

FINAL REPORT

Produced for the Town of Nags Head, NC
October 2021



SUMMER 2021 ANNUAL BEACH MONITORING SURVEY EVALUATION TOWN OF NAGS HEAD, NORTH CAROLINA



TOWN OF NAGS HEAD

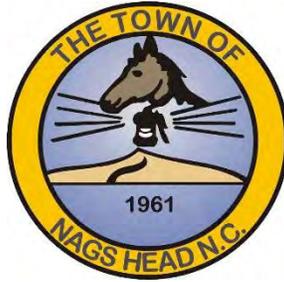
2021 SUMMER ANNUAL MONITORING SURVEY EVALUATION

Prepared for:



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TOWN OF NAGS HEAD

**2021 SUMMER ANNUAL MONITORING
SURVEY EVALUATION**

EXECUTIVE SUMMARY

The Town of Nags Head Beach Monitoring and Maintenance Plan is sponsored by the Town of Nags Head (Town) as a continuation of the 2011 monitoring program initiated for assessing beach conditions. The primary purpose of the program is to assess current and historical shoreline conditions, determine shoreline and volumetric changes and evaluate the performance of beach nourishment and other restoration efforts. Evaluating and documenting these changes consistently over successive years provides information necessary to plan for future beach nourishments and to support development of the Town's multi-decadal Beach Nourishment Master Plan.

The most recent annual survey occurred during the summer of 2021 (July) and was performed by McKim & Creed. This report documents the data sources, methods, and results of a survey evaluation by Moffatt & Nichol performed to compare the July 2021 survey with a previous survey performed by McKim & Creed in June 2020.

In the summer 2020 report the reach extending between the Stations 1025+00 and 1200+00, covering part of the National Seashore, was referred to as Oregon Inlet Reach. In 2020 transects near the inlet were added and extended the reach to cover the National Seashore shoreline between north of Nags Head to the Oregon Inlet. Therefore, in the current report the Oregon Inlet Reach was renamed as National Seashore-North and a new reach named as National Seashore-South was added to the south of it extending between the Stations 1200+00 and 1290+00.

The survey data was used to compute shoreline change at Mean High Water (MHW), which is designated as +1.18 ft NAVD88 for Nags Head, and volume change above +6 ft NAVD88 (berm), MHW, -6 ft NAVD88 (wading depth), -14 ft NAVD88 (outer bar), -19 ft NAVD88 (approximate depth of closure), and -30 ft NAVD88 (offshore). This allows a detailed review of the shoreline and active profile performance during the 2020-2021 monitoring period.

During the 2019 Beach Nourishment Project approximately 4.0 million cy of material was placed along approximately 10 miles of shoreline. The shoreline position and volume changes above six elevations relative to pre-nourishment conditions (April 2019) along the Nourished Oceanfront (Station 495+00 – 1025+00) are illustrated below.

Figure ES-1 shows the shoreline changes relative to pre-nourishment condition (April 2019) along the Nourished Oceanfront. The shoreline experienced a significant landward recession along the Nourished Oceanfront since the completion of nourishment project. Most of the recession that has occurred since nourishment occurred before the post-Dorian survey which indicates that most of the recession can be attributed to Hurricane Dorian. At Reach 3-North, Reach 3-South and Reach 4 further recession of the shoreline compared to the 2019 post-nourishment condition was experienced during the current monitoring period.

Figure ES-2 illustrates that the overall changes in sand volume vary with the depth. The results confirmed the total volume change above -19 ft NAVD88 since 2019 pre-nourishment was +4,417,905 cy (115 percent of the project volume). Since the completion of the 2019 Beach Nourishment project approximately 576,800 cy (+10.9 cy/ft) volume gain was observed above -19ft NAVD88 along the Nourished Oceanfront. However, the results show large-scale shifts of sand cross-shore, across different elevations.

Figure ES-3 presents the volume changes relative to pre-nourishment conditions (April 2019) above -19 ft NAVD88 along the Nourished Oceanfront. Reach 1 and Reach 2 show continuing volume gain. Although Reach 3-North experienced minor material loss during the current monitoring period, volume gain is observed above -19 ft NAVD88 relative to the pre-nourishment conditions. However, in Reach 3-South and Reach 4 volume losses were experienced extending below -19 ft NAVD88, indicating material loss well beyond the depth of closure that will likely not migrate back onshore.

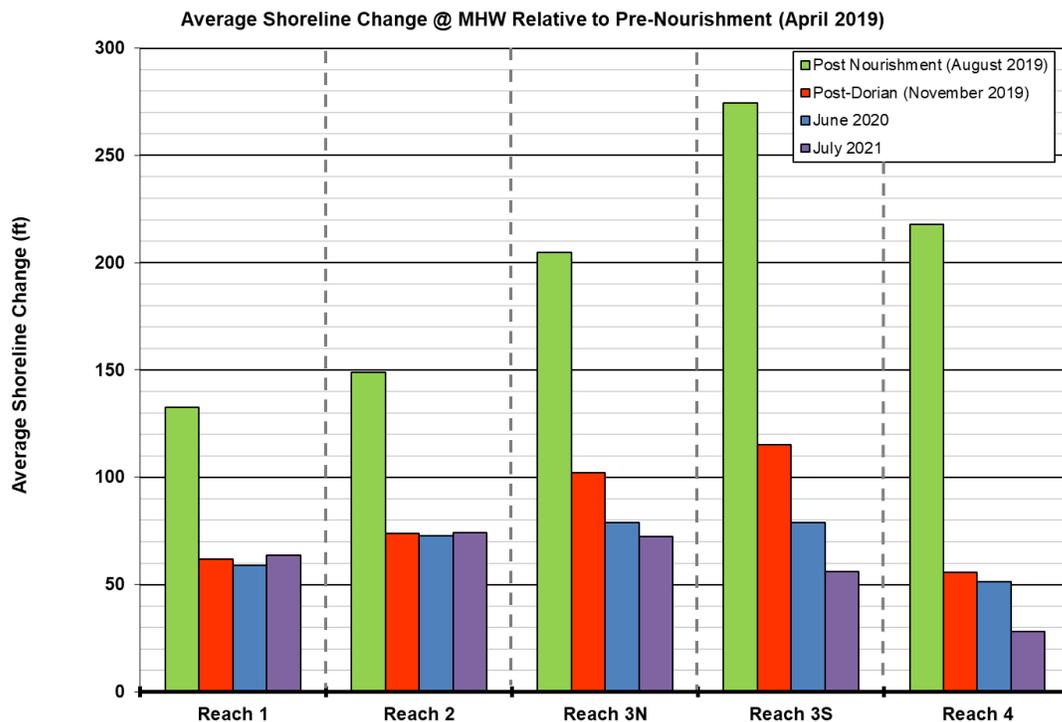


Figure ES-1. Nourished Oceanfront Average Shoreline Change Relative to April 2019 Pre-Nourishment Conditions

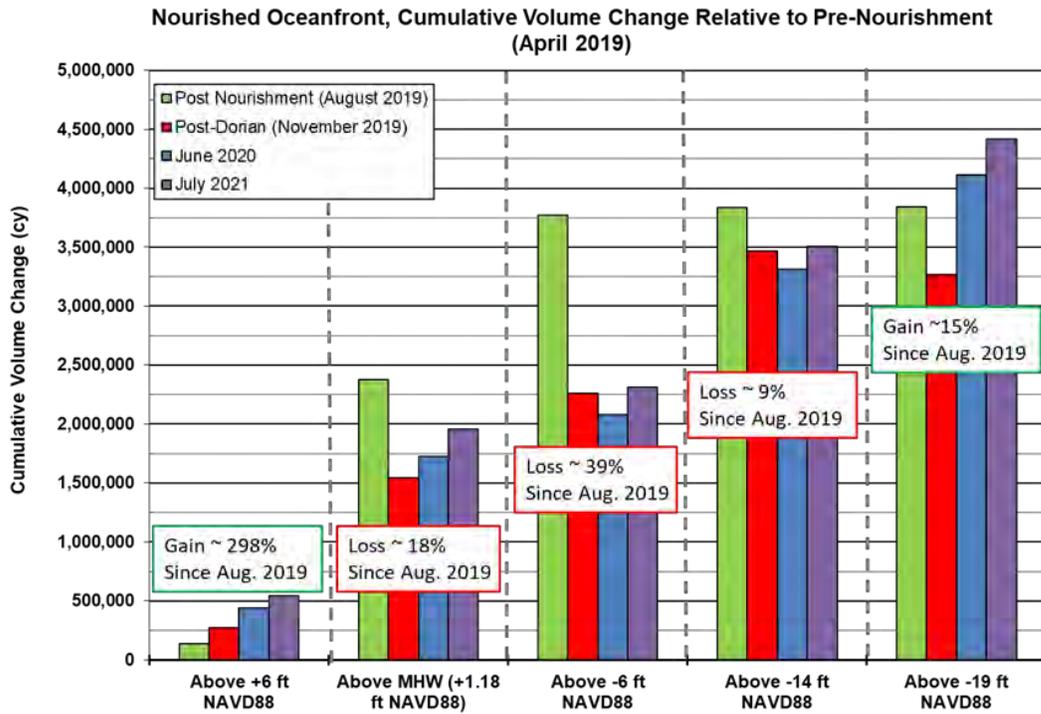


Figure ES-2. Nourished Oceanfront Cumulative Volume Change Relative to April 2019 Pre-Nourishment Conditions

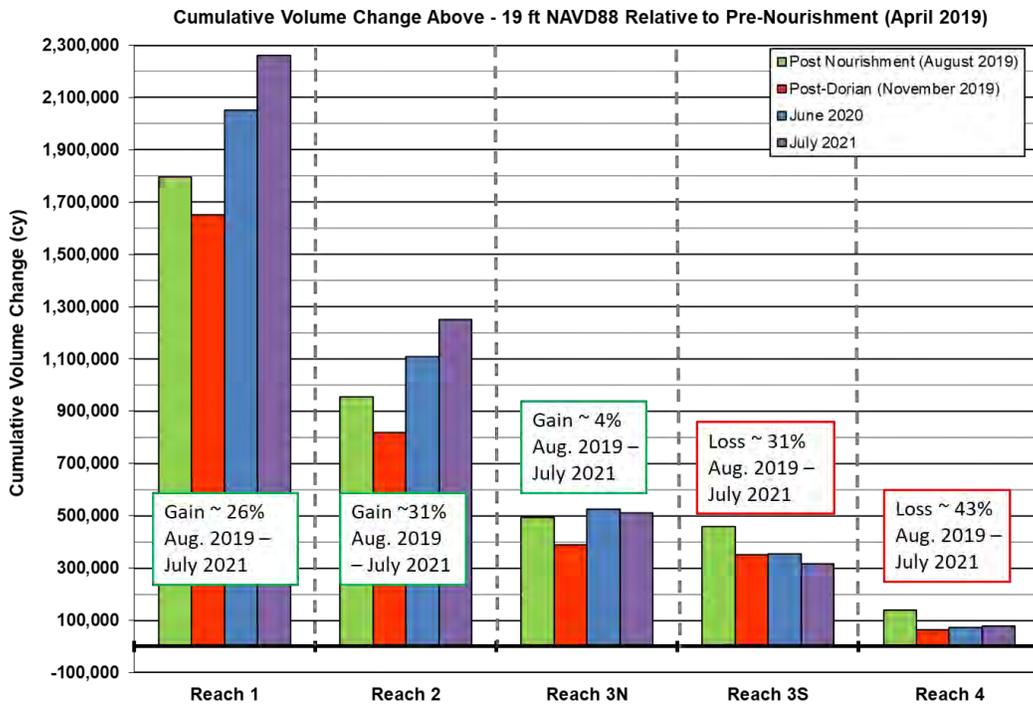


Figure ES-3. Cumulative Volume Change Above -19 ft NAVD88 Relative to Pre-Nourishment

Volume changes during the monitoring period indicated that the Nourished Oceanfront experienced gains in material at all elevations, over the period June 2020 to June 2021. Relative to the 2019 post-nourishment condition, the Nourished Oceanfront experienced net volume gains along the upper (+6 ft NAVD88) and lower (-19 ft NAVD88) portions of the profiles, with net volume losses at the intermediate elevations shown in Figure ES-2. Although these net losses were experienced above MHW, -6 ft NAVD88 and -14 ft NAVD88, recovery of material following Hurricane Dorian is evident in all the reaches. It is likely that the fairly calm wave climate between the summer 2020 and summer 2021 surveys allowed for some natural recovery from Hurricane Dorian which had not previously been allowed to take place due to an active 2020 winter storm season following the passage of the hurricane.

Key statistics for individual reaches along Nags Head along with the entire oceanfront shoreline were as follows:

Table ES-1. Nags Head Shoreline and Average Unit Volume Change Statistics (2020 – 2021)

2020 vs. 2021 (Total Change)	Transects	Reach Length	avg shoreline change @ +1.18 ft NAVD88	avg volume change above +6 ft NAVD88	avg volume change above +1.18 ft NAVD88	avg volume change above -6 ft NAVD88	avg volume change above -14 ft NAVD88	avg volume change above -19 ft NAVD88	avg volume change above -30 ft NAVD88
Reach	#	ft	ft	cy/ft	cy/ft	cy/ft	cy/ft	cy/ft	cy/ft
Nags Head - North	430+00 - 495+00	6,500	23.3	2.5	6.6	16.9	5.7	9.1	0.8
Nags Head - Reach 1	495+00 - 790+00	29,500	4.7	2.7	6.1	6.1	7.2	7.2	0.6
Nags Head - Reach 2	790+00 - 920+00	13,000	1.5	2.3	4.4	11.6	7.7	10.8	-1.8
Nags Head - Reach 3N	920+00 - 975+00	5,500	-6.7	0.4	2.5	-3.5	-5.8	-2.6	-17.4
Nags Head - Reach 3S	975+00 - 1010+00	3,500	-23.0	-0.6	-3.0	-14.4	-18.2	-10.8	-26.4
Nags Head - Reach 4	1010+00 - 1025+00	1,500	-23.1	-1.7	-4.0	-10.7	-12.7	4.4	-5.2
National Seashore North	1025+00 - 1200+00	17,500	28.6	2.2	7.9	15.5	25.9	27.0	10.5
	Transects	Reach Length	weighted avg	weighted avg	weighted avg	weighted avg	weighted avg	weighted avg	weighted avg
Nourished Oceanfront	495+00 - 1025+00	53,000	0.1	2.0	4.4	4.6	3.7	5.8	-3.8
Total Monitored Oceanfront	430+00 - 1200+00	77,000	8.5	2.1	5.4	8.1	8.9	10.9	-0.2

Table ES-2. Nags Head Cumulative Volume Change Statistics (2020 – 2021)

2020 vs. 2021 (Total Change)	Transects	Reach Length	cumulative volume change above +6 ft NAVD88	cumulative volume change above +1.18 ft NAVD88	cumulative volume change above -6 ft NAVD88	cumulative volume change above -14 ft NAVD88	cumulative volume change above -19 ft NAVD88	cumulative volume change above -30 ft NAVD88
Reach	#	ft	cy	cy	cy	cy	cy	cy
Nags Head - North	430+00 - 495+00	6,500	16,348	43,028	109,695	37,296	59,014	5,411
Nags Head - Reach 1	495+00 - 790+00	29,500	77,319	177,696	176,619	209,487	208,249	16,916
Nags Head - Reach 2	790+00 - 920+00	13,000	29,539	57,186	150,932	99,834	140,508	-23,763
Nags Head - Reach 3N	920+00 - 975+00	5,500	2,575	14,414	-19,915	-33,545	-14,863	-100,221
Nags Head - Reach 3S	975+00 - 1010+00	3,500	-1,964	-10,633	-50,393	-63,614	-37,895	-92,418
Nags Head - Reach 4	1010+00 - 1025+00	1,500	-3,048	-6,959	-18,765	-22,191	7,724	-9,120
National Seashore - North	1025+00 - 1200+00	17,500	38,629	138,230	271,727	452,381	471,822	184,188
	Transects	Reach Length	total	total	total	total	total	total
Nourished Oceanfront	495+00 - 1025+00	53,000	104,422	231,703	238,477	189,972	303,722	-208,606
Total Monitored Oceanfront	430+00 - 1200+00	77,000	159,398	412,962	619,899	679,648	834,558	-19,007

During the 2020-2021 monitoring period Reach 1 and Reach 2 shorelines observed minor seaward advancements whereas Reach 3-North shoreline slightly retreated. Among the nourished reaches Reach 3-South and Reach 4 experienced higher recession rates. Shorelines along the Nags Head-North reach and the National Seashore-North reach to the north and south of the Nourished Oceanfront both experienced seaward advancements.

The Nourished Oceanfront and Total Monitored Oceanfront both experienced gains in material along all the analyzed elevations except -30 ft NAVD88. A majority of the volume gains can be attributed to continuing recovery of the beach following Hurricane Dorian during a calmer summer 2020 – summer 2021 wave climate compared to the previous monitoring period. In all management reaches except Reach 3-North and Reach 3-South, material gain was observed above -19 ft NAVD88 indicating that the material remained within the system. The maximum material gain was observed above -19 ft NAVD88 with a 303,722 cy increase along the Nourished Oceanfront. Over the Total Monitored Oceanfront, approximately 834,558 cy was gained above -19 ft NAVD88, with 56.5% of the material gain occurring in the National Seashore-North reach. The significant material gain in the National Seashore-North reach can likely be attributed to the littoral transport of material to the south from Reach 3-North, Reach 3-South and Reach 4, within which volume losses extending above -19 ft NAVD88 were observed.

The long-term dune erosion locations, determined during the 2019-2020 monitoring effort, remained the same during the current monitoring period. The first location is observed at Reach 1, between East Hollowell Street and East Soundside Road. The second area covered the south part of the monitoring area starting from the hotspot location at Reach 3-South and extending south through Reach 4.

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1.0 OBJECTIVE

The Town of Nags Head Beach Monitoring and Maintenance Plan is sponsored by the Town of Nags Head (Town) as a continuation of the 2011 monitoring program initiated for assessing beach conditions. The primary purpose of the program is to assess current and historical shoreline conditions, determine shoreline and volumetric changes and evaluate the performance of beach nourishment and other restoration efforts. Evaluating and documenting these changes consistently over successive years provides information necessary to plan for future beach nourishments and to support development of the Town's multi-decadal Beach Nourishment Master Plan.

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2.0 SUMMARY OF PREVIOUS WORK

Moffatt & Nichol began preparing the Town's annual beach and nearshore monitoring evaluations in 2020. At that time, Moffatt & Nichol reviewed previous beach monitoring studies performed by Coastal Science & Engineering Inc. (CSE) between 2010 and 2018 to gain an understanding of previous survey methods, associated coastal analysis, and observed trends. Shoreline and volume change data for each year was compared to an initial survey performed in 2010, taken before the 2011 beach nourishment project providing for some long-term analysis. **Figure 2-1** presents the extents of each of the monitoring shoreline reaches. It should be noted that the monitoring Reach 1 begins from Station 495+00 while the 2011 construction reach began from 497+00. **Table 2-1** shows the long-term volume changes from previous studies over the various reaches of shoreline.



Figure 2-1: Prior Established Monitoring Reaches

Table 2-1. Long-term Volume Change (Previous Studies: 2010-2018)

		Nov 2010- Nov 2011	Nov 2010- Jun 2012	Nov 2010- Nov 2012	Nov 2010- Jun 2013	Nov 2010- Jun 2014	Nov 2010- Jun 2015	Nov 2010- Jun 2016	Nov 2010- July 2017	Nov 2010- May 2018
		cy	cy							
Dune to +6 ft NAVD88	Reach 1 (495- 790)	135,789	213,713	124,589	344,963	456,407	466,904	505,144	551,781	526,825
	Reach 2 (790-920)	117,999	164,846	145,705	254,009	287,513	281,663	302,382	328,262	293,650
	Reach 3 (920-1010)	85,345	100,273	144,338	243,163	221,848	211,574	221,481	237,733	227,253
	Reach 4 (1010-1025)	10,824	17,767	13,678	26,771	35,216	18,915	5,486	9,292	2,746
	Project Oceanfront	349,957	496,599	428,310	868,906	1,000,984	979,056	1,034,493	1,127,068	1,050,474
Dune to -6 ft NAVD88	Reach 1 (495- 790)	1,138,026	1,032,425	1,014,648	1,219,411	1,085,981	1,079,356	1,086,961	1,194,858	985,588
	Reach 2 (790-920)	967,742	902,188	883,008	1,002,007	844,702	809,453	783,717	721,915	599,858
	Reach 3 (920-1010)	1,026,681	904,870	789,190	823,748	669,903	658,157	579,130	604,978	420,428
	Reach 4 (1010-1025)	110,880	118,284	93,392	90,268	77,033	31,752	29,024	22,168	-14,344
	Project Oceanfront	3,243,329	2,957,767	2,780,238	3,135,434	2,677,619	2,578,718	2,478,832	2,543,919	1,991,530
Dune to -19 ft NAVD88	Reach 1 (495- 790)	1,700,982	2,101,133	1,713,410	1,911,609	1,908,360	1,790,705	2,088,642	1,699,296	1,053,383
	Reach 2 (790-920)	1,297,082	1,373,586	1,141,685	1,292,398	1,346,691	1,268,412	1,305,026	888,118	573,200
	Reach 3 (920-1010)	1,281,379	1,296,493	1,003,944	1,137,586	1,025,817	799,182	760,191	408,100	157,253
	Reach 4 (1010-1025)	173,344	207,830	176,447	137,614	114,850	61,492	16,051	-59,743	-114,154
	Project Oceanfront	4,452,787	4,979,042	4,035,486	4,479,207	4,395,718	3,919,791	4,169,910	2,935,771	1,669,682

3.0 SURVEY PROCEDURES AND DATA PROCESSING

3.1 Survey Transects and Reaches

The present monitoring survey and evaluation continue to use the existing transect lines and origins established by CSE in monitoring periods prior to 2020. Additional monitoring transects were added in 2020 as recommended by Moffatt & Nichol to better understand sand movement and trends at hotspots and along the National Seashore shoreline south of the Town limits. McKim & Creed conducted the summer 2021 survey in July 2021, including both the additional transects and the previously established transect lines. **Figure 3-1** shows the location of the original and additional survey lines and origins applied by McKim & Creed and Moffatt & Nichol. As shown, survey transect lines were stationed from north to south along Nags Head. A summary of streets/landmarks present at the start and end of each reach are provided in **Table 3-1**. In the summer 2020 report the reach extending between Stations 1025+00 and 1200+00, covering part of the National Seashore, was referred to as the Oregon Inlet Reach. In 2020, transects near the inlet were added and extended the reach to cover the National Seashore shoreline between north of Nags Head to Oregon Inlet. Therefore, in the current report the Oregon Inlet Reach was renamed as National Seashore-North and a new reach named as National Seashore-South was added to the south of it, extending between Stations 1200+00 and 1290+00.

Table 3-1. Reach Start and End Points

Reach	Stations	Length (ft)	Start Point	End Point
Nags Head - North	430+00-495+00	6,750	E 8 th Street	Bonnett Street
Reach 1	495+00-790+00	29,000	Bonnett Street	Governor Street
Reach 2	790+00-920+00	13,000	Governor Street	James Street
Reach 3 - North	920+00-975+00	5,500	James Street	Limulus Drive
Reach 3 - South	975+00-1010+00	3,500	Limulus Drive	Loon Court
Reach 4	1010+00-1025+00	2,000	Loon Court	McCall Court
National Seashore - North	1025+00-1200+00	17,250	McCall Court	North of Oregon Inlet Campground
National Seashore - South	1200+00-1290+00	9,000	North of Oregon Inlet Campground	Oregon Inlet

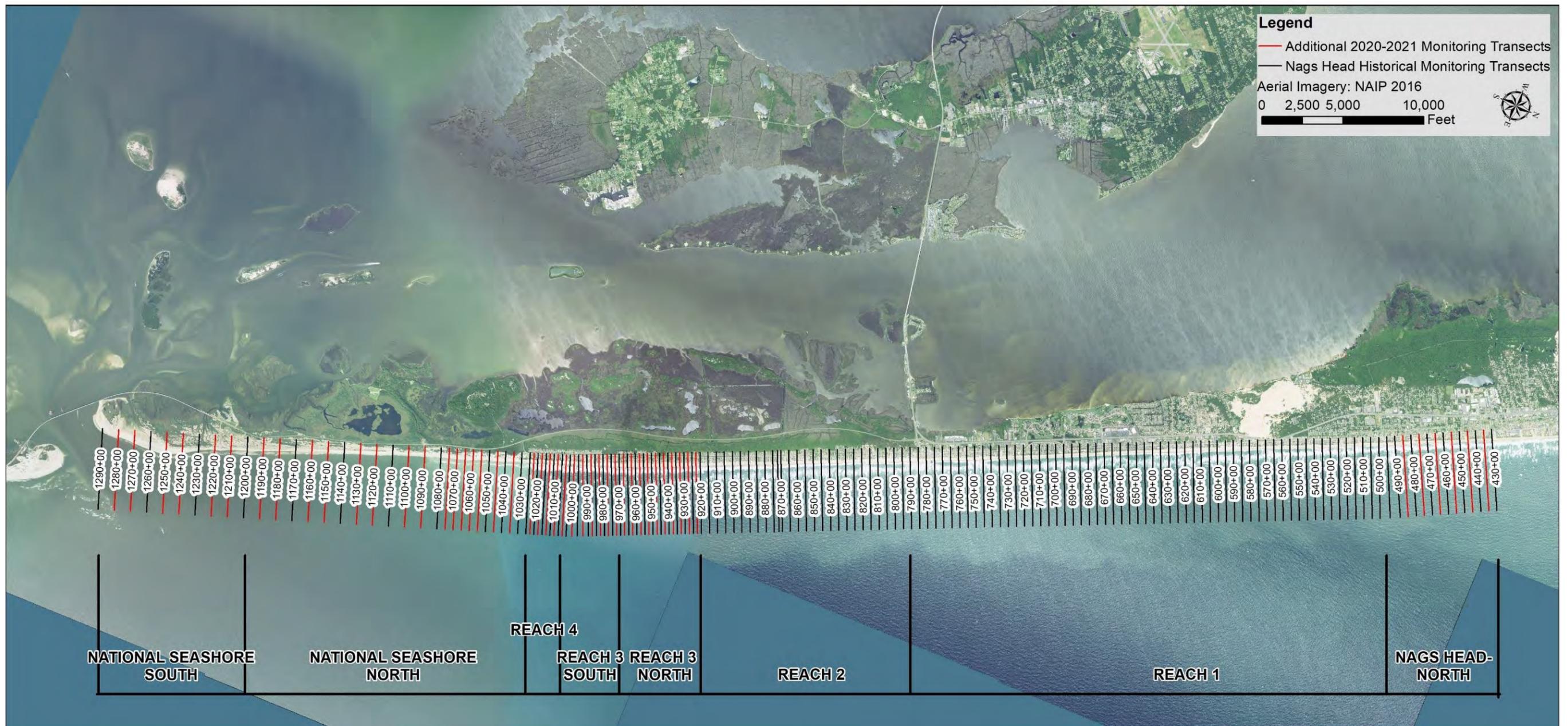


Figure 3-1. Nags Head Profile Line Locations

3.2 Survey Data Acquisition

To enable a reproducible and consistent result for the monitoring analysis, the survey events for each shoreline segment are assigned a single date for their completion. Assigning the survey date allows the determination of a consistent timeframe for each monitoring period between survey events for use in calculating shoreline and volumetric change rates.

2021 Survey Event

The most recent set of annual survey data was collected by McKim & Creed on July 13-20 and on August 5. The date used for the 2021 Nags Head profiles for this report is July 20, 2021, when majority of the surveying was completed.

2020 Survey Event

The previous set of annual survey data was by McKim & Creed on June 18-24. The date used for the 2020 Nags Head profiles for this report is June 24, 2020, when surveying was completed.

2019 Pre – Nourishment Survey Event

Before the 2019 Beach Nourishment Project, CSE conducted a pre-nourishment survey in April 2019. The date used for the 2019 Nags Head profiles for this report is April 8.

McKim & Creed provided the processed survey data to Moffatt & Nichol in ASCII (xyz), Excel (xyz), BMAP (free format), and GIS (shapefile, grid) formats allowing for compatibility with multiple programs. The data referenced the horizontal North American Datum 1983 (NAD83) State Plane North Carolina (U.S. survey feet) and elevations were provided in feet relative to the North American Vertical Datum of 1988 (NAVD88). A copy of the survey data files is included on the attached CD also containing an electronic copy of the report.

Appendix A contains the McKim & Creed Field Report which discusses, in detail, the singlebeam (bathymetric) and topographic data acquisition. The field report also provides the associated equipment and quality control procedures (QA/QC) utilized in the data collection and processing tasks.

4.0 SURVEY EVALUATION METHODS

4.1 Shoreline Change

Shoreline change designated at the MHW contour, defined as +1.18 ft NAVD88, was calculated at each transect between the June 2020 and July 2021 surveys. The MHW elevation is based on a National Oceanic and Atmospheric Administration (NOAA) tidal benchmark at Duck, NC shown in **Figure 4-1**. The resulting values represent the shoreline change (ft) over the time between surveys.

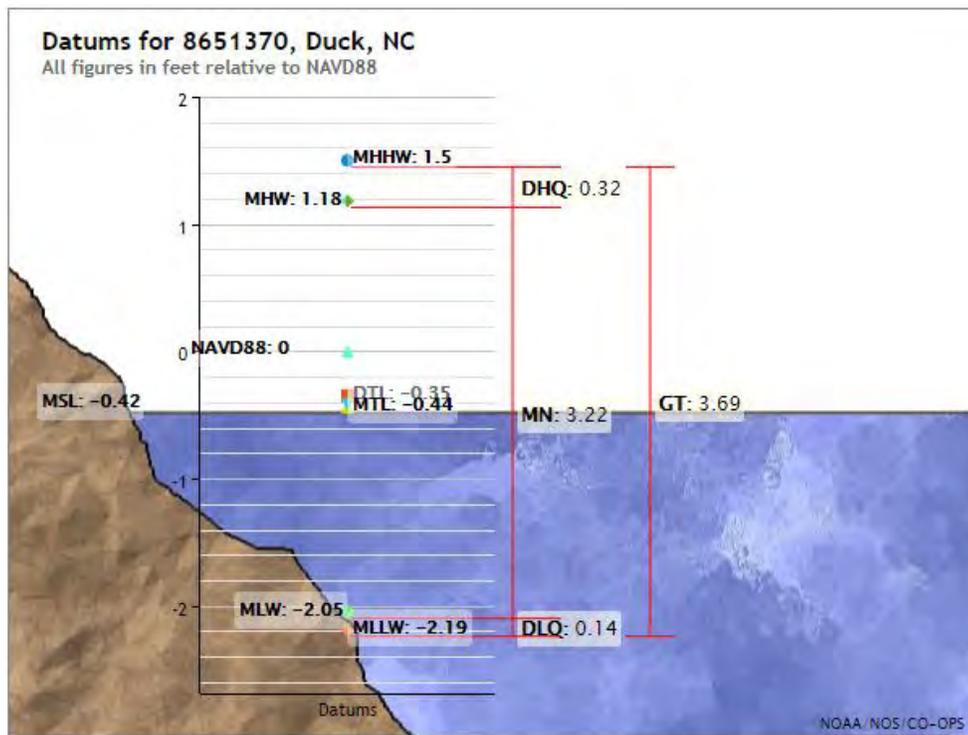


Figure 4-1. Tidal Datum for Duck, NC Station 8651370

4.2 Volume Change

Representative volume changes were calculated at each transect between the 2020 and 2021 surveys. Volume changes were calculated for six different elevation extents to better understand the processes occurring onshore and offshore of Nags Head. Calculations included volume change above the following elevations:

- above +6 ft NAVD88 (berm),
- above +1.18 ft NAVD88 (MHW),
- above -6 ft NAVD88 (wading depth/recreational beach),
- above -14 ft NAVD88 (outer bar),
- above -19 ft NAVD88 (depth of closure), and
- above -30 ft NAVD88.

For those profiles which did not extend to -30 ft NAVD88, volume calculations were performed above -30 ft NAVD88 out to the extent of the shortest survey. **Figure 4-2** presents a graphical display of the various elevations for which volume change calculations were made.

As with the shoreline change, the results represent volume change (cy/ft) over the period of time between surveys. In addition, the volume changes were converted to cumulative changes over each of the management reaches and for the entire shoreline. This was done by applying the average end area method to the unit volume changes (cy/ft) computed at each transect and summing the total volume changes between each neighboring pair of transects. The resulting value indicated the total loss or gain of material between survey periods based on the applicable profile extents.

It should be noted that the uncertainty in the hydrographic portion of the survey can result in a significant volumetric change in offshore areas where the slope of the seafloor declines gradually. If an uncertainty of ± 0.11 ft is applied along the portion of the profile between the seaward side of the depth of closure (approximately 2,050 ft offshore) and a depth of -30 ft NAVD88 (approximately 2,950 ft offshore) along all 77,000 ft of oceanfront shoreline, this lends itself to an uncertainty of approximately $\pm 282,300$ cy. For this reason, more attention is given to the volume change calculations at -19 ft NAVD88 and above.

The profile volume calculation lenses (see **Figure 4-2**) were strategically chosen to help understand and track the movement of sand onshore and offshore. Volume changes calculated for portions of the profiles above +6 ft NAVD88 and above MHW are representative of changes in the amount of material in the dune system and on the subaerial beach. These areas of the profile are highly influenced by storm activity, and they are both very significant in the ability of the beach and dune to mitigate storm surge and wave impacts on landward structures and infrastructure. Volume comparisons for portions of the profiles above -6 ft NAVD88, an approximate wading depth, represent changes in the recreational beach area. Volume comparisons above -14 ft NAVD88 help to track sand movement to and from the outer sand bar and are valuable in decision making for future beach nourishment projects. Volume comparisons above -19 ft NAVD88 provide general estimates of the total volumetric change along the respective profile out to the depth of closure. Finally, volume comparisons above -30 ft NAVD88 allow the complete tracking of sand movement offshore. However, hydrographic survey measurement accuracy may impact these calculations. This is a proven, comprehensive way to assess the impact of storm activity on the subaerial beach and dune system as well as track the movement of sand offshore and quantify total gains and losses in the entire system.

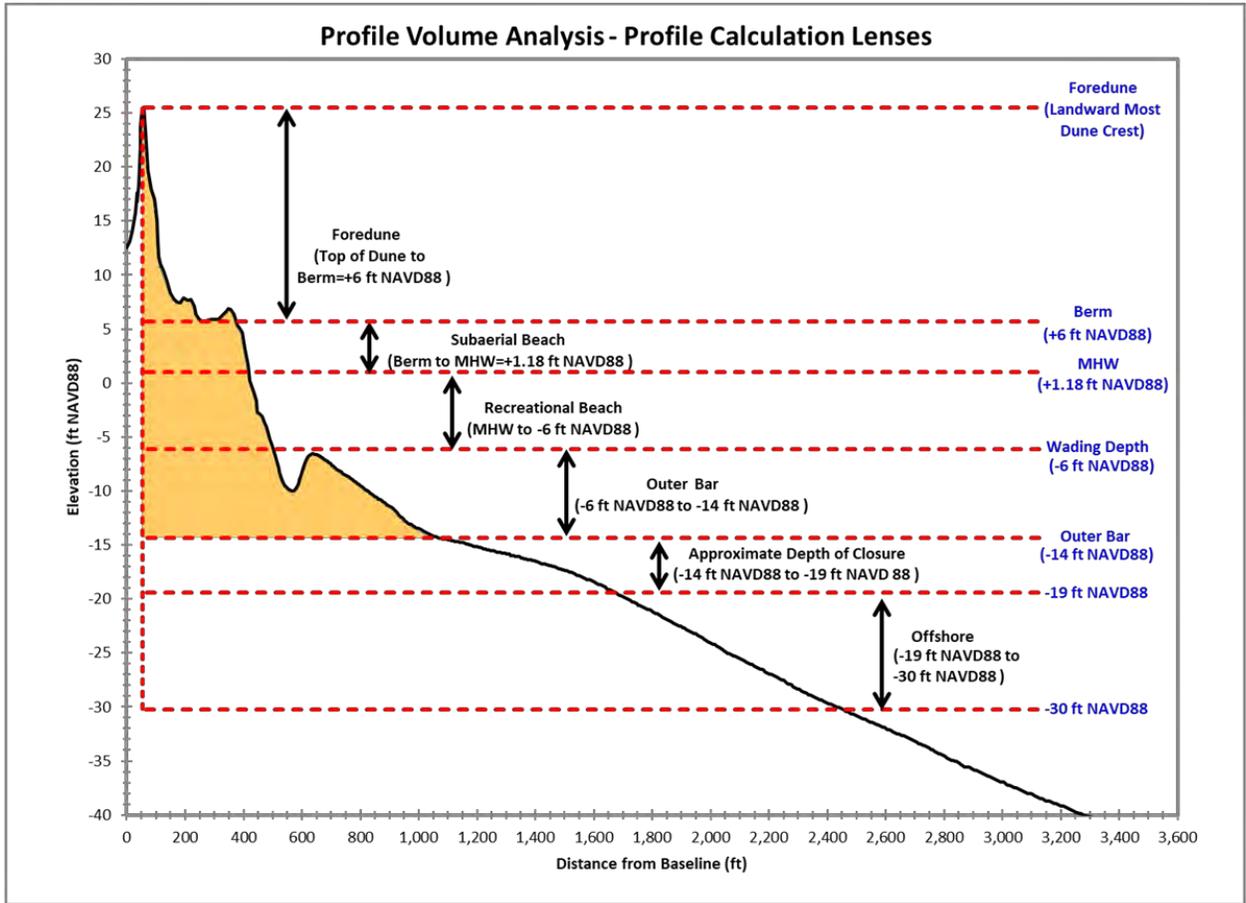


Figure 4-2. Profile Volume Calculation Lenses

5.0 DISCUSSION OF ANNUAL SURVEYING EVALUATION

This section discusses key events in the past year which influence the results of the annual analysis (i.e. nourishment projects, storms, etc.), development of background erosion rates, annual shoreline and volume change trends (2020 – 2021), and analysis of long-term trends (2011 – 2021).

5.1 Key Events During the Reporting Period

Beach changes are greatly influenced by natural and engineered processes. This section describes key events that occurred during the reporting period that likely had an impact on shoreline change as well as profile volume gains and losses.

5.1.1 *Sand Placement Events*

No sand placement events have occurred during the 2020 – 2021 monitoring period.

5.1.2 *Wave Climate and Storm Events*

Wave data from the USACE Field Research Facility (FRF), located approximately 15 miles north of the Town, was downloaded for June 2020 through July 2021 to cover the period of time between the 2020 and 2021 surveys. The wave data was then plotted in order to analyze storm activity which may have impacted the study area. It should be noted that the buoy was unmoored during the Nor'easter event on December 18, 2020, and data collection resumed on January 21, 2021. **Figure 5-1** shows the location of the buoy while **Figure 5-2** presents a plot of the wave heights during the reporting period. The 2020 Atlantic hurricane season (June 2020 – November 2020) was signified by the passage of Hurricane Isaias and Hurricane Teddy. The winter storm season that followed (December 2020 – May 2021) was also fairly calm with only 6 events in which offshore wave heights exceeded 8 ft. It is likely that the comparatively calmer storm season between the summer 2020 and summer 2021 surveys allowed for some natural recovery from Hurricane Dorian which had not previously been allowed to take place due to an active winter storm season following the passage of the hurricane.

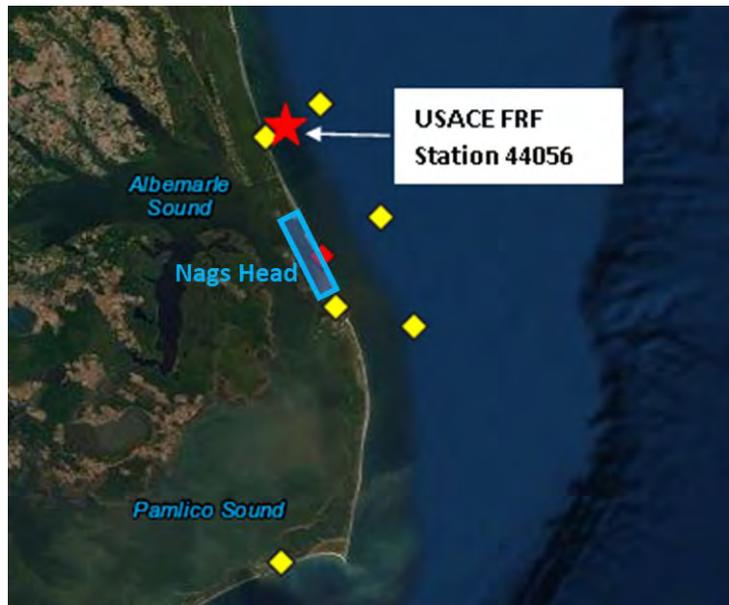


Figure 5-1. USACE FRF -51 ft Depth Waverider Buoy Location

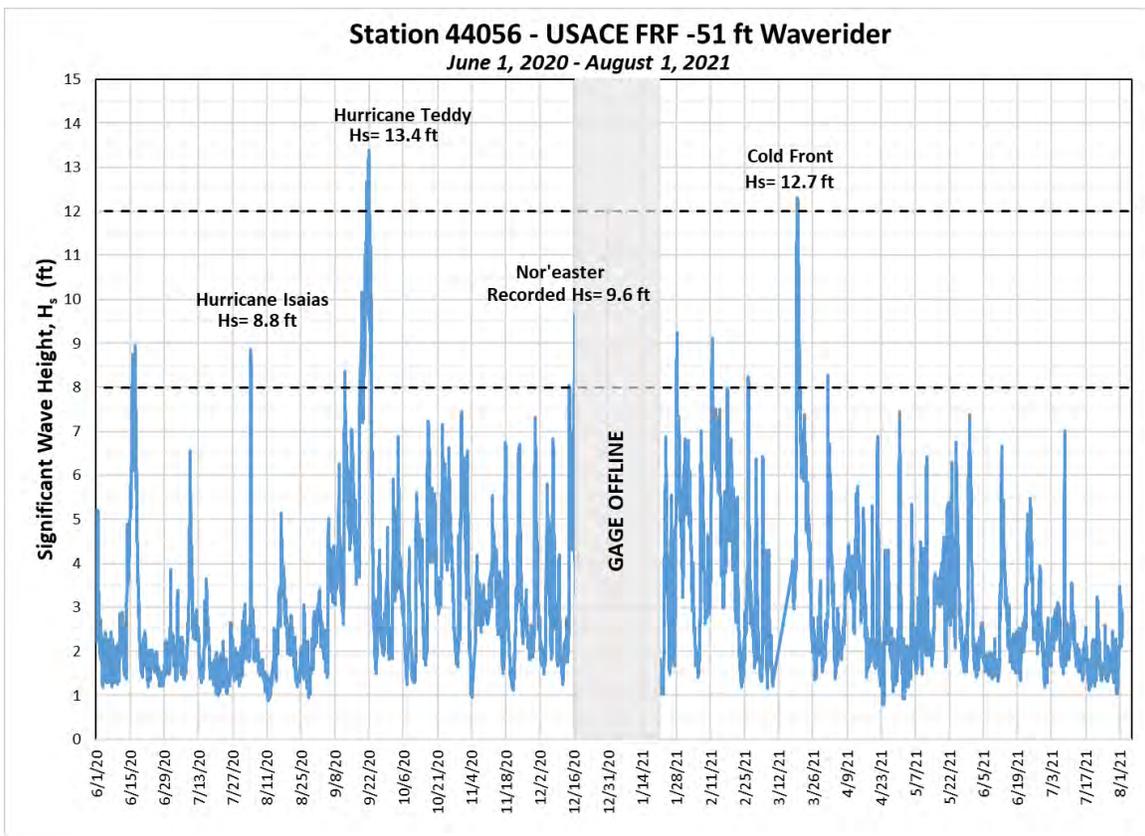


Figure 5-2. USACE FRF Station 44056 Wave Height

Figure 5-3 and **Figure 5-4** presents the directional wave roses for the annual monitoring period and for the time period between January 1997 (wave direction was not recorded prior to 1997) and August 2021, respectively. Based on the statistics, for both time periods the prevailing waves are from east-northeast to the east-southeast directions. Higher waves are from the east to the northeast direction.

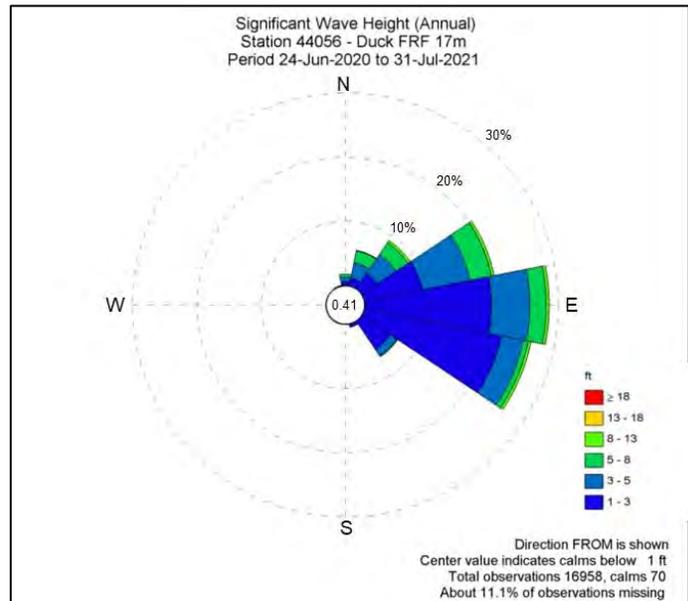


Figure 5-3. Station 44056 Offshore Significant Wave Height Rose from June 2020 – July 2021

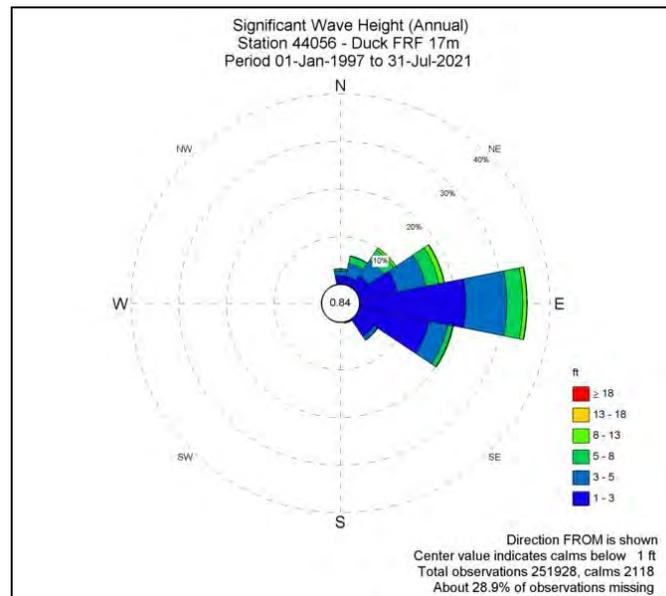


Figure 5-4. Station 44056 Offshore Significant Wave Height Rose from January 1997 – July 2021

Figure 5-5 presents the annual histograms of significant wave heights recorded for the current and previous annual monitoring periods, and for the time period between January 1997 and July 2021. The histogram shows that a slightly higher percentage (approximately 4%) of waves with height between 1.5–3.0 ft occurred during the monitoring period compared to the historical distribution. The figure also shows that during the previous 2019-2020 monitoring period waves with higher wave heights occurred more frequently. The comparatively calmer wave climate in the present monitoring period likely led to smaller erosion rates and further recovery of the beach from Hurricane Dorian.

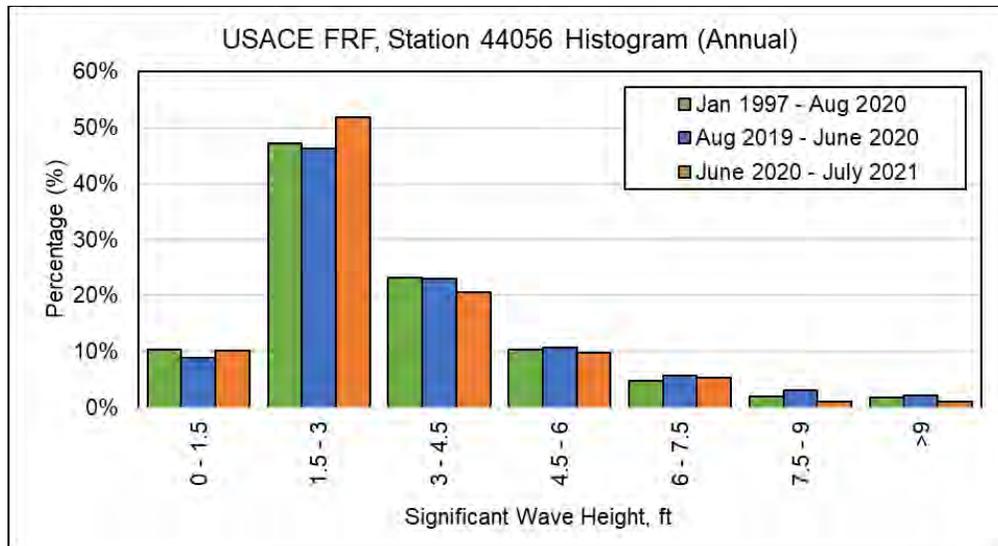


Figure 5-5. Station 44056 Significant Wave Height Histogram

5.2 Determination of Background Erosion Rates for Town of Nags Head (2011 – 2021)

To develop long-term trends in volume losses/gains, it is important to determine background erosion rates which do not include the volume gains from nourishment events. Since the establishment of the beach monitoring program immediately after the construction of the 2011 Beach Nourishment project, the Nags Head oceanfront has undergone only one other beach nourishment project in 2019. **Table 5-1** shows the nourishment volume placed at each reach within the monitoring program during the 2019 nourishment project.

Table 5-1. Nourishment Volumes by Management Reach

Reach	Transects	Length	Nourishment Volume (cy)
Nags Head - North	430+00 - 495+00	6,750	0
Nags Head - Reach 1	495+00 - 790+00	29,500	1,762,213
Nags Head - Reach 2	790+00 - 920+00	13,000	885,587
Nags Head - Reach 3N	920+00 - 975+00	5,500	576,703
Nags Head - Reach 3S	975+00 - 1010+00	3,500	540,833
Nags Head - Reach 4	1010+00 - 1025+00	1,500	239,298
National Seashore - North	1025+00 - 1200+00	17,250	0
Total		77,000	4,004,634

Historical volume changes above -19 ft NAVD88 were documented from 2011 through 2021. **Table 5-2** shows the computed volume change (including nourishments) above -19 ft NAVD88 from 2011-2021 for the defined monitoring reaches.

Table 5-2. Volume Change by Reach Above -19 ft NAVD88

Reach	Volume Change (cy) 2011-2012	Volume Change (cy) 2012-2013	Volume Change (cy) 2013-2014	Volume Change (cy) 2014-2015	Volume Change (cy) 2015-2016	Volume Change (cy) 2016-2017	Volume Change (cy) 2017-2018	Volume Change (cy) 2018-2019	Volume Change (cy) 2019-2020	Volume Change (cy) 2020-2021
Nags Head - North (430+00 - 495+00)	12,512	459	-61,997	42,855	-21,464	-107,963	-76,609	-273	14,451	82,466
Nags Head - Reach 1 (495+00 - 790+00)	199,722	-210,804	16,718	-110,558	294,941	-418,152	-644,783	1,441,871	253,604	80,995
Nags Head - Reach 2 (790+00 - 920+00)	117,215	-195,136	54,157	-81,138	33,499	-429,523	-328,626	696,896	156,913	80,515
Nags Head - Reach 3N (920+00 - 975+00)	85,381	-144,828	-13,818	-133,901	15,540	-252,798	-168,797	423,513	21,457	66,086
Nags Head - Reach 3S (975+00 - 1010+00)	-32,942	-48,873	-101,531	-89,412	-54,799	-104,590	-84,187	383,465	-106,581	37,609
Nags Head - Reach 4 (1010+00 - 1025+00)	71,930	-105,463	-14,079	-33,271	-42,050	-57,636	-31,569	136,047	-42,197	30,174
National Seashore - North (1025+00 - 1200+00)	107,833	-235,944	153,705	-442,192	3,220	-470,987	-520,298	-181,579	-93,041	47,461
Nourished Oceanfront (495+00 - 1025+00)	441,306	-705,102	-58,553	-448,280	247,132	-1,262,698	-1,257,961	3,081,792	283,196	295,378
Total Monitored Oceanfront (430+00 - 1200+00)	561,651	-940,588	33,154	-847,616	228,887	-1,841,647	-1,854,868	2,899,940	204,606	425,306

To calculate the background erosion rate, the documented nourishment volumes were subtracted from total volume changes above -19 ft NAVD88 between 2011 and 2021 and annualized over the 10-year time period. **Table 5-3** shows the average annual background erosion rates for each management reach of the Nags Head oceanfront. The average background erosion rate for the Town’s Nourished Oceanfront and the Total Monitored Oceanfront shoreline is approximately -7.1 cy/ft/yr and -7.4 cy/ft/yr, respectively. Nags Head Reaches 3N, 3S, and 4 have considerably higher background erosion rates than the remainder of the oceanfront shoreline, signifying these areas need to be monitored closely and taken into special consideration during future planning and nourishment efforts.

Table 5-3. Average Annual Background Erosion Rates (2011 - 2021)

Reach (Transects)	Length	Volume Change Above -19 ft NAVD88 (cy) 2011-2021	Nourishment Volume (cy)	Background Erosion (cy)	Average Annual Background Erosion Rates (cy/ft/yr)
Nags Head - North (430+00 - 495+00)	6,500	-115,562	0	-115,562	-2.0
Nags Head - Reach 1 (495+00 - 790+00)	29,500	903,555	1,762,213	-858,658	-3.2
Nags Head - Reach 2 (790+00 - 920+00)	13,000	104,772	885,587	-780,815	-6.7
Nags Head - Reach 3N (920+00 - 975+00)	5,500	-102,164	576,703	-678,867	-13.7
Nags Head - Reach 3S (975+00 - 1010+00)	3,500	-201,840	540,833	-742,673	-23.6
Nags Head - Reach 4 (1010+00 - 1025+00)	1,500	-88,115	239,298	-327,413	-24.3
National Nearshore - North (1030+00 - 1200+00)	17,500	-1,631,821	0	-1,631,821	-10.4
Nourished Oceanfront (495+00 - 1025+00)	53,000	616,208	4,004,634	-3,388,426	-7.1
Total Monitored Oceanfront (430+00 - 1200+00)	77,000	-1,131,175	4,004,634	-5,135,809	-7.4

5.3 Nags Head Shoreline and Volume Change Analysis (2020 – 2021)

This section discusses the results of the shoreline and volume change analysis for the defined monitoring reaches along Nags Head (see **Figure 3-1**). Key statistics were calculated to quantify average shoreline and volume changes for individual monitoring reaches as well as the entire oceanfront shoreline for Nags Head. The computed statistics include average shoreline change, average unit volume change, and cumulative volume change (e.g. total volume of material lost or gained along a section of shoreline). Evaluation of the computed statistics takes into account volume changes computed for portions of the profile above the berm (+6 ft NAVD88), above MHW (+1.18 ft NAVD88), above -6 ft NAVD88, above -14 ft NAVD88, above -19 ft NAVD88, and above -30 ft NAVD88 in order to better understand onshore and offshore processes.

Appendix B presents profile comparison plots for individual transects for the summer 2020 and the summer 2021 surveys. **Appendix C** provides the computed shoreline changes and volume changes measured at each individual transect between the summer 2020 and the summer 2021 surveys in tabular format.

5.3.1 Nags Head - North Reach (2020 - 2021)

The Nags Head – North survey reach extends approximately 6,500 ft between E 8th Street and Bonnett Street, containing 13 survey transects (Station 430+00 – 495+00) at approximately 1000 ft spacing (see **Figure 3-1**). As a reminder, six transects were added to this reach during the 2020 surveying effort, creating 500 ft spacing for the whole reach. A summary of average shoreline and volume changes between 2020 and 2021 for Nags Head – North in comparison with the Total Monitored Oceanfront is presented in **Table 5-4** and **Table 5-5**.

Table 5-4. Average Shoreline and Average Unit Volume Change for Nags Head – North Reach (2020 – 2021)

2020 vs. 2021 (Total Change)	Transects	Reach Length	avg shoreline change @ +1.18 ft NAVD88	avg volume change above +6 ft NAVD88	avg volume change above +1.18 ft NAVD88	avg volume change above -6 ft NAVD88	avg volume change above -14 ft NAVD88	avg volume change above -19 ft NAVD88	avg volume change above -30 ft NAVD88
Reach	#	ft	ft	cy/ft	cy/ft	cy/ft	cy/ft	cy/ft	cy/ft
Nags Head - North	430+00 - 495+00	6,500	23.3	2.5	6.6	16.9	5.7	9.1	0.8
Total Monitored Oceanfront	430+00 - 1200+00	77,000	8.5	2.0	5.2	8.1	8.9	10.9	-0.2

Table 5-5. Cumulative Volume Change for Nags Head – North Reach (2020 – 2021)

2020 vs. 2021 (Total Change)	Transects	Reach Length	cumulative volume change above +6 ft NAVD88	cumulative volume change above +1.18 ft NAVD88	cumulative volume change above -6 ft NAVD88	cumulative volume change above -14 ft NAVD88	cumulative volume change above -19 ft NAVD88	cumulative volume change above -30 ft NAVD88
Reach	#	ft	cy	cy	cy	cy	cy	cy
Nags Head - North	430+00 - 495+00	6,500	16,348	43,028	109,695	37,296	59,014	5,411
Total Monitored Oceanfront	430+00 - 1200+00	77,000	154,820	395,313	619,899	679,648	834,558	-19,007

Table 5-4 indicates that there was seaward advancement at MHW. This is likely the result of some recovery from Hurricane Dorian that was delayed due to an active 2019/2020 storm season following the hurricane. **Figure 5-6** presents the shoreline changes at each transect, indicating seaward advancement at the majority of the transects within the reach.

Table 5-4 and **Table 5-5** indicates that the Nags Head – North reach experienced volume gain above all elevations analyzed. A majority of the volume gains can be attributed to continuing recovery of the beach after Hurricane Dorian. A maximum volume gain of 109,695 cy (16.9 cy/ft) was observed above -6 ft NAVD88. This gain was attributed to the adjustment of the offshore bar.

Figure 5-7 displays the unit volume change at each transect for the Nags Head – North reach. Apparent from this figure is the consistent trend of material gain across the reach. **Figure 5-8** presents an example of material moving onshore to fill the trough in the 2020 profile.

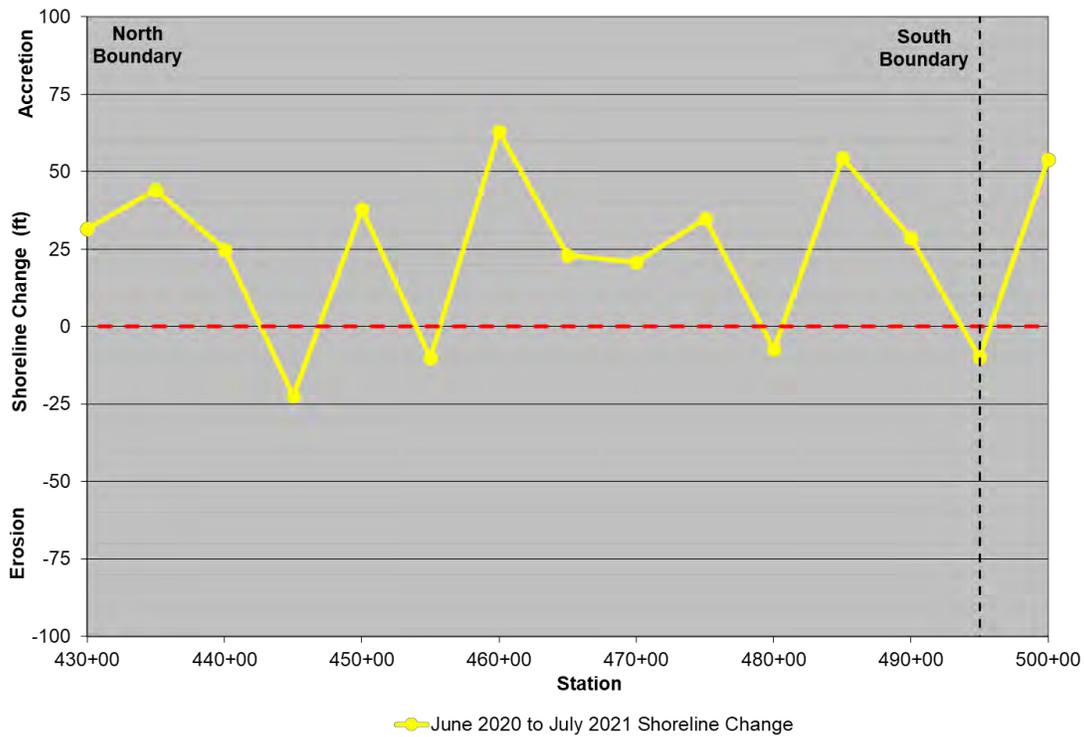


Figure 5-6. Nags Head – North Shoreline Change (2020 – 2021)

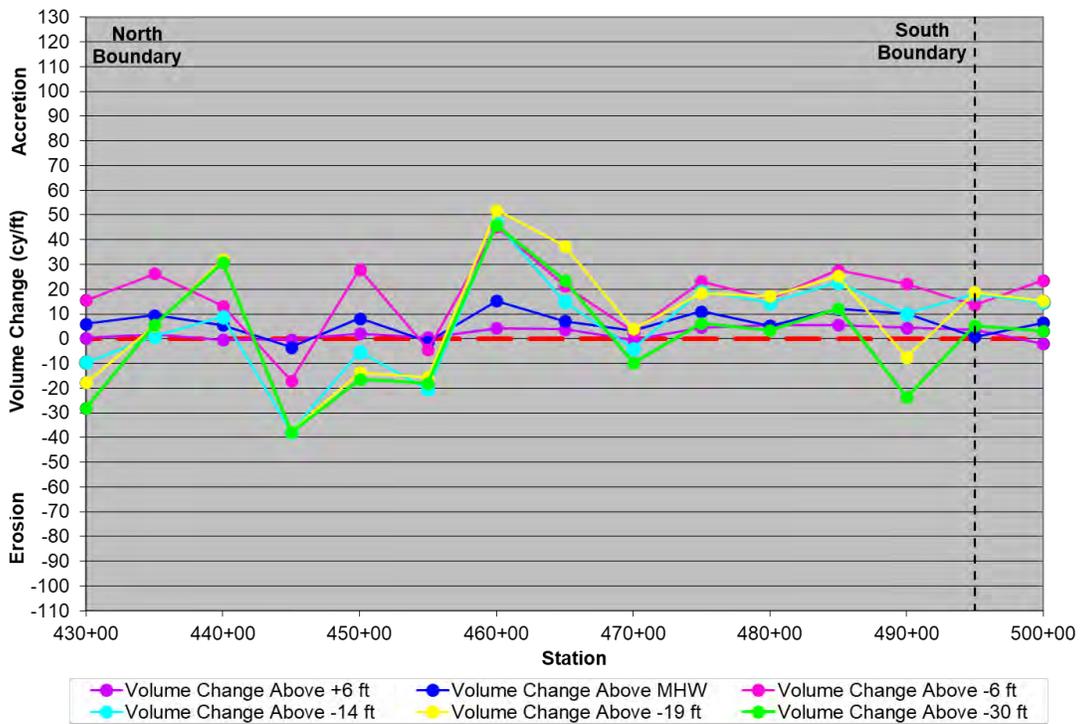


Figure 5-7. Nags Head – North Unit Volume Change (2020 – 2021)

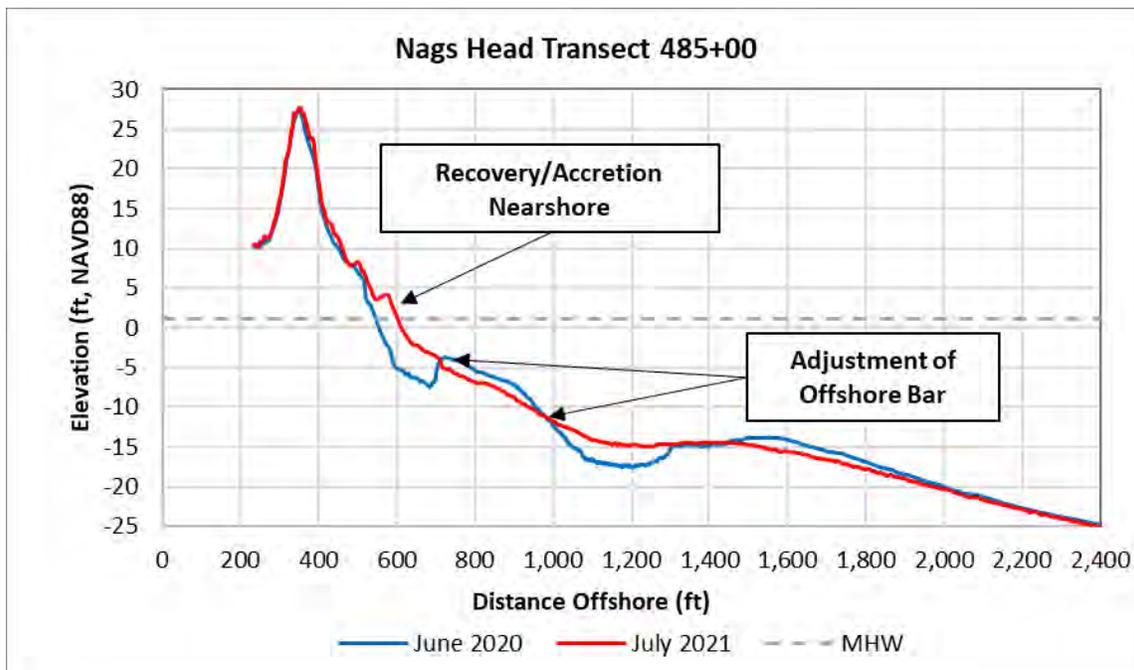


Figure 5-8. Example Nags Head – North Profile, Station 485+00 (Barnes St.)

5.3.2 *Nags Head - Reach 1 (2020 - 2021)*

The Nags Head – Reach 1 survey reach extends approximately 29,500 ft between Bonnett Street and Governor Street, containing 59 survey transects (Station 495+00 – 790+00), at 500 ft spacing (see **Figure 3-1**). A summary of average shoreline and volume changes between 2020 and 2021 for Reach 1 in comparison with the Total Monitored Oceanfront is presented in **Table 5-6** and **Table 5-7**.

Table 5-6. Average Shoreline and Average Unit Volume Change for Reach 1 (2020 – 2021)

2020 vs. 2021 (Total Change)	Transects	Reach Length	avg shoreline change @ +1.18 ft NAVD88	avg volume change above +6 ft NAVD88	avg volume change above +1.18 ft NAVD88	avg volume change above -6 ft NAVD88	avg volume change above -14 ft NAVD88	avg volume change above -19 ft NAVD88	avg volume change above -30 ft NAVD88
Reach	#	ft	ft	cy/ft	cy/ft	cy/ft	cy/ft	cy/ft	cy/ft
Nags Head - Reach 1	495+00 - 790+00	29,500	4.8	2.7	6.1	6.3	7.3	7.2	0.4
Total Monitored Oceanfront	430+00 - 1200+00	77,000	8.7	2.1	5.4	8.2	8.9	10.9	-0.2

Table 5-7. Cumulative Volume Change for Reach 1 (2020 – 2021)

2020 vs. 2021 (Total Change)	Transects	Reach Length	cumulative volume change above +6 ft NAVD88	cumulative volume change above +1.18 ft NAVD88	cumulative volume change above -6 ft NAVD88	cumulative volume change above -14 ft NAVD88	cumulative volume change above -19 ft NAVD88	cumulative volume change above -30 ft NAVD88
Reach	#	ft	cy	cy	cy	cy	cy	cy
Nags Head - Reach 1	495+00 - 790+00	29,500	79,331	180,441	185,614	216,552	211,046	12,299
Total Monitored Oceanfront	430+00 - 1200+00	77,000	159,398	412,962	619,899	679,648	834,558	-19,007

Shoreline change at MHW showed an overall average seaward movement of 4.8 ft. **Figure 5-9** presents the shoreline changes at each transect from 2020 to 2021. The figure indicates widely varying shoreline movement patterns within the reach ranging between -79.4 ft at the southern boundary to +89.9 ft at station 715+00.

Table 5-6 and **Table 5-7** indicates that Reach 1 experienced gains in material above all elevations analyzed. The largest volume gains were experienced above -14 ft NAVD88 (+216,552 cy or 7.3 cy/ft) and above -19 ft NAVD88 (+211,046 cy or 7.2 cy/ft).

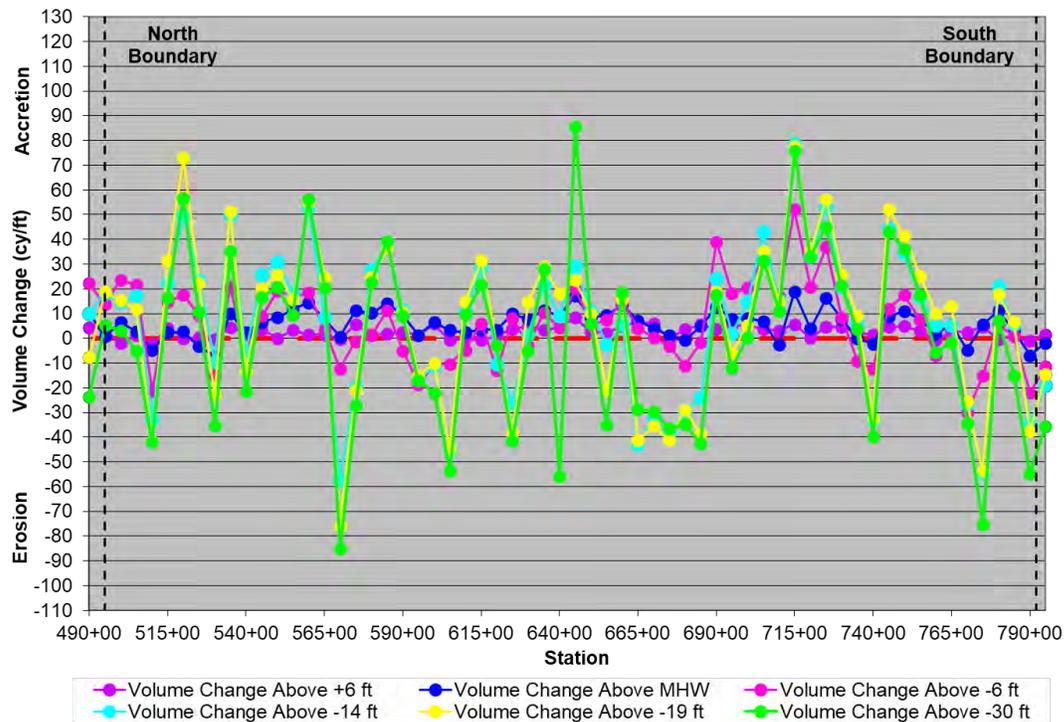


Figure 5-10 displays the unit volume change at each transect above the six elevations analyzed. As can be seen, a majority of transects experienced volume gains above +6 ft NAVD88, MHW and -6 ft NAVD88. Profile plots in **Appendix B** show many instances where sand is pushed onshore or nearshore. **Figure 5-11** presents an example profile where sand bar has been displaced and sand has been pushed onshore. A majority of the volume gains can be attributed to continuing recovery of the beach following Hurricane Dorian during a comparatively calmer summer 2020 – summer 2021 wave climate.

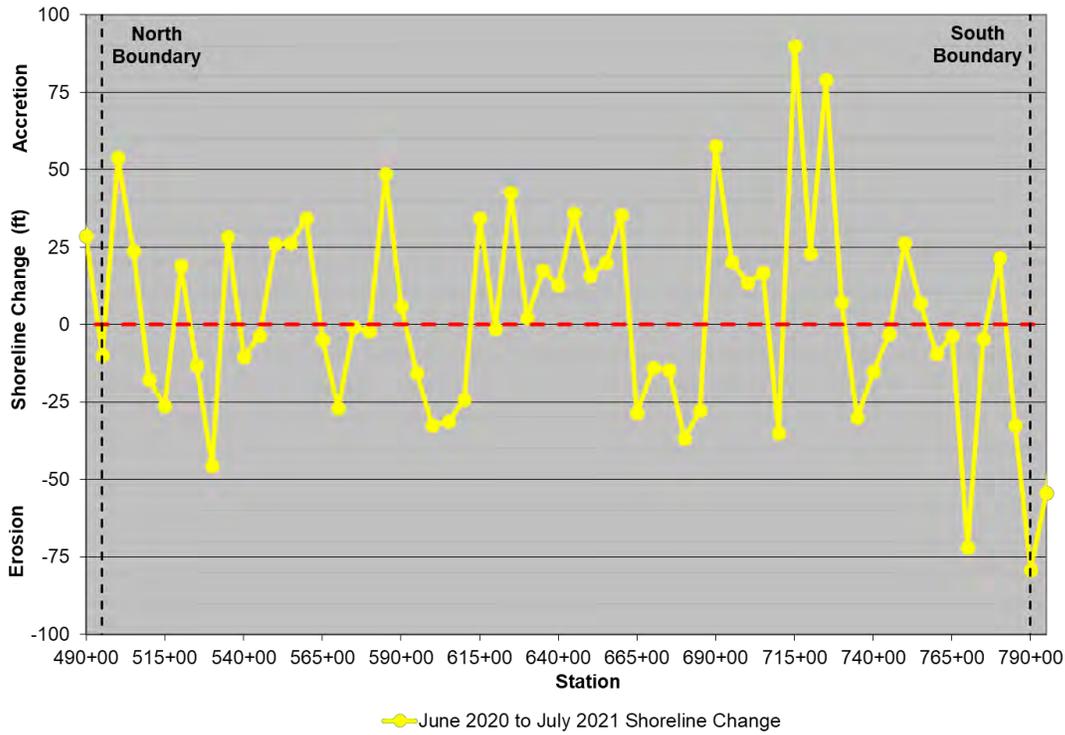


Figure 5-9. Nags Head – Reach 1 Shoreline Change (2020 – 2021)

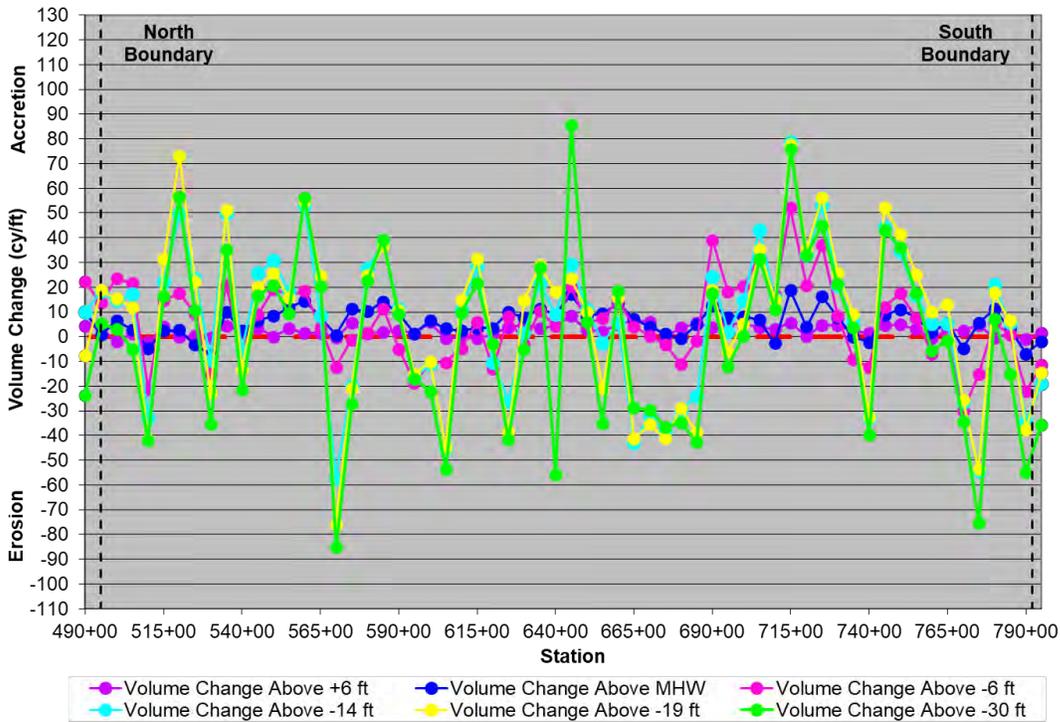


Figure 5-10. Nags Head – Reach 1 Unit Volume Change (2020 – 2021)

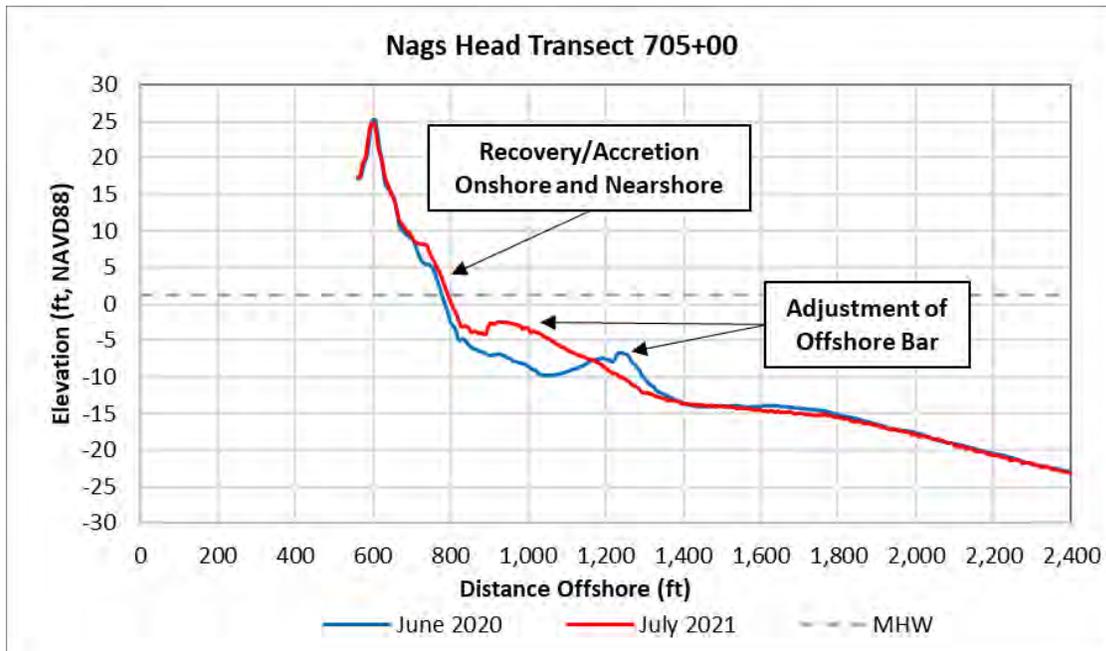


Figure 5-11. Example Reach 1 Profile, Station 705+00 (E Sea Spray Ct.)

5.3.3 *Nags Head - Reach 2 (2020 - 2021)*

The Nags Head – Reach 2 survey reach extends approximately 13,000 ft between Governor Street and James Street, containing 26 survey transects (Station 790+00 – 920+00), at 500 ft spacing (see **Figure 3-1**). A summary of average shoreline and volume changes between 2020 and 2021 for Nags Head – Reach 2 in comparison with the Total Monitored Oceanfront is presented in **Table 5-8** and **Table 5-9**.

Table 5-8. Average Shoreline and Average Unit Volume Change for Reach 2 (2020 – 2021)

2020 vs. 2021 (Total Change)	Transects	Reach Length	avg shoreline change @ +1.18 ft NAVD88	avg volume change above +6 ft NAVD88	avg volume change above +1.18 ft NAVD88	avg volume change above -6 ft NAVD88	avg volume change above -14 ft NAVD88	avg volume change above -19 ft NAVD88	avg volume change above -30 ft NAVD88
Reach	#	ft	ft	cy/ft	cy/ft	cy/ft	cy/ft	cy/ft	cy/ft
Nags Head - Reach 2	790+00 - 920+00	13,000	1.5	2.3	4.4	11.6	7.7	10.8	-1.8
Total Monitored Oceanfront	430+00 - 1200+00	77,000	8.5	2.0	5.2	8.1	8.9	10.9	-0.2

Table 5-9. Cumulative Volume Change for Reach 2 (2020 – 2021)

2020 vs. 2021 (Total Change)	Transects	Reach Length	cumulative volume change above +6 ft NAVD88	cumulative volume change above +1.18 ft NAVD88	cumulative volume change above -6 ft NAVD88	cumulative volume change above -14 ft NAVD88	cumulative volume change above -19 ft NAVD88	cumulative volume change above -30 ft NAVD88
Reach	#	ft	cy	cy	cy	cy	cy	cy
Nags Head - Reach 2	790+00 - 920+00	13,000	29,539	57,186	150,932	99,834	140,508	-23,763
Total Monitored Oceanfront	430+00 - 1200+00	77,000	154,820	395,313	619,899	679,648	834,558	-19,007

Shoreline change at MHW showed an overall minor seaward advancement of 1.5 ft. **Figure 5-12** presents the shoreline changes at each transect from 2020 to 2021, showing erosion (up to -79.4 ft) along the northern transects and accretion (up to +63.7 ft) along the southern ones.

Overall, Reach 2 experienced volume gains above all the analyzed elevations except a minor loss above –30 ft NAVD88. The largest volume gains were experienced above -6 ft NAVD88 (+150,932 cy or 11.6 cy/ft) and above -19 ft NAVD88 (+140,508 cy or 10.8 cy/ft).

Figure 5-13 displays the unit volume change at each transect above the six elevations analyzed. As can be seen, a majority of transects experienced volume gains above -6 ft NAVD88. Profile plots in **Appendix B** show many instances of adjustment of the offshore bar towards the nearshore causing material gain between MHW and -6 ft NAVD88. **Figure 5-14** presents an example profile where sand bar has been displaced and sand has been pushed onshore.

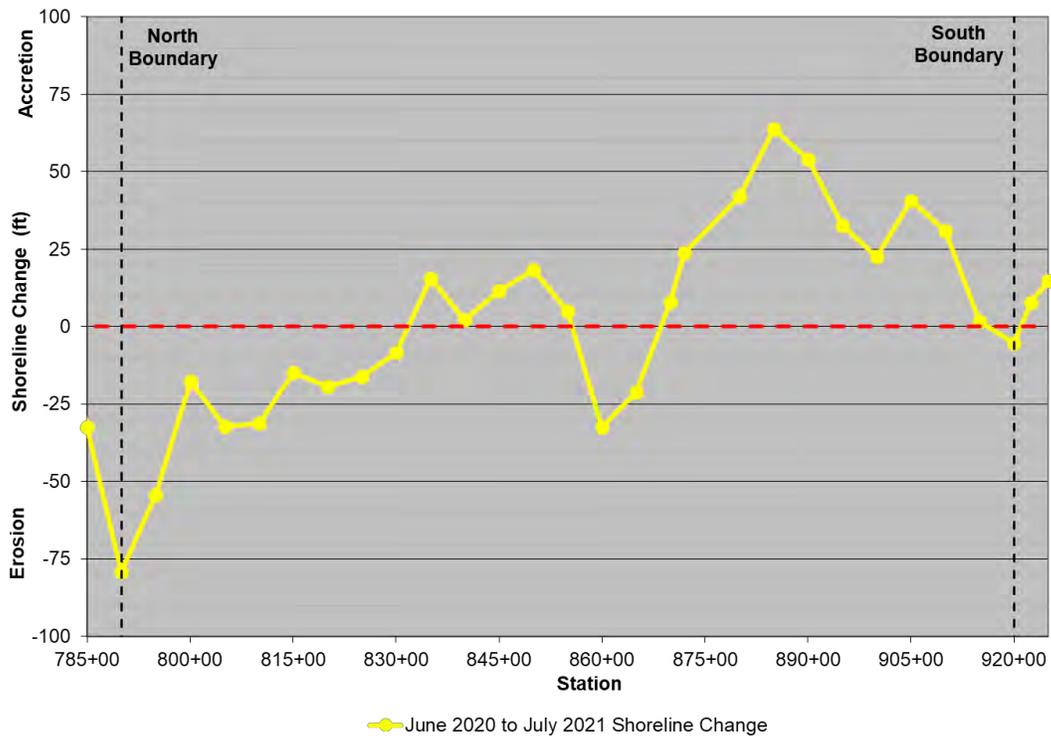


Figure 5-12. Nags Head – Reach 2 Shoreline Change (2020 – 2021)

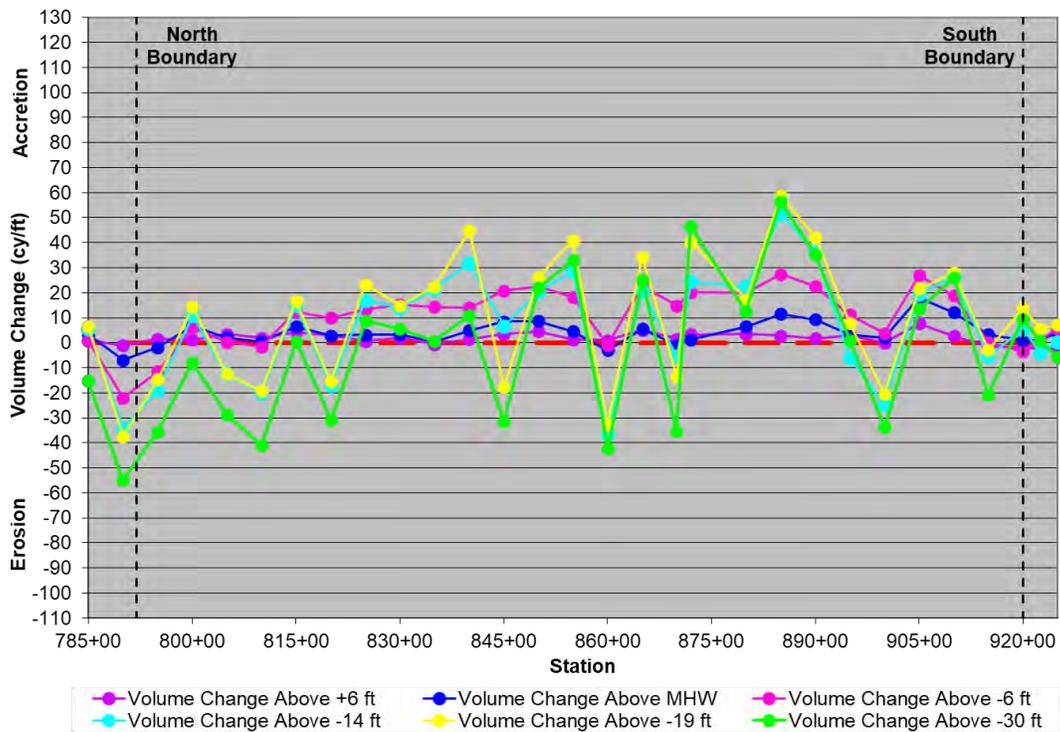


Figure 5-13. Nags Head – Reach 2 Unit Volume Change (2020 – 2021)

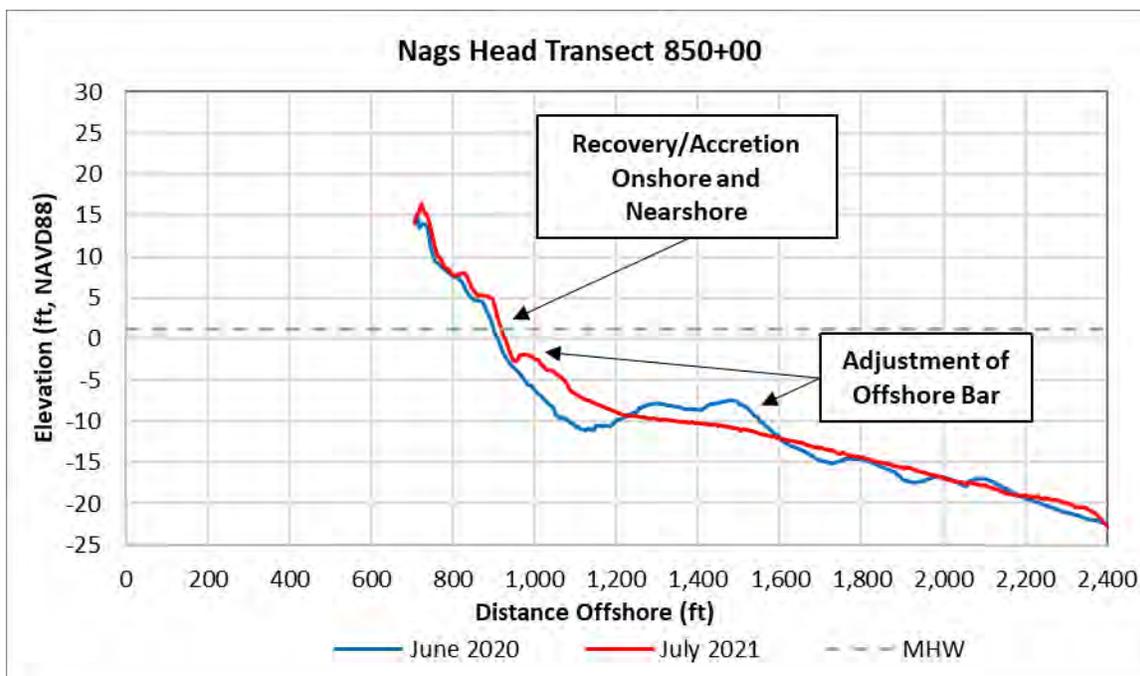


Figure 5-14. Example Reach 2 Profile, Station 850+00 (E Tides Dr.)

5.3.4 Nags Head - Reach 3 - North (2020 - 2021)

The Nags Head – Reach 3 - North survey reach extends approximately 5,500 ft between James Street and Limulus Drive, containing 22 survey transects (Station 920+00 – 975+00), at 500 ft spacing (see **Figure 3-1**). As a reminder, 11 of the transects were added to this reach during the 2020 surveying effort, creating 250 ft spacing for the whole reach. A summary of average shoreline and volume changes between 2020 and 2021 for Nags Head – Reach 3 - North in comparison with the Total Monitored Oceanfront is presented in **Table 5-10** and **Table 5-11**.

Table 5-10. Average Shoreline and Average Unit Volume Change for Reach 3 - North (2020 – 2021)

2020 vs. 2021 (Total Change)	Transects	Reach Length	avg shoreline change @ +1.18 ft NAVD88	avg volume change above +6 ft NAVD88	avg volume change above +1.18 ft NAVD88	avg volume change above -6 ft NAVD88	avg volume change above -14 ft NAVD88	avg volume change above -19 ft NAVD88	avg volume change above -30 ft NAVD88
Reach	#	ft	ft	cy/ft	cy/ft	cy/ft	cy/ft	cy/ft	cy/ft
Nags Head - Reach 3 - North	920+00 - 975+00	5,500	-6.7	0.4	2.5	-3.5	-5.8	-2.6	-17.4
Total Monitored Oceanfront	430+00 - 1200+00	77,000	8.5	2.0	5.2	8.1	8.9	10.9	-0.2

Table 5-11. Cumulative Volume Change for Reach 3 - North (2020 – 2021)

2020 vs. 2021 (Total Change)	Transects	Reach Length	cumulative volume change above +6 ft NAVD88	cumulative volume change above +1.18 ft NAVD88	cumulative volume change above -6 ft NAVD88	cumulative volume change above -14 ft NAVD88	cumulative volume change above -19 ft NAVD88	cumulative volume change above -30 ft NAVD88
Reach	#	ft	cy	cy	cy	cy	cy	cy
Nags Head - Reach 3 - North	920+00 - 975+00	5,500	2,575	14,414	-19,915	-33,545	-14,863	-100,221
Total Monitored Oceanfront	430+00 - 1200+00	77,000	154,820	395,313	619,899	679,648	834,558	-19,007

Shoreline change at MHW showed a minor overall average landward recession of -6.7 ft. **Figure 5-15** presents the shoreline changes at each transect from 2020 to 2021, showing up to -50 ft erosion along the transects at the middle and the south of the reach.

Volumetrically, **Table 5-10** and **Table 5-11** indicates that Reach 3 - North experienced overall volume losses at the analyzed elevations below MHW. Volume losses observed above -30 ft NAVD88 might indicate that some of the material was transported offshore completely or to adjacent reaches, as longshore transport rates in this area start to accelerate in comparison with the more stable northern reaches. However, compared to the average annual background erosion rate previously experienced at Reach 3 – North (-13.7 cy/ft/yr) (**Table 5-3**) volume loss experienced above -19 ft NAVD88 during the monitoring period is minor.

Figure 5-16 displays the unit volume change at each transect above the six elevations analyzed. Profile plots in **Appendix B** show many instances where the offshore bar has eroded. **Figure 5-17** presents an example profile which shows the minor recession of the shoreline and loss of material from the offshore sand bar.

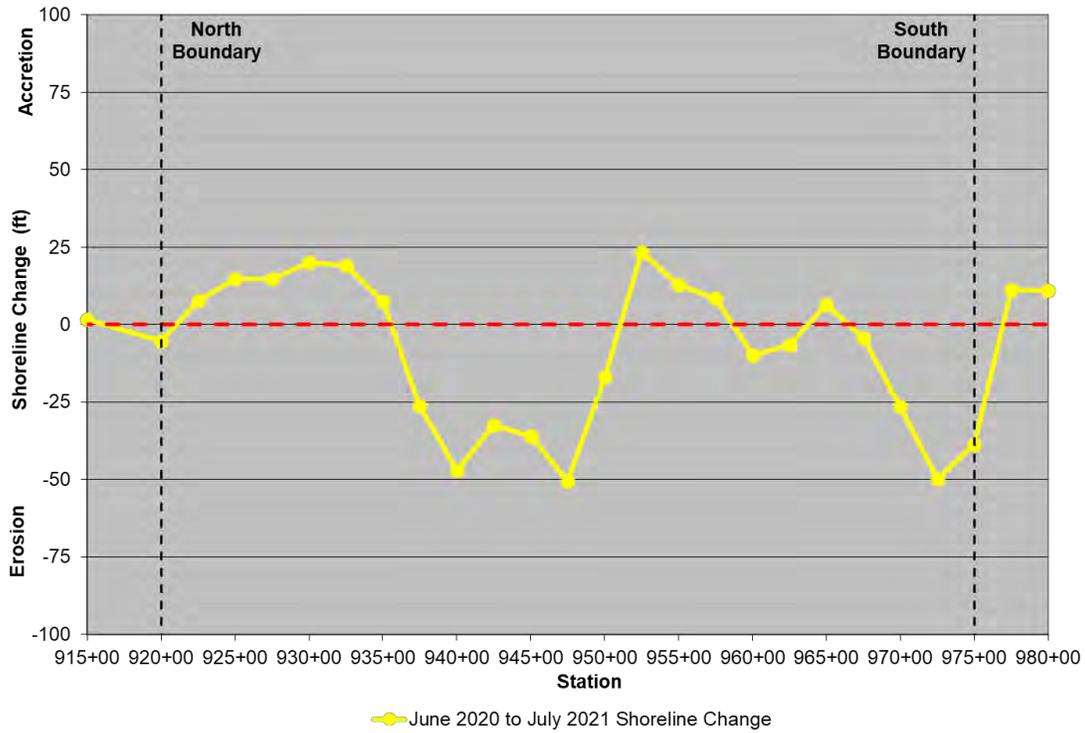


Figure 5-15. Nags Head – Reach 3 - North Shoreline Change (2020 – 2021)

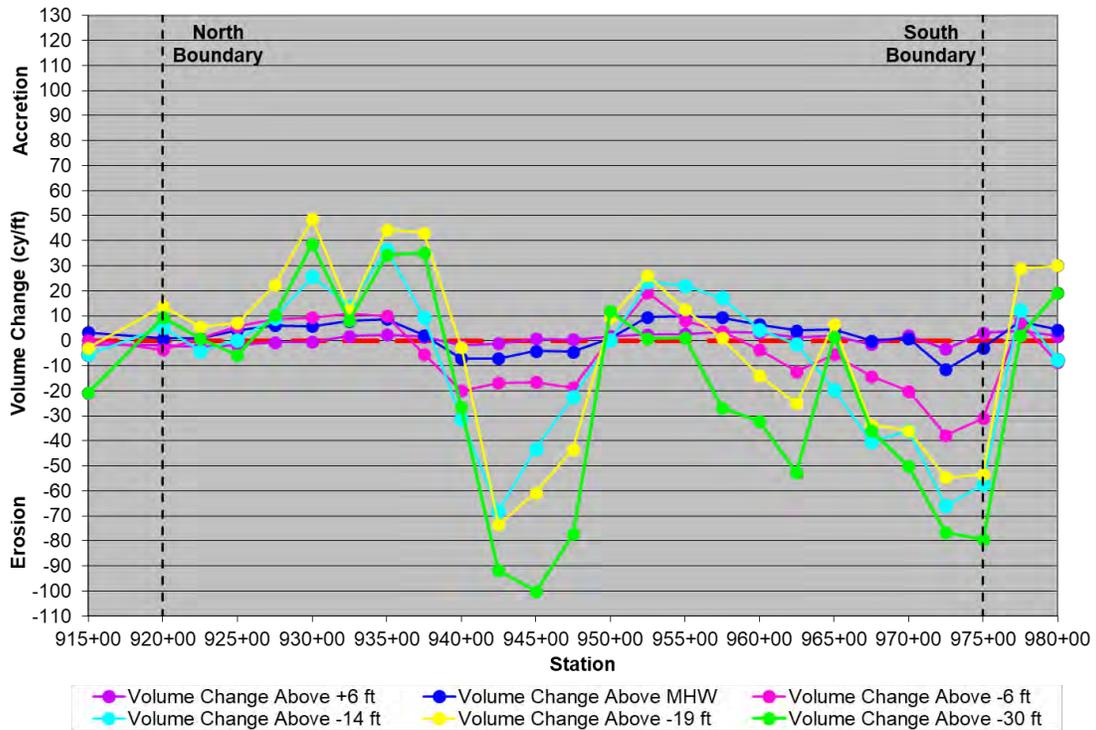


Figure 5-16. Nags Head – Reach 3 - North Unit Volume Change (2020 – 2021)

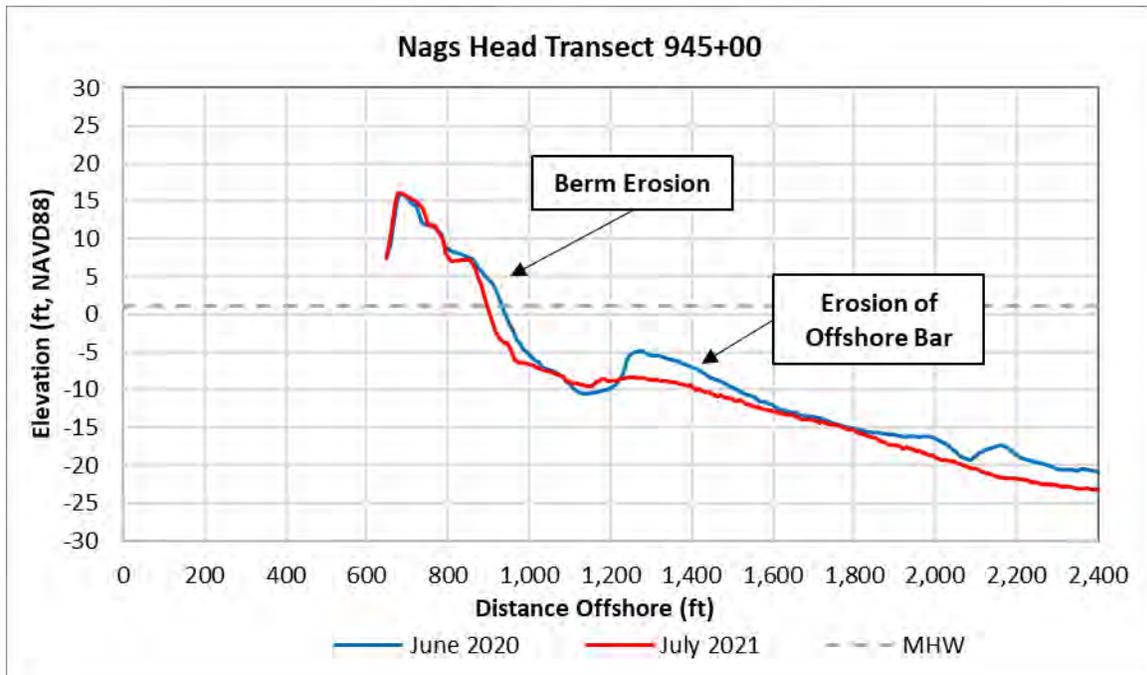


Figure 5-17. Example Reach 3 - North Profile, Station 945+00 (E Spencer St.)

5.3.5 Nags Head - Reach 3 - South (2020 - 2021)

The Nags Head – Reach 3 - South survey reach extends approximately 3,500 ft between Limulus Drive and Loon Court, containing 14 survey transects (Station 975+00 – 1010+00) (see **Figure 3-1**). Seven of these transects were added to this reach during the 2020 surveying effort, creating 250 ft spacing for the whole reach. A summary of average shoreline and volume changes between 2020 and 2021 for Reach 3 – South in comparison with the Total Monitored Oceanfront is presented in **Table 5-12** and **Table 5-13**.

Table 5-12. Average Shoreline and Average Unit Volume Change for Reach 3 - South (2020 – 2021)

2020 vs. 2021 (Total Change)	Transects	Reach Length	avg shoreline change @ +1.18 ft NAVD88	avg volume change above +6 ft NAVD88	avg volume change above +1.18 ft NAVD88	avg volume change above -6 ft NAVD88	avg volume change above -14 ft NAVD88	avg volume change above -19 ft NAVD88	avg volume change above -30 ft NAVD88
Reach	#	ft	ft	cy/ft	cy/ft	cy/ft	cy/ft	cy/ft	cy/ft
Nags Head - Reach 3 - South	975+00 - 1010+00	3,500	-23.0	-0.6	-3.0	-14.4	-18.2	-10.8	-26.4
Total Monitored Oceanfront	430+00 - 1200+00	77,000	8.5	2.0	5.2	8.1	8.9	10.9	-0.2

Table 5-13. Cumulative Volume Change for Reach 3 - South (2020 – 2021)

2020 vs. 2021 (Total Change)	Transects	Reach Length	cumulative volume change above +6 ft NAVD88	cumulative volume change above +1.18 ft NAVD88	cumulative volume change above -6 ft NAVD88	cumulative volume change above -14 ft NAVD88	cumulative volume change above -19 ft NAVD88	cumulative volume change above -30 ft NAVD88
Reach	#	ft	cy	cy	cy	cy	cy	cy
Nags Head - Reach 3 - South	975+00 - 1010+00	3,500	-1,964	-10,633	-50,393	-63,614	-37,895	-92,418
Total Monitored Oceanfront	430+00 - 1200+00	77,000	154,820	395,313	619,899	679,648	834,558	-19,007

Shoreline change at MHW showed an overall average recession of -23 ft. **Figure 5-18** presents the shoreline changes at each transect from 2020 to 2021, showing erosion along majority of the transects. Majority of recession in this reach occurs in the middle portion.

Volumetrically, **Table 5-12** and **Table 5-13** indicates that Reach 3 - South experienced volume losses above all the analyzed elevations throughout the monitoring period. Overall, the largest losses were experienced above -30 ft NAVD88 (-92,418 cy or -26.4 cy/ft). Volume losses observed above -30 ft NAVD88 might indicate that some of the material was transported offshore completely or to adjacent reaches, as longshore transport rates in this area are greater than in Reach 3 - North, and net annual transport is toward the south. Losses above -19 ft NAVD88 (-37,815 cy or -10.8 cy/ft) were slightly smaller than losses above -14 ft NAVD88 (-63,614 cy or -18.2 cy/ft) indicating recovery of a small portion of the losses at the offshore bar and beyond. Similar to Reach 3 – North the erosion experienced above -19 ft NAVD88 during the 2020-2021 monitoring period was smaller compared to the average annual background erosion rates (-23.6 cy/ft/yr) (**Table 5-3**). This is likely due to the fairly calm wave climate during the 2020-2021 monitoring period. **Figure 5-19** displays the unit volume change at each transect above the six elevations analyzed, showing volume losses at all elevations analyzed at majority of transects.

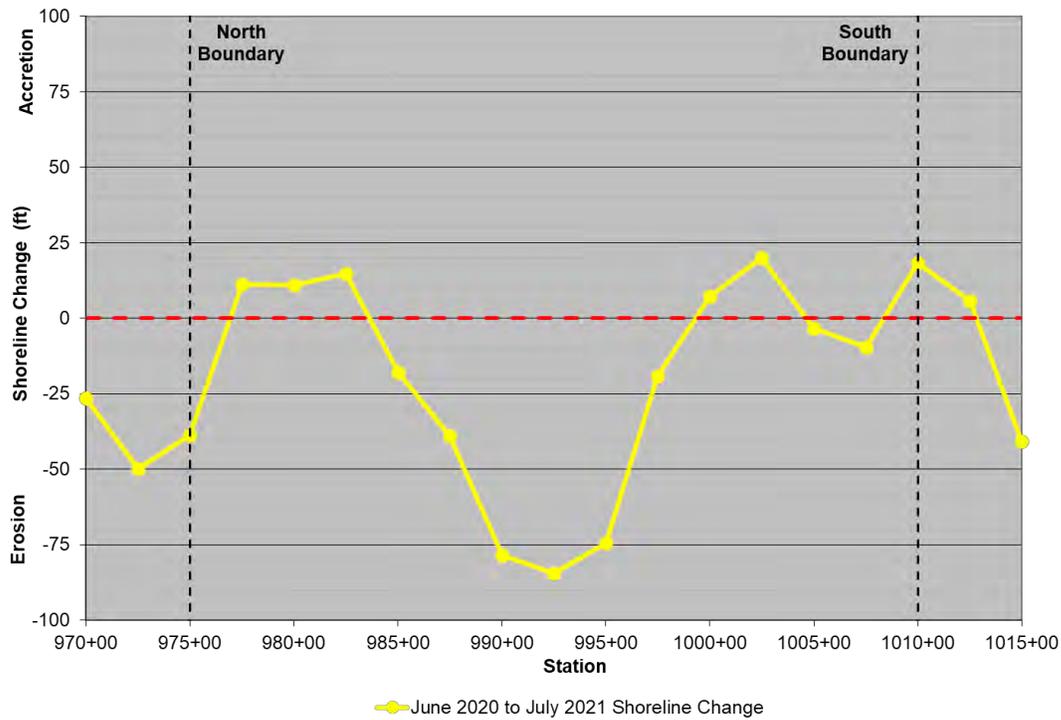


Figure 5-18. Nags Head – Reach 3 – South Shoreline Change (2020 – 2021)

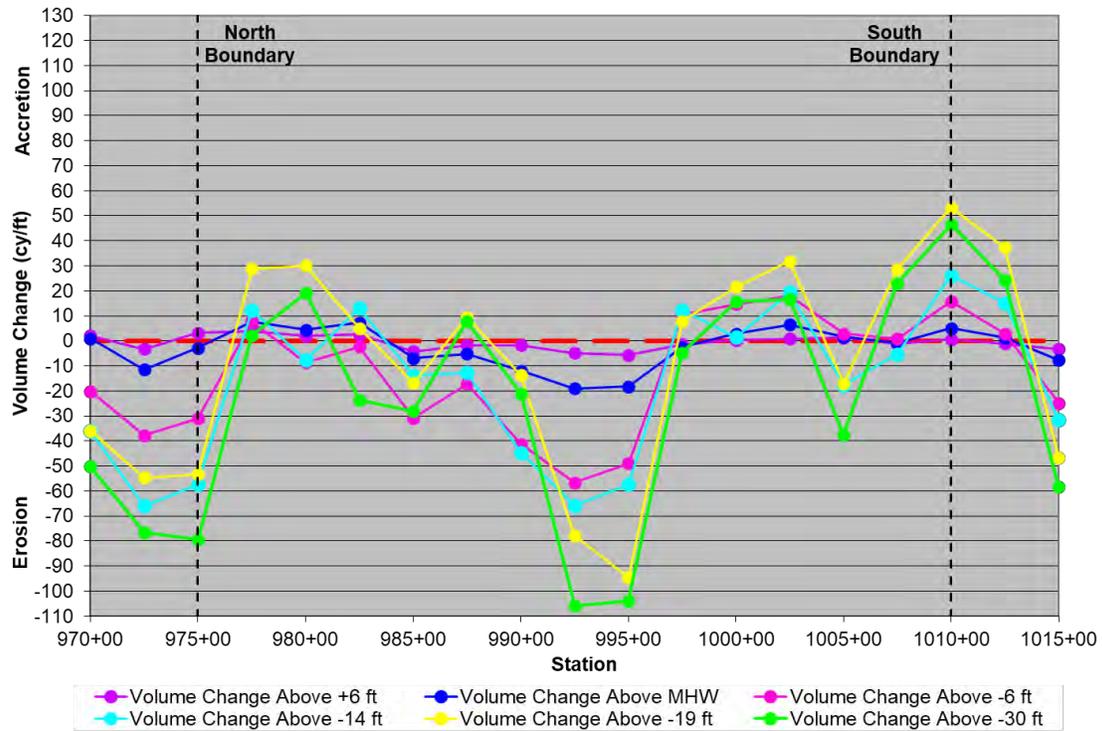


Figure 5-19. Nags Head – Reach 3 – South Unit Volume Change (2020 – 2021)

Figure 5-20 presents an example profile from Reach 3- South that presents the shoreline recession and erosion along the profile from berm to -6 ft NAVD88 followed by material capture between -6 ft NAVD88 to -19 ft NAVD88.

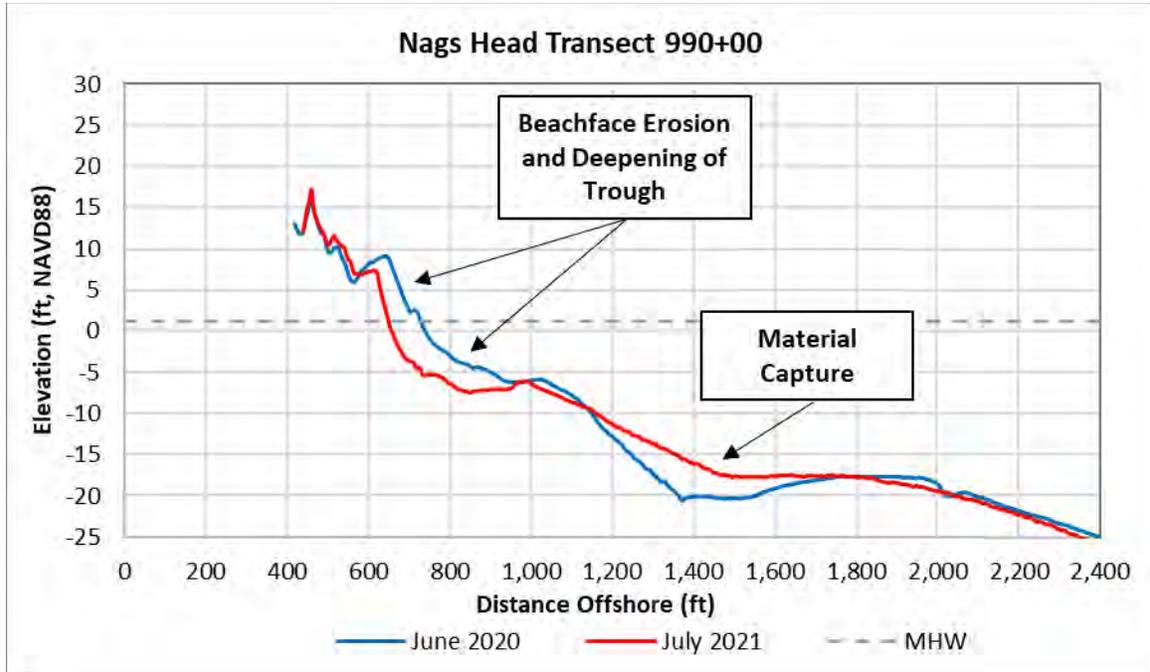


Figure 5-20. Example Reach 3 - South Profile, Station 990+00 (E Seagull Dr.)

5.3.6 Nags Head - Reach 4 (2020 - 2021)

The Nags Head – Reach 4 survey reach extends approximately 1,500 ft between Loon Court and McCall Court, containing seven survey transects (Station 1010+00 – 1025+00), at 500 ft spacing (see **Figure 3-1**). Three of these transects were added to this reach during the 2020 surveying effort, creating 250 ft spacing for the whole reach. A summary of average shoreline and volume changes between 2020 and 2021 for Nags Head – Reach 4 in comparison with the Total Monitored Oceanfront is presented in **Table 5-14** and **Table 5-15**.

Table 5-14. Average Shoreline and Average Unit Volume Change for Reach 4 (2020 – 2021)

2020 vs. 2021 (Total Change)	Transects	Reach Length	avg shoreline change @ +1.18 ft NAVD88	avg volume change above +6 ft NAVD88	avg volume change above +1.18 ft NAVD88	avg volume change above -6 ft NAVD88	avg volume change above -14 ft NAVD88	avg volume change above -19 ft NAVD88	avg volume change above -30 ft NAVD88
Reach	#	ft	ft	cy/ft	cy/ft	cy/ft	cy/ft	cy/ft	cy/ft
Nags Head - Reach 4	1010+00 - 1025+00	1,500	-23.1	-1.7	-4.0	-10.7	-12.7	4.4	-5.2
Total Monitored Oceanfront	430+00 - 1200+00	77,000	8.5	2.0	5.2	8.1	8.9	10.9	-0.2

Table 5-15. Cumulative Volume Change for Reach 4 (2020 – 2021)

2020 vs. 2021 (Total Change)	Transects	Reach Length	cumulative volume change above +6 ft NAVD88	cumulative volume change above +1.18 ft NAVD88	cumulative volume change above -6 ft NAVD88	cumulative volume change above -14 ft NAVD88	cumulative volume change above -19 ft NAVD88	cumulative volume change above -30 ft NAVD88
Reach	#	ft	cy	cy	cy	cy	cy	cy
Nags Head - Reach 4	1010+00 - 1025+00	1,500	-3,048	-6,959	-18,765	-22,191	7,724	-9,120
Total Monitored Oceanfront	430+00 - 1200+00	77,000	154,820	395,313	619,899	679,648	834,558	-19,007

Shoreline change at MHW showed a significant overall average recession of -23.1 ft. **Figure 5-21** presents the shoreline changes at each transect from 2020 to 2021, showing erosion along most of the transects.

Volumetrically, **Table 5-14** and **Table 5-15** indicates that Reach 4 experienced minor volume losses above all the analyzed elevations except -19 ft NAVD88 throughout the monitoring period. Overall, Reach 4 experienced the largest losses above -14 ft NAVD88 (-22,191 cy or -12.7 cy/ft). Minor volume gain was observed above -19 ft NAVD88 (+7,724 cy or +4.4 cy/ft) indicating recovery of the losses at the offshore bar and beyond.

Figure 5-22 displays the unit volume change at each transect above the six elevations analyzed. As can be seen, volume losses are evident at every transect in Reach 4 except the northern stations 1010+00 and 1012+50. **Figure 5-23** presents an example profile that shows the erosion along the beachface and nearshore.

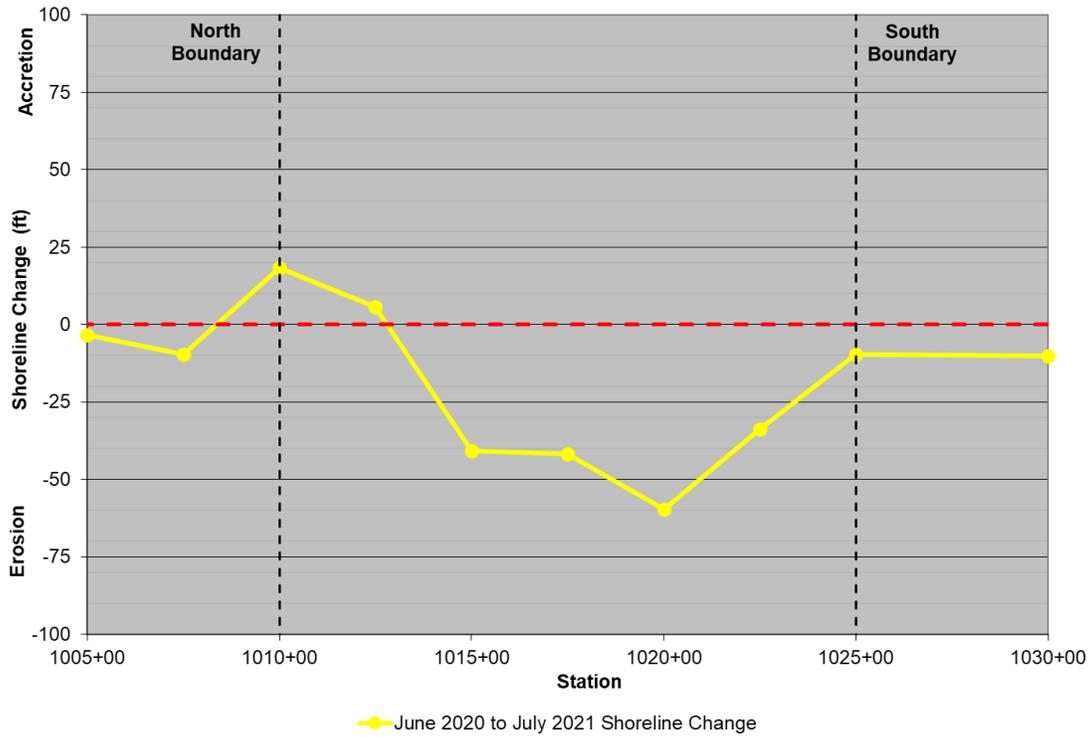


Figure 5-21. Nags Head – Reach 4 Shoreline Change (2020 – 2021)

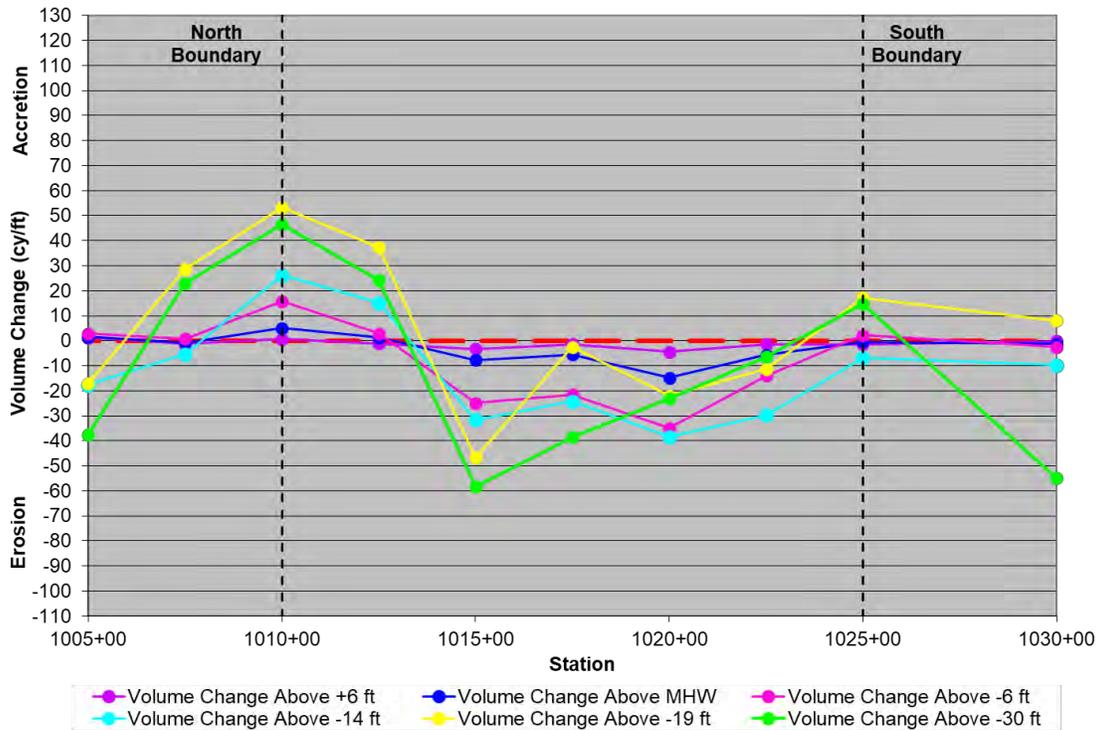


Figure 5-22. Nags Head – Reach 4 Unit Volume Change (2020 – 2021)

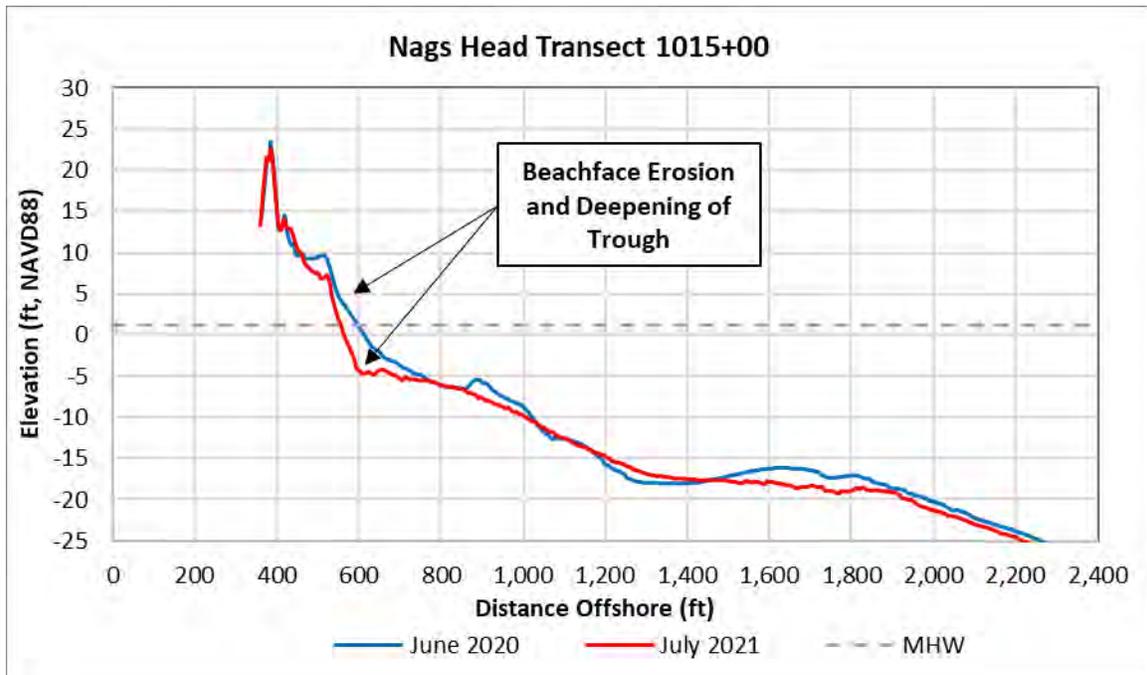


Figure 5-23. Example Reach 4 Profile, Station 1015+00 (S Colony South Dr.)

5.3.7 National Seashore - North (2020 - 2021)

The National Seashore - North survey reach, previously named Oregon Inlet reach in the summer 2020 monitoring report (M&N 2020), extends approximately 17,500 ft between McCall Court and Oregon Inlet Campground. The National Seashore - North reach contains 23 survey transects (Station 1025+00 – 1200+00), varying in spacing between 1,000 ft (see **Figure 3-1**). A summary of average shoreline and volume changes between 2020 and 2021 for the National Seashore - North Reach is presented along with total oceanfront changes in **Table 5-16** and **Table 5-17**.

Table 5-16. Average Shoreline and Average Unit Volume Change for National Seashore - North (2020 – 2021)

2020 vs. 2021 (Total Change)	Transects	Reach Length	avg shoreline change @ +1.18 ft NAVD88	avg volume change above +6 ft NAVD88	avg volume change above +1.18 ft NAVD88	avg volume change above -6 ft NAVD88	avg volume change above -14 ft NAVD88	avg volume change above -19 ft NAVD88	avg volume change above -30 ft NAVD88
Reach	#	ft	ft	cy/ft	cy/ft	cy/ft	cy/ft	cy/ft	cy/ft
National Seashore - North	1025+00 - 1200+00	17,500	28.6	2.2	7.9	15.5	25.9	27.0	10.5
Total Monitored Oceanfront	430+00 - 1200+00	77,000	8.5	2.1	5.4	8.1	8.9	10.9	-0.2

Table 5-17. Cumulative Volume Change for National Seashore - North (2020 – 2021)

2020 vs. 2021 (Total Change)	Transects	Reach Length	cumulative volume change above +6 ft NAVD88	cumulative volume change above +1.18 ft NAVD88	cumulative volume change above -6 ft NAVD88	cumulative volume change above -14 ft NAVD88	cumulative volume change above -19 ft NAVD88	cumulative volume change above -30 ft NAVD88
Reach	#	ft	cy	cy	cy	cy	cy	cy
National Seashore - North	1025+00 - 1200+00	17,500	38,629	138,230	271,727	452,381	471,822	184,188
Total Monitored Oceanfront	430+00 - 1200+00	77,000	159,398	412,962	619,899	679,648	834,558	-19,007

Shoreline change at MHW showed an overall average seaward advancement of 28.6 ft. **Figure 5-24** presents the shoreline changes at each transect, showing advancement along majority of transects.

Overall, the National Seashore - North reach experienced the largest volume gains above -19 ft NAVD88 of 471,822 cy (+27 cy/ft). The significant volume gain can likely be attributed to the littoral transport of material to the south from Reach 3 and Reach 4. **Figure 5-25** displays the unit volume change at each transect above the six elevations analyzed. As can be seen, a majority of transects experienced volume gains above the analyzed elevations. Profile plots in **Appendix B** show many instances where sand has been pushed onshore and nearshore adding volume to the berm and sand bar. **Figure 5-26** shows an example profile that presents the seaward advancement of the berm and the sand deposited along the profile berm to -19 ft NAVD88.

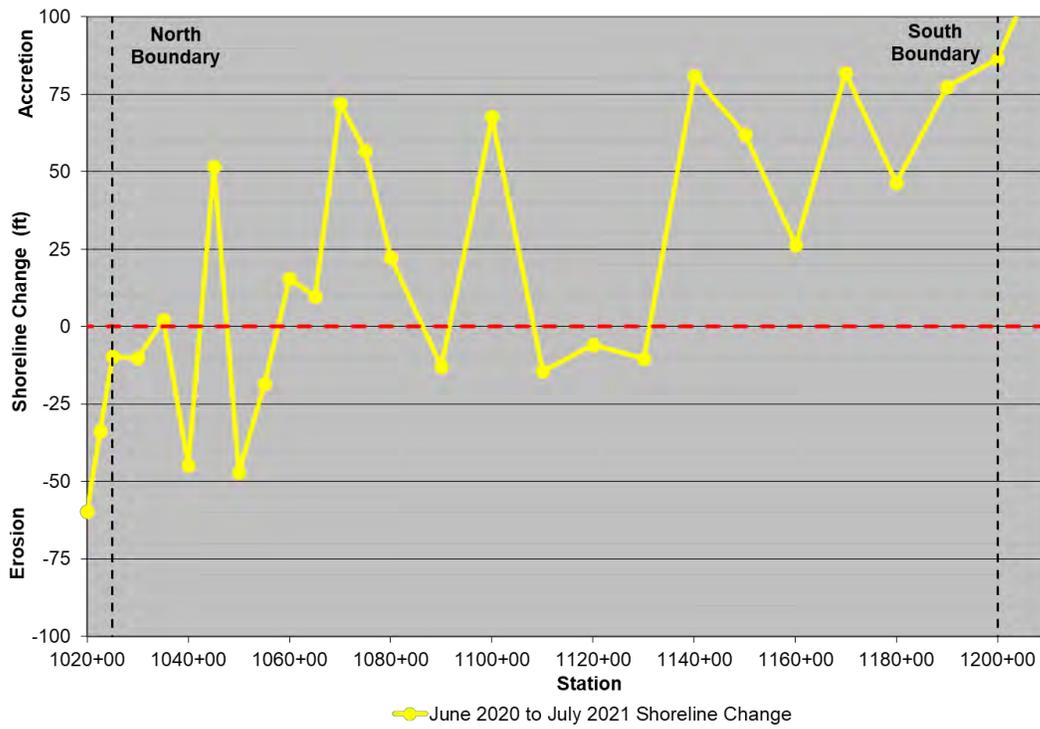


Figure 5-24. National Seashore - North Shoreline Change (2020 – 2021)

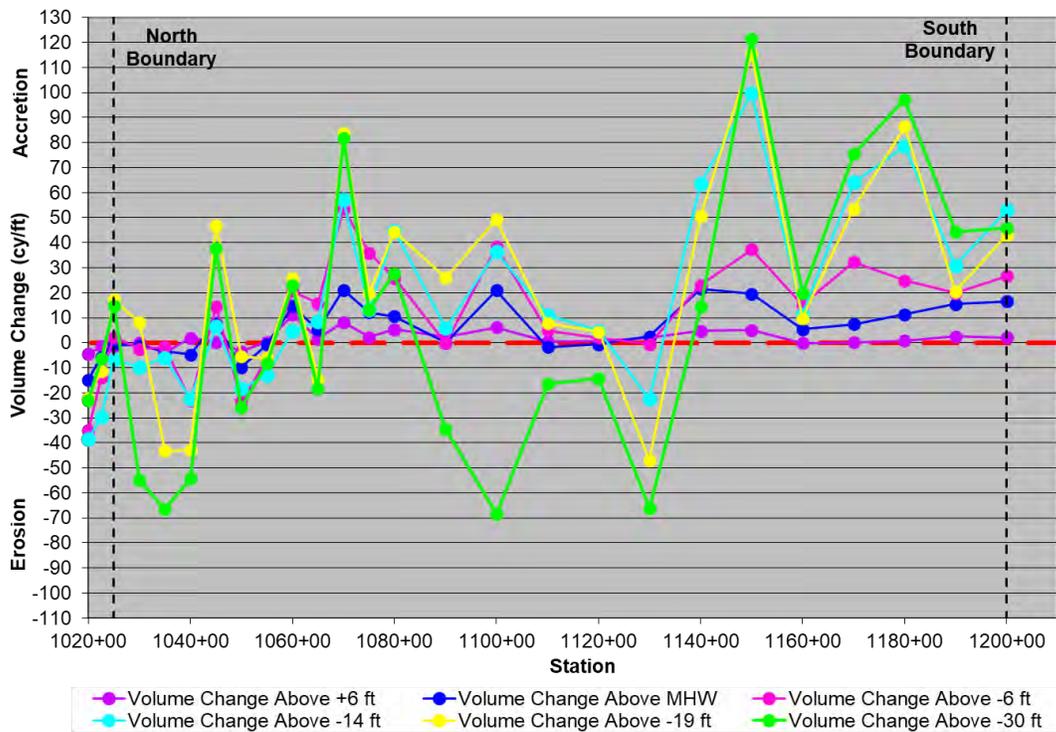


Figure 5-25. National Seashore - North Unit Volume Change (2020 – 2021)

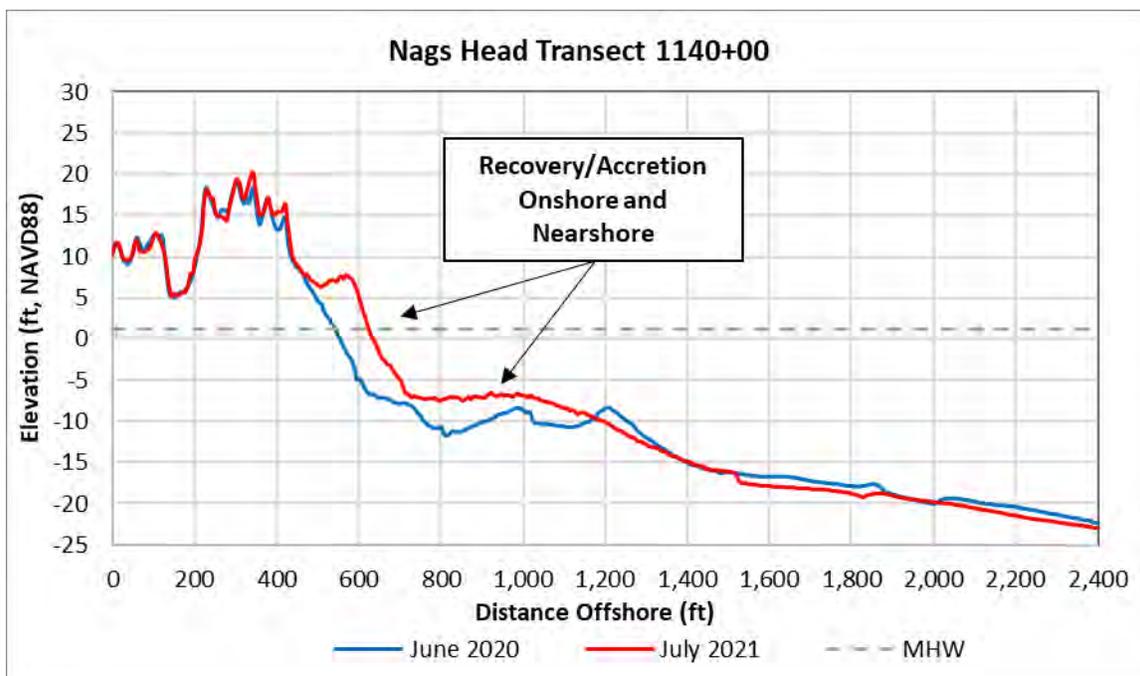


Figure 5-26. Example National Seashore - North Profile, Station 1140

5.3.8 National Seashore - South (2020 - 2021)

The National Seashore - South survey reach extends approximately 9,000 ft north of Oregon Inlet, containing eight survey transects (Station 1200+00 – 1290+00), at 1,000 ft spacing (see **Figure 3-1**). Shorelines adjacent to an inlet are typically very active due to more complex hydrodynamics and often greater sediment transport rates, leading to more extreme profile changes from year to year. Shoreline change at MHW along the reach showed an overall average recession of -58 ft. **Figure 5-27** presents the shoreline changes at each transect. As can be seen from the figure there is a significant variance between shoreline changes from +343.4 at station 1260+00 to -589.4 at station 1290+00. **Figure 5-28** shows the aerial image of the Oregon Inlet from beginning and end of the monitoring period. The significant changes of shoreline positions including the significant erosion at the Bodie Island spit can also be observed from the aerials.

Due to the dynamic nature of Oregon Inlet, volume calculations were not meaningful. Instead profile comparisons between summer 2020 and summer 2021 (**Appendix B**) were investigated to determine trends. In the majority of profiles except 1280+00 and 1290+00, there was onshore sand movement and sand was deposited along the profile between +5 ft NAVD88 to -5 ft NAVD88 (**Figure 5-29**). During the monitoring period the Bodie Island Spit experienced material loss (**Figure 5-28**) which caused significant recession of the shoreline at the two transects next to the inlet. **Figure 5-30** shows an example profile near the inlet that presents the significant material loss and corresponding landward recession.

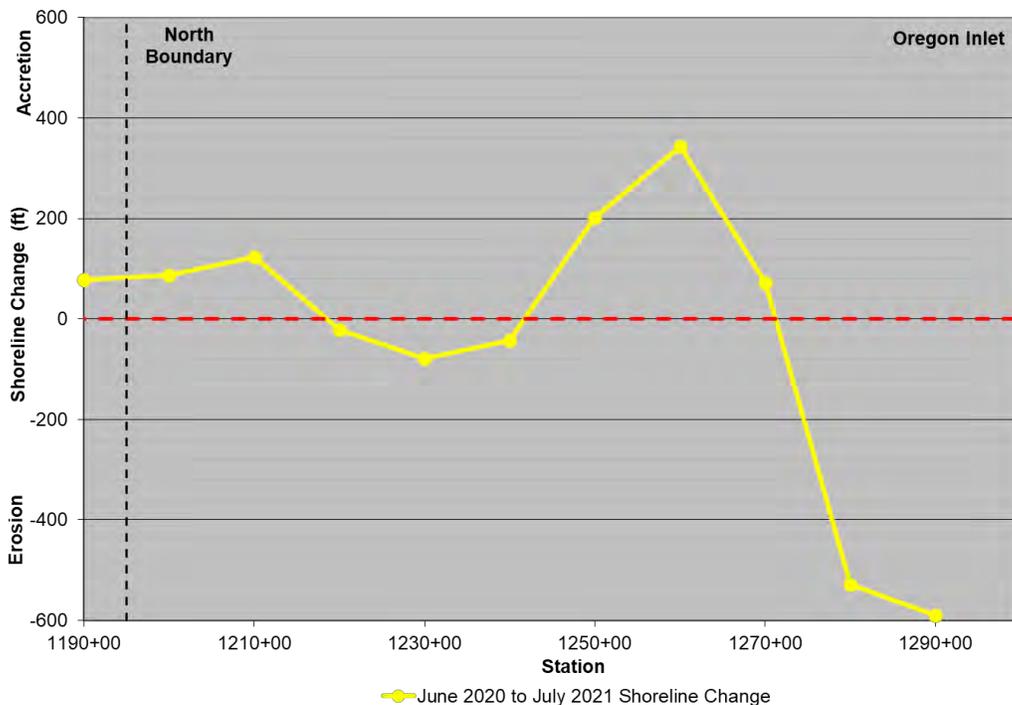


Figure 5-27. National Seashore - South Shoreline Change (2020 – 2021)

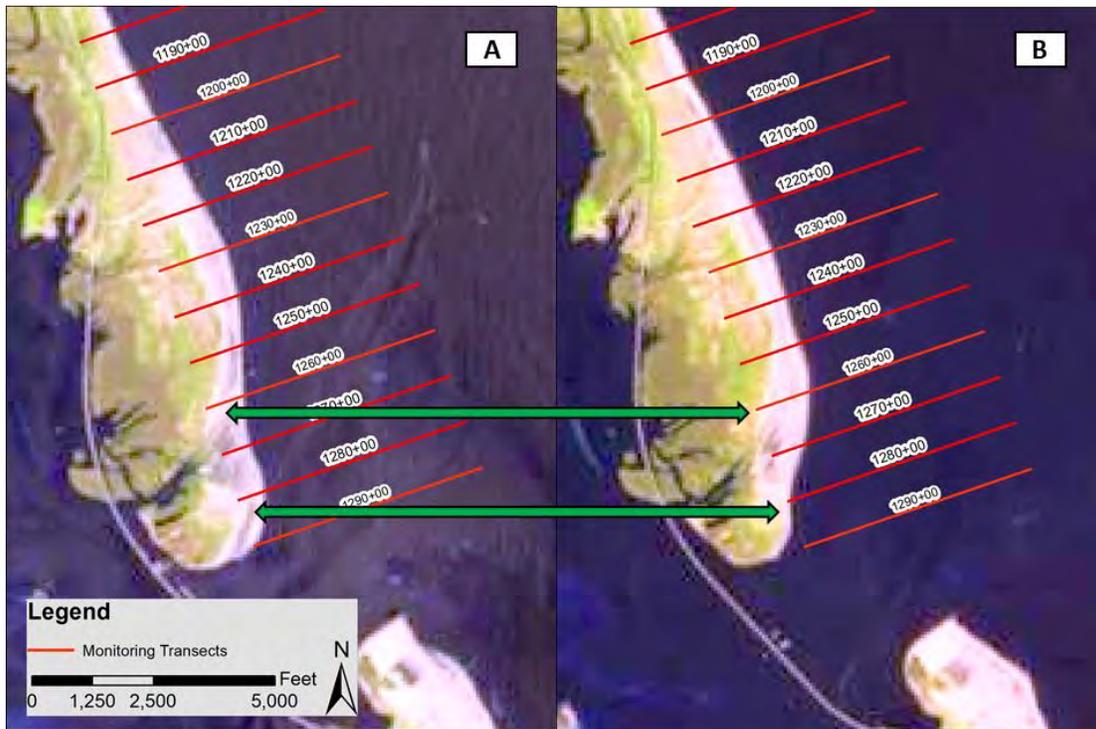


Figure 5-28. Oregon Inlet Change (Image A: 06/26/2020 USGS Sentinel Imagery; Image B:07/01/2021 USGS-Sentinel Imagery)

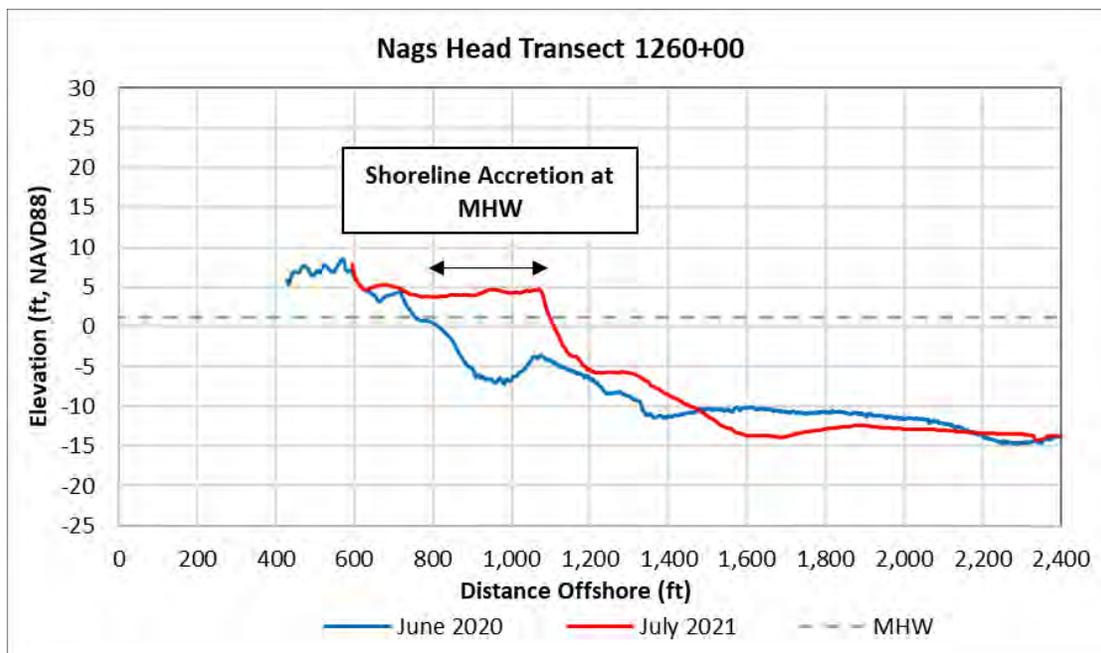


Figure 5-29. Example National Seashore - North Profile, Station 1260 (Bodie Island Spit)

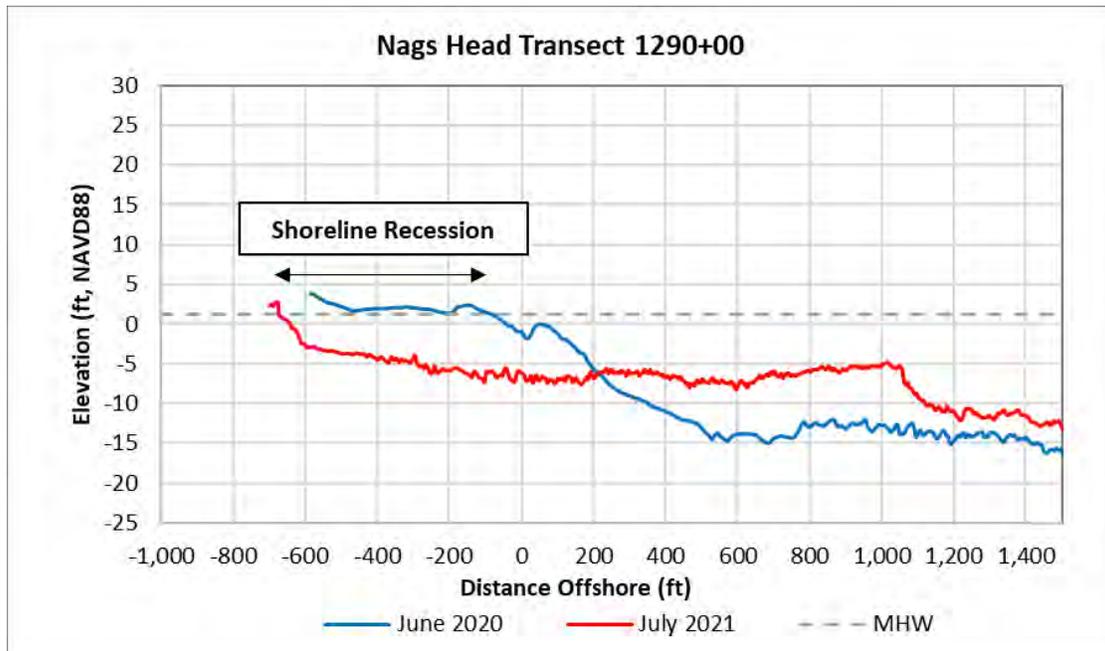


Figure 5-30. Example National Seashore - South Profile, Station 1290 (Bodie Island Spit)

5.3.9 Oceanfront Trends Summary for All Reaches (2020 - 2021)

Table 5-18 and **Table 5-19** provides a summary of the shoreline and volume changes along Nags Head as presented in the previous sections along with average and total oceanfront values. For Nags Head, since each reach consists of a different length of shoreline, the calculations provide a weighted average for unit shoreline change (ft) and unit volume change (cy/ft) along the Nags Head oceanfront. The weighted average also accounts for differences in the shoreline length between each transect. **Figure 5-31** and **Figure 5-32** contains plots of the shoreline and volume changes between the summer 2020 and the summer 2021 surveys at each transect along Nags Head.

Table 5-18. Nags Head Shoreline and Average Unit Volume Change Statistics (2020 – 2021)

2020 vs. 2021 (Total Change)	Transects	Reach Length	avg shoreline change @ +1.18 ft NAVD88	avg volume change above +6 ft NAVD88	avg volume change above +1.18 ft NAVD88	avg volume change above -6 ft NAVD88	avg volume change above -14 ft NAVD88	avg volume change above -19 ft NAVD88	avg volume change above -30 ft NAVD88
Reach	#	ft	ft	cy/ft	cy/ft	cy/ft	cy/ft	cy/ft	cy/ft
Nags Head - North	430+00 - 495+00	6,500	23.3	2.5	6.6	16.9	5.7	9.1	0.8
Nags Head - Reach 1	495+00 - 790+00	29,500	4.7	2.7	6.1	6.1	7.2	7.2	0.6
Nags Head - Reach 2	790+00 - 920+00	13,000	1.5	2.3	4.4	11.6	7.7	10.8	-1.8
Nags Head - Reach 3N	920+00 - 975+00	5,500	-6.7	0.4	2.5	-3.5	-5.8	-2.6	-17.4
Nags Head - Reach 3S	975+00 - 1010+00	3,500	-23.0	-0.6	-3.0	-14.4	-18.2	-10.8	-26.4
Nags Head - Reach 4	1010+00 - 1025+00	1,500	-23.1	-1.7	-4.0	-10.7	-12.7	4.4	-5.2
National Seashore North	1025+00 - 1200+00	17,500	28.6	2.2	7.9	15.5	25.9	27.0	10.5
	Transects	Reach Length	weighted avg	weighted avg	weighted avg	weighted avg	weighted avg	weighted avg	weighted avg
Nourished Oceanfront	495+00 - 1025+00	53,000	0.1	2.0	4.4	4.6	3.7	5.8	-3.8
Total Monitored Oceanfront	430+00 - 1200+00	77,000	8.5	2.1	5.4	8.1	8.9	10.9	-0.2

Table 5-19. Nags Head Cumulative Volume Change Statistics (2020 – 2021)

2020 vs. 2021 (Total Change)	Transects	Reach Length	cumulative volume change above +6 ft NAVD88	cumulative volume change above +1.18 ft NAVD88	cumulative volume change above -6 ft NAVD88	cumulative volume change above -14 ft NAVD88	cumulative volume change above -19 ft NAVD88	cumulative volume change above -30 ft NAVD88
Reach	#	ft	cy	cy	cy	cy	cy	cy
Nags Head - North	430+00 - 495+00	6,500	16,348	43,028	109,695	37,296	59,014	5,411
Nags Head - Reach 1	495+00 - 790+00	29,500	77,319	177,696	176,619	209,487	208,249	16,916
Nags Head - Reach 2	790+00 - 920+00	13,000	29,539	57,186	150,932	99,834	140,508	-23,763
Nags Head - Reach 3N	920+00 - 975+00	5,500	2,575	14,414	-19,915	-33,545	-14,863	-100,221
Nags Head - Reach 3S	975+00 - 1010+00	3,500	-1,964	-10,633	-50,393	-63,614	-37,895	-92,418
Nags Head - Reach 4	1010+00 - 1025+00	1,500	-3,048	-6,959	-18,765	-22,191	7,724	-9,120
National Seashore - North	1025+00 - 1200+00	17,500	38,629	138,230	271,727	452,381	471,822	184,188
	Transects	Reach Length	total	total	total	total	total	total
Nourished Oceanfront	495+00 - 1025+00	53,000	104,422	231,703	238,477	189,972	303,722	-208,606
Total Monitored Oceanfront	430+00 - 1200+00	77,000	159,398	412,962	619,899	679,648	834,558	-19,007

During the 2020-2021 monitoring period Reach 1 and Reach 2 shorelines observed minor seaward advancements whereas Reach 3-North shoreline slightly retreated. Among the nourished reaches Reach 3-South and Reach 4 experienced higher recession rates. Shorelines along the Nags Head-North reach and the National Seashore-North reach to the north and south of the Nourished Oceanfront both experienced seaward advancements.

The Nourished Oceanfront and Total Monitored Oceanfront both experienced gains in material along all the analyzed elevations except -30 ft NAVD88. A majority of the volume gains can be attributed to continuing recovery of the beach following Hurricane Dorian during a calmer summer 2020 – summer 2021 wave climate compared to the previous monitoring period. In all management reaches except Reach 3-North and Reach 3-South, material gain was observed above -19 ft NAVD88 indicating that the material remained within the system. The maximum material gain was observed above -19 ft NAVD88 with a 303,722 cy increase along the Nourished Oceanfront. Over the Total Monitored Oceanfront, approximately 834,558 cy was gained above -19 ft NAVD88, with 56.5% of the material gain occurring in the National Seashore-North reach. The significant material gain in the National Seashore-North reach can likely be attributed to the littoral transport of material to the south from Reach 3-North, Reach 3-South and Reach 4, within which volume losses extending above -19 ft NAVD88 were observed.

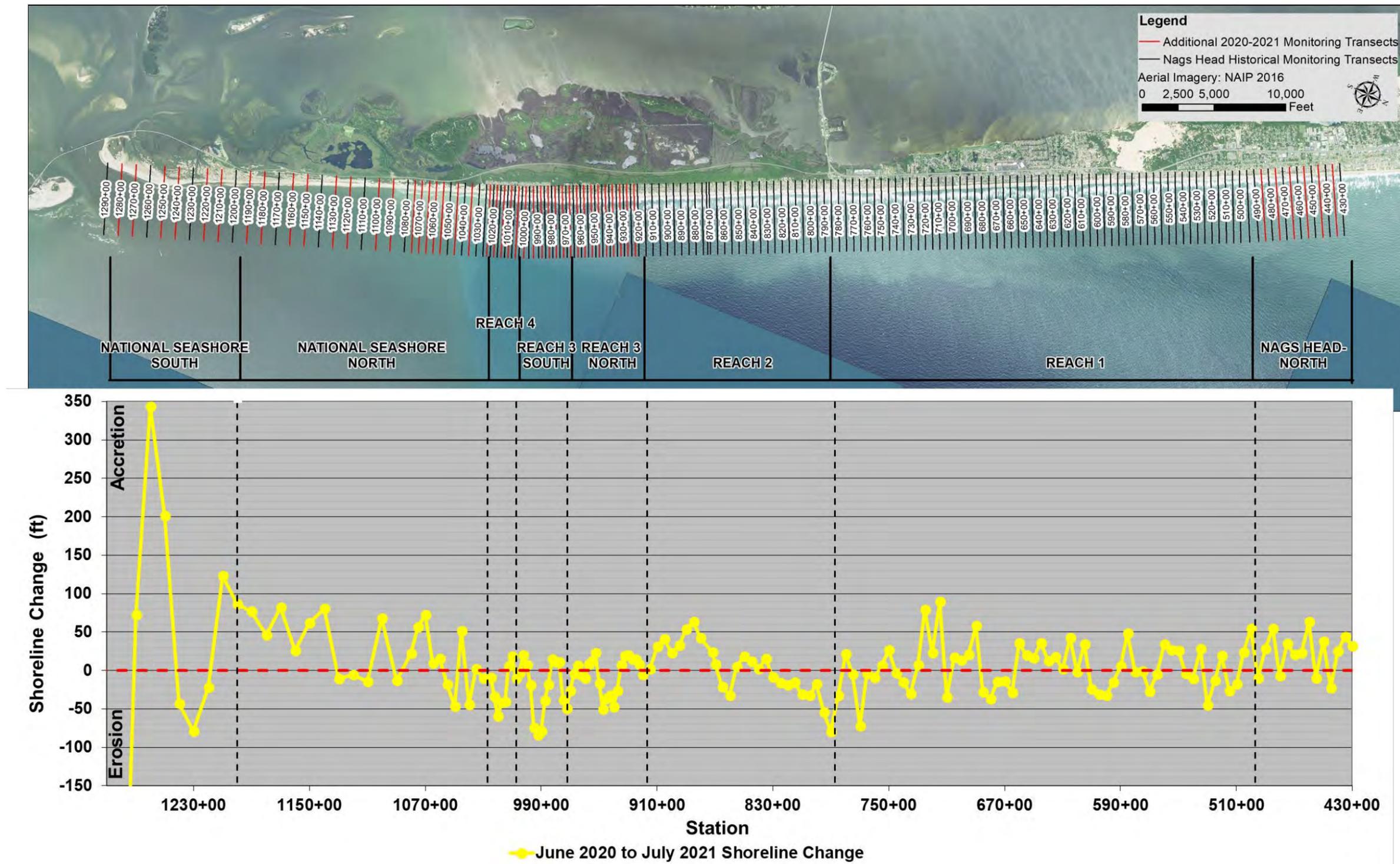


Figure 5-31. Nags Head – Oceanfront Shoreline Change (2020 – 2021)

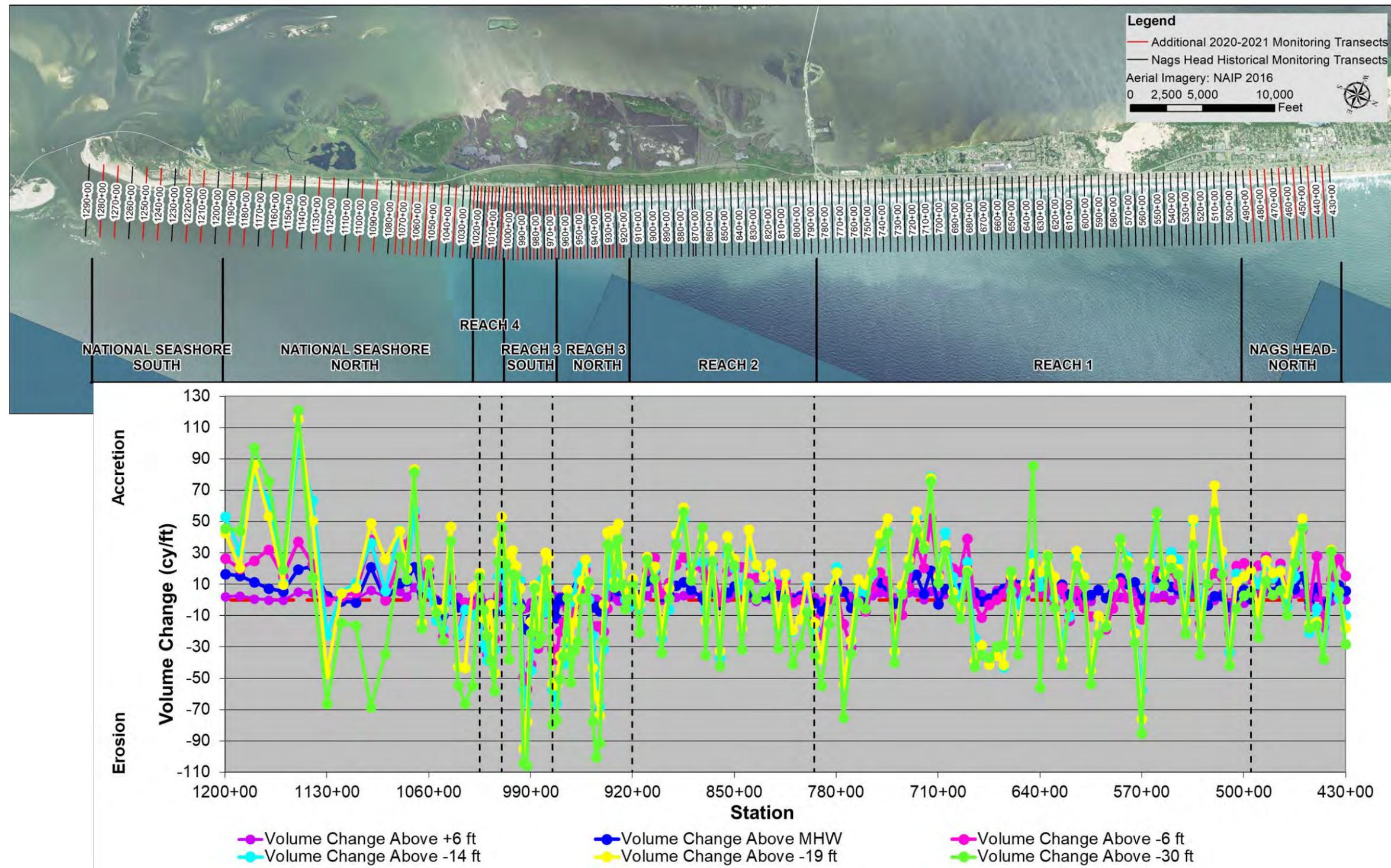


Figure 5-32. Nags Head – Unit Volume Change (2020 – 2021)

Figure 5-33 and **Figure 5-34** display the trends seen in **Table 5-18** and **Table 5-19** with bar plots of the average unit volume changes as well as total cumulative volume changes at each sub-reach to help visualize changes that occurred to the Nags Head monitoring area as a whole and how the magnitude of changes compares from one reach to the next. Apparent from these figures are the volume losses along Reach 3-South, Reach 3-North and Reach 4, with drift of material from these reaches to National Seashore - North reach.

The survey data can indicate the volume change experienced across the surveyed area, but analysis of the data alone is not always sufficient to determine how or why these changes occurred. A detailed explanation of the processes by which the indicated gains and losses occurred is beyond the scope of this monitoring evaluation report. Numerical modeling and coastal engineering analysis taking place as part of the Town’s ongoing beach nourishment master planning project may further investigate those sediment movement processes.

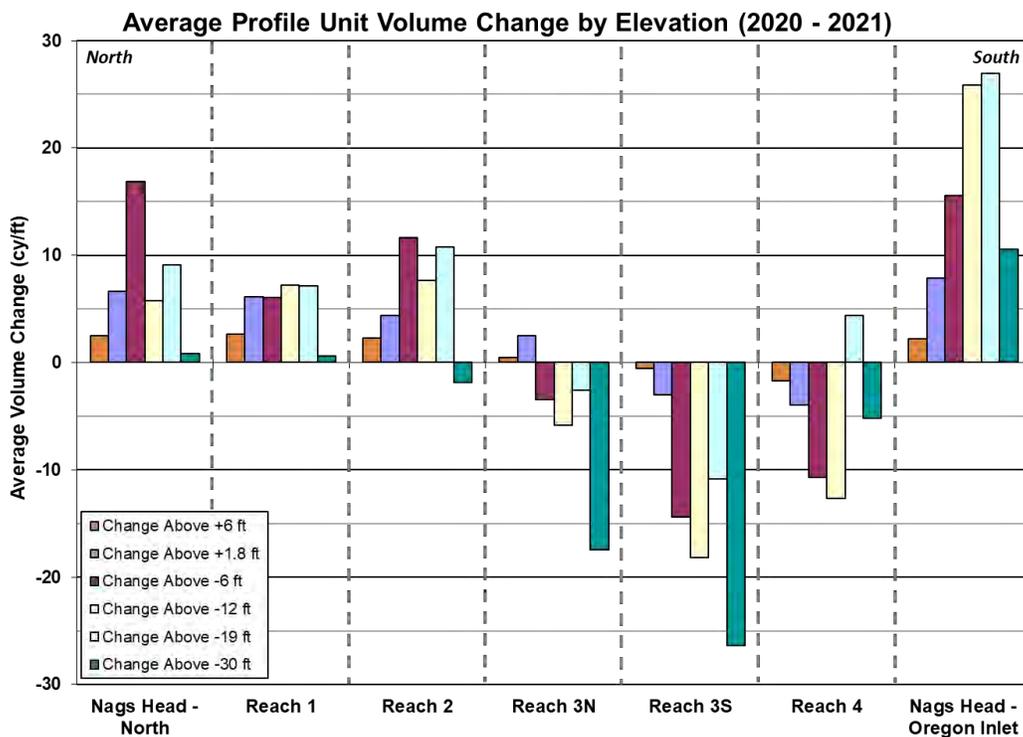


Figure 5-33. Average Unit Volume Change Within Each Reach (2020 – 2021)

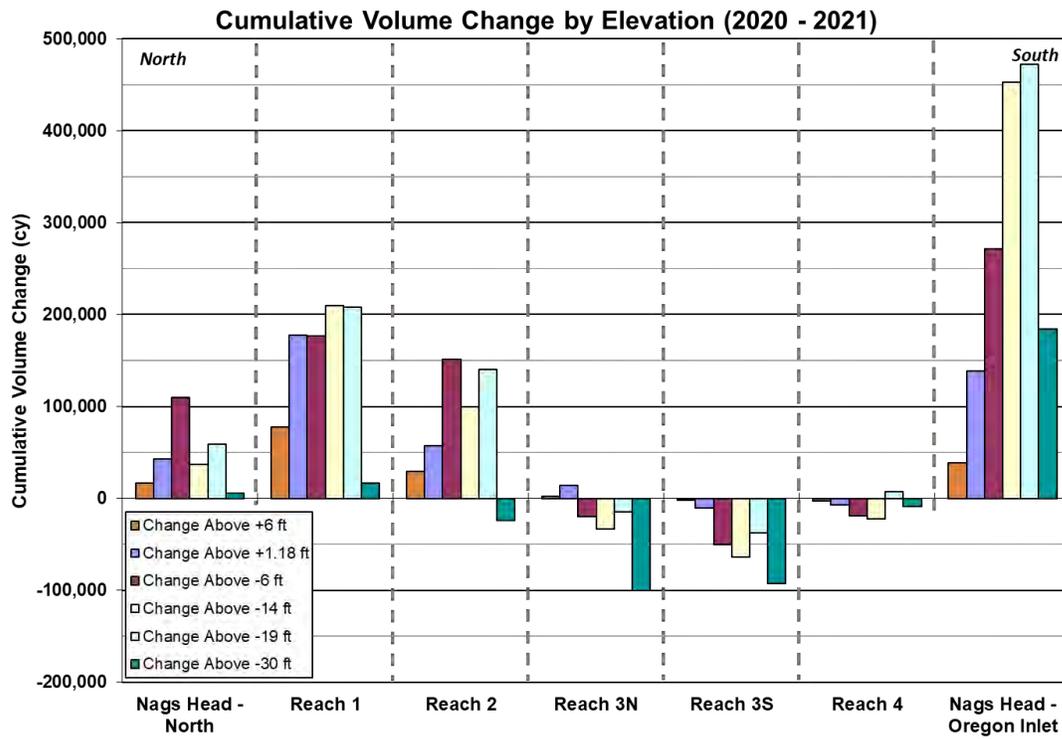


Figure 5-34. Cumulative Volume Change Within Each Reach (2020 – 2021)

5.4 Nourished Oceanfront Performance Relative to Pre-Nourishment

Construction of the 2019 Nags Head Beach Nourishment Project was carried out between May 1, 2019 and August 18, 2019. During the project, a total of 4 million cy of material was placed along approximately 10 miles of shoreline. CSE conducted a pre-construction survey in April 2019. To quantify the performance of the nourishment project, the volume changes between the pre-nourishment survey, August 2019 survey (post nourishment survey), June 2020 survey and the July 2021 survey were analyzed.

Figure 5-35 illustrates the shoreline changes relative to pre-nourishment condition (April 2019) along the Nourished Oceanfront. As can be seen from the figure, the shoreline experienced a significant landward recession along the Nourished Oceanfront since the completion of nourishment project. Most of the recession that has occurred since nourishment occurred before the post-Dorian survey which indicates that most of the recession can be attributed to Hurricane Dorian. At Reach 3-North, Reach 3-South and Reach 4 further recession of shoreline compared to post-nourishment conditions were experienced during the current monitoring period.

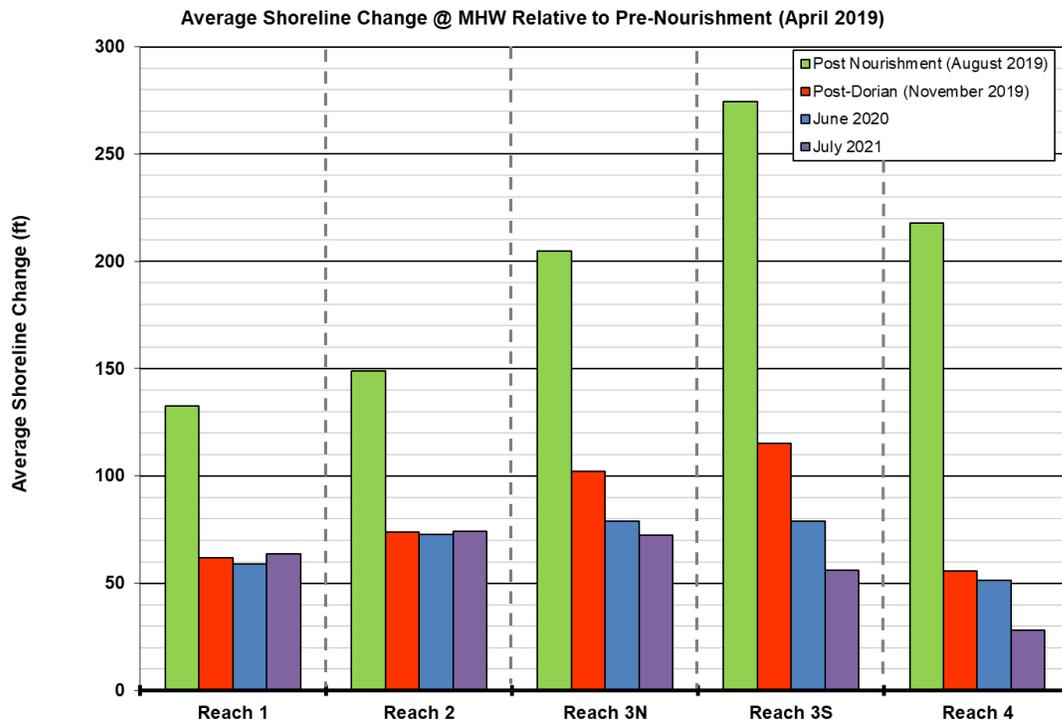


Figure 5-35. Nourished Oceanfront Average Shoreline Change Relative to Pre-Nourishment Conditions

Figure 5-36 and **Table 5-20** presents the volume changes relative to pre-nourishment conditions (April 2019) above six elevations along the Nourished Oceanfront. The Nourished Oceanfront experienced gains in material along the upper (+6 ft NAVD88) and lower (-19 ft NAVD88) portions of the profiles. Although losses were experienced above

MHW, -6 ft NAVD88 and -14 ft NAVD88, recovery of material following Hurricane Dorian is evident. It is likely that the fairly calm wave climate between the summer 2020 and summer 2021 surveys allowed for some natural recovery from Hurricane Dorian which had not previously been allowed to take place due to an active 2020 winter storm season following the passage of the hurricane.

Table 5-20. Nourished Oceanfront Cumulative Volume Change Relative to Pre-Nourishment Conditions

	Reaches	Stations	cumulative volume change above +6 ft NAVD88	cumulative volume change above +1.18 ft NAVD88	cumulative volume change above -6 ft NAVD88	cumulative volume change above -14 ft NAVD88	cumulative volume change above -19 ft NAVD88
Pre-Nourishment (April 2019) -Post Nourishment (August 2019)	Reach 1	495+00 - 790+00	48,815	1,281,699	1,725,297	1,788,187	1,795,175
	Reach 2	790+00 - 920+00	17,218	612,985	929,222	952,787	955,405
	Reach 3N	920+00 - 975+00	38,435	381,697	514,686	494,606	492,375
	Reach 3S	975+00 - 1010+00	20,844	79,833	442,278	456,810	458,425
	Reach 4	1010+00 - 1025+00	11,451	21,641	157,842	141,537	139,725
	Nourished Oceanfront	495+00 - 1025+00	136,762	2,377,855	3,769,324	3,833,927	3,841,105
Pre-Nourishment (April 2019) -Post Nourishment (November 2019)	Reach 1	495+00 - 790+00	122,742	890,211	1,043,259	1,670,583	1,649,959
	Reach 2	790+00 - 920+00	53,589	441,740	550,539	906,718	817,193
	Reach 3N	920+00 - 975+00	53,200	273,200	304,616	414,929	388,407
	Reach 3S	975+00 - 1010+00	29,753	-14,098	295,230	387,901	350,928
	Reach 4	1010+00 - 1025+00	10,924	-47,450	67,788	85,461	62,951
	Nourished Oceanfront	495+00 - 1025+00	270,208	1,543,604	2,261,432	3,465,591	3,269,438
Pre-Nourishment (April 2019) - June 2020	Reach 1	495+00 - 790+00	193,057	964,264	991,610	1,633,023	2,052,621
	Reach 2	790+00 - 920+00	110,115	502,260	554,438	935,933	1,109,539
	Reach 3N	920+00 - 975+00	72,432	288,994	261,920	383,133	526,039
	Reach 3S	975+00 - 1010+00	41,649	-4,082	235,215	316,084	354,188
	Reach 4	1010+00 - 1025+00	21,996	-28,740	33,984	45,101	71,796
	Nourished Oceanfront	495+00 - 1025+00	439,248	1,722,697	2,077,167	3,313,273	4,114,183
Pre-Nourishment (April 2019) - July 2021	Reach 1	495+00 - 790+00	270,375	1,141,960	1,168,229	1,842,510	2,260,870
	Reach 2	790+00 - 920+00	139,655	559,446	705,370	1,035,767	1,250,047
	Reach 3N	920+00 - 975+00	75,007	303,408	242,005	349,588	511,176
	Reach 3S	975+00 - 1010+00	39,685	-14,715	184,822	252,470	316,292
	Reach 4	1010+00 - 1025+00	18,948	-35,699	15,219	22,910	79,520
	Nourished Oceanfront	495+00 - 1025+00	543,670	1,954,400	2,315,644	3,503,244	4,417,905

Table 5-20 shows that the total volume change above -19 ft NAVD88 since 2019 pre-nourishment was +4,417,905 cy (115 percent of the project volume). Since the completion of the 2019 Beach Nourishment project approximately 576,800 cy (+10.9 cy/ft) volume gain was observed above -19ft NAVD88 along the Nourished Oceanfront. However, the results show large-scale shifts of sand cross-shore, across different elevations.

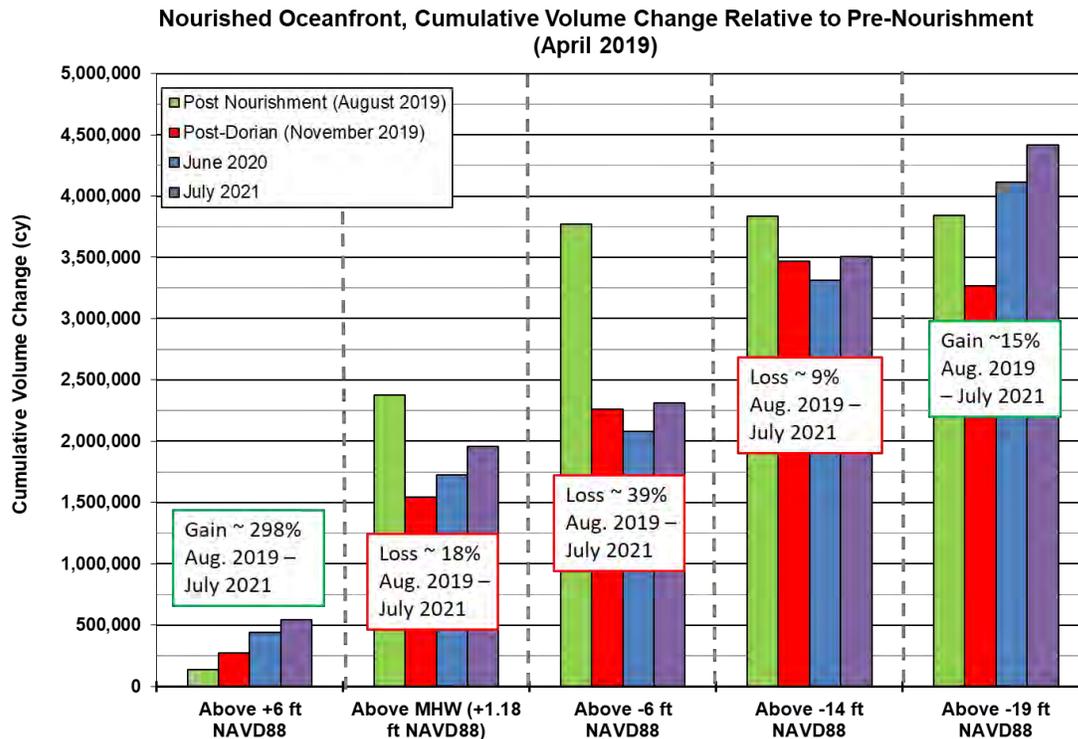


Figure 5-36. Nourished Oceanfront Cumulative Volume Change Relative to Pre-Nourishment

Figure 5-37 illustrates the volume changes relative to pre-nourishment conditions (April 2019) above +6 ft NAVD88 along the Nourished Oceanfront. All the reaches gained material above +6 ft NAVD88 since the completion of nourishment project, which may be due to sand fencing capturing the wind-blown sand from the widened beaches and storm waves pushing material above the berm.

Figure 5-38 shows the volume changes relative to pre-nourishment conditions (April 2019) above MHW (+1.18 ft NAVD88) along the Nourished Oceanfront. All the reaches lost material above MHW since the completion of nourishment project. During the 2019-2020 monitoring period all the reaches show recovery of material after Hurricane Dorian. During the current monitoring period Reach 1, Reach 2, and Reach 3-North has continued to gain material above MHW, whereas Reach 3-South and Reach 4 experienced minor losses.

Figure 5-39 presents the volume changes relative to pre-nourishment conditions (April 2019) above -19 ft NAVD88 along the Nourished Oceanfront. The reaches north of the hotspot at Reach 3-South show volume gain above -19 ft NAVD88 relative to the pre-nourishment conditions. However, in Reach 3-South and Reach 4 volume losses were observed extending below -19 ft NAVD88 indicating material loss well beyond the depth of closure that will likely not migrate back onshore.

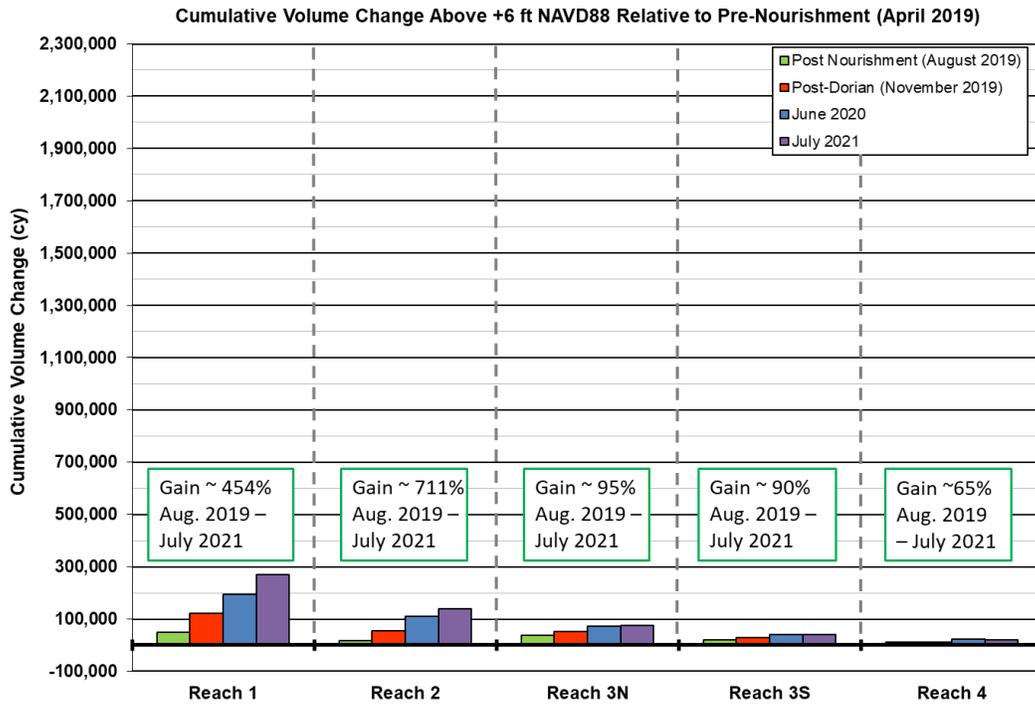


Figure 5-37. Cumulative Volume Change Above +6 ft NAVD88 Relative to Pre-Nourishment

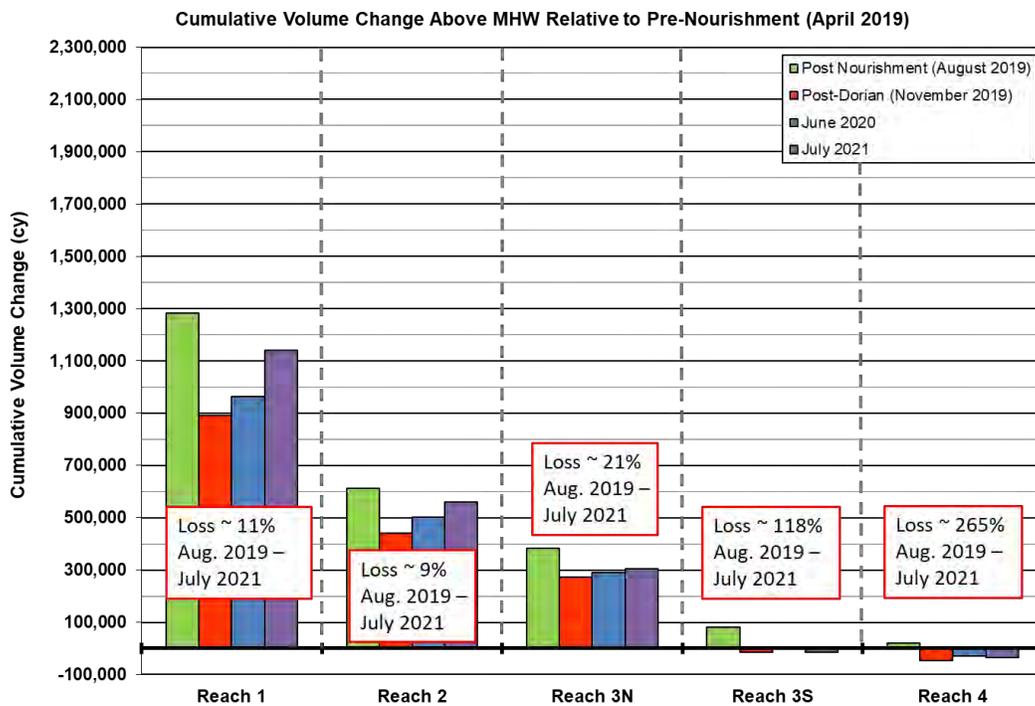


Figure 5-38. Cumulative Volume Change Above MHW Relative to Pre-Nourishment

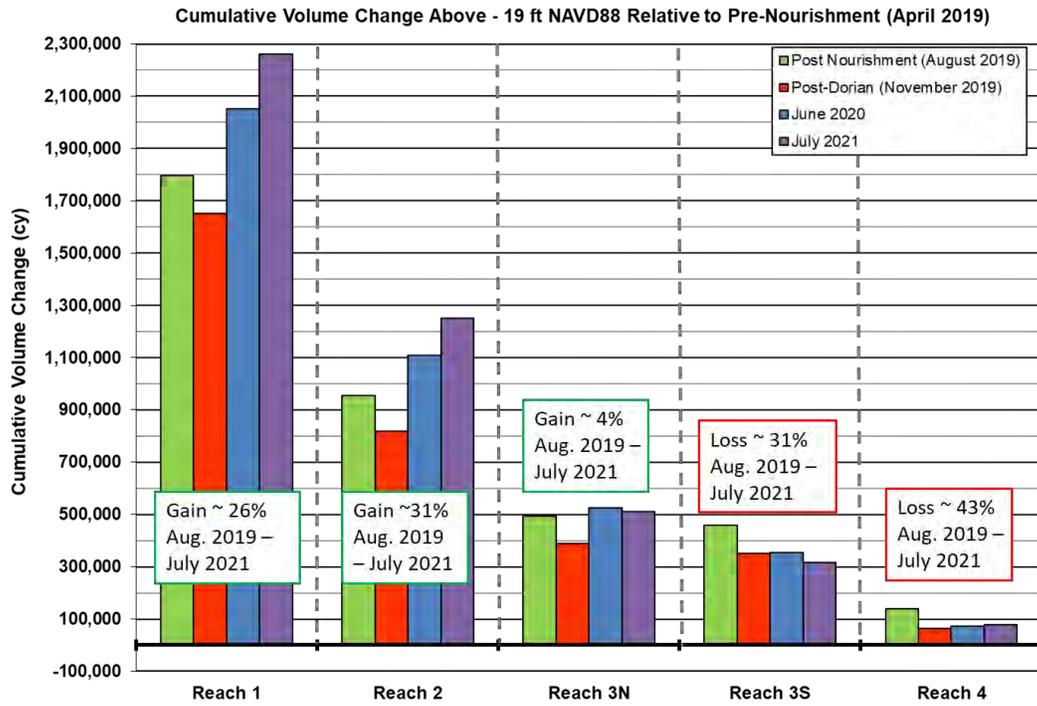


Figure 5-39. Cumulative Volume Change Above -19 ft NAVD88 Relative to Pre-Nourishment

5.5 Long-Term Change Trends (2011 – 2021)

To determine the long-term trends along Nags Head, annual volume changes from the present and previous monitoring reports were averaged at each transect. Material placed during the 2019 Beach Nourishment project was subtracted out of the total volume change at each transect in order to determine the background erosion rate. **Figure 5-40** shows the mean volume change from 2011 to 2021 with nourishment, and **Figure 5-41** shows the mean volume change over the same years with the nourishment subtracted out. In comparison of the two figures, the hotspot at Reach 3-South (in the center of the red circle on each figure) is very visible when nourishment effects are subtracted out. In both figures increases in volume losses from north to south can be observed. The majority of profiles to the south of Reach 2 experience volume losses above all elevations analyzed when the nourishment material is subtracted. From **Table 5-18** and **Figure 5-33** it can be seen that 2020-2021 shoreline volume trends followed a similar behavior to the long-term trends. The reaches to the south of Reach 2, except for the Nags Head-National Seashore - North reach, showed significantly more unit volume loss compared to the northern reaches. The volume gains at National Seashore - North reach were likely caused by littoral transport of the material placed during the 2019 Beach Nourishment Project to the south from Reach 3 and Reach 4.

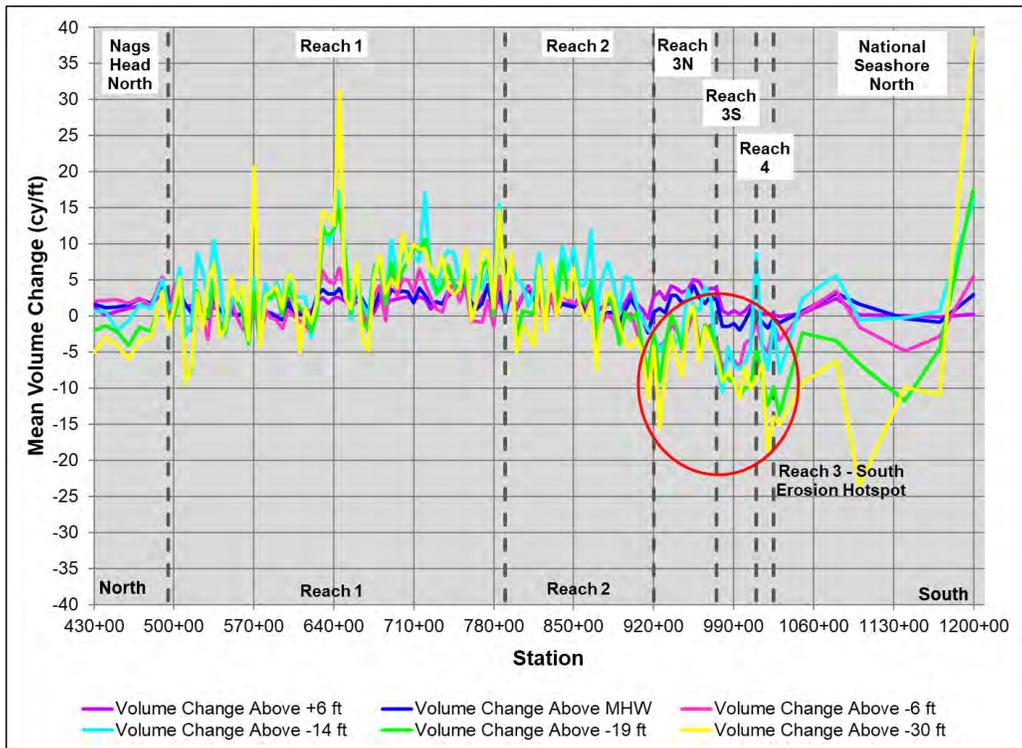


Figure 5-40. Mean Volume Change per year (2011 – 2021) (With Nourishment)

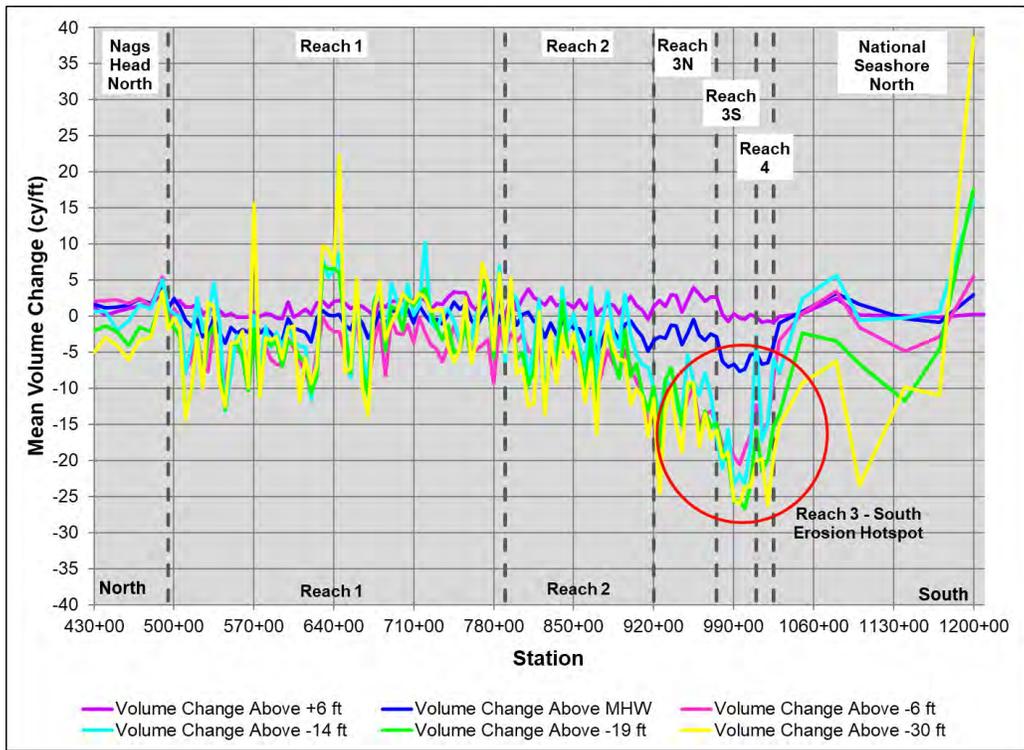


Figure 5-41. Mean Volume Change per year (2011 – 2021) (Without Nourishment)

5.6 Dune Volume Trends

After the 2011 Beach Nourishment study it was noted (CSE 2018) that sand fencing has managed to capture the wind-blown sand and caused steady dune growth until 2014. The dune growth rates declined after 2014 as the available sand for aeolian transport decreased. Shoreline recession and reduction in dry beach width for aeolian transport caused dunes to lose sand from 2016 to 2018. The wider beaches created by the 2019 Beach Nourishment Project allowed for aeolian transport, and the 2020-2021 annual monitoring period observed dune growth above +6 ft NAVD88 of 104,422 cy (+2 cy/ft) along the Nourished Oceanfront. The dune growth along the Nourished Oceanfront occurred only at the northern reaches. During the monitoring period material loss was observed at Reach 3-South and Reach 4 of -1,964 cy (-0.6 cy/ft) and -3,048 cy (-1.7 cy/ft) respectively (**Table 5-18**). Both of the reaches (Nags Head-North and National Seashore-North) located north and south of the Nourished Oceanfront observed dune growth.

In an attempt to determine the vulnerable locations, the mean volume change +6 ft NAVD88 in between 2011 and 2019 beach nourishment projects was examined. **Figure 5-42** shows the mean volume change above +6 ft NAVD88, indicating two erosional locations. The first location is observed at Reach 1, in front of the Jockey's Ridge State Park, between E Hollowell Street and E Soundside Road. The second area covers the south part of the monitoring area starting from the hotspot location at Reach 3-South and extending south to National Seashore – North reach. The rest of the dunes across the Nags Head Oceanfront display either volume gain or no overall change.

To investigate how the volume changes occurred over time a moving average analysis was done by averaging the unit volume of a profile with profiles within 1,000 ft distance to it. Using moving average helps visualize the trends by displaying the localized trends while smoothing the instantaneous changes of volume between profiles. **Figure 5-43** presents the moving average analysis of unit volumes above +6 NAVD88 ft along the monitoring shoreline from 2011 to 2021, displaying the same dune erosion locations.

Dune growth/erosion locations observed during the current monitoring period were similar to the locations observed during the 2019-2020 monitoring period. At the Reach 1 erosion location, the 2019 dune volumes are smaller compared to 2011, whereas at the second location 2019 volumes are in between 2011 and 2012 volumes. Similar to the mean volume change trends the over the rest of the oceanfront majority of the profiles display volume gains compared to 2011. Following the 2019 Nourishment project dune growth is observed south of the 1130+00 transect along the National Park Service (NPS) managed area. This is likely due to material shifting south and providing more material to boost aeolian transport.

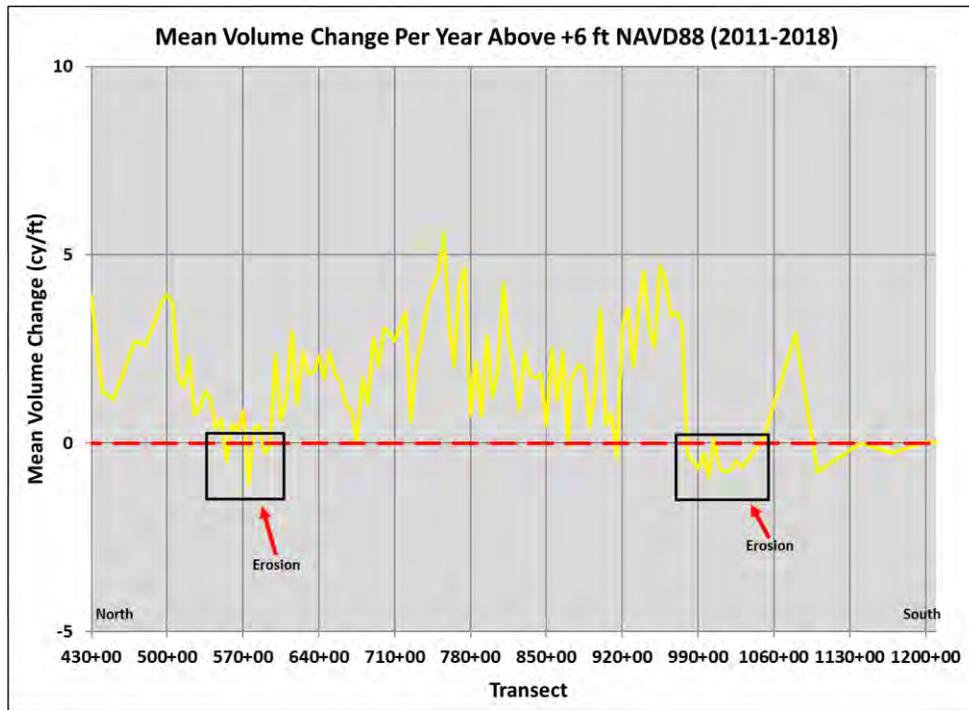


Figure 5-42. Unit Dune Volume Change from 2011 to 2018 (Moving Average Trend Above +6 ft NAVD88)

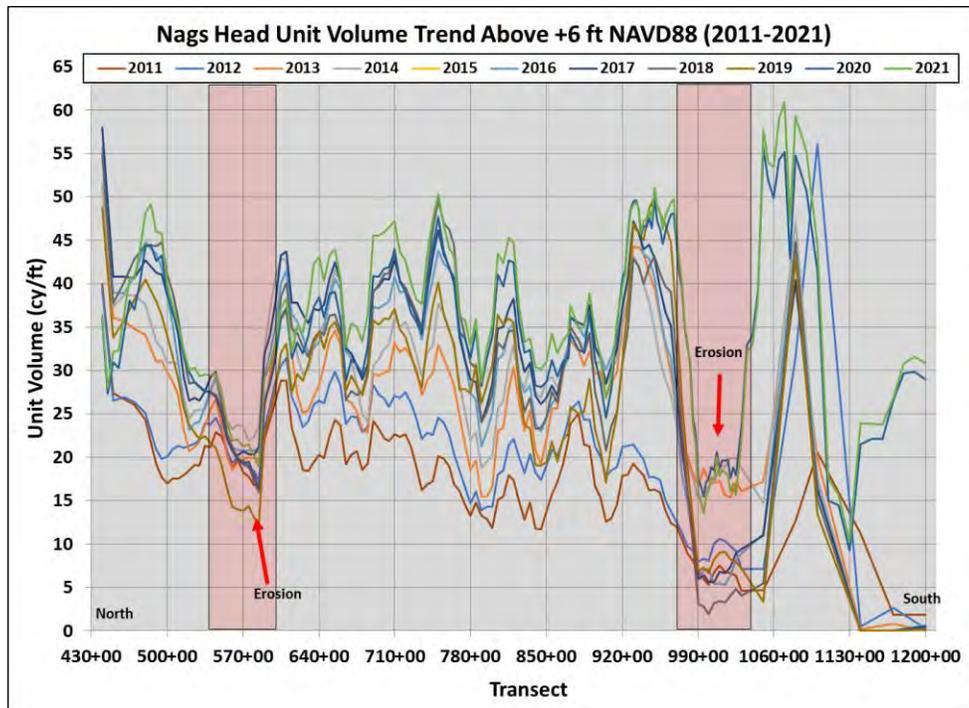


Figure 5-43. Unit Dune Volume by Year (Moving Average Trend Above +6 ft NAVD88)

6.0 SUMMARY

The Town of Nags Head Beach Monitoring and Maintenance Plan is sponsored by the Town of Nags Head (Town) as a continuation of the 2011 monitoring program initiated for assessing beach conditions. The primary purpose of the program is to assess current and historical shoreline conditions, determine shoreline and volumetric changes and evaluate the performance of beach nourishment and other restoration efforts. Evaluating and documenting these changes consistently over successive years provides information necessary to plan for future beach nourishments and to support development of the Town's multi-decadal Beach Nourishment Master Plan.

The most recent set of annual survey data was collected by McKim & Creed on July 13-20 and on August 5. This report documents the data sources, methods, and results of a survey evaluation by Moffatt & Nichol performed to compare the July 2021 survey with June 2020 survey with a previous survey performed by McKim & Creed in June 2020.

The survey data was used to compute shoreline change at Mean High Water (MHW), which is designated as +1.18 ft NAVD88 for Nags Head, and volume change above +6 ft NAVD88 (berm), MHW, -6 ft NAVD88 (wading depth), -14 ft NAVD88 (outer bar), -19 ft NAVD88 (approximate depth of closure), and -30 ft NAVD88 (offshore). This allows a detailed review of the shoreline and active profile performance during the 2020-2021 monitoring period.

During 2019 Beach Nourishment Project approximately 4.0 million cy of material was placed along approximately 10 miles of shoreline. The shoreline position and volume changes above six elevations relative to pre-nourishment conditions (April 2019) along the Nourished Oceanfront (Station 495+00 – 1025+00) are illustrated below.

Figure 6-1 shows the shoreline changes relative to pre-nourishment condition (April 2019) along the Nourished Oceanfront. As can be seen from the figure, the shoreline experienced a significant landward recession along the Nourished Oceanfront since the completion of nourishment project. Most of the recession that has occurred since nourishment occurred before the post-Dorian survey which indicates that most of the recession can be attributed to Hurricane Dorian. At Reach 3-North, Reach 3-South and Reach 4 further recession of shoreline compared to post-nourishment conditions were experienced during the current monitoring period.

Figure 6-2 illustrates that the overall changes in sand volume vary with the depth. The results confirmed the total volume change above -19 ft NAVD88 since pre-nourishment was +4,417,905 cy (115 percent of the project volume). After the completion of the 2019 Beach Nourishment project approximately 576,800 cy (+10.9 cy/ft) volume gain was observed above -19ft NAVD88 along the Nourished Oceanfront. However, the results show large-scale shifts of sand cross-shore, across different elevations.

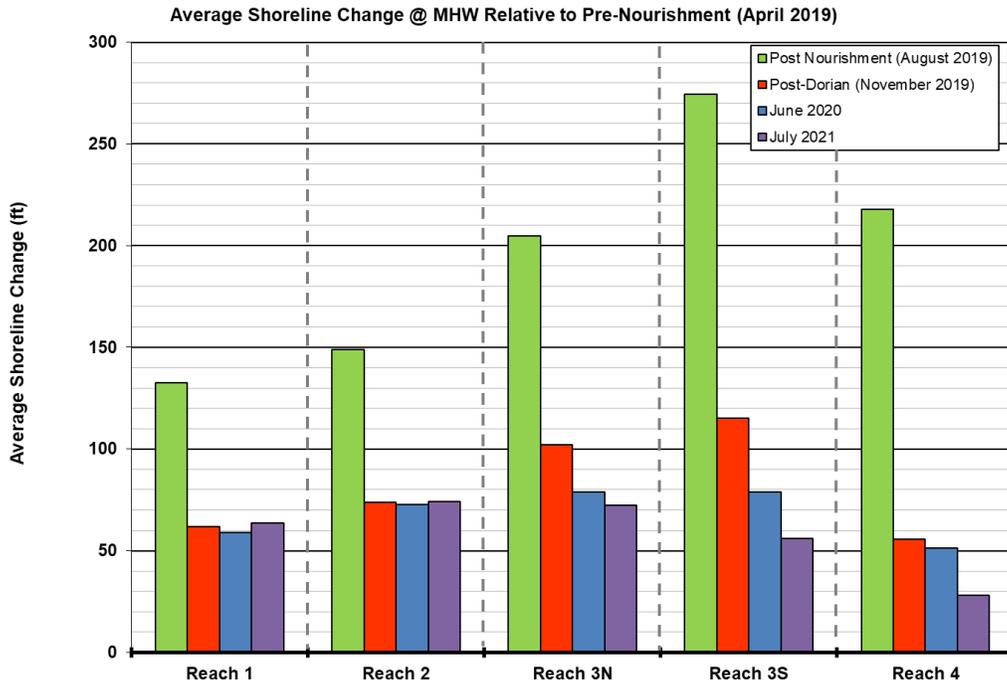


Figure 6-1. Nourished Oceanfront Average Shoreline Change Relative to April 2019 Pre-Nourishment Conditions

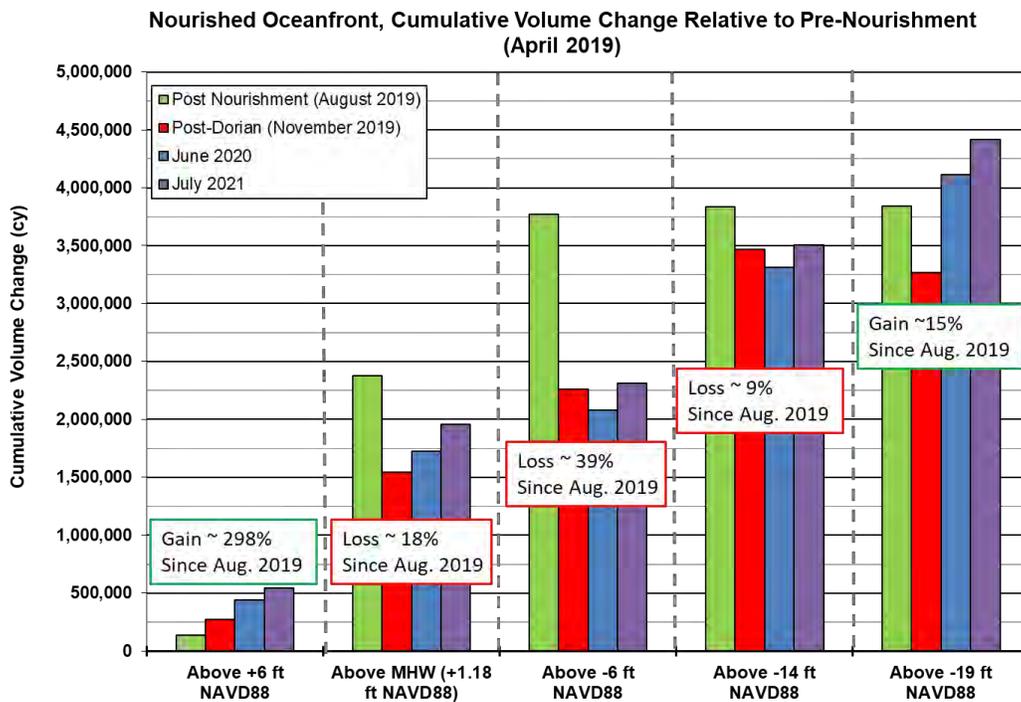


Figure 6-2. Nourished Oceanfront Cumulative Volume Change Relative to April 2019 Pre-Nourishment Conditions

Figure 6-3 presents the volume changes relative to pre-nourishment conditions (April 2019) above -19 ft NAVD88 along the Nourished Oceanfront. The reaches north of the hotspot at Reach 3-South show volume gain above -19 ft NAVD88 relative to the pre-nourishment conditions. However, in Reach 3-South and Reach 4 volume losses were observed extending below -19 ft NAVD88 indicating material loss well beyond the depth of closure that will likely not migrate back onshore.

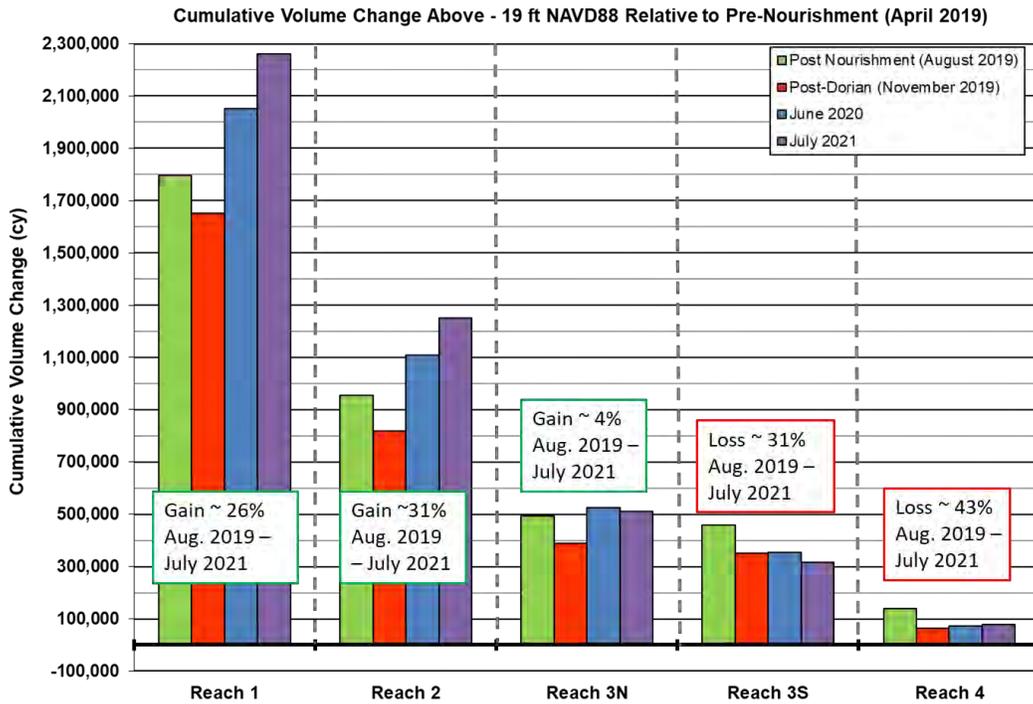


Figure 6-3. Cumulative Volume Change Above -19 ft NAVD88 Relative to Pre-Nourishment

Volume changes during the monitoring period indicated that the Nourished Oceanfront experienced gains in material along the upper (+6 ft NAVD88) and lower (-19 ft NAVD88) portions of the profiles. Although losses were experienced above MHW, -6 ft NAVD88 and -14 ft NAVD88, recovery of material following Hurricane Dorian is evident. It is likely that the fairly calm wave climate between the summer 2020 and summer 2021 surveys allowed for some natural recovery from Hurricane Dorian which had not previously been allowed to take place due to an active 2020 winter storm season following the passage of the hurricane.

Key statistics for individual reaches along Nags Head along with the entire oceanfront shoreline were as follows:

Table 6-1. Nags Head Shoreline and Average Unit Volume Change Statistics (2020 – 2021)

2020 vs. 2021 (Total Change)	Transects	Reach Length	avg shoreline change @ +1.18 ft NAVD88	avg volume change above +6 ft NAVD88	avg volume change above +1.18 ft NAVD88	avg volume change above -6 ft NAVD88	avg volume change above -14 ft NAVD88	avg volume change above -19 ft NAVD88	avg volume change above -30 ft NAVD88
Reach	#	ft	ft	cy/ft	cy/ft	cy/ft	cy/ft	cy/ft	cy/ft
Nags Head - North	430+00 - 495+00	6,500	23.3	2.5	6.6	16.9	5.7	9.1	0.8
Nags Head - Reach 1	495+00 - 790+00	29,500	4.7	2.7	6.1	6.1	7.2	7.2	0.6
Nags Head - Reach 2	790+00 - 920+00	13,000	1.5	2.3	4.4	11.6	7.7	10.8	-1.8
Nags Head - Reach 3N	920+00 - 975+00	5,500	-6.7	0.4	2.5	-3.5	-5.8	-2.6	-17.4
Nags Head - Reach 3S	975+00 - 1010+00	3,500	-23.0	-0.6	-3.0	-14.4	-18.2	-10.8	-26.4
Nags Head - Reach 4	1010+00 - 1025+00	1,500	-23.1	-1.7	-4.0	-10.7	-12.7	4.4	-5.2
National Seashore North	1025+00 - 1200+00	17,500	28.6	2.2	7.9	15.5	25.9	27.0	10.5
	Transects	Reach Length	weighted avg	weighted avg	weighted avg	weighted avg	weighted avg	weighted avg	weighted avg
Nourished Oceanfront	495+00 - 1025+00	53,000	0.1	2.0	4.4	4.6	3.7	5.8	-3.8
Total Monitored Oceanfront	430+00 - 1200+00	77,000	8.5	2.1	5.4	8.1	8.9	10.9	-0.2

Table 6-2. Nags Head Cumulative Volume Change Statistics (2020 – 2021)

2020 vs. 2021 (Total Change)	Transects	Reach Length	cumulative volume change above +6 ft NAVD88	cumulative volume change above +1.18 ft NAVD88	cumulative volume change above -6 ft NAVD88	cumulative volume change above -14 ft NAVD88	cumulative volume change above -19 ft NAVD88	cumulative volume change above -30 ft NAVD88
Reach	#	ft	cy	cy	cy	cy	cy	cy
Nags Head - North	430+00 - 495+00	6,500	16,348	43,028	109,695	37,296	59,014	5,411
Nags Head - Reach 1	495+00 - 790+00	29,500	77,319	177,696	176,619	209,487	208,249	16,916
Nags Head - Reach 2	790+00 - 920+00	13,000	29,539	57,186	150,932	99,834	140,508	-23,763
Nags Head - Reach 3N	920+00 - 975+00	5,500	2,575	14,414	-19,915	-33,545	-14,863	-100,221
Nags Head - Reach 3S	975+00 - 1010+00	3,500	-1,964	-10,633	-50,393	-63,614	-37,895	-92,418
Nags Head - Reach 4	1010+00 - 1025+00	1,500	-3,048	-6,959	-18,765	-22,191	7,724	-9,120
National Seashore - North	1025+00 - 1200+00	17,500	38,629	138,230	271,727	452,381	471,822	184,188
	Transects	Reach Length	total	total	total	total	total	total
Nourished Oceanfront	495+00 - 1025+00	53,000	104,422	231,703	238,477	189,972	303,722	-208,606
Total Monitored Oceanfront	430+00 - 1200+00	77,000	159,398	412,962	619,899	679,648	834,558	-19,007

During the 2020-2021 monitoring period Reach 1 and Reach 2 shorelines observed minor seaward advancements whereas Reach 3-North shoreline slightly retreated. Among the nourished reaches Reach 3-South and Reach 4 experienced higher recession rates. Shorelines along the Nags Head-North reach and the National Seashore-North reach to the north and south of the Nourished Oceanfront both experienced seaward advancements.

The Nourished Oceanfront and Total Monitored Oceanfront both experienced gains in material along all the analyzed elevations except -30 ft NAVD88. A majority of the volume gains can be attributed to continuing recovery of the beach following Hurricane Dorian during a calmer summer 2020 – summer 2021 wave climate compared to the previous monitoring period. In all management reaches except Reach 3-North and Reach 3-South, material gain was observed above -19 ft NAVD88 indicating that the material remained within the system. The maximum material gain was observed above -19 ft NAVD88 with a 303,722 cy increase along the Nourished Oceanfront. Over the Total Monitored Oceanfront, approximately 834,558 cy was gained above -19 ft NAVD88, with 56.5% of the material gain occurring in the National Seashore-North reach. The significant material gain in the National Seashore-North reach can likely be attributed to the littoral transport of material to the south from Reach 3-North, Reach 3-South and Reach 4, within which volume losses extending above -19 ft NAVD88 were observed.

The long-term dune erosion locations, determined during the 2019-2020 monitoring effort remained the same during the current monitoring period. The first location is observed at Reach 1, between East Hollowell Street and East Soundside Road. The second area covered the south part of the monitoring area starting from the hotspot location at Reach 3-South and extending south through Reach 4.

7.0 REFERENCES

Coastal Science & Engineering Inc. (CSE), 2018. Monitoring and Analyses of the 2011 Nags Head Beach Nourishment Project. Year 7 (2018) Beach Monitoring Report for Town of Nags Head., NC. Columbia, SC. October 2018.

Moffatt & Nichol (MN), 2020. Town of Nags Head Beach Monitoring Analysis Program. 2020 Summer Annual Monitoring Survey Evaluation. Raleigh, NC. October 2020.

APPENDIX A

MCKIM & CREED SURVEY REPORT





August 5, 2021

TOWN OF NAGS HEAD, NORTH CAROLINA BEACH MONITORING SURVEY

GENERAL SCOPE OF WORK

The work under the Task Order shall consist of performing topographic and hydrographic surveys along 125 historic profile lines and another 48 optional lines, bringing the number of lines to be surveyed to a total of 173.

SURVEY AREA

The study area starts on the North between the Town of Nags Head and Kill Devil Hills and ends South at Oregon Inlet. This area has total linear distance of approximately 18 statute miles.

PLANNING

On July 12th, 2021, McKim & Creed held a meeting to discuss the scope of work entailing the 173 beach monitoring profiles survey to be conducted in Nags Head, North Carolina. In the three weeks prior to the meeting preparations started to get the boat ready, arrange accommodations, gather control point information, create line files, etc.

FIELD WORK

The field team started monitoring the weather conditions in the beginning of June to decide when it would be the best time to mobilize to the survey area. Multiple field crews traveled to the survey area on June 12th and started surveying on July 13th 2021.

All profile lines were surveyed from July 13th to July 20th 2021, and on August 5th 2021. Below is the timeline for the field work.



DATE	ACTIVITIES
07/12/2021	Scope Meeting at the office before departing. Three survey crews mobilized to the job site.
07/13/2021	Survey was performed on lines: Topo – 660+00 to 765+00 Wade - 725+00 to 765+00 Hydro – 570+00 to 765+00
07/14/2021	Survey was performed on lines: Topo – 545+00 to 655+00 Wade – 500+00 to 560+00, 680+00 to 720+00 Hydro – 430+00 to 575+00, 770+00 to 825+00
07/15/2021	Survey was performed on lines: Wade – 610+00 to 675+00 Hydro – 830+00 to 995+00
07/16/2021	Survey was performed on lines: Topo – 430+00 to 495+00, and 770+00 to 835+00 Wade – 450+00 to 495+00, 565+00, 575+00, 585+00, 600+00 to 605+00, and 770+00 to 845+00
07/17/2021	Survey was performed on lines: Topo – 500+00 to 540+00, and 840+00 to 927+50 Wade – 430+00 to 445+00
07/18/2021	Survey was performed on lines: Topo – 930+00 to 965+00, and 977+50 to 997+50 Wade – 840+00 to 920+00, and 935+00 to 997+50
07/19/2021	Survey was performed on lines: Topo – 967+50 to 975+00, and 1000+00 to 1017+50 Wade – 860+00, 922+50 to 932+50, and 1000+00 to 1100+00 Hydro – 997+50 to 1005+00
07/20/2021	Survey was performed on lines: Topo – 1020+00 to 1290+00 Wade – 1100+00 to 1290+00 Hydro – 895+00, 997+50, 1000+00 to 1290+00
07/21/2021	Crew demobilized from survey area.

8/5/2021

A crew member returned to the survey area to take extra shot points landward on lines 520+00, 555+00, 565+00, 610+00, 660+00, 670+00, 770+00, 942+50, 965+00, 972+50, 977+50, 1015+00.

Special considerations:

- Line 872+00 was ran in place of 875+00 due to Jennette's pier online.
- There is a groin close to line 555+00, 1022+50
- Line 1250+00 was shortened due to sand bar online
- Line 1290+00 had a very strong current inshore
- Line 555+00 has a gap of 45 feet between wade and hydro due to strong rip current at location.
- Line 1170+00 has a gap on land data of approximately 60' due to bird's sanctuary.
- Lines 1025+00 to 1290+00 are inside the Cape Hatteras National Seashore and the National Park requires a permit to enter.

LIST OF EQUIPMENT USED DURING THE SURVEY

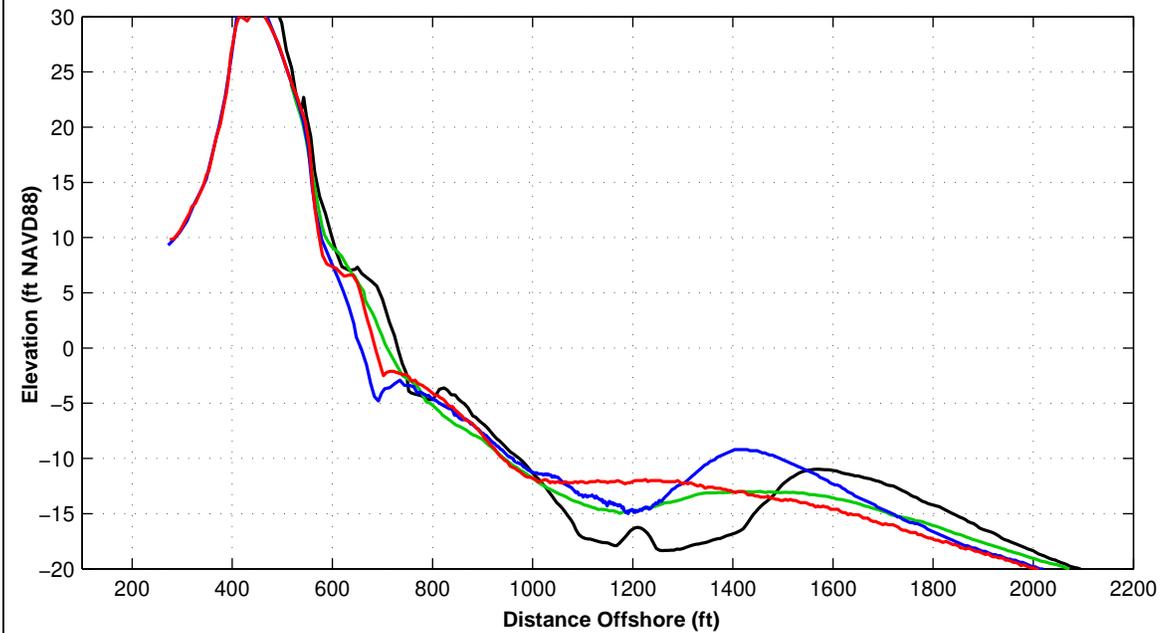
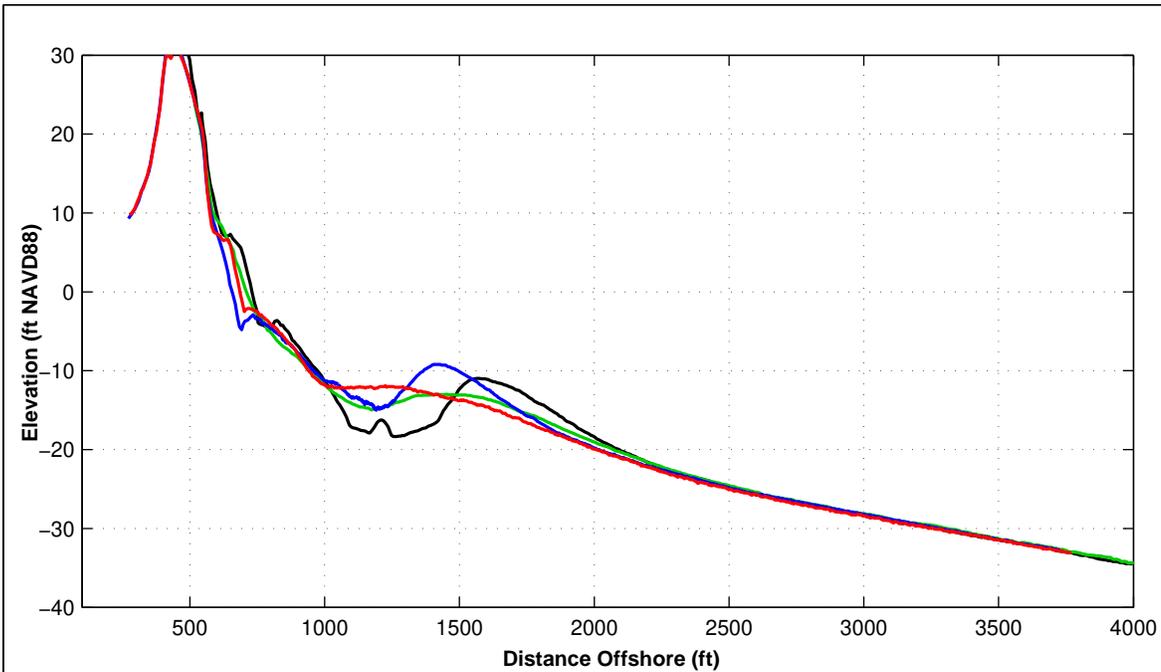
Below is a list of equipment used during the survey:

- 28' Survey Vessel Clock
- Odom CV200 and Odom transducer 200 kHz
- Applanix Pos-MV Inertia Navigation System I2NS
- Sound Velocity Profiler AML CTD Base X Profiler
- Hypack 2020/2021 for hydrographic data collection and processing
- Trimble R8 GNSS Receivers/ TSC3 data collectors
- Trimble R10 GNSS Receivers/ TSC3 data collectors

APPENDIX B

SURVEY PROFILE COMPARISON PLOTS



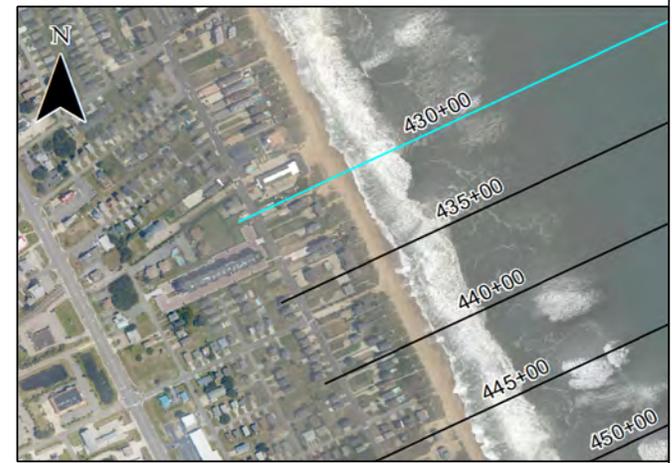


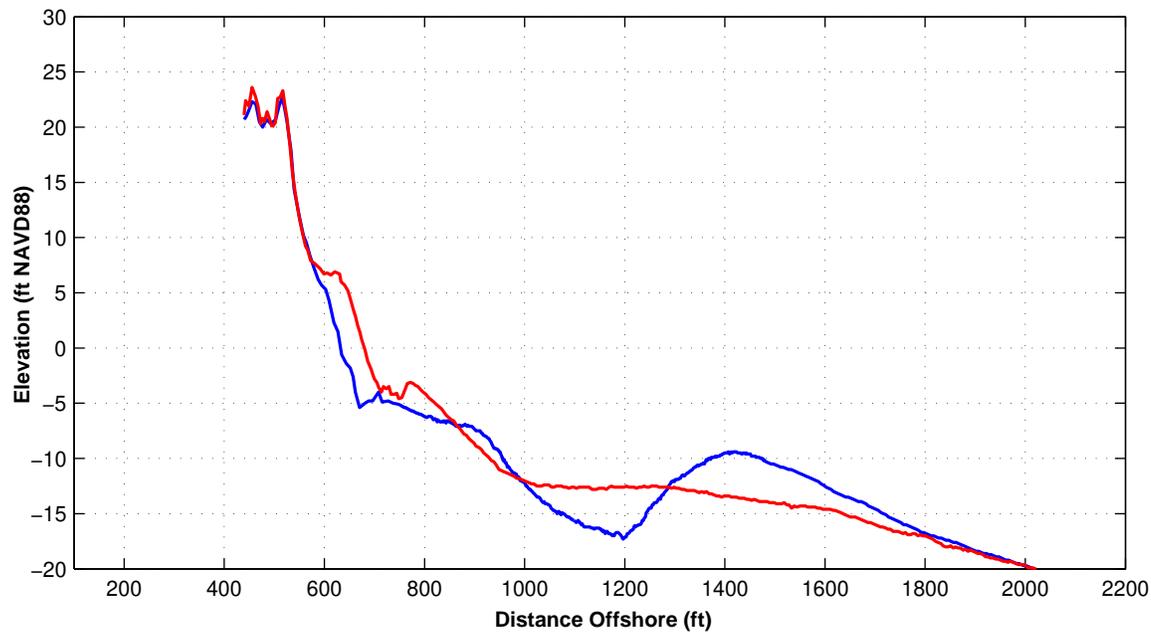
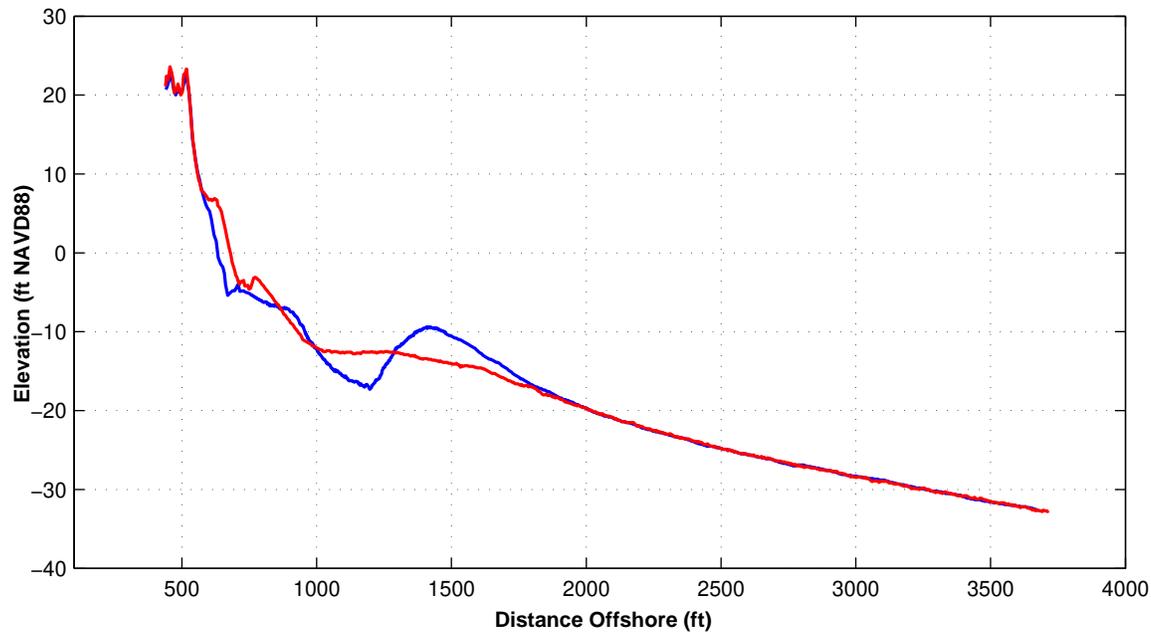
Survey Transect 430+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	-51.49 ft	31.72 ft
Volume Change Above +6 ft NAVD88	-4.32 cy/ft	0.37 cy/ft
Volume Change Above 1.18 ft NAVD88	-11.87 cy/ft	5.96 cy/ft
Volume Change Above -6 ft NAVD88	-21.77 cy/ft	15.53 cy/ft
Volume Change Above -14 ft NAVD88	21.22 cy/ft	-9.54 cy/ft
Volume Change Above -19 ft NAVD88	18.21 cy/ft	-17.77 cy/ft
Volume Change Above -30 ft NAVD88	6.67 cy/ft	-28.06 cy/ft

LEGEND:

JULY 2021		AUGUST 2019	
JUNE 2020		MAY 2018	

- Notes:
1. Station From North To South At Varying Intervals.
 2. All Survey Elevations In Feet Referenced to NAVD88.

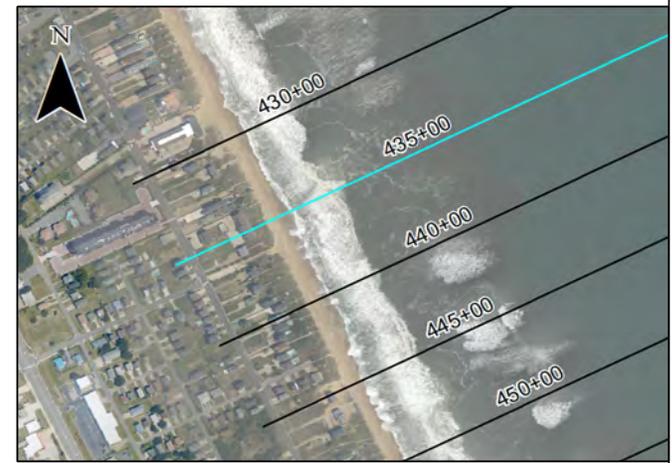


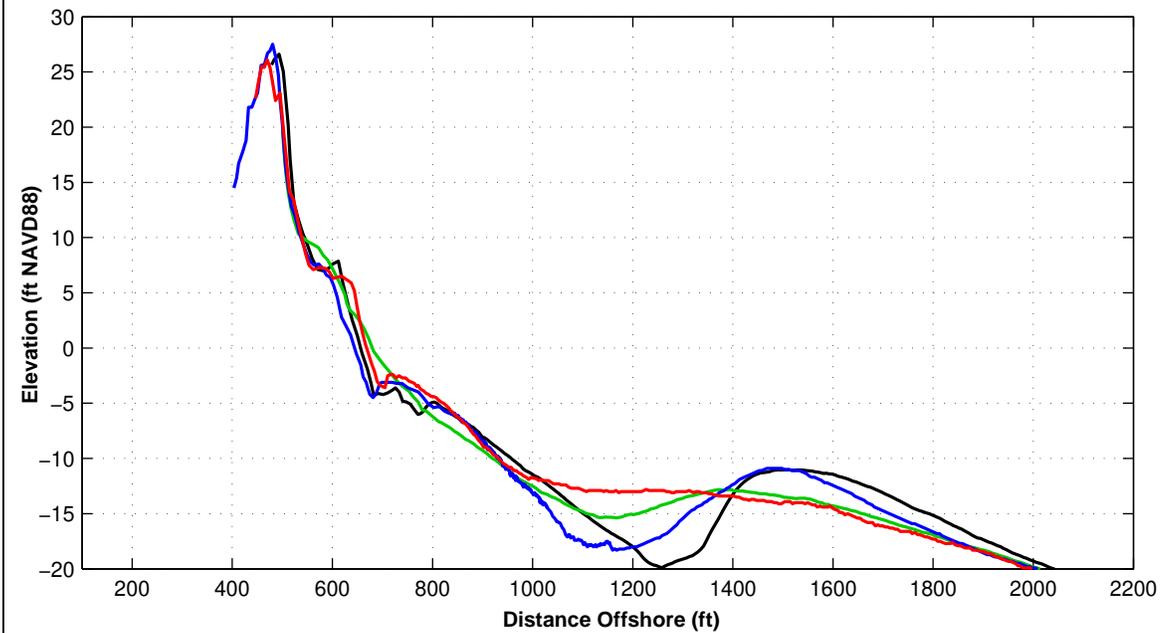
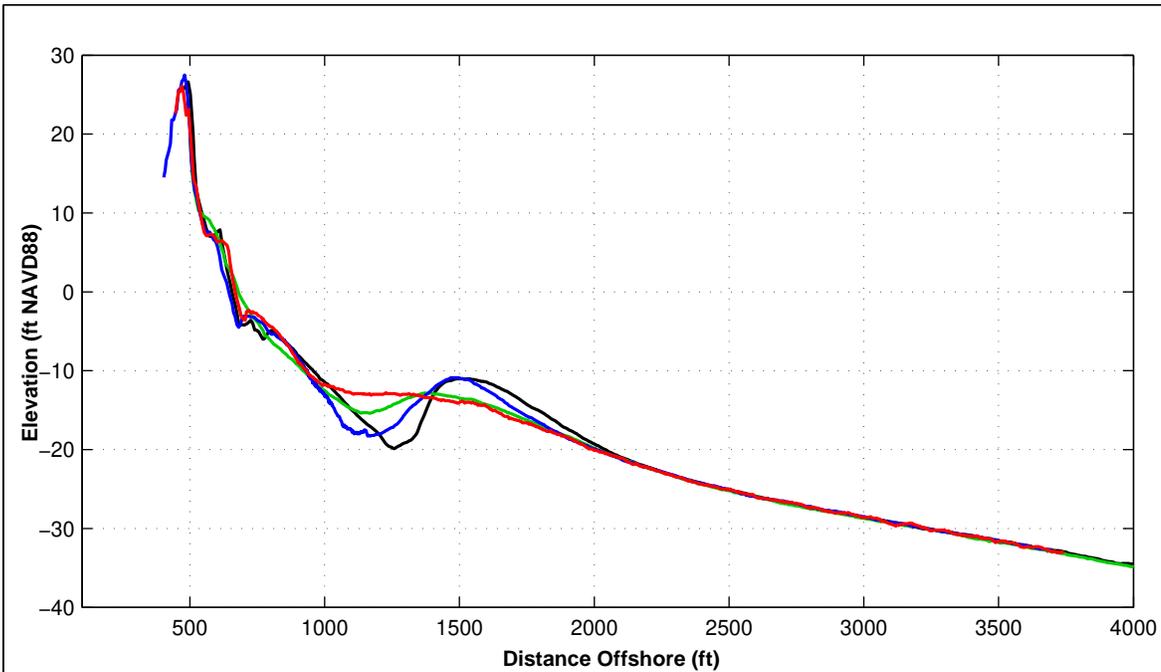


Survey Transect 435+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	– ft	44.15 ft
Volume Change Above +6 ft NAVD88	– cy/ft	1.57 cy/ft
Volume Change Above 1.18 ft NAVD88	– cy/ft	9.48 cy/ft
Volume Change Above –6 ft NAVD88	– cy/ft	26.24 cy/ft
Volume Change Above –14 ft NAVD88	– cy/ft	0.99 cy/ft
Volume Change Above –19 ft NAVD88	– cy/ft	5.44 cy/ft
Volume Change Above –30 ft NAVD88	– cy/ft	5.64 cy/ft

LEGEND:
 JULY 2021 ————
 JUNE 2020 ————

- Notes:
 1. Station From North To South At Varying Intervals.
 2. All Survey Elevations In Feet Referenced to NAVD88.



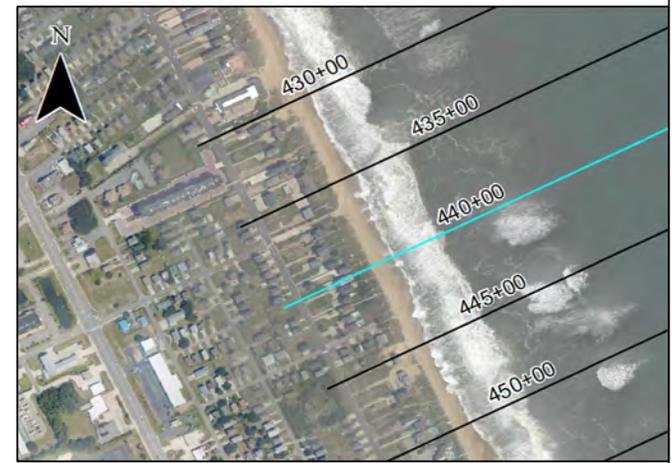


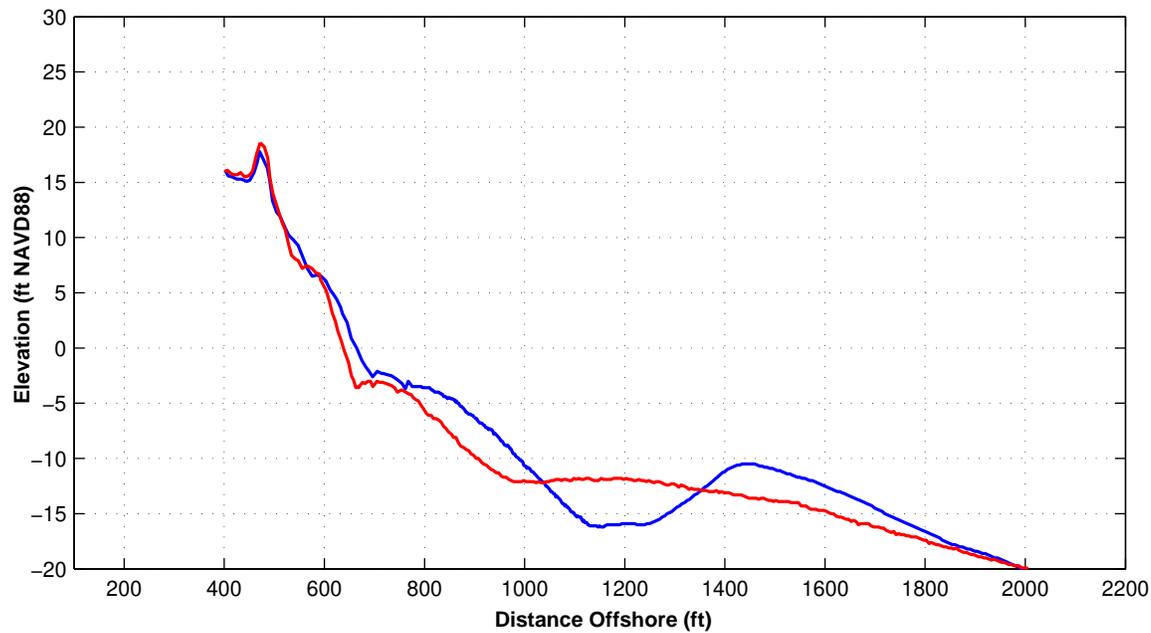
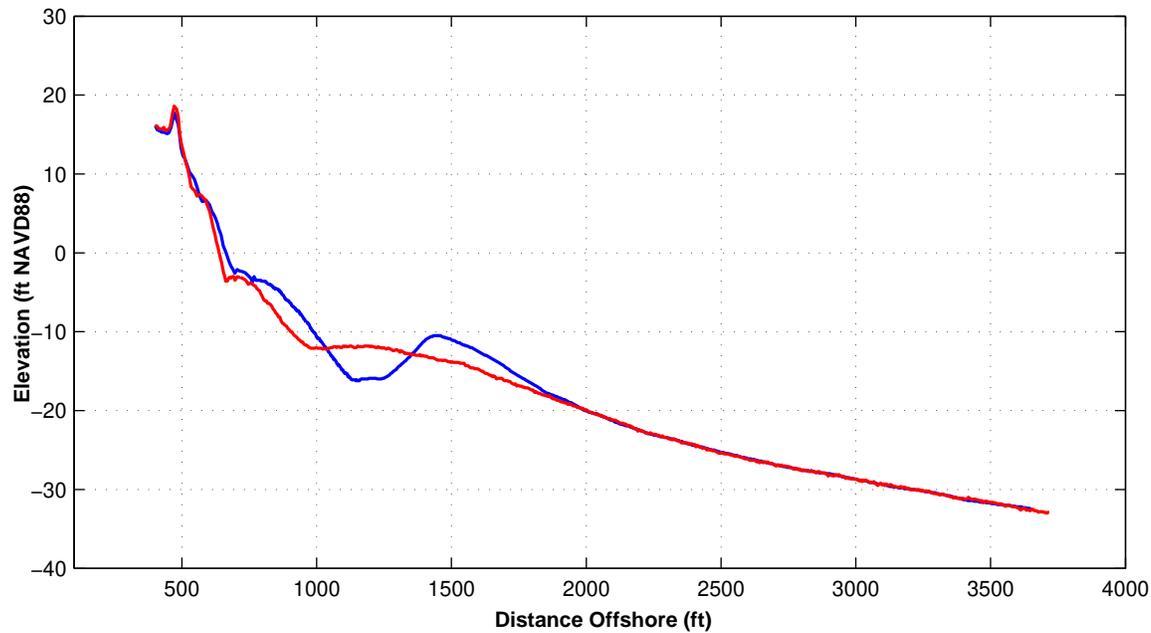
Survey Transect 440+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	-32.63 ft	24.87 ft
Volume Change Above +6 ft NAVD88	-2.82 cy/ft	-0.49 cy/ft
Volume Change Above 1.18 ft NAVD88	-6.89 cy/ft	5.58 cy/ft
Volume Change Above -6 ft NAVD88	-12.66 cy/ft	13.18 cy/ft
Volume Change Above -14 ft NAVD88	5.79 cy/ft	8.77 cy/ft
Volume Change Above -19 ft NAVD88	-15.78 cy/ft	32.02 cy/ft
Volume Change Above -30 ft NAVD88	-11.62 cy/ft	30.84 cy/ft

LEGEND:

JULY 2021	—	AUGUST 2019	—
JUNE 2020	—	MAY 2018	—

- Notes:
1. Station From North To South At Varying Intervals.
 2. All Survey Elevations In Feet Referenced to NAVD88.

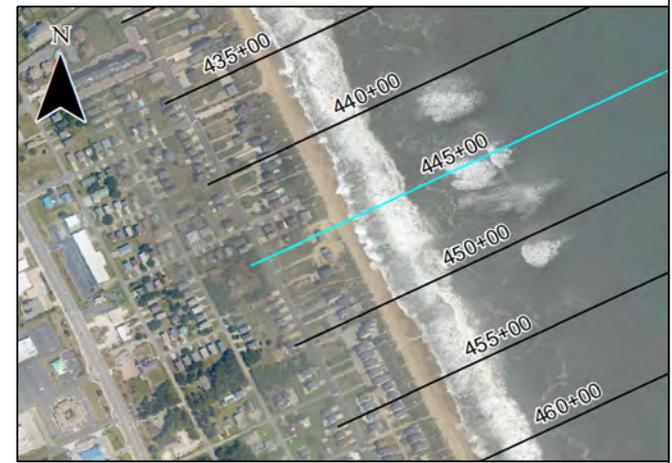


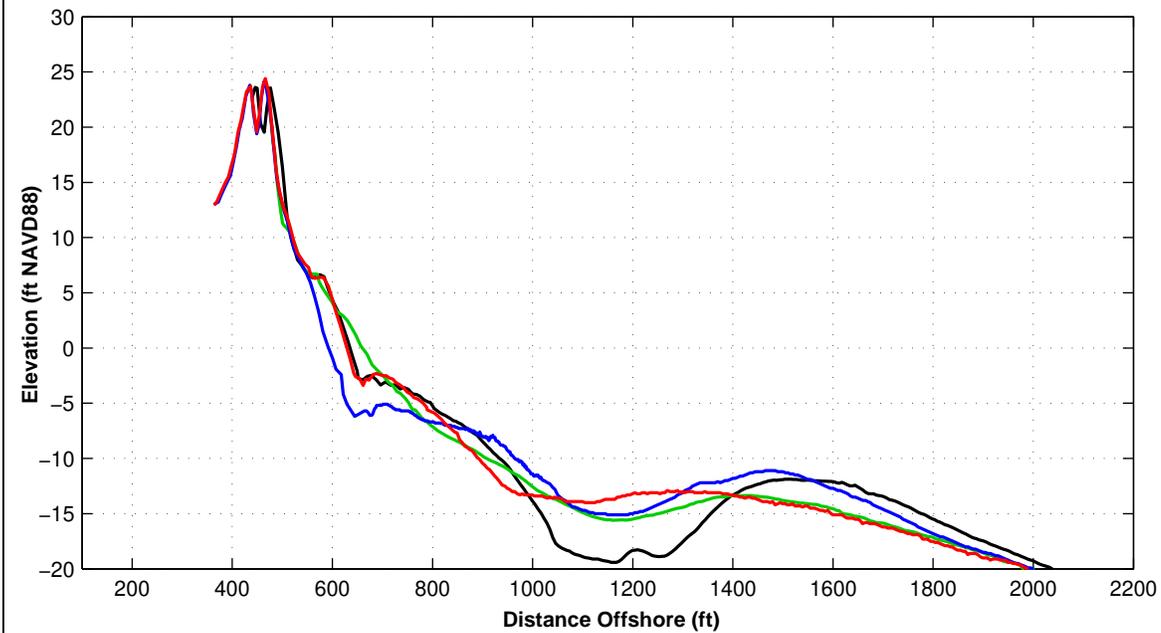
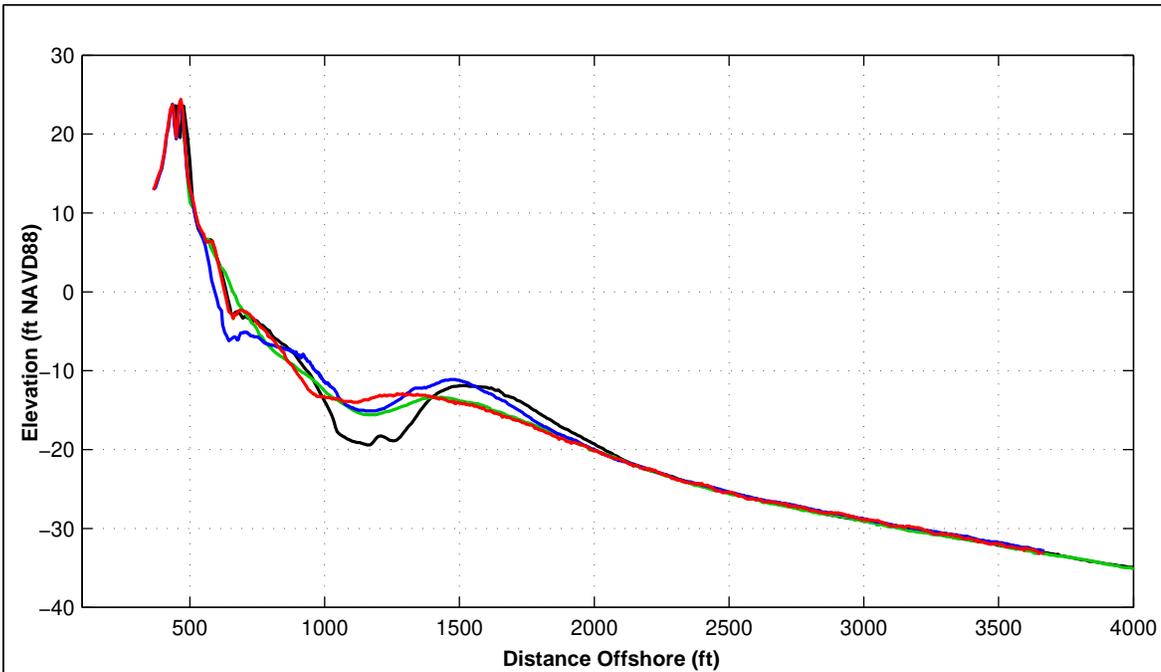


Survey Transect 445+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	– ft	–22.40 ft
Volume Change Above +6 ft NAVD88	– cy/ft	–0.33 cy/ft
Volume Change Above 1.18 ft NAVD88	– cy/ft	–3.46 cy/ft
Volume Change Above –6 ft NAVD88	– cy/ft	–17.02 cy/ft
Volume Change Above –14 ft NAVD88	– cy/ft	–37.75 cy/ft
Volume Change Above –19 ft NAVD88	– cy/ft	–37.43 cy/ft
Volume Change Above –30 ft NAVD88	– cy/ft	–37.71 cy/ft

LEGEND:
 JULY 2021 ————
 JUNE 2020 ————

- Notes:
1. Station From North To South At Varying Intervals.
 2. All Survey Elevations In Feet Referenced to NAVD88.



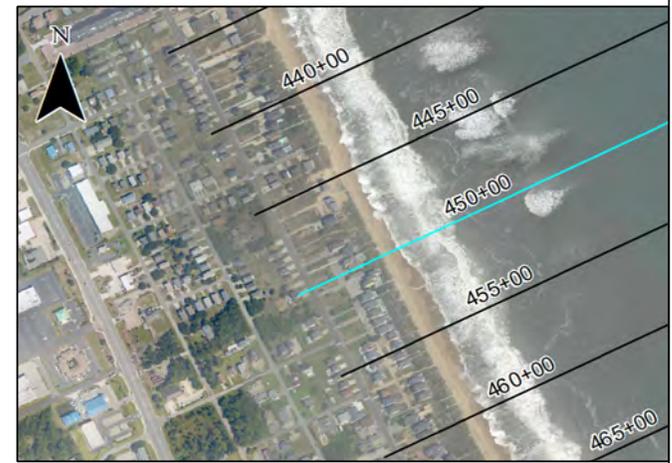


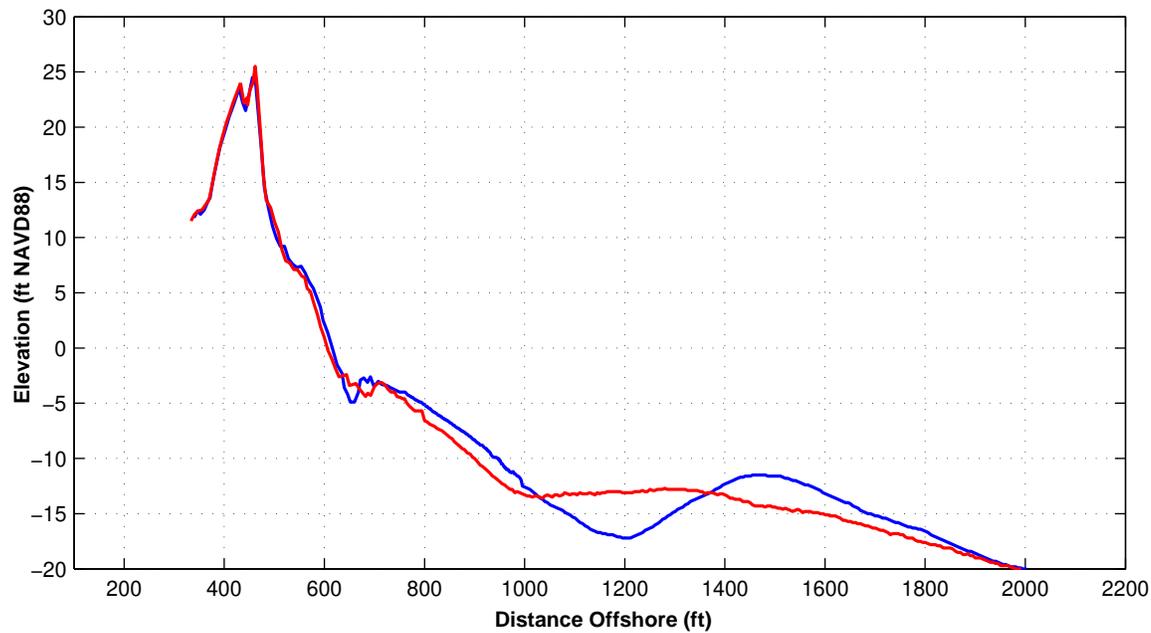
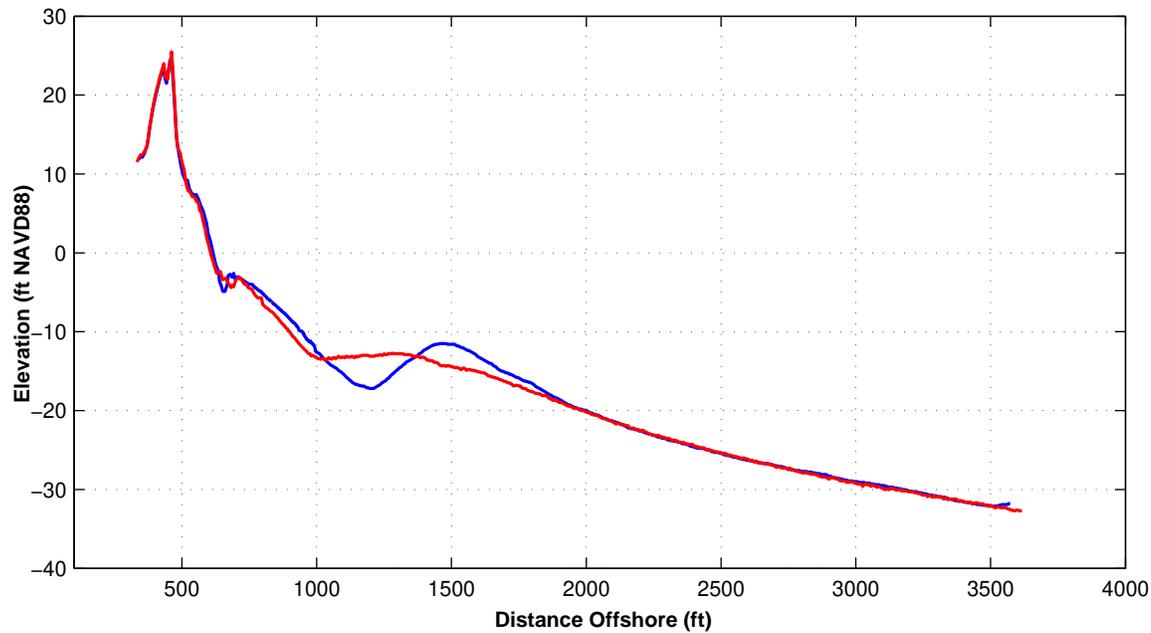
Survey Transect 450+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	-63.15 ft	37.79 ft
Volume Change Above +6 ft NAVD88	-0.08 cy/ft	1.99 cy/ft
Volume Change Above 1.18 ft NAVD88	-7.08 cy/ft	8.25 cy/ft
Volume Change Above -6 ft NAVD88	-29.60 cy/ft	28.09 cy/ft
Volume Change Above -14 ft NAVD88	6.75 cy/ft	-5.32 cy/ft
Volume Change Above -19 ft NAVD88	20.18 cy/ft	-13.74 cy/ft
Volume Change Above -30 ft NAVD88	28.85 cy/ft	-16.30 cy/ft

LEGEND:

JULY 2021	—	AUGUST 2019	—
JUNE 2020	—	MAY 2018	—

- Notes:
1. Station From North To South At Varying Intervals.
 2. All Survey Elevations In Feet Referenced to NAVD88.



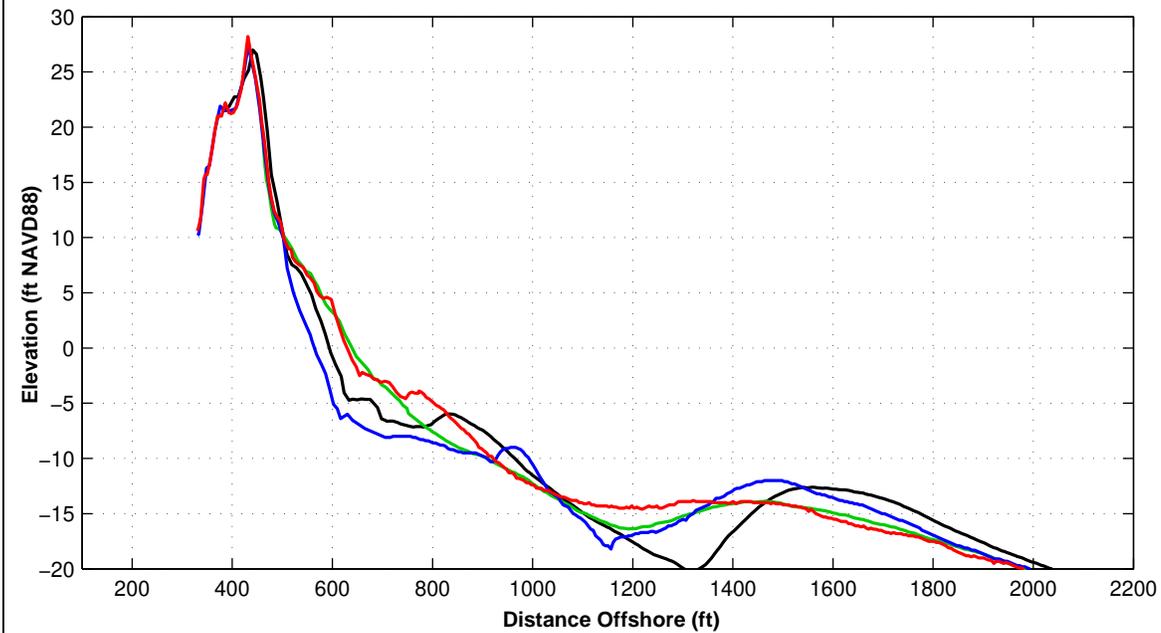
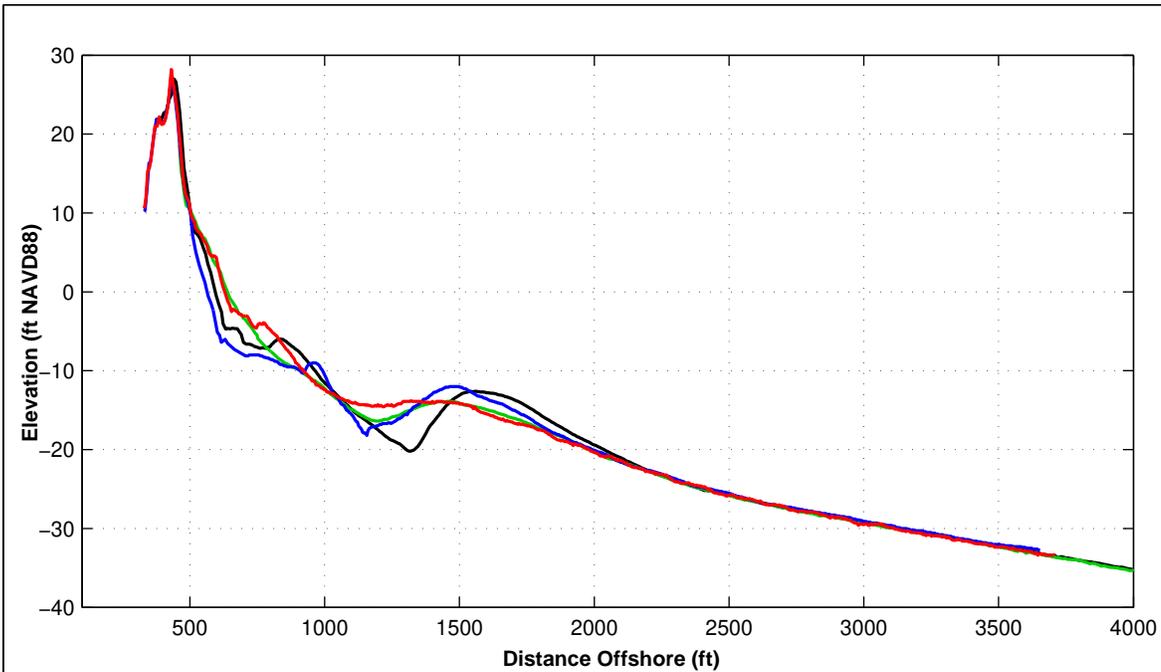


Survey Transect 455+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	– ft	–10.19 ft
Volume Change Above +6 ft NAVD88	– cy/ft	0.52 cy/ft
Volume Change Above 1.18 ft NAVD88	– cy/ft	–1.19 cy/ft
Volume Change Above –6 ft NAVD88	– cy/ft	–4.38 cy/ft
Volume Change Above –14 ft NAVD88	– cy/ft	–20.59 cy/ft
Volume Change Above –19 ft NAVD88	– cy/ft	–15.56 cy/ft
Volume Change Above –30 ft NAVD88	– cy/ft	–17.89 cy/ft

LEGEND:
 JULY 2021 ————
 JUNE 2020 ————

- Notes:
 1. Station From North To South At Varying Intervals.
 2. All Survey Elevations In Feet Referenced to NAVD88.



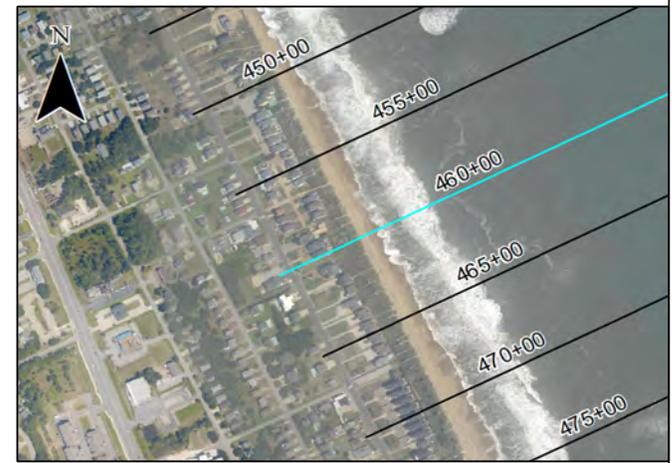


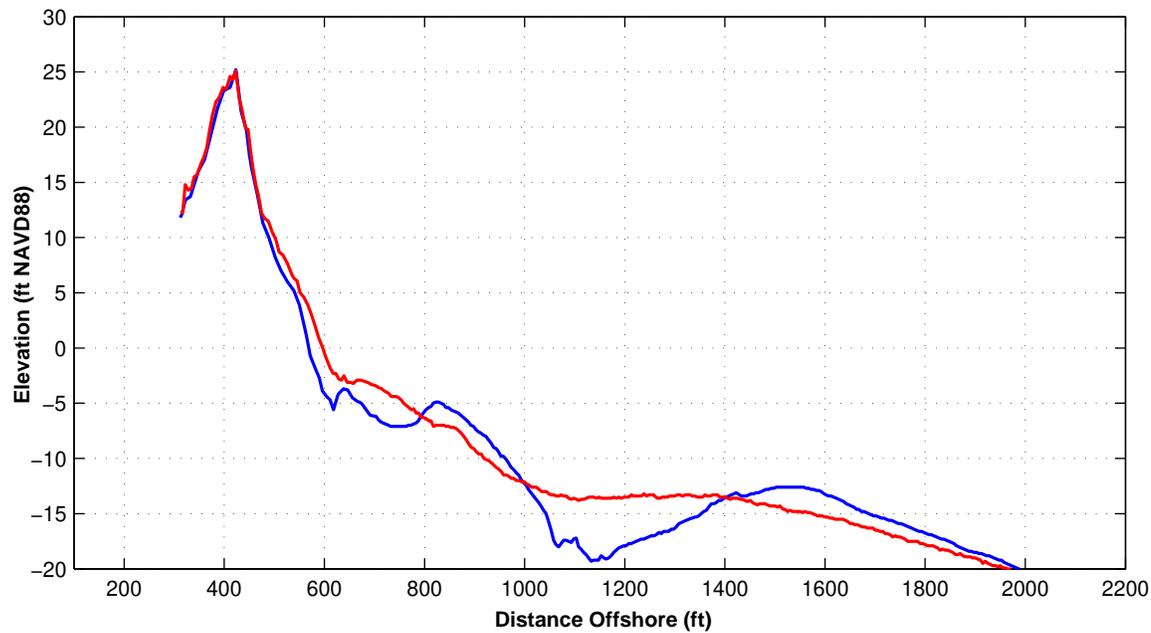
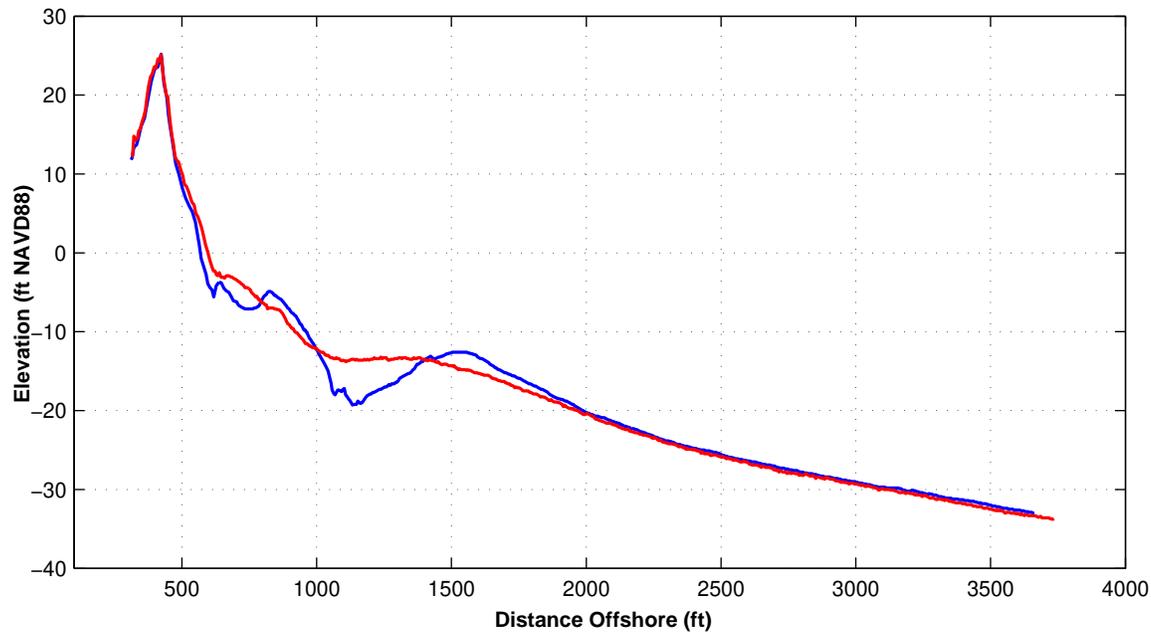
Survey Transect 460+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	-69.42 ft	63.07 ft
Volume Change Above +6 ft NAVD88	-2.83 cy/ft	4.30 cy/ft
Volume Change Above 1.18 ft NAVD88	-13.72 cy/ft	15.27 cy/ft
Volume Change Above -6 ft NAVD88	-40.31 cy/ft	45.16 cy/ft
Volume Change Above -14 ft NAVD88	-33.10 cy/ft	46.74 cy/ft
Volume Change Above -19 ft NAVD88	-30.08 cy/ft	51.95 cy/ft
Volume Change Above -30 ft NAVD88	-21.58 cy/ft	45.77 cy/ft

LEGEND:

JULY 2021	—	AUGUST 2019	—
JUNE 2020	—	MAY 2018	—

- Notes:
1. Station From North To South At Varying Intervals.
 2. All Survey Elevations In Feet Referenced to NAVD88.

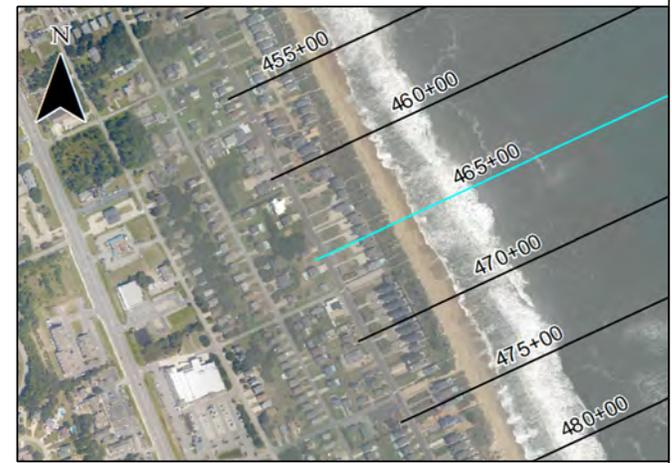


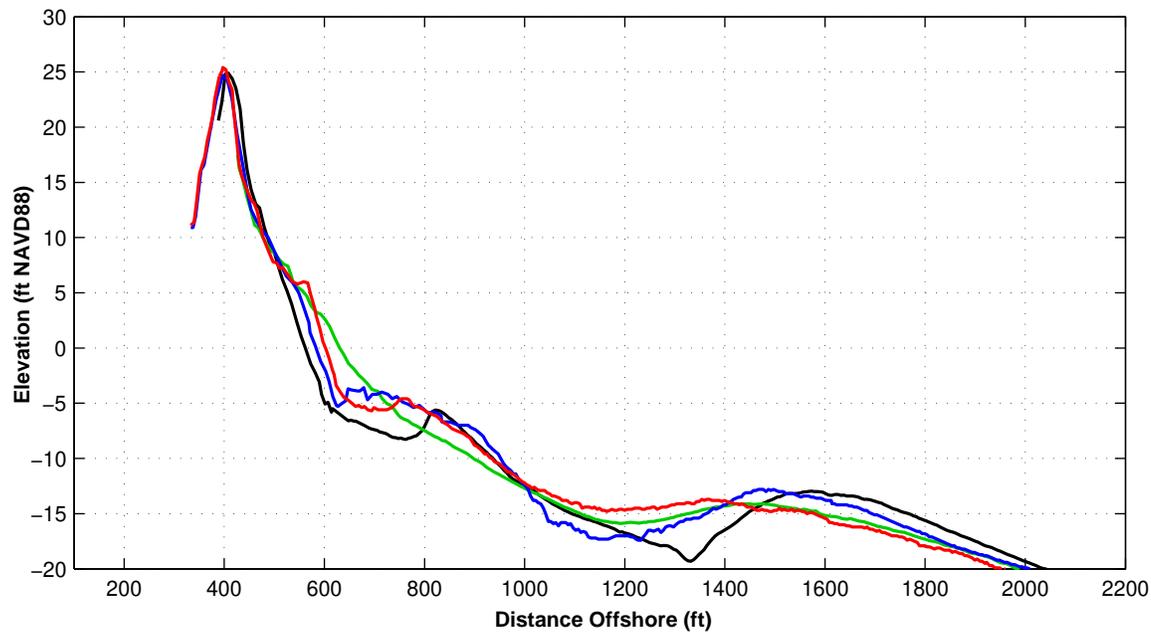
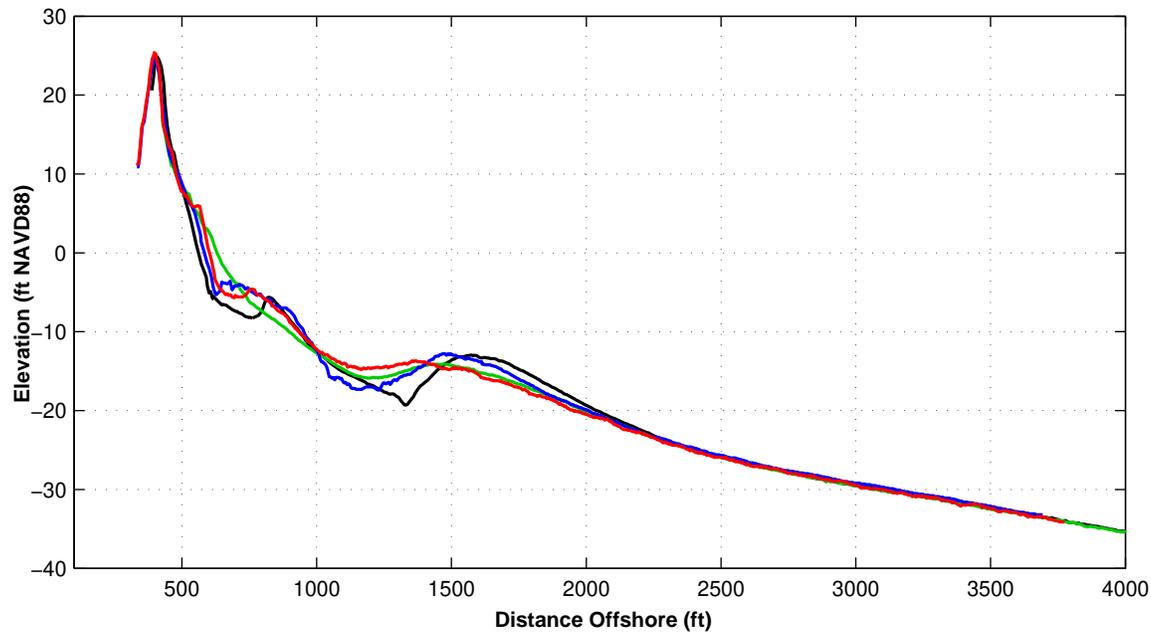


Survey Transect 465+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	– ft	23.11 ft
Volume Change Above +6 ft NAVD88	– cy/ft	3.84 cy/ft
Volume Change Above 1.18 ft NAVD88	– cy/ft	7.04 cy/ft
Volume Change Above –6 ft NAVD88	– cy/ft	21.38 cy/ft
Volume Change Above –14 ft NAVD88	– cy/ft	15.04 cy/ft
Volume Change Above –19 ft NAVD88	– cy/ft	37.46 cy/ft
Volume Change Above –30 ft NAVD88	– cy/ft	23.57 cy/ft

LEGEND:
 JULY 2021 ————
 JUNE 2020 ————

- Notes:
1. Station From North To South At Varying Intervals.
 2. All Survey Elevations In Feet Referenced to NAVD88.

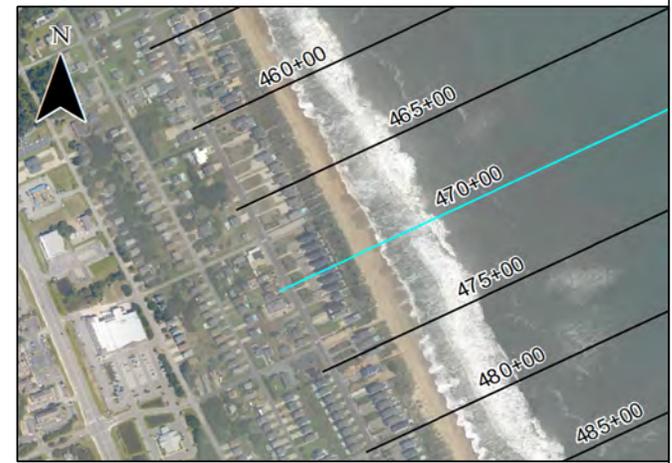


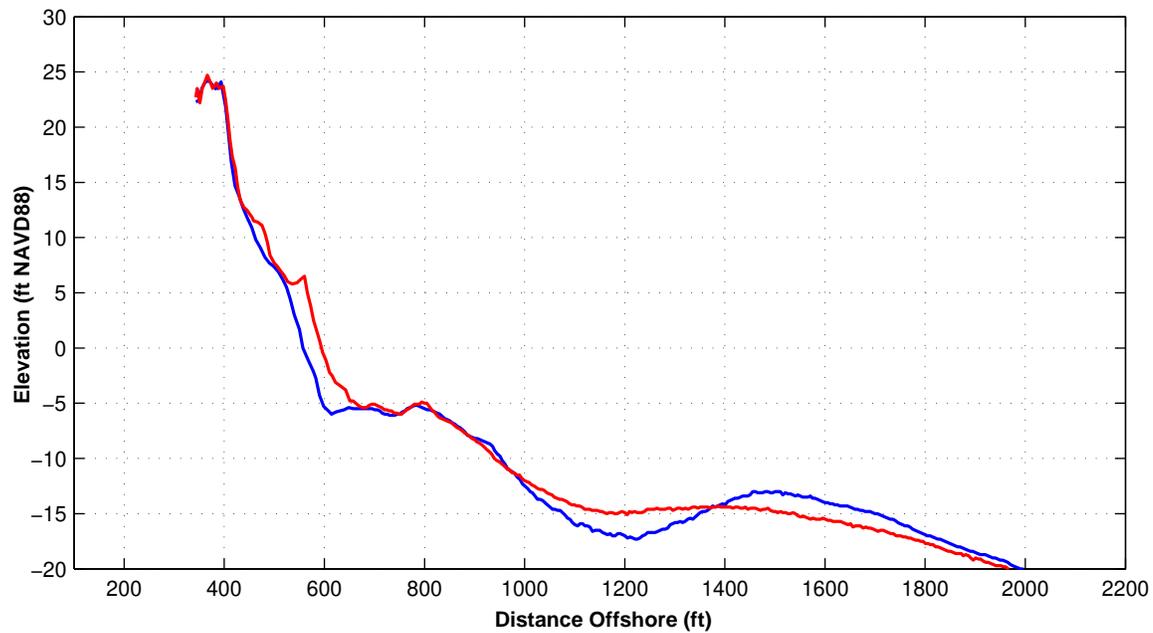
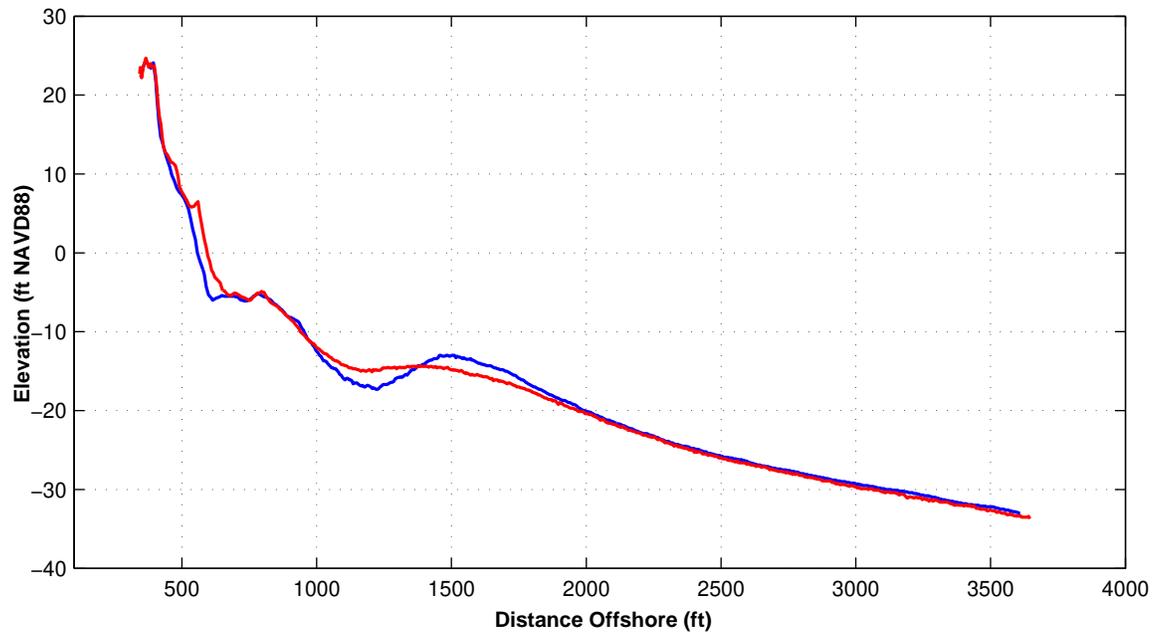


Survey Transect 470+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	-44.72 ft	20.75 ft
Volume Change Above +6 ft NAVD88	1.42 cy/ft	-0.52 cy/ft
Volume Change Above 1.18 ft NAVD88	-2.64 cy/ft	3.29 cy/ft
Volume Change Above -6 ft NAVD88	-12.02 cy/ft	2.85 cy/ft
Volume Change Above -14 ft NAVD88	7.76 cy/ft	-4.09 cy/ft
Volume Change Above -19 ft NAVD88	3.63 cy/ft	3.93 cy/ft
Volume Change Above -30 ft NAVD88	13.69 cy/ft	-9.84 cy/ft

LEGEND:
 JULY 2021 — AUGUST 2019 —
 JUNE 2020 — MAY 2018 —

- Notes:
 1. Station From North To South At Varying Intervals.
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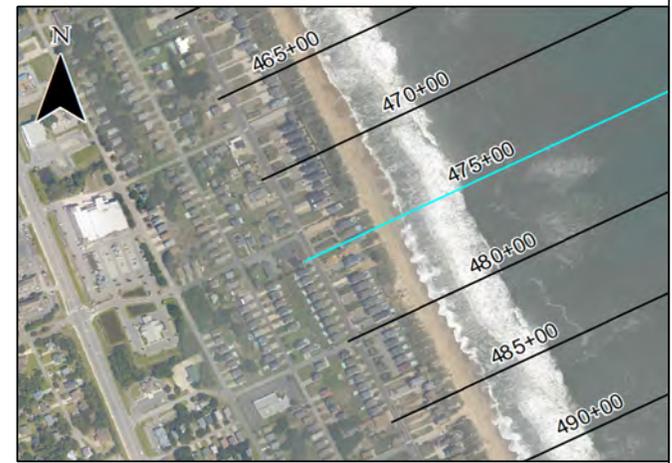


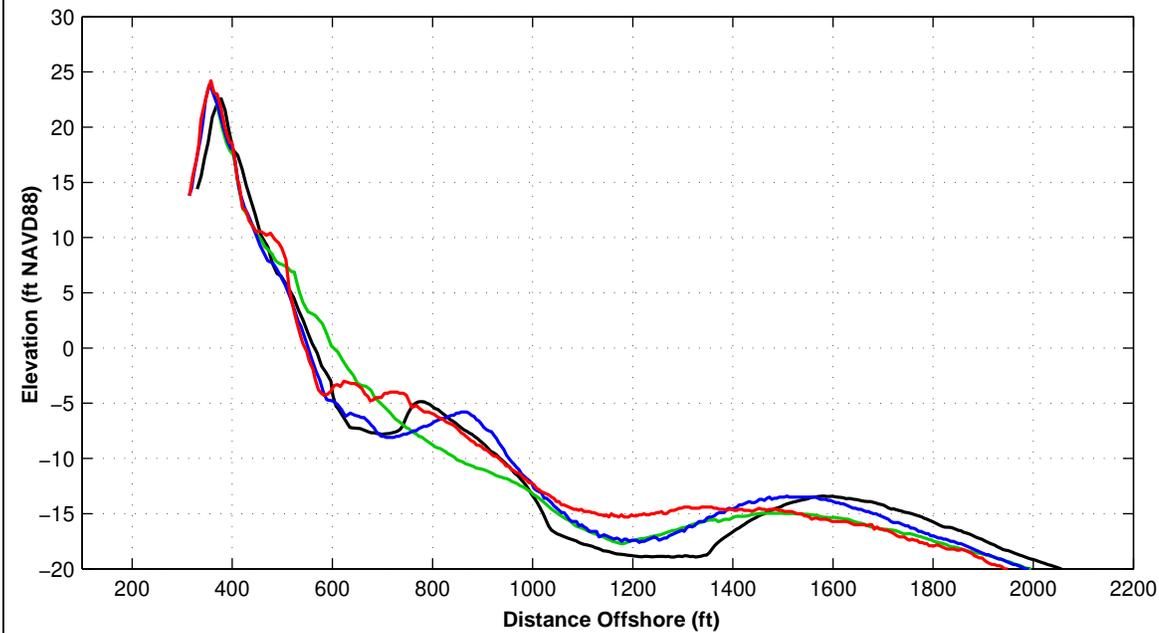
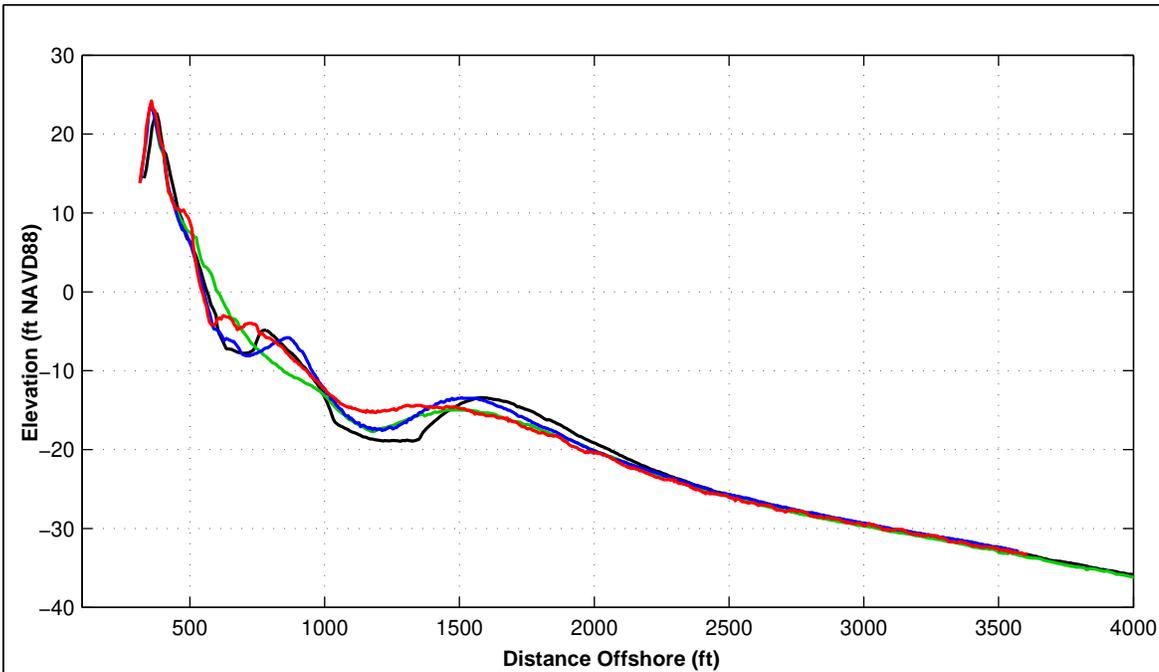


Survey Transect 475+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	– ft	34.93 ft
Volume Change Above +6 ft NAVD88	– cy/ft	4.55 cy/ft
Volume Change Above 1.18 ft NAVD88	– cy/ft	11.03 cy/ft
Volume Change Above –6 ft NAVD88	– cy/ft	23.08 cy/ft
Volume Change Above –14 ft NAVD88	– cy/ft	19.20 cy/ft
Volume Change Above –19 ft NAVD88	– cy/ft	18.40 cy/ft
Volume Change Above –30 ft NAVD88	– cy/ft	6.13 cy/ft

LEGEND:
 JULY 2021 ————
 JUNE 2020 ————

- Notes:
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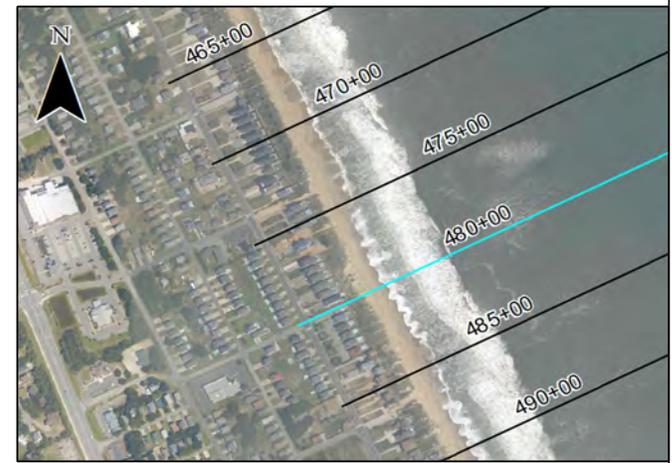


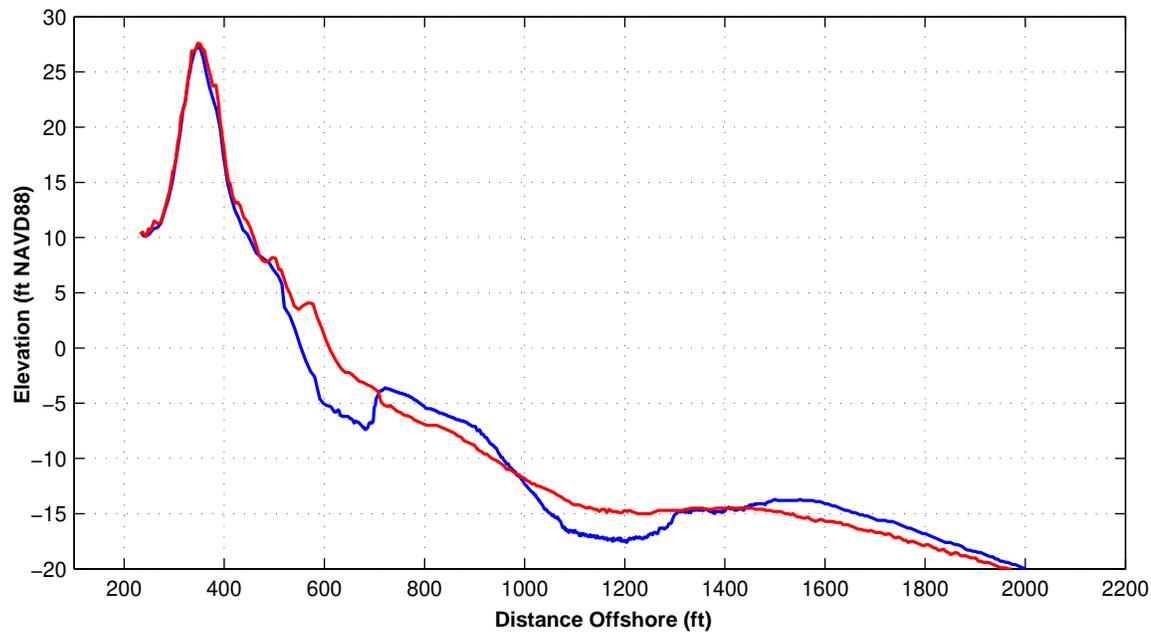
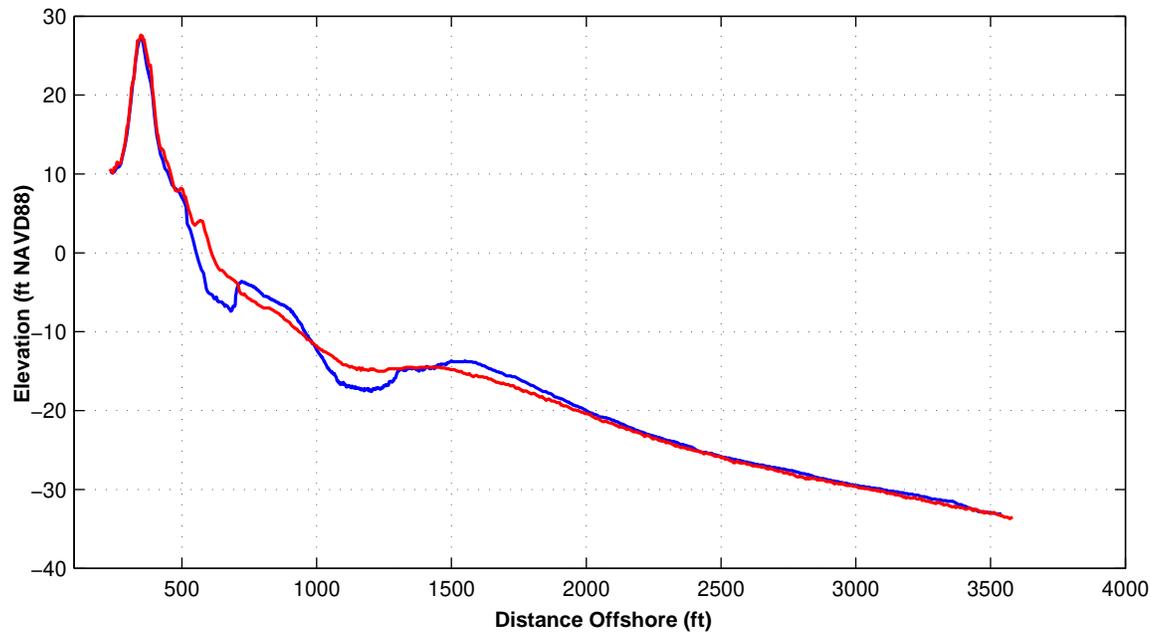
Survey Transect 480+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	-46.73 ft	-7.32 ft
Volume Change Above +6 ft NAVD88	-1.87 cy/ft	5.36 cy/ft
Volume Change Above 1.18 ft NAVD88	-7.53 cy/ft	5.26 cy/ft
Volume Change Above -6 ft NAVD88	-26.59 cy/ft	16.21 cy/ft
Volume Change Above -14 ft NAVD88	-4.74 cy/ft	14.43 cy/ft
Volume Change Above -19 ft NAVD88	13.54 cy/ft	17.21 cy/ft
Volume Change Above -30 ft NAVD88	22.98 cy/ft	3.40 cy/ft

LEGEND:

JULY 2021	—	AUGUST 2019	—
JUNE 2020	—	MAY 2018	—

- Notes:
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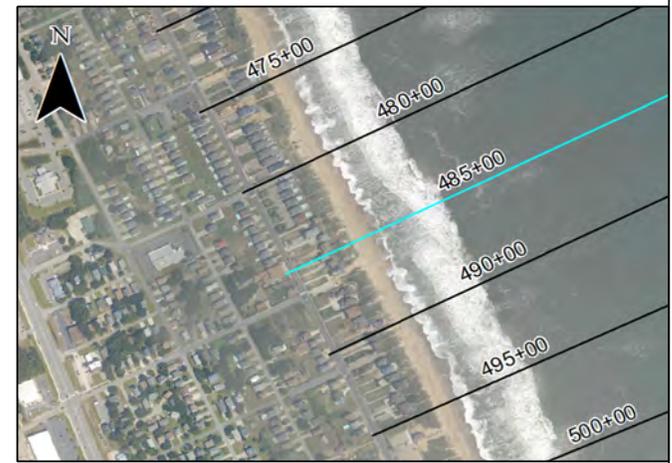


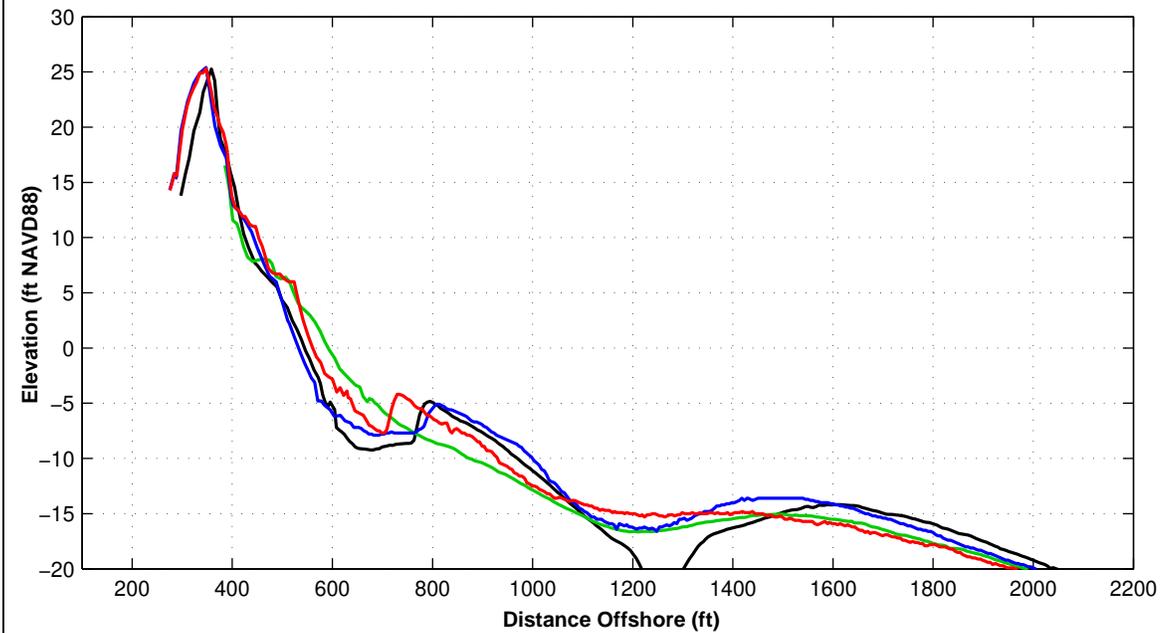
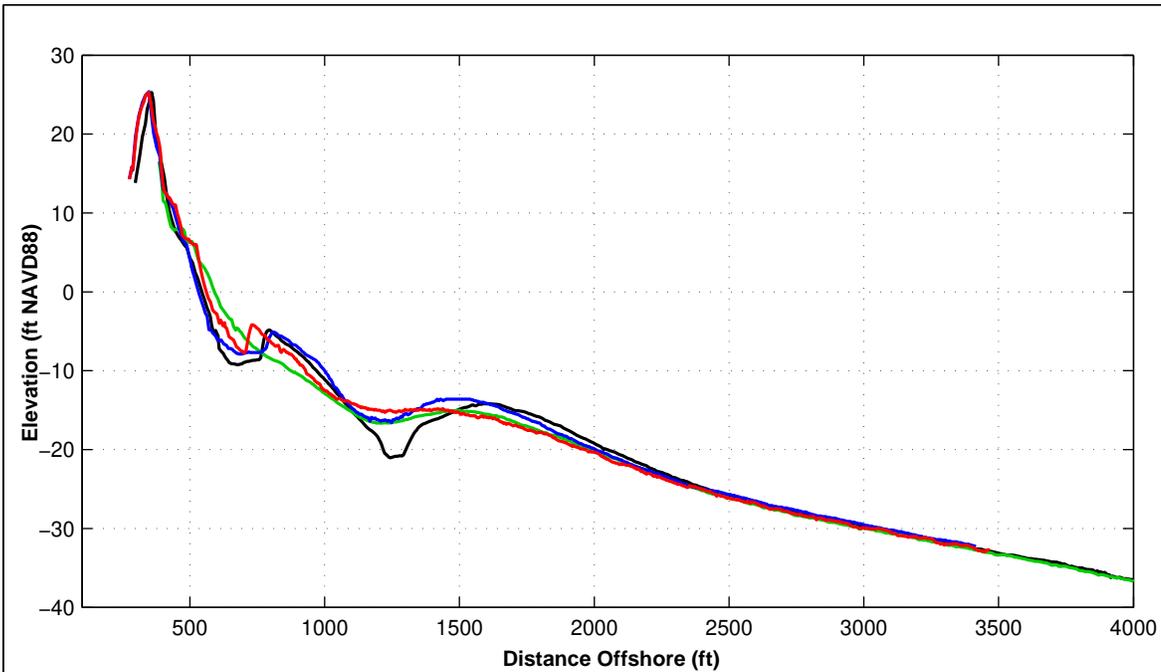


Survey Transect 485+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	– ft	54.50 ft
Volume Change Above +6 ft NAVD88	– cy/ft	5.45 cy/ft
Volume Change Above 1.18 ft NAVD88	– cy/ft	11.95 cy/ft
Volume Change Above –6 ft NAVD88	– cy/ft	27.72 cy/ft
Volume Change Above –14 ft NAVD88	– cy/ft	22.73 cy/ft
Volume Change Above –19 ft NAVD88	– cy/ft	25.43 cy/ft
Volume Change Above –30 ft NAVD88	– cy/ft	12.31 cy/ft

LEGEND:
 JULY 2021 ————
 JUNE 2020 ————

- Notes:
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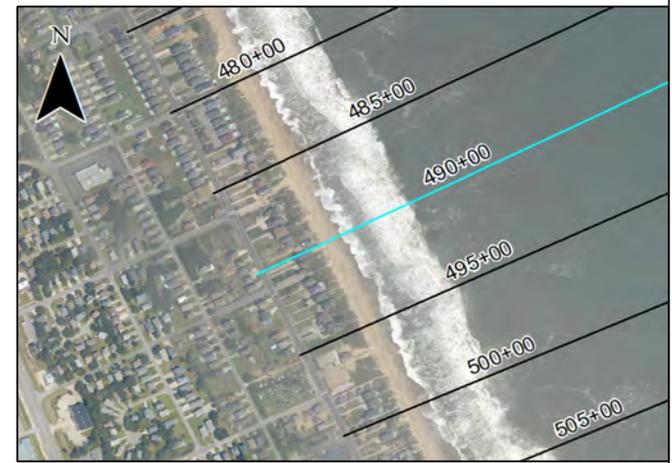


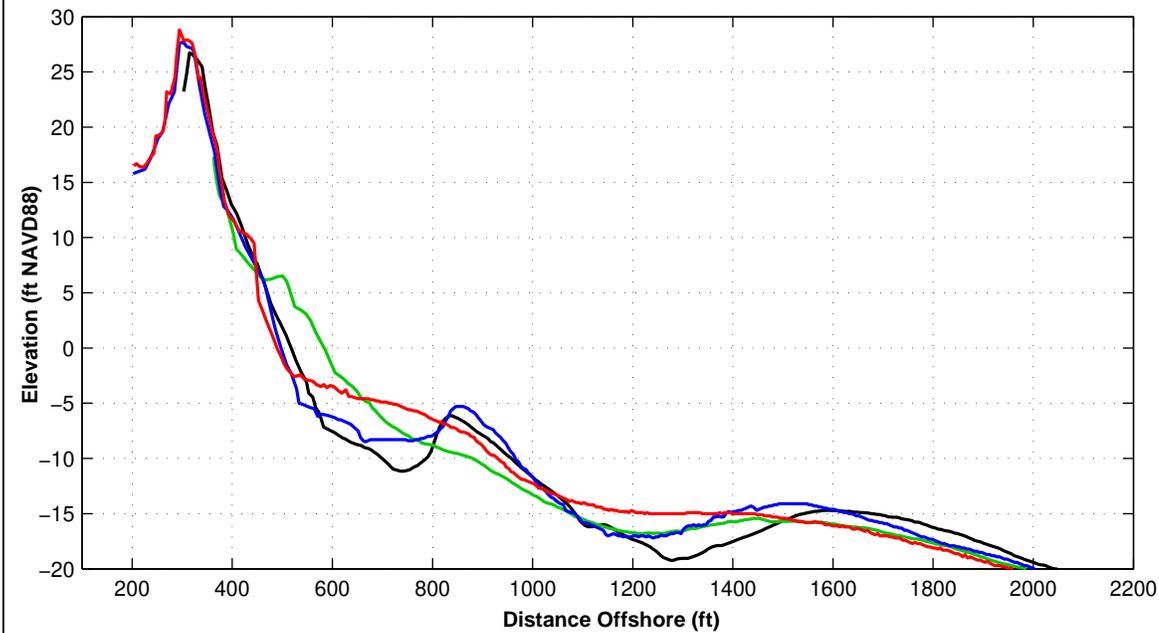
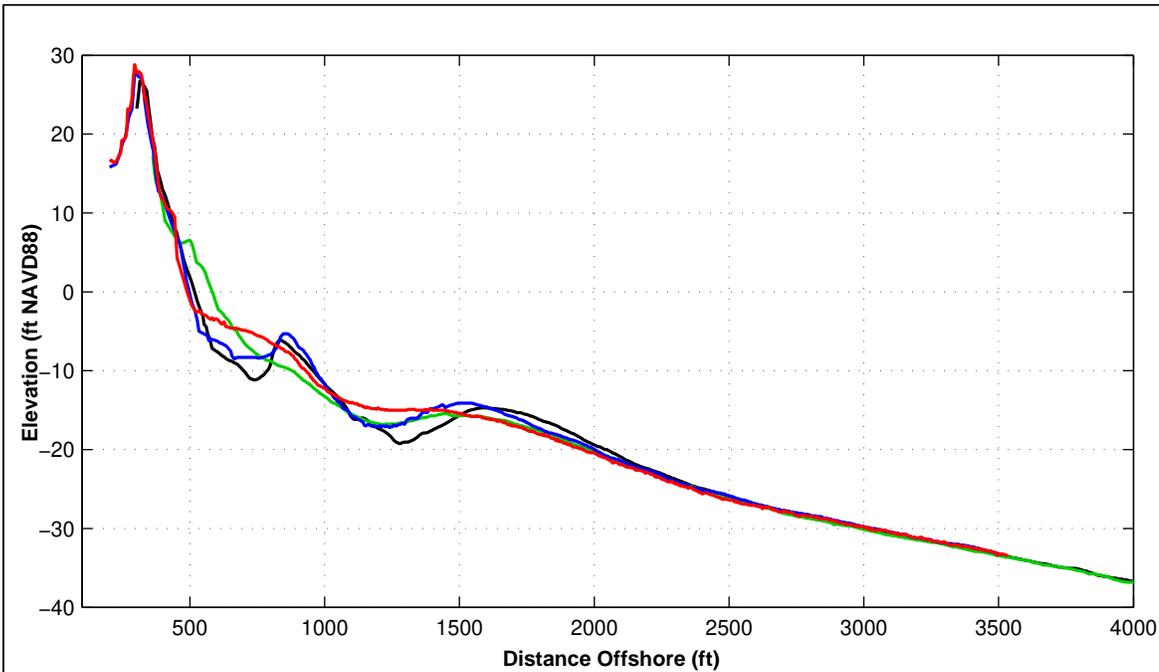
Survey Transect 490+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	-56.39 ft	28.49 ft
Volume Change Above +6 ft NAVD88	3.46 cy/ft	4.46 cy/ft
Volume Change Above 1.18 ft NAVD88	-3.64 cy/ft	10.17 cy/ft
Volume Change Above -6 ft NAVD88	-22.87 cy/ft	22.27 cy/ft
Volume Change Above -14 ft NAVD88	3.04 cy/ft	10.13 cy/ft
Volume Change Above -19 ft NAVD88	30.10 cy/ft	-7.59 cy/ft
Volume Change Above -30 ft NAVD88	43.57 cy/ft	-23.67 cy/ft

LEGEND:

JULY 2021	—	AUGUST 2019	—
JUNE 2020	—	MAY 2018	—

- Notes:
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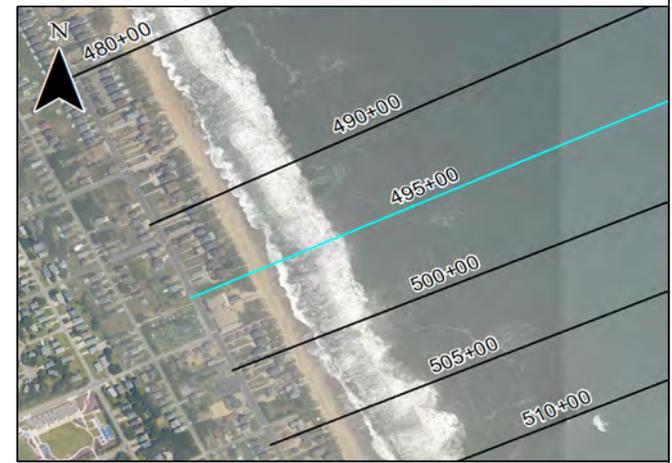


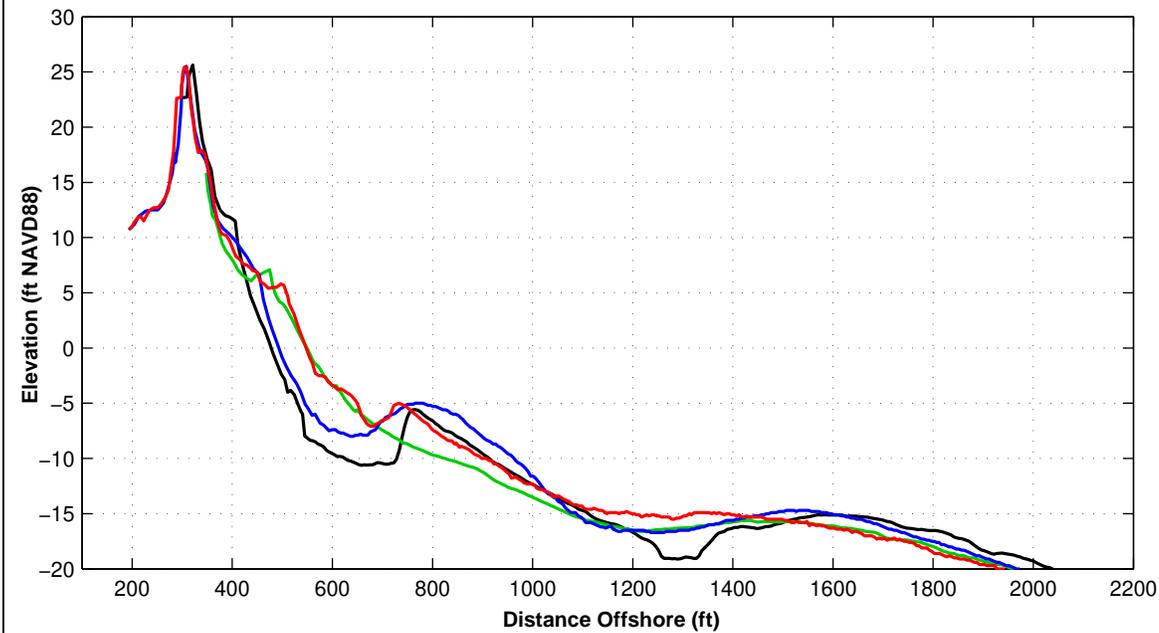
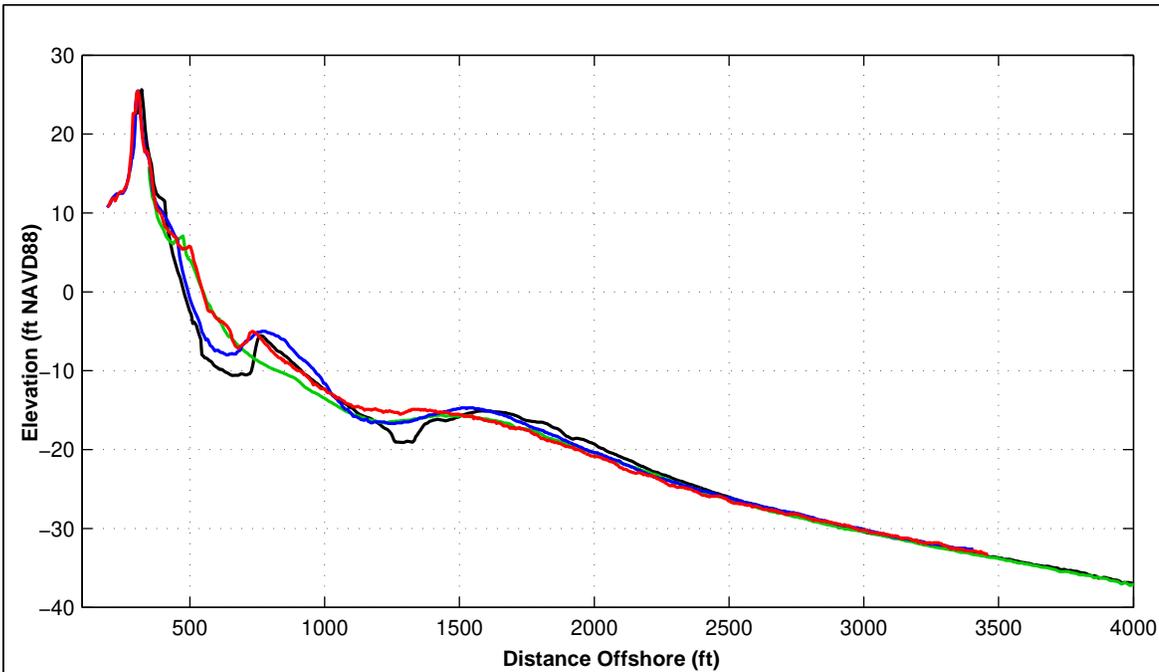
Survey Transect 495+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	-80.14 ft	-9.85 ft
Volume Change Above +6 ft NAVD88	2.65 cy/ft	3.58 cy/ft
Volume Change Above 1.18 ft NAVD88	-8.14 cy/ft	0.82 cy/ft
Volume Change Above -6 ft NAVD88	-34.42 cy/ft	13.71 cy/ft
Volume Change Above -14 ft NAVD88	-17.72 cy/ft	18.13 cy/ft
Volume Change Above -19 ft NAVD88	-0.93 cy/ft	18.78 cy/ft
Volume Change Above -30 ft NAVD88	9.36 cy/ft	5.20 cy/ft

LEGEND:

JULY 2021	—	AUGUST 2019	—
JUNE 2020	—	MAY 2018	—

- Notes:
1. Station From North To South At Varying Intervals.
 2. All Survey Elevations In Feet Referenced to NAVD88.



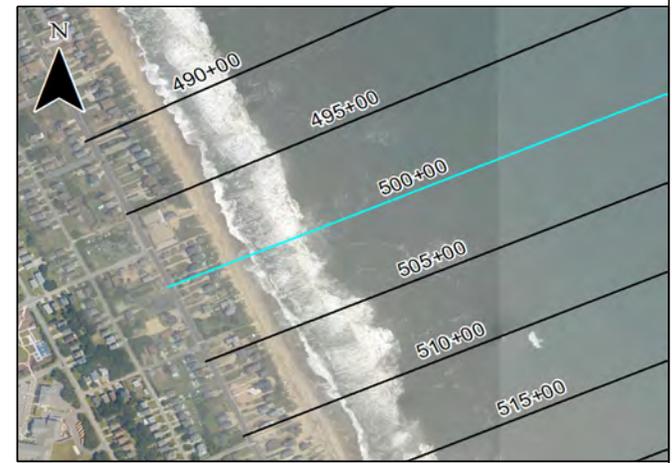


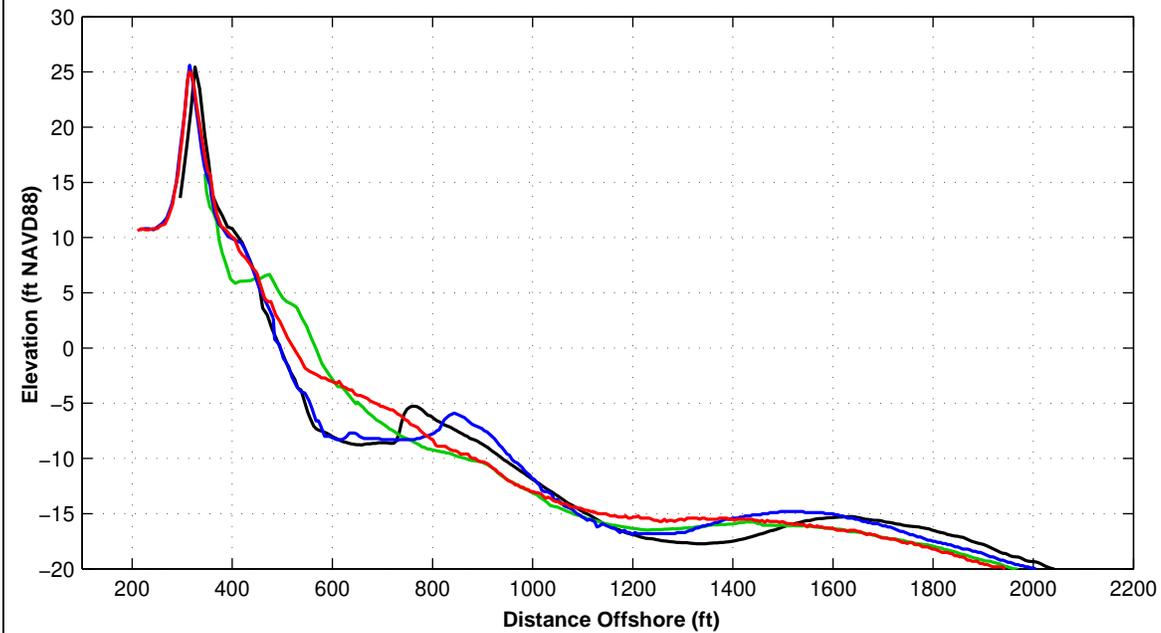
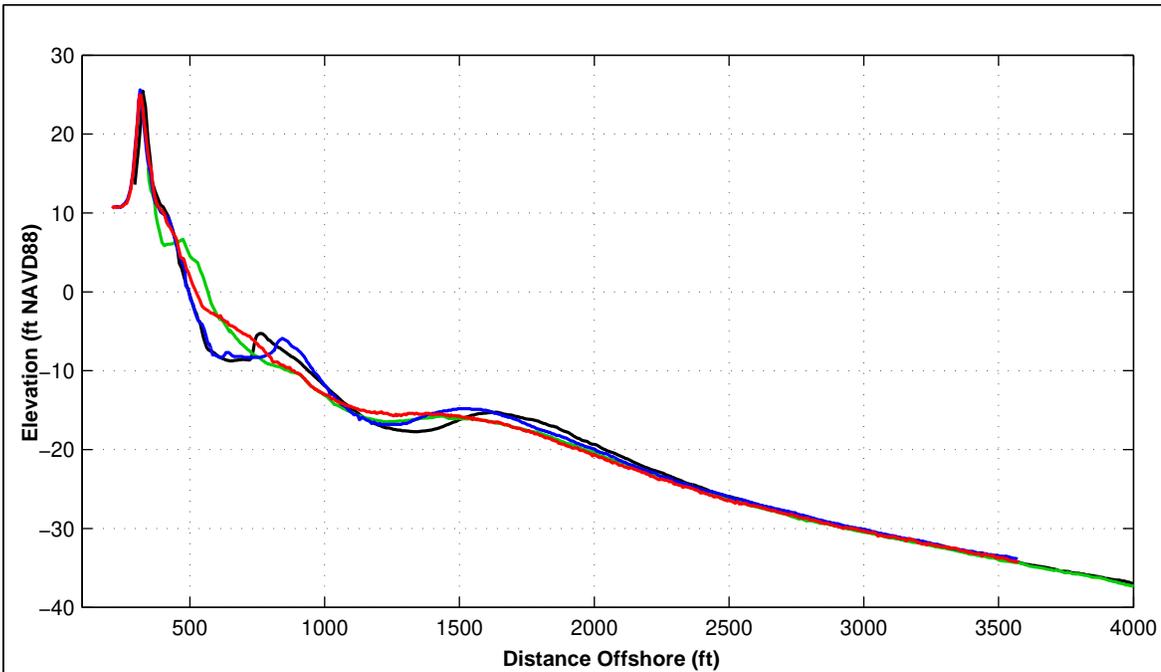
Survey Transect 500+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	-51.16 ft	54.07 ft
Volume Change Above +6 ft NAVD88	5.23 cy/ft	-1.95 cy/ft
Volume Change Above 1.18 ft NAVD88	-1.47 cy/ft	6.50 cy/ft
Volume Change Above -6 ft NAVD88	-17.04 cy/ft	23.63 cy/ft
Volume Change Above -14 ft NAVD88	13.28 cy/ft	14.73 cy/ft
Volume Change Above -19 ft NAVD88	26.32 cy/ft	15.27 cy/ft
Volume Change Above -30 ft NAVD88	32.53 cy/ft	3.06 cy/ft

LEGEND:

JULY 2021	—	AUGUST 2019	—
JUNE 2020	—	MAY 2018	—

- Notes:
1. Station From North To South At Varying Intervals.
 2. All Survey Elevations In Feet Referenced to NAVD88.



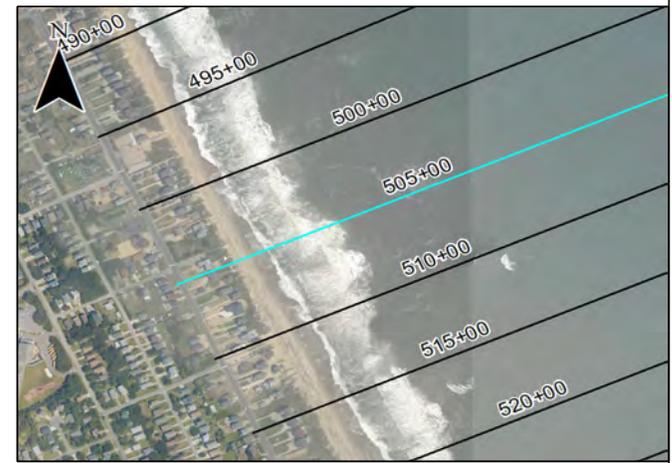


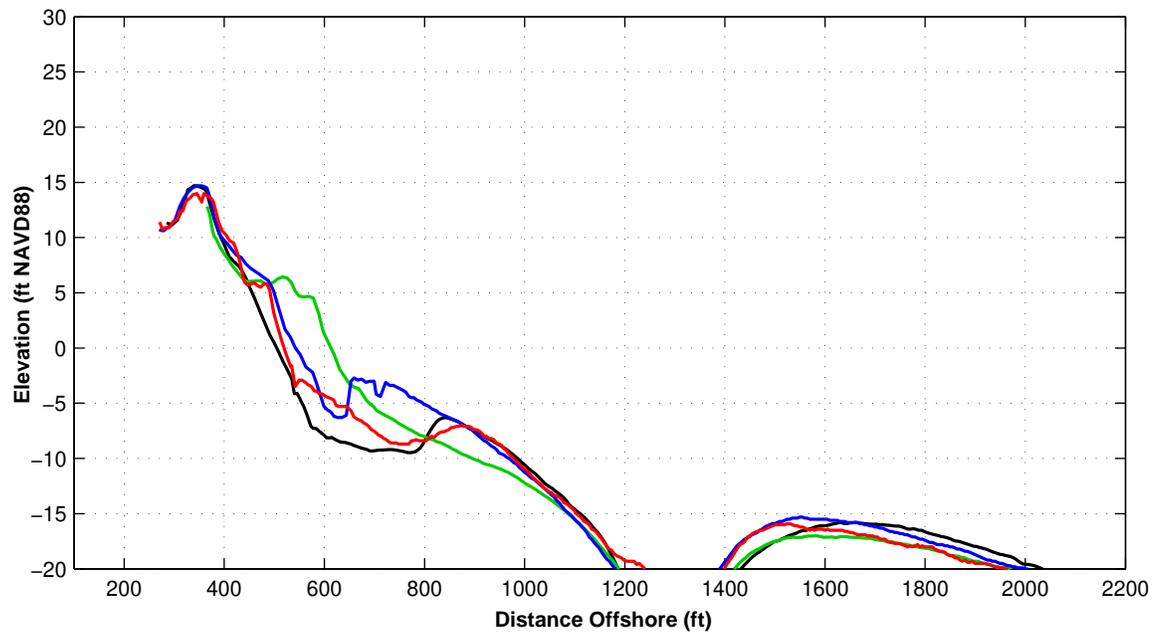
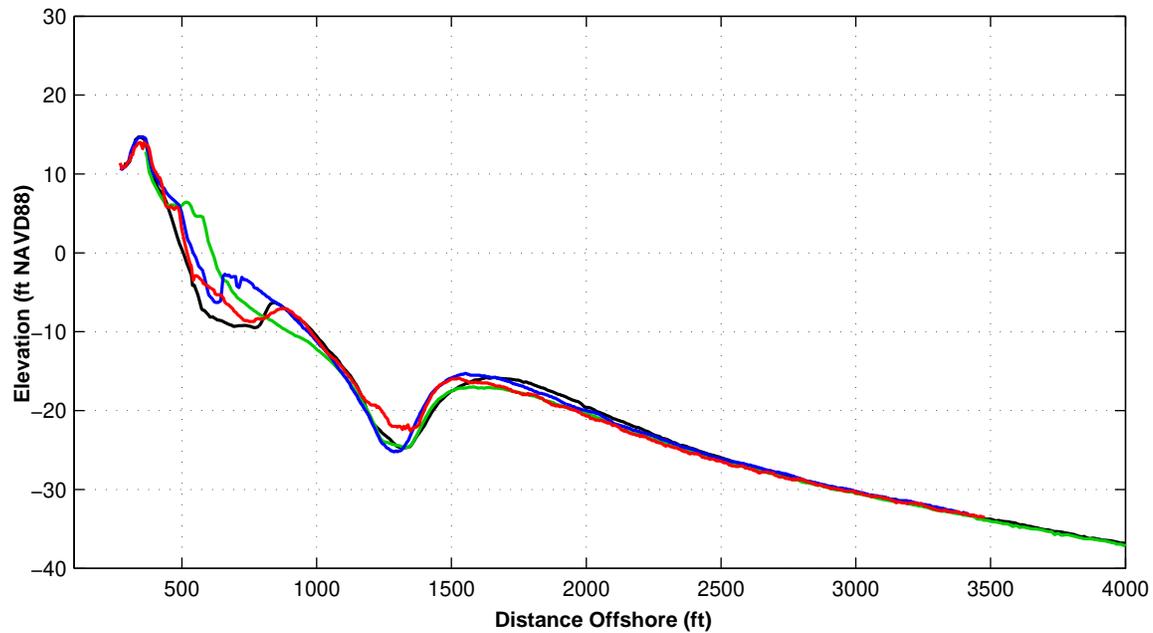
Survey Transect 505+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	-71.50 ft	23.89 ft
Volume Change Above +6 ft NAVD88	7.85 cy/ft	1.22 cy/ft
Volume Change Above 1.18 ft NAVD88	-1.23 cy/ft	2.90 cy/ft
Volume Change Above -6 ft NAVD88	-22.71 cy/ft	21.61 cy/ft
Volume Change Above -14 ft NAVD88	-10.59 cy/ft	17.10 cy/ft
Volume Change Above -19 ft NAVD88	5.17 cy/ft	11.91 cy/ft
Volume Change Above -30 ft NAVD88	17.25 cy/ft	-5.09 cy/ft

LEGEND:

JULY 2021	—	AUGUST 2019	—
JUNE 2020	—	MAY 2018	—

- Notes:
1. Station From North To South At Varying Intervals.
 2. All Survey Elevations In Feet Referenced to NAVD88.





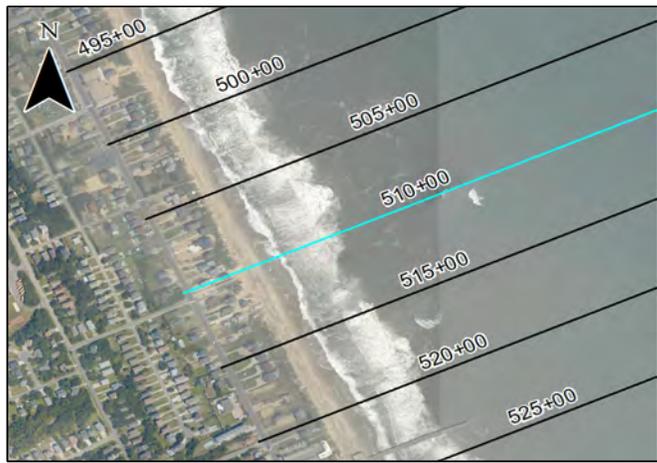
Survey Transect 510+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	-71.43 ft	-17.62 ft
Volume Change Above +6 ft NAVD88	5.20 cy/ft	-2.27 cy/ft
Volume Change Above 1.18 ft NAVD88	-6.54 cy/ft	-4.65 cy/ft
Volume Change Above -6 ft NAVD88	-12.77 cy/ft	-21.42 cy/ft
Volume Change Above -14 ft NAVD88	7.17 cy/ft	-32.84 cy/ft
Volume Change Above -19 ft NAVD88	28.69 cy/ft	-41.52 cy/ft
Volume Change Above -30 ft NAVD88	42.30 cy/ft	-41.87 cy/ft

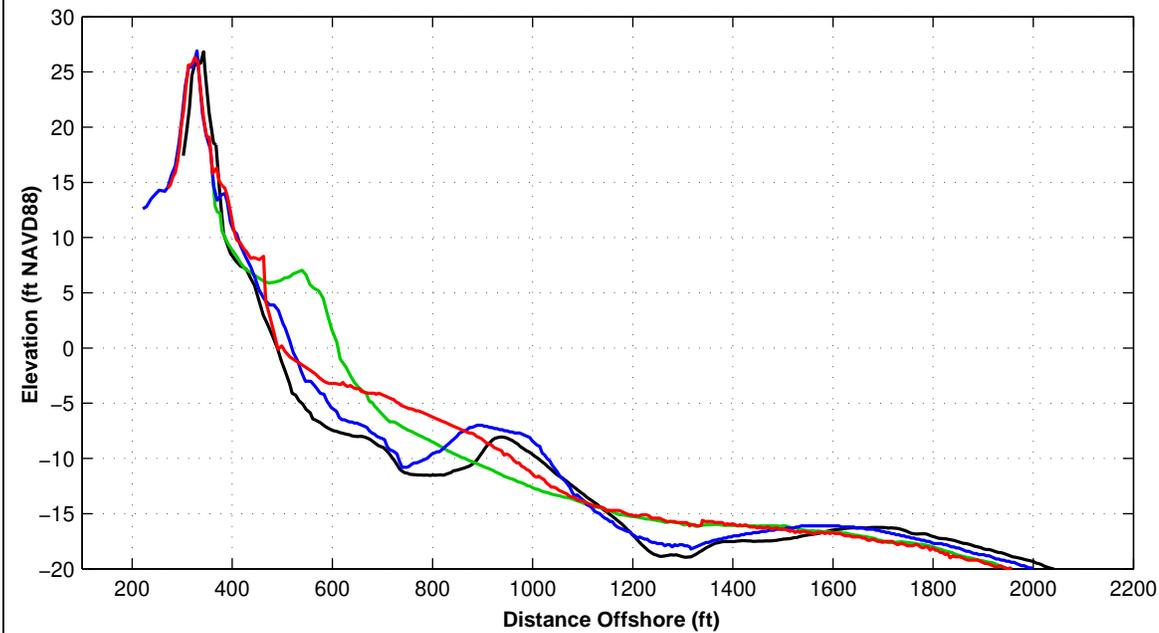
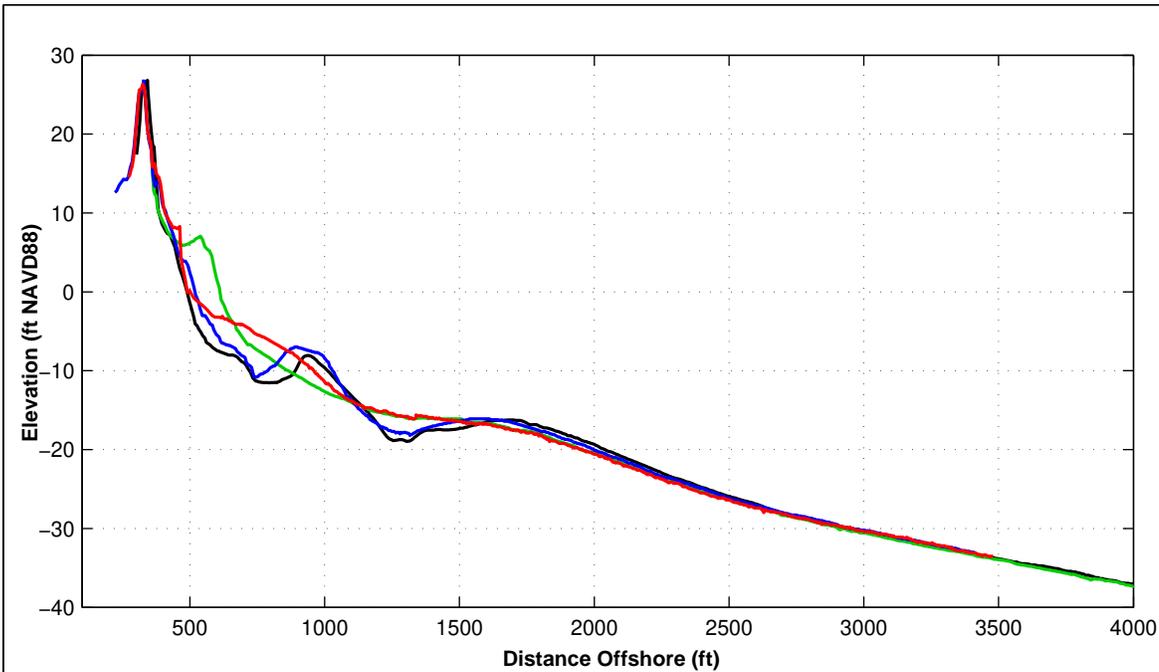
LEGEND:

JULY 2021 — AUGUST 2019 —
 JUNE 2020 — MAY 2018 —

Notes:

1. Station From North To South At Varying Intervals.
2. All Survey Elevations In Feet Referenced to NAVD88.



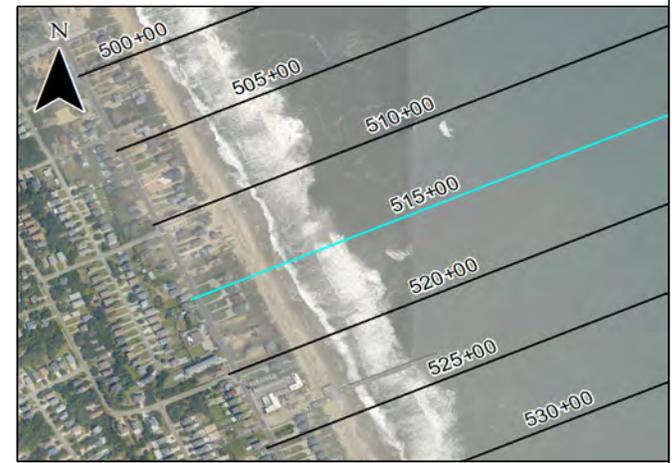


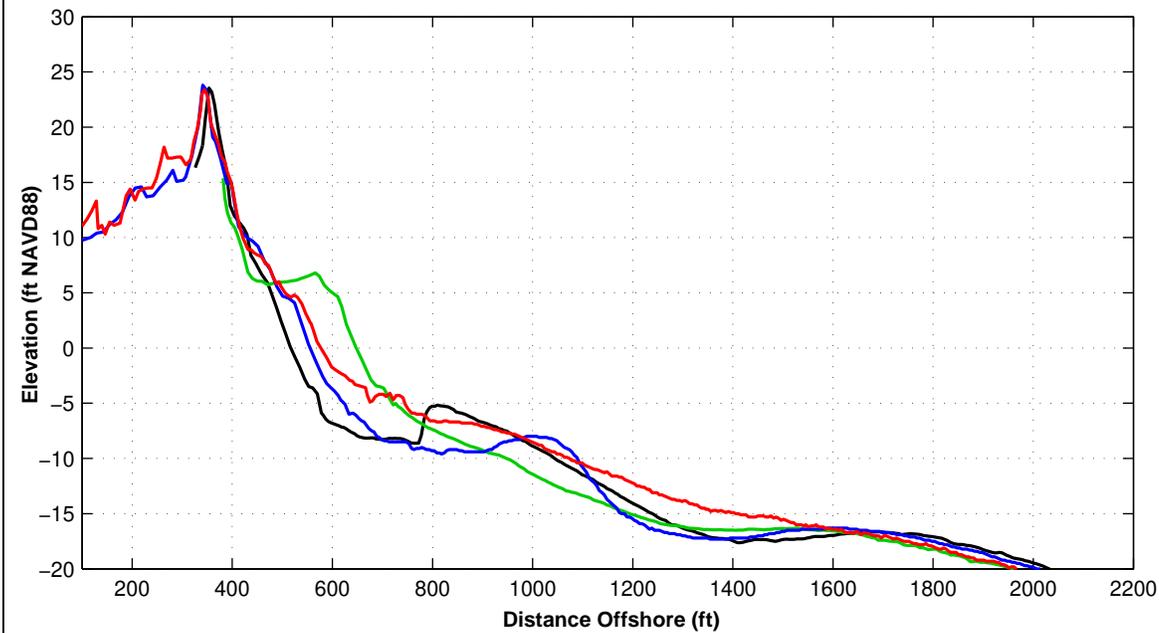
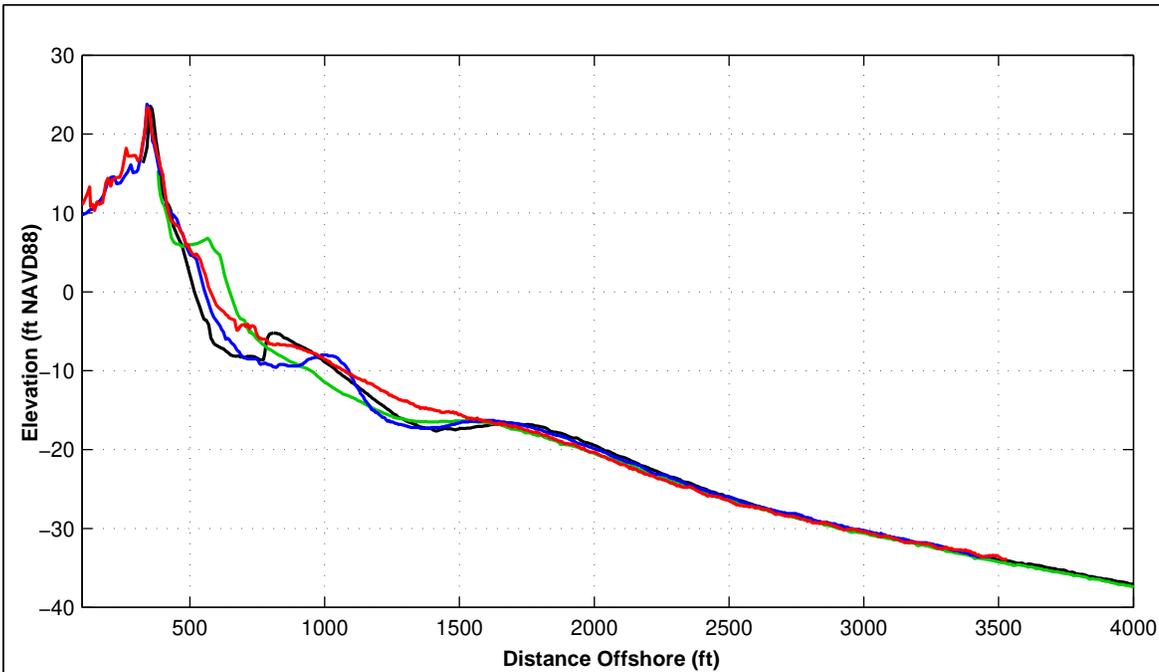
Survey Transect 515+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	-92.35 ft	-26.16 ft
Volume Change Above +6 ft NAVD88	3.91 cy/ft	4.04 cy/ft
Volume Change Above 1.18 ft NAVD88	-14.43 cy/ft	2.44 cy/ft
Volume Change Above -6 ft NAVD88	-38.31 cy/ft	14.79 cy/ft
Volume Change Above -14 ft NAVD88	-22.48 cy/ft	22.22 cy/ft
Volume Change Above -19 ft NAVD88	-32.82 cy/ft	31.52 cy/ft
Volume Change Above -30 ft NAVD88	-20.21 cy/ft	16.44 cy/ft

LEGEND:

JULY 2021	—	AUGUST 2019	—
JUNE 2020	—	MAY 2018	—

- Notes:
1. Station From North To South At Varying Intervals.
 2. All Survey Elevations In Feet Referenced to NAVD88.



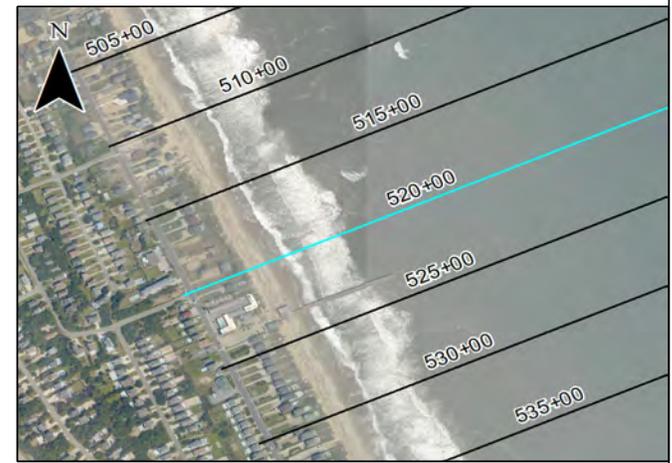


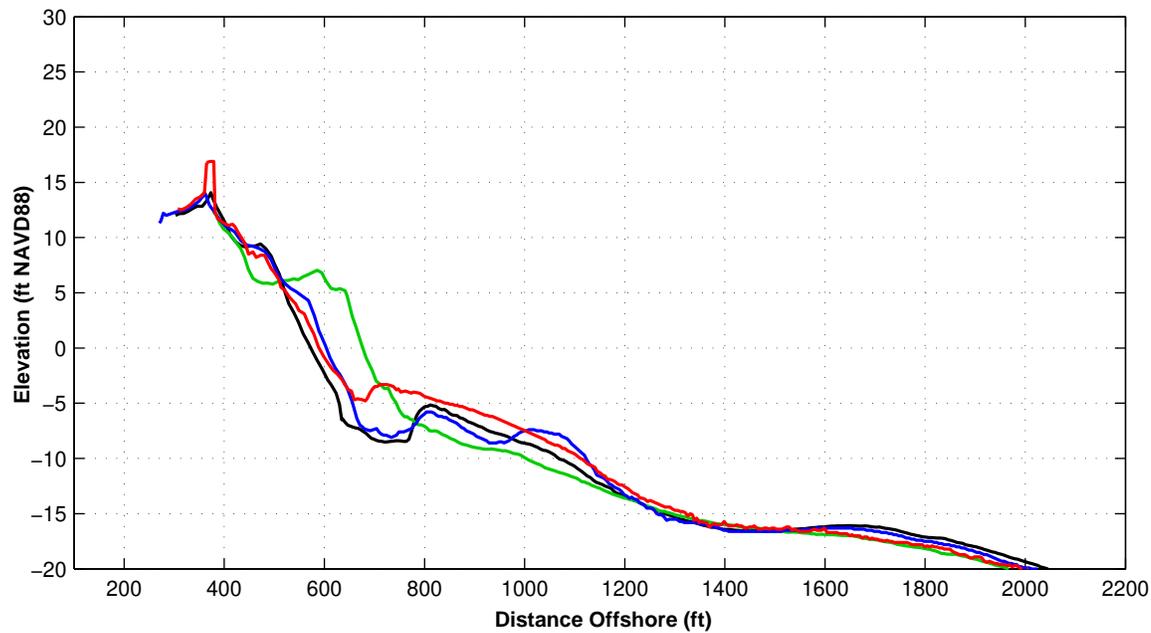
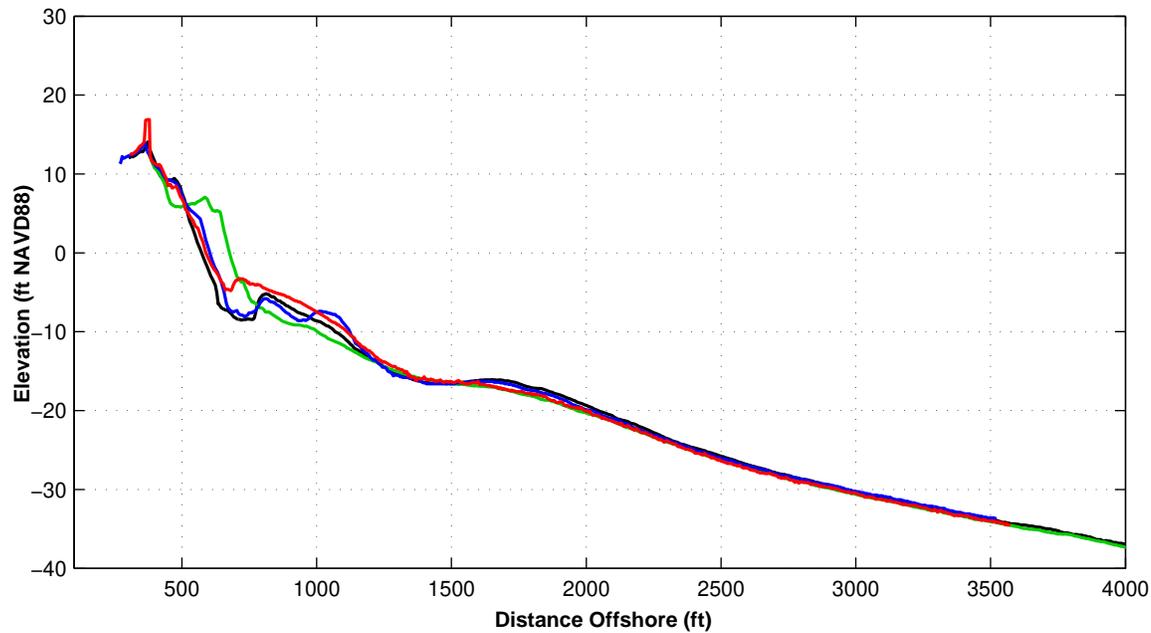
Survey Transect 520+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	-90.52 ft	19.11 ft
Volume Change Above +6 ft NAVD88	7.63 cy/ft	0.01 cy/ft
Volume Change Above 1.18 ft NAVD88	-8.93 cy/ft	2.63 cy/ft
Volume Change Above -6 ft NAVD88	-34.58 cy/ft	17.43 cy/ft
Volume Change Above -14 ft NAVD88	-27.32 cy/ft	49.76 cy/ft
Volume Change Above -19 ft NAVD88	-27.67 cy/ft	73.07 cy/ft
Volume Change Above -30 ft NAVD88	-14.16 cy/ft	56.65 cy/ft

LEGEND:

JULY 2021	—	AUGUST 2019	—
JUNE 2020	—	MAY 2018	—

- Notes:
1. Station From North To South At Varying Intervals.
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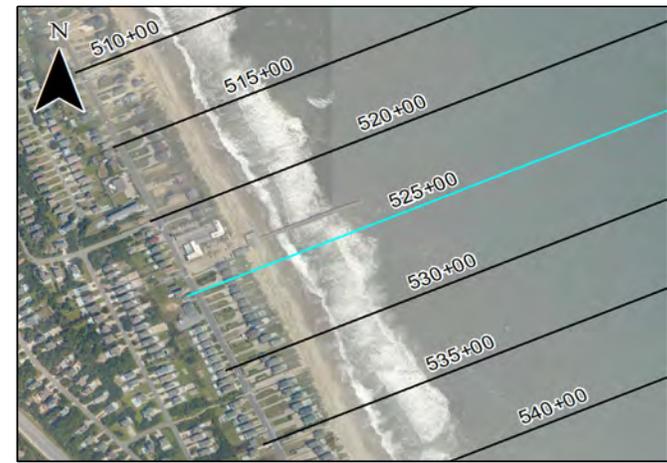


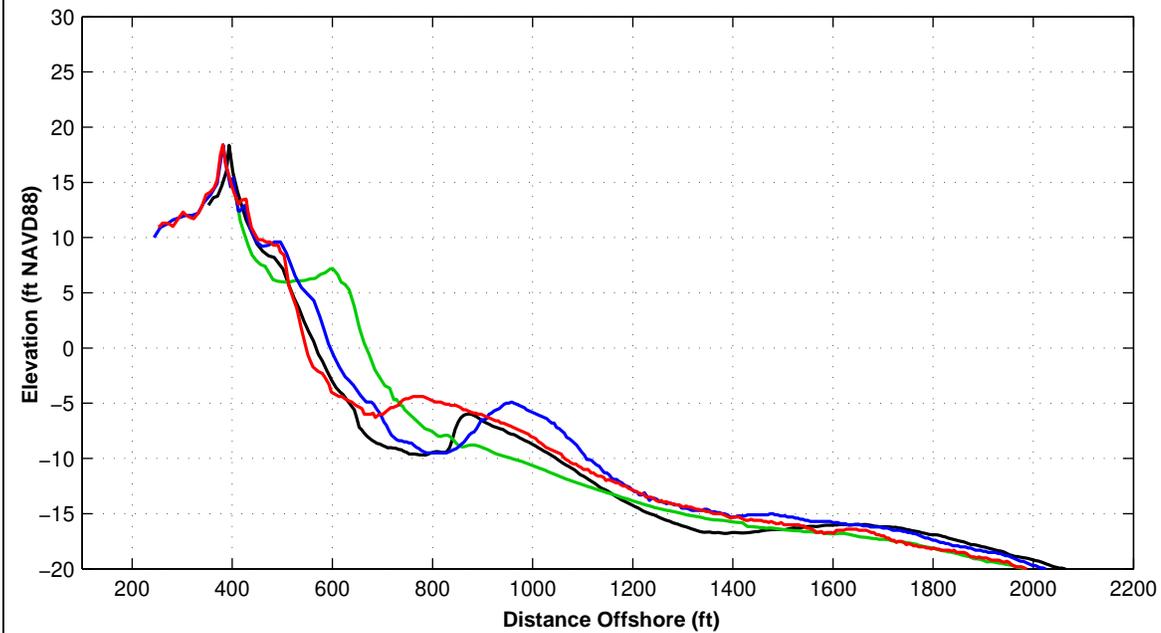
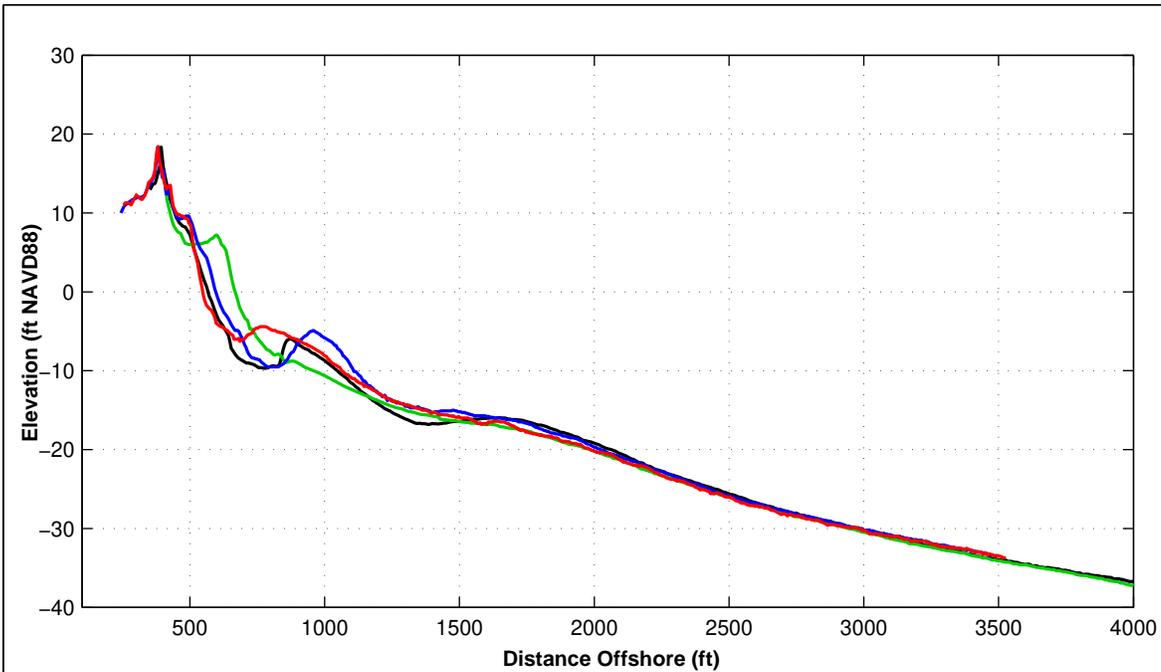


Survey Transect 525+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	-75.27 ft	-13.19 ft
Volume Change Above +6 ft NAVD88	5.46 cy/ft	0.22 cy/ft
Volume Change Above 1.18 ft NAVD88	-8.81 cy/ft	-3.36 cy/ft
Volume Change Above -6 ft NAVD88	-28.92 cy/ft	9.46 cy/ft
Volume Change Above -14 ft NAVD88	-8.46 cy/ft	23.62 cy/ft
Volume Change Above -19 ft NAVD88	-2.15 cy/ft	22.16 cy/ft
Volume Change Above -30 ft NAVD88	9.48 cy/ft	10.79 cy/ft

LEGEND:
 JULY 2021 ———— (red line)
 JUNE 2020 ———— (blue line)
 AUGUST 2019 ———— (green line)
 MAY 2018 ———— (black line)

- Notes:
 1. Station From North To South At Varying Intervals.
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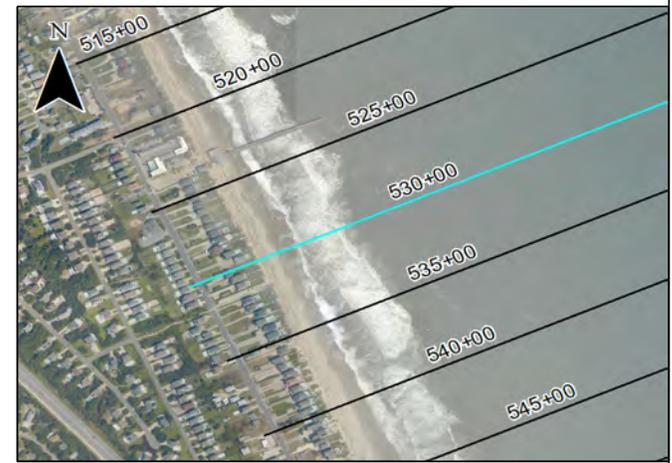


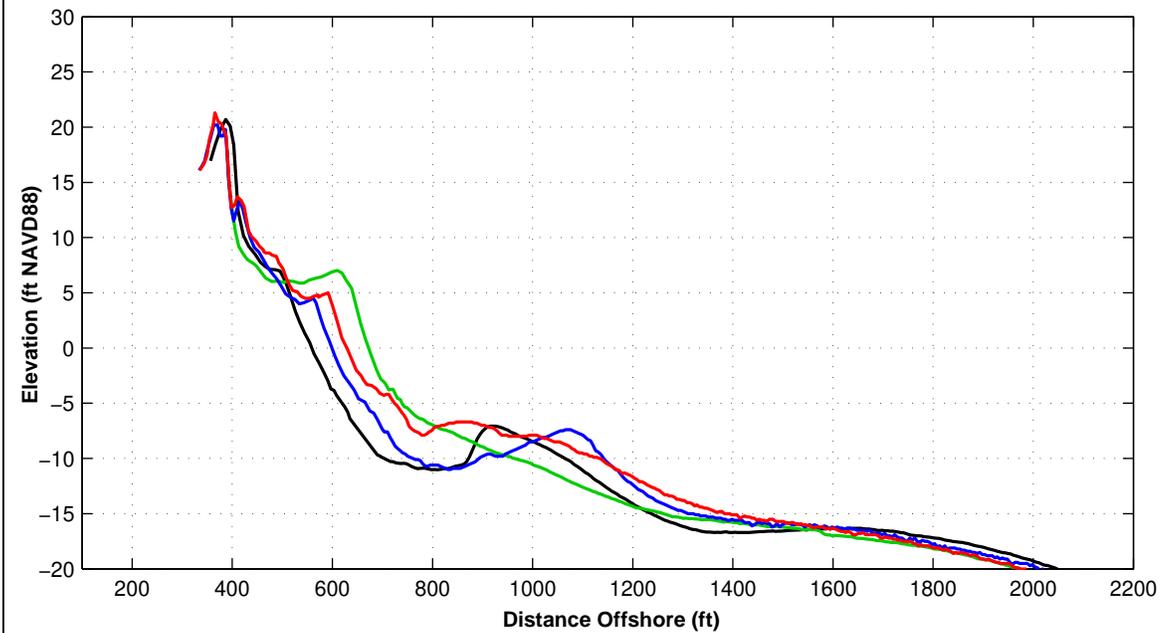
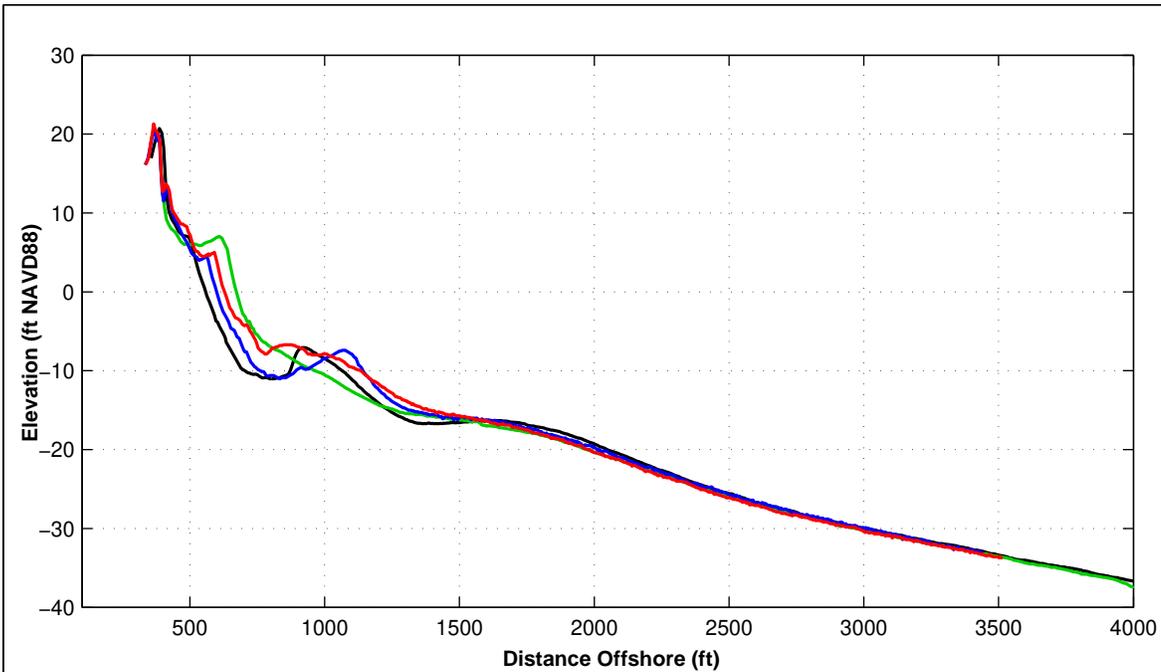
Survey Transect 530+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	-71.58 ft	-45.51 ft
Volume Change Above +6 ft NAVD88	7.84 cy/ft	-0.45 cy/ft
Volume Change Above 1.18 ft NAVD88	-6.14 cy/ft	-7.15 cy/ft
Volume Change Above -6 ft NAVD88	-21.72 cy/ft	-14.71 cy/ft
Volume Change Above -14 ft NAVD88	7.20 cy/ft	-9.37 cy/ft
Volume Change Above -19 ft NAVD88	29.60 cy/ft	-22.80 cy/ft
Volume Change Above -30 ft NAVD88	43.32 cy/ft	-35.20 cy/ft

LEGEND:

JULY 2021	—	AUGUST 2019	—
JUNE 2020	—	MAY 2018	—

- Notes:
1. Station From North To South At Varying Intervals.
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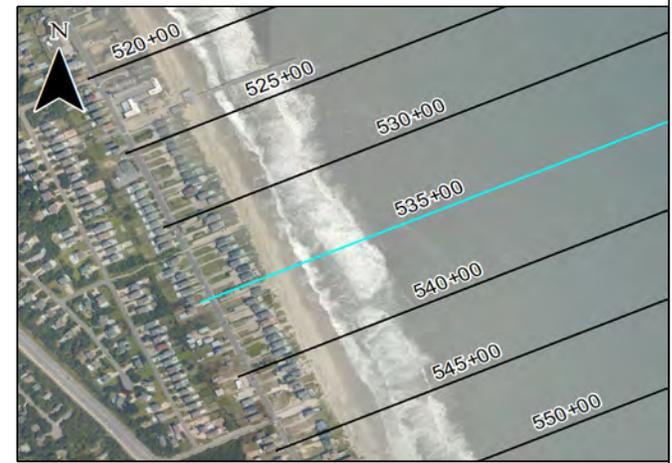


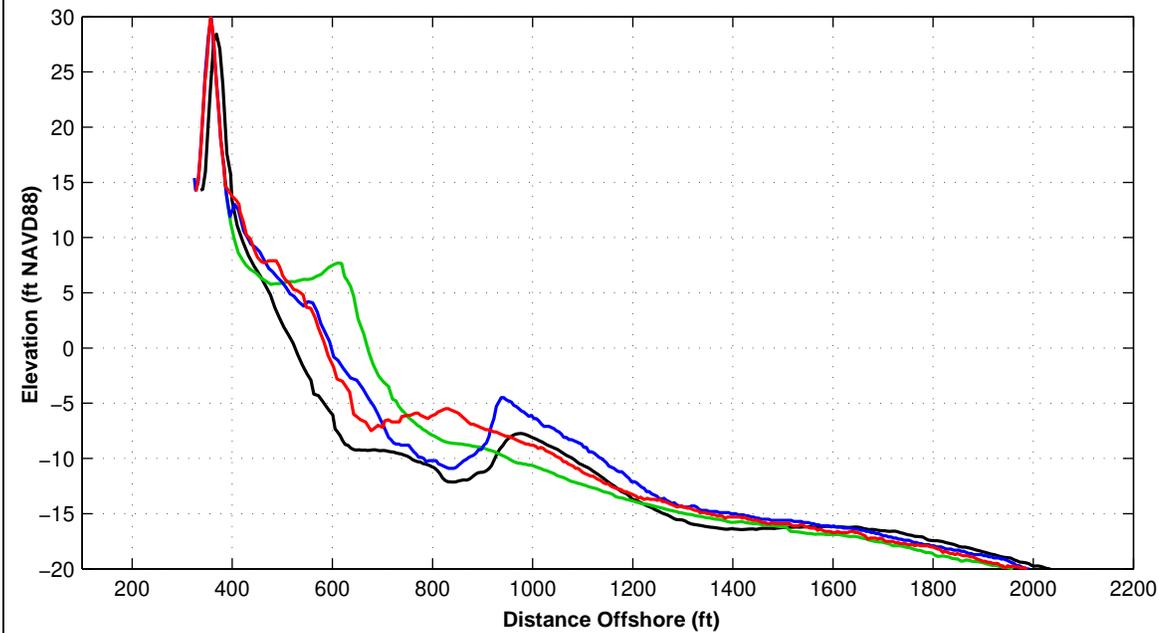
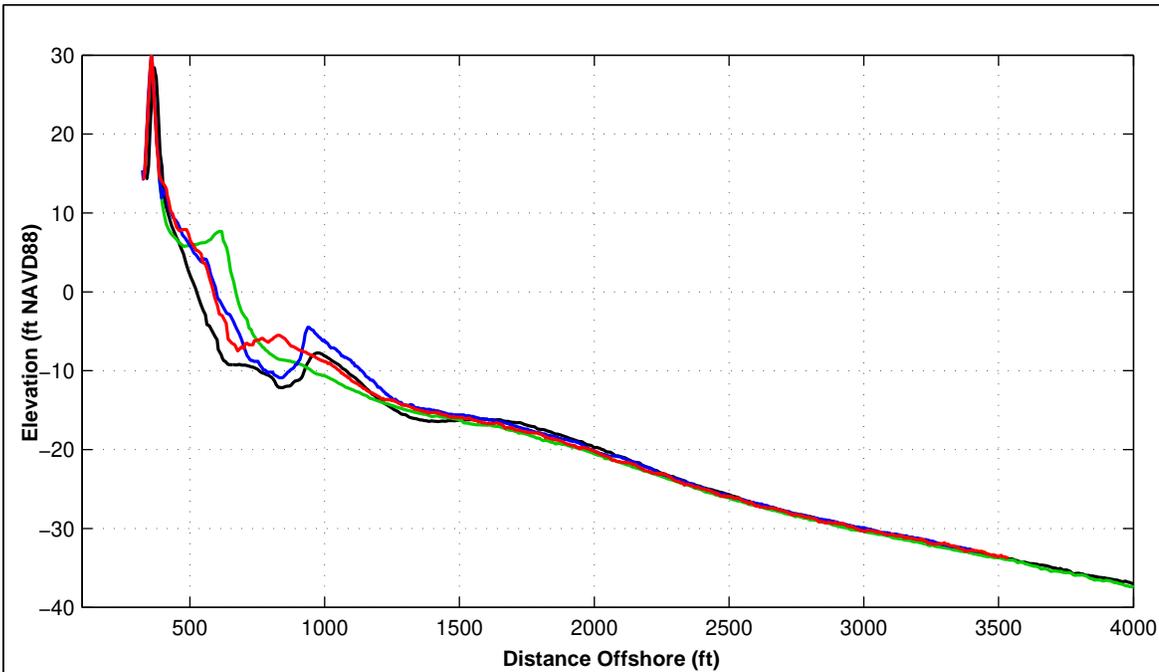
Survey Transect 535+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	-74.45 ft	28.34 ft
Volume Change Above +6 ft NAVD88	4.21 cy/ft	4.41 cy/ft
Volume Change Above 1.18 ft NAVD88	-13.10 cy/ft	10.15 cy/ft
Volume Change Above -6 ft NAVD88	-32.69 cy/ft	20.78 cy/ft
Volume Change Above -14 ft NAVD88	-26.44 cy/ft	49.88 cy/ft
Volume Change Above -19 ft NAVD88	-14.20 cy/ft	51.34 cy/ft
Volume Change Above -30 ft NAVD88	-1.67 cy/ft	35.23 cy/ft

LEGEND:

JULY 2021	—	AUGUST 2019	—
JUNE 2020	—	MAY 2018	—

- Notes:
1. Station From North To South At Varying Intervals.
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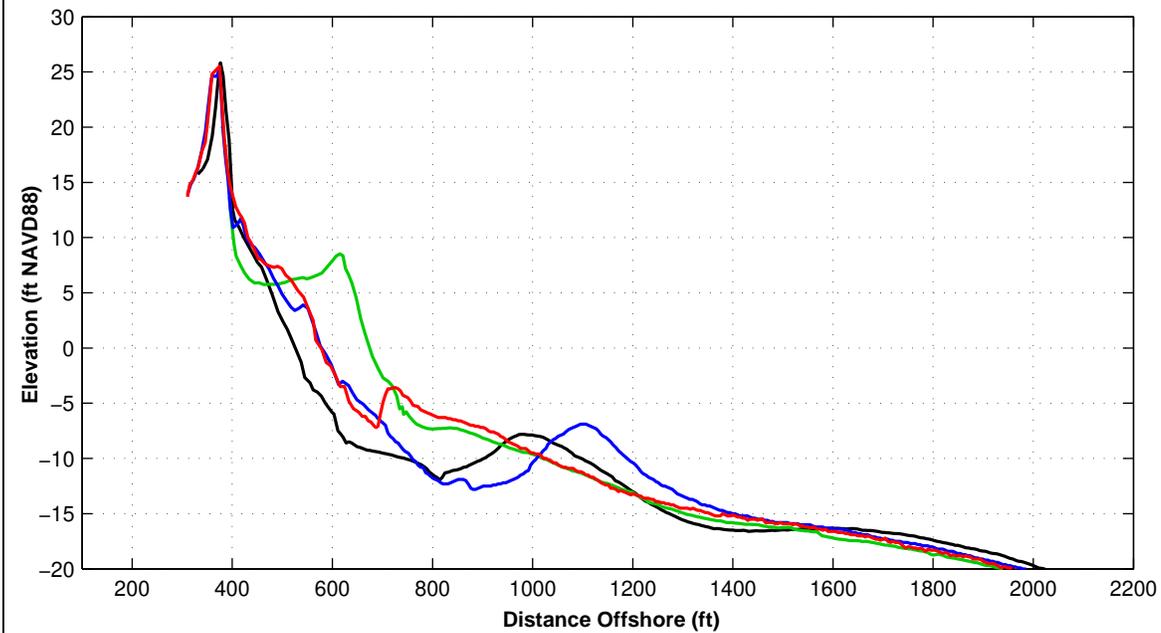
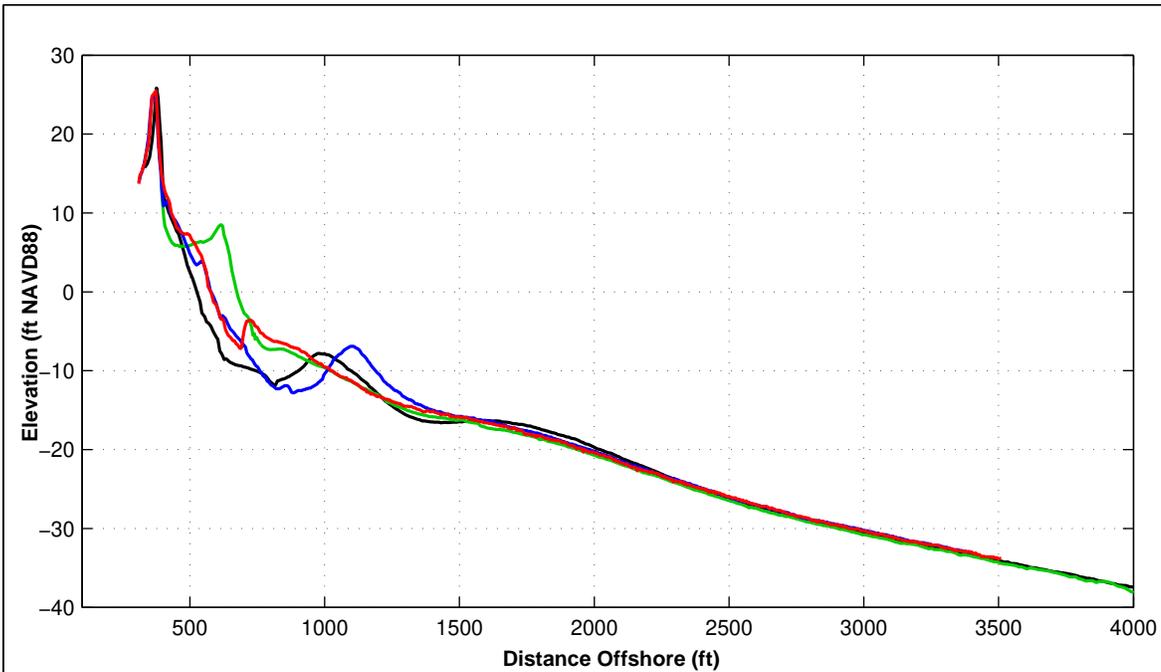
Survey Transect 540+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	-75.09 ft	-10.40 ft
Volume Change Above +6 ft NAVD88	4.69 cy/ft	2.25 cy/ft
Volume Change Above 1.18 ft NAVD88	-12.35 cy/ft	2.35 cy/ft
Volume Change Above -6 ft NAVD88	-26.47 cy/ft	-5.68 cy/ft
Volume Change Above -14 ft NAVD88	-2.12 cy/ft	-5.81 cy/ft
Volume Change Above -19 ft NAVD88	14.54 cy/ft	-13.20 cy/ft
Volume Change Above -30 ft NAVD88	30.68 cy/ft	-21.35 cy/ft

LEGEND:

JULY 2021	—	AUGUST 2019	—
JUNE 2020	—	MAY 2018	—

- Notes:
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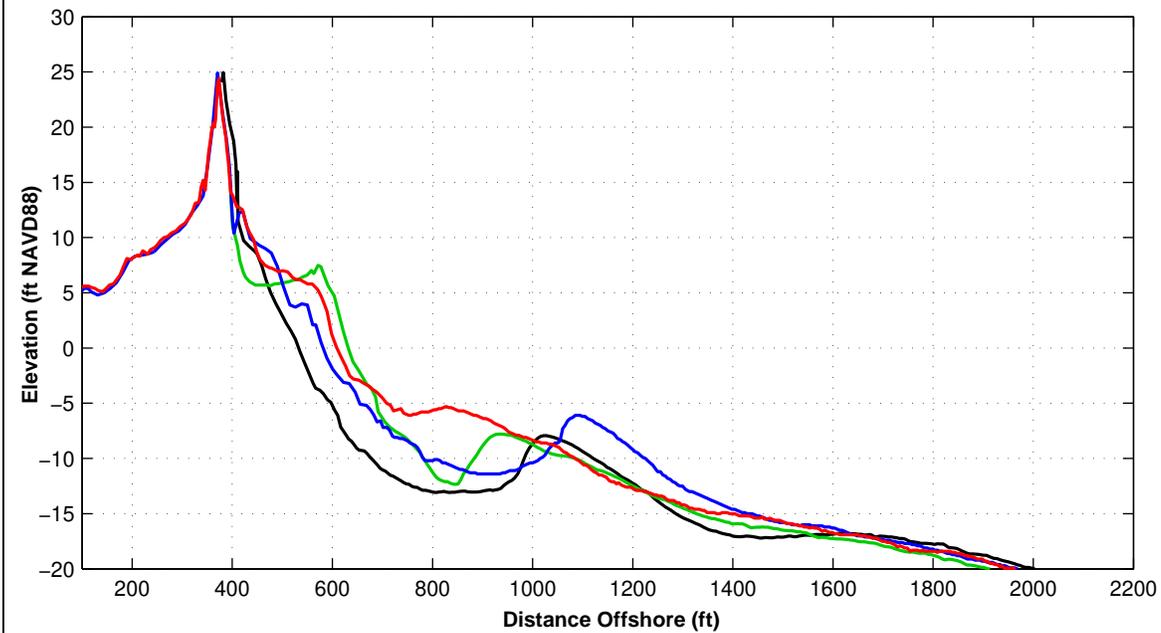
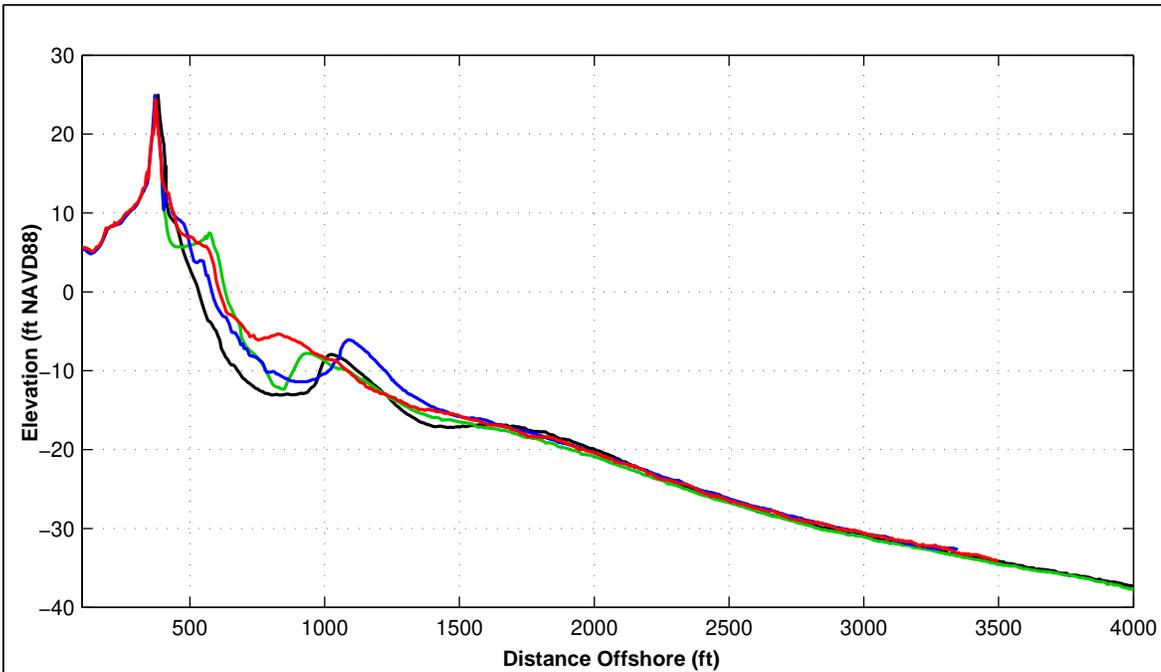
Survey Transect 545+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	-96.75 ft	-3.65 ft
Volume Change Above +6 ft NAVD88	3.54 cy/ft	3.51 cy/ft
Volume Change Above 1.18 ft NAVD88	-17.60 cy/ft	6.63 cy/ft
Volume Change Above -6 ft NAVD88	-40.90 cy/ft	9.01 cy/ft
Volume Change Above -14 ft NAVD88	-51.40 cy/ft	25.73 cy/ft
Volume Change Above -19 ft NAVD88	-35.91 cy/ft	20.03 cy/ft
Volume Change Above -30 ft NAVD88	-18.23 cy/ft	16.72 cy/ft

LEGEND:

JULY 2021	—	AUGUST 2019	—
JUNE 2020	—	MAY 2018	—

- Notes:
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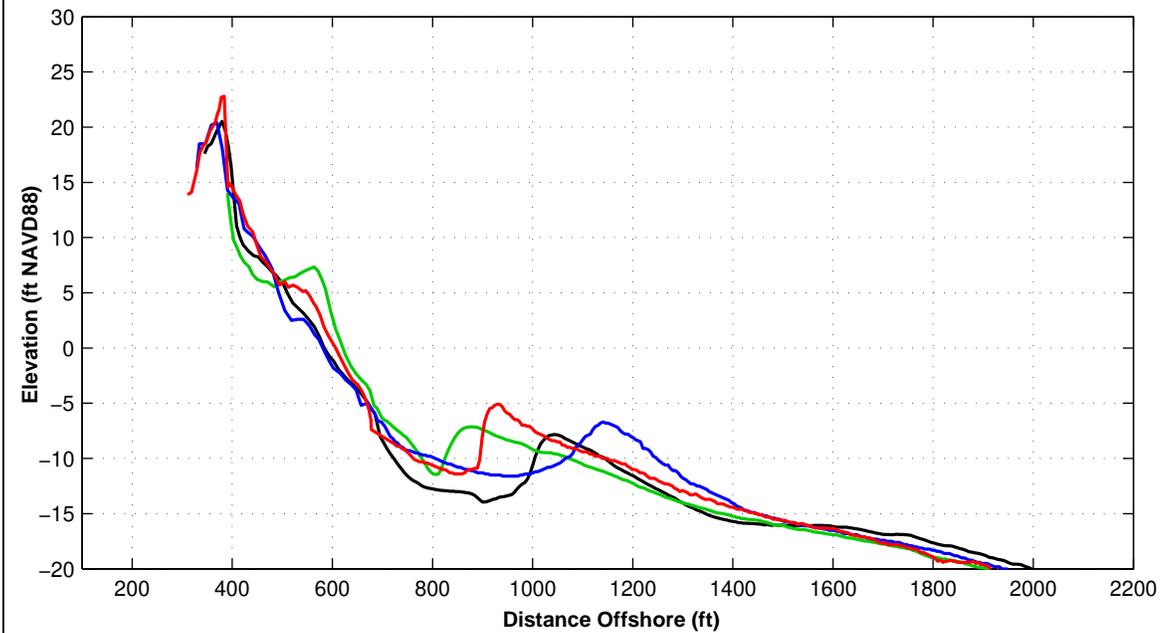
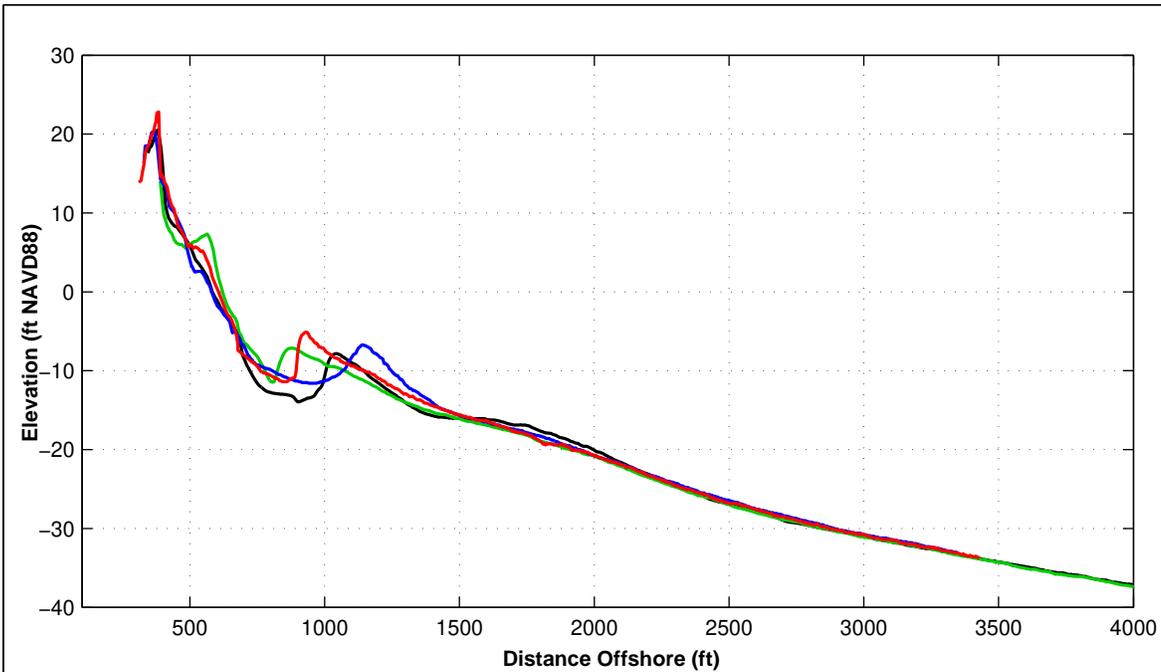
Survey Transect 550+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	-50.69 ft	26.06 ft
Volume Change Above +6 ft NAVD88	9.14 cy/ft	-0.02 cy/ft
Volume Change Above 1.18 ft NAVD88	-3.11 cy/ft	8.32 cy/ft
Volume Change Above -6 ft NAVD88	-14.12 cy/ft	19.18 cy/ft
Volume Change Above -14 ft NAVD88	6.41 cy/ft	30.68 cy/ft
Volume Change Above -19 ft NAVD88	23.04 cy/ft	25.77 cy/ft
Volume Change Above -30 ft NAVD88	45.12 cy/ft	20.66 cy/ft

LEGEND:

JULY 2021	—	AUGUST 2019	—
JUNE 2020	—	MAY 2018	—

- Notes:
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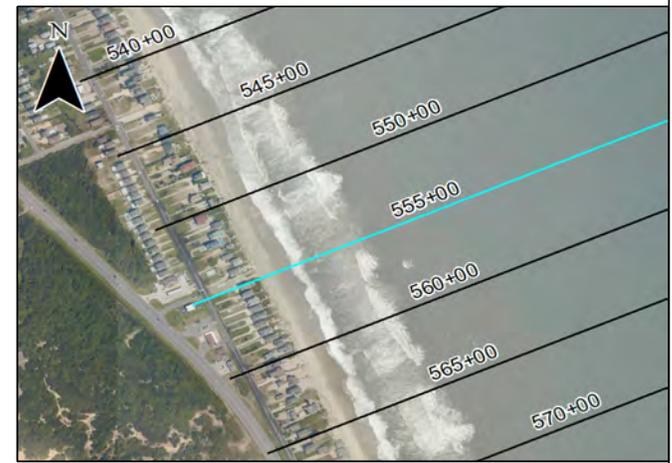


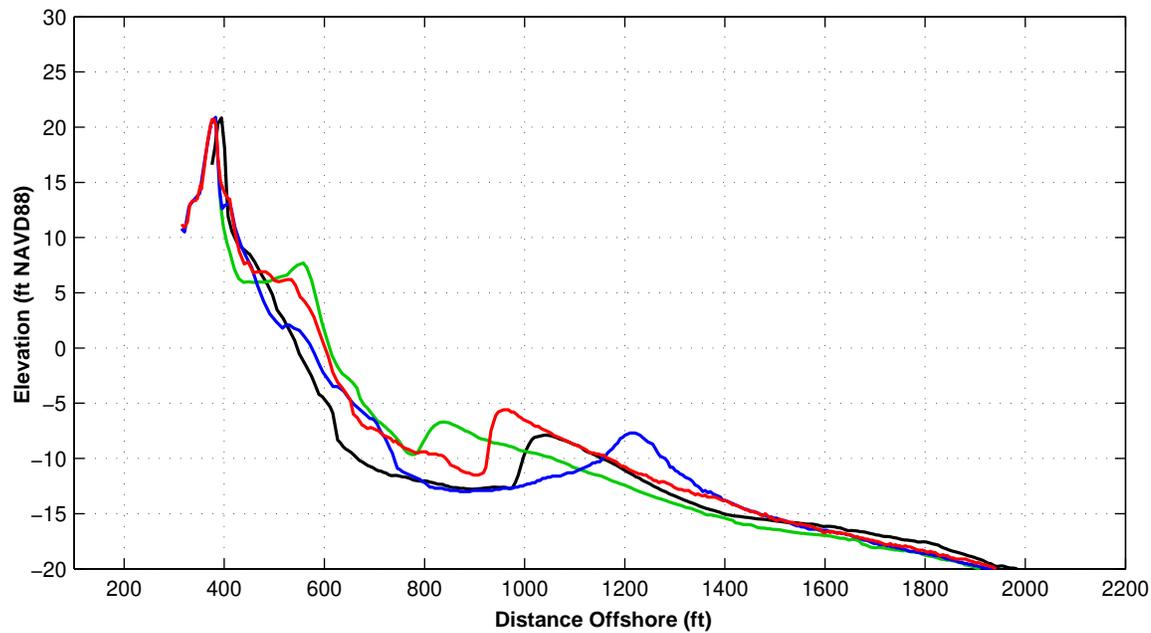
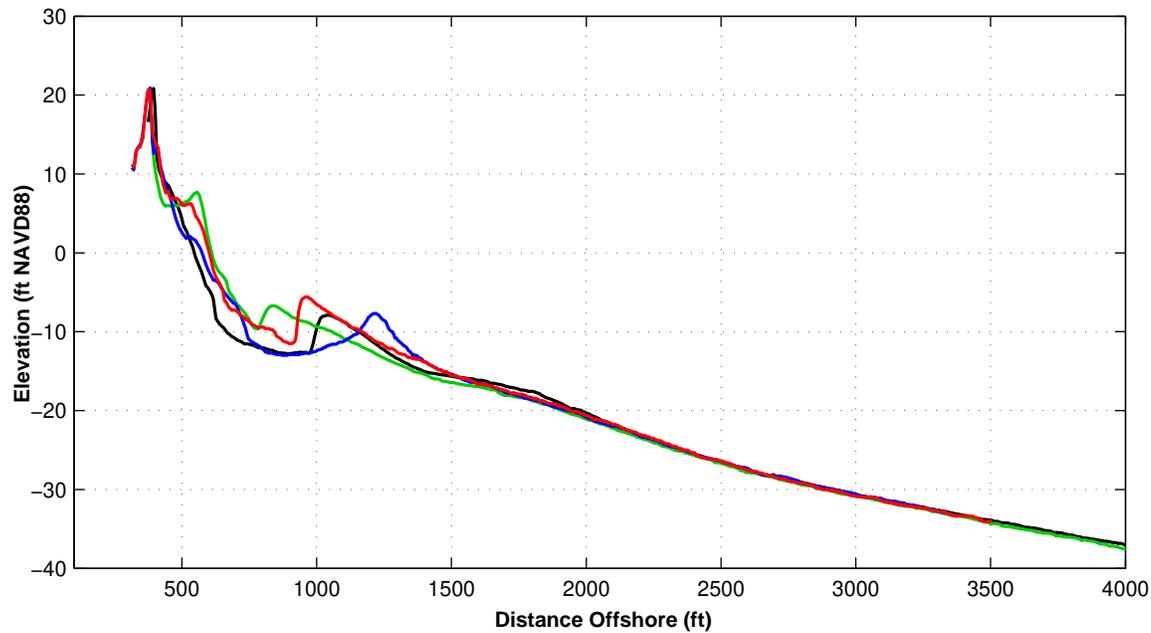
Survey Transect 555+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	-46.06 ft	26.36 ft
Volume Change Above +6 ft NAVD88	7.79 cy/ft	3.37 cy/ft
Volume Change Above 1.18 ft NAVD88	-6.34 cy/ft	11.77 cy/ft
Volume Change Above -6 ft NAVD88	-14.68 cy/ft	16.91 cy/ft
Volume Change Above -14 ft NAVD88	-7.43 cy/ft	18.12 cy/ft
Volume Change Above -19 ft NAVD88	2.79 cy/ft	15.83 cy/ft
Volume Change Above -30 ft NAVD88	18.53 cy/ft	9.49 cy/ft

LEGEND:

JULY 2021	—	AUGUST 2019	—
JUNE 2020	—	MAY 2018	—

- Notes:
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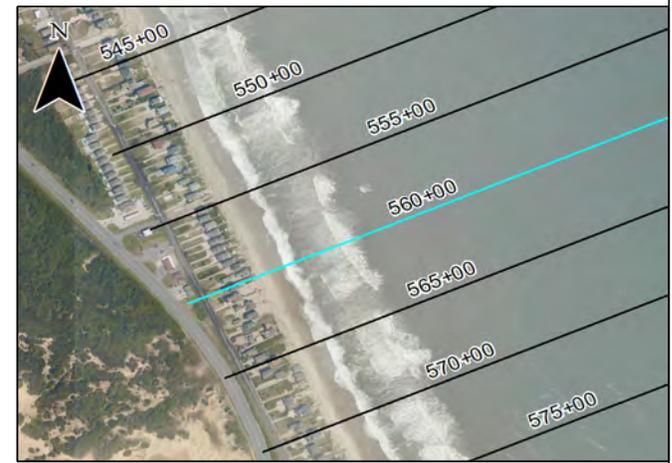


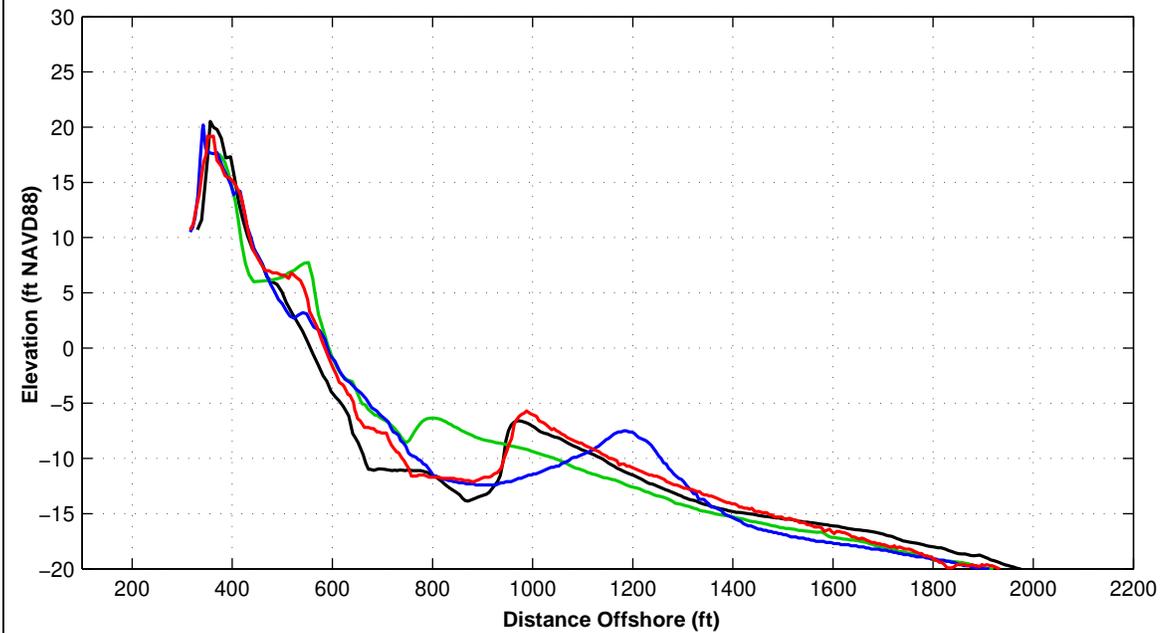
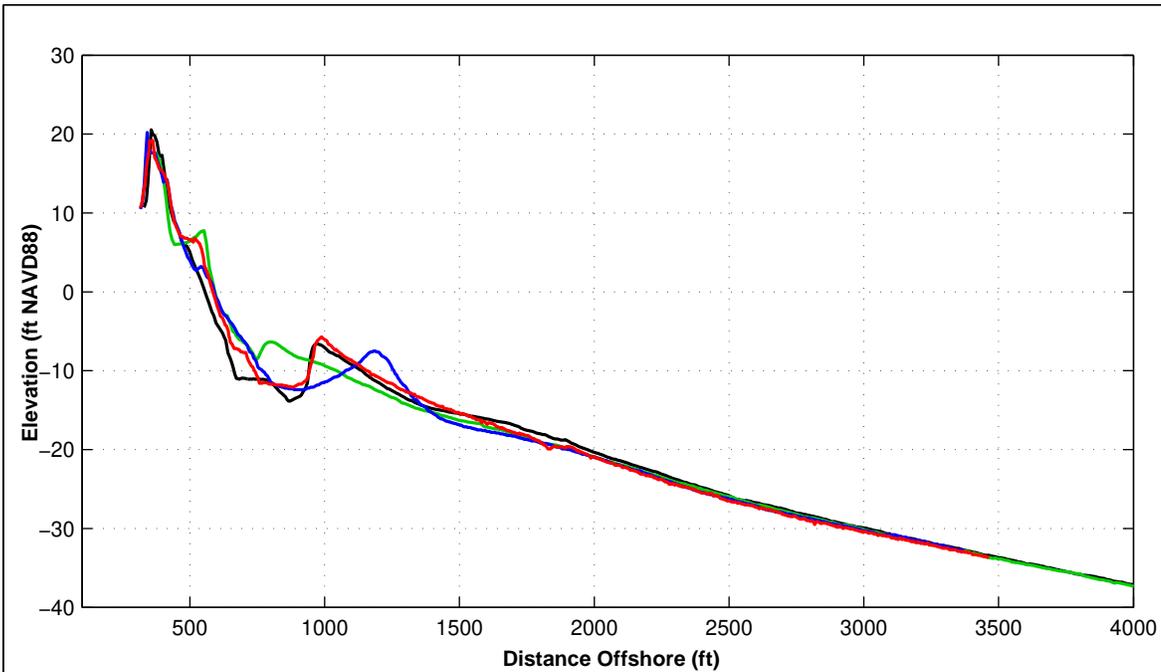


Survey Transect 560+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	-45.13 ft	34.41 ft
Volume Change Above +6 ft NAVD88	4.21 cy/ft	1.42 cy/ft
Volume Change Above 1.18 ft NAVD88	-12.59 cy/ft	14.48 cy/ft
Volume Change Above -6 ft NAVD88	-21.26 cy/ft	18.47 cy/ft
Volume Change Above -14 ft NAVD88	-42.54 cy/ft	53.24 cy/ft
Volume Change Above -19 ft NAVD88	-29.80 cy/ft	54.79 cy/ft
Volume Change Above -30 ft NAVD88	-19.48 cy/ft	56.27 cy/ft

LEGEND:
 JULY 2021 ———— (red line)
 JUNE 2020 ———— (blue line)
 AUGUST 2019 ———— (green line)
 MAY 2018 ———— (black line)

- Notes:
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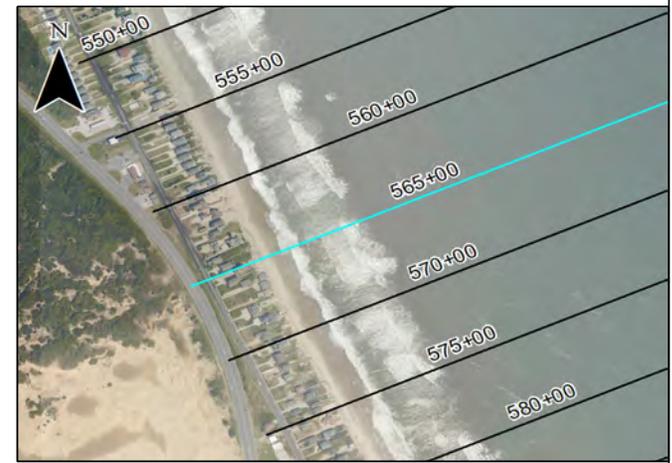


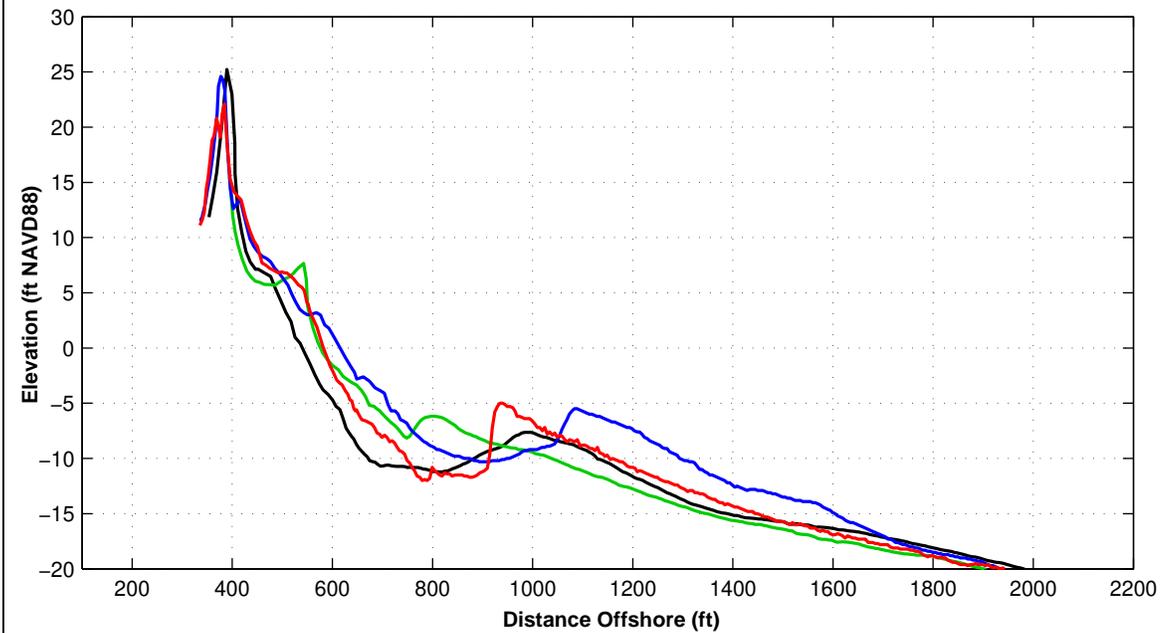
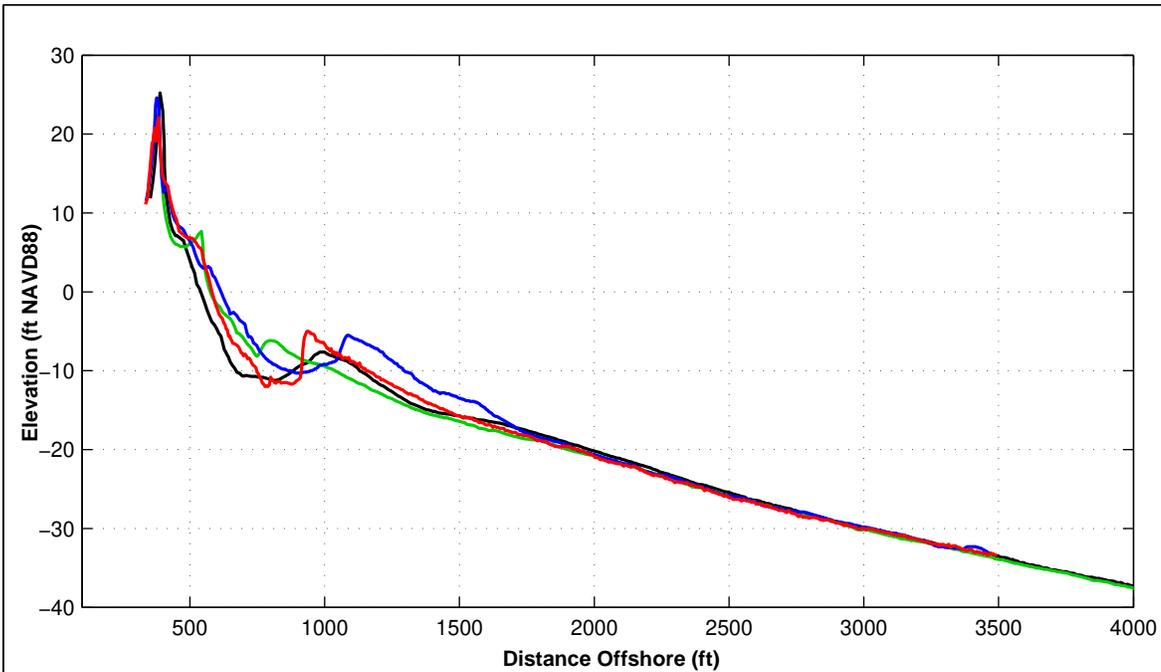
Survey Transect 565+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	-4.64 ft	-4.81 ft
Volume Change Above +6 ft NAVD88	3.18 cy/ft	1.59 cy/ft
Volume Change Above 1.18 ft NAVD88	-6.17 cy/ft	8.11 cy/ft
Volume Change Above -6 ft NAVD88	-5.58 cy/ft	3.73 cy/ft
Volume Change Above -14 ft NAVD88	-15.44 cy/ft	8.31 cy/ft
Volume Change Above -19 ft NAVD88	-20.31 cy/ft	24.50 cy/ft
Volume Change Above -30 ft NAVD88	-28.78 cy/ft	20.50 cy/ft

LEGEND:

JULY 2021	—	AUGUST 2019	—
JUNE 2020	—	MAY 2018	—

- Notes:
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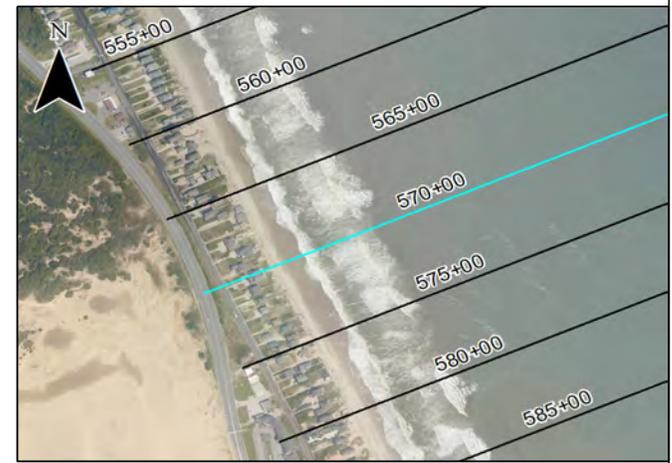


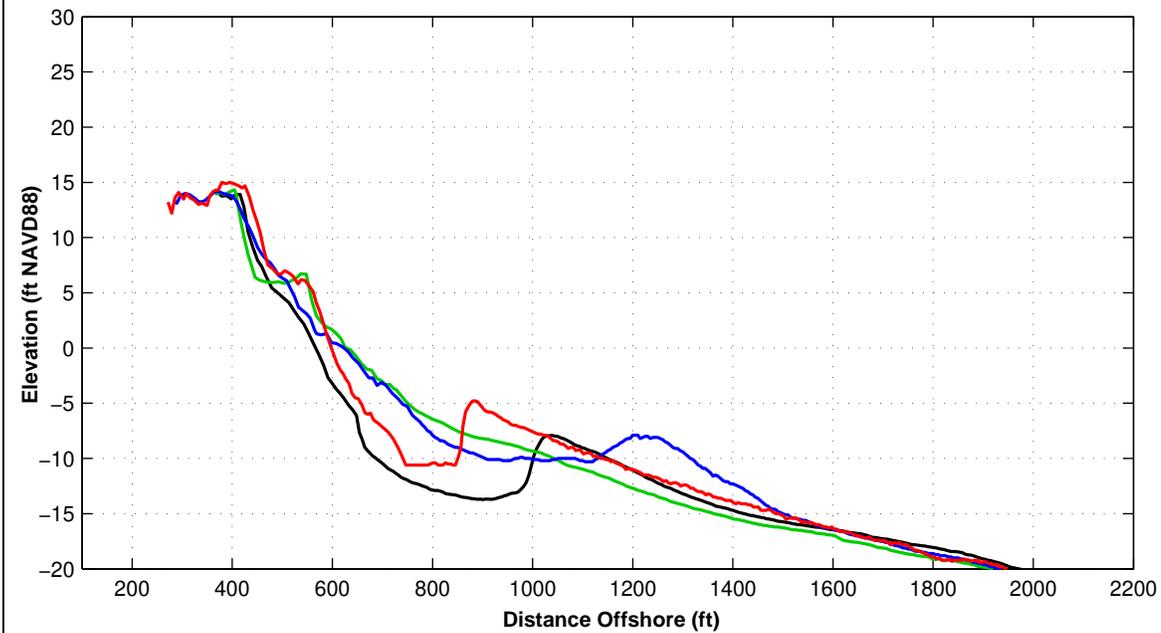
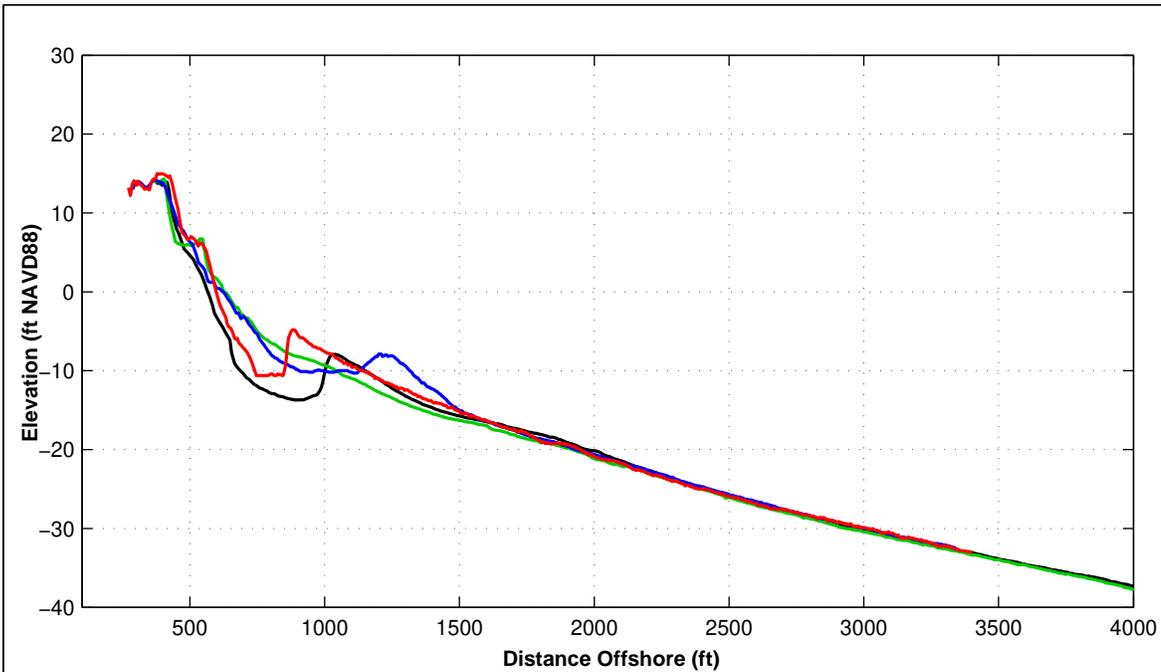
Survey Transect 570+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	35.02 ft	-27.06 ft
Volume Change Above +6 ft NAVD88	8.07 cy/ft	-0.32 cy/ft
Volume Change Above 1.18 ft NAVD88	7.45 cy/ft	0.66 cy/ft
Volume Change Above -6 ft NAVD88	17.34 cy/ft	-12.33 cy/ft
Volume Change Above -14 ft NAVD88	65.52 cy/ft	-57.21 cy/ft
Volume Change Above -19 ft NAVD88	97.26 cy/ft	-75.82 cy/ft
Volume Change Above -30 ft NAVD88	104.06 cy/ft	-85.12 cy/ft

LEGEND:

JULY 2021	—	AUGUST 2019	—
JUNE 2020	—	MAY 2018	—

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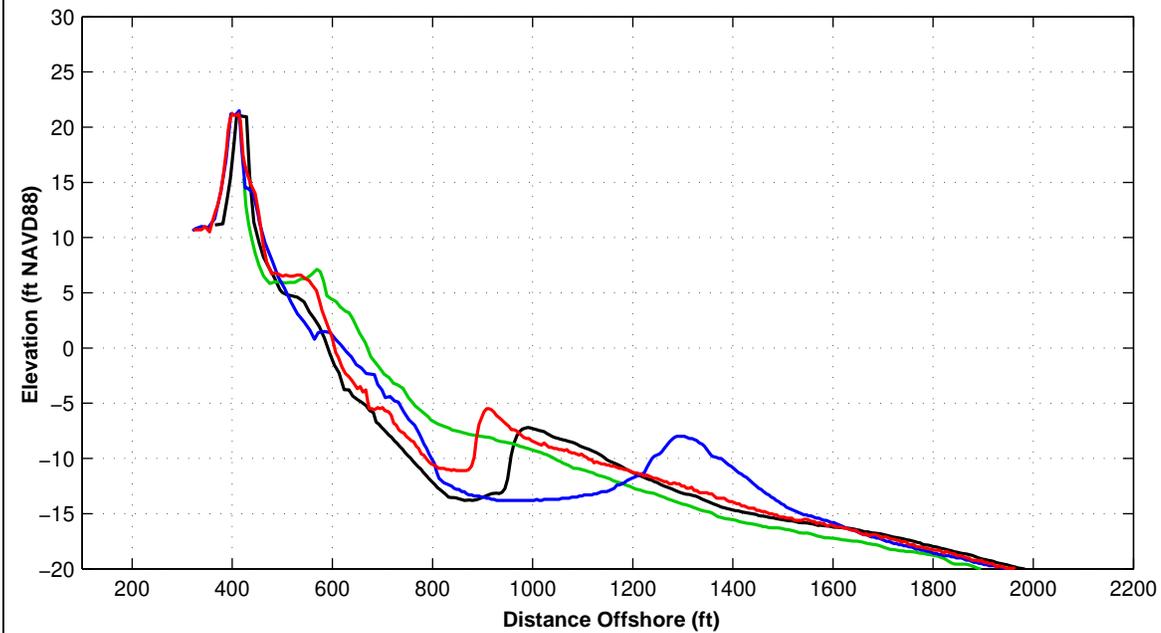
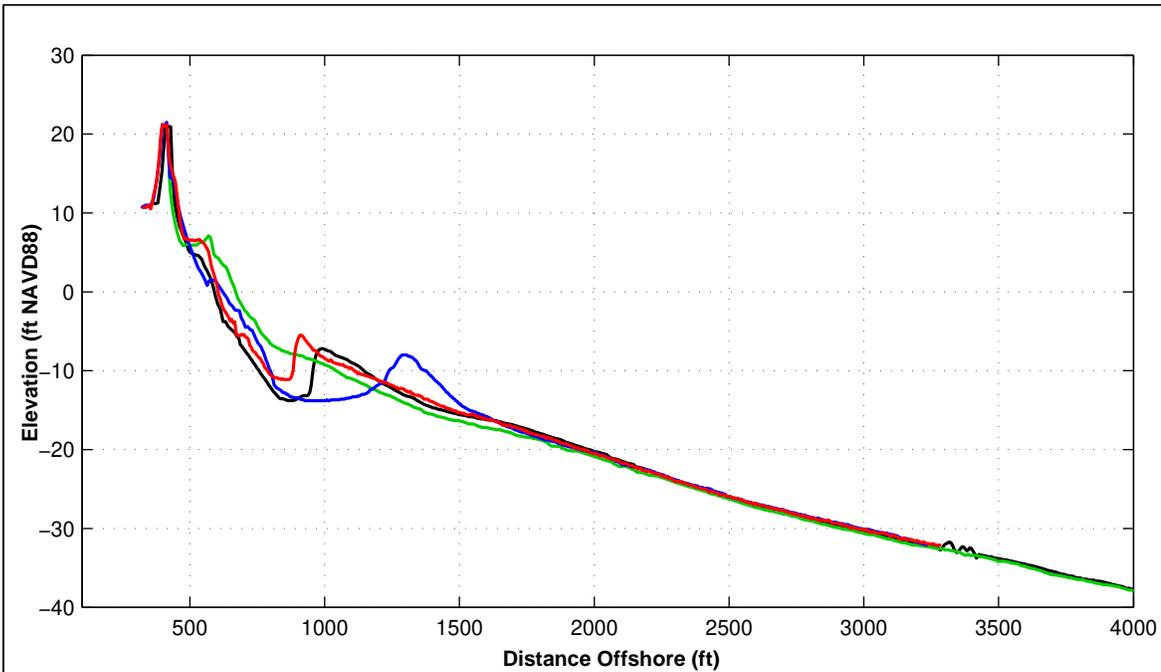
Survey Transect 575+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	-20.70 ft	-0.72 ft
Volume Change Above +6 ft NAVD88	5.39 cy/ft	5.56 cy/ft
Volume Change Above 1.18 ft NAVD88	0.24 cy/ft	11.23 cy/ft
Volume Change Above -6 ft NAVD88	-2.98 cy/ft	-1.23 cy/ft
Volume Change Above -14 ft NAVD88	26.04 cy/ft	-19.78 cy/ft
Volume Change Above -19 ft NAVD88	43.03 cy/ft	-20.74 cy/ft
Volume Change Above -30 ft NAVD88	58.94 cy/ft	-27.27 cy/ft

LEGEND:

JULY 2021	—	AUGUST 2019	—
JUNE 2020	—	MAY 2018	—

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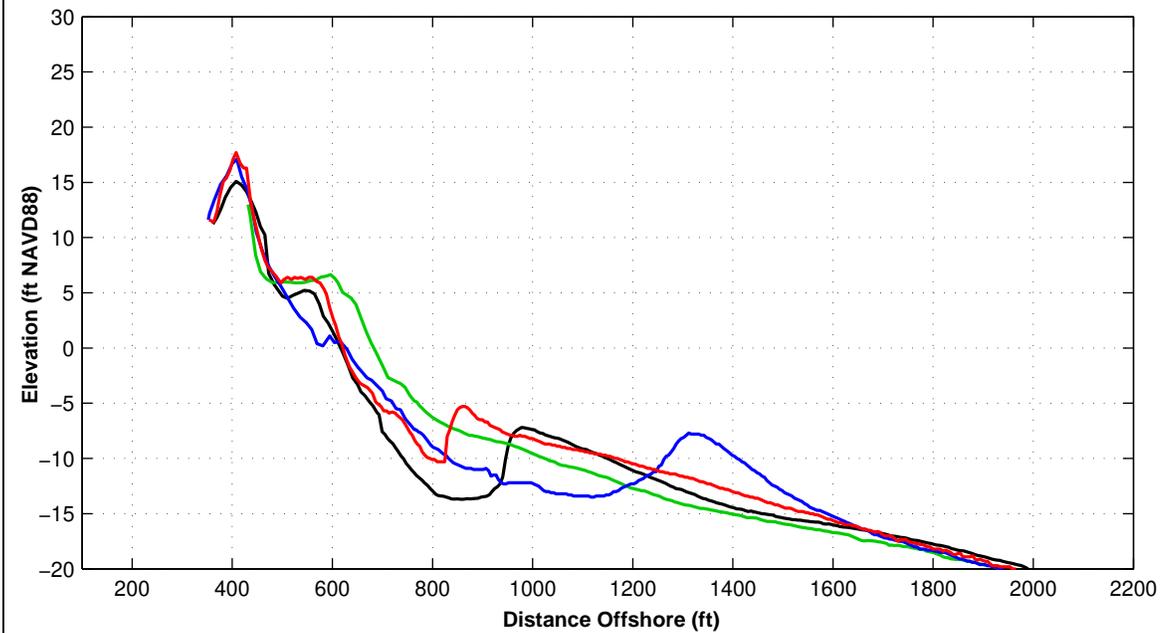
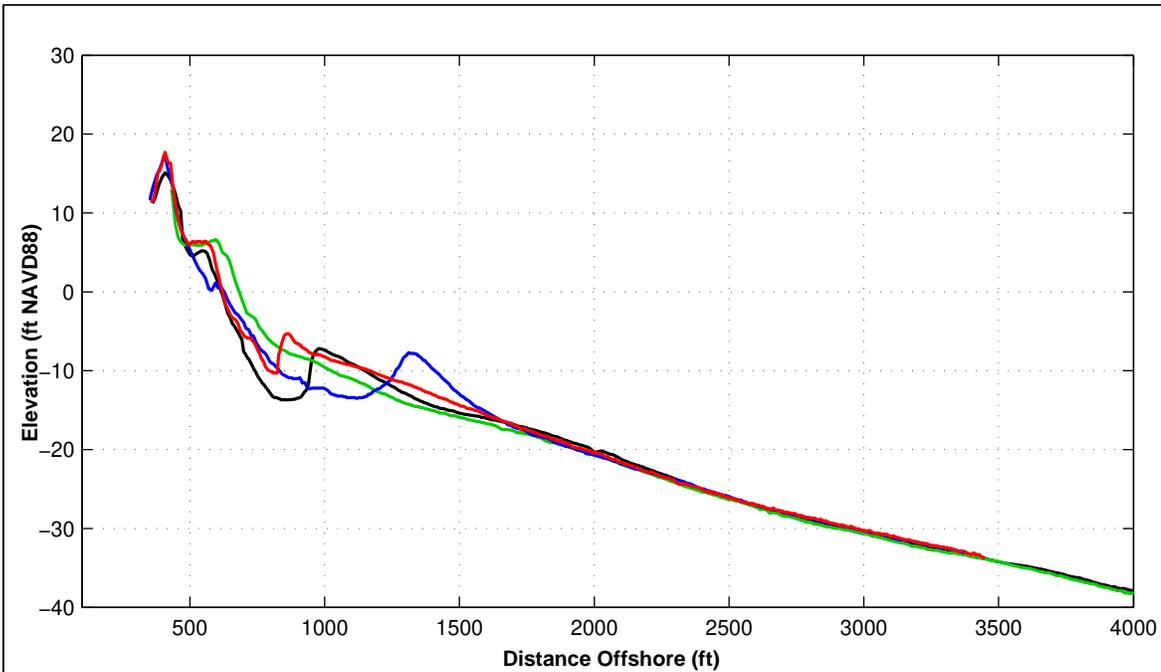
Survey Transect 580+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	-56.91 ft	-2.08 ft
Volume Change Above +6 ft NAVD88	6.45 cy/ft	1.32 cy/ft
Volume Change Above 1.18 ft NAVD88	-9.58 cy/ft	10.30 cy/ft
Volume Change Above -6 ft NAVD88	-20.21 cy/ft	1.37 cy/ft
Volume Change Above -14 ft NAVD88	-42.19 cy/ft	27.75 cy/ft
Volume Change Above -19 ft NAVD88	-19.72 cy/ft	24.94 cy/ft
Volume Change Above -30 ft NAVD88	-1.49 cy/ft	22.60 cy/ft

LEGEND:

JULY 2021	—	AUGUST 2019	—
JUNE 2020	—	MAY 2018	—

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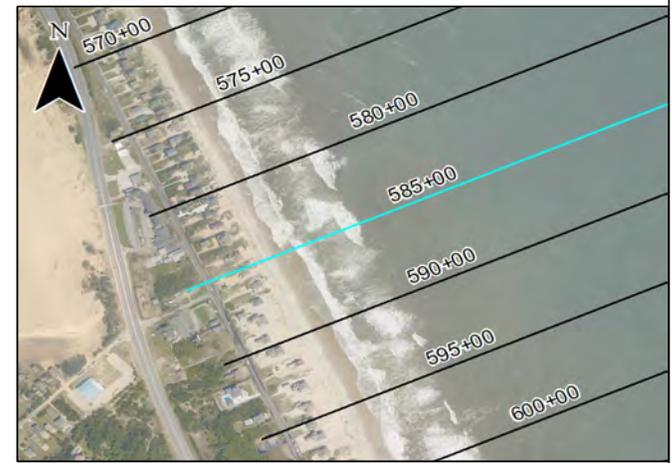


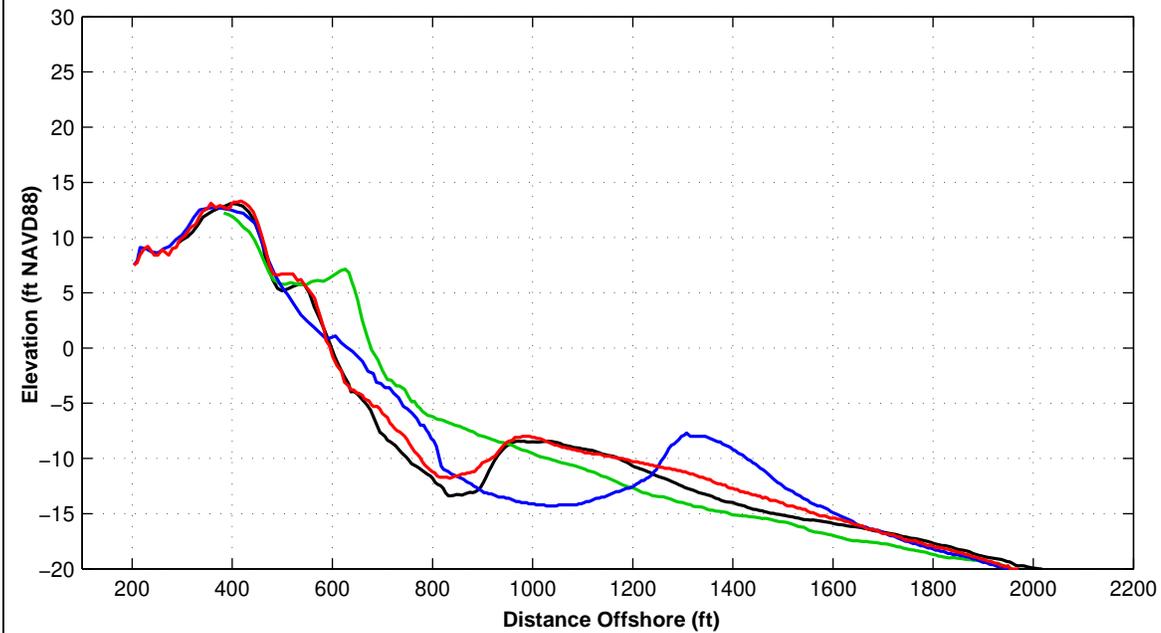
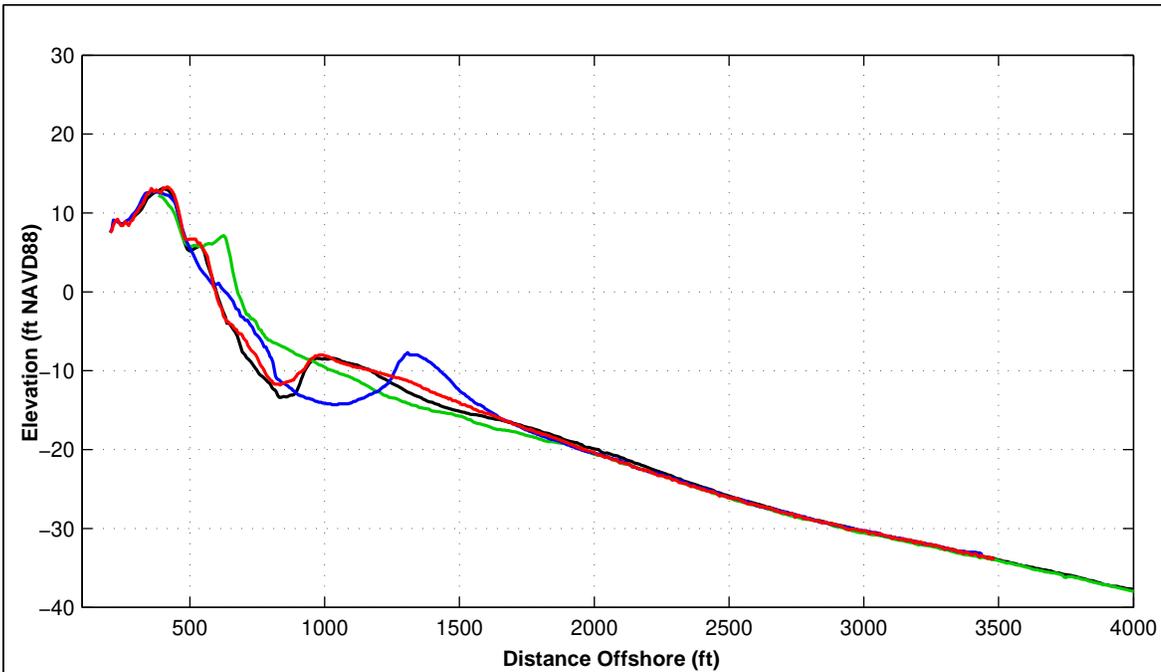
Survey Transect 585+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	-107.53 ft	48.74 ft
Volume Change Above +6 ft NAVD88	2.74 cy/ft	1.83 cy/ft
Volume Change Above 1.18 ft NAVD88	-18.31 cy/ft	14.16 cy/ft
Volume Change Above -6 ft NAVD88	-33.12 cy/ft	11.27 cy/ft
Volume Change Above -14 ft NAVD88	-31.81 cy/ft	37.50 cy/ft
Volume Change Above -19 ft NAVD88	-11.72 cy/ft	36.66 cy/ft
Volume Change Above -30 ft NAVD88	-1.34 cy/ft	39.24 cy/ft

LEGEND:

JULY 2021	—	AUGUST 2019	—
JUNE 2020	—	MAY 2018	—

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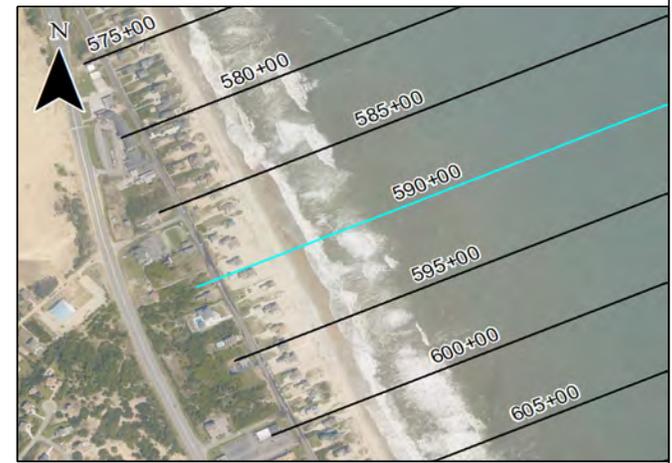


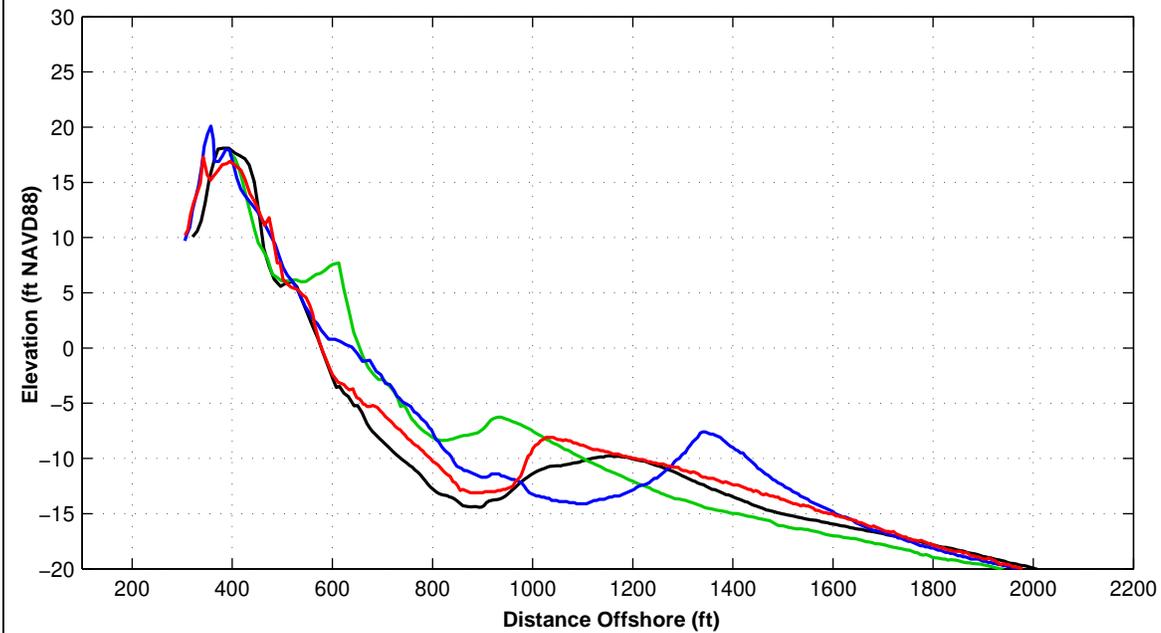
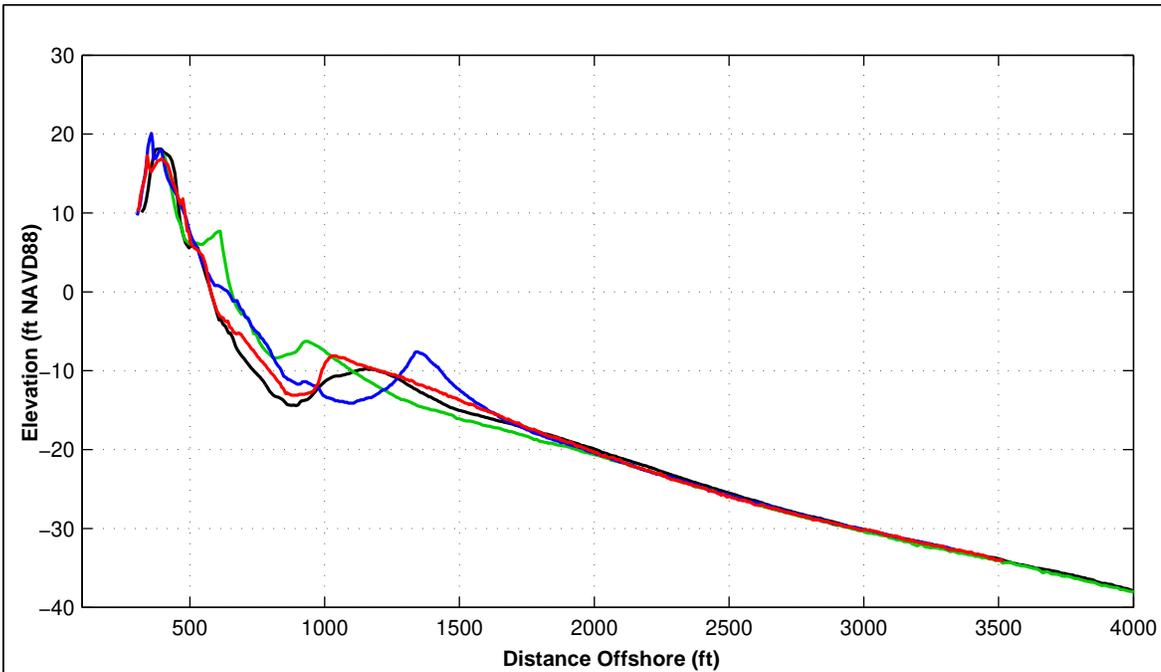
Survey Transect 590+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	-89.00 ft	5.96 ft
Volume Change Above +6 ft NAVD88	1.94 cy/ft	2.59 cy/ft
Volume Change Above 1.18 ft NAVD88	-19.51 cy/ft	9.17 cy/ft
Volume Change Above -6 ft NAVD88	-28.62 cy/ft	-5.07 cy/ft
Volume Change Above -14 ft NAVD88	-38.23 cy/ft	11.35 cy/ft
Volume Change Above -19 ft NAVD88	-14.48 cy/ft	10.80 cy/ft
Volume Change Above -30 ft NAVD88	-10.01 cy/ft	9.10 cy/ft

LEGEND:

JULY 2021	—	AUGUST 2019	—
JUNE 2020	—	MAY 2018	—

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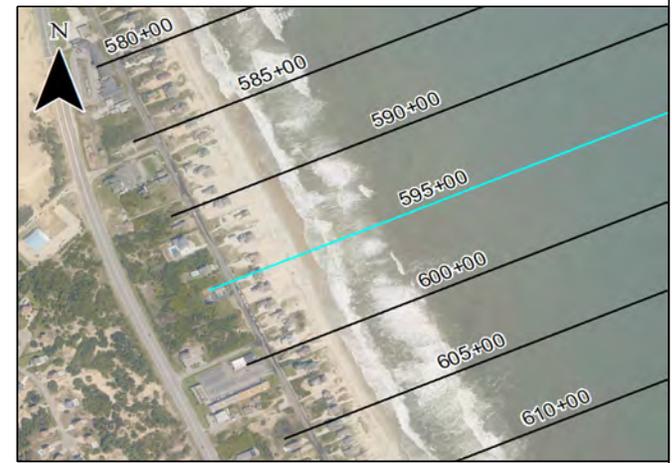


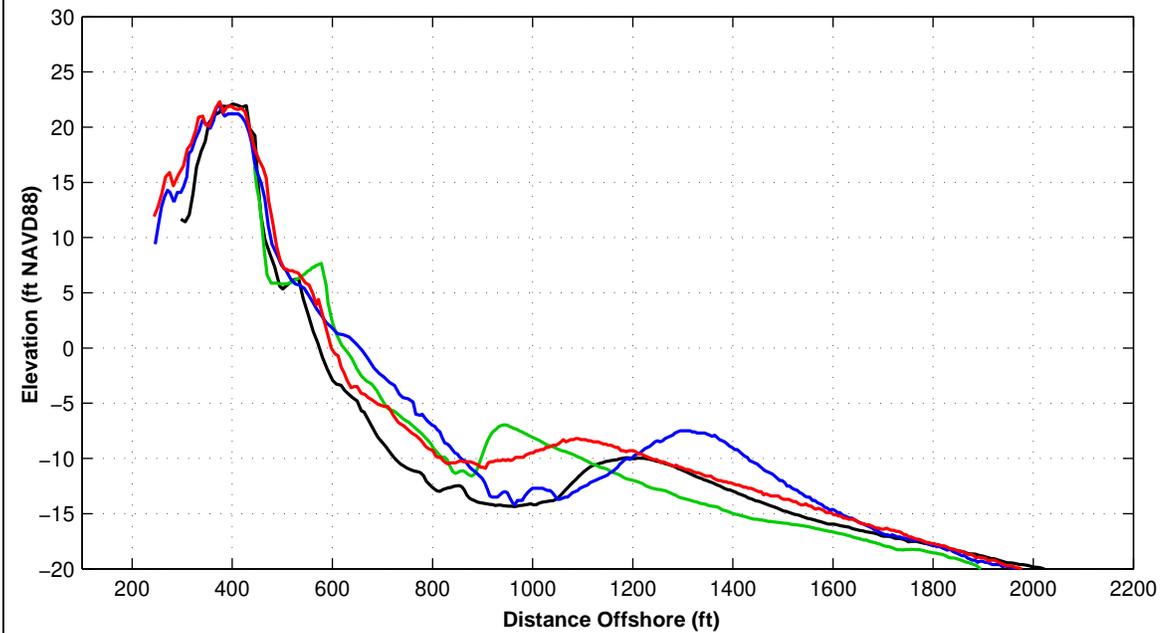
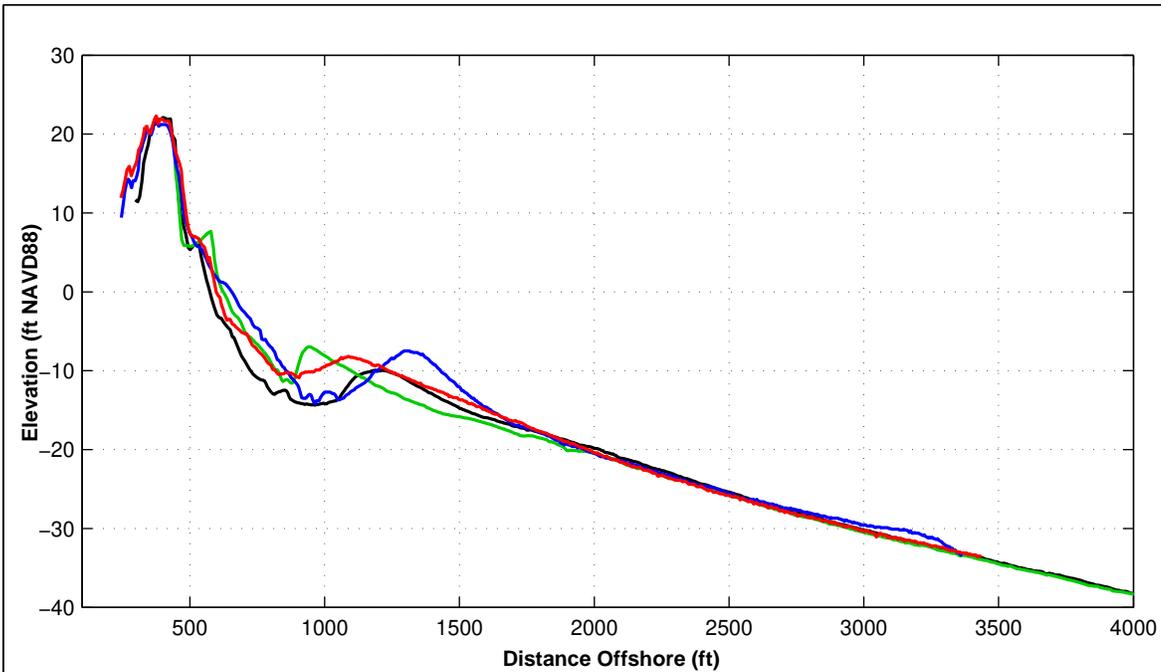
Survey Transect 595+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	-58.96 ft	-15.57 ft
Volume Change Above +6 ft NAVD88	3.06 cy/ft	1.28 cy/ft
Volume Change Above 1.18 ft NAVD88	-11.47 cy/ft	1.29 cy/ft
Volume Change Above -6 ft NAVD88	-12.08 cy/ft	-18.54 cy/ft
Volume Change Above -14 ft NAVD88	-25.66 cy/ft	-16.81 cy/ft
Volume Change Above -19 ft NAVD88	0.10 cy/ft	-15.33 cy/ft
Volume Change Above -30 ft NAVD88	6.20 cy/ft	-17.04 cy/ft

LEGEND:

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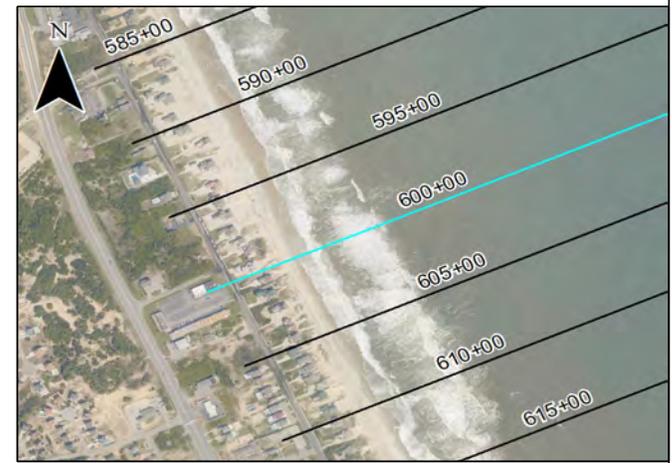


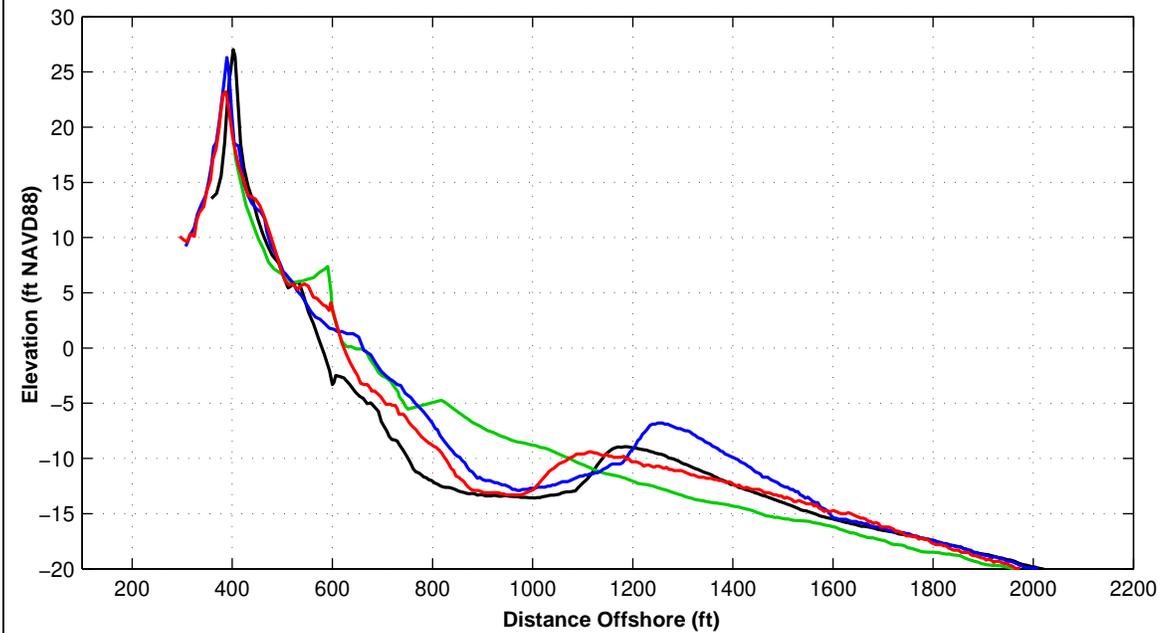
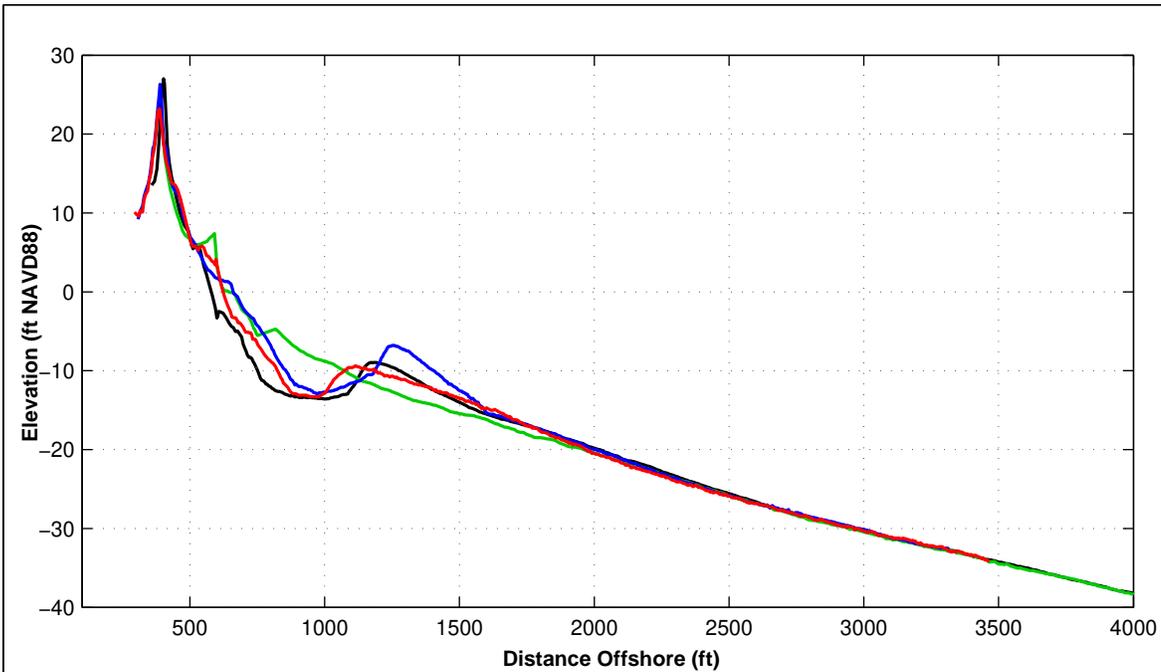
Survey Transect 600+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	14.80 ft	-32.52 ft
Volume Change Above +6 ft NAVD88	4.79 cy/ft	5.86 cy/ft
Volume Change Above 1.18 ft NAVD88	0.50 cy/ft	6.49 cy/ft
Volume Change Above -6 ft NAVD88	10.83 cy/ft	-10.55 cy/ft
Volume Change Above -14 ft NAVD88	33.63 cy/ft	-10.98 cy/ft
Volume Change Above -19 ft NAVD88	58.41 cy/ft	-10.06 cy/ft
Volume Change Above -30 ft NAVD88	74.64 cy/ft	-22.02 cy/ft

LEGEND:

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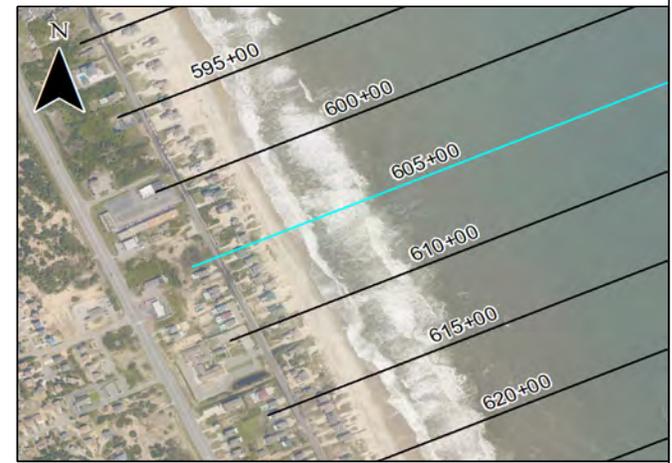


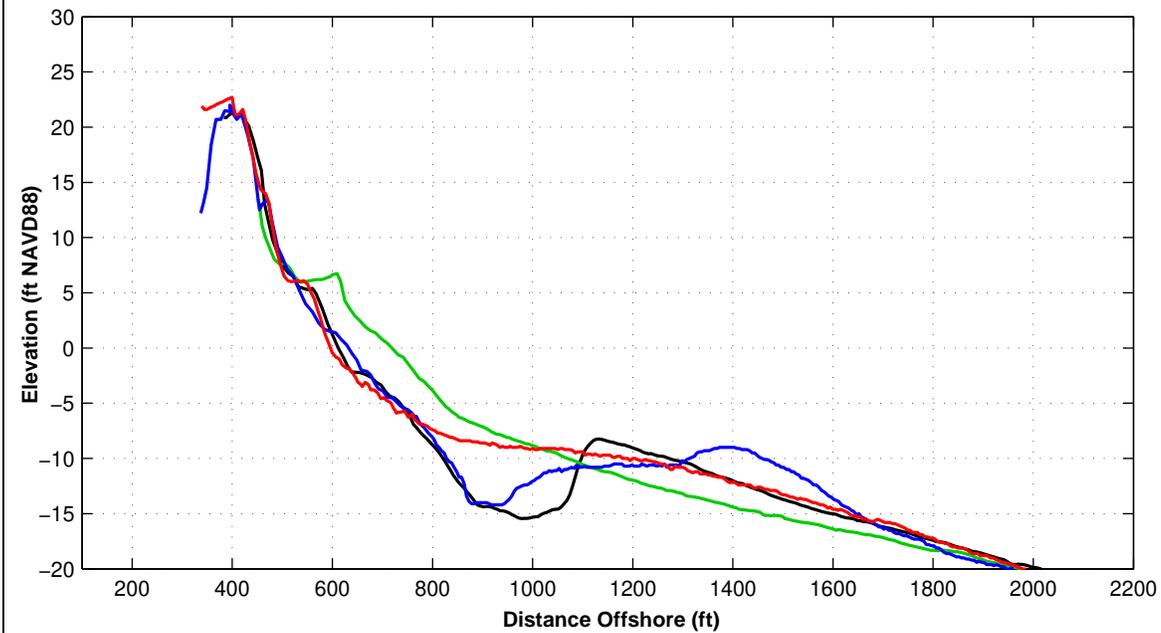
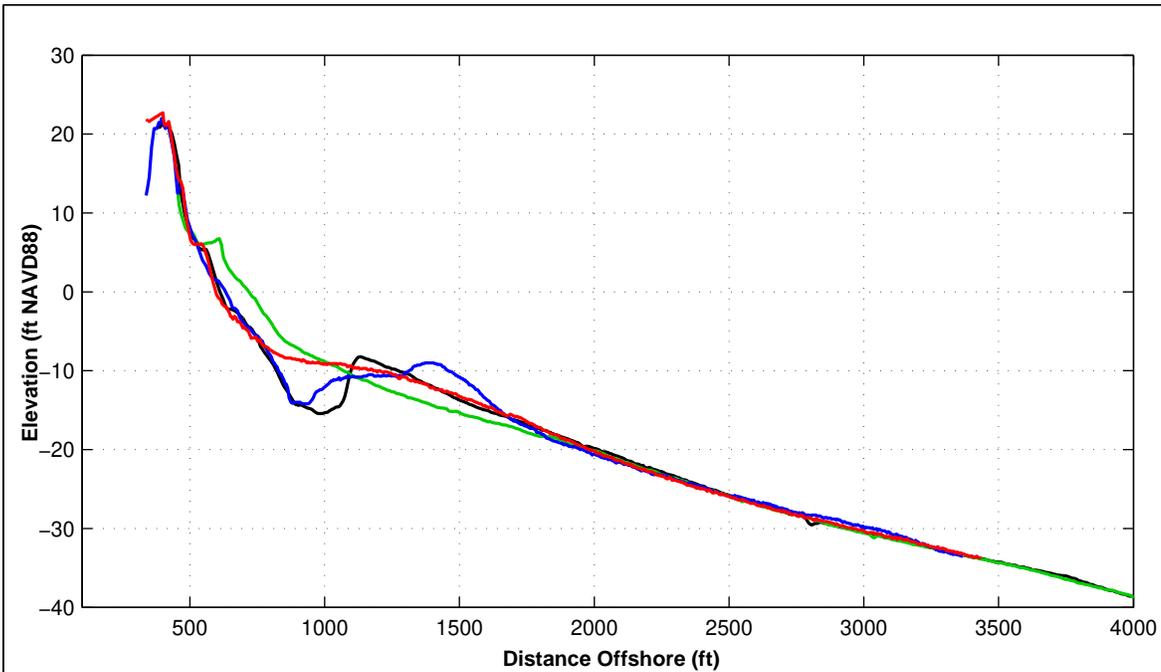
Survey Transect 605+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	31.58 ft	-31.25 ft
Volume Change Above +6 ft NAVD88	5.36 cy/ft	-0.75 cy/ft
Volume Change Above 1.18 ft NAVD88	-2.03 cy/ft	3.34 cy/ft
Volume Change Above -6 ft NAVD88	-0.86 cy/ft	-10.37 cy/ft
Volume Change Above -14 ft NAVD88	13.76 cy/ft	-45.07 cy/ft
Volume Change Above -19 ft NAVD88	34.32 cy/ft	-44.83 cy/ft
Volume Change Above -30 ft NAVD88	41.72 cy/ft	-53.56 cy/ft

LEGEND:

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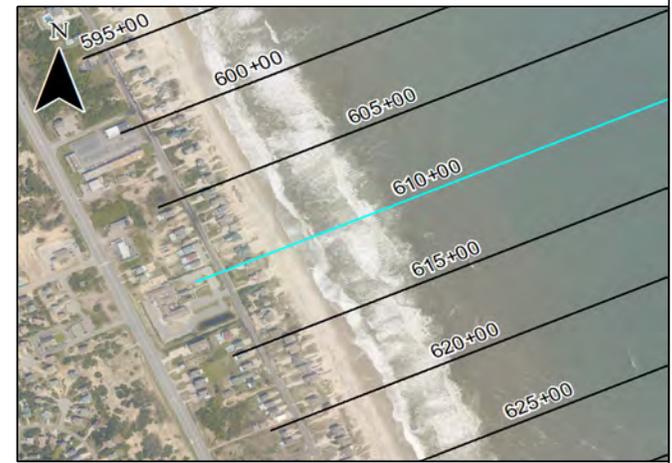


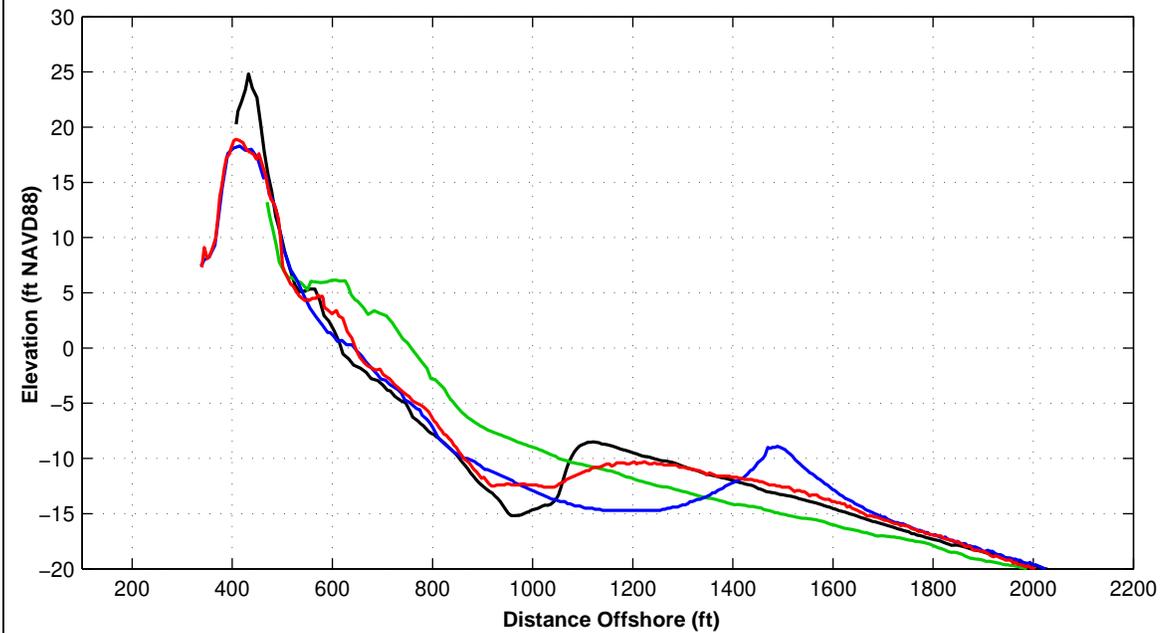
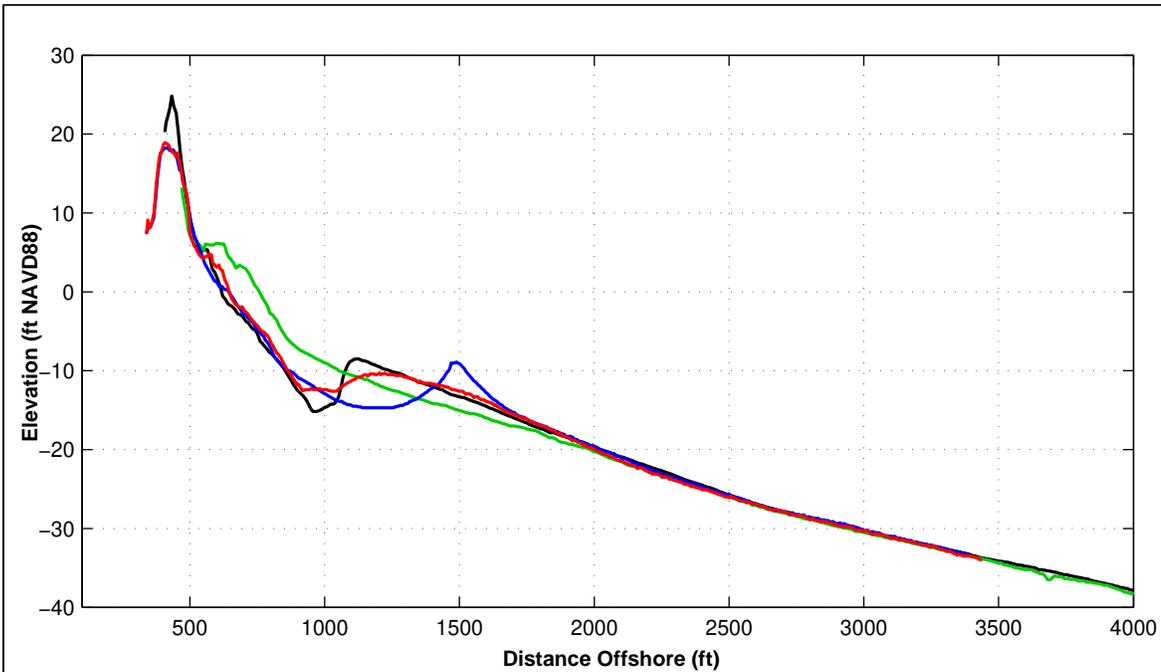
Survey Transect 610+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	-80.11 ft	-24.23 ft
Volume Change Above +6 ft NAVD88	2.75 cy/ft	0.23 cy/ft
Volume Change Above 1.18 ft NAVD88	-12.18 cy/ft	2.32 cy/ft
Volume Change Above -6 ft NAVD88	-36.92 cy/ft	-4.70 cy/ft
Volume Change Above -14 ft NAVD88	-34.25 cy/ft	10.69 cy/ft
Volume Change Above -19 ft NAVD88	-15.78 cy/ft	14.88 cy/ft
Volume Change Above -30 ft NAVD88	-12.04 cy/ft	9.74 cy/ft

LEGEND:

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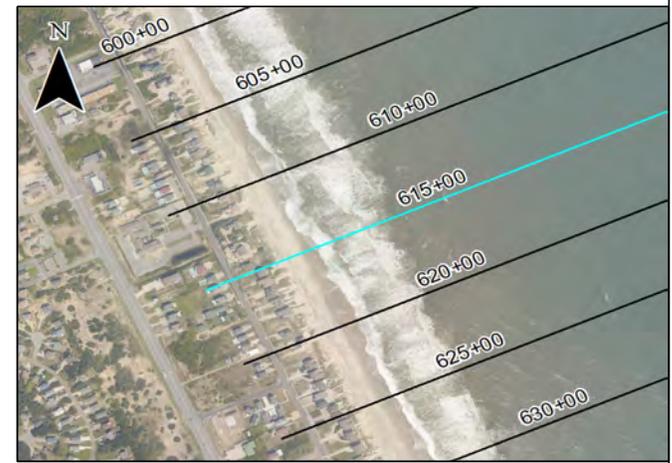


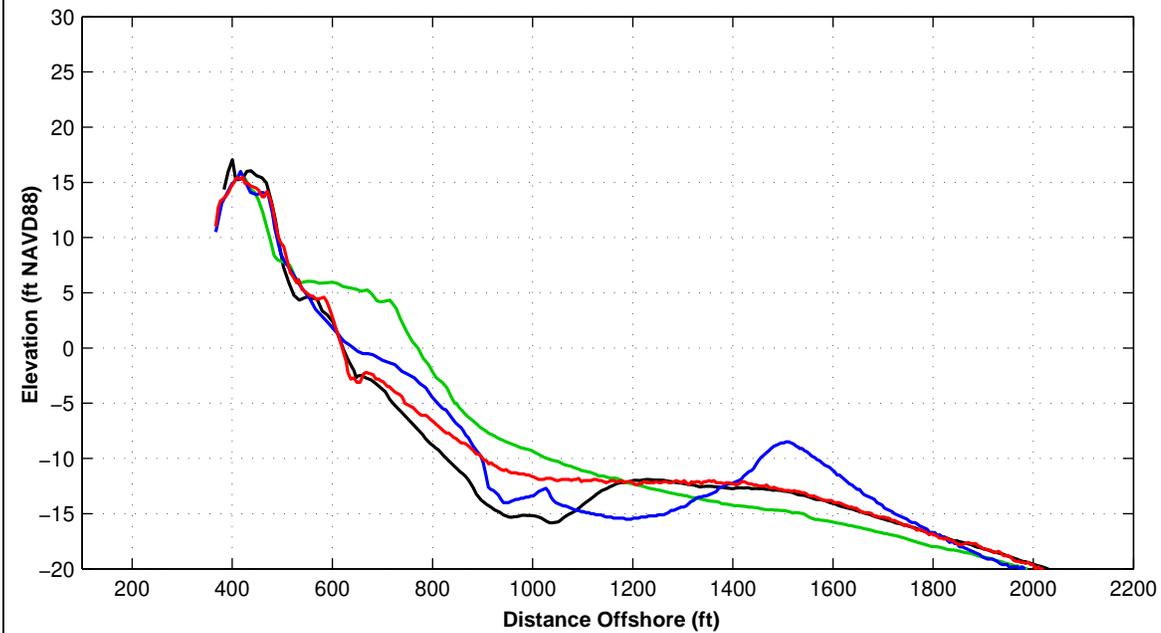
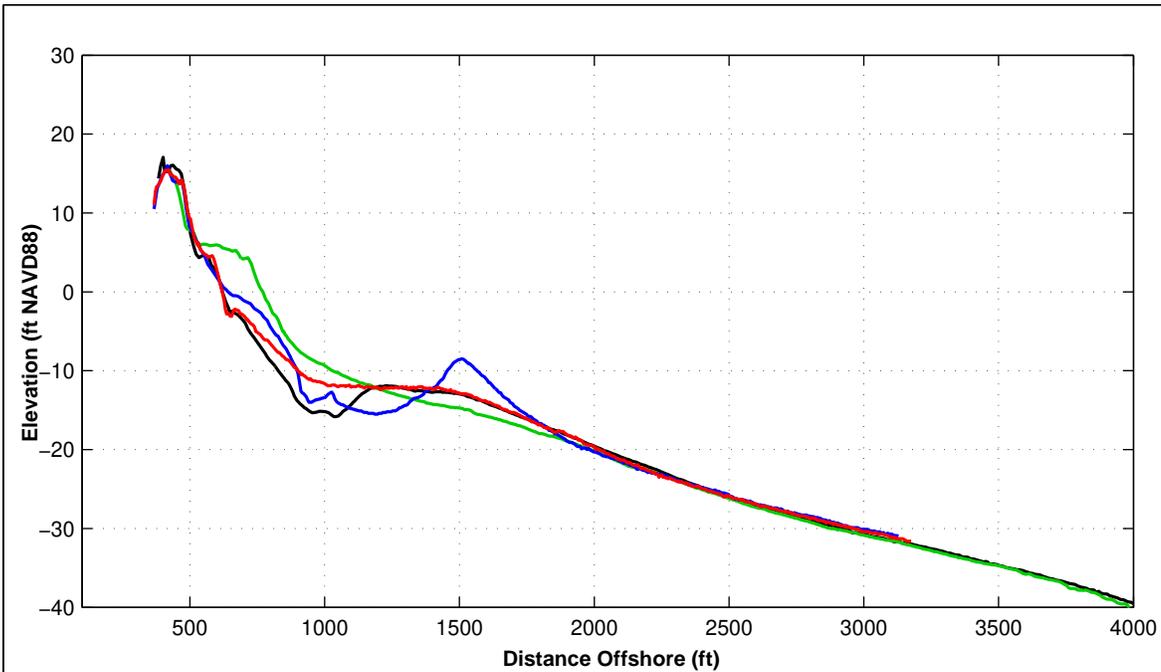
Survey Transect 615+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	-135.21 ft	34.26 ft
Volume Change Above +6 ft NAVD88	3.94 cy/ft	-0.81 cy/ft
Volume Change Above 1.18 ft NAVD88	-16.67 cy/ft	3.47 cy/ft
Volume Change Above -6 ft NAVD88	-44.33 cy/ft	6.01 cy/ft
Volume Change Above -14 ft NAVD88	-74.76 cy/ft	28.54 cy/ft
Volume Change Above -19 ft NAVD88	-55.21 cy/ft	31.32 cy/ft
Volume Change Above -30 ft NAVD88	-42.96 cy/ft	21.79 cy/ft

LEGEND:

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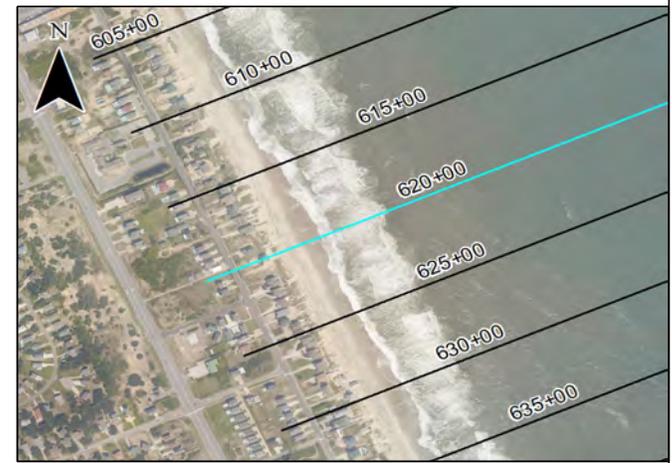


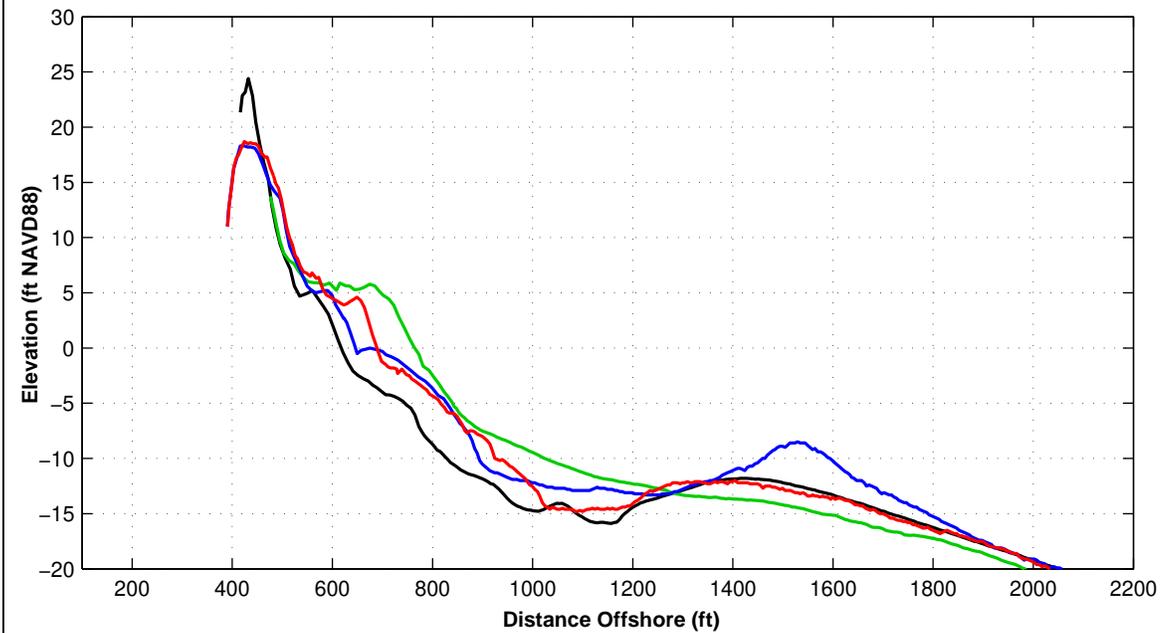
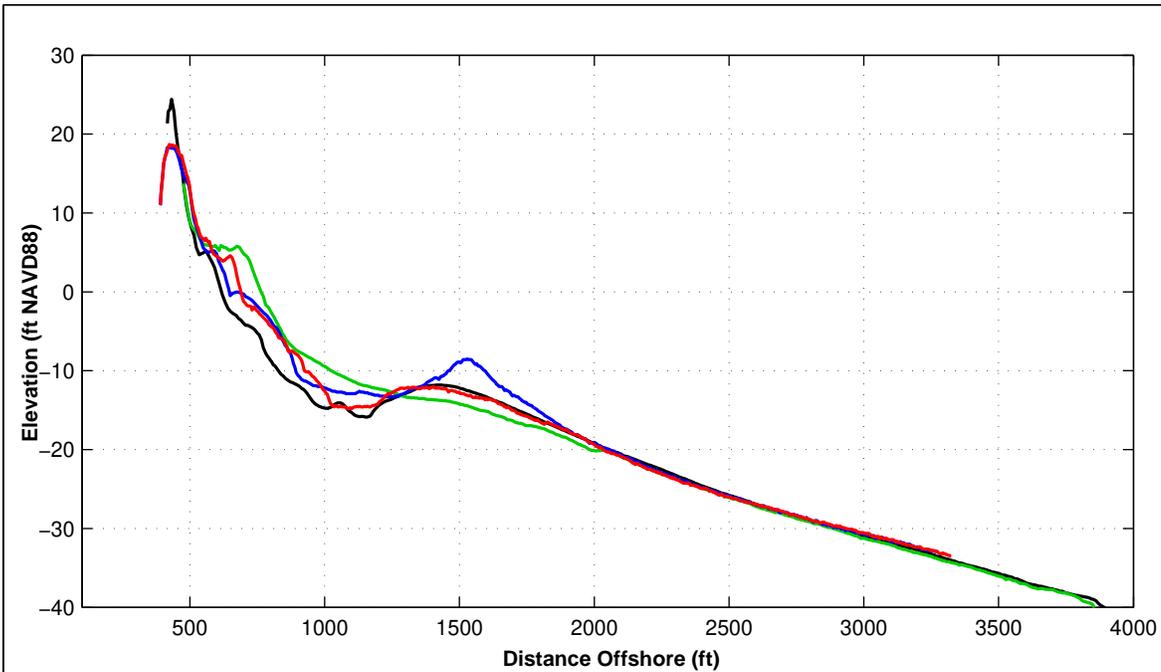
Survey Transect 620+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	-139.59 ft	-1.39 ft
Volume Change Above +6 ft NAVD88	3.55 cy/ft	1.14 cy/ft
Volume Change Above 1.18 ft NAVD88	-20.82 cy/ft	3.50 cy/ft
Volume Change Above -6 ft NAVD88	-39.54 cy/ft	-12.88 cy/ft
Volume Change Above -14 ft NAVD88	-49.85 cy/ft	-10.45 cy/ft
Volume Change Above -19 ft NAVD88	-35.73 cy/ft	-3.26 cy/ft
Volume Change Above -30 ft NAVD88	-24.80 cy/ft	-2.87 cy/ft

LEGEND:

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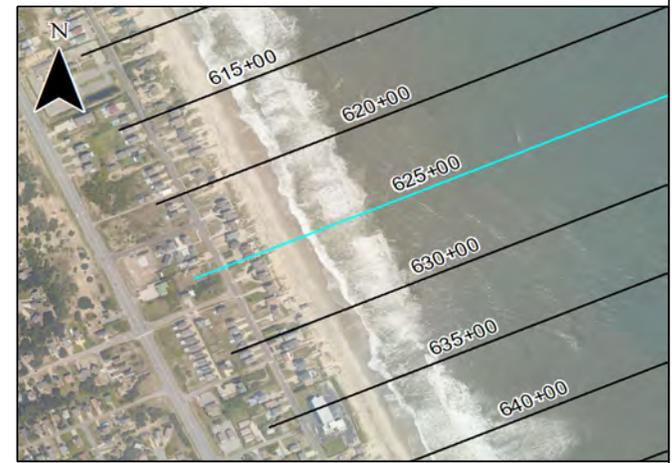


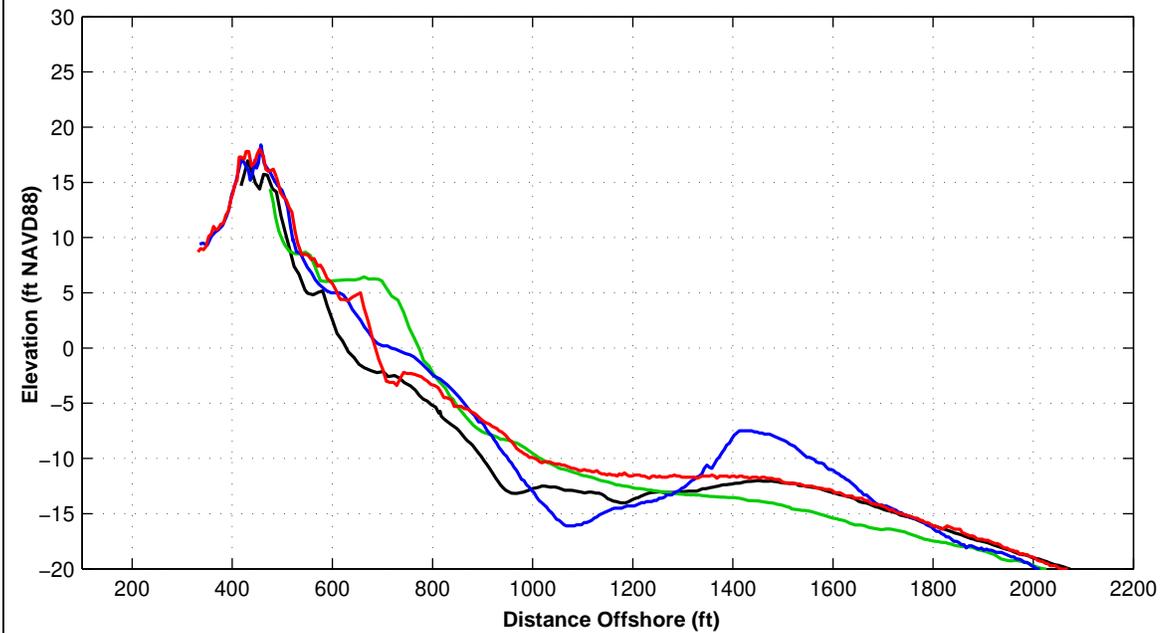
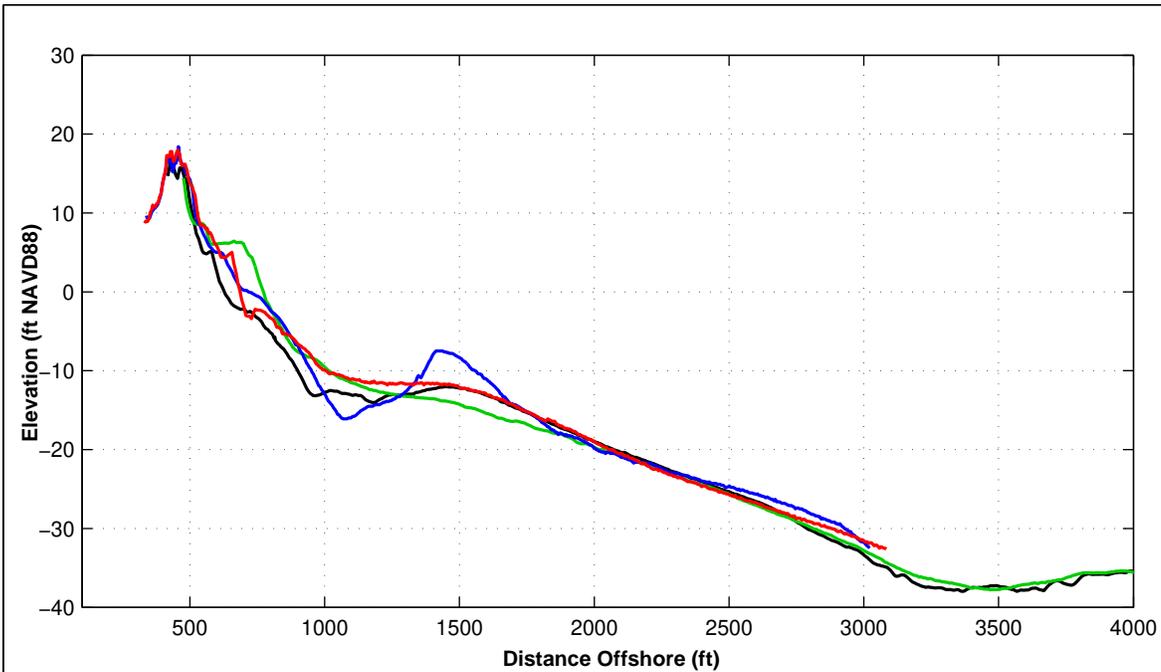
Survey Transect 625+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	-113.00 ft	42.74 ft
Volume Change Above +6 ft NAVD88	4.27 cy/ft	3.74 cy/ft
Volume Change Above 1.18 ft NAVD88	-14.64 cy/ft	9.88 cy/ft
Volume Change Above -6 ft NAVD88	-26.67 cy/ft	8.13 cy/ft
Volume Change Above -14 ft NAVD88	-8.64 cy/ft	-26.11 cy/ft
Volume Change Above -19 ft NAVD88	17.61 cy/ft	-38.59 cy/ft
Volume Change Above -30 ft NAVD88	26.21 cy/ft	-41.74 cy/ft

LEGEND:

JULY 2021	—	AUGUST 2019	—
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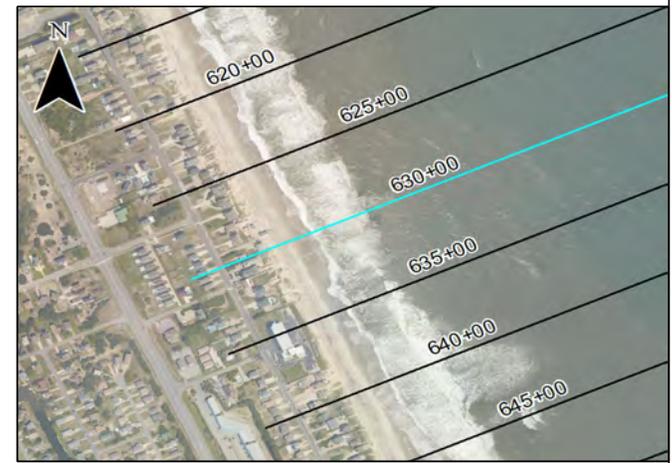


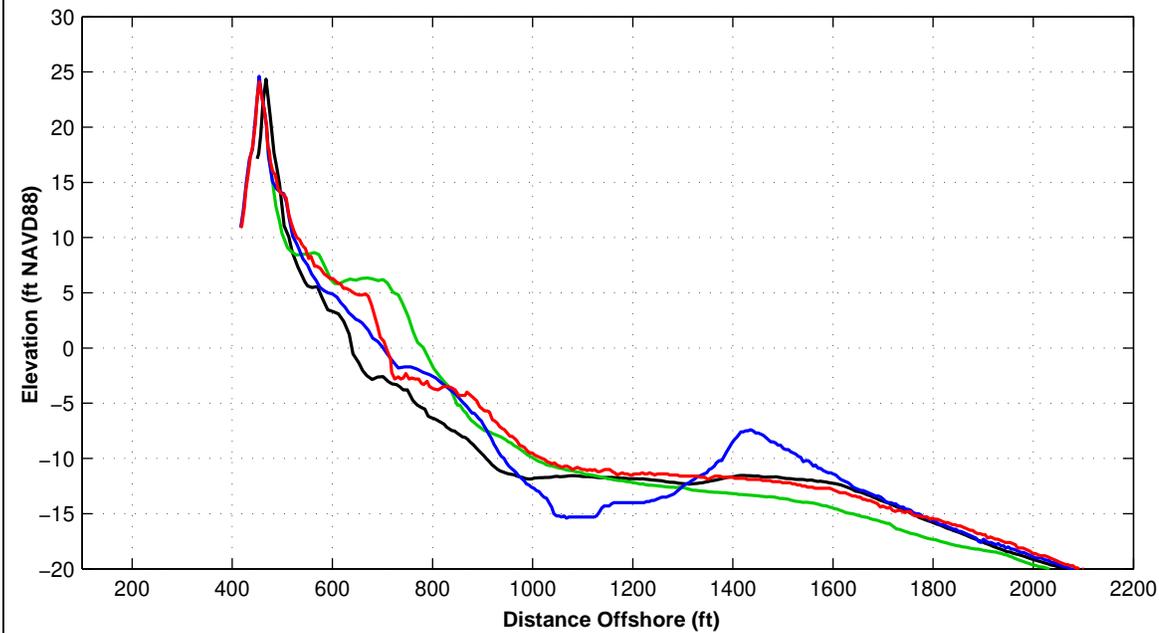
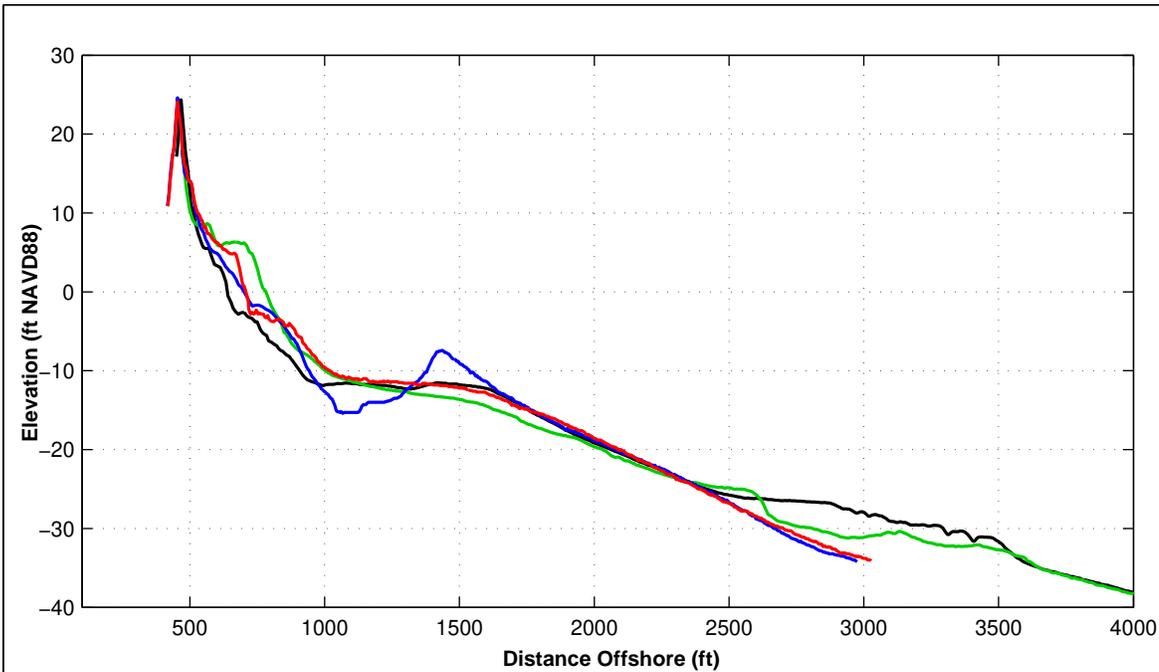
Survey Transect 630+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	-84.36 ft	2.07 ft
Volume Change Above +6 ft NAVD88	3.65 cy/ft	4.74 cy/ft
Volume Change Above 1.18 ft NAVD88	-14.37 cy/ft	7.68 cy/ft
Volume Change Above -6 ft NAVD88	-17.53 cy/ft	-2.93 cy/ft
Volume Change Above -14 ft NAVD88	9.32 cy/ft	1.59 cy/ft
Volume Change Above -19 ft NAVD88	19.85 cy/ft	14.87 cy/ft
Volume Change Above -30 ft NAVD88	45.96 cy/ft	-5.00 cy/ft

LEGEND:

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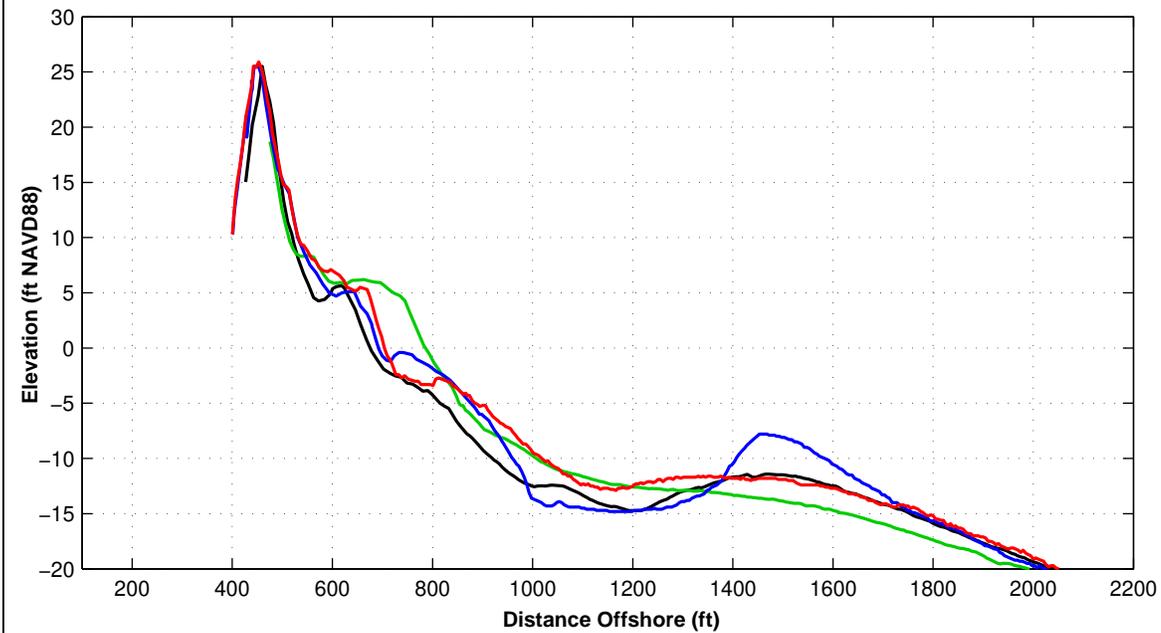
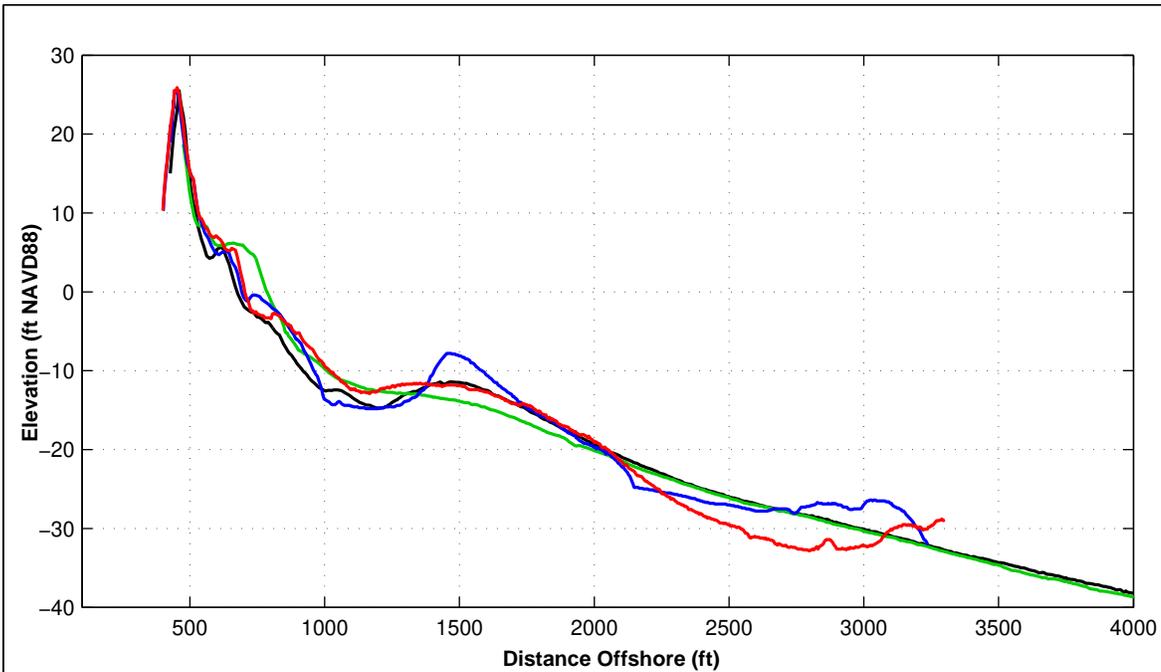
Survey Transect 635+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	-87.19 ft	17.44 ft
Volume Change Above +6 ft NAVD88	0.61 cy/ft	3.51 cy/ft
Volume Change Above 1.18 ft NAVD88	-19.89 cy/ft	11.36 cy/ft
Volume Change Above -6 ft NAVD88	-28.75 cy/ft	10.42 cy/ft
Volume Change Above -14 ft NAVD88	-11.71 cy/ft	21.73 cy/ft
Volume Change Above -19 ft NAVD88	2.69 cy/ft	28.83 cy/ft
Volume Change Above -30 ft NAVD88	-9.85 cy/ft	28.09 cy/ft

LEGEND:

JULY 2021	—	AUGUST 2019	—
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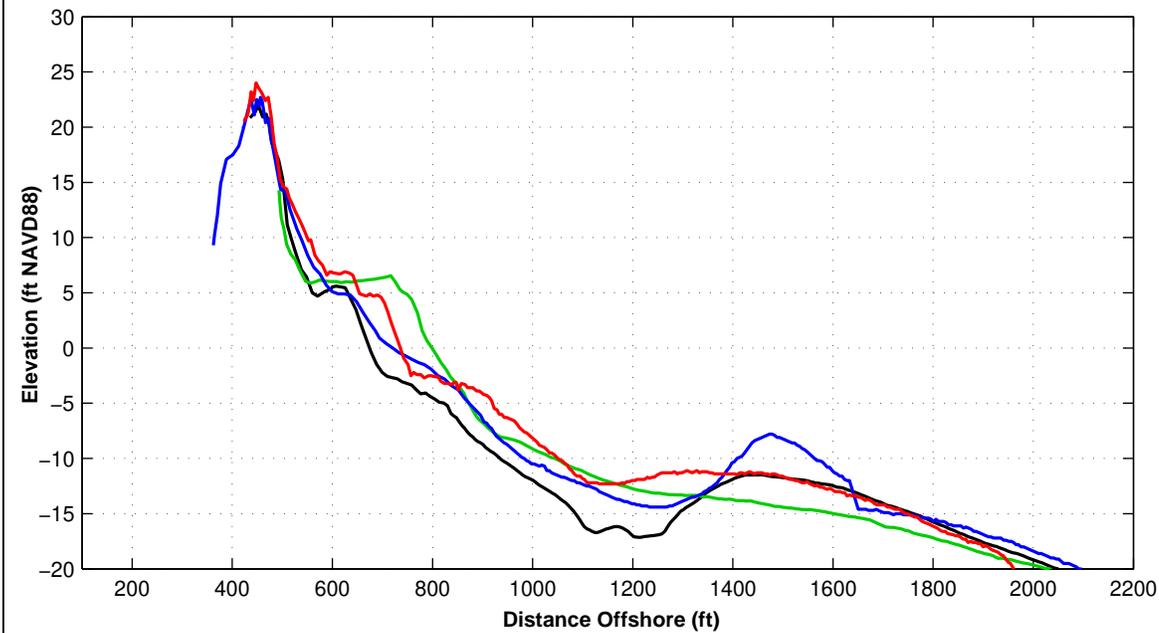
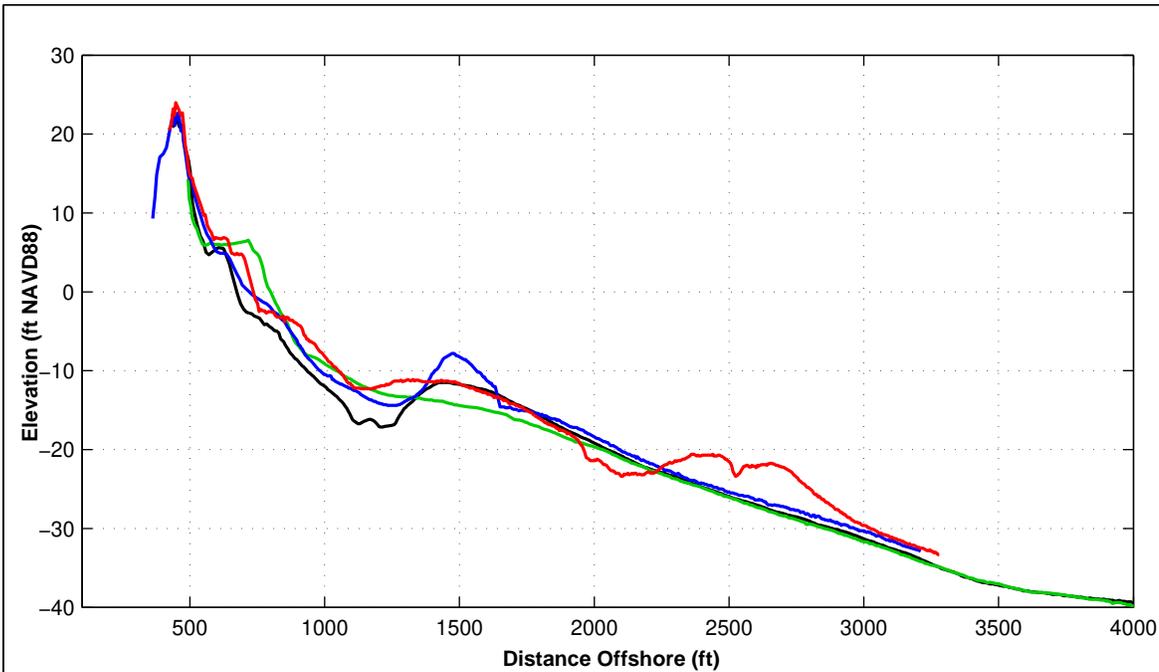
Survey Transect 640+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	-89.34 ft	12.81 ft
Volume Change Above +6 ft NAVD88	4.13 cy/ft	4.23 cy/ft
Volume Change Above 1.18 ft NAVD88	-12.78 cy/ft	8.94 cy/ft
Volume Change Above -6 ft NAVD88	-18.38 cy/ft	4.27 cy/ft
Volume Change Above -14 ft NAVD88	2.15 cy/ft	8.96 cy/ft
Volume Change Above -19 ft NAVD88	16.71 cy/ft	18.09 cy/ft
Volume Change Above -30 ft NAVD88	29.56 cy/ft	-55.85 cy/ft

LEGEND:

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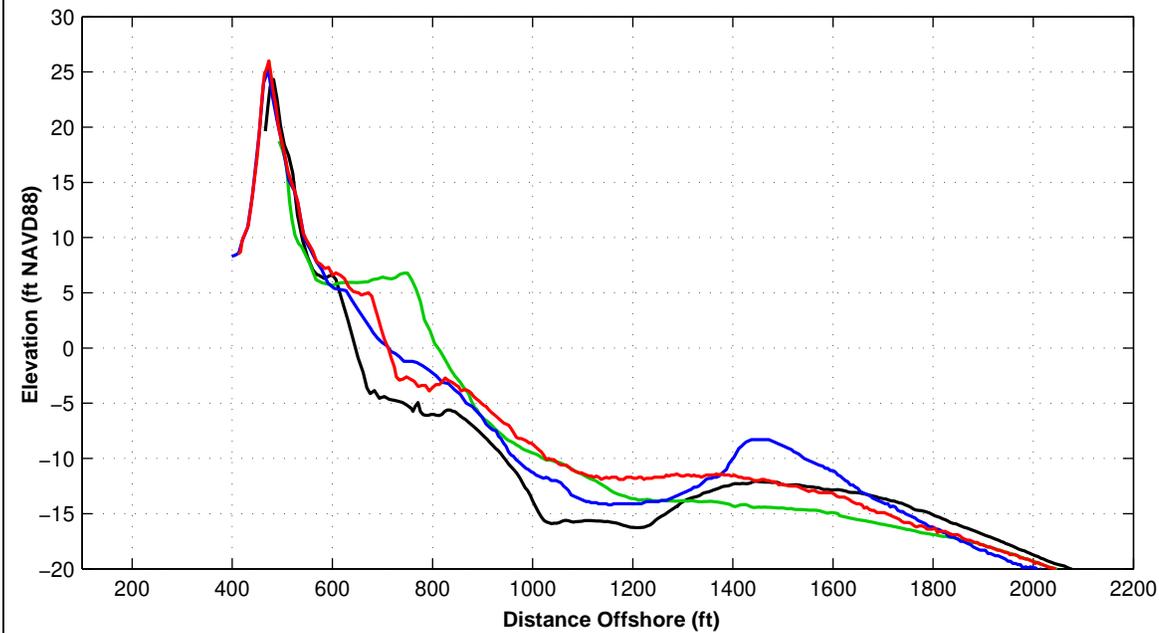
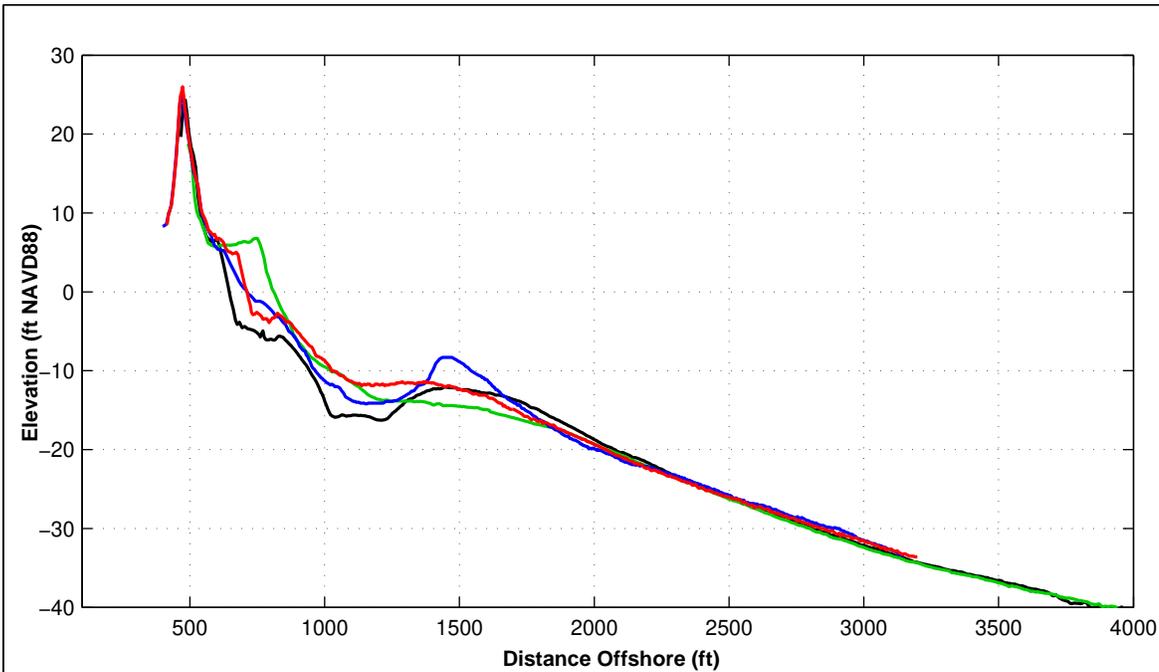
Survey Transect 645+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	-92.87 ft	35.88 ft
Volume Change Above +6 ft NAVD88	7.50 cy/ft	8.39 cy/ft
Volume Change Above 1.18 ft NAVD88	-12.69 cy/ft	17.11 cy/ft
Volume Change Above -6 ft NAVD88	-21.63 cy/ft	20.30 cy/ft
Volume Change Above -14 ft NAVD88	6.67 cy/ft	29.26 cy/ft
Volume Change Above -19 ft NAVD88	29.82 cy/ft	23.51 cy/ft
Volume Change Above -30 ft NAVD88	60.92 cy/ft	85.68 cy/ft

LEGEND:

JULY 2021	—	AUGUST 2019	—
JUNE 2020	—	MAY 2018	—

- Notes:
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Survey Transect 650+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	-112.84 ft	15.87 ft
Volume Change Above +6 ft NAVD88	4.28 cy/ft	2.68 cy/ft
Volume Change Above 1.18 ft NAVD88	-18.96 cy/ft	8.14 cy/ft
Volume Change Above -6 ft NAVD88	-32.31 cy/ft	5.39 cy/ft
Volume Change Above -14 ft NAVD88	-0.94 cy/ft	11.11 cy/ft
Volume Change Above -19 ft NAVD88	11.96 cy/ft	10.11 cy/ft
Volume Change Above -30 ft NAVD88	19.39 cy/ft	5.88 cy/ft

LEGEND:

JULY 2021 — AUGUST 2019 —
 JUNE 2020 — MAY 2018 —

Notes:

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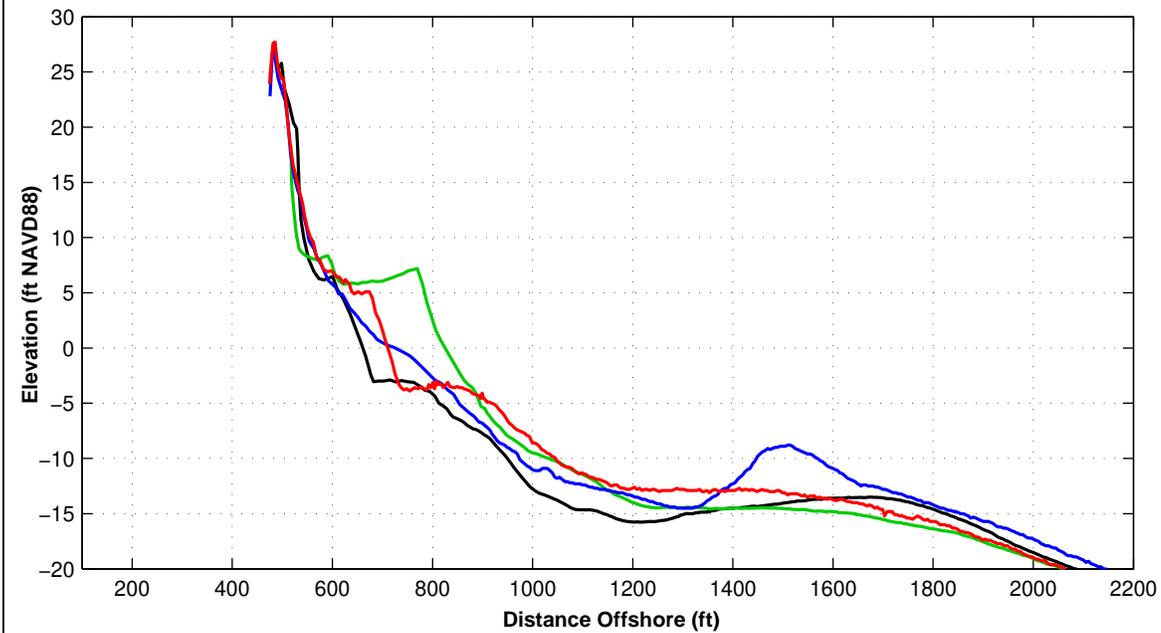
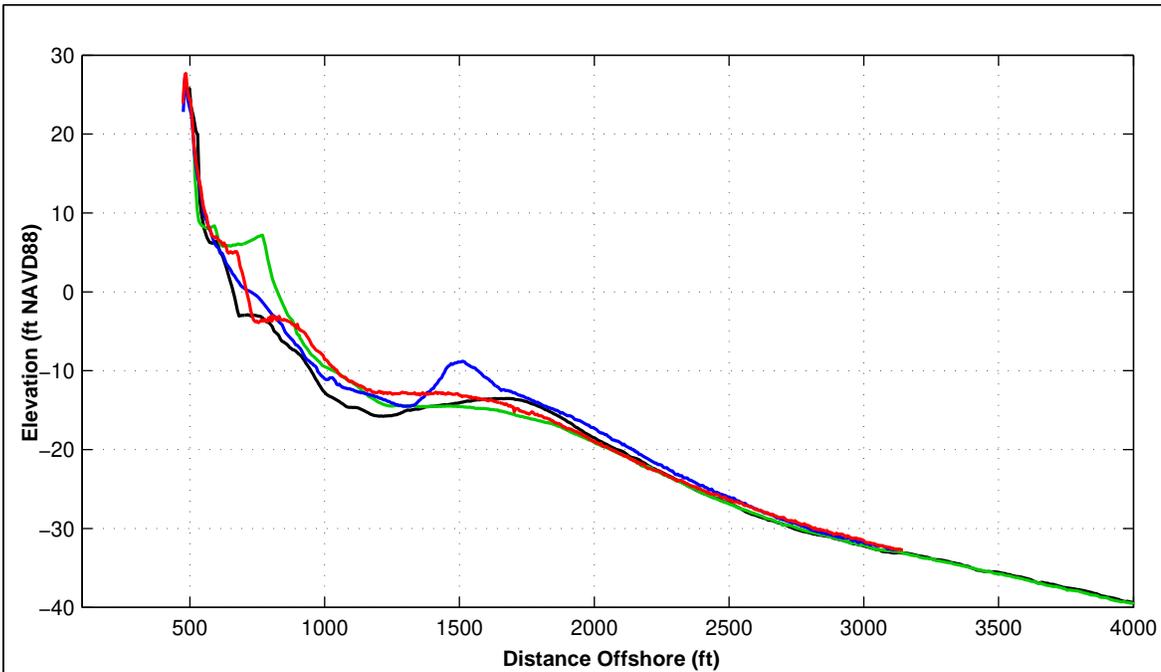


Town of Nags Head Periodic Surveying Data Analysis

ST 650+00

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Summer 2021

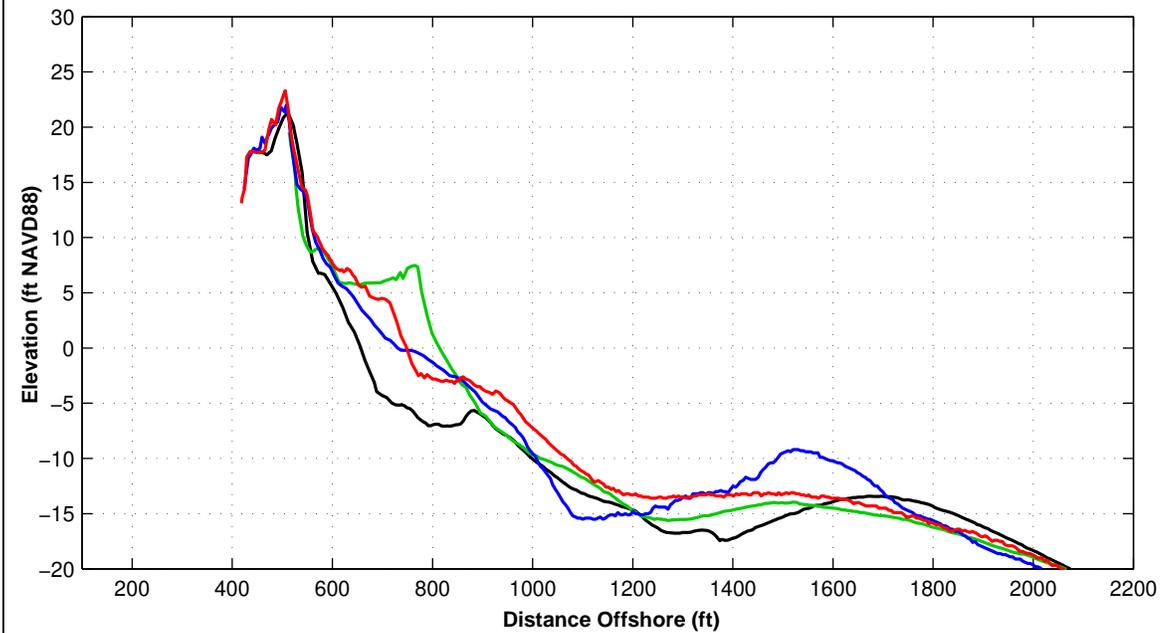
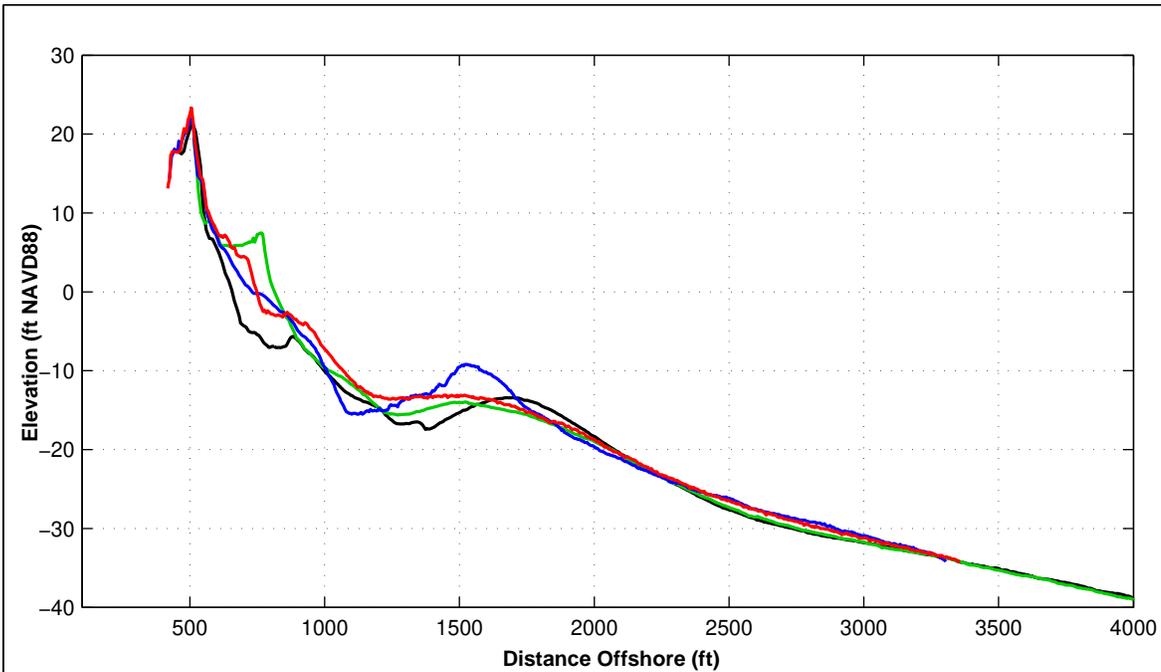


Survey Transect 655+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	-128.66 ft	20.13 ft
Volume Change Above +6 ft NAVD88	1.67 cy/ft	2.26 cy/ft
Volume Change Above 1.18 ft NAVD88	-25.82 cy/ft	9.39 cy/ft
Volume Change Above -6 ft NAVD88	-44.04 cy/ft	7.35 cy/ft
Volume Change Above -14 ft NAVD88	-12.44 cy/ft	-2.56 cy/ft
Volume Change Above -19 ft NAVD88	22.03 cy/ft	-20.83 cy/ft
Volume Change Above -30 ft NAVD88	46.33 cy/ft	-34.90 cy/ft

LEGEND:
 JULY 2021 ————
 JUNE 2020 ————
 AUGUST 2019 ————
 MAY 2018 ————

- Notes:
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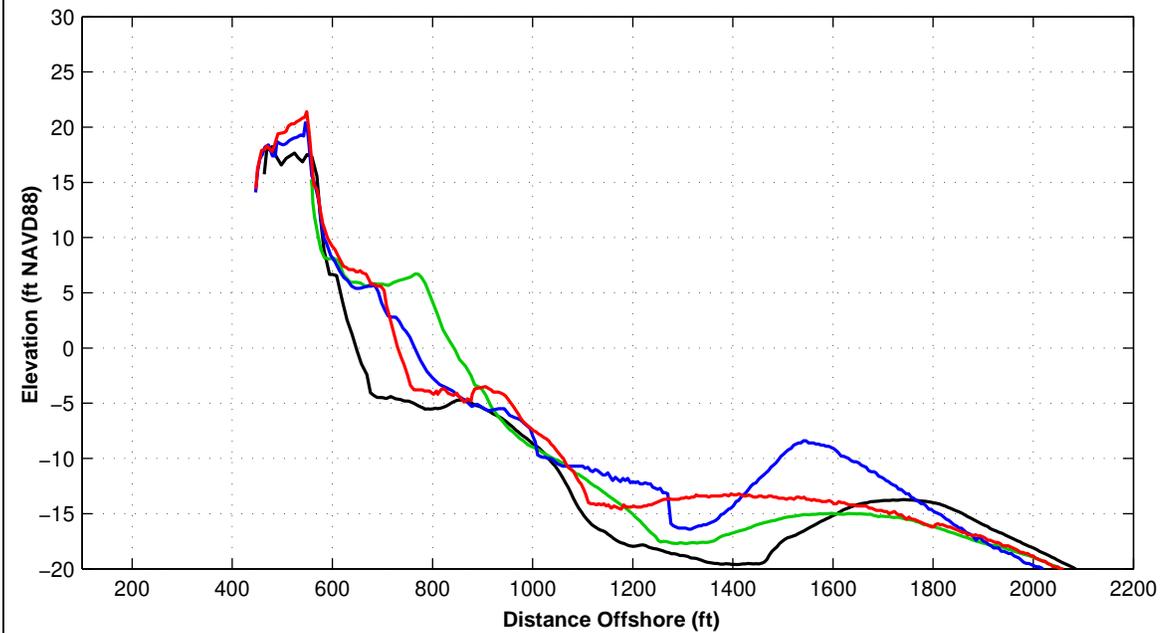
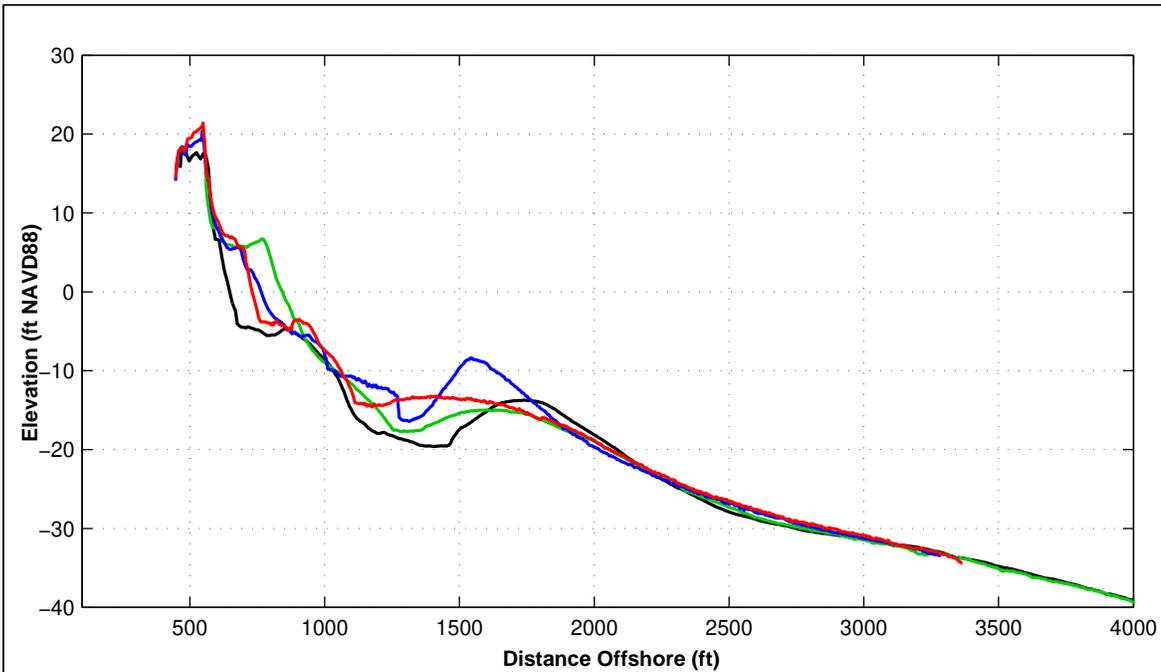
Survey Transect 660+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	-99.68 ft	35.33 ft
Volume Change Above +6 ft NAVD88	1.86 cy/ft	4.83 cy/ft
Volume Change Above 1.18 ft NAVD88	-20.70 cy/ft	13.41 cy/ft
Volume Change Above -6 ft NAVD88	-26.00 cy/ft	14.77 cy/ft
Volume Change Above -14 ft NAVD88	6.86 cy/ft	5.70 cy/ft
Volume Change Above -19 ft NAVD88	15.70 cy/ft	15.58 cy/ft
Volume Change Above -30 ft NAVD88	28.68 cy/ft	18.53 cy/ft

LEGEND:

JULY 2021	—	AUGUST 2019	—
JUNE 2020	—	MAY 2018	—

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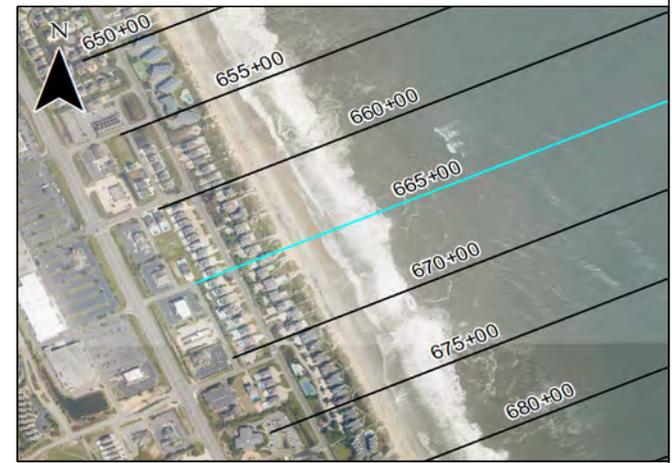


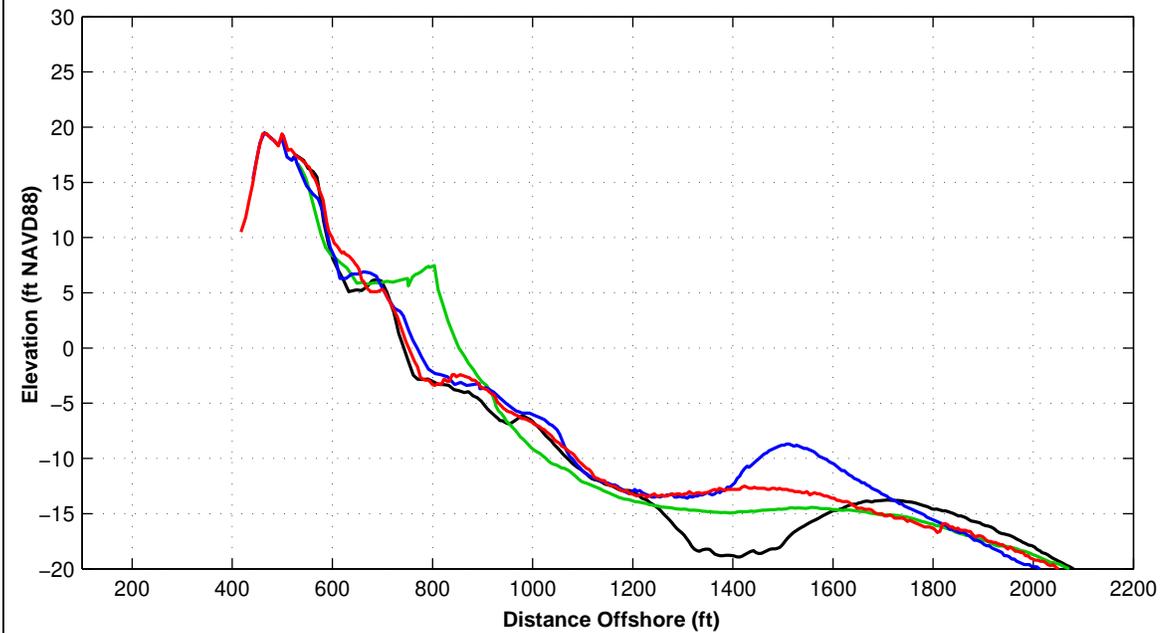
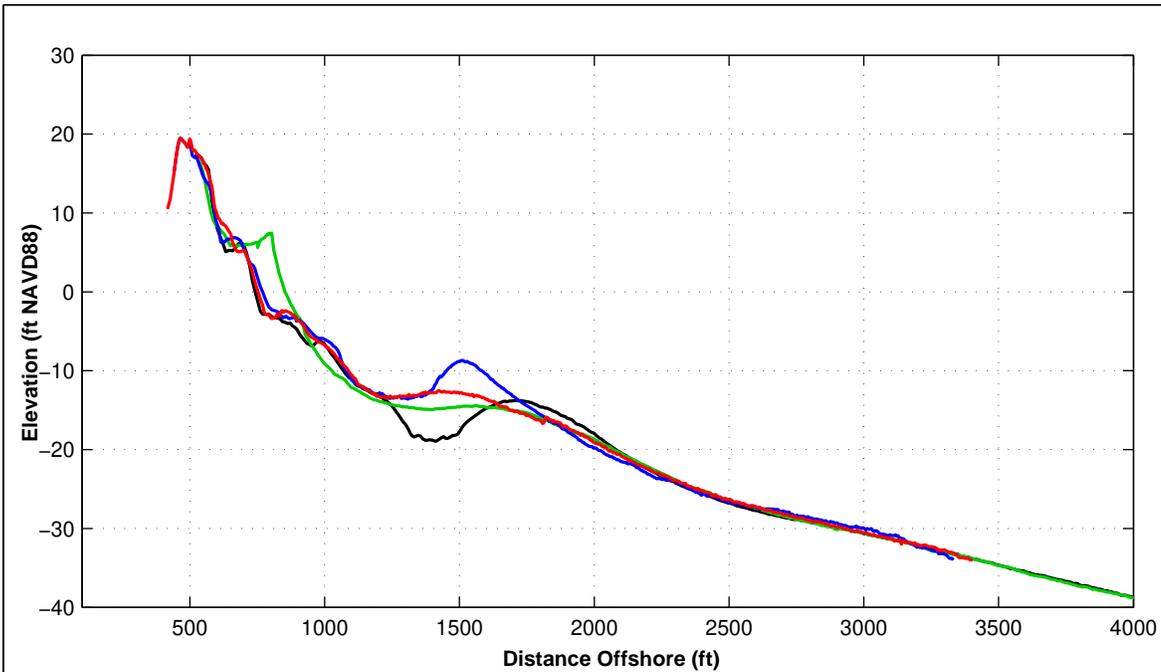
Survey Transect 665+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	-74.98 ft	-28.41 ft
Volume Change Above +6 ft NAVD88	1.94 cy/ft	6.85 cy/ft
Volume Change Above 1.18 ft NAVD88	-15.06 cy/ft	7.33 cy/ft
Volume Change Above -6 ft NAVD88	-31.89 cy/ft	4.12 cy/ft
Volume Change Above -14 ft NAVD88	24.45 cy/ft	-42.92 cy/ft
Volume Change Above -19 ft NAVD88	63.01 cy/ft	-41.38 cy/ft
Volume Change Above -30 ft NAVD88	66.56 cy/ft	-28.70 cy/ft

LEGEND:

JULY 2021	—	AUGUST 2019	—
JUNE 2020	—	MAY 2018	—

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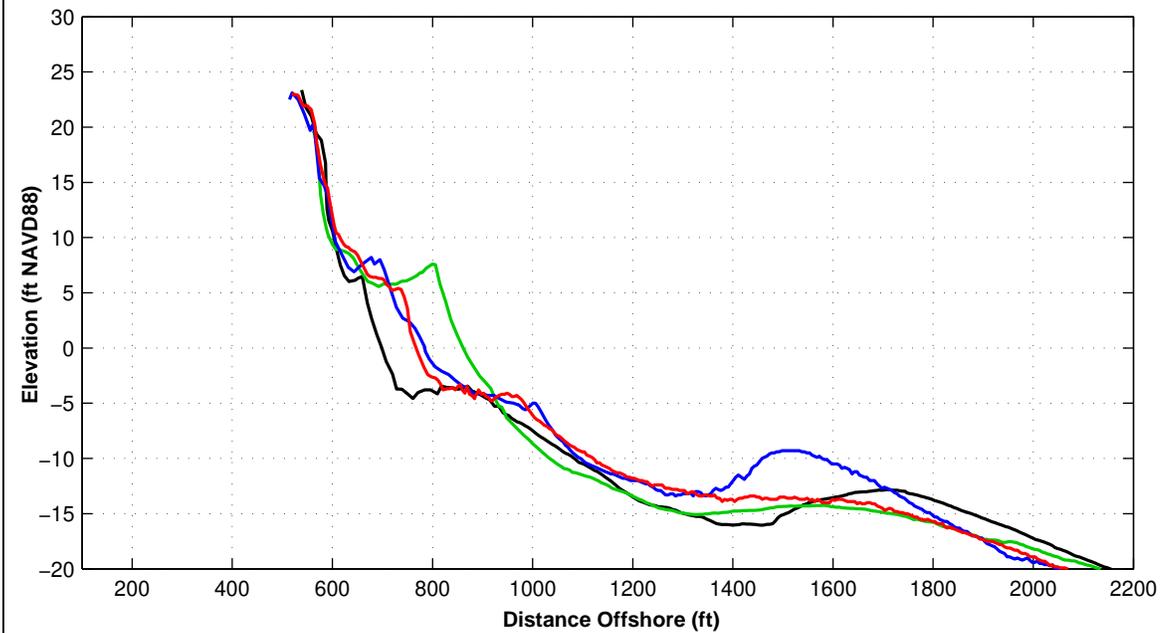
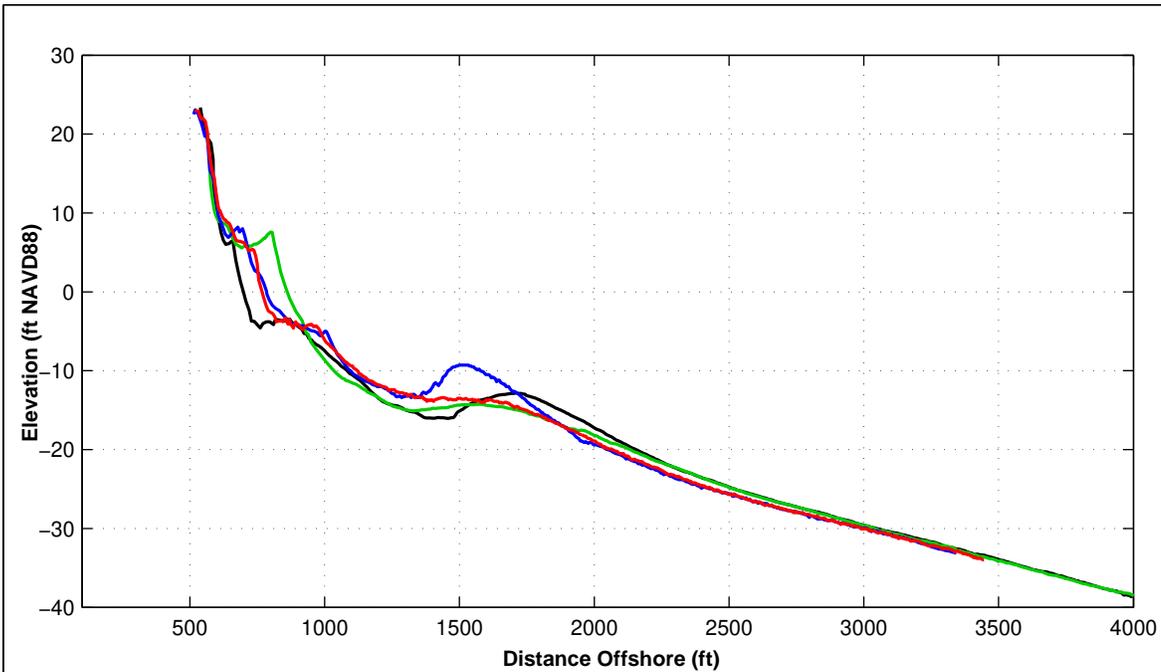
Survey Transect 670+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	-85.61 ft	-13.88 ft
Volume Change Above +6 ft NAVD88	0.57 cy/ft	6.05 cy/ft
Volume Change Above 1.18 ft NAVD88	-16.48 cy/ft	3.97 cy/ft
Volume Change Above -6 ft NAVD88	-28.26 cy/ft	0.28 cy/ft
Volume Change Above -14 ft NAVD88	32.79 cy/ft	-32.07 cy/ft
Volume Change Above -19 ft NAVD88	45.75 cy/ft	-35.40 cy/ft
Volume Change Above -30 ft NAVD88	39.88 cy/ft	-29.59 cy/ft

LEGEND:

JULY 2021	—	AUGUST 2019	—
JUNE 2020	—	MAY 2018	—

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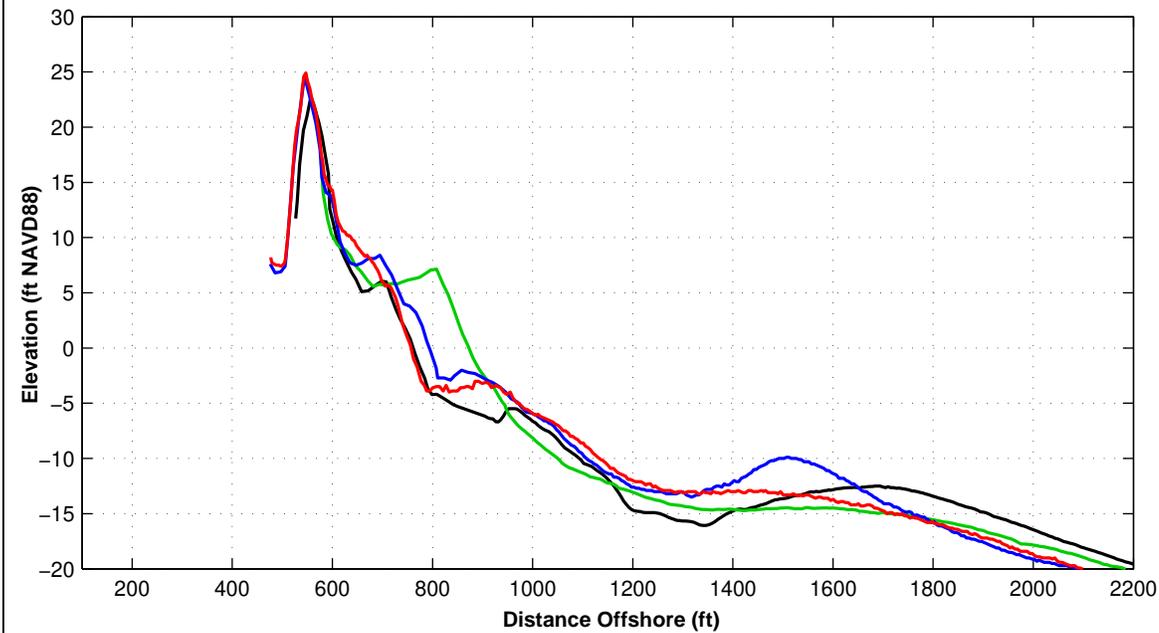
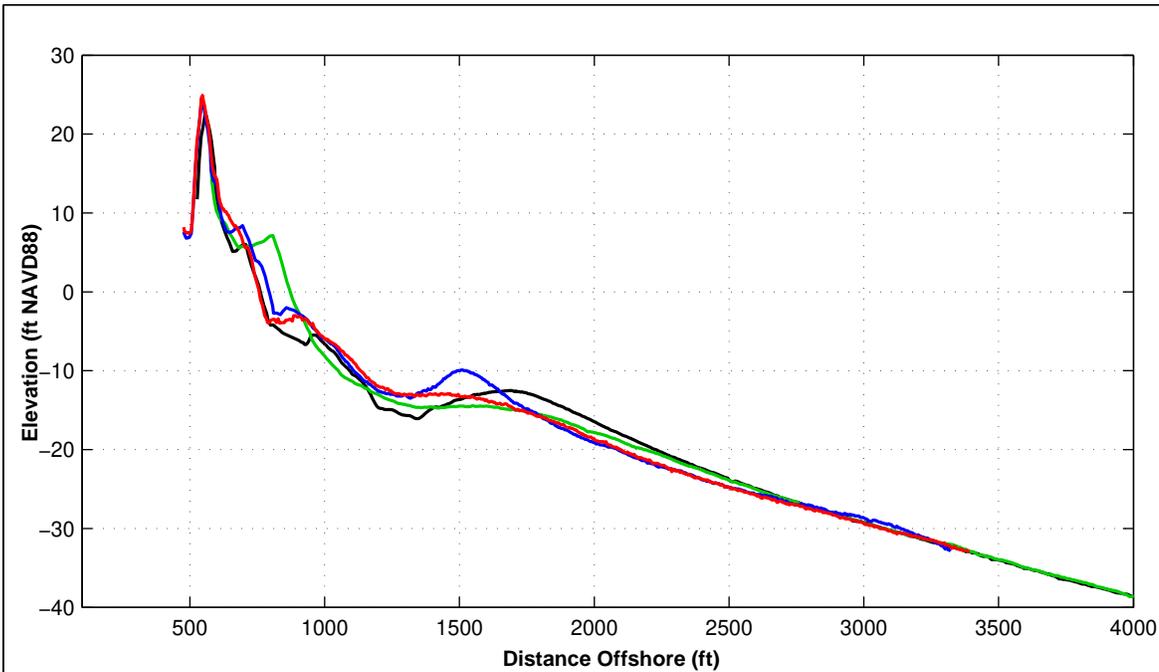
Survey Transect 675+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	-76.67 ft	-14.62 ft
Volume Change Above +6 ft NAVD88	-0.11 cy/ft	-0.27 cy/ft
Volume Change Above 1.18 ft NAVD88	-16.54 cy/ft	1.21 cy/ft
Volume Change Above -6 ft NAVD88	-27.38 cy/ft	-3.06 cy/ft
Volume Change Above -14 ft NAVD88	37.08 cy/ft	-38.60 cy/ft
Volume Change Above -19 ft NAVD88	48.24 cy/ft	-41.01 cy/ft
Volume Change Above -30 ft NAVD88	15.23 cy/ft	-36.63 cy/ft

LEGEND:

JULY 2021	—	AUGUST 2019	—
JUNE 2020	—	MAY 2018	—

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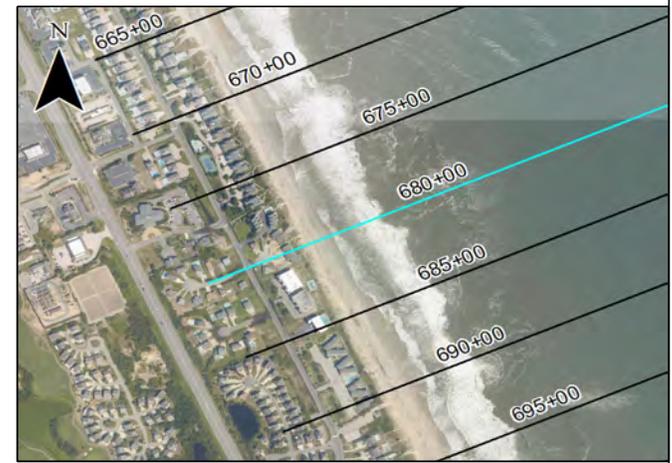


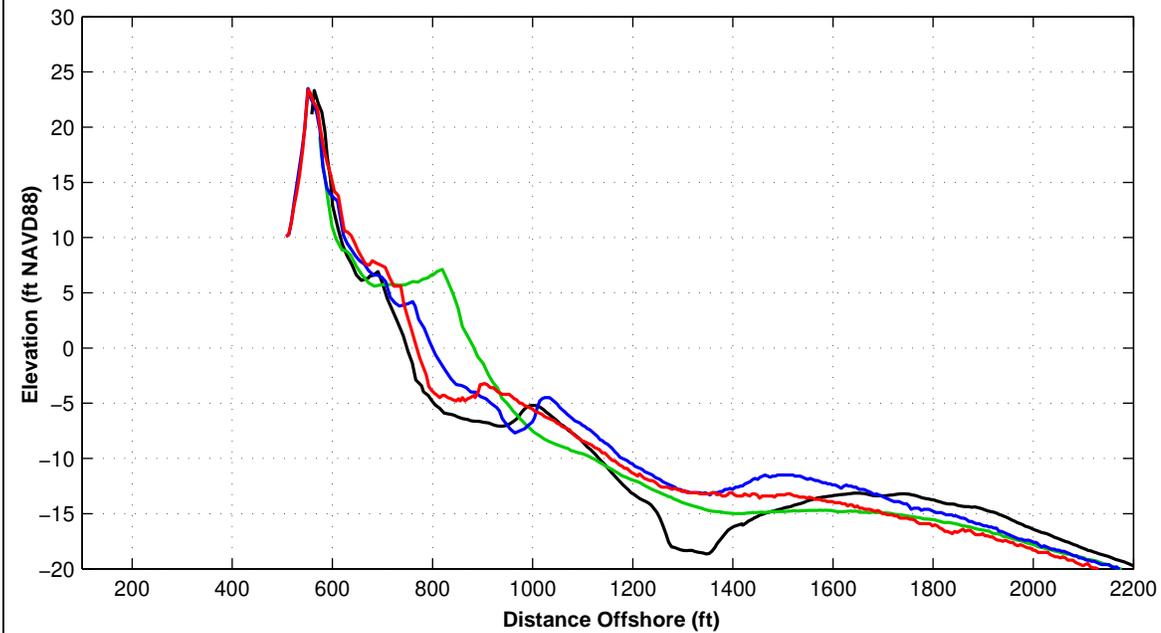
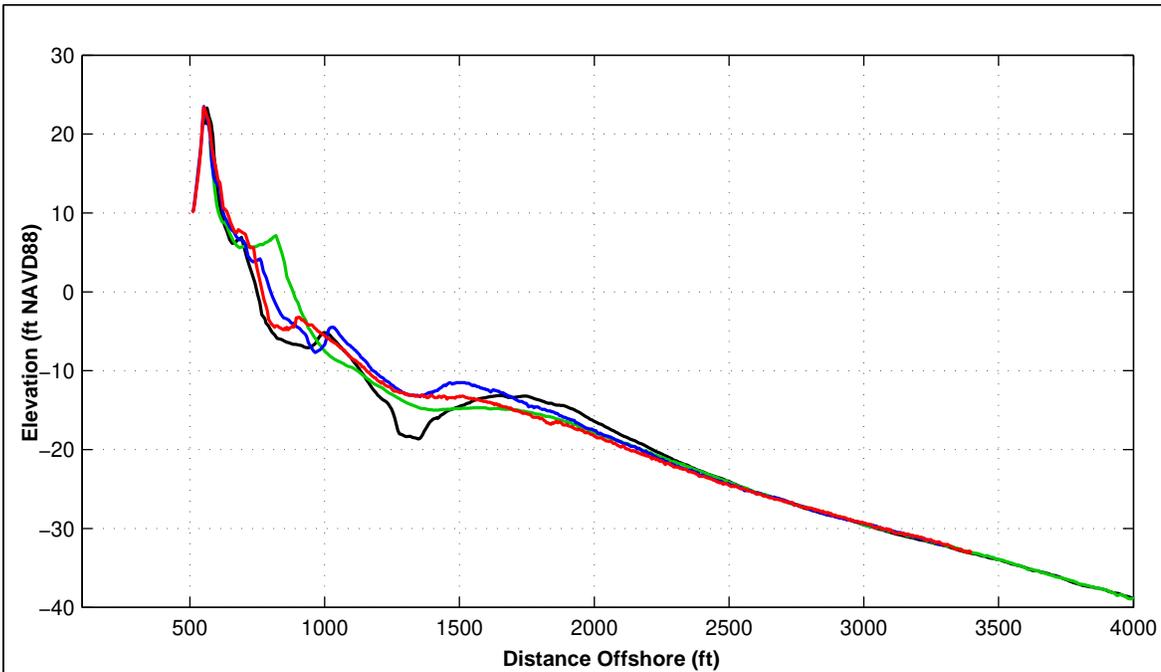
Survey Transect 680+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	-76.02 ft	-36.85 ft
Volume Change Above +6 ft NAVD88	4.93 cy/ft	3.63 cy/ft
Volume Change Above 1.18 ft NAVD88	-9.72 cy/ft	-0.85 cy/ft
Volume Change Above -6 ft NAVD88	-18.13 cy/ft	-11.07 cy/ft
Volume Change Above -14 ft NAVD88	32.58 cy/ft	-29.60 cy/ft
Volume Change Above -19 ft NAVD88	33.49 cy/ft	-28.92 cy/ft
Volume Change Above -30 ft NAVD88	12.50 cy/ft	-34.84 cy/ft

LEGEND:

JULY 2021	—	AUGUST 2019	—
JUNE 2020	—	MAY 2018	—

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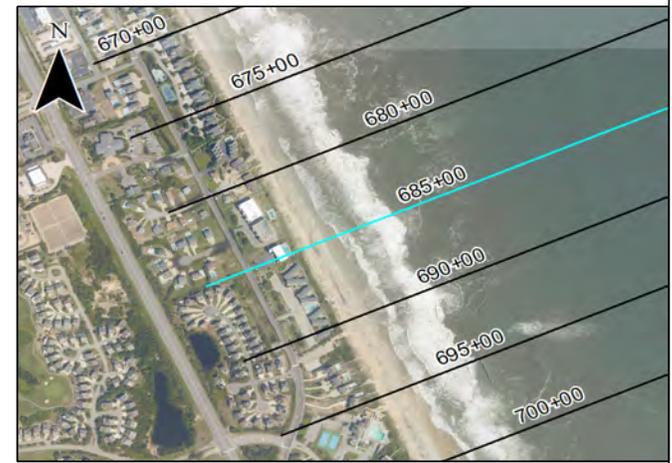


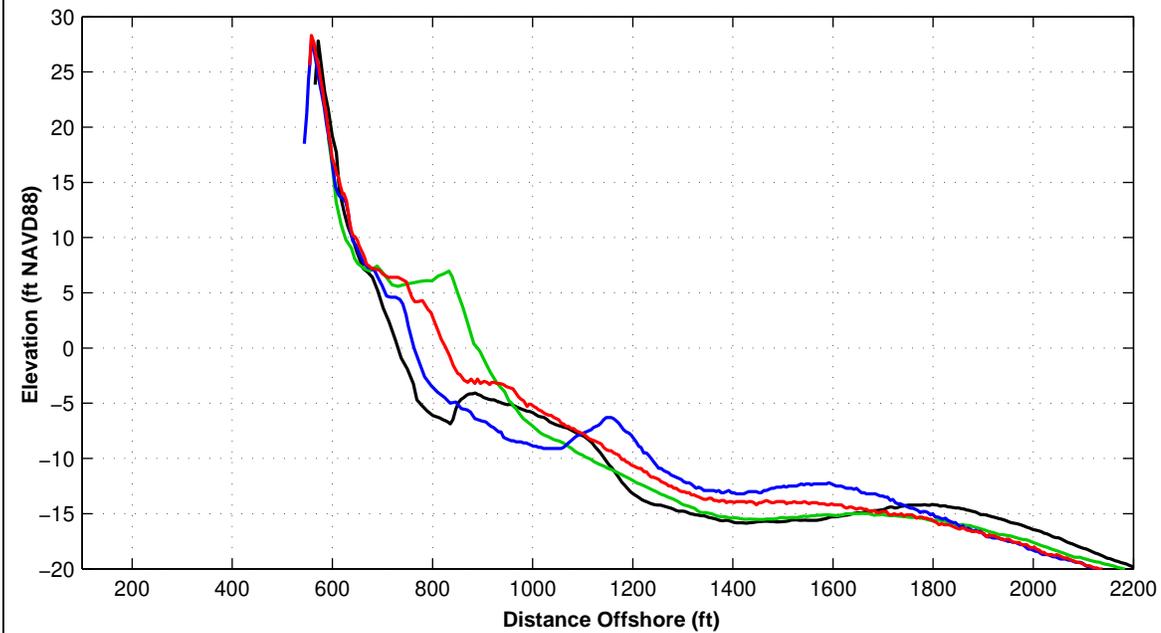
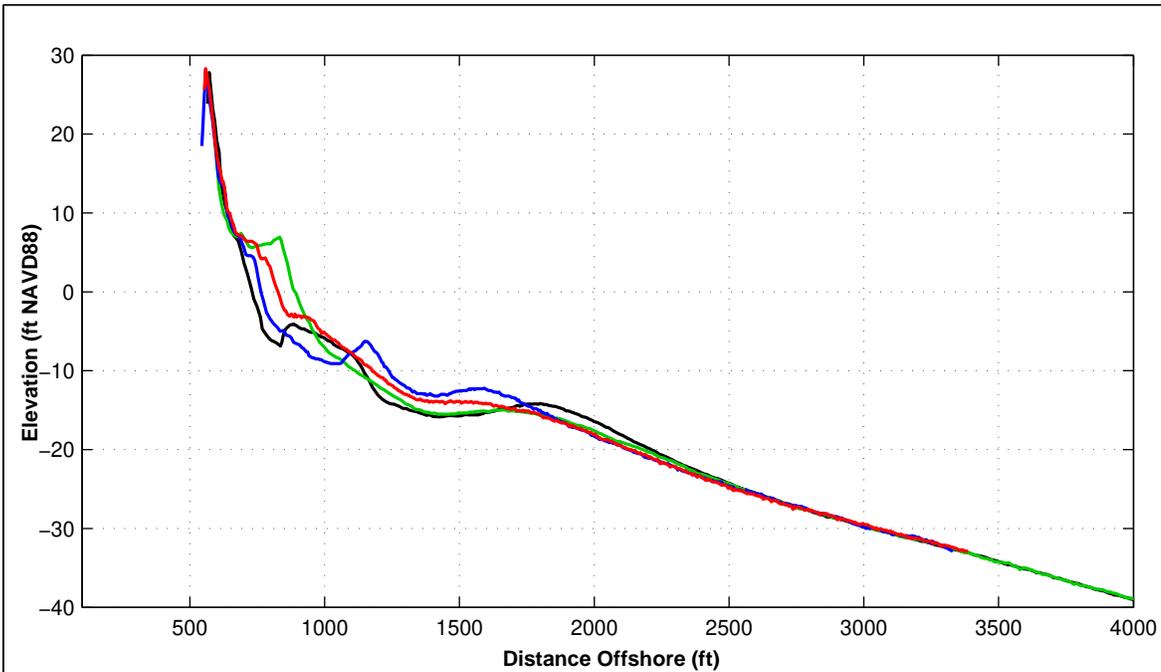
Survey Transect 685+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	-79.89 ft	-27.77 ft
Volume Change Above +6 ft NAVD88	4.49 cy/ft	5.59 cy/ft
Volume Change Above 1.18 ft NAVD88	-12.62 cy/ft	4.85 cy/ft
Volume Change Above -6 ft NAVD88	-28.04 cy/ft	-1.75 cy/ft
Volume Change Above -14 ft NAVD88	15.21 cy/ft	-23.96 cy/ft
Volume Change Above -19 ft NAVD88	33.97 cy/ft	-38.85 cy/ft
Volume Change Above -30 ft NAVD88	28.79 cy/ft	-42.65 cy/ft

LEGEND:

JULY 2021	—	AUGUST 2019	—
JUNE 2020	—	MAY 2018	—

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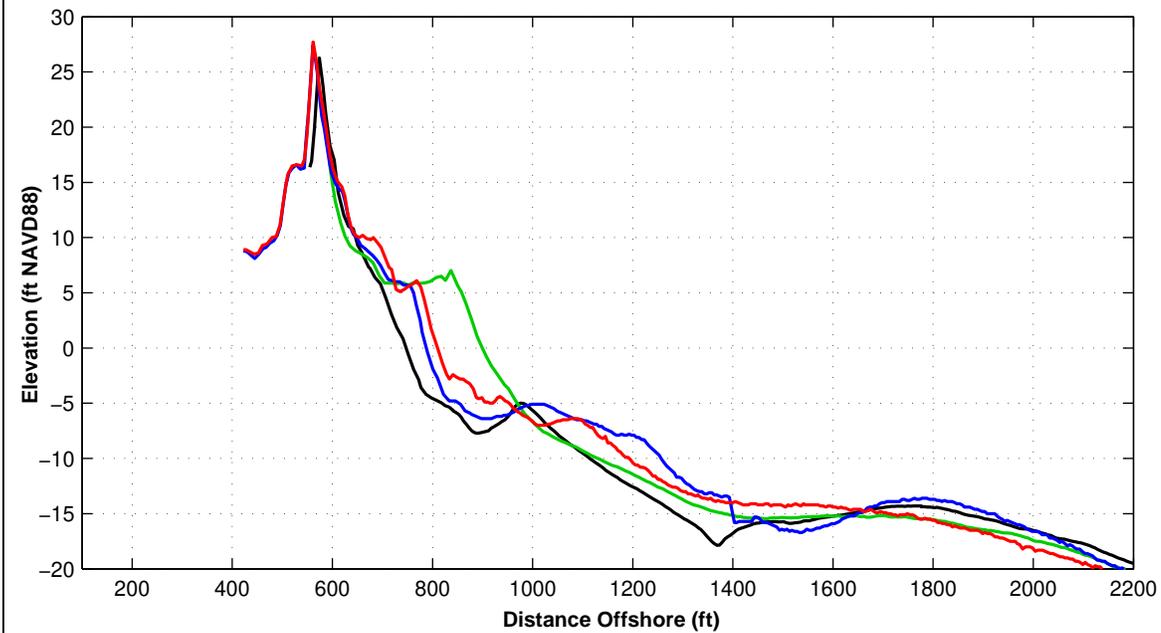
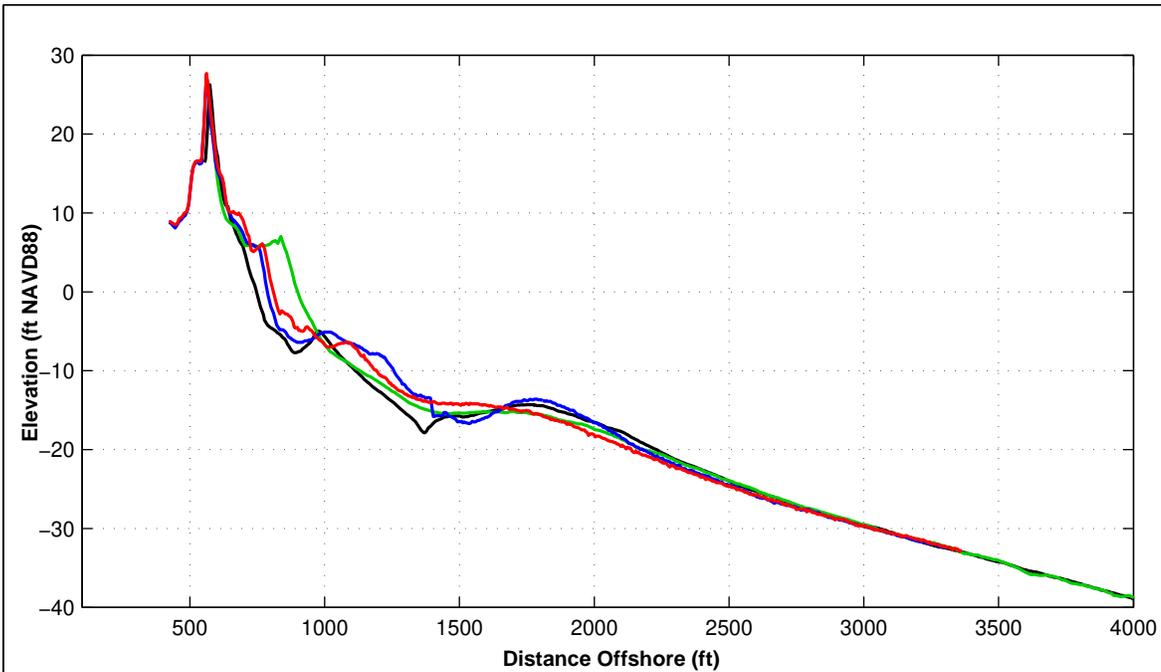
Survey Transect 690+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	-120.70 ft	57.80 ft
Volume Change Above +6 ft NAVD88	2.34 cy/ft	3.80 cy/ft
Volume Change Above 1.18 ft NAVD88	-19.86 cy/ft	12.63 cy/ft
Volume Change Above -6 ft NAVD88	-53.43 cy/ft	39.08 cy/ft
Volume Change Above -14 ft NAVD88	-18.90 cy/ft	24.18 cy/ft
Volume Change Above -19 ft NAVD88	-1.87 cy/ft	18.86 cy/ft
Volume Change Above -30 ft NAVD88	-10.09 cy/ft	17.71 cy/ft

LEGEND:

JULY 2021	—	AUGUST 2019	—
JUNE 2020	—	MAY 2018	—

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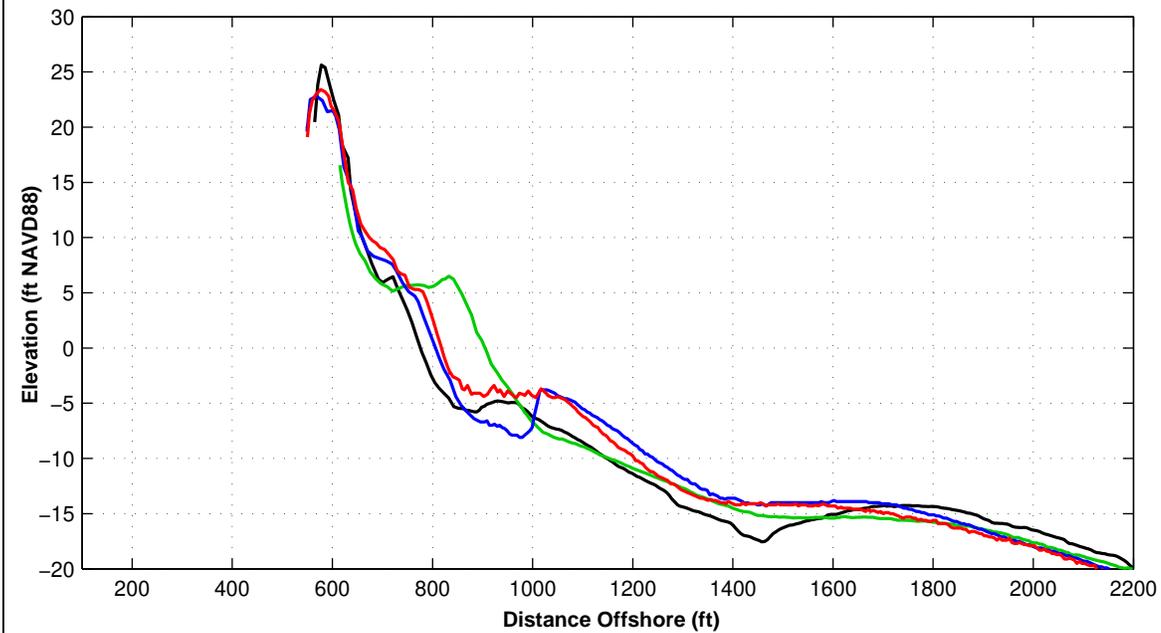
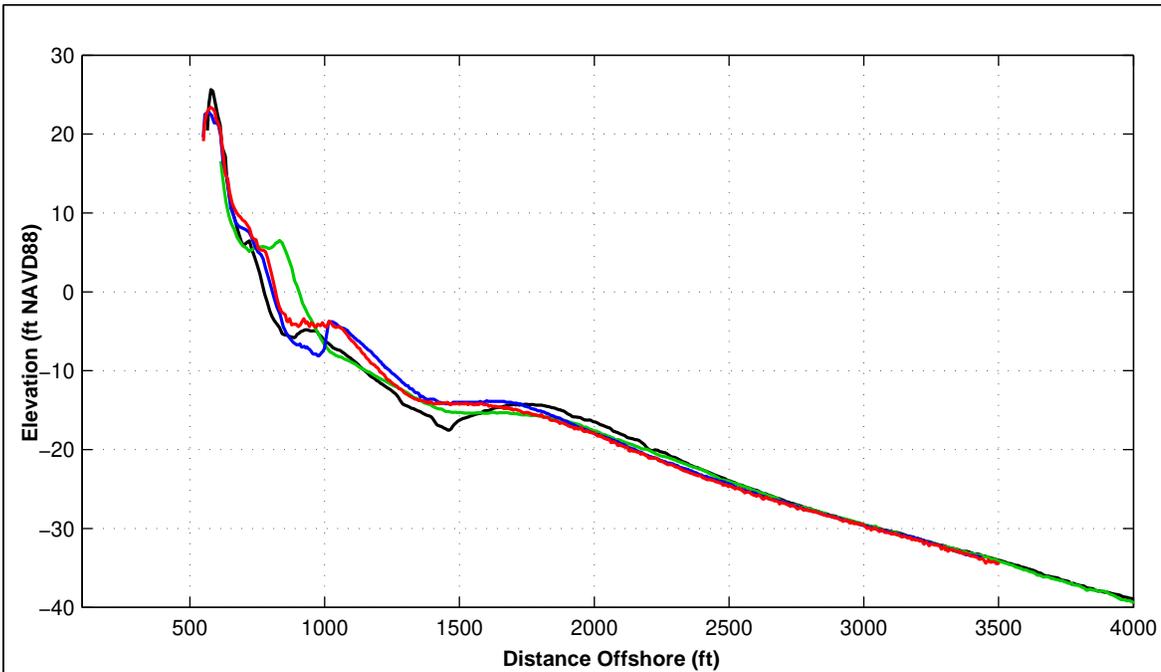
Survey Transect 695+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	-107.13 ft	20.36 ft
Volume Change Above +6 ft NAVD88	5.01 cy/ft	5.19 cy/ft
Volume Change Above 1.18 ft NAVD88	-12.69 cy/ft	7.86 cy/ft
Volume Change Above -6 ft NAVD88	-42.25 cy/ft	18.06 cy/ft
Volume Change Above -14 ft NAVD88	-9.06 cy/ft	1.91 cy/ft
Volume Change Above -19 ft NAVD88	6.37 cy/ft	-6.04 cy/ft
Volume Change Above -30 ft NAVD88	-7.95 cy/ft	-12.02 cy/ft

LEGEND:

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JUNE 2020	—	MAY 2018	—

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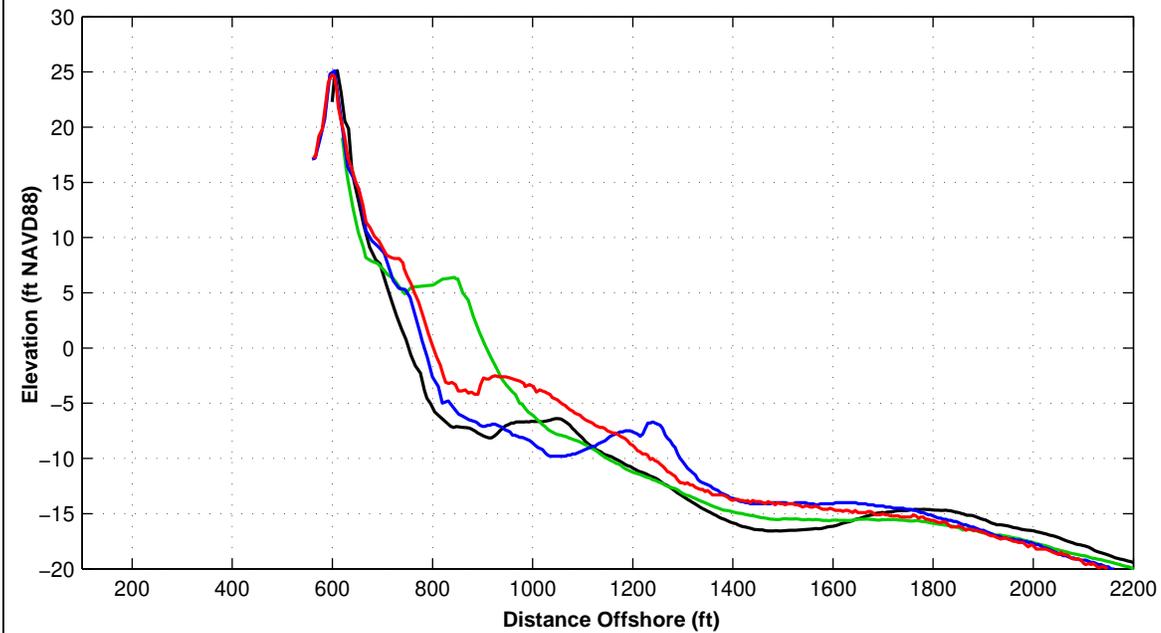
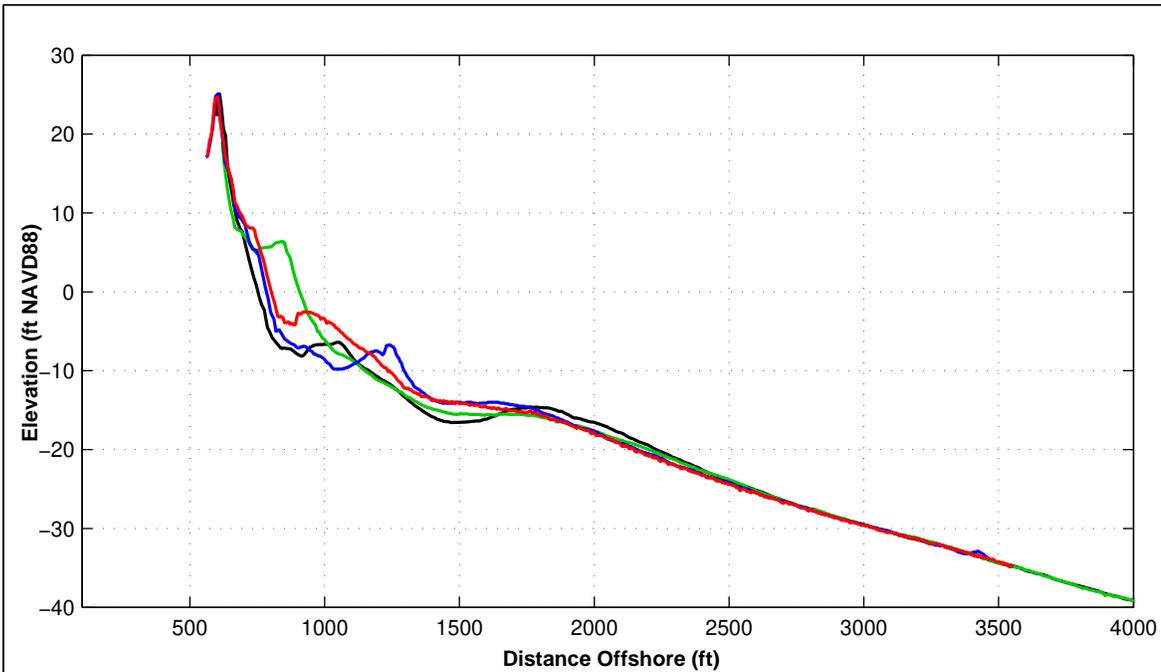
Survey Transect 700+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	-95.12 ft	13.58 ft
Volume Change Above +6 ft NAVD88	8.82 cy/ft	5.21 cy/ft
Volume Change Above 1.18 ft NAVD88	-6.77 cy/ft	8.16 cy/ft
Volume Change Above -6 ft NAVD88	-29.33 cy/ft	20.31 cy/ft
Volume Change Above -14 ft NAVD88	-7.98 cy/ft	14.59 cy/ft
Volume Change Above -19 ft NAVD88	8.67 cy/ft	5.30 cy/ft
Volume Change Above -30 ft NAVD88	-3.91 cy/ft	0.16 cy/ft

LEGEND:

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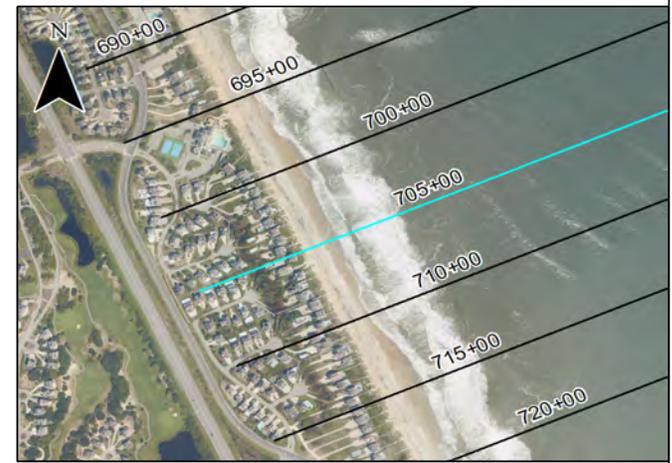


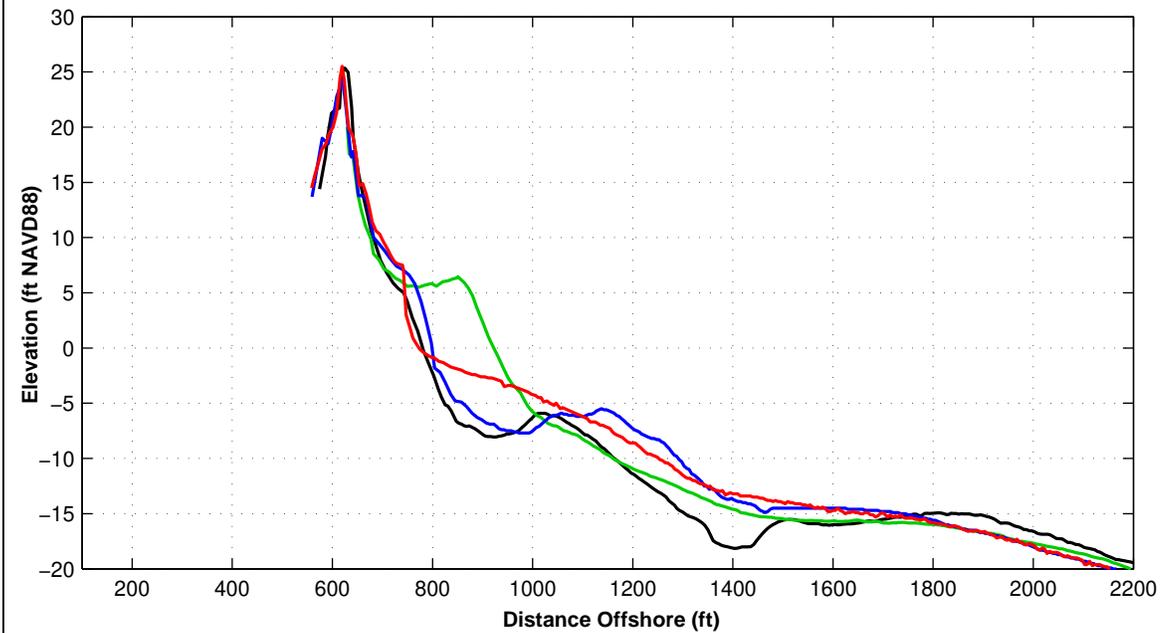
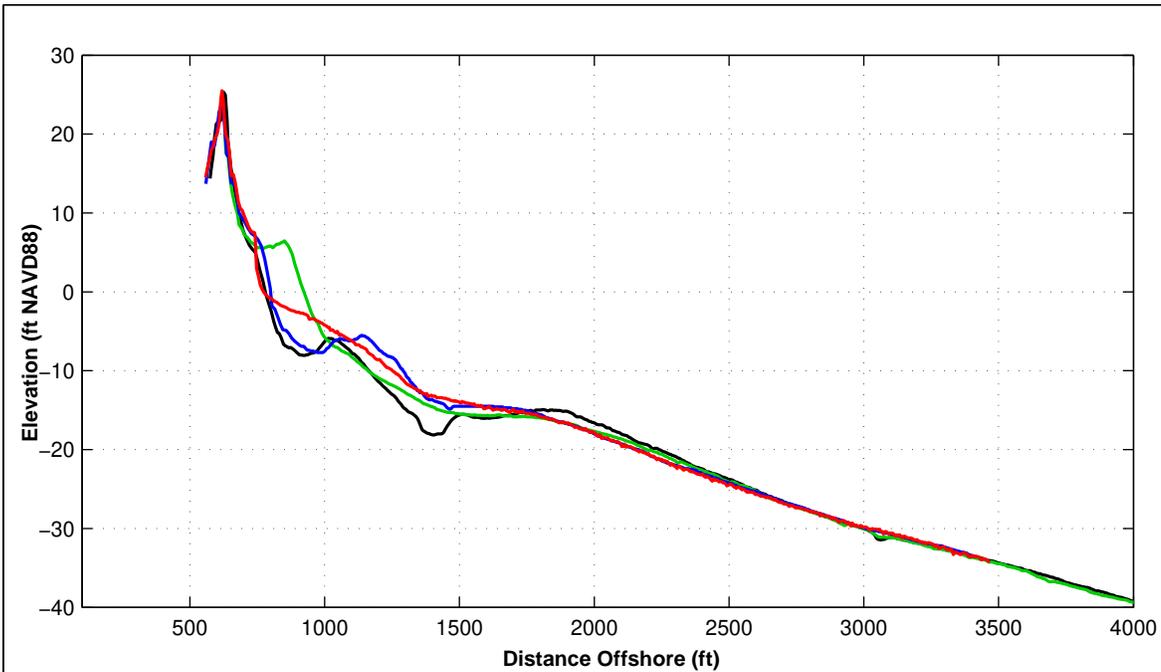
Survey Transect 705+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	-119.94 ft	16.68 ft
Volume Change Above +6 ft NAVD88	7.00 cy/ft	3.80 cy/ft
Volume Change Above 1.18 ft NAVD88	-12.39 cy/ft	6.83 cy/ft
Volume Change Above -6 ft NAVD88	-48.24 cy/ft	32.49 cy/ft
Volume Change Above -14 ft NAVD88	-34.12 cy/ft	43.11 cy/ft
Volume Change Above -19 ft NAVD88	-14.01 cy/ft	35.11 cy/ft
Volume Change Above -30 ft NAVD88	-24.77 cy/ft	31.30 cy/ft

LEGEND:

JULY 2021	—	AUGUST 2019	—
JUNE 2020	—	MAY 2018	—

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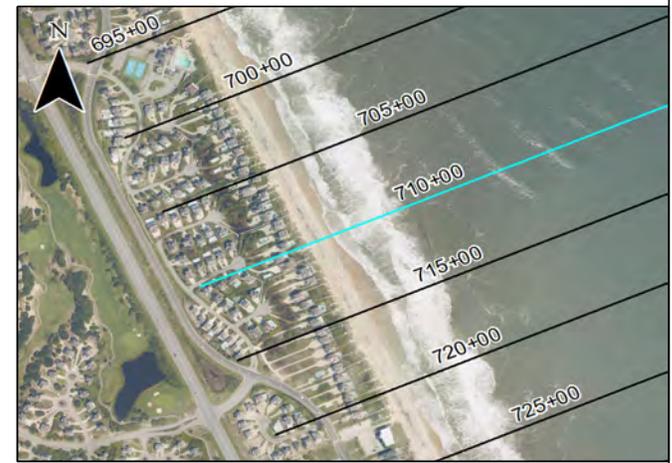


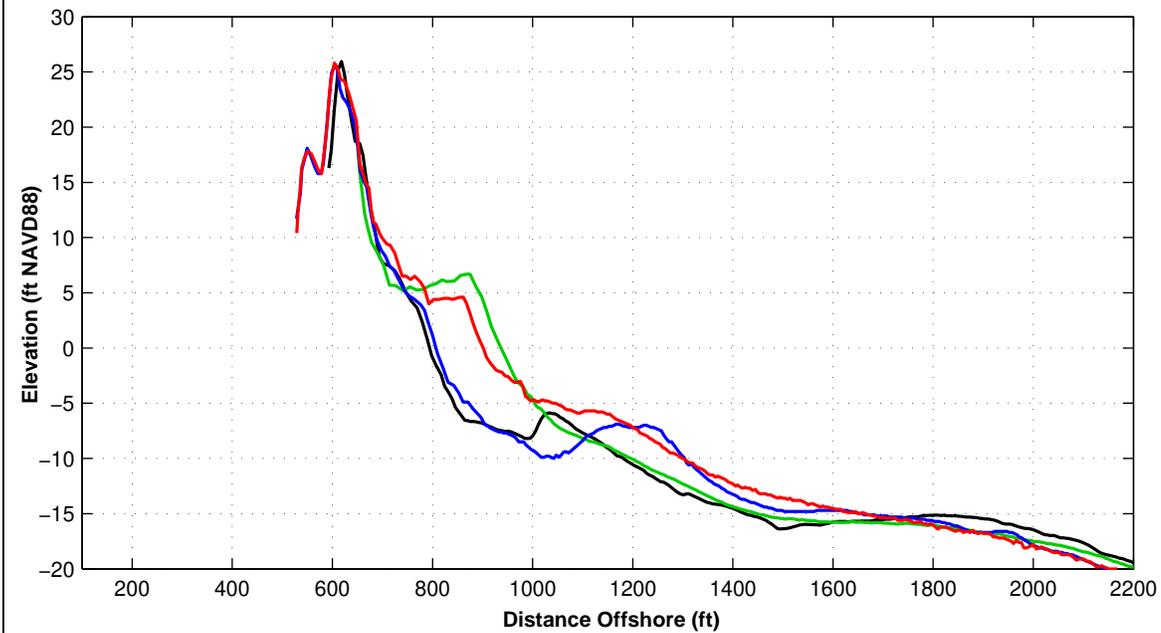
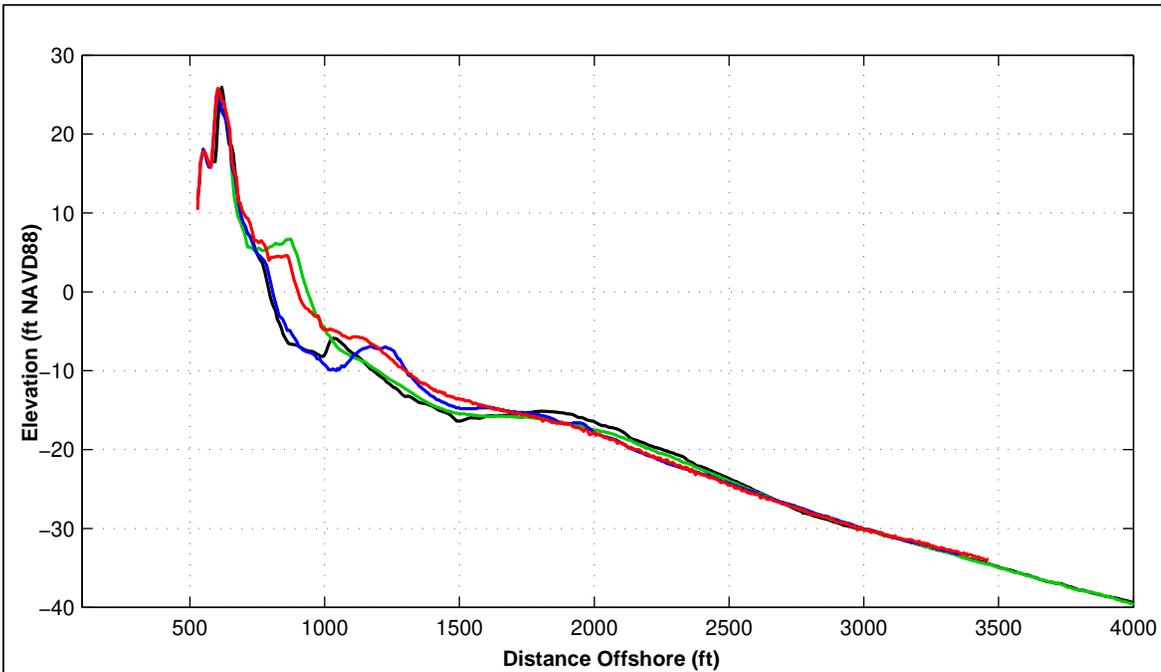
Survey Transect 710+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	-116.20 ft	-34.96 ft
Volume Change Above +6 ft NAVD88	5.60 cy/ft	2.99 cy/ft
Volume Change Above 1.18 ft NAVD88	-12.88 cy/ft	-2.70 cy/ft
Volume Change Above -6 ft NAVD88	-46.84 cy/ft	16.89 cy/ft
Volume Change Above -14 ft NAVD88	-20.02 cy/ft	15.21 cy/ft
Volume Change Above -19 ft NAVD88	-7.83 cy/ft	15.10 cy/ft
Volume Change Above -30 ft NAVD88	-14.04 cy/ft	10.96 cy/ft

LEGEND:

JULY 2021	—	AUGUST 2019	—
JUNE 2020	—	MAY 2018	—

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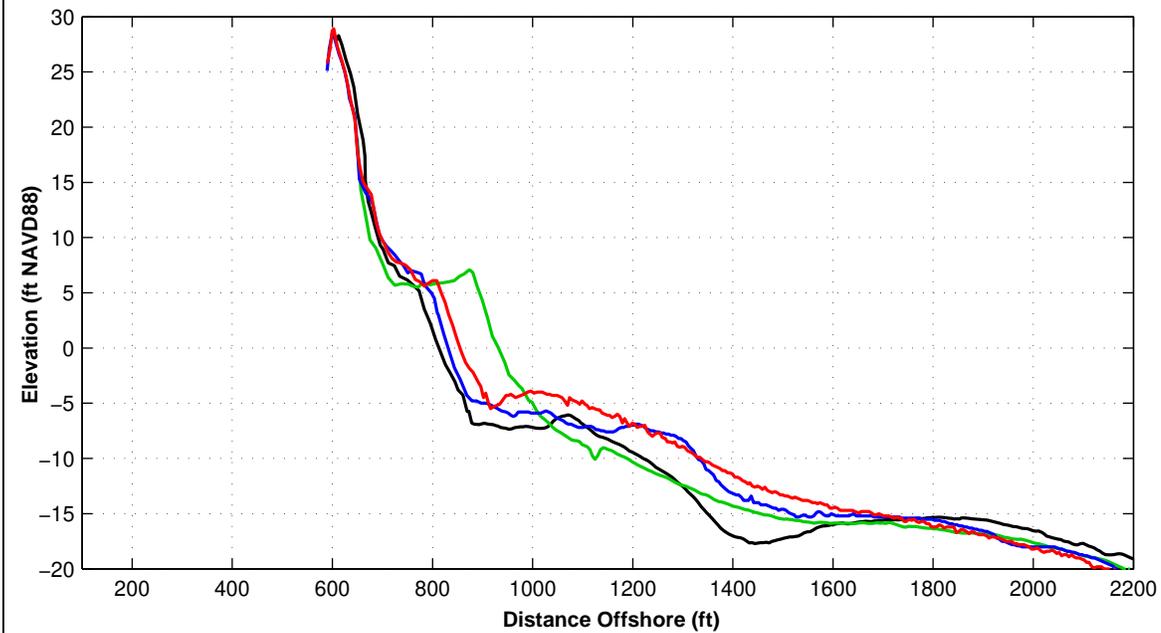
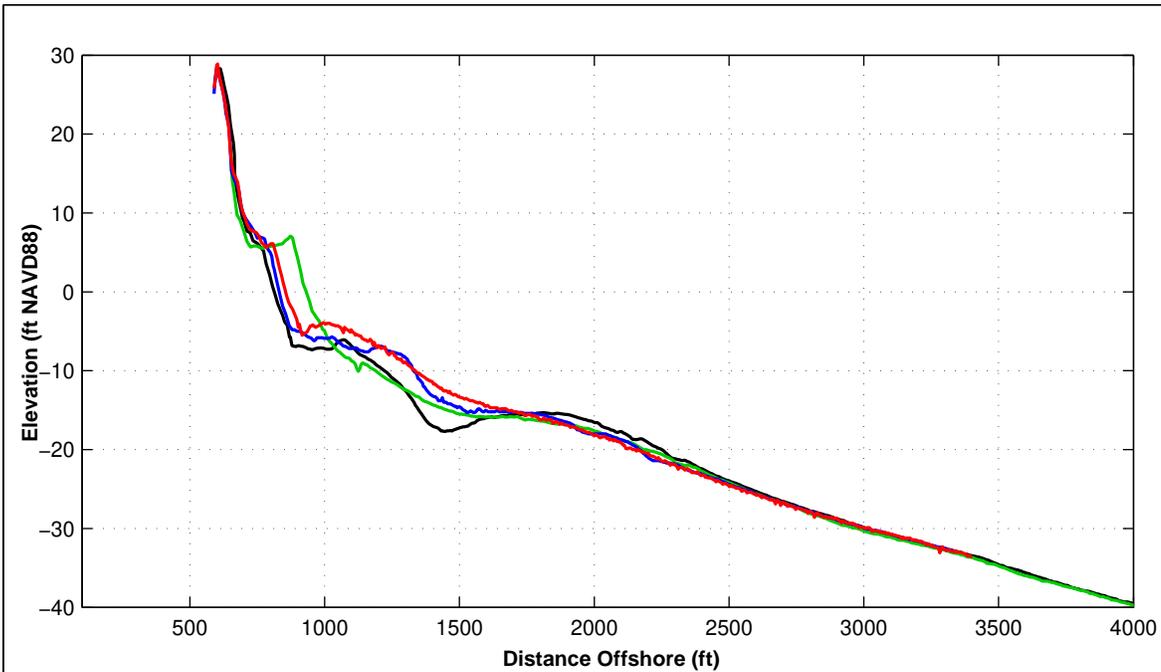
Survey Transect 715+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	-125.11 ft	89.90 ft
Volume Change Above +6 ft NAVD88	3.70 cy/ft	5.65 cy/ft
Volume Change Above 1.18 ft NAVD88	-18.00 cy/ft	18.81 cy/ft
Volume Change Above -6 ft NAVD88	-53.57 cy/ft	52.11 cy/ft
Volume Change Above -14 ft NAVD88	-44.84 cy/ft	78.72 cy/ft
Volume Change Above -19 ft NAVD88	-35.12 cy/ft	77.83 cy/ft
Volume Change Above -30 ft NAVD88	-44.91 cy/ft	75.65 cy/ft

LEGEND:

JULY 2021	—	AUGUST 2019	—
JUNE 2020	—	MAY 2018	—

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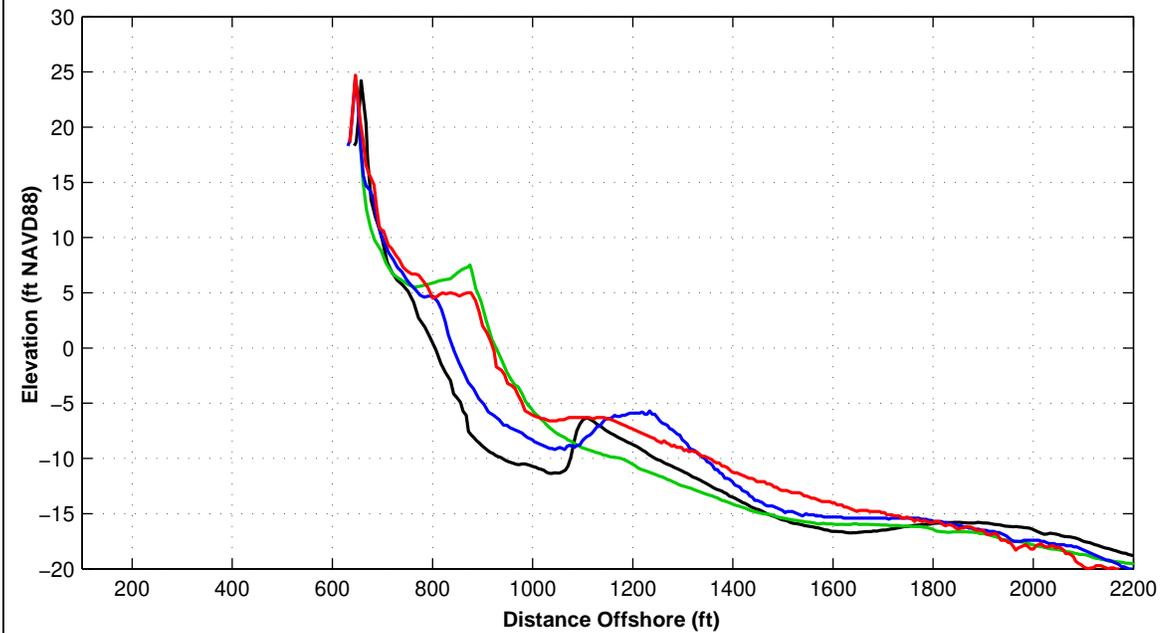
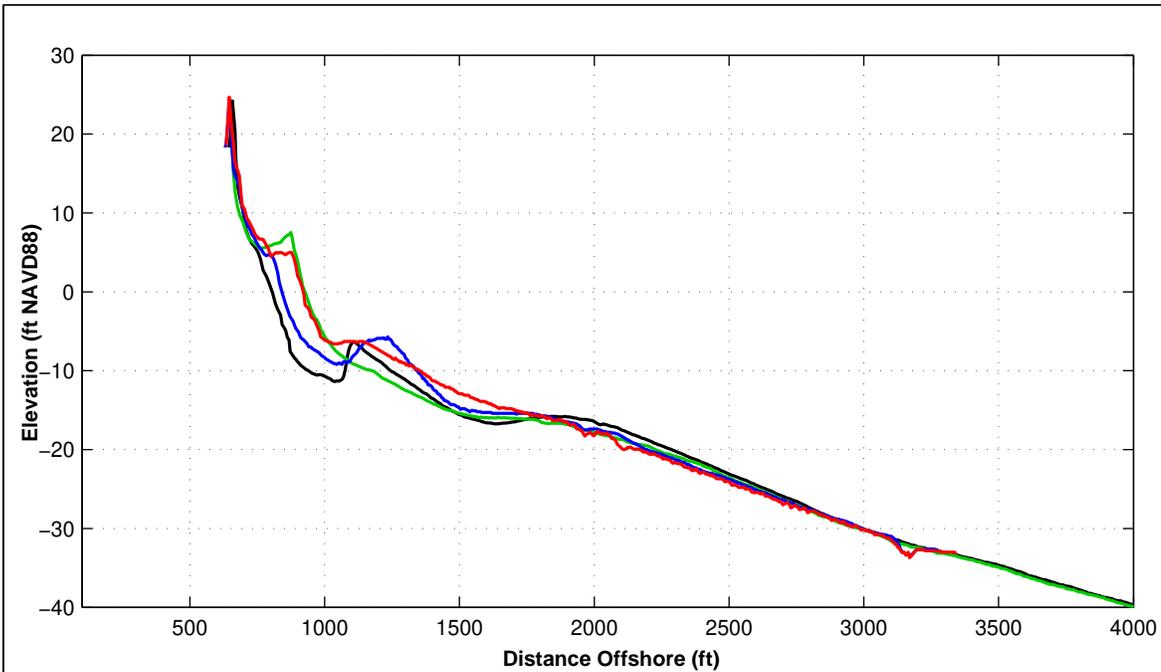
Survey Transect 720+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	-95.87 ft	23.12 ft
Volume Change Above +6 ft NAVD88	7.65 cy/ft	0.15 cy/ft
Volume Change Above 1.18 ft NAVD88	-8.76 cy/ft	3.91 cy/ft
Volume Change Above -6 ft NAVD88	-35.31 cy/ft	20.64 cy/ft
Volume Change Above -14 ft NAVD88	0.16 cy/ft	32.96 cy/ft
Volume Change Above -19 ft NAVD88	11.39 cy/ft	35.11 cy/ft
Volume Change Above -30 ft NAVD88	6.91 cy/ft	32.93 cy/ft

LEGEND:

JULY 2021	—	AUGUST 2019	—
JUNE 2020	—	MAY 2018	—

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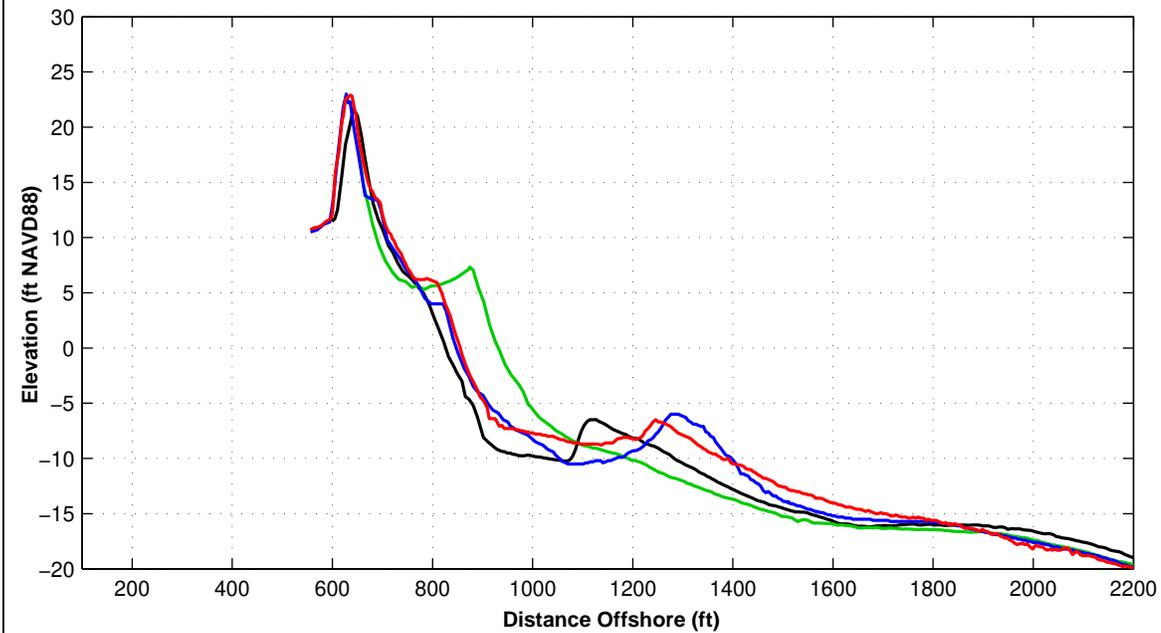
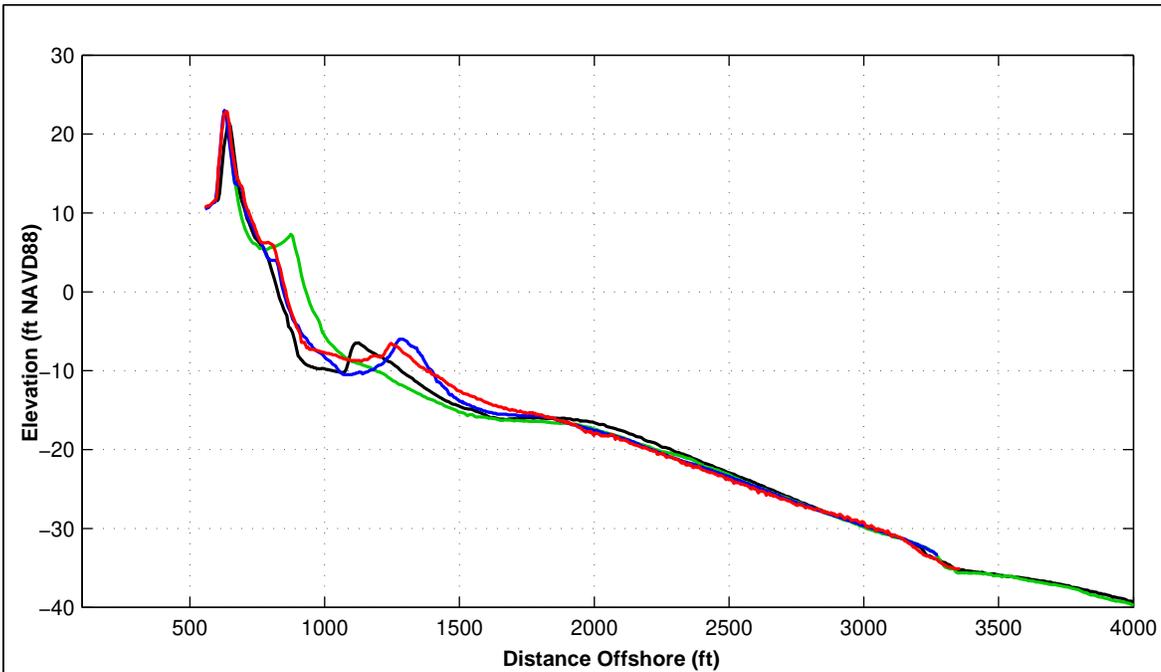
Survey Transect 725+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	-84.22 ft	79.03 ft
Volume Change Above +6 ft NAVD88	3.56 cy/ft	4.69 cy/ft
Volume Change Above 1.18 ft NAVD88	-12.73 cy/ft	16.27 cy/ft
Volume Change Above -6 ft NAVD88	-35.92 cy/ft	36.93 cy/ft
Volume Change Above -14 ft NAVD88	-2.58 cy/ft	53.15 cy/ft
Volume Change Above -19 ft NAVD88	12.69 cy/ft	56.35 cy/ft
Volume Change Above -30 ft NAVD88	8.15 cy/ft	45.03 cy/ft

LEGEND:

JULY 2021	—	AUGUST 2019	—
JUNE 2020	—	MAY 2018	—

- Notes:
1. Station From North To South At Varying Intervals.
 2. All Survey Elevations In Feet Referenced to NAVD88.





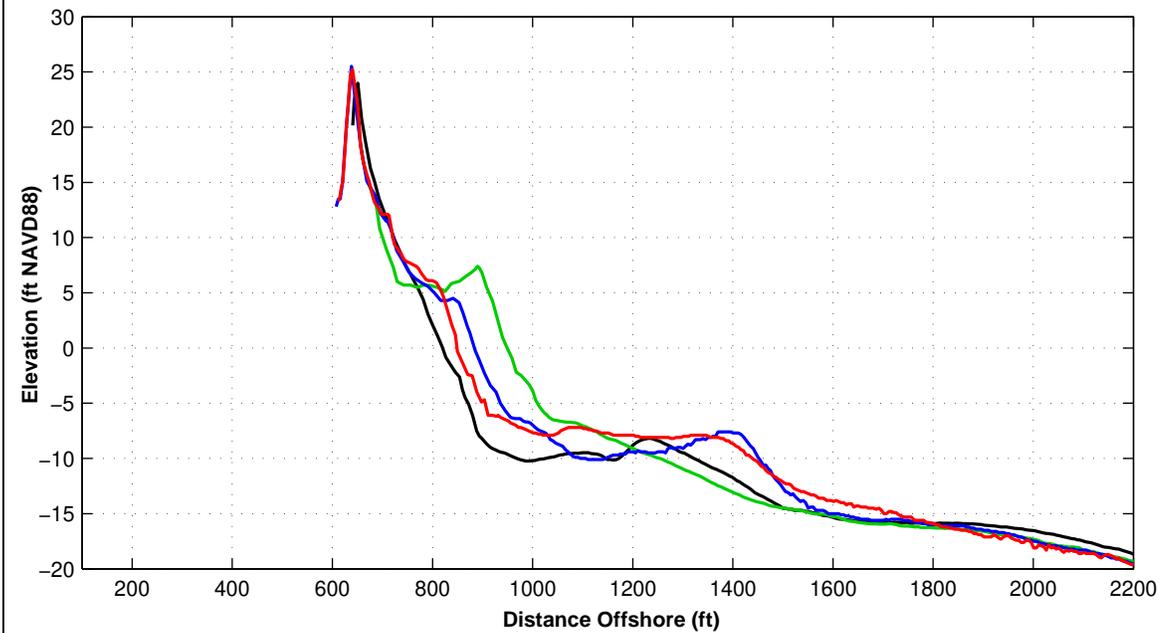
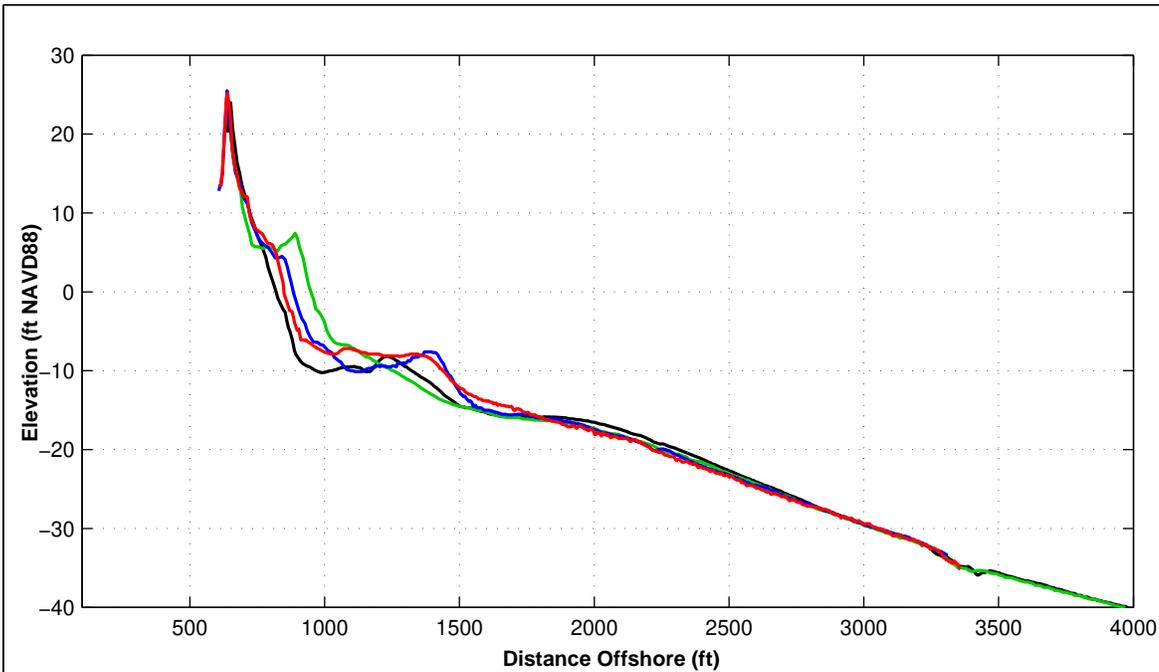
Survey Transect 730+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	-81.43 ft	7.32 ft
Volume Change Above +6 ft NAVD88	5.52 cy/ft	4.57 cy/ft
Volume Change Above 1.18 ft NAVD88	-10.29 cy/ft	7.92 cy/ft
Volume Change Above -6 ft NAVD88	-32.81 cy/ft	8.40 cy/ft
Volume Change Above -14 ft NAVD88	-8.71 cy/ft	20.65 cy/ft
Volume Change Above -19 ft NAVD88	3.09 cy/ft	25.69 cy/ft
Volume Change Above -30 ft NAVD88	-1.20 cy/ft	21.32 cy/ft

LEGEND:

JULY 2021	—	AUGUST 2019	—
JUNE 2020	—	MAY 2018	—

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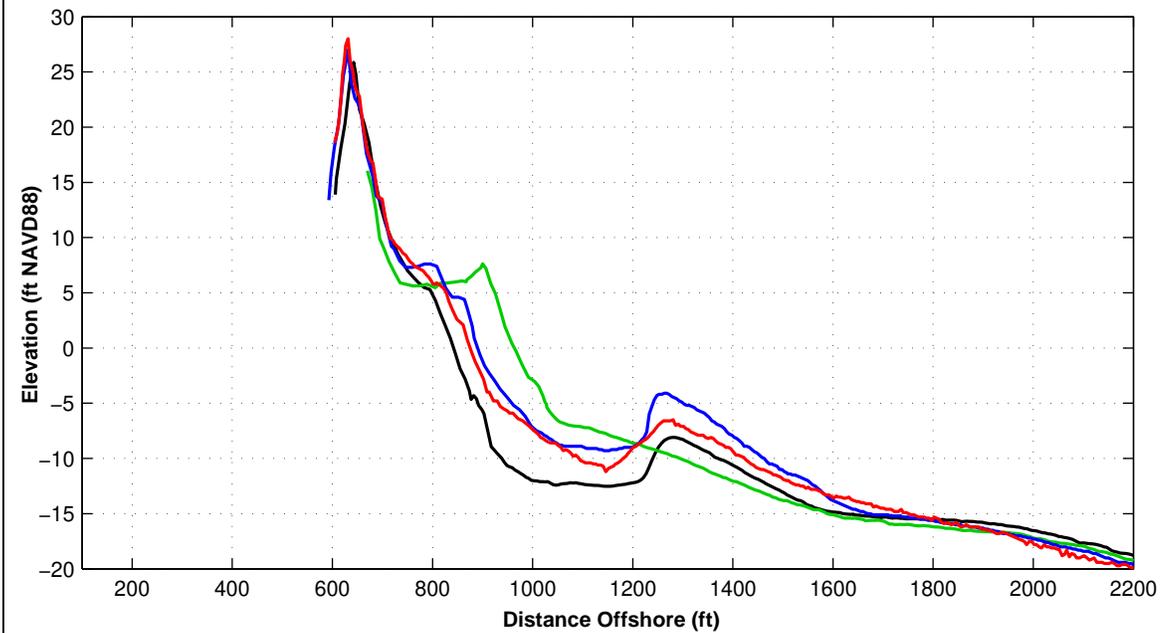
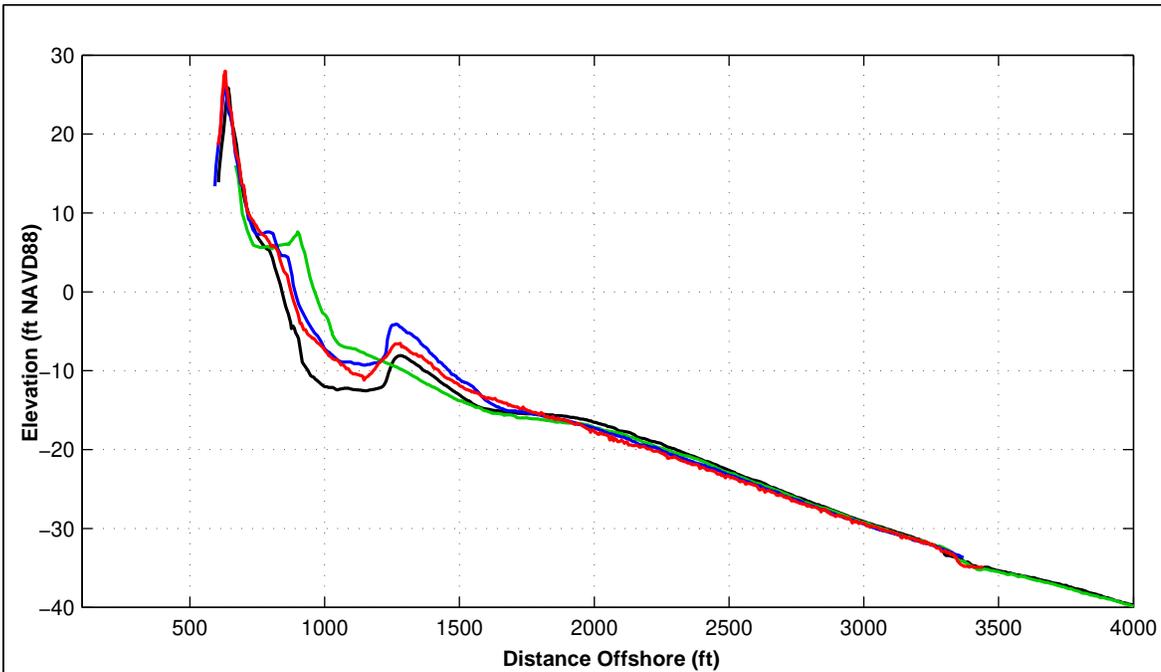
Survey Transect 735+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	-62.80 ft	-29.98 ft
Volume Change Above +6 ft NAVD88	4.10 cy/ft	2.17 cy/ft
Volume Change Above 1.18 ft NAVD88	-8.80 cy/ft	-0.17 cy/ft
Volume Change Above -6 ft NAVD88	-27.38 cy/ft	-9.19 cy/ft
Volume Change Above -14 ft NAVD88	-10.64 cy/ft	6.09 cy/ft
Volume Change Above -19 ft NAVD88	-4.99 cy/ft	9.17 cy/ft
Volume Change Above -30 ft NAVD88	-7.91 cy/ft	3.58 cy/ft

LEGEND:

JULY 2021	—	AUGUST 2019	—
JUNE 2020	—	MAY 2018	—

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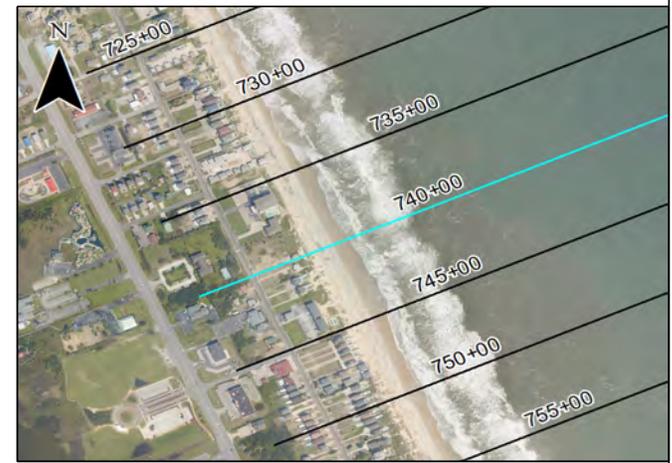


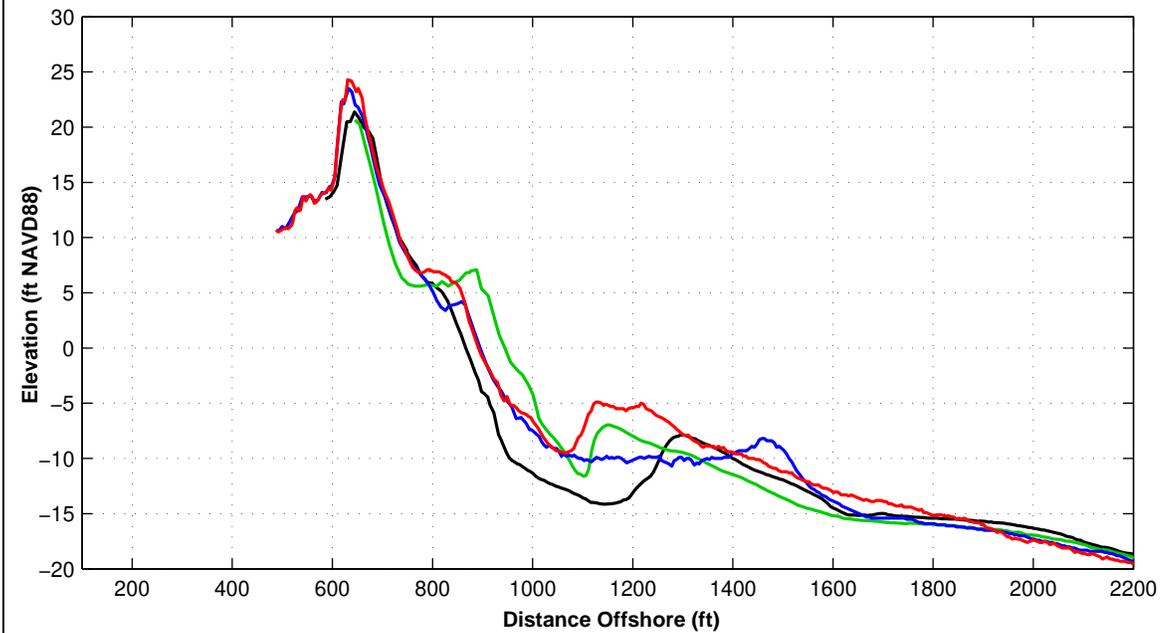
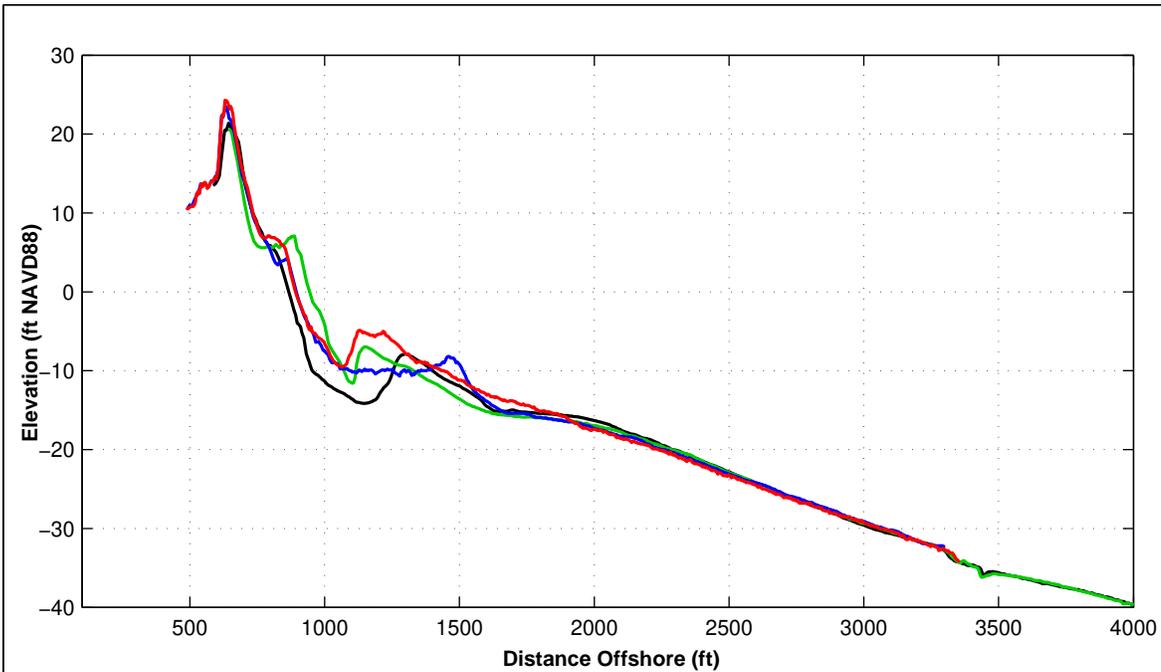
Survey Transect 740+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	-69.44 ft	-15.25 ft
Volume Change Above +6 ft NAVD88	8.17 cy/ft	1.42 cy/ft
Volume Change Above 1.18 ft NAVD88	-3.96 cy/ft	-2.21 cy/ft
Volume Change Above -6 ft NAVD88	-18.73 cy/ft	-12.22 cy/ft
Volume Change Above -14 ft NAVD88	14.14 cy/ft	-32.90 cy/ft
Volume Change Above -19 ft NAVD88	20.83 cy/ft	-32.57 cy/ft
Volume Change Above -30 ft NAVD88	11.31 cy/ft	-39.85 cy/ft

LEGEND:

JULY 2021	—	AUGUST 2019	—
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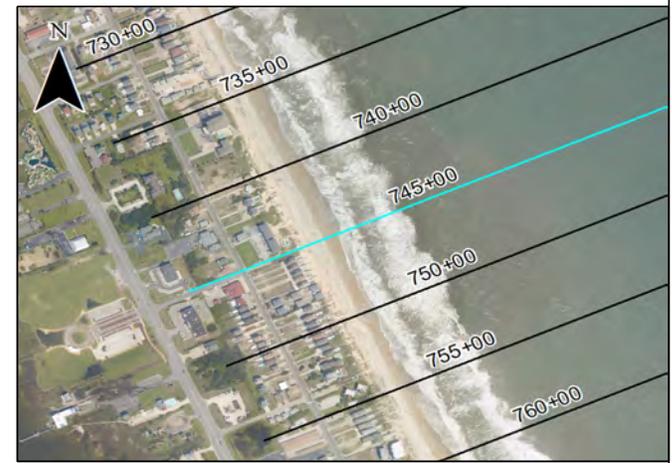


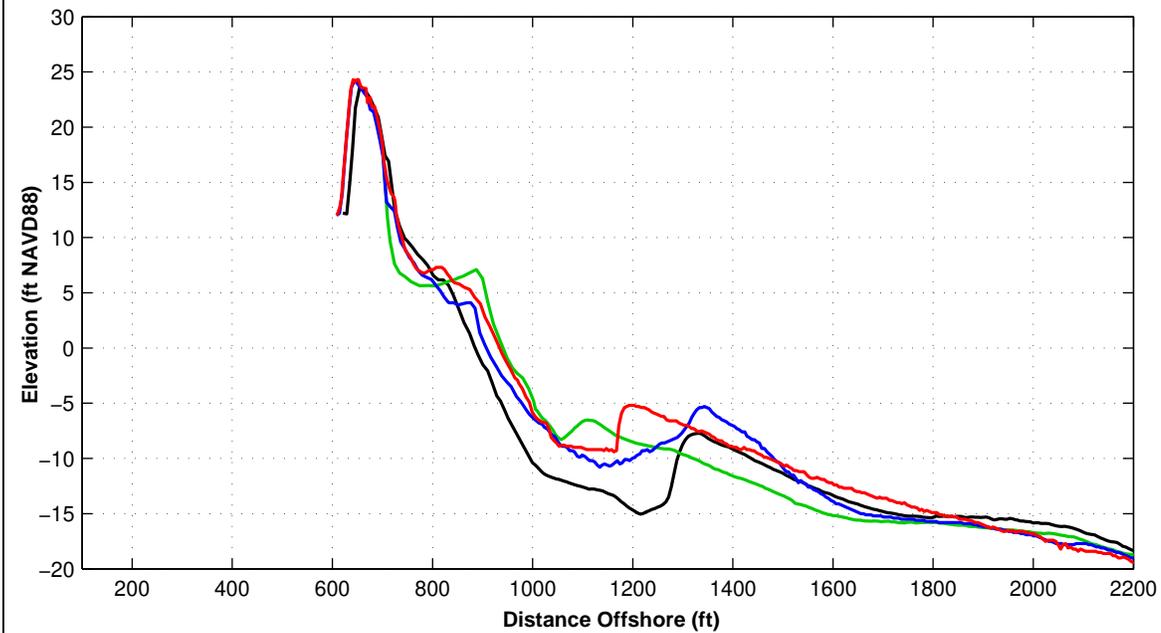
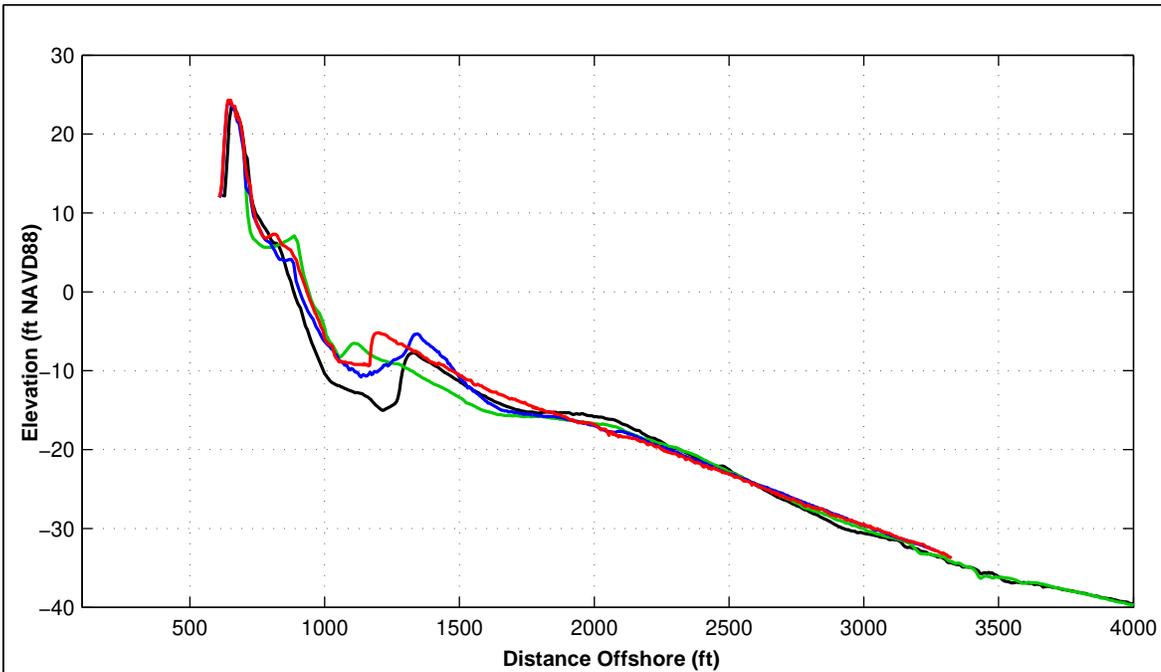
Survey Transect 745+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	-47.44 ft	-3.21 ft
Volume Change Above +6 ft NAVD88	9.34 cy/ft	4.53 cy/ft
Volume Change Above 1.18 ft NAVD88	-2.80 cy/ft	8.72 cy/ft
Volume Change Above -6 ft NAVD88	-17.25 cy/ft	12.02 cy/ft
Volume Change Above -14 ft NAVD88	-9.54 cy/ft	44.36 cy/ft
Volume Change Above -19 ft NAVD88	-7.35 cy/ft	52.20 cy/ft
Volume Change Above -30 ft NAVD88	-8.76 cy/ft	42.97 cy/ft

LEGEND:

JULY 2021		AUGUST 2019	
JUNE 2020		MAY 2018	

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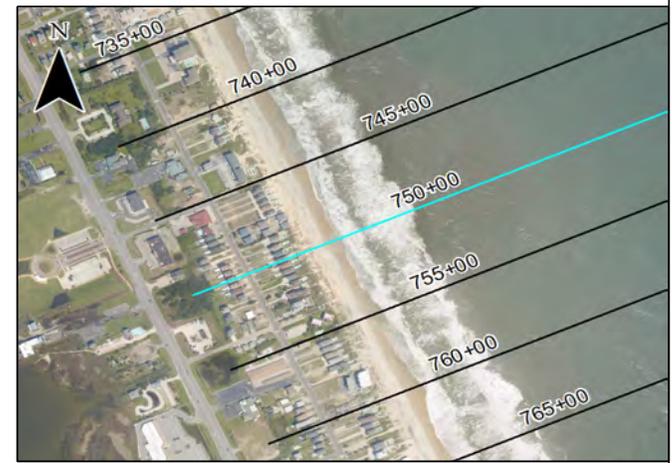


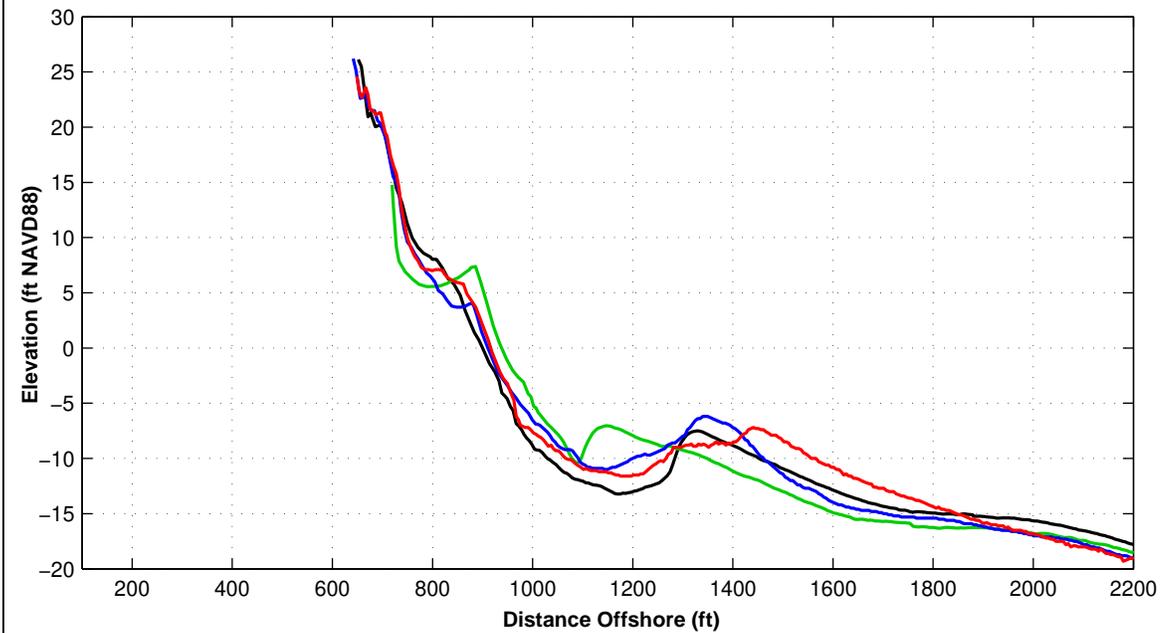
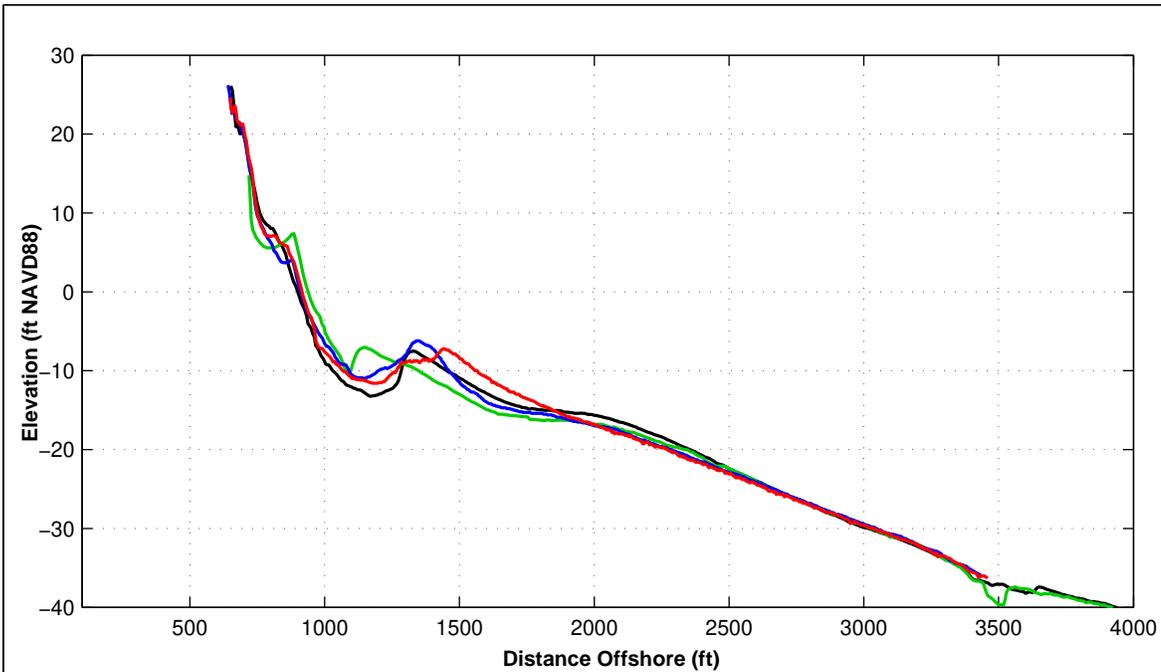
Survey Transect 750+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	-34.33 ft	26.42 ft
Volume Change Above +6 ft NAVD88	5.24 cy/ft	4.84 cy/ft
Volume Change Above 1.18 ft NAVD88	-3.80 cy/ft	11.00 cy/ft
Volume Change Above -6 ft NAVD88	-11.38 cy/ft	17.56 cy/ft
Volume Change Above -14 ft NAVD88	8.90 cy/ft	34.43 cy/ft
Volume Change Above -19 ft NAVD88	11.81 cy/ft	41.60 cy/ft
Volume Change Above -30 ft NAVD88	13.19 cy/ft	36.09 cy/ft

LEGEND:

JULY 2021	—	AUGUST 2019	—
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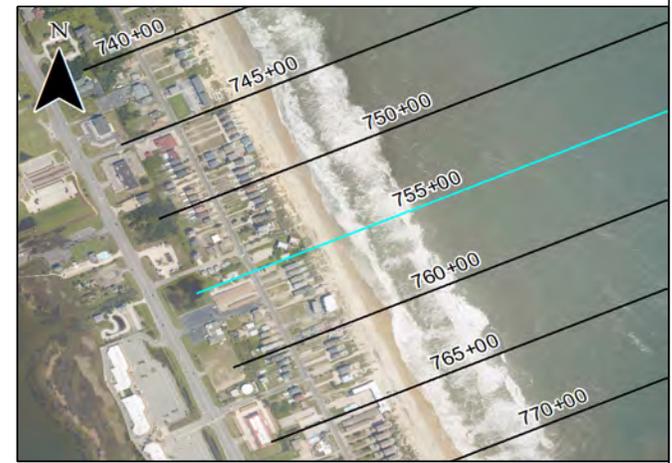


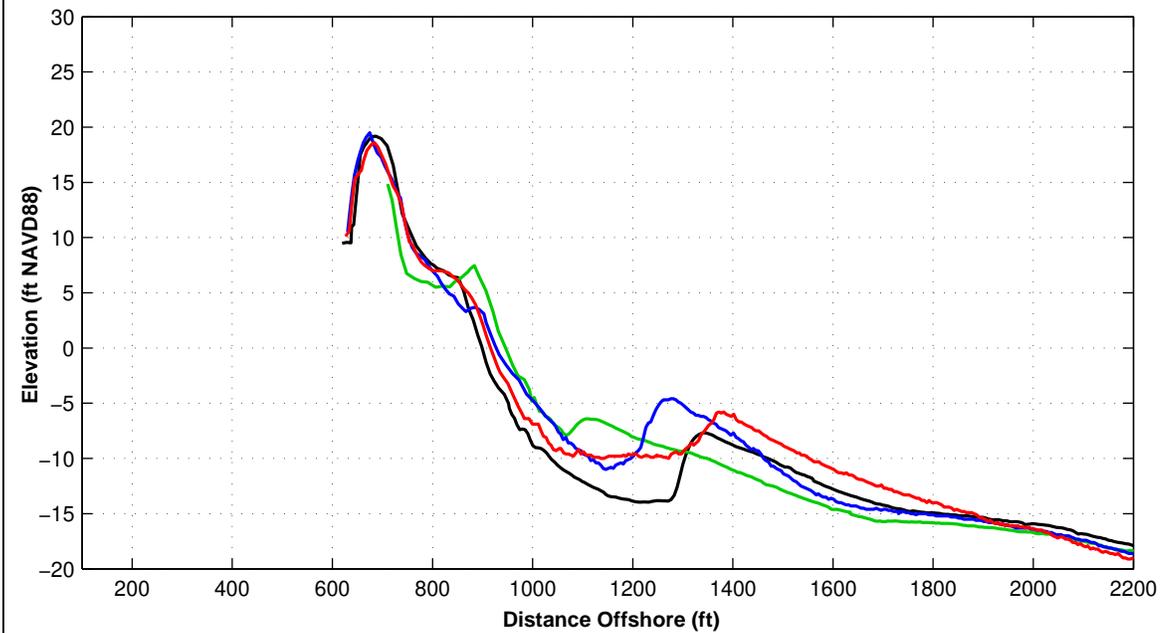
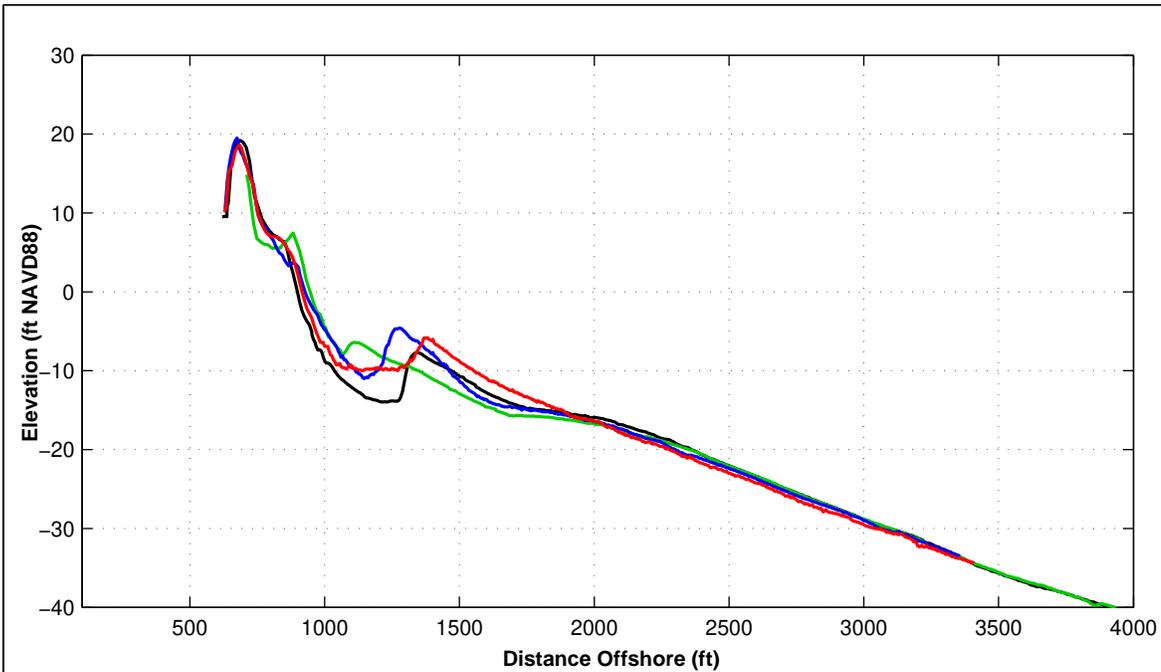
Survey Transect 755+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	-27.39 ft	6.86 ft
Volume Change Above +6 ft NAVD88	6.67 cy/ft	2.96 cy/ft
Volume Change Above 1.18 ft NAVD88	-1.98 cy/ft	7.52 cy/ft
Volume Change Above -6 ft NAVD88	-9.73 cy/ft	7.37 cy/ft
Volume Change Above -14 ft NAVD88	0.87 cy/ft	16.48 cy/ft
Volume Change Above -19 ft NAVD88	6.42 cy/ft	25.15 cy/ft
Volume Change Above -30 ft NAVD88	1.93 cy/ft	17.67 cy/ft

LEGEND:

JULY 2021	—	AUGUST 2019	—
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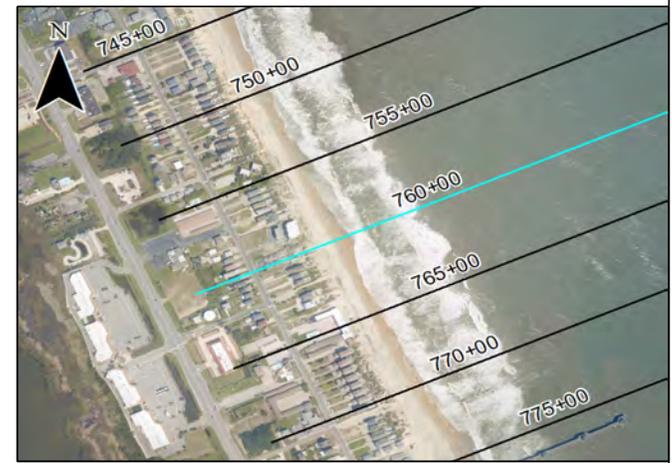


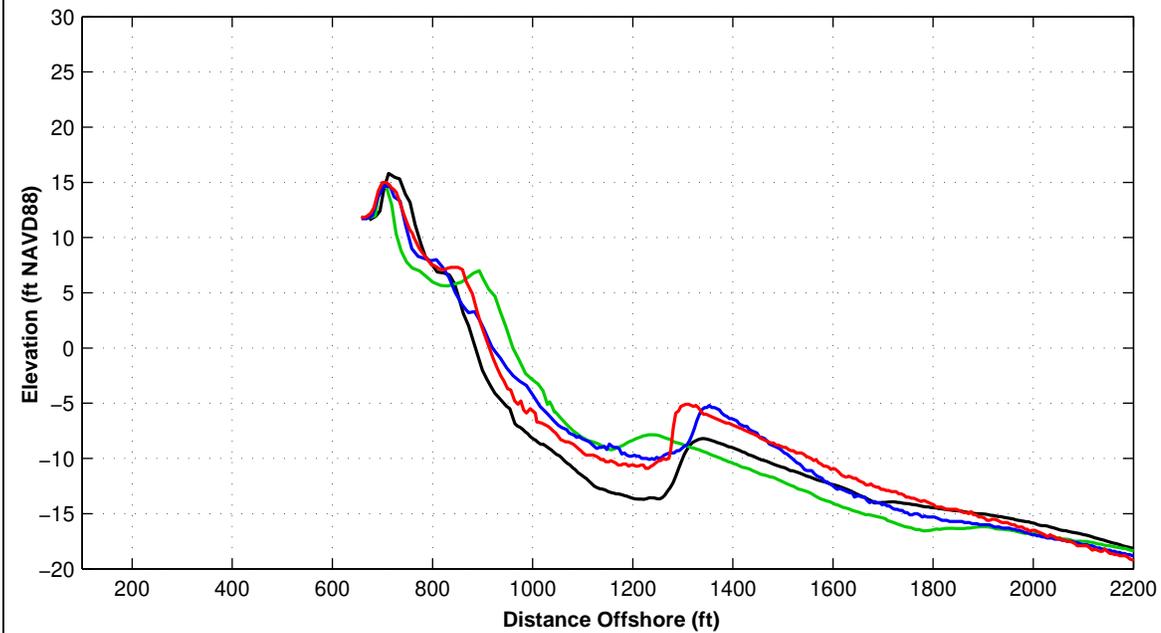
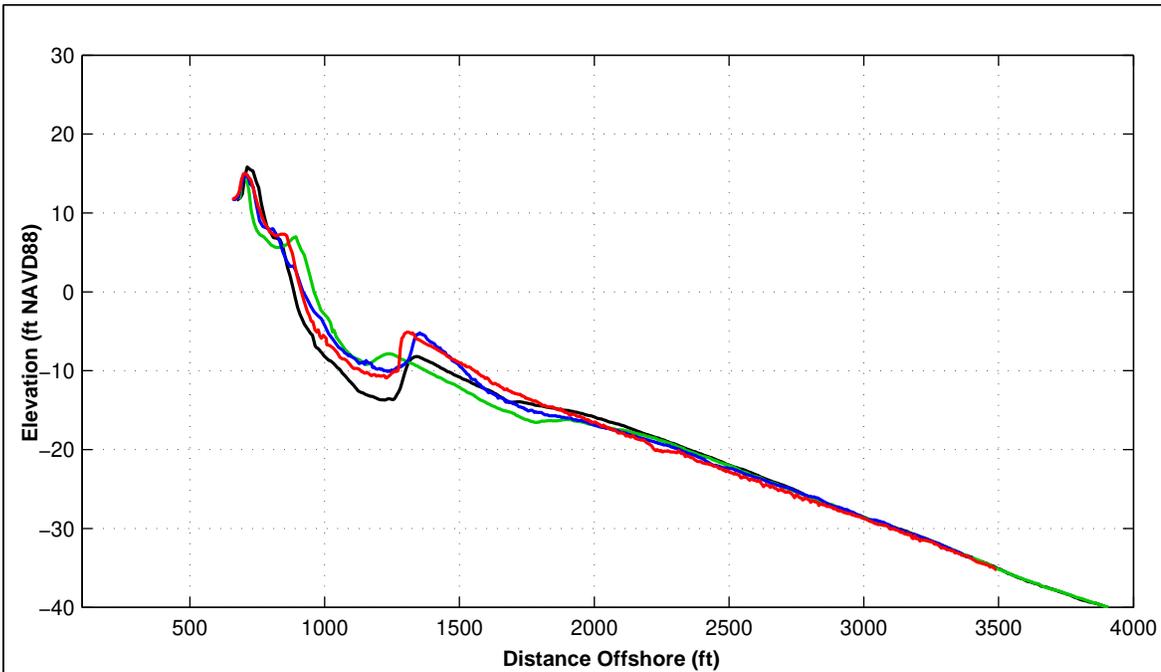
Survey Transect 760+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	-18.11 ft	-9.44 ft
Volume Change Above +6 ft NAVD88	7.94 cy/ft	-0.70 cy/ft
Volume Change Above 1.18 ft NAVD88	0.42 cy/ft	1.80 cy/ft
Volume Change Above -6 ft NAVD88	0.29 cy/ft	-6.94 cy/ft
Volume Change Above -14 ft NAVD88	17.56 cy/ft	5.21 cy/ft
Volume Change Above -19 ft NAVD88	28.06 cy/ft	9.95 cy/ft
Volume Change Above -30 ft NAVD88	17.76 cy/ft	-5.77 cy/ft

LEGEND:

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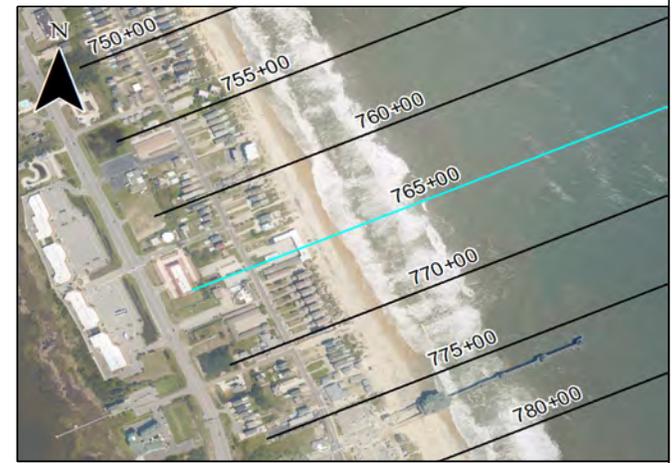


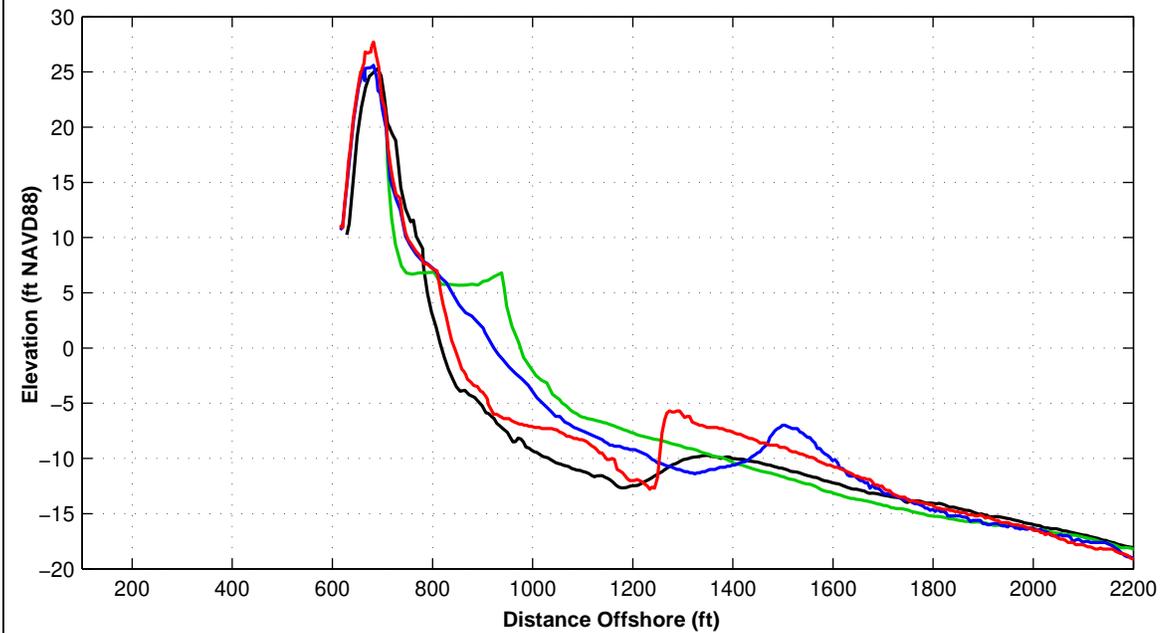
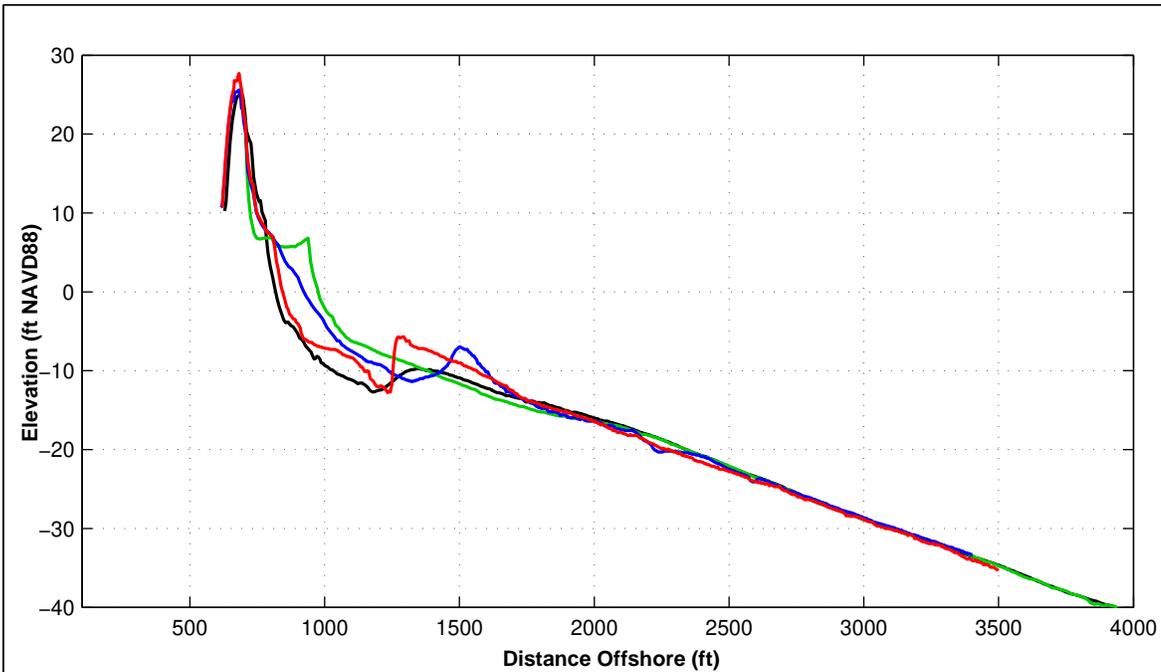
Survey Transect 765+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	-44.04 ft	-3.72 ft
Volume Change Above +6 ft NAVD88	7.93 cy/ft	2.72 cy/ft
Volume Change Above 1.18 ft NAVD88	-2.34 cy/ft	5.62 cy/ft
Volume Change Above -6 ft NAVD88	-9.69 cy/ft	-0.30 cy/ft
Volume Change Above -14 ft NAVD88	15.35 cy/ft	5.32 cy/ft
Volume Change Above -19 ft NAVD88	23.19 cy/ft	13.17 cy/ft
Volume Change Above -30 ft NAVD88	19.71 cy/ft	-1.68 cy/ft

LEGEND:

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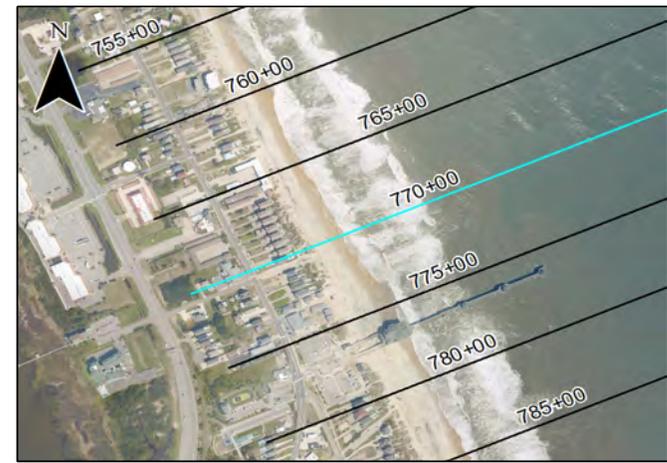


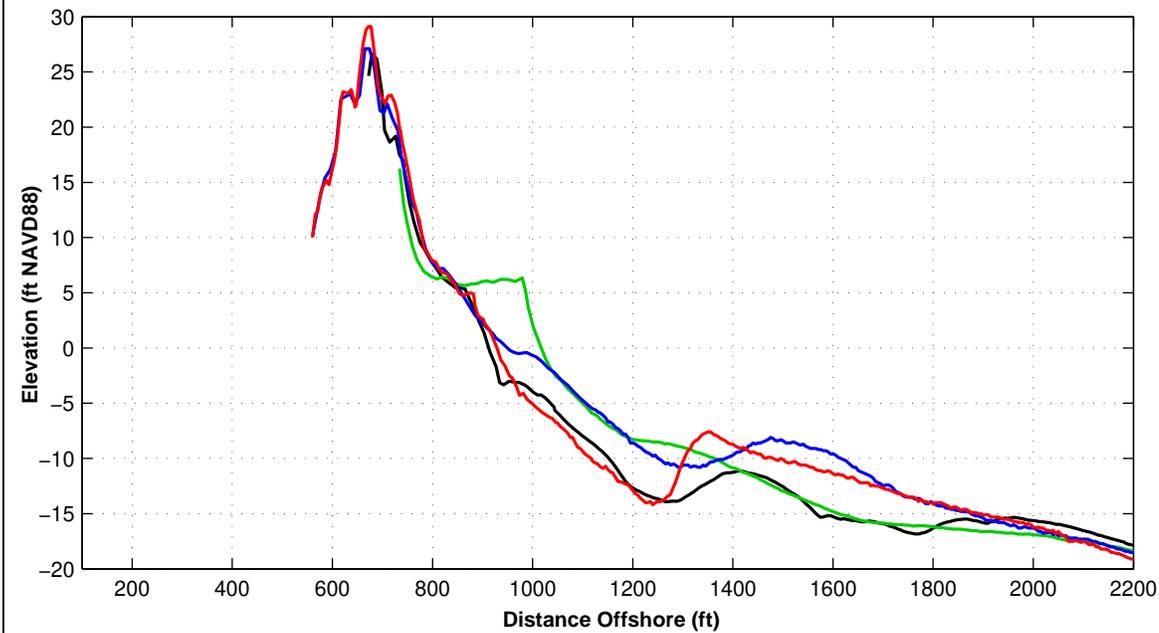
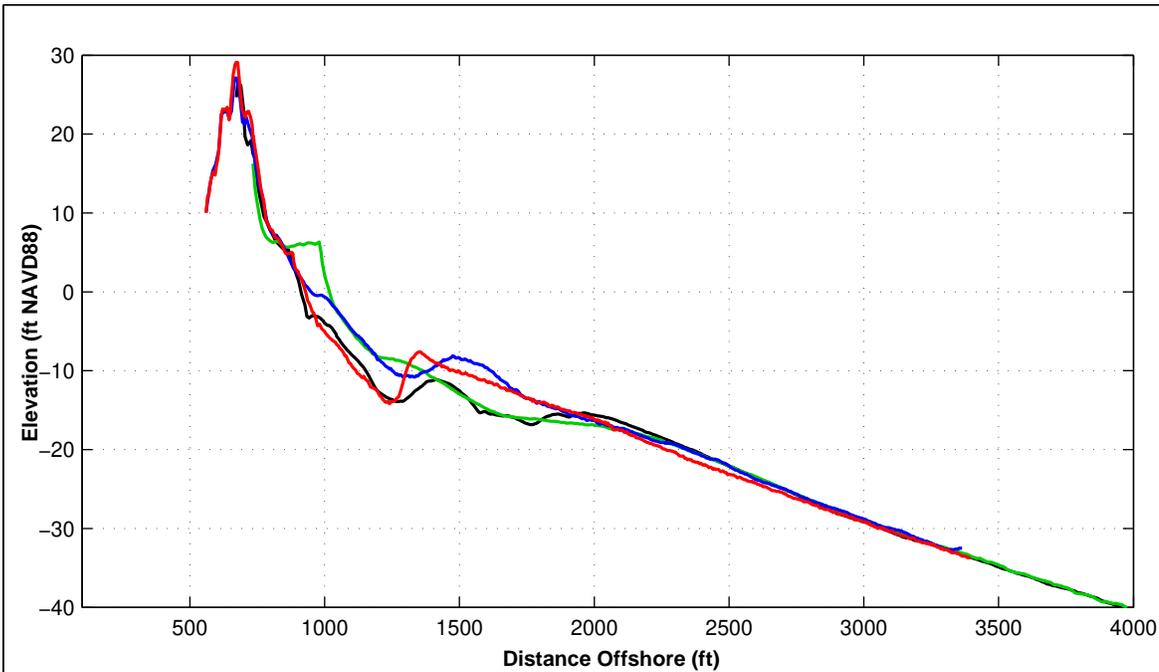
Survey Transect 770+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	-57.95 ft	-72.08 ft
Volume Change Above +6 ft NAVD88	7.83 cy/ft	2.54 cy/ft
Volume Change Above 1.18 ft NAVD88	-6.82 cy/ft	-4.76 cy/ft
Volume Change Above -6 ft NAVD88	-18.50 cy/ft	-30.13 cy/ft
Volume Change Above -14 ft NAVD88	-8.26 cy/ft	-26.50 cy/ft
Volume Change Above -19 ft NAVD88	-8.02 cy/ft	-25.57 cy/ft
Volume Change Above -30 ft NAVD88	-13.78 cy/ft	-34.23 cy/ft

LEGEND:

JULY 2021	—	AUGUST 2019	—
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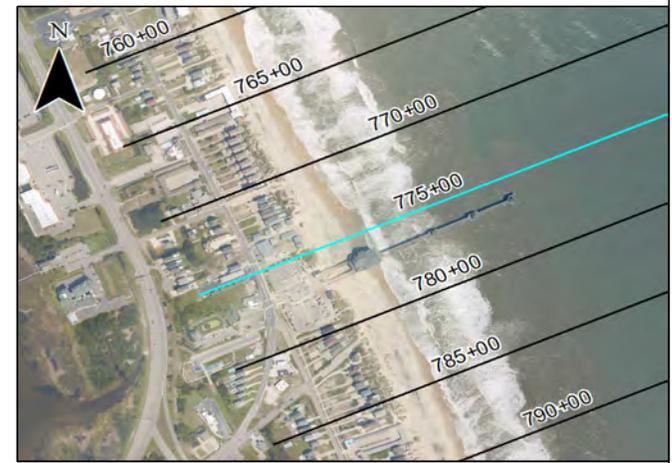


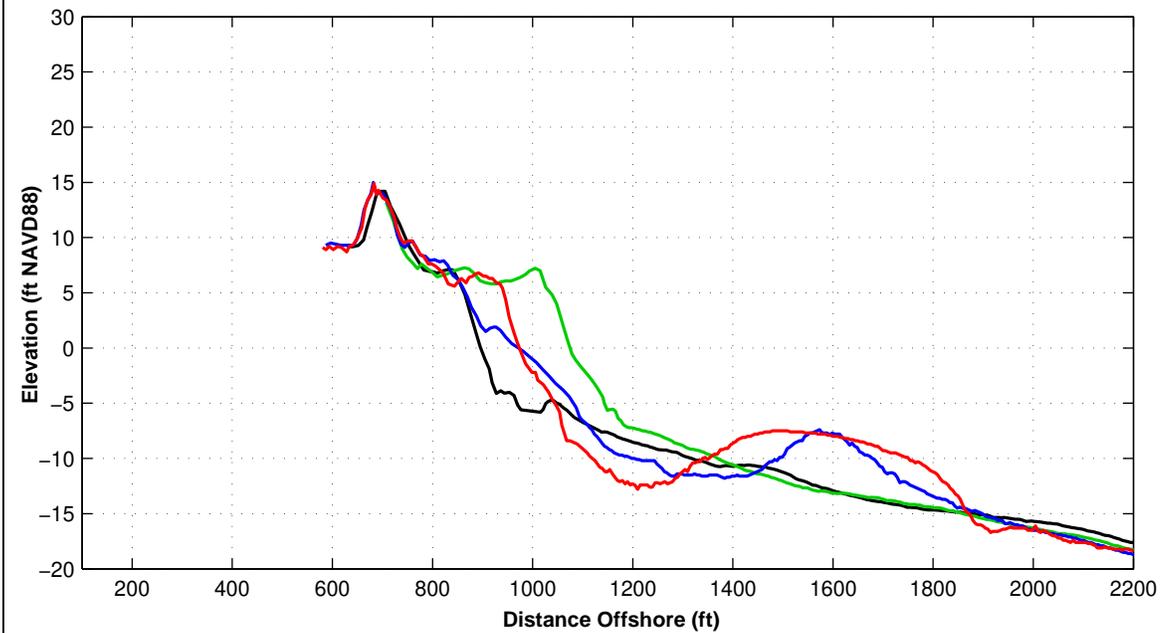
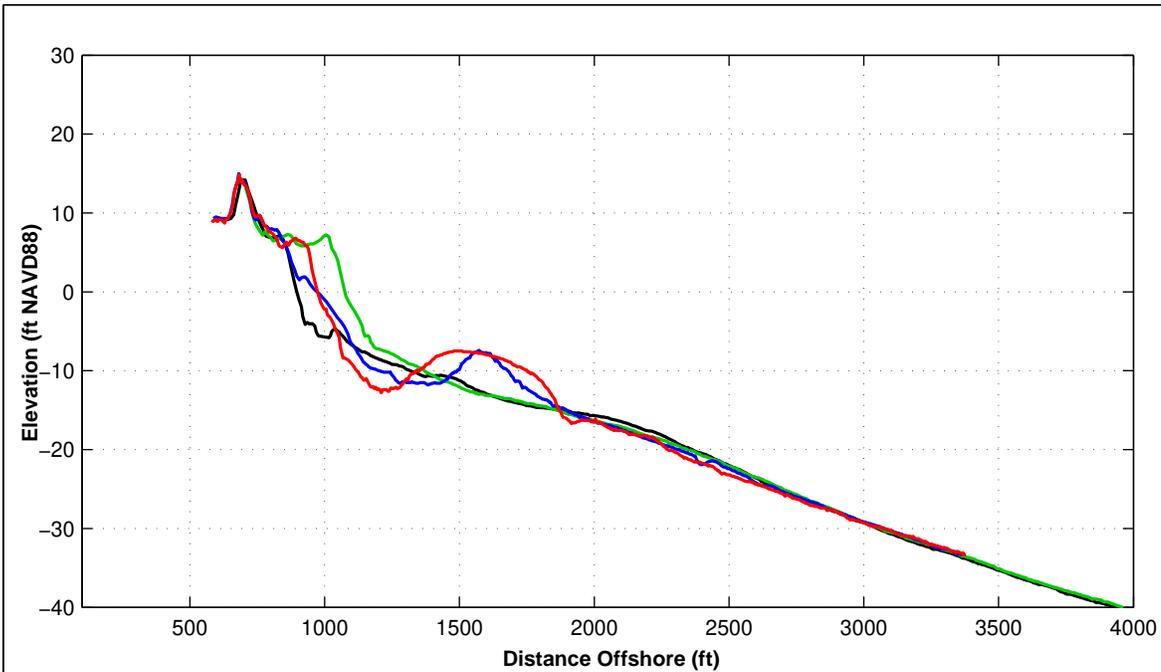
Survey Transect 775+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	-84.60 ft	-4.51 ft
Volume Change Above +6 ft NAVD88	8.20 cy/ft	4.60 cy/ft
Volume Change Above 1.18 ft NAVD88	-11.64 cy/ft	5.59 cy/ft
Volume Change Above -6 ft NAVD88	-15.84 cy/ft	-15.27 cy/ft
Volume Change Above -14 ft NAVD88	20.53 cy/ft	-54.18 cy/ft
Volume Change Above -19 ft NAVD88	43.96 cy/ft	-53.67 cy/ft
Volume Change Above -30 ft NAVD88	43.89 cy/ft	-75.31 cy/ft

LEGEND:

JULY 2021	—	AUGUST 2019	—
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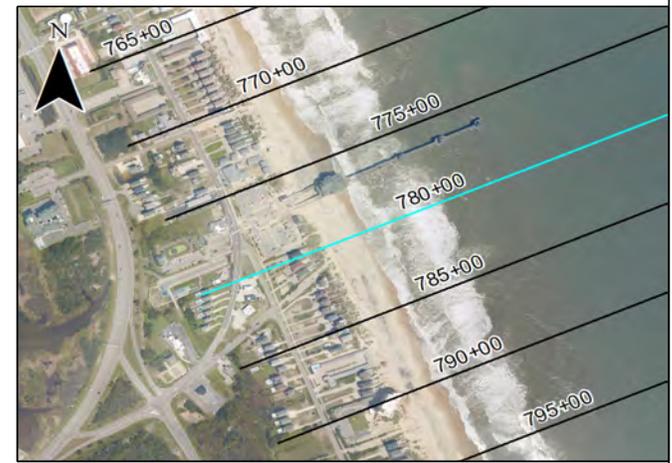


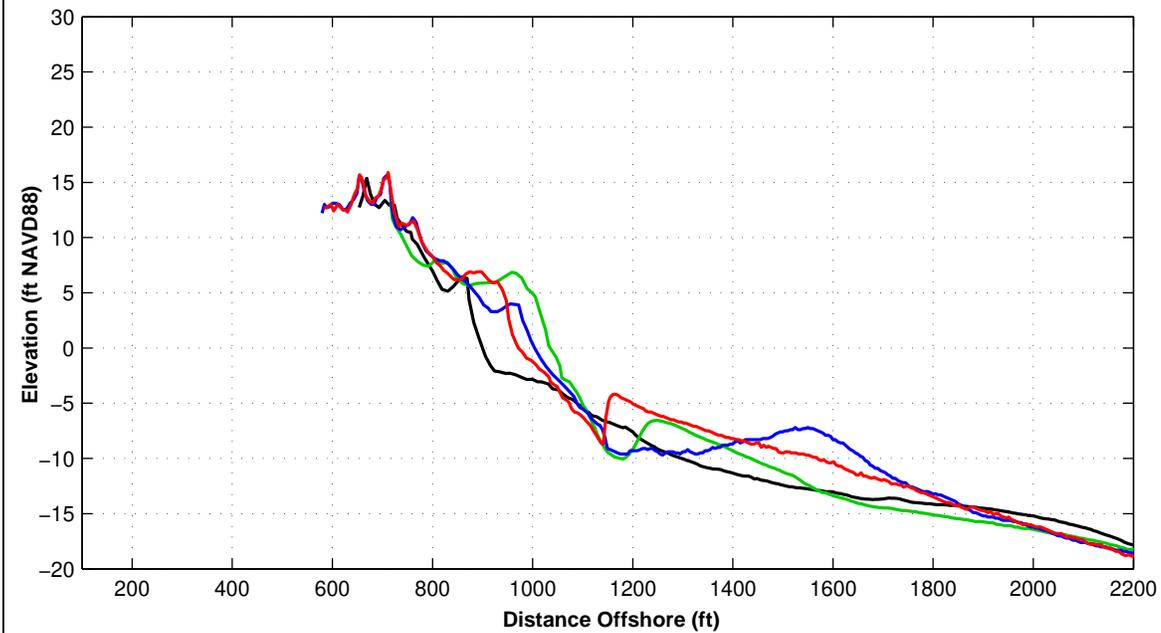
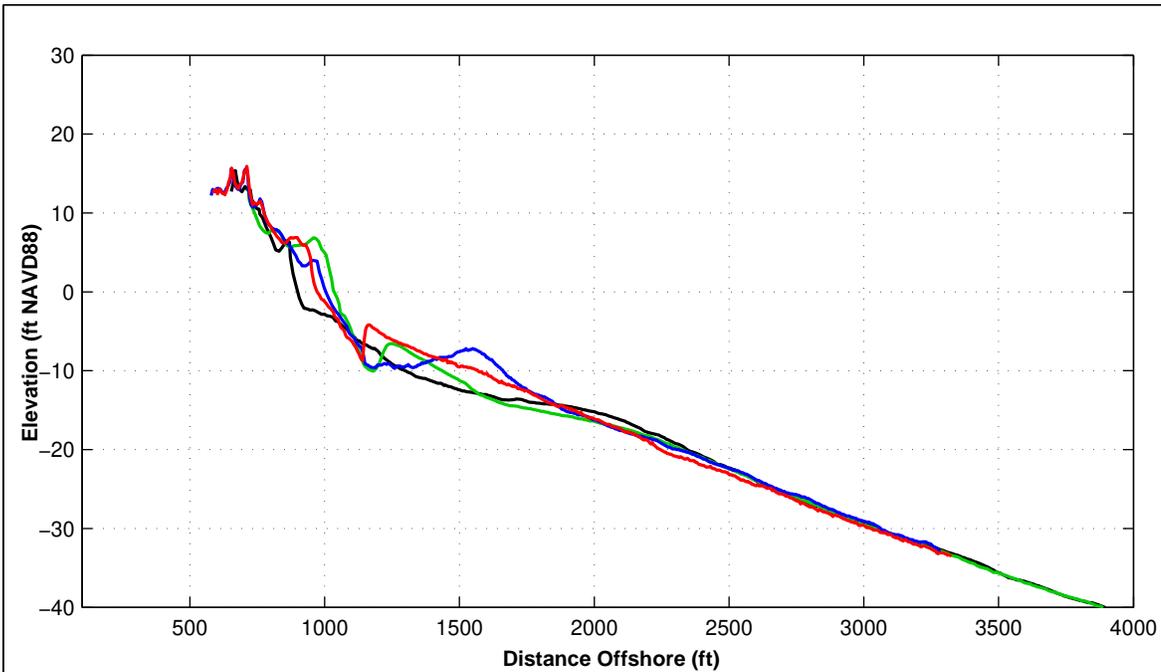
Survey Transect 780+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	-123.68 ft	21.51 ft
Volume Change Above +6 ft NAVD88	1.03 cy/ft	-0.26 cy/ft
Volume Change Above 1.18 ft NAVD88	-28.03 cy/ft	11.18 cy/ft
Volume Change Above -6 ft NAVD88	-50.12 cy/ft	5.82 cy/ft
Volume Change Above -14 ft NAVD88	-36.16 cy/ft	20.94 cy/ft
Volume Change Above -19 ft NAVD88	-36.35 cy/ft	17.84 cy/ft
Volume Change Above -30 ft NAVD88	-45.78 cy/ft	7.05 cy/ft

LEGEND:

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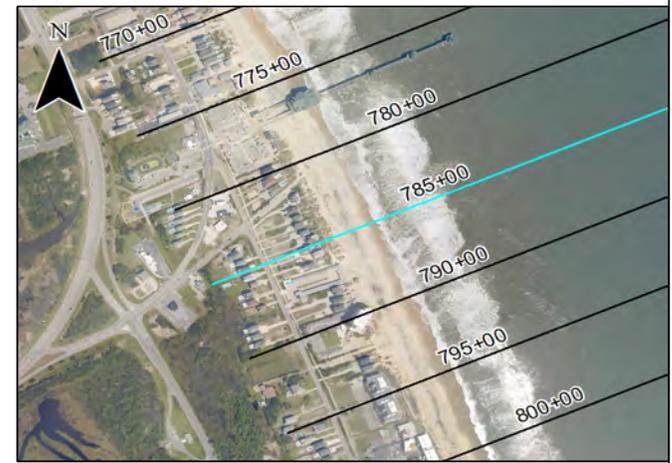


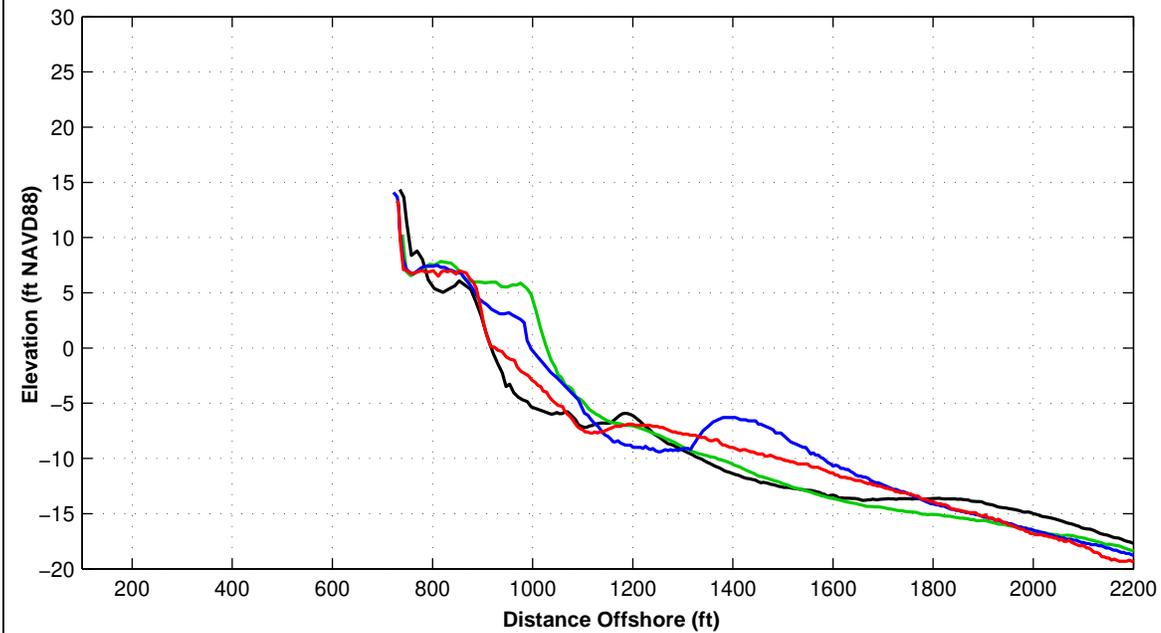
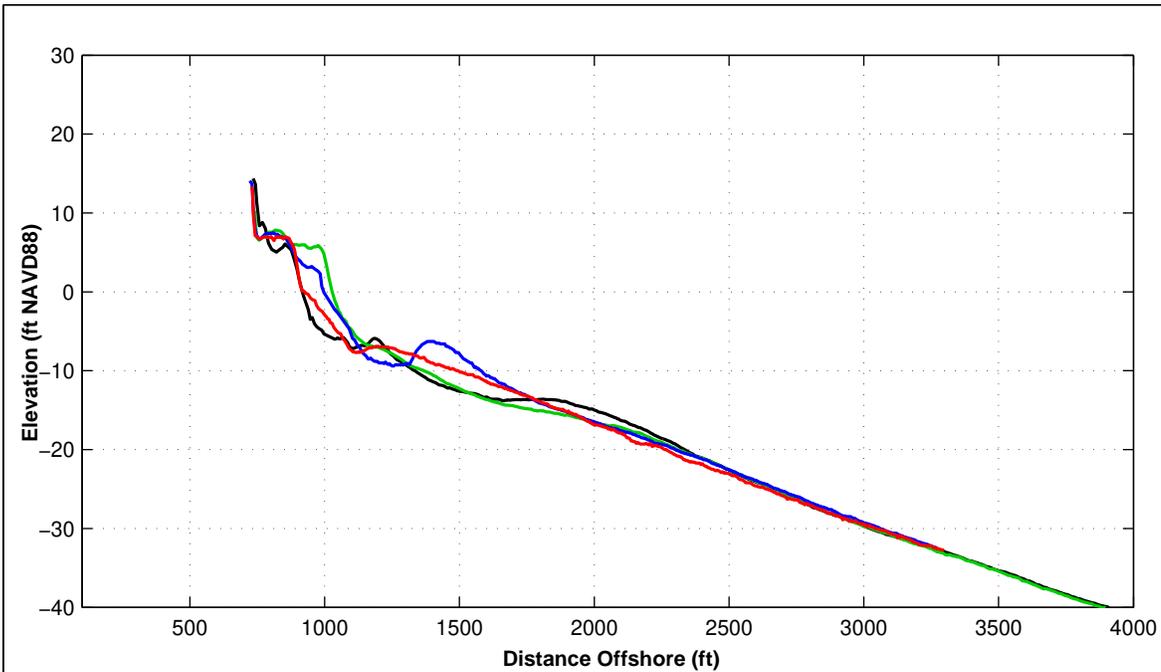
Survey Transect 785+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	-35.29 ft	-32.57 ft
Volume Change Above +6 ft NAVD88	4.42 cy/ft	0.98 cy/ft
Volume Change Above 1.18 ft NAVD88	-8.36 cy/ft	3.10 cy/ft
Volume Change Above -6 ft NAVD88	-13.84 cy/ft	0.72 cy/ft
Volume Change Above -14 ft NAVD88	24.55 cy/ft	5.45 cy/ft
Volume Change Above -19 ft NAVD88	31.75 cy/ft	6.47 cy/ft
Volume Change Above -30 ft NAVD88	36.17 cy/ft	-15.07 cy/ft

LEGEND:

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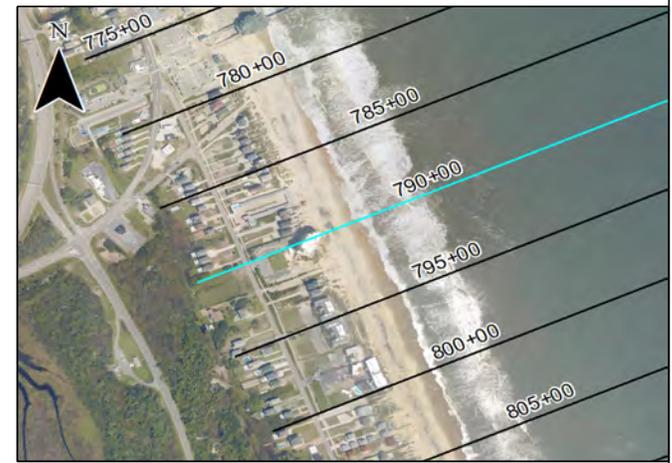


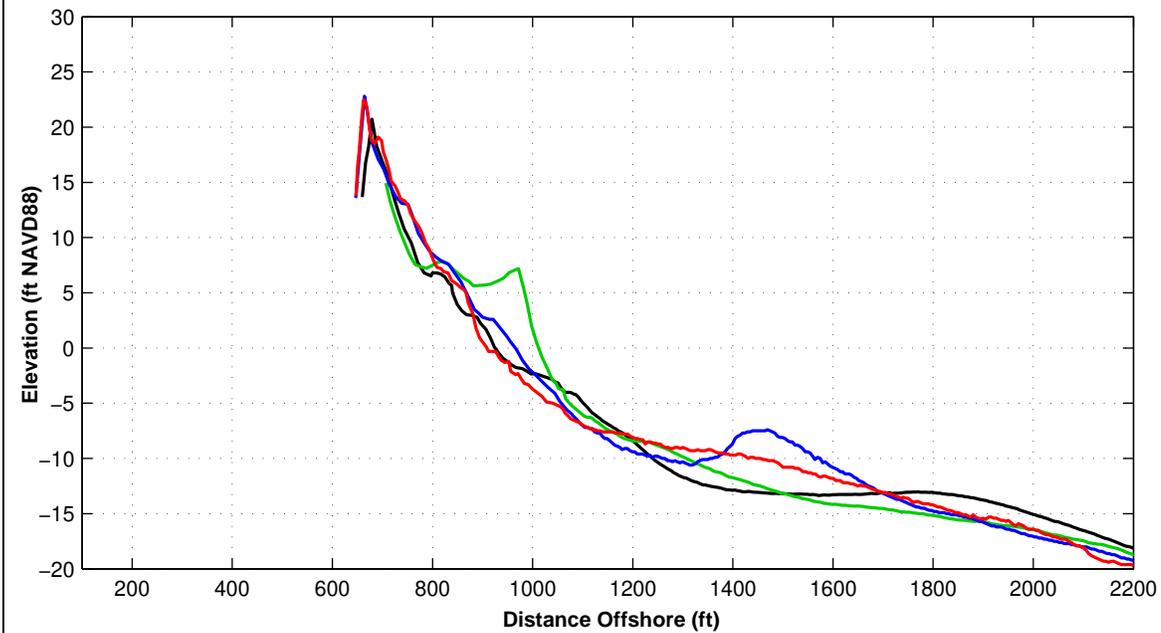
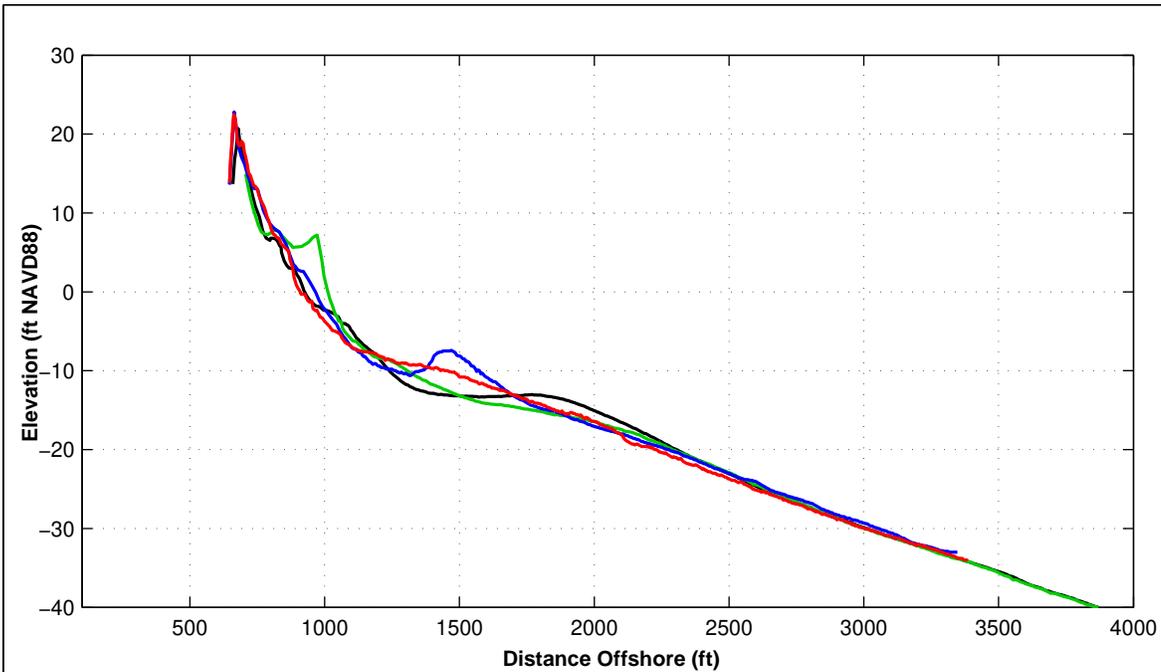
Survey Transect 790+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	-32.54 ft	-79.37 ft
Volume Change Above +6 ft NAVD88	-1.17 cy/ft	-1.01 cy/ft
Volume Change Above 1.18 ft NAVD88	-13.71 cy/ft	-6.94 cy/ft
Volume Change Above -6 ft NAVD88	-18.11 cy/ft	-22.09 cy/ft
Volume Change Above -14 ft NAVD88	23.75 cy/ft	-34.34 cy/ft
Volume Change Above -19 ft NAVD88	28.16 cy/ft	-37.52 cy/ft
Volume Change Above -30 ft NAVD88	32.82 cy/ft	-54.71 cy/ft

LEGEND:

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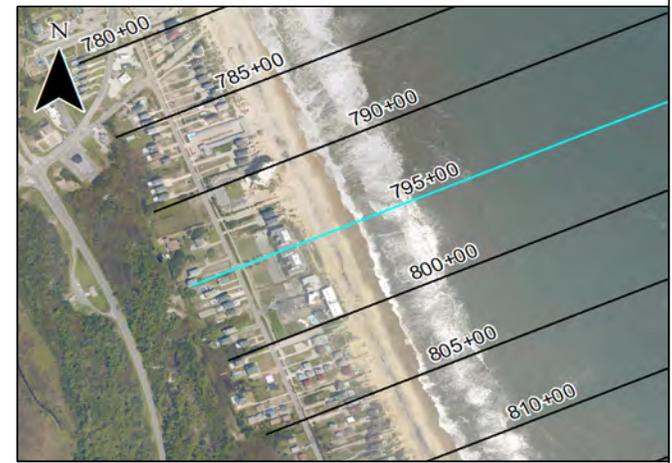


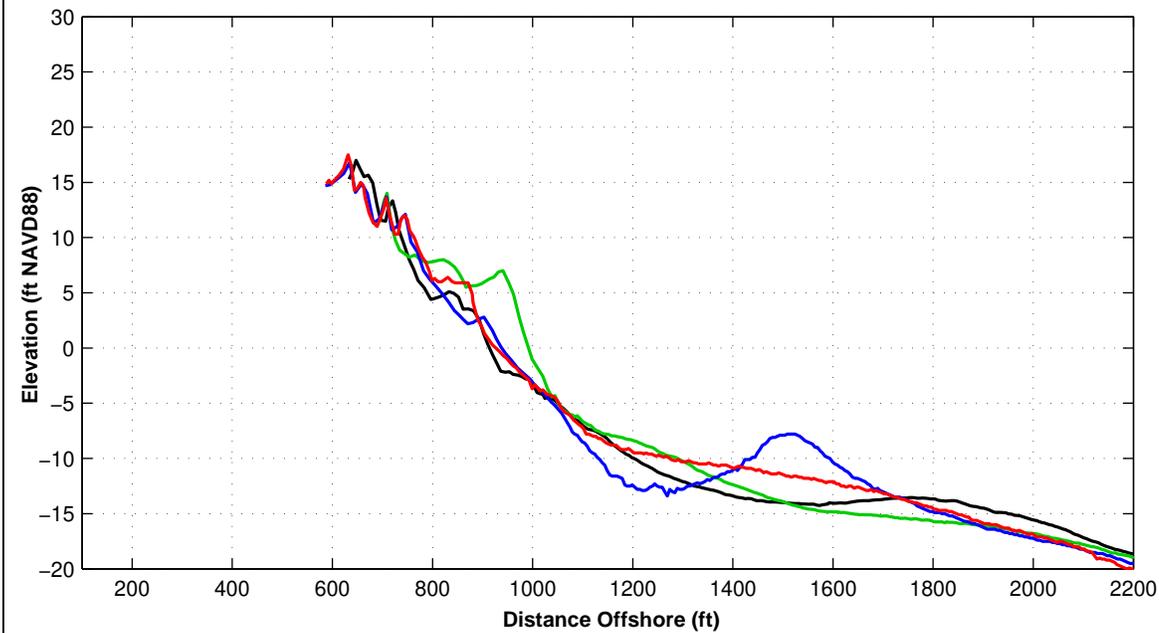
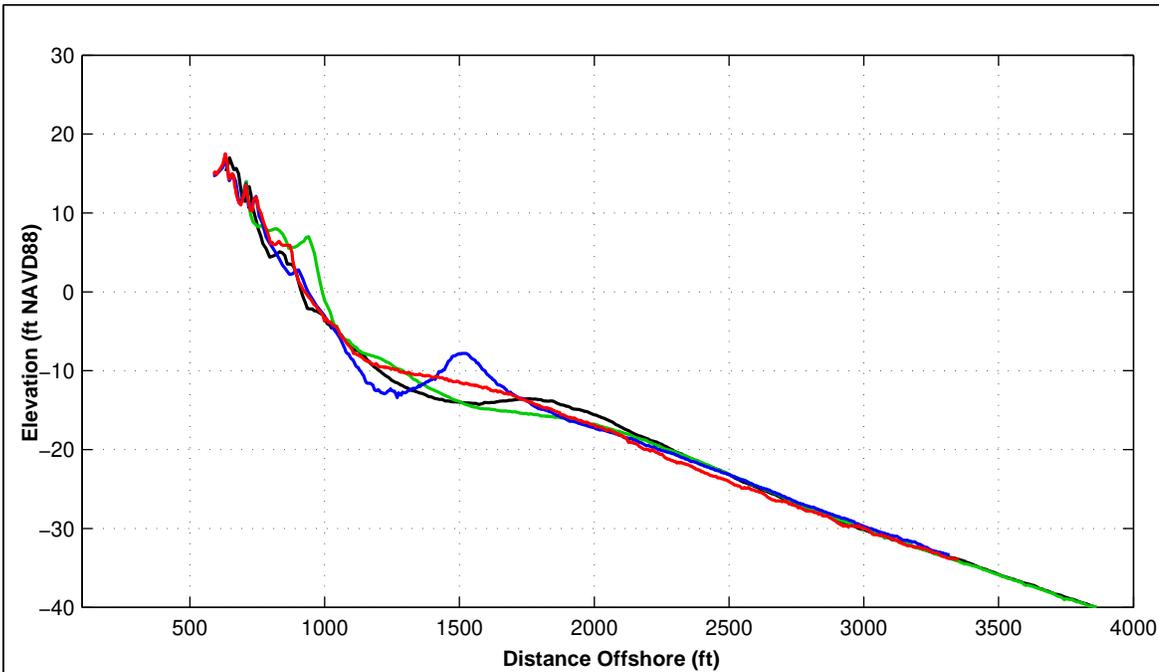
Survey Transect 795+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	-56.84 ft	-54.25 ft
Volume Change Above +6 ft NAVD88	7.66 cy/ft	1.62 cy/ft
Volume Change Above 1.18 ft NAVD88	-9.18 cy/ft	-1.83 cy/ft
Volume Change Above -6 ft NAVD88	-17.76 cy/ft	-11.48 cy/ft
Volume Change Above -14 ft NAVD88	19.42 cy/ft	-18.85 cy/ft
Volume Change Above -19 ft NAVD88	18.75 cy/ft	-14.61 cy/ft
Volume Change Above -30 ft NAVD88	23.18 cy/ft	-35.71 cy/ft

LEGEND:

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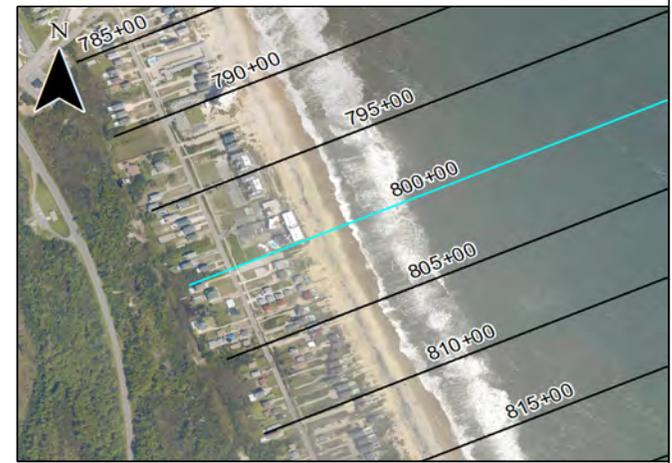


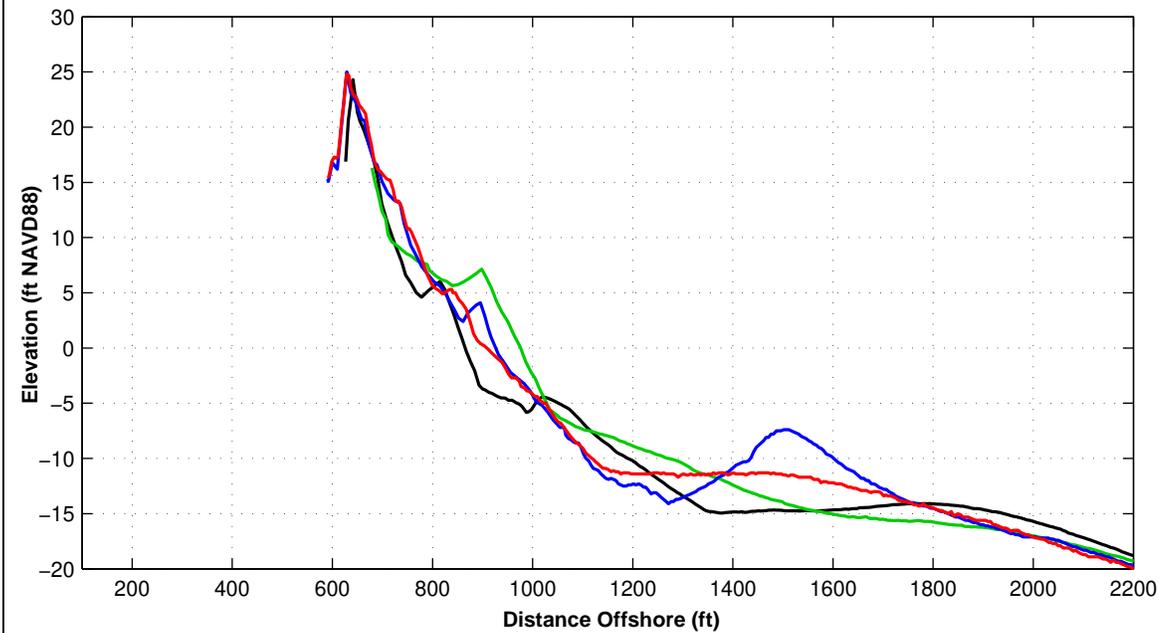
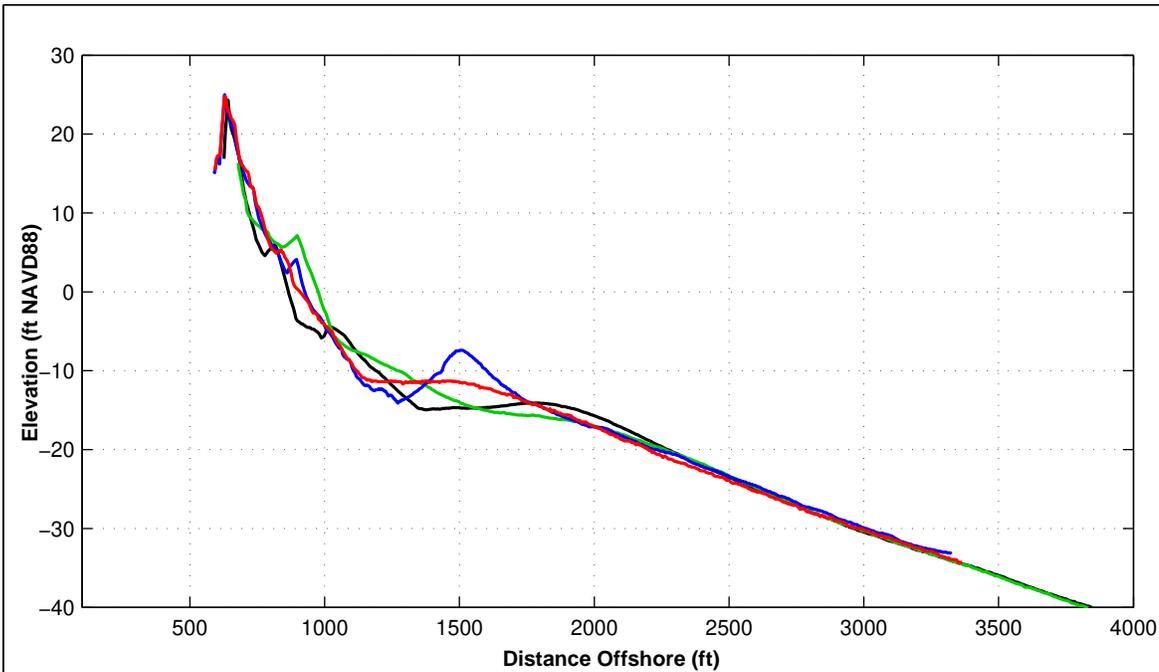
Survey Transect 800+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	-59.45 ft	-17.76 ft
Volume Change Above +6 ft NAVD88	-2.11 cy/ft	1.05 cy/ft
Volume Change Above 1.18 ft NAVD88	-22.15 cy/ft	6.73 cy/ft
Volume Change Above -6 ft NAVD88	-30.80 cy/ft	6.09 cy/ft
Volume Change Above -14 ft NAVD88	-15.94 cy/ft	10.86 cy/ft
Volume Change Above -19 ft NAVD88	-8.24 cy/ft	14.30 cy/ft
Volume Change Above -30 ft NAVD88	-8.90 cy/ft	-7.81 cy/ft

LEGEND:

JULY 2021		AUGUST 2019	
JUNE 2020		MAY 2018	

- Notes:
1. Station From North To South At Varying Intervals.
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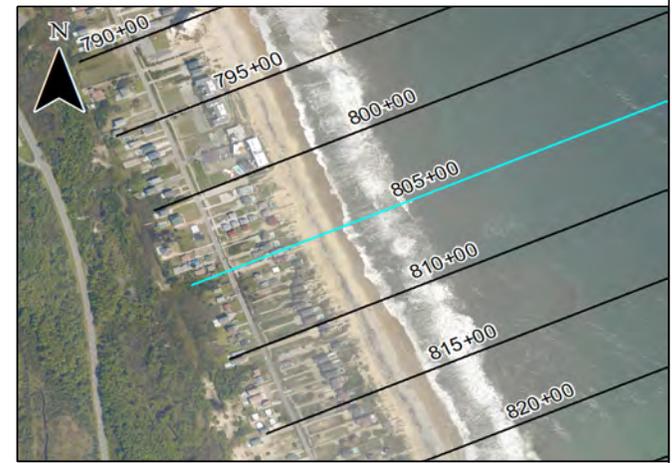


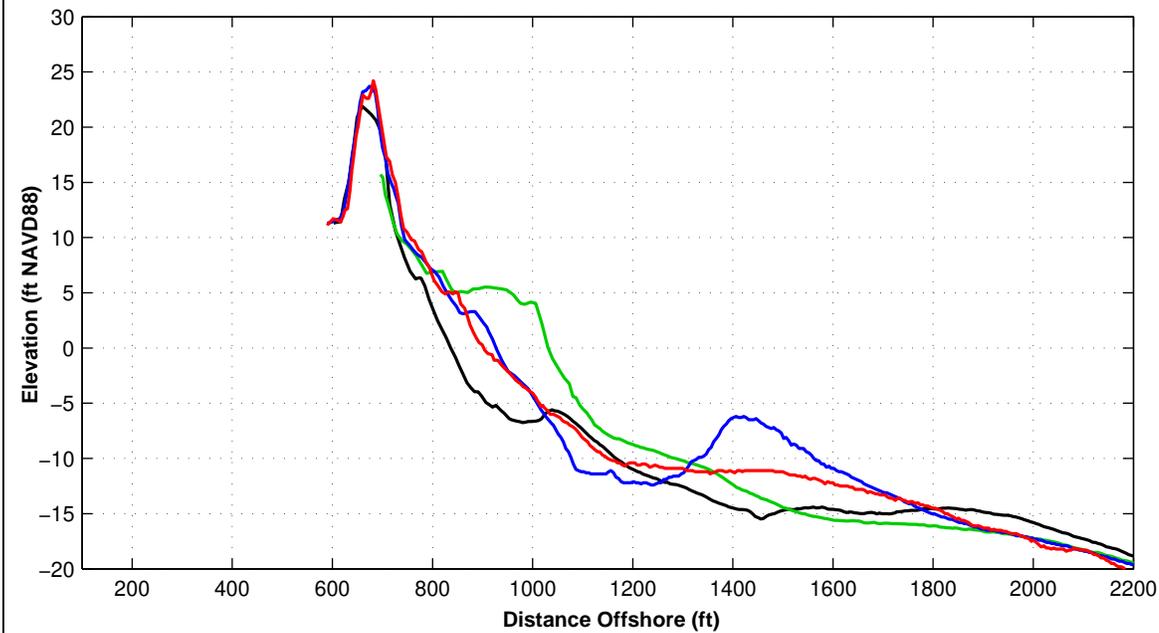
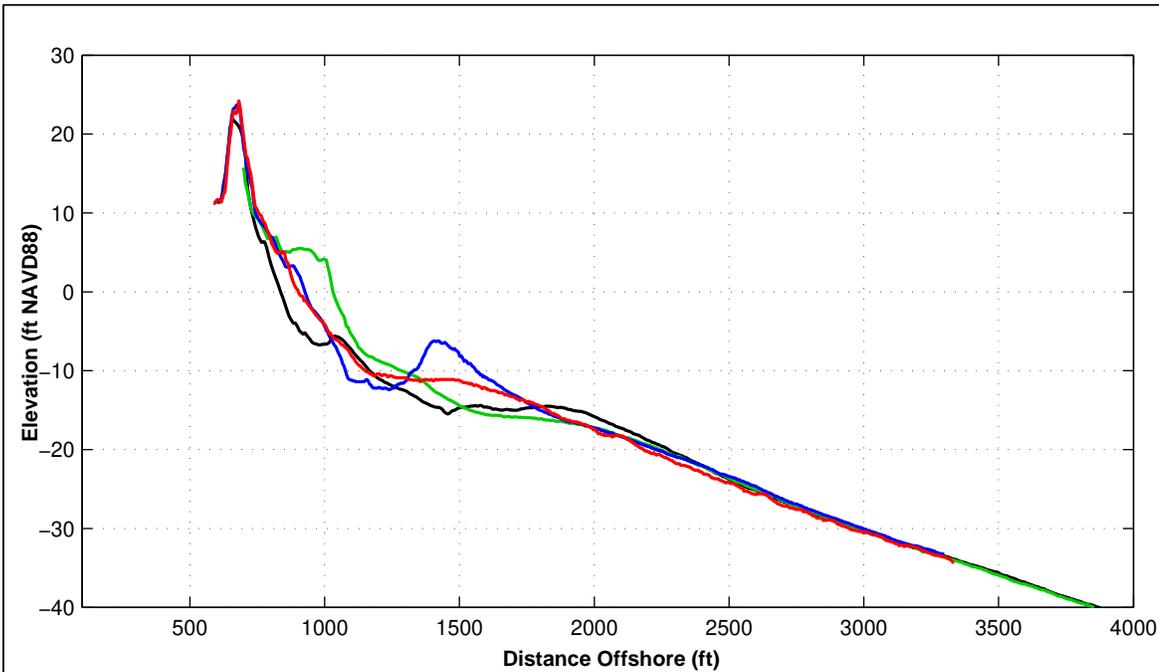
Survey Transect 805+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	-46.94 ft	-32.28 ft
Volume Change Above +6 ft NAVD88	6.78 cy/ft	3.42 cy/ft
Volume Change Above 1.18 ft NAVD88	-6.02 cy/ft	2.04 cy/ft
Volume Change Above -6 ft NAVD88	-14.99 cy/ft	0.30 cy/ft
Volume Change Above -14 ft NAVD88	-0.08 cy/ft	-12.41 cy/ft
Volume Change Above -19 ft NAVD88	14.42 cy/ft	-12.37 cy/ft
Volume Change Above -30 ft NAVD88	16.44 cy/ft	-28.77 cy/ft

LEGEND:

JULY 2021	—	AUGUST 2019	—
JUNE 2020	—	MAY 2018	—

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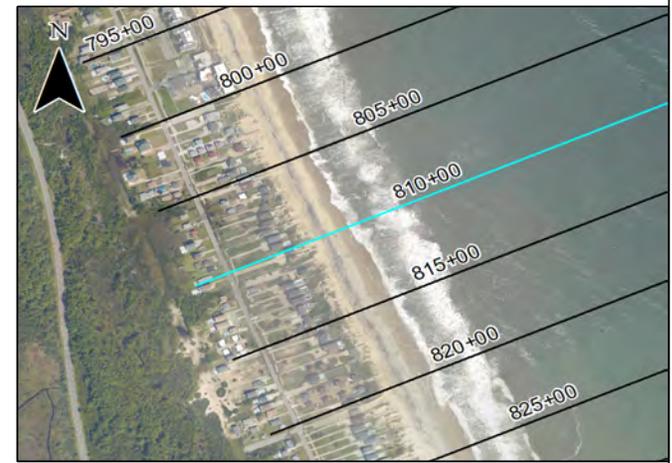


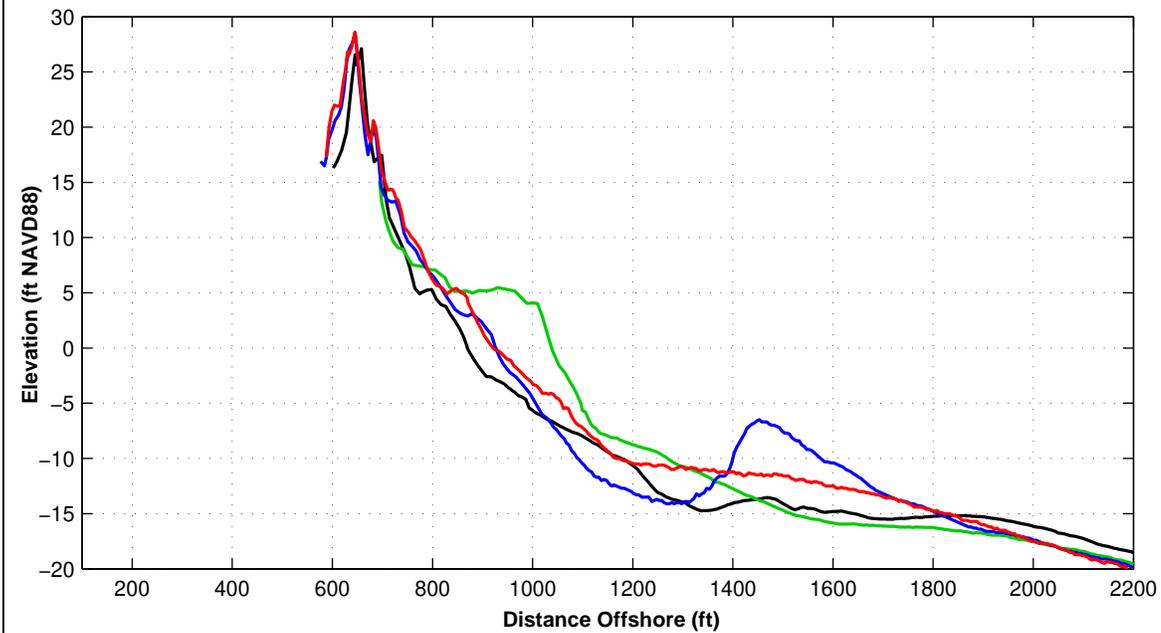
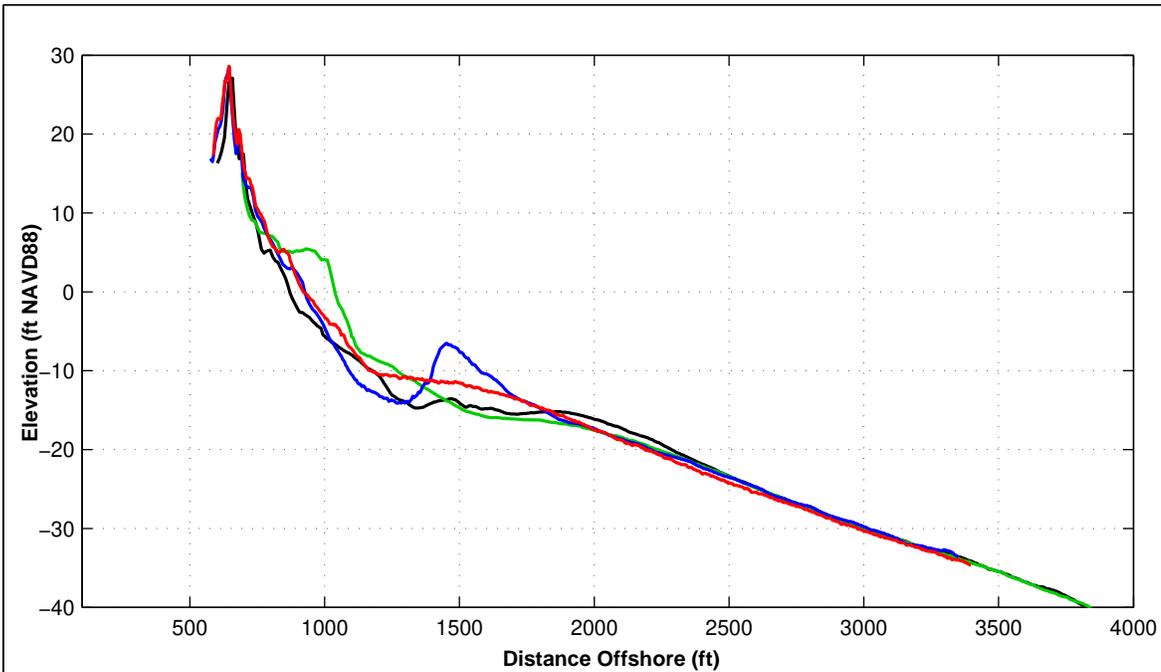
Survey Transect 810+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	-108.58 ft	-31.19 ft
Volume Change Above +6 ft NAVD88	5.25 cy/ft	1.83 cy/ft
Volume Change Above 1.18 ft NAVD88	-14.71 cy/ft	0.41 cy/ft
Volume Change Above -6 ft NAVD88	-40.10 cy/ft	-1.61 cy/ft
Volume Change Above -14 ft NAVD88	-14.77 cy/ft	-20.15 cy/ft
Volume Change Above -19 ft NAVD88	3.93 cy/ft	-19.40 cy/ft
Volume Change Above -30 ft NAVD88	8.29 cy/ft	-40.97 cy/ft

LEGEND:

JULY 2021	—	AUGUST 2019	—
JUNE 2020	—	MAY 2018	—

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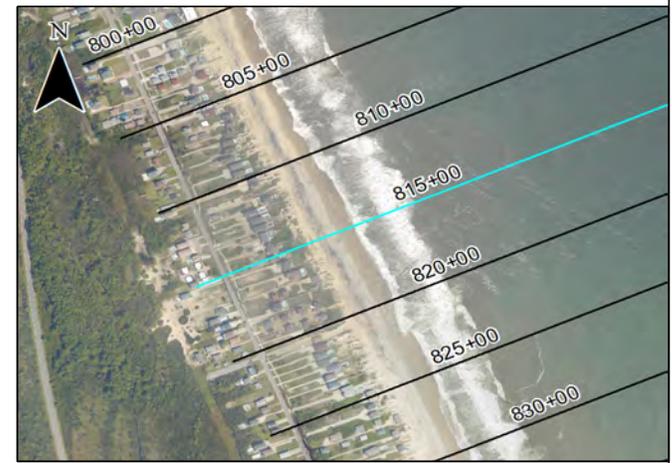


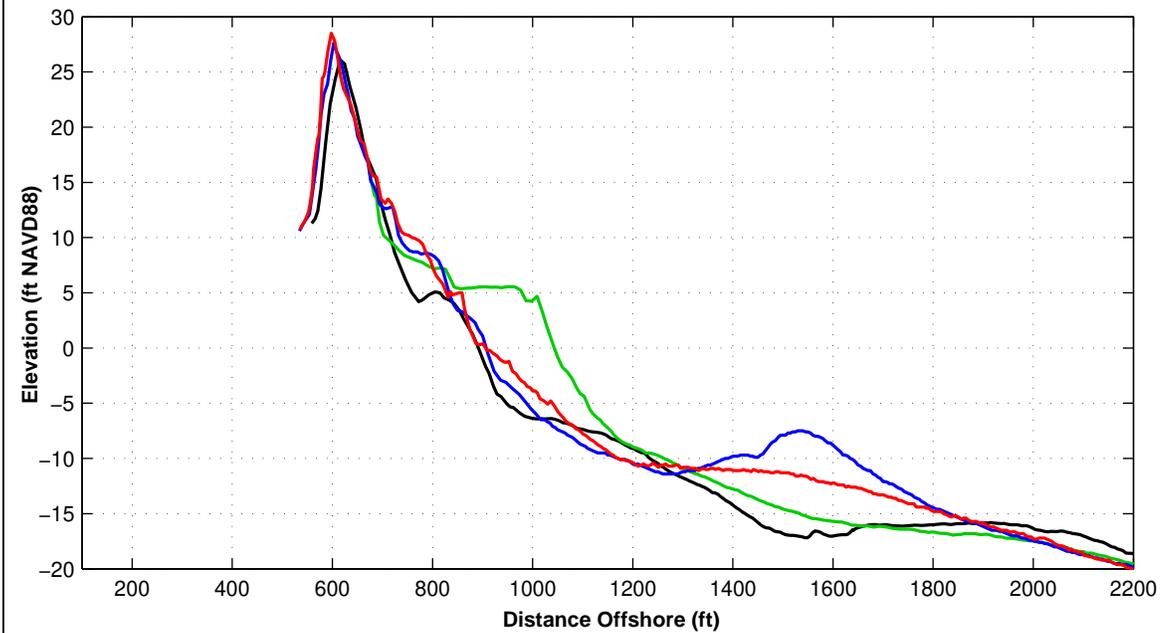
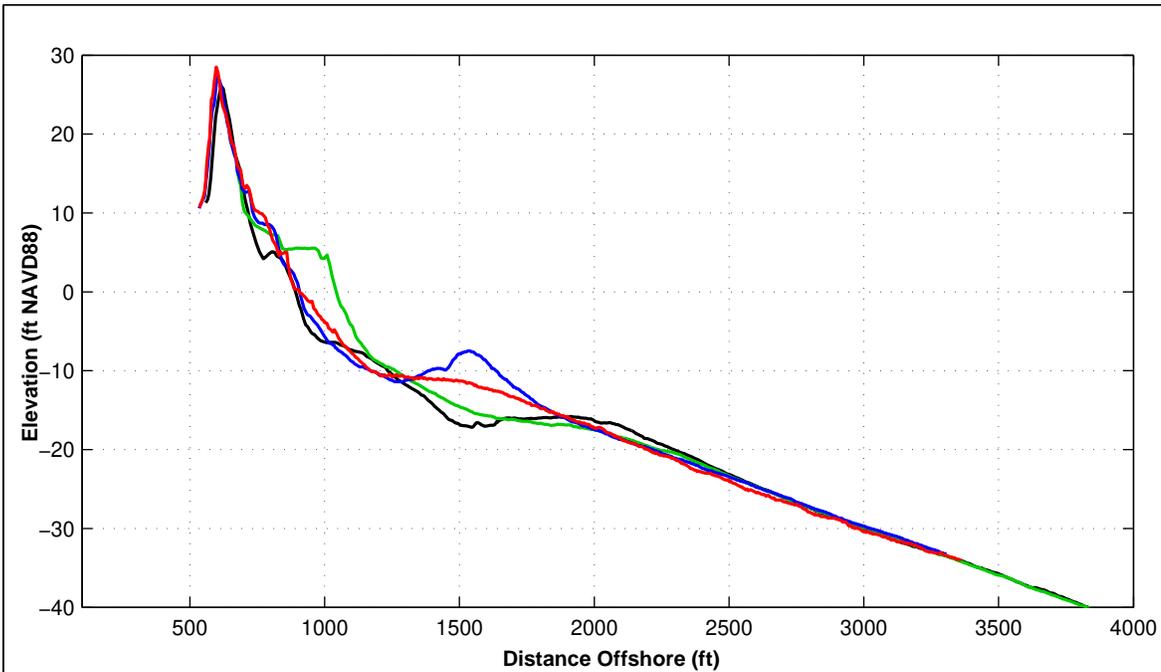
Survey Transect 815+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	-112.04 ft	-14.99 ft
Volume Change Above +6 ft NAVD88	5.81 cy/ft	4.32 cy/ft
Volume Change Above 1.18 ft NAVD88	-15.86 cy/ft	6.41 cy/ft
Volume Change Above -6 ft NAVD88	-43.08 cy/ft	12.30 cy/ft
Volume Change Above -14 ft NAVD88	-33.72 cy/ft	15.03 cy/ft
Volume Change Above -19 ft NAVD88	-9.94 cy/ft	16.72 cy/ft
Volume Change Above -30 ft NAVD88	-11.08 cy/ft	0.67 cy/ft

LEGEND:

JULY 2021	—	AUGUST 2019	—
JUNE 2020	—	MAY 2018	—

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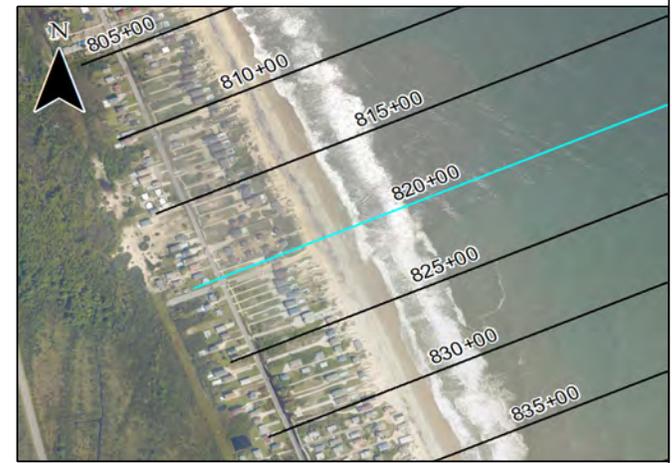


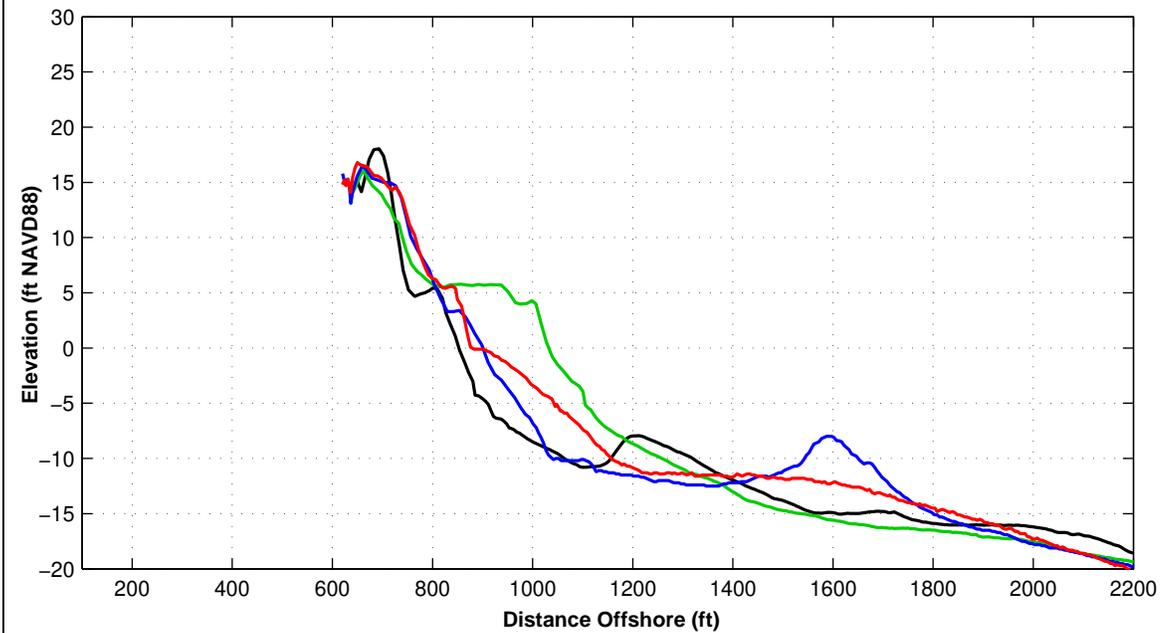
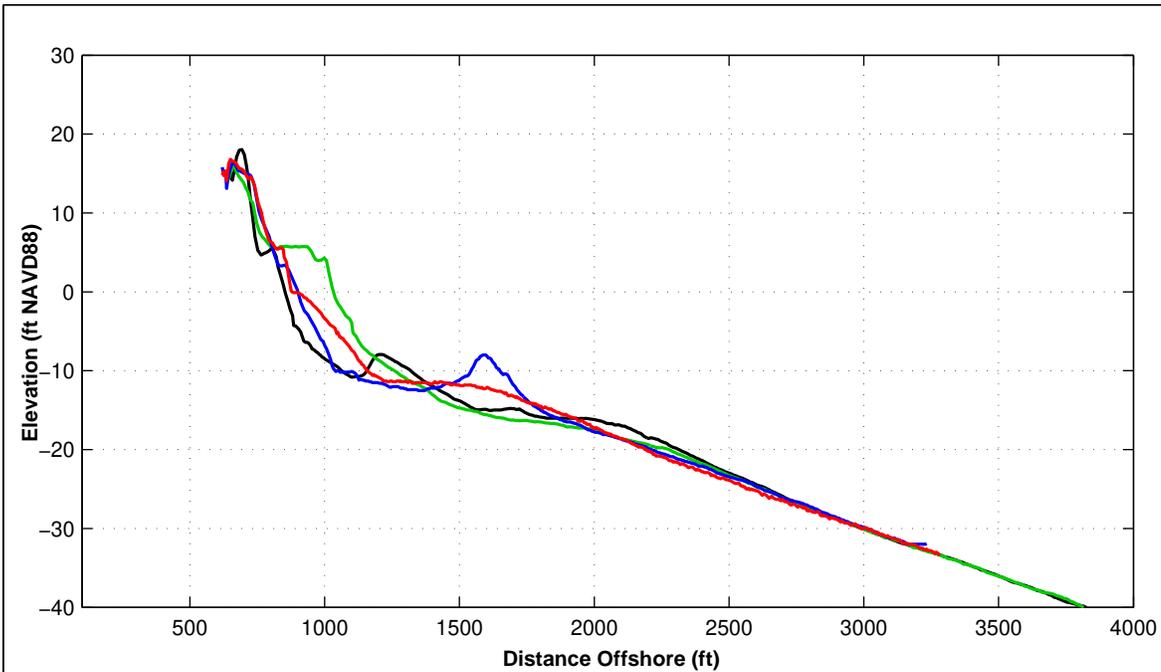


Survey Transect 820+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	-135.29 ft	-19.34 ft
Volume Change Above +6 ft NAVD88	6.29 cy/ft	2.77 cy/ft
Volume Change Above 1.18 ft NAVD88	-18.02 cy/ft	2.89 cy/ft
Volume Change Above -6 ft NAVD88	-53.33 cy/ft	9.94 cy/ft
Volume Change Above -14 ft NAVD88	-12.34 cy/ft	-17.02 cy/ft
Volume Change Above -19 ft NAVD88	14.90 cy/ft	-15.60 cy/ft
Volume Change Above -30 ft NAVD88	11.43 cy/ft	-30.89 cy/ft

LEGEND:
 JULY 2021 — AUGUST 2019 —
 JUNE 2020 — MAY 2018 —

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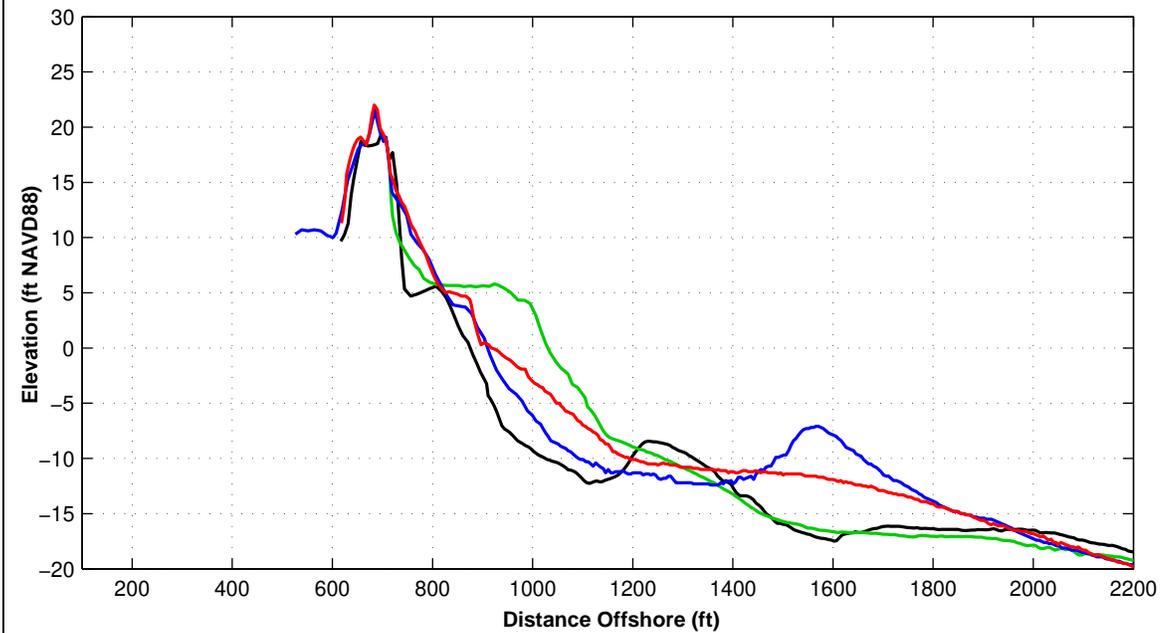
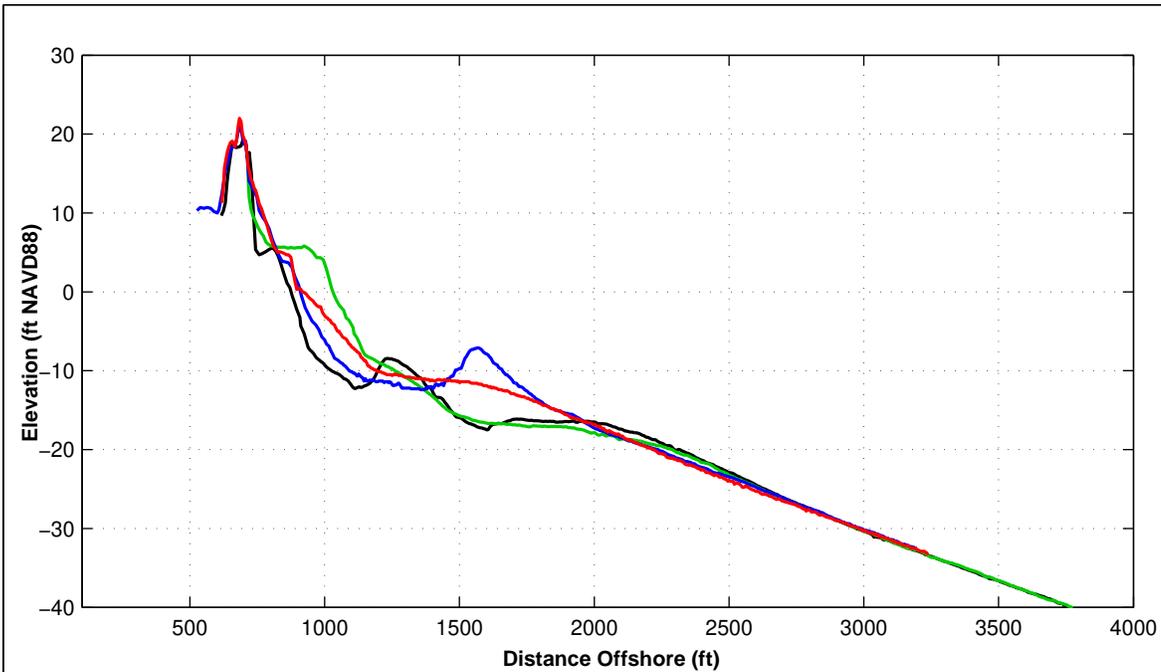
Survey Transect 825+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	-137.17 ft	-16.22 ft
Volume Change Above +6 ft NAVD88	9.19 cy/ft	0.71 cy/ft
Volume Change Above 1.18 ft NAVD88	-15.74 cy/ft	3.09 cy/ft
Volume Change Above -6 ft NAVD88	-52.24 cy/ft	13.41 cy/ft
Volume Change Above -14 ft NAVD88	-47.68 cy/ft	16.97 cy/ft
Volume Change Above -19 ft NAVD88	-23.62 cy/ft	23.35 cy/ft
Volume Change Above -30 ft NAVD88	-27.88 cy/ft	8.77 cy/ft

LEGEND:

JULY 2021	—	AUGUST 2019	—
JUNE 2020	—	MAY 2018	—

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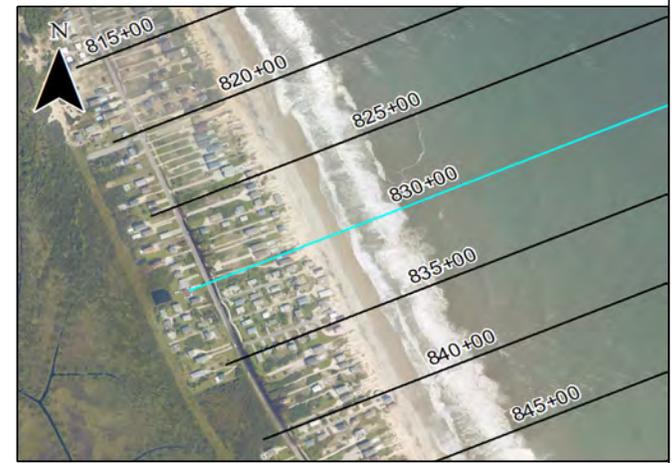


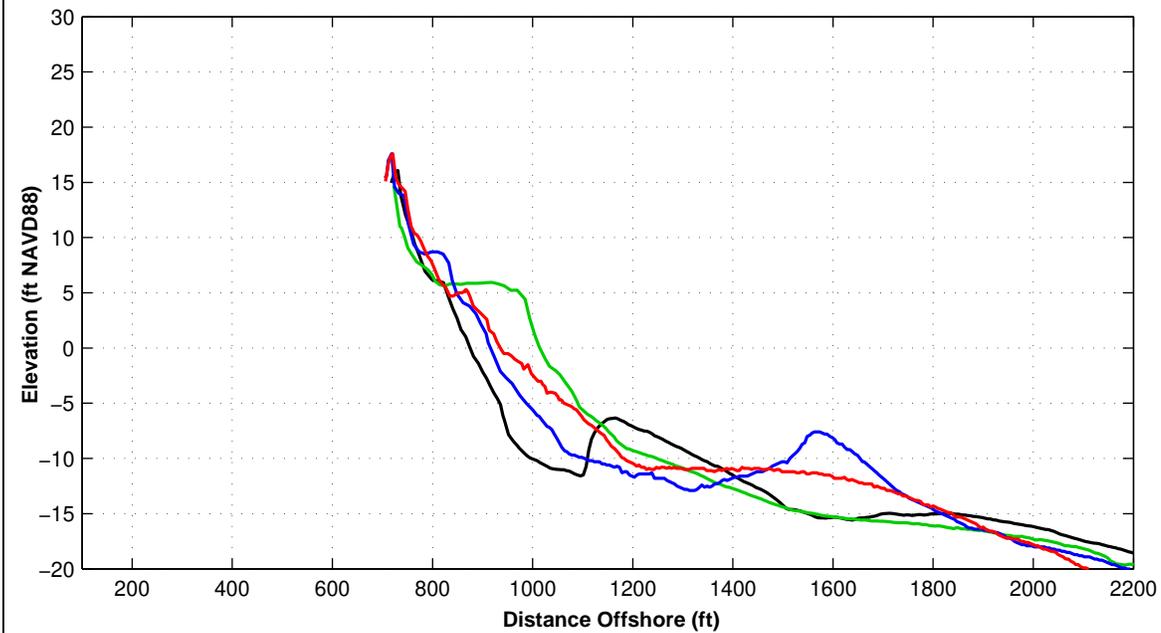
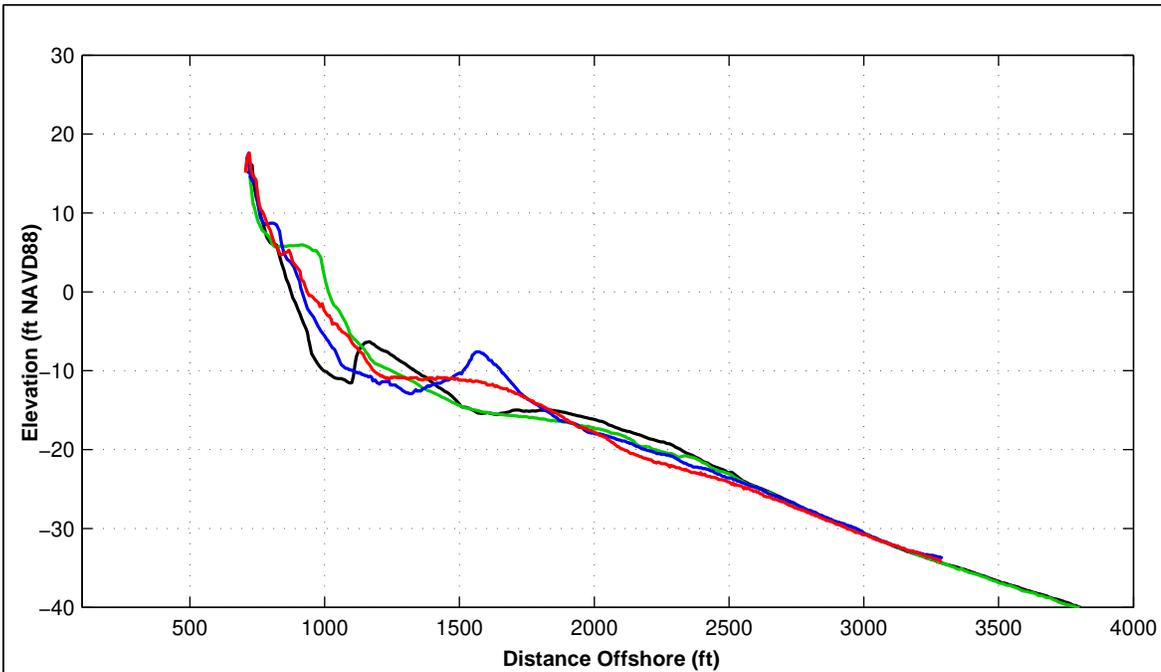
Survey Transect 830+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	-120.49 ft	-8.40 ft
Volume Change Above +6 ft NAVD88	8.36 cy/ft	1.89 cy/ft
Volume Change Above 1.18 ft NAVD88	-12.97 cy/ft	3.36 cy/ft
Volume Change Above -6 ft NAVD88	-47.05 cy/ft	15.29 cy/ft
Volume Change Above -14 ft NAVD88	-22.60 cy/ft	13.92 cy/ft
Volume Change Above -19 ft NAVD88	23.71 cy/ft	14.86 cy/ft
Volume Change Above -30 ft NAVD88	16.63 cy/ft	5.65 cy/ft

LEGEND:

JULY 2021	—	AUGUST 2019	—
JUNE 2020	—	MAY 2018	—

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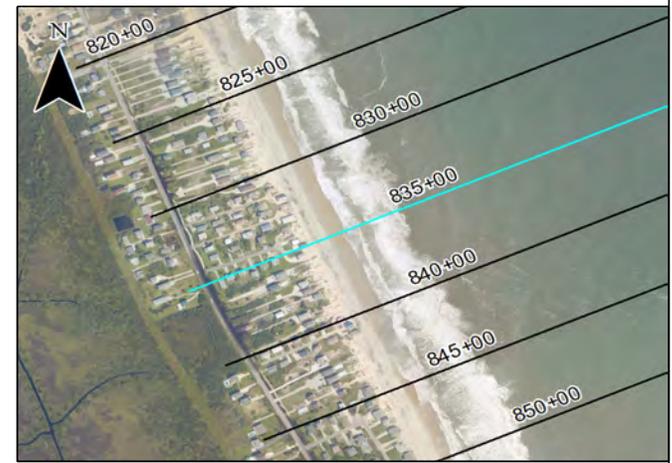


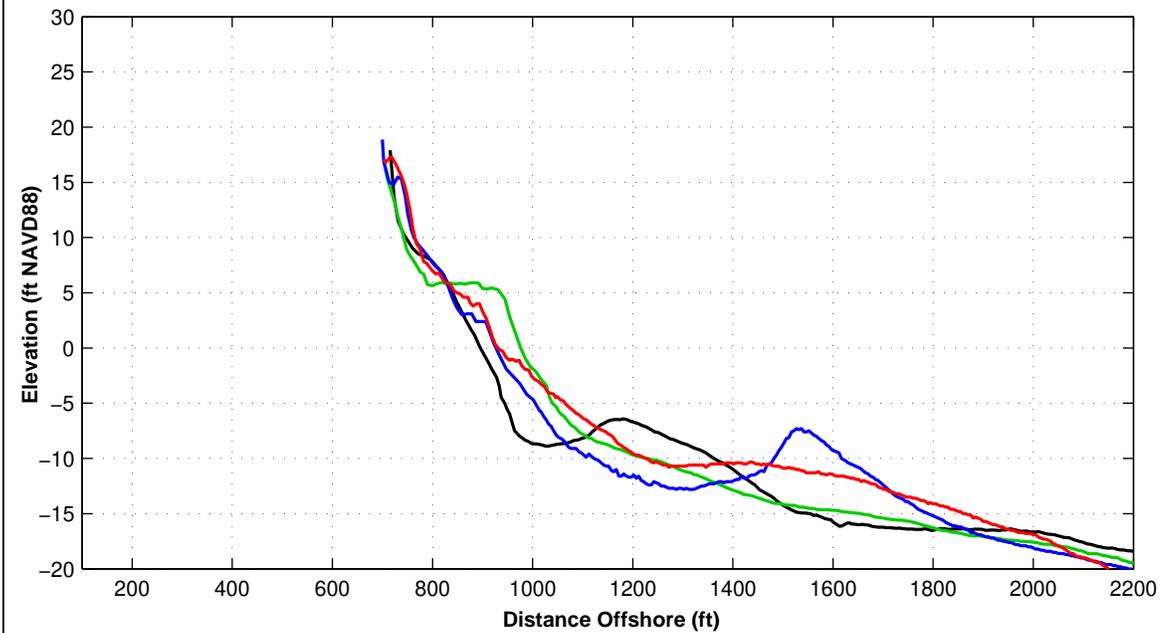
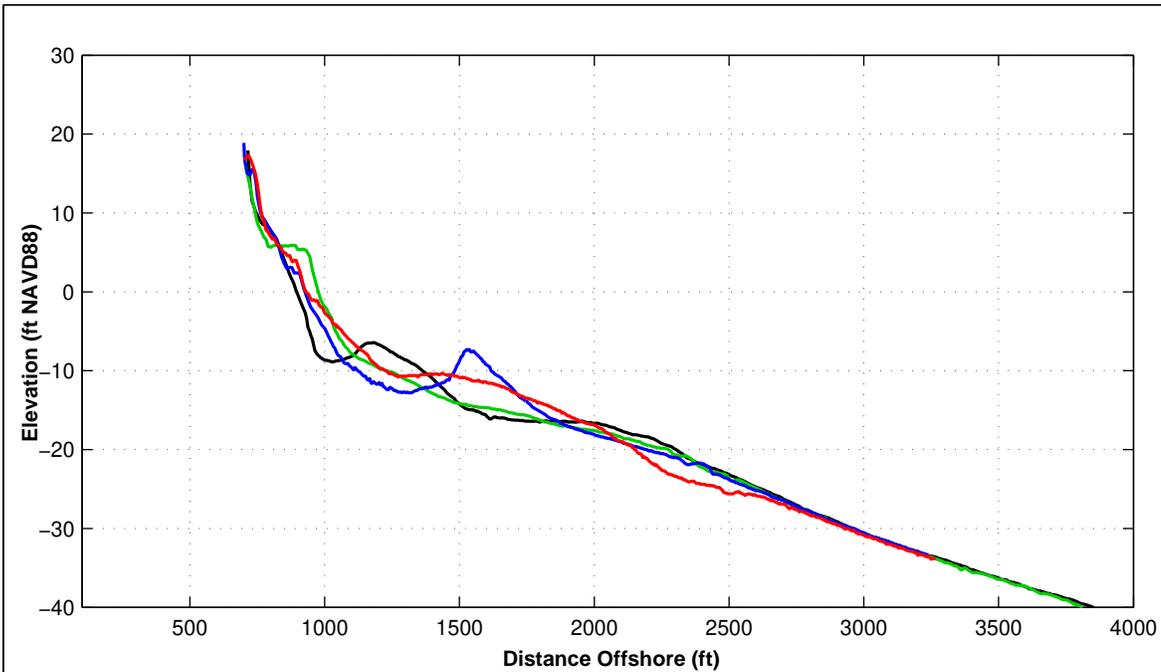
Survey Transect 835+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	-96.57 ft	15.60 ft
Volume Change Above +6 ft NAVD88	8.37 cy/ft	-0.69 cy/ft
Volume Change Above 1.18 ft NAVD88	-10.30 cy/ft	0.54 cy/ft
Volume Change Above -6 ft NAVD88	-37.89 cy/ft	14.41 cy/ft
Volume Change Above -14 ft NAVD88	-19.92 cy/ft	21.35 cy/ft
Volume Change Above -19 ft NAVD88	-5.86 cy/ft	22.37 cy/ft
Volume Change Above -30 ft NAVD88	-12.61 cy/ft	0.57 cy/ft

LEGEND:

JULY 2021	—	AUGUST 2019	—
JUNE 2020	—	MAY 2018	—

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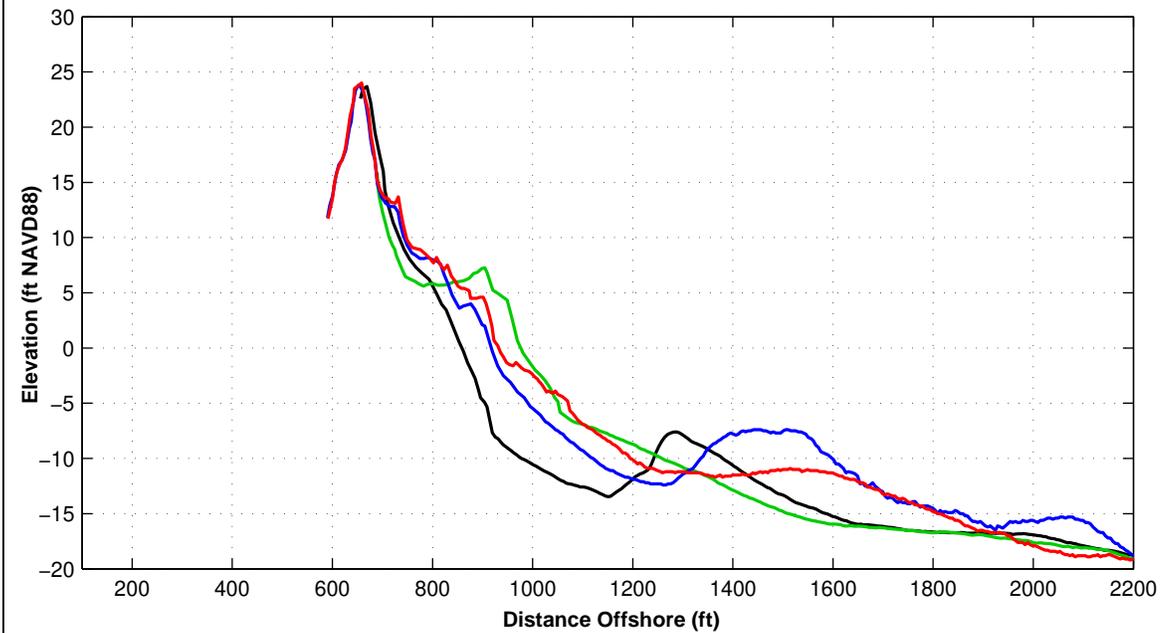
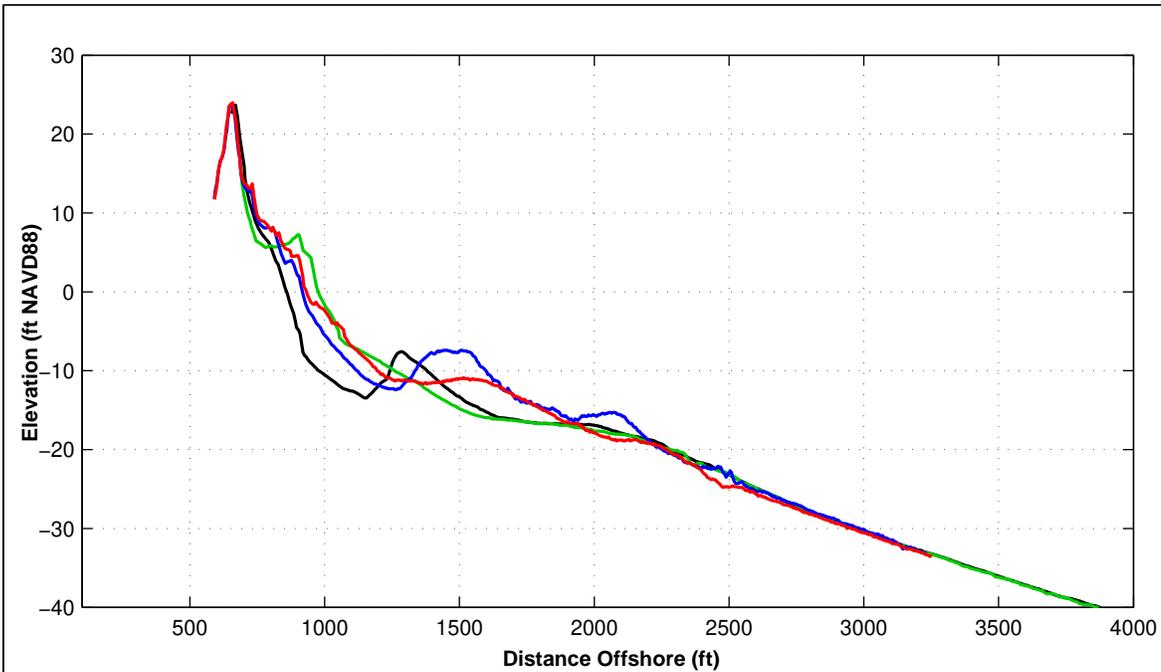
Survey Transect 840+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	-50.59 ft	2.25 ft
Volume Change Above +6 ft NAVD88	9.33 cy/ft	1.37 cy/ft
Volume Change Above 1.18 ft NAVD88	-4.17 cy/ft	4.88 cy/ft
Volume Change Above -6 ft NAVD88	-16.60 cy/ft	14.05 cy/ft
Volume Change Above -14 ft NAVD88	6.59 cy/ft	31.86 cy/ft
Volume Change Above -19 ft NAVD88	15.84 cy/ft	44.93 cy/ft
Volume Change Above -30 ft NAVD88	9.01 cy/ft	10.82 cy/ft

LEGEND:

JULY 2021	—	AUGUST 2019	—
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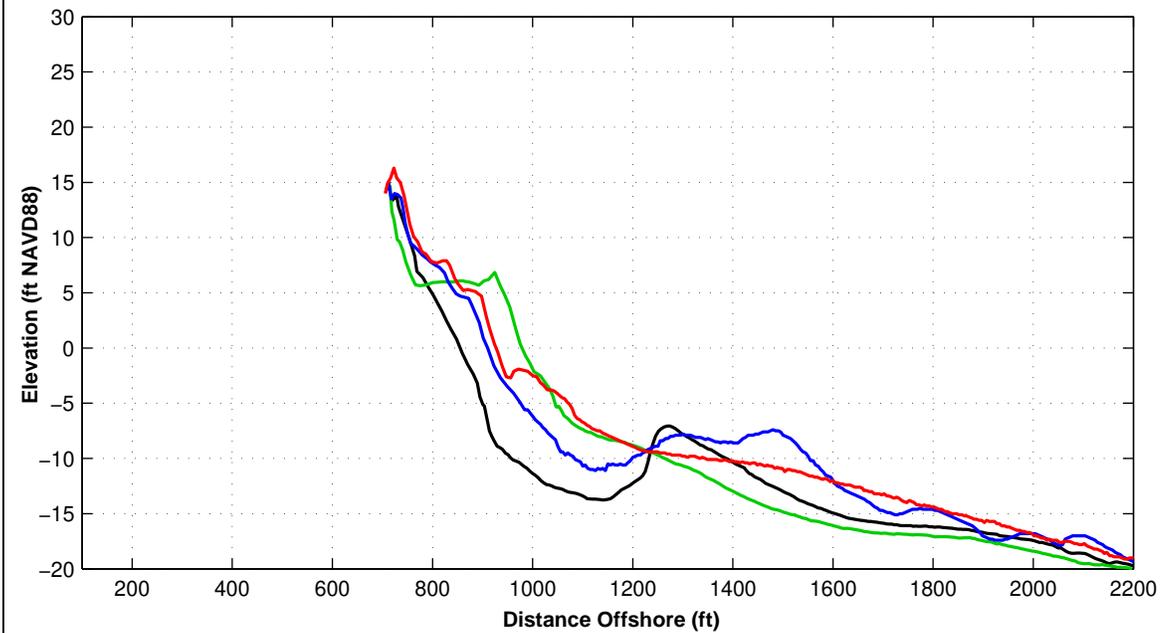
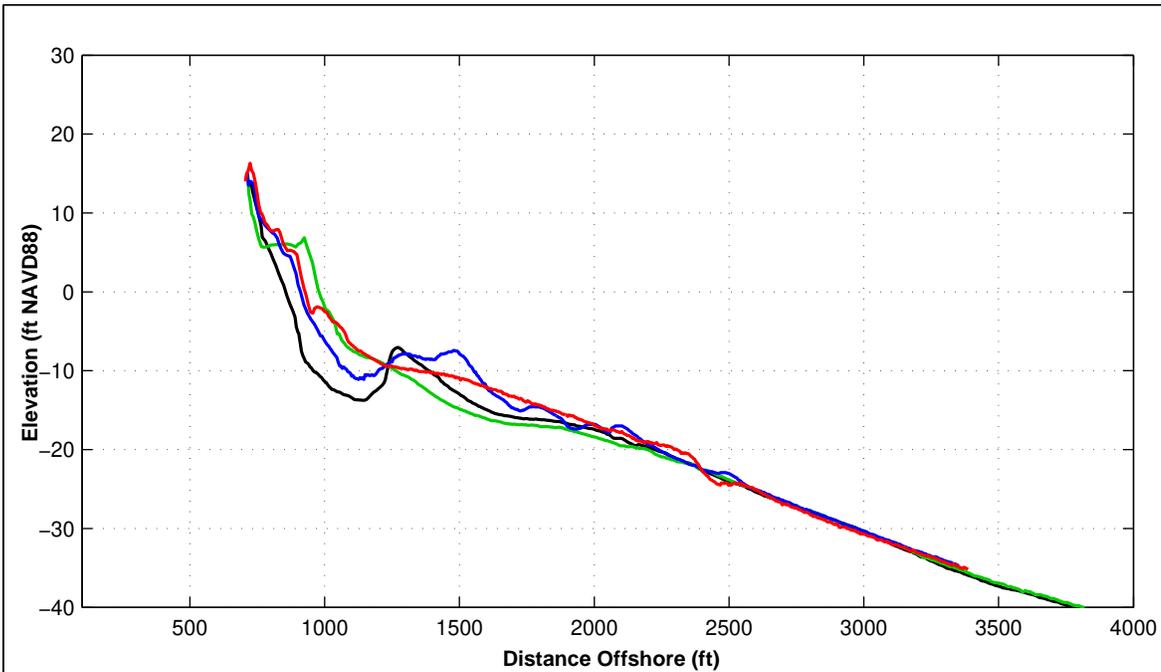
Survey Transect 845+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	-57.06 ft	11.47 ft
Volume Change Above +6 ft NAVD88	10.24 cy/ft	3.47 cy/ft
Volume Change Above 1.18 ft NAVD88	-2.86 cy/ft	8.48 cy/ft
Volume Change Above -6 ft NAVD88	-19.75 cy/ft	20.84 cy/ft
Volume Change Above -14 ft NAVD88	16.68 cy/ft	6.58 cy/ft
Volume Change Above -19 ft NAVD88	64.25 cy/ft	-17.56 cy/ft
Volume Change Above -30 ft NAVD88	60.98 cy/ft	-31.51 cy/ft

LEGEND:

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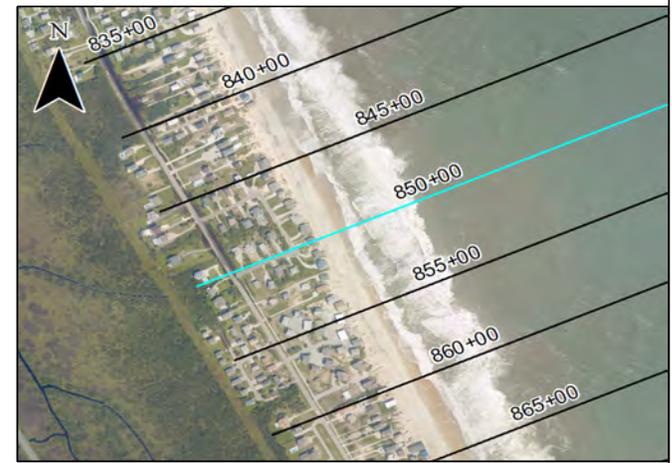


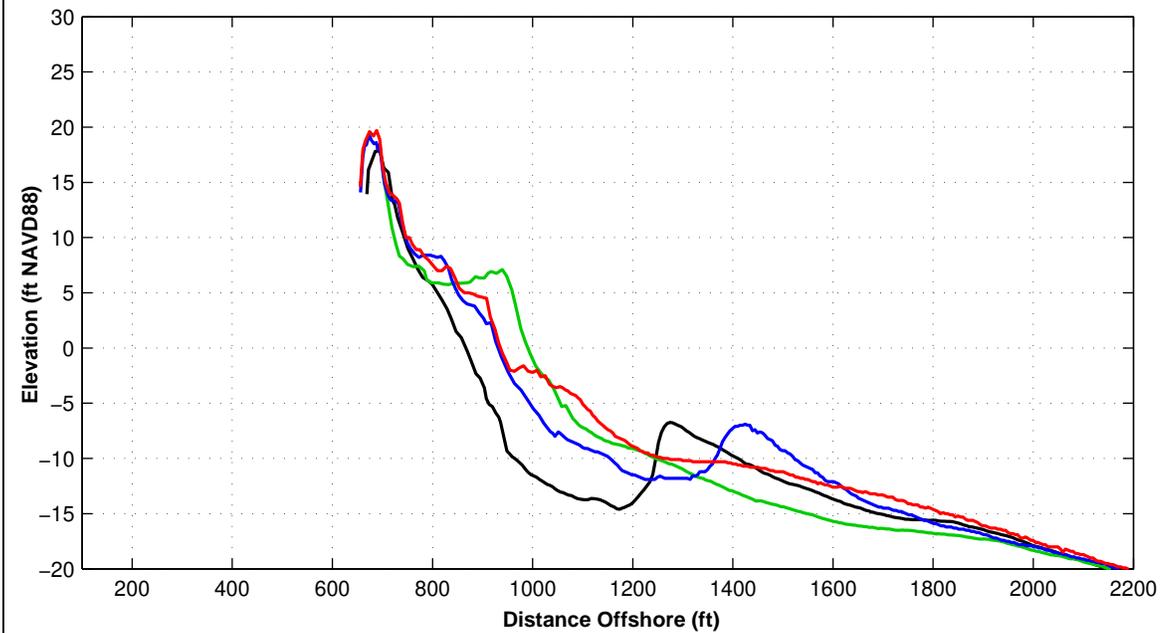
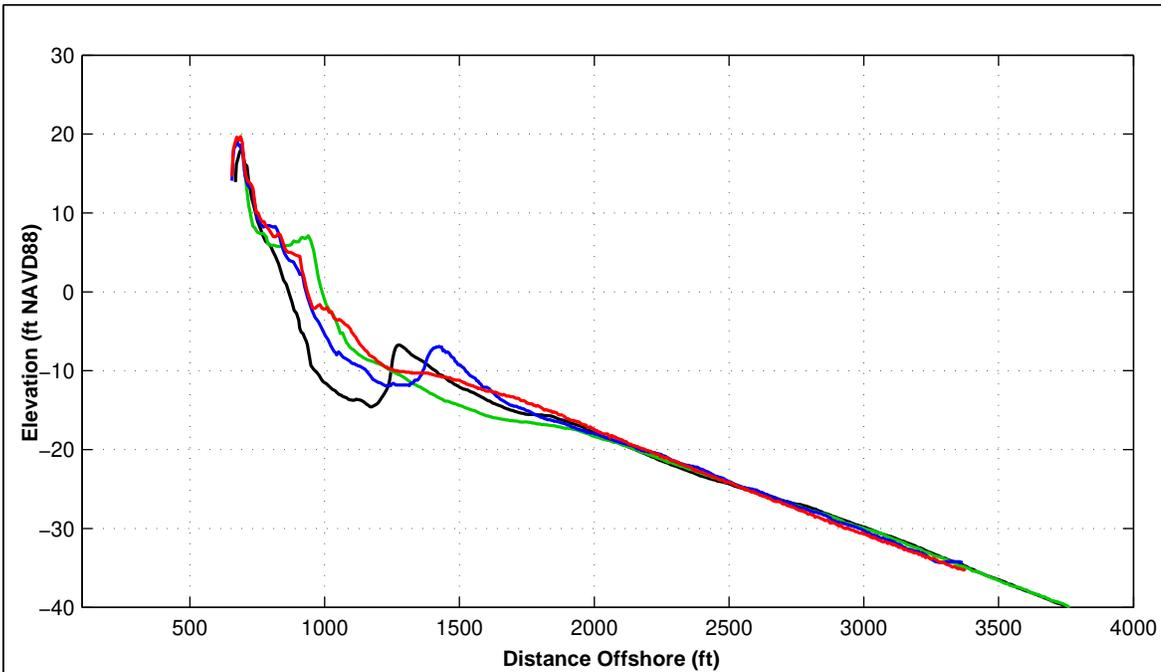
Survey Transect 850+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	-69.91 ft	18.27 ft
Volume Change Above +6 ft NAVD88	9.46 cy/ft	4.55 cy/ft
Volume Change Above 1.18 ft NAVD88	-4.08 cy/ft	8.64 cy/ft
Volume Change Above -6 ft NAVD88	-23.56 cy/ft	22.43 cy/ft
Volume Change Above -14 ft NAVD88	14.79 cy/ft	20.28 cy/ft
Volume Change Above -19 ft NAVD88	55.85 cy/ft	26.10 cy/ft
Volume Change Above -30 ft NAVD88	64.33 cy/ft	21.94 cy/ft

LEGEND:

JULY 2021	—	AUGUST 2019	—
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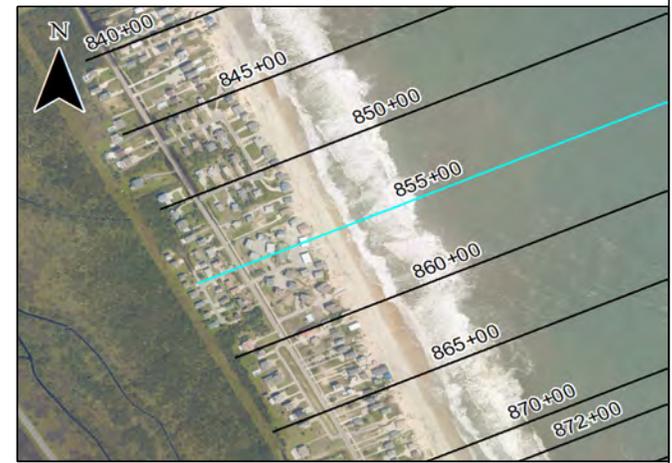


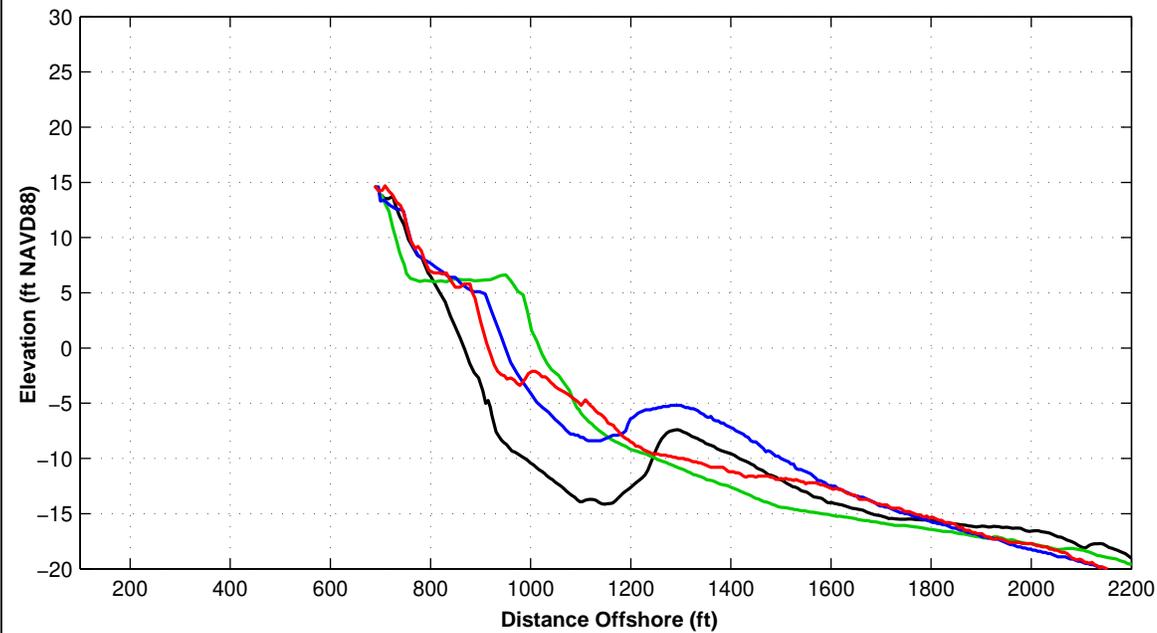
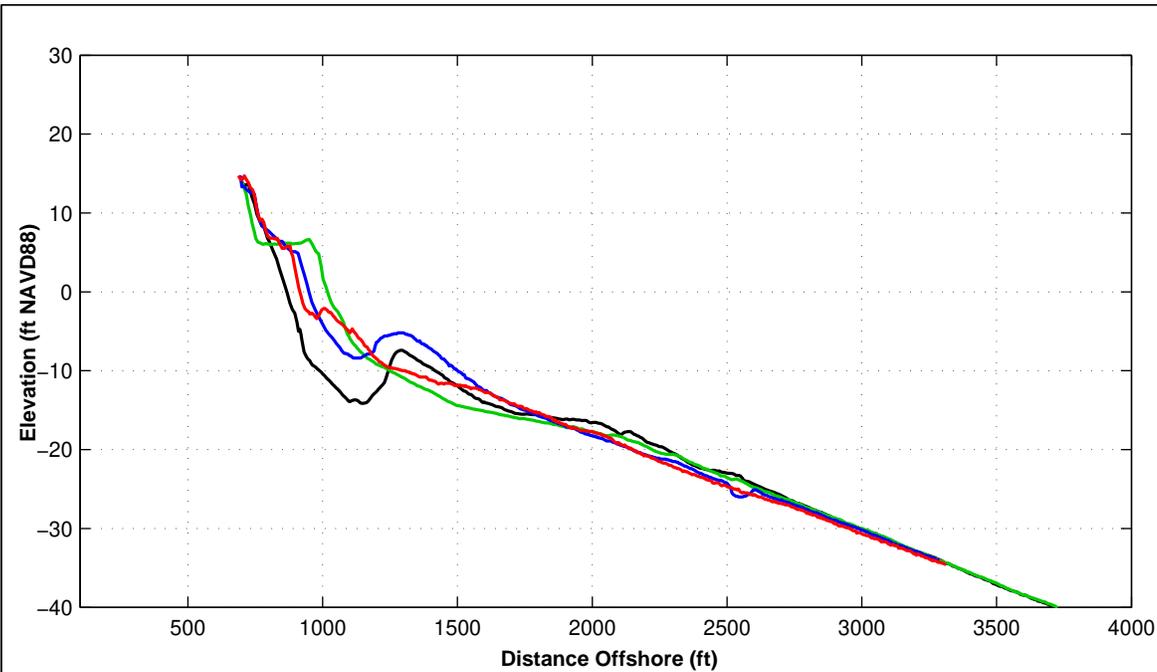
Survey Transect 855+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	-57.84 ft	4.88 ft
Volume Change Above +6 ft NAVD88	8.11 cy/ft	1.29 cy/ft
Volume Change Above 1.18 ft NAVD88	-6.64 cy/ft	4.65 cy/ft
Volume Change Above -6 ft NAVD88	-23.50 cy/ft	18.35 cy/ft
Volume Change Above -14 ft NAVD88	0.76 cy/ft	28.64 cy/ft
Volume Change Above -19 ft NAVD88	21.85 cy/ft	40.71 cy/ft
Volume Change Above -30 ft NAVD88	26.34 cy/ft	33.04 cy/ft

LEGEND:

JULY 2021	—	AUGUST 2019	—
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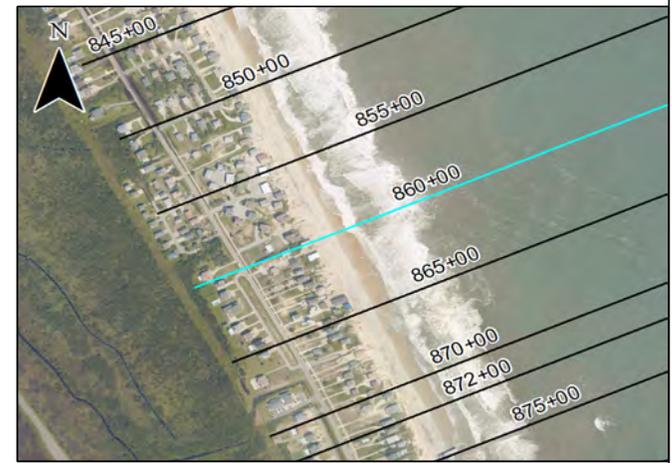


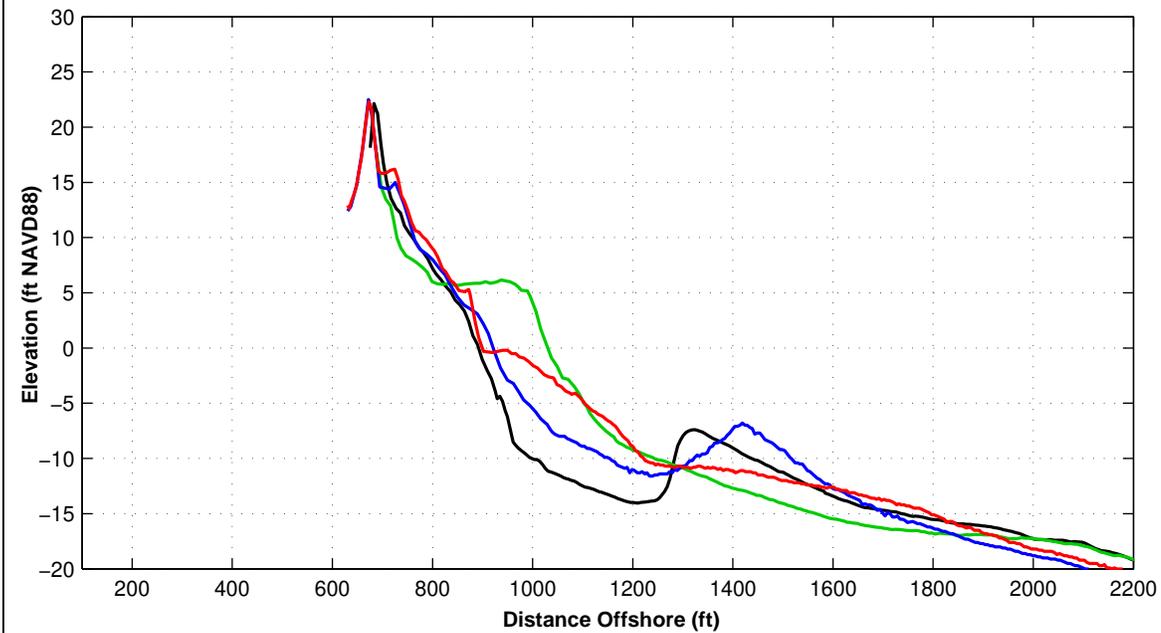
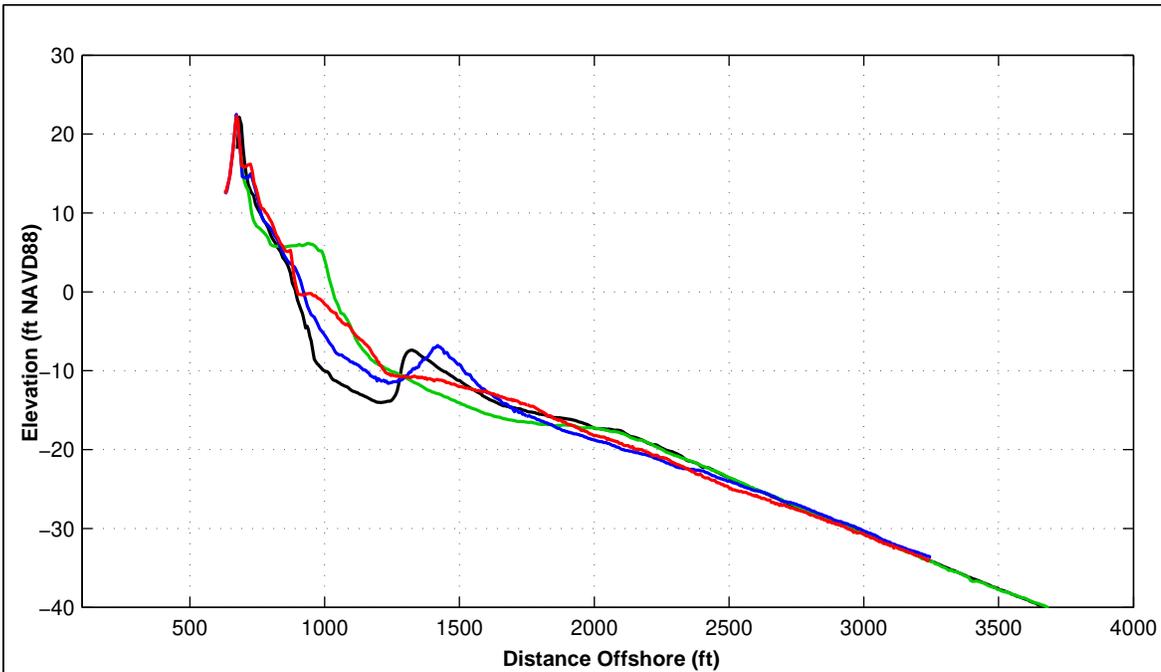
Survey Transect 860+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	-66.14 ft	-32.52 ft
Volume Change Above +6 ft NAVD88	9.11 cy/ft	1.01 cy/ft
Volume Change Above 1.18 ft NAVD88	-4.42 cy/ft	-3.02 cy/ft
Volume Change Above -6 ft NAVD88	-21.35 cy/ft	-0.92 cy/ft
Volume Change Above -14 ft NAVD88	40.80 cy/ft	-36.66 cy/ft
Volume Change Above -19 ft NAVD88	50.85 cy/ft	-32.70 cy/ft
Volume Change Above -30 ft NAVD88	28.11 cy/ft	-42.40 cy/ft

LEGEND:

JULY 2021	—	AUGUST 2019	—
JUNE 2020	—	MAY 2018	—

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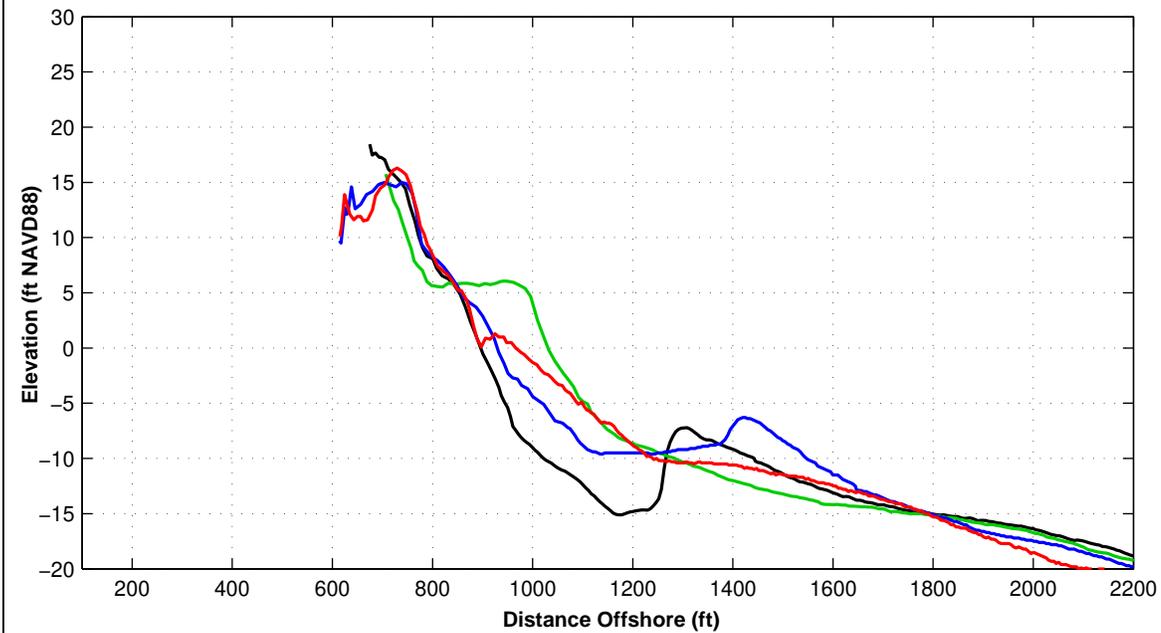
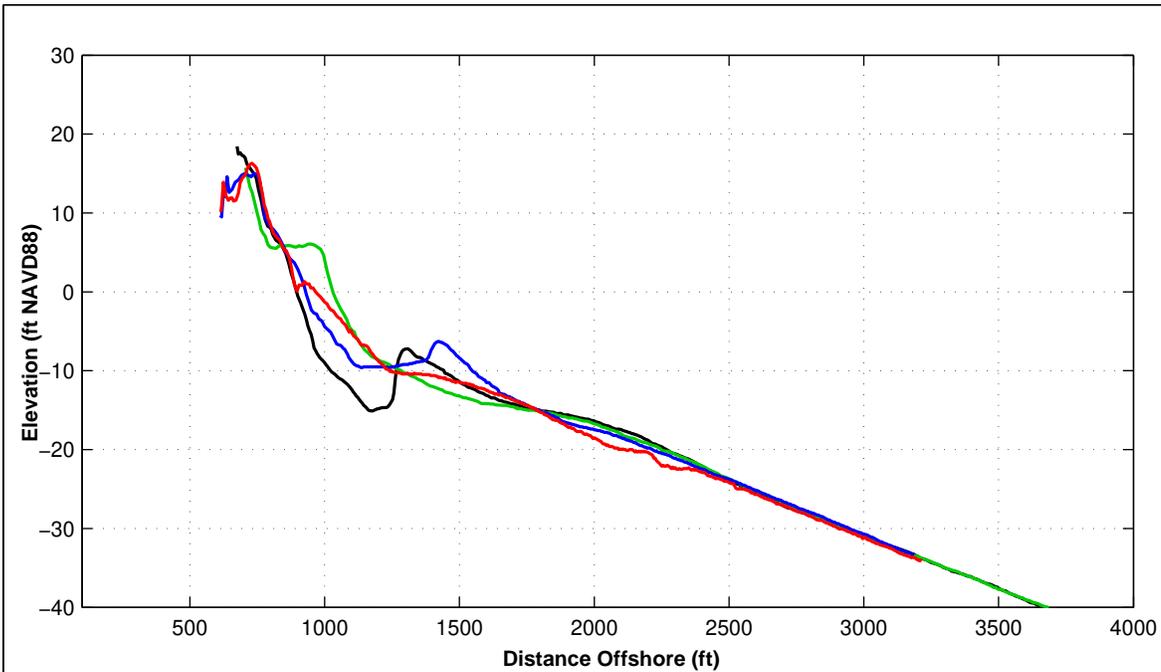
Survey Transect 865+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	-108.16 ft	-21.23 ft
Volume Change Above +6 ft NAVD88	10.28 cy/ft	5.01 cy/ft
Volume Change Above 1.18 ft NAVD88	-11.50 cy/ft	5.48 cy/ft
Volume Change Above -6 ft NAVD88	-41.48 cy/ft	22.83 cy/ft
Volume Change Above -14 ft NAVD88	-18.49 cy/ft	20.80 cy/ft
Volume Change Above -19 ft NAVD88	-17.26 cy/ft	34.32 cy/ft
Volume Change Above -30 ft NAVD88	-34.06 cy/ft	25.23 cy/ft

LEGEND:

JULY 2021	—	AUGUST 2019	—
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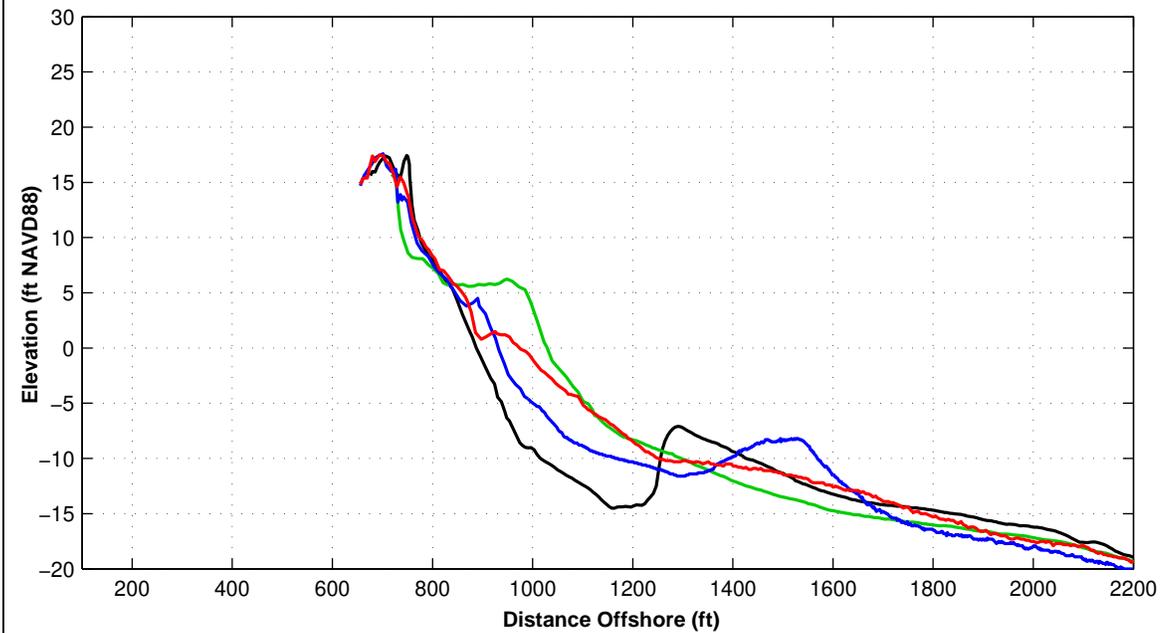
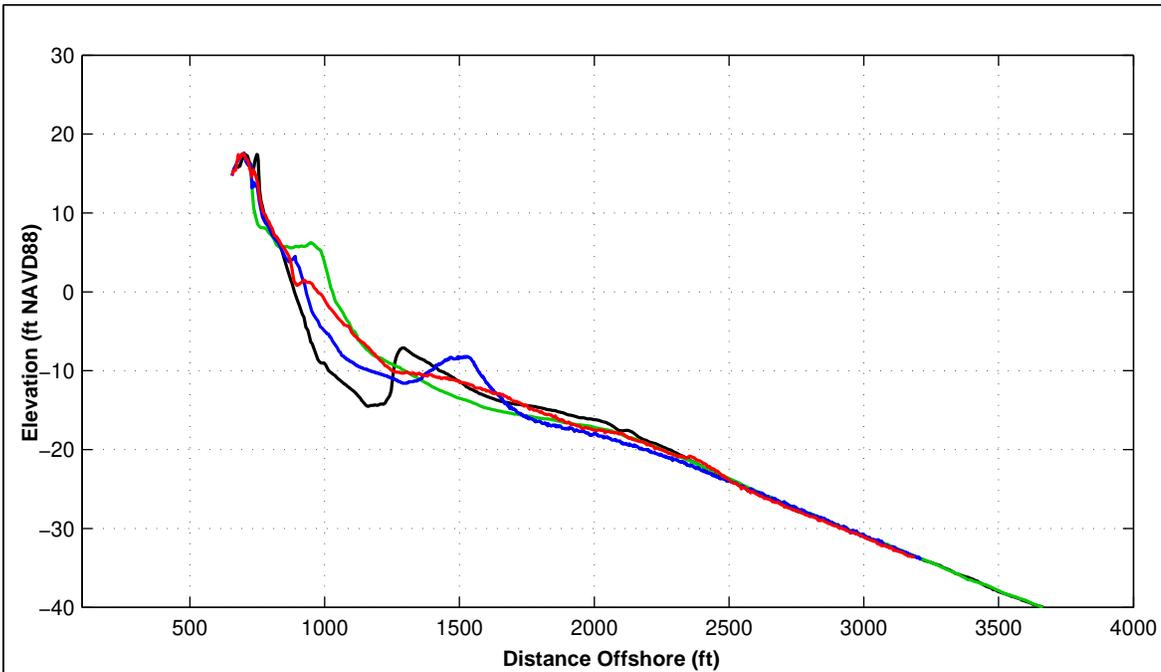
Survey Transect 870+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	-100.70 ft	7.98 ft
Volume Change Above +6 ft NAVD88	11.92 cy/ft	1.52 cy/ft
Volume Change Above 1.18 ft NAVD88	-7.58 cy/ft	-0.99 cy/ft
Volume Change Above -6 ft NAVD88	-33.77 cy/ft	14.80 cy/ft
Volume Change Above -14 ft NAVD88	4.26 cy/ft	-5.49 cy/ft
Volume Change Above -19 ft NAVD88	0.38 cy/ft	-13.55 cy/ft
Volume Change Above -30 ft NAVD88	-2.55 cy/ft	-35.20 cy/ft

LEGEND:

JULY 2021	—	AUGUST 2019	—
JUNE 2020	—	MAY 2018	—

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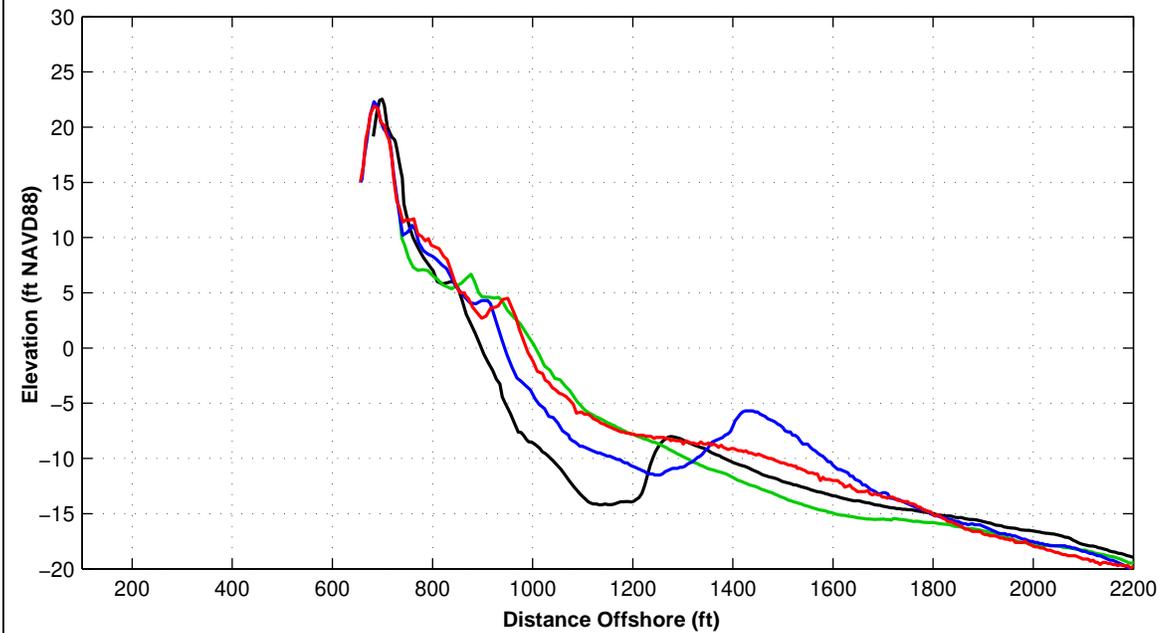
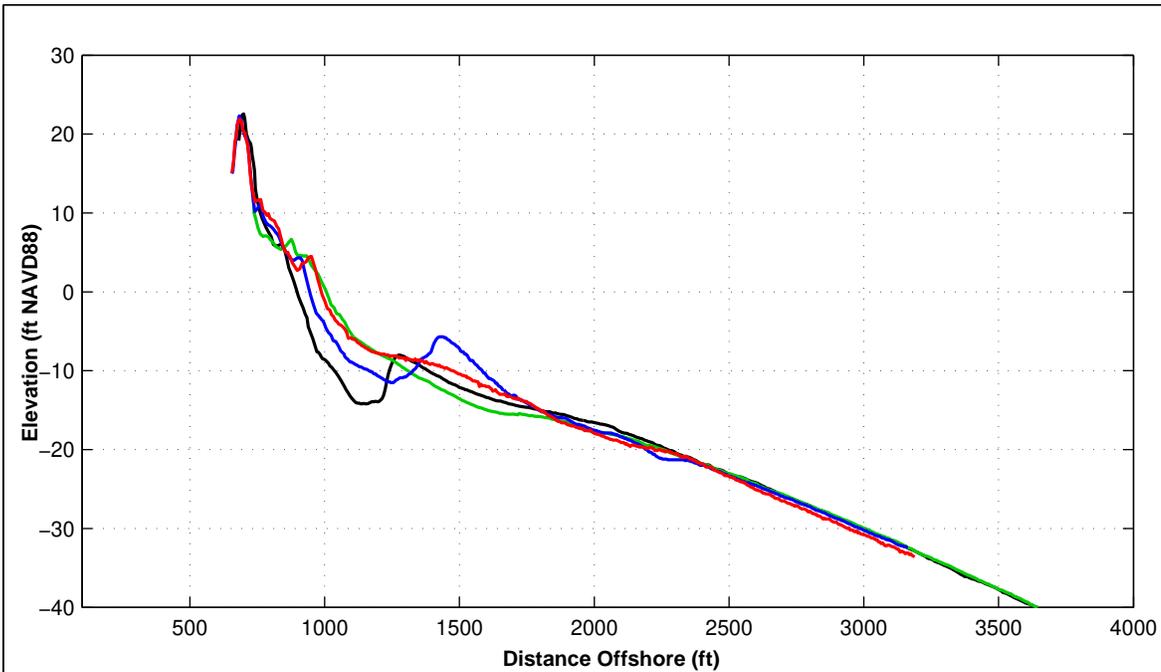
Survey Transect 872+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	-95.34 ft	23.68 ft
Volume Change Above +6 ft NAVD88	5.57 cy/ft	3.26 cy/ft
Volume Change Above 1.18 ft NAVD88	-13.82 cy/ft	1.28 cy/ft
Volume Change Above -6 ft NAVD88	-41.44 cy/ft	20.09 cy/ft
Volume Change Above -14 ft NAVD88	-27.59 cy/ft	24.47 cy/ft
Volume Change Above -19 ft NAVD88	-34.09 cy/ft	40.34 cy/ft
Volume Change Above -30 ft NAVD88	-43.69 cy/ft	46.64 cy/ft

LEGEND:

JULY 2021	—	AUGUST 2019	—
JUNE 2020	—	MAY 2018	—

- Notes:
1. Station From North To South At Varying Intervals.
 2. All Survey Elevations In Feet Referenced to NAVD88.



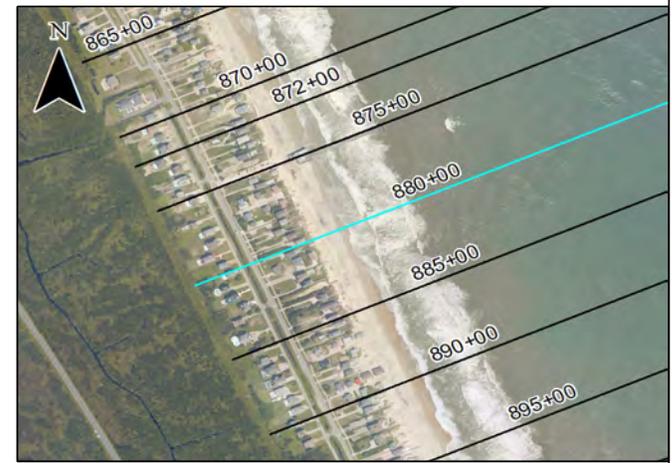


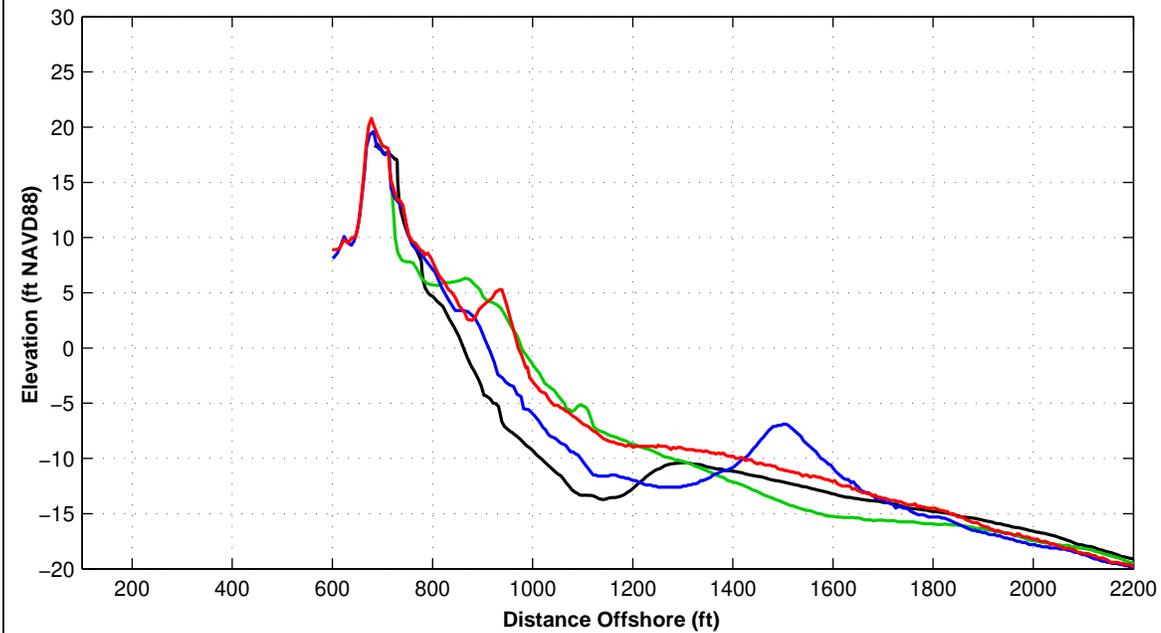
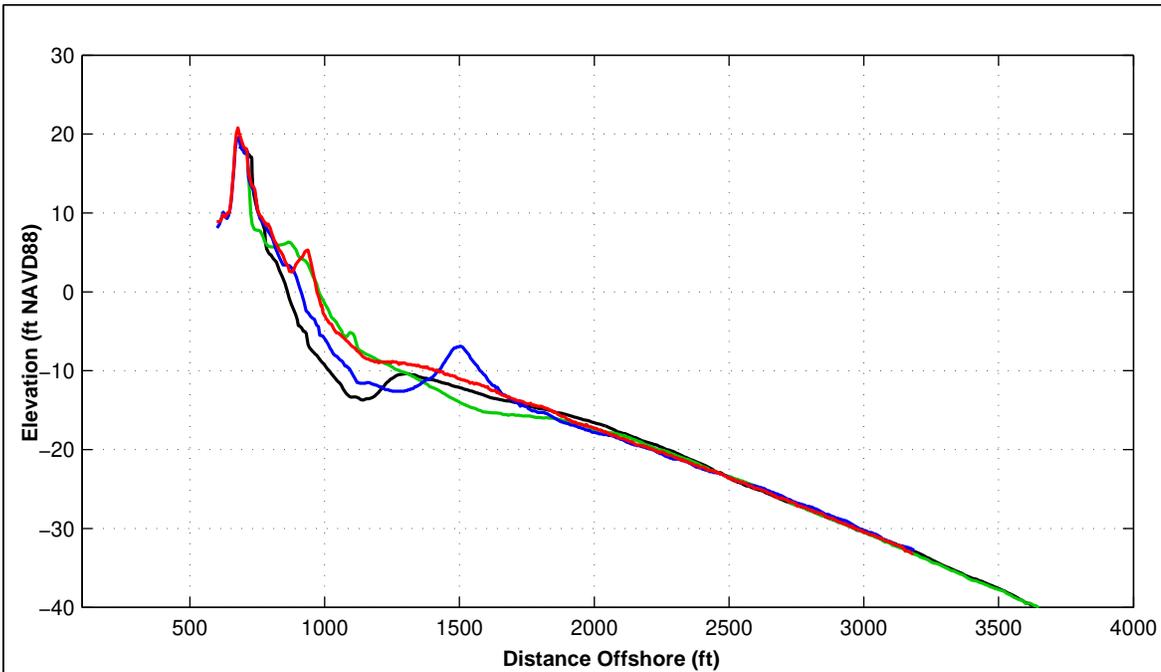
Survey Transect 880+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	-53.90 ft	42.21 ft
Volume Change Above +6 ft NAVD88	6.59 cy/ft	3.45 cy/ft
Volume Change Above 1.18 ft NAVD88	-0.25 cy/ft	6.54 cy/ft
Volume Change Above -6 ft NAVD88	-18.93 cy/ft	20.01 cy/ft
Volume Change Above -14 ft NAVD88	13.64 cy/ft	22.58 cy/ft
Volume Change Above -19 ft NAVD88	27.70 cy/ft	17.36 cy/ft
Volume Change Above -30 ft NAVD88	16.96 cy/ft	12.43 cy/ft

LEGEND:

JULY 2021	—	AUGUST 2019	—
JUNE 2020	—	MAY 2018	—

- Notes:
1. Station From North To South At Varying Intervals.
 2. All Survey Elevations In Feet Referenced to NAVD88.



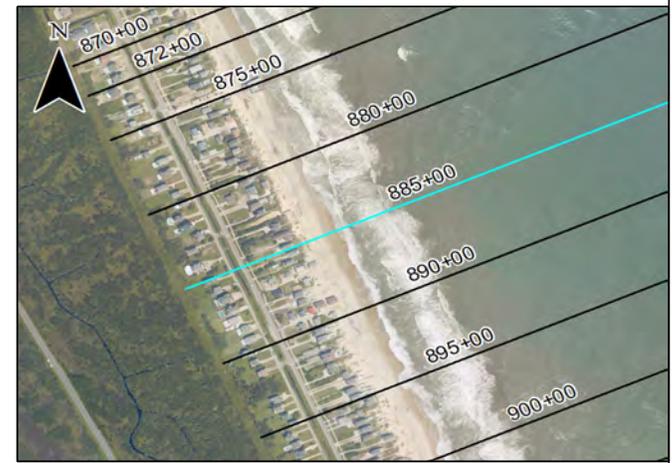


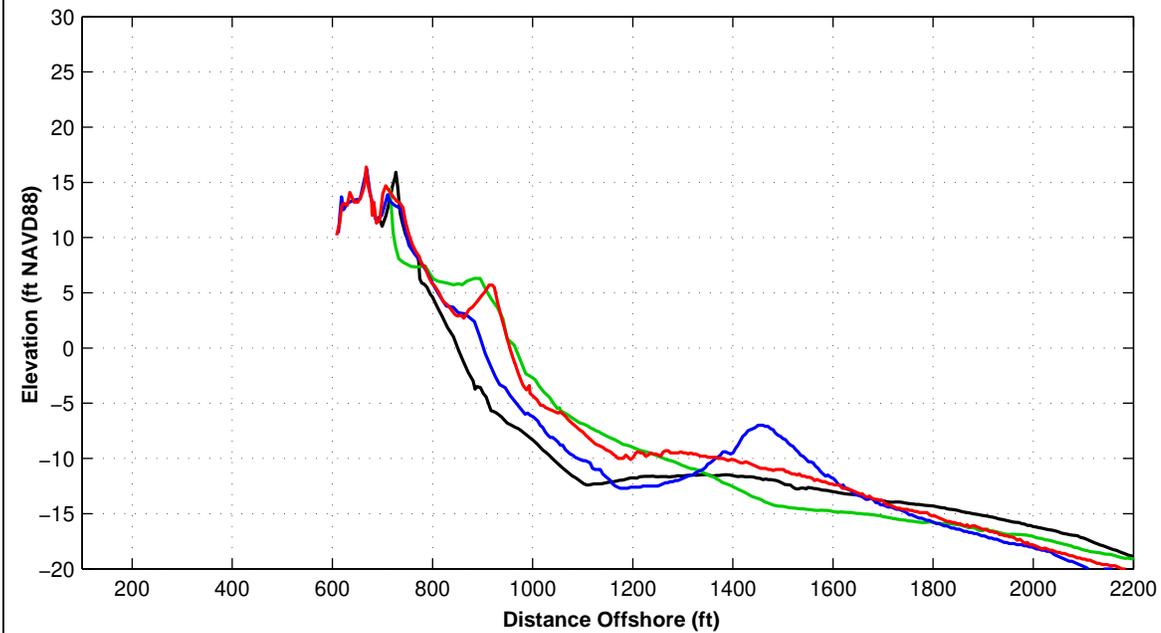
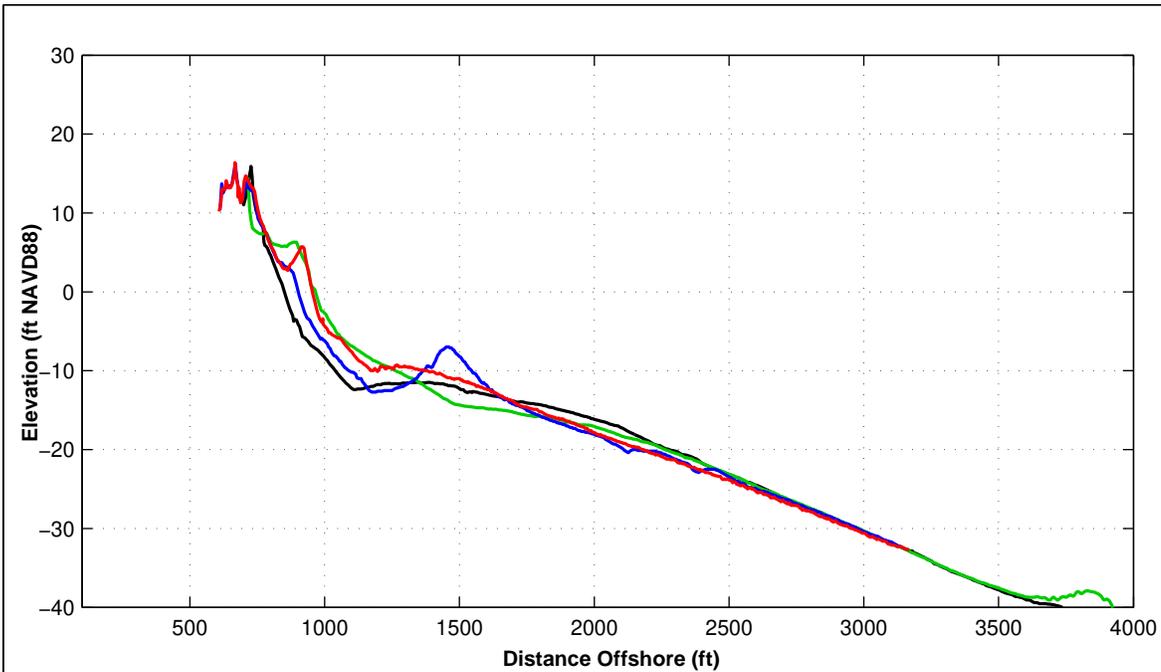
Survey Transect 885+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	-67.08 ft	63.67 ft
Volume Change Above +6 ft NAVD88	7.74 cy/ft	2.85 cy/ft
Volume Change Above 1.18 ft NAVD88	-4.76 cy/ft	11.52 cy/ft
Volume Change Above -6 ft NAVD88	-25.52 cy/ft	27.35 cy/ft
Volume Change Above -14 ft NAVD88	-20.19 cy/ft	51.46 cy/ft
Volume Change Above -19 ft NAVD88	-11.61 cy/ft	58.95 cy/ft
Volume Change Above -30 ft NAVD88	-12.34 cy/ft	56.28 cy/ft

LEGEND:

JULY 2021	—	AUGUST 2019	—
JUNE 2020	—	MAY 2018	—

- Notes:
1. Station From North To South At Varying Intervals.
 2. All Survey Elevations In Feet Referenced to NAVD88.



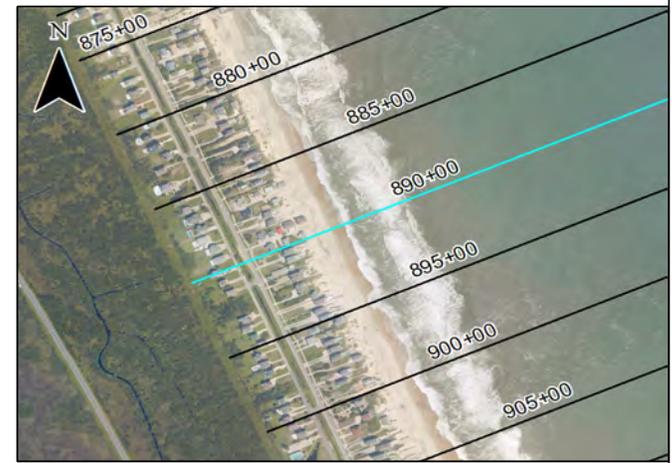


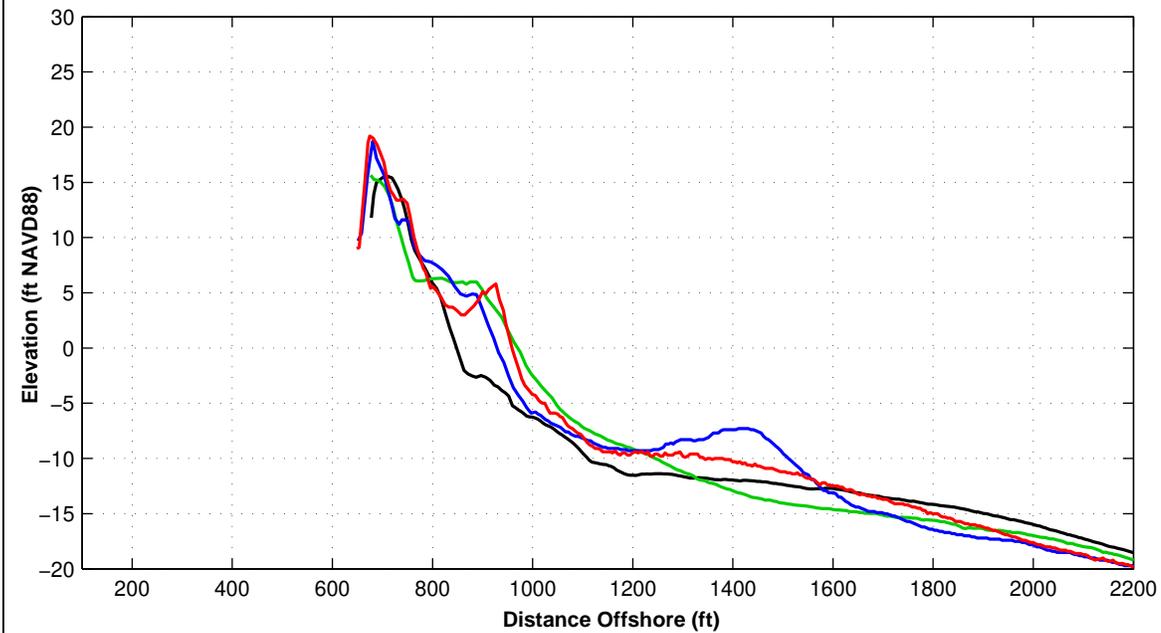
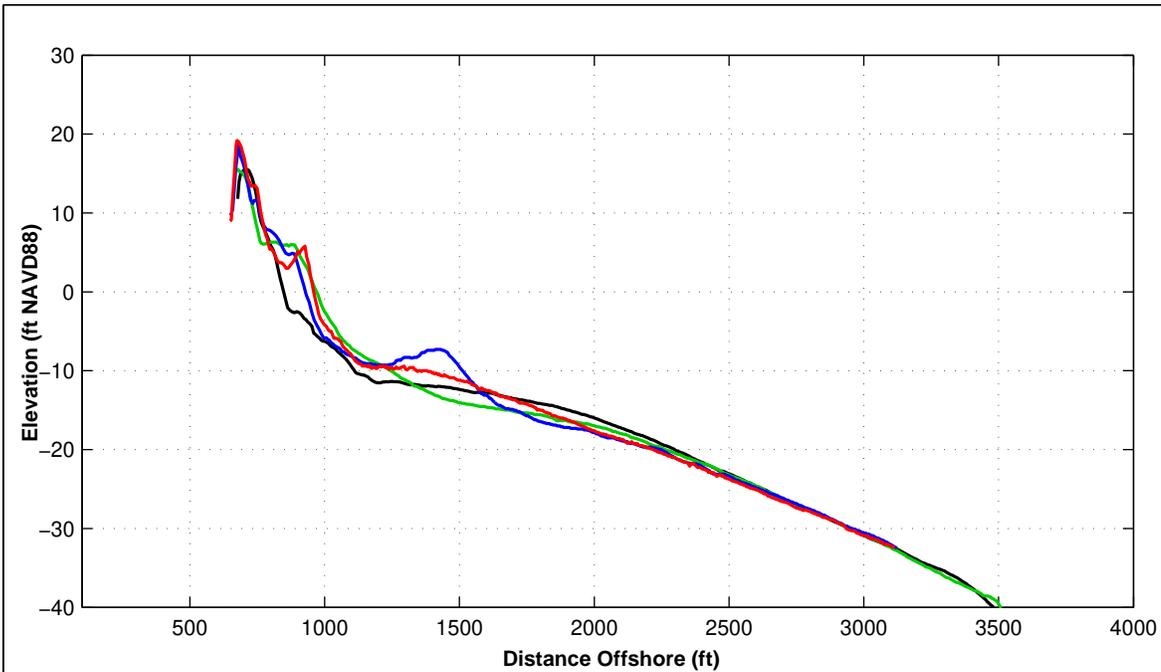
Survey Transect 890+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	-53.78 ft	53.93 ft
Volume Change Above +6 ft NAVD88	4.88 cy/ft	1.81 cy/ft
Volume Change Above 1.18 ft NAVD88	-9.35 cy/ft	9.24 cy/ft
Volume Change Above -6 ft NAVD88	-27.51 cy/ft	22.58 cy/ft
Volume Change Above -14 ft NAVD88	-16.72 cy/ft	36.09 cy/ft
Volume Change Above -19 ft NAVD88	-17.44 cy/ft	42.07 cy/ft
Volume Change Above -30 ft NAVD88	-33.28 cy/ft	35.28 cy/ft

LEGEND:

JULY 2021	—	AUGUST 2019	—
JUNE 2020	—	MAY 2018	—

- Notes:
1. Station From North To South At Varying Intervals.
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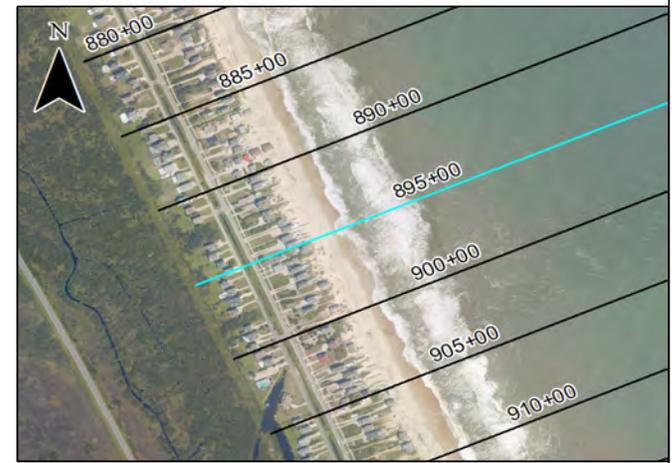


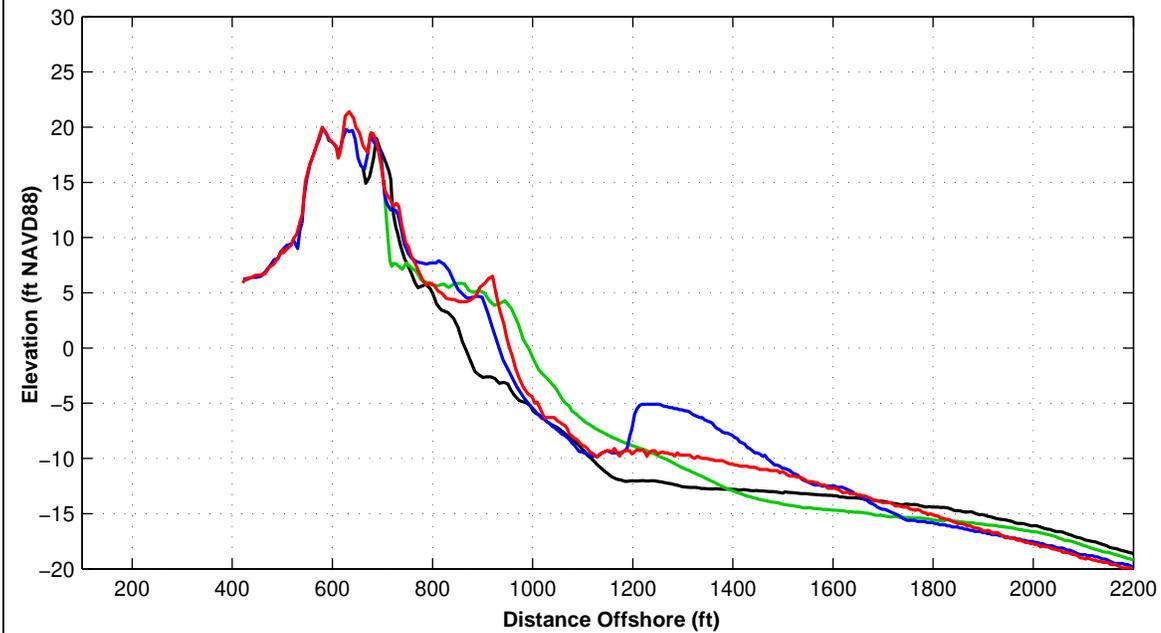
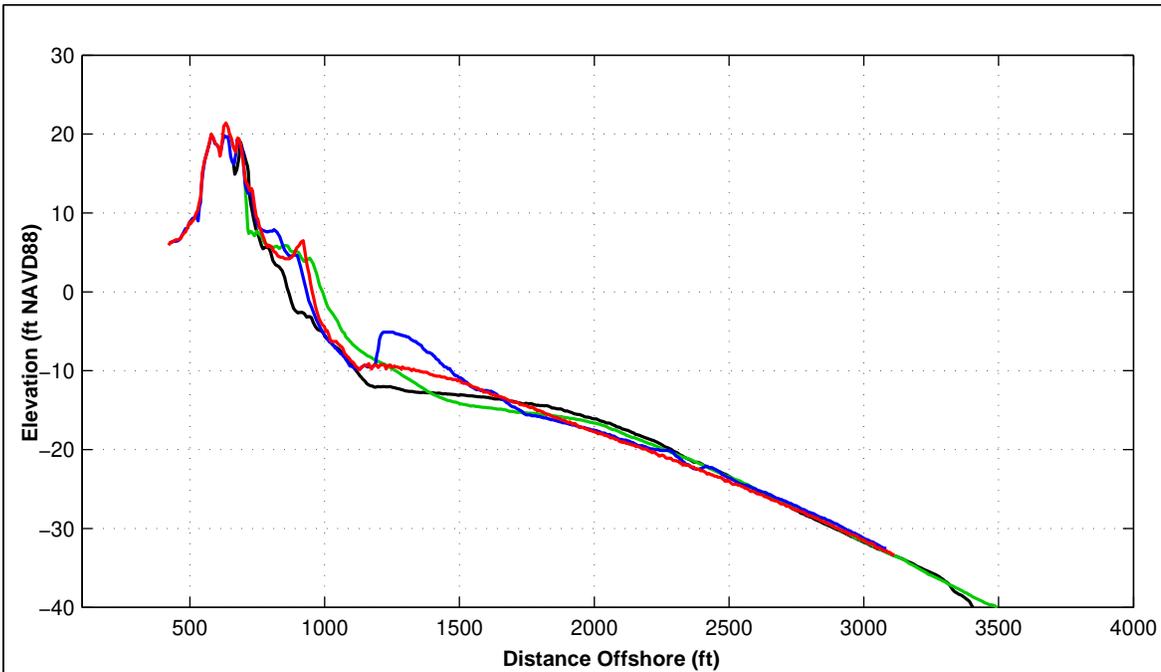
Survey Transect 895+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	-35.48 ft	32.62 ft
Volume Change Above +6 ft NAVD88	9.26 cy/ft	2.81 cy/ft
Volume Change Above 1.18 ft NAVD88	3.38 cy/ft	3.23 cy/ft
Volume Change Above -6 ft NAVD88	-9.96 cy/ft	11.11 cy/ft
Volume Change Above -14 ft NAVD88	34.49 cy/ft	-5.99 cy/ft
Volume Change Above -19 ft NAVD88	25.05 cy/ft	7.85 cy/ft
Volume Change Above -30 ft NAVD88	18.41 cy/ft	0.94 cy/ft

LEGEND:

JULY 2021	—	AUGUST 2019	—
JUNE 2020	—	MAY 2018	—

- Notes:
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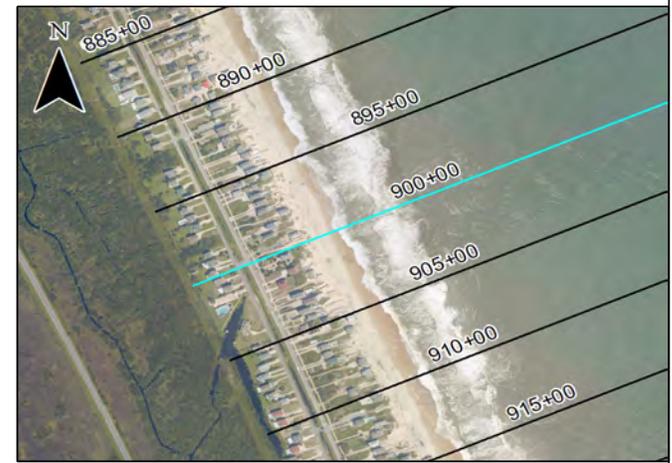


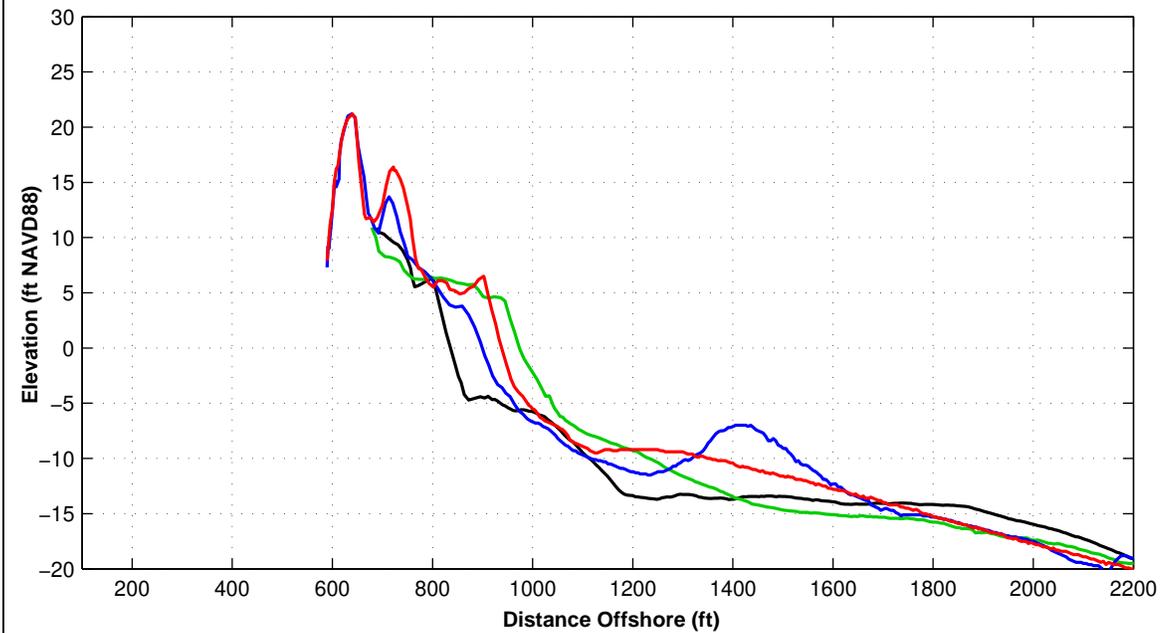
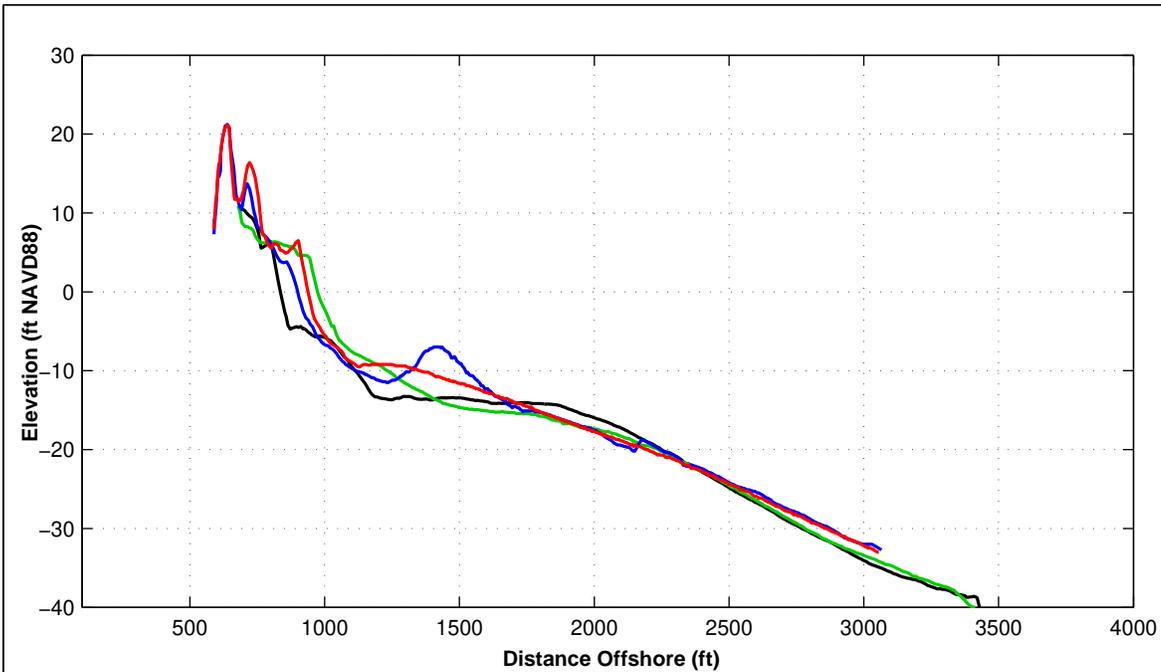
Survey Transect 900+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	-53.72 ft	22.65 ft
Volume Change Above +6 ft NAVD88	10.20 cy/ft	0.04 cy/ft
Volume Change Above 1.18 ft NAVD88	3.69 cy/ft	2.04 cy/ft
Volume Change Above -6 ft NAVD88	-11.28 cy/ft	3.83 cy/ft
Volume Change Above -14 ft NAVD88	35.68 cy/ft	-24.61 cy/ft
Volume Change Above -19 ft NAVD88	30.22 cy/ft	-20.38 cy/ft
Volume Change Above -30 ft NAVD88	28.49 cy/ft	-33.72 cy/ft

LEGEND:

JULY 2021	—	AUGUST 2019	—
JUNE 2020	—	MAY 2018	—

- Notes:
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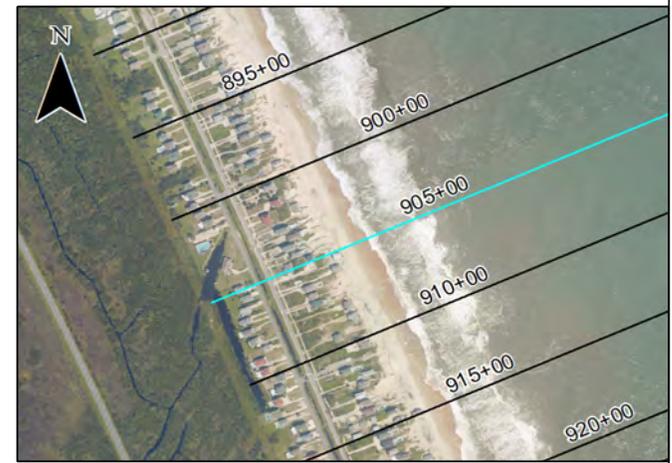


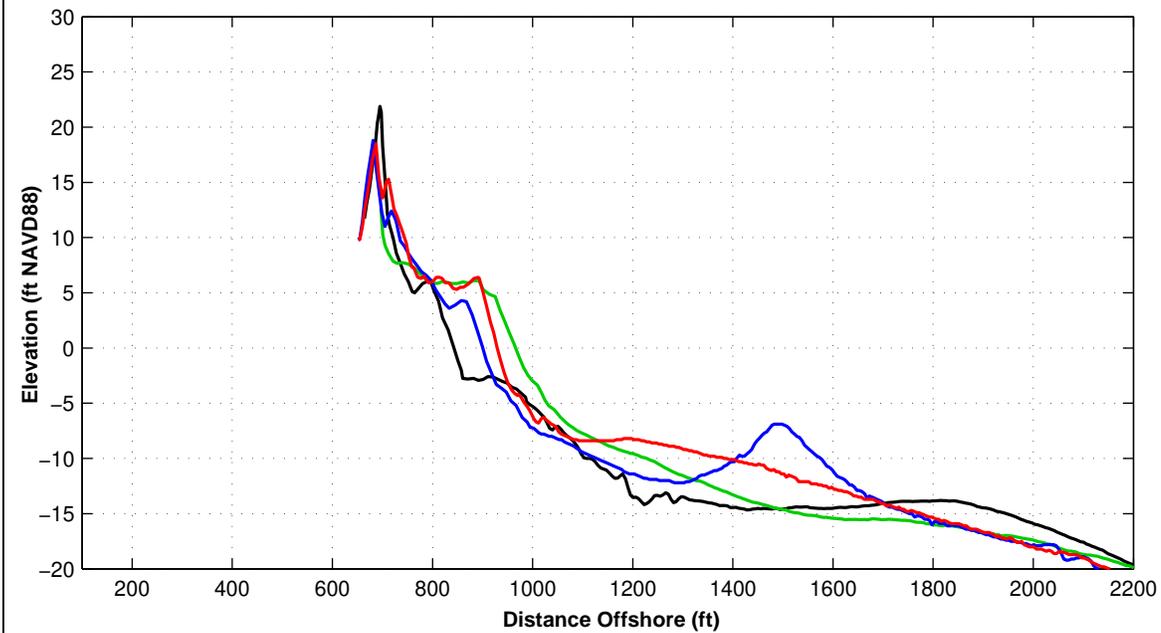
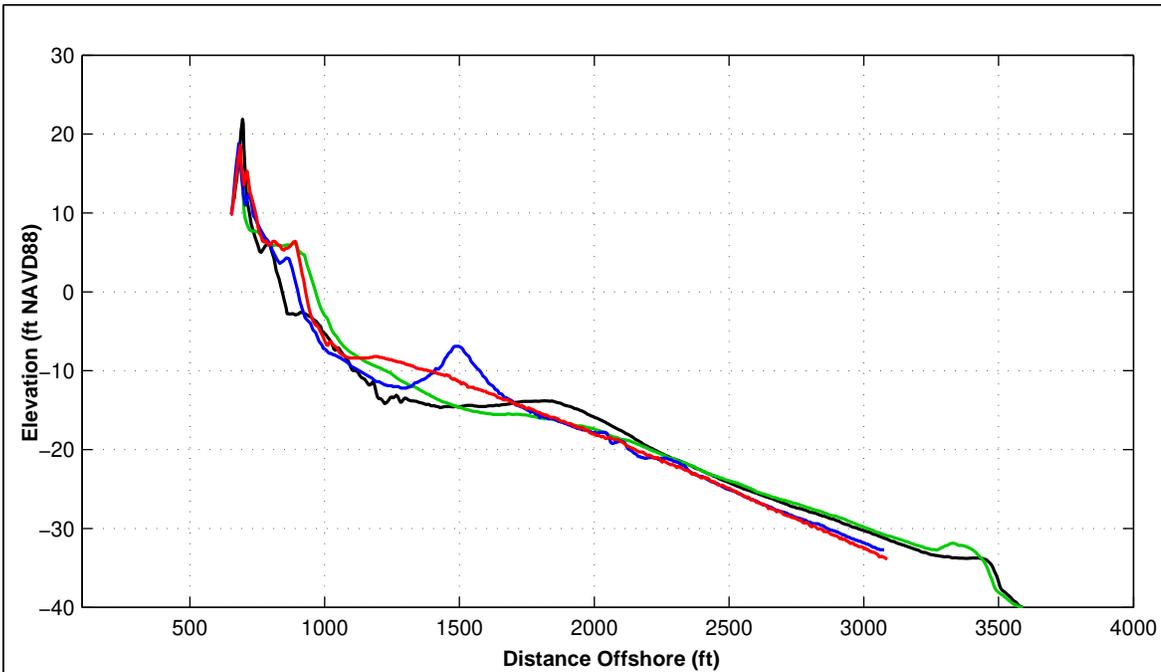
Survey Transect 905+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	-75.12 ft	40.68 ft
Volume Change Above +6 ft NAVD88	8.53 cy/ft	7.71 cy/ft
Volume Change Above 1.18 ft NAVD88	-6.41 cy/ft	18.10 cy/ft
Volume Change Above -6 ft NAVD88	-27.03 cy/ft	26.99 cy/ft
Volume Change Above -14 ft NAVD88	7.71 cy/ft	19.50 cy/ft
Volume Change Above -19 ft NAVD88	16.59 cy/ft	21.57 cy/ft
Volume Change Above -30 ft NAVD88	30.30 cy/ft	13.58 cy/ft

LEGEND:

JULY 2021	—	AUGUST 2019	—
JUNE 2020	—	MAY 2018	—

- Notes:
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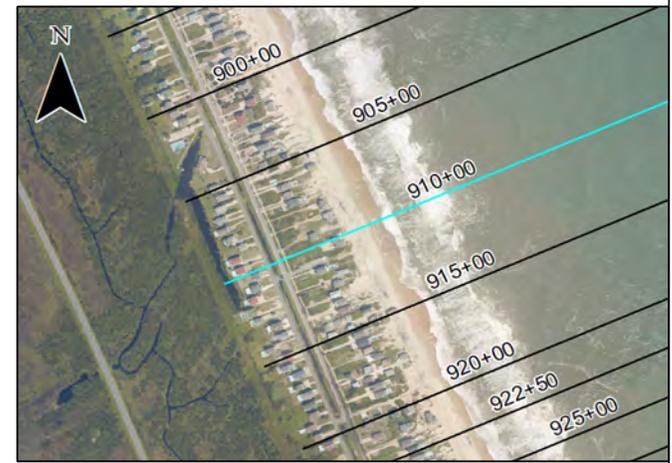


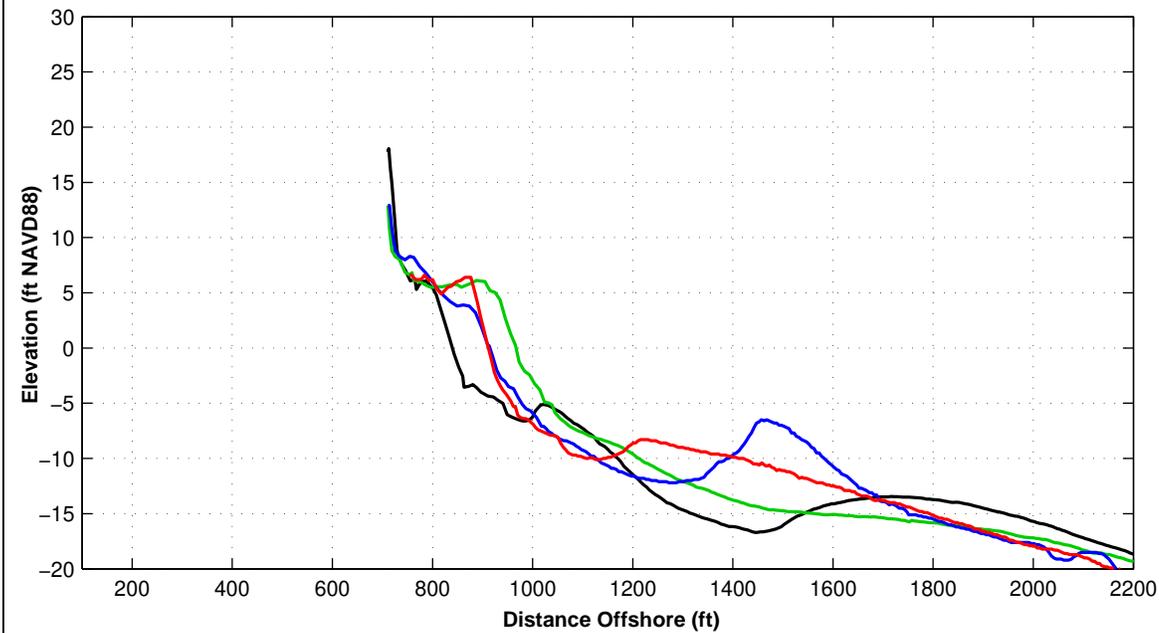
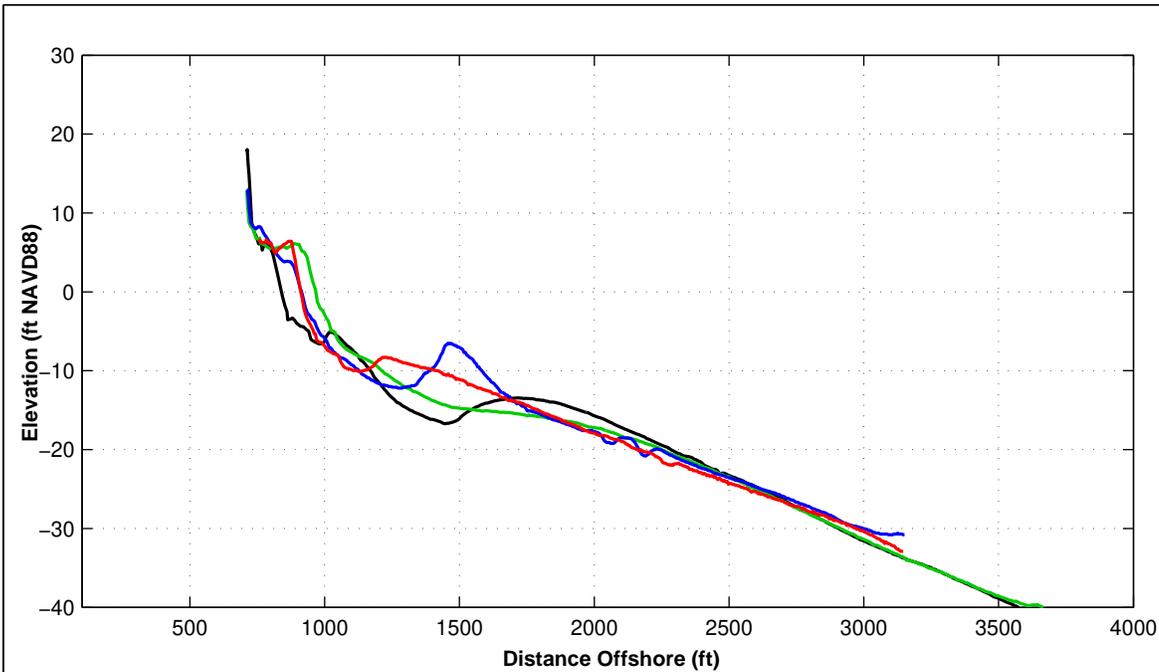
Survey Transect 910+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	-62.75 ft	30.91 ft
Volume Change Above +6 ft NAVD88	5.80 cy/ft	2.73 cy/ft
Volume Change Above 1.18 ft NAVD88	-7.79 cy/ft	12.15 cy/ft
Volume Change Above -6 ft NAVD88	-26.23 cy/ft	18.82 cy/ft
Volume Change Above -14 ft NAVD88	2.19 cy/ft	26.41 cy/ft
Volume Change Above -19 ft NAVD88	12.74 cy/ft	27.80 cy/ft
Volume Change Above -30 ft NAVD88	-24.61 cy/ft	25.93 cy/ft

LEGEND:

JULY 2021	—	AUGUST 2019	—
JUNE 2020	—	MAY 2018	—

- Notes:
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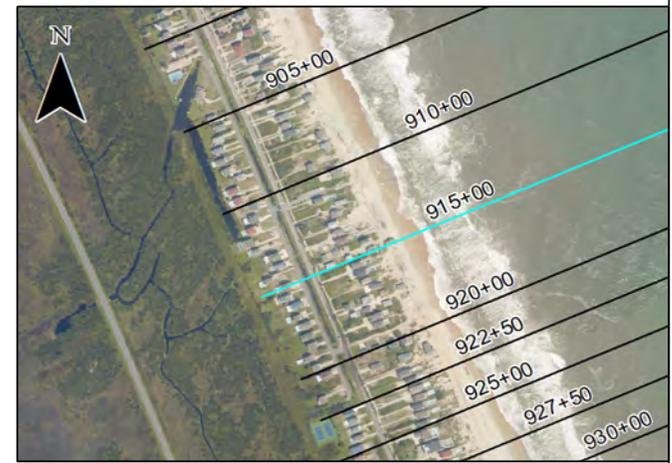


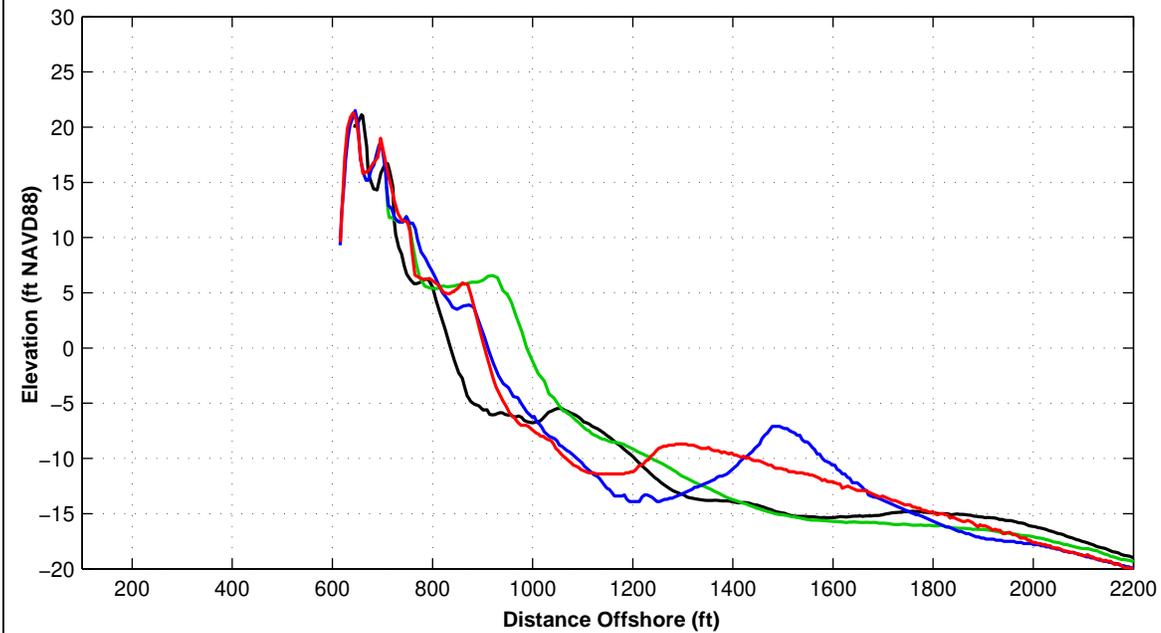
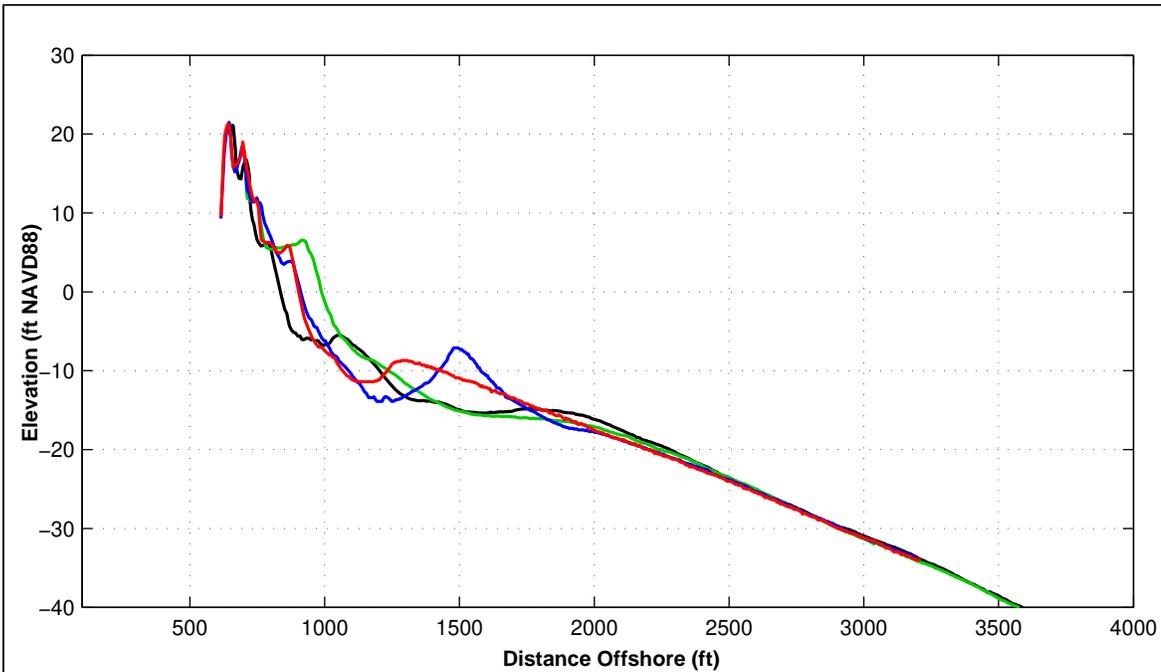
Survey Transect 915+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	-53.81 ft	1.70 ft
Volume Change Above +6 ft NAVD88	3.59 cy/ft	-1.58 cy/ft
Volume Change Above 1.18 ft NAVD88	-8.84 cy/ft	3.33 cy/ft
Volume Change Above -6 ft NAVD88	-22.98 cy/ft	0.40 cy/ft
Volume Change Above -14 ft NAVD88	16.24 cy/ft	-5.52 cy/ft
Volume Change Above -19 ft NAVD88	22.88 cy/ft	-2.81 cy/ft
Volume Change Above -30 ft NAVD88	28.26 cy/ft	-20.72 cy/ft

LEGEND:

JULY 2021	—	AUGUST 2019	—
JUNE 2020	—	MAY 2018	—

- Notes:
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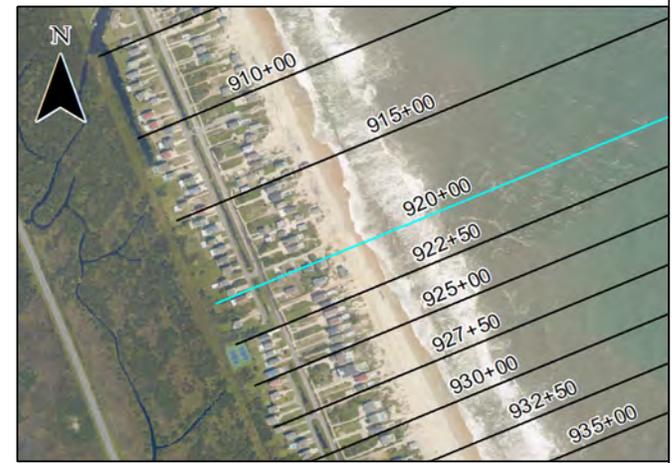


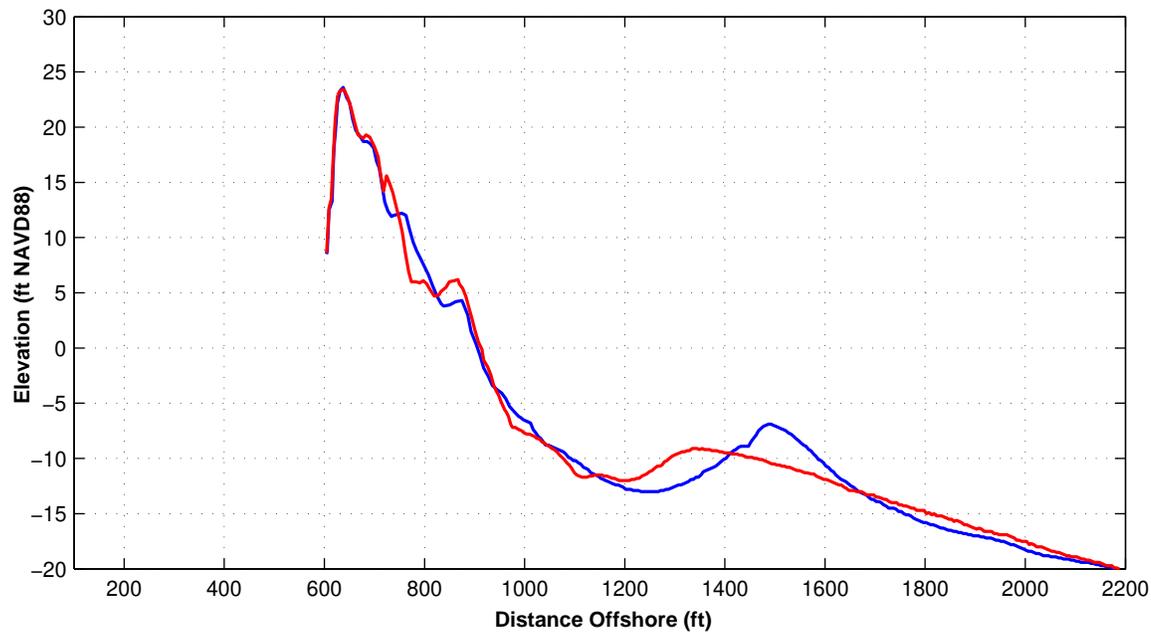
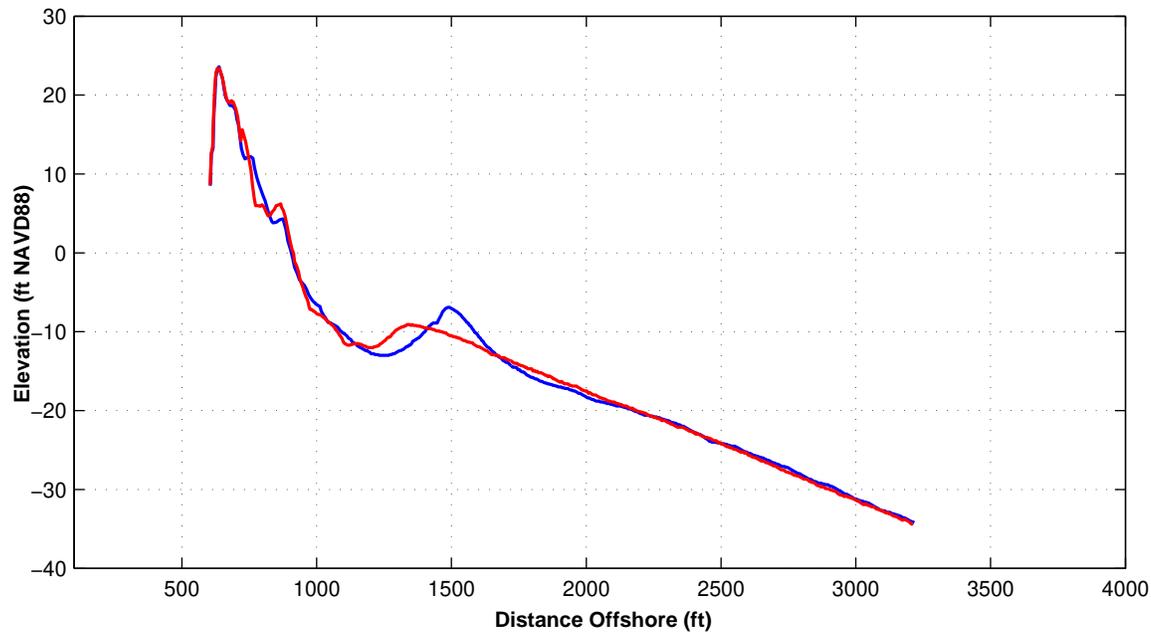
Survey Transect 920+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	-78.07 ft	-5.40 ft
Volume Change Above +6 ft NAVD88	3.51 cy/ft	-1.80 cy/ft
Volume Change Above 1.18 ft NAVD88	-12.91 cy/ft	0.95 cy/ft
Volume Change Above -6 ft NAVD88	-33.66 cy/ft	-3.62 cy/ft
Volume Change Above -14 ft NAVD88	-23.24 cy/ft	5.35 cy/ft
Volume Change Above -19 ft NAVD88	-11.69 cy/ft	13.71 cy/ft
Volume Change Above -30 ft NAVD88	-18.78 cy/ft	9.42 cy/ft

LEGEND:

JULY 2021	—	AUGUST 2019	—
JUNE 2020	—	MAY 2018	—

- Notes:
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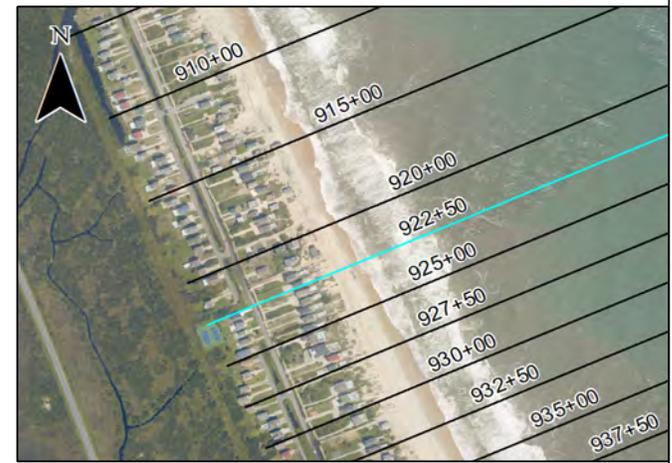


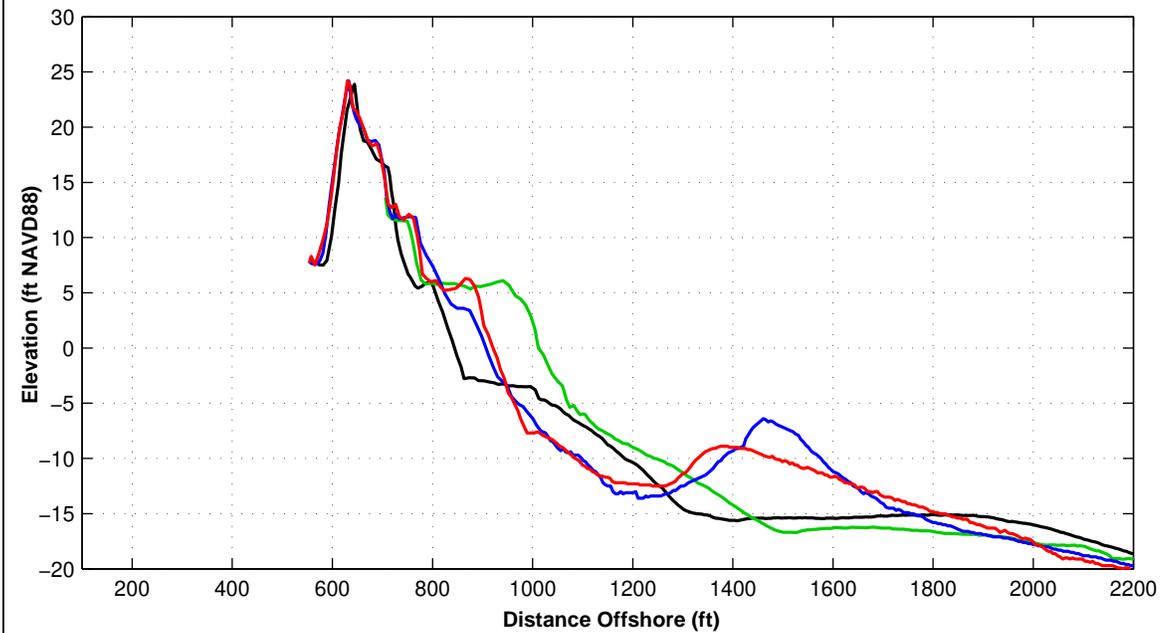
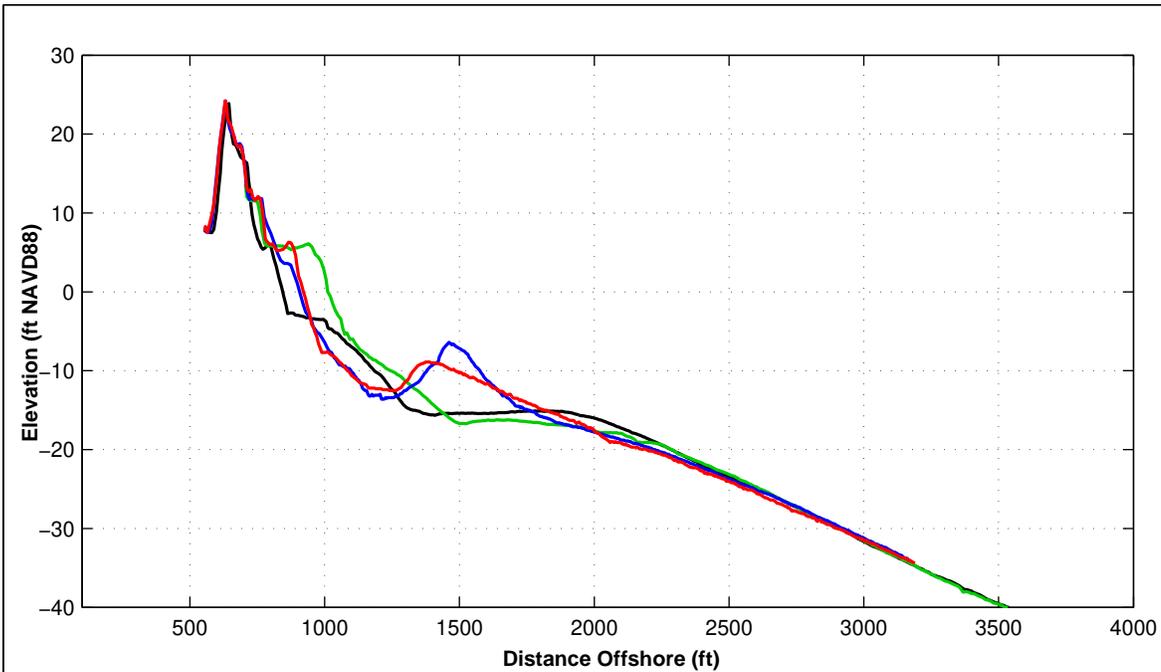


Survey Transect 922+50	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	– ft	7.64 ft
Volume Change Above +6 ft NAVD88	– cy/ft	–2.57 cy/ft
Volume Change Above 1.18 ft NAVD88	– cy/ft	0.94 cy/ft
Volume Change Above –6 ft NAVD88	– cy/ft	1.06 cy/ft
Volume Change Above –14 ft NAVD88	– cy/ft	–4.15 cy/ft
Volume Change Above –19 ft NAVD88	– cy/ft	5.63 cy/ft
Volume Change Above –30 ft NAVD88	– cy/ft	0.80 cy/ft

LEGEND:
 JULY 2021 —
 JUNE 2020 —

- Notes:
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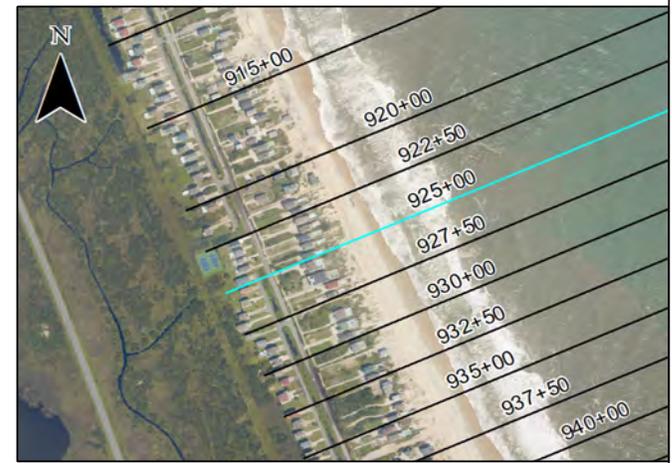


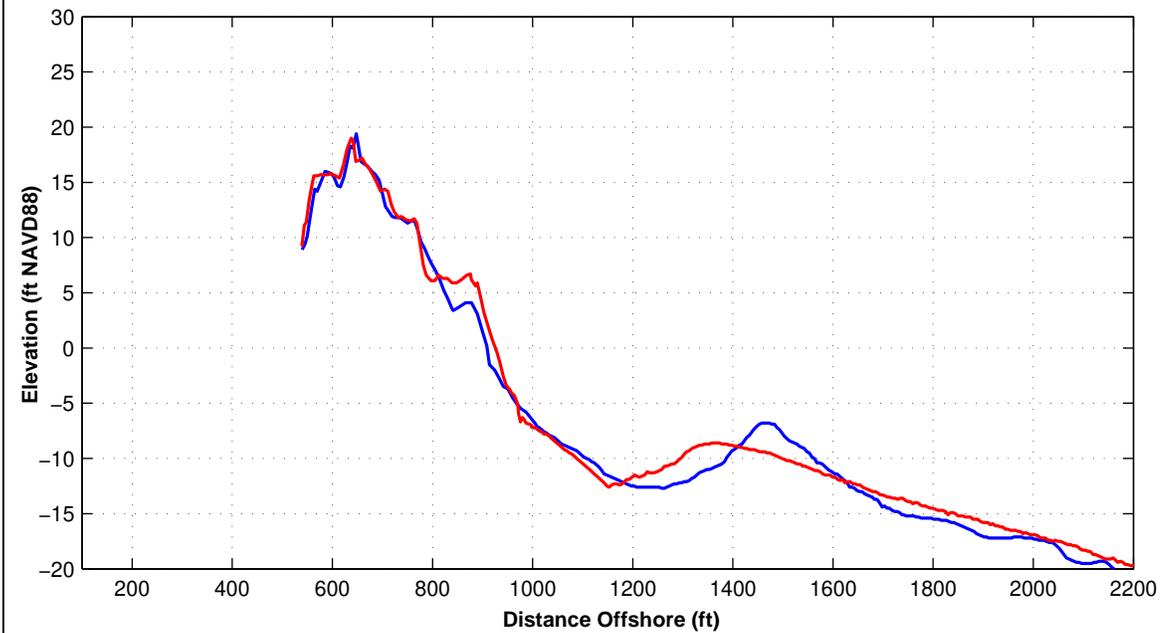
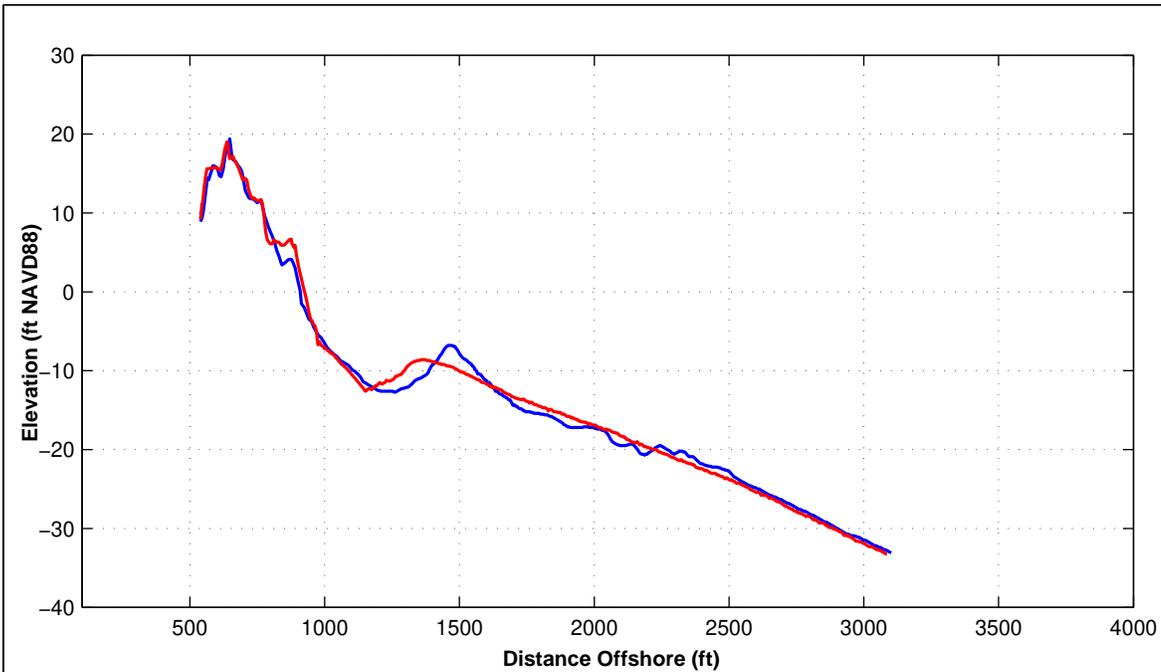
Survey Transect 925+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	-109.42 ft	14.80 ft
Volume Change Above +6 ft NAVD88	5.57 cy/ft	-1.75 cy/ft
Volume Change Above 1.18 ft NAVD88	-15.64 cy/ft	4.31 cy/ft
Volume Change Above -6 ft NAVD88	-44.29 cy/ft	5.70 cy/ft
Volume Change Above -14 ft NAVD88	-28.45 cy/ft	0.37 cy/ft
Volume Change Above -19 ft NAVD88	-0.47 cy/ft	7.13 cy/ft
Volume Change Above -30 ft NAVD88	-10.33 cy/ft	-5.73 cy/ft

LEGEND:

JULY 2021	—	AUGUST 2019	—
JUNE 2020	—	MAY 2018	—

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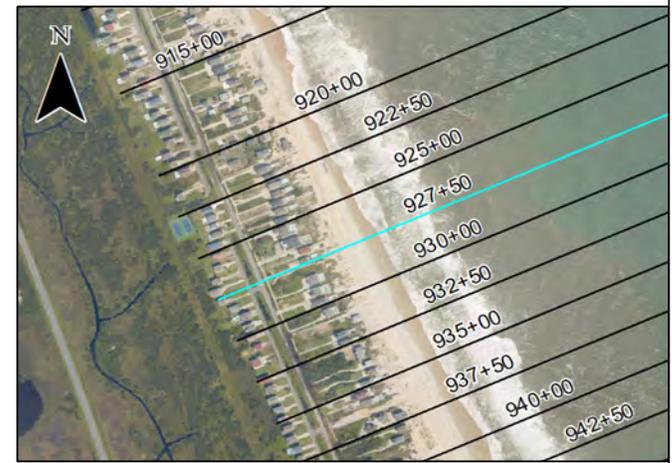


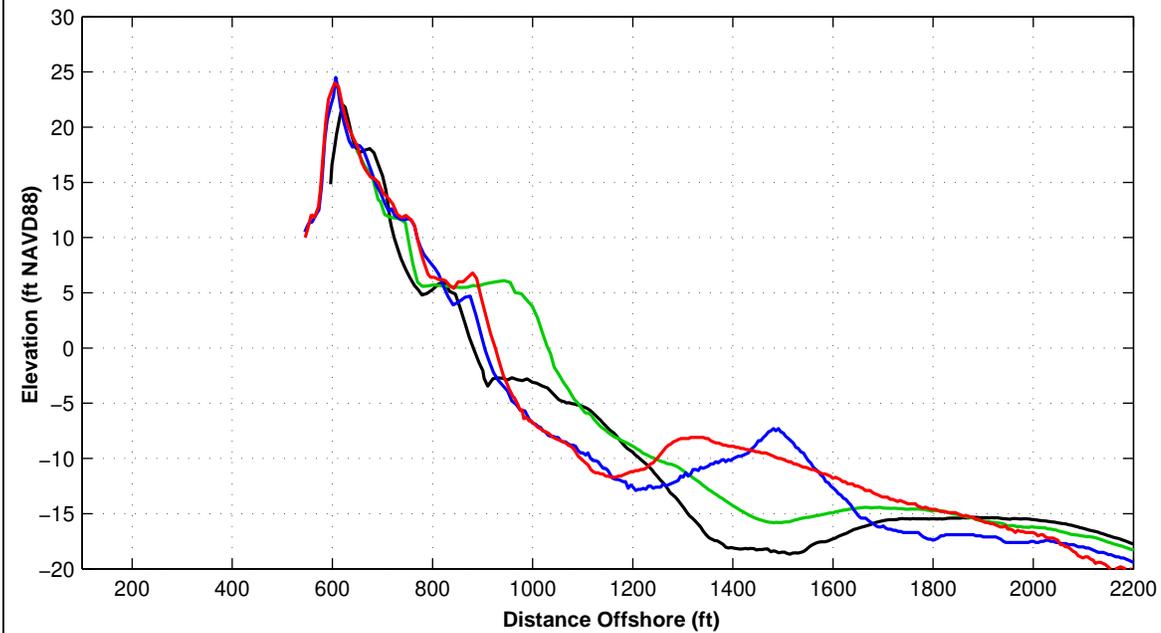
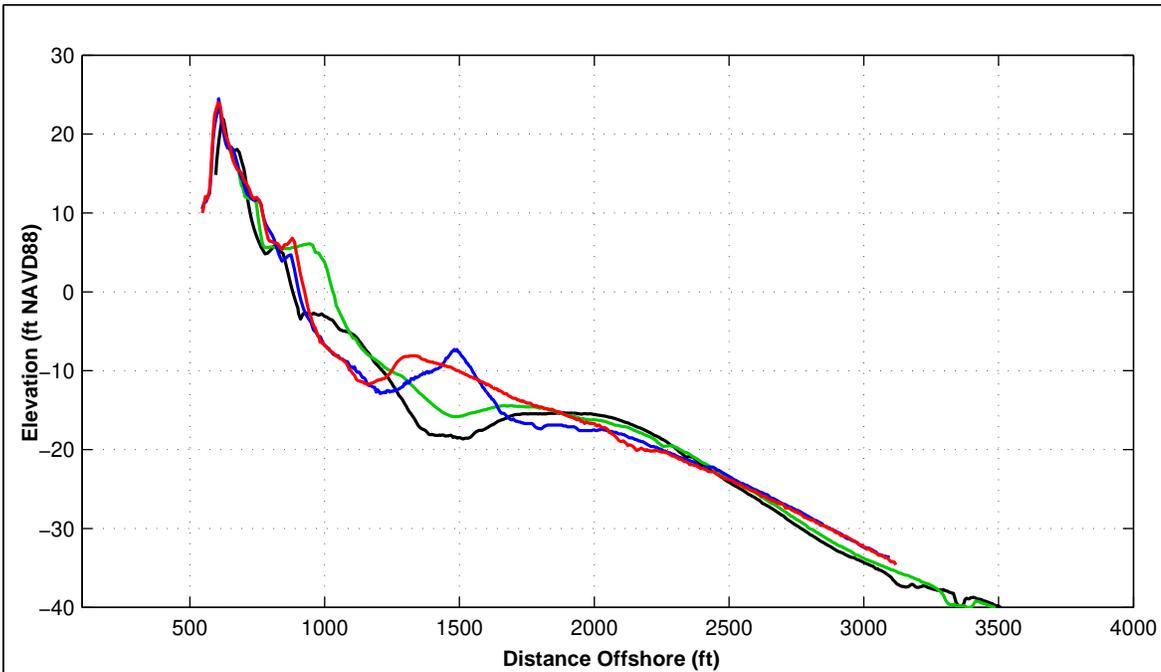


Survey Transect 927+50	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	– ft	14.74 ft
Volume Change Above +6 ft NAVD88	– cy/ft	–0.67 cy/ft
Volume Change Above 1.18 ft NAVD88	– cy/ft	6.16 cy/ft
Volume Change Above –6 ft NAVD88	– cy/ft	8.75 cy/ft
Volume Change Above –14 ft NAVD88	– cy/ft	9.13 cy/ft
Volume Change Above –19 ft NAVD88	– cy/ft	22.21 cy/ft
Volume Change Above –30 ft NAVD88	– cy/ft	10.32 cy/ft

LEGEND:
 JULY 2021 ————
 JUNE 2020 ————

- Notes:
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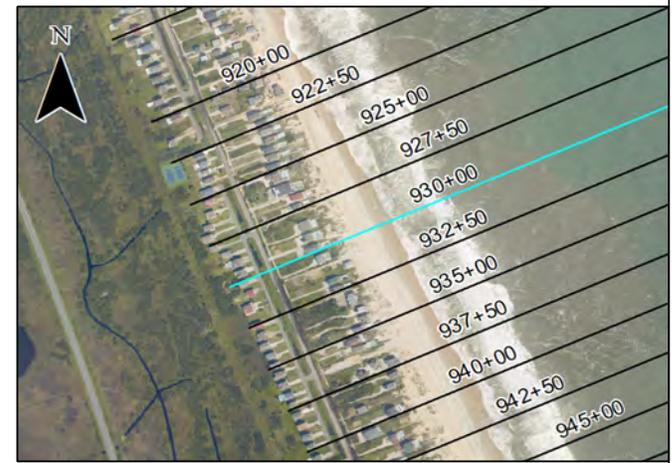


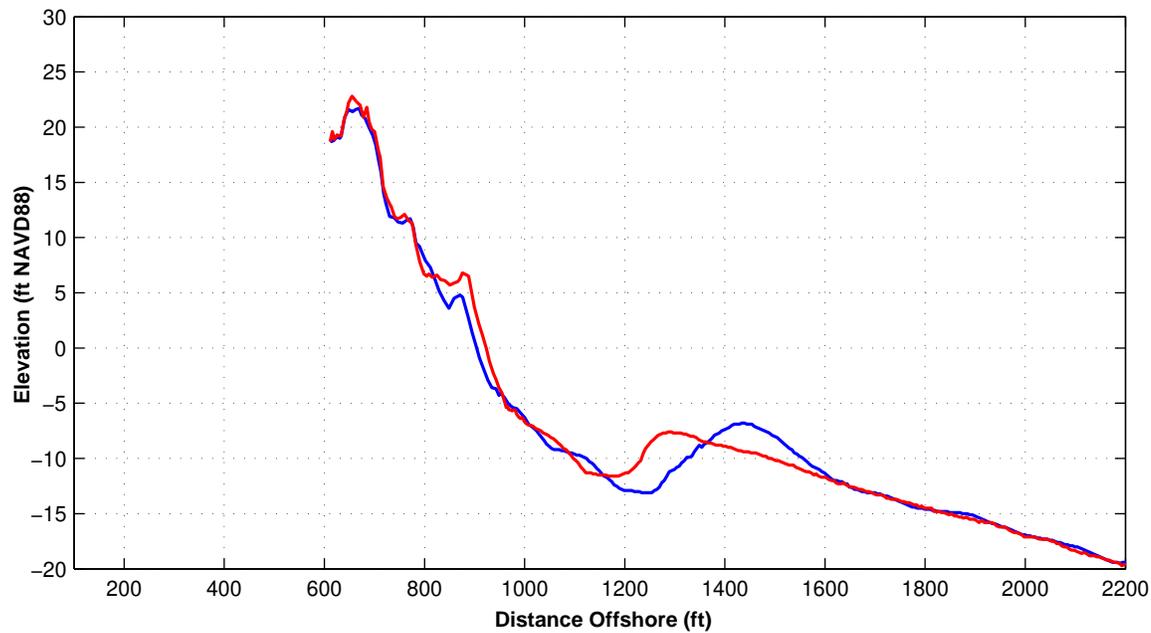
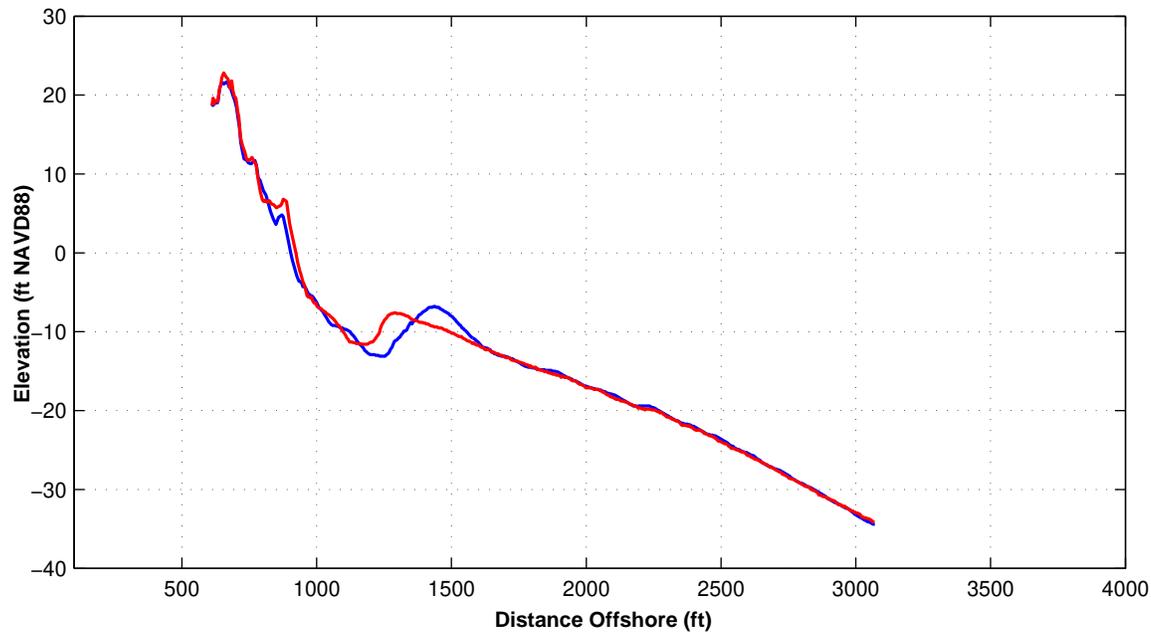
Survey Transect 930+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	-124.06 ft	19.94 ft
Volume Change Above +6 ft NAVD88	8.14 cy/ft	-0.40 cy/ft
Volume Change Above 1.18 ft NAVD88	-12.70 cy/ft	5.82 cy/ft
Volume Change Above -6 ft NAVD88	-46.18 cy/ft	9.36 cy/ft
Volume Change Above -14 ft NAVD88	-34.56 cy/ft	25.70 cy/ft
Volume Change Above -19 ft NAVD88	-54.65 cy/ft	48.61 cy/ft
Volume Change Above -30 ft NAVD88	-50.93 cy/ft	38.73 cy/ft

LEGEND:

JULY 2021		AUGUST 2019	
JUNE 2020		MAY 2018	

- Notes:
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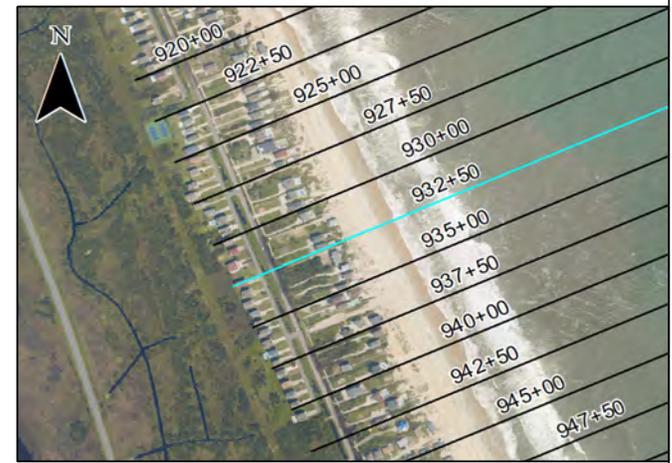


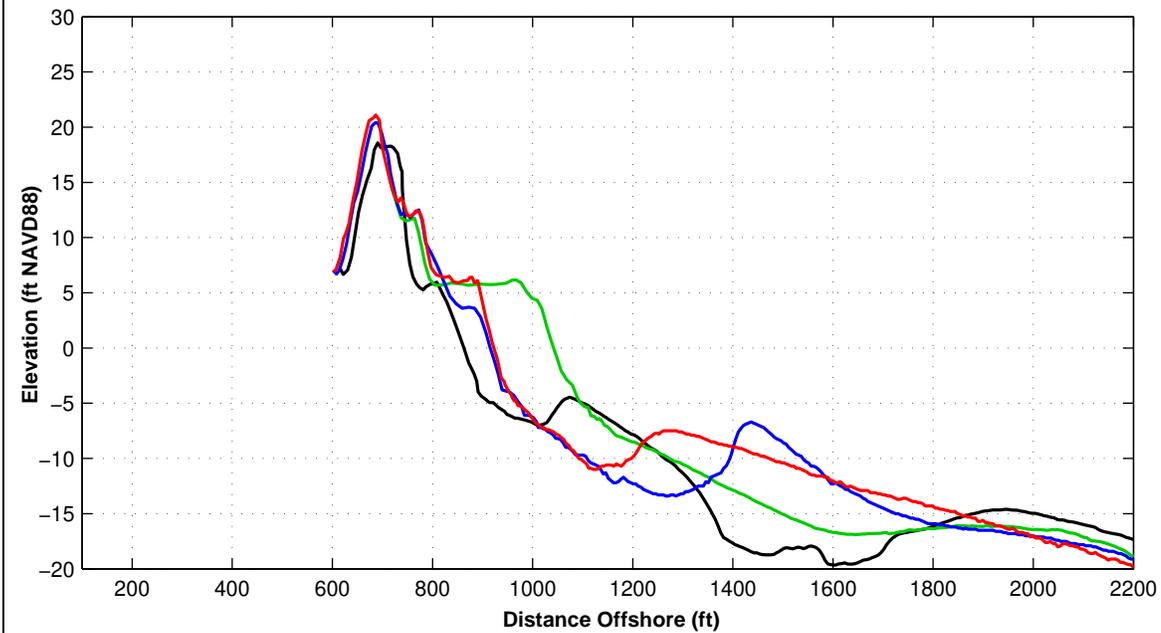
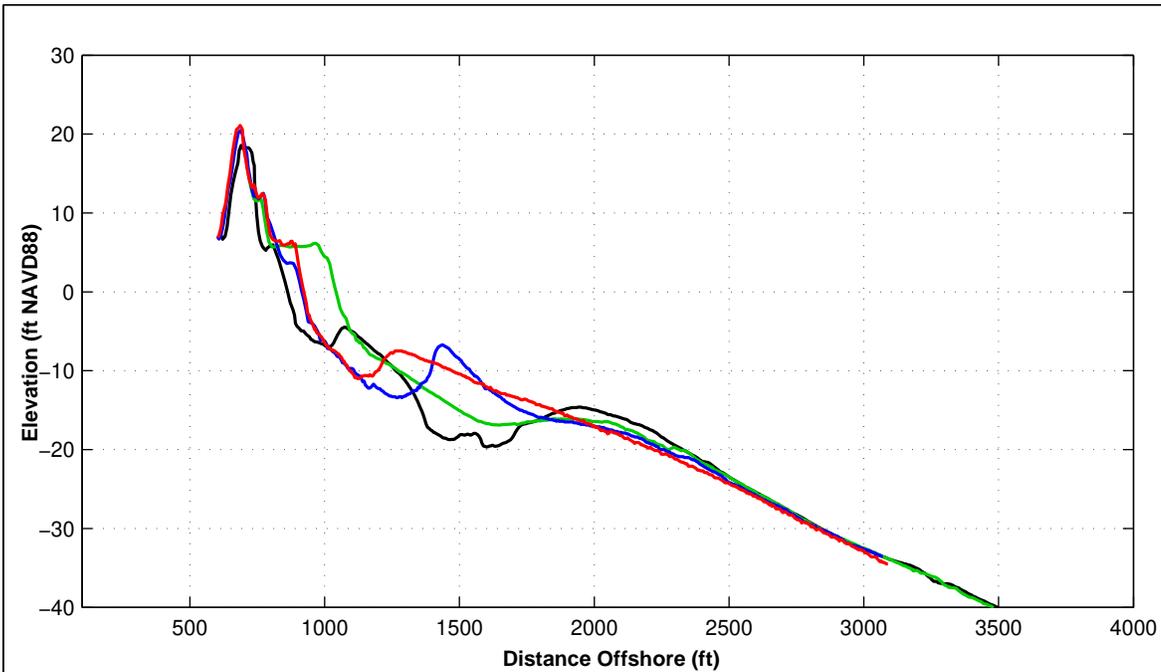


Survey Transect 932+50	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	– ft	19.02 ft
Volume Change Above +6 ft NAVD88	– cy/ft	1.90 cy/ft
Volume Change Above 1.18 ft NAVD88	– cy/ft	7.83 cy/ft
Volume Change Above –6 ft NAVD88	– cy/ft	10.67 cy/ft
Volume Change Above –14 ft NAVD88	– cy/ft	13.92 cy/ft
Volume Change Above –19 ft NAVD88	– cy/ft	12.18 cy/ft
Volume Change Above –30 ft NAVD88	– cy/ft	8.14 cy/ft

LEGEND:
 JULY 2021 —
 JUNE 2020 —

- Notes:
1. Station From North To South At Varying Intervals.
 2. All Survey Elevations In Feet Referenced to NAVD88.



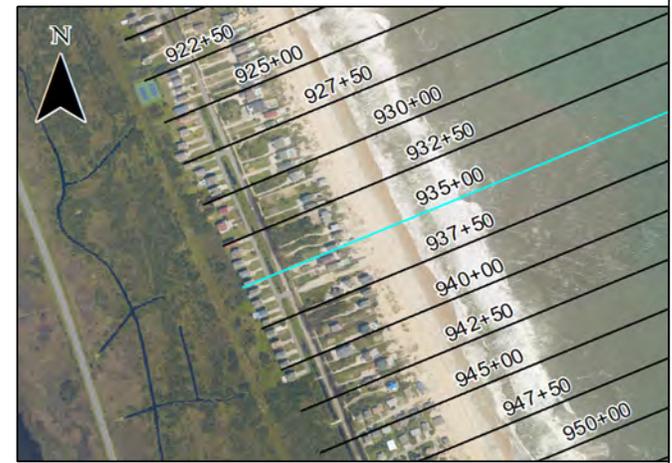


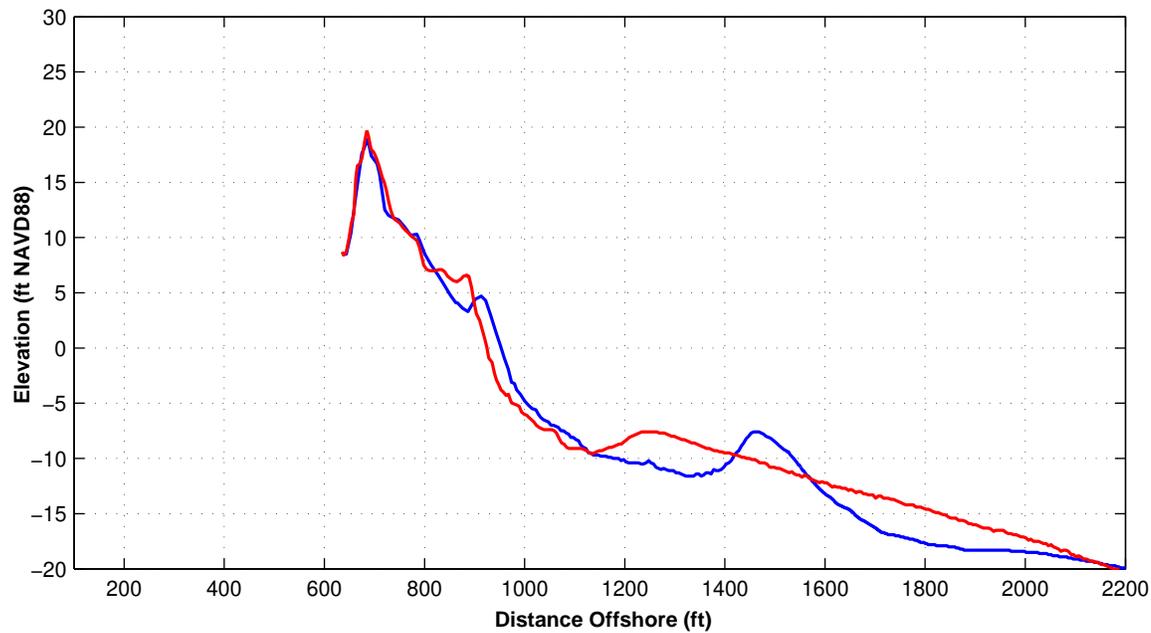
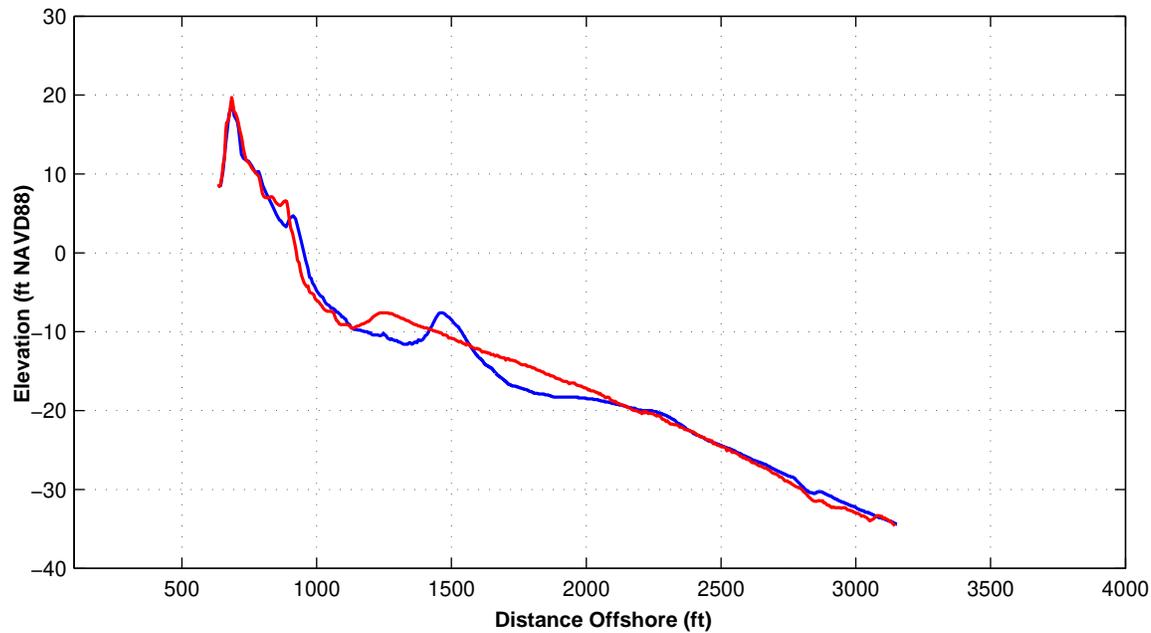
Survey Transect 935+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	-125.70 ft	7.56 ft
Volume Change Above +6 ft NAVD88	4.88 cy/ft	2.43 cy/ft
Volume Change Above 1.18 ft NAVD88	-19.41 cy/ft	8.63 cy/ft
Volume Change Above -6 ft NAVD88	-53.82 cy/ft	9.85 cy/ft
Volume Change Above -14 ft NAVD88	-52.40 cy/ft	36.50 cy/ft
Volume Change Above -19 ft NAVD88	-36.40 cy/ft	44.47 cy/ft
Volume Change Above -30 ft NAVD88	-45.65 cy/ft	34.41 cy/ft

LEGEND:

JULY 2021	—	AUGUST 2019	—
JUNE 2020	—	MAY 2018	—

- Notes:
1. Station From North To South At Varying Intervals.
 2. All Survey Elevations In Feet Referenced to NAVD88.

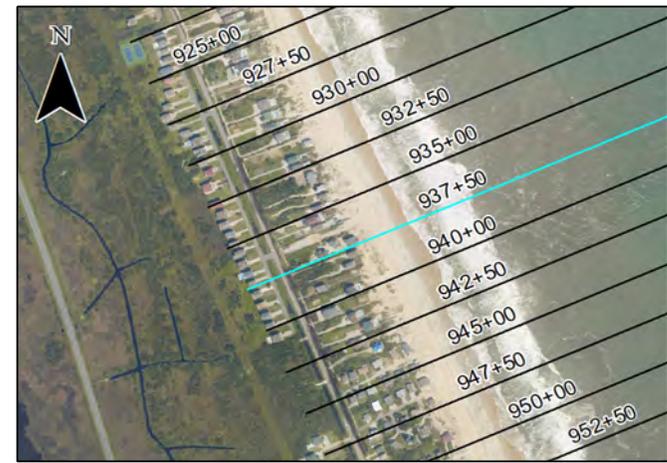


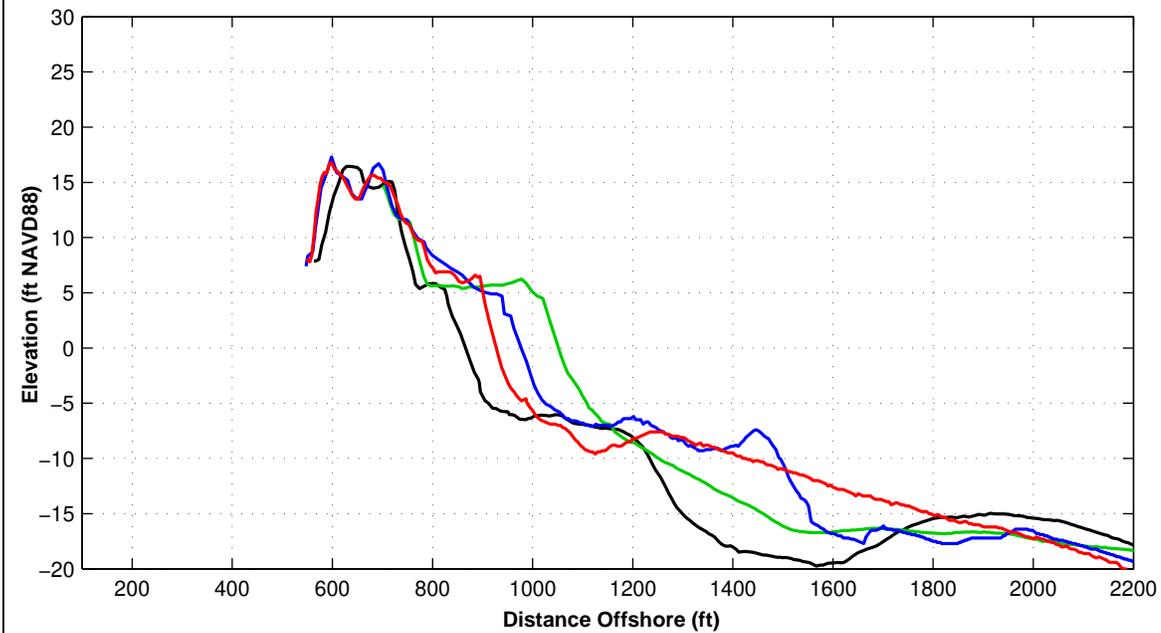
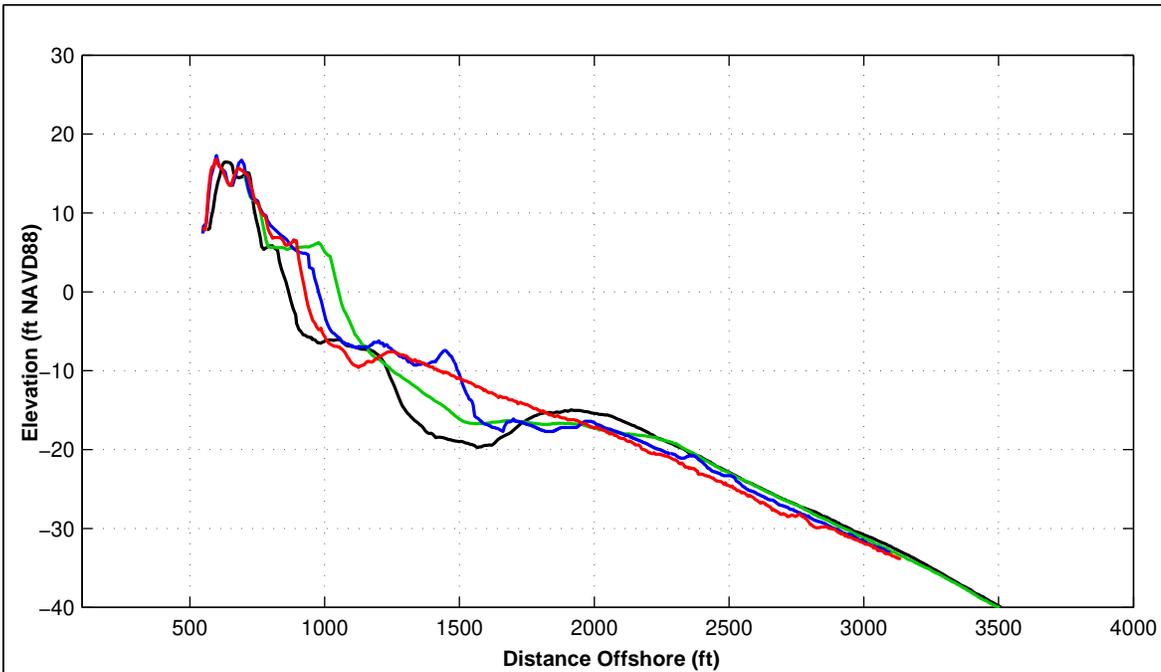


Survey Transect 937+50	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	– ft	–26.25 ft
Volume Change Above +6 ft NAVD88	– cy/ft	1.60 cy/ft
Volume Change Above 1.18 ft NAVD88	– cy/ft	2.23 cy/ft
Volume Change Above –6 ft NAVD88	– cy/ft	–5.36 cy/ft
Volume Change Above –14 ft NAVD88	– cy/ft	9.47 cy/ft
Volume Change Above –19 ft NAVD88	– cy/ft	43.13 cy/ft
Volume Change Above –30 ft NAVD88	– cy/ft	35.27 cy/ft

LEGEND:
 JULY 2021 ————
 JUNE 2020 ————

- Notes:
1. Station From North To South At Varying Intervals.
 2. All Survey Elevations In Feet Referenced to NAVD88.



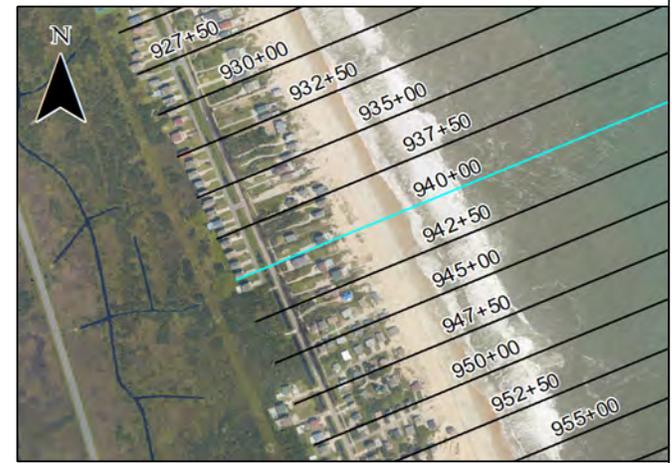


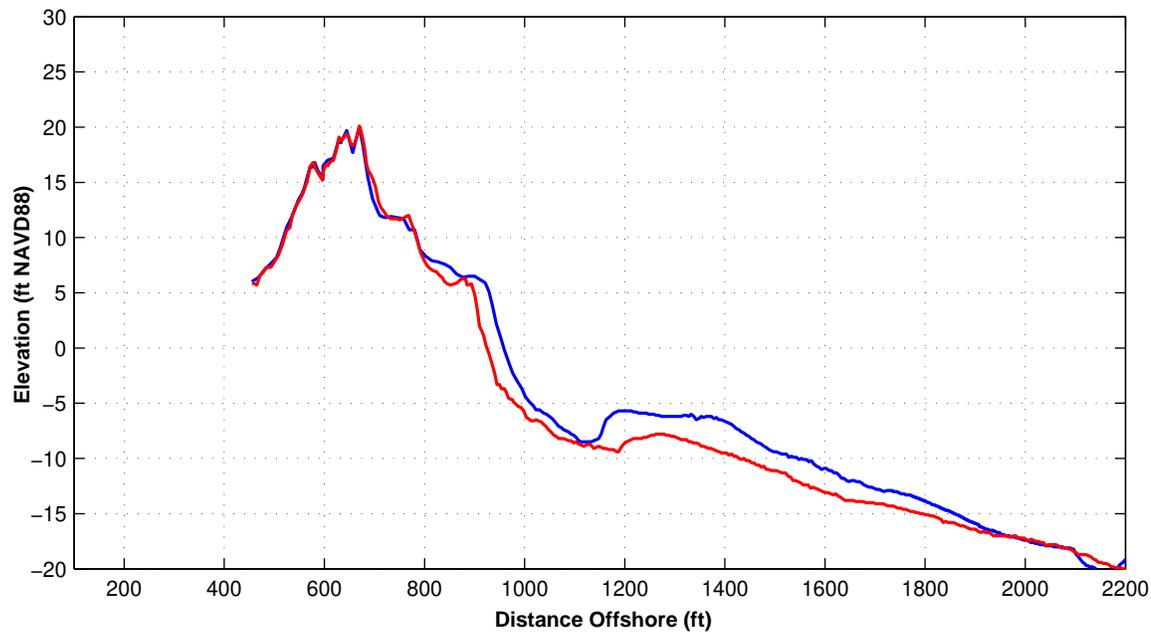
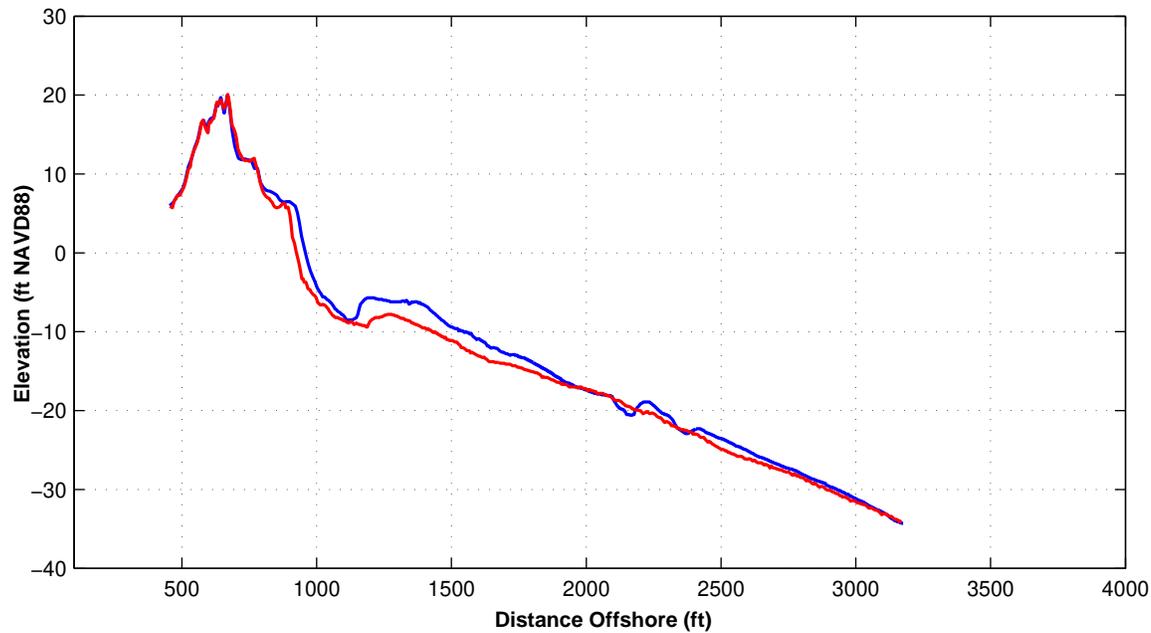
Survey Transect 940+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	-75.61 ft	-47.17 ft
Volume Change Above +6 ft NAVD88	6.93 cy/ft	-1.92 cy/ft
Volume Change Above 1.18 ft NAVD88	-5.84 cy/ft	-7.09 cy/ft
Volume Change Above -6 ft NAVD88	-26.52 cy/ft	-19.99 cy/ft
Volume Change Above -14 ft NAVD88	18.15 cy/ft	-31.24 cy/ft
Volume Change Above -19 ft NAVD88	19.70 cy/ft	-2.72 cy/ft
Volume Change Above -30 ft NAVD88	-0.69 cy/ft	-26.39 cy/ft

LEGEND:

JULY 2021	—	AUGUST 2019	—
JUNE 2020	—	MAY 2018	—

- Notes:
1. Station From North To South At Varying Intervals.
 2. All Survey Elevations In Feet Referenced to NAVD88.

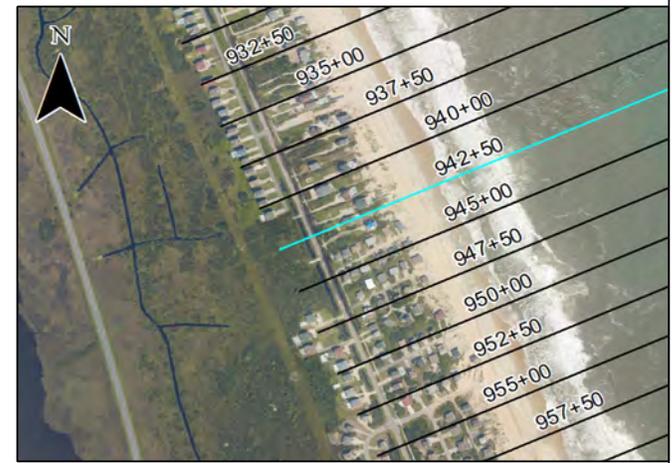


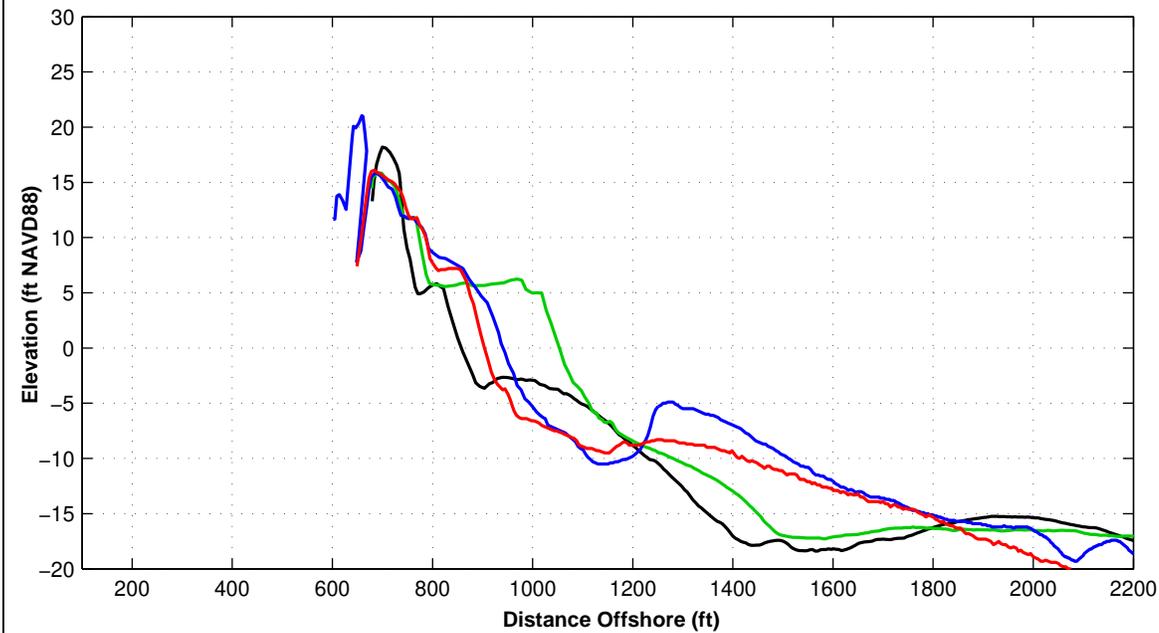
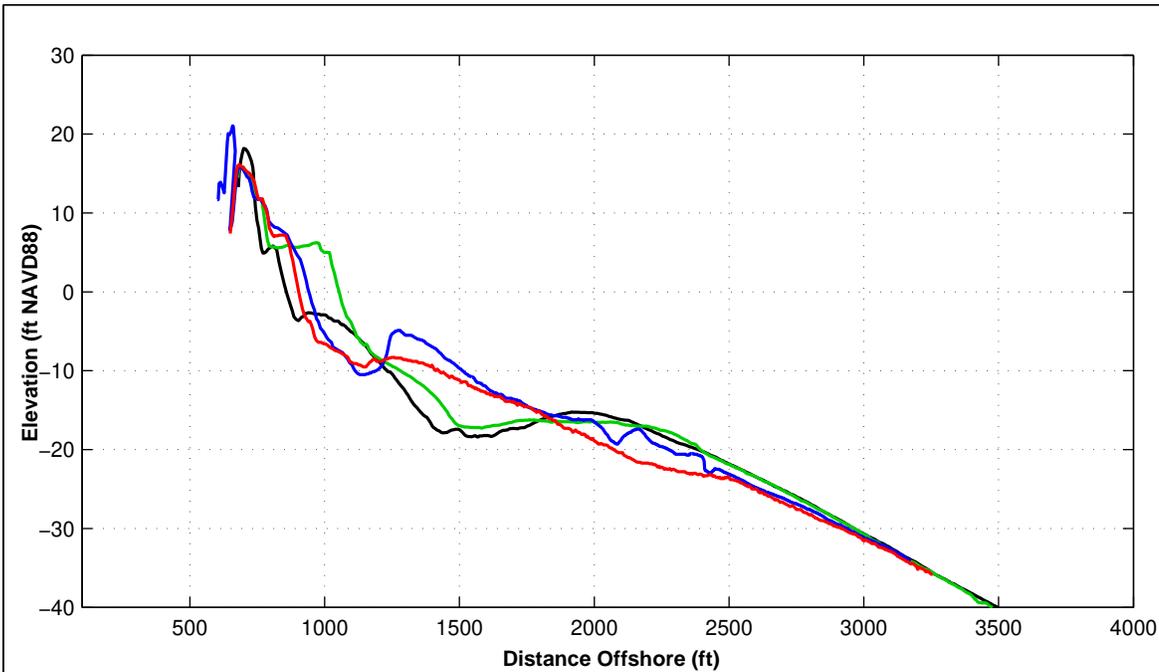


Survey Transect 942+50	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	– ft	–32.41 ft
Volume Change Above +6 ft NAVD88	– cy/ft	–1.15 cy/ft
Volume Change Above 1.18 ft NAVD88	– cy/ft	–7.06 cy/ft
Volume Change Above –6 ft NAVD88	– cy/ft	–16.88 cy/ft
Volume Change Above –14 ft NAVD88	– cy/ft	–67.94 cy/ft
Volume Change Above –19 ft NAVD88	– cy/ft	–73.50 cy/ft
Volume Change Above –30 ft NAVD88	– cy/ft	–91.57 cy/ft

LEGEND:
 JULY 2021 ————
 JUNE 2020 ————

- Notes:
1. Station From North To South At Varying Intervals.
 2. All Survey Elevations In Feet Referenced to NAVD88.



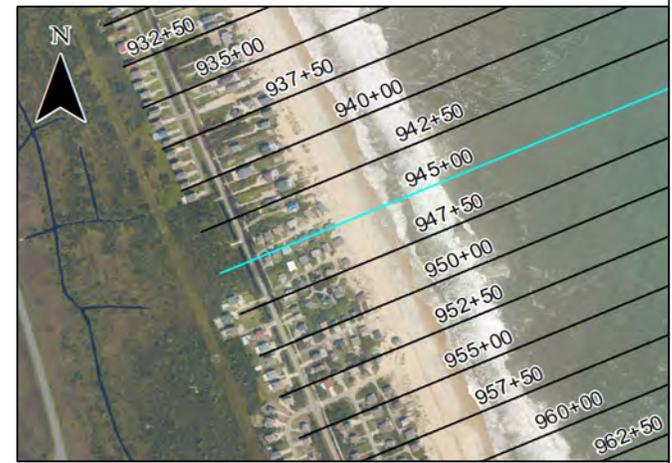


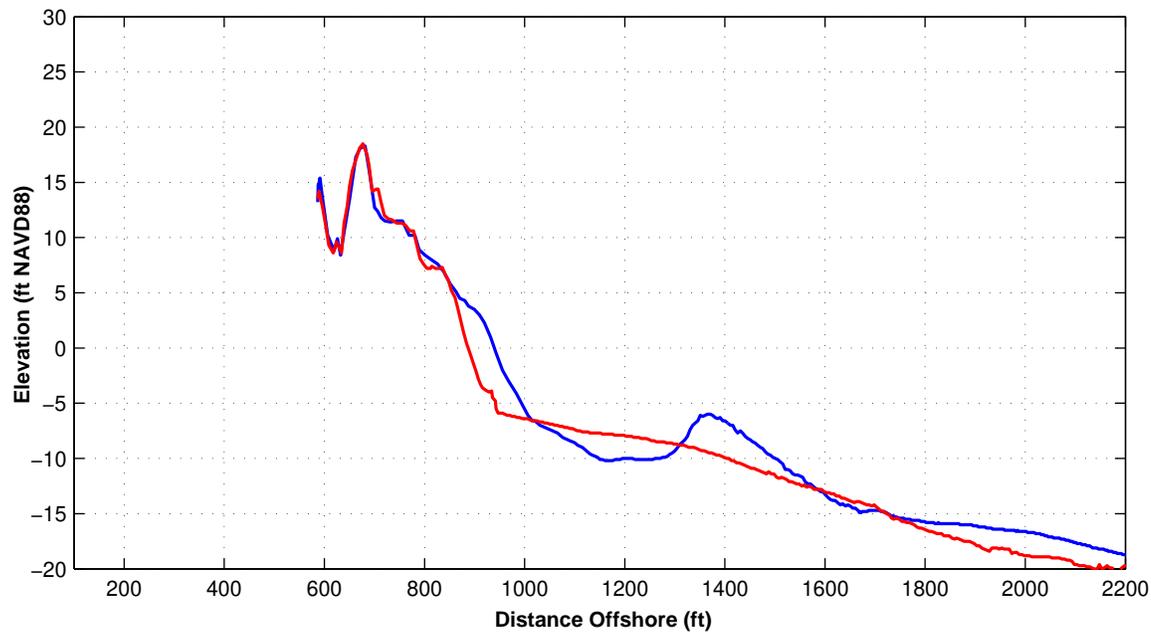
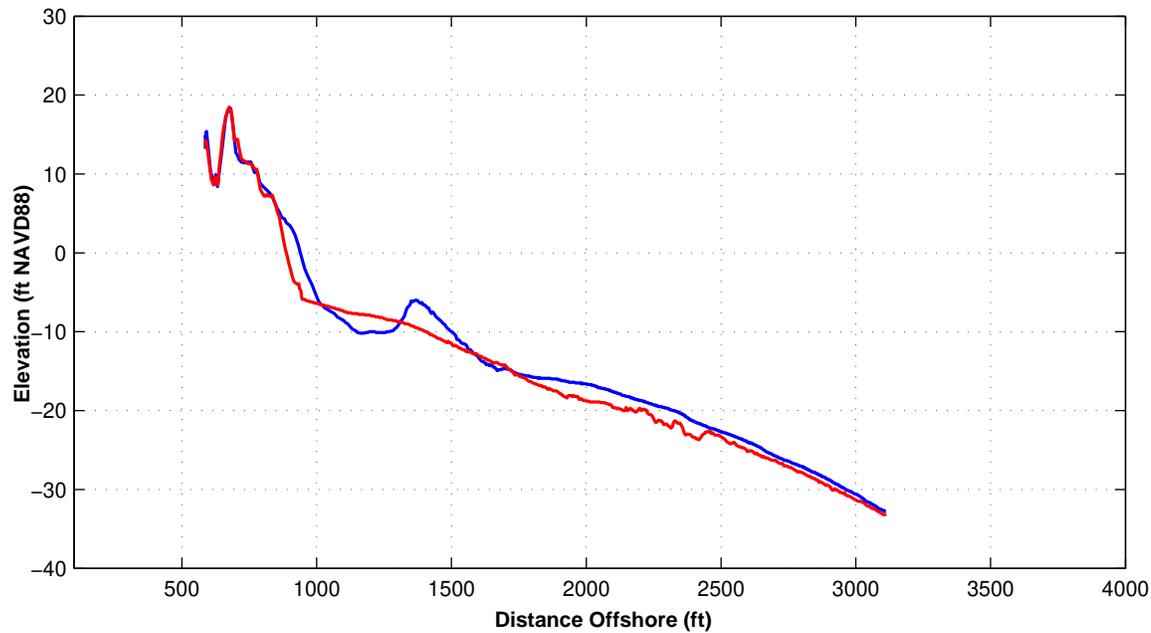
Survey Transect 945+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	-111.31 ft	-36.10 ft
Volume Change Above +6 ft NAVD88	6.40 cy/ft	0.74 cy/ft
Volume Change Above 1.18 ft NAVD88	-11.90 cy/ft	-4.12 cy/ft
Volume Change Above -6 ft NAVD88	-39.91 cy/ft	-16.59 cy/ft
Volume Change Above -14 ft NAVD88	7.04 cy/ft	-43.08 cy/ft
Volume Change Above -19 ft NAVD88	29.19 cy/ft	-60.75 cy/ft
Volume Change Above -30 ft NAVD88	0.45 cy/ft	-100.23 cy/ft

LEGEND:

JULY 2021	—	AUGUST 2019	—
JUNE 2020	—	MAY 2018	—

- Notes:
1. Station From North To South At Varying Intervals.
 2. All Survey Elevations In Feet Referenced to NAVD88.

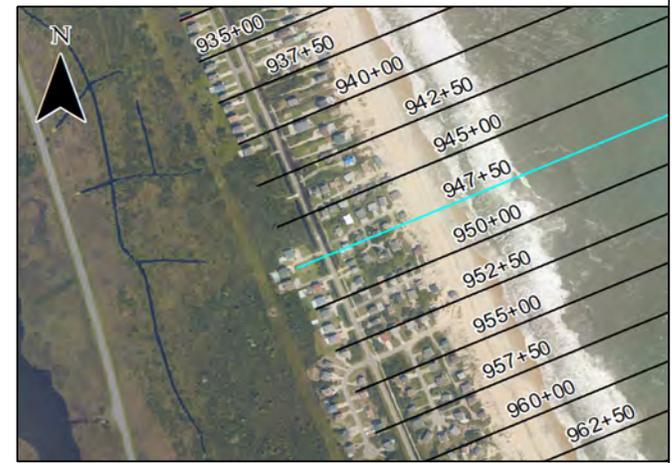


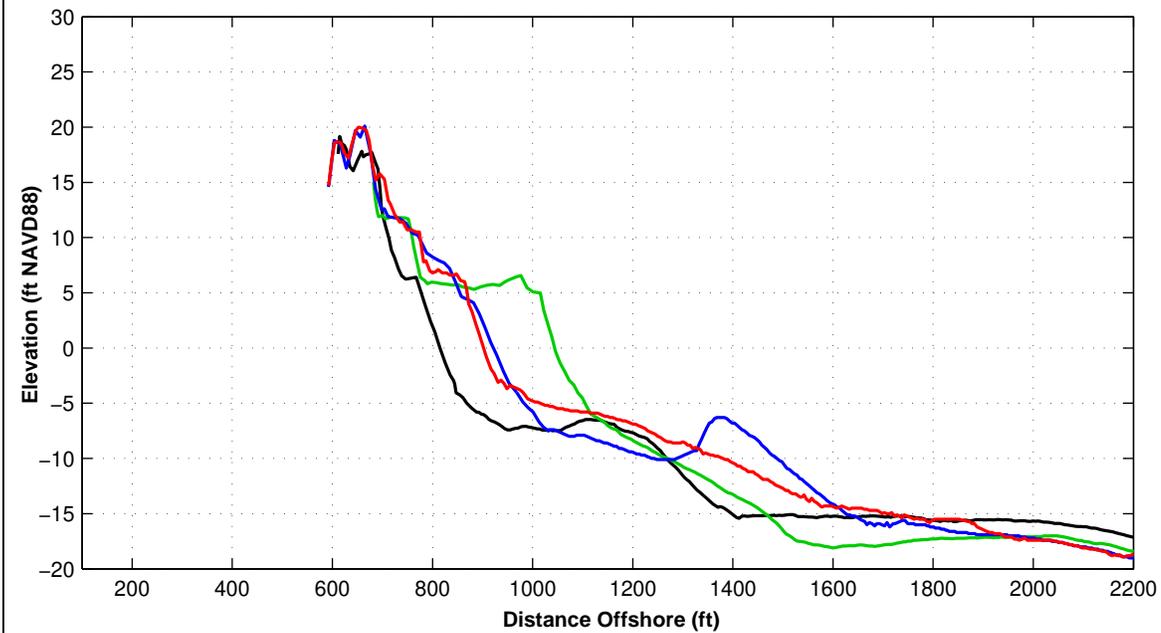
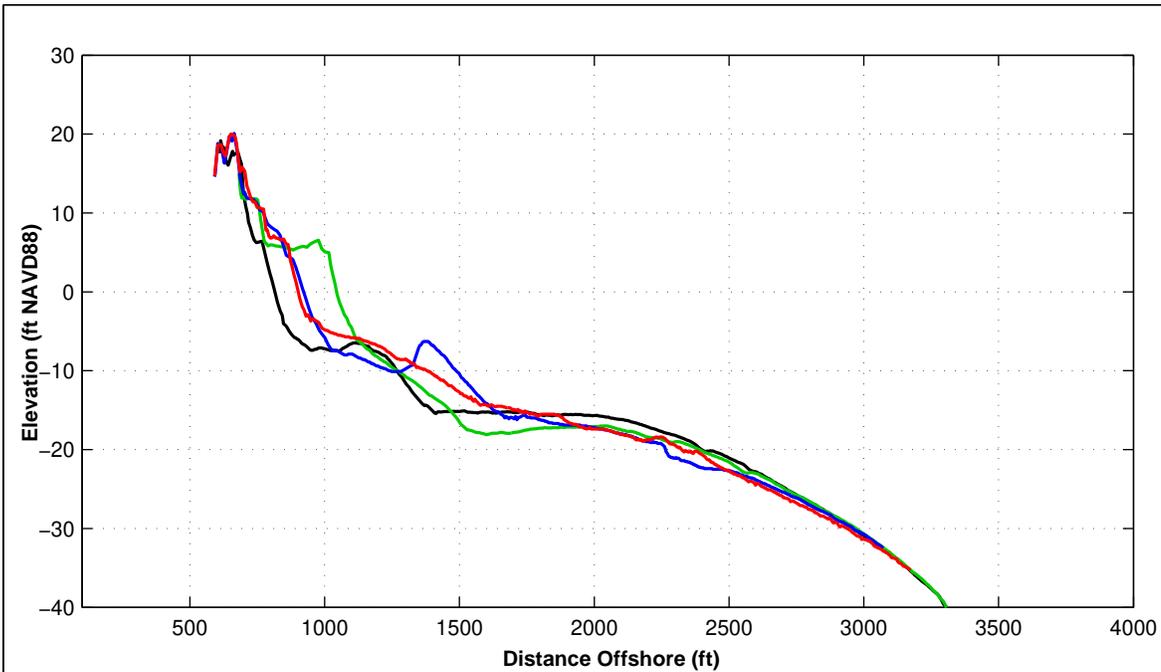


Survey Transect 947+50	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	– ft	–50.51 ft
Volume Change Above +6 ft NAVD88	– cy/ft	0.50 cy/ft
Volume Change Above 1.18 ft NAVD88	– cy/ft	–4.42 cy/ft
Volume Change Above –6 ft NAVD88	– cy/ft	–18.71 cy/ft
Volume Change Above –14 ft NAVD88	– cy/ft	–22.45 cy/ft
Volume Change Above –19 ft NAVD88	– cy/ft	–43.45 cy/ft
Volume Change Above –30 ft NAVD88	– cy/ft	–77.29 cy/ft

LEGEND:
 JULY 2021 ————
 JUNE 2020 ————

- Notes:
1. Station From North To South At Varying Intervals.
 2. All Survey Elevations In Feet Referenced to NAVD88.



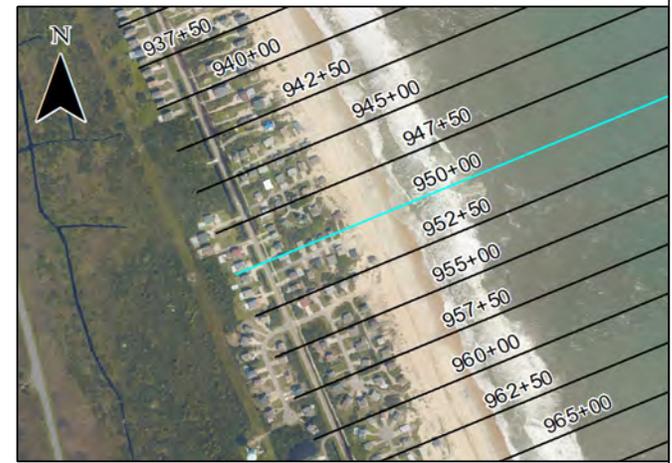


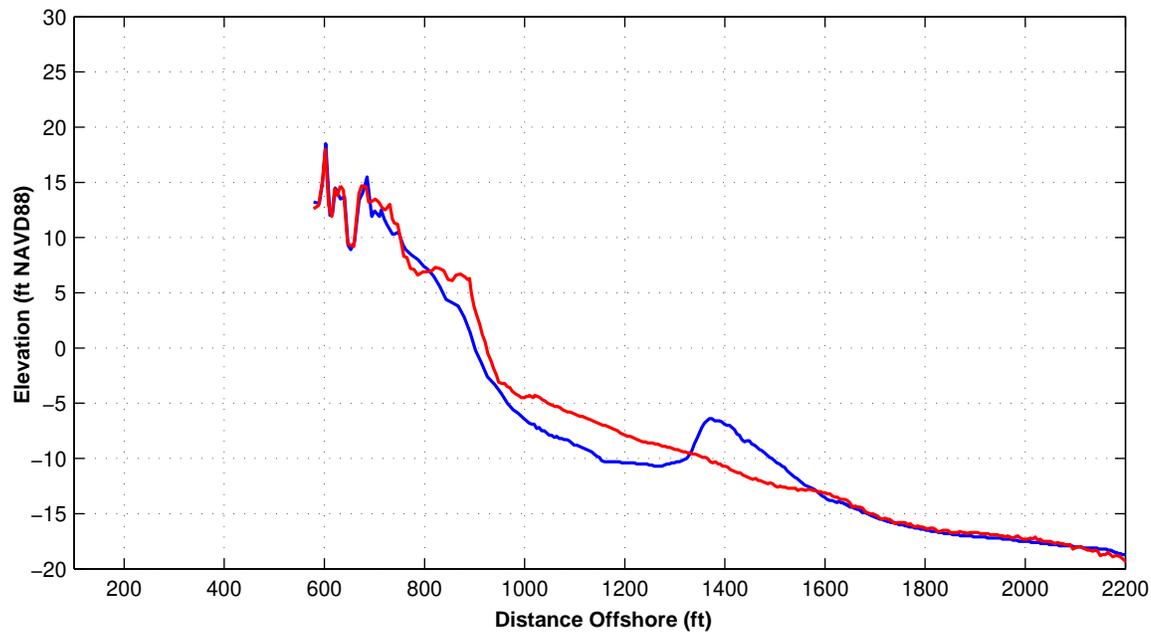
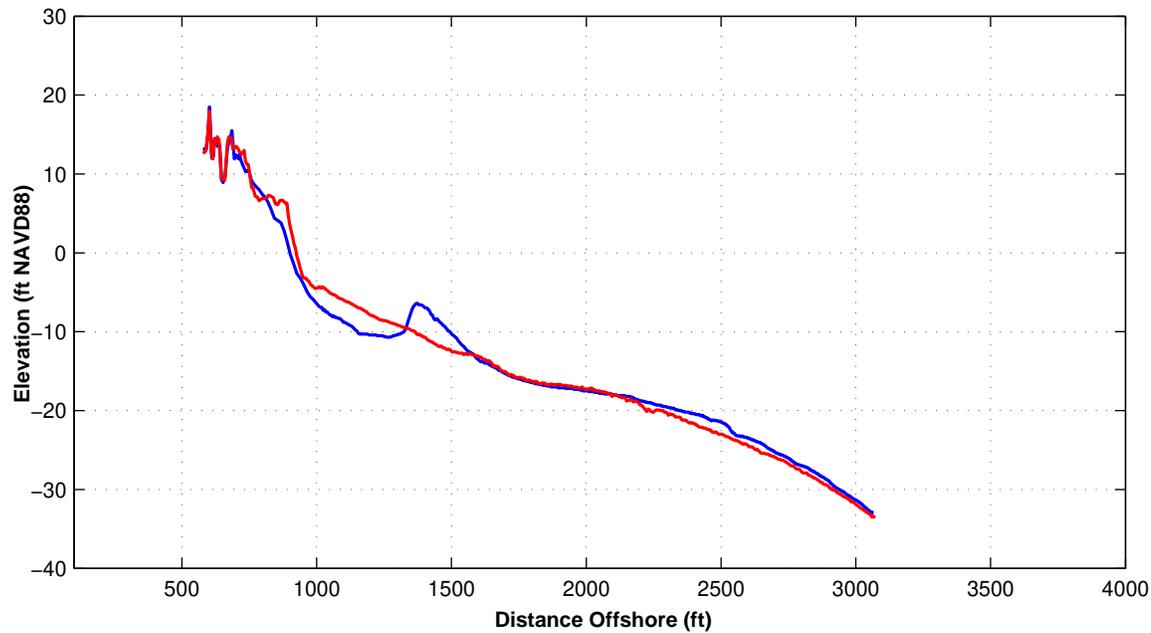
Survey Transect 950+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	-126.15 ft	-16.91 ft
Volume Change Above +6 ft NAVD88	6.48 cy/ft	1.68 cy/ft
Volume Change Above 1.18 ft NAVD88	-16.06 cy/ft	0.97 cy/ft
Volume Change Above -6 ft NAVD88	-48.49 cy/ft	0.93 cy/ft
Volume Change Above -14 ft NAVD88	-19.67 cy/ft	0.22 cy/ft
Volume Change Above -19 ft NAVD88	9.59 cy/ft	9.37 cy/ft
Volume Change Above -30 ft NAVD88	-15.98 cy/ft	11.78 cy/ft

LEGEND:

JULY 2021	—	AUGUST 2019	—
JUNE 2020	—	MAY 2018	—

- Notes:
1. Station From North To South At Varying Intervals.
 2. All Survey Elevations In Feet Referenced to NAVD88.

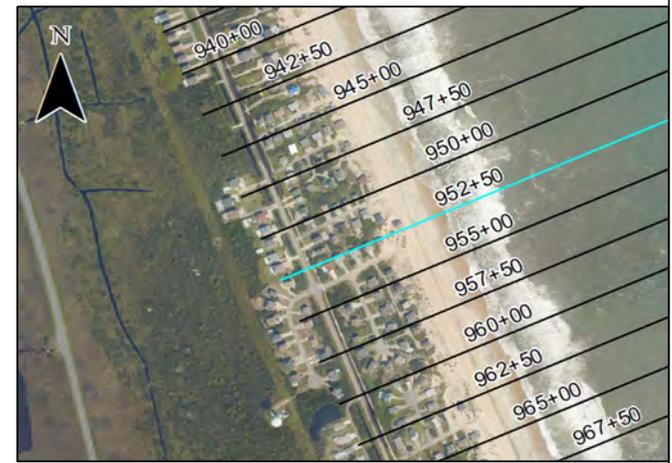


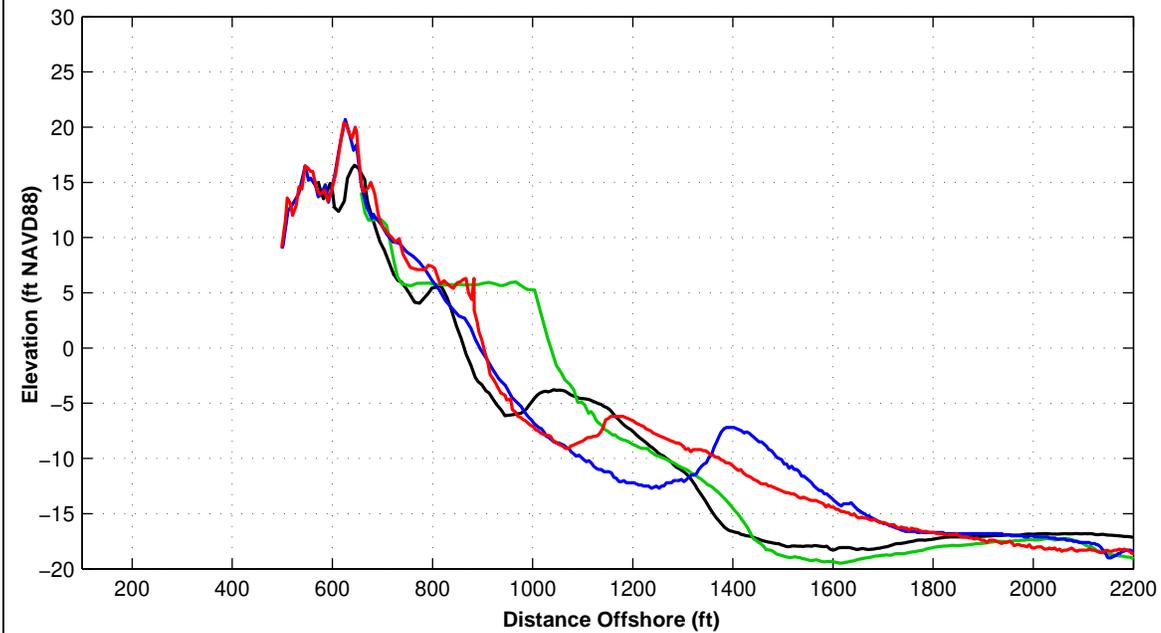
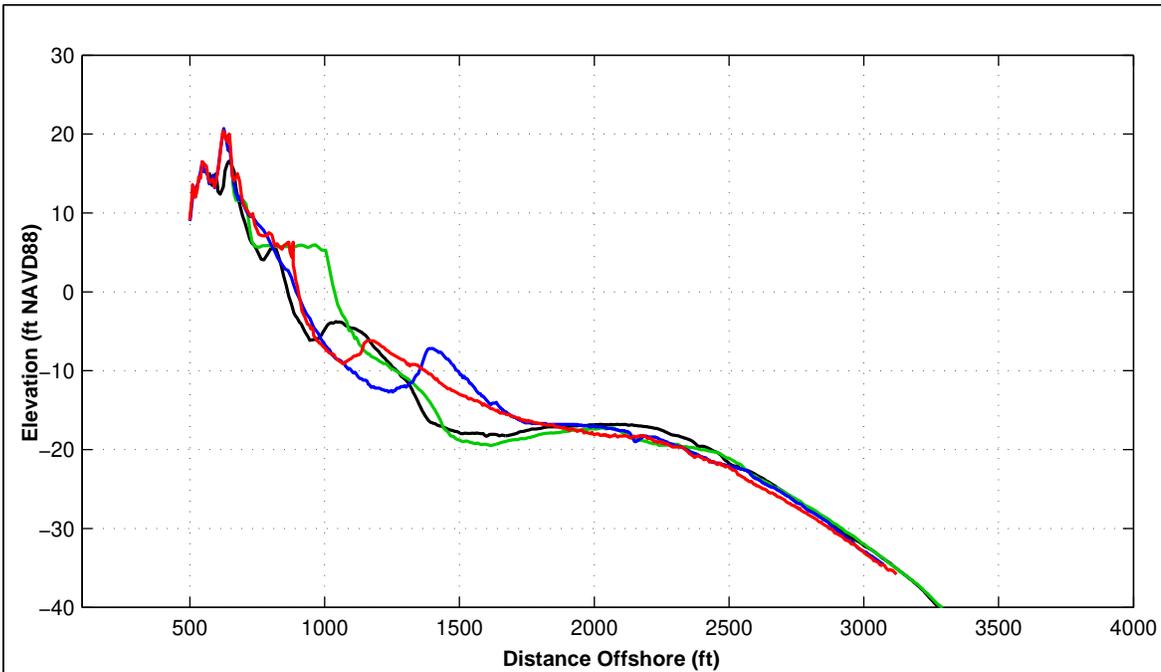


Survey Transect 952+50	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	– ft	23.28 ft
Volume Change Above +6 ft NAVD88	– cy/ft	2.55 cy/ft
Volume Change Above 1.18 ft NAVD88	– cy/ft	9.53 cy/ft
Volume Change Above –6 ft NAVD88	– cy/ft	19.28 cy/ft
Volume Change Above –14 ft NAVD88	– cy/ft	23.39 cy/ft
Volume Change Above –19 ft NAVD88	– cy/ft	25.93 cy/ft
Volume Change Above –30 ft NAVD88	– cy/ft	0.89 cy/ft

LEGEND:
 JULY 2021 ————
 JUNE 2020 ————

- Notes:
1. Station From North To South At Varying Intervals.
 2. All Survey Elevations In Feet Referenced to NAVD88.



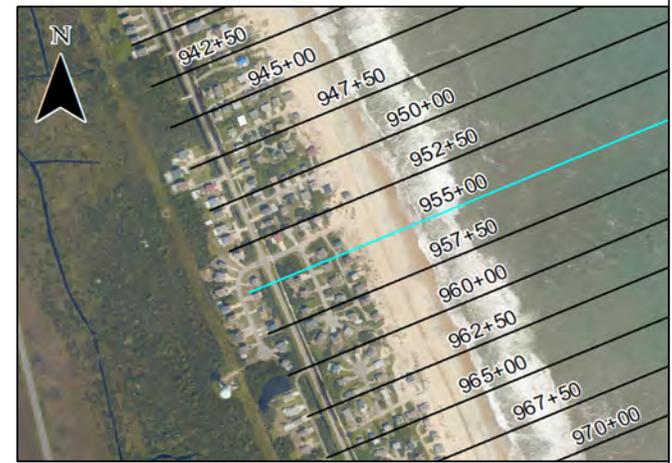


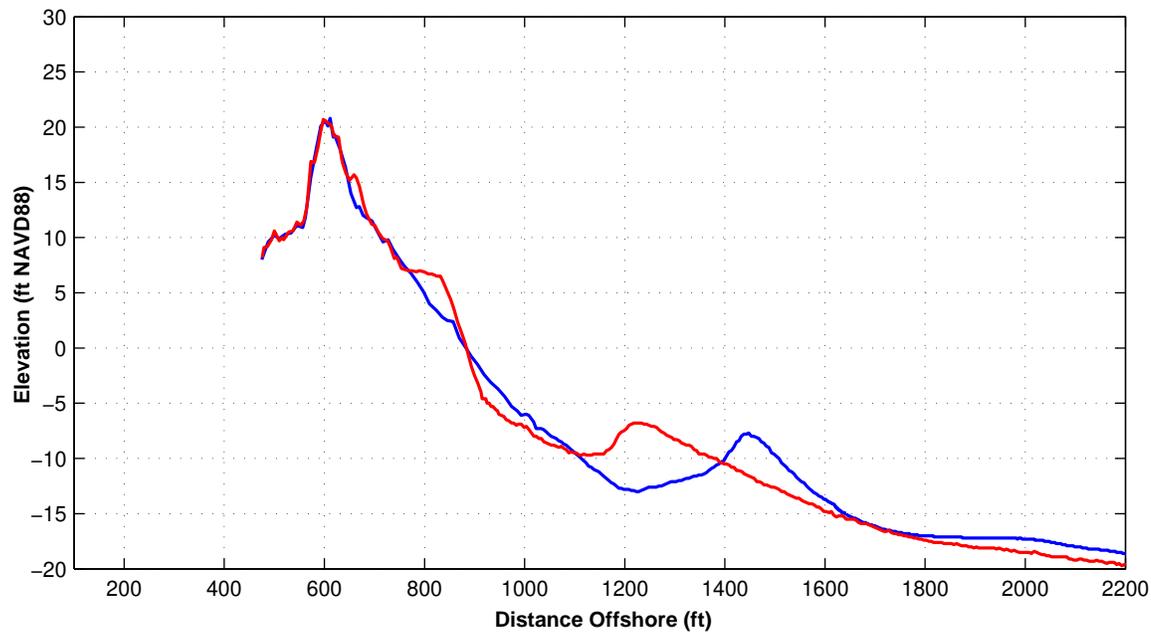
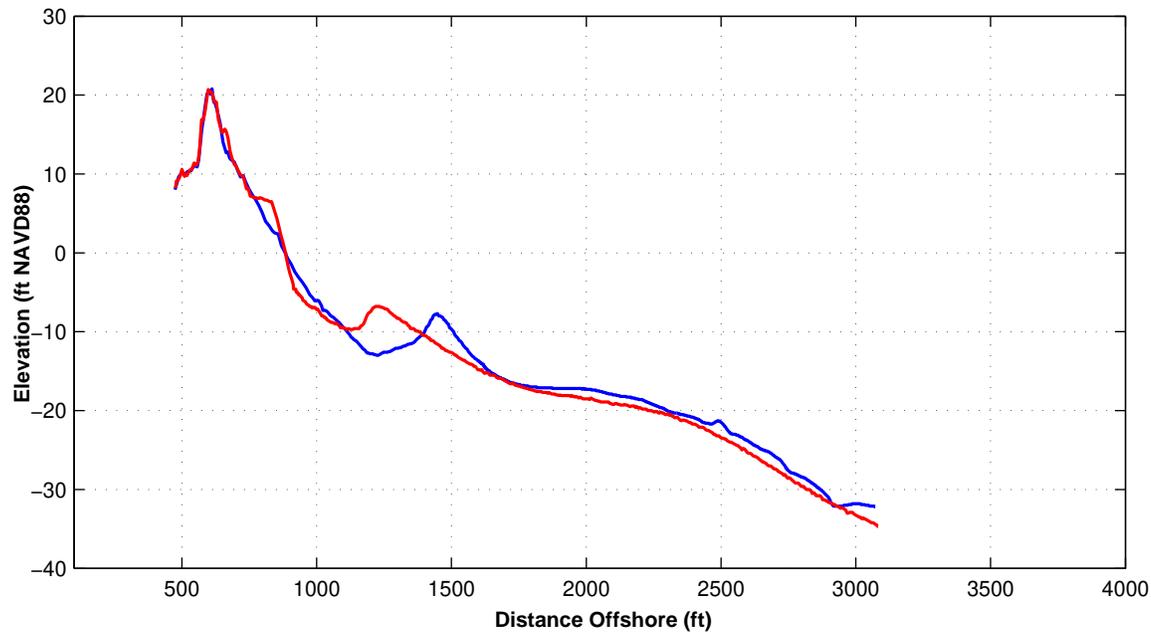
Survey Transect 955+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	-146.21 ft	12.81 ft
Volume Change Above +6 ft NAVD88	6.47 cy/ft	2.75 cy/ft
Volume Change Above 1.18 ft NAVD88	-21.66 cy/ft	9.77 cy/ft
Volume Change Above -6 ft NAVD88	-57.23 cy/ft	8.11 cy/ft
Volume Change Above -14 ft NAVD88	-53.00 cy/ft	22.04 cy/ft
Volume Change Above -19 ft NAVD88	8.79 cy/ft	12.55 cy/ft
Volume Change Above -30 ft NAVD88	-0.29 cy/ft	1.09 cy/ft

LEGEND:

JULY 2021	—	AUGUST 2019	—
JUNE 2020	—	MAY 2018	—

- Notes:
1. Station From North To South At Varying Intervals.
 2. All Survey Elevations In Feet Referenced to NAVD88.

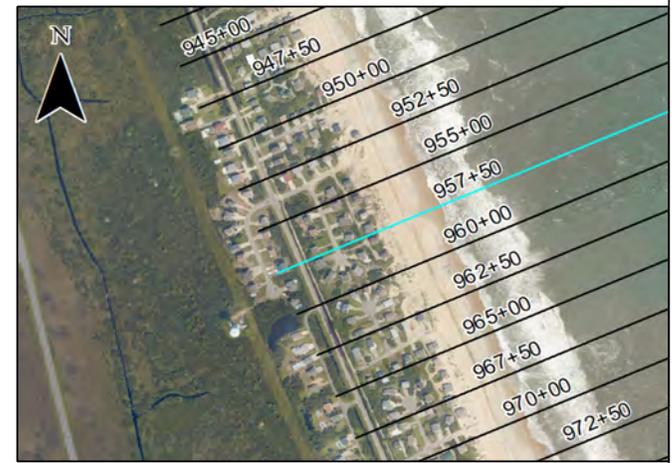


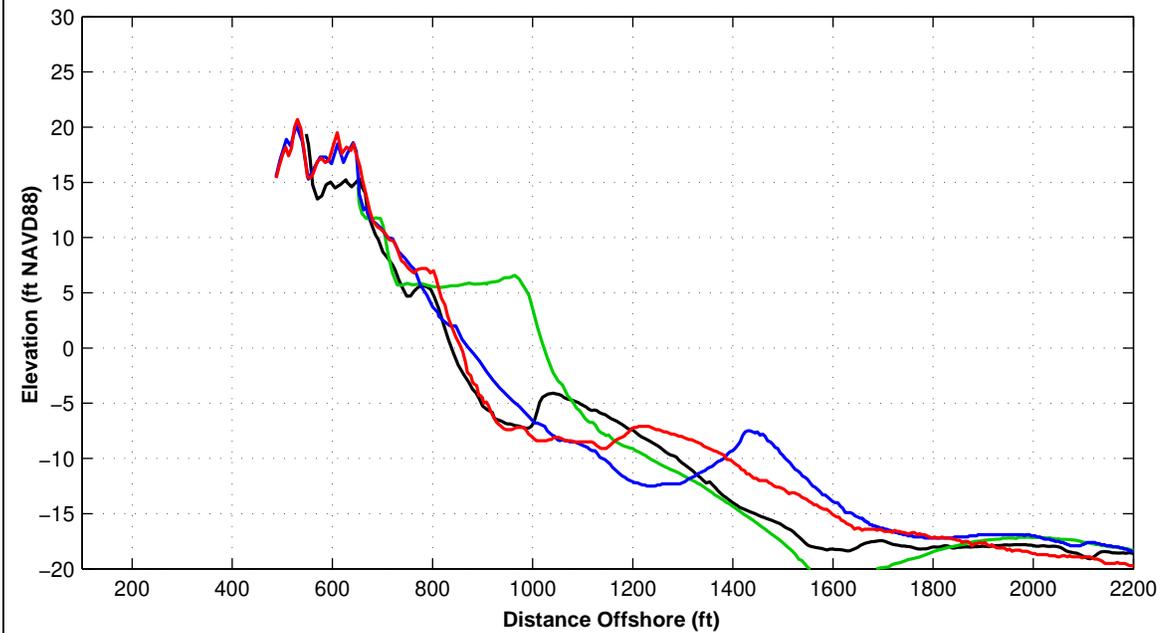
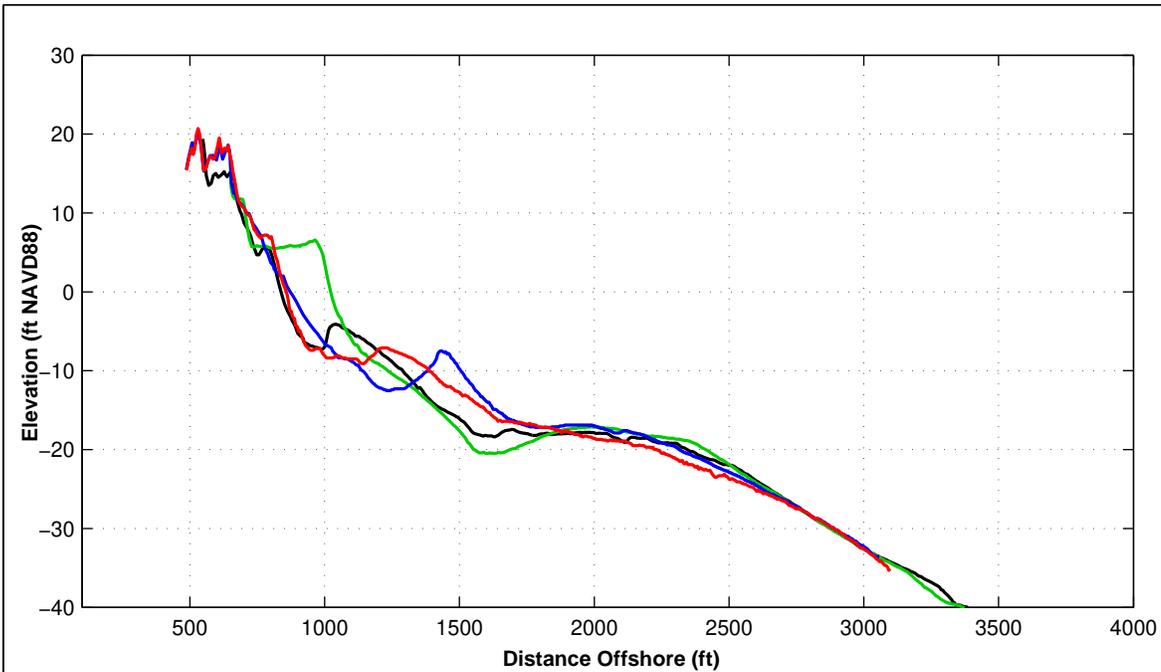


Survey Transect 957+50	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	– ft	8.35 ft
Volume Change Above +6 ft NAVD88	– cy/ft	3.40 cy/ft
Volume Change Above 1.18 ft NAVD88	– cy/ft	9.27 cy/ft
Volume Change Above –6 ft NAVD88	– cy/ft	3.80 cy/ft
Volume Change Above –14 ft NAVD88	– cy/ft	17.20 cy/ft
Volume Change Above –19 ft NAVD88	– cy/ft	1.15 cy/ft
Volume Change Above –30 ft NAVD88	– cy/ft	–26.77 cy/ft

LEGEND:
 JULY 2021 ————
 JUNE 2020 ————

- Notes:
1. Station From North To South At Varying Intervals.
 2. All Survey Elevations In Feet Referenced to NAVD88.



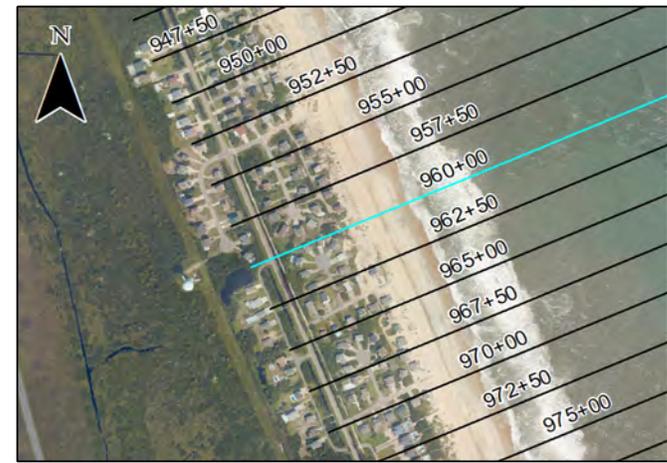


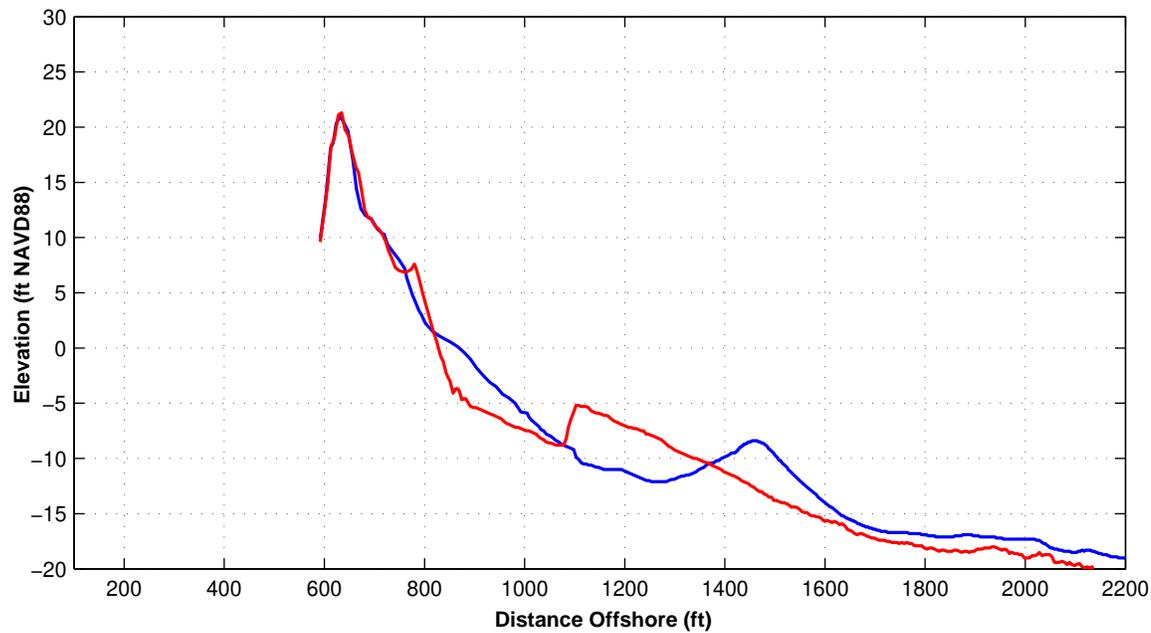
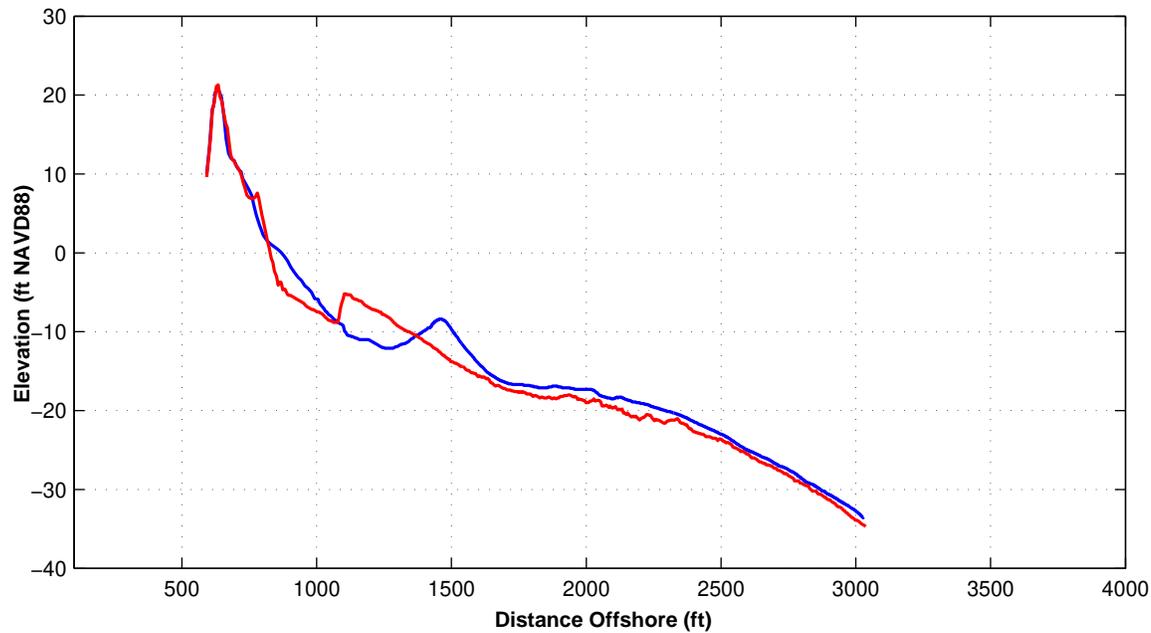
Survey Transect 960+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	-159.39 ft	-9.78 ft
Volume Change Above +6 ft NAVD88	4.39 cy/ft	3.23 cy/ft
Volume Change Above 1.18 ft NAVD88	-27.61 cy/ft	6.39 cy/ft
Volume Change Above -6 ft NAVD88	-62.99 cy/ft	-3.59 cy/ft
Volume Change Above -14 ft NAVD88	-50.99 cy/ft	4.43 cy/ft
Volume Change Above -19 ft NAVD88	-3.54 cy/ft	-13.99 cy/ft
Volume Change Above -30 ft NAVD88	-8.20 cy/ft	-32.24 cy/ft

LEGEND:

JULY 2021	—	AUGUST 2019	—
JUNE 2020	—	MAY 2018	—

- Notes:
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 2. All Survey Elevations In Feet Referenced to NAVD88.

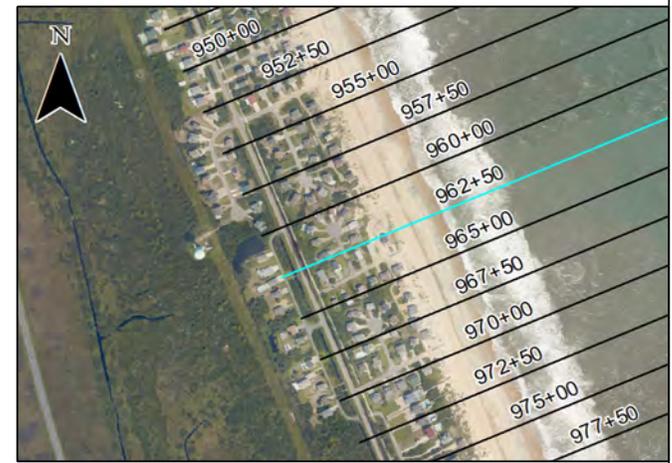


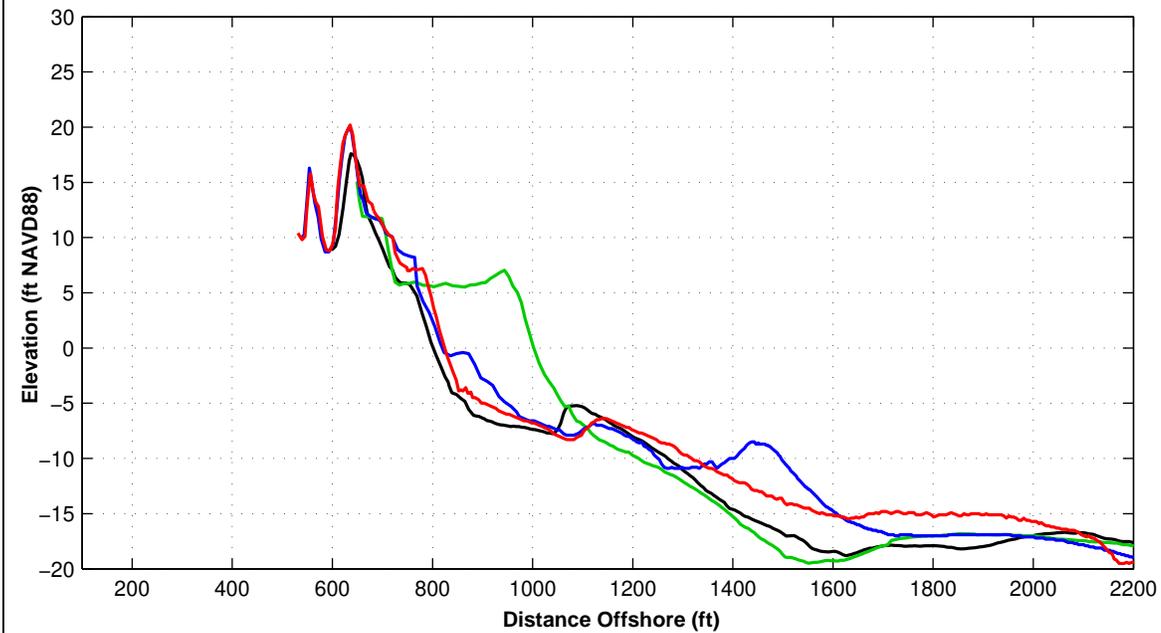
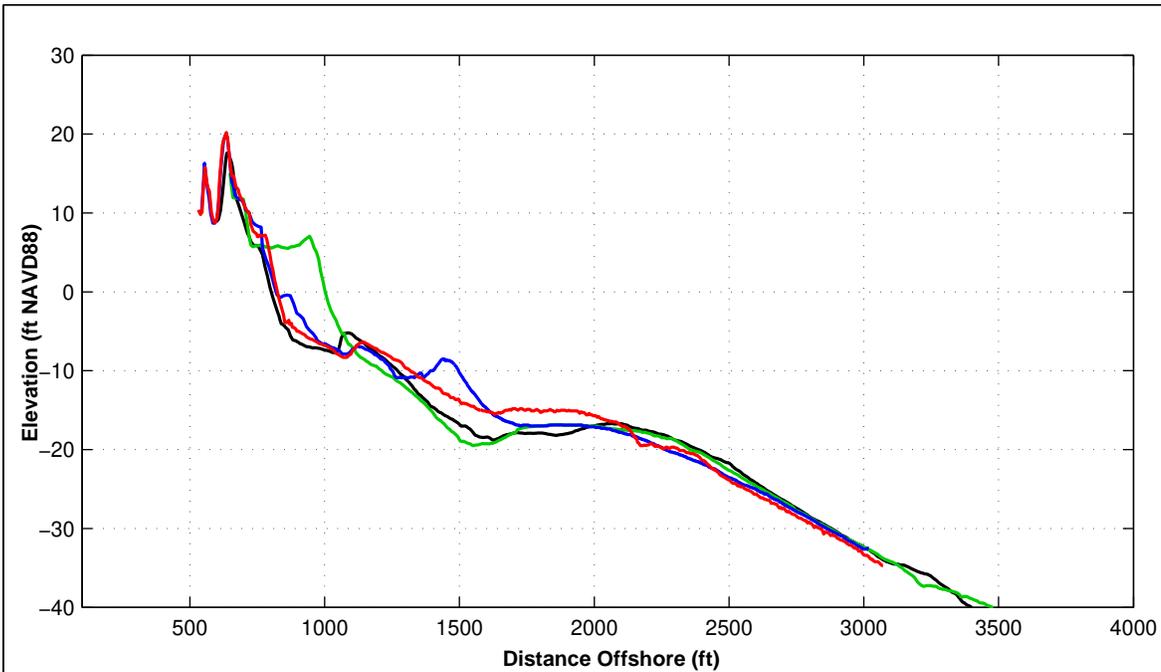


Survey Transect 962+50	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	– ft	–6.55 ft
Volume Change Above +6 ft NAVD88	– cy/ft	1.40 cy/ft
Volume Change Above 1.18 ft NAVD88	– cy/ft	4.12 cy/ft
Volume Change Above –6 ft NAVD88	– cy/ft	–12.34 cy/ft
Volume Change Above –14 ft NAVD88	– cy/ft	–1.34 cy/ft
Volume Change Above –19 ft NAVD88	– cy/ft	–25.04 cy/ft
Volume Change Above –30 ft NAVD88	– cy/ft	–52.49 cy/ft

LEGEND:
 JULY 2021 ————
 JUNE 2020 ————

- Notes:
1. Station From North To South At Varying Intervals.
 2. All Survey Elevations In Feet Referenced to NAVD88.



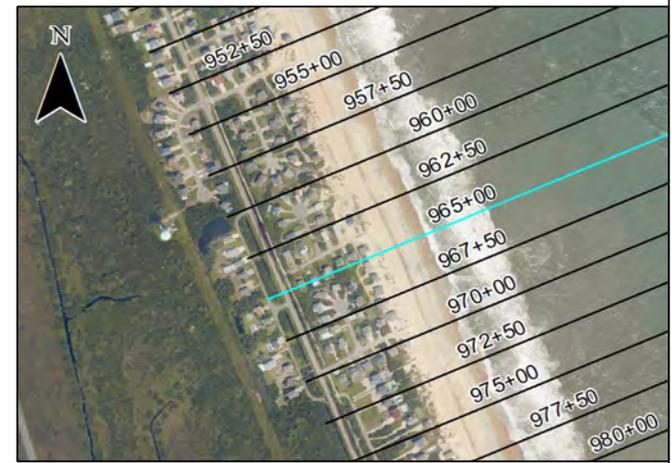


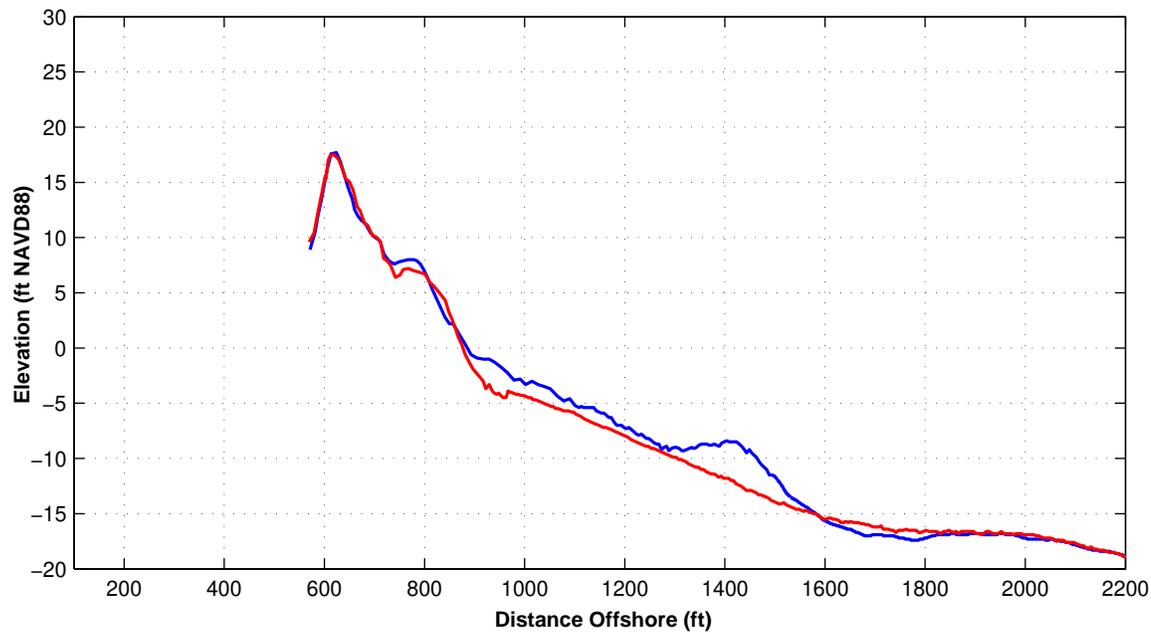
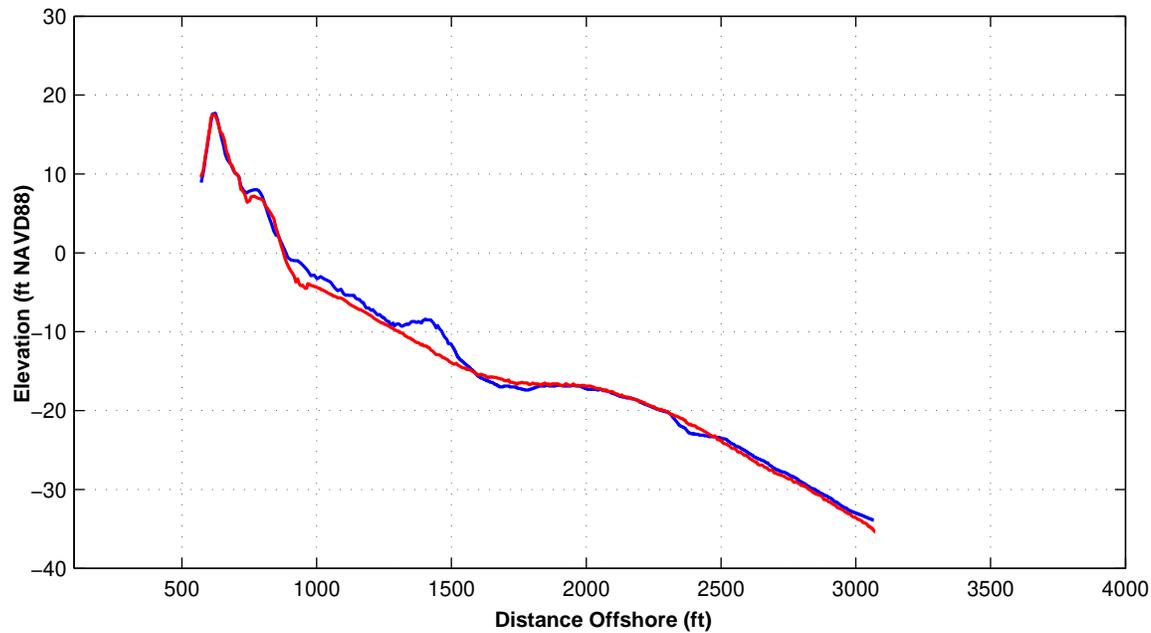
Survey Transect 965+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	-184.22 ft	6.39 ft
Volume Change Above +6 ft NAVD88	5.00 cy/ft	1.84 cy/ft
Volume Change Above 1.18 ft NAVD88	-27.17 cy/ft	4.41 cy/ft
Volume Change Above -6 ft NAVD88	-63.53 cy/ft	-5.47 cy/ft
Volume Change Above -14 ft NAVD88	-26.84 cy/ft	-19.51 cy/ft
Volume Change Above -19 ft NAVD88	8.62 cy/ft	6.67 cy/ft
Volume Change Above -30 ft NAVD88	-6.83 cy/ft	1.38 cy/ft

LEGEND:

JULY 2021	—	AUGUST 2019	—
JUNE 2020	—	MAY 2018	—

- Notes:
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 2. All Survey Elevations In Feet Referenced to NAVD88.

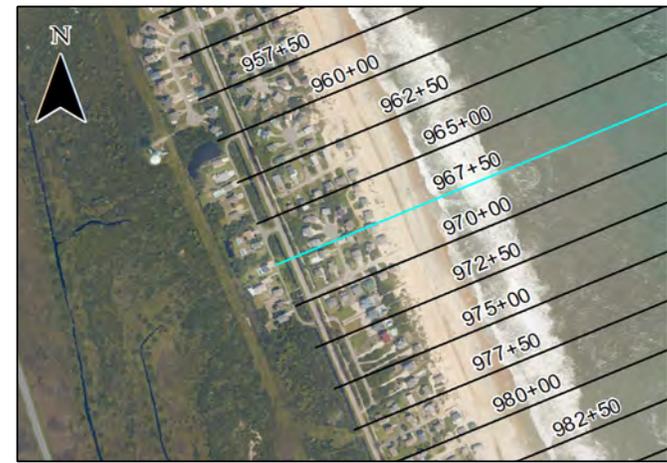


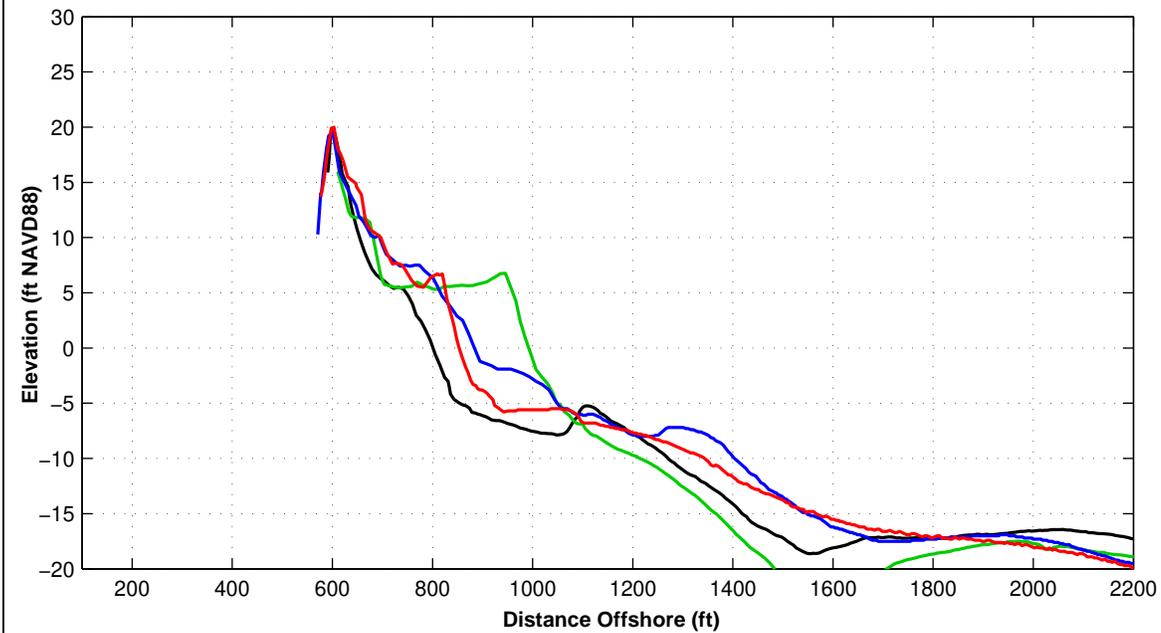
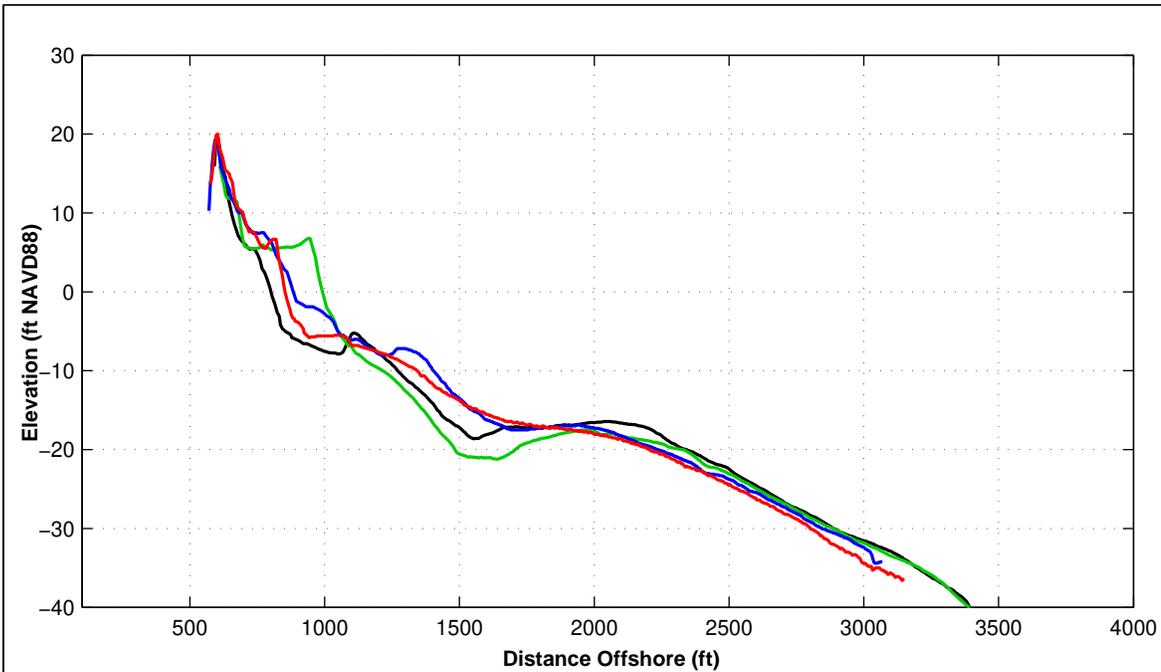


Survey Transect 967+50	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	– ft	–4.26 ft
Volume Change Above +6 ft NAVD88	– cy/ft	–1.45 cy/ft
Volume Change Above 1.18 ft NAVD88	– cy/ft	0.05 cy/ft
Volume Change Above –6 ft NAVD88	– cy/ft	–14.15 cy/ft
Volume Change Above –14 ft NAVD88	– cy/ft	–40.27 cy/ft
Volume Change Above –19 ft NAVD88	– cy/ft	–33.65 cy/ft
Volume Change Above –30 ft NAVD88	– cy/ft	–35.91 cy/ft

LEGEND:
 JULY 2021 ————
 JUNE 2020 ————

- Notes:
1. Station From North To South At Varying Intervals.
 2. All Survey Elevations In Feet Referenced to NAVD88.



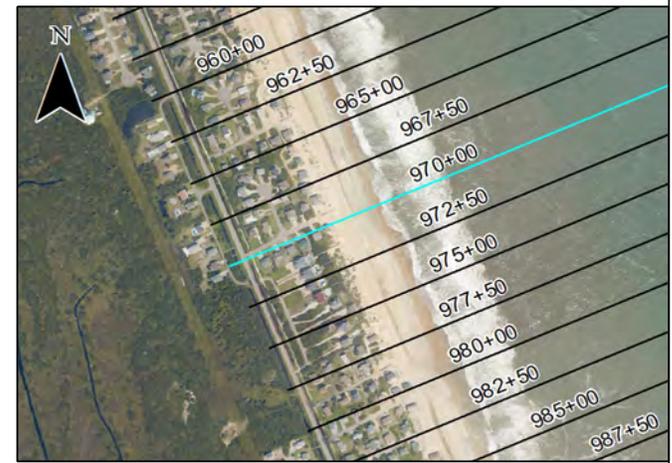


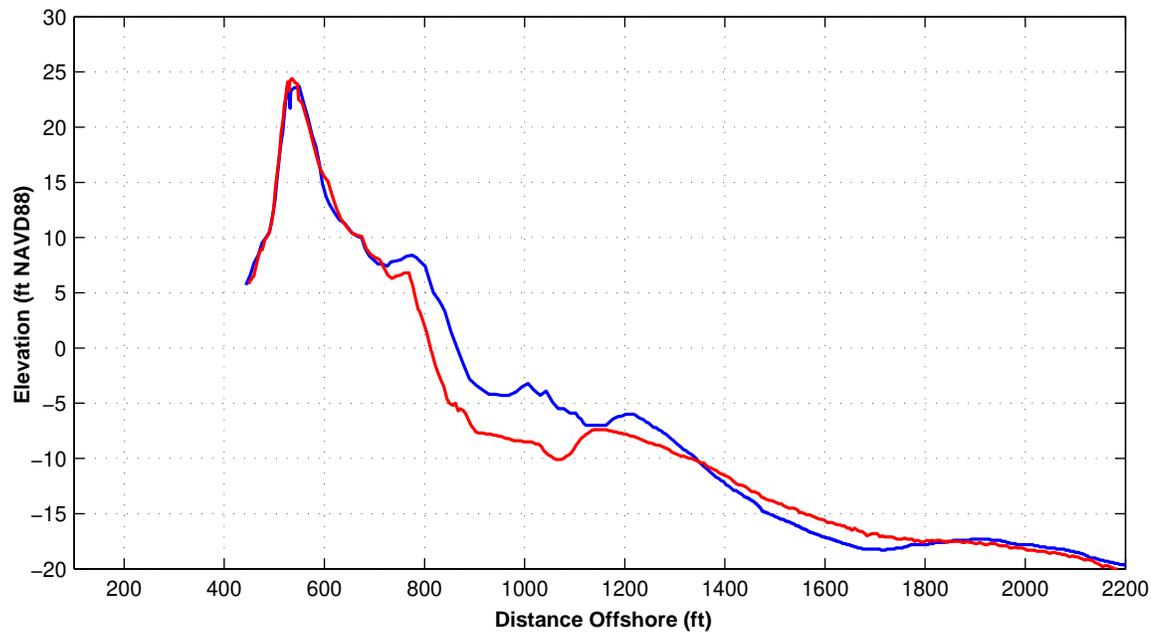
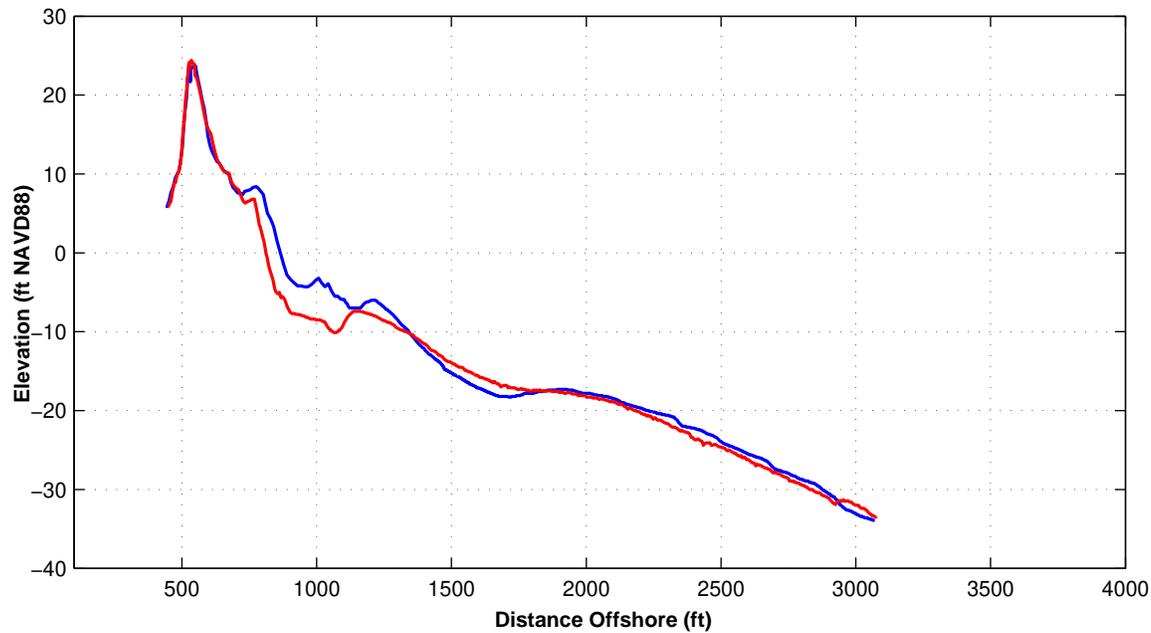
Survey Transect 970+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	-110.19 ft	-26.41 ft
Volume Change Above +6 ft NAVD88	7.45 cy/ft	2.08 cy/ft
Volume Change Above 1.18 ft NAVD88	-12.81 cy/ft	0.88 cy/ft
Volume Change Above -6 ft NAVD88	-26.17 cy/ft	-20.18 cy/ft
Volume Change Above -14 ft NAVD88	22.33 cy/ft	-36.10 cy/ft
Volume Change Above -19 ft NAVD88	75.83 cy/ft	-35.85 cy/ft
Volume Change Above -30 ft NAVD88	73.86 cy/ft	-50.18 cy/ft

LEGEND:

JULY 2021	—	AUGUST 2019	—
JUNE 2020	—	MAY 2018	—

- Notes:
1. Station From North To South At Varying Intervals.
 2. All Survey Elevations In Feet Referenced to NAVD88.

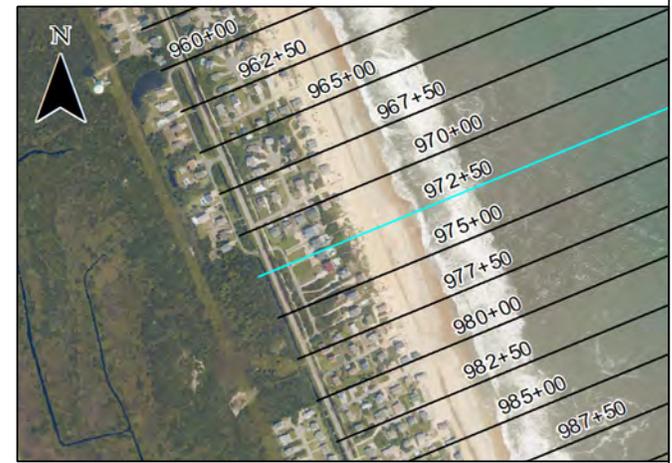


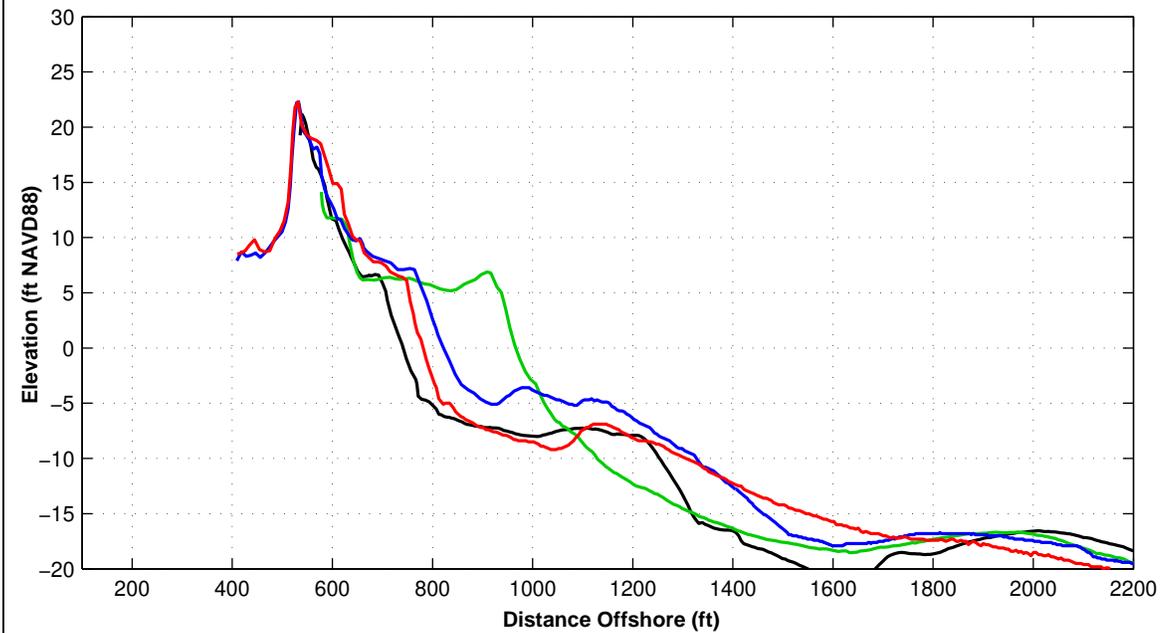
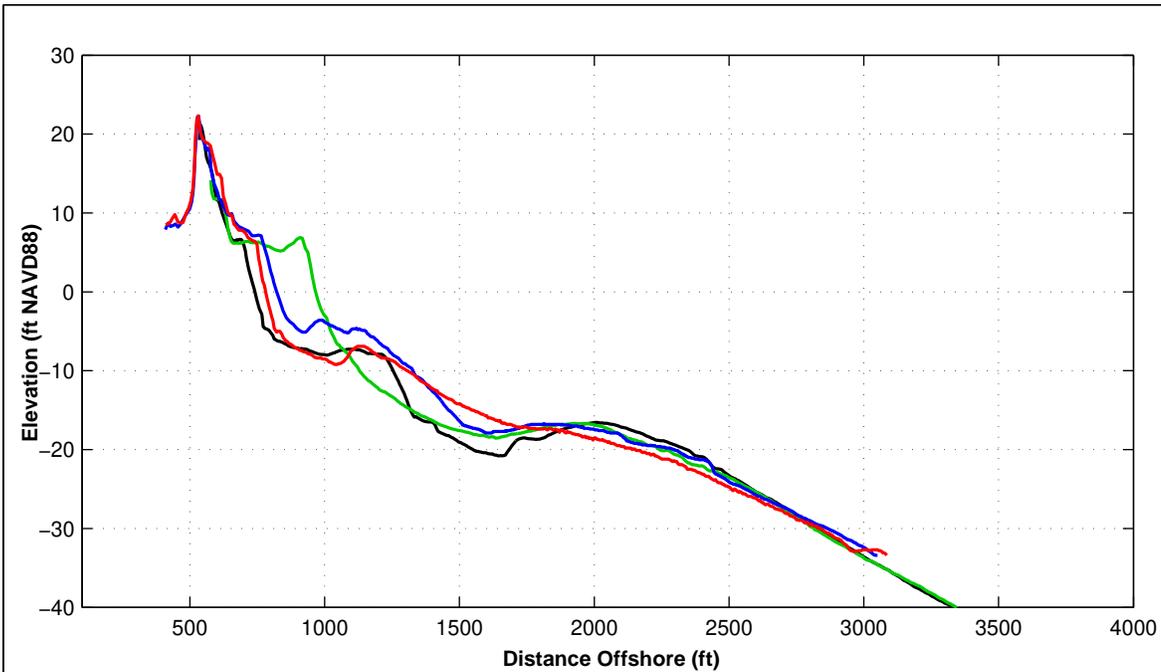


Survey Transect 972+50	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	– ft	–49.91 ft
Volume Change Above +6 ft NAVD88	– cy/ft	–3.25 cy/ft
Volume Change Above 1.18 ft NAVD88	– cy/ft	–11.43 cy/ft
Volume Change Above –6 ft NAVD88	– cy/ft	–37.83 cy/ft
Volume Change Above –14 ft NAVD88	– cy/ft	–65.93 cy/ft
Volume Change Above –19 ft NAVD88	– cy/ft	–54.56 cy/ft
Volume Change Above –30 ft NAVD88	– cy/ft	–76.57 cy/ft

LEGEND:
 JULY 2021 ————
 JUNE 2020 ————

- Notes:
 1. Station From North To South At Varying Intervals.
 2. All Survey Elevations In Feet Referenced to NAVD88.



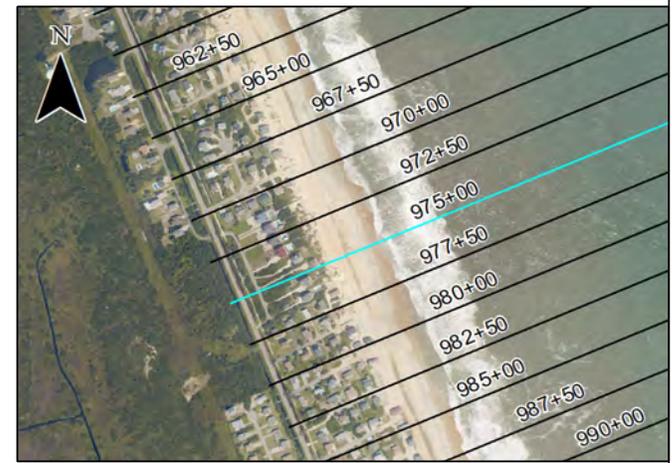


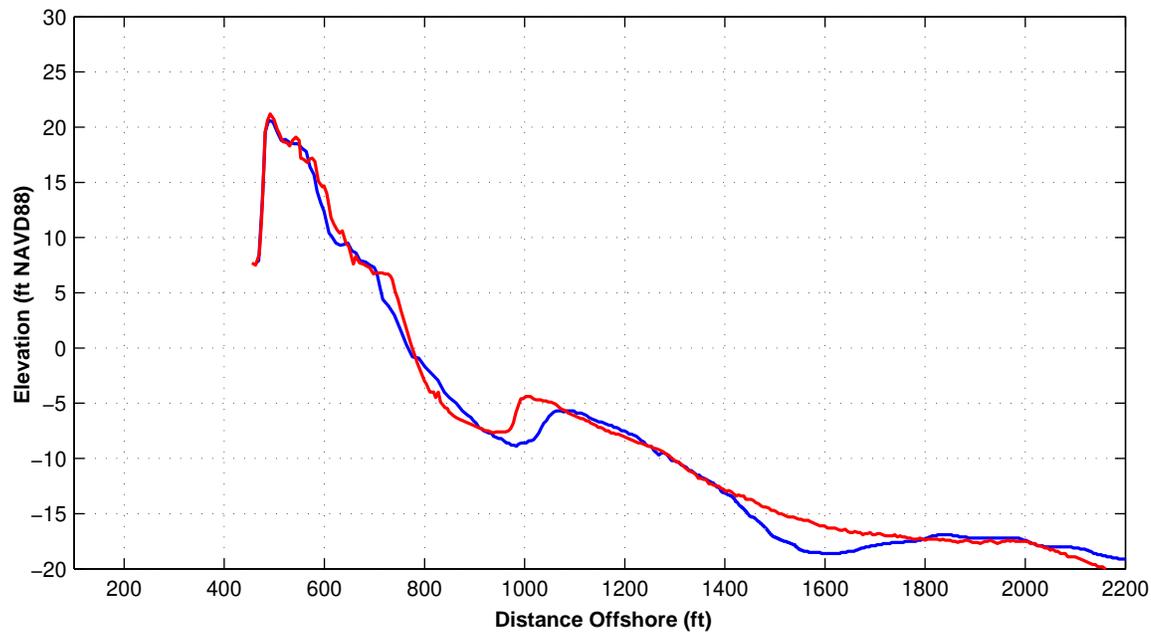
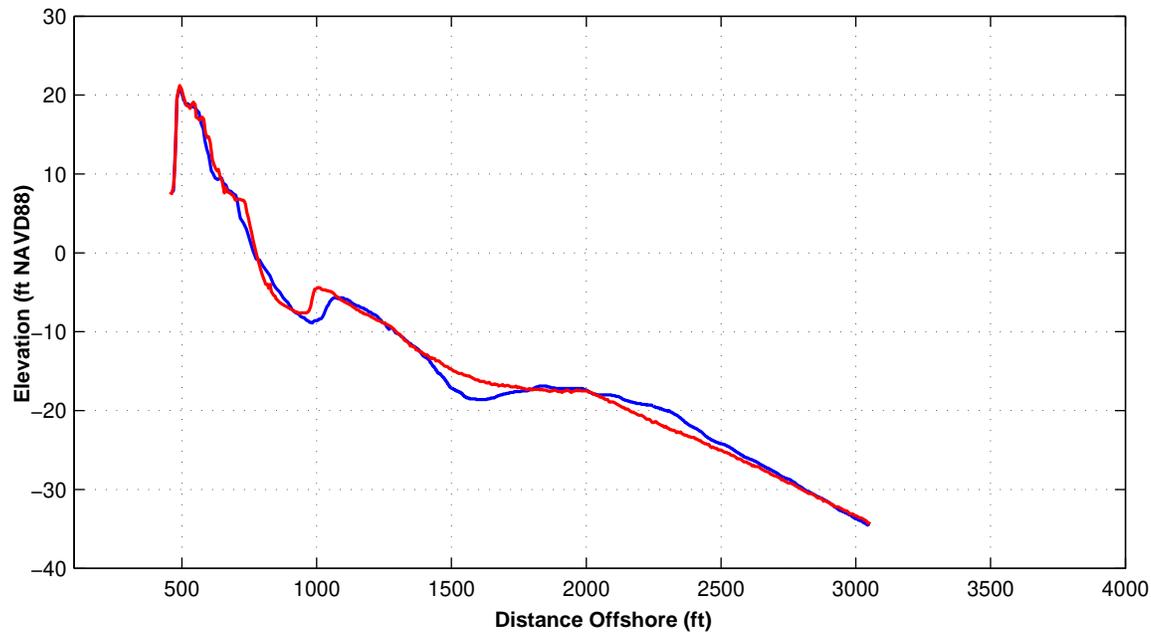
Survey Transect 975+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	-147.44 ft	-38.72 ft
Volume Change Above +6 ft NAVD88	9.05 cy/ft	3.19 cy/ft
Volume Change Above 1.18 ft NAVD88	-16.29 cy/ft	-2.82 cy/ft
Volume Change Above -6 ft NAVD88	-39.17 cy/ft	-31.00 cy/ft
Volume Change Above -14 ft NAVD88	14.11 cy/ft	-57.38 cy/ft
Volume Change Above -19 ft NAVD88	33.02 cy/ft	-53.33 cy/ft
Volume Change Above -30 ft NAVD88	36.94 cy/ft	-79.50 cy/ft

LEGEND:

JULY 2021	—	AUGUST 2019	—
JUNE 2020	—	MAY 2018	—

- Notes:
1. Station From North To South At Varying Intervals.
 2. All Survey Elevations In Feet Referenced to NAVD88.



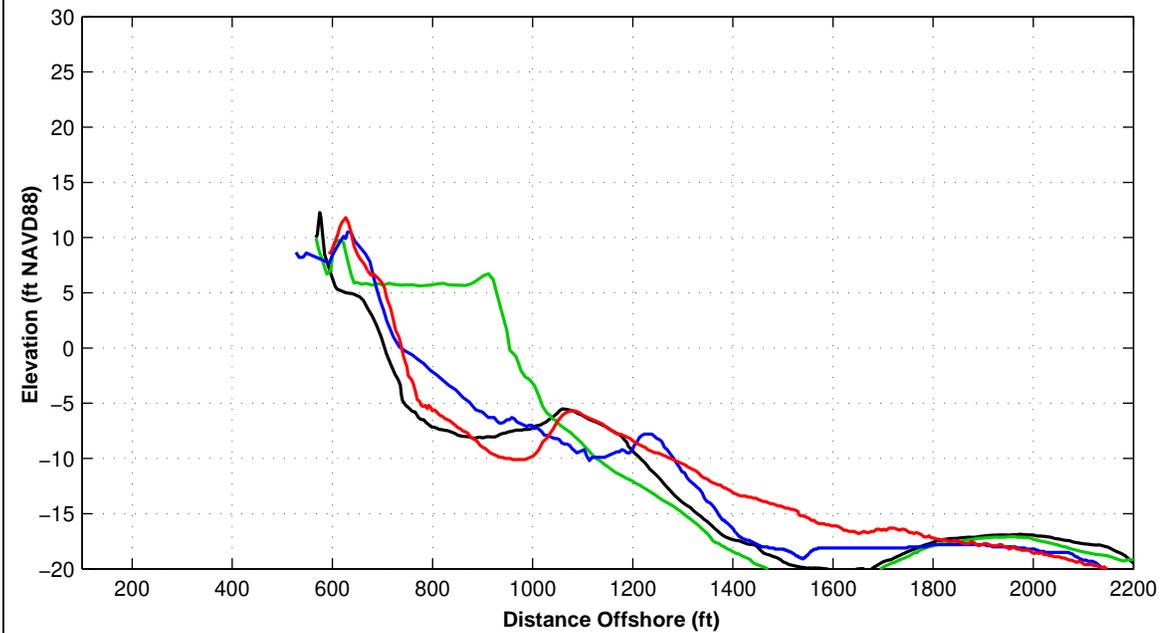
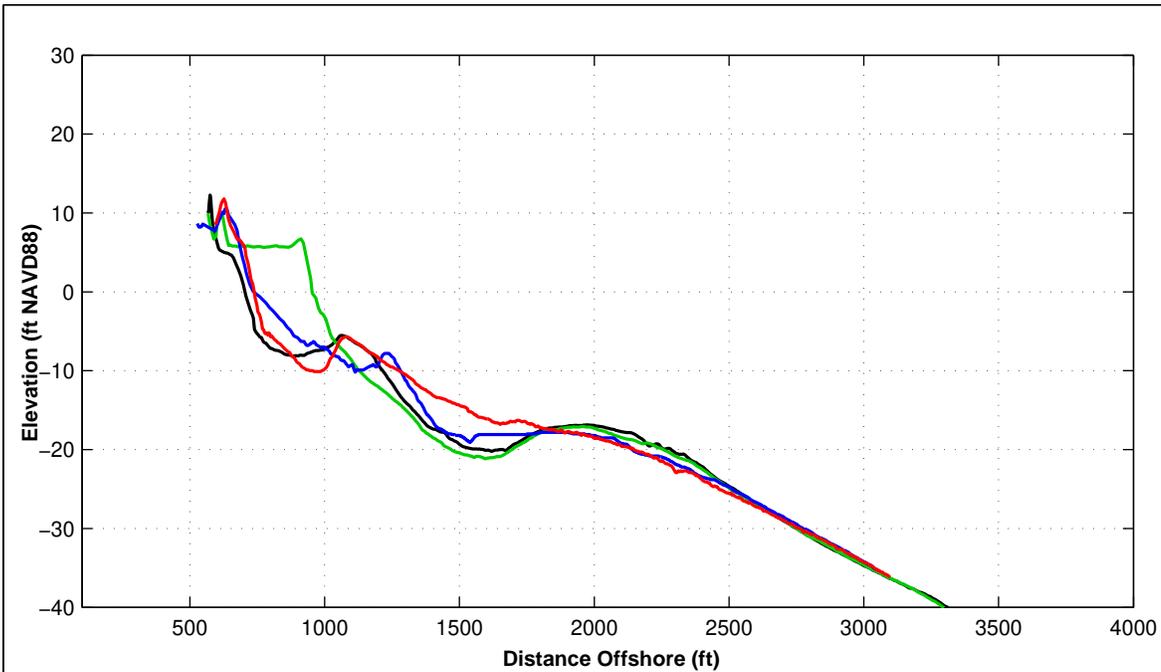


Survey Transect 977+50	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	– ft	11.30 ft
Volume Change Above +6 ft NAVD88	– cy/ft	3.99 cy/ft
Volume Change Above 1.18 ft NAVD88	– cy/ft	7.76 cy/ft
Volume Change Above –6 ft NAVD88	– cy/ft	7.80 cy/ft
Volume Change Above –14 ft NAVD88	– cy/ft	12.29 cy/ft
Volume Change Above –19 ft NAVD88	– cy/ft	28.84 cy/ft
Volume Change Above –30 ft NAVD88	– cy/ft	2.05 cy/ft

LEGEND:
 JULY 2021 ————
 JUNE 2020 ————

- Notes:
1. Station From North To South At Varying Intervals.
 2. All Survey Elevations In Feet Referenced to NAVD88.



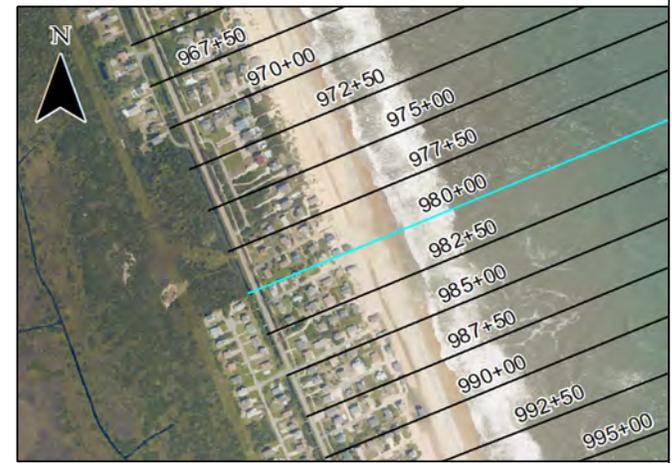


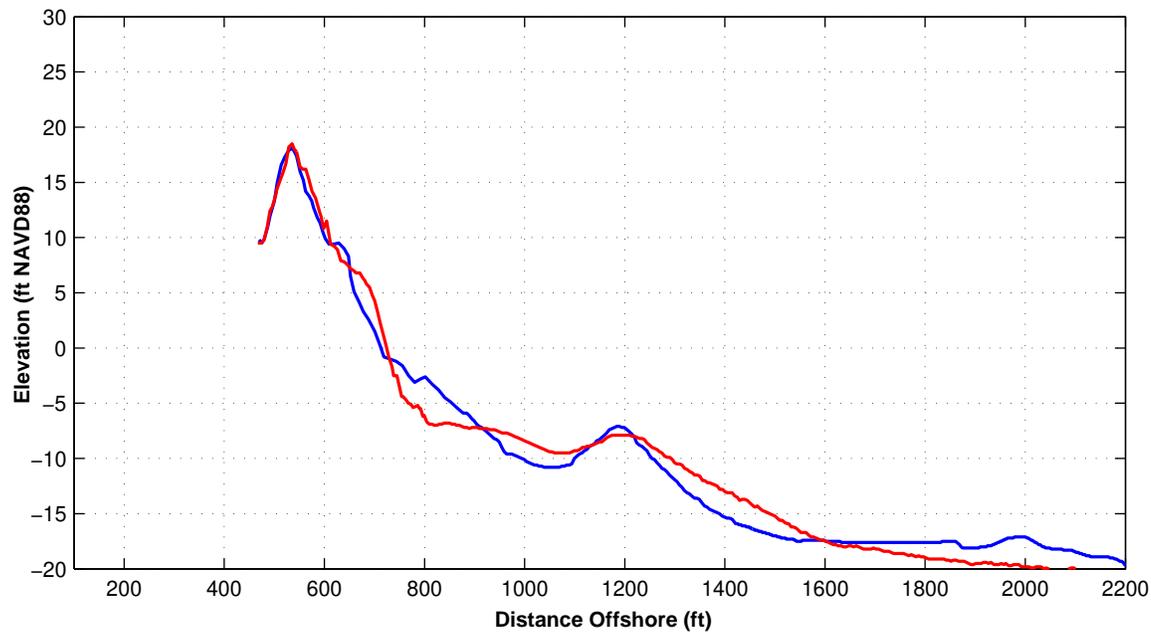
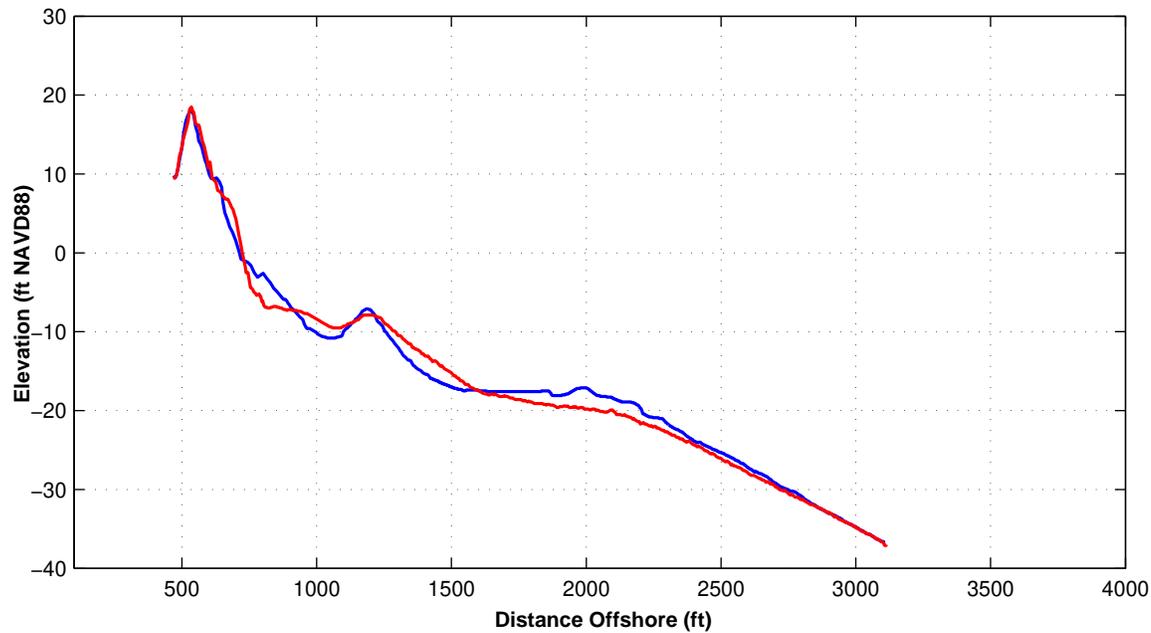
Survey Transect 980+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	-229.56 ft	10.86 ft
Volume Change Above +6 ft NAVD88	4.51 cy/ft	1.85 cy/ft
Volume Change Above 1.18 ft NAVD88	-35.28 cy/ft	4.34 cy/ft
Volume Change Above -6 ft NAVD88	-83.02 cy/ft	-8.57 cy/ft
Volume Change Above -14 ft NAVD88	-67.52 cy/ft	-7.74 cy/ft
Volume Change Above -19 ft NAVD88	-53.86 cy/ft	30.10 cy/ft
Volume Change Above -30 ft NAVD88	-48.30 cy/ft	19.27 cy/ft

LEGEND:

JULY 2021	—	AUGUST 2019	—
JUNE 2020	—	MAY 2018	—

- Notes:
1. Station From North To South At Varying Intervals.
 2. All Survey Elevations In Feet Referenced to NAVD88.



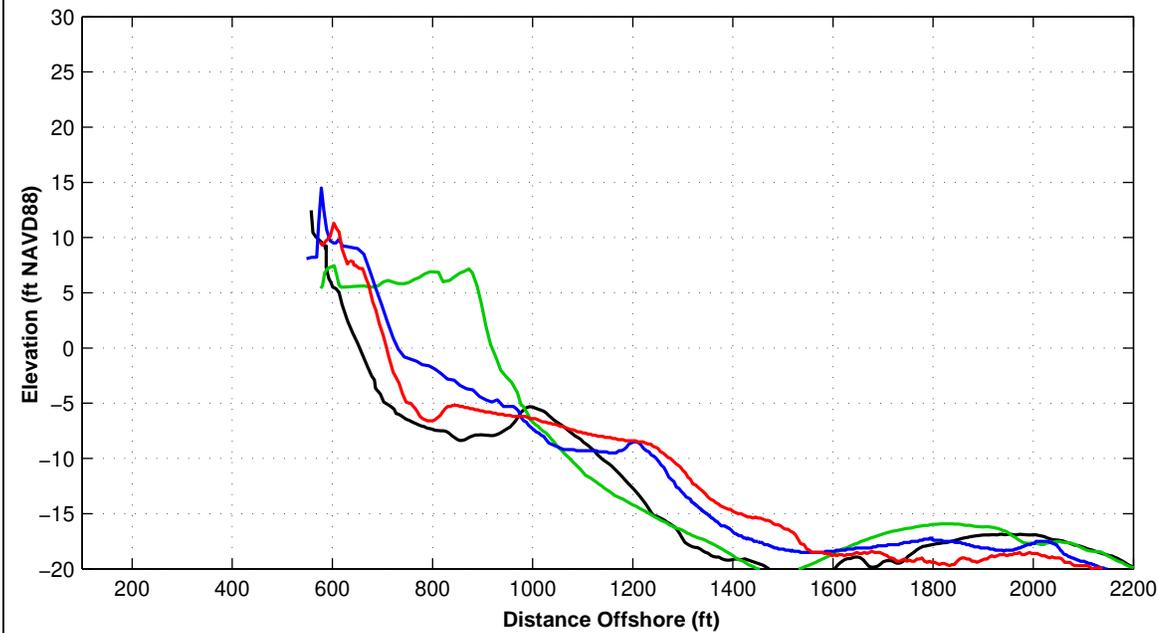
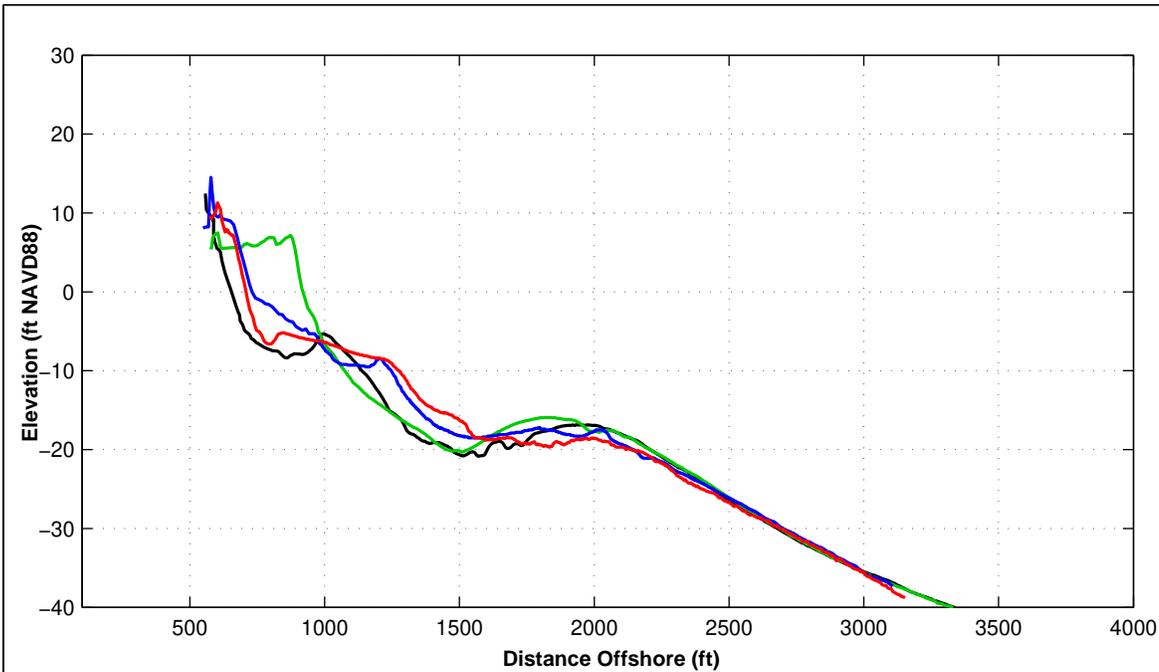


Survey Transect 982+50	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	– ft	14.64 ft
Volume Change Above +6 ft NAVD88	– cy/ft	2.58 cy/ft
Volume Change Above 1.18 ft NAVD88	– cy/ft	7.33 cy/ft
Volume Change Above –6 ft NAVD88	– cy/ft	–2.32 cy/ft
Volume Change Above –14 ft NAVD88	– cy/ft	13.03 cy/ft
Volume Change Above –19 ft NAVD88	– cy/ft	5.00 cy/ft
Volume Change Above –30 ft NAVD88	– cy/ft	–23.62 cy/ft

LEGEND:
 JULY 2021 ————
 JUNE 2020 ————

- Notes:
1. Station From North To South At Varying Intervals.
 2. All Survey Elevations In Feet Referenced to NAVD88.



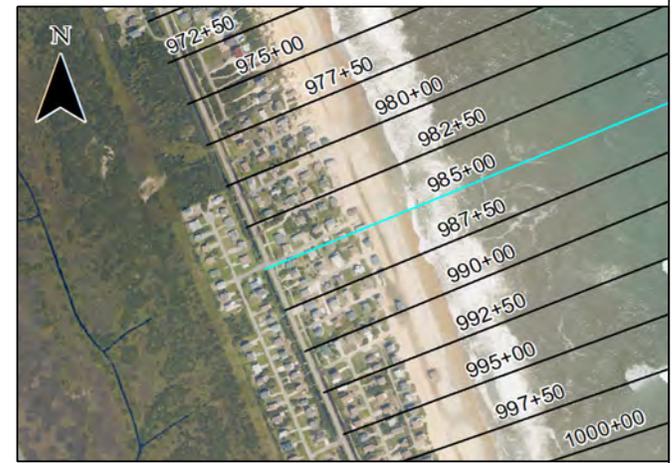


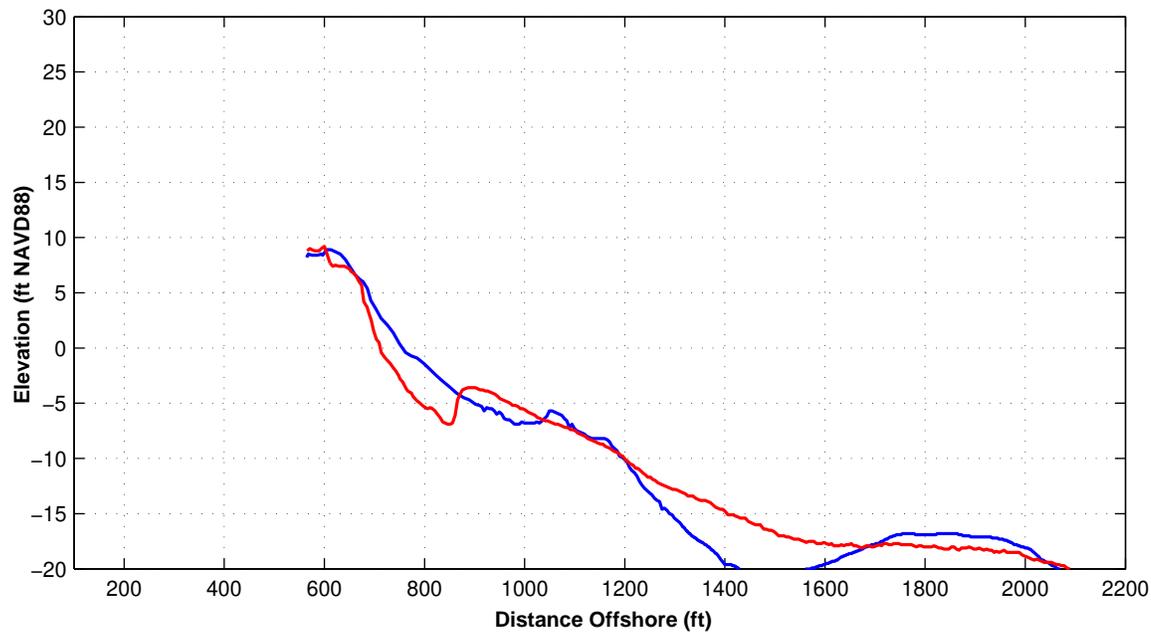
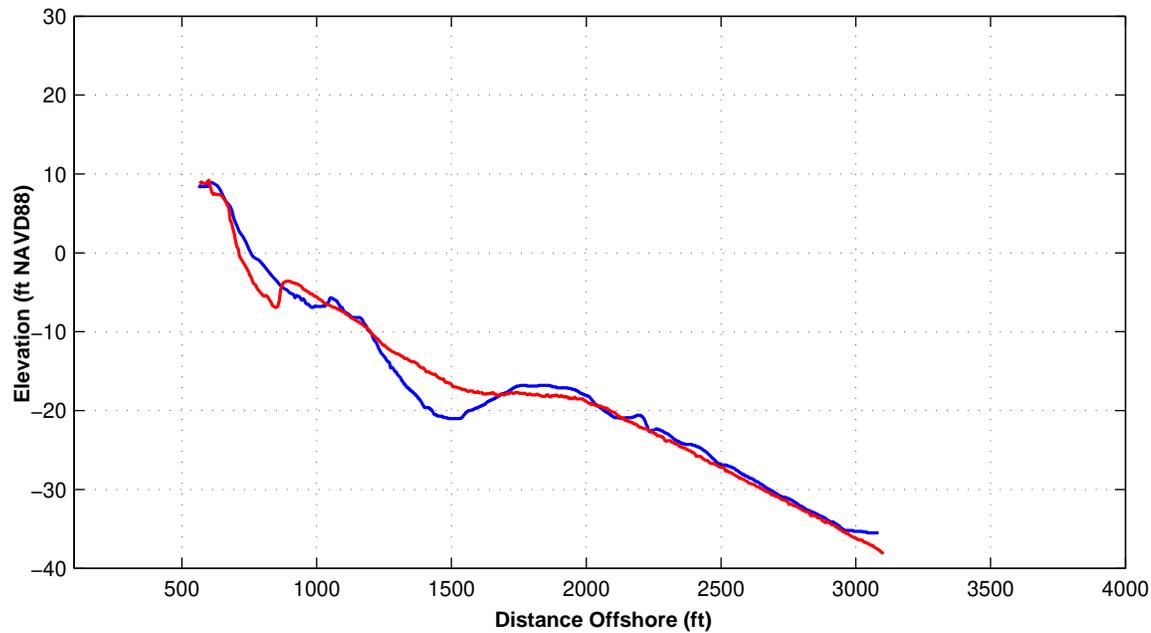
Survey Transect 985+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	-191.70 ft	-18.00 ft
Volume Change Above +6 ft NAVD88	7.41 cy/ft	-4.17 cy/ft
Volume Change Above 1.18 ft NAVD88	-26.43 cy/ft	-6.93 cy/ft
Volume Change Above -6 ft NAVD88	-58.68 cy/ft	-30.91 cy/ft
Volume Change Above -14 ft NAVD88	-31.93 cy/ft	-13.77 cy/ft
Volume Change Above -19 ft NAVD88	-30.16 cy/ft	-16.84 cy/ft
Volume Change Above -30 ft NAVD88	-33.58 cy/ft	-27.95 cy/ft

LEGEND:

JULY 2021	—	AUGUST 2019	—
JUNE 2020	—	MAY 2018	—

- Notes:
1. Station From North To South At Varying Intervals.
 2. All Survey Elevations In Feet Referenced to NAVD88.



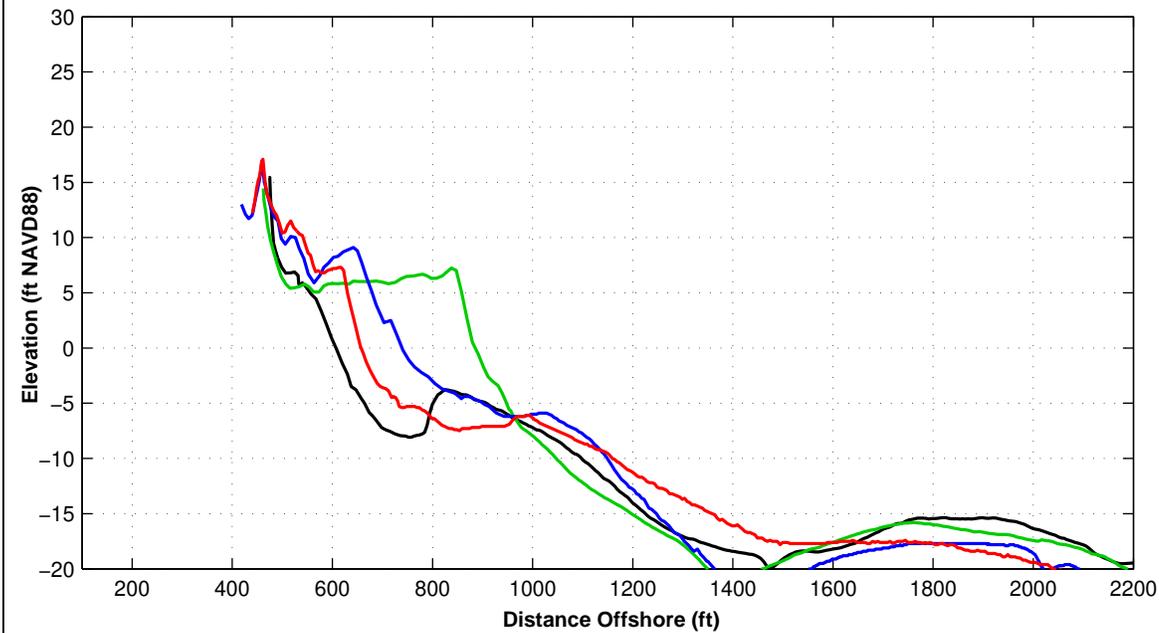
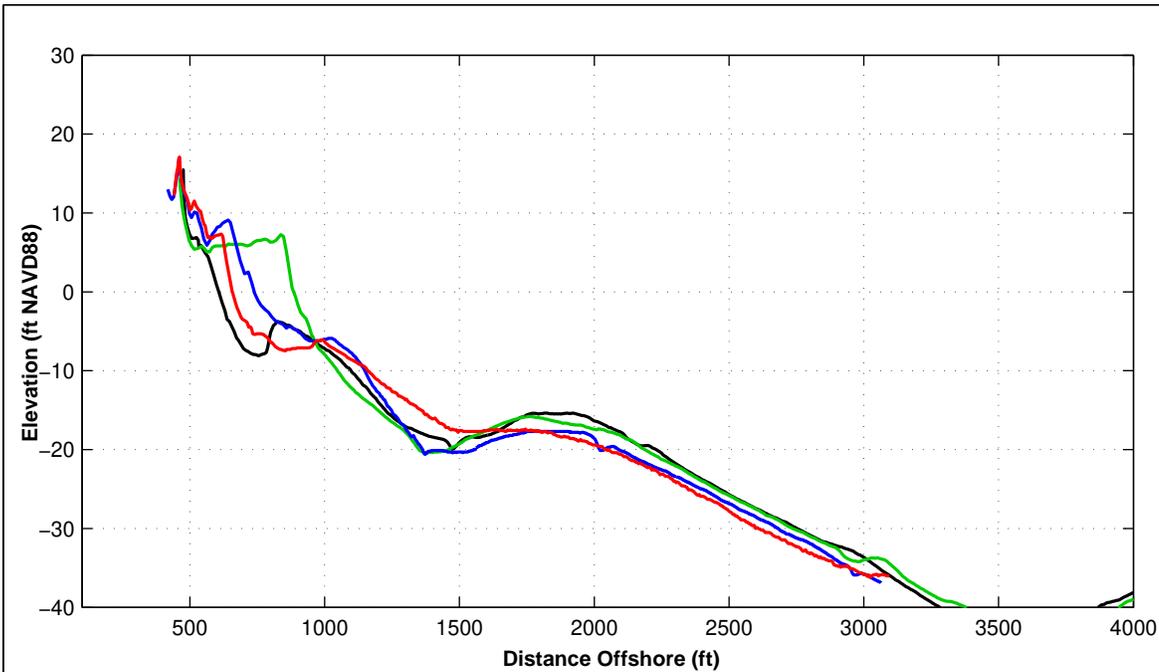


Survey Transect 987+50	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	– ft	–39.07 ft
Volume Change Above +6 ft NAVD88	– cy/ft	–1.73 cy/ft
Volume Change Above 1.18 ft NAVD88	– cy/ft	–5.17 cy/ft
Volume Change Above –6 ft NAVD88	– cy/ft	–17.18 cy/ft
Volume Change Above –14 ft NAVD88	– cy/ft	–12.78 cy/ft
Volume Change Above –19 ft NAVD88	– cy/ft	9.42 cy/ft
Volume Change Above –30 ft NAVD88	– cy/ft	7.81 cy/ft

LEGEND:
 JULY 2021 ————
 JUNE 2020 ————

- Notes:
1. Station From North To South At Varying Intervals.
 2. All Survey Elevations In Feet Referenced to NAVD88.





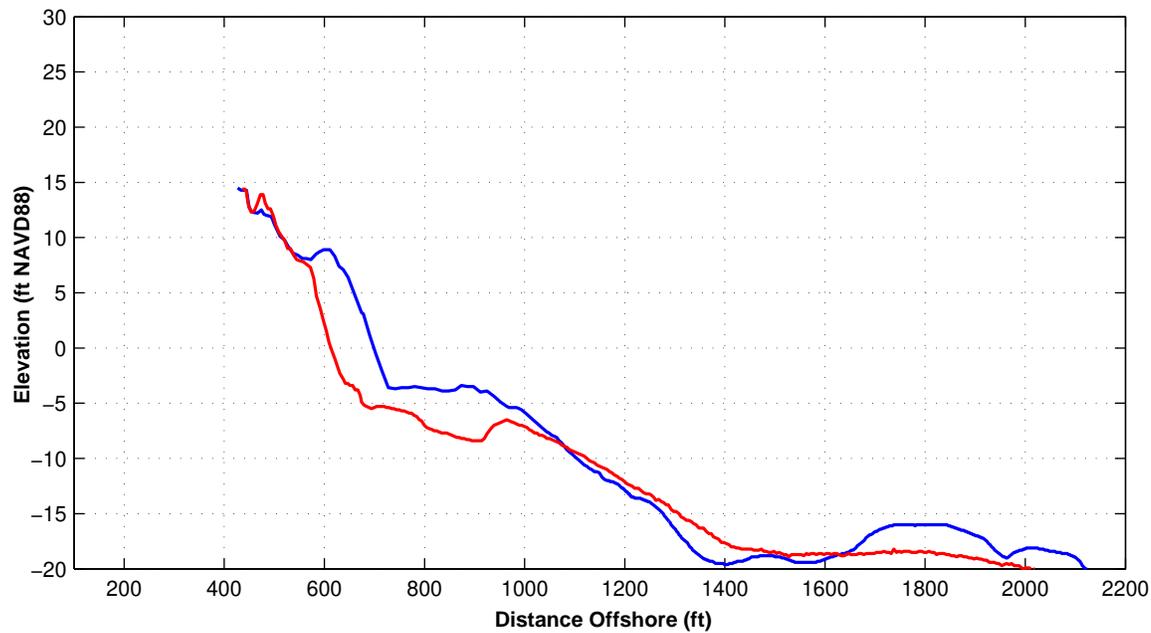
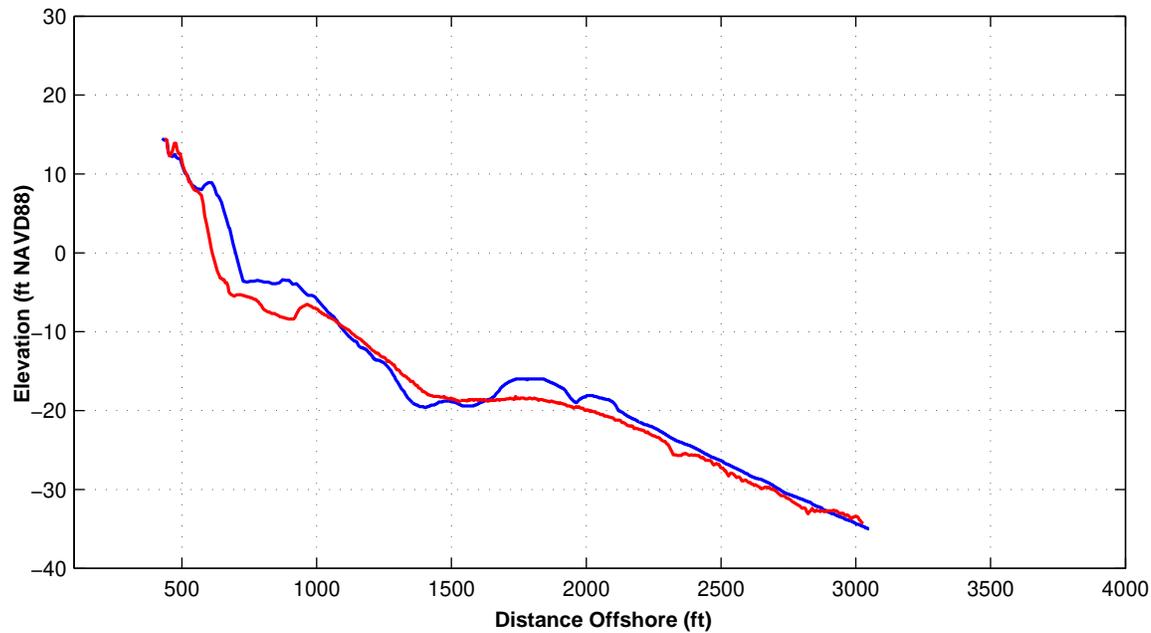
Survey Transect 990+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	-147.47 ft	-78.58 ft
Volume Change Above +6 ft NAVD88	11.91 cy/ft	-1.71 cy/ft
Volume Change Above 1.18 ft NAVD88	-16.26 cy/ft	-11.99 cy/ft
Volume Change Above -6 ft NAVD88	-46.04 cy/ft	-41.28 cy/ft
Volume Change Above -14 ft NAVD88	-18.97 cy/ft	-44.68 cy/ft
Volume Change Above -19 ft NAVD88	-42.64 cy/ft	-13.75 cy/ft
Volume Change Above -30 ft NAVD88	-76.08 cy/ft	-21.21 cy/ft

LEGEND:

JULY 2021	—	AUGUST 2019	—
JUNE 2020	—	MAY 2018	—

- Notes:
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 2. All Survey Elevations In Feet Referenced to NAVD88.





Survey Transect 992+50	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	– ft	–84.46 ft
Volume Change Above +6 ft NAVD88	– cy/ft	–4.89 cy/ft
Volume Change Above 1.18 ft NAVD88	– cy/ft	–19.07 cy/ft
Volume Change Above –6 ft NAVD88	– cy/ft	–56.69 cy/ft
Volume Change Above –14 ft NAVD88	– cy/ft	–65.74 cy/ft
Volume Change Above –19 ft NAVD88	– cy/ft	–77.78 cy/ft
Volume Change Above –30 ft NAVD88	– cy/ft	–105.69 cy/ft

LEGEND:

JULY 2021 ————
JUNE 2020 ————

Notes:

1. Station From North To South At Varying Intervals.
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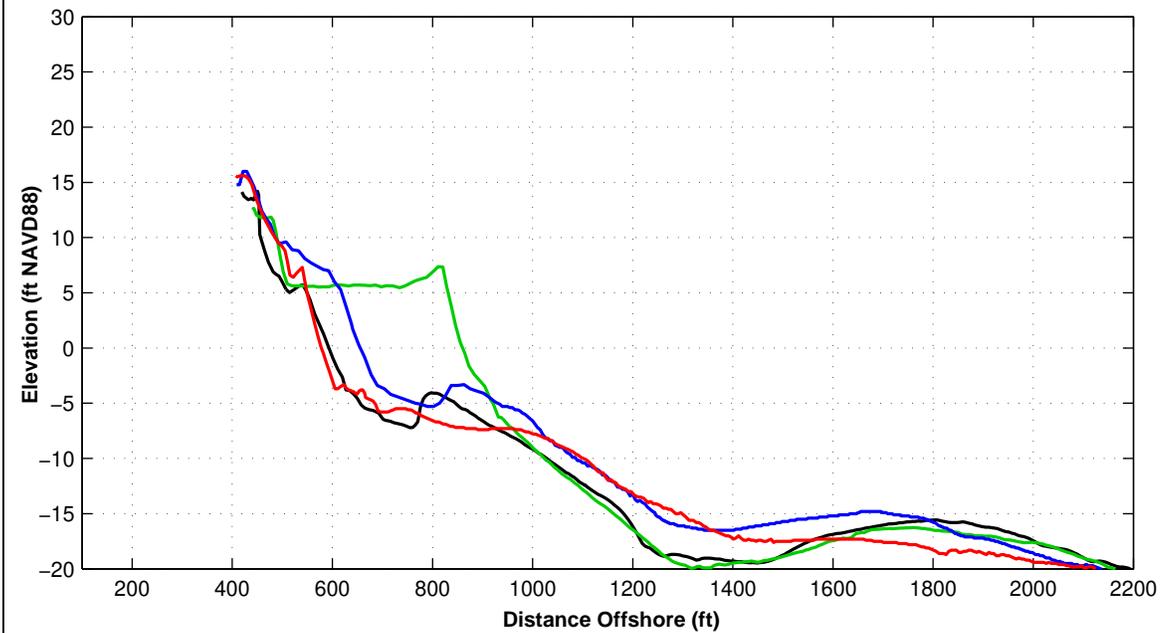
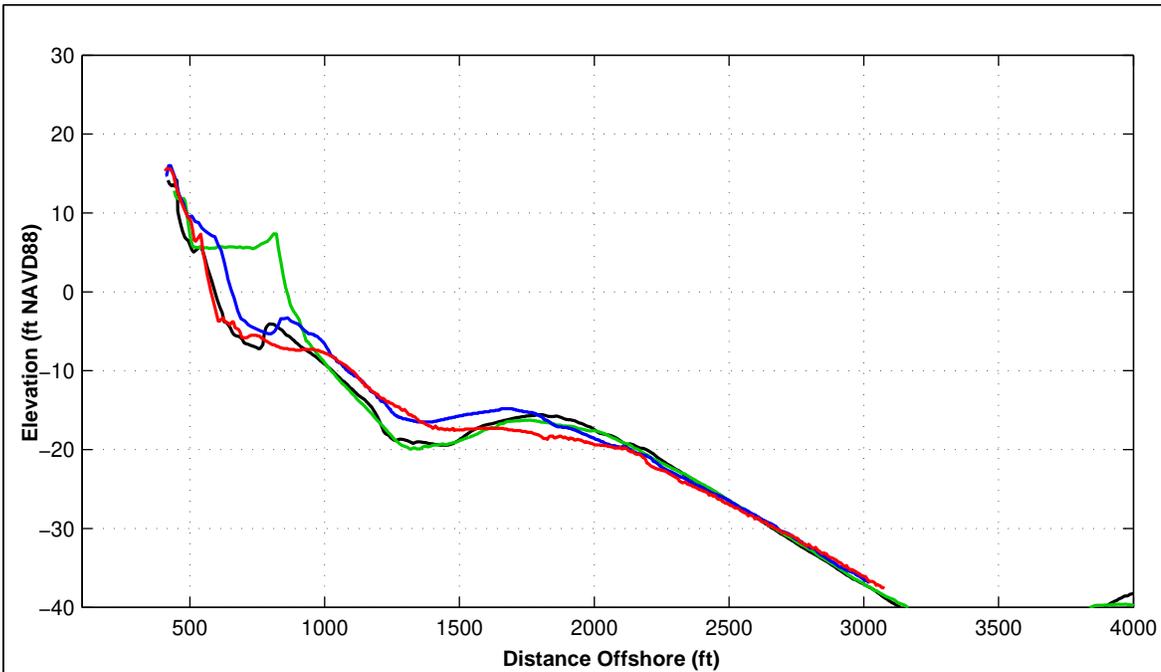


Town of Nags Head Periodic Surveying Data Analysis

ST 992+50

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Summer 2021



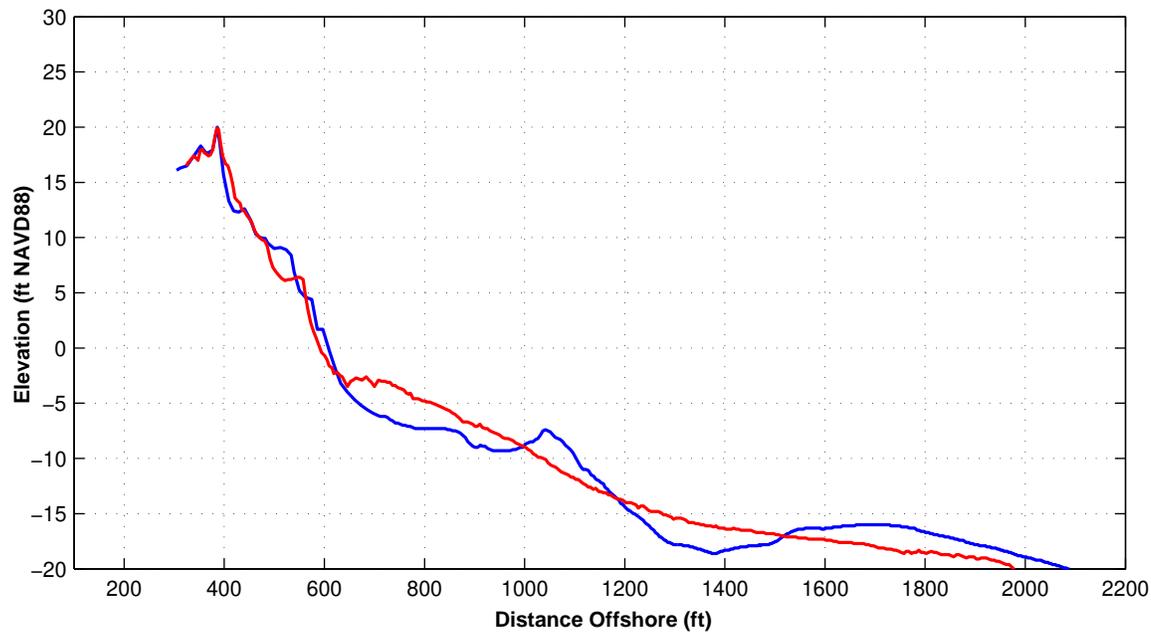
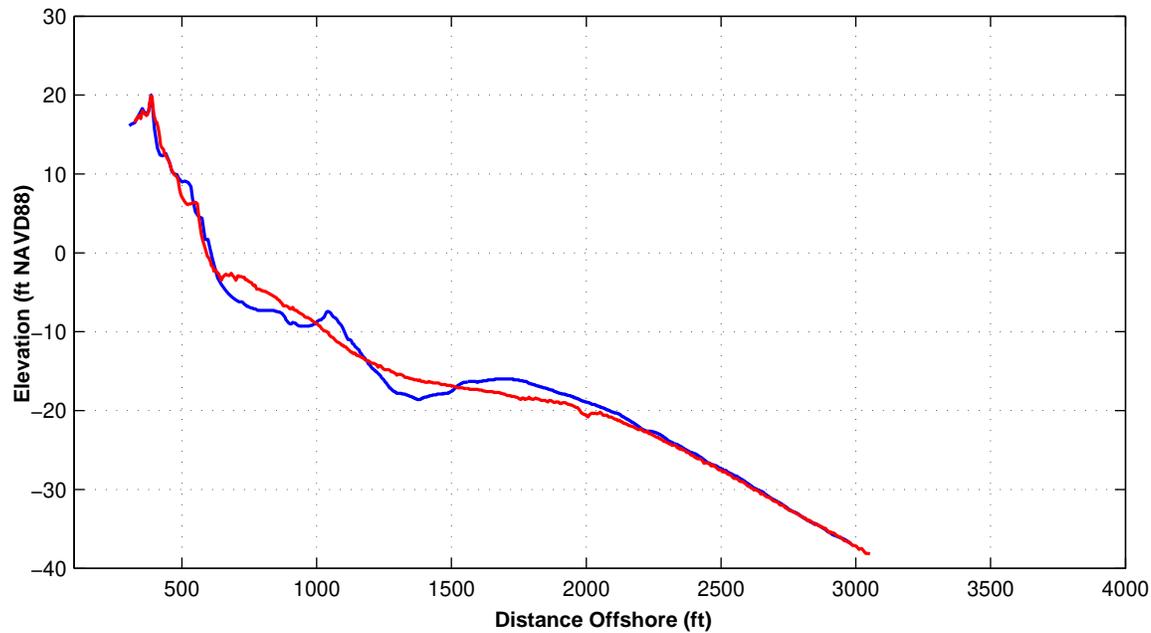
Survey Transect 995+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	-206.25 ft	-74.46 ft
Volume Change Above +6 ft NAVD88	6.08 cy/ft	-5.68 cy/ft
Volume Change Above 1.18 ft NAVD88	-28.16 cy/ft	-18.27 cy/ft
Volume Change Above -6 ft NAVD88	-68.83 cy/ft	-48.90 cy/ft
Volume Change Above -14 ft NAVD88	-49.20 cy/ft	-57.48 cy/ft
Volume Change Above -19 ft NAVD88	2.20 cy/ft	-94.65 cy/ft
Volume Change Above -30 ft NAVD88	-0.19 cy/ft	-103.97 cy/ft

LEGEND:

JULY 2021	—	AUGUST 2019	—
JUNE 2020	—	MAY 2018	—

- Notes:
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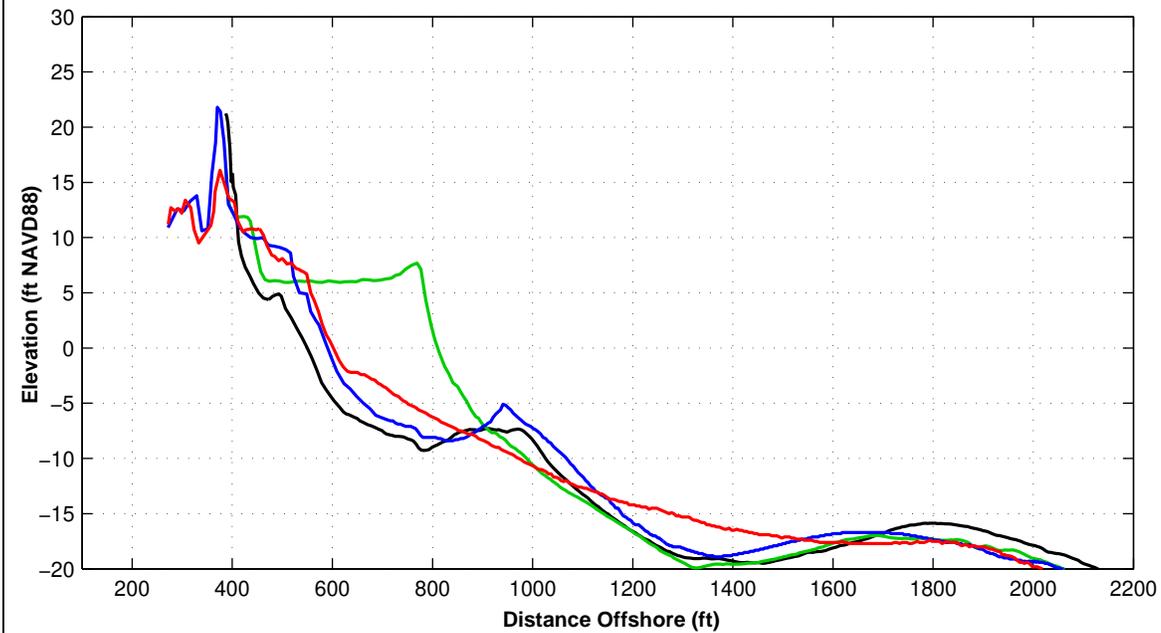
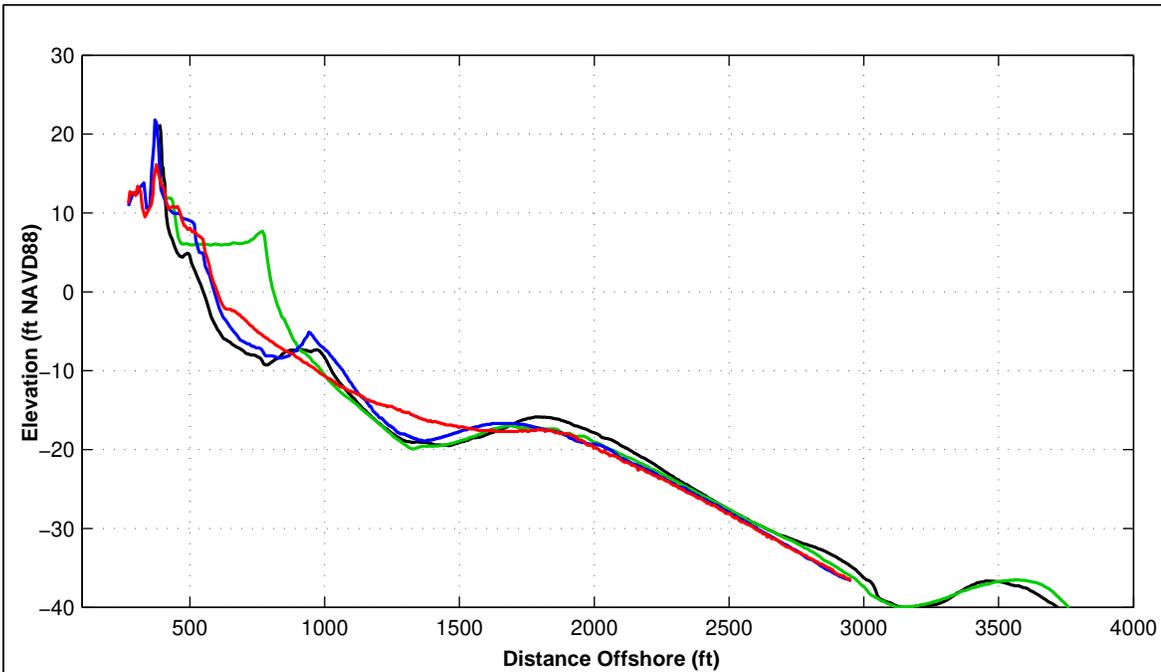


Survey Transect 997+50	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	– ft	–19.13 ft
Volume Change Above +6 ft NAVD88	– cy/ft	–1.47 cy/ft
Volume Change Above 1.18 ft NAVD88	– cy/ft	–2.56 cy/ft
Volume Change Above –6 ft NAVD88	– cy/ft	10.37 cy/ft
Volume Change Above –14 ft NAVD88	– cy/ft	12.32 cy/ft
Volume Change Above –19 ft NAVD88	– cy/ft	7.81 cy/ft
Volume Change Above –30 ft NAVD88	– cy/ft	–4.71 cy/ft

LEGEND:
 JULY 2021 ————
 JUNE 2020 ————

- Notes:
1. Station From North To South At Varying Intervals.
 2. All Survey Elevations In Feet Referenced to NAVD88.





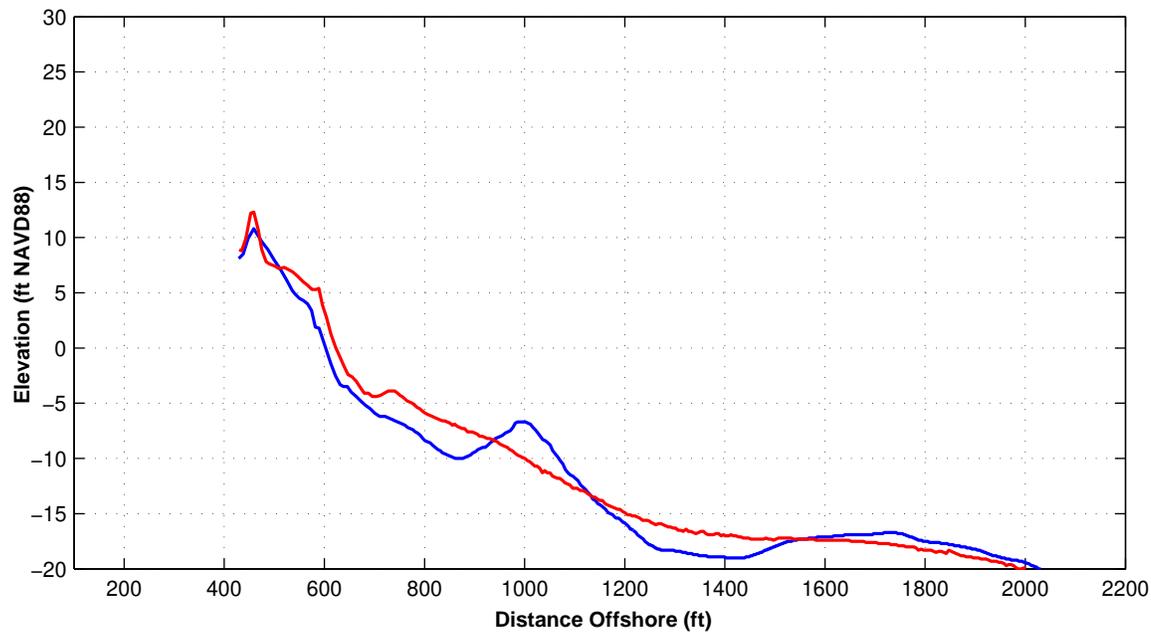
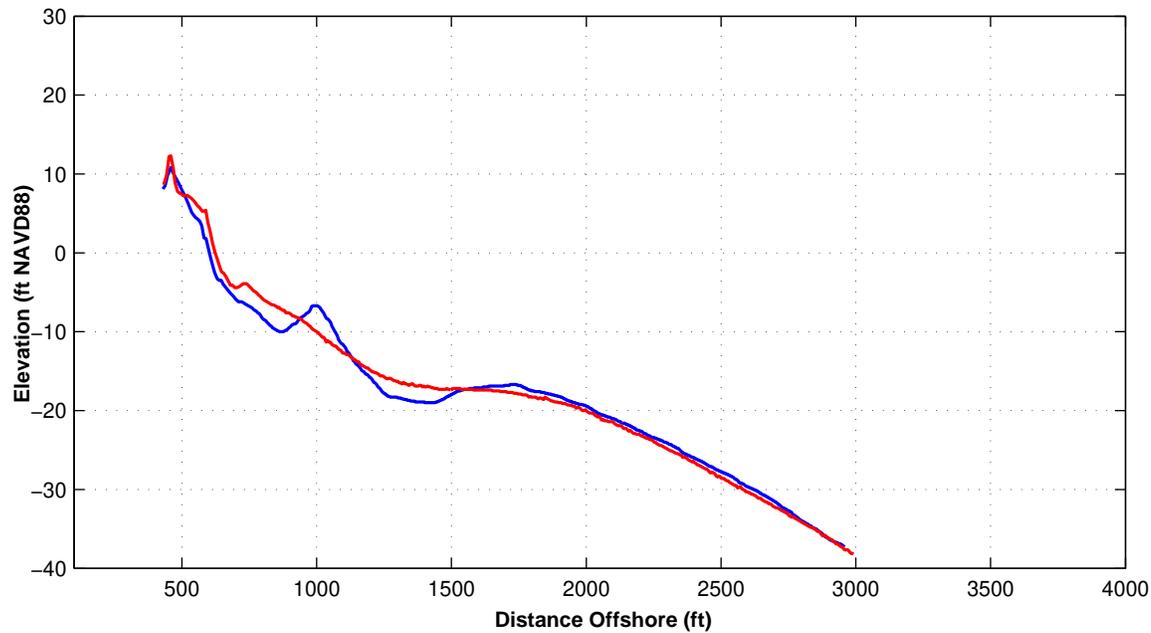
Survey Transect 1000+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	-221.49 ft	7.31 ft
Volume Change Above +6 ft NAVD88	4.05 cy/ft	0.38 cy/ft
Volume Change Above 1.18 ft NAVD88	-37.85 cy/ft	2.82 cy/ft
Volume Change Above -6 ft NAVD88	-94.71 cy/ft	14.67 cy/ft
Volume Change Above -14 ft NAVD88	-85.11 cy/ft	1.36 cy/ft
Volume Change Above -19 ft NAVD88	-70.03 cy/ft	21.63 cy/ft
Volume Change Above -30 ft NAVD88	-75.41 cy/ft	15.61 cy/ft

LEGEND:

JULY 2021	—	AUGUST 2019	—
JUNE 2020	—	MAY 2018	—

- Notes:
1. Station From North To South At Varying Intervals.
 2. All Survey Elevations In Feet Referenced to NAVD88.



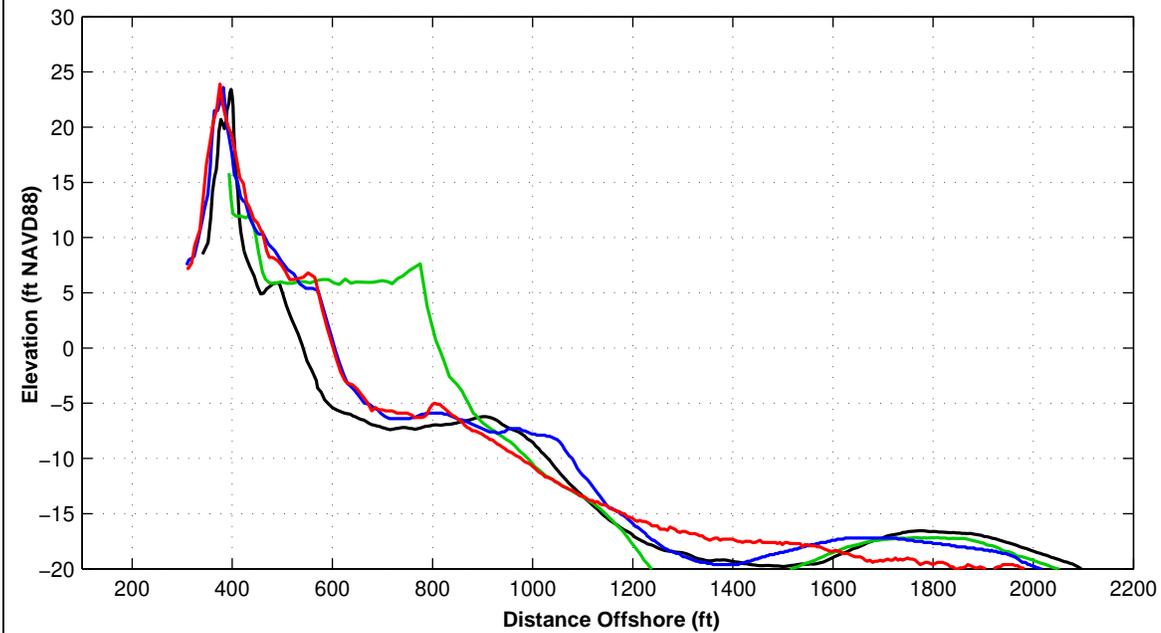
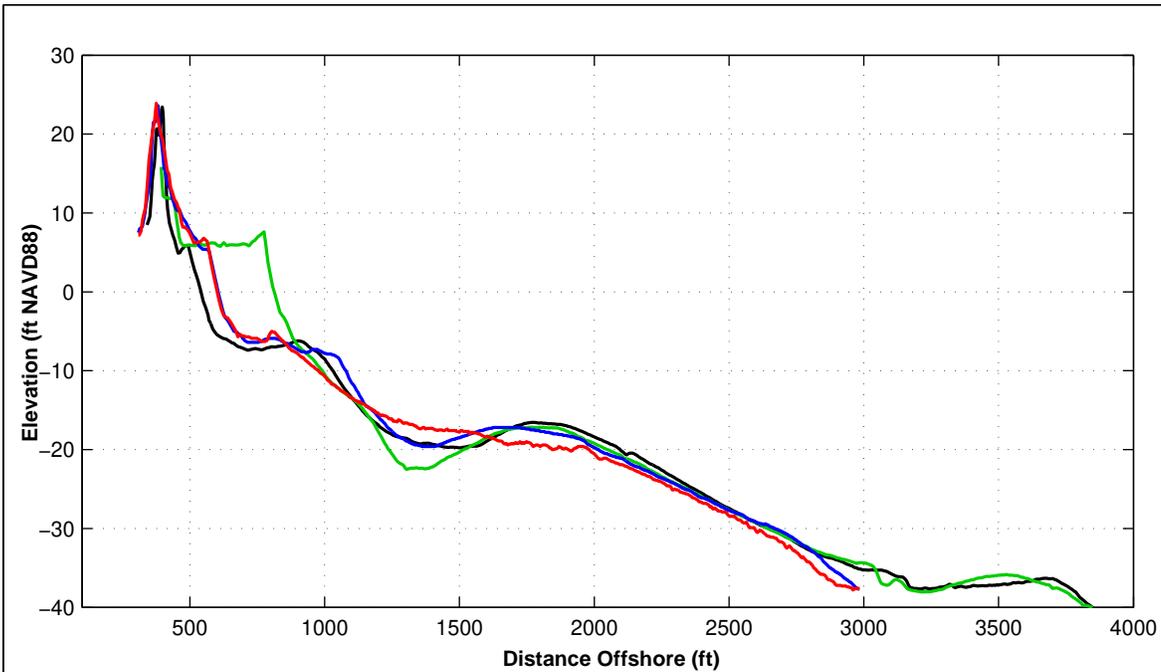


Survey Transect 1002+50	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	– ft	19.91 ft
Volume Change Above +6 ft NAVD88	– cy/ft	0.78 cy/ft
Volume Change Above 1.18 ft NAVD88	– cy/ft	6.49 cy/ft
Volume Change Above –6 ft NAVD88	– cy/ft	18.04 cy/ft
Volume Change Above –14 ft NAVD88	– cy/ft	19.36 cy/ft
Volume Change Above –19 ft NAVD88	– cy/ft	31.85 cy/ft
Volume Change Above –30 ft NAVD88	– cy/ft	16.71 cy/ft

LEGEND:
 JULY 2021 ————
 JUNE 2020 ————

- Notes:
1. Station From North To South At Varying Intervals.
 2. All Survey Elevations In Feet Referenced to NAVD88.





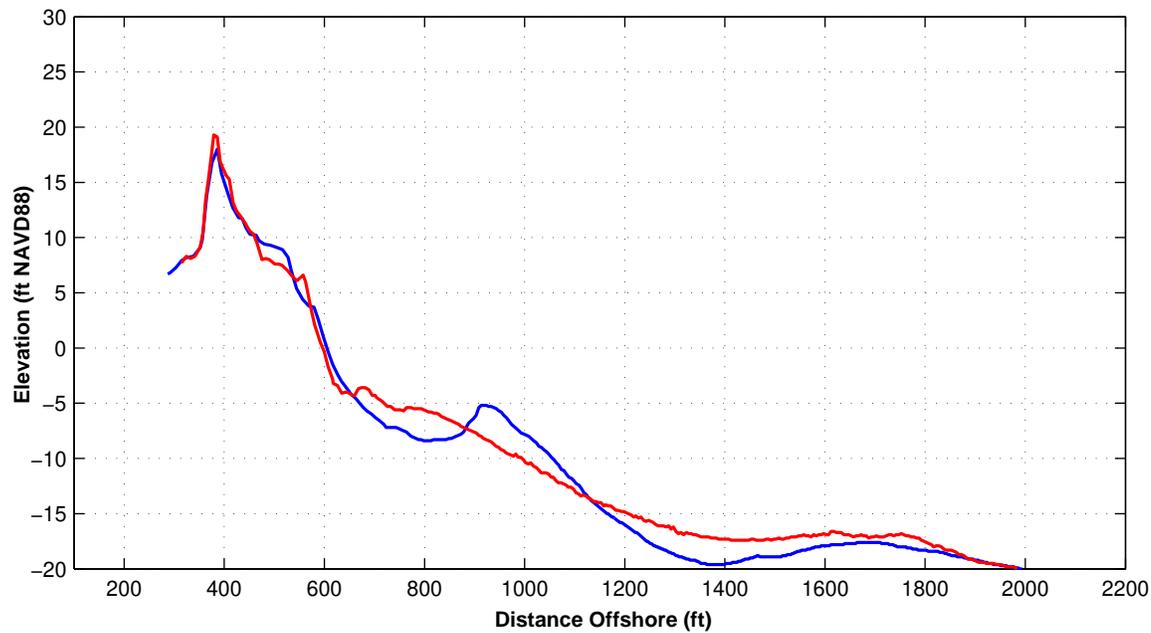
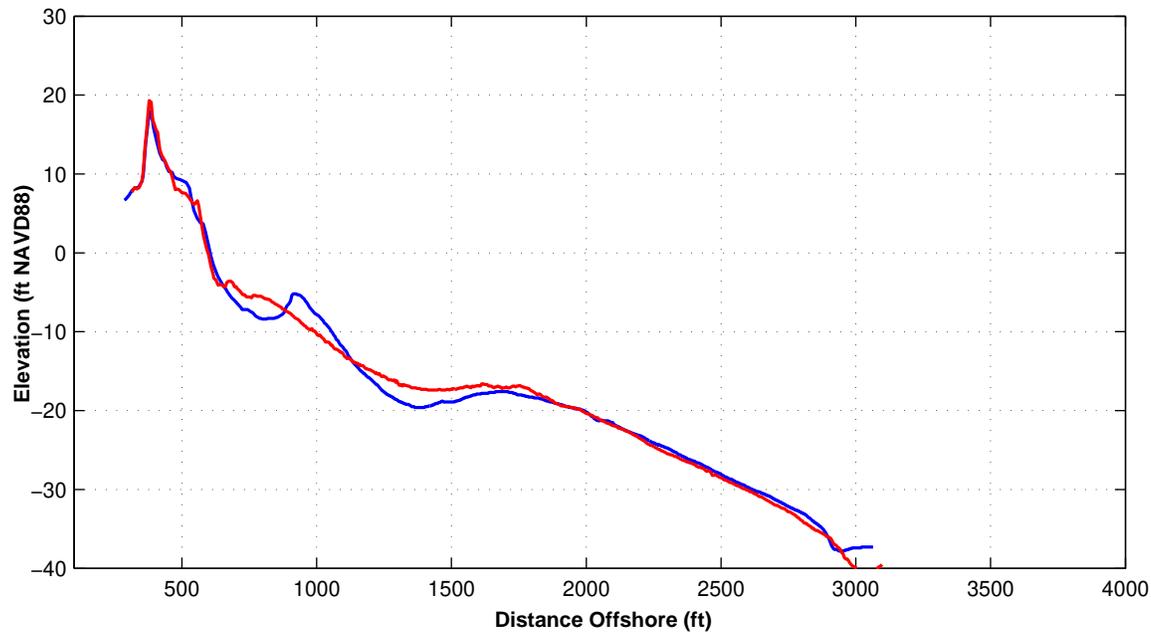
Survey Transect 1005+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	-206.89 ft	-3.29 ft
Volume Change Above +6 ft NAVD88	6.22 cy/ft	1.25 cy/ft
Volume Change Above 1.18 ft NAVD88	-31.41 cy/ft	1.62 cy/ft
Volume Change Above -6 ft NAVD88	-86.54 cy/ft	2.88 cy/ft
Volume Change Above -14 ft NAVD88	-71.53 cy/ft	-17.60 cy/ft
Volume Change Above -19 ft NAVD88	-61.00 cy/ft	-16.96 cy/ft
Volume Change Above -30 ft NAVD88	-39.75 cy/ft	-37.67 cy/ft

LEGEND:

JULY 2021	—	AUGUST 2019	—
JUNE 2020	—	MAY 2018	—

- Notes:
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Survey Transect 1007+50	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	– ft	–9.72 ft
Volume Change Above +6 ft NAVD88	– cy/ft	–1.18 cy/ft
Volume Change Above 1.18 ft NAVD88	– cy/ft	–0.76 cy/ft
Volume Change Above –6 ft NAVD88	– cy/ft	0.86 cy/ft
Volume Change Above –14 ft NAVD88	– cy/ft	–5.37 cy/ft
Volume Change Above –19 ft NAVD88	– cy/ft	28.68 cy/ft
Volume Change Above –30 ft NAVD88	– cy/ft	22.93 cy/ft

LEGEND:

JULY 2021 —
 JUNE 2020 —

Notes:

1. Station From North To South At Varying Intervals.
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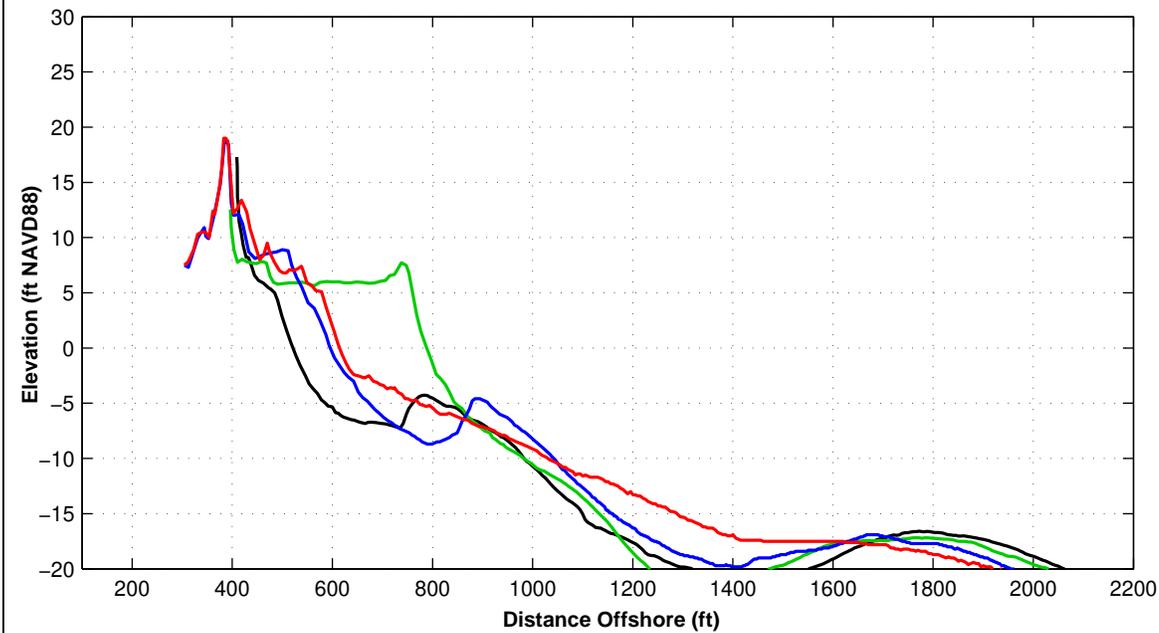
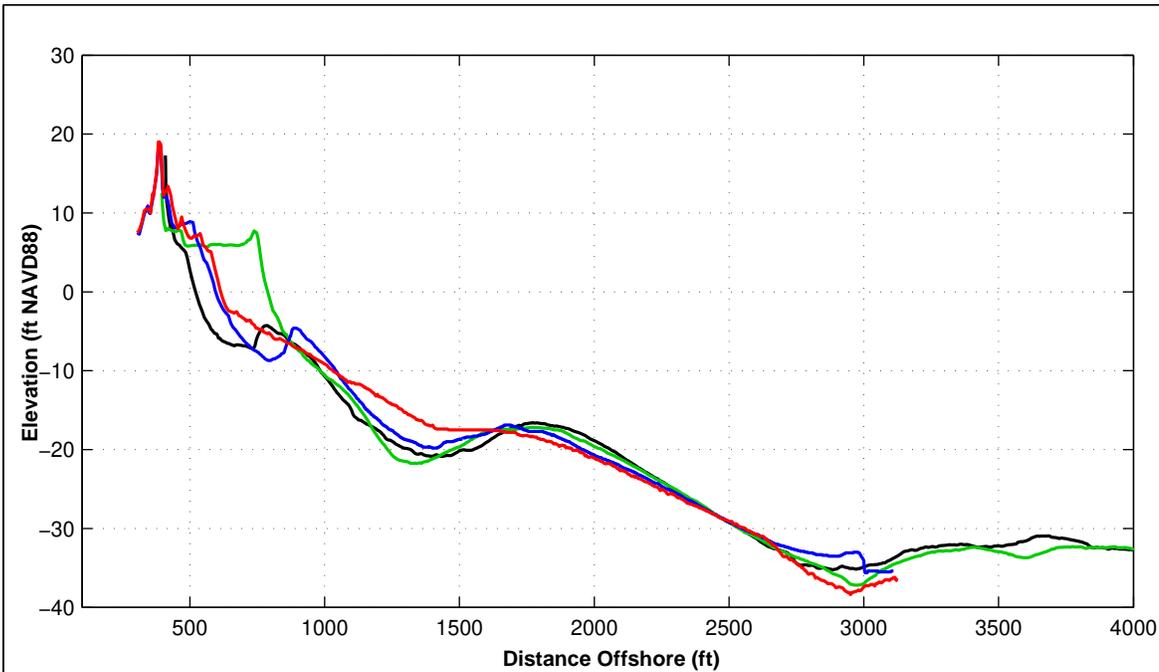


Town of Nags Head Periodic Surveying Data Analysis

ST 1007+50

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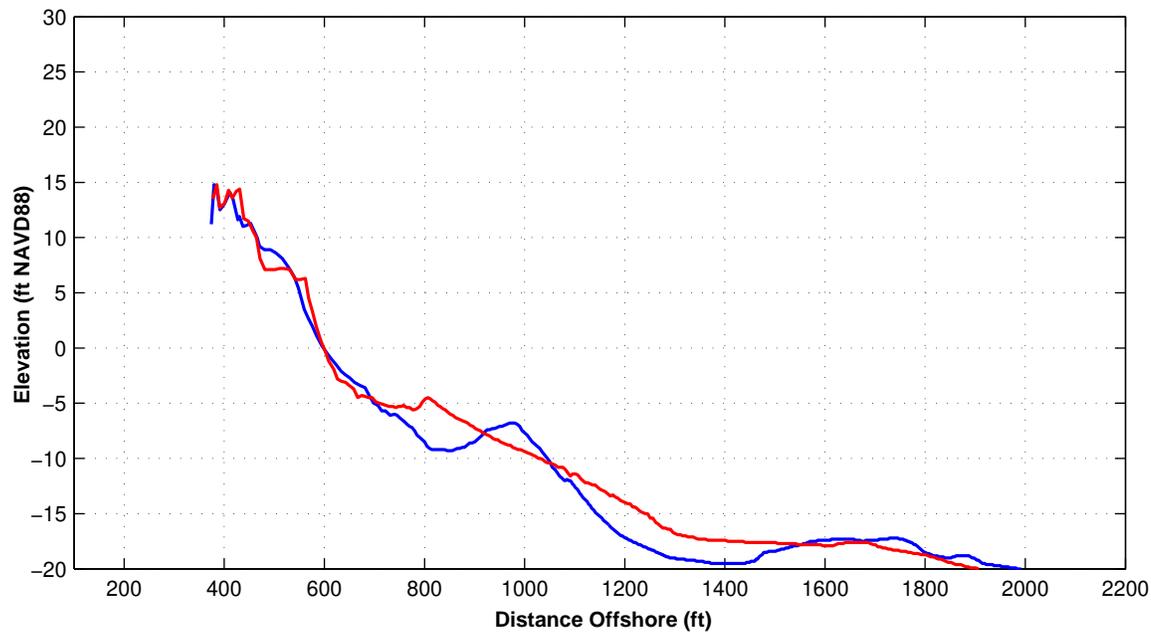
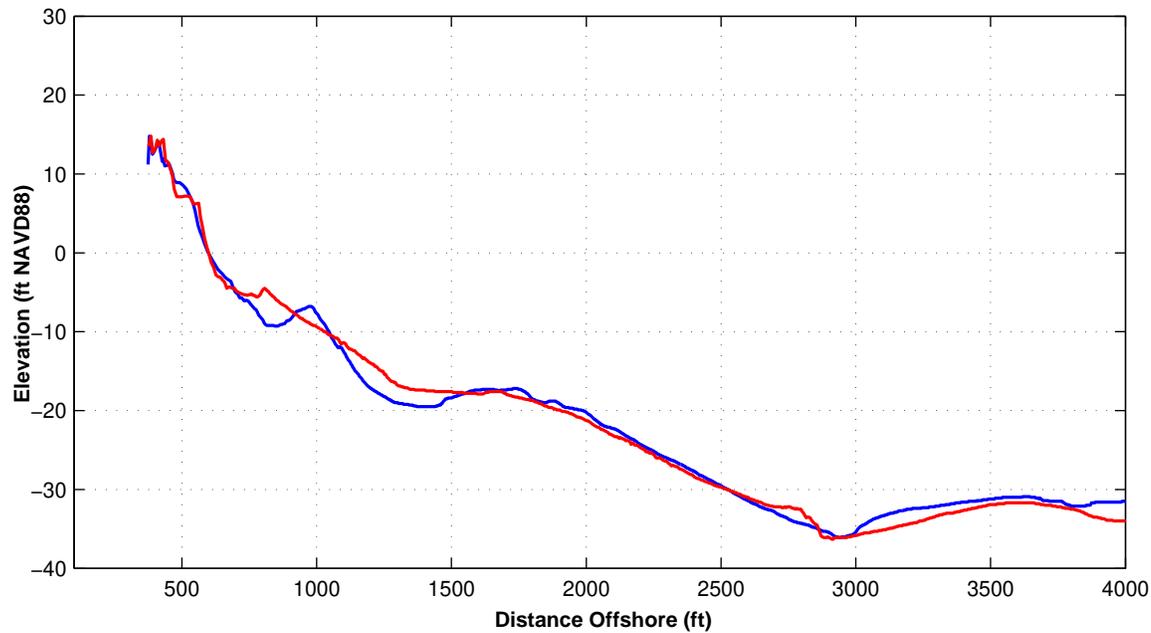
Survey Transect 1010+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	-191.89 ft	18.33 ft
Volume Change Above +6 ft NAVD88	4.65 cy/ft	0.69 cy/ft
Volume Change Above 1.18 ft NAVD88	-31.32 cy/ft	5.12 cy/ft
Volume Change Above -6 ft NAVD88	-78.05 cy/ft	15.78 cy/ft
Volume Change Above -14 ft NAVD88	-72.98 cy/ft	26.09 cy/ft
Volume Change Above -19 ft NAVD88	-66.59 cy/ft	53.15 cy/ft
Volume Change Above -30 ft NAVD88	-61.13 cy/ft	46.38 cy/ft

LEGEND:

JULY 2021	—	AUGUST 2019	—
JUNE 2020	—	MAY 2018	—

- Notes:
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 2. All Survey Elevations In Feet Referenced to NAVD88.



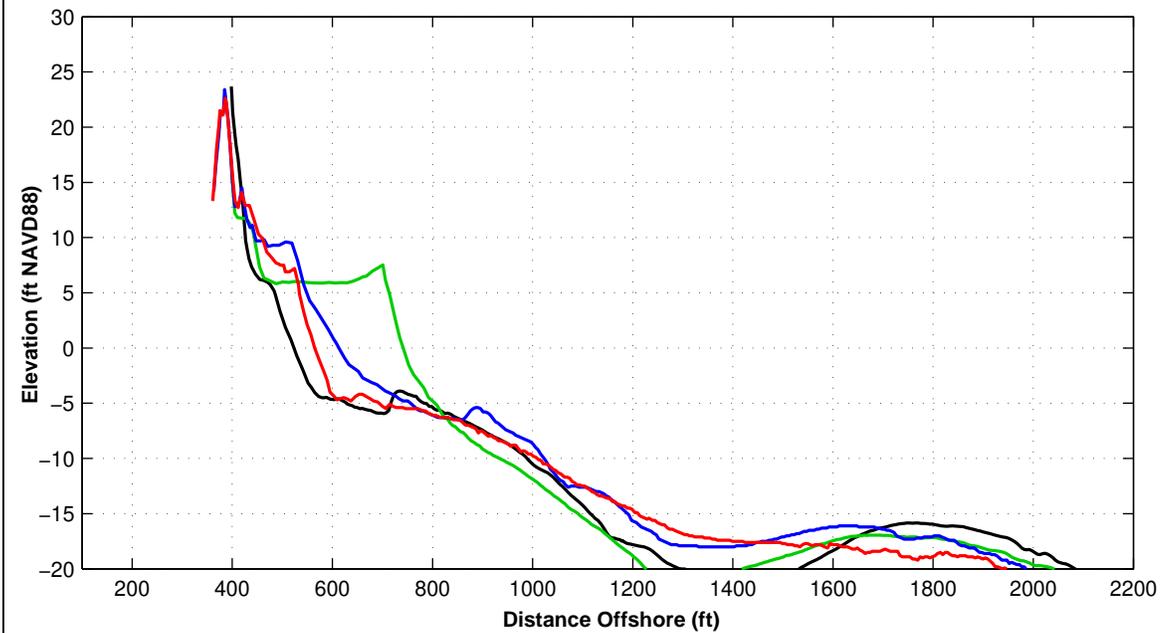
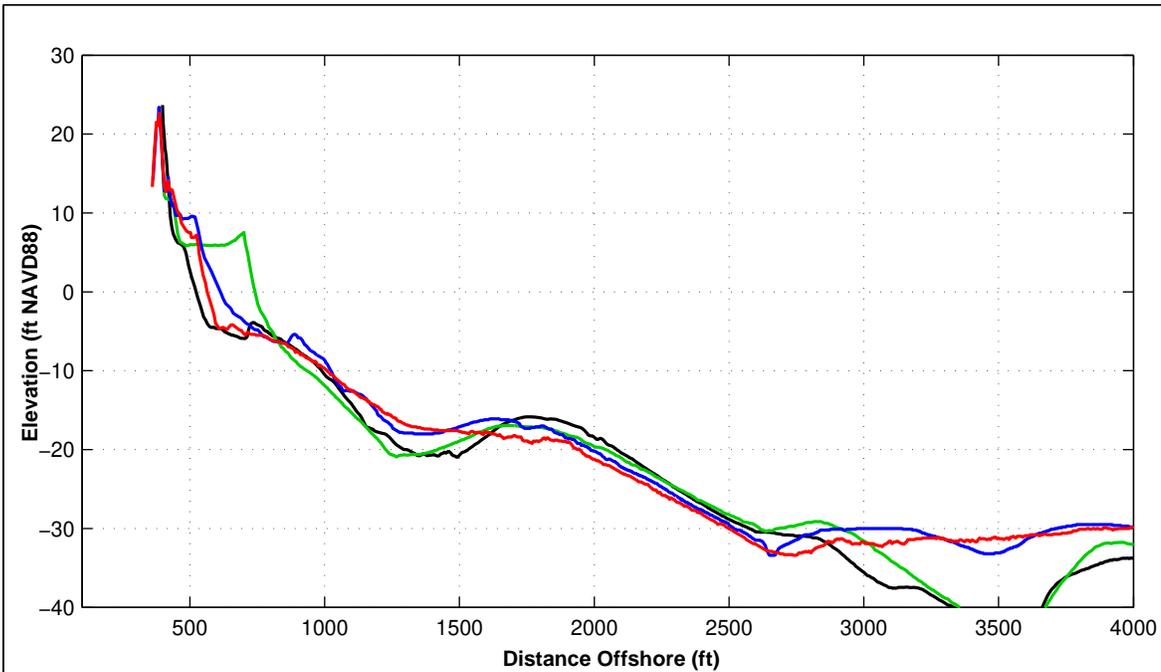


Survey Transect 1012+50	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	– ft	5.64 ft
Volume Change Above +6 ft NAVD88	– cy/ft	–1.13 cy/ft
Volume Change Above 1.18 ft NAVD88	– cy/ft	1.25 cy/ft
Volume Change Above –6 ft NAVD88	– cy/ft	2.91 cy/ft
Volume Change Above –14 ft NAVD88	– cy/ft	15.13 cy/ft
Volume Change Above –19 ft NAVD88	– cy/ft	37.34 cy/ft
Volume Change Above –30 ft NAVD88	– cy/ft	24.32 cy/ft

LEGEND:
 JULY 2021 ————
 JUNE 2020 ————

- Notes:
1. Station From North To South At Varying Intervals.
 2. All Survey Elevations In Feet Referenced to NAVD88.



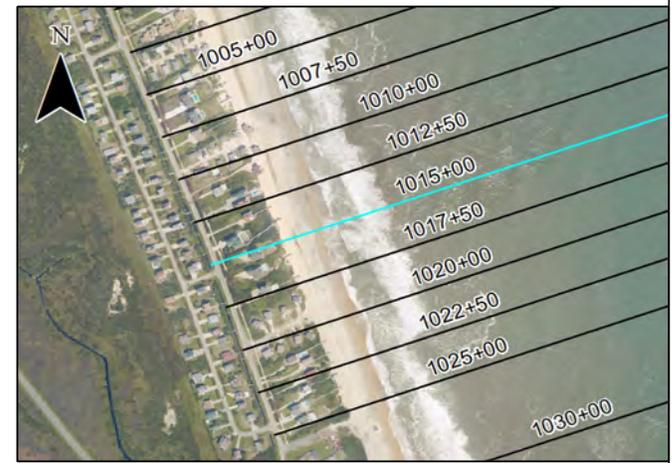


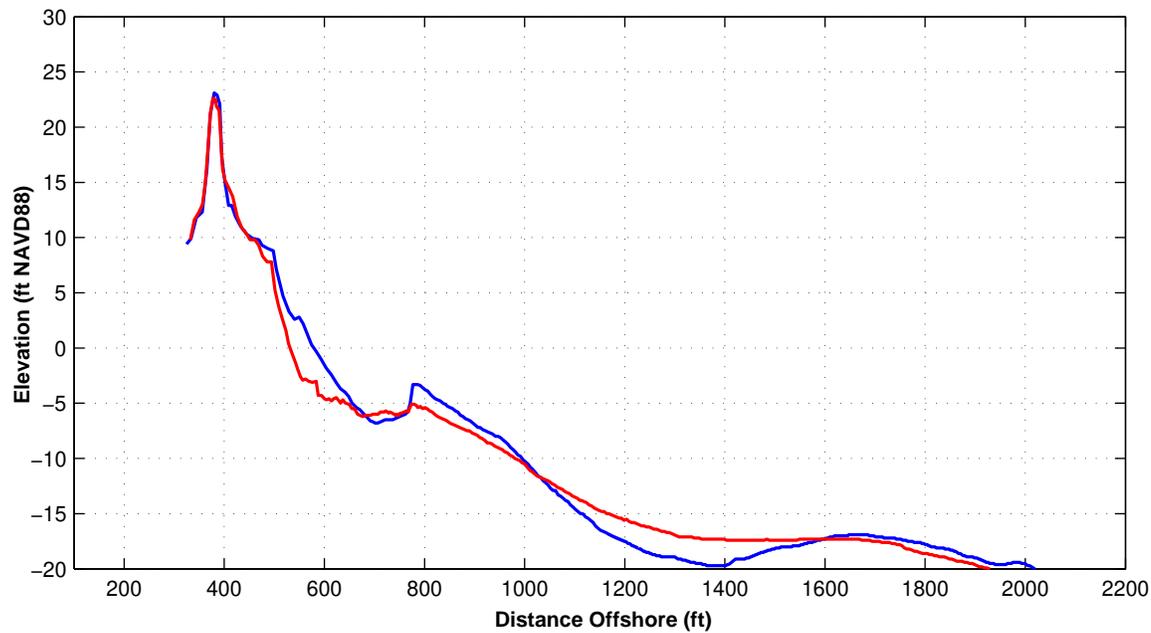
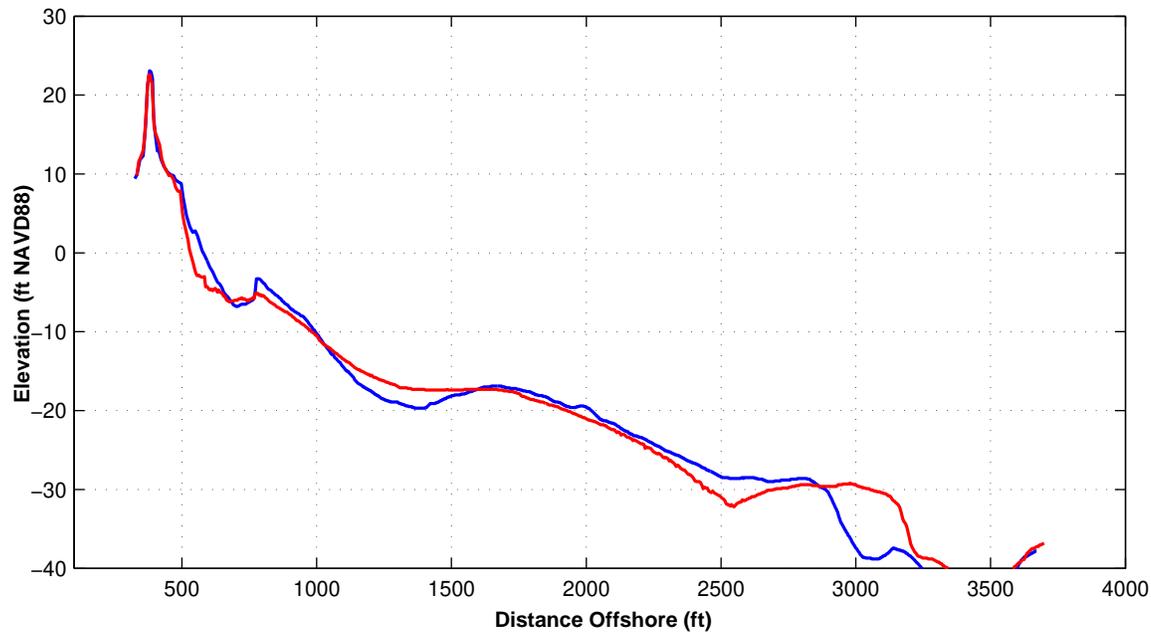
Survey Transect 1015+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	-135.29 ft	-40.76 ft
Volume Change Above +6 ft NAVD88	9.28 cy/ft	-3.28 cy/ft
Volume Change Above 1.18 ft NAVD88	-17.80 cy/ft	-7.71 cy/ft
Volume Change Above -6 ft NAVD88	-42.93 cy/ft	-24.87 cy/ft
Volume Change Above -14 ft NAVD88	-17.57 cy/ft	-31.60 cy/ft
Volume Change Above -19 ft NAVD88	18.38 cy/ft	-46.69 cy/ft
Volume Change Above -30 ft NAVD88	7.47 cy/ft	-58.23 cy/ft

LEGEND:

JULY 2021		AUGUST 2019	
JUNE 2020		MAY 2018	

- Notes:
1. Station From North To South At Varying Intervals.
 2. All Survey Elevations In Feet Referenced to NAVD88.



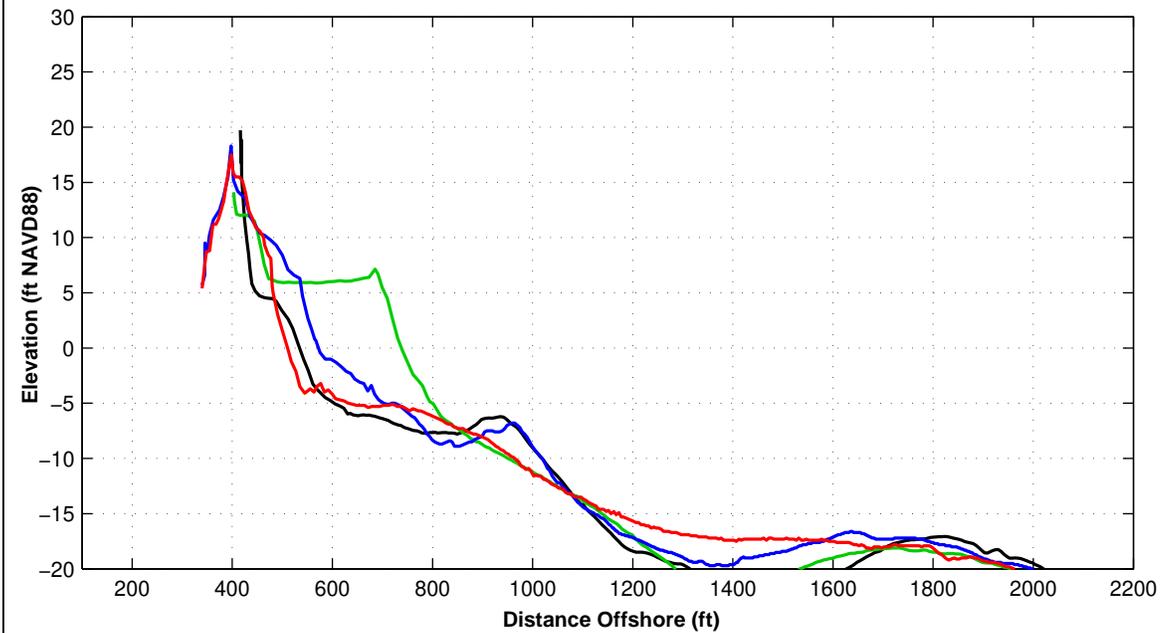
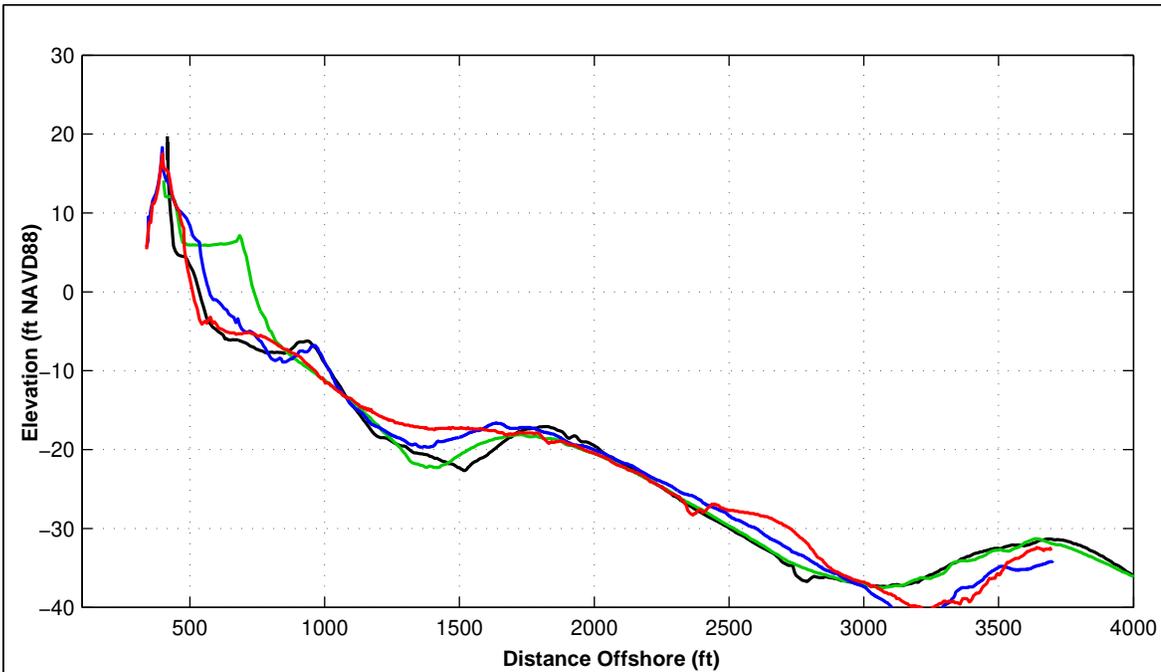


Survey Transect 1017+50	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	– ft	–41.69 ft
Volume Change Above +6 ft NAVD88	– cy/ft	–1.46 cy/ft
Volume Change Above 1.18 ft NAVD88	– cy/ft	–5.50 cy/ft
Volume Change Above –6 ft NAVD88	– cy/ft	–21.52 cy/ft
Volume Change Above –14 ft NAVD88	– cy/ft	–24.19 cy/ft
Volume Change Above –19 ft NAVD88	– cy/ft	–2.51 cy/ft
Volume Change Above –30 ft NAVD88	– cy/ft	–38.40 cy/ft

LEGEND:
 JULY 2021 ————
 JUNE 2020 ————

- Notes:
 1. Station From North To South At Varying Intervals.
 2. All Survey Elevations In Feet Referenced to NAVD88.



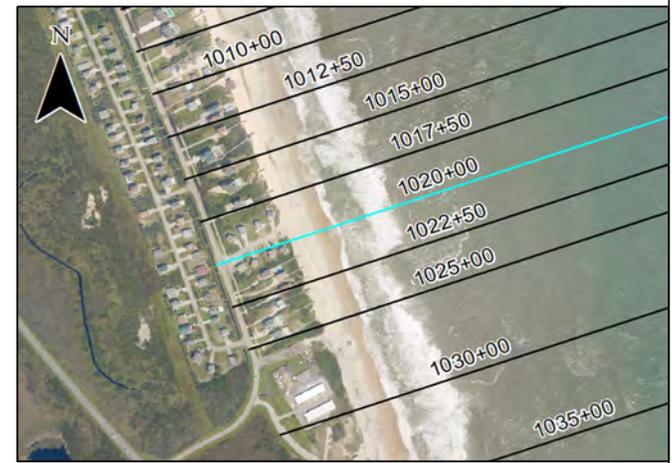


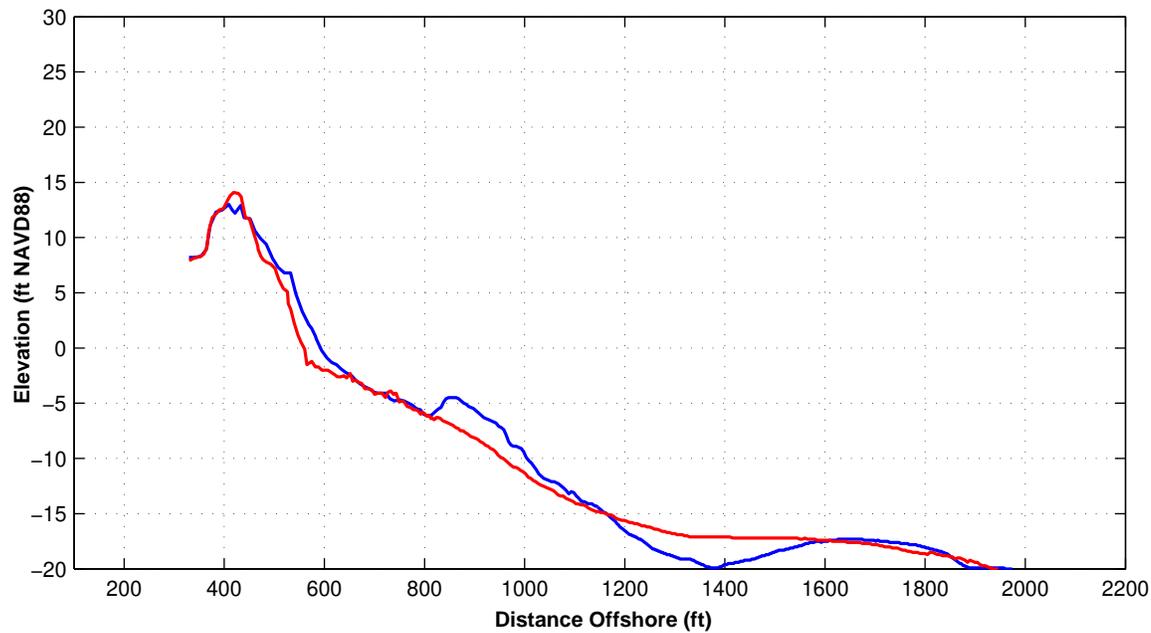
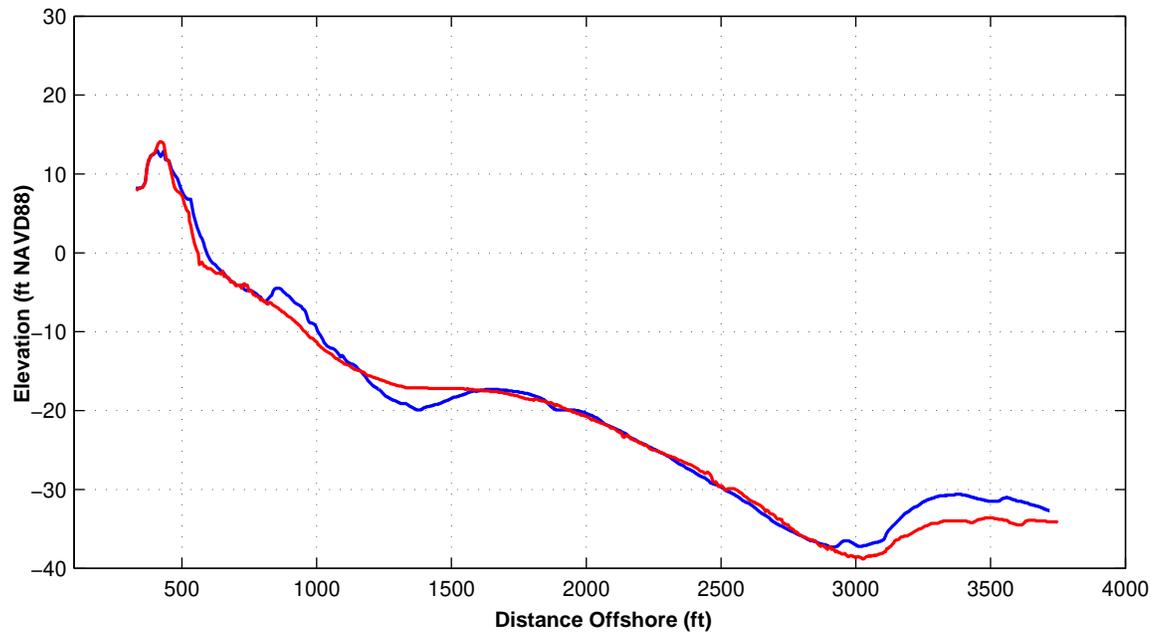
Survey Transect 1020+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	-166.28 ft	-59.58 ft
Volume Change Above +6 ft NAVD88	5.46 cy/ft	-4.35 cy/ft
Volume Change Above 1.18 ft NAVD88	-24.04 cy/ft	-14.75 cy/ft
Volume Change Above -6 ft NAVD88	-57.52 cy/ft	-34.94 cy/ft
Volume Change Above -14 ft NAVD88	-52.37 cy/ft	-38.41 cy/ft
Volume Change Above -19 ft NAVD88	-36.04 cy/ft	-21.96 cy/ft
Volume Change Above -30 ft NAVD88	5.01 cy/ft	-22.95 cy/ft

LEGEND:

JULY 2021	—	AUGUST 2019	—
JUNE 2020	—	MAY 2018	—

- Notes:
1. Station From North To South At Varying Intervals.
 2. All Survey Elevations In Feet Referenced to NAVD88.



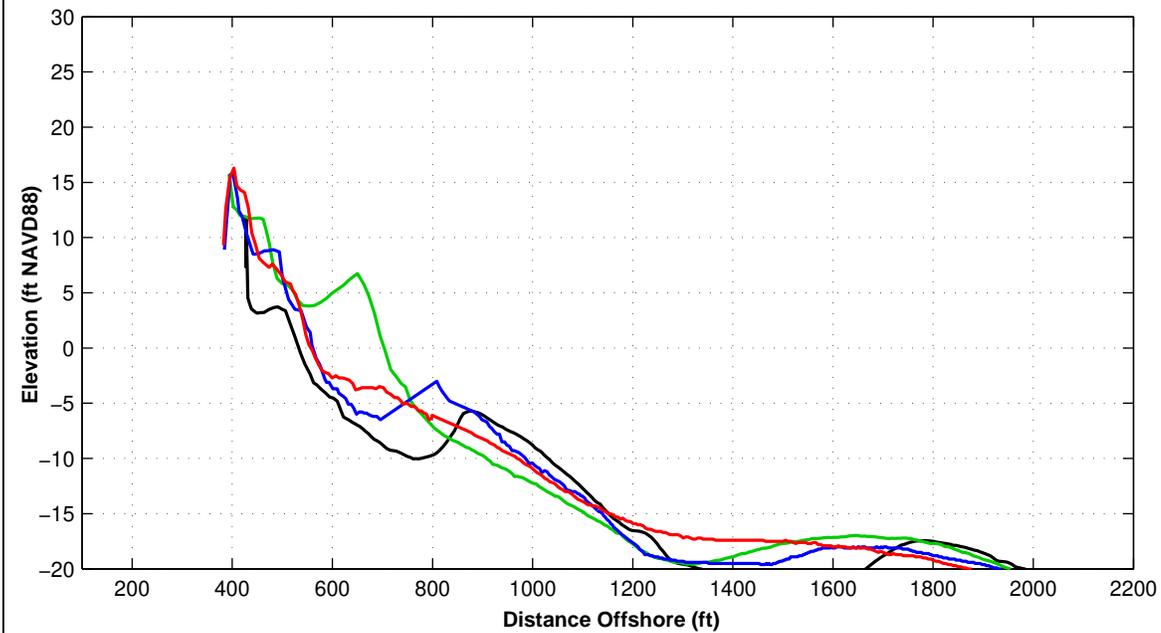
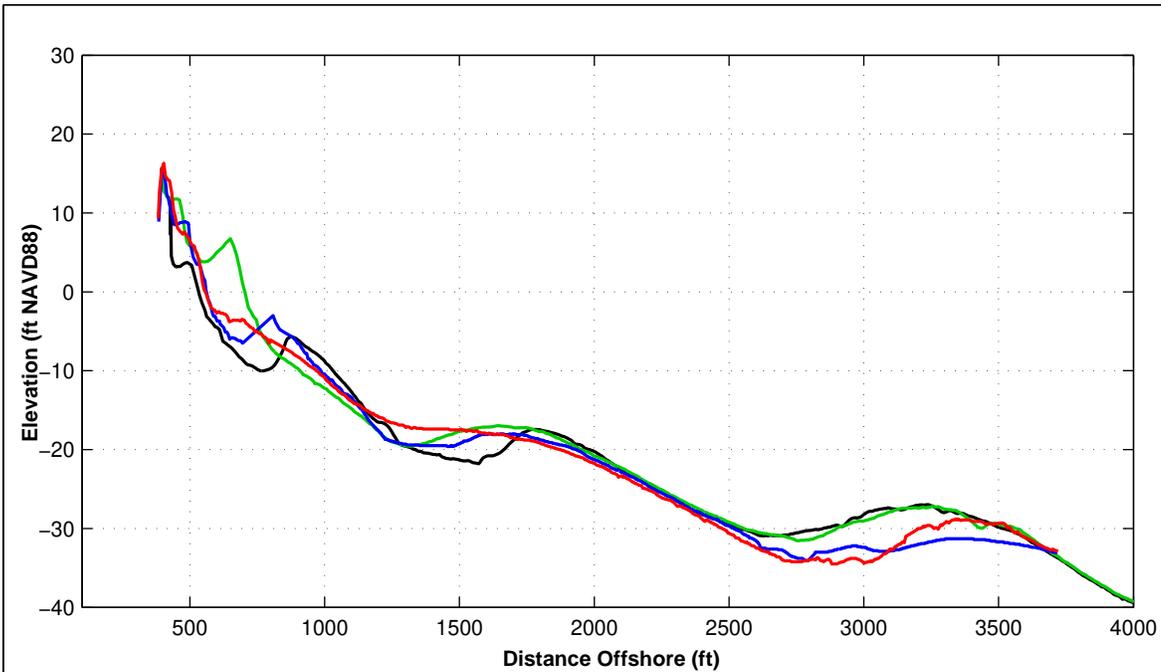


Survey Transect 1022+50	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	– ft	–33.80 ft
Volume Change Above +6 ft NAVD88	– cy/ft	–1.38 cy/ft
Volume Change Above 1.18 ft NAVD88	– cy/ft	–5.66 cy/ft
Volume Change Above –6 ft NAVD88	– cy/ft	–13.93 cy/ft
Volume Change Above –14 ft NAVD88	– cy/ft	–29.71 cy/ft
Volume Change Above –19 ft NAVD88	– cy/ft	–11.36 cy/ft
Volume Change Above –30 ft NAVD88	– cy/ft	–6.44 cy/ft

LEGEND:
 JULY 2021 ————
 JUNE 2020 ————

- Notes:
1. Station From North To South At Varying Intervals.
 2. All Survey Elevations In Feet Referenced to NAVD88.





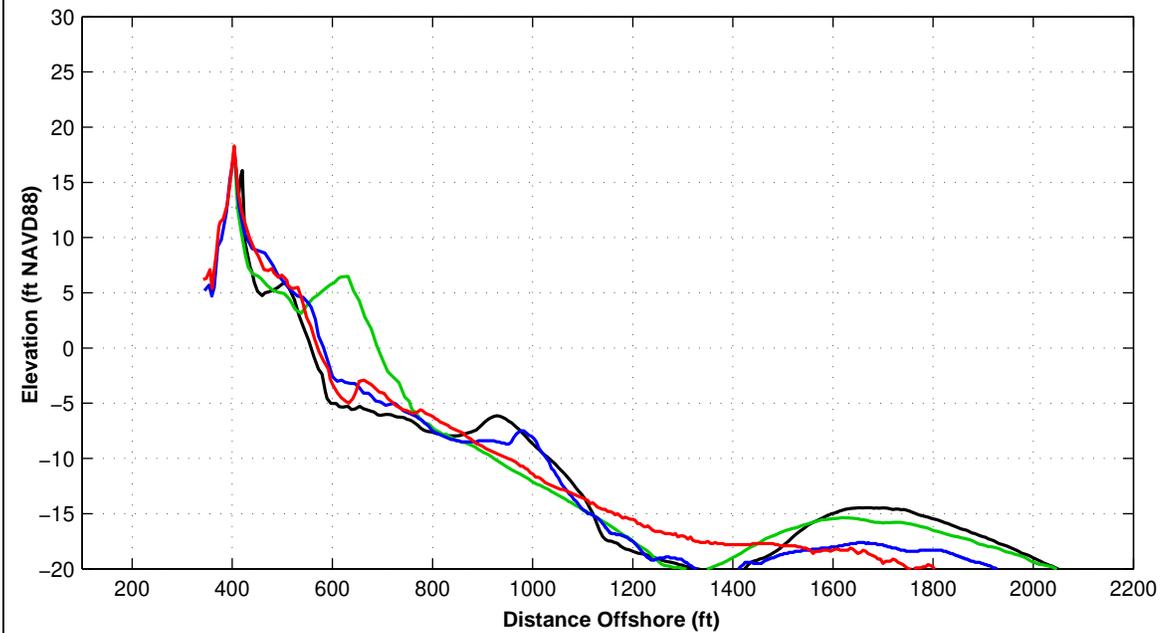
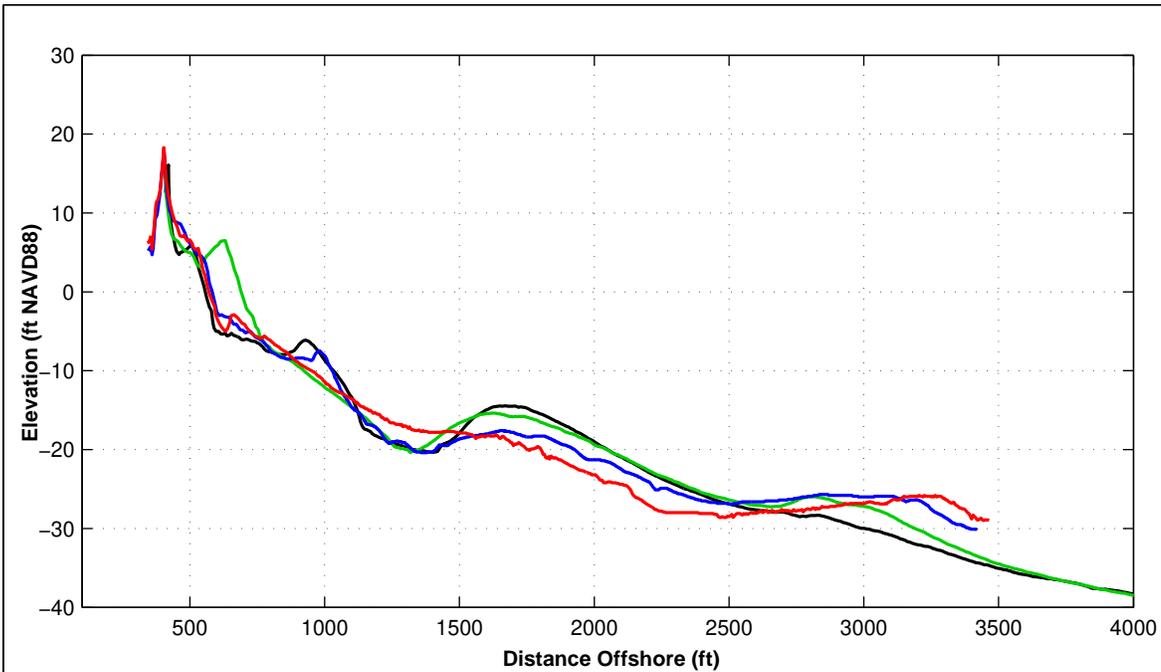
Survey Transect 1025+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	-138.37 ft	-9.60 ft
Volume Change Above +6 ft NAVD88	-2.83 cy/ft	-1.39 cy/ft
Volume Change Above 1.18 ft NAVD88	-23.80 cy/ft	-0.43 cy/ft
Volume Change Above -6 ft NAVD88	-51.89 cy/ft	2.15 cy/ft
Volume Change Above -14 ft NAVD88	-28.38 cy/ft	-6.78 cy/ft
Volume Change Above -19 ft NAVD88	-42.23 cy/ft	17.15 cy/ft
Volume Change Above -30 ft NAVD88	-92.16 cy/ft	14.74 cy/ft

LEGEND:

JULY 2021	—	AUGUST 2019	—
JUNE 2020	—	MAY 2018	—

- Notes:
1. Station From North To South At Varying Intervals.
 2. All Survey Elevations In Feet Referenced to NAVD88.





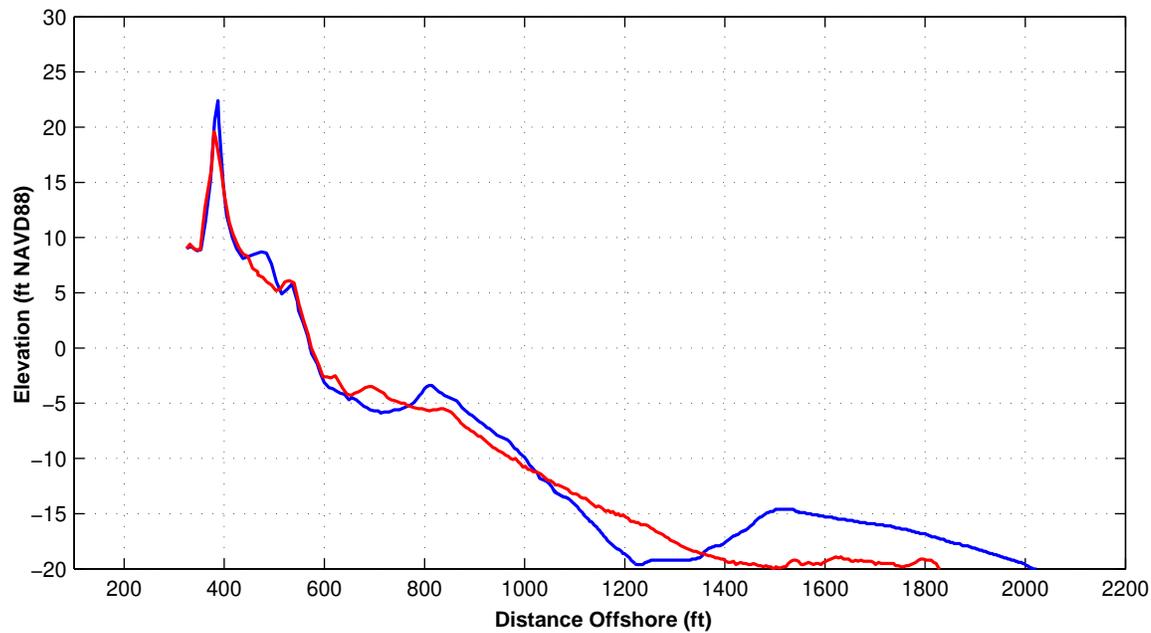
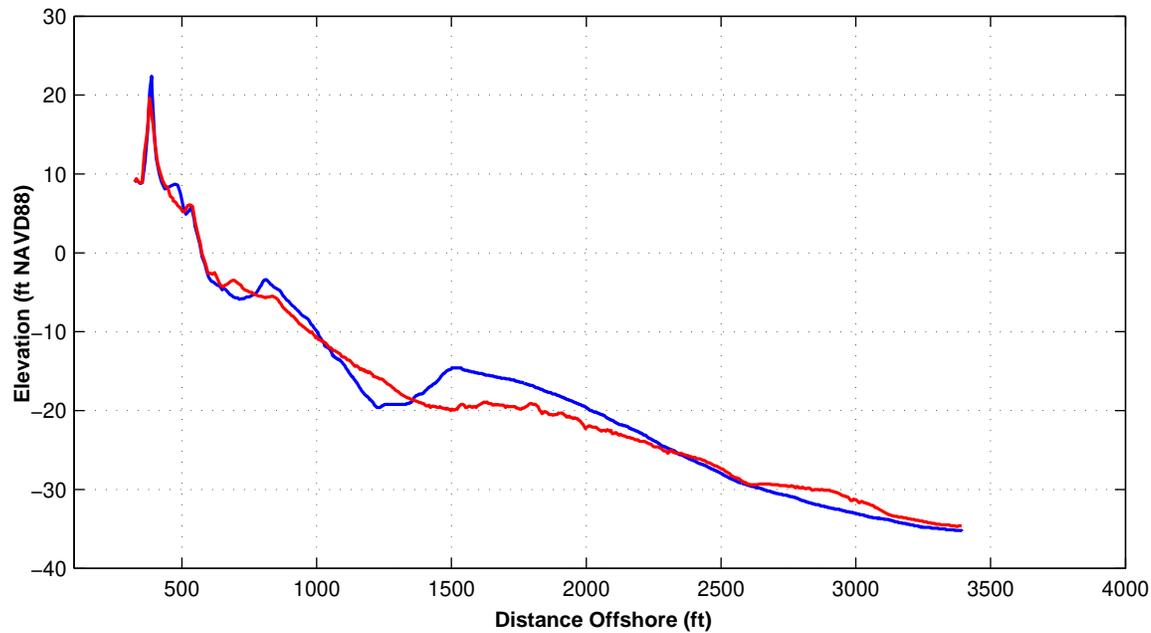
Survey Transect 1030+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	-109.66 ft	-10.01 ft
Volume Change Above +6 ft NAVD88	5.73 cy/ft	-0.14 cy/ft
Volume Change Above 1.18 ft NAVD88	-7.22 cy/ft	-1.29 cy/ft
Volume Change Above -6 ft NAVD88	-31.10 cy/ft	-2.54 cy/ft
Volume Change Above -14 ft NAVD88	-15.18 cy/ft	-9.71 cy/ft
Volume Change Above -19 ft NAVD88	-53.90 cy/ft	8.00 cy/ft
Volume Change Above -30 ft NAVD88	-47.63 cy/ft	-54.82 cy/ft

LEGEND:

JULY 2021	—	AUGUST 2019	—
JUNE 2020	—	MAY 2018	—

- Notes:
1. Station From North To South At Varying Intervals.
 2. All Survey Elevations In Feet Referenced to NAVD88.

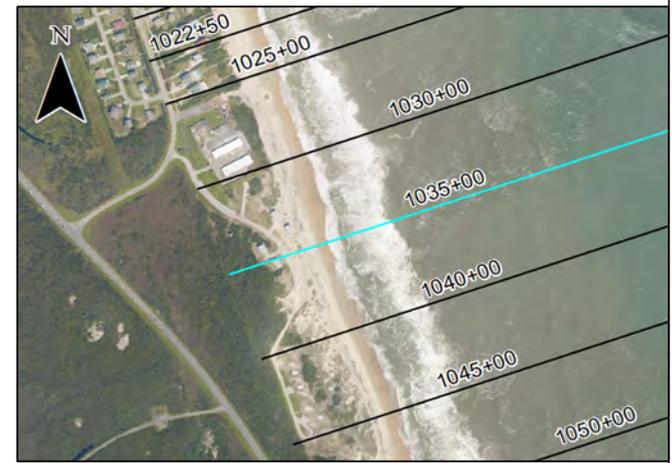


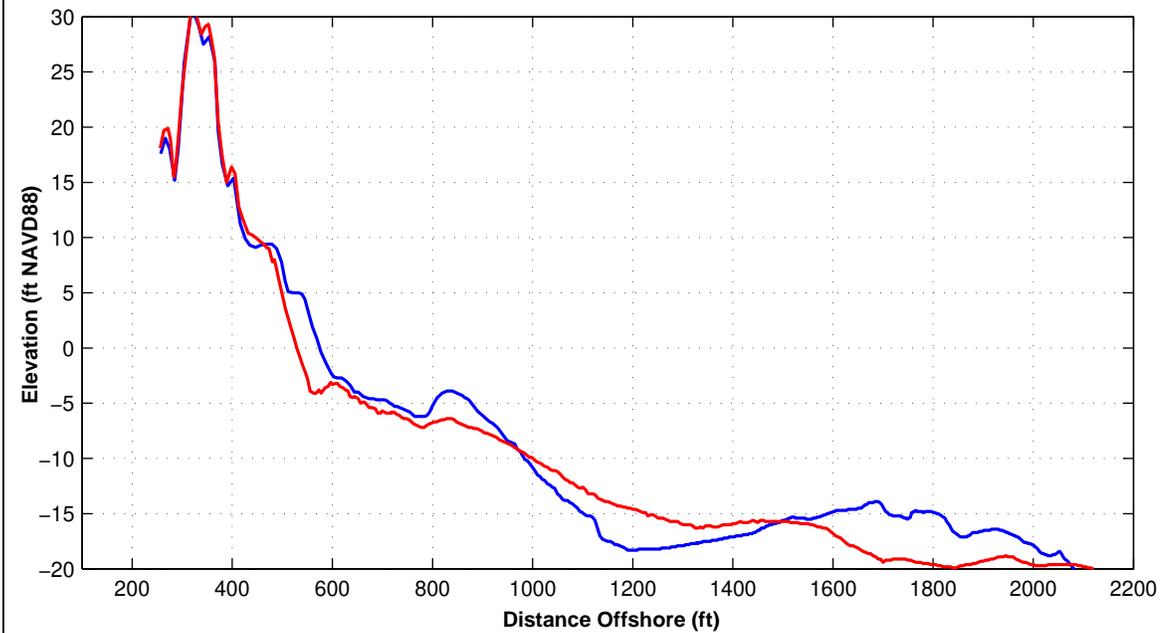
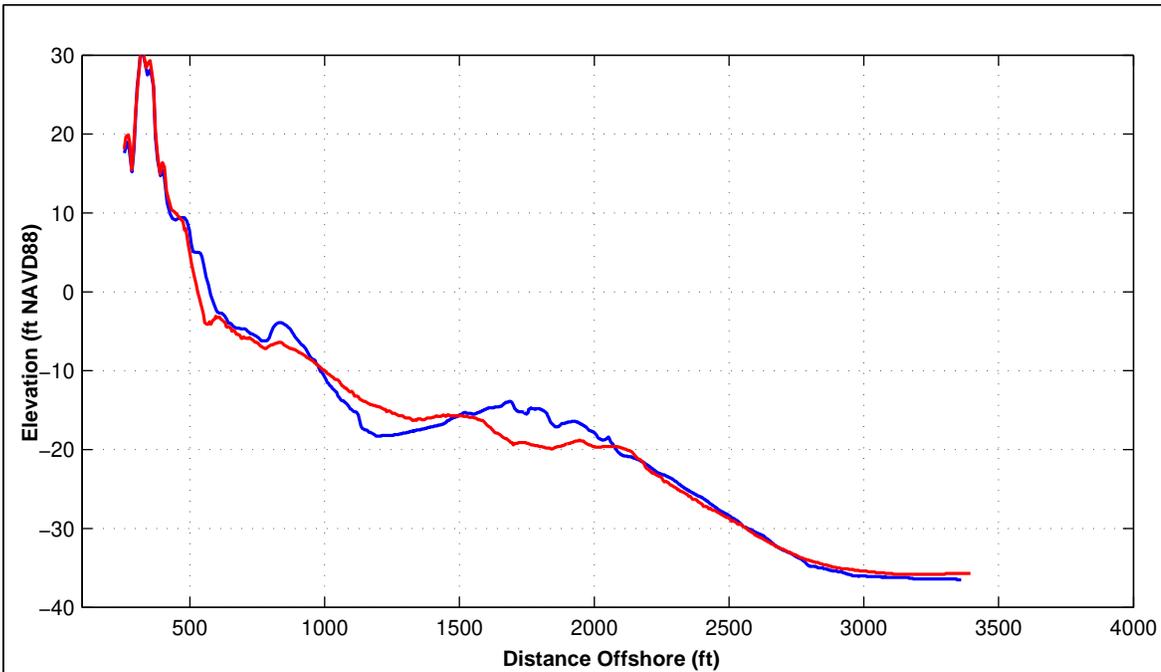


Survey Transect 1035+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	– ft	2.22 ft
Volume Change Above +6 ft NAVD88	– cy/ft	–4.05 cy/ft
Volume Change Above 1.18 ft NAVD88	– cy/ft	–3.38 cy/ft
Volume Change Above –6 ft NAVD88	– cy/ft	–1.71 cy/ft
Volume Change Above –14 ft NAVD88	– cy/ft	–6.04 cy/ft
Volume Change Above –19 ft NAVD88	– cy/ft	–43.26 cy/ft
Volume Change Above –30 ft NAVD88	– cy/ft	–66.42 cy/ft

LEGEND:
 JULY 2021 ————
 JUNE 2020 ————

- Notes:
1. Station From North To South At Varying Intervals.
 2. All Survey Elevations In Feet Referenced to NAVD88.

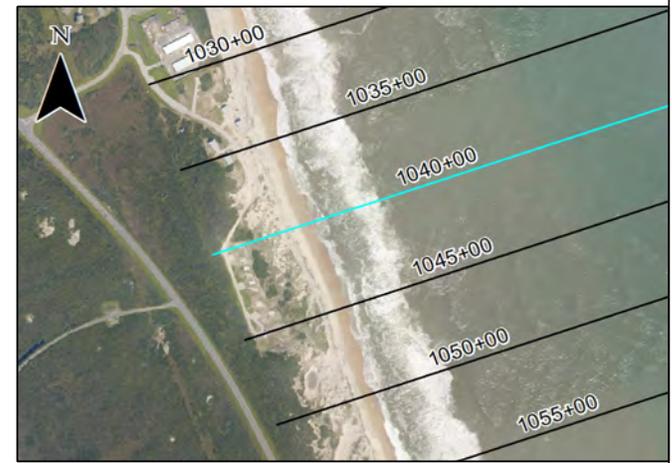


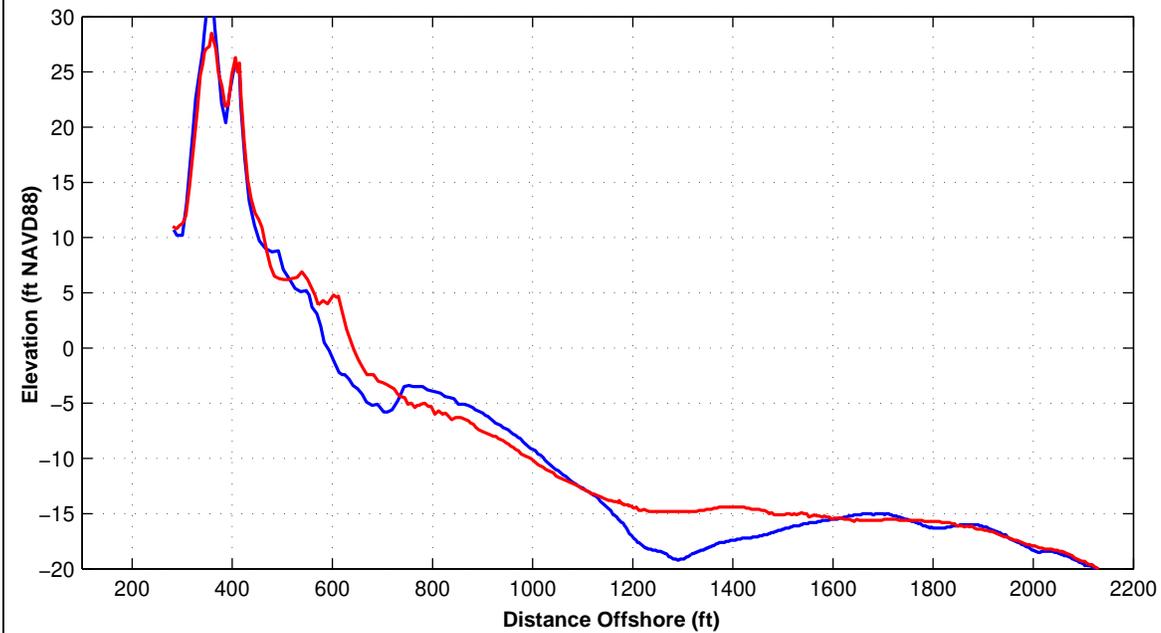
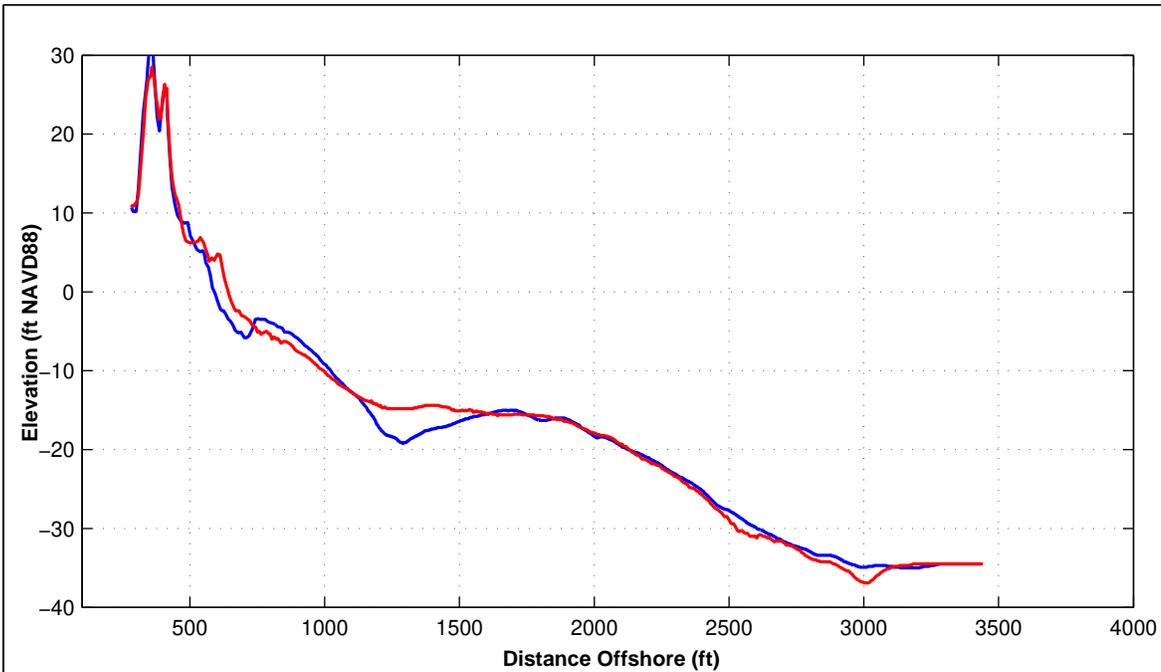


Survey Transect 1040+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	– ft	–44.71 ft
Volume Change Above +6 ft NAVD88	– cy/ft	1.93 cy/ft
Volume Change Above 1.18 ft NAVD88	– cy/ft	–4.66 cy/ft
Volume Change Above –6 ft NAVD88	– cy/ft	–22.89 cy/ft
Volume Change Above –14 ft NAVD88	– cy/ft	–22.41 cy/ft
Volume Change Above –19 ft NAVD88	– cy/ft	–42.77 cy/ft
Volume Change Above –30 ft NAVD88	– cy/ft	–54.25 cy/ft

LEGEND:
 JULY 2021 ——— (red line)
 JUNE 2020 ——— (blue line)

- Notes:
1. Station From North To South At Varying Intervals.
 2. All Survey Elevations In Feet Referenced to NAVD88.

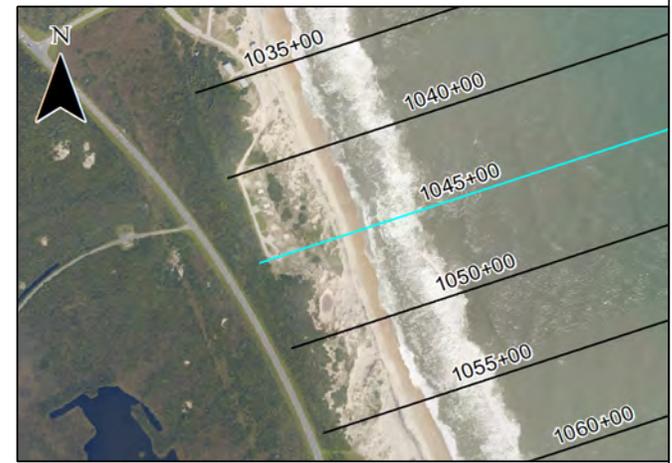


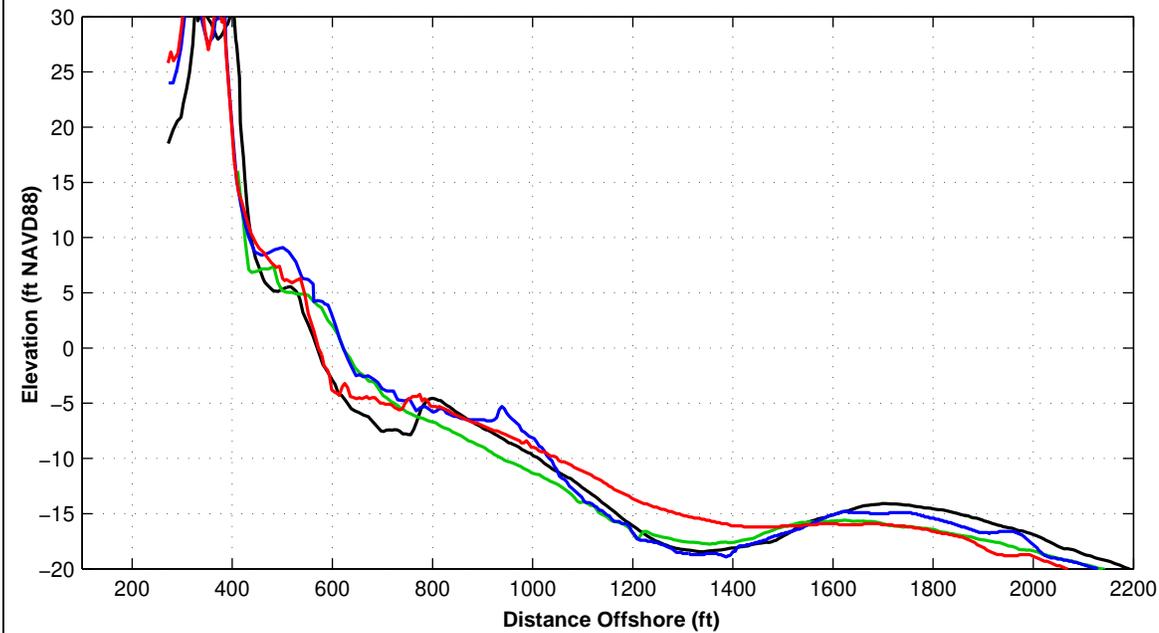
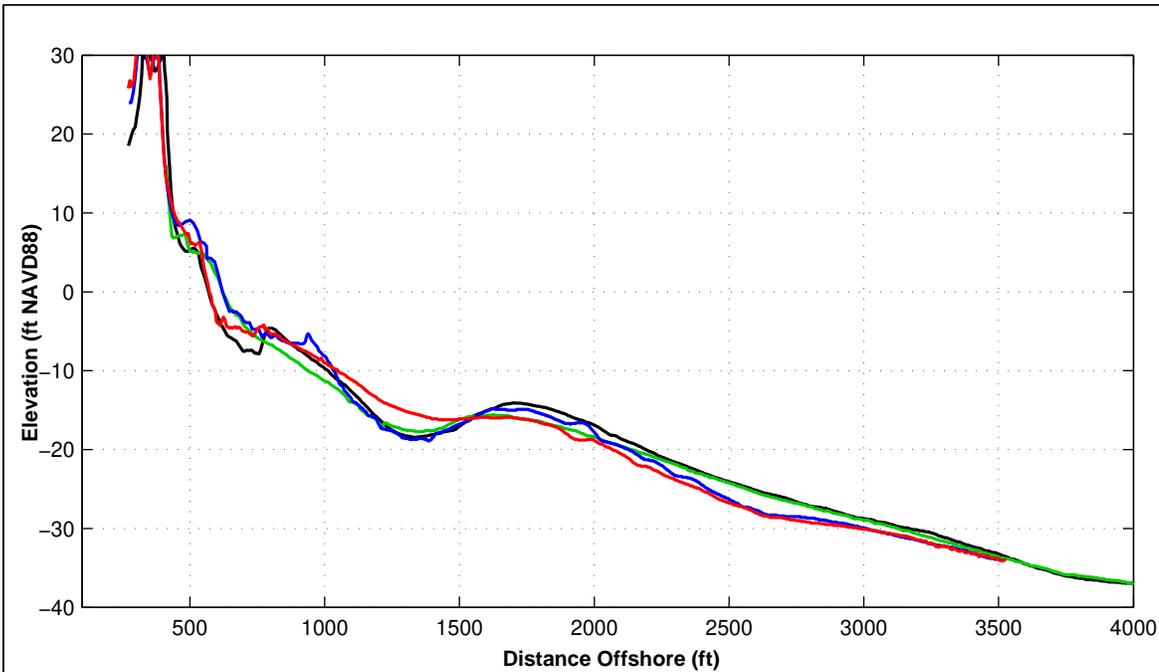


Survey Transect 1045+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	– ft	51.69 ft
Volume Change Above +6 ft NAVD88	– cy/ft	0.28 cy/ft
Volume Change Above 1.18 ft NAVD88	– cy/ft	7.86 cy/ft
Volume Change Above –6 ft NAVD88	– cy/ft	14.35 cy/ft
Volume Change Above –14 ft NAVD88	– cy/ft	6.46 cy/ft
Volume Change Above –19 ft NAVD88	– cy/ft	46.95 cy/ft
Volume Change Above –30 ft NAVD88	– cy/ft	37.57 cy/ft

LEGEND:
 JULY 2021 ——— (red line)
 JUNE 2020 ——— (blue line)

- Notes:
1. Station From North To South At Varying Intervals.
 2. All Survey Elevations In Feet Referenced to NAVD88.





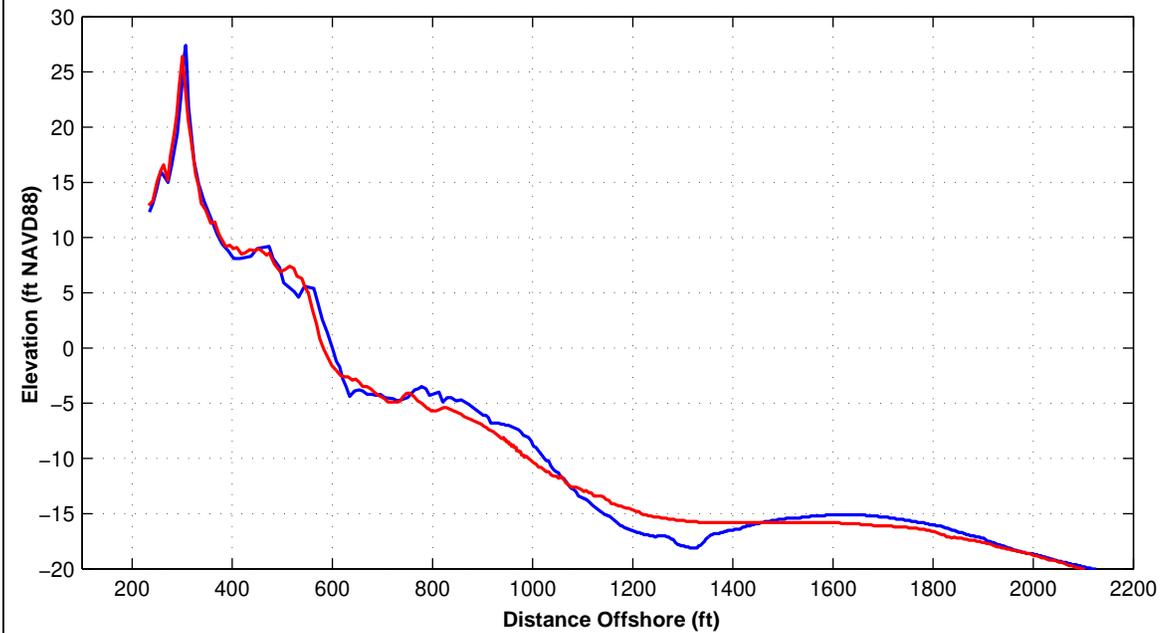
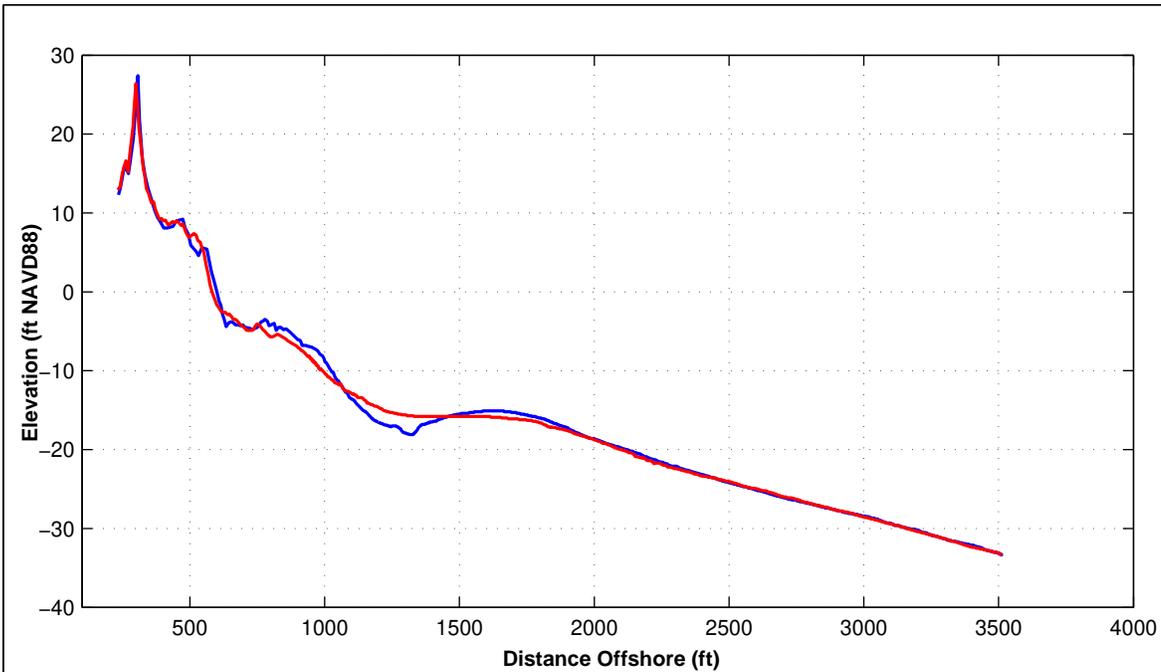
Survey Transect 1050+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	1.04 ft	-47.07 ft
Volume Change Above +6 ft NAVD88	8.71 cy/ft	-3.49 cy/ft
Volume Change Above 1.18 ft NAVD88	12.65 cy/ft	-9.80 cy/ft
Volume Change Above -6 ft NAVD88	16.00 cy/ft	-23.41 cy/ft
Volume Change Above -14 ft NAVD88	40.76 cy/ft	-18.48 cy/ft
Volume Change Above -19 ft NAVD88	46.50 cy/ft	-5.46 cy/ft
Volume Change Above -30 ft NAVD88	-3.02 cy/ft	-25.92 cy/ft

LEGEND:

JULY 2021	—	AUGUST 2019	—
JUNE 2020	—	MAY 2018	—

- Notes:
1. Station From North To South At Varying Intervals.
 2. All Survey Elevations In Feet Referenced to NAVD88.

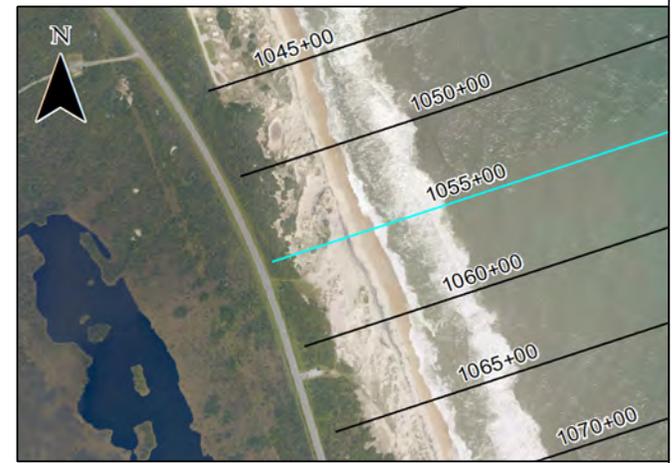


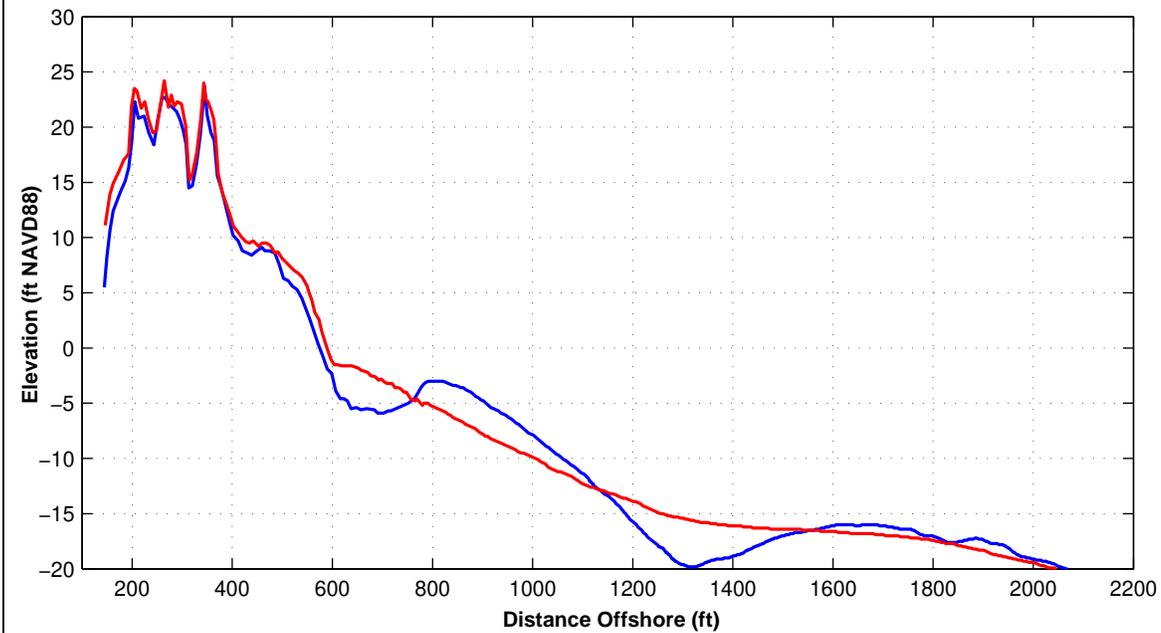
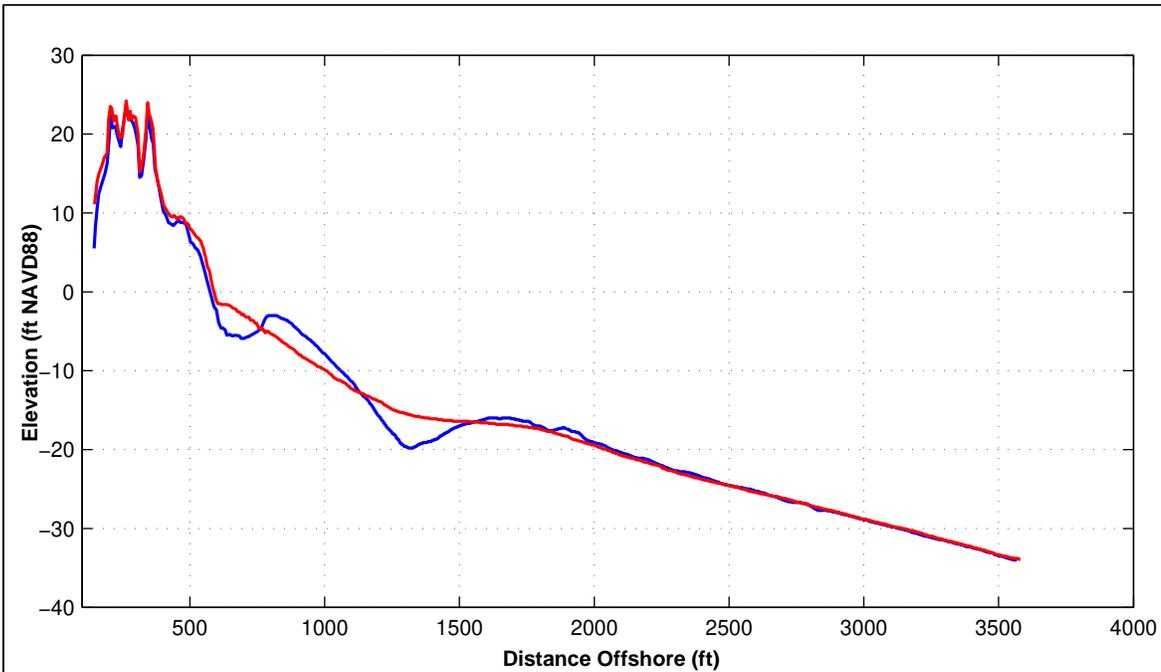


Survey Transect 1055+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	– ft	–18.38 ft
Volume Change Above +6 ft NAVD88	– cy/ft	0.40 cy/ft
Volume Change Above 1.18 ft NAVD88	– cy/ft	–0.85 cy/ft
Volume Change Above –6 ft NAVD88	– cy/ft	–6.40 cy/ft
Volume Change Above –14 ft NAVD88	– cy/ft	–12.91 cy/ft
Volume Change Above –19 ft NAVD88	– cy/ft	–6.11 cy/ft
Volume Change Above –30 ft NAVD88	– cy/ft	–8.24 cy/ft

LEGEND:
 JULY 2021 ————
 JUNE 2020 ————

Notes:
 1. Station From North To South At Varying Intervals.
 2. All Survey Elevations In Feet Referenced to NAVD88.

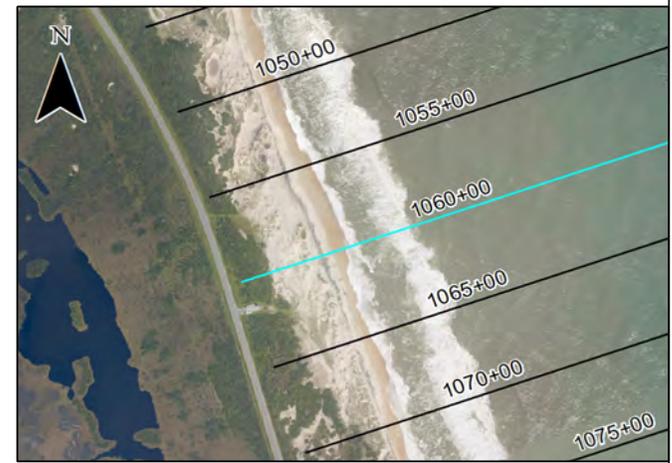


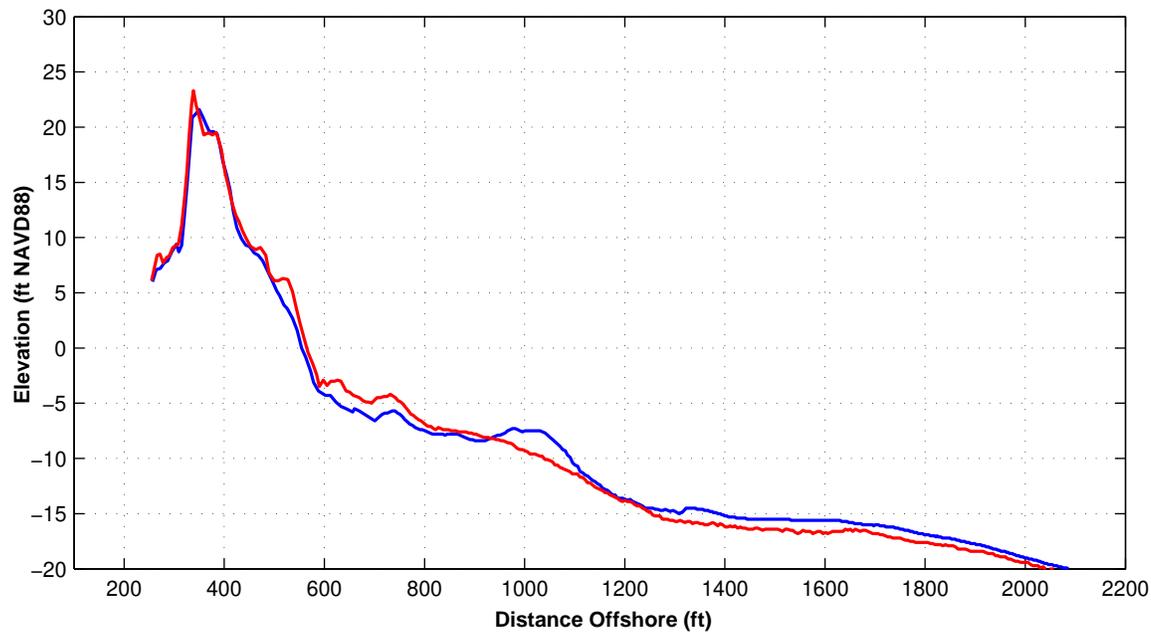
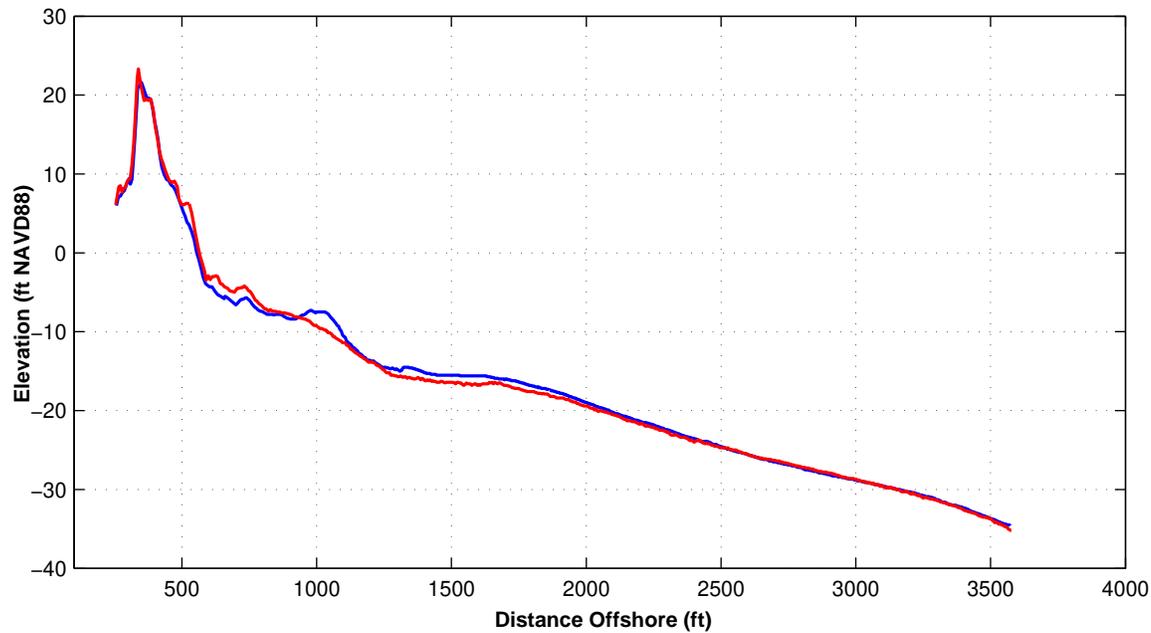


Survey Transect 1060+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	– ft	15.54 ft
Volume Change Above +6 ft NAVD88	– cy/ft	11.24 cy/ft
Volume Change Above 1.18 ft NAVD88	– cy/ft	14.65 cy/ft
Volume Change Above –6 ft NAVD88	– cy/ft	20.64 cy/ft
Volume Change Above –14 ft NAVD88	– cy/ft	4.75 cy/ft
Volume Change Above –19 ft NAVD88	– cy/ft	25.66 cy/ft
Volume Change Above –30 ft NAVD88	– cy/ft	22.99 cy/ft

LEGEND:
 JULY 2021 ————
 JUNE 2020 ————

- Notes:
 1. Station From North To South At Varying Intervals.
 2. All Survey Elevations In Feet Referenced to NAVD88.

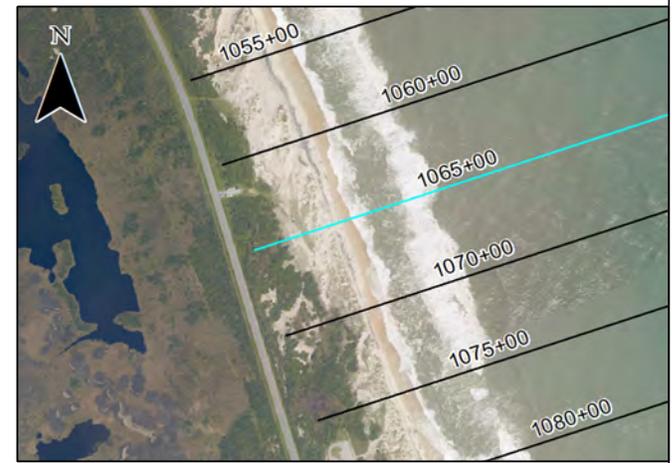


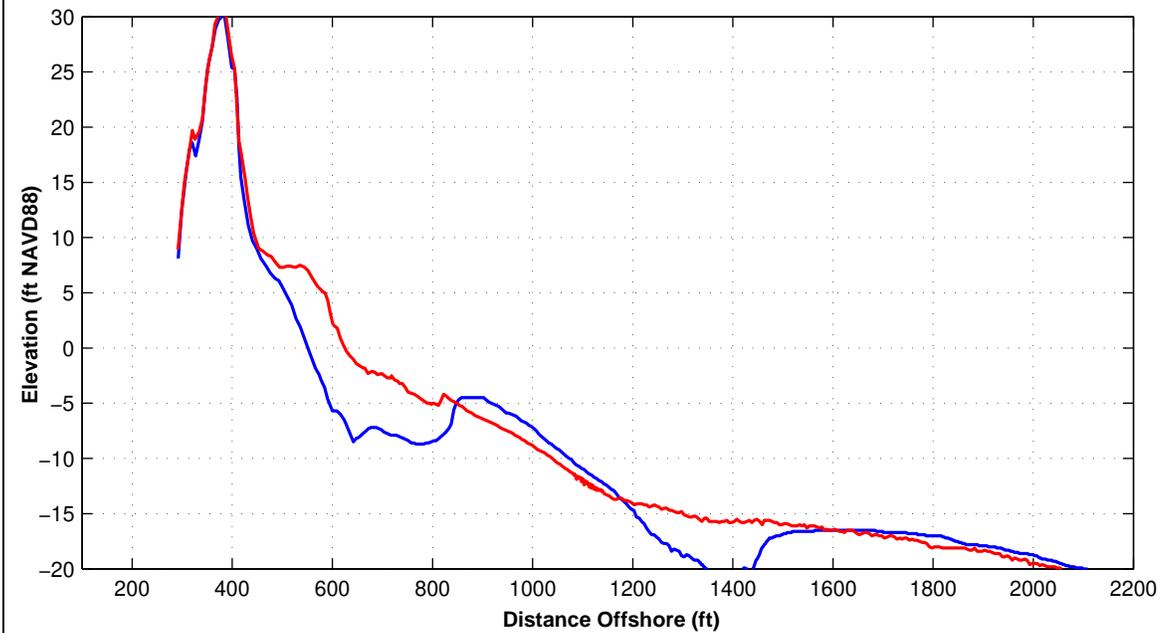
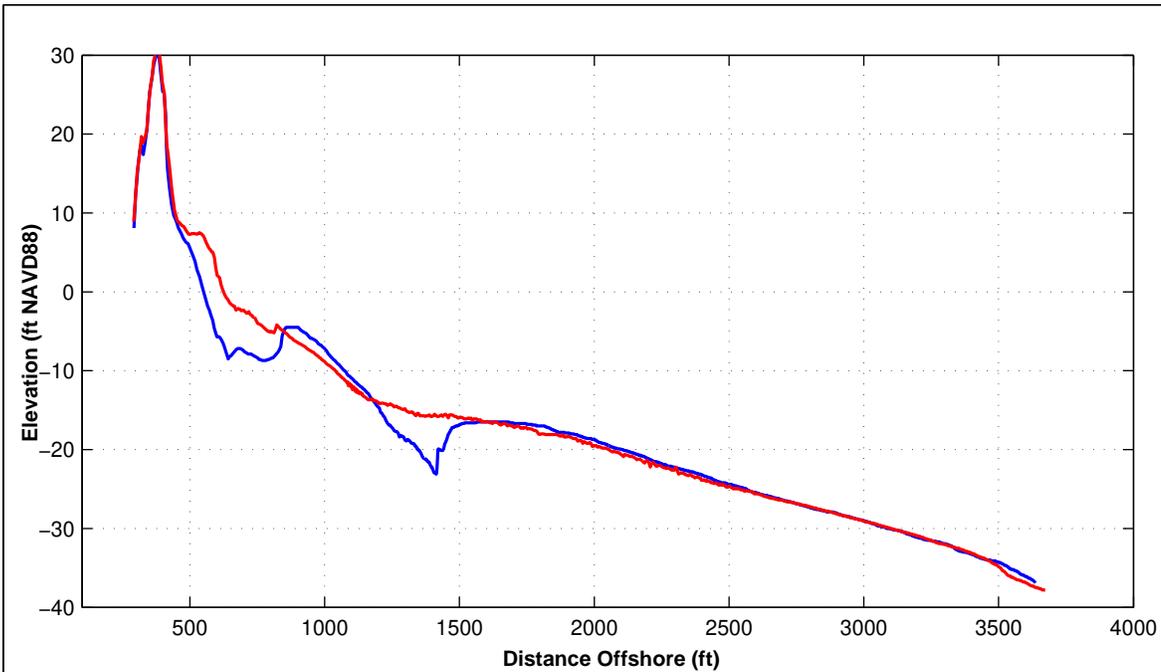


Survey Transect 1065+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	– ft	9.67 ft
Volume Change Above +6 ft NAVD88	– cy/ft	1.65 cy/ft
Volume Change Above 1.18 ft NAVD88	– cy/ft	5.20 cy/ft
Volume Change Above –6 ft NAVD88	– cy/ft	15.76 cy/ft
Volume Change Above –14 ft NAVD88	– cy/ft	8.55 cy/ft
Volume Change Above –19 ft NAVD88	– cy/ft	–14.40 cy/ft
Volume Change Above –30 ft NAVD88	– cy/ft	–18.18 cy/ft

LEGEND:
 JULY 2021 ————
 JUNE 2020 ————

- Notes:
1. Station From North To South At Varying Intervals.
 2. All Survey Elevations In Feet Referenced to NAVD88.

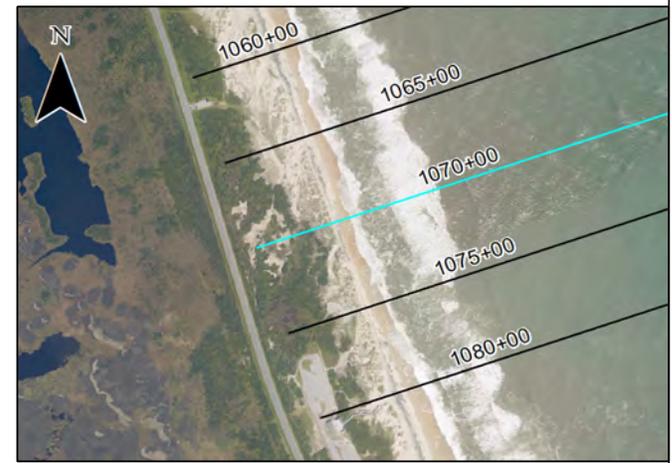


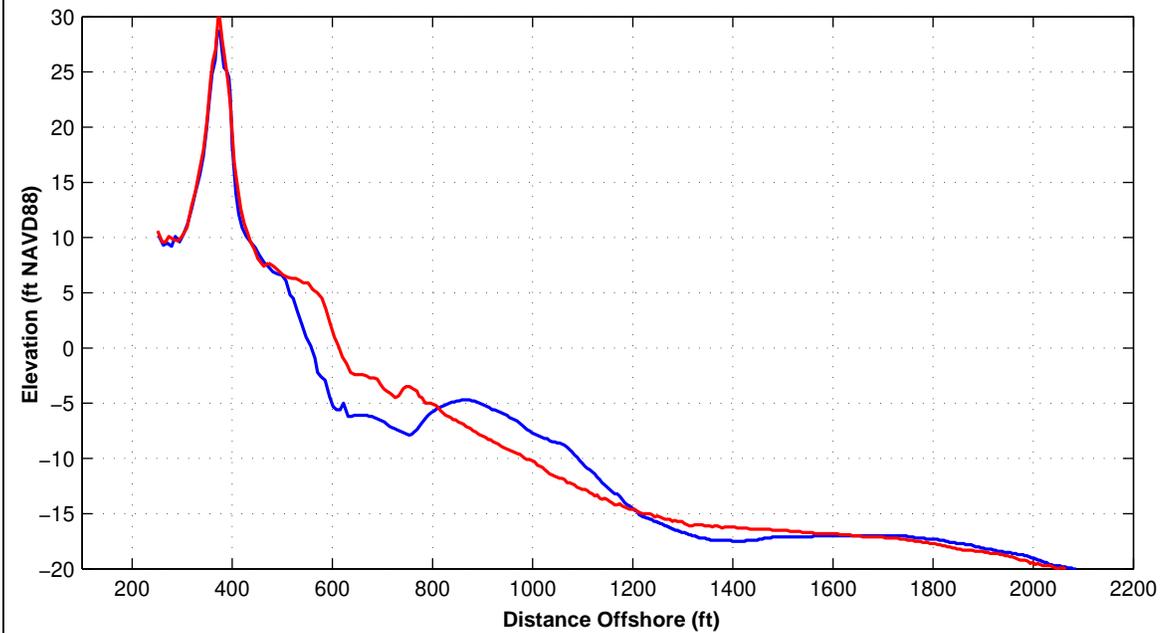
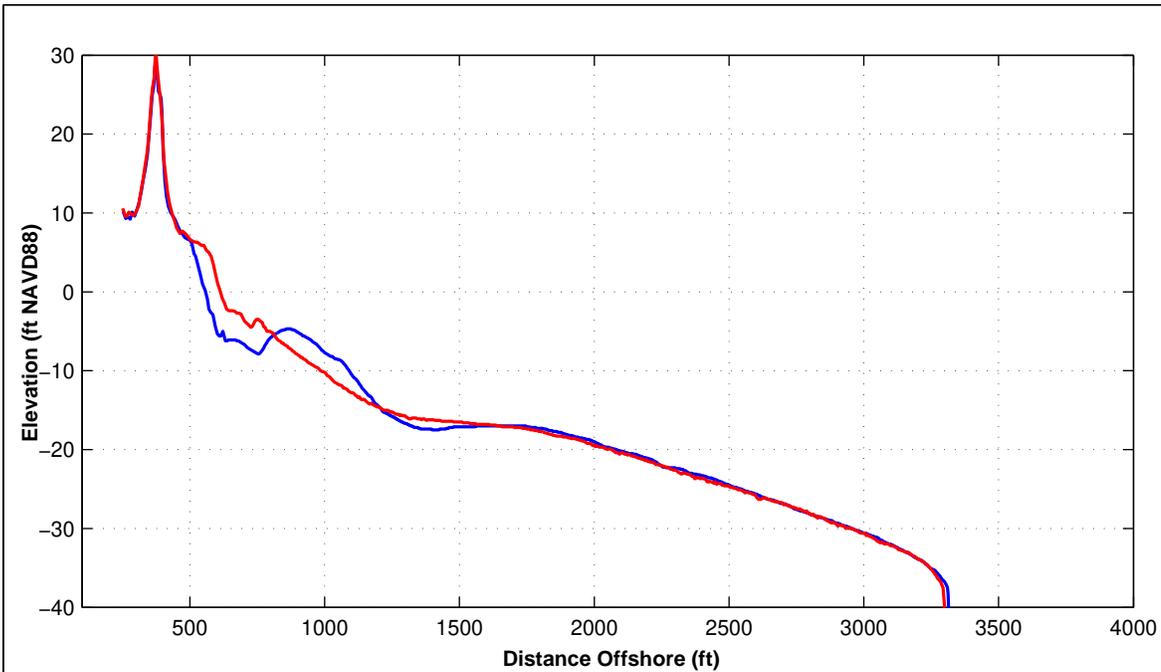


Survey Transect 1070+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	– ft	72.17 ft
Volume Change Above +6 ft NAVD88	– cy/ft	8.12 cy/ft
Volume Change Above 1.18 ft NAVD88	– cy/ft	21.13 cy/ft
Volume Change Above –6 ft NAVD88	– cy/ft	53.52 cy/ft
Volume Change Above –14 ft NAVD88	– cy/ft	57.32 cy/ft
Volume Change Above –19 ft NAVD88	– cy/ft	83.58 cy/ft
Volume Change Above –30 ft NAVD88	– cy/ft	81.63 cy/ft

LEGEND:
 JULY 2021 ————
 JUNE 2020 ————

- Notes:
 1. Station From North To South At Varying Intervals.
 2. All Survey Elevations In Feet Referenced to NAVD88.



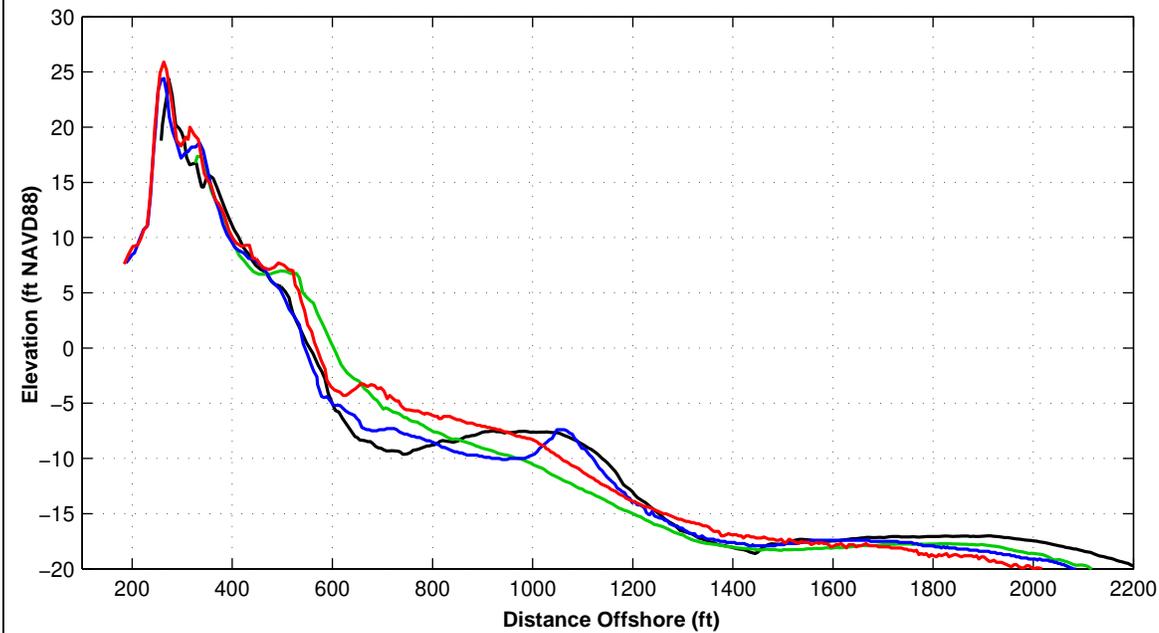
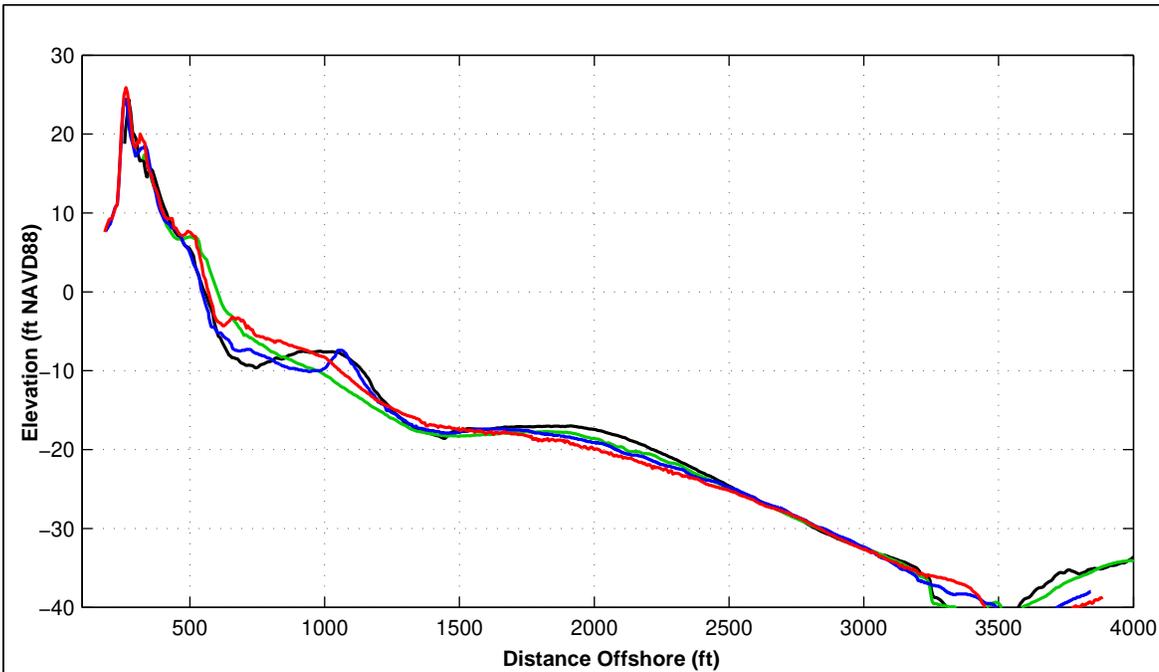


Survey Transect 1075+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	– ft	56.69 ft
Volume Change Above +6 ft NAVD88	– cy/ft	2.25 cy/ft
Volume Change Above 1.18 ft NAVD88	– cy/ft	12.10 cy/ft
Volume Change Above –6 ft NAVD88	– cy/ft	35.95 cy/ft
Volume Change Above –14 ft NAVD88	– cy/ft	13.20 cy/ft
Volume Change Above –19 ft NAVD88	– cy/ft	19.90 cy/ft
Volume Change Above –30 ft NAVD88	– cy/ft	13.25 cy/ft

LEGEND:
 JULY 2021 ————
 JUNE 2020 ————

Notes:
 1. Station From North To South At Varying Intervals.
 2. All Survey Elevations In Feet Referenced to NAVD88.





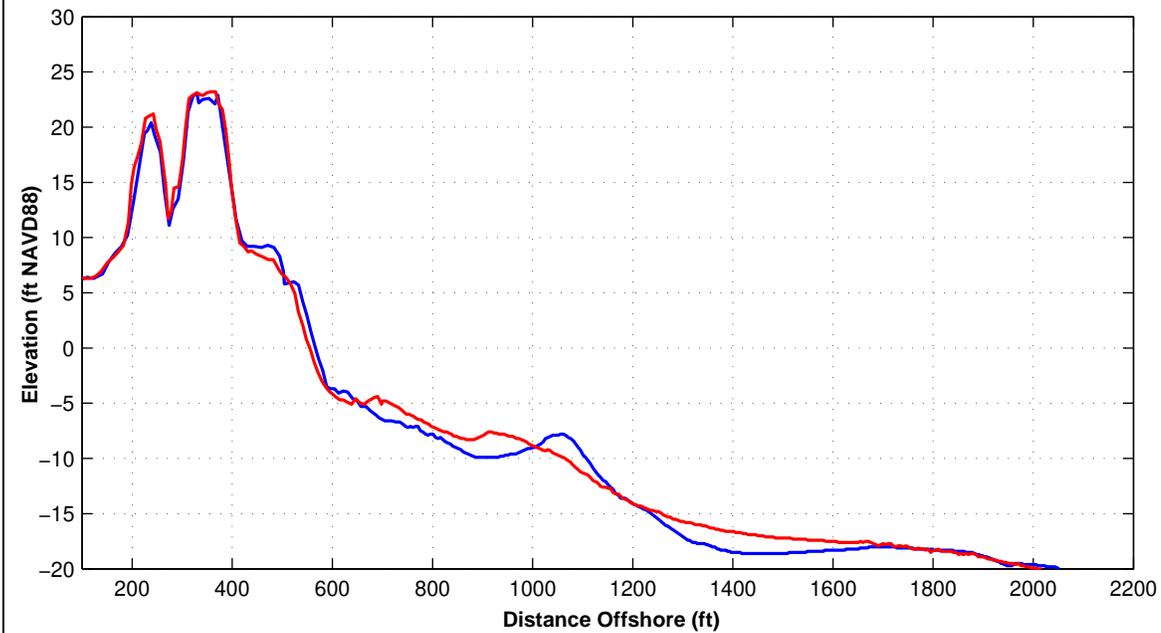
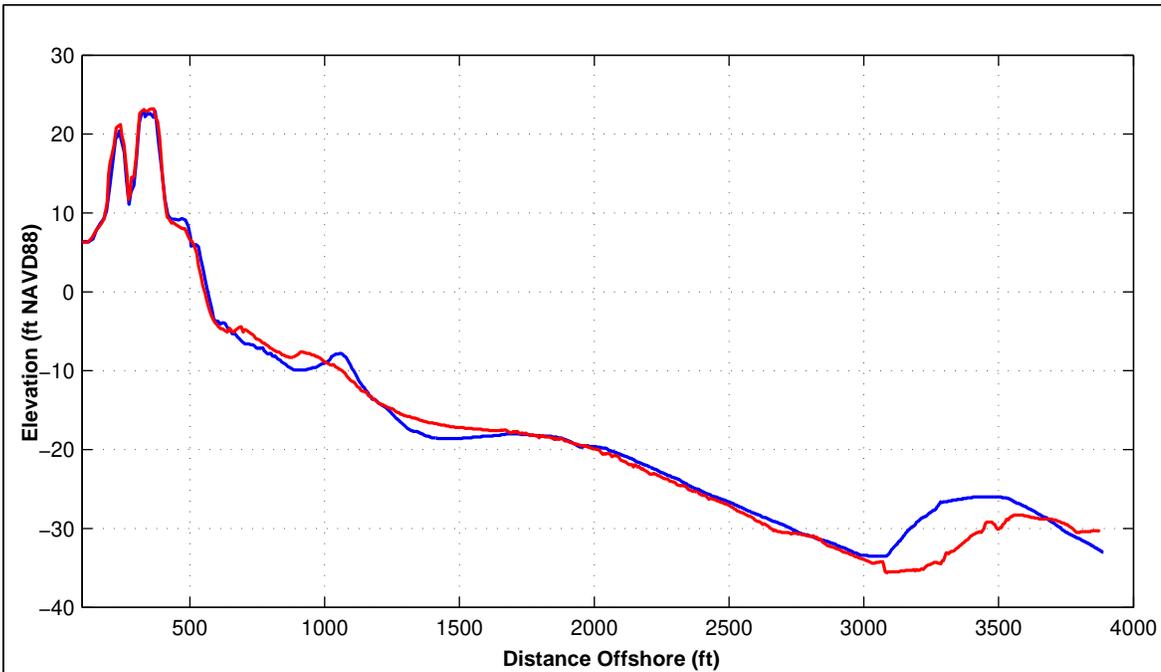
Survey Transect 1080+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	-52.22 ft	22.19 ft
Volume Change Above +6 ft NAVD88	0.54 cy/ft	5.44 cy/ft
Volume Change Above 1.18 ft NAVD88	-8.20 cy/ft	10.48 cy/ft
Volume Change Above -6 ft NAVD88	-27.79 cy/ft	25.77 cy/ft
Volume Change Above -14 ft NAVD88	-19.61 cy/ft	44.70 cy/ft
Volume Change Above -19 ft NAVD88	-11.68 cy/ft	44.34 cy/ft
Volume Change Above -30 ft NAVD88	-16.00 cy/ft	27.74 cy/ft

LEGEND:

JULY 2021	—	AUGUST 2019	—
JUNE 2020	—	MAY 2018	—

- Notes:
1. Station From North To South At Varying Intervals.
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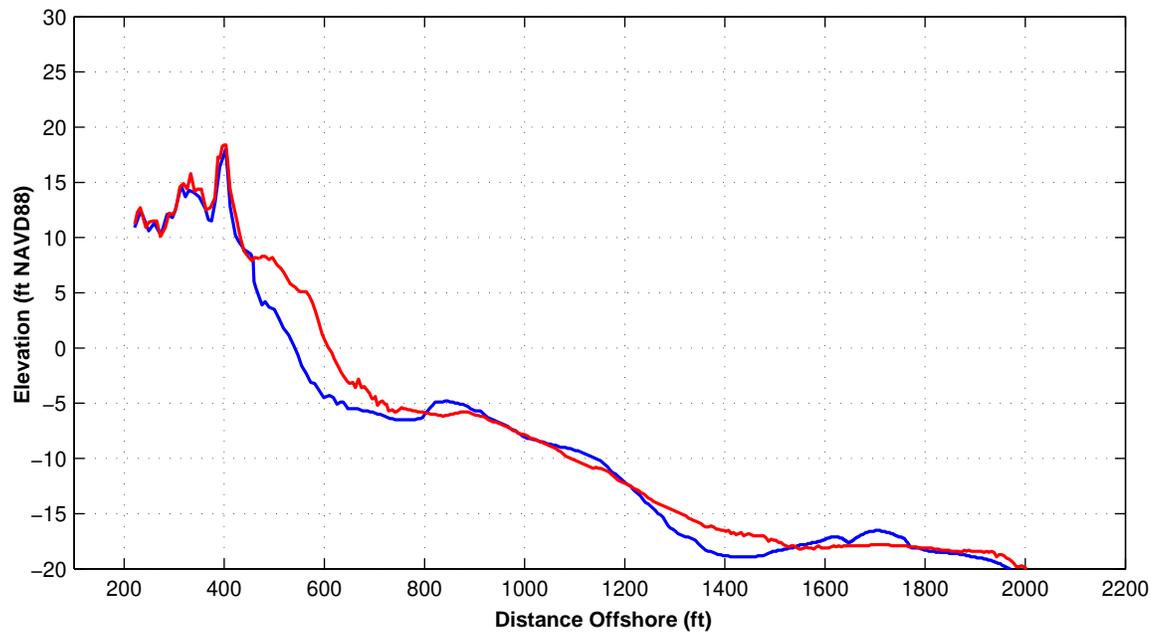
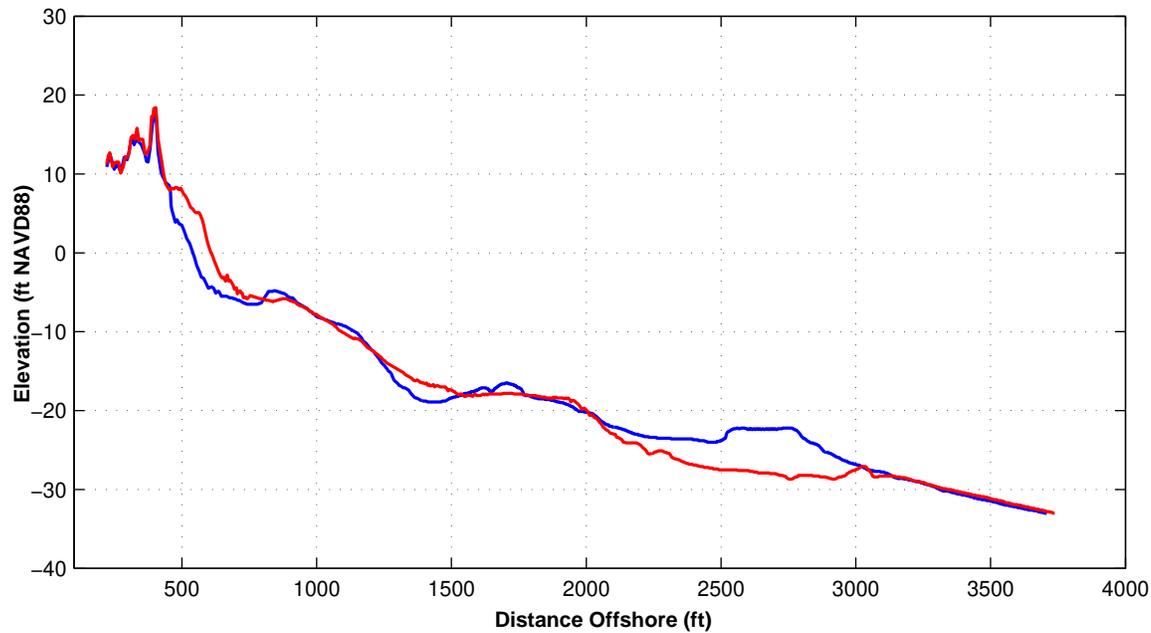


Survey Transect 1090+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	– ft	–12.97 ft
Volume Change Above +6 ft NAVD88	– cy/ft	2.26 cy/ft
Volume Change Above 1.18 ft NAVD88	– cy/ft	–0.03 cy/ft
Volume Change Above –6 ft NAVD88	– cy/ft	–0.16 cy/ft
Volume Change Above –14 ft NAVD88	– cy/ft	5.78 cy/ft
Volume Change Above –19 ft NAVD88	– cy/ft	26.03 cy/ft
Volume Change Above –30 ft NAVD88	– cy/ft	–34.45 cy/ft

LEGEND:
 JULY 2021 —
 JUNE 2020 —

- Notes:
 1. Station From North To South At Varying Intervals.
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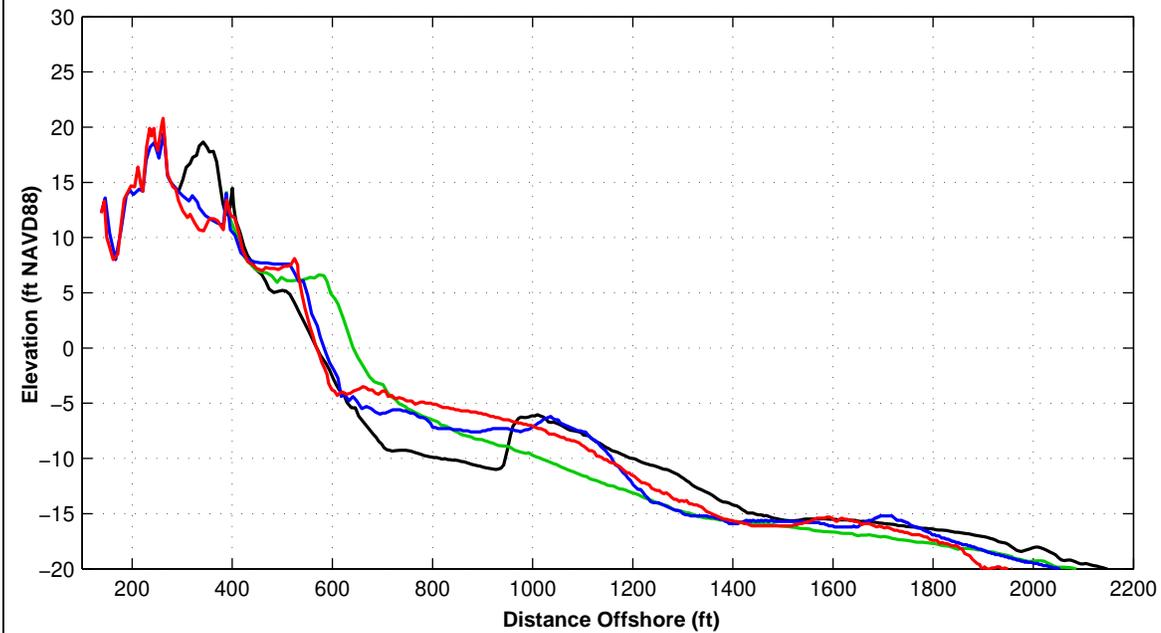
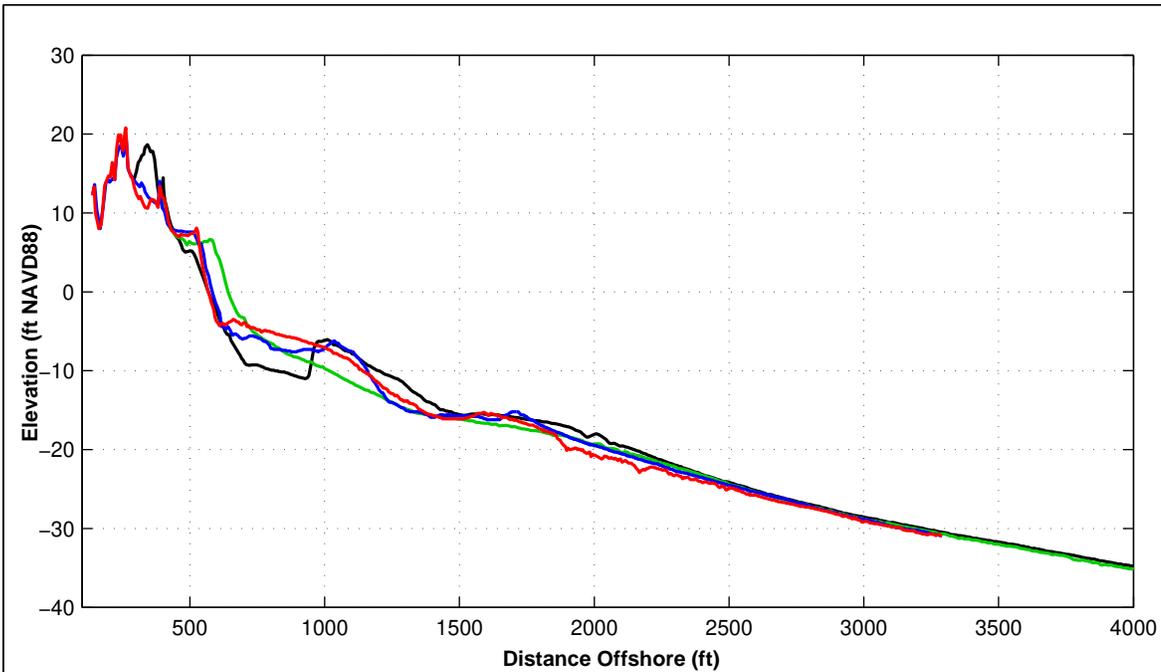


Survey Transect 1100+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	– ft	67.73 ft
Volume Change Above +6 ft NAVD88	– cy/ft	6.11 cy/ft
Volume Change Above 1.18 ft NAVD88	– cy/ft	20.89 cy/ft
Volume Change Above –6 ft NAVD88	– cy/ft	38.32 cy/ft
Volume Change Above –14 ft NAVD88	– cy/ft	36.42 cy/ft
Volume Change Above –19 ft NAVD88	– cy/ft	49.22 cy/ft
Volume Change Above –30 ft NAVD88	– cy/ft	–68.43 cy/ft

LEGEND:
 JULY 2021 ————
 JUNE 2020 ————

- Notes:
1. Station From North To South At Varying Intervals.
 2. All Survey Elevations In Feet Referenced to NAVD88.





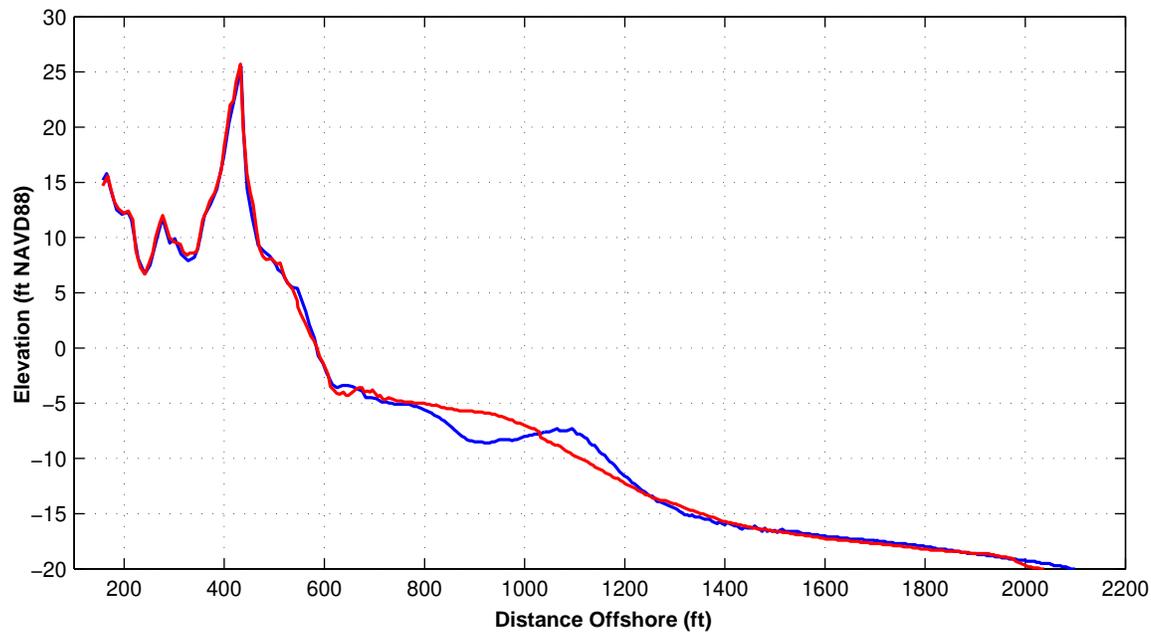
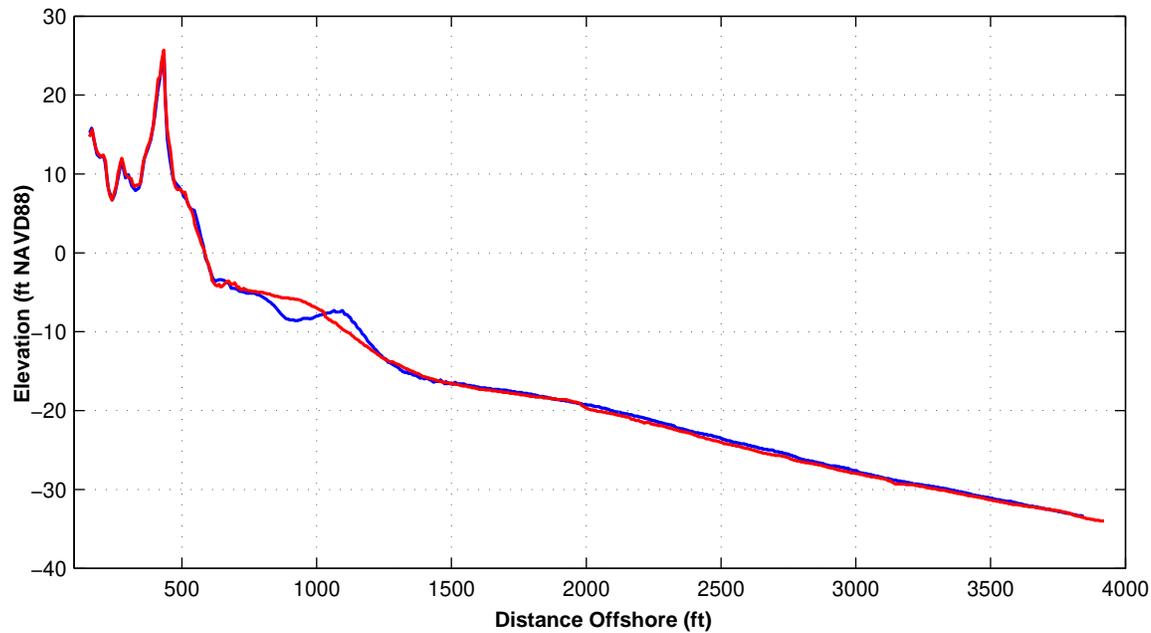
Survey Transect 1110+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	-57.85 ft	-14.43 ft
Volume Change Above +6 ft NAVD88	2.27 cy/ft	0.45 cy/ft
Volume Change Above 1.18 ft NAVD88	-7.45 cy/ft	-1.64 cy/ft
Volume Change Above -6 ft NAVD88	-25.72 cy/ft	4.84 cy/ft
Volume Change Above -14 ft NAVD88	4.74 cy/ft	11.06 cy/ft
Volume Change Above -19 ft NAVD88	18.43 cy/ft	7.65 cy/ft
Volume Change Above -30 ft NAVD88	10.38 cy/ft	-16.28 cy/ft

LEGEND:

JULY 2021	—	AUGUST 2019	—
JUNE 2020	—	MAY 2018	—

- Notes:
1. Station From North To South At Varying Intervals.
 2. All Survey Elevations In Feet Referenced to NAVD88.



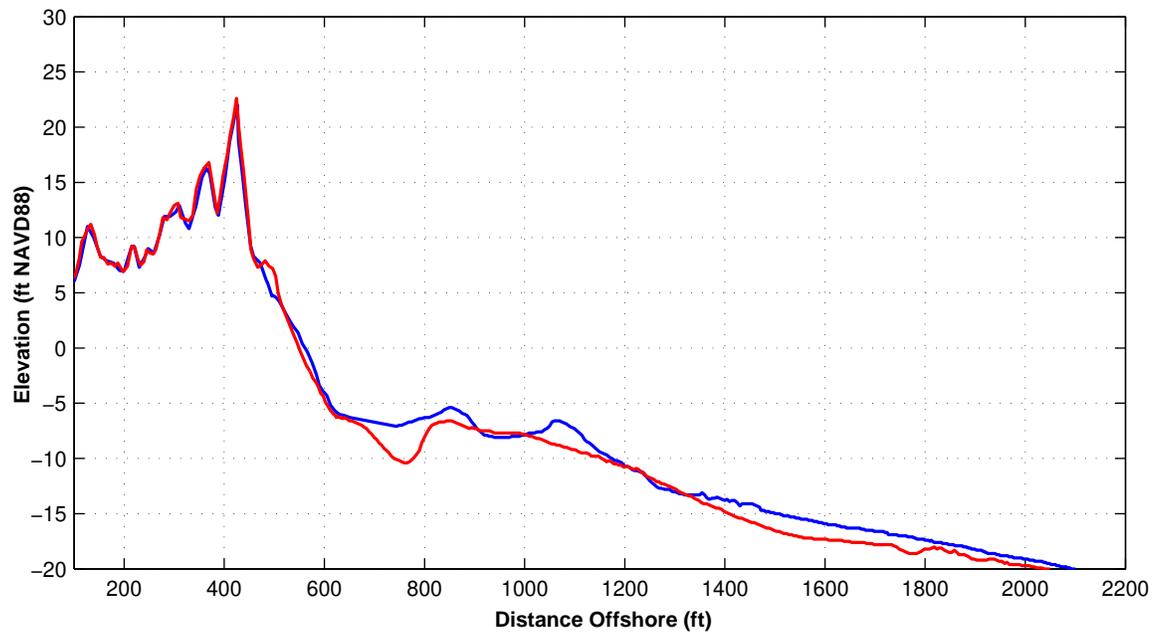
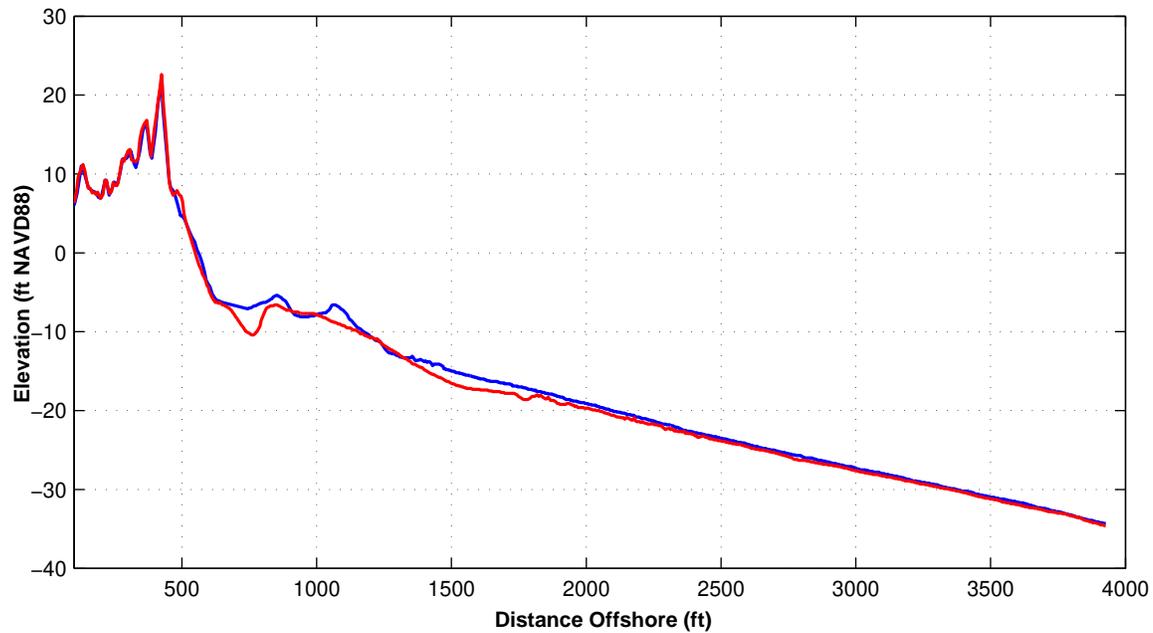


Survey Transect 1120+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	– ft	–5.78 ft
Volume Change Above +6 ft NAVD88	– cy/ft	0.85 cy/ft
Volume Change Above 1.18 ft NAVD88	– cy/ft	–0.66 cy/ft
Volume Change Above –6 ft NAVD88	– cy/ft	2.06 cy/ft
Volume Change Above –14 ft NAVD88	– cy/ft	4.77 cy/ft
Volume Change Above –19 ft NAVD88	– cy/ft	4.42 cy/ft
Volume Change Above –30 ft NAVD88	– cy/ft	–14.31 cy/ft

LEGEND:
 JULY 2021 ————
 JUNE 2020 ————

- Notes:
1. Station From North To South At Varying Intervals.
 2. All Survey Elevations In Feet Referenced to NAVD88.



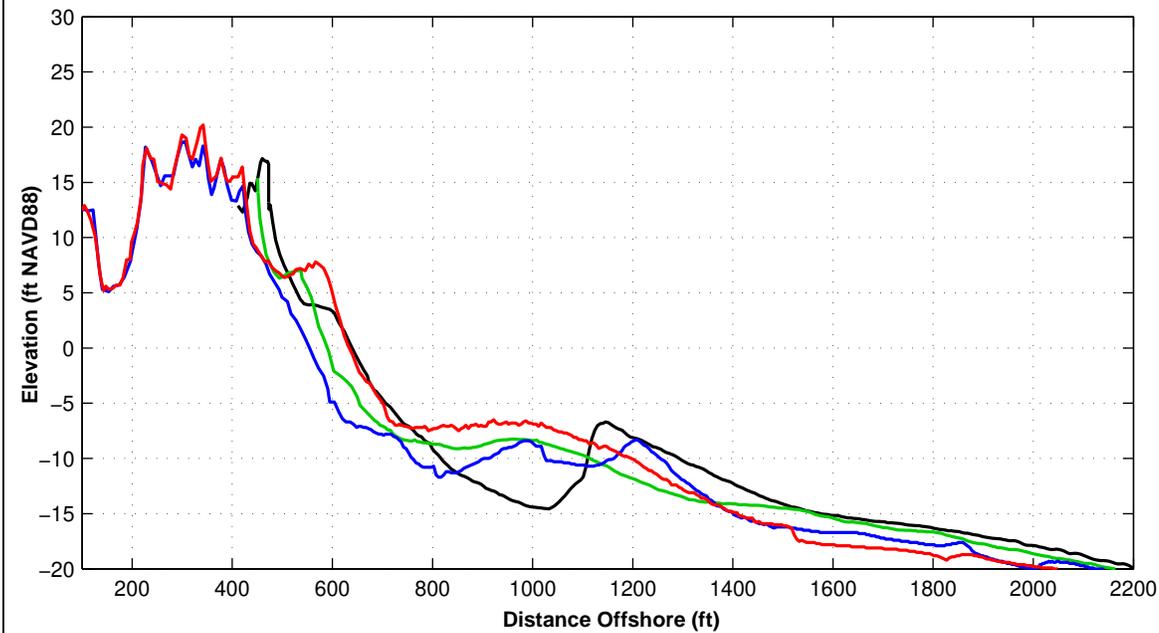
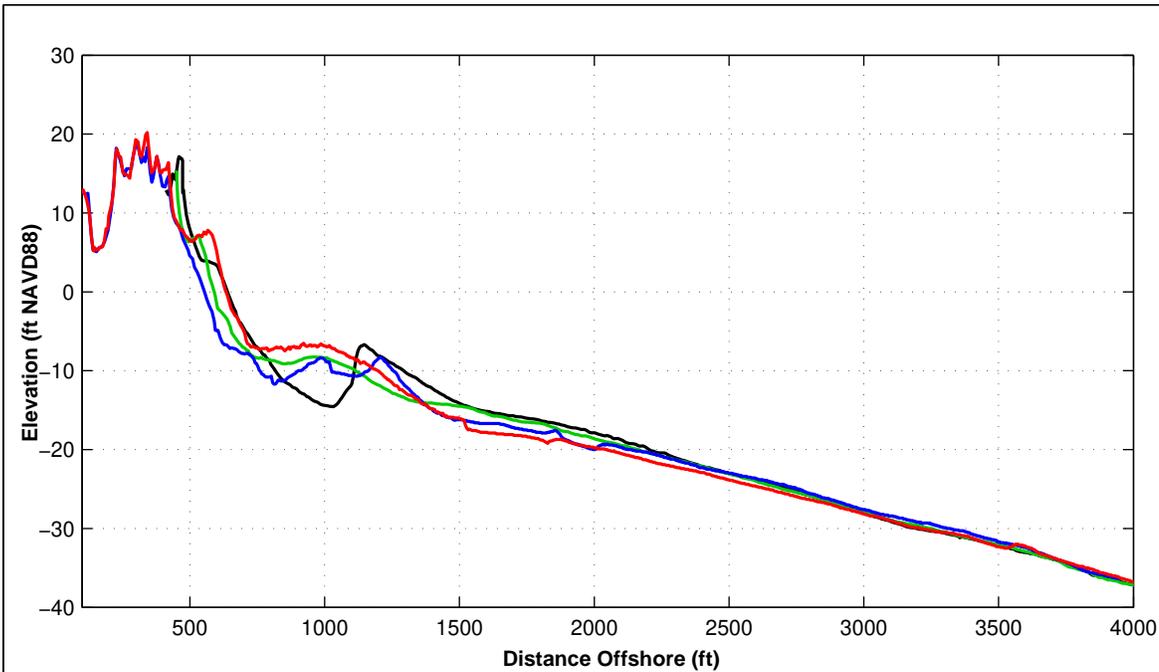


Survey Transect 1130+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	– ft	–10.39 ft
Volume Change Above +6 ft NAVD88	– cy/ft	2.07 cy/ft
Volume Change Above 1.18 ft NAVD88	– cy/ft	2.55 cy/ft
Volume Change Above –6 ft NAVD88	– cy/ft	–0.69 cy/ft
Volume Change Above –14 ft NAVD88	– cy/ft	–22.43 cy/ft
Volume Change Above –19 ft NAVD88	– cy/ft	–46.89 cy/ft
Volume Change Above –30 ft NAVD88	– cy/ft	–66.27 cy/ft

LEGEND:
 JULY 2021 ————
 JUNE 2020 ————

- Notes:
1. Station From North To South At Varying Intervals.
 2. All Survey Elevations In Feet Referenced to NAVD88.





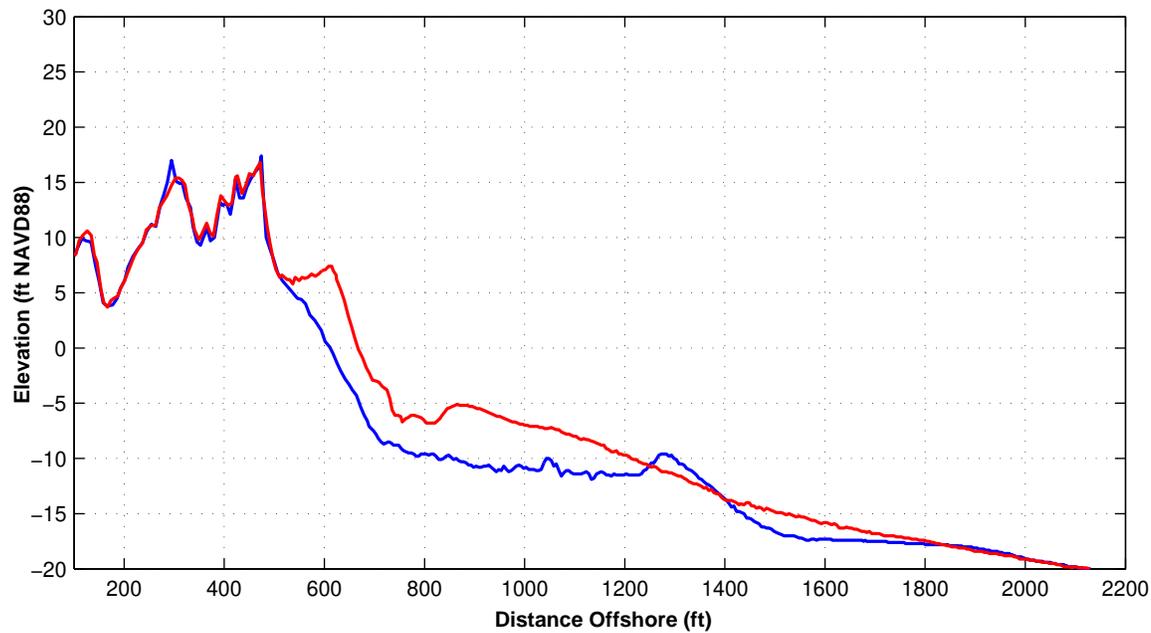
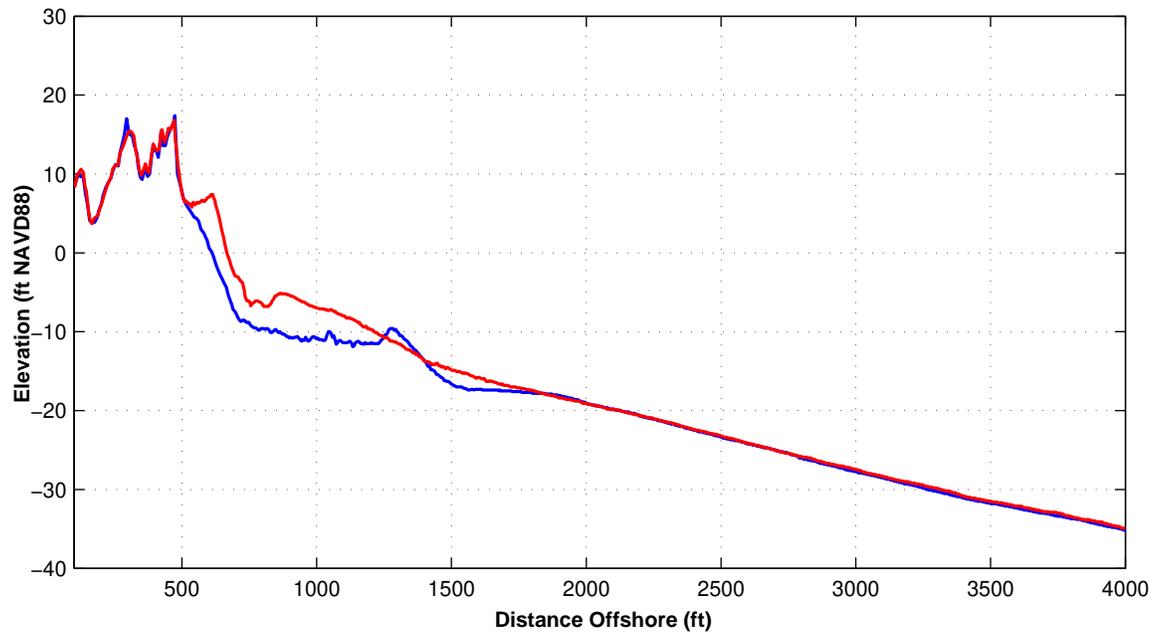
Survey Transect 1140+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	-37.57 ft	80.78 ft
Volume Change Above +6 ft NAVD88	-4.63 cy/ft	4.68 cy/ft
Volume Change Above 1.18 ft NAVD88	-12.10 cy/ft	21.57 cy/ft
Volume Change Above -6 ft NAVD88	-7.51 cy/ft	23.02 cy/ft
Volume Change Above -14 ft NAVD88	-13.57 cy/ft	63.58 cy/ft
Volume Change Above -19 ft NAVD88	-39.31 cy/ft	50.53 cy/ft
Volume Change Above -30 ft NAVD88	-32.47 cy/ft	14.35 cy/ft

LEGEND:

JULY 2021		AUGUST 2019	
JUNE 2020		MAY 2018	

- Notes:
1. Station From North To South At Varying Intervals.
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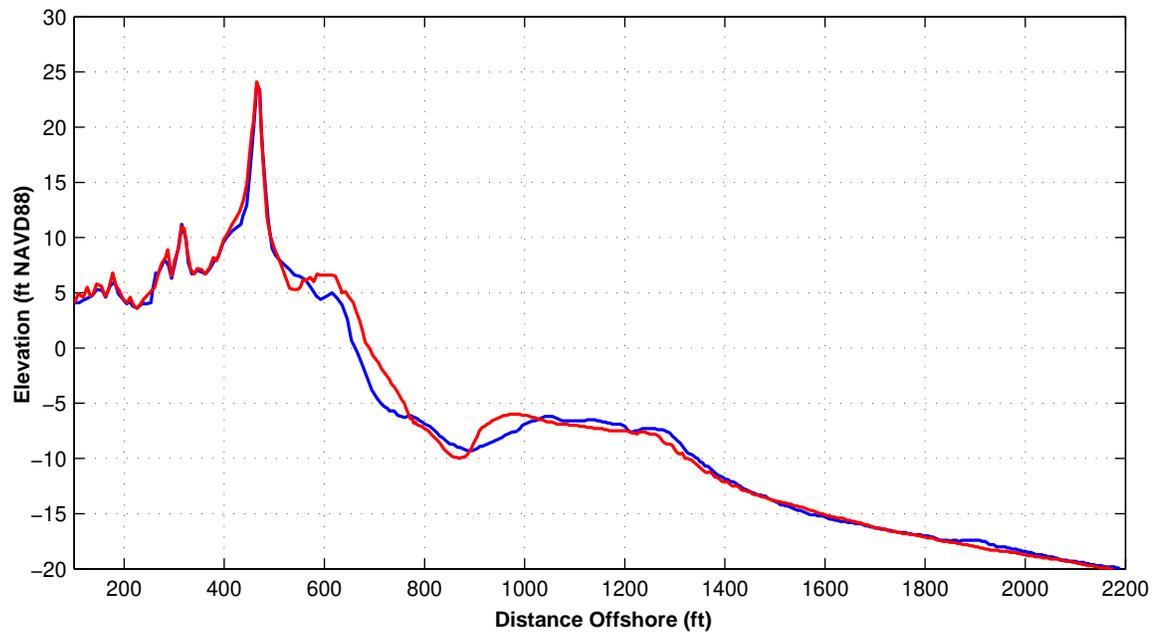
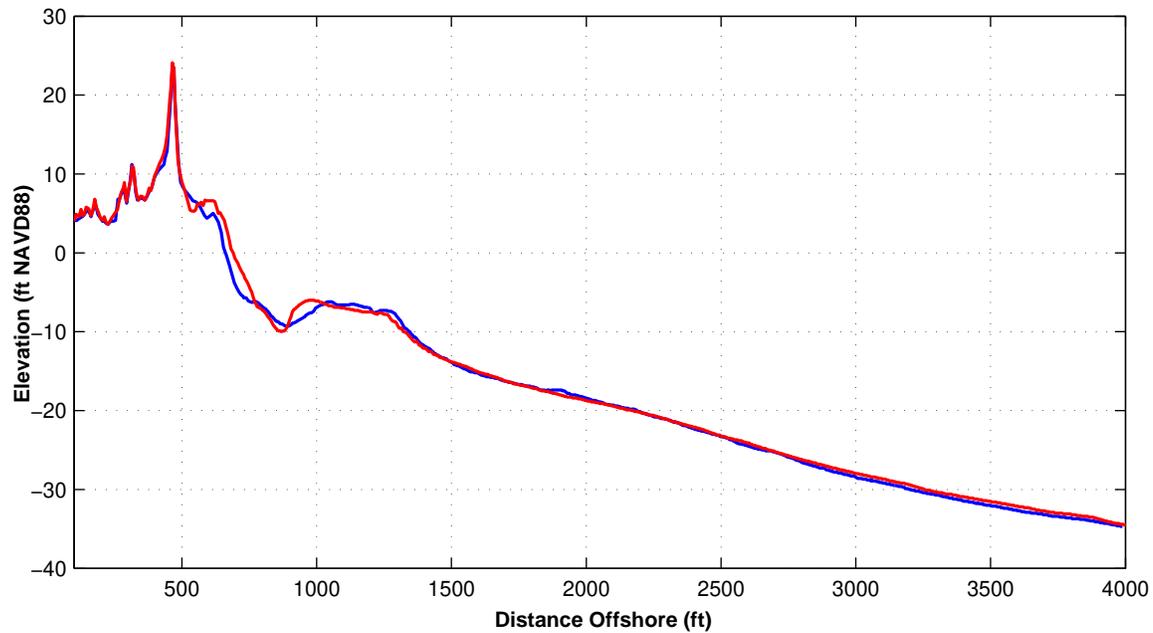


Survey Transect 1150+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	– ft	62.01 ft
Volume Change Above +6 ft NAVD88	– cy/ft	5.09 cy/ft
Volume Change Above 1.18 ft NAVD88	– cy/ft	19.58 cy/ft
Volume Change Above –6 ft NAVD88	– cy/ft	37.34 cy/ft
Volume Change Above –14 ft NAVD88	– cy/ft	99.71 cy/ft
Volume Change Above –19 ft NAVD88	– cy/ft	115.60 cy/ft
Volume Change Above –30 ft NAVD88	– cy/ft	121.32 cy/ft

LEGEND:
 JULY 2021 ————
 JUNE 2020 ————

- Notes:
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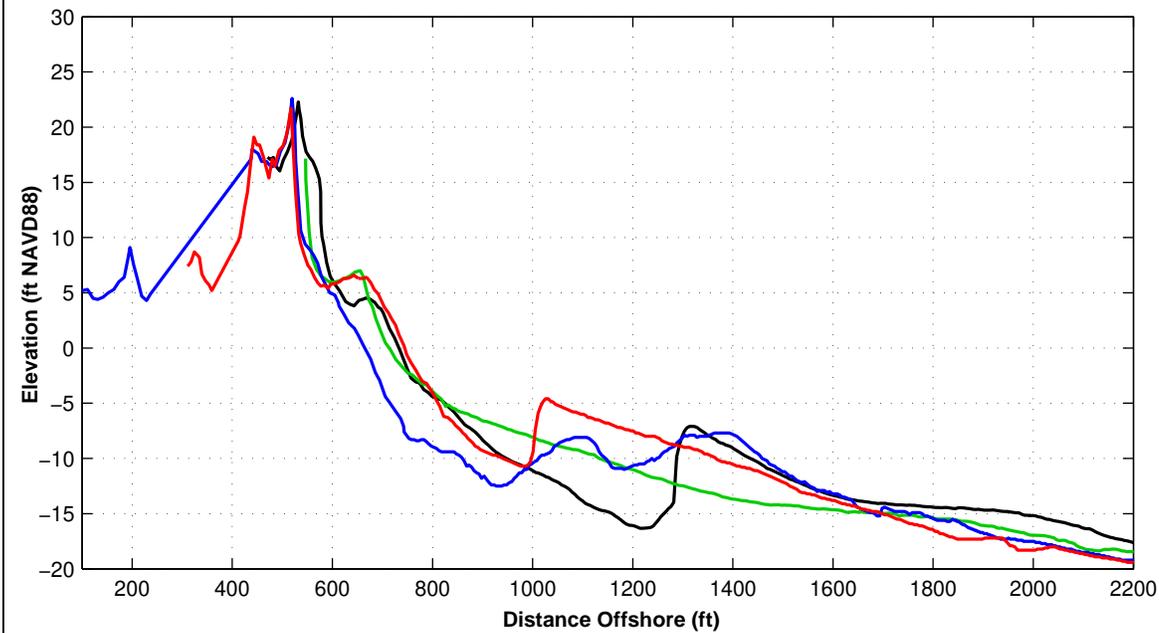
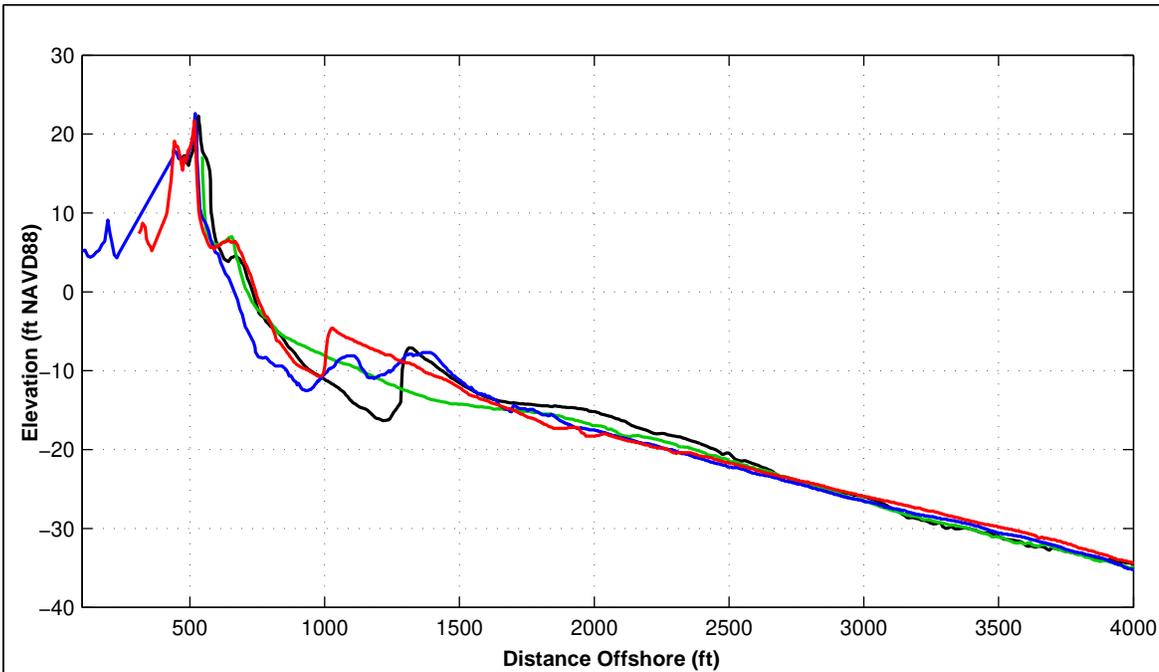


Survey Transect 1160+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	– ft	26.29 ft
Volume Change Above +6 ft NAVD88	– cy/ft	–0.22 cy/ft
Volume Change Above 1.18 ft NAVD88	– cy/ft	5.30 cy/ft
Volume Change Above –6 ft NAVD88	– cy/ft	15.15 cy/ft
Volume Change Above –14 ft NAVD88	– cy/ft	11.15 cy/ft
Volume Change Above –19 ft NAVD88	– cy/ft	9.77 cy/ft
Volume Change Above –30 ft NAVD88	– cy/ft	19.68 cy/ft

LEGEND:
 JULY 2021 —
 JUNE 2020 —

- Notes:
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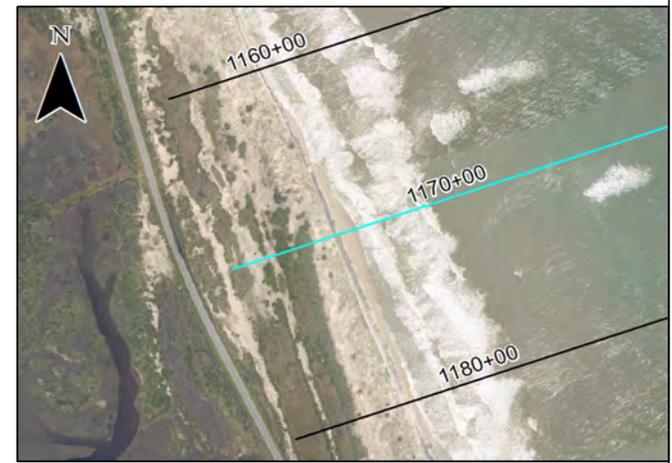


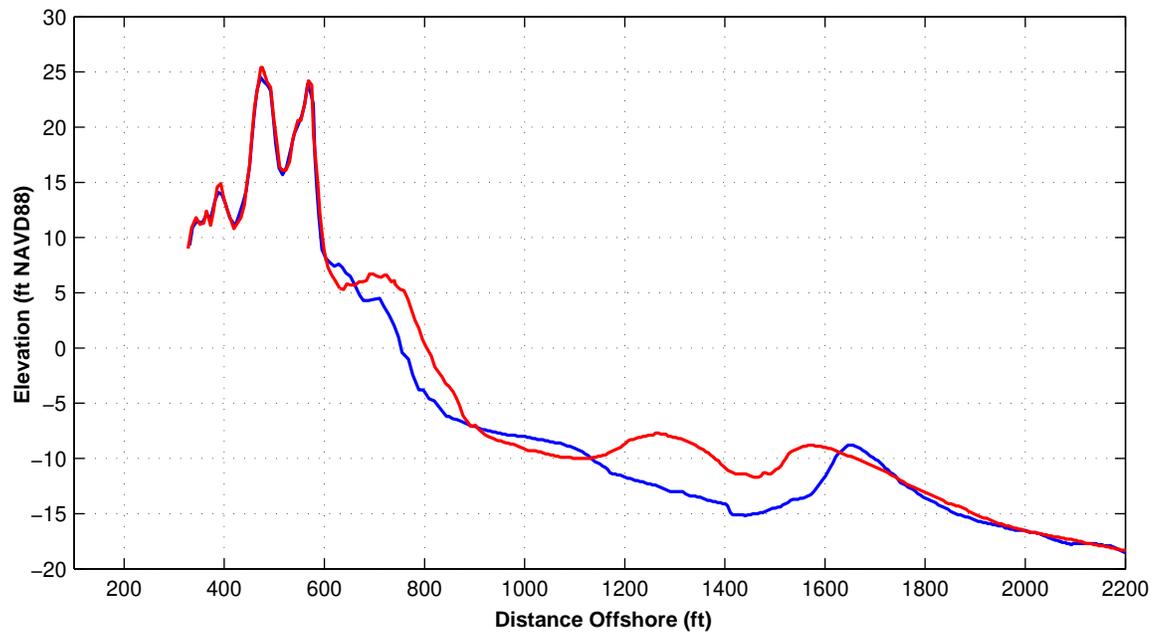
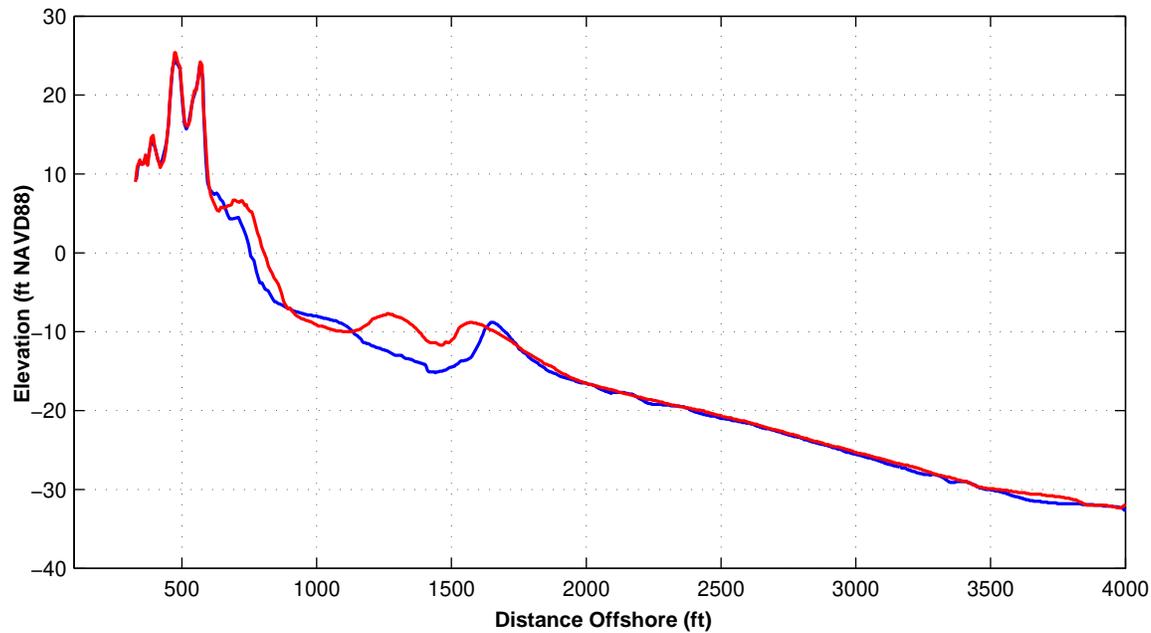
Survey Transect 1170+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	-47.85 ft	81.82 ft
Volume Change Above +6 ft NAVD88	0.86 cy/ft	0.10 cy/ft
Volume Change Above 1.18 ft NAVD88	-2.75 cy/ft	7.43 cy/ft
Volume Change Above -6 ft NAVD88	-22.74 cy/ft	32.27 cy/ft
Volume Change Above -14 ft NAVD88	-8.20 cy/ft	64.14 cy/ft
Volume Change Above -19 ft NAVD88	-12.71 cy/ft	53.53 cy/ft
Volume Change Above -30 ft NAVD88	-22.88 cy/ft	75.59 cy/ft

LEGEND:

JULY 2021	—	AUGUST 2019	—
JUNE 2020	—	MAY 2018	—

- Notes:
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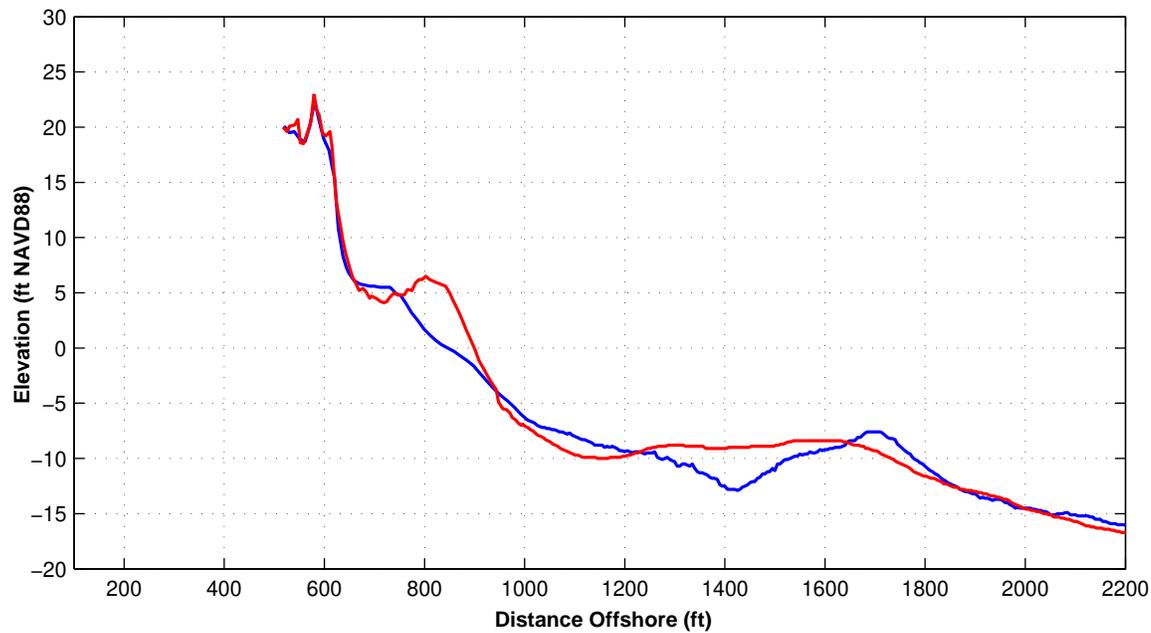
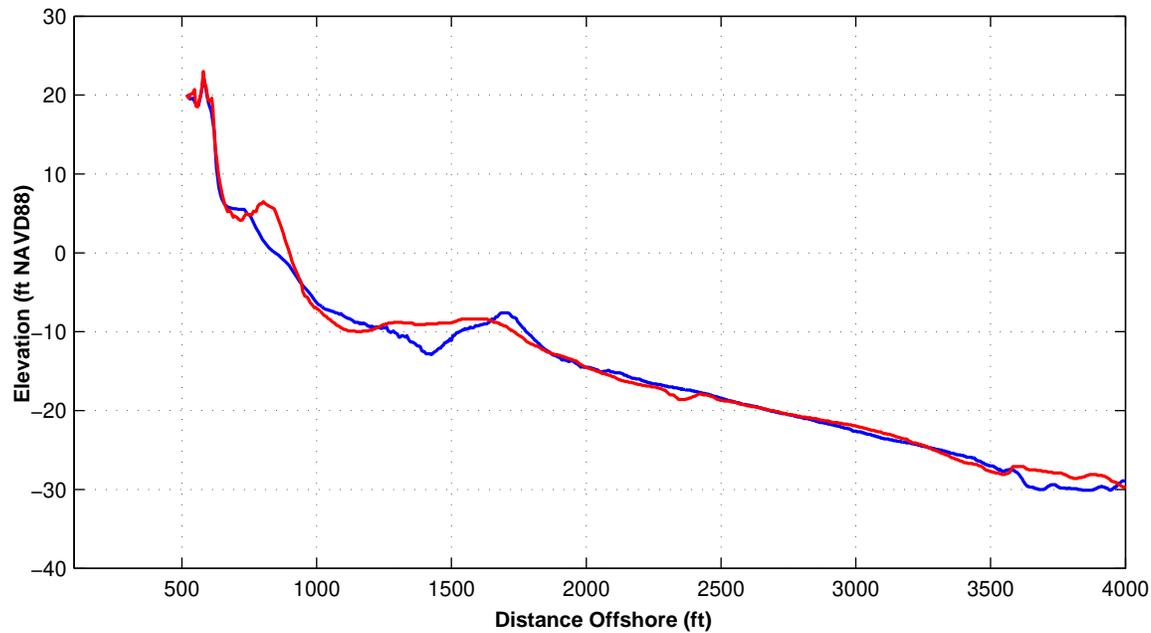


Survey Transect 1180+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	– ft	46.37 ft
Volume Change Above +6 ft NAVD88	– cy/ft	0.78 cy/ft
Volume Change Above 1.18 ft NAVD88	– cy/ft	11.34 cy/ft
Volume Change Above –6 ft NAVD88	– cy/ft	24.93 cy/ft
Volume Change Above –14 ft NAVD88	– cy/ft	78.59 cy/ft
Volume Change Above –19 ft NAVD88	– cy/ft	86.39 cy/ft
Volume Change Above –30 ft NAVD88	– cy/ft	97.31 cy/ft

LEGEND:
 JULY 2021 ————
 JUNE 2020 ————

- Notes:
1. Station From North To South At Varying Intervals.
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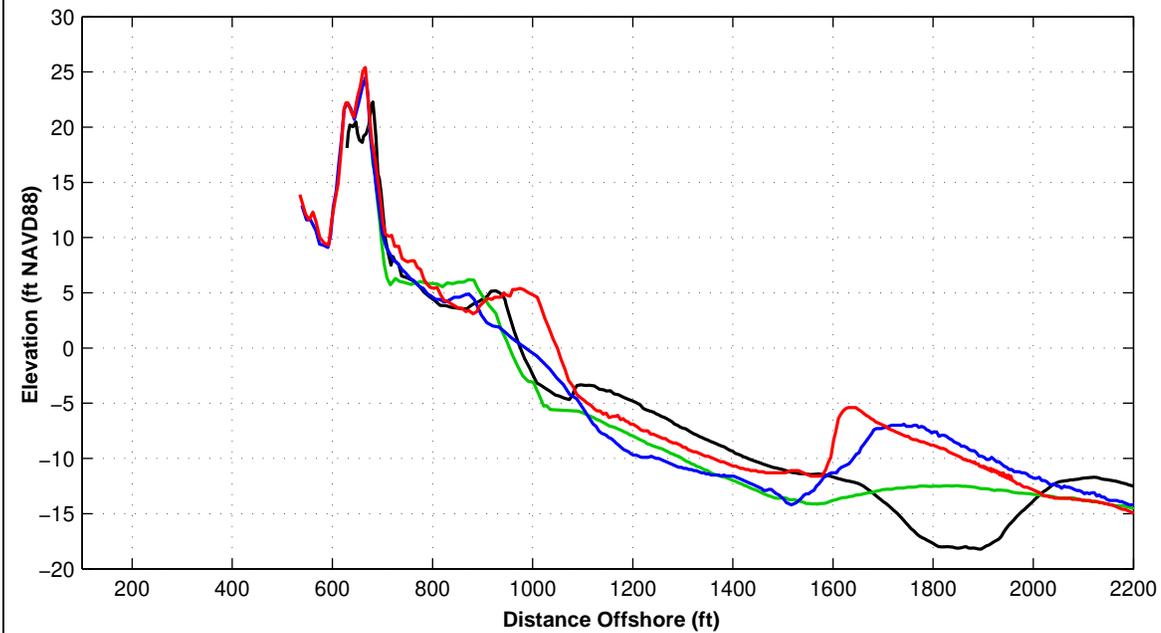
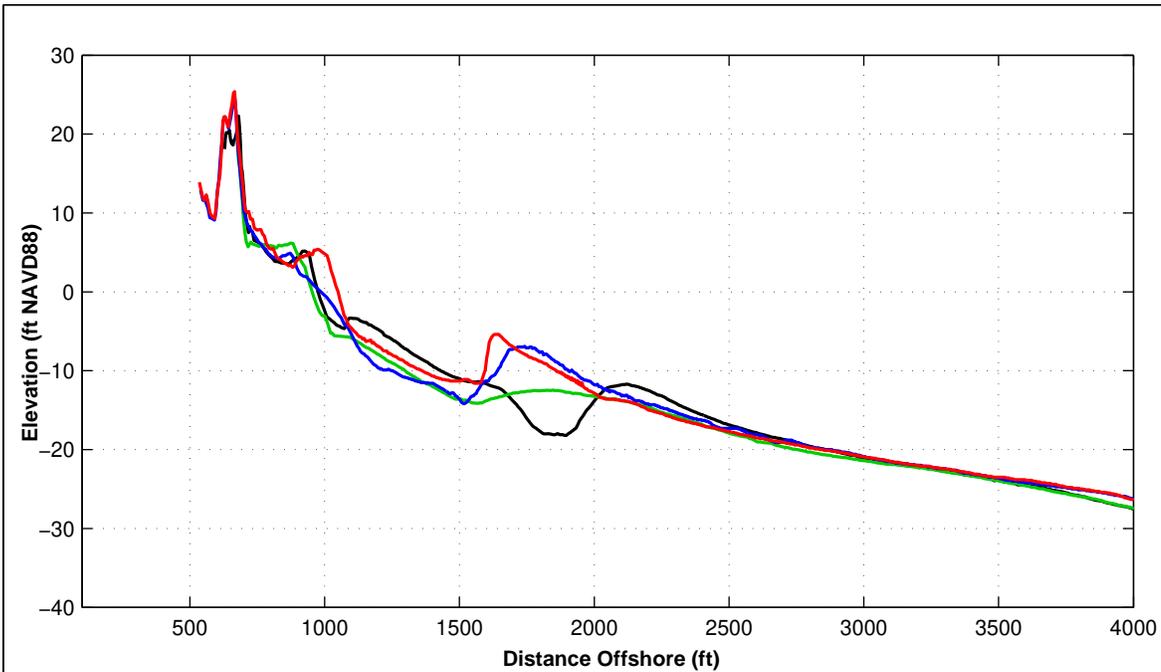


Survey Transect 1190+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	– ft	77.21 ft
Volume Change Above +6 ft NAVD88	– cy/ft	2.61 cy/ft
Volume Change Above 1.18 ft NAVD88	– cy/ft	15.43 cy/ft
Volume Change Above –6 ft NAVD88	– cy/ft	19.85 cy/ft
Volume Change Above –14 ft NAVD88	– cy/ft	30.88 cy/ft
Volume Change Above –19 ft NAVD88	– cy/ft	20.50 cy/ft
Volume Change Above –30 ft NAVD88	– cy/ft	44.41 cy/ft

LEGEND:
 JULY 2021 —
 JUNE 2020 —

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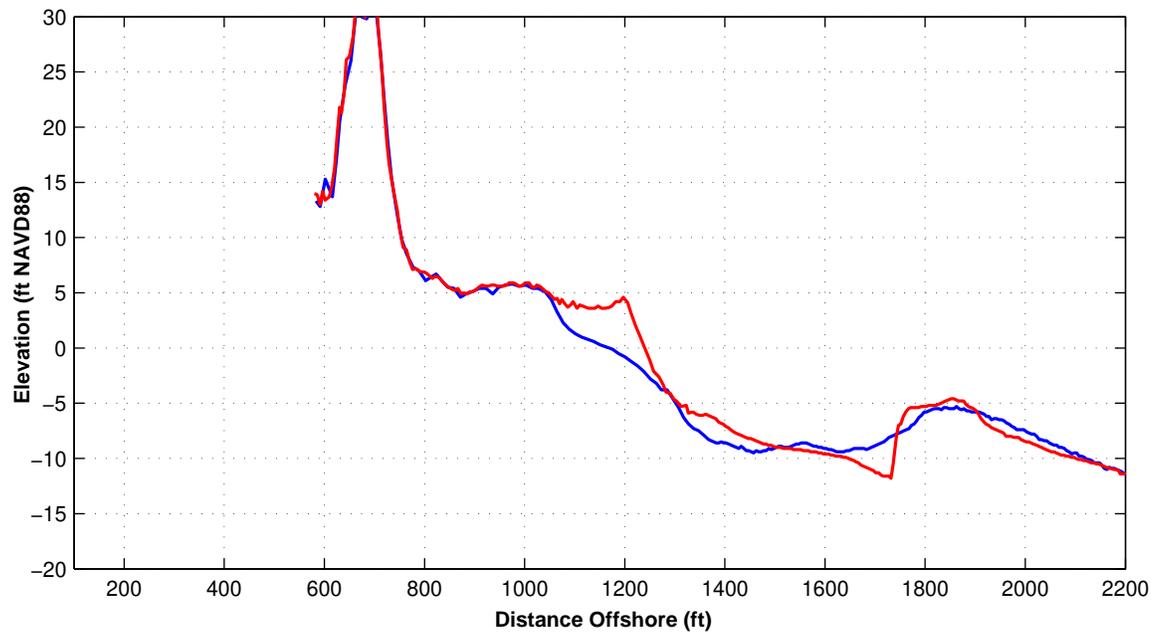
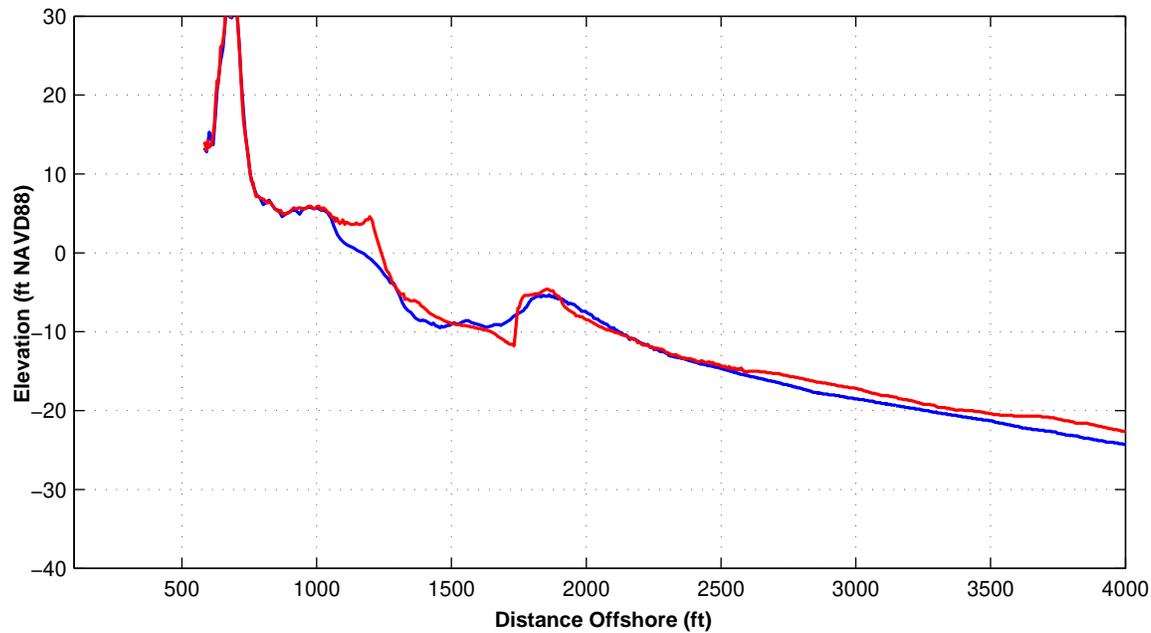
Survey Transect 1200+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	8.77 ft	86.41 ft
Volume Change Above +6 ft NAVD88	0.37 cy/ft	2.02 cy/ft
Volume Change Above 1.18 ft NAVD88	-7.29 cy/ft	16.47 cy/ft
Volume Change Above -6 ft NAVD88	6.12 cy/ft	26.59 cy/ft
Volume Change Above -14 ft NAVD88	65.23 cy/ft	53.08 cy/ft
Volume Change Above -19 ft NAVD88	75.36 cy/ft	42.92 cy/ft
Volume Change Above -30 ft NAVD88	120.69 cy/ft	45.94 cy/ft

LEGEND:

JULY 2021	—	AUGUST 2019	—
JUNE 2020	—	MAY 2018	—

- Notes:
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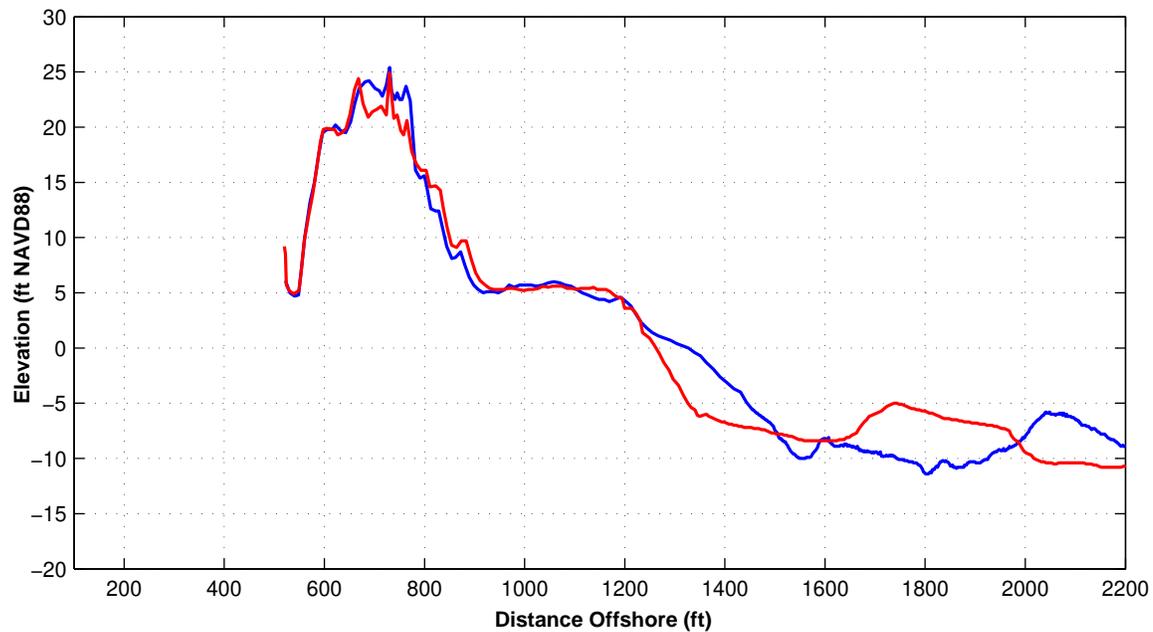
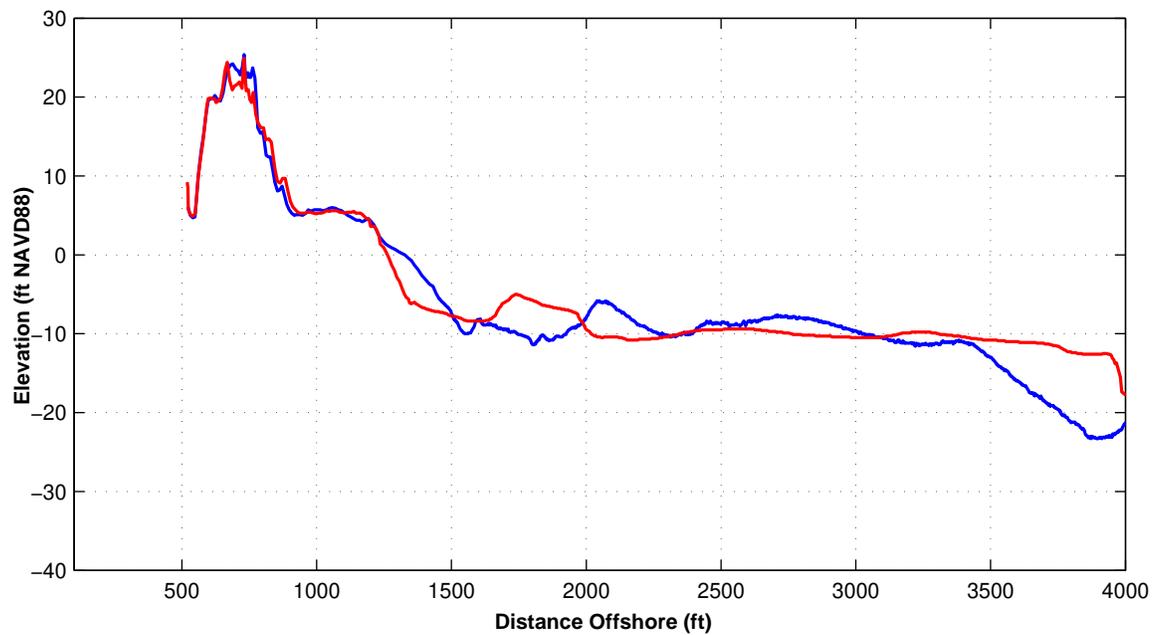


Survey Transect 1210+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	– ft	123.34 ft
Volume Change Above +6 ft NAVD88	– cy/ft	– cy/ft
Volume Change Above 1.18 ft NAVD88	– cy/ft	– cy/ft
Volume Change Above –6 ft NAVD88	– cy/ft	– cy/ft
Volume Change Above –14 ft NAVD88	– cy/ft	– cy/ft
Volume Change Above –19 ft NAVD88	– cy/ft	– cy/ft
Volume Change Above –30 ft NAVD88	– cy/ft	– cy/ft

LEGEND:
 JULY 2021 ————
 JUNE 2020 ————

- Notes:
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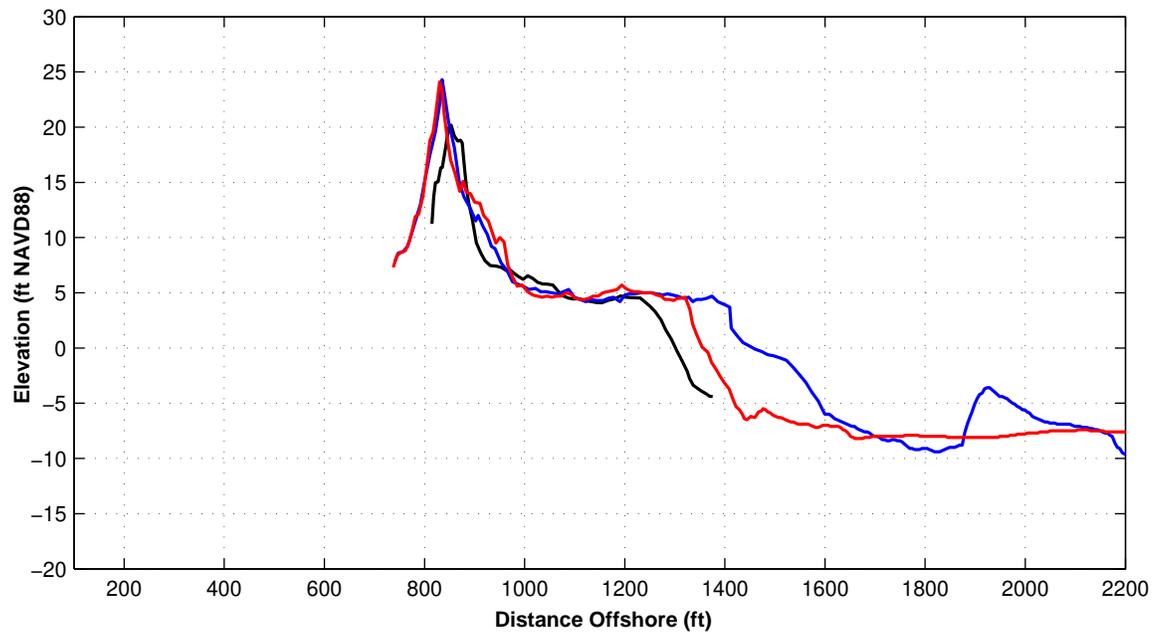
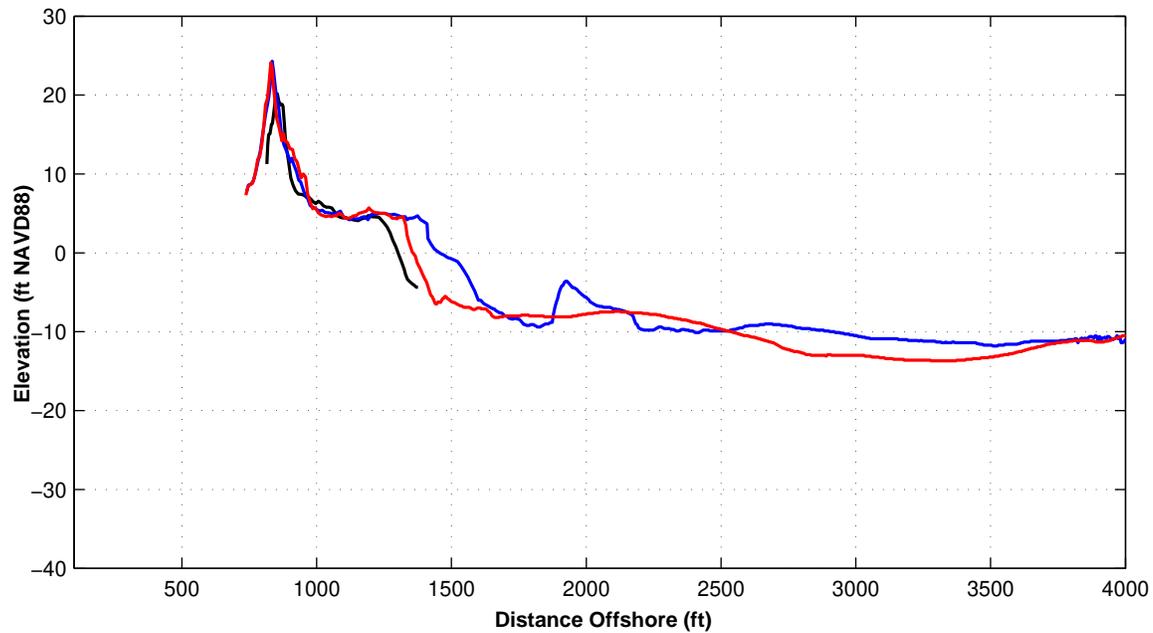
Survey Transect 1220+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	– ft	–22.32 ft
Volume Change Above +6 ft NAVD88	– cy/ft	– cy/ft
Volume Change Above 1.18 ft NAVD88	– cy/ft	– cy/ft
Volume Change Above –6 ft NAVD88	– cy/ft	– cy/ft
Volume Change Above –14 ft NAVD88	– cy/ft	– cy/ft
Volume Change Above –19 ft NAVD88	– cy/ft	– cy/ft
Volume Change Above –30 ft NAVD88	– cy/ft	– cy/ft

LEGEND:
 JULY 2021 ————
 JUNE 2020 ————

Notes:

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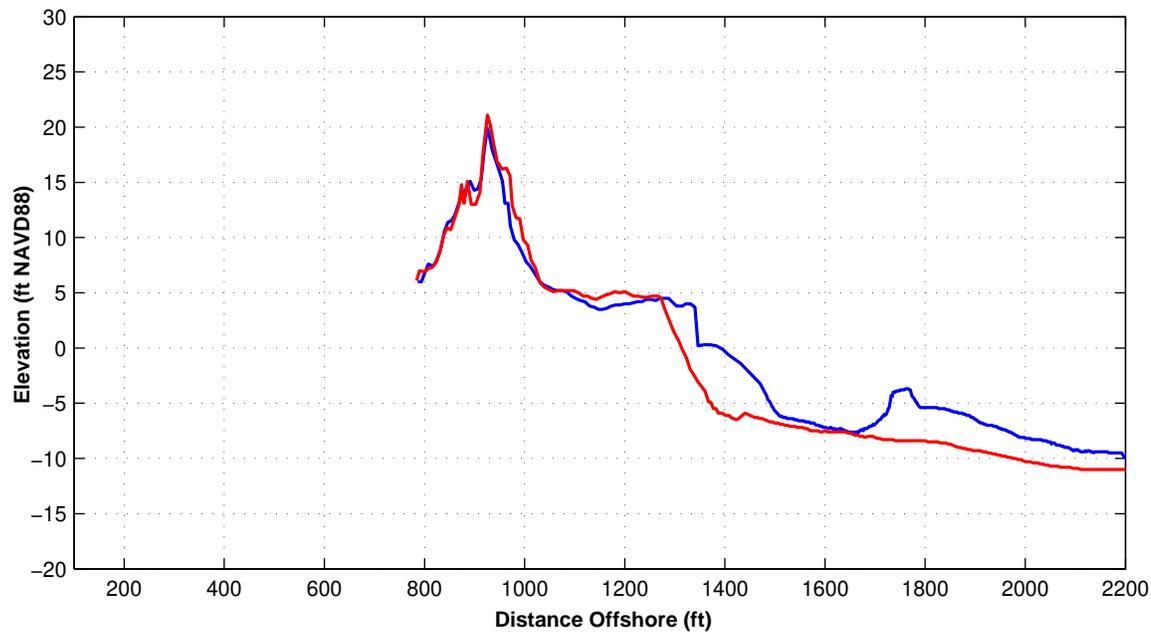
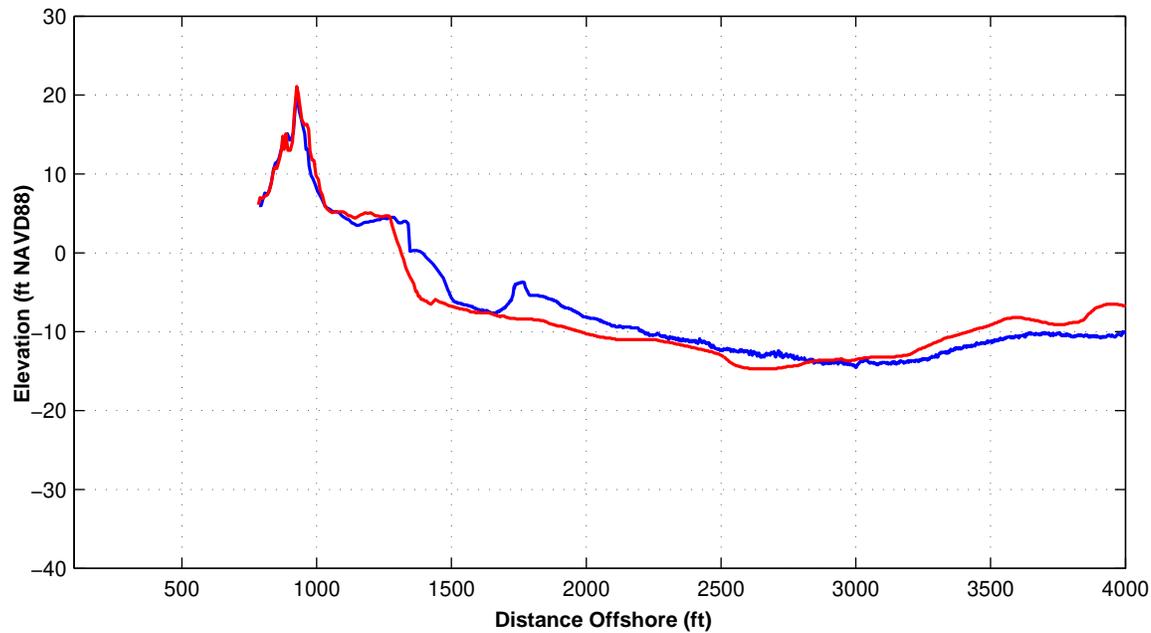


Survey Transect 1230+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	– ft	–79.14 ft
Volume Change Above +6 ft NAVD88	– cy/ft	– cy/ft
Volume Change Above 1.18 ft NAVD88	– cy/ft	– cy/ft
Volume Change Above –6 ft NAVD88	– cy/ft	– cy/ft
Volume Change Above –14 ft NAVD88	– cy/ft	– cy/ft
Volume Change Above –19 ft NAVD88	– cy/ft	– cy/ft
Volume Change Above –30 ft NAVD88	– cy/ft	– cy/ft

LEGEND:
 JULY 2021 —
 JUNE 2020 —

- Notes:
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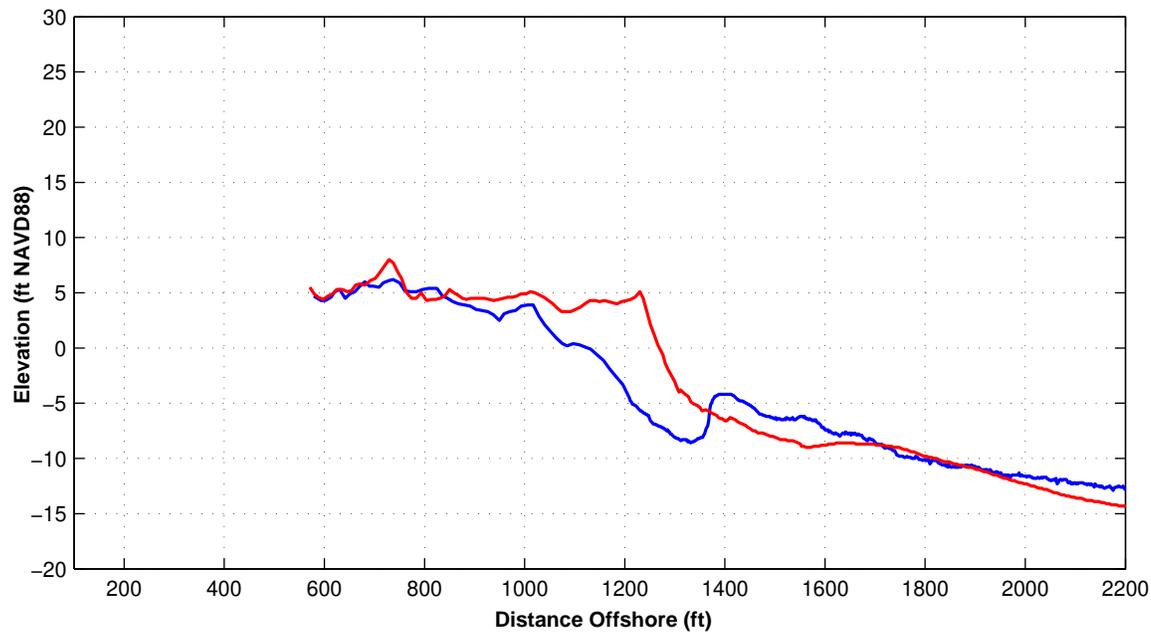
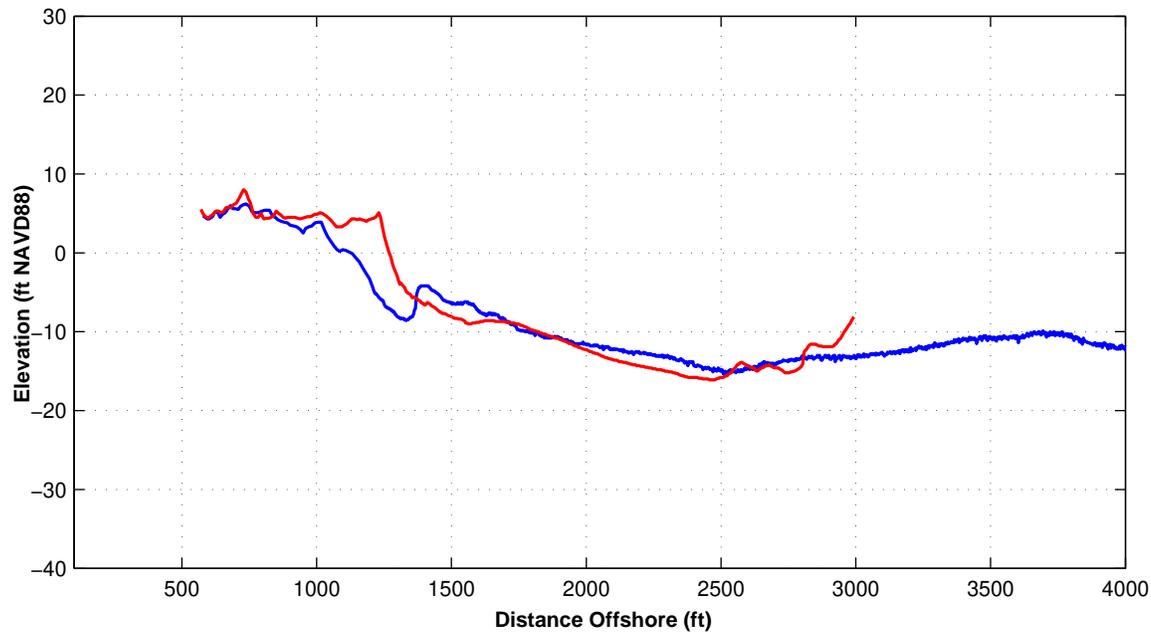


Survey Transect 1240+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	– ft	–42.91 ft
Volume Change Above +6 ft NAVD88	– cy/ft	– cy/ft
Volume Change Above 1.18 ft NAVD88	– cy/ft	– cy/ft
Volume Change Above –6 ft NAVD88	– cy/ft	– cy/ft
Volume Change Above –14 ft NAVD88	– cy/ft	– cy/ft
Volume Change Above –19 ft NAVD88	– cy/ft	– cy/ft
Volume Change Above –30 ft NAVD88	– cy/ft	– cy/ft

LEGEND:
 JULY 2021 ————
 JUNE 2020 ————

- Notes:
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 2. All Survey Elevations In Feet Referenced to NAVD88.



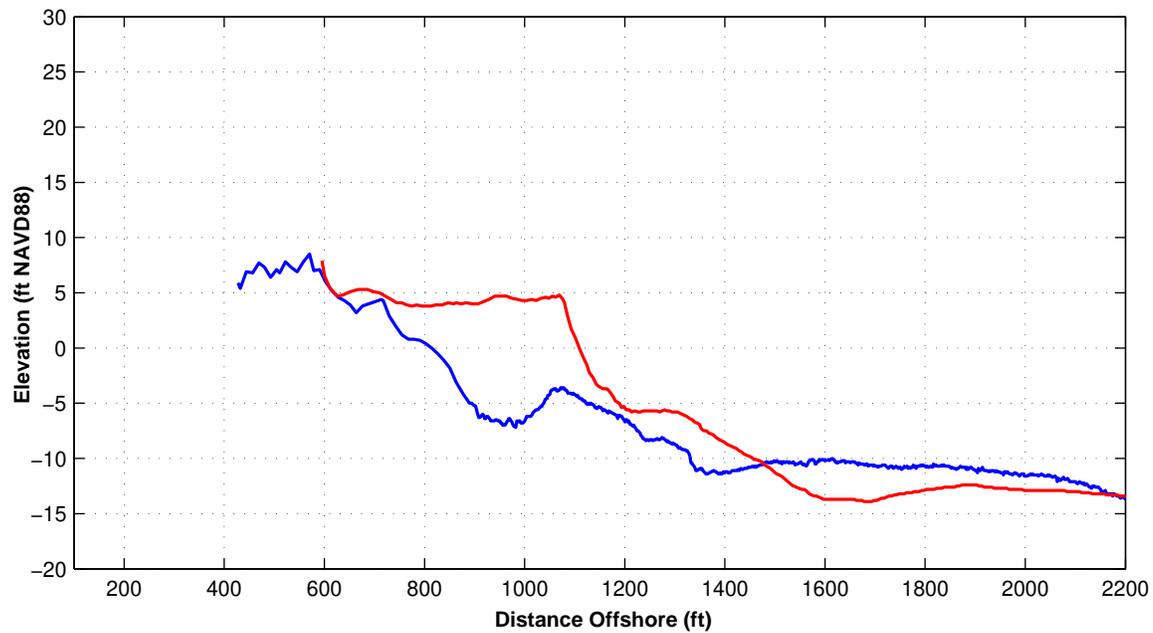
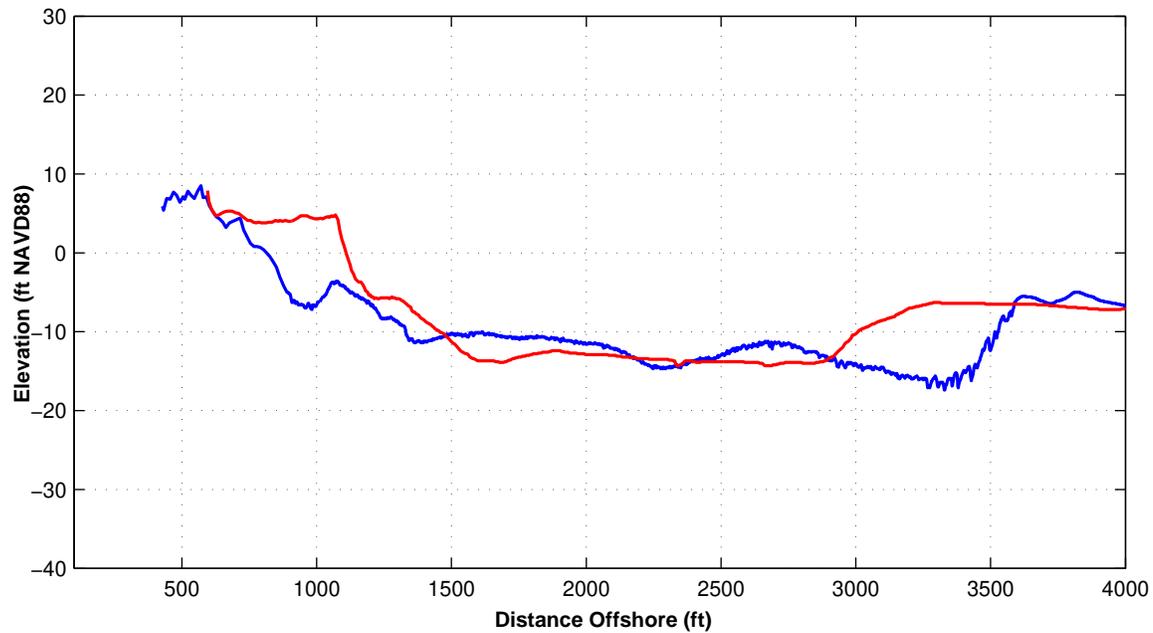


Survey Transect 1250+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	– ft	200.90 ft
Volume Change Above +6 ft NAVD88	– cy/ft	– cy/ft
Volume Change Above 1.18 ft NAVD88	– cy/ft	– cy/ft
Volume Change Above –6 ft NAVD88	– cy/ft	– cy/ft
Volume Change Above –14 ft NAVD88	– cy/ft	– cy/ft
Volume Change Above –19 ft NAVD88	– cy/ft	– cy/ft
Volume Change Above –30 ft NAVD88	– cy/ft	– cy/ft

LEGEND:
 JULY 2021 ————
 JUNE 2020 ————

- Notes:
1. Station From North To South At Varying Intervals.
 2. All Survey Elevations In Feet Referenced to NAVD88.



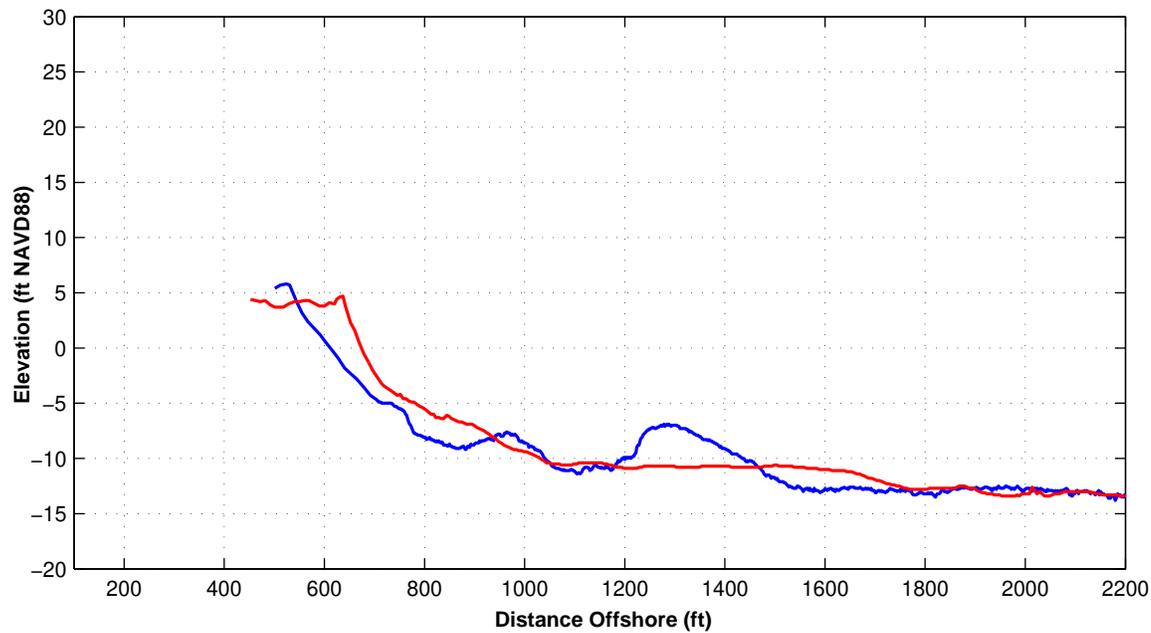
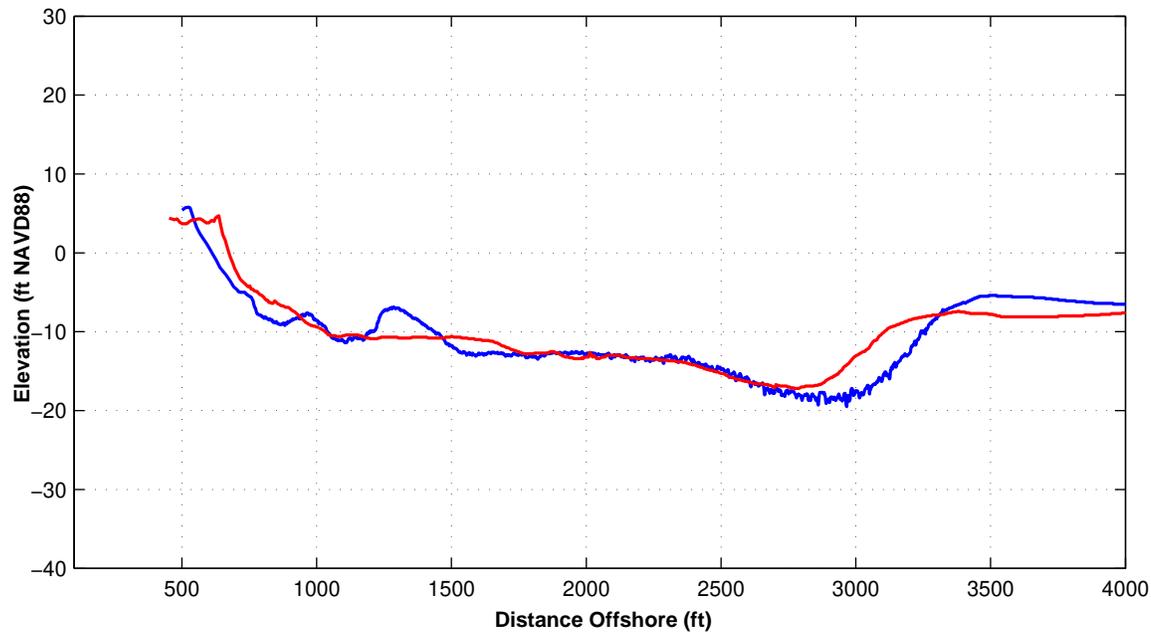


Survey Transect 1260+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	– ft	343.36 ft
Volume Change Above +6 ft NAVD88	– cy/ft	– cy/ft
Volume Change Above 1.18 ft NAVD88	– cy/ft	– cy/ft
Volume Change Above –6 ft NAVD88	– cy/ft	– cy/ft
Volume Change Above –14 ft NAVD88	– cy/ft	– cy/ft
Volume Change Above –19 ft NAVD88	– cy/ft	– cy/ft
Volume Change Above –30 ft NAVD88	– cy/ft	– cy/ft

LEGEND:
 JULY 2021 ——— (red line)
 JUNE 2020 ——— (blue line)

- Notes:
1. Station From North To South At Varying Intervals.
 2. All Survey Elevations In Feet Referenced to NAVD88.



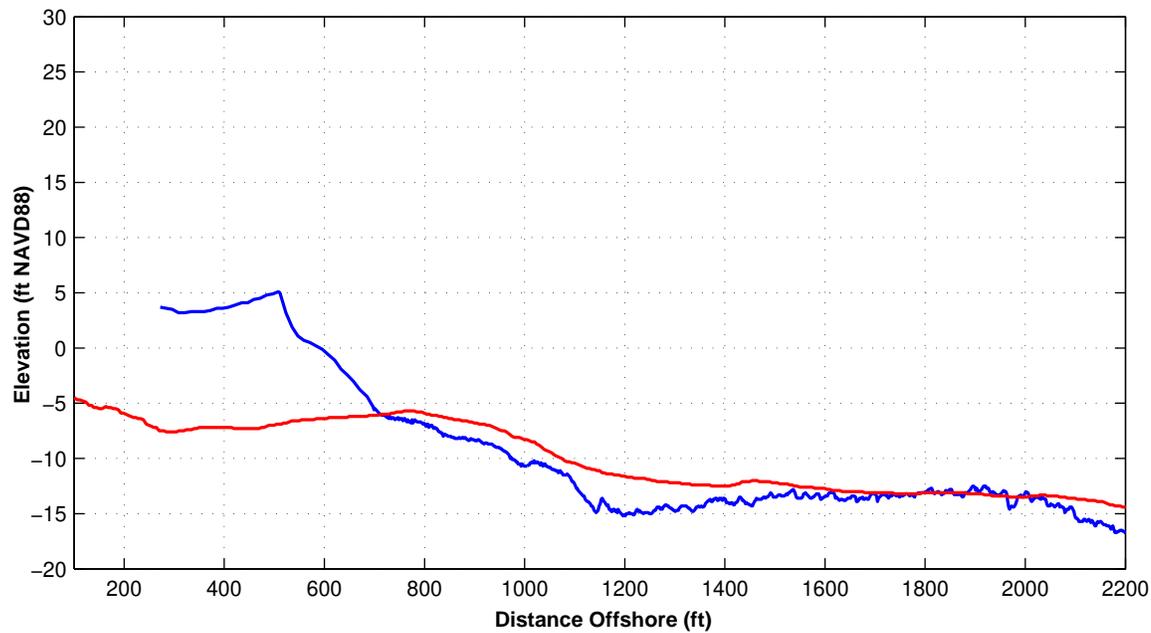
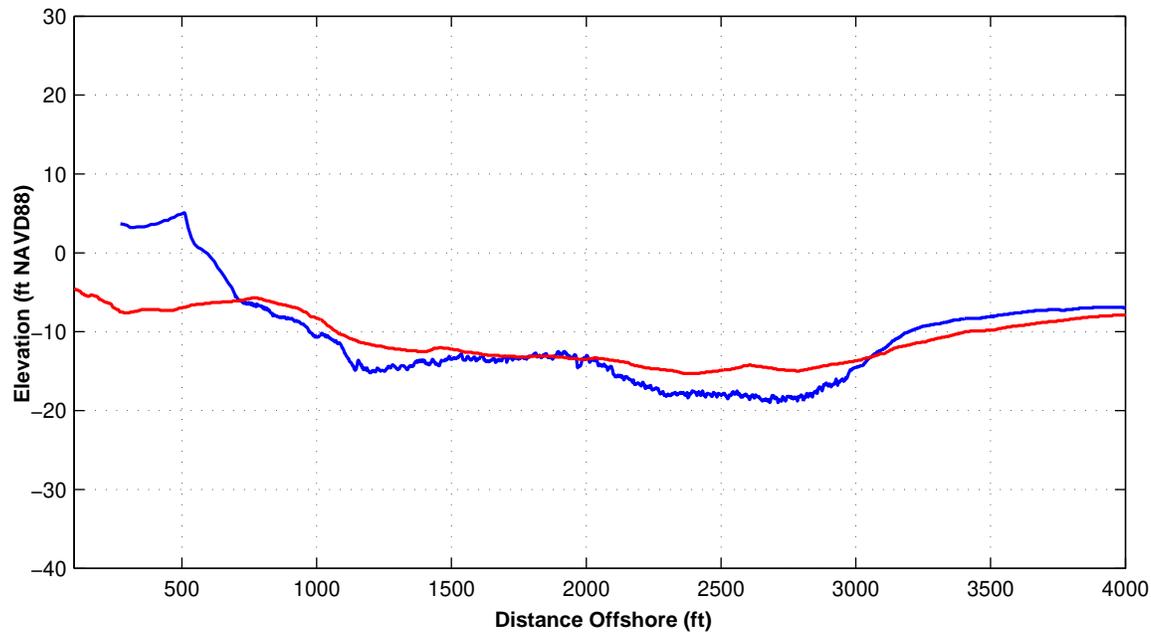


Survey Transect 1270+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	– ft	72.34 ft
Volume Change Above +6 ft NAVD88	– cy/ft	– cy/ft
Volume Change Above 1.18 ft NAVD88	– cy/ft	– cy/ft
Volume Change Above –6 ft NAVD88	– cy/ft	– cy/ft
Volume Change Above –14 ft NAVD88	– cy/ft	– cy/ft
Volume Change Above –19 ft NAVD88	– cy/ft	– cy/ft
Volume Change Above –30 ft NAVD88	– cy/ft	– cy/ft

LEGEND:
 JULY 2021 ————
 JUNE 2020 ————

- Notes:
1. Station From North To South At Varying Intervals.
 2. All Survey Elevations In Feet Referenced to NAVD88.



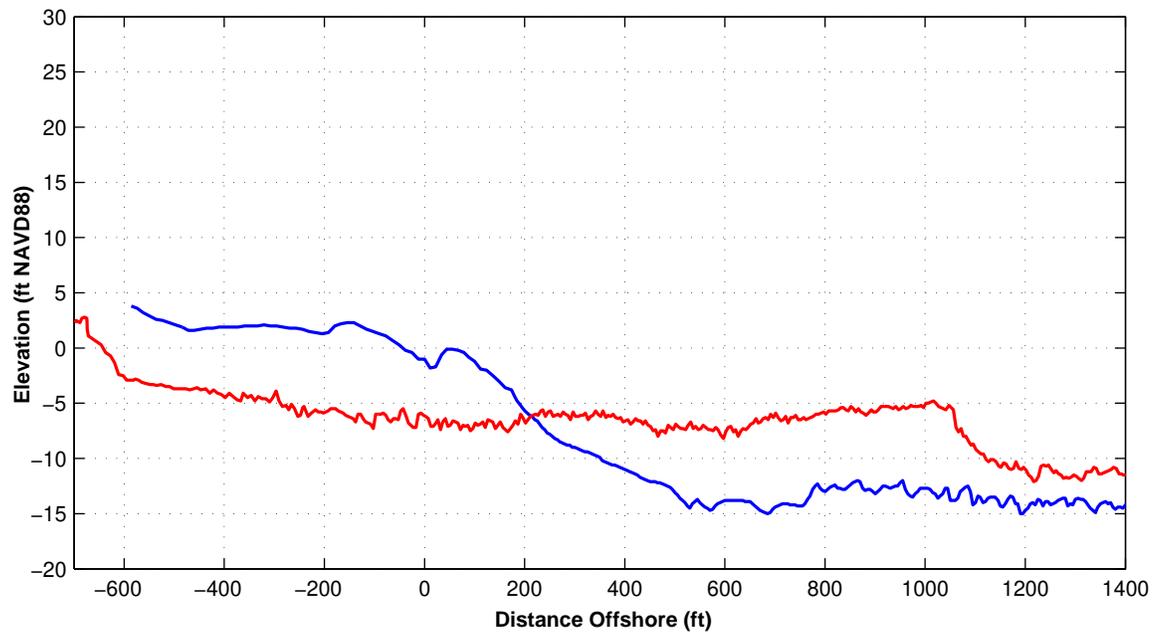
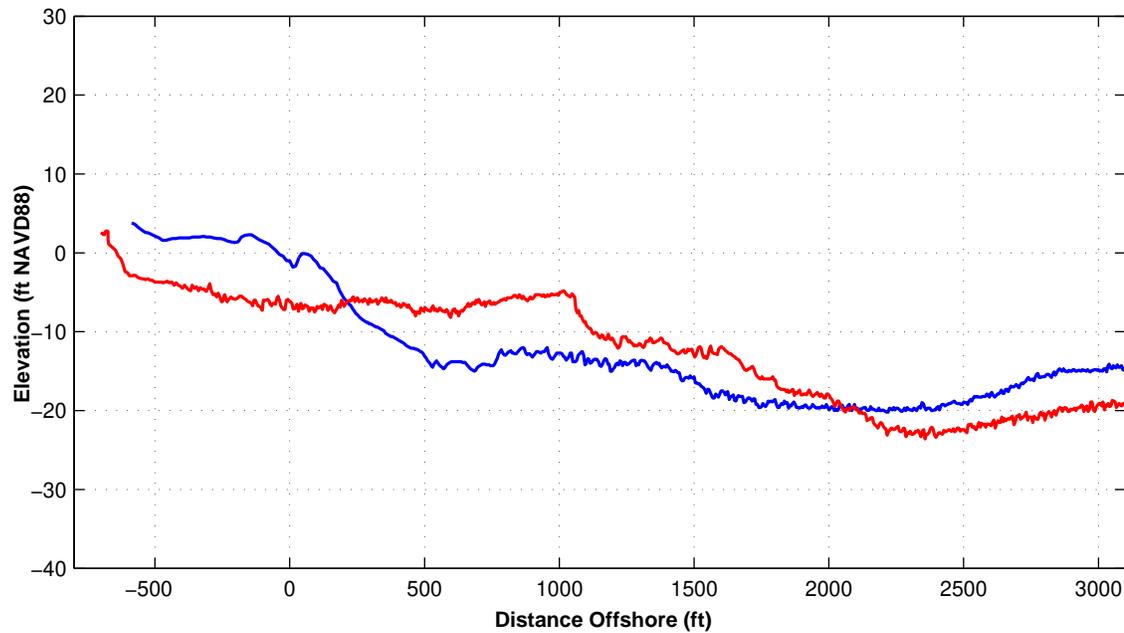


Survey Transect 1280+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	– ft	–528.15 ft
Volume Change Above +6 ft NAVD88	– cy/ft	– cy/ft
Volume Change Above 1.18 ft NAVD88	– cy/ft	– cy/ft
Volume Change Above –6 ft NAVD88	– cy/ft	– cy/ft
Volume Change Above –14 ft NAVD88	– cy/ft	– cy/ft
Volume Change Above –19 ft NAVD88	– cy/ft	– cy/ft
Volume Change Above –30 ft NAVD88	– cy/ft	– cy/ft

LEGEND:
 JULY 2021 ————
 JUNE 2020 ————

- Notes:
 1. Station From North To South At Varying Intervals.
 2. All Survey Elevations In Feet Referenced to NAVD88.





Survey Transect 1290+00	JUNE 2020 – AUGUST 2019	JULY 2021 – JUNE 2020
Shoreline Change at MHW (1.18 ft NAVD88)	– ft	–589.44 ft
Volume Change Above +6 ft NAVD88	– cy/ft	– cy/ft
Volume Change Above 1.18 ft NAVD88	– cy/ft	– cy/ft
Volume Change Above –6 ft NAVD88	– cy/ft	– cy/ft
Volume Change Above –14 ft NAVD88	– cy/ft	– cy/ft
Volume Change Above –19 ft NAVD88	– cy/ft	– cy/ft
Volume Change Above –30 ft NAVD88	– cy/ft	– cy/ft

LEGEND:
 JULY 2021 ————
 JUNE 2020 ————

- Notes:
1. Station From North To South At Varying Intervals.
 2. All Survey Elevations In Feet Referenced to NAVD88.



APPENDIX C

TABULATED SHORELINE AND VOLUME CHANGE DATA



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. Shoreline Change and Volume Change is calculated for the period between surveys from June 24, 2020 to July 20, 2021.

Reach	Transect Number	Station	Shoreline Change @ MHW (+1.18 ft NAVD)	Above Berm (+6 ft NAVD88)		Above MHW (+1.18 ft NAVD88)		Above -6 ft NAVD88		Above -14 ft NAVD88		Above -19 ft NAVD88		Above -30 ft NAVD88			
				2020 Measured Volume (cy/ft)	2019-2020 Volume Change (cy/ft)	2020 Measured Volume (cy/ft)	2019-2020 Volume Change (cy/ft)	2020 Measured Volume (cy/ft)	2019-2020 Volume Change (cy/ft)	2020 Measured Volume (cy/ft)	2019-2020 Volume Change (cy/ft)	2020 Measured Volume (cy/ft)	2019-2020 Volume Change (cy/ft)	2020 Measured Volume (cy/ft)	2019-2020 Volume Change (cy/ft)	2020 Measured Volume (cy/ft)	2019-2020 Volume Change (cy/ft)
Nags Head - North	1	430+00	31.72	80.58	0.37	117.91	5.96	195.71	15.53	369.16	-9.54	607.75	-17.77	1438.45	-28.06		
	2	435+00	44.15	19.91	1.57	45.02	9.49	101.76	26.24	245.55	0.99	472.43	5.44	1286.92	5.64		
	3	440+00	24.87	31.61	-0.49	62.83	5.58	130.61	13.18	284.50	8.77	518.62	32.03	1335.76	30.84		
	4	445+00	-22.40	21.48	-0.33	47.10	-3.46	107.04	-17.02	266.75	-37.75	499.31	-37.43	1312.03	-37.71		
	5	450+00	37.79	28.79	1.99	55.05	8.25	117.44	28.09	257.02	-5.32	490.45	-13.74	1302.32	-16.30		
	6	455+00	-10.19	37.93	0.52	64.42	-1.19	126.59	-4.39	278.44	-20.59	513.92	-15.56	1331.61	-17.89		
	7	460+00	63.07	40.95	4.30	71.42	15.27	143.66	45.16	294.49	46.74	527.50	51.96	1338.62	45.77		
	8	465+00	23.11	32.70	3.84	58.67	7.04	122.54	21.38	280.12	15.04	515.64	37.46	1321.19	23.57		
	9	470+00	20.75	41.89	-0.52	75.72	3.29	141.45	2.85	304.72	-4.09	540.21	3.93	1356.77	-9.84		
	10	475+00	34.93	49.56	4.55	86.36	11.03	157.44	23.08	329.18	19.20	565.09	18.40	1389.43	6.13		
	11	480+00	-7.31	37.67	5.36	64.93	5.26	130.25	16.21	295.93	14.43	527.06	17.21	1348.88	3.40		
	12	485+00	54.50	57.18	5.45	96.03	11.95	180.35	27.72	354.97	22.73	592.35	25.43	1425.01	12.31		
	13	490+00	28.49	54.21	4.47	91.03	10.17	164.36	22.27	339.57	10.13	571.83	-7.59	1405.19	-23.67		
Reach 1	14	495+00	-9.84	47.15	3.58	72.26	0.82	139.05	13.71	319.82	18.13	553.54	18.78	1386.64	5.20		
	15	500+00	54.07	33.86	-1.95	70.51	6.51	145.85	23.63	320.64	14.73	549.71	15.27	1377.66	3.06		
	16	505+00	23.89	36.56	1.22	66.41	2.90	140.58	21.61	308.17	17.10	531.90	11.92	1360.71	-5.09		
	17	510+00	-17.62	27.58	-2.27	60.71	-4.65	127.26	-21.42	309.28	-32.85	493.65	-41.52	1305.72	-41.87		
	18	515+00	-26.17	42.01	4.04	68.83	2.44	142.15	14.79	329.07	22.22	545.29	31.52	1370.36	16.44		
	19	520+00	19.11	36.26	0.01	70.51	2.63	149.34	17.43	363.67	49.76	597.59	73.07	1413.27	56.65		
	20	525+00	-13.19	19.30	0.22	50.35	-3.36	131.53	9.46	347.18	23.62	566.30	22.17	1378.51	10.79		
	21	530+00	-45.51	25.39	-0.45	51.16	-7.15	111.48	-14.71	316.06	-9.37	539.08	-22.80	1353.24	-35.20		
	22	535+00	28.34	28.60	4.41	66.48	10.15	145.36	20.78	356.35	49.88	584.17	51.34	1401.77	35.23		
	23	540+00	-10.40	37.41	2.25	72.64	2.35	141.67	-5.68	343.39	-5.81	569.73	-13.20	1396.48	-21.35		
	24	545+00	-3.65	37.10	3.51	71.51	6.63	142.69	9.01	341.41	25.73	566.58	20.03	1388.96	16.72		
	25	550+00	26.06	18.88	-0.02	54.15	8.32	126.53	19.18	331.49	30.68	552.24	25.77	1352.77	20.66		
	26	555+00	26.36	26.32	3.37	60.13	11.77	130.94	16.91	326.26	18.12	552.32	15.83	1346.67	9.49		
	27	560+00	34.41	16.13	1.42	49.01	14.48	113.46	18.47	313.24	53.24	540.76	54.79	1338.20	56.27		
	28	565+00	-4.81	21.87	1.59	53.76	8.11	116.00	3.73	300.13	8.32	525.71	24.50	1322.69	20.50		
	29	570+00	-27.06	26.57	-0.32	58.72	0.66	122.13	-12.33	315.19	-57.21	538.87	-75.82	1352.58	-85.12		
	30	575+00	-0.72	19.19	5.56	49.78	11.23	110.74	-1.23	307.90	-19.78	532.72	-20.74	1338.37	-27.27		
	31	580+00	-2.08	22.32	1.32	52.93	10.30	114.56	1.37	304.26	27.75	531.21	24.94	1335.13	22.60		
	32	585+00	48.74	17.64	1.83	51.21	14.16	117.03	11.27	328.61	37.50	562.89	36.66	1364.92	39.24		
	33	590+00	5.96	14.70	2.59	42.95	9.17	101.04	-5.07	292.74	11.35	529.22	10.80	1329.24	9.10		
	34	595+00	-15.57	20.84	1.28	45.91	1.29	100.55	-18.54	285.12	-16.81	524.77	-15.33	1329.52	-17.04		
	35	600+00	-32.52	69.93	5.86	109.94	6.49	186.53	-10.55	409.11	-10.98	661.37	-10.06	1492.27	-22.02		
	36	605+00	-31.25	29.61	-0.75	63.73	3.34	135.01	-10.37	317.80	-45.07	564.40	-44.83	1375.15	-53.56		
	37	610+00	-24.23	30.67	0.24	59.00	2.32	122.70	-4.70	338.95	10.69	585.93	14.88	1389.77	9.74		
	38	615+00	34.26	34.96	-0.81	66.57	3.47	145.76	6.01	338.57	28.54	591.12	31.33	1396.76	21.79		
	39	620+00	-1.39	26.27	1.14	56.68	3.50	126.55	-12.88	310.29	-10.45	563.63	-3.26	1370.41	-2.87		
	40	625+00	42.74	39.24	3.74	78.58	9.88	166.08	8.13	339.69	-26.11	593.54	-38.59	1399.18	-41.74		
	41	630+00	2.07	43.90	4.74	85.48	7.68	175.25	-2.93	395.00	1.59	658.53	14.87	1470.35	-5.00		
	42	635+00	17.44	27.81	3.51	65.27	11.36	149.63	10.42	359.89	21.74	620.27	28.83	1394.55	28.10		
	43	640+00	12.81	49.61	4.23	91.86	8.94	182.98	4.27	392.85	8.95	656.43	18.09	1386.39	-55.85		
	44	645+00	35.88	50.54	8.39	96.51	17.12	195.95	20.30	418.17	29.26	674.27	23.51	1557.53	85.68		
	45	650+00	15.87	43.70	2.68	82.46	8.14	168.69	5.39	377.08	11.11	626.43	10.11	1410.32	5.88		
	46	655+00	20.13	29.98	2.26	63.16	9.39	140.47	7.35	324.01	-2.56	573.82	-20.83	1341.49	-34.90		
	47	660+00	35.33	42.53	4.83	82.85	13.41	176.71	14.77	363.24	5.70	616.32	15.58	1386.49	18.53		
	48	665+00	-28.41	53.46	6.85	94.32	7.33	179.73	4.12	355.51	-42.92	605.18	-41.38	1374.41	-28.70		
	49	670+00	-13.88	33.01	6.05	68.33	3.97	151.85	0.28	336.00	-32.07	578.48	-35.40	1339.36	-29.59		
	50	675+00	-14.62	4.67	-0.27	26.44	1.21	83.91	-3.06	241.48	-38.60	467.87	-41.01	1206.47	-36.63		
	51	680+00	-36.85	43.53	3.63	77.73	-0.85	156.22	-11.07	345.62	-29.60	587.15	-28.92	1386.92	-34.84		
	52	685+00	-27.77	40.36	5.59	75.38	4.85	150.36	-1.75	339.30	-23.96	578.99	-38.85	1384.51	-42.65		
	53	690+00	57.80	45.11	3.80	85.49	12.63	175.30	39.08	361.35	24.18	601.89	18.86	1396.88	17.71		
	54	695+00	20.35	48.37	5.19	88.84	7.86	169.56	18.06	358.27	1.91	597.56	-6.04	1392.68	-12.02		
	55	700+00	13.58	50.35	5.22	89.51	8.16	176.22	20.31	365.96	14.59	602.21	5.30	1392.76	0.16		
	56	705+00	16.68	43.54	3.80	76.26	6.83	158.33	32.49	350.08	43.11	582.67	35.11	1369.78	31.30		
	57	710+00	-34.96	42.31	2.99	68.24	-2.70	146.75	16.89	340.46	15.21	570.30	15.10	1350.29	10.96		
	58	715+00	89.90	47.85	5.65	91.22	18.81	185.59	52.11	395.31	78.72	623.55	77.82	1401.91	75.65		
	59	720+00	23.12	52.01	0.15	92.45	3.91	178.38	20.64	397.45	32.96	626.89	35.11	1406.36	32.93		
	60	725+00	79.03	32.62	4.69	74.56	16.27	157.34	36.93	366.24	53.15	593.24	56.35	1364.10	45.03		
	61	730+00	7.32	38.57	4.57	74.77	7.92	141.55	8.40	344.65	20.65	575.01	25.69	1366.37	21.32		
	62	735+00	-29.98	29.81	2.17	62.71	-0.17	123.98	-9.19	334.49	6.09	562.03	9.17	1353.46	3.58		
	63	740+00	-15.25	37.82	1.42	73.69	-2.22	143.15	-12.22	345.04	-32.90	577.06	-32.57	1368.87	-39.86		
	64	745+00	-3.21	49.29	4.53	91.14	8.72	171.20	12.02	399.57	44.36	639.19	52.20	1440.26	42.97		
	65	750+00	26.42	61.78	4.84	110.04	11.00	201.45	17.56	436.90	34.43	682.13	41.60	1487.43	36.09		
	66	755+00	6.86	58.26	2.96	101.54	7.52	180.46	7.36	394.41	16.48	640.56	25.15	1440.67	17.67		
	67	760+00	-9.44	44.08	-0.70	87.05	1.80	165.77	-6.94	395.59	5.21	645.55	9.95	1448.78	-5.77		
	68	765+00	-3.72	20.06	2.72	51.89	5.62	114.69	-0.30								

Reach	Transect Number	Station	Shoreline Change @ MHW (+1.18 ft NAVD)	Above Berm (+6 ft NAVD88)		Above MHW (+1.18 ft NAVD88)		Above -6 ft NAVD88		Above -14 ft NAVD88		Above -19 ft NAVD88		Above -30 ft NAVD88			
				2020 Measured Volume (cy/ft)	2019-2020 Volume Change (cy/ft)	2020 Measured Volume (cy/ft)	2019-2020 Volume Change (cy/ft)	2020 Measured Volume (cy/ft)	2019-2020 Volume Change (cy/ft)	2020 Measured Volume (cy/ft)	2019-2020 Volume Change (cy/ft)	2020 Measured Volume (cy/ft)	2019-2020 Volume Change (cy/ft)	2020 Measured Volume (cy/ft)	2019-2020 Volume Change (cy/ft)	2020 Measured Volume (cy/ft)	2019-2020 Volume Change (cy/ft)
				Reach 2	73	790+00	-79.37	4.93	-1.01	33.70	-6.94	100.61	-22.09	317.70	-34.34	549.62	-37.52
74	795+00	-54.25	51.88		1.62	91.93	-1.83	177.53	-11.48	402.76	-18.85	649.67	-14.61	1430.19	-35.71		
75	800+00	-17.76	20.94		1.05	58.51	6.73	140.73	6.09	339.45	10.86	577.63	14.30	1337.72	-7.81		
76	805+00	-32.28	43.03		3.42	79.69	2.04	162.21	0.31	346.47	-12.41	587.59	-12.37	1359.14	-28.77		
77	810+00	-31.19	55.73		1.83	94.24	0.41	178.68	-1.61	375.35	-20.15	615.31	-19.40	1382.32	-40.97		
78	815+00	-14.99	45.97		4.32	85.32	6.41	174.90	12.30	370.02	15.03	607.81	16.72	1376.41	0.67		
79	820+00	-19.34	46.11		2.77	86.02	2.89	174.68	9.94	376.54	-17.02	618.94	-15.60	1396.24	-30.89		
80	825+00	-16.22	35.58		0.71	70.56	3.09	153.70	13.41	341.89	16.97	581.32	23.35	1349.38	8.77		
81	830+00	-8.40	40.49		1.89	75.68	3.36	159.76	15.29	357.86	13.92	598.42	14.86	1364.99	5.65		
82	835+00	15.60	18.55		-0.69	47.79	0.54	123.15	14.42	309.83	21.35	532.54	22.37	1260.50	0.57		
83	840+00	2.25	25.74		1.37	58.60	4.88	137.47	14.05	337.77	31.86	570.75	44.93	1290.49	10.81		
84	845+00	11.47	48.20		3.47	93.42	8.48	186.73	20.84	391.00	6.58	625.82	-17.56	1397.07	-31.51		
85	850+00	18.27	18.95		4.55	50.73	8.64	122.98	22.43	317.55	20.28	549.73	26.10	1297.26	21.94		
86	855+00	4.88	39.18		1.29	82.01	4.65	175.00	18.35	383.14	28.64	618.95	40.71	1377.62	33.04		
87	860+00	-32.52	23.08		1.01	58.58	-3.02	139.63	-0.92	334.71	-36.66	555.97	-32.70	1292.91	-42.40		
88	865+00	-21.23	41.98		5.01	78.94	5.48	171.35	22.83	368.93	20.80	595.41	34.32	1342.78	25.23		
89	870+00	7.98	36.80		1.52	71.44	-0.99	164.60	14.80	366.44	-5.49	588.24	-13.55	1329.26	-35.20		
90	872+00	23.68	26.07		3.26	56.05	1.28	143.27	20.09	338.33	24.47	563.90	40.34	1314.94	46.64		
91	880+00	42.21	43.33		3.45	86.40	6.54	179.79	20.01	404.08	22.58	630.69	17.36	1400.14	12.43		
92	885+00	63.67	39.12		2.85	81.50	11.52	170.62	27.35	382.73	51.46	618.44	58.95	1391.96	56.28		
93	890+00	53.93	29.25		1.82	70.36	9.24	156.42	22.58	360.25	36.09	590.22	42.07	1356.04	35.28		
94	895+00	32.62	36.92		2.81	78.21	3.23	163.95	11.11	364.87	-5.98	597.70	7.85	1367.19	0.94		
95	900+00	22.65	46.01		0.04	94.62	2.04	185.62	3.83	389.89	-24.61	625.23	-20.38	1395.05	-33.72		
96	905+00	40.68	20.67		7.71	57.82	18.10	126.96	26.99	310.83	19.50	533.80	21.56	1268.49	13.58		
97	910+00	30.91	24.99		2.73	66.94	12.15	141.74	18.82	342.15	26.41	568.02	27.80	1298.22	25.93		
98	915+00	1.70	5.76		-1.58	37.17	3.33	95.72	0.40	278.00	-5.52	498.24	-2.81	1238.02	-20.72		
Reach 3 - North	99	920+00	-5.40		49.39	-1.80	93.71	0.95	172.01	-3.62	370.78	5.35	611.22	13.71	1385.50	9.42	
	100	922+50	7.64		56.24	-2.57	100.79	0.94	180.87	1.07	374.43	-4.15	613.29	5.63	1381.41	0.80	
	101	925+00	14.80	56.35	-1.75	103.35	4.31	186.80	5.70	380.06	0.37	619.53	7.13	1390.61	-5.73		
	102	927+50	14.74	43.24	-0.67	90.38	6.16	172.04	8.75	372.07	9.13	617.13	22.21	1389.71	10.32		
	103	930+00	19.94	41.86	-0.40	88.50	5.82	169.49	9.36	377.37	25.70	621.00	48.61	1389.33	38.74		
	104	932+50	19.02	50.76	1.90	94.80	7.83	171.23	10.67	378.98	13.92	621.78	12.18	1383.25	8.14		
	105	935+00	7.56	57.78	2.43	109.09	8.63	196.22	9.85	419.58	36.50	668.80	44.47	1437.48	34.41		
	106	937+50	-26.25	31.75	1.60	70.90	2.23	140.84	-5.36	346.80	9.47	579.67	43.14	1314.35	35.27		
	107	940+00	-47.17	54.52	-1.92	109.06	-7.09	201.91	-19.99	429.96	-31.24	676.35	-2.72	1444.94	-26.39		
	108	942+50	-32.41	51.97	-1.15	100.20	-7.06	183.99	-16.88	398.80	-67.94	637.36	-73.50	1399.56	-91.57		
	109	945+00	-36.11	49.63	0.74	99.81	-4.12	186.18	-16.59	406.91	-43.08	639.86	-60.75	1408.31	-100.23		
	110	947+50	-50.51	30.86	0.50	64.85	-4.42	127.44	-18.71	331.04	-22.45	543.53	-43.45	1301.99	-77.29		
	111	950+00	-16.91	56.49	1.68	102.98	0.97	191.34	0.93	412.87	0.22	652.22	9.37	1464.37	11.78		
	112	952+50	23.28	42.48	2.55	95.95	9.53	193.10	19.28	416.54	23.39	654.19	25.93	1462.07	0.89		
	113	955+00	12.81	62.04	2.76	120.32	9.77	218.44	8.11	444.45	22.04	679.65	12.55	1510.28	1.09		
	114	957+50	8.35	47.81	3.40	94.29	9.27	175.71	3.80	384.25	17.20	598.75	1.15	1388.26	-26.77		
	115	960+00	-9.78	63.94	3.23	113.56	6.39	201.41	-3.59	425.45	4.43	648.15	-13.99	1460.72	-32.24		
	116	962+50	-6.55	34.41	1.40	65.97	4.12	126.92	-12.34	328.59	-1.34	526.06	-25.04	1289.92	-52.49		
	117	965+00	6.39	47.44	1.84	90.63	4.41	168.88	-5.47	384.88	-19.51	645.51	6.66	1452.09	1.38		
	118	967+50	-4.26	31.67	-1.45	72.93	0.05	158.24	-14.15	362.79	-40.27	590.77	-33.65	1371.52	-35.91		
119	970+00	-26.41	45.01	2.08	91.67	0.88	176.48	-20.18	397.60	-36.10	618.17	-35.85	1400.47	-50.18			
Reach 3 - South	120	972+50	-49.91	61.90	-3.25	108.84	-11.43	190.17	-37.83	400.66	-65.93	624.41	-54.56	1420.54	-76.57		
	121	975+00	-38.72	50.53	3.19	91.45	-2.82	163.58	-31.00	371.29	-57.38	590.54	-53.33	1383.22	-79.50		
	122	977+50	11.30	64.73	3.99	112.19	7.77	200.03	7.80	430.87	12.29	661.25	28.84	1464.24	2.05		
	123	980+00	10.86	16.60	1.85	48.42	4.34	107.27	-8.57	301.93	-7.74	521.06	30.10	1293.19	19.27		
	124	982+50	14.64	31.76	2.58	63.21	7.33	121.18	-2.32	318.47	13.03	512.13	5.00	1267.75	-23.62		
	125	985+00	-18.00	11.78	-4.17	35.92	-6.93	85.26	-30.91	285.63	-13.77	462.91	-16.84	1207.16	-27.94		
	126	987+50	-39.07	3.50	-1.73	18.79	-5.18	67.03	-17.18	241.77	-12.78	421.76	9.42	1131.68	7.81		
	127	990+00	-78.58	13.08	-1.71	38.90	-11.99	91.95	-41.28	280.43	-44.68	472.22	-13.75	1214.86	-21.21		
	128	992+50	-84.46	18.70	-4.89	42.59	-19.07	92.97	-56.69	277.95	-65.74	452.21	-77.77	1208.47	-105.69		
	129	995+00	-74.46	4.68	-5.68	18.29	-18.27	55.20	-48.90	227.96	-57.48	413.71	-94.65	1178.62	-103.98		
	130	997+50	-19.13	29.35	-1.47	61.92	-2.56	140.94	10.37	332.35	12.33	535.21	7.81	1319.16	-4.71		
	131	1000+00	7.31	12.98	0.38	39.05	2.82	104.21	14.67	267.66	1.36	469.02	21.63	1228.78	15.61		
	132	1002+50	19.91	7.89	0.78	33.44	6.49	92.86	18.04	252.94	19.36	435.71	31.85	1176.16	16.71		
	133	1005+00	-3.29	19.86	1.25	51.07	1.62	112.68	2.88	281.20	-17.60	454.49	-16.96	1205.72	-37.67		
	Reach 4	134	1007+50	-9.72	29.25	-1.18	64.02	-0.76	134.36	0.86	314.78	-5.37	516.18	28.68	1279.76	22.93	
135		1010+00	18.33	10.45	0.69	39.50	5.12	107.76	15.78	289.86	26.09	480.43	53.15	1209.18	46.38		
136		1012+50	5.64	25.71	-1.13	60.67	1.25	133.82	2.91	325.76	15.13	515.26	37.34	1249.38	24.33		
137		1015+00	-40.76	16.67	-3.28	40.75	-7.71	94.64	-24.87	269.99	-31.60	449.05	-46.69	1184.34	-58.23		
138		1017+50	-41.69	28.22	-1.46	51.92	-5.50	104.77	-21.52	281.57	-24.19	470.54	-2.51	1216.36	-38.40		
139		1020+00	-59.58	9.39	-4.35	20.79	-14.75	57.88	-34.94	215.85	-38.41	394.40	-21.96	1143.54	-22.95		
140		1022+50	-33.80	19.64	-1.38	43.67	-5.66	109.46	-13.93	275.22	-29.71	460.12	-11.36	1204.42	-6.44		
141		1025+00	-9.60	5.01	-1.39	22.59	-0.43	75.38	2.15	231.02	-6.78	399.42	17.15	1108.66	14.74		



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