014	4/21/2015	-22.28	-2.38	6.43
183+63	10/7/2014	4/21/2015	17.44	2.50	9.09
185+63	10/7/2014	4/21/2015	-0.25	0.21	2.62
187+63	10/7/2014	4/21/2015	2.15	0.34	6.41
189+63	10/7/2014	4/21/2015	-3.63	-0.17	0.56
191+63	10/7/2014	4/21/2015	1.92	-0.45	0.70
193+63	10/7/2014	4/21/2015	-1.20	-0.60	-4.13
195+63	10/7/2014	4/21/2015	-10.23	-2.18	-10.03
206+86	10/7/2014	4/21/2015	6.12	2.40	3.89
218+66	10/7/2014	4/21/2015	10.03	4.11	5.46
229+85	10/7/2014	4/21/2015	11.61	3.47	8.23
242+03	10/7/2014	4/21/2015	5.44	-3.64	-7.29
252+62	10/7/2014	4/21/2015	9.41	-0.21	6.53
263+22	10/7/2014	4/21/2015	-2.07	2.26	1.78
274+53	10/7/2014	4/21/2015	8.49	-0.43	8.16
281+40	10/7/2014	4/21/2015	14.44	2.18	-3.74
288+39	10/7/2014	4/21/2015	-10.67	3.48	10.26
295+27	10/7/2014	4/21/2015	2.97	0.79	4.44
302+24	10/7/2014	4/21/2015	18.99	3.00	6.21
315+96	10/7/2014	4/21/2015	-3.62	0.68	0.09
323+09	10/7/2014	4/21/2015	6.00	0.11	3.80
329+63	10/7/2014	4/21/2015	19.42	3.94	4.51
331+43	10/7/2014	4/21/2015	-2.37	1.14	7.31
333+23	10/7/2014	4/21/2015	-0.77	1.29	7.87
335+03	10/7/2014	4/21/2015	-5.87	-0.19	8.26
336+83	10/7/2014	4/21/2015	0.38	0.59	8.03
338+63	10/7/2014	4/21/2015	-4.56	0.13	1.97
340+43	10/7/2014	4/21/2015	0.54	0.00	7.53

Table C-2. Summary of Shoreline Change and Volume Change (October 2014 to April 2015) 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 7, 2014 to April 21, 2015.

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	10/7/2014	4/21/2015	1.99	1.40	7.33
344+05	10/7/2014	4/21/2015	-3.70	2.28	5.47
345+85	10/7/2014	4/21/2015	-5.80	-0.74	5.03
347+63	10/7/2014	4/21/2015	2.61	1.07	-5.49
349+43	10/7/2014	4/21/2015	-11.27	-1.01	3.95
351+23	10/7/2014	4/21/2015	-3.19	0.13	-6.25
353+03	10/7/2014	4/21/2015	-10.99	-1.31	2.98
354+83	10/7/2014	4/21/2015	-12.48	-1.68	-9.94
356+63	10/7/2014	4/21/2015	-17.71	-2.36	1.70
358+43	10/7/2014	4/21/2015	-9.34	-0.47	-7.70
360+23	10/7/2014	4/21/2015	-10.00	-1.24	4.78
362+03	10/7/2014	4/21/2015	1.94	0.38	-4.35
363+83	10/7/2014	4/21/2015	-11.46	-1.28	2.70
365+63	10/7/2014	4/21/2015	0.36	-0.47	-6.24
367+43	10/7/2014	4/21/2015	-12.09	-1.87	2.95
369+23	10/7/2014	4/21/2015	5.57	0.11	-1.49
371+03	10/7/2014	4/21/2015	-15.74	-1.77	1.37
372+83	10/7/2014	4/21/2015	1.03	0.04	6.04
375+08	10/7/2014	4/21/2015	-21.94	-2.41	-4.47
376+78	10/7/2014	4/21/2015	17.45	1.76	0.85
378+48	10/7/2014	4/21/2015	0.46	0.67	2.48
380+18	10/7/2014	4/21/2015	-7.30	-0.40	-0.91
381+88	10/7/2014	4/21/2015	3.47	1.60	7.01
383+58	10/7/2014	4/21/2015	-4.00	1.30	-1.32

Table C-3. Summary of Shoreline Change and Volume Change from East Ocean View Nourishment (March 2009 to April 2015)

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 March 20, 2009 to April 21, 2015.

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)
329+63	3/20/2009	4/21/2015	-14.23	-3.18	-
331+43	3/20/2009	4/21/2015	-18.00	-3.06	-
333+23	3/20/2009	4/21/2015	-13.92	-2.15	-
335+03	3/20/2009	4/21/2015	-12.45	-1.69	-
336+83	3/20/2009	4/21/2015	-11.47	-1.40	-
338+63	3/20/2009	4/21/2015	-11.54	-1.57	-
340+43	3/20/2009	4/21/2015	-12.14	-0.96	-
342+23	3/20/2009	4/21/2015	-13.87	-1.55	-
344+05	3/20/2009	4/21/2015	-15.46	-2.68	-
345+85	3/20/2009	4/21/2015	-12.79	-2.69	-
347+63	3/20/2009	4/21/2015	-9.66	-2.17	-
349+43	3/20/2009	4/21/2015	-13.11	-2.65	-
351+23	3/20/2009	4/21/2015	-9.66	-1.95	-
353+03	3/20/2009	4/21/2015	-13.14	-2.61	-
354+83	3/20/2009	4/21/2015	-10.64	-2.02	-
356+63	3/20/2009	4/21/2015	-14.10	-2.99	-
358+43	3/20/2009	4/21/2015	-13.60	-2.52	-
360+23	3/20/2009	4/21/2015	-17.13	-3.40	-
362+03	3/20/2009	4/21/2015	-13.95	-2.63	-
363+83	3/20/2009	4/21/2015	-12.94	-2.59	-
365+63	3/20/2009	4/21/2015	-12.31	-2.39	-
367+43	3/20/2009	4/21/2015	-20.47	-3.76	-
369+23	3/20/2009	4/21/2015	-16.61	-2.69	-
371+03	3/20/2009	4/21/2015	-24.80	-4.18	-
372+83	3/20/2009	4/21/2015	-22.14	-3.91	-
375+08	3/20/2009	4/21/2015	-31.22	-5.73	-
376+78	3/20/2009	4/21/2015	-22.87	-4.08	-
378+48	3/20/2009	4/21/2015	-33.68	-6.27	-
380+18	3/20/2009	4/21/2015	-32.86	-5.81	-
381+88	3/20/2009	4/21/2015	-23.76	-4.53	-
383+58	3/20/2009	4/21/2015	-33.50	-6.15	-

Table C-4. Summary of Shoreline Change and Volume Change from Central Ocean View Nourishment (March 2005 to April 2015)

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 March 15, 2005 to April 21, 2015.

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)
15+00	3/15/2005	4/21/2015	5.90	1.96	-
17+50	3/15/2005	4/21/2015	4.60	1.33	-
20+00	3/15/2005	4/21/2015	0.87	-0.05	-
22+50	3/15/2005	4/21/2015	-3.68	-1.65	-
25+00	3/15/2005	4/21/2015	8.72	-0.40	-
27+50	3/15/2005	4/21/2015	3.18	-0.90	-
30+00	3/15/2005	4/21/2015	1.39	-0.45	-
32+50	3/15/2005	4/21/2015	-2.48	-1.28	-
35+00	3/15/2005	4/21/2015	2.98	0.09	-
37+50	3/15/2005	4/21/2015	2.01	-0.77	-
40+00	3/15/2005	4/21/2015	-3.82	-1.11	-
42+50	3/15/2005	4/21/2015	-4.75	-1.88	-
45+00	3/15/2005	4/21/2015	-8.87	-2.69	-
45+25	3/15/2005	4/21/2015	-10.89	-3.17	-
47+30	3/15/2005	4/21/2015	-11.69	-3.24	-
49+35	3/15/2005	4/21/2015	-7.56	-2.36	-
51+41	3/15/2005	4/21/2015	-6.94	-1.65	-
53+46	3/15/2005	4/21/2015	-2.79	-1.01	-
55+51	3/15/2005	4/21/2015	-7.98	-2.31	-
57+57	3/15/2005	4/21/2015	-0.47	-0.75	-
59+62	3/15/2005	4/21/2015	-6.62	-1.76	-
61+62	3/15/2005	4/21/2015	1.62	0.25	-
63+62	3/15/2005	4/21/2015	-5.96	-0.81	-
65+62	3/15/2005	4/21/2015	0.26	0.57	-
67+62	3/15/2005	4/21/2015	-12.14	-1.45	-
69+62	3/15/2005	4/21/2015	-3.21	-0.30	-
71+62	3/15/2005	4/21/2015	-10.94	-1.44	-
73+62	3/15/2005	4/21/2015	-2.26	0.28	-
75+62	3/15/2005	4/21/2015	-6.94	-0.44	-
77+62	3/15/2005	4/21/2015	-1.86	0.65	-
79+62	3/15/2005	4/21/2015	-2.88	-0.54	-
81+62	3/15/2005	4/21/2015	-3.77	-1.04	-
83+62	3/15/2005	4/21/2015	-6.90	-1.88	-
85+62	3/15/2005	4/21/2015	-3.70	-1.36	-
87+62	3/15/2005	4/21/2015	-2.64	-0.58	-
93+41	3/15/2005	4/21/2015	-1.94	-0.90	-
103+08	3/15/2005	4/21/2015	-2.79	-1.15	-
120+93	3/15/2005	4/21/2015	-2.28	-1.67	-
129+17	3/15/2005	4/21/2015	-5.06	-2.64	-
141+98	3/15/2005	4/21/2015	-1.68	-1.10	-
152+01	3/15/2005	4/21/2015	-5.90	-2.10	-

Table C-4. Summary of Shoreline Change and Volume Change from Central Ocean View Nourishment (March 2005 to April 2015) 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 March 15, 2005 to April 21, 2015.

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)
163+49	3/15/2005	4/21/2015	-2.65	-1.13	-
169+63	3/15/2005	4/21/2015	0.14	-0.53	-
171+63	3/15/2005	4/21/2015	-3.13	-1.15	-
173+63	3/15/2005	4/21/2015	-1.68	-1.10	-
175+63	3/15/2005	4/21/2015	-3.36	-0.71	-
177+63	3/15/2005	4/21/2015	-0.85	-0.06	-
179+63	3/15/2005	4/21/2015	-2.46	-0.79	-
181+63	3/15/2005	4/21/2015	-3.52	-1.25	-
183+63	3/15/2005	4/21/2015	2.52	0.48	-
185+63	3/15/2005	4/21/2015	-1.02	-0.29	-
187+63	3/15/2005	4/21/2015	3.94	1.27	-
189+63	3/15/2005	4/21/2015	0.37	0.89	-
191+63	3/15/2005	4/21/2015	6.12	1.94	-
193+63	3/15/2005	4/21/2015	-0.20	0.68	-
195+63	3/15/2005	4/21/2015	-1.77	0.25	-