

**BONITA BEACH AND LOVERS KEY BEACH RENOURISHMENT
2021 ANNUAL MONITORING REPORT**



DEP Permit 0311811-001-JC

Prepared for:

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TABLE OF CONTENTS

1	INTRODUCTION	1
1.1	Bonita Beach Project History and Design	3
1.2	Lovers Key Project History and Design	3
1.3	Adjacent Coastal Projects	4
2	SCOPE OF WORK	4
3	SURVEYS	4
4	PHYSICAL MONITORING	5
4.1	Depth of Closure	5
4.2	Beach Profiles	5
4.3	Big Hickory Pass Ebb Tidal Shoal	18
4.4	Morphologic Changes	20
4.4.1	Overall	20
4.4.2	New Pass Ebb Tidal Shoal	24
4.4.3	Big Hickory Pass Ebb Tidal Shoal	26
5	CONCLUSION	28
6	REFERENCES	28

LIST OF FIGURES

Figure 1. Location Map..... 2
Figure 2. MHW Shoreline Positions Relative to 2014 Pre-Construction MHW Positions. 8
Figure 3. 2020 – 2021 Annualized Volumetric Changes Above MHW..... 11
Figure 4. 2020 – 2021 Annualized Volumetric Changes Above Depth of Closure. 14
Figure 5. Big Hickory Pass Profile Lines. 19
Figure 6. 2020 Monitoring Survey Contour Map. 21
Figure 7. 2021 Monitoring Survey Contour Map. 22
Figure 8. Morphologic Changes between 2020 and 2021 Monitoring Surveys. 23
Figure 9. Morphologic Changes Within New Pass Ebb Shoal. 25
Figure 10. Morphologic Changes Within Big Hickory Pass Ebb Shoal..... 27

LIST OF TABLES

Table 1. Timing of Monitoring Activities..... 1
Table 2. 2020 – 2021 Shoreline Positions at MHW. 7
Table 3. 2020 – 2021 Volumetric Changes Above 2020 MHW..... 9
Table 4. 2020 – 2021 Volumetric Changes Above Depth of Closure. 12
Table 5. 2014 – 2015 Total Beach Fill Placed Landward of 2015 MHW..... 15
Table 6. 2015 – 2021 Beach Fill Volume Changes Landward of 2015 MHW. 16

LIST OF APPENDICES

APPENDIX 1. SURVEY REPORT

APPENDIX 2. BEACH PROFILES

APPENDIX 3. BIG HICKORY PASS EBB TIDAL SHOAL CROSS SECTIONS

1 INTRODUCTION

In 2014, Lee County completed construction of the Bonita Beach and Lovers Key Beach Renourishment Project (Project). The contractor, Orion Marine Construction, Inc. (Orion), mobilized to the work site beginning June 4, 2014. Sand placement began at Bonita Beach on July 13, 2014, and was completed on September 30, 2014. Orion mobilized to Lovers Key and began sand placement on October 1, 2014. The Lovers Key beach fill was completed on December 2, 2014. Approximately 140,200 cubic yards and 342,400 cubic yards were excavated from the Borrow Areas and placed within the permitted limits of the Bonita Beach and Lovers Key beach fills, respectively. All work including final site clean-up and demobilization was completed on December 11, 2014. The post-construction survey was completed by Coastal Engineering Consultants, Inc. (CEC) on January 7, 2015 (CEC, 2015). The 1st annual monitoring survey was completed by CEC on July 1, 2016 (CEC, 2016). The 2nd annual monitoring survey was completed by CEC October 17-19, 2017 (CEC, 2018a). The 3rd annual monitoring survey was completed by CEC between June 28 and July 6, 2018 (CEC, 2018b). The 4th annual monitoring survey was completed by CEC July 17-18, 2019 (CEC, 2019). The 5th annual monitoring survey was completed by CEC June 11-12, 2020 (CEC 2020). A location map is presented in Figure 1.

This report summarizes the Project performance and presents the results of the 6th annual physical monitoring survey completed by CEC June 10-11. The physical monitoring survey was completed in accordance with the Physical Monitoring Plan (PMP) dated May 2012 as outlined in the Florida Department of Environmental Protection (FDEP) Permit No. 0311811-001-JC. The timing of PMP activities is presented in Table 1 below. Funding for the monitoring was provided by Lee County.

Table 1. Timing of Monitoring Activities.

Monitoring Activity	Pre-Con	Post-Con	1st Year Mon	2nd Year Mon	3rd Year Mon	4th Year Mon*	5th Year Mon	6th Year Mon*
Beach Profiles	✓	✓	✓	✓	✓	✓	✓	✓
Borrow Area Survey	✓	✓	✓	-	✓	-	✓	✓
Big Hickory Pass Ebb Shoal	-	✓	✓	-	✓	✓	✓	✓
Sediment Analysis	-	✓	-	-	-	-	-	-
Report	-	✓	✓	✓	✓	✓	✓	✓

(-) Indicates data collection is not proposed for this time period

* 4th and 6th Year Monitoring not required by Permit

It should be noted that due to the 2017 construction of the Big Carlos Pass Dredging Project (Permit No. 0332643-003-JN) located within this Project’s May 2012 PMP limits (R-205 to R-235), the Big Carlos Pass Project PMP was updated in November 2016 to include monitoring of the R-205 to R-210 segment. As a result, the shoreline change and beach volume change analyses between R-205 and R-210 are no longer included in the Lovers Key and Bonita Beach Monitoring Reports.

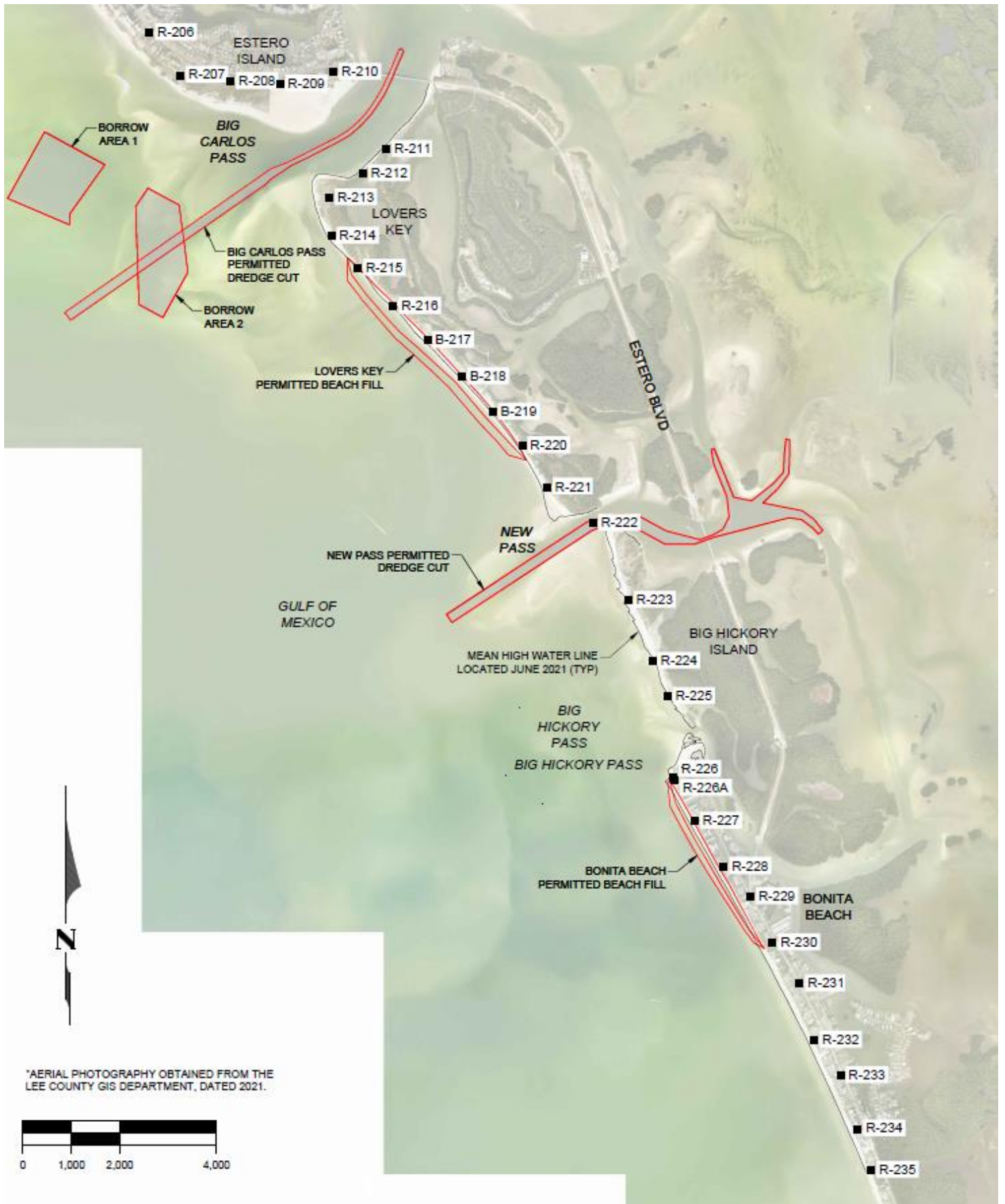


Figure 1. Location Map.

1.1 Bonita Beach Project History and Design

The original Bonita Beach restoration project took place in 1995 and the first maintenance nourishment was completed in May 2004. The 2004 maintenance design extended the shoreline seaward an average of 115 feet as measured from the surveyed 2001 shoreline with an anticipated design fill life of approximately 6 years. Design documentation from that effort did not indicate specific dimensions or fill quantities for a design minimum beach/berm or advance maintenance fill, although it is assumed that 115-foot width was based on some combination of a storm damage reduction berm buffered by sacrificial advanced maintenance. As part of the design of the Project, Coastal Technology Corporation (Coastal Tech) completed a review of the prior Bonita Beach project performance that indicated *additional* advanced fill was not warranted. Although there was a minor erosional ‘hotspot’ located at R-227, the previous maintenance project had generally performed as expected (Coastal Tech, 2012).

The Bonita Beach construction template proposed (Coastal Tech, 2012) generally consisted of:

- no separate dune feature
- a berm which ranges from 105 feet to 134 feet wide with
 - crest slope of 1 vertical to 200 horizontal (1V:200H)
 - seaward edge of top of berm crest elevation at +4.3 feet NAVD
 - seaward berm face slope of 15H:1V down to the existing profile (modified/flattened from prior 10H:1V design).

1.2 Lovers Key Project History and Design

The Lovers Key initial restoration project was completed in October 2004 as a construction contract extension of the first Bonita Beach maintenance project. The fill template included a 40-foot wide “design beach” width measured from the 2001 shoreline, a seaward slope of 15H:1V to the existing profile and advance maintenance fill placed seaward of the design beach intended to maintain the design beach for 8 years. The initial project generally performed as expected, except for an erosional ‘hotspot’ generally centered around R-216.5 where the shoreline had receded landward of the design beach (Coastal Tech, 2012).

The Lovers Key construction template proposed (Coastal Tech, 2012) generally consisted of:

- a small dune feature only at R-215 with an elevation of +4.9 feet NAVD
- berm design with:
 - width varying from 49 feet to 151 feet from pre-project MWH
 - crest slope of 1 vertical to 200 horizontal (1V:200H)
 - seaward edge of top of berm crest elevation at +2.9 feet NAVD
 - with a seaward berm face slope of 15H:1V down to the existing profile
 - additional “weighted” advanced maintenance volume centered roughly on R-217.

The Lovers Key full advanced maintenance volume was included in the Project design and in the required regulatory approvals, but the final volume placed was field adjusted at the time of construction based on actual pre-project beach conditions, the Project funds available following

receipt and evaluation of the construction bids, and the volume of sand available in the borrow areas.

1.3 Adjacent Coastal Projects

Between November 25 and December 18, 2020, on behalf of the West Coast Inland Navigation District (WCIND) and Lee County, Cavache Inc. dredged New Pass and placed approximately 21,270 cubic yards of fill on Lover’s Key between R-216.5 and R-219.5.

2 SCOPE OF WORK

Beach Profiles: Establish temporary horizontal and vertical control, one-time, on the uplands within the Project. Conduct 6th year beach profile monitoring surveys of the active beach zone along the shoreline at each reference monument (R monument) from R-211 to R-235. Additional profiles at half monuments within the Lovers Key fill limits (R-214.5 to R-220.5) and within the Bonita Beach fill limits (R-226A to R-230) will be included to provide increased detail on Project performance. Perform analyses of shoreline and volumetric change within the surveyed area in accordance with the agency approved plan.

Big Hickory Pass Ebb Tidal Shoal: Use traditional hydrographic survey methods to collect profile data for the Big Hickory Pass Ebb Tidal Shoal in accordance with the agency approved plan.

Physical Monitoring Report: Prepare and submit to the agencies an annual Physical Monitoring Report within 90 days following completion of the 6th year monitoring survey. The report shall include:

- signed and sealed survey report,
- analysis for patterns, trends, or changes between surveys and for cumulative changes over time,
- evaluation of the erosion and accretion rates occurring between the initial post-construction survey and consecutive annual monitoring surveys; and an assessment of the volume of fill remaining within the Project area,
- comparative review of project performance to performance expectations and identification of adverse impacts attributable to the project.

3 SURVEYS

CEC conducted the monitoring survey of Lovers Key, Big Hickory Island, Big Hickory Pass Shoal, and Bonita Beach June 10-11, 2021. The survey report is presented in Appendix 1. All work activities and deliverables were conducted in accordance with the latest update of the FDEP Monitoring Standards for Beach Erosion Control Projects, Sections 01000, 01100, and 01200.

Bathymetric survey data collection was conducted in calm seas. Maximum wave heights during the data collection period were less than 3 feet. The data was collected at intervals not exceeding 25 feet and at all grade breaks along the profile sufficient to accurately describe the bathymetry at the profile locations.

Bathymetric survey data collection was performed as close in time as possible with the upland topographic survey data collection. This significantly increased the efficiency by conducting the work with the same base station set-up. Safety was also increased by having both crews visible to each other at all times.

The beach profile deliverables were produced by merging the upland and offshore survey data in Hypack 2017. The processed data was exported into AutoCAD and individual profiles/sections were plotted to the specified scale.

4 PHYSICAL MONITORING

4.1 Depth of Closure

The depth of closure for Big Hickory Island and Bonita Beach was determined to be -11.2 feet NAVD88. The Lovers Key beach profiles are shallower compared to those of Bonita Beach with much milder profile slopes due to the presence of the large Big Carlos Pass ebb shoal system sheltering these areas. From visual observations of the profiles, a distance of 500 feet seaward of MHW was previously established as the depth of closure for the purpose of computing volume changes for the monitoring requirements (CEC, 2016).

4.2 Beach Profiles

Appendix 2 presents the beach profiles measured at each R-monument for the 2014 pre-construction, 2015 post-construction, as well as the 2019, 2020 and 2021 monitoring surveys.

Table 2 presents the 2020 and 2021 monitoring survey shoreline positions at MHW (MHW = 0.3 feet NAVD88) and the shoreline changes that occurred between the surveys. The unweighted average shoreline change for individual beach segments was calculated based upon these changes. Figure 2 presents the permitted beach fill templates, 2015 post-construction, 2019 monitoring, 2020 monitoring and 2021 monitoring surveys relative to the 2014 pre-construction survey. It should be noted that the 2014 pre-construction survey was utilized as the baseline for comparative purposes. The design templates (without advanced maintenance) were specifically depicted for tracking fill diffusion and evolution over time in support of future funding requests and evaluating renourishment needs.

Table 3 presents the volumetric changes landward of MHW and Figure 3 presents the annualized volumetric change rate landward of MHW calculated by comparing the 2020 and 2021 monitoring surveys and annualizing the changes to be consistent with prior year monitoring reports. For the purpose of monitoring and reporting, the cell boundary was set equal to the 2021 MHW line. Table 4 presents the overall volumetric changes calculated to the depth of closure and Figure 4 presents the annualized volumetric change to the depth of closure for this period.

Table 5 presents the total beach fill placed landward of the post-construction MHW line utilizing the pre- and post-construction R-monument beach profile surveys. Table 6 presents the beach fill volume changes landward of the 2015 MHW line utilizing the post-construction and 2021 monitoring surveys. As this analysis was completed in support of the County's funding application

to the Beach Management Funding Assistance Program, the cell boundary was set equal to the 2015 MHW line.

The Average End-Area method was used to compute volumetric changes. For parallel R-monument lines the perpendicular distance between R-the monument lines was used for the volumetric calculations. For non-parallel R-monument lines, the distance between the monument lines and their respective intersections with 2020 MHW was used for the volumetric calculations.

Additional half monuments were surveyed on Big Hickory Island (R-222.5, R-223.5, R-224.5), and Bonita Beach (R-225.5A, R-230.5) for future comparison and analysis. Volumetric changes landward of MHW and to the depth of closure were not computed for these monuments in this monitoring report. These profiles are included in Appendix 2.

Table 2. 2020 – 2021 Shoreline Positions at MHW.

Mon.	2020 Position Monitoring (FT)	2021 Position Monitoring (FT)	Shoreline Change (FT)	Average** Change (FT)	Segment
R-211	69.4	71.2	1.8	-0.2	Big Carlos Pass (South)
R-212	84.3	82.1	-2.2		
R-213	432.4	373.6	-58.8	-15.4	Lovers Key North Adjacent Shoreline
R-214	59.3	70.8	11.5		
R-214.5	12.5	13.6	1.1		
R-215	37.2	8.9	-28.3	-20.7	Lovers Key Beach Fill
R-215.5	63.8	61.1	-2.8		
R-216	38.8	21.6	-17.3		
R-216.5	101.8	78.0	-23.8		
R-217	73.1	60.7	-12.5		
R-217.5	165.7	143.4	-22.3		
R-218	69.5	45.6	-23.9		
R-218.5	158.7	138.5	-20.3		
R-219	45.4	21.7	-23.8		
R-219.5	97.1	73.9	-23.2		
R-220	123.1	93.5	-29.6		
R-220.5	142.5	115.0	-27.6	-5.1	Lovers Key South Adjacent Shoreline
R-221	100.1	117.4	17.3		
R-222	N/D	N/D	N/D	N/D	New Pass
R-223	85.5	50.3	-35.2	-22.8	Big Hickory Island
R-224	-6.2	-35.8	-29.6		
R-225	-15.7	-19.4	-3.7		
R-226	104.2	96.3	-7.8	-7.8	Bonita Beach North Adjacent Shoreline
R-226A	168.1	180.5	12.4	-1.2	Bonita Beach Fill
R-226.5	85.4	91.9	6.5		
R-227	106.6	110.1	3.5		
R-227.5	97.5	94.4	-3.0		
R-228	177.0	173.8	-3.1		
R-228.5	383.3	371.2	-12.1		
R-229	350.6	350.2	-0.4		
R-229.5	327.7	313.1	-14.6		
R-230	299.8	300.2	0.4		
R-231	394.3	391.8	-2.5	-4.5	Bonita Beach South Adjacent Shoreline
R-232	145.5	139.8	-5.7		
R-233	327.9	323.8	-4.2		
R-234	200.9	200.3	-0.6		
R-235	123.1	113.9	-9.3		

*N/D = No data, profile does not cross MHW

**Average is unweighted

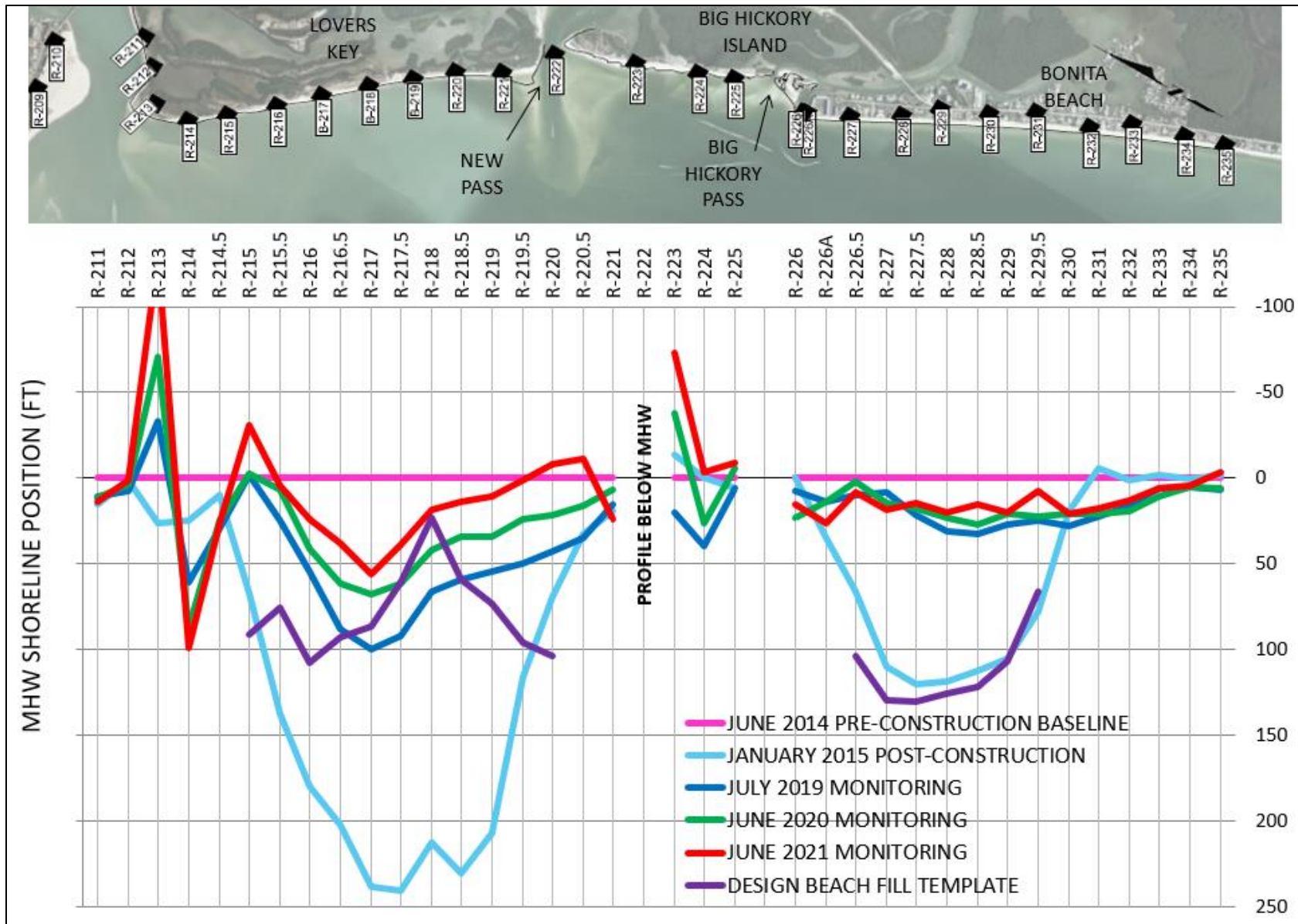


Figure 2. MHW Shoreline Positions Relative to 2014 Pre-Construction MHW Positions.

Table 3. 2020 – 2021 Volumetric Changes Above 2021 MHW.

	Monument	Area (YD ³ /FT)	Avg Area (YD ³ /FT)	Length (FT)	Volume (YD ³)	Total Volume Change (YD ³)		
Big Carlos Pass (R-211 - R-212)								
LK North Adjacent Shoreline	R-213	-4.6	-2.3	843	-1,934	-1,953		
	R-214	0.0	0.6	376	220			
	R-214.5	1.2	-0.5	434	-238			
	R-215	-2.3	-2.2	559	-1,232			
Lovers Key Beach Fill	R-215.5	-2.1	-1.4	506	-720	-6,281		
	R-216	-0.7	-1.7	535	-900			
	R-216.5	-2.7	-2.5	542	-1,339			
	R-217	-2.3	-1.4	467	-677			
	R-217.5	-0.6	-0.4	560	-243			
	R-218	-0.3	1.0	504	482			
	R-218.5	2.2	0.5	463	209			
	R-219	-1.3	-1.7	489	-844			
	R-219.5	-2.2	-2.3	442	-1,017			
	R-220	-2.4	-1.1	500	-566			
	LK South Adjacent Shoreline	R-220.5	0.2	0.2	500		107	-459
		R-221	0.3					
		New Pass (R-222)						
	Big Hickory Island	R-223	-2.0	-1.1	1337		-1,427	-725
		R-224	-0.2	0.0	891		14	
		R-225	0.2	0.1	297		20	
BHP-3		-0.1	-0.5	200	-105			
BHP-4		-1.0	-0.7	200	-140			
BHP-5		-0.4	4.6	200	914			
BHP-6		9.5						

Big Hickory Pass						
Bonita North Adjacent Shoreline	BHP-7	0.0				945
			2.7	200	541	
	BHP-8	5.4				
			2.6	200	524	
	BHP-9	-0.2				
			-0.6	257	-152	
	R-226	-1.0				892
			0.5	73	33	
Bonita Beach Fill	R-226A	1.9				
			1.6	436	704	
	R-226.5	1.3				
			0.5	498	260	
	R-227	-0.3				
			-0.1	519	-55	
	R-227.5	0.1				
			0.3	582	179	
	R-228	0.5				
			0.1	326	38	
	R-228.5	-0.3				
			-0.1	476	-47	
	R-229	0.1				
			-0.2	540	-100	
	R-229.5	-0.5				
			-0.2	505	-88	
	R-230	0.1				1,180
Bonita South Adjacent Shoreline			0.1	1014	107	
	R-231	0.1				
			0.1	1179	144	
	R-232	0.1				
			0.1	890	97	
	R-233	0.1				
			0.6	1158	691	
	R-234	1.1				
		0.2	892	141		
	R-235	-0.8				

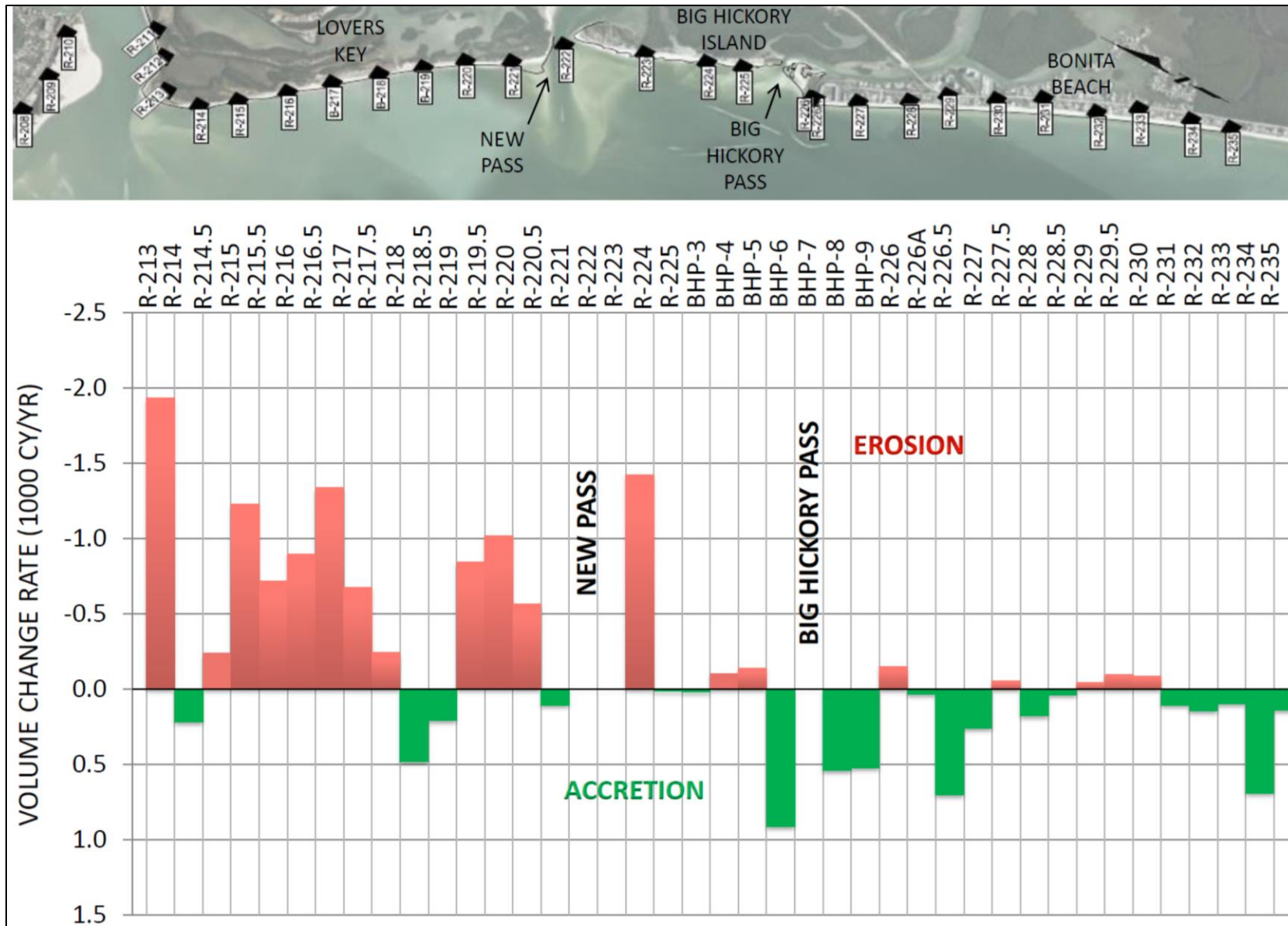


Figure 3. 2020 – 2021 Annualized Volumetric Changes Above MHW.

Table 4. 2020 – 2021 Volumetric Changes Above Depth of Closure.

	Monument	Area (YD ³ /FT)	Avg Area (YD ³ /FT)	Length (FT)	Volume (YD ³)	Total Volume Change (YD3)
Big Carlos Pass (R-211 - R-212)						
LK North Adjacent Shoreline	R-213	-16.5				1,398
			-2.5	843	-2,088	
	R-214	11.5				
			8.7	376	3,260	
	R-214.5	5.8				
		0.5	434	227		
Lovers Key Beach Fill	R-215	-4.8				-28,687
			-3.2	559	-1,791	
	R-215.5	-1.6				
			-4.4	506	-2,246	
	R-216	-7.2				
			-6.8	535	-3,651	
	R-216.5	-6.4				
			-6.3	542	-3,440	
	R-217	-6.3				
			-5.8	467	-2,732	
	R-217.5	-5.4				
			-5.6	560	-3,160	
	R-218	-5.9				
			-4.1	504	-2,074	
	R-218.5	-2.3				
		-4.4	463	-2,038		
R-219	-6.5					
		-7.6	489	-3,713		
R-219.5	-8.7					
		-8.7	442	-3,842		
R-220	-8.7					
LK South Adjacent Shoreline			-5.6	500	-2,788	-808
	R-220.5	-2.5				
			4.0	500	1,981	
	R-221	10.4				
New Pass (R-222)						
Big Hickory Island						-22,542
	R-223	0.0				
			-8.8	1337	-11,745	
	R-224	-17.6				
			-11.9	891	-10,571	
	R-225	-6.2				
			0.2	297	55	
	BHP-3	6.5				
			-1.0	200	-205	
	BHP-4	-8.6				
			-2.3	200	-467	
BHP-5	3.9					
		2.0	200	391		
BHP-6	0.0					
Big Hickory Pass						

Bonita Beach and Lovers Key Beach Renourishment

2021 Annual Monitoring Report

Bonita North Adjacent Shoreline	BHP-7	0.0				-563	
			0.0	200	0		
	BHP-8	0.0					
			-1.5	200	-301		
	BHP-9	-3.0					
			-1.2	257	-316		
Bonita Beach Fill	R-226	0.6				-7,168	
			0.7	73	53		
	R-226A	0.9					
			-0.3	436	-129		
	R-226.5	-1.5					
			-2.3	498	-1,133		
	R-227	-3.0					
			-2.4	519	-1,252		
	R-227.5	-1.8					
			-2.1	582	-1,243		
	R-228	-2.5					
			-3.0	326	-978		
	R-228.5	-3.5					
			-2.2	476	-1,054		
R-229	-0.9						
		-2.0	540	-1,084			
R-229.5	-3.1						
		-0.6	505	-293			
R-230	1.9						
Bonita South Adjacent Shoreline			1.2	1014	1,222	2,613	
	R-231	0.5					
			0.1	1179	75		
	R-232	-0.3					
			-0.5	890	-476		
	R-233	-0.7					
			1.0	1158	1,165		
	R-234	2.7					
		0.7	892	627			
R-235	-1.3						

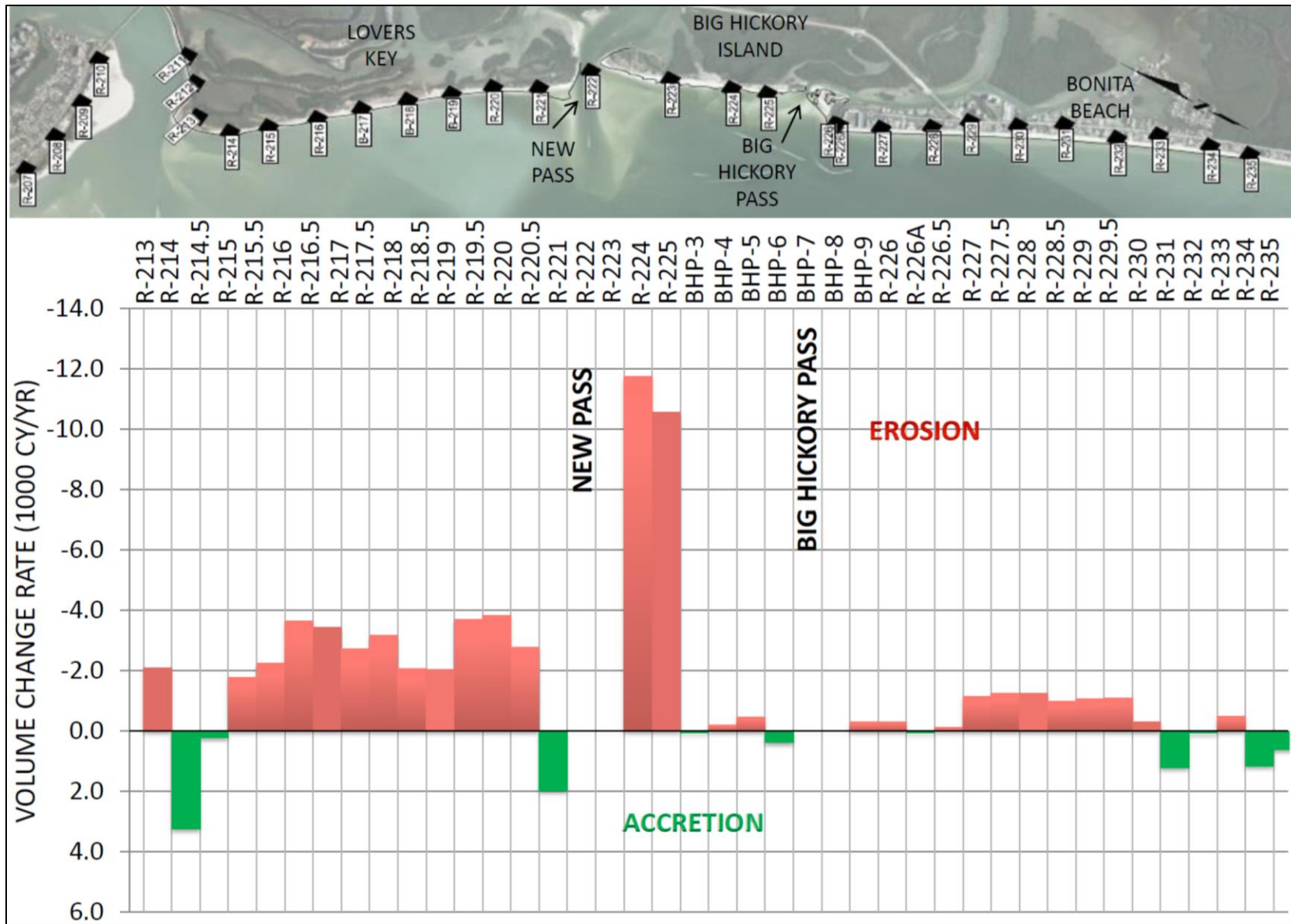


Figure 4. 2020 – 2021 Annualized Volumetric Changes Above Depth of Closure.

Table 5. 2014 – 2015 Total Beach Fill Placed Landward of 2015 MHW.

	Monument	Area (YD ³ /FT)	Avg Area (YD ³ /FT)	Length (FT)	Volume (YD ³)	
Lovers Key Beach Fill	R-215	17.9				250,119
			24.8	540	13,379	
	R-215.5	31.7				
			39.3	567	22,285	
	R-216	46.9				
			49.5	452	22,386	
	R-216.5	52.1				
			62.7	489	30,642	
	R-217	73.3				
			72.4	520	37,688	
	R-217.5	71.6				
			66.8	532	35,548	
	R-218	62.0				
			65.1	531	34,614	
	R-218.5	68.2				
			62.2	436	27,125	
	R-219	56.1				
		38.9	514	20,002		
R-219.5	21.7					
		16.4	392	6,449		
R-220	11.2					
Bonita Beach Fill	R-226A	4.7				98,380
			11.5	445	5,097	
	R-226.5	18.3				
			24.1	515	12,401	
	R-227	29.9				
			31.0	519	16,080	
	R-227.5	32.1				
			32.0	582	18,644	
	R-228	32.0				
			32.1	326	10,477	
	R-228.5	32.2				
			32.4	476	15,424	
	R-229	32.5				
			27.3	519	14,151	
R-229.5	22.1					
		12.1	504	6,105		
R-230	2.1					

Table 6. 2015 – 2021 Beach Fill Volume Changes Landward of 2015 MHW.

	Monument	Area (YD ³ /FT)	Avg Area (YD ³ /FT)	Length (FT)	Volume (YD ³)	
Lovers Key Beach Fill	R-215	-23.1				-201,823
			-26.1	540	-14,085	
	R-215.5	-29.1				
			-29.9	567	-16,961	
	R-216	-30.7				
			-34.6	452	-15,658	
	R-216.5	-38.5				
			-43.0	489	-21,014	
	R-217	-47.5				
			-49.3	520	-25,671	
	R-217.5	-51.2				
			-51.4	532	-27,351	
	R-218	-51.6				
			-57.3	531	-30,435	
	R-218.5	-62.9				
			-57.6	436	-25,126	
	R-219	-52.2				
		-36.7	514	-18,886		
R-219.5	-21.2					
		-16.9	392	-6,644		
R-220	-12.7					
Bonita Beach Fill	R-226A	2.1				-68,286
			-4.9	445	-2,194	
	R-226.5	-12.0				
			-17.6	515	-9,083	
	R-227	-23.3				
			-24.2	519	-12,551	
	R-227.5	-25.1				
			-24.0	582	-13,965	
	R-228	-22.9				
			-23.3	326	-7,591	
	R-228.5	-23.7				
			-21.9	476	-10,429	
	R-229	-20.1				
			-18.0	519	-9,331	
R-229.5	-15.9					
		-6.2	504	-3,142		
R-230	3.4					

A summary of the shoreline and volumetric changes based on the comparisons between the 2020 and 2021 monitoring surveys at the R-monuments is presented below. Several of the Big Hickory Pass ebb shoal lines, presented in detail in Section 4.3, were included in the volumetric change analysis.

Big Carlos Pass: The segment extending from R-211 to R-212 is within Big Carlos Pass on its south side and therefore no volumetric analysis was performed. The shoreline receded on average 0.2 feet between the 2020 and 2021 monitoring surveys.

Lovers Key North Adjacent Shoreline: The beach segment extending from R-213 to R-214.5 receded on average approximately 15.4 feet between the 2020 and 2021 monitoring surveys. The range of shoreline change measured at MHW was approximately from 58.8 feet of recession at R-213 to 11.5 feet of advancement at R-214. The total volume change was approximately 1,400 cubic yards of accretion above the depth of closure and approximately 1,950 cubic yards of recession above MHW.

Lovers Key Beach Fill: The beach segment extending from R-214.5 to R-220 was constructed based upon the design template with the addition of advanced maintenance fill. The beach segment receded on average approximately 20.7 feet between the 2020 and 2021 monitoring surveys. The range of shoreline change measured at MHW was from approximately 29.6 feet of recession at R-220 to 2.8 feet of recession at R-215.5. The total volume change was approximately 28,690 cubic yards of erosion above the depth of closure and approximately 6,280 cubic yards of erosion above MHW. Of the 250,120 cubic yards of beach fill that were placed above MHW, approximately 201,830 cubic yards eroded between the 2015 post-construction and 2021 monitoring survey indicating approximately 19% of the original beach fill placed above MHW remains. WCIND and Lee County completed a beneficial use project, placing approximately 21,270 cubic yards within the original beach fill limits. Thus the net erosion rates would be higher and the percent remaining of the original fill would be less.

Lovers Key South Adjacent Shoreline: The beach segment extending from R-220 to R-221 receded on average approximately 5.1 feet between the 2020 and 2021 monitoring surveys. The range of shoreline change measured at MHW was approximately from 27.6 feet of recession at R-220.5 to 17.3 feet of advancement at R-221. The total volume change was approximately 810 cubic yards of erosion above the depth of closure and approximately 460 cubic yards of erosion above MHW.

New Pass: The segment at R-222 is within New Pass and therefore no volumetric analysis was performed. The monument is located within the middle of the channel, so the profile does not reach MHW. Accordingly, shoreline change was not calculated.

Big Hickory Island Shoreline: The beach segment extending from R-223 to R-225 receded on average approximately 22.8 feet between the 2020 and 2021 monitoring surveys. The range of shoreline change measured at MHW was approximately from 35.2 feet of recession at R-223 to 3.7 feet of recession at R-225. The total volume change was approximately 22,540 cubic yards of erosion above the depth of closure and approximately 720 cubic yards of erosion above MHW.

Bonita Beach North Adjacent Shoreline: The beach segment at R-226 recessed approximately 7.8 feet, when measured at MHW, between the 2020 and 2021 monitoring surveys. The total volume change from Big Hickory Pass to R-226 was approximately 560 cubic yards of recession above the depth of closure and approximately 940 cubic yards of accretion above MHW.

Bonita Beach Fill: The beach segment extending from R-226 to R-230 was constructed based upon the design template. The beach segment receded on average approximately 1.2 feet between the 2020 and 2021 monitoring surveys. The range of shoreline change measured at MHW was approximately from 14.6 feet of recession at R-229.5 to 12.4 feet of advancement at R-226A. The total volume change was approximately 7,170 cubic yards of erosion above the depth of closure and approximately 890 cubic yards of accretion above MHW. Of the 98,380 cubic yards of beach fill that were placed above MHW, approximately 68,290 cubic yards eroded between the 2015 post-construction and 2021 monitoring survey indicating approximately 31% of the original beach fill placed above MHW remains.

Bonita Beach South Adjacent Shoreline: The beach segment extending from R-230 to R-235 receded on average approximately 4.5 feet between the 2020 and 2021 monitoring surveys. The range of shoreline change measured at MHW was approximately from 9.3 feet of recession at R-235 to 0.6 feet of recession at R-234. The total volume change was approximately 2,610 cubic yards of accretion above the depth of closure and approximately 1,180 cubic yards of accretion above MHW.

4.3 Big Hickory Pass Ebb Tidal Shoal

Appendix 3 presents the Big Hickory Pass Ebb Tidal Shoal cross-sections measured at the profile lines spaced 200 feet apart from R-225 to R-226 for the 2014 pre-construction, 2015 post-construction, and 2019, 2020, and 2021 monitoring surveys. The profile line locations are depicted in Figure 5.



Figure 5. Big Hickory Pass Profile Lines.

4.4 Morphologic Changes

4.4.1 Overall

Figures 6 and 7 present elevation contour maps based on the 2020 and 2021 monitoring surveys, respectively, noting that they include additional survey data at Big Carlos Pass and New Pass collected concurrently with this Project as part of other Lee County survey projects. The morphologic changes that occurred between the two surveys are presented in Figure 8.

Because the Big Carlos Pass ebb shoal was not surveyed in detail in 2021, the R-monument survey data were interpolated over the ebb shoal to create the contour map. Because of this, portions of the 2020-2021 morphologic changes over the Big Carlos Pass system may not be representative of actual changes.

The 2020 and 2021 survey coverage was near identical between R-214 and R-235, therefore the morphologic changes over this shoreline segment are accurate.

The Lovers Key fill area experienced nearshore erosion of 1 to 2 feet between R-215 and R-220. Some overwash was observed at R-215.5 and R-218.5. Big Hickory Island experienced 1 to 2 feet of beach erosion between R-223 and R-225, 1 foot of accretion just north of R-223, and up to 4 feet of accretion at the north end of the island. The Bonita Beach fill area experienced minor nearshore erosion within a 1-foot range.

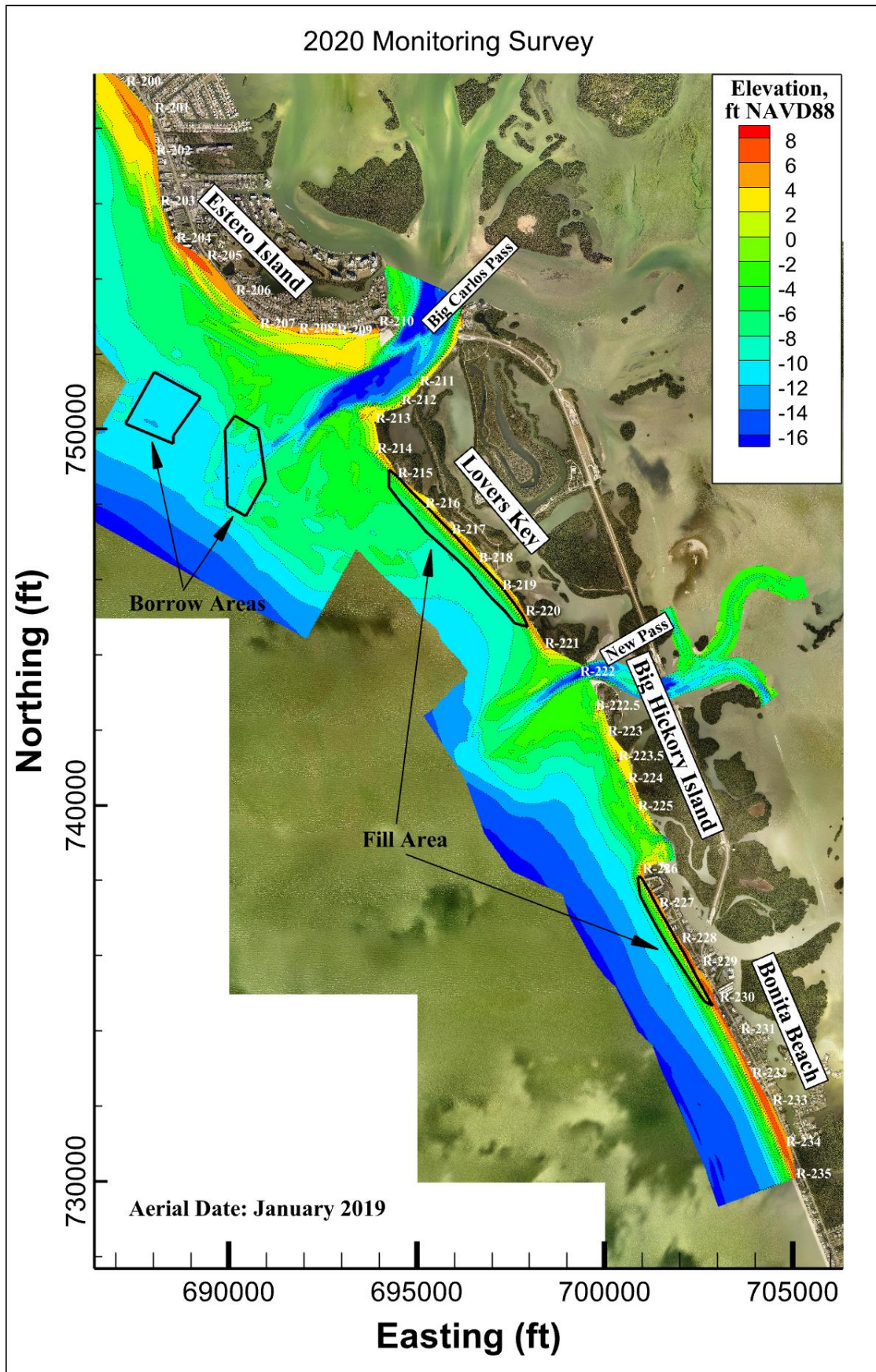


Figure 6. 2020 Monitoring Survey Contour Map.

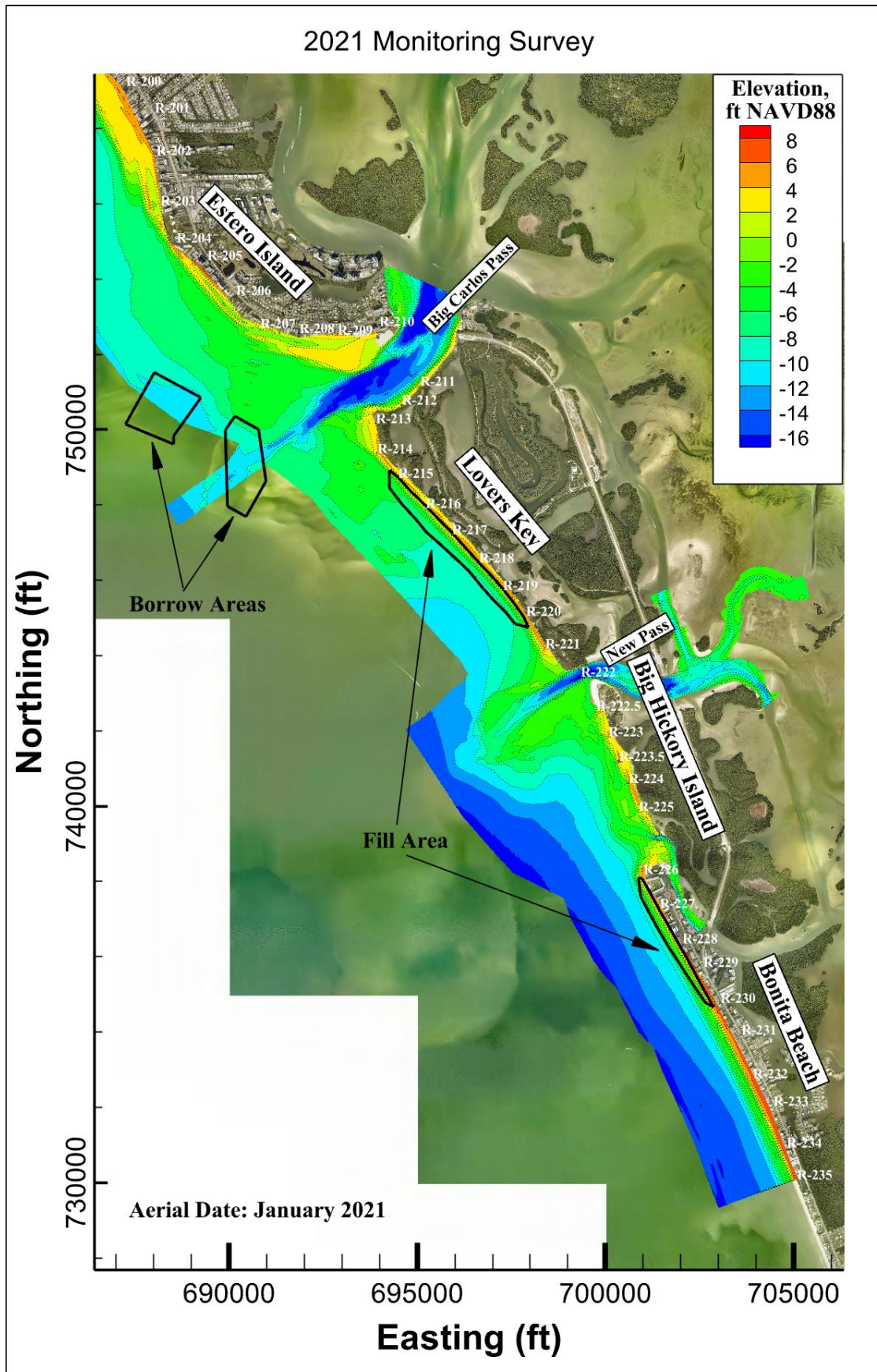


Figure 7. 2021 Monitoring Survey Contour Map.

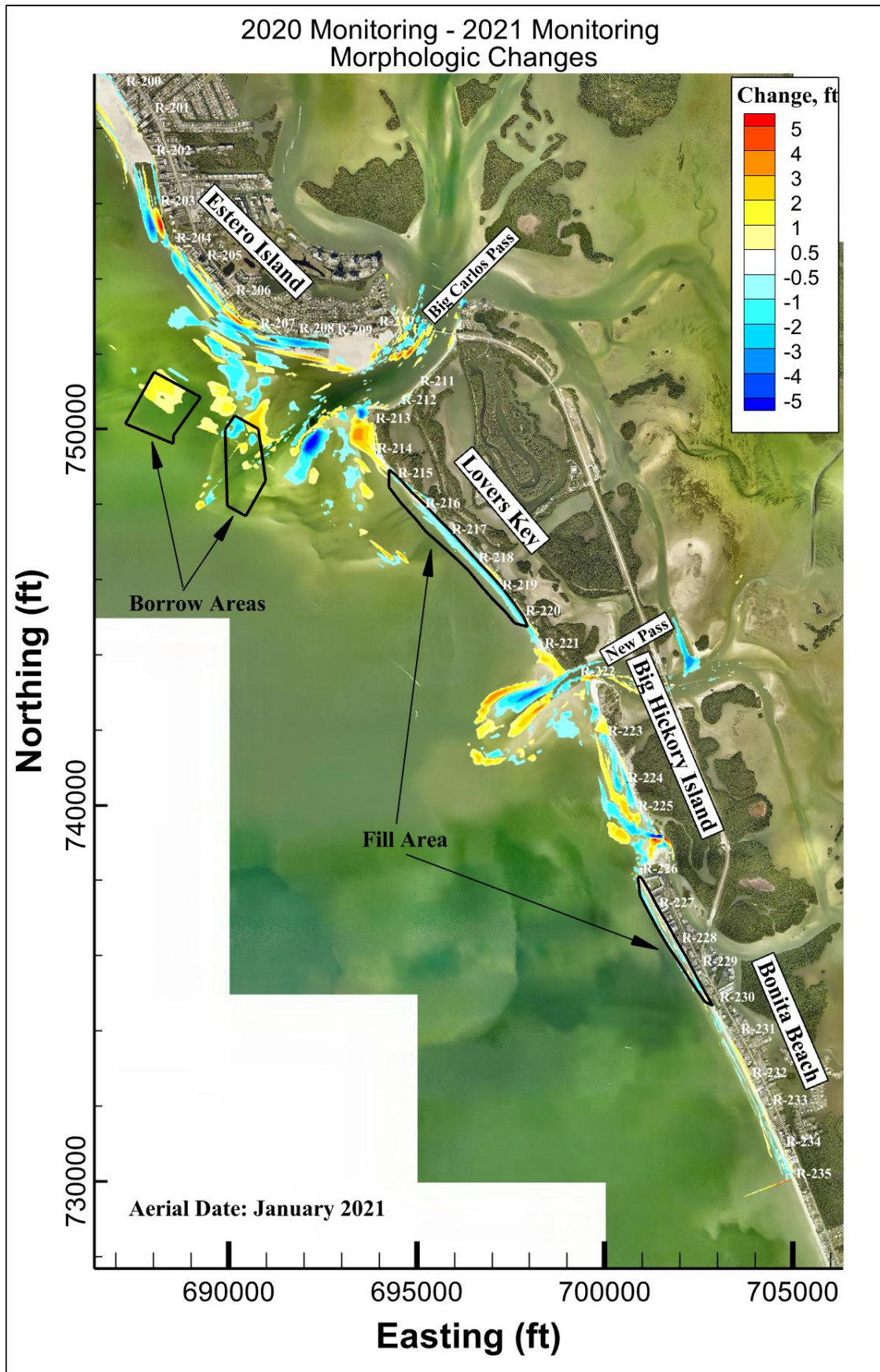


Figure 8. Morphologic Changes between 2020 and 2021 Monitoring Surveys.

4.4.2 New Pass Ebb Tidal Shoal

Morphologic changes within the New Pass ebb shoal are presented in Figure 9. The figure also depicts MHW positions and channel delineations based on the 2020 and 2021 surveys. The channel was delineated using the deepest path connecting the Gulf of Mexico and New Pass.

Comparing the 2020 and 2021 MHW positions, the north end of Big Hickory Island adjacent to the pass experienced shoreline advancement into the pass of approximately 60 feet noting that the shoreline along the gulf immediately south of New Pass receded. The changes over the ebb shoal and New Pass channel ranged from +4 feet to -5 feet. The shoreline at the south end of Lovers Key experienced significant accretion gaining up to 2.5 feet vertically and advancing approximately 250 feet. The morphologic changes indicated the channel alignment was fairly stable. The pattern of the changes also indicated that during this monitoring period the net longshore sediment transport was from north to south moving material off Lovers Key, bypassing the channel around the edge of the ebb shoal, delineated in the figure by the -6-ft contour line, and depositing material on the south side of the channel by wave action.

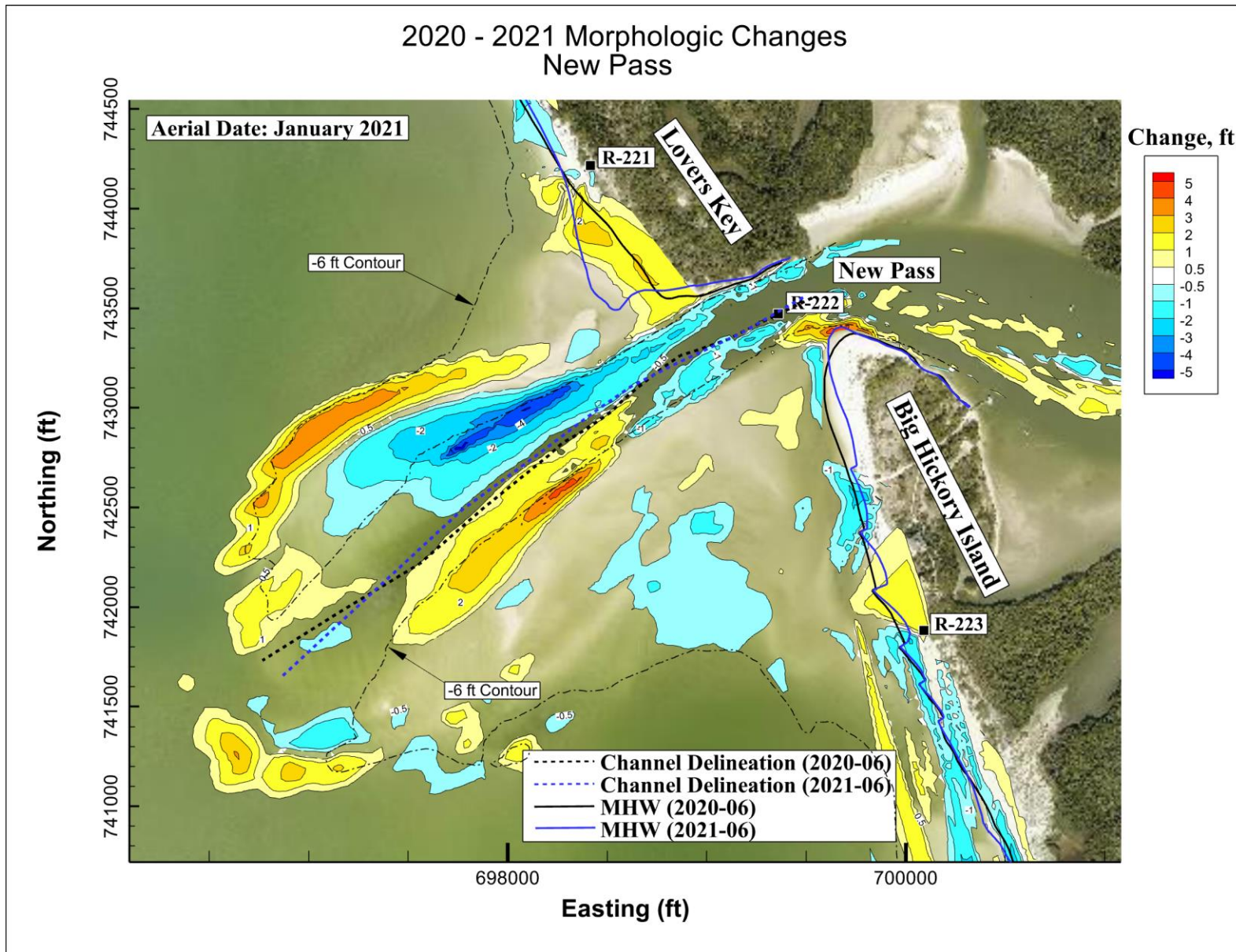


Figure 9. Morphologic Changes Within New Pass Ebb Shoal.

4.4.3 Big Hickory Pass Ebb Tidal Shoal

Morphologic changes within the Big Hickory Pass ebb shoal are presented in Figure 10. The figure also depicts MHW positions and channel delineations based on the 2020 and 2021 surveys. The channel was delineated using the deepest path connecting the Gulf of Mexico and Big Hickory Pass.

The south end of Big Hickory Island, north of the pass, experienced shoreline recession of approximately 15 feet. The pass experienced scouring of up to 8 feet at the throat of the pass and shoaling of up to 6 feet inside the pass. Also, based on the MHW shoreline comparison between 2020 and 2021, the spit off the north end of Bonita Beach grew in size and migrated towards the pass by approximately 180 feet. This growth area experienced shoaling of up to 6 feet. The entrance into the pass narrowed from approximately 270 feet in 2020 to approximately 100 feet in 2021. The channel alignment turned counterclockwise by approximately 23 degrees. The changes over the ebb shoal were mixed within a ± 3 -foot range. The pattern of the changes indicates that during this monitoring period the net longshore sediment transport was from south to north moving material off Bonita Beach, depositing some of it along the south lobe of the shoal, bypassing the channel around the ebb shoal and transporting the remaining material along Big Hickory Island between R-224 and R-225.

It should be noted that the survey limits were expanded in 2021 to include interior channel cross-sections of Big Hickory Pass at 100-foot intervals. The interior channel will be surveyed again in future monitoring events. This will allow for a more comprehensive analysis of morphologic changes of the pass system.

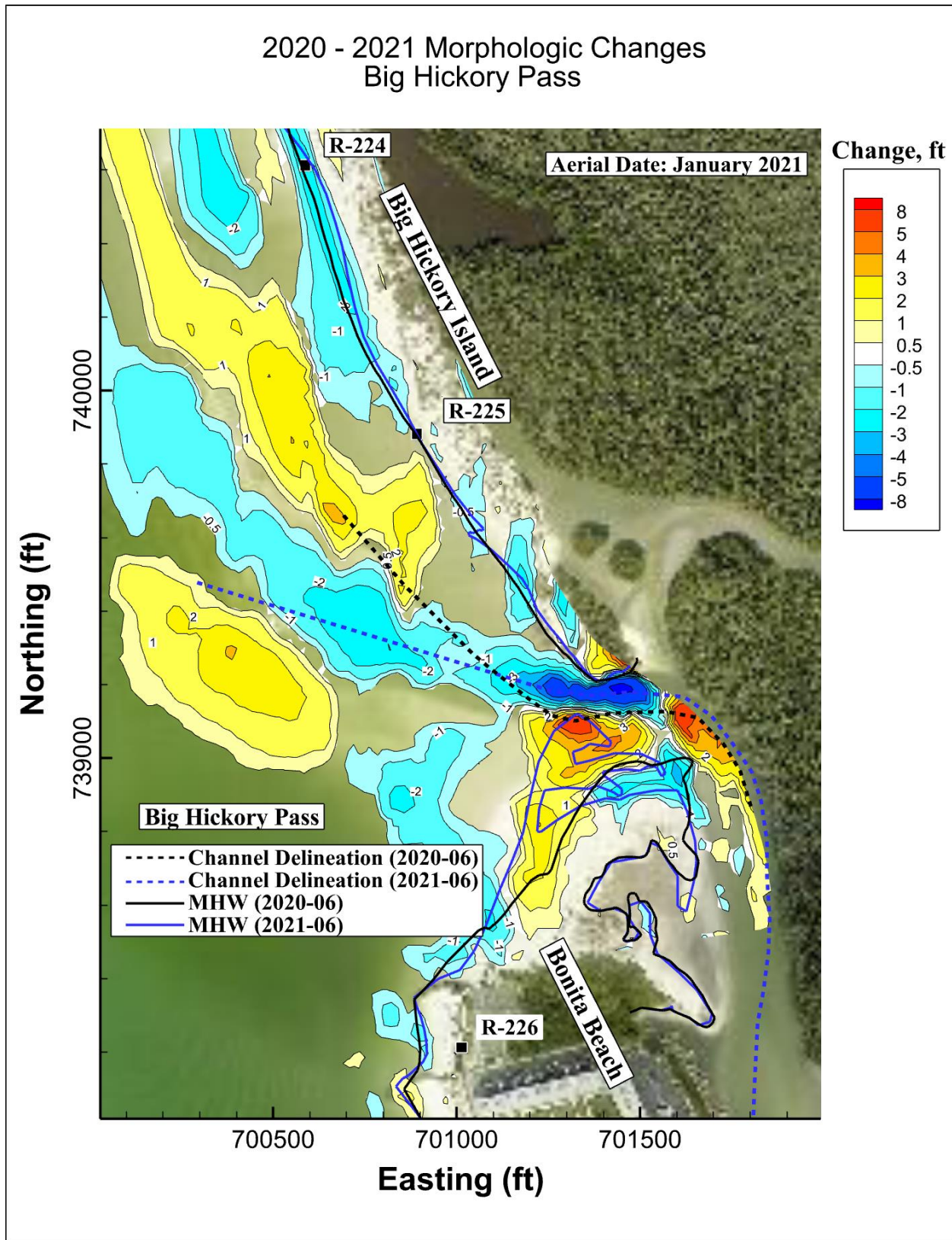


Figure 10. Morphologic Changes Within Big Hickory Pass Ebb Shoal.

5 CONCLUSION

This report describes the 6th-year annual monitoring results of the 2014 Bonita Beach and Lovers Key Beach Renourishment Project.

The information presented herein provides necessary data for both the County and FDEP to observe and assess, with quantitative measurements, the performance of the Project, any adverse effects which have occurred, and the need for any adjustments, modifications, or mitigative response to the Project. The monitoring process also provides the County and FDEP information necessary to plan, design, and optimize subsequent follow-up projects, potentially reducing the need for and costs of unnecessary work, as well as potentially reducing any environmental impacts that may have occurred or be expected. Based on the monitoring, there were no documented adverse impacts to the coastal system within the Project area.

Comparing the 2020 and 2021 monitoring surveys of the R-monuments, the monitoring area (R-213 to R-235) experienced a net loss, measured above the depth of closure, of approximately 55,760 cubic yards. Lovers Key lost approximately 28,100 cubic yards, Big Hickory Island lost approximately 22,540 cubic yards, and Bonita Beach lost approximately 5,120 cubic yards

Above MHW, the net change within the monitoring area was a loss of approximately 6,400 cubic yards. Lovers Key lost approximately 8,700 cubic yards, Big Hickory Island lost approximately 720 cubic yards, and Bonita Beach gained approximately 3,020 cubic yards.

Approximately 201,820 cubic yards eroded above MHW within the Lovers Key Beach Fill between the 2015 post-construction and 2021 monitoring surveys with approximately 19% of the original fill placed above MHW remaining on the beach compared to the 2020 survey equal to 29% remaining (CEC, 2020) noting the actual losses were higher as the 2020 New Pass maintenance dredging and beneficial use project placed over 21,000 cubic yards within the original fill limits.

Approximately 69,210 cubic yards eroded above MHW within Bonita Beach Fill between the 2015 post-construction and 2021 monitoring surveys with approximately 31% of the original fill placed above MHW remaining on the beach compared to the 2020 survey equal to 30% remaining (CEC, 2020).

6 REFERENCES

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Hubertz, J.M. 1992, “User’s Guide to the Wave Information Studies (WIS) Wave Model: Version 2.0”, WIS Report 27, US Army Corps of Engineers, Waterways Experiment Station, Vicksburg, MS, 41 pp.

APPENDIX 1
SURVEY REPORT

2021 BONITA BEACH / LOVERS KEY ANNUAL MONITORING SURVEY

SURVEY REPORT

CEC conducted the monitoring surveys of Lovers Key, Big Hickory Island, Big Hickory Pass Shoal, and Bonita Beach on June 10 and 11, 2021. Surveys were conducted utilizing multiple Trimble Real Time Kinematic (RTK) Global Positioning Systems (GPS). All GPS control during this survey was referenced from previously established Florida Department of Environmental Protection (FDEP) Bureau of Beaches and Coastal Systems (BBCS) and meets or exceeds Geospatial Positioning Accuracy Standards, Range VIII.

All “R monument” and intermediate beach profiles were collected on the State Plane Coordinate System Grid, Florida West Zone and survey data was collected along FDEP established grid bearings as outlined in the project Scope of Work. The horizontal and vertical datums were North American Datum (NAD) of 1983/2011 Adjustment and North American Vertical Datum (NAVD) of 1988, Geoid 2012A, respectively.

All survey control was established as part of the upland topographic survey control work and conducted in accordance with the FDEP Monitoring Standards for Beach Erosion Control Projects. These surveys meet the requirements set forth in Chapter 5J-17 (F.A.C.) Florida Administrative Code. The following published FDEP vertical control was used during the surveys:

USGS E248 1965, PID No. AD1334
Northing: 742689.561’
Easting: 701857.275’
Elevation: 22.09’ NAVD 1988

USGS D248 1965, PID No. AD1312
Northing: 736847.789’
Easting: 702767.371’
Elevation: 11.95’ NAVD 1988

Equipment

Upland: CEC employed two Trimble Real Time Kinetic (RTK) GPS rover receivers with GLONASS capability systems for the upland surveys. These systems are capable of delivering RTK positions with coordinate accuracy of $\pm 10\text{mm} + 2\text{ppm}$. Wireless Bluetooth technology allows our surveyors to collect data seaward of the Mean High Water line in the “surf zone” up to 5 feet deep.

Offshore: The survey vessel used for this work was a 20-foot fiberglass hull powered by an outboard motor. A CEE ECHO single beam echo sounder was used with a side mounted transducer. A Trimble R8 GPS antenna with GLONASS capability was installed on the side mount bracket directly above the transducer. The Trimble R8 receiver was integrated with the on-board computer system. Hypack 2017 software package was the hydrographic guidance program utilized.

QA/QC Procedures

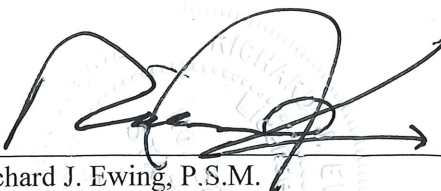
CEC employs an advanced QA/QC program to ensure work performed by us meets the FDEP accuracy standards. CEC upland field crews utilize RTK systems for data collection. CEC also incorporates the necessary equipment on the survey vessel to collect bathymetric survey data "Real-Time". To meet the specification calling for an approximate 50-foot overlap in data between the boat and the upland crew, CEC implements the following procedure. Utilizing "Real-Time" data collection, the boat crew immediately accounts for the tide correction, as well as the draft, and reports measured water depth in NAVD88 at each profile with the upland crew. This gives the upland crew, who simultaneously collects the upland and nearshore profile data, the necessary information to achieve the "overlap" specification.

Upland Data Collection: CEC mobilized one operator and GPS rover unit to collect survey data from the approximate MHW line landward while an additional operator and unit collected data just landward of MHW seaward to wading depth or approximately -5 feet NAVD88. The recorded data was maintained within tolerances of ± 3.00 feet horizontal and ± 0.16 feet vertical. QA/QC procedures were maintained by both comparison of values with higher accuracy and by repeat measurement.

An electronic list of R-monument coordinates and profile azimuths was loaded into the rover units and measurements were recorded along the azimuth line at intervals no greater than 25 feet or wherever geographical features dictated. The measurements were taken landward along the azimuth line to a minimum of 150 feet landward of the R-monument or to the edge of a building or road, whichever is the most seaward. When possible, a measurement was taken on the R-monument. The extent of the vegetation line and prominent features such as seawalls were also noted in the data collection. The measurements were taken seaward along the azimuth line to a minimum depth of -5 feet NAVD88 or as far as conditions dictated, to maintain a minimum of 50 feet of overlap with the data being collected by the offshore survey crew. This data was then compiled and merged with the offshore data to produce the profile drawings.

Offshore Data Collection: All survey equipment was properly calibrated and operated in accordance with FDEP standards. Bar checks to calibrate the fathometer were performed periodically throughout the survey. Bathymetric survey data collection was conducted in calm seas. Maximum wave heights during the data collection period were less than 3 feet. The data was collected at intervals not exceeding 25 feet and at all grade breaks along the profile sufficient to accurately describe the bathymetry at the profile locations. The beach profile survey extended seaward to a minimum of 3,000 feet from MHW.

COASTAL ENGINEERING CONSULTANTS, INC.
FLORIDA BUSINESS AUTHORIZATION NO. LB 2464



Richard J. Ewing, P.S.M.
Professional Surveyor and Mapper
Florida Certificate No. 5295

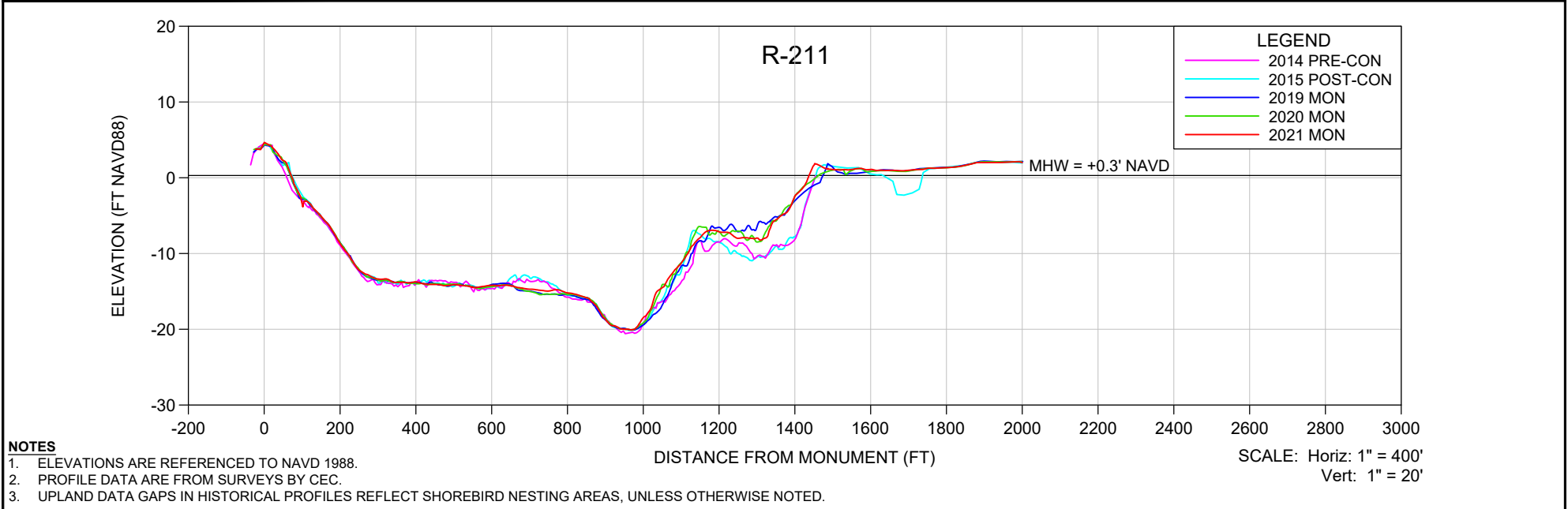
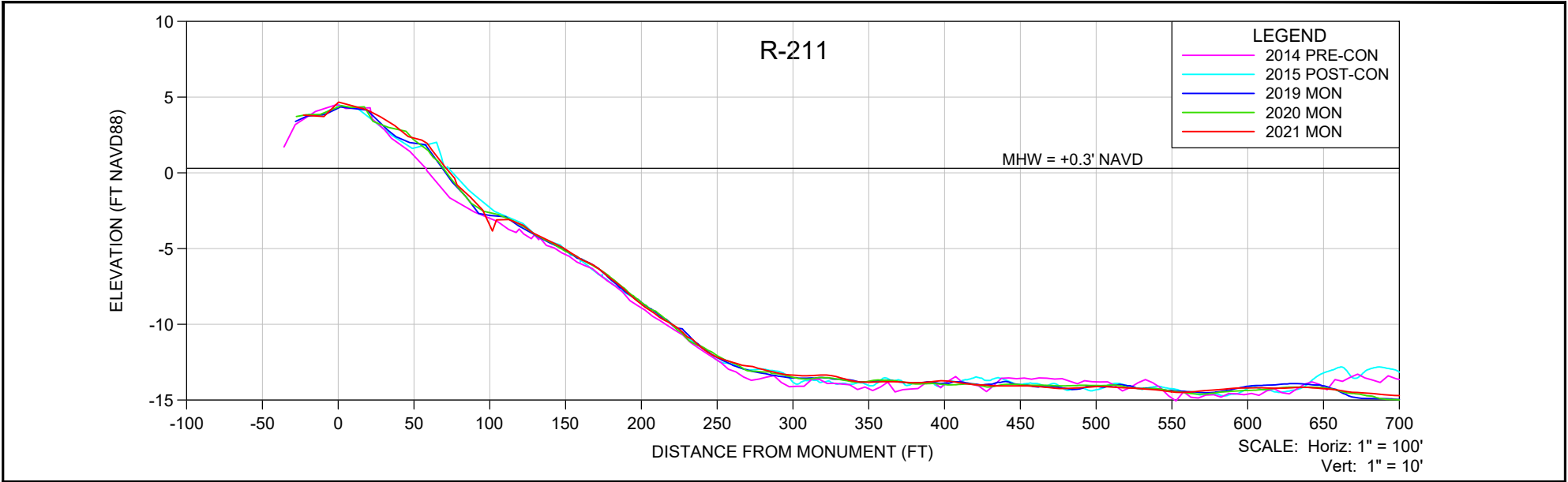
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THE ORIGINAL RAISED SEAL OF A FLORIDA
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CEC FILE NO. 21.079

DATE OF SIGNATURE: 9-21-21

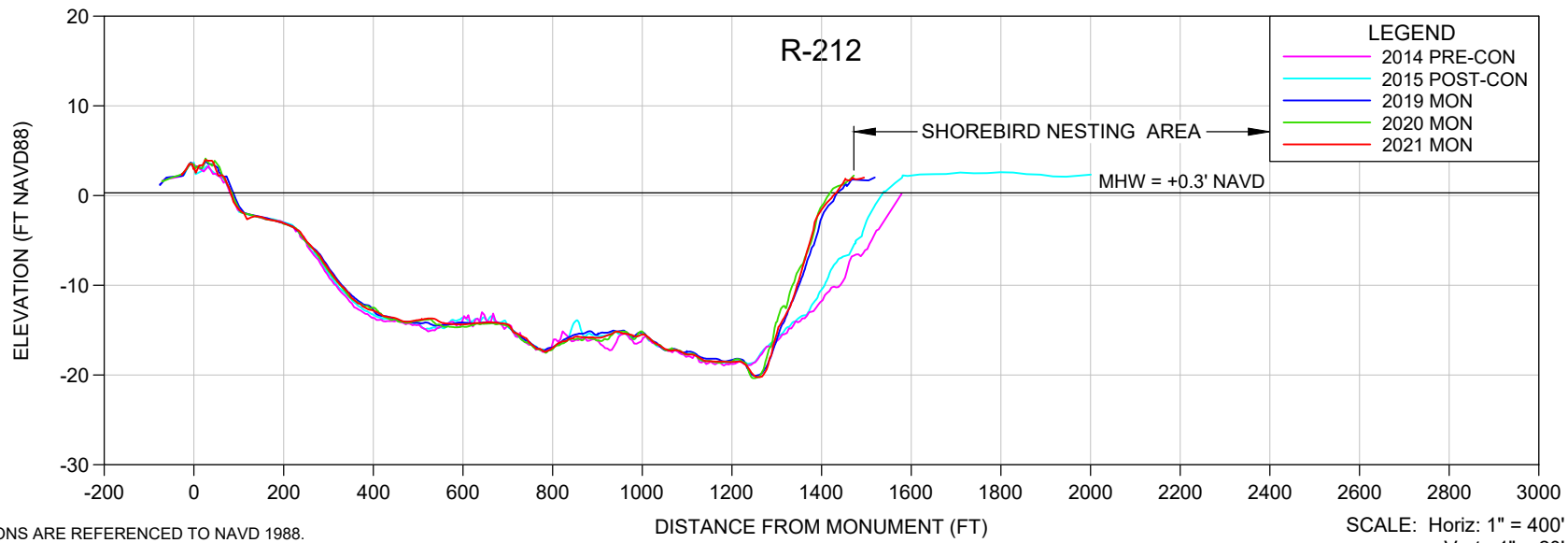
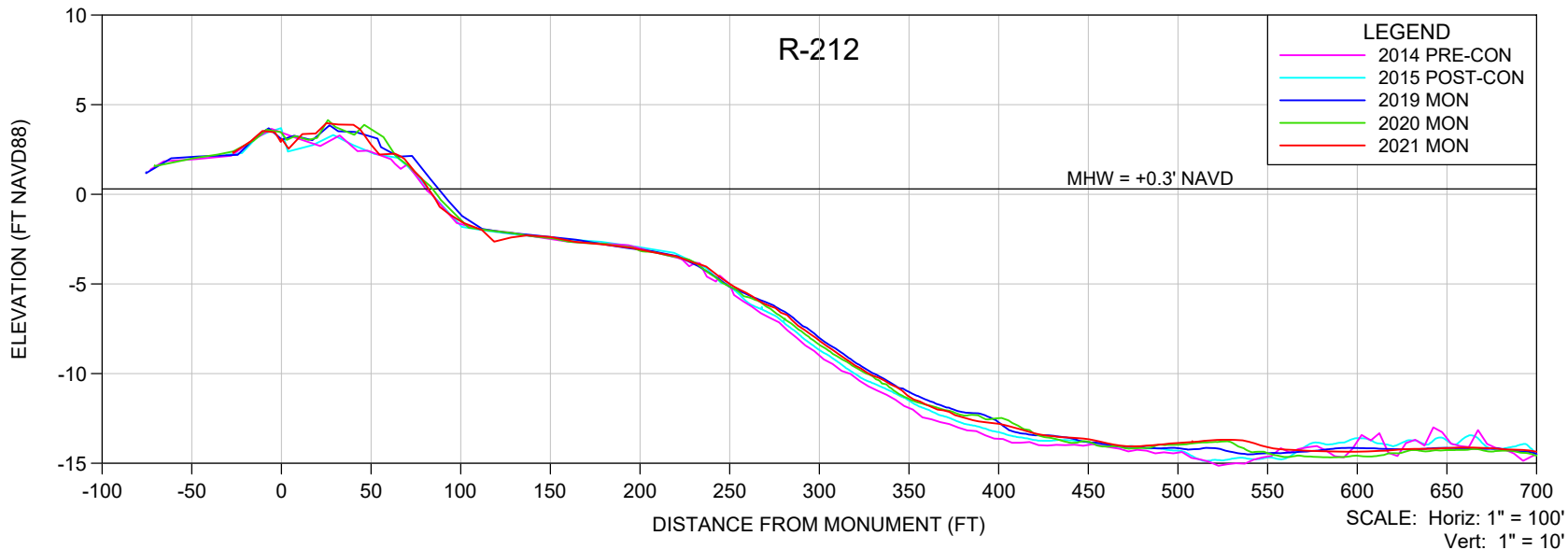
APPENDIX 2

BEACH PROFILES



- NOTES**
- ELEVATIONS ARE REFERENCED TO NAVD 1988.
 - PROFILE DATA ARE FROM SURVEYS BY CEC.
 - UPLAND DATA GAPS IN HISTORICAL PROFILES REFLECT SHOREBIRD NESTING AREAS, UNLESS OTHERWISE NOTED.

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		PHONE: (239)643-2324 FAX: (239)643-1143 www.coastalengineering.com E-Mail: info@ceciff.com	TITLE:	BONITA BEACH AND LOVERS KEY R-211 MONITORING SURVEY		DRAWN:	VVA	F.B.						
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		REF. NO.	21.079											
										NO.	DATE	BY	REVISION DESCRIPTION	



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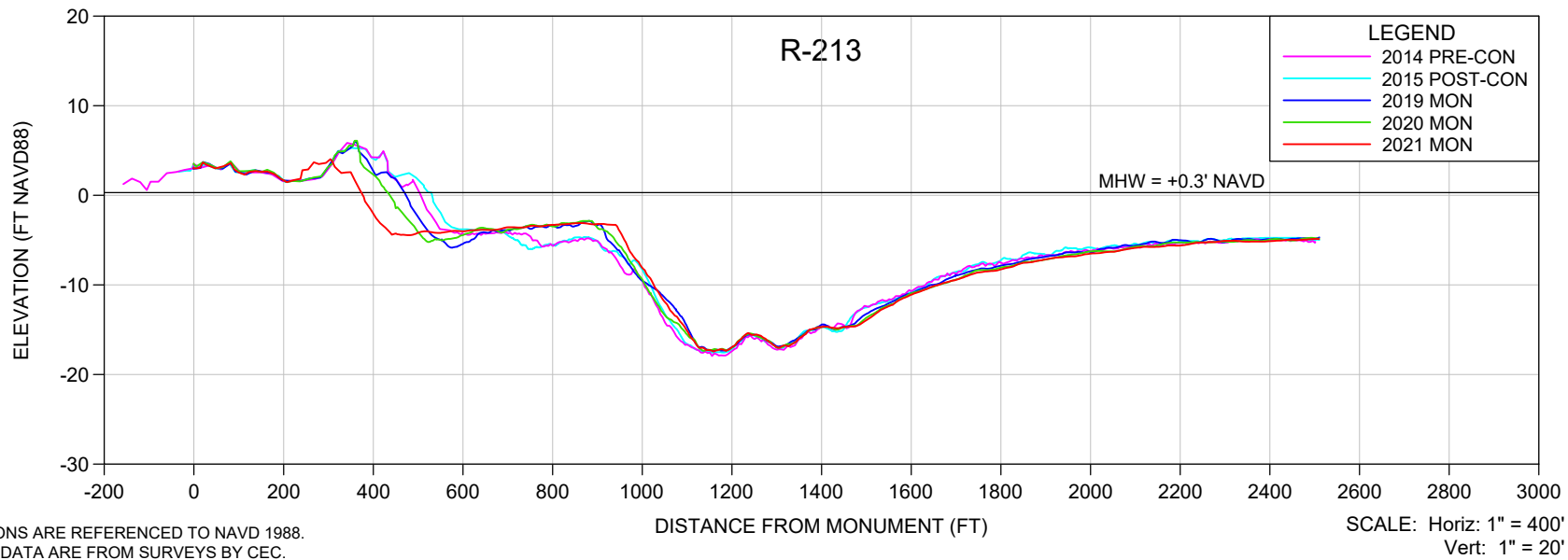
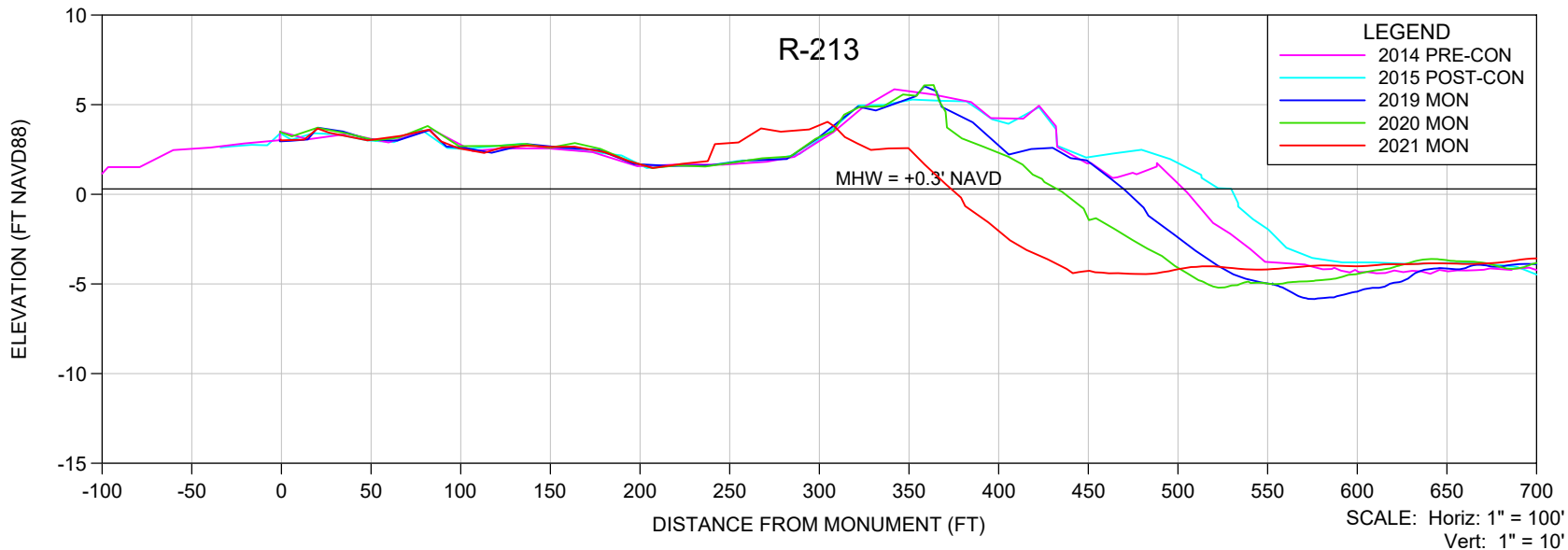
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SURVEYING: LB 2464

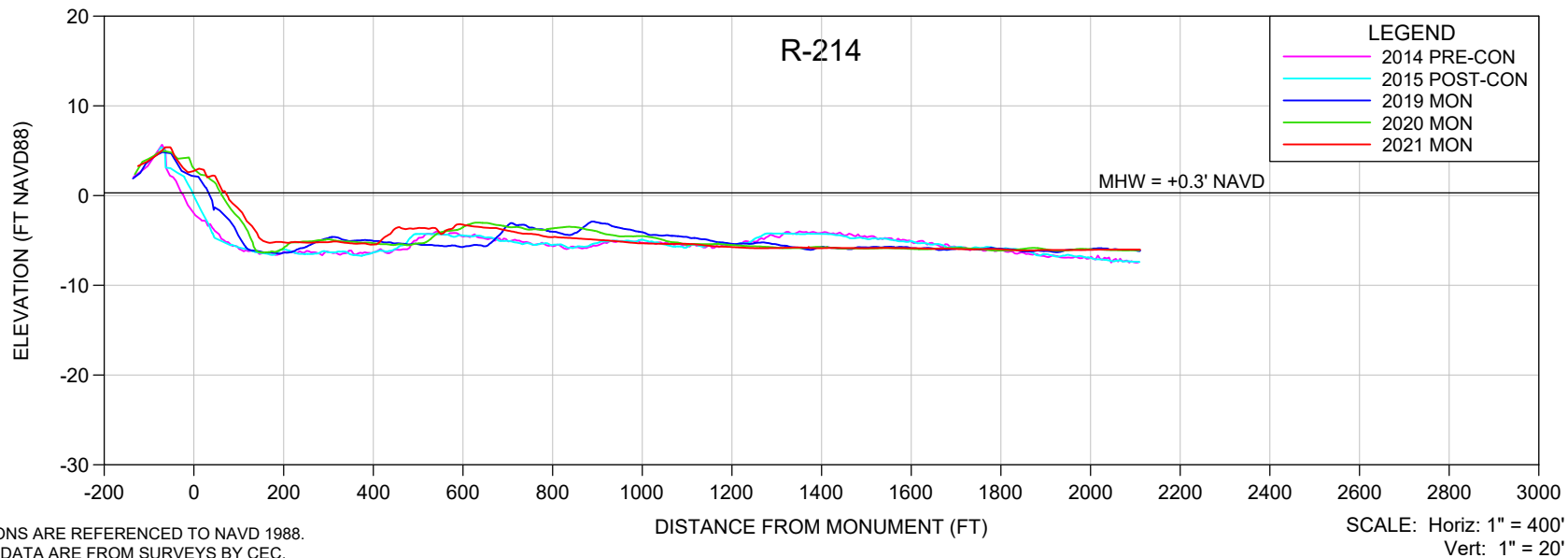
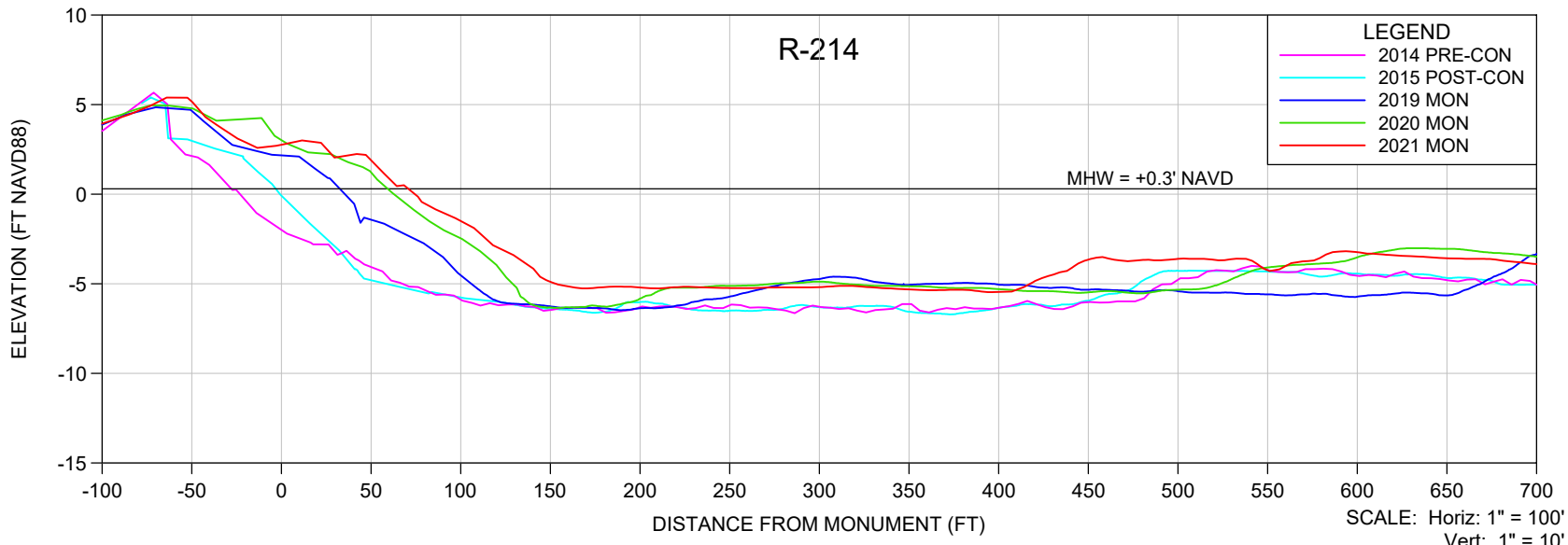
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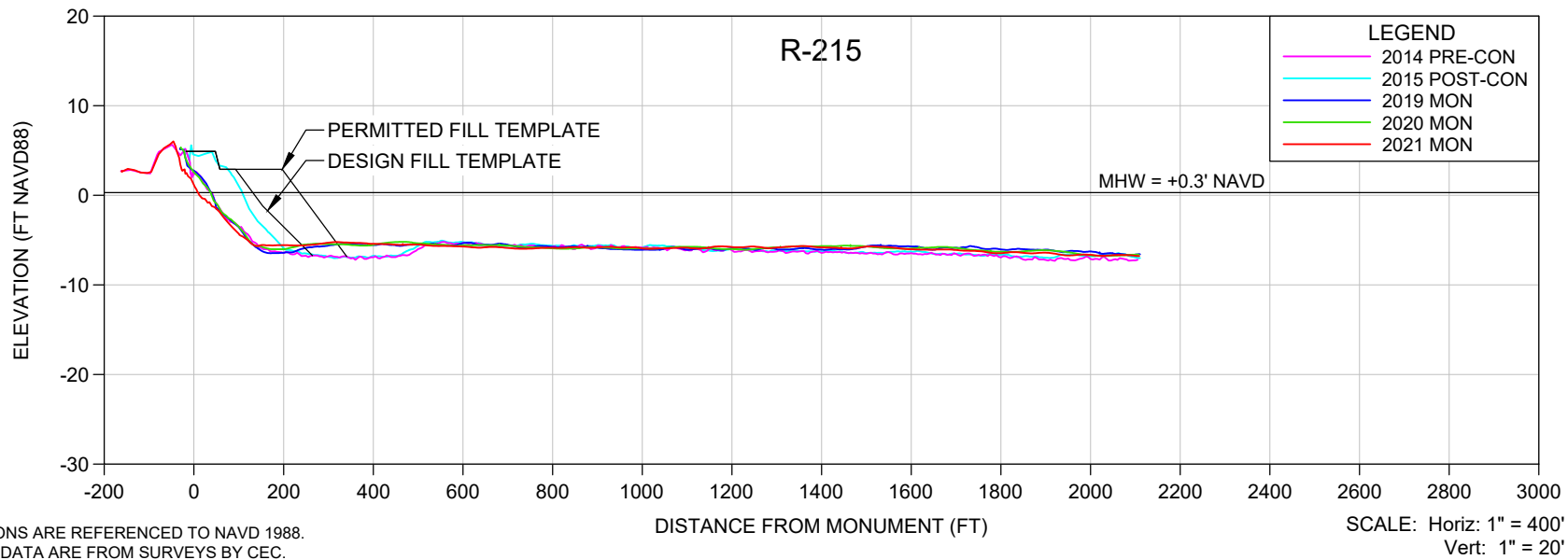
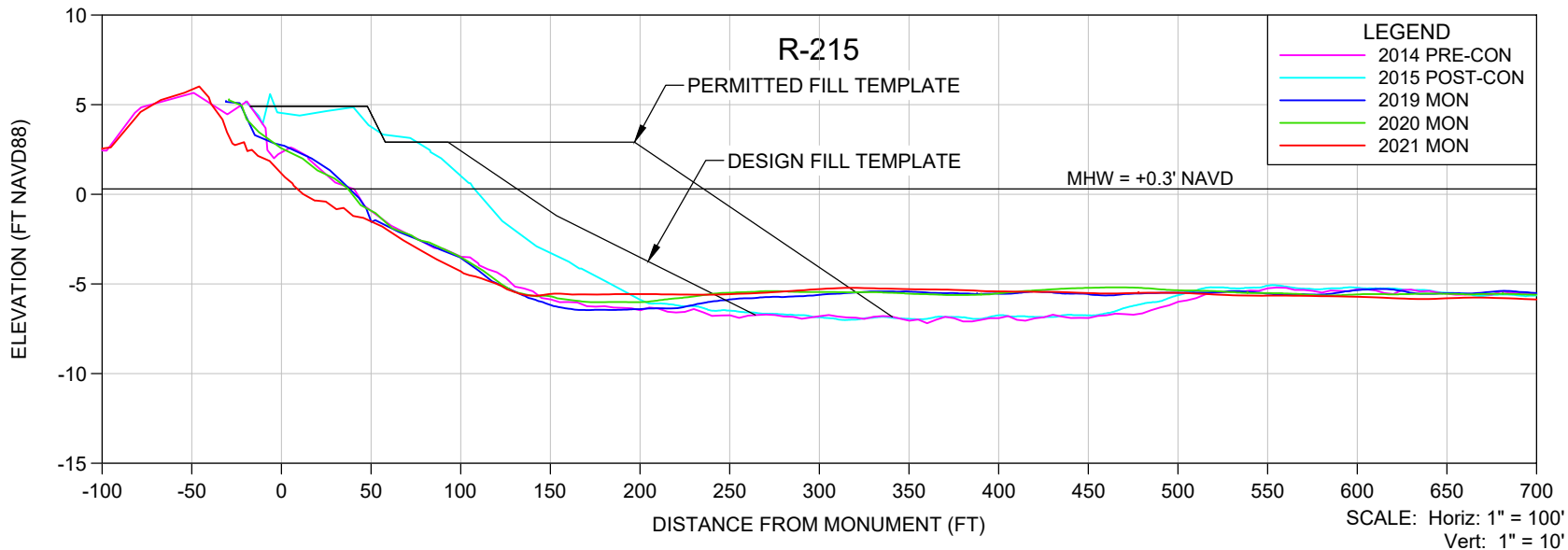
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				REF. NO.	21.079			NO.	DATE	BY	REVISION DESCRIPTION				



NOTES

1. ELEVATIONS ARE REFERENCED TO NAVD 1988.
2. PROFILE DATA ARE FROM SURVEYS BY CEC.
3. UPLAND DATA GAPS IN HISTORICAL PROFILES REFLECT SHOREBIRD NESTING AREAS, UNLESS OTHERWISE NOTED.

SHEET 6
FILE NO.: 21079-R-215

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SURVEYING: LB 2464

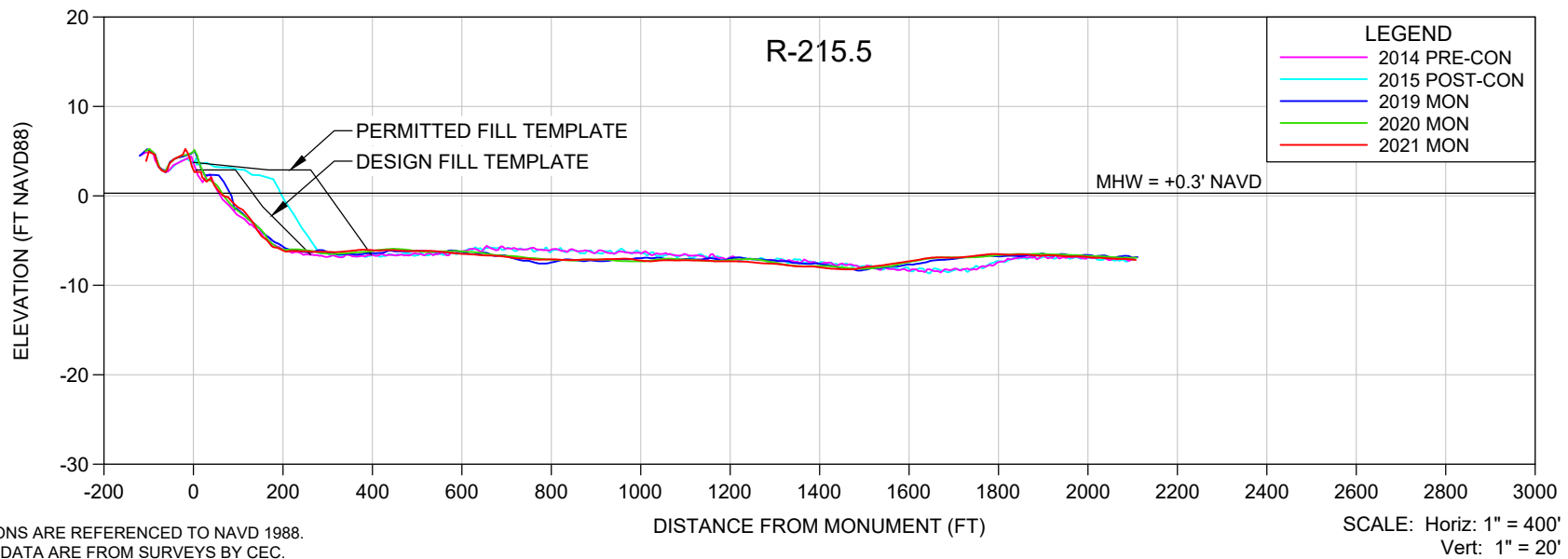
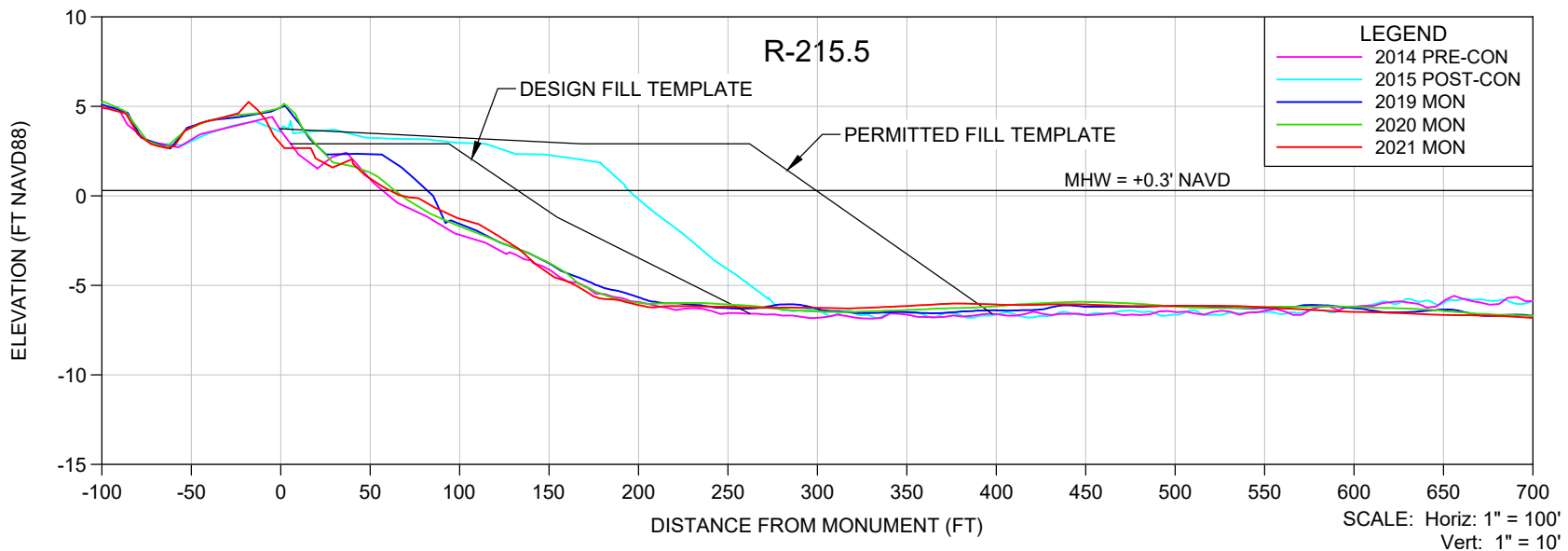
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E-Mail: info@ceciff.com

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REF. NO.	21.079	NO.	DATE

NO.	DATE	BY	REVISION DESCRIPTION



NOTES

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- UPLAND DATA GAPS IN HISTORICAL PROFILES REFLECT SHOREBIRD NESTING AREAS, UNLESS OTHERWISE NOTED.

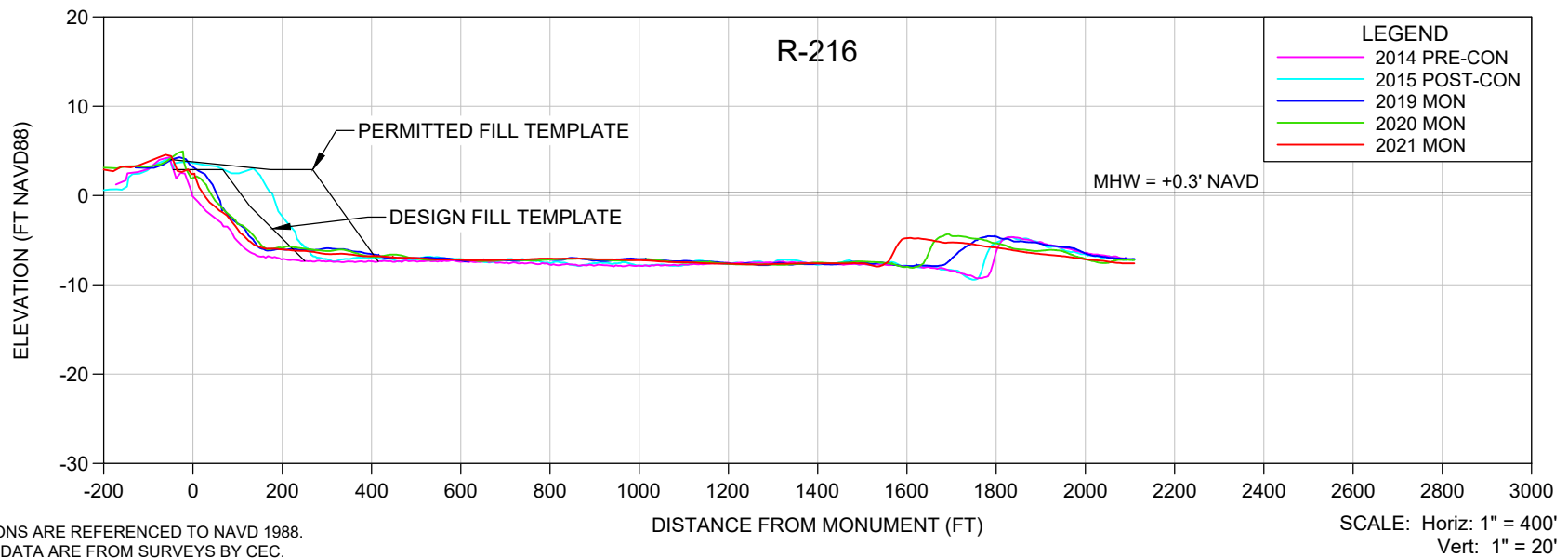
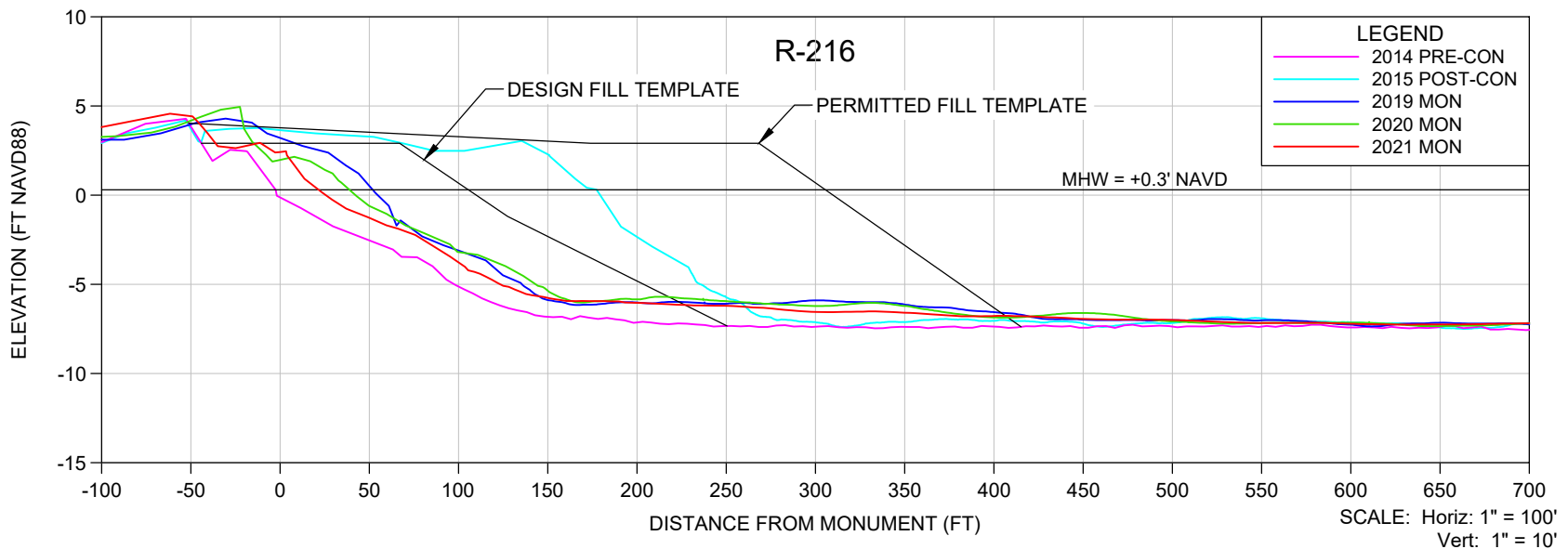
COASTAL ENGINEERING CONSULTANTS INC.
Serving Florida Since 1977
28421 BONITA CROSSINGS BLVD
BONITA SPRINGS, FLORIDA 34135

COASTAL & MARINE ENGINEERING
ENVIRONMENTAL & GEOLOGICAL SERVICES
SURVEY & MAPPING
ENGINEERING: CA 2464
SURVEYING: LB 2464
PHONE: (239)643-2324
FAX: (239)643-1143
www.coastalengineering.com
E-Mail: info@ceciff.com

CLIENT: **LEE COUNTY**
TITLE: **BONITA BEACH AND LOVERS KEY
R-215.5 MONITORING SURVEY**

DATE: 6/15/2021 SCALE: AS SHOWN
DRAWN: VVA F.B.
CHECKED: MTP PG.
SEC. TWP. RNG.
ACAD NO: 21079-Lovers Bonita Mon Profiles.dwg
REF. NO. 21.079

NO.	DATE	BY	REVISION DESCRIPTION



NOTES

- ELEVATIONS ARE REFERENCED TO NAVD 1988.
- PROFILE DATA ARE FROM SURVEYS BY CEC.
- UPLAND DATA GAPS IN HISTORICAL PROFILES REFLECT SHOREBIRD NESTING AREAS, UNLESS OTHERWISE NOTED.

SHEET 8
FILE NO.: 21079-R-216

COASTAL ENGINEERING CONSULTANTS INC.
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BONITA SPRINGS, FLORIDA 34135

COASTAL & MARINE ENGINEERING
ENVIRONMENTAL & GEOLOGICAL SERVICES
SURVEY & MAPPING
ENGINEERING: CA 2464
SURVEYING: LB 2464

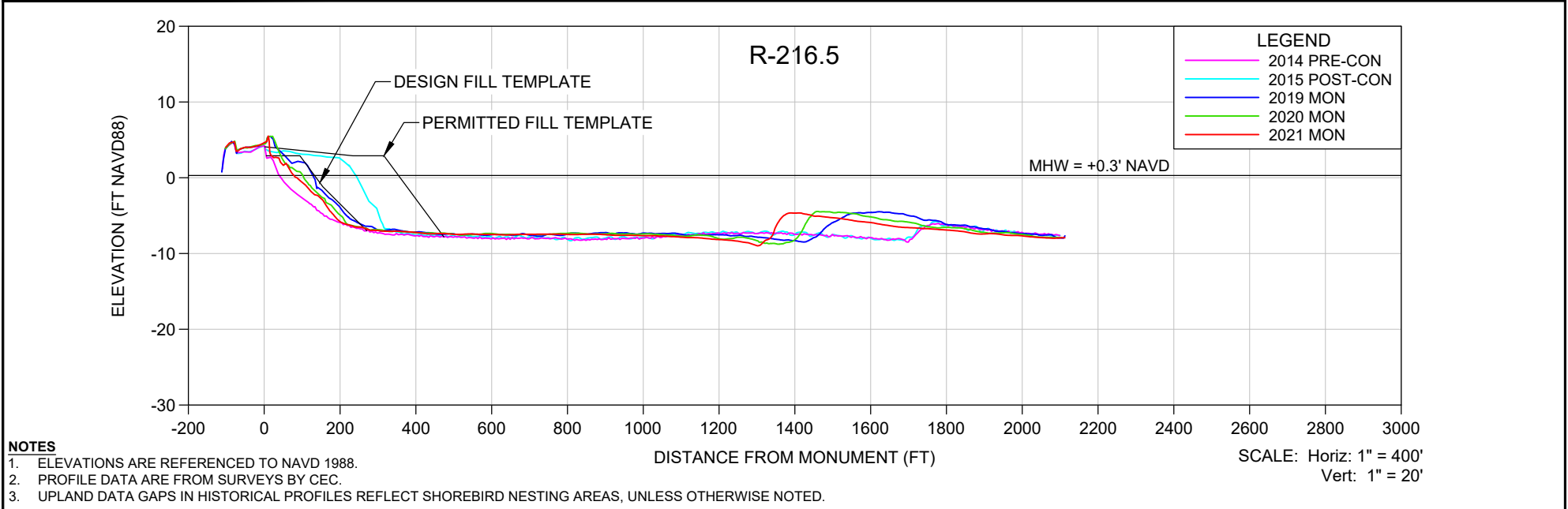
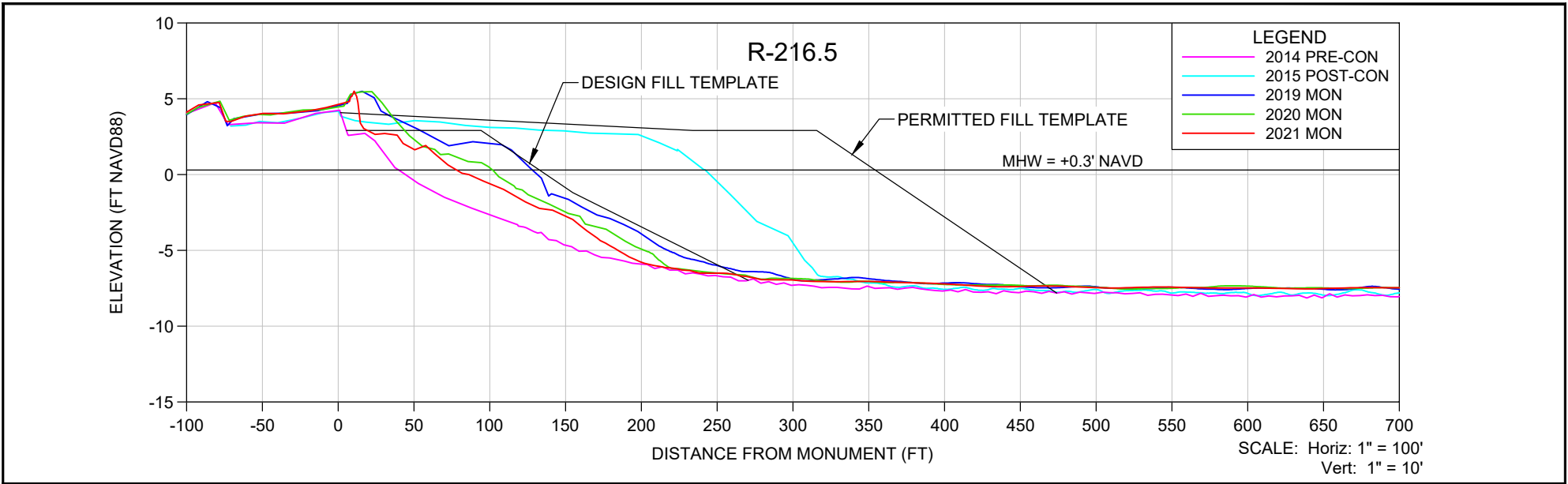
PHONE: (239)643-2324
FAX: (239)643-1143
www.coastalengineering.com
E-Mail: info@ceciff.com

CLIENT: **LEE COUNTY**

TITLE: **BONITA BEACH AND LOVERS KEY
R-216 MONITORING SURVEY**

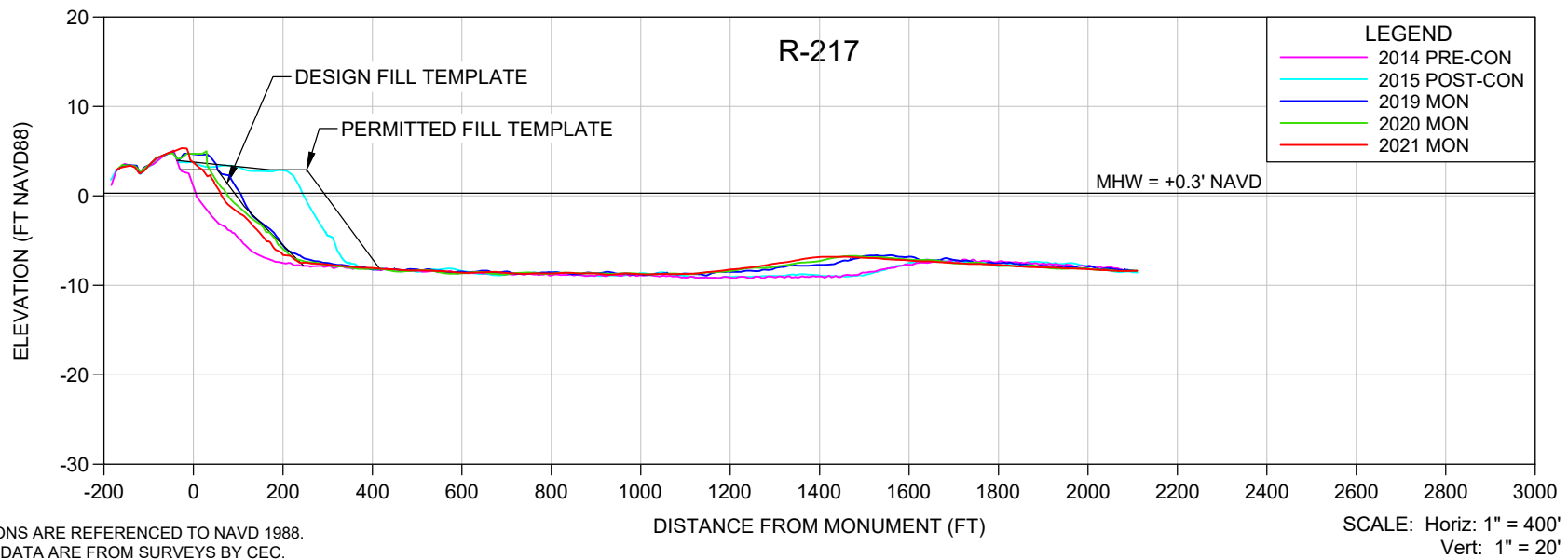
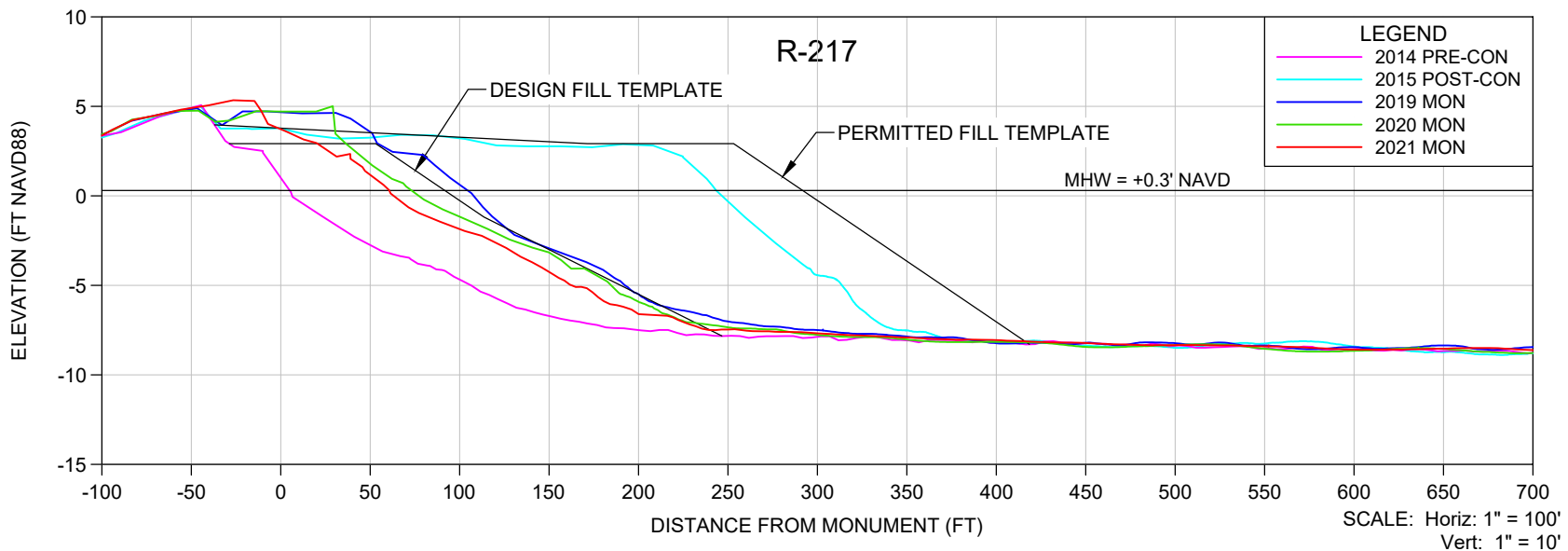
DATE:	6/15/2021	SCALE:	AS SHOWN
DRAWN:	VVA	F.B.	
CHECKED:	MTP	PG.	
SEC.	TWP.	RNG.	
ACAD NO.	21079-Lovers Bonita Mon Profiles.dwg		
REF. NO.	21.079	NO.	DATE

NO.	DATE	BY	REVISION DESCRIPTION



- NOTES**
- ELEVATIONS ARE REFERENCED TO NAVD 1988.
 - PROFILE DATA ARE FROM SURVEYS BY CEC.
 - UPLAND DATA GAPS IN HISTORICAL PROFILES REFLECT SHOREBIRD NESTING AREAS, UNLESS OTHERWISE NOTED.

SHEET 9 FILE NO.: 21079-R-216.5 COASTAL ENGINEERING CONSULTANTS INC. Serving Florida Since 1977 28421 BONITA CROSSINGS BLVD BONITA SPRINGS, FLORIDA 34135	COASTAL & MARINE ENGINEERING ENVIRONMENTAL & GEOLOGICAL SERVICES SURVEY & MAPPING ENGINEERING: CA 2464 SURVEYING: LB 2464	CLIENT: LEE COUNTY TITLE: BONITA BEACH AND LOVERS KEY R-216.5 MONITORING SURVEY	DATE: 6/15/2021 DRAWN: VVA CHECKED: MTP SEC.: TWP.: RNG.: ACAD NO.: 21079-Lovers Bonita Mon Profiles.dwg REF. NO.: 21.079	SCALE: AS SHOWN F.B.: PG.: NO. DATE BY REVISION DESCRIPTION
	PHONE: (239)643-2324 FAX: (239)643-1143 www.coastalengineering.com E-Mail: info@ceciff.com			



NOTES

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SHEET 10
FILE NO.: 2109-R-217

COASTAL ENGINEERING CONSULTANTS INC.
Serving Florida Since 1977
28421 BONITA CROSSINGS BLVD
BONITA SPRINGS, FLORIDA 34135

COASTAL & MARINE ENGINEERING
ENVIRONMENTAL & GEOLOGICAL SERVICES
SURVEY & MAPPING
ENGINEERING: CA 2464
SURVEYING: LB 2464

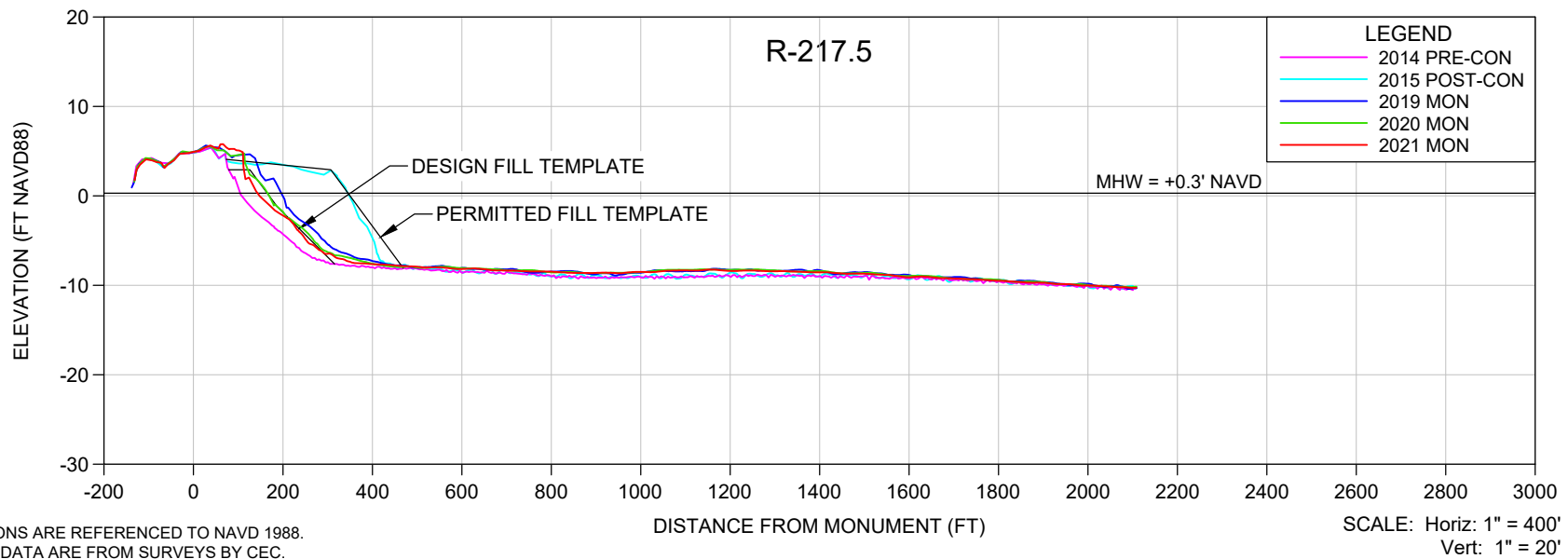
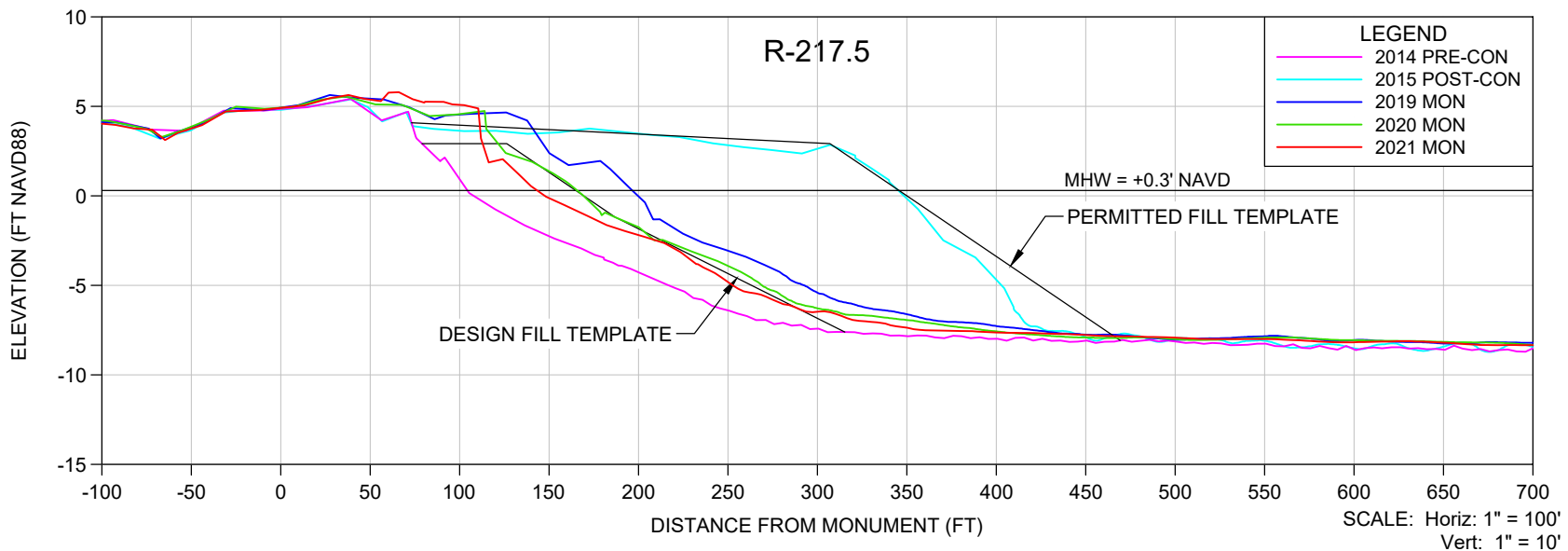
PHONE: (239)643-2324
FAX: (239)643-1143
www.coastalengineering.com
E-Mail: info@ceciff.com

CLIENT: **LEE COUNTY**

TITLE: **BONITA BEACH AND LOVERS KEY
R-217 MONITORING SURVEY**

DATE:	6/15/2021	SCALE:	AS SHOWN
DRAWN:	VVA	F.B.	
CHECKED:	MTP	PG.	
SEC.	TWP.	RNG.	
ACAD NO.	21079-Lovers Bonita Mon Profiles.dwg		
REF. NO.	21.079	NO.	DATE

NO.	DATE	BY	REVISION DESCRIPTION



NOTES

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SHEET 11
FILE NO.: 21079-R-217.5

COASTAL ENGINEERING CONSULTANTS INC.
Serving Florida Since 1977
28421 BONITA CROSSINGS BLVD
BONITA SPRINGS, FLORIDA 34135

COASTAL & MARINE ENGINEERING
ENVIRONMENTAL & GEOLOGICAL SERVICES
SURVEY & MAPPING
ENGINEERING: CA 2464
SURVEYING: LB 2464

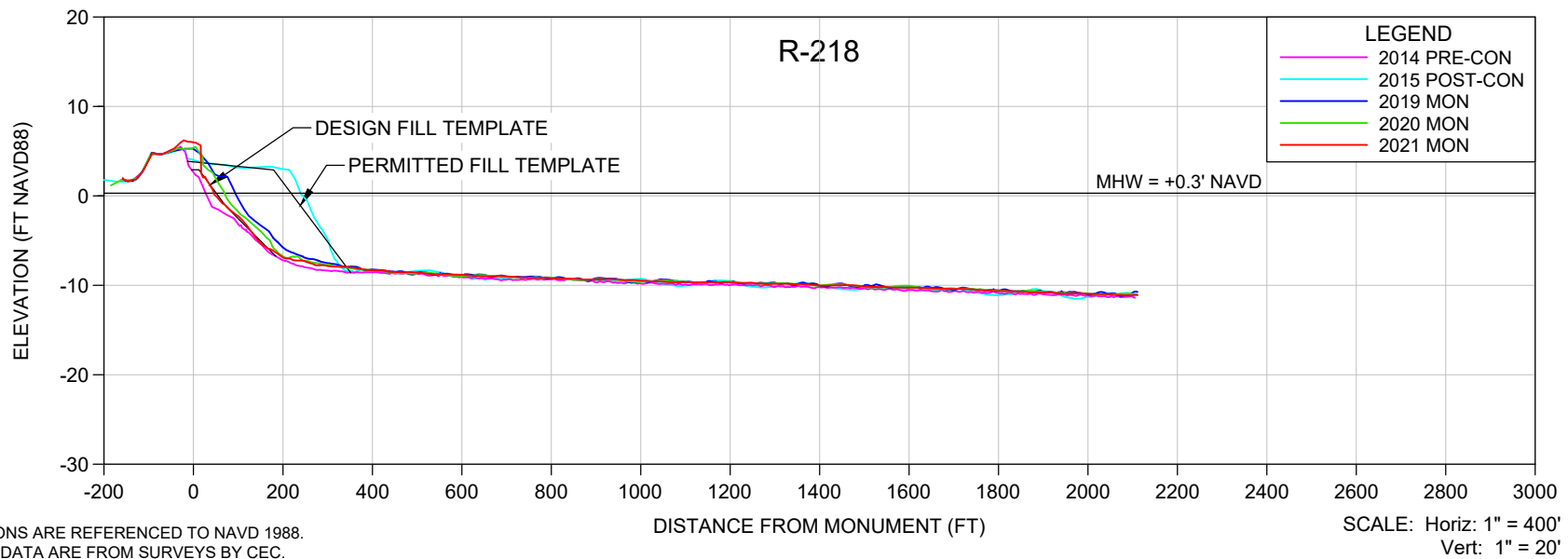
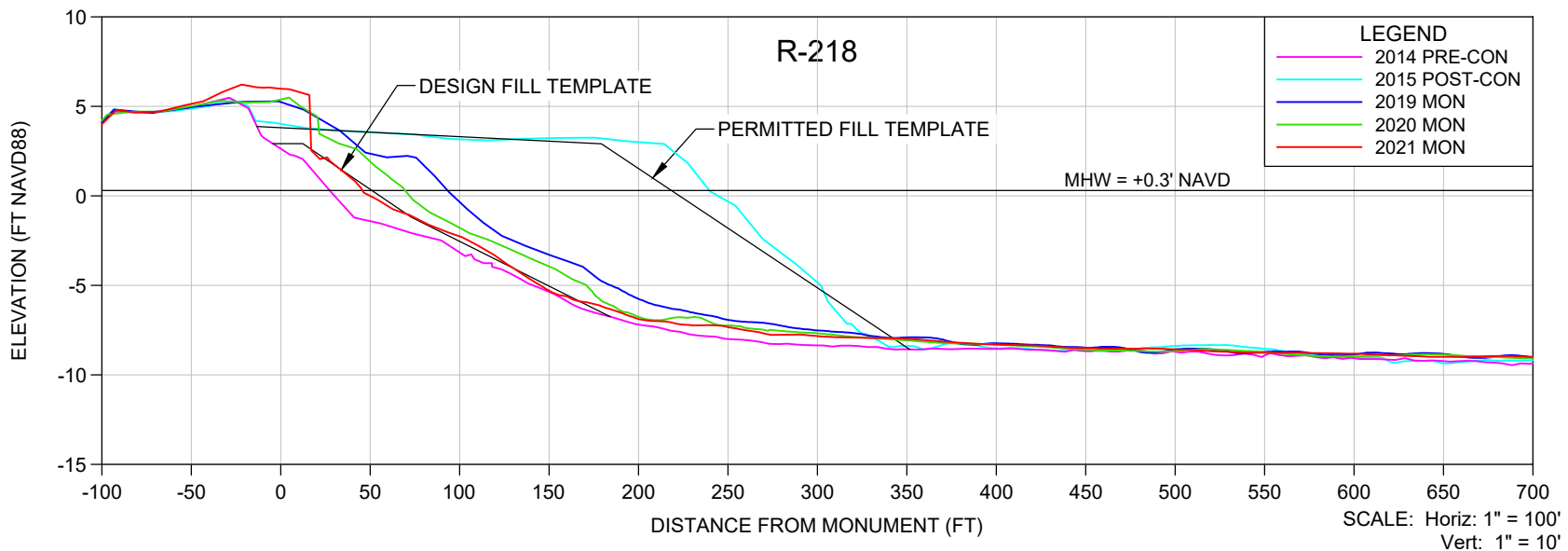
PHONE: (239)643-2324
FAX: (239)643-1143
www.coastalengineering.com
E-Mail: info@ceciff.com

CLIENT: **LEE COUNTY**

TITLE: **BONITA BEACH AND LOVERS KEY
R-217.5 MONITORING SURVEY**

DATE:	6/15/2021	SCALE:	AS SHOWN
DRAWN:	VVA	F.B.	
CHECKED:	MTP	PG.	
SEC.	TWP.	RNG.	
ACAD NO.	21079-Lovers Bonita Mon Profiles.dwg		
REF. NO.	21.079	NO.	DATE

NO.	DATE	BY	REVISION DESCRIPTION



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SHEET 12
FILE NO.: 2109-R-218

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BONITA SPRINGS, FLORIDA 34135

COASTAL & MARINE ENGINEERING
ENVIRONMENTAL & GEOLOGICAL SERVICES
SURVEY & MAPPING
ENGINEERING: CA 2464
SURVEYING: LB 2464

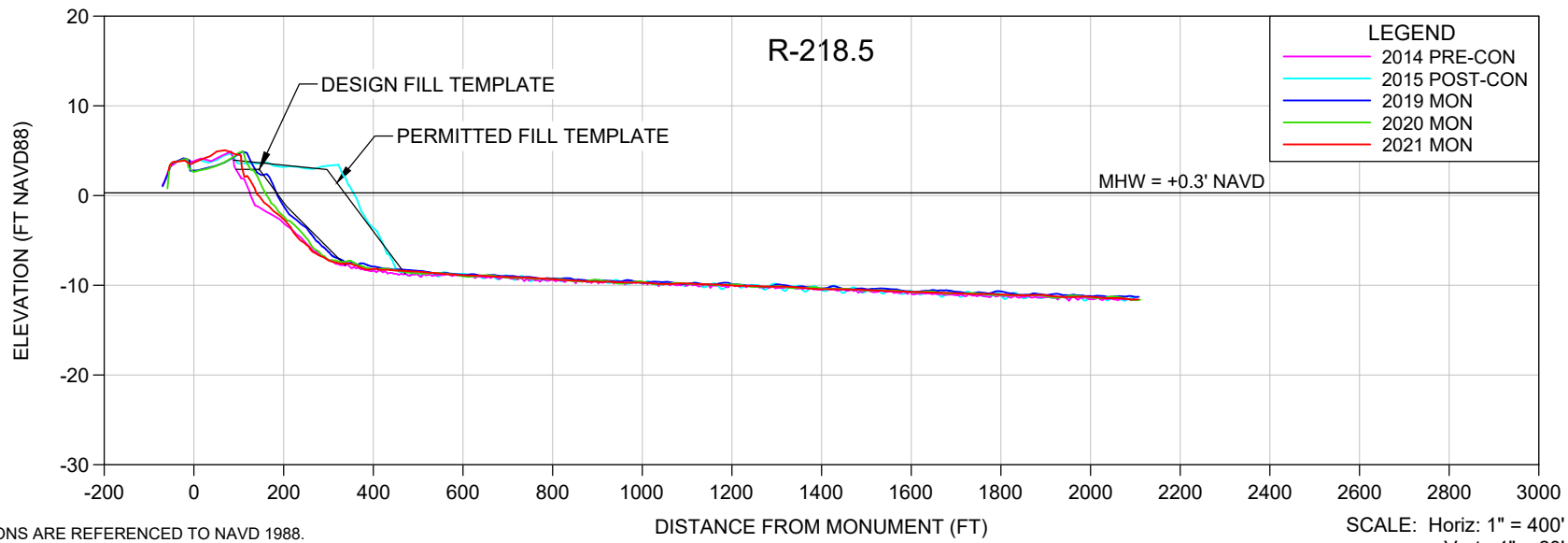
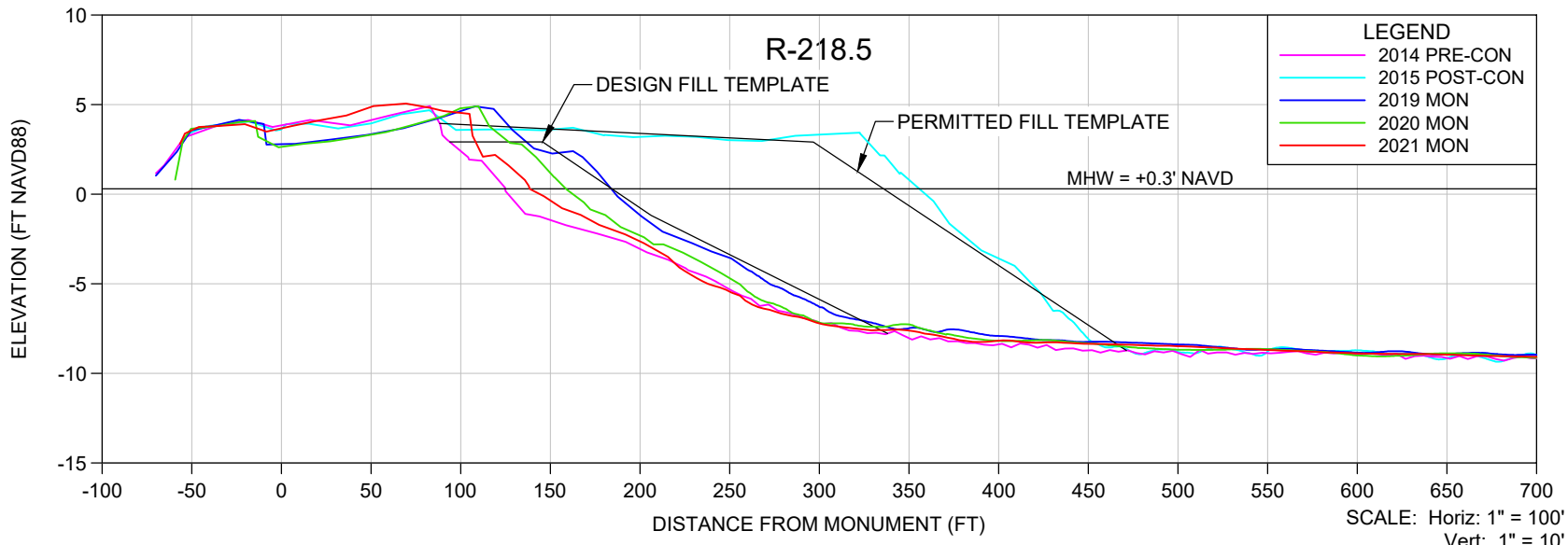
PHONE: (239)643-2324
FAX: (239)643-1143
www.coastalengineering.com
E-Mail: info@ceciff.com

CLIENT: **LEE COUNTY**

TITLE: **BONITA BEACH AND LOVERS KEY
R-218 MONITORING SURVEY**

DATE:	6/15/2021	SCALE:	AS SHOWN
DRAWN:	VVA	F.B.	
CHECKED:	MTP	PG.	
SEC.	TWP.	RNG.	
ACAD NO.	21079-Lovers Bonita Mon Profiles.dwg		
REF. NO.	21.079	NO.	DATE

NO.	DATE	BY	REVISION DESCRIPTION



NOTES

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SHEET 13
FILE NO.: 21079-B-218.5

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28421 BONITA CROSSINGS BLVD
BONITA SPRINGS, FLORIDA 34135

COASTAL & MARINE ENGINEERING
ENVIRONMENTAL & GEOLOGICAL SERVICES
SURVEY & MAPPING
ENGINEERING: CA 2464
SURVEYING: LB 2464

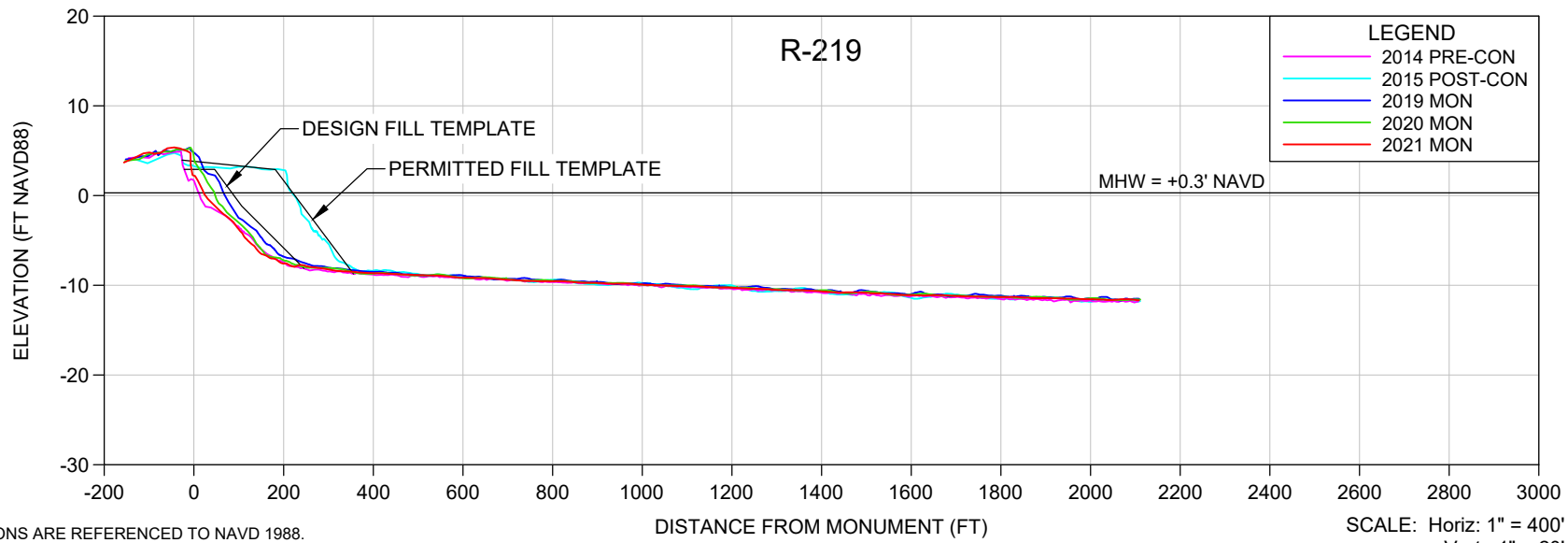
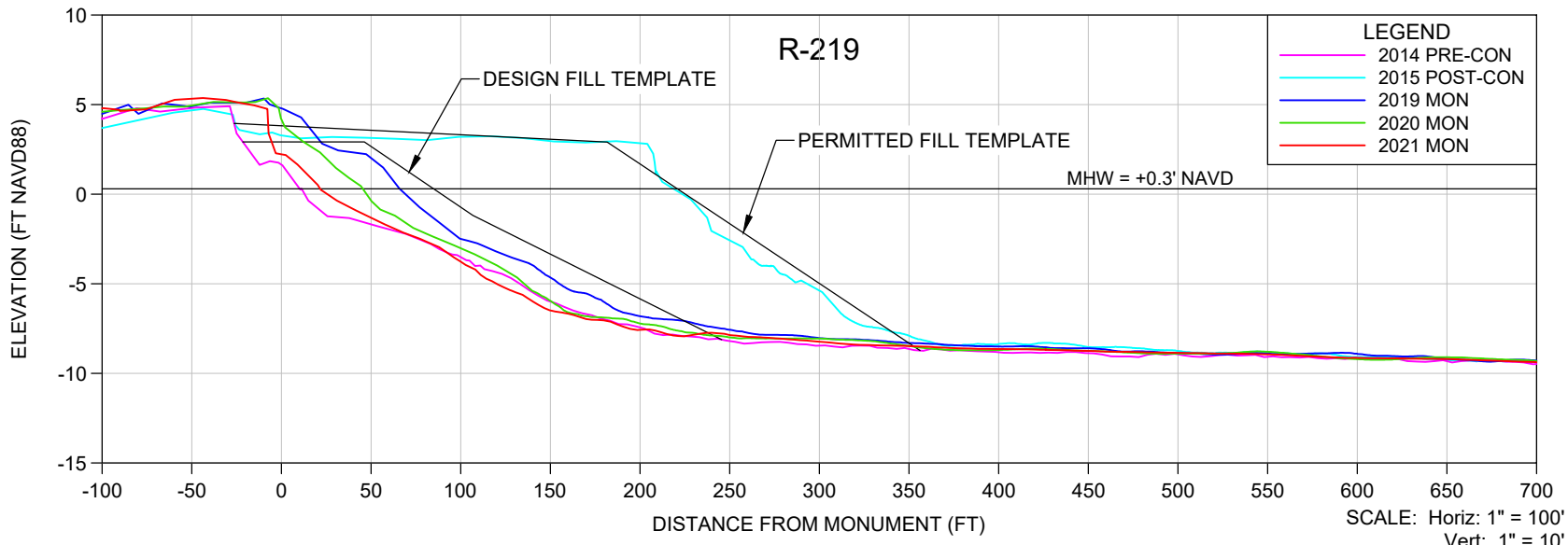
PHONE: (239)643-2324
FAX: (239)643-1143
www.coastalengineering.com
E-Mail: info@ceciff.com

CLIENT: **LEE COUNTY**

TITLE: **BONITA BEACH AND LOVERS KEY
R-218.5 MONITORING SURVEY**

DATE:	6/15/2021	SCALE:	AS SHOWN
DRAWN:	VVA	F.B.	
CHECKED:	MTP	PG.	
SEC.	TWP.	RNG.	
ACAD NO.	21079-Lovers Bonita Mon Profiles.dwg		
REF. NO.	21.079	NO.	DATE

NO.	DATE	BY	REVISION DESCRIPTION



NOTES

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SHEET 14
FILE NO.: 2109-R-219

COASTAL ENGINEERING CONSULTANTS INC.
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BONITA SPRINGS, FLORIDA 34135

COASTAL & MARINE ENGINEERING
ENVIRONMENTAL & GEOLOGICAL SERVICES
SURVEY & MAPPING
ENGINEERING: CA 2464
SURVEYING: LB 2464

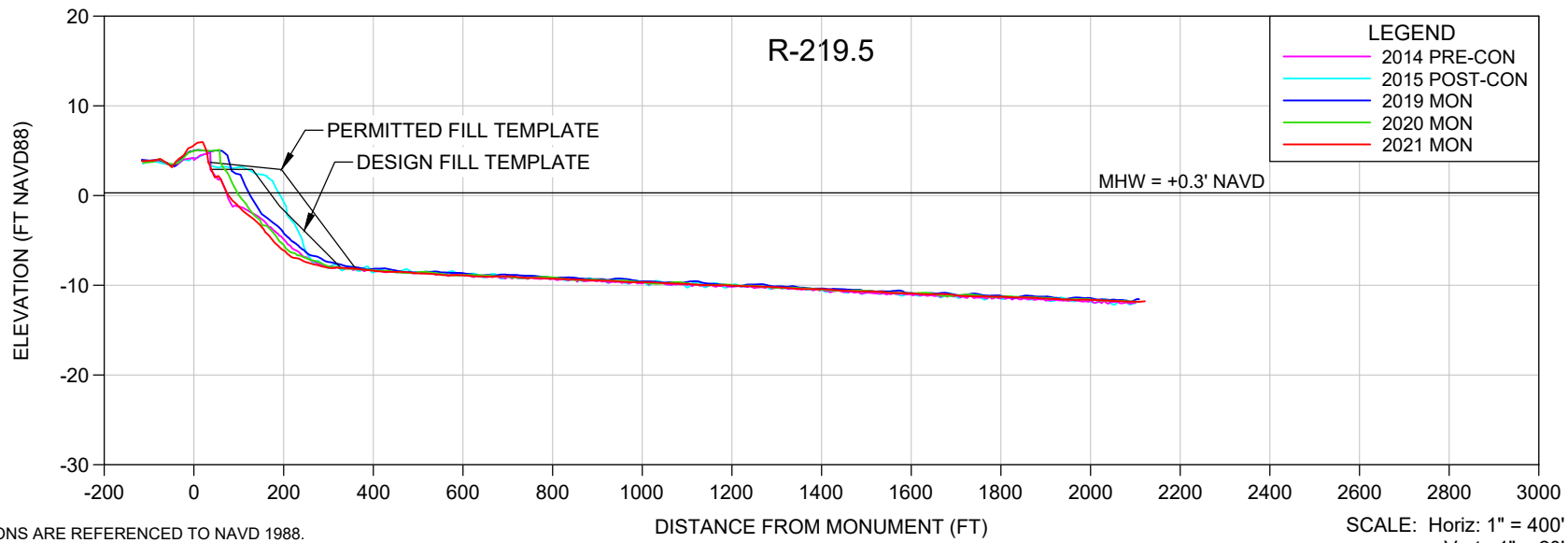
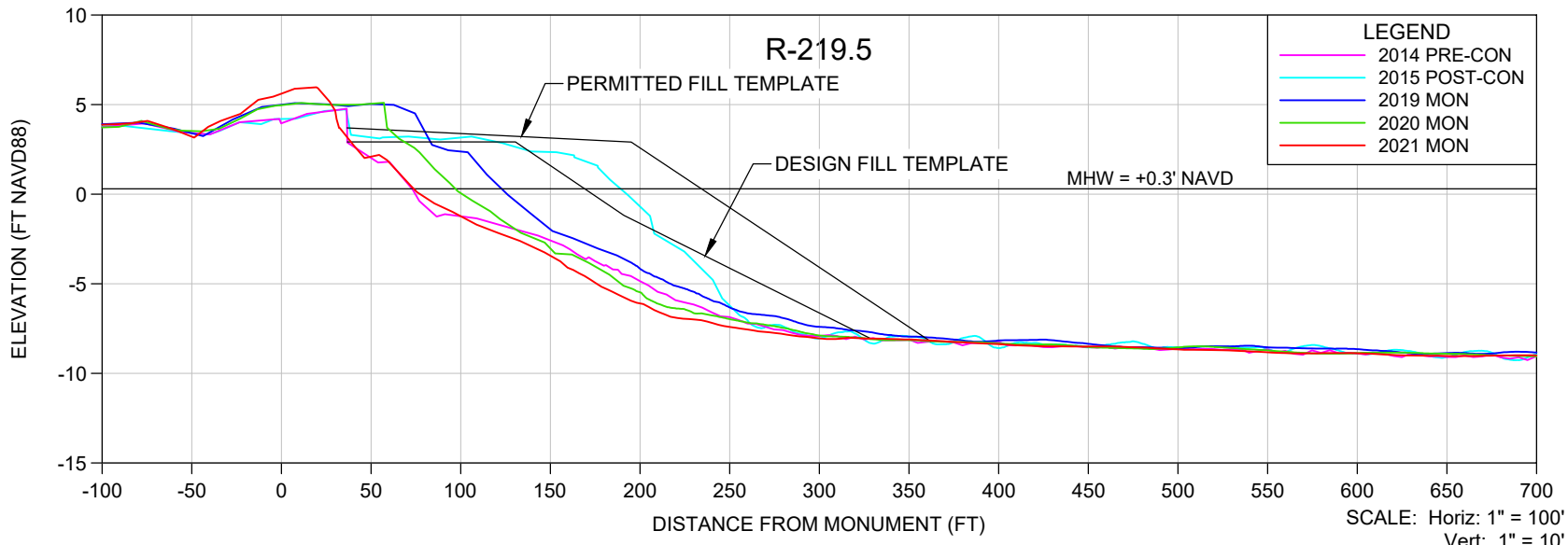
PHONE: (239)643-2324
FAX: (239)643-1143
www.coastalengineering.com
E-Mail: info@ceciff.com

CLIENT: **LEE COUNTY**

TITLE: **BONITA BEACH AND LOVERS KEY
R-219 MONITORING SURVEY**

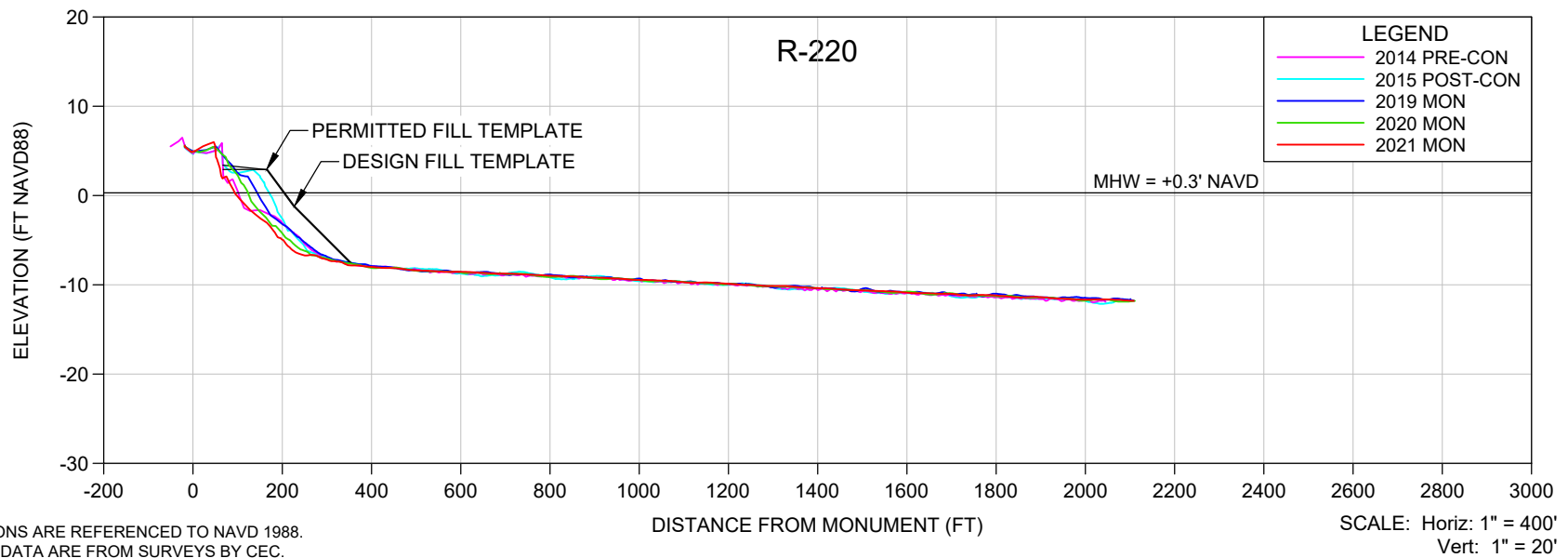
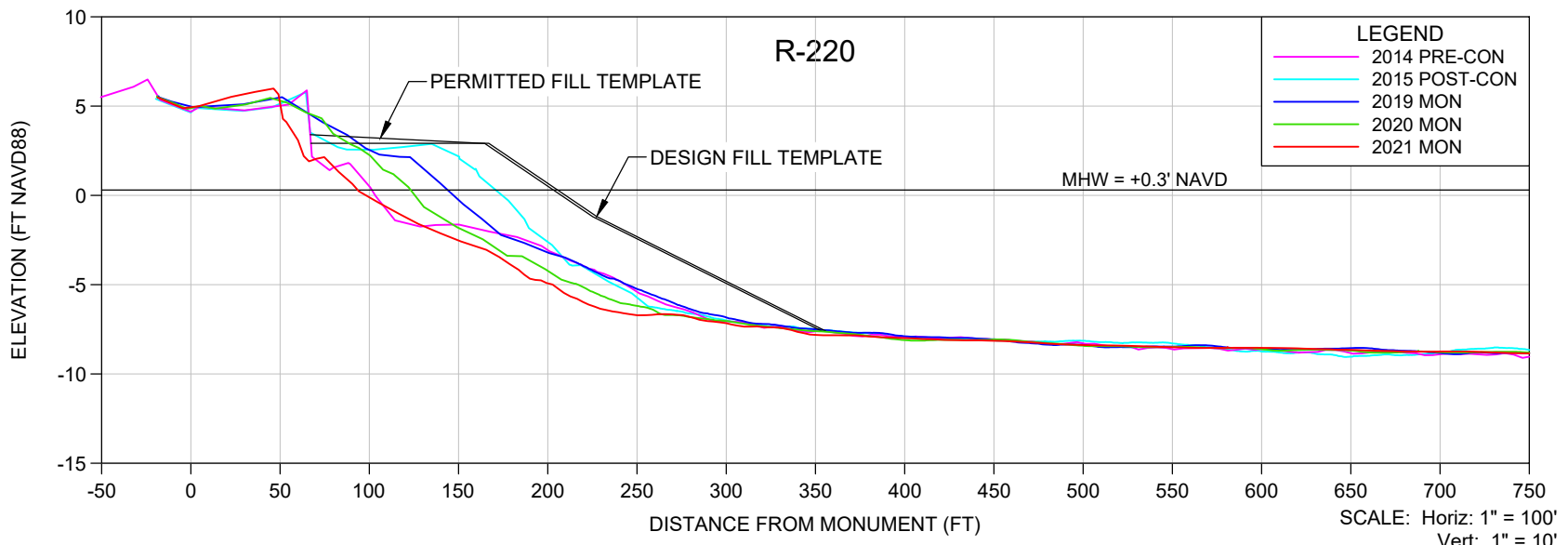
DATE:	6/15/2021	SCALE:	AS SHOWN
DRAWN:	VVA	F.B.	
CHECKED:	MTP	PG.	
SEC.	TWP.	RNG.	
ACAD NO.	21079-Lovers Bonita Mon Profiles.dwg		
REF. NO.	21.079	NO.	DATE

NO.	DATE	BY	REVISION DESCRIPTION



- NOTES**
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SHEET 15 FILE NO.: 21079-R-219.5	<p>COASTAL ENGINEERING CONSULTANTS INC. Serving Florida Since 1977 28421 BONITA CROSSINGS BLVD BONITA SPRINGS, FLORIDA 34135</p>	<p>COASTAL & MARINE ENGINEERING ENVIRONMENTAL & GEOLOGICAL SERVICES SURVEY & MAPPING ENGINEERING: CA 2464 SURVEYING: LB 2464</p> <p>PHONE: (239)643-2324 FAX: (239)643-1143 www.coastalengineering.com E-Mail: info@ceciff.com</p>	CLIENT:	LEE COUNTY			DATE:	6/15/2021	SCALE:	AS SHOWN					
			TITLE:	BONITA BEACH AND LOVERS KEY R-219.5 MONITORING SURVEY			DRAWN:	VVA	F.B.						
						CHECKED:	MTP	PG.							
						SEC.	TWP.	RNG.							
						ACAD NO:	21079-Lovers Bonita Mon Profiles.dwg								
			REF. NO.	21.079			NO.	DATE	BY	REVISION DESCRIPTION					



NOTES

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SHEET 16
FILE NO.: 21079-R-220

COASTAL ENGINEERING CONSULTANTS INC.
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28421 BONITA CROSSINGS BLVD
BONITA SPRINGS, FLORIDA 34135

COASTAL & MARINE ENGINEERING
ENVIRONMENTAL & GEOLOGICAL SERVICES
SURVEY & MAPPING
ENGINEERING: CA 2464
SURVEYING: LB 2464

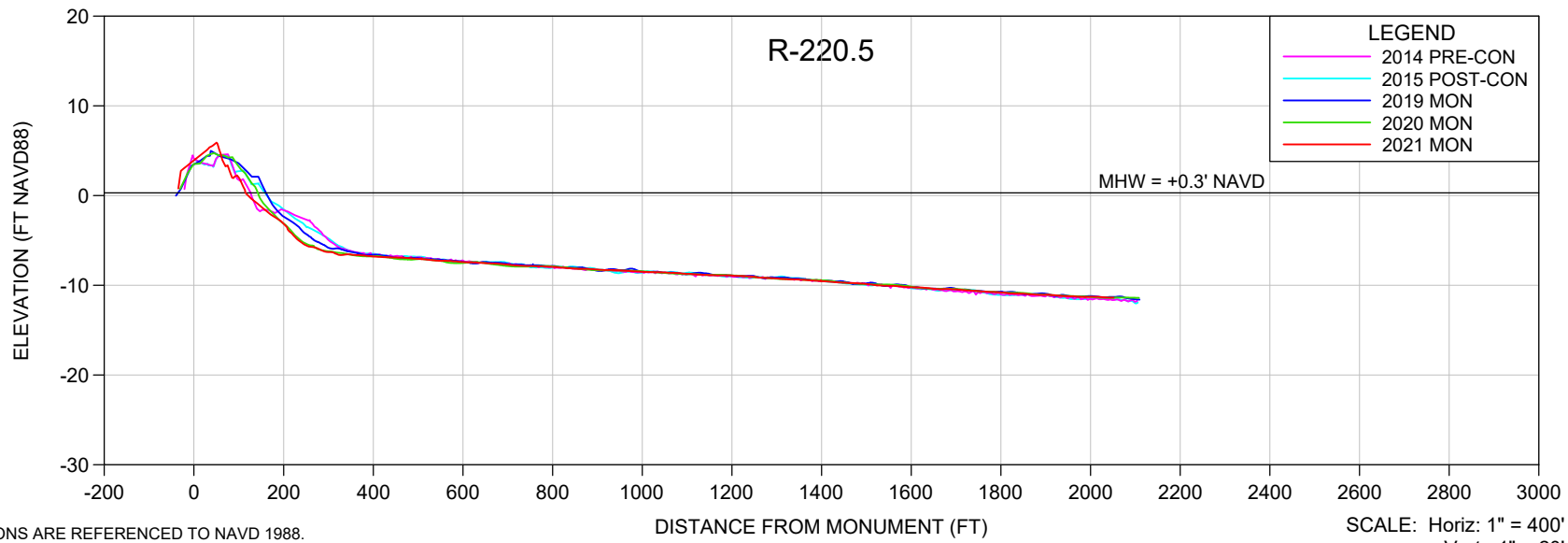
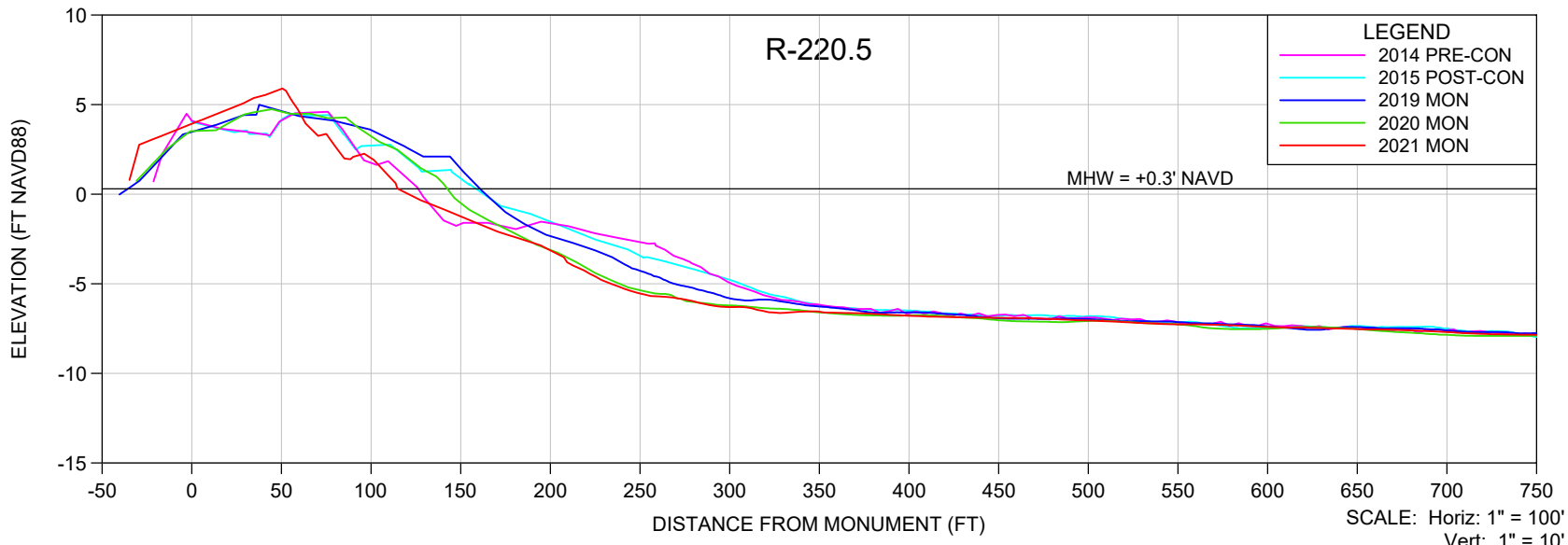
PHONE: (239)643-2324
FAX: (239)643-1143
www.coastalengineering.com
E-Mail: info@ceciff.com

CLIENT: **LEE COUNTY**

TITLE: **BONITA BEACH AND LOVERS KEY
R-220 MONITORING SURVEY**

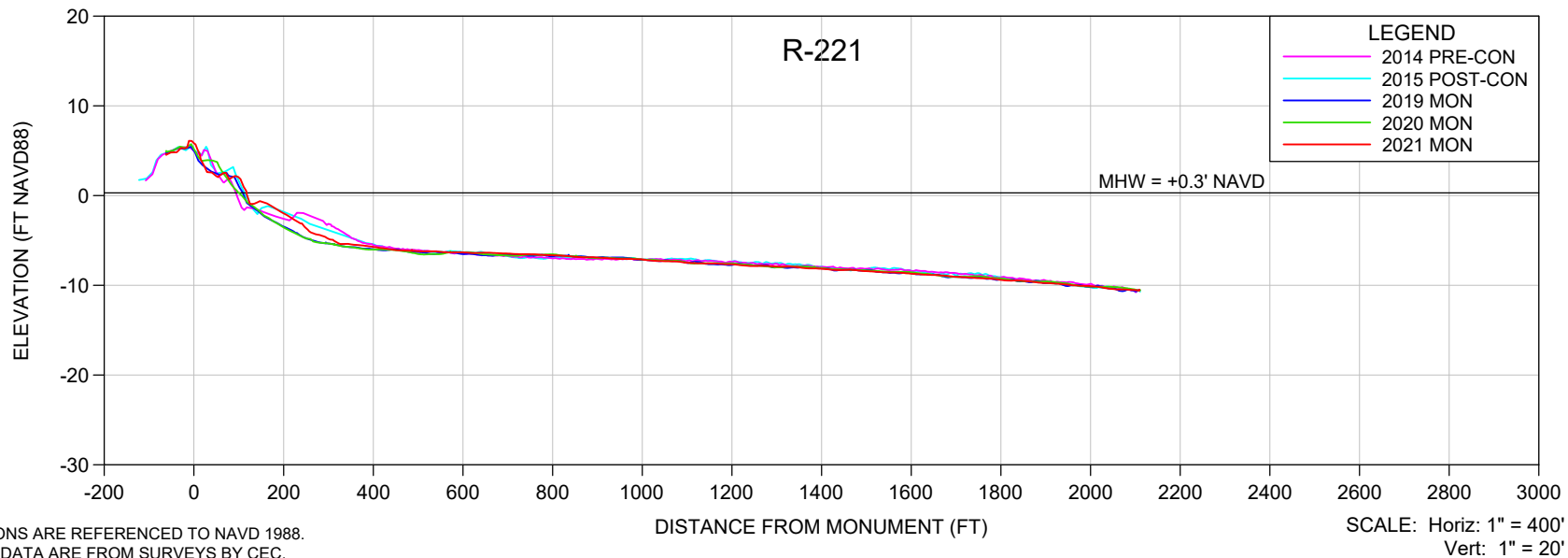
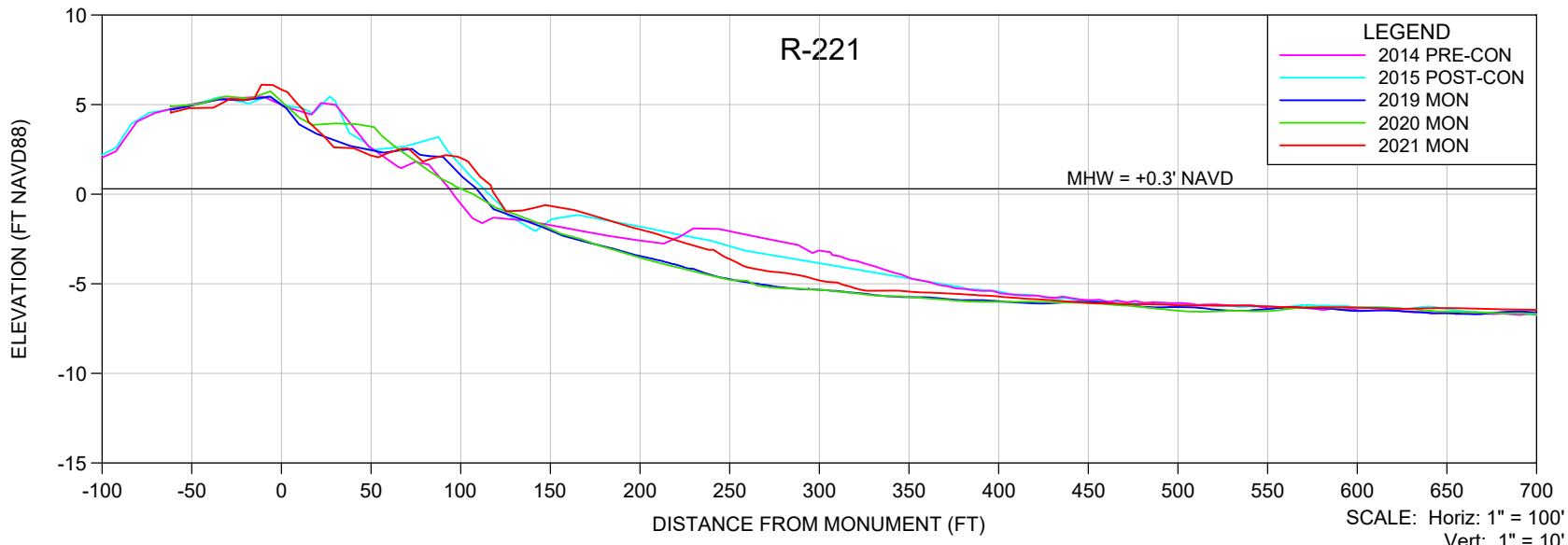
DATE:	6/15/2021	SCALE:	AS SHOWN
DRAWN:	VVA	F.B.	
CHECKED:	MTP	PG.	
SEC.	TWP.	RNG.	
ACAD NO.	21079-Lovers Bonita Mon Profiles.dwg		
REF. NO.	21.079	NO.	DATE

NO.	DATE	BY	REVISION DESCRIPTION



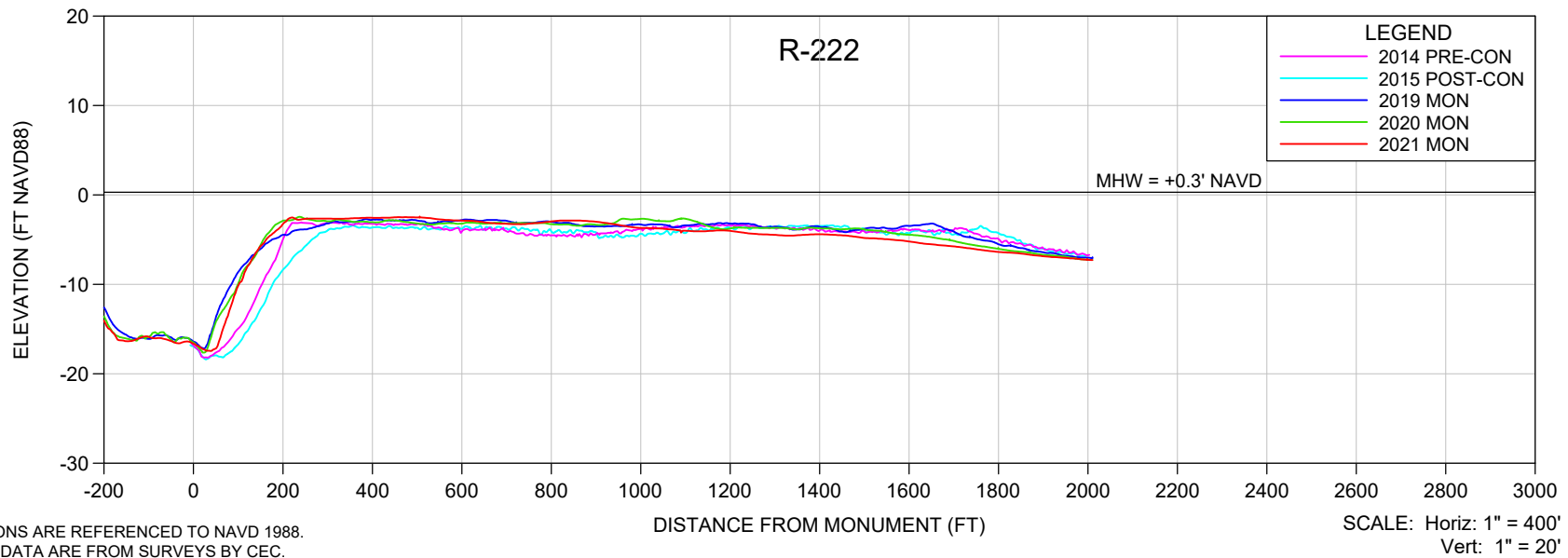
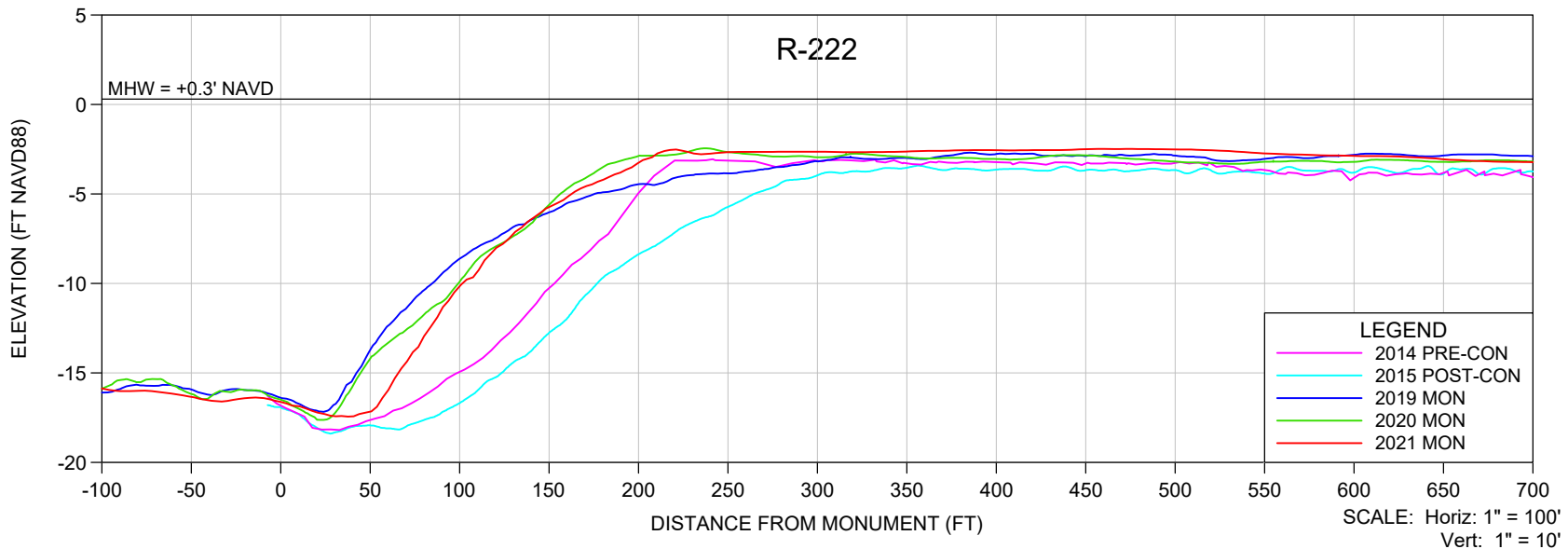
- NOTES**
- ELEVATIONS ARE REFERENCED TO NAVD 1988.
 - PROFILE DATA ARE FROM SURVEYS BY CEC.
 - UPLAND DATA GAPS IN HISTORICAL PROFILES REFLECT SHOREBIRD NESTING AREAS, UNLESS OTHERWISE NOTED.

SHEET 17 FILE NO.: 21079-R-220.5	<p>COASTAL ENGINEERING CONSULTANTS INC. Serving Florida Since 1977 28421 BONITA CROSSINGS BLVD BONITA SPRINGS, FLORIDA 34135</p>	<p>COASTAL & MARINE ENGINEERING ENVIRONMENTAL & GEOLOGICAL SERVICES SURVEY & MAPPING ENGINEERING: CA 2464 SURVEYING: LB 2464</p>	CLIENT:	LEE COUNTY		DATE:	6/15/2021	SCALE:	AS SHOWN					
		PHONE: (239)643-2324 FAX: (239)643-1143 www.coastalengineering.com E-Mail: info@ceciff.com	TITLE:	BONITA BEACH AND LOVERS KEY R-220.5 MONITORING SURVEY		DRAWN:	VVA	F.B.						
				CHECKED:	MTP	PG.								
				SEC.	TWP.	RNG.								
				ACAD NO:	21079-Lovers Bonita Mon Profiles.dwg									
		REF. NO.	21.079											
										NO.	DATE	BY	REVISION DESCRIPTION	



- NOTES**
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 - PROFILE DATA ARE FROM SURVEYS BY CEC.
 - UPLAND DATA GAPS IN HISTORICAL PROFILES REFLECT SHOREBIRD NESTING AREAS, UNLESS OTHERWISE NOTED.

SHEET 18 FILE NO.: 21079-R-221	<p>COASTAL ENGINEERING CONSULTANTS INC. Serving Florida Since 1977 28421 BONITA CROSSINGS BLVD BONITA SPRINGS, FLORIDA 34135</p>	<p>COASTAL & MARINE ENGINEERING ENVIRONMENTAL & GEOLOGICAL SERVICES SURVEY & MAPPING ENGINEERING: CA 2464 SURVEYING: LB 2464</p>	<p>CLIENT: LEE COUNTY</p>	<p>DATE: 6/15/2021 DRAWN: VVA CHECKED: MTP SEC. TWP. RNG. ACAD NO: 21079-Lovers Bonita Mon Profiles.dwg REF. NO. 21.079</p>	<p>SCALE: AS SHOWN F.B. PG. RNG.</p>	<p>NO. DATE BY REVISION DESCRIPTION</p>
		<p>PHONE: (239)643-2324 FAX: (239)643-1143 www.coastalengineering.com E-Mail: info@ceciff.com</p>	<p>TITLE: BONITA BEACH AND LOVERS KEY R-221 MONITORING SURVEY</p>			



NOTES

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- UPLAND DATA GAPS IN HISTORICAL PROFILES REFLECT SHOREBIRD NESTING AREAS, UNLESS OTHERWISE NOTED.

SHEET 19
FILE NO.: 2109-R-222

COASTAL ENGINEERING CONSULTANTS INC.
Serving Florida Since 1977
28421 BONITA CROSSINGS BLVD
BONITA SPRINGS, FLORIDA 34135

COASTAL & MARINE ENGINEERING
ENVIRONMENTAL & GEOLOGICAL SERVICES
SURVEY & MAPPING
ENGINEERING: CA 2464
SURVEYING: LB 2464

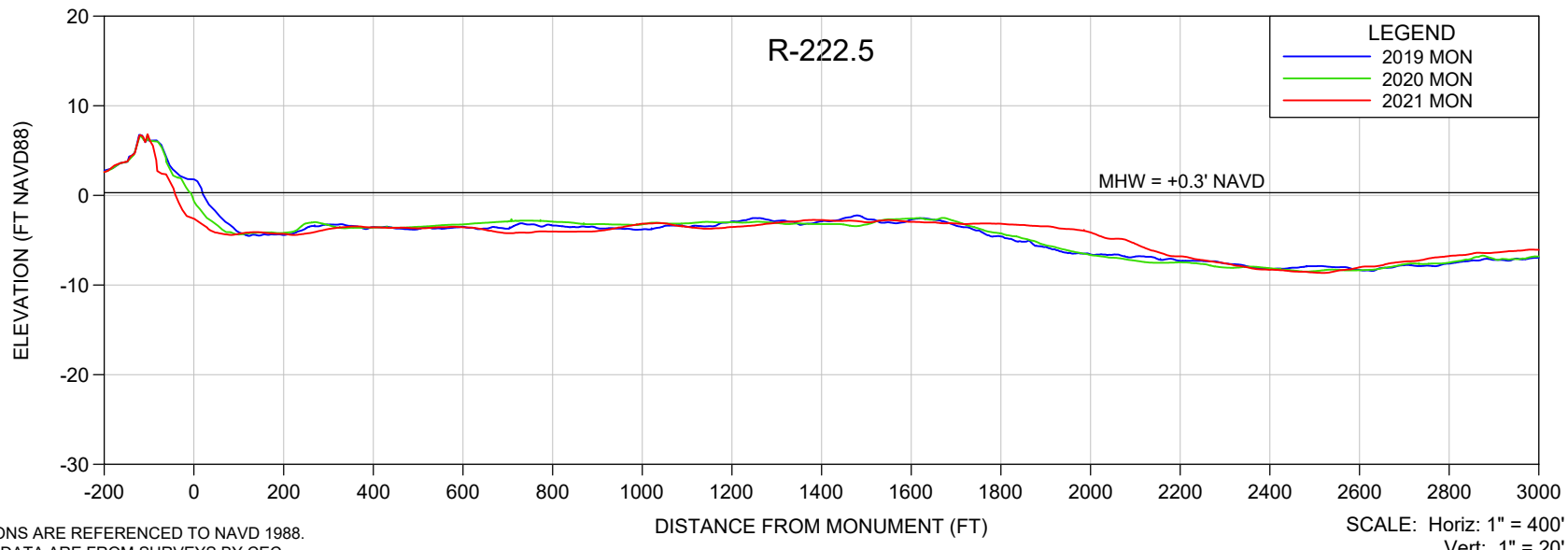
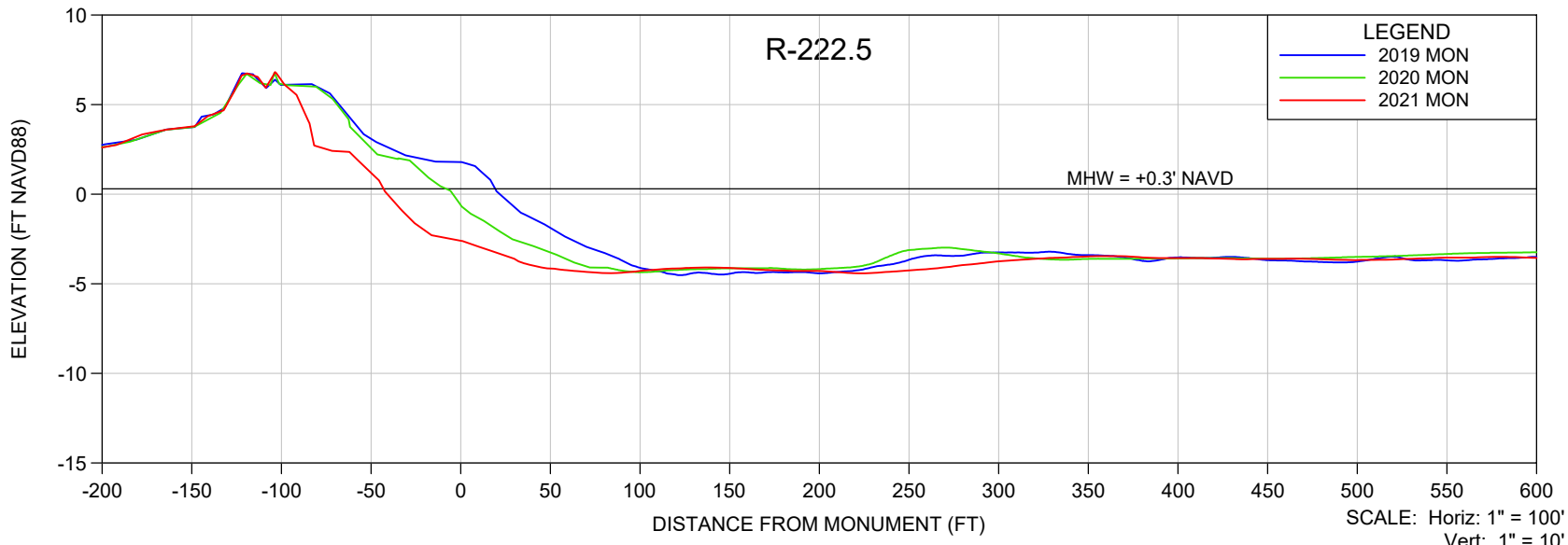
PHONE: (239)643-2324
FAX: (239)643-1143
www.coastalengineering.com
E-Mail: info@ceciff.com

CLIENT: **LEE COUNTY**

TITLE: **BONITA BEACH AND LOVERS KEY
R-222 MONITORING SURVEY**

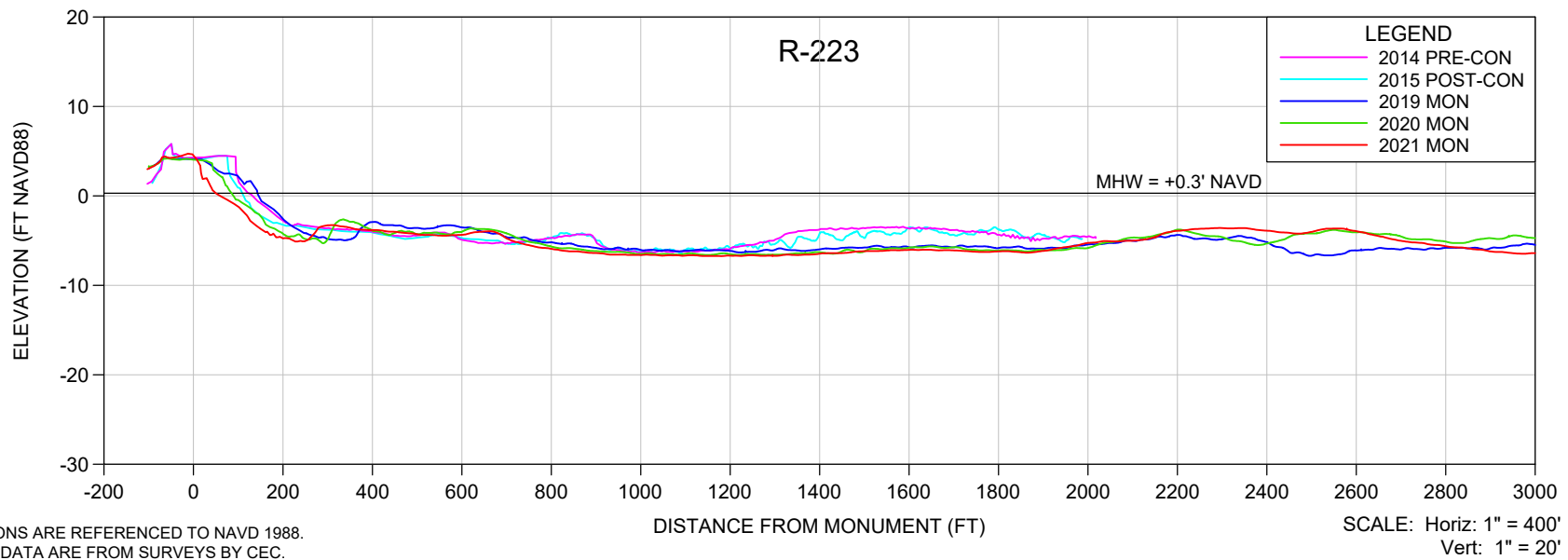
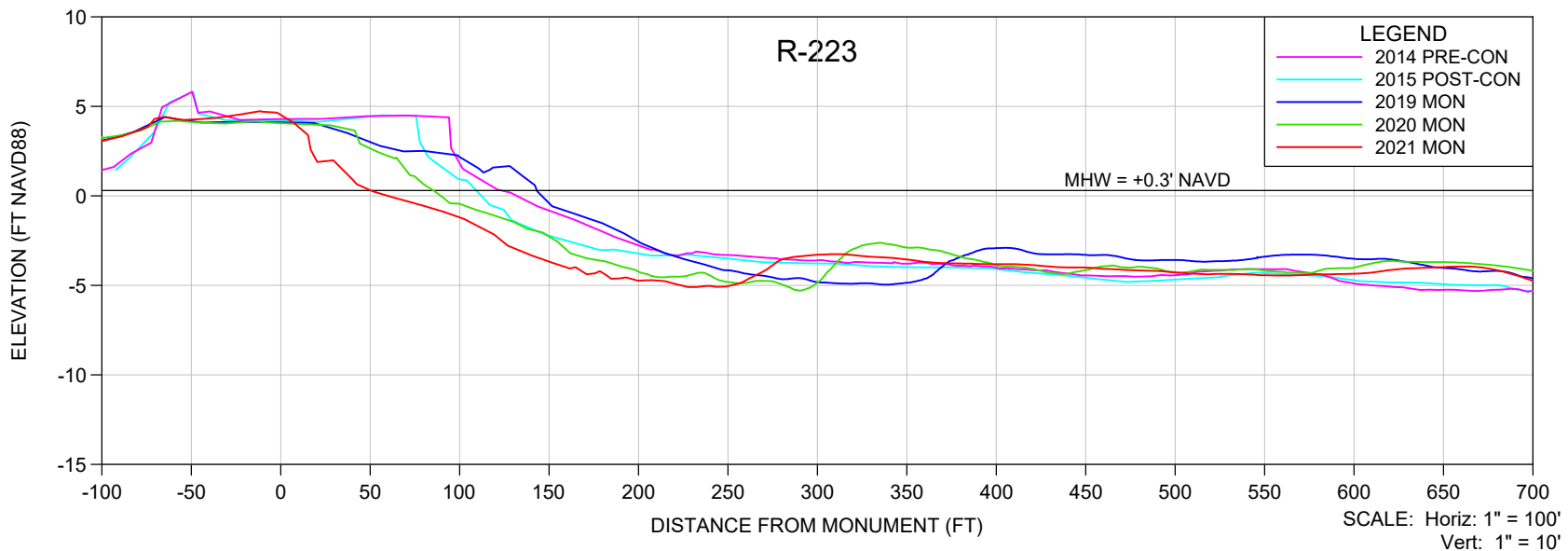
DATE:	6/15/2021	SCALE:	AS SHOWN
DRAWN:	VVA	F.B.	
CHECKED:	MTP	PG.	
SEC.	TWP.	RNG.	
ACAD NO.	21079-Lovers Bonita Mon Profiles.dwg		
REF. NO.	21.079	NO.	DATE

NO.	DATE	BY	REVISION DESCRIPTION



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SHEET 20 FILE NO.: 21079-R-222.5	<p>COASTAL ENGINEERING CONSULTANTS INC. Serving Florida Since 1977 28421 BONITA CROSSINGS BLVD BONITA SPRINGS, FLORIDA 34135</p>	COASTAL & MARINE ENGINEERING ENVIRONMENTAL & GEOLOGICAL SERVICES SURVEY & MAPPING ENGINEERING: CA 2464 SURVEYING: LB 2464	CLIENT:	LEE COUNTY		DATE:	6/15/2021	SCALE:	AS SHOWN						
			TITLE:	BONITA BEACH AND LOVERS KEY R-222.5 MONITORING SURVEY		DRAWN:	VVA	F.B.							
					CHECKED:	MTP	PG.								
					SEC.	TWP.	RNG.								
					ACAD NO:	21079-Lovers Bonita Mon Profiles.dwg									
			REF. NO.	21.079						NO.	DATE	BY	REVISION DESCRIPTION		



NOTES

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- UPLAND DATA GAPS IN HISTORICAL PROFILES REFLECT SHOREBIRD NESTING AREAS, UNLESS OTHERWISE NOTED.

SHEET 21
FILE NO.: 2109-R-223

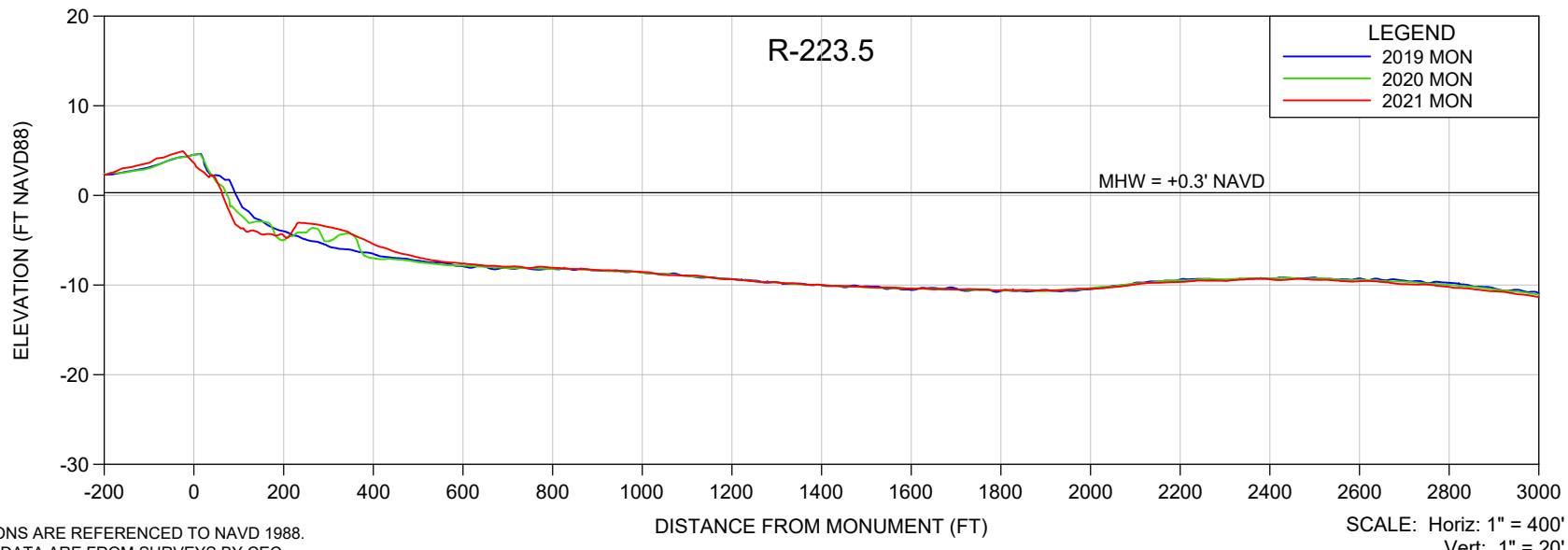
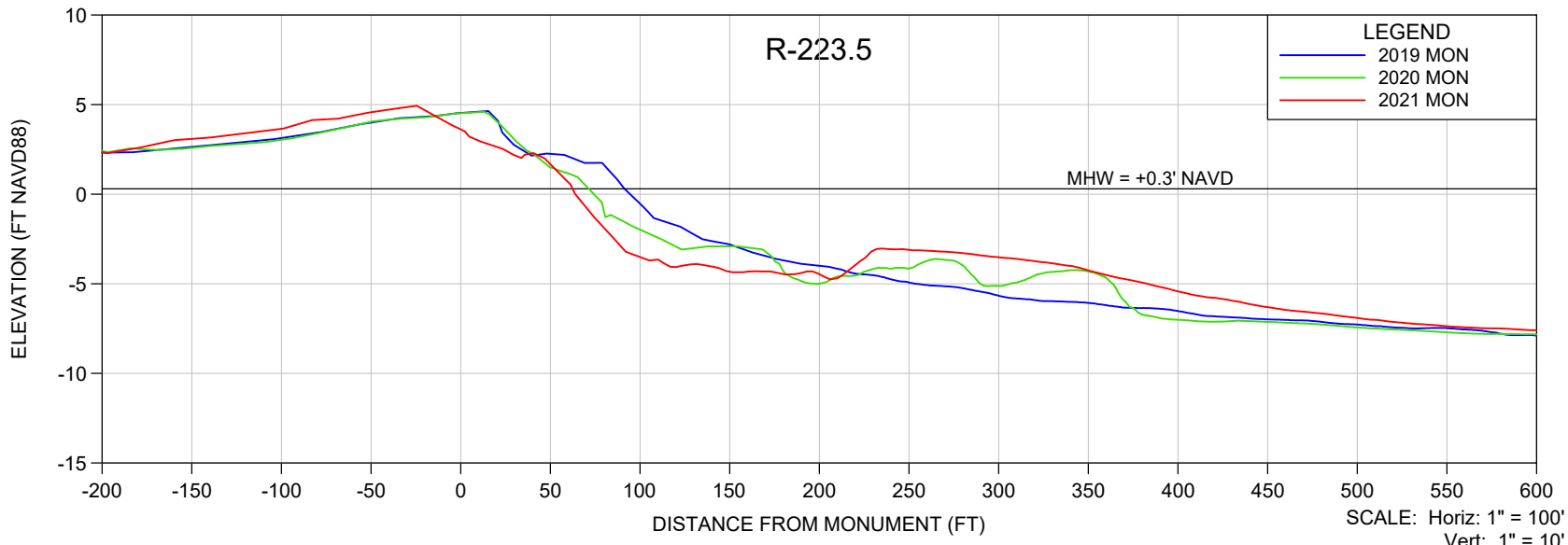
COASTAL ENGINEERING CONSULTANTS INC.
Serving Florida Since 1977
28421 BONITA CROSSINGS BLVD
BONITA SPRINGS, FLORIDA 34135

COASTAL & MARINE ENGINEERING
ENVIRONMENTAL & GEOLOGICAL SERVICES
SURVEY & MAPPING
ENGINEERING: CA 2464
SURVEYING: LB 2464
PHONE: (239)643-2324
FAX: (239)643-1143
www.coastalengineering.com
E-Mail: info@ceciff.com

CLIENT: **LEE COUNTY**
TITLE: **BONITA BEACH AND LOVERS KEY
R-223 MONITORING SURVEY**

DATE:	6/15/2021	SCALE:	AS SHOWN
DRAWN:	VVA	F.B.	
CHECKED:	MTP	PG.	
SEC.	TWP.	RNG.	
ACAD NO:	21079-Lovers Bonita Mon Profiles.dwg		
REF. NO.	21.079	NO.	DATE

NO.	DATE	BY	REVISION DESCRIPTION



NOTES

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2. PROFILE DATA ARE FROM SURVEYS BY CEC.
3. UPLAND DATA GAPS IN HISTORICAL PROFILES REFLECT SHOREBIRD NESTING AREAS, UNLESS OTHERWISE NOTED.

SHEET 22
FILE NO.: 21079-R-223

COASTAL ENGINEERING CONSULTANTS INC.
 Serving Florida Since 1977
 28421 BONITA CROSSINGS BLVD
 BONITA SPRINGS, FLORIDA 34135

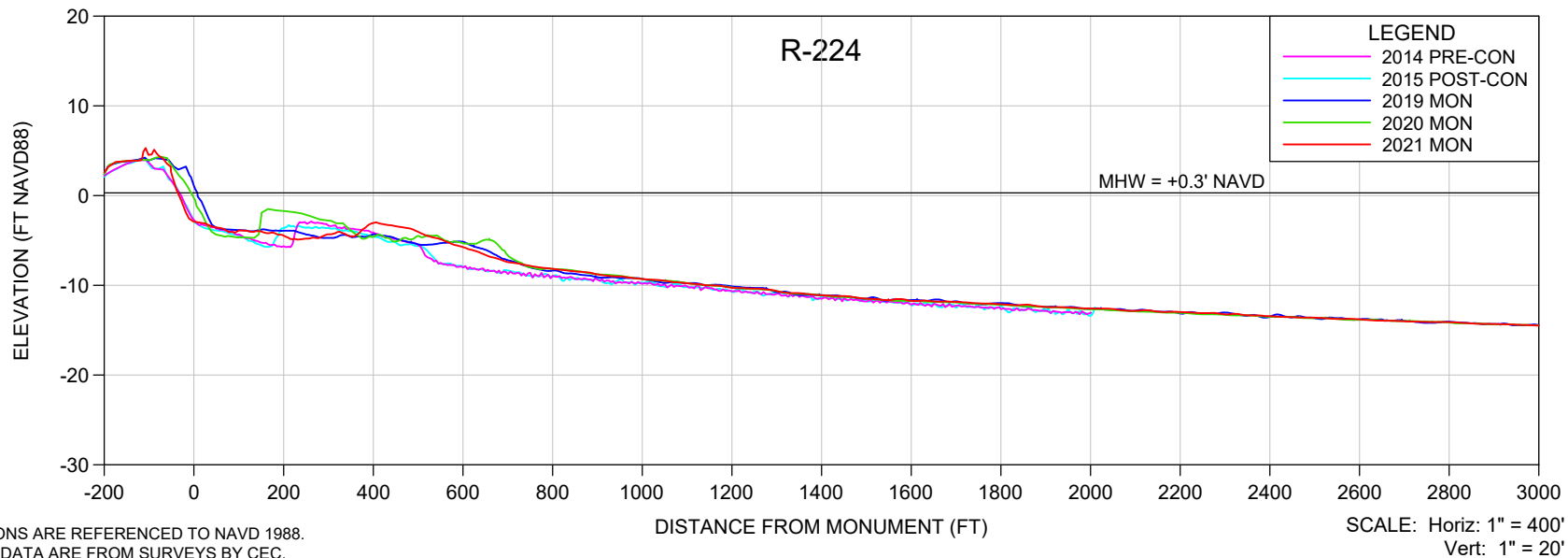
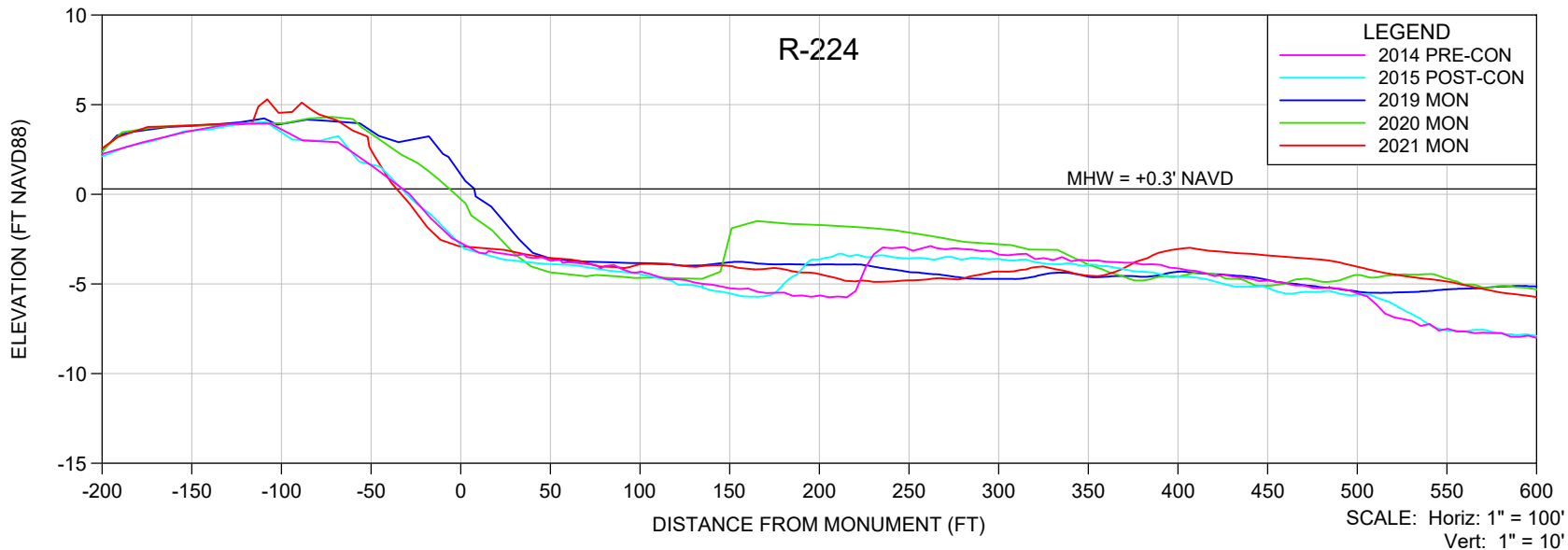
COASTAL & MARINE ENGINEERING
 ENVIRONMENTAL & GEOLOGICAL SERVICES
 SURVEY & MAPPING
 ENGINEERING: CA 2464
 SURVEYING: LB 2464
 PHONE: (239)643-2324
 FAX: (239)643-1143
 www.coastalengineering.com
 E-Mail: info@ceciff.com

CLIENT: **LEE COUNTY**

TITLE: **BONITA BEACH AND LOVERS KEY
R-223.5 MONITORING SURVEY**

DATE:	6/15/2021	SCALE:	AS SHOWN
DRAWN:	VVA	F.B.	
CHECKED:	MTP	PG.	
SEC.	TWP.	RNG.	
ACAD NO.	21079-Lovers Bonita Mon Profiles.dwg		
REF. NO.	21.079	NO.	DATE

NO.	DATE	BY	REVISION DESCRIPTION



NOTES

- ELEVATIONS ARE REFERENCED TO NAVD 1988.
- PROFILE DATA ARE FROM SURVEYS BY CEC.
- UPLAND DATA GAPS IN HISTORICAL PROFILES REFLECT SHOREBIRD NESTING AREAS, UNLESS OTHERWISE NOTED.

SHEET 23
FILE NO.: 2109-R-224

COASTAL ENGINEERING CONSULTANTS INC.
Serving Florida Since 1977
28421 BONITA CROSSINGS BLVD
BONITA SPRINGS, FLORIDA 34135

COASTAL & MARINE ENGINEERING
ENVIRONMENTAL & GEOLOGICAL SERVICES
SURVEY & MAPPING
ENGINEERING: CA 2464
SURVEYING: LB 2464

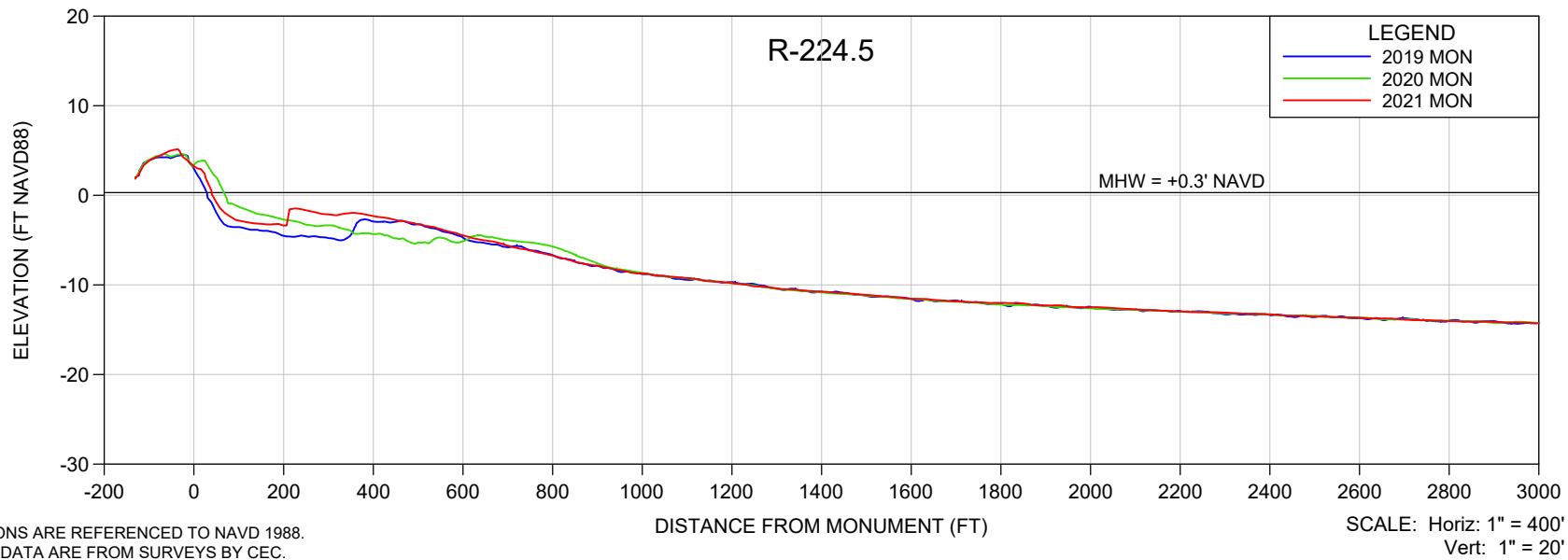
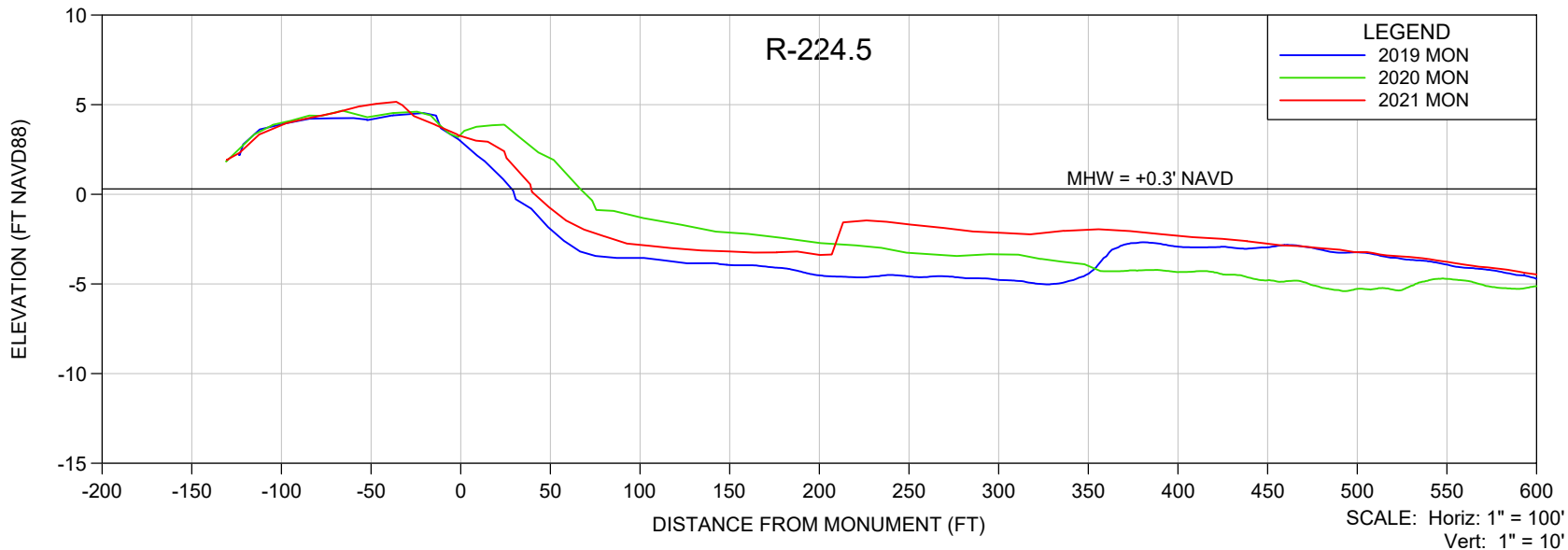
PHONE: (239)643-2324
FAX: (239)643-1143
www.coastalengineering.com
E-Mail: info@ceciff.com

CLIENT: **LEE COUNTY**

TITLE: **BONITA BEACH AND LOVERS KEY
R-224 MONITORING SURVEY**

DATE:	6/15/2021	SCALE:	AS SHOWN
DRAWN:	VVA	F.B.	
CHECKED:	MTP	PG.	
SEC.	TWP.	RNG.	
ACAD NO.	21079-Lovers Bonita Mon Profiles.dwg		
REF. NO.	21.079	NO.	DATE

NO.	DATE	BY	REVISION DESCRIPTION



NOTES

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SHEET 24
 FILE NO.: 21079-R-224.5

COASTAL ENGINEERING CONSULTANTS INC.
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 BONITA SPRINGS, FLORIDA 34135

COASTAL & MARINE ENGINEERING
 ENVIRONMENTAL & GEOLOGICAL SERVICES
 SURVEY & MAPPING
 ENGINEERING: CA 2464
 SURVEYING: LB 2464

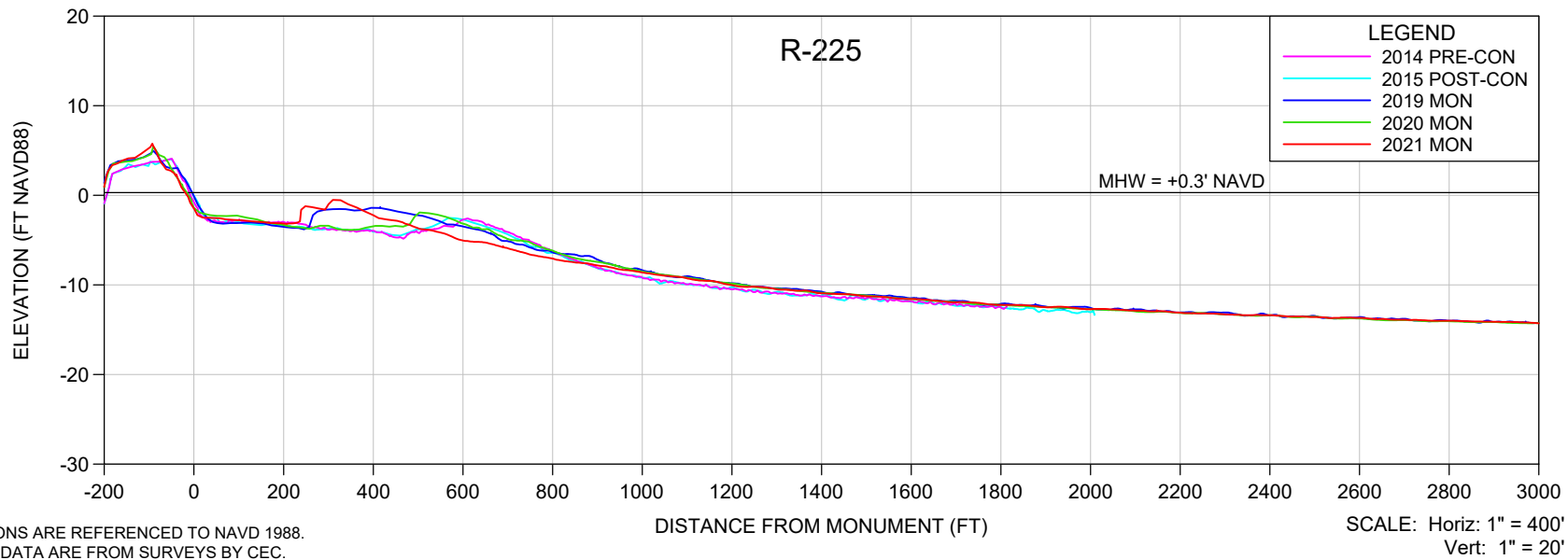
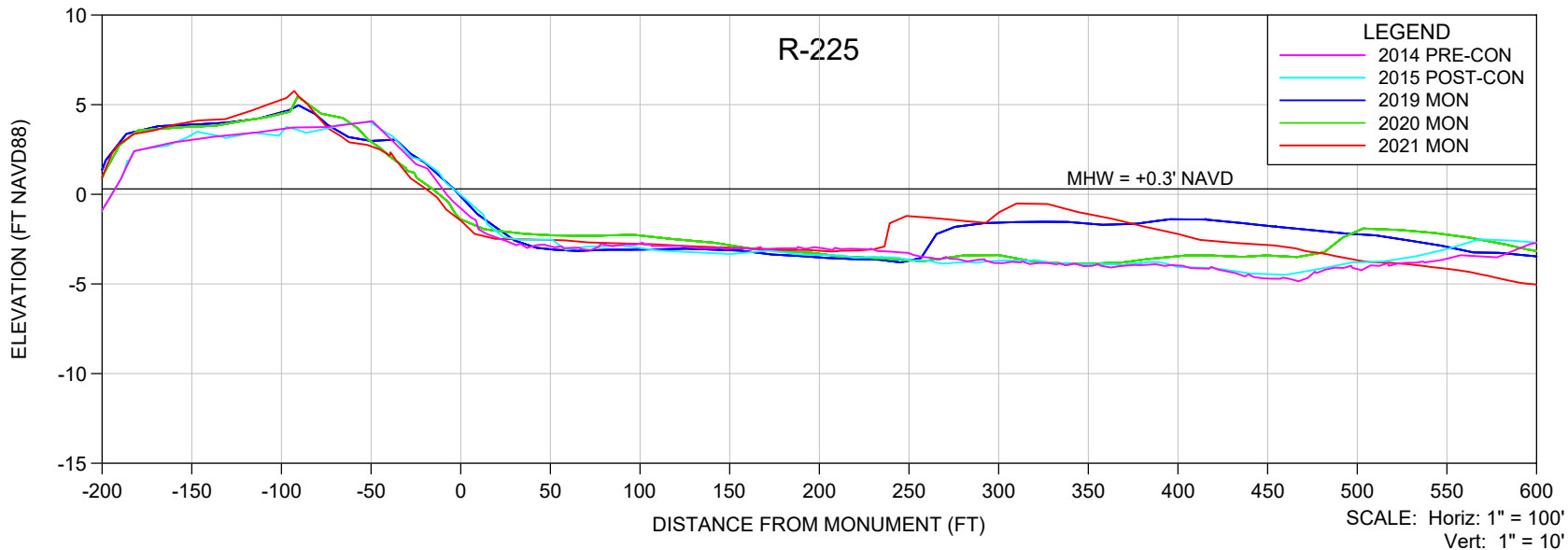
PHONE: (239)643-2324
 FAX: (239)643-1143
 www.coastalengineering.com
 E-Mail: info@ceciff.com

CLIENT: **LEE COUNTY**

TITLE: **BONITA BEACH AND LOVERS KEY
 R-224.5 MONITORING SURVEY**

DATE:	6/15/2021	SCALE:	AS SHOWN
DRAWN:	VVA	F.B.	
CHECKED:	MTP	PG.	
SEC.	TWP.	RNG.	
ACAD NO:	21079-Lovers Bonita Mon Profiles.dwg		
REF. NO.	21.079	NO.	DATE

NO.	DATE	BY	REVISION DESCRIPTION



NOTES

1. ELEVATIONS ARE REFERENCED TO NAVD 1988.
2. PROFILE DATA ARE FROM SURVEYS BY CEC.
3. UPLAND DATA GAPS IN HISTORICAL PROFILES REFLECT SHOREBIRD NESTING AREAS, UNLESS OTHERWISE NOTED.

SHEET 25
FILE NO.: 21079-R-225

COASTAL ENGINEERING CONSULTANTS INC.
Serving Florida Since 1977
28421 BONITA CROSSINGS BLVD
BONITA SPRINGS, FLORIDA 34135

COASTAL & MARINE ENGINEERING
ENVIRONMENTAL & GEOLOGICAL SERVICES
SURVEY & MAPPING
ENGINEERING: CA 2464
SURVEYING: LB 2464

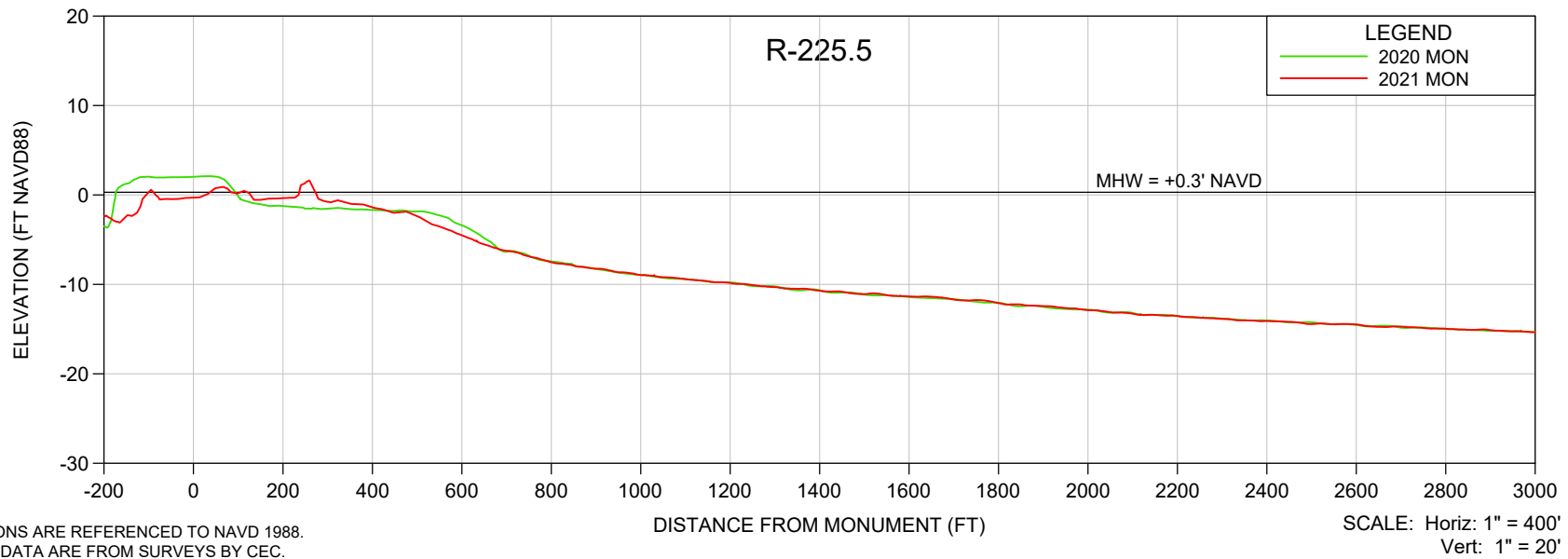
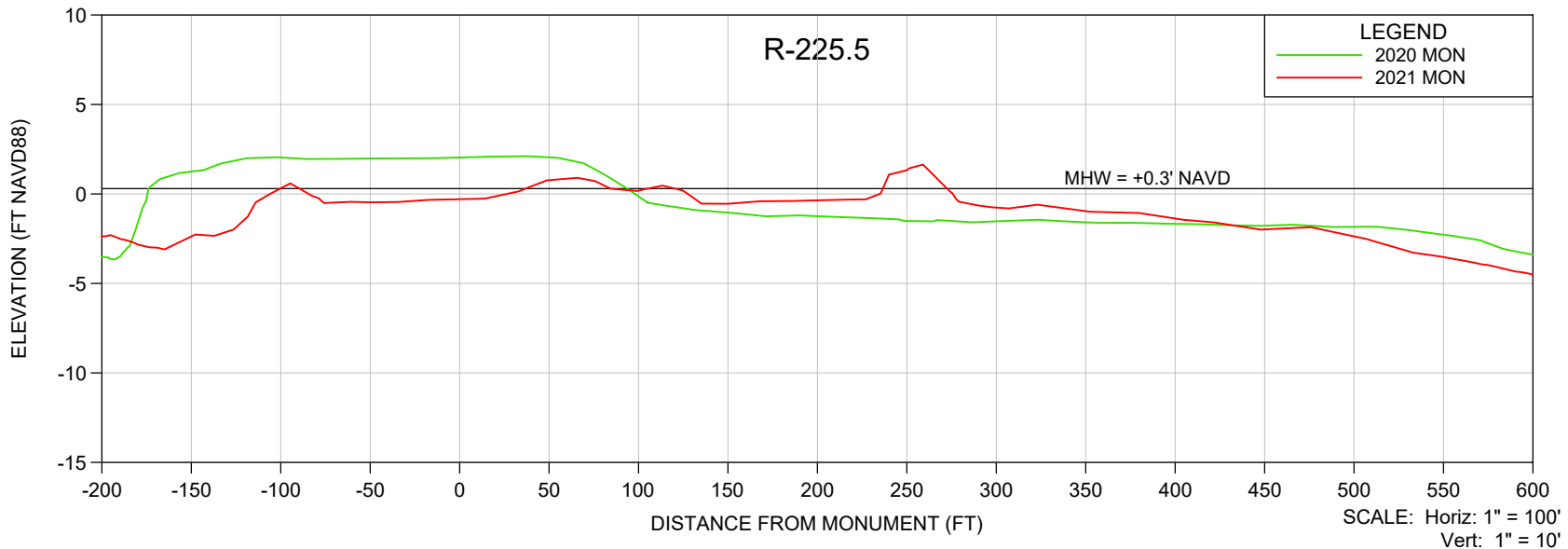
PHONE: (239)643-2324
FAX: (239)643-1143
www.coastalengineering.com
E-Mail: info@ceciff.com

CLIENT: **LEE COUNTY**

TITLE: **BONITA BEACH AND LOVERS KEY
R-225 MONITORING SURVEY**

DATE:	6/15/2021	SCALE:	AS SHOWN
DRAWN:	VVA	F.B.	
CHECKED:	MTP	PG.	
SEC.	TWP.	RNG.	
ACAD NO.	21079-Lovers Bonita Mon Profiles.dwg		
REF. NO.	21.079	NO.	DATE

NO.	DATE	BY	REVISION DESCRIPTION



NOTES

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SHEET 26
 FILE NO.: 21079-R-225.5

COASTAL ENGINEERING CONSULTANTS INC.
 Serving Florida Since 1977
 28421 BONITA CROSSINGS BLVD
 BONITA SPRINGS, FLORIDA 34135

COASTAL & MARINE ENGINEERING
 ENVIRONMENTAL & GEOLOGICAL SERVICES
 SURVEY & MAPPING
 ENGINEERING: CA 2464
 SURVEYING: LB 2464

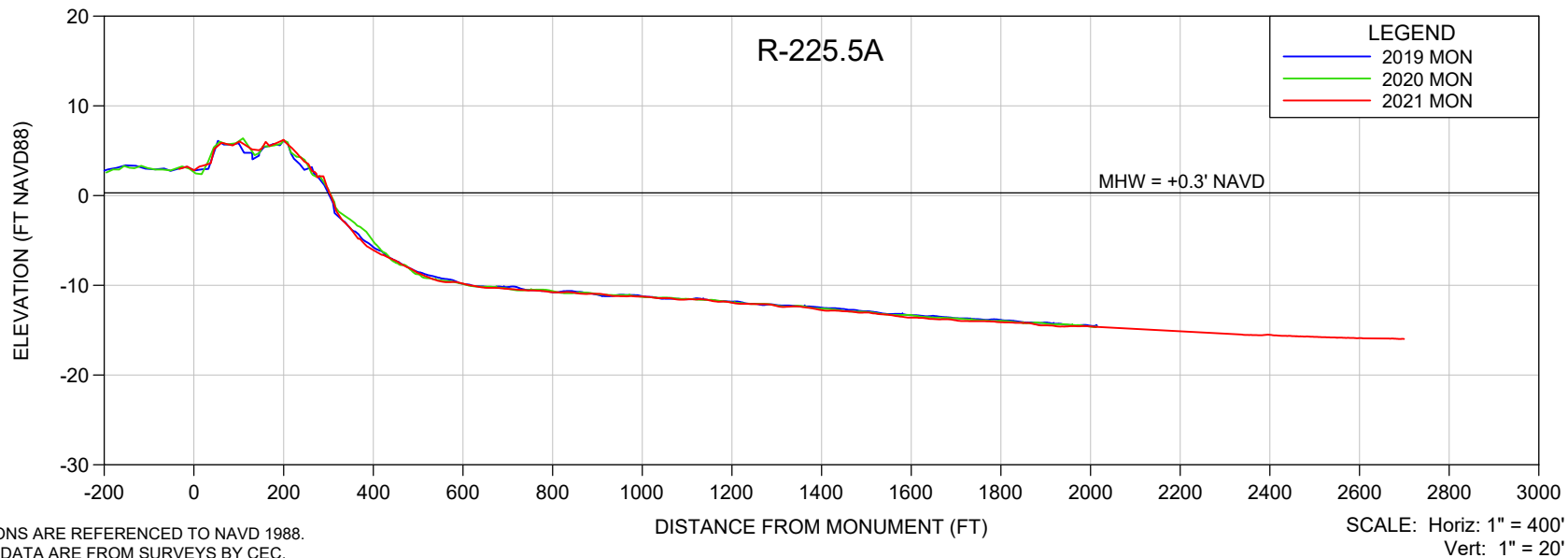
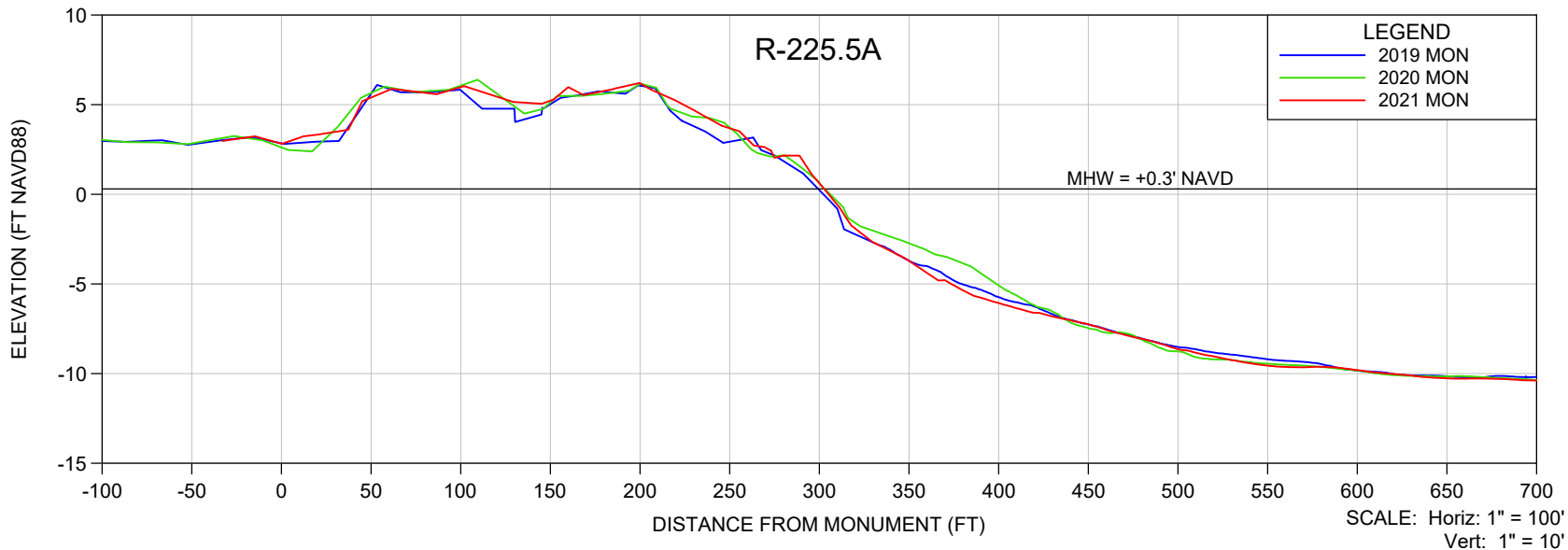
PHONE: (239)643-2324
 FAX: (239)643-1143
 www.coastalengineering.com
 E-Mail: info@ceciff.com

CLIENT: **LEE COUNTY**

TITLE: **BONITA BEACH AND LOVERS KEY
 R-225.5 MONITORING SURVEY**

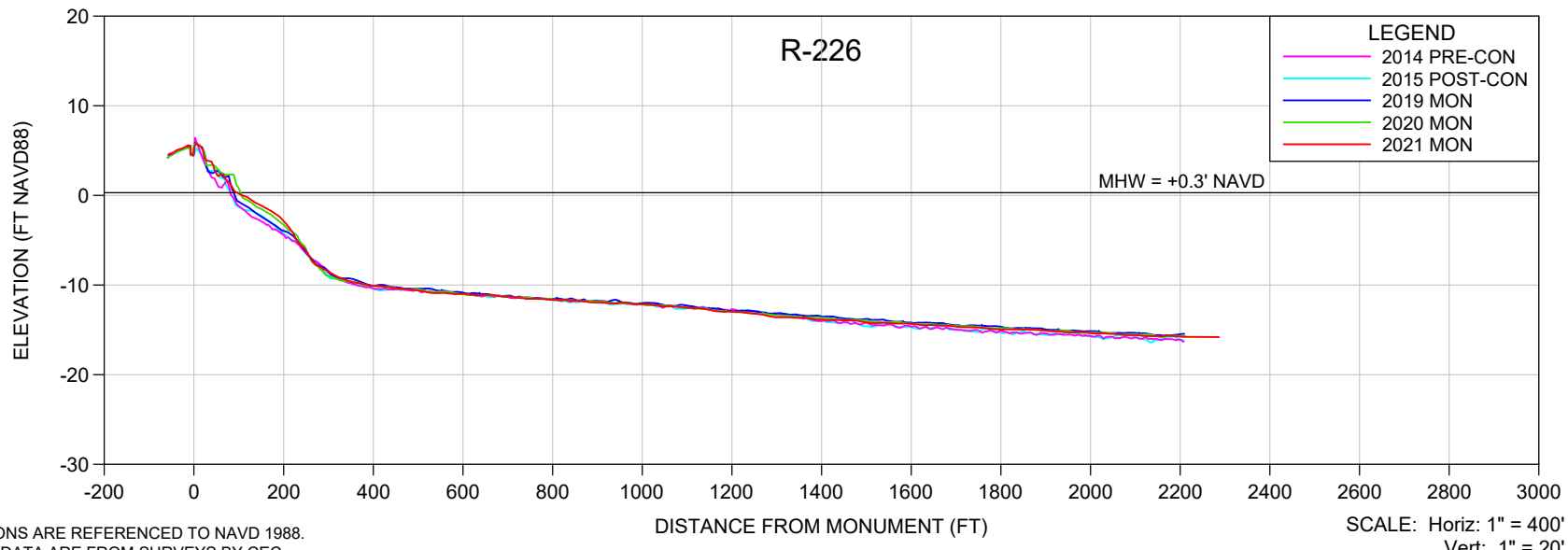
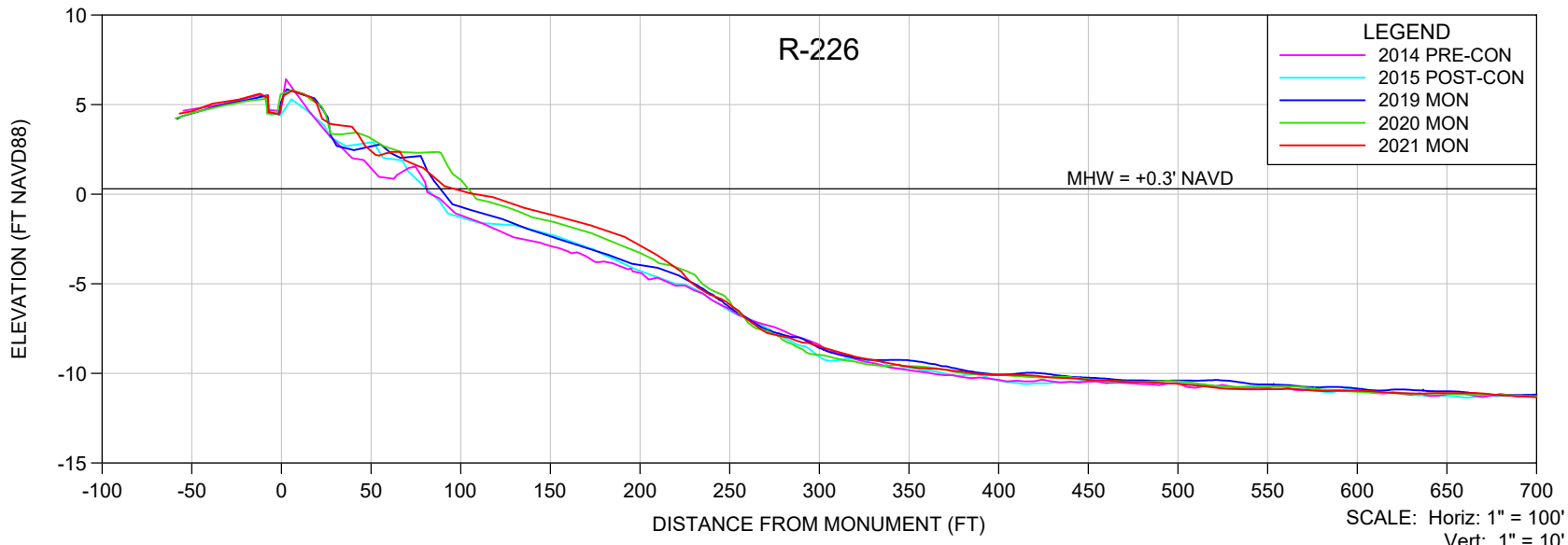
DATE:	6/15/2021	SCALE:	AS SHOWN
DRAWN:	VVA	F.B.	
CHECKED:	MTP	PG.	
SEC.	TWP.	RNG.	
ACAD NO:	21079-Lovers Bonita Mon Profiles.dwg		
REF. NO.	21.079	NO.	DATE

NO.	DATE	BY	REVISION DESCRIPTION



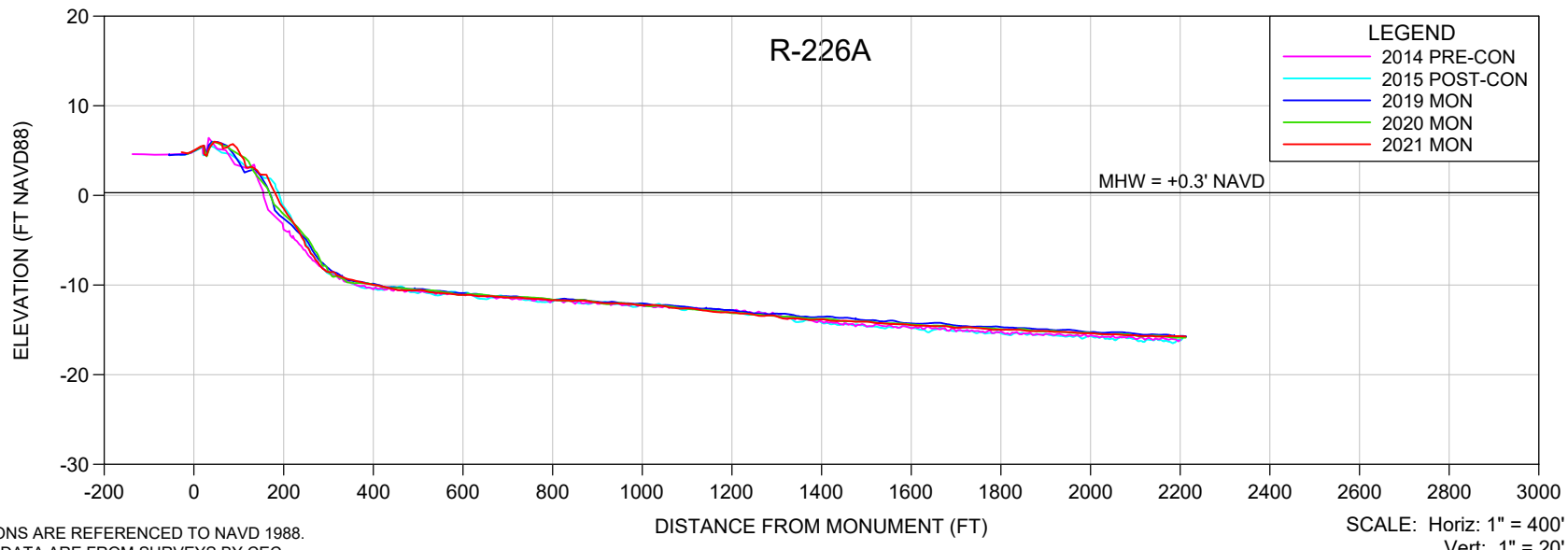
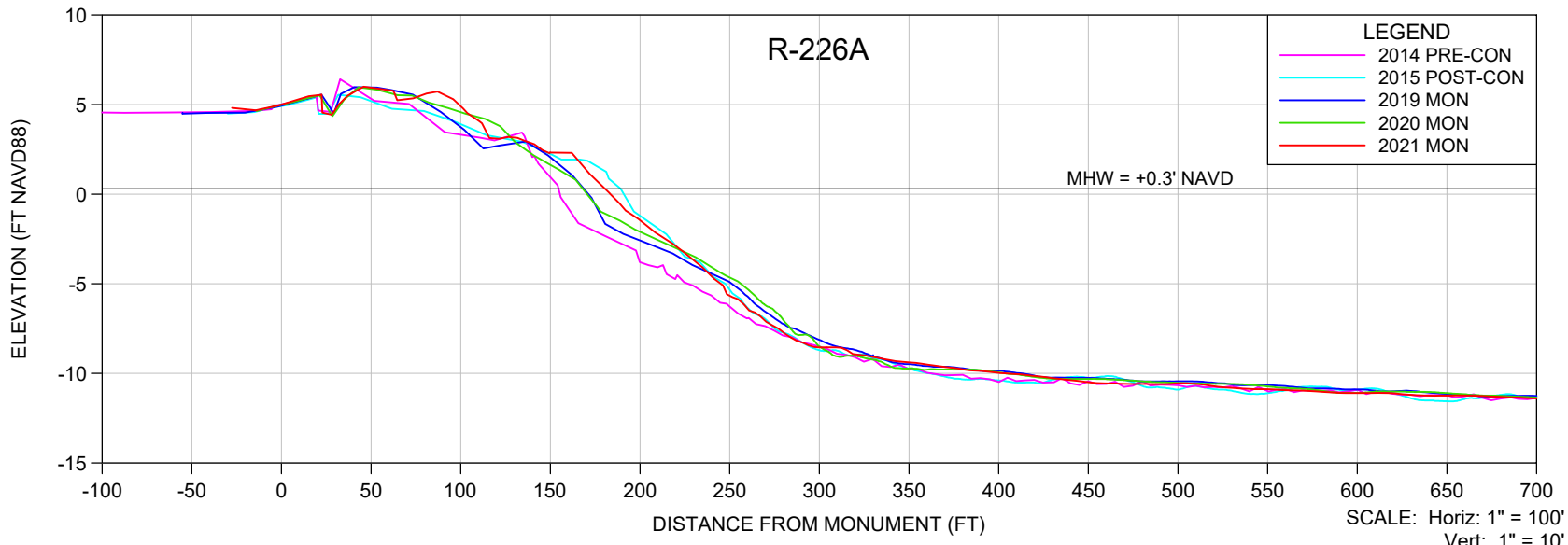
- NOTES**
- ELEVATIONS ARE REFERENCED TO NAVD 1988.
 - PROFILE DATA ARE FROM SURVEYS BY CEC.
 - UPLAND DATA GAPS IN HISTORICAL PROFILES REFLECT SHOREBIRD NESTING AREAS, UNLESS OTHERWISE NOTED.

SHEET 27 FILE NO.: 21079-R-225.5A	<p>COASTAL ENGINEERING CONSULTANTS INC. Serving Florida Since 1977 28421 BONITA CROSSINGS BLVD BONITA SPRINGS, FLORIDA 34135</p>	<p>COASTAL & MARINE ENGINEERING ENVIRONMENTAL & GEOLOGICAL SERVICES SURVEY & MAPPING ENGINEERING: CA 2464 SURVEYING: LB 2464</p> <p>PHONE: (239)643-2324 FAX: (239)643-1143 www.coastalengineering.com E-Mail: info@ceciff.com</p>	CLIENT:	LEE COUNTY			DATE:	6/15/2021	SCALE:	AS SHOWN					
			TITLE:	BONITA BEACH AND LOVERS KEY R-225.5A MONITORING SURVEY			DRAWN:	VVA	F.B.						
						CHECKED:	MTP	PG.							
						SEC.	TWP.	RNG.							
						ACAD NO:	21079-Lovers Bonita Mon Profiles.dwg								
			REF. NO.	21.079			NO.	DATE	BY	REVISION DESCRIPTION					



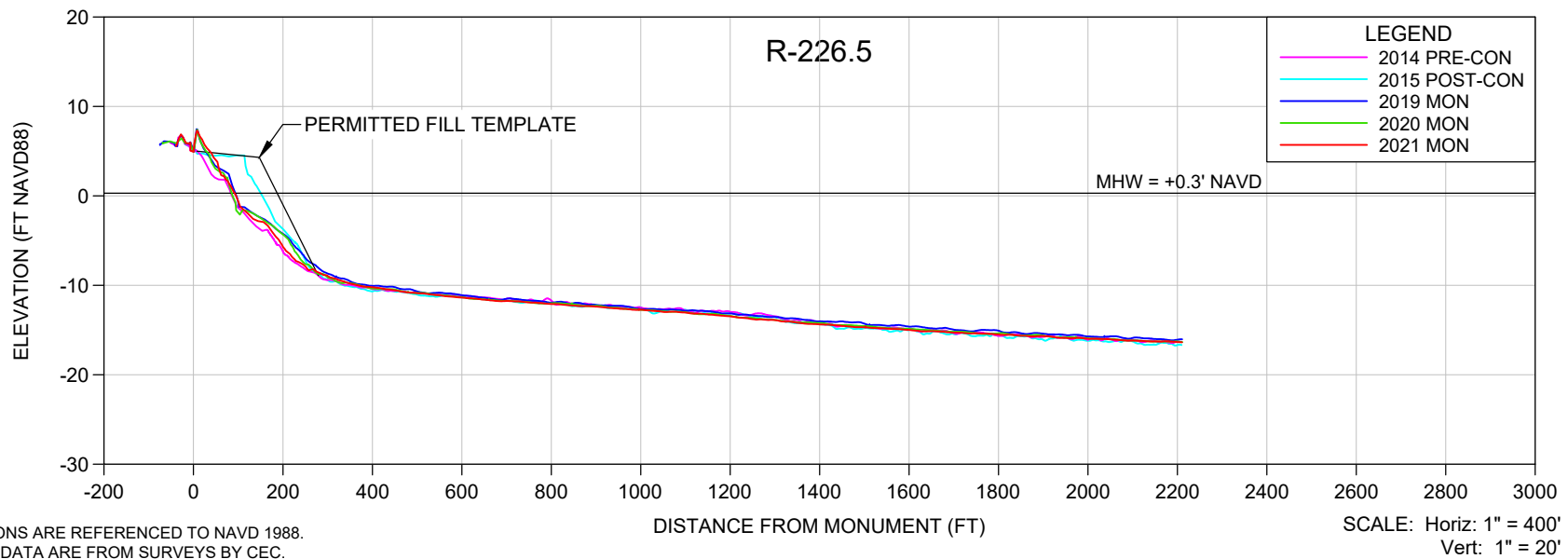
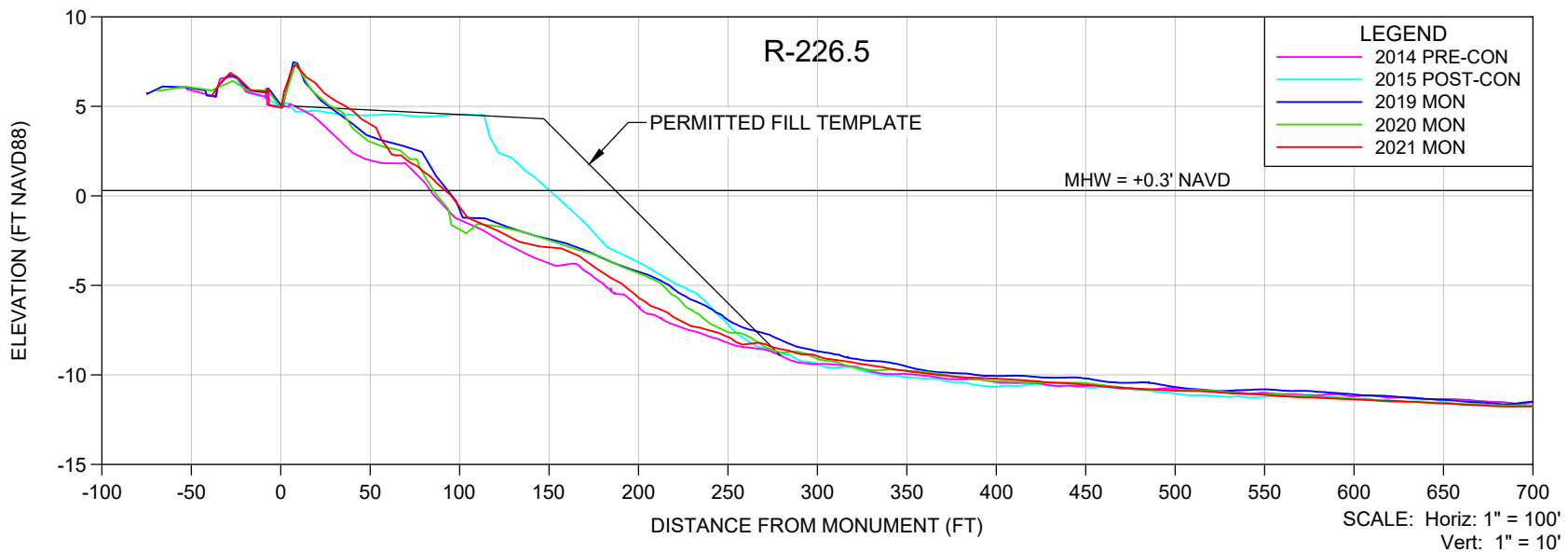
- NOTES**
- ELEVATIONS ARE REFERENCED TO NAVD 1988.
 - PROFILE DATA ARE FROM SURVEYS BY CEC.
 - UPLAND DATA GAPS IN HISTORICAL PROFILES REFLECT SHOREBIRD NESTING AREAS, UNLESS OTHERWISE NOTED.

SHEET 28 FILE NO.: 21079-R-226	<p>COASTAL ENGINEERING CONSULTANTS INC. Serving Florida Since 1977 28421 BONITA CROSSINGS BLVD BONITA SPRINGS, FLORIDA 34135</p>	<p>COASTAL & MARINE ENGINEERING ENVIRONMENTAL & GEOLOGICAL SERVICES SURVEY & MAPPING ENGINEERING: CA 2464 SURVEYING: LB 2464</p> <p>PHONE: (239)643-2324 FAX: (239)643-1143 www.coastalengineering.com E-Mail: info@ceciff.com</p>	CLIENT:	LEE COUNTY		DATE:	6/15/2021	SCALE:	AS SHOWN							
			TITLE:	BONITA BEACH AND LOVERS KEY R-226 MONITORING SURVEY		DRAWN:	VVA	F.B.								
					CHECKED:	MTP	PG.									
					SEC.	TWP.	RNG.									
					ACAD NO.	21079-Lovers Bonita Mon Profiles.dwg										
		REF. NO.	21.079		NO.	DATE	BY	REVISION DESCRIPTION								



- NOTES**
- ELEVATIONS ARE REFERENCED TO NAVD 1988.
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SHEET 29 FILE NO.: 21079-R-226A	<p>COASTAL ENGINEERING CONSULTANTS INC. Serving Florida Since 1977 28421 BONITA CROSSINGS BLVD BONITA SPRINGS, FLORIDA 34135</p>	<p>COASTAL & MARINE ENGINEERING ENVIRONMENTAL & GEOLOGICAL SERVICES SURVEY & MAPPING ENGINEERING: CA 2464 SURVEYING: LB 2464</p>	CLIENT:	LEE COUNTY		DATE:	6/15/2021	SCALE:	AS SHOWN					
		PHONE: (239)643-2324 FAX: (239)643-1143 www.coastalengineering.com E-Mail: info@ceciff.com	TITLE:	BONITA BEACH AND LOVERS KEY R-226A MONITORING SURVEY		DRAWN:	VVA	F.B.						
				CHECKED:	MTP	PG.								
				SEC.	TWP.	RNG.								
				ACAD NO.	21079-Lovers Bonita Mon Profiles.dwg									
		REF. NO.	21.079							NO.	DATE	BY	REVISION DESCRIPTION	



NOTES

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SHEET 30
FILE NO.: 21079-R-226.5

COASTAL ENGINEERING CONSULTANTS INC.
Serving Florida Since 1977
28421 BONITA CROSSINGS BLVD
BONITA SPRINGS, FLORIDA 34135

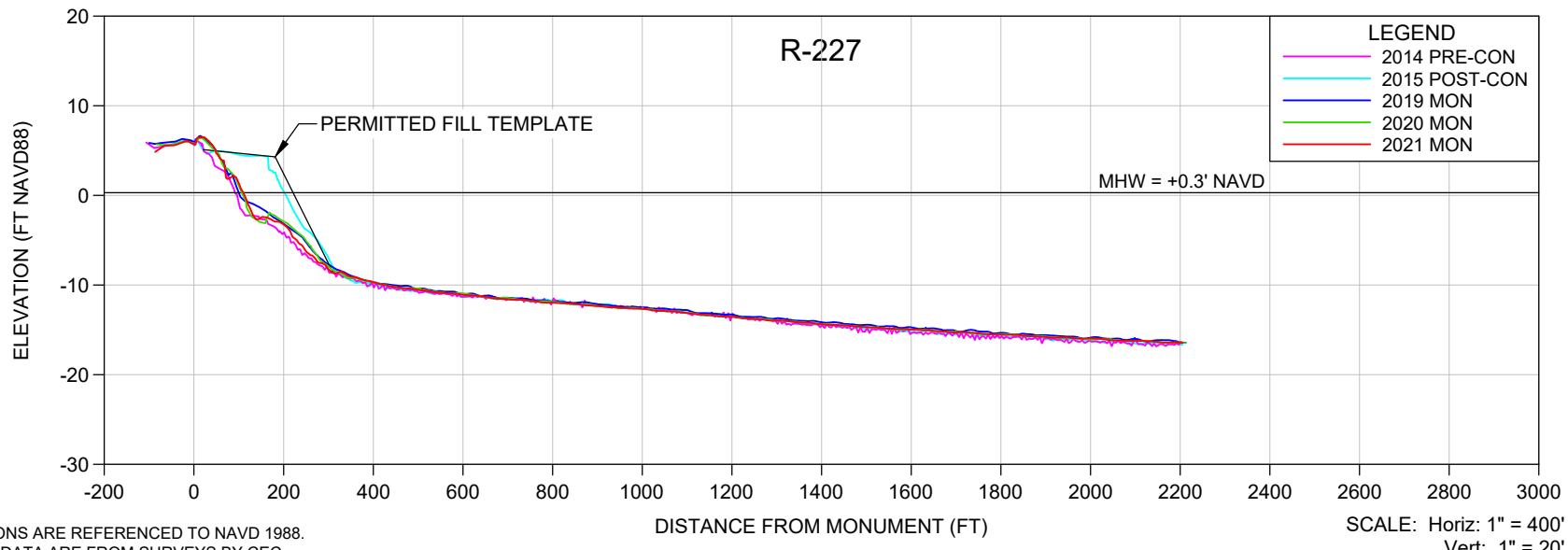
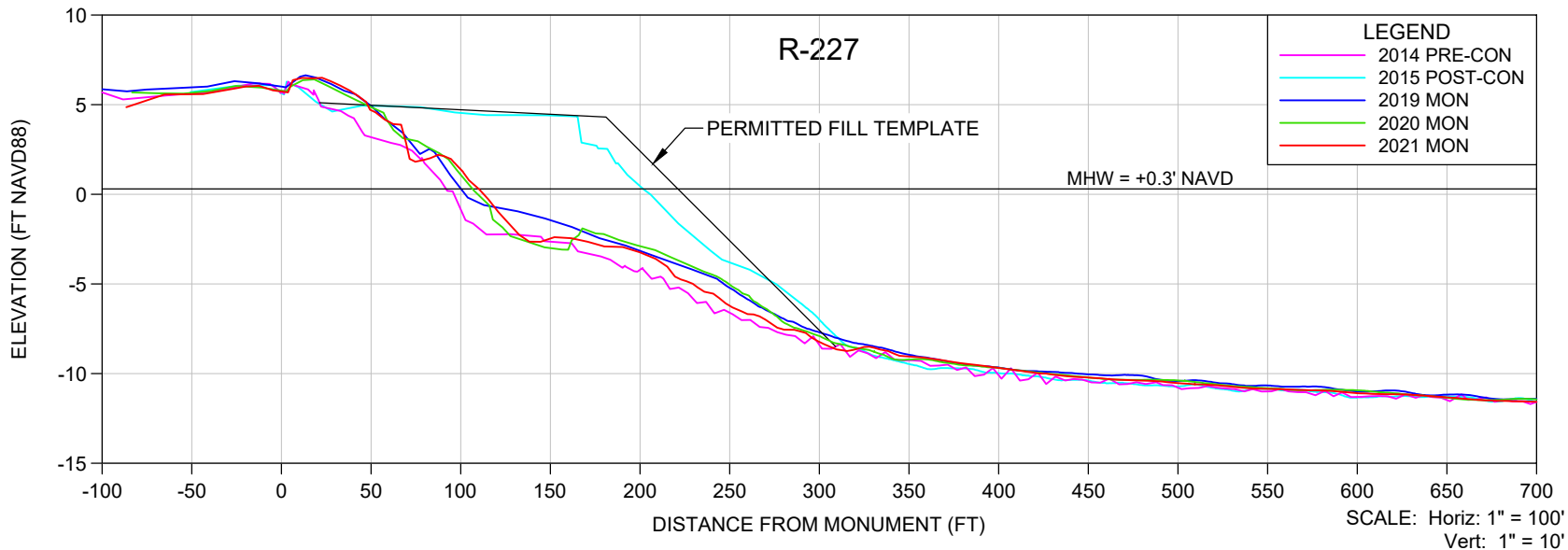
COASTAL & MARINE ENGINEERING
ENVIRONMENTAL & GEOLOGICAL SERVICES
SURVEY & MAPPING
ENGINEERING: CA 2464
SURVEYING: LB 2464
PHONE: (239)643-2324
FAX: (239)643-1143
www.coastalengineering.com
E-Mail: info@ceciff.com

CLIENT: **LEE COUNTY**

TITLE: **BONITA BEACH AND LOVERS KEY
R-226.5 MONITORING SURVEY**

DATE:	6/15/2021	SCALE:	AS SHOWN
DRAWN:	VVA	F.B.	
CHECKED:	MTP	PG.	
SEC.	TWP.	RNG.	
ACAD NO.	21079-Lovers Bonita Mon Profiles.dwg		
REF. NO.	21.079	NO.	DATE

NO.	DATE	BY	REVISION DESCRIPTION



NOTES

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SHEET 31
FILE NO.: 21079-R-227

COASTAL ENGINEERING CONSULTANTS INC.
Serving Florida Since 1977
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BONITA SPRINGS, FLORIDA 34135

COASTAL & MARINE ENGINEERING
ENVIRONMENTAL & GEOLOGICAL SERVICES
SURVEY & MAPPING
ENGINEERING: CA 2464
SURVEYING: LB 2464

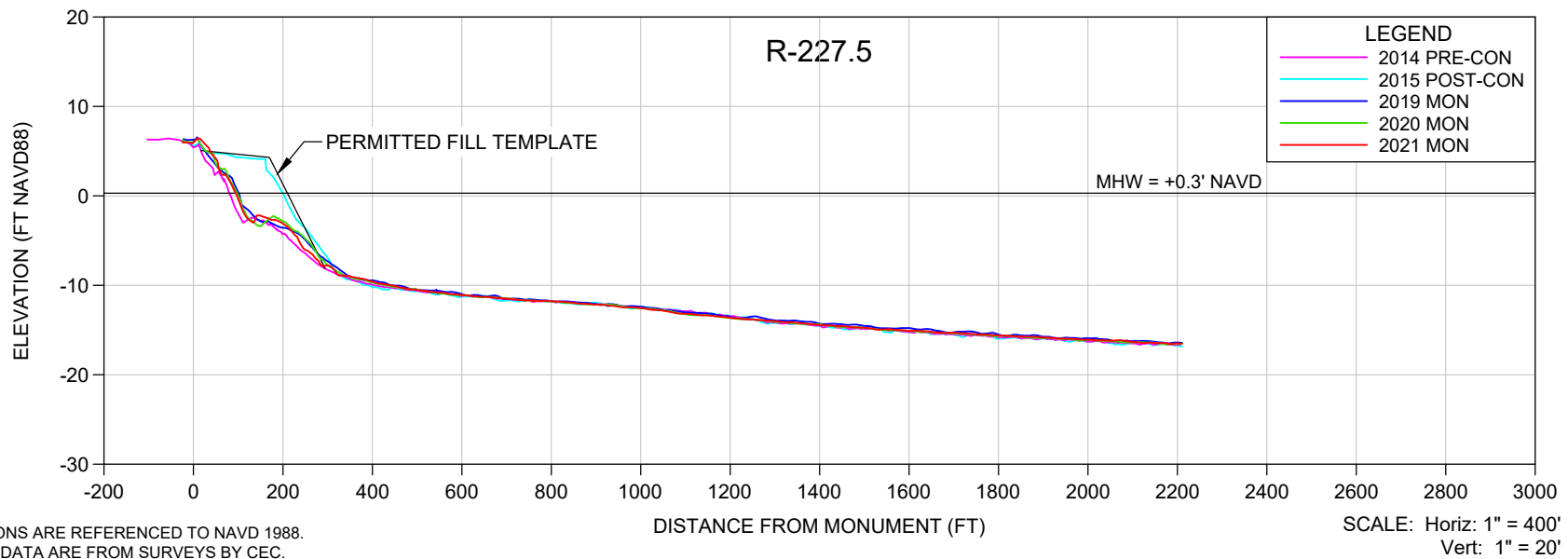
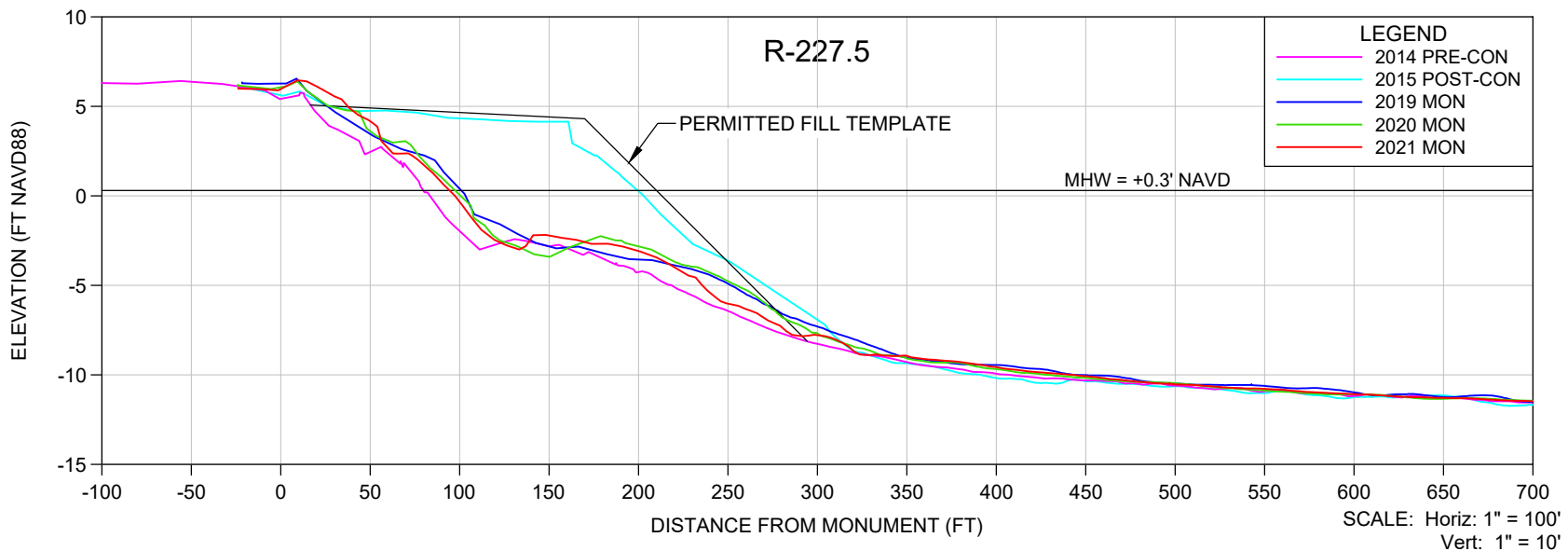
PHONE: (239)643-2324
FAX: (239)643-1143
www.coastalengineering.com
E-Mail: info@ceciff.com

CLIENT: **LEE COUNTY**

TITLE: **BONITA BEACH AND LOVERS KEY
R-227 MONITORING SURVEY**

DATE:	6/15/2021	SCALE:	AS SHOWN
DRAWN:	VVA	F.B.	
CHECKED:	MTP	PG.	
SEC.	TWP.	RNG.	
ACAD NO.	21079-Lovers Bonita Mon Profiles.dwg		
REF. NO.	21.079	NO.	DATE

NO.	DATE	BY	REVISION DESCRIPTION



NOTES

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SHEET 32
FILE NO.: 21079-R-227.5

COASTAL ENGINEERING CONSULTANTS INC.
Serving Florida Since 1977
28421 BONITA CROSSINGS BLVD
BONITA SPRINGS, FLORIDA 34135

COASTAL & MARINE ENGINEERING
ENVIRONMENTAL & GEOLOGICAL SERVICES
SURVEY & MAPPING
ENGINEERING: CA 2464
SURVEYING: LB 2464

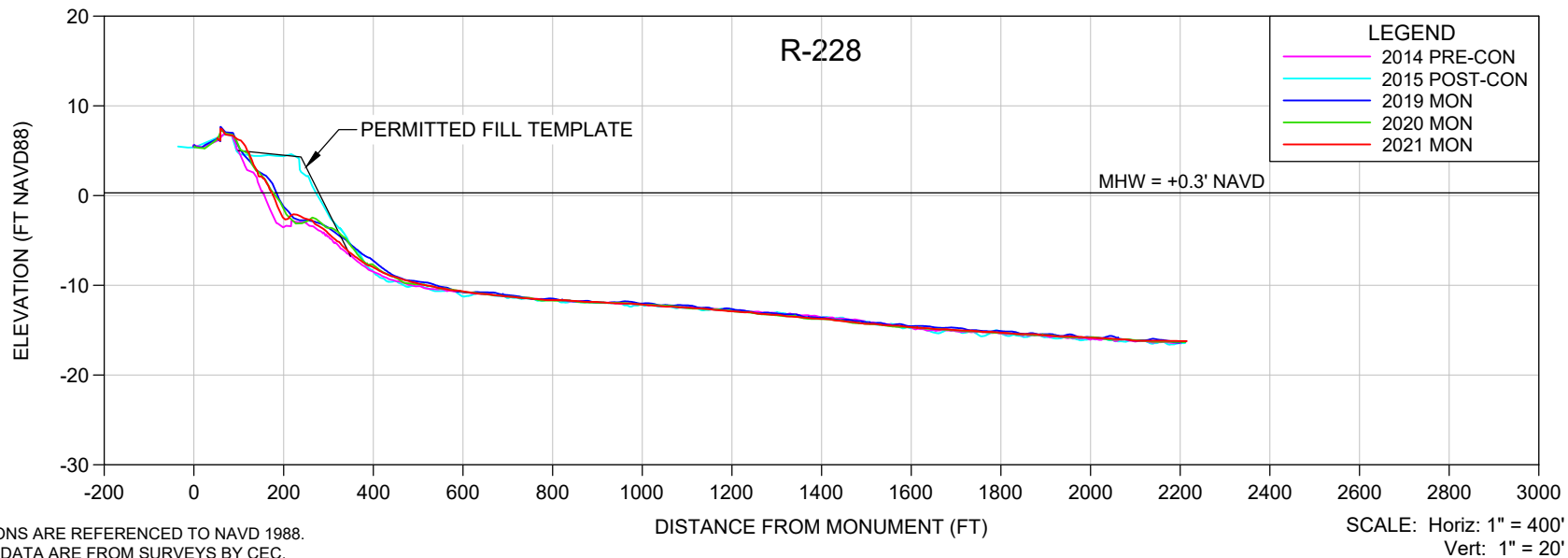
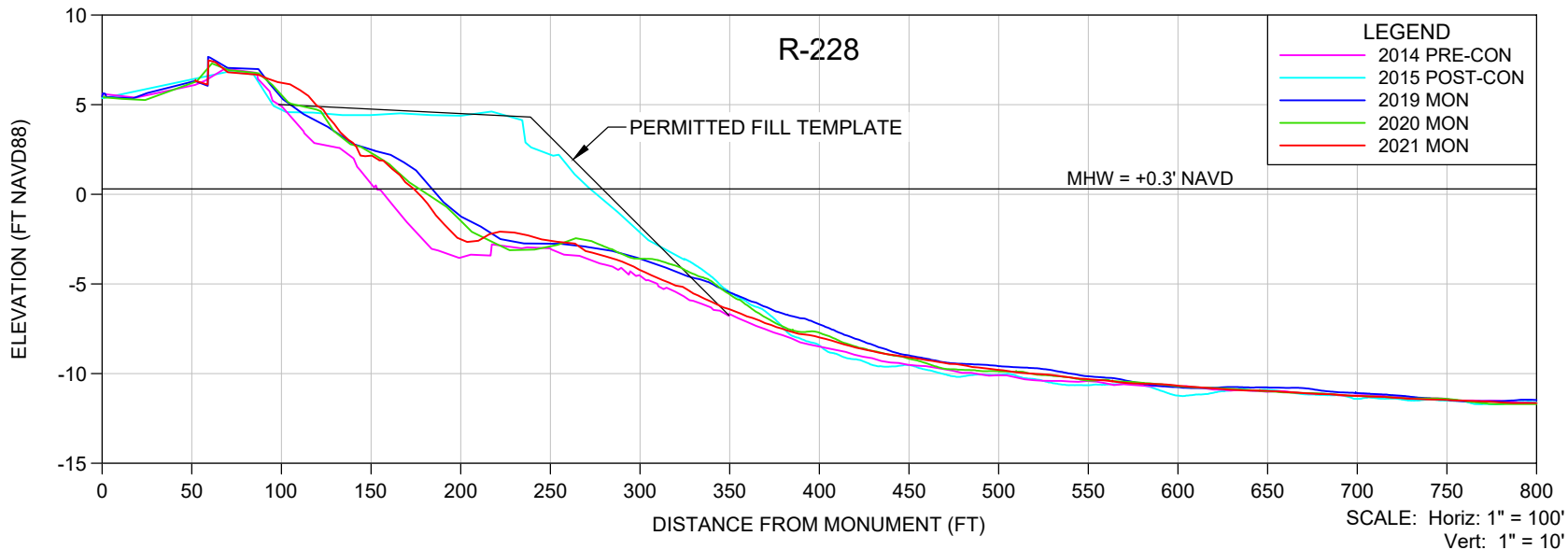
PHONE: (239)643-2324
FAX: (239)643-1143
www.coastalengineering.com
E-Mail: info@ceciff.com

CLIENT: **LEE COUNTY**

TITLE: **BONITA BEACH AND LOVERS KEY
R-227.5 MONITORING SURVEY**

DATE:	6/15/2021	SCALE:	AS SHOWN
DRAWN:	VVA	F.B.	
CHECKED:	MTP	PG.	
SEC.	TWP.	RNG.	
ACAD NO.	21079-Lovers Bonita Mon Profiles.dwg		
REF. NO.	21.079	NO.	DATE

NO.	DATE	BY	REVISION DESCRIPTION



NOTES

- ELEVATIONS ARE REFERENCED TO NAVD 1988.
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SHEET 33
FILE NO.: 21079-R-228

COASTAL ENGINEERING CONSULTANTS INC.
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28421 BONITA CROSSINGS BLVD
BONITA SPRINGS, FLORIDA 34135

COASTAL & MARINE ENGINEERING
ENVIRONMENTAL & GEOLOGICAL SERVICES
SURVEY & MAPPING
ENGINEERING: CA 2464
SURVEYING: LB 2464

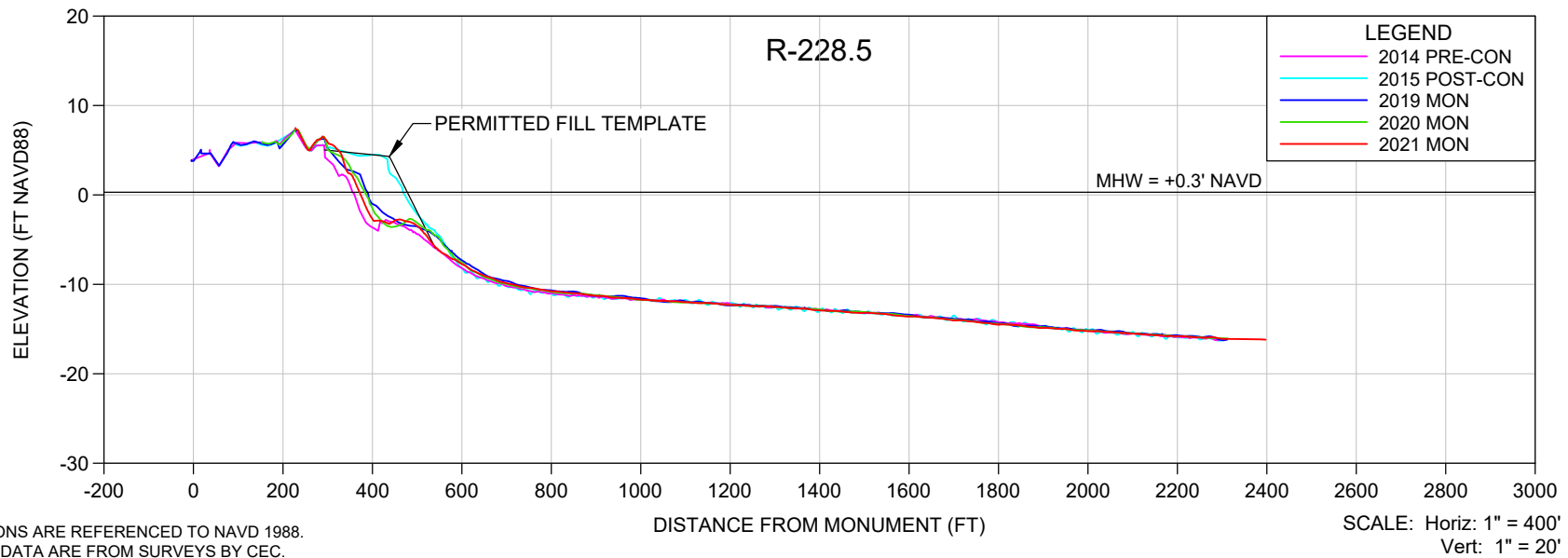
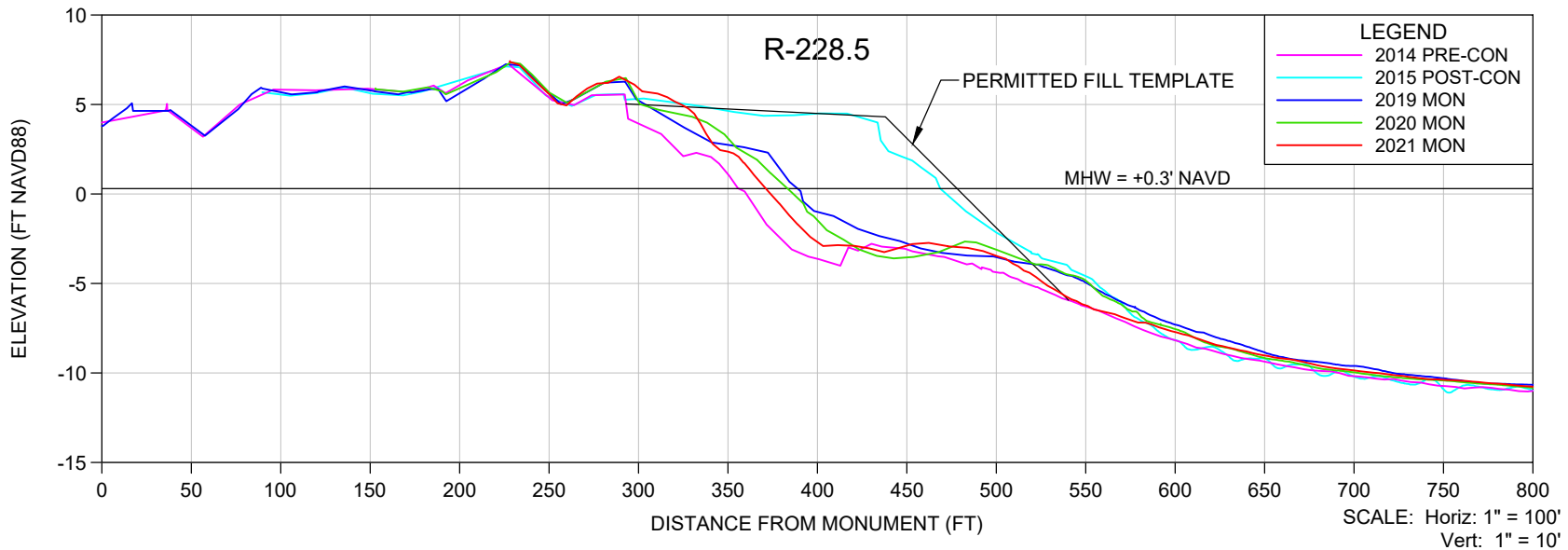
PHONE: (239)643-2324
FAX: (239)643-1143
www.coastalengineering.com
E-Mail: info@ceciff.com

CLIENT: **LEE COUNTY**

TITLE: **BONITA BEACH AND LOVERS KEY
R-228 MONITORING SURVEY**

DATE:	6/15/2021	SCALE:	AS SHOWN
DRAWN:	VVA	F.B.	
CHECKED:	MTP	PG.	
SEC.	TWP.	RNG.	
ACAD NO.	21079-Lovers Bonita Mon Profiles.dwg		
REF. NO.	21.079	NO.	DATE

NO.	DATE	BY	REVISION DESCRIPTION



NOTES

- ELEVATIONS ARE REFERENCED TO NAVD 1988.
- PROFILE DATA ARE FROM SURVEYS BY CEC.
- UPLAND DATA GAPS IN HISTORICAL PROFILES REFLECT SHOREBIRD NESTING AREAS, UNLESS OTHERWISE NOTED.

SHEET 34
FILE NO.: 21079-R-228.5

COASTAL ENGINEERING CONSULTANTS INC.
Serving Florida Since 1977
28421 BONITA CROSSINGS BLVD
BONITA SPRINGS, FLORIDA 34135

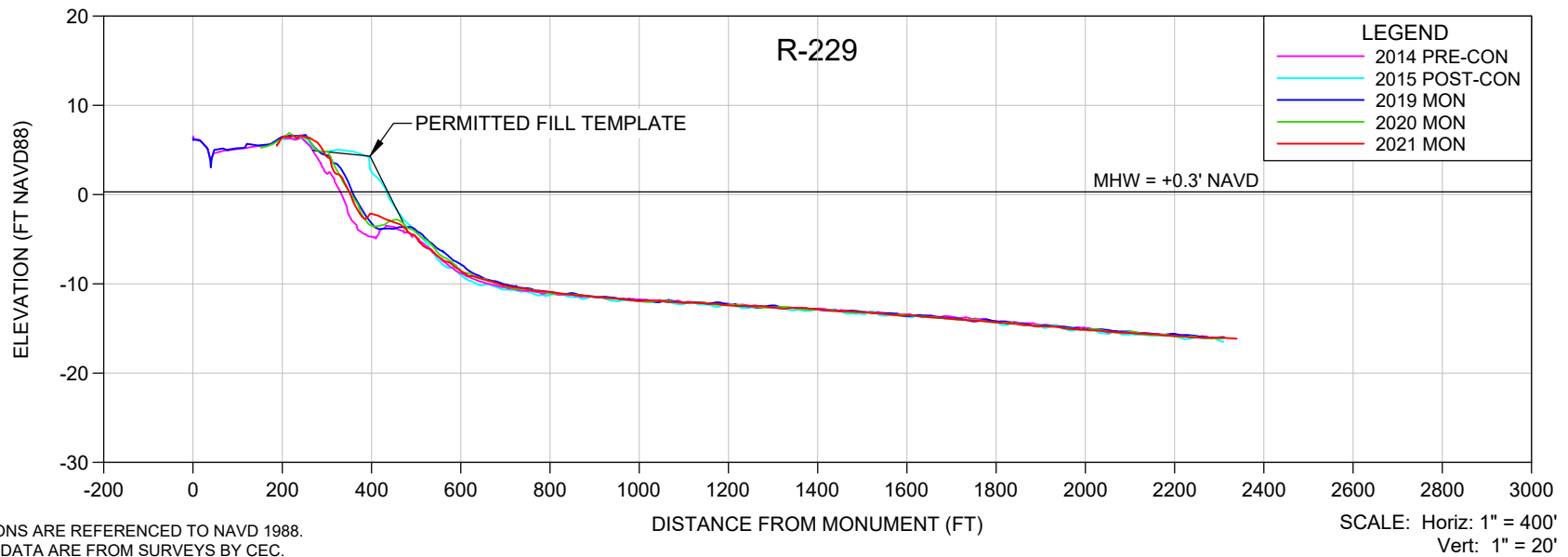
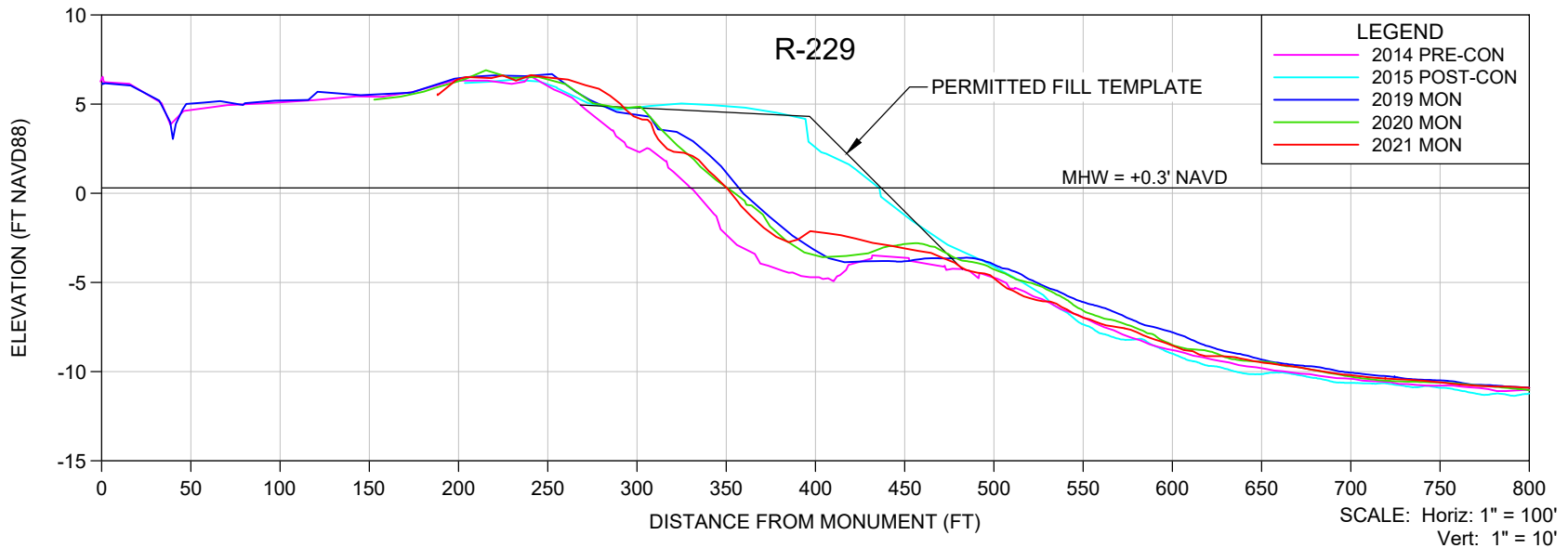
COASTAL & MARINE ENGINEERING
ENVIRONMENTAL & GEOLOGICAL SERVICES
SURVEY & MAPPING
ENGINEERING: CA 2464
SURVEYING: LB 2464
PHONE: (239)643-2324
FAX: (239)643-1143
www.coastalengineering.com
E-Mail: info@ceciff.com

CLIENT: **LEE COUNTY**

TITLE: **BONITA BEACH AND LOVERS KEY
R-228.5 MONITORING SURVEY**

DATE:	6/15/2021	SCALE:	AS SHOWN
DRAWN:	VVA	F.B.	
CHECKED:	MTP	PG.	
SEC.	TWP.	RNG.	
ACAD NO:	21079-Lovers Bonita Mon Profiles.dwg		
REF. NO.	21.079	NO.	DATE

NO.	DATE	BY	REVISION DESCRIPTION



NOTES

- ELEVATIONS ARE REFERENCED TO NAVD 1988.
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SHEET 35
FILE NO.: 21079-R-229

COASTAL ENGINEERING CONSULTANTS INC.
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28421 BONITA CROSSINGS BLVD
BONITA SPRINGS, FLORIDA 34135

COASTAL & MARINE ENGINEERING
ENVIRONMENTAL & GEOLOGICAL SERVICES
SURVEY & MAPPING
ENGINEERING: CA 2464
SURVEYING: LB 2464

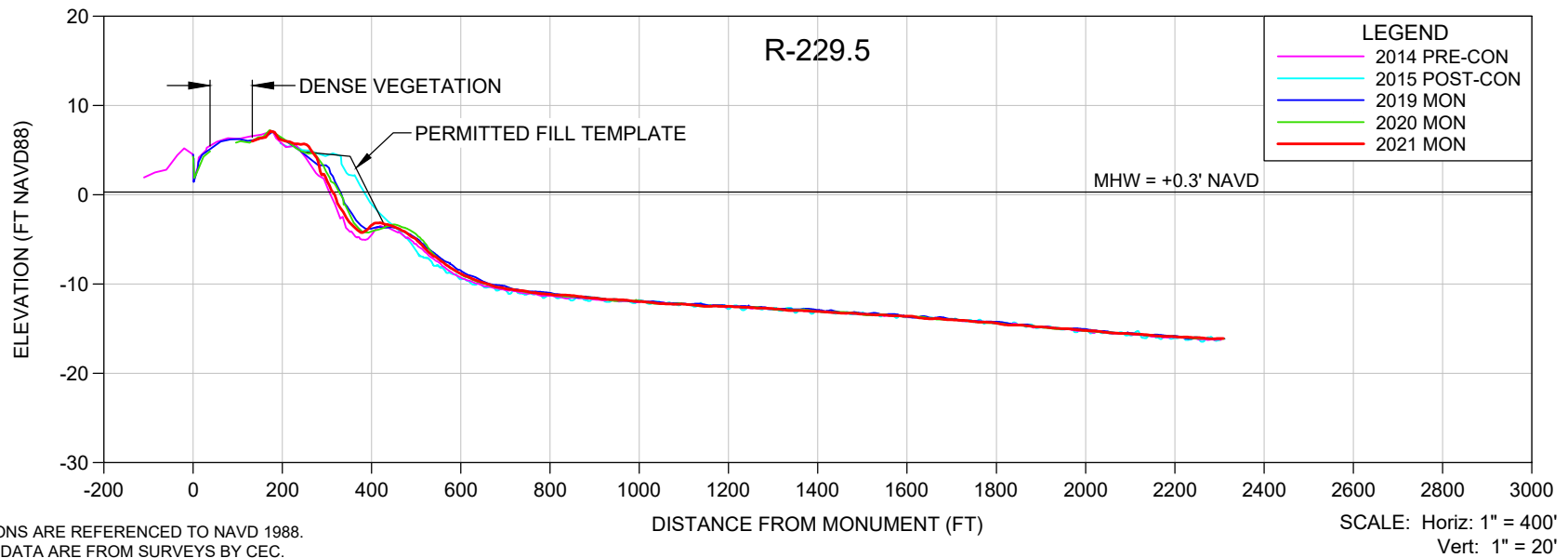
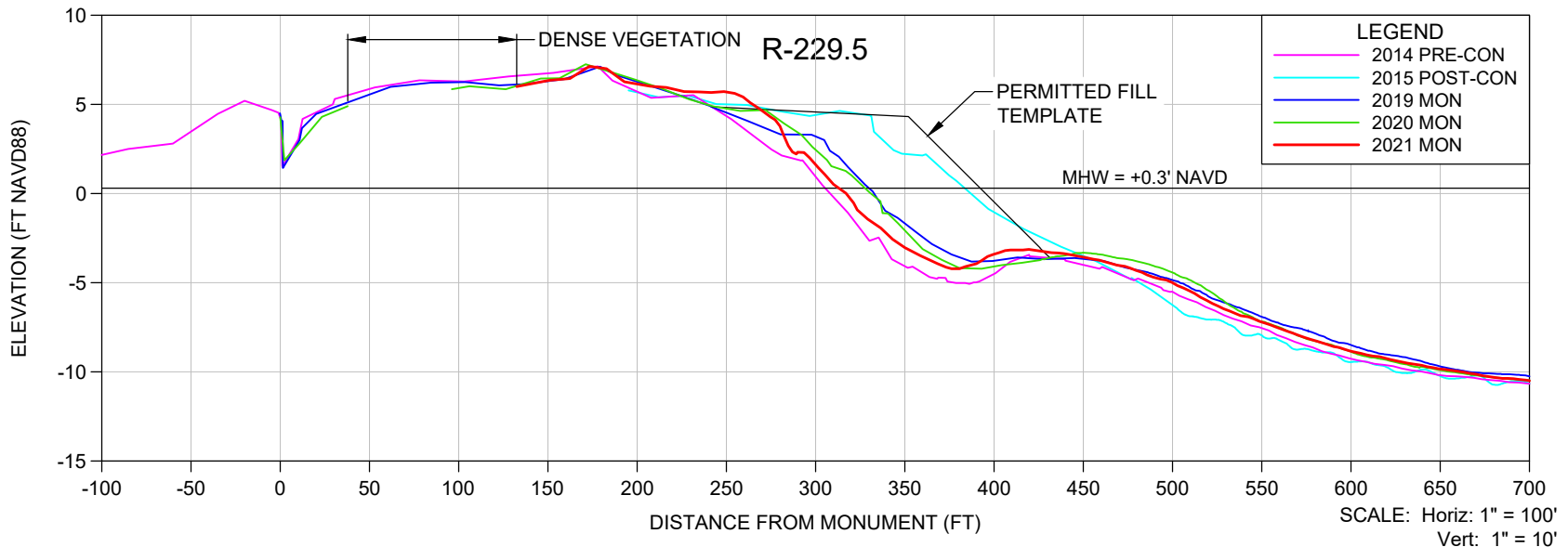
PHONE: (239)643-2324
FAX: (239)643-1143
www.coastalengineering.com
E-Mail: info@cecif.com

CLIENT: **LEE COUNTY**

TITLE: **BONITA BEACH AND LOVERS KEY
R-229 MONITORING SURVEY**

DATE:	6/15/2021	SCALE:	AS SHOWN
DRAWN:	VVA	F.B.	
CHECKED:	MTP	PG.	
SEC.	TWP.	RNG.	
ACAD NO.	21079-Lovers Bonita Mon Profiles.dwg		
REF. NO.	21.079	NO.	DATE

NO.	DATE	BY	REVISION DESCRIPTION



NOTES

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SHEET 36
FILE NO.: 21079-R-229.5

COASTAL ENGINEERING CONSULTANTS INC.
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28421 BONITA CROSSINGS BLVD
BONITA SPRINGS, FLORIDA 34135

COASTAL & MARINE ENGINEERING
ENVIRONMENTAL & GEOLOGICAL SERVICES
SURVEY & MAPPING
ENGINEERING: CA 2464
SURVEYING: LB 2464

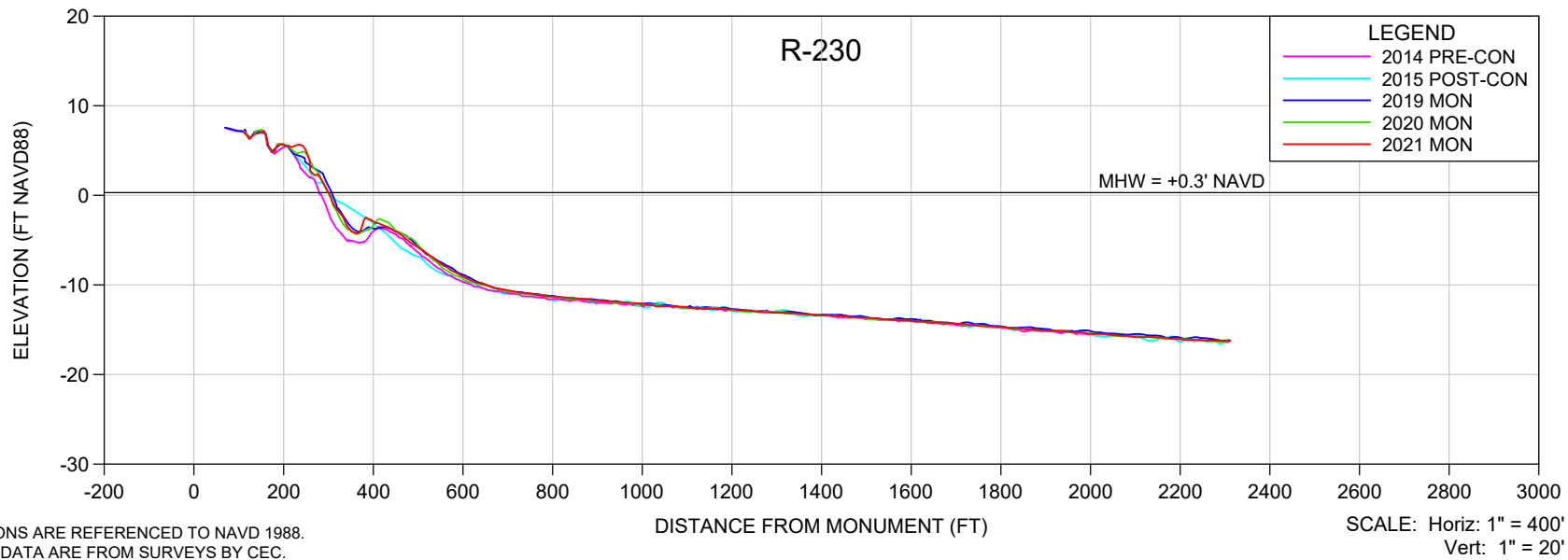
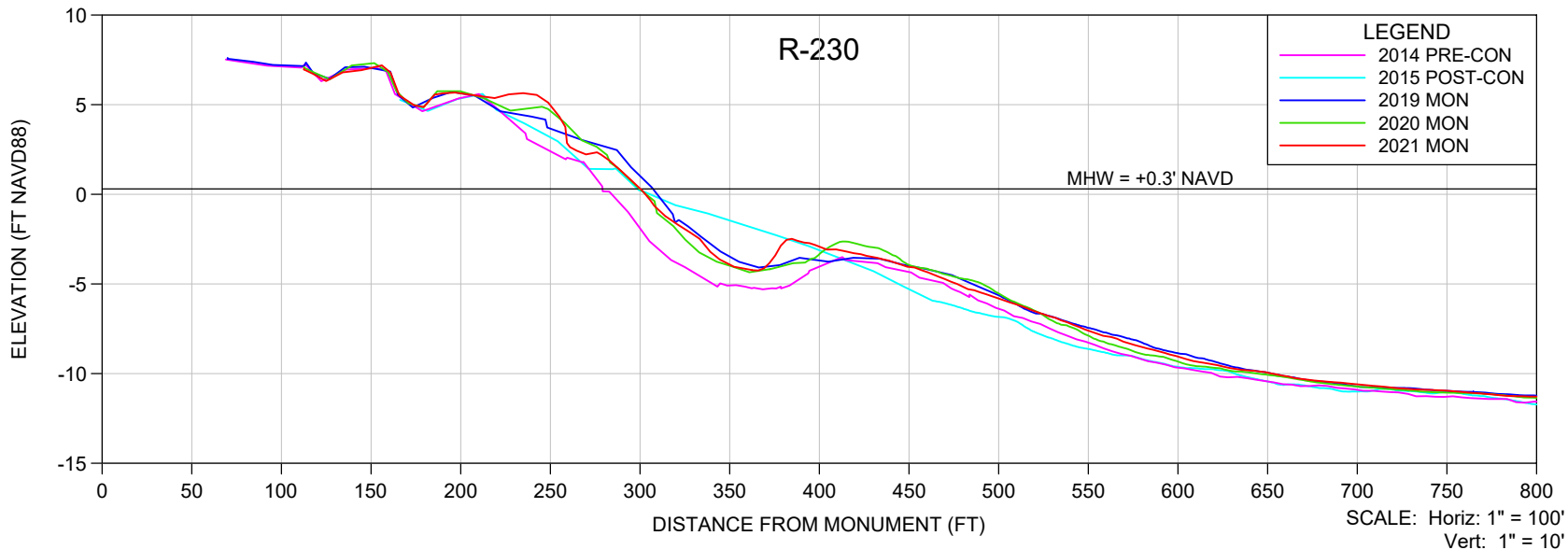
PHONE: (239)643-2324
FAX: (239)643-1143
www.coastalengineering.com
E-Mail: info@ceciff.com

CLIENT: **LEE COUNTY**

TITLE: **BONITA BEACH AND LOVERS KEY
R-229.5 MONITORING SURVEY**

DATE:	6/15/2021	SCALE:	AS SHOWN
DRAWN:	VVA	F.B.	
CHECKED:	MTP	PG.	
SEC.	TWP.	RNG.	
ACAD NO:	21079-Lovers Bonita Mon Profiles.dwg		
REF. NO.	21.079	NO.	DATE

NO.	DATE	BY	REVISION DESCRIPTION



NOTES

- ELEVATIONS ARE REFERENCED TO NAVD 1988.
- PROFILE DATA ARE FROM SURVEYS BY CEC.
- UPLAND DATA GAPS IN HISTORICAL PROFILES REFLECT SHOREBIRD NESTING AREAS, UNLESS OTHERWISE NOTED.

SHEET 37
FILE NO.: 21079-R-230

COASTAL ENGINEERING CONSULTANTS INC.
Serving Florida Since 1977
28421 BONITA CROSSINGS BLVD
BONITA SPRINGS, FLORIDA 34135

COASTAL & MARINE ENGINEERING
ENVIRONMENTAL & GEOLOGICAL SERVICES
SURVEY & MAPPING
ENGINEERING: CA 2464
SURVEYING: LB 2464

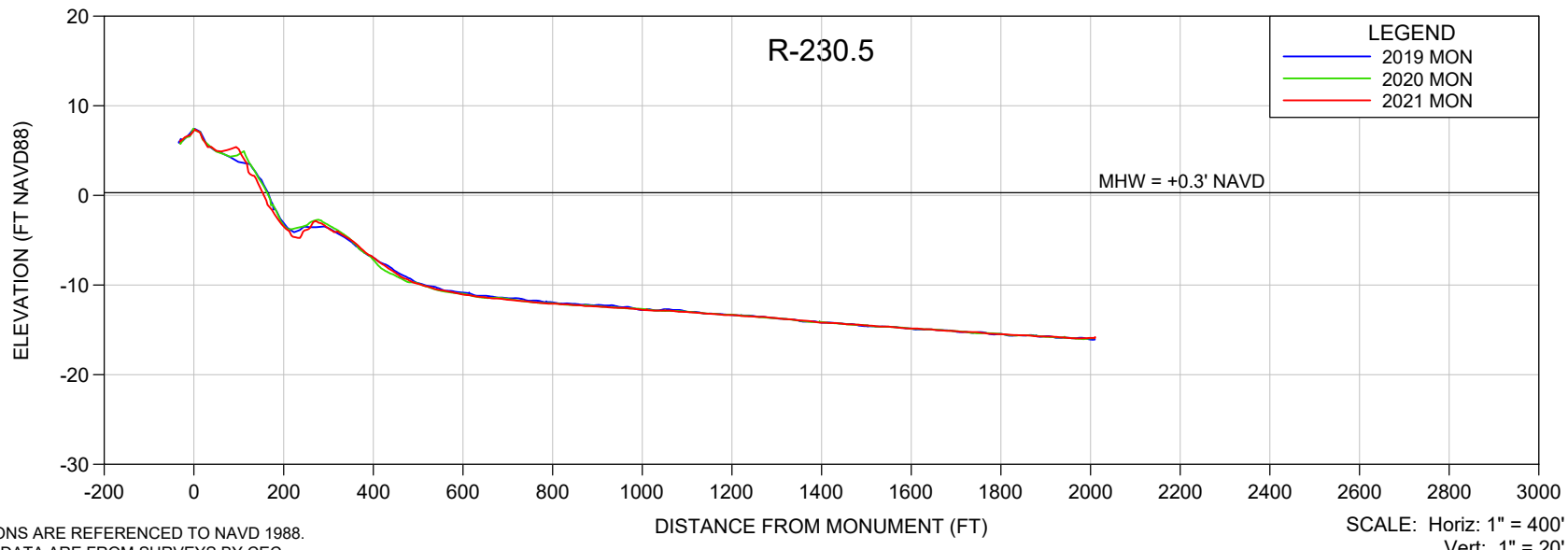
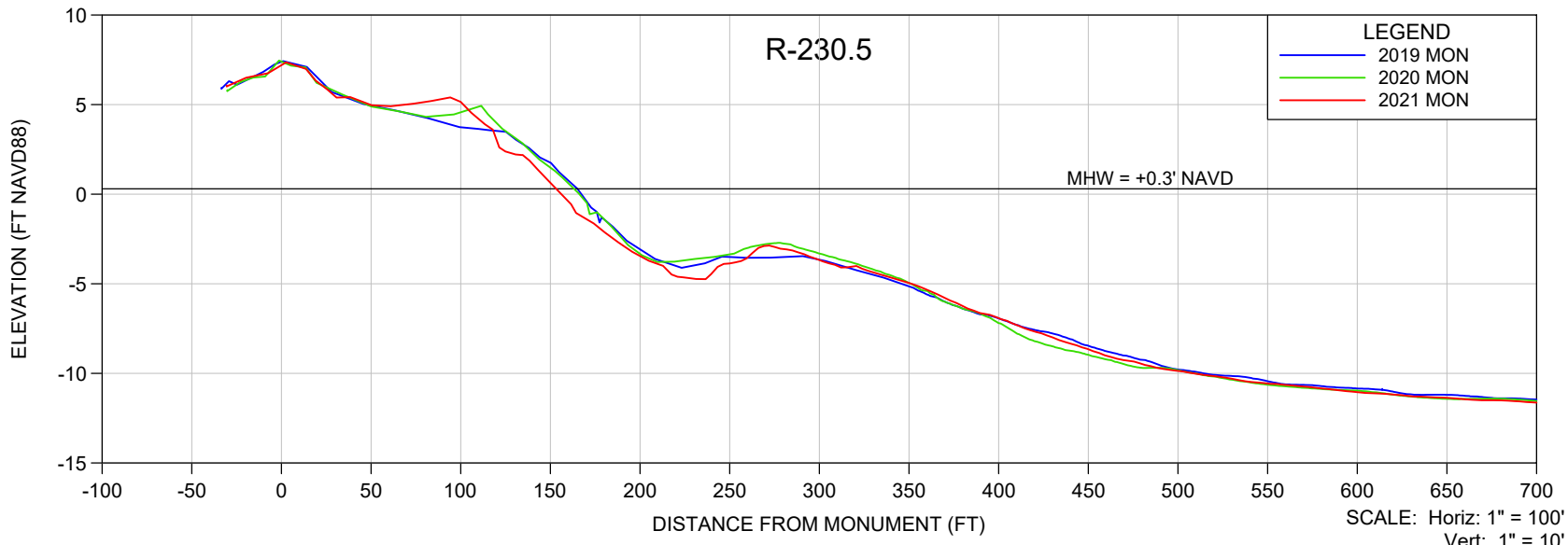
PHONE: (239)643-2324
FAX: (239)643-1143
www.coastalengineering.com
E-Mail: info@ceciff.com

CLIENT: **LEE COUNTY**

TITLE: **BONITA BEACH AND LOVERS KEY
R-230 MONITORING SURVEY**

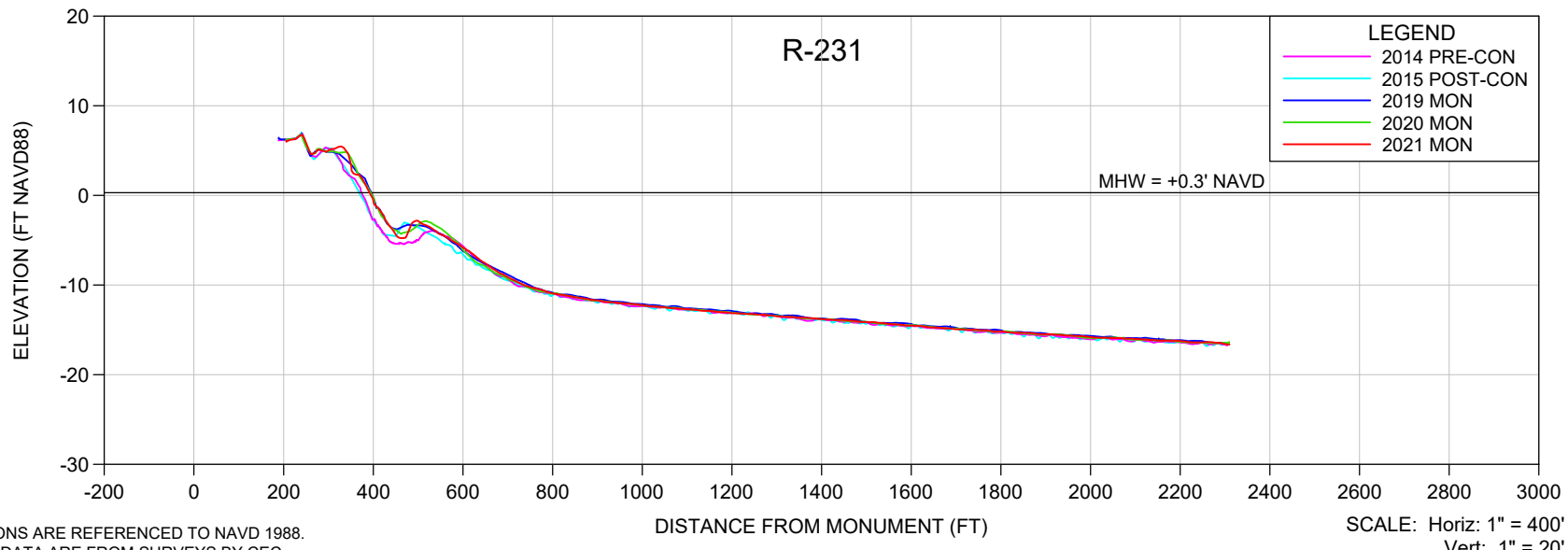
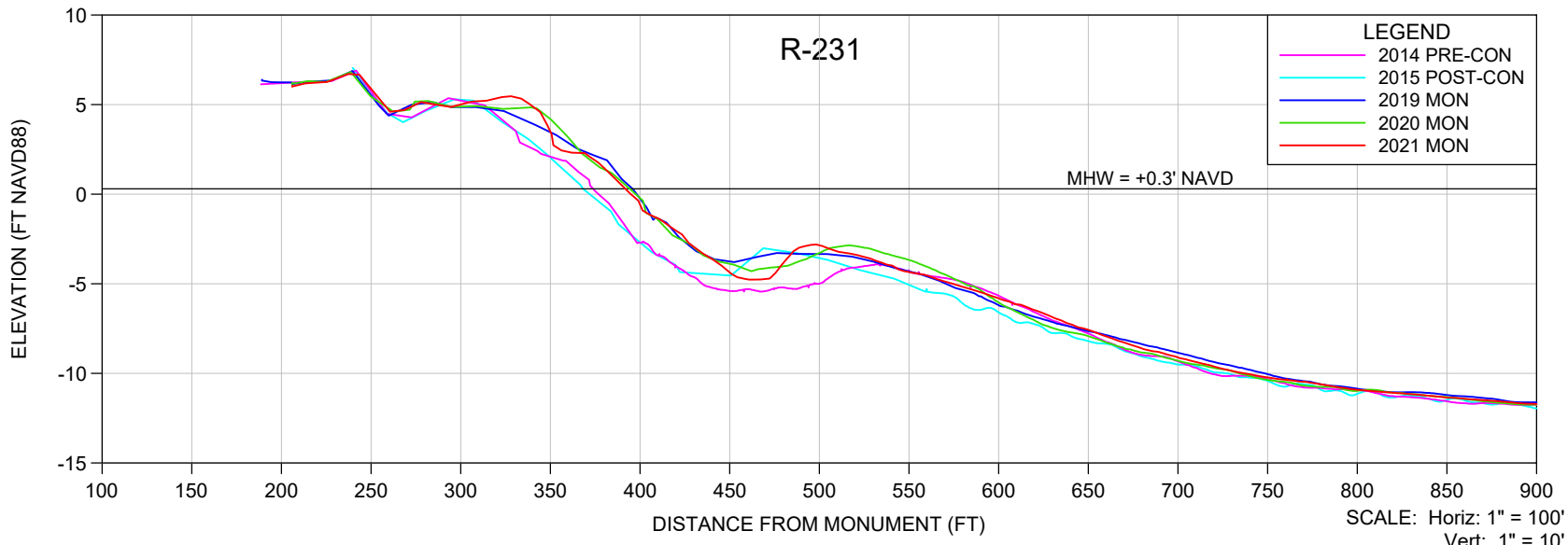
DATE:	6/15/2021	SCALE:	AS SHOWN
DRAWN:	VVA	F.B.	
CHECKED:	MTP	PG.	
SEC.	TWP.	RNG.	
ACAD NO.	21079-Lovers Bonita Mon Profiles.dwg		
REF. NO.	21.079	NO.	DATE

NO.	DATE	BY	REVISION DESCRIPTION



- NOTES**
- ELEVATIONS ARE REFERENCED TO NAVD 1988.
 - PROFILE DATA ARE FROM SURVEYS BY CEC.
 - UPLAND DATA GAPS IN HISTORICAL PROFILES REFLECT SHOREBIRD NESTING AREAS, UNLESS OTHERWISE NOTED.

SHEET 38 FILE NO.: 21079-R-230.5	<p>COASTAL ENGINEERING CONSULTANTS INC. Serving Florida Since 1977 28421 BONITA CROSSINGS BLVD BONITA SPRINGS, FLORIDA 34135</p>	COASTAL & MARINE ENGINEERING ENVIRONMENTAL & GEOLOGICAL SERVICES SURVEY & MAPPING ENGINEERING: CA 2464 SURVEYING: LB 2464	CLIENT:	LEE COUNTY		DATE:	6/15/2021	SCALE:	AS SHOWN						
			TITLE:	BONITA BEACH AND LOVERS KEY R-230.5 MONITORING SURVEY		DRAWN:	VVA	F.B.							
			PHONE: (239)643-2324 FAX: (239)643-1143 www.coastalengineering.com E-Mail: info@ceciff.com			CHECKED:	MTP	PG.							
						SEC.	TWP.	RNG.							
				ACAD NO:	21079-Lovers Bonita Mon Profiles.dwg										
				REF. NO.	21.079										
										NO.	DATE	BY	REVISION DESCRIPTION		



NOTES

1. ELEVATIONS ARE REFERENCED TO NAVD 1988.
2. PROFILE DATA ARE FROM SURVEYS BY CEC.
3. UPLAND DATA GAPS IN HISTORICAL PROFILES REFLECT SHOREBIRD NESTING AREAS, UNLESS OTHERWISE NOTED.

SHEET 39
FILE NO.: 21079-R-231

COASTAL ENGINEERING CONSULTANTS INC.
Serving Florida Since 1977
28421 BONITA CROSSINGS BLVD
BONITA SPRINGS, FLORIDA 34135

COASTAL & MARINE ENGINEERING
ENVIRONMENTAL & GEOLOGICAL SERVICES
SURVEY & MAPPING
ENGINEERING: CA 2464
SURVEYING: LB 2464

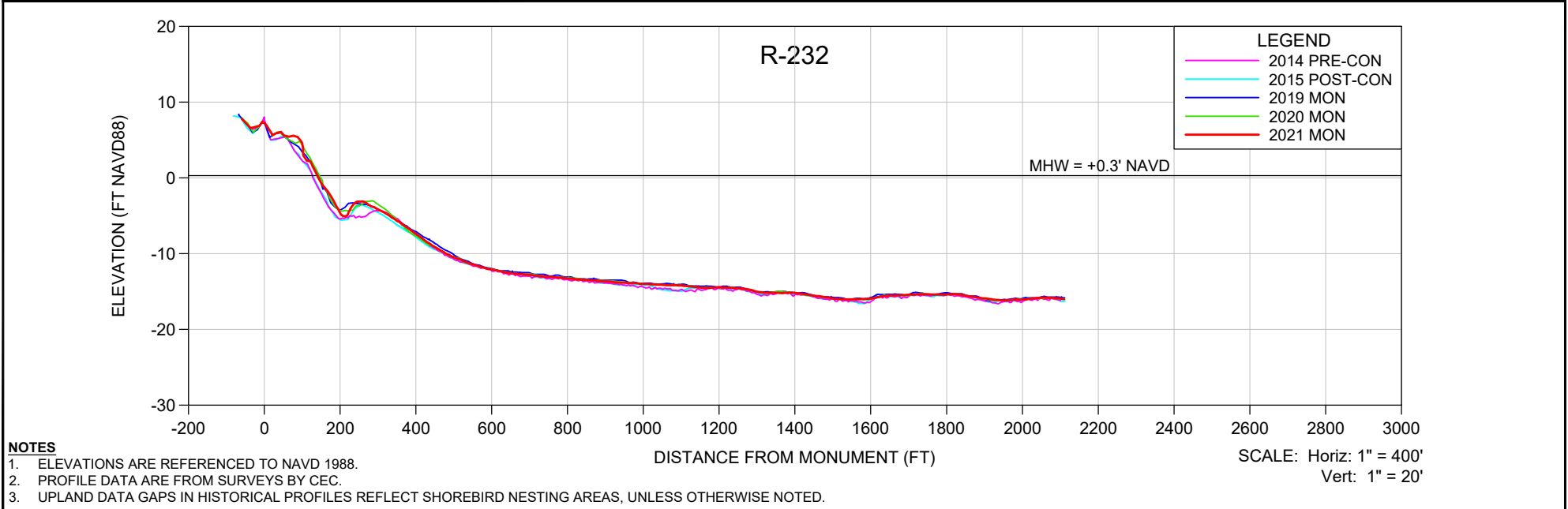
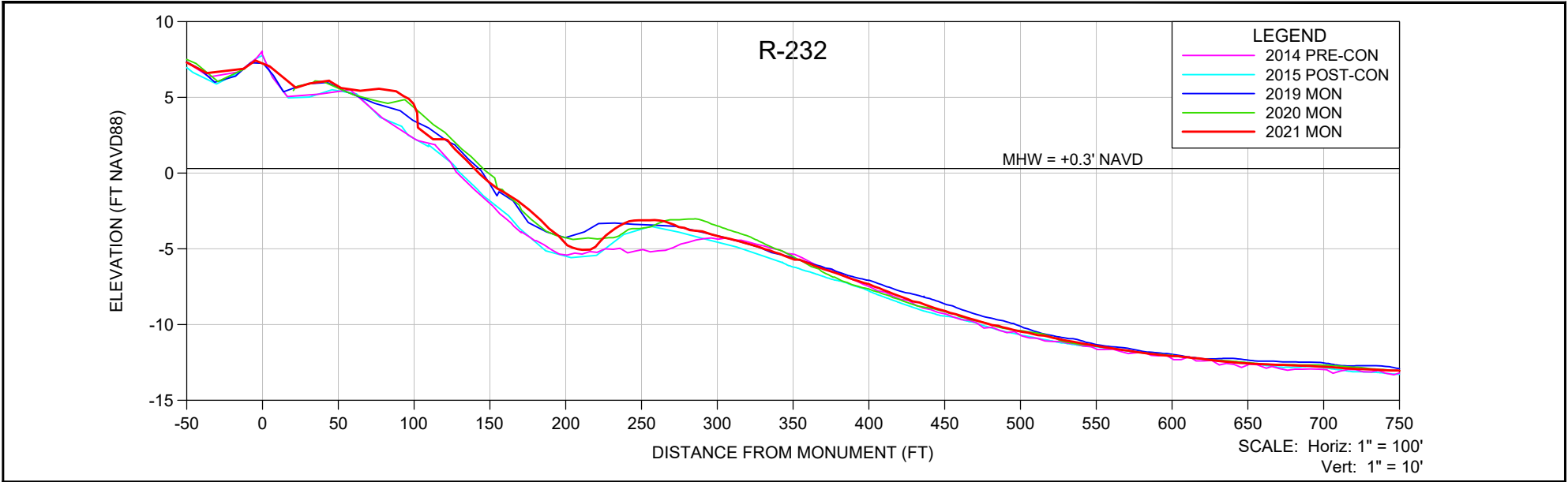
PHONE: (239)643-2324
FAX: (239)643-1143
www.coastalengineering.com
E-Mail: info@ceciff.com

CLIENT: **LEE COUNTY**

TITLE: **BONITA BEACH AND LOVERS KEY
R-231 MONITORING SURVEY**

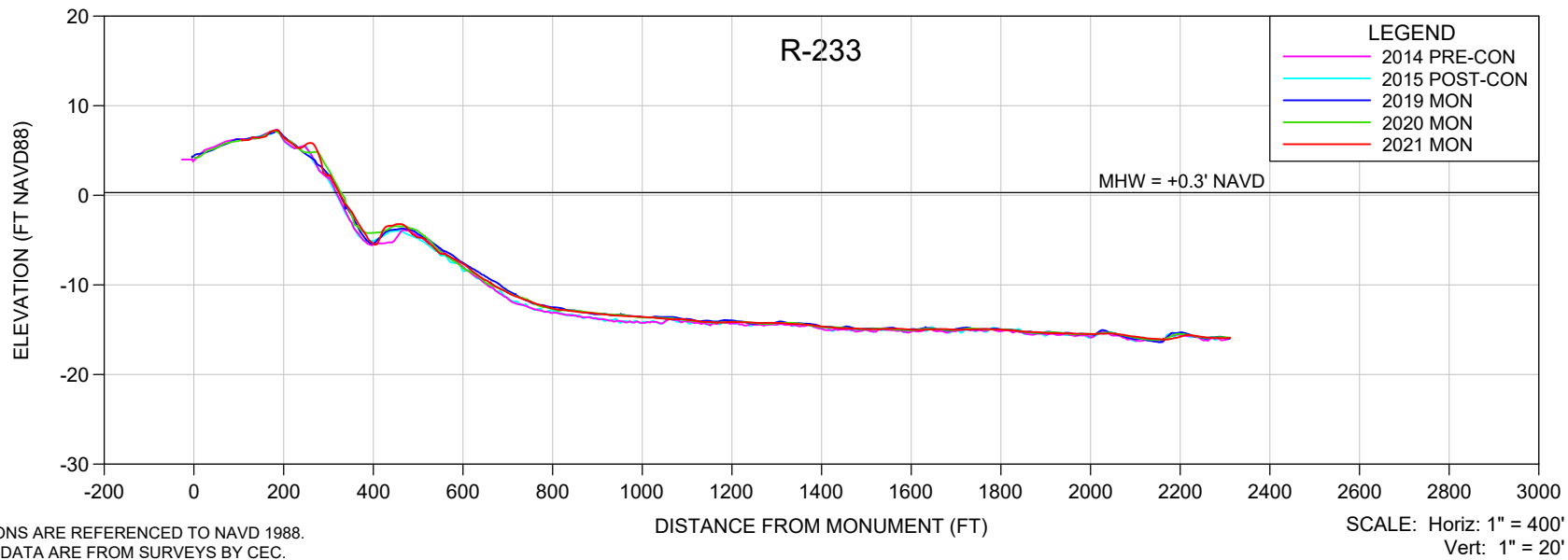
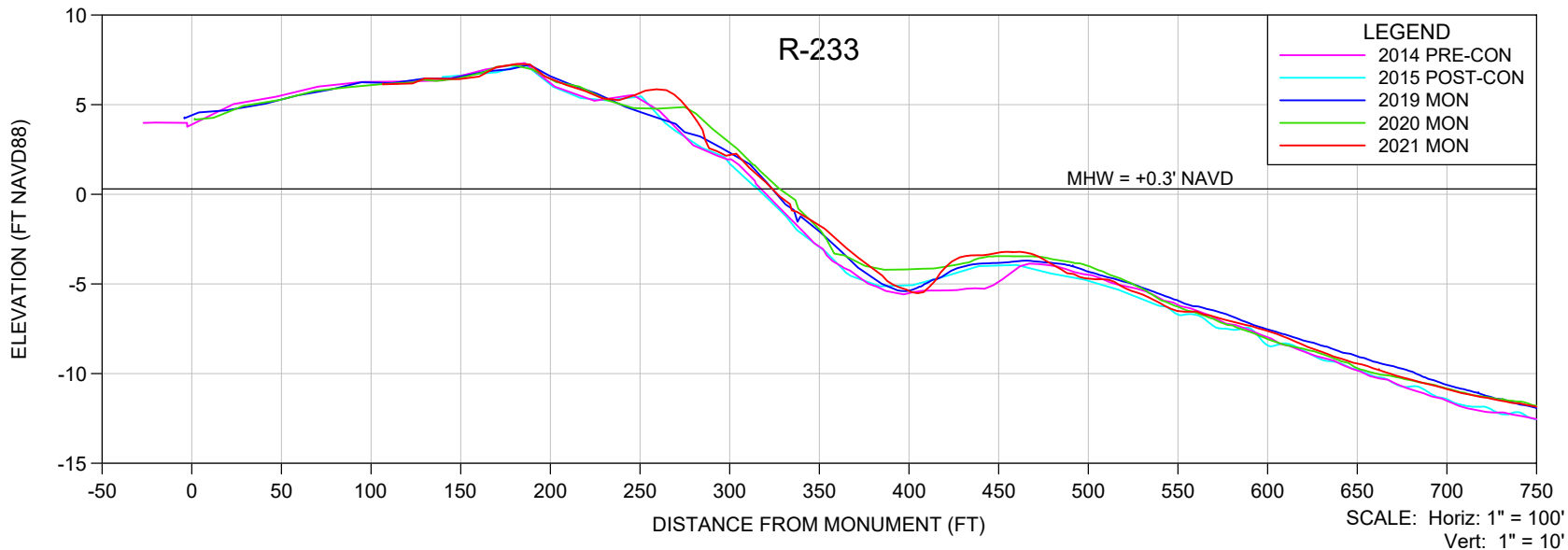
DATE:	6/15/2021	SCALE:	AS SHOWN
DRAWN:	VVA	F.B.	
CHECKED:	MTP	PG.	
SEC.	TWP.	RNG.	
ACAD NO.	21079-Lovers Bonita Mon Profiles.dwg		
REF. NO.	21.079	NO.	DATE

NO.	DATE	BY	REVISION DESCRIPTION



- NOTES**
- ELEVATIONS ARE REFERENCED TO NAVD 1988.
 - PROFILE DATA ARE FROM SURVEYS BY CEC.
 - UPLAND DATA GAPS IN HISTORICAL PROFILES REFLECT SHOREBIRD NESTING AREAS, UNLESS OTHERWISE NOTED.

SHEET 40 FILE NO.: 21079-R-232	<p>COASTAL ENGINEERING CONSULTANTS INC. Serving Florida Since 1977 28421 BONITA CROSSINGS BLVD BONITA SPRINGS, FLORIDA 34135</p>	<p>COASTAL & MARINE ENGINEERING ENVIRONMENTAL & GEOLOGICAL SERVICES SURVEY & MAPPING ENGINEERING: CA 2464 SURVEYING: LB 2464</p> <p>PHONE: (239)643-2324 FAX: (239)643-1143 www.coastalengineering.com E-Mail: info@ceciff.com</p>	CLIENT:	LEE COUNTY		DATE:	6/15/2021	SCALE:	AS SHOWN							
			TITLE:	BONITA BEACH AND LOVERS KEY R-232 MONITORING SURVEY		DRAWN:	VVA	F.B.								
					CHECKED:	MTP	PG.									
					SEC.	TWP.	RNG.									
		ACAD NO:	21079-Lovers Bonita Mon Profiles.dwg		REF. NO.	21.079		NO.	DATE	BY	REVISION DESCRIPTION					



NOTES

- ELEVATIONS ARE REFERENCED TO NAVD 1988.
- PROFILE DATA ARE FROM SURVEYS BY CEC.
- UPLAND DATA GAPS IN HISTORICAL PROFILES REFLECT SHOREBIRD NESTING AREAS, UNLESS OTHERWISE NOTED.

SHEET 41
FILE NO.: 21079-R-233

COASTAL ENGINEERING CONSULTANTS INC.
Serving Florida Since 1977
28421 BONITA CROSSINGS BLVD
BONITA SPRINGS, FLORIDA 34135

COASTAL & MARINE ENGINEERING
ENVIRONMENTAL & GEOLOGICAL SERVICES
SURVEY & MAPPING
ENGINEERING: CA 2464
SURVEYING: LB 2464

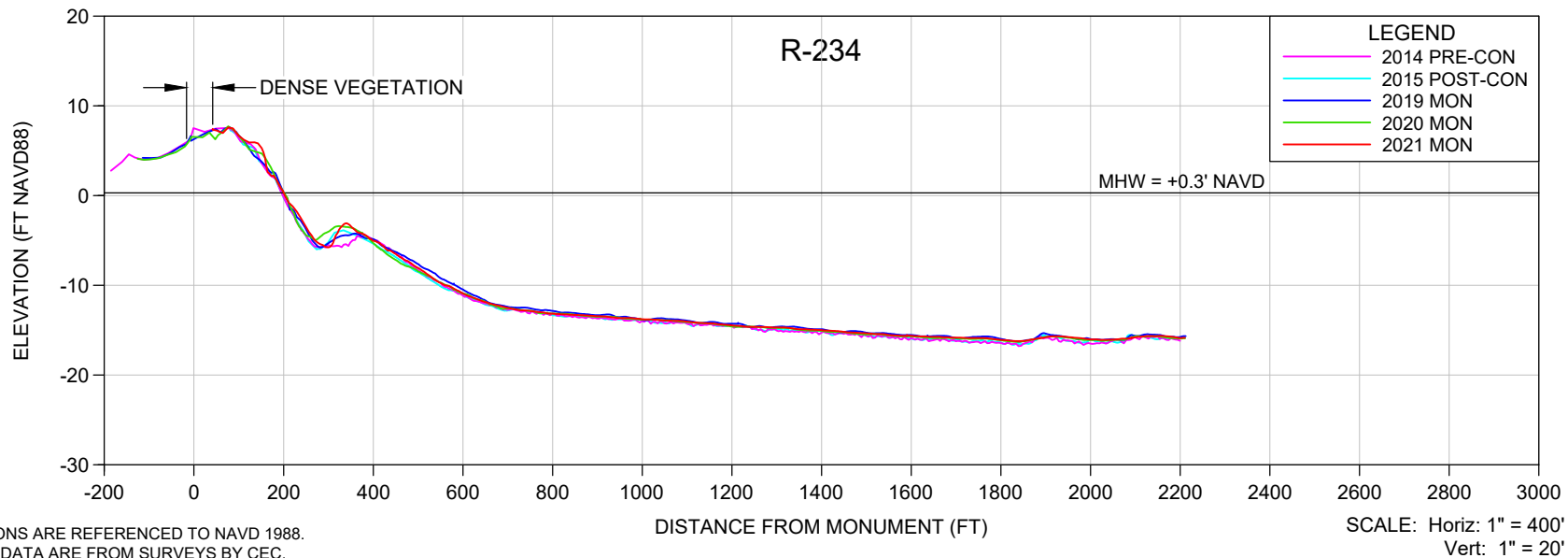
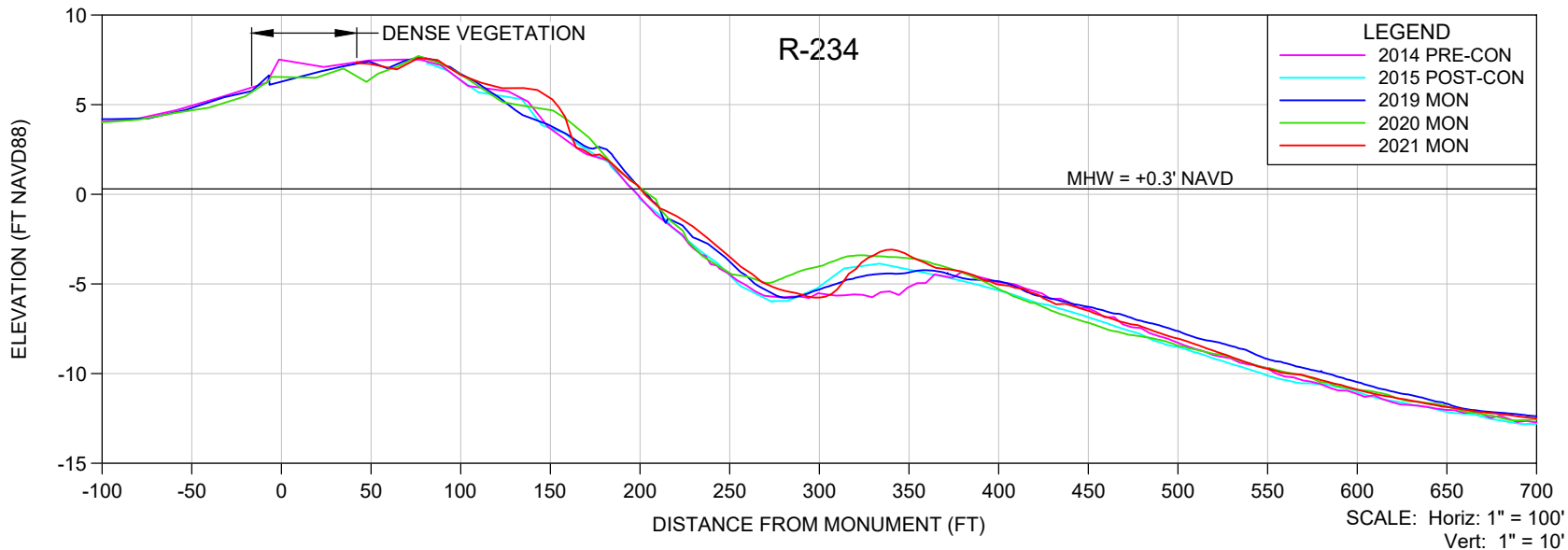
PHONE: (239)643-2324
FAX: (239)643-1143
www.coastalengineering.com
E-Mail: info@ceciff.com

CLIENT: **LEE COUNTY**

TITLE: **BONITA BEACH AND LOVERS KEY
R-233 MONITORING SURVEY**

DATE:	6/15/2021	SCALE:	AS SHOWN
DRAWN:	VVA	F.B.	
CHECKED:	MTP	PG.	
SEC.	TWP.	RNG.	
ACAD NO.	21079-Lovers Bonita Mon Profiles.dwg		
REF. NO.	21.079	NO.	DATE

NO.	DATE	BY	REVISION DESCRIPTION



NOTES

- ELEVATIONS ARE REFERENCED TO NAVD 1988.
- PROFILE DATA ARE FROM SURVEYS BY CEC.
- UPLAND DATA GAPS IN HISTORICAL PROFILES REFLECT SHOREBIRD NESTING AREAS, UNLESS OTHERWISE NOTED.

SHEET 42
FILE NO.: 2109-R-234

COASTAL ENGINEERING CONSULTANTS INC.
Serving Florida Since 1977
28421 BONITA CROSSINGS BLVD
BONITA SPRINGS, FLORIDA 34135

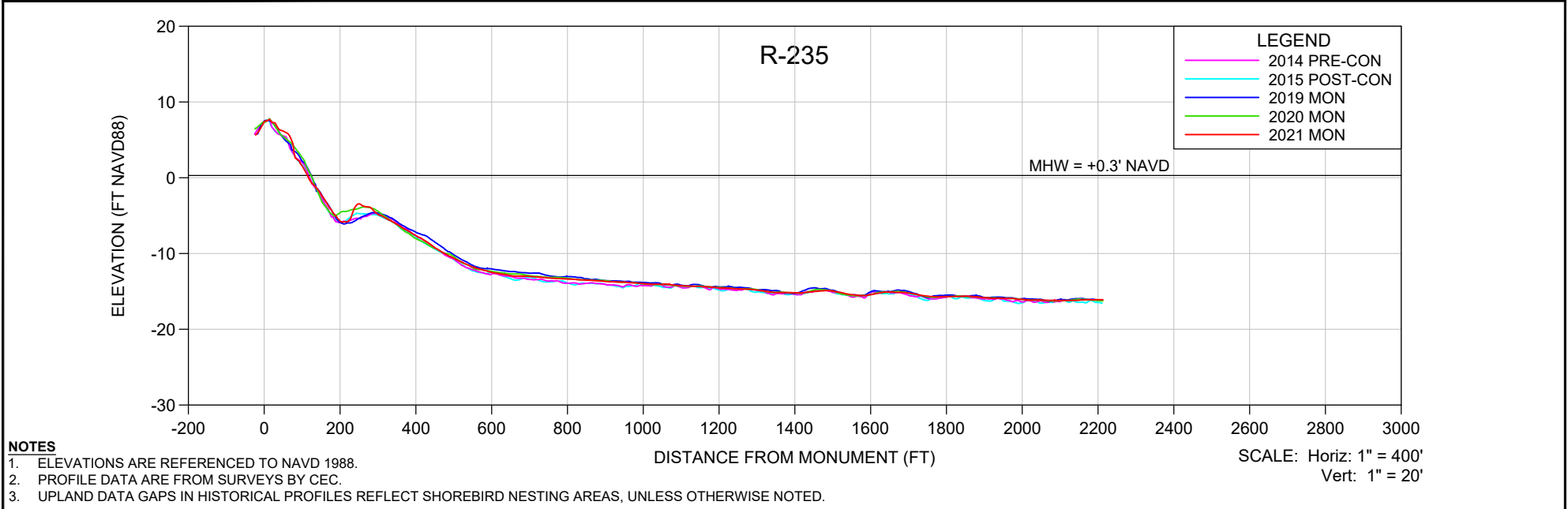
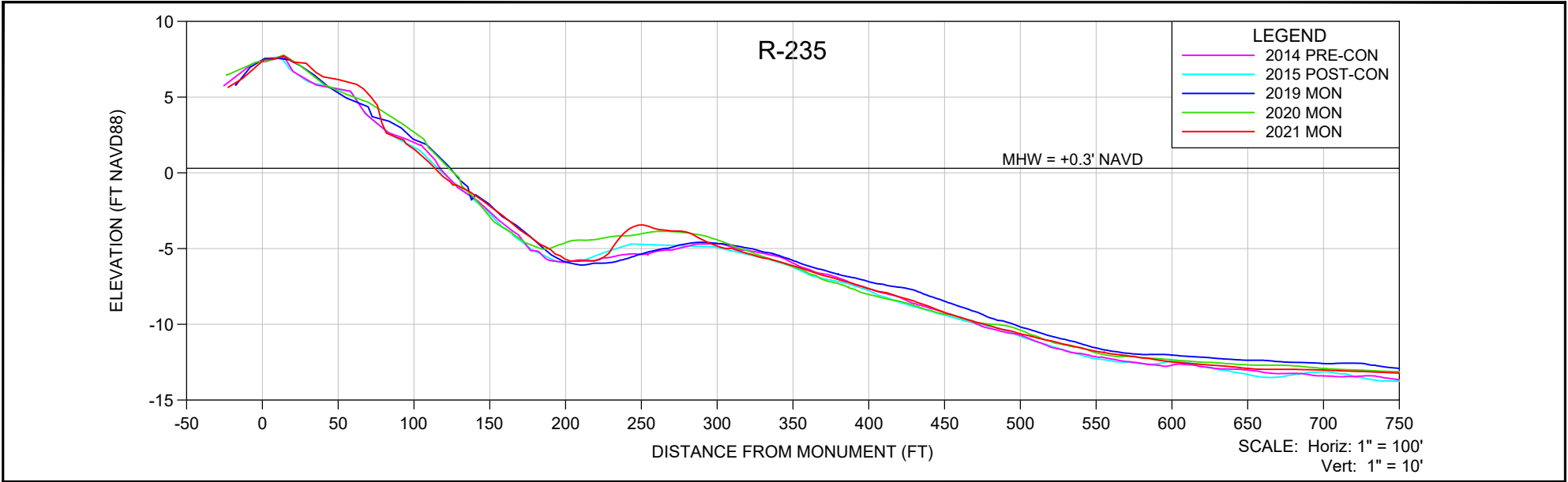
COASTAL & MARINE ENGINEERING
ENVIRONMENTAL & GEOLOGICAL SERVICES
SURVEY & MAPPING
ENGINEERING: CA 2464
SURVEYING: LB 2464
PHONE: (239)643-2324
FAX: (239)643-1143
www.coastalengineering.com
E-Mail: info@ceciff.com

CLIENT: **LEE COUNTY**

TITLE: **BONITA BEACH AND LOVERS KEY
R-234 MONITORING SURVEY**

DATE:	6/15/2021	SCALE:	AS SHOWN
DRAWN:	VVA	F.B.	
CHECKED:	MTP	PG.	
SEC.	TWP.	RNG.	
ACAD NO.	21079-Lovers Bonita Mon Profiles.dwg		
REF. NO.	21.079	NO.	DATE

NO.	DATE	BY	REVISION DESCRIPTION

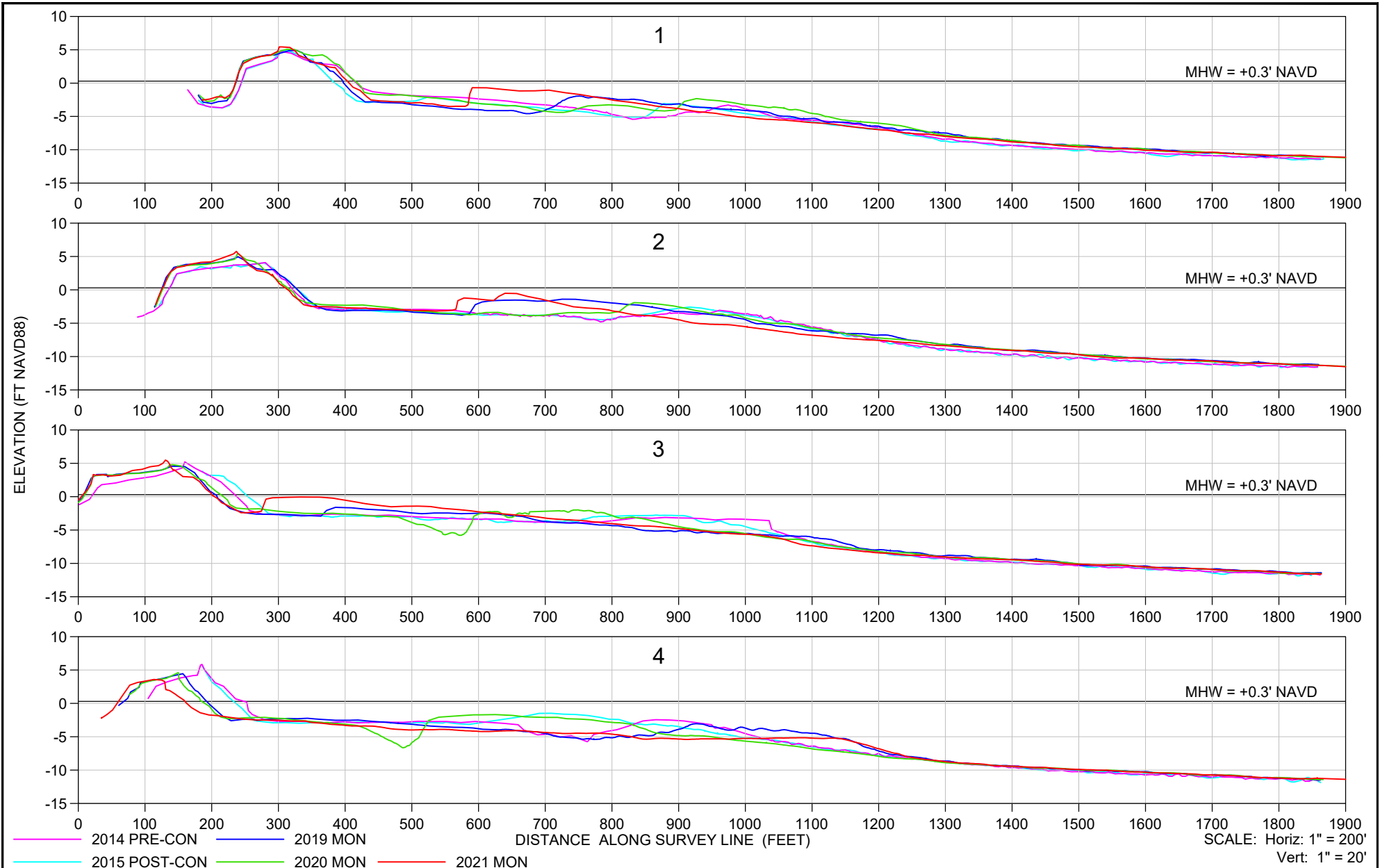


- NOTES**
- ELEVATIONS ARE REFERENCED TO NAVD 1988.
 - PROFILE DATA ARE FROM SURVEYS BY CEC.
 - UPLAND DATA GAPS IN HISTORICAL PROFILES REFLECT SHOREBIRD NESTING AREAS, UNLESS OTHERWISE NOTED.

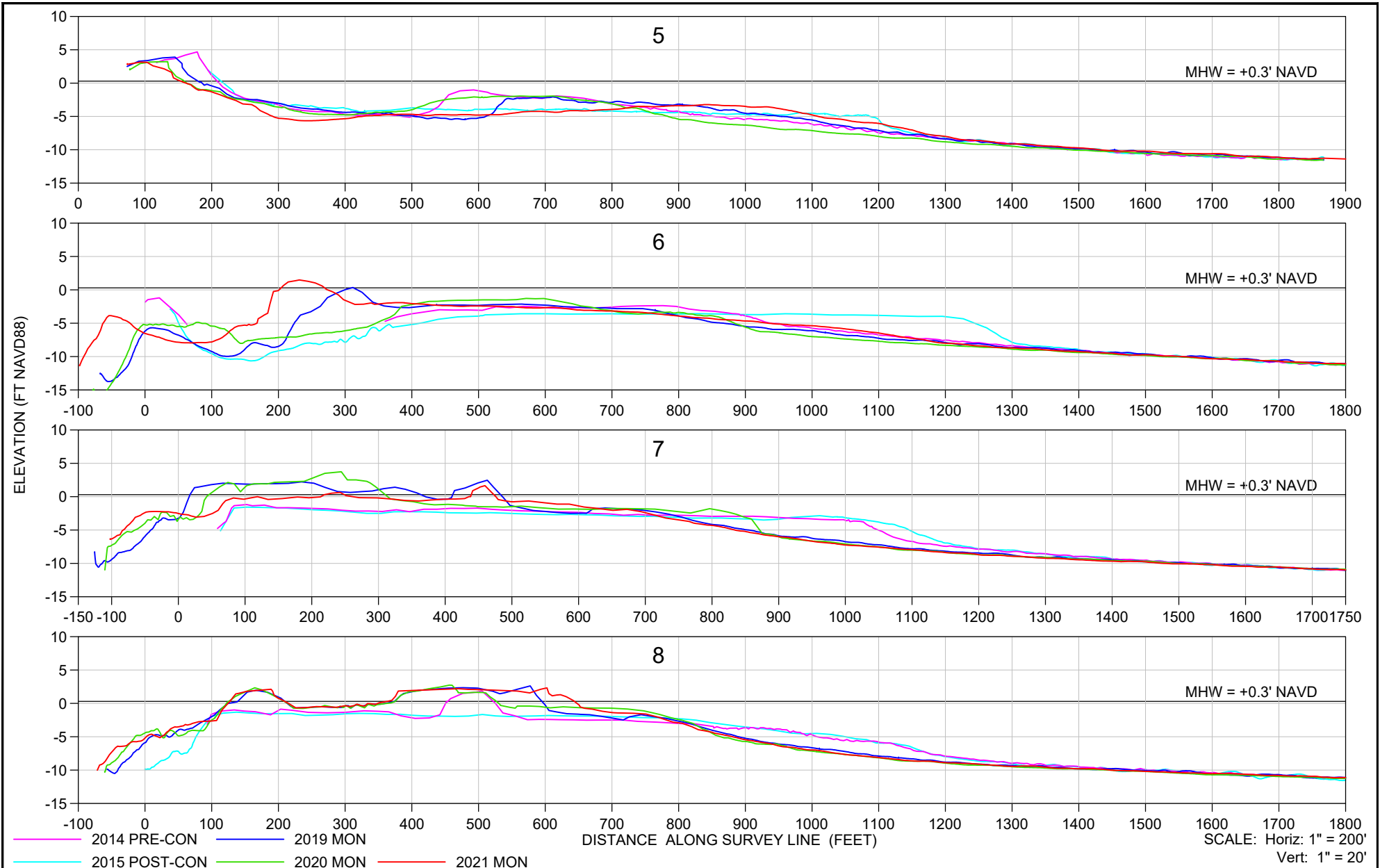
SHEET 43 FILE NO.: 21079-R-235	<p>COASTAL ENGINEERING CONSULTANTS INC. Serving Florida Since 1977 28421 BONITA CROSSINGS BLVD BONITA SPRINGS, FLORIDA 34135</p>	<p>COASTAL & MARINE ENGINEERING ENVIRONMENTAL & GEOLOGICAL SERVICES SURVEY & MAPPING ENGINEERING: CA 2464 SURVEYING: LB 2464</p> <p>PHONE: (239)643-2324 FAX: (239)643-1143 www.coastalengineering.com E-Mail: info@ceciff.com</p>	CLIENT:	LEE COUNTY			DATE:	6/15/2021	SCALE:	AS SHOWN					
			TITLE:	BONITA BEACH AND LOVERS KEY R-235 MONITORING SURVEY			DRAWN:	VVA	F.B.						
						CHECKED:	MTP	PG.							
						SEC.	TWP.	RNG.							
						ACAD NO:	21079-Lovers Bonita Mon Profiles.dwg								
			REF. NO.	21.079			NO.	DATE	BY	REVISION DESCRIPTION					

APPENDIX 3

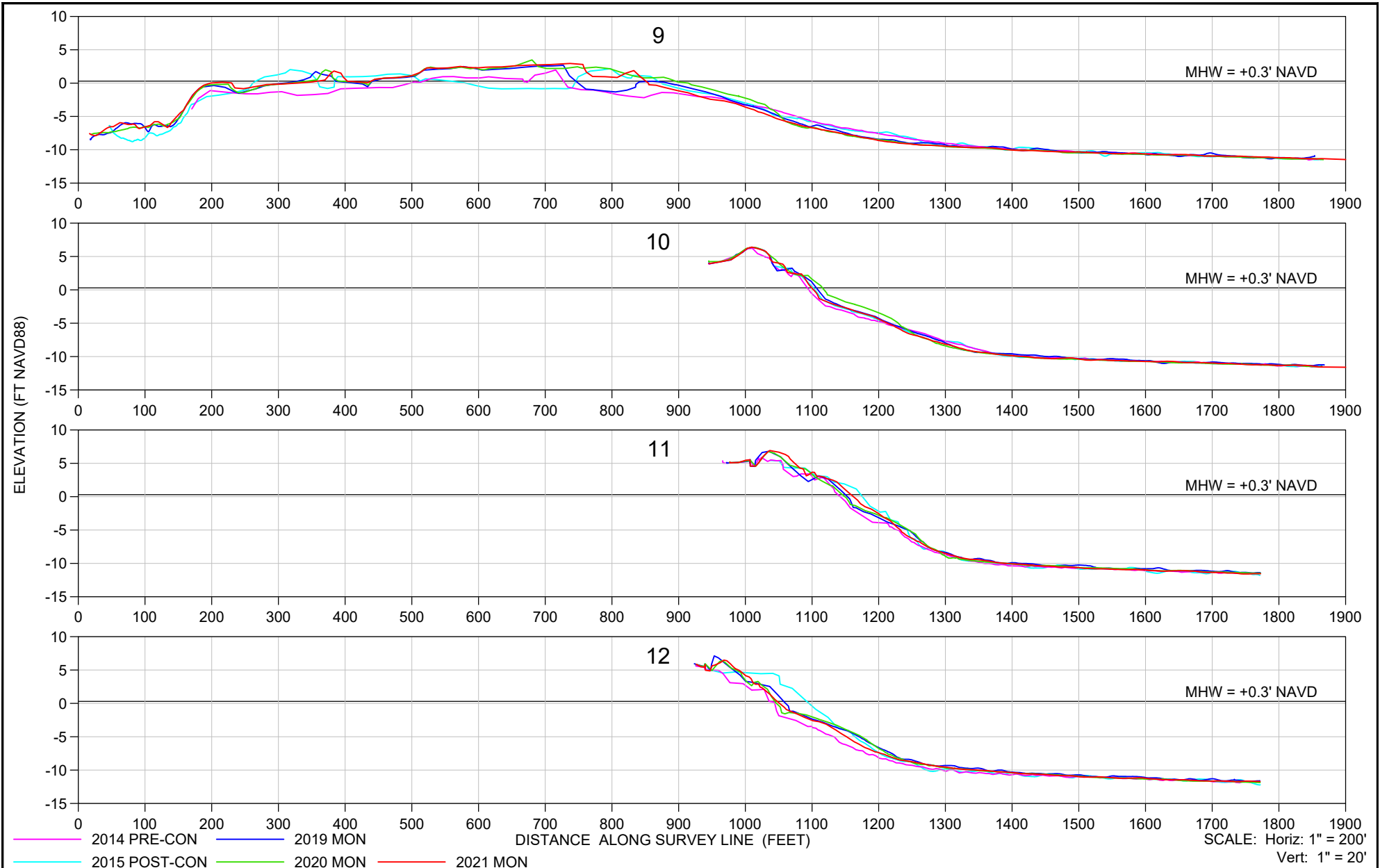
BIG HICKORY PASS EBB TIDAL SHOAL CROSS SECTIONS



SHEET 54 FILE NO.: 21079-BH-1 COASTAL ENGINEERING CONSULTANTS INC. Serving Florida Since 1977 28421 BONITA CROSSINGS BLVD BONITA SPRINGS, FLORIDA 34135	COASTAL & MARINE ENGINEERING ENVIRONMENTAL & GEOLOGICAL SERVICES SURVEY & MAPPING ENGINEERING: CA 2464 SURVEYING: LB 2464	CLIENT: LEE COUNTY TITLE: BONITA BEACH AND LOVERS KEY BIG HICKORY PASS CROSS SECTIONS 1 - 4	DATE: 6/15/2021 DRAWN: VVA CHECKED: MTP SEC.: TWP. RNG. ACAD NO: 21079-Lovers Bonita Mon Profiles.dwg REF. NO: 21.079	SCALE: AS SHOWN F.B. PG. NO. DATE BY REVISION DESCRIPTION
	PHONE: (239)643-2324 FAX: (239)643-1143 www.coastalengineering.com E-Mail: info@ceciff.com			



SHEET 55 FILE NO.: 21079-BH-2	<p>COASTAL ENGINEERING CONSULTANTS INC. Serving Florida Since 1977 28421 BONITA CROSSINGS BLVD BONITA SPRINGS, FLORIDA 34135</p>	<p>COASTAL & MARINE ENGINEERING ENVIRONMENTAL & GEOLOGICAL SERVICES SURVEY & MAPPING ENGINEERING: CA 2464 SURVEYING: LB 2464</p> <p>PHONE: (239)643-2324 FAX: (239)643-1143 www.coastalengineering.com E-Mail: info@ceciff.com</p>	<p>CLIENT: LEE COUNTY</p> <p>TITLE: BONITA BEACH AND LOVERS KEY BIG HICKORY PASS CROSS SECTIONS 5 - 8</p>	DATE: 6/15/2021	SCALE: AS SHOWN					
				DRAWN: VVA	F.B.					
				CHECKED: MTP	PG.					
				SEC.	TWP.					RNG.
				ACAD NO: 21079-Lovers Bonita Mon Profiles.dwg						
REF. NO.	21.079	NO.	DATE	BY	REVISION DESCRIPTION					



SHEET 56 FILE NO.: 21079-BH-3	COASTAL ENGINEERING CONSULTANTS INC. Serving Florida Since 1977 28421 BONITA CROSSINGS BLVD BONITA SPRINGS, FLORIDA 34135	COASTAL & MARINE ENGINEERING ENVIRONMENTAL & GEOLOGICAL SERVICES SURVEY & MAPPING ENGINEERING: CA 2464 SURVEYING: LB 2464 PHONE: (239)643-2324 FAX: (239)643-1143 www.coastalengineering.com E-Mail: info@ceciff.com	CLIENT: LEE COUNTY TITLE: BONITA BEACH AND LOVERS KEY BIG HICKORY PASS CROSS SECTIONS 9 - 12	DATE: 6/15/2021 DRAWN: VVA CHECKED: MTP SEC.: TWP. RNG. ACAD NO: 21079-Lovers Bonita Mon Profiles.dwg REF. NO.: 21.079	SCALE: AS SHOWN F.B. PG. NO. DATE BY REVISION DESCRIPTION
	SCALE: Horiz: 1" = 200' Vert: 1" = 20'				
	DISTANCE ALONG SURVEY LINE (FEET)				
	2014 PRE-CON 2019 MON 2015 POST-CON 2020 MON 2021 MON				
	MHW = +0.3' NAVD				