

**2019 ANNUAL REPORT - TO THE CITY OF NORTH WILDWOOD
ON THE
CONDITION OF THE CITY BEACHES**



Aerial view of North Wildwood looking northwest into Hereford Inlet on October 12, 2019 showing high tide at the north end of the City. The new bulkhead is evident starting at 5th Avenue replacing the dune once present. The accumulation of shoal sand northeast of the inlet jetty is also evident with the expectation of greater accretion to come. The prior year's back pass sand lies partially in the pocket between the jetty and earlier spit growth into the inlet. (Aerial photo taken by Ted Kingston)

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February 26, 2020**

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Introduction:

The North Wildwood oceanfront beach continued to suffer sand volume losses during 2019, bolstered by continued transfer of sand by truck from the stormwater discharge drain field array along the City of Wildwood's oceanfront. Over the past several years, the effort has moved between 150,000 to 200,000 cubic yards of Wildwood sand back to where it originally resided during the late 1990's. Dramatic shifts in the main tidal channel configuration within Hereford Inlet allowed a beach over 1,300 feet wide from Kennedy Boulevard to retreat until the 2009 NJ State and local beach restoration effort was undertaken. Over 1.3 million cubic yards of Hereford ebb-tidal shoal sand was placed along the oceanfront following hurricane Irene, done in 2012 and following Sandy, done in 2015. Since the last hydraulic restoration, the use of truck hauling has provided at least a half million cubic yards of sand.

The natural forces seem to divide the northern oceanfront sand supply between the Hereford Inlet shoreline in North Wildwood under the influence of the flood-tidal currents moving it around the 2nd Avenue jetty into the inlet and the northeast wave direction providing the energy to move sand south, eventually back onto Wildwood's oceanfront beaches. Current sediment transport forces starve the northern 10 blocks of the North Wildwood shoreline, but the southern transport maintains the southern 16 blocks of the City as an equilibrium exists between that section's sand loss to Wildwood offset by the introduction of material from the northern beaches.

While the US Army Corps permit to move sand remains valid, the focus was shifted to acquiring sand from Wildwood's oceanfront instead of from Hereford Inlet. Some work has been focused on involving the NJ Division of Coastal Engineering in a second cooperative hydraulic project similar to the 2009 work has started. The US Army regulatory branch has also served notice that permits will need renewal and, perhaps, redefinition of scope if the goal is to move material from Hereford Inlet again. The Corps Hereford Inlet to Cape May Inlet Shore Protection Project remains authorized, but unconstructed with issues related to real estate and with detailed design points in the proposed back passing methodology in the preferred plan.

2019 Weather Events:

January and February were relatively storm free with several minor events from the northeast. March and April contributed 3 mild to mild/moderate events with the worst occurring on March 22nd and repeated April 2nd. Minor summer accretion did occur south of 15th Avenue, but nothing appeared on the northern beaches. The vast area of shallow water northeast of the gazebo at 2nd and Kennedy Boulevard continued to grow as the shoal island continues to collect sand and extend its shallow ebb-oriented tail of shallow deposition toward the ocean. As of December 7, 2019, the tide channel between the shoal island and the No. Wildwood inlet shore grew narrower and shallower but turns northeast as it exits into the sea leaving a wide, shallow zone between the jetty and the channel with turbulent breaking waves. No clear trend of sand placement has emerged since 2015 as the shoal island migrated southeast toward the 2nd Avenue jetty. A spring 2020 resurvey of the Hereford Inlet authorized sand borrow zone has been authorized by the City and should find that the potential sand supply available far exceeds any need on the beach.

Figure 1, next page, shows the shoal island and the channel configurations as of December 7, 2019. The "tail" of white water extending toward the ocean from the shoal island is indicative of very shallow conditions. This configuration does not emphasize sand deposition around the northeast corner of North Wildwood as yet. Compare the 2019 view with that from 1995 to see that the shoal island needs to be closer to the jetty and with the tide channel close to the North Wildwood shoreline and not out into the inlet opening.



Figure 1. Aerial view from 12/7/2019 of Hereford Inlet and northern North Wildwood. There are three tidal channels exiting Hereford Inlet with the main channel positioned medially between two major shoals. Two smaller channels exist along the South Point shoreline close to the coast and the other hugs the North Wildwood shoreline southeast of New Jersey Avenue. The emerged shoal island has moved southeast over 1,500 feet since 2010, but to conform to the 1995 configuration (Figure 2), needs to move opposite the end of Surf Avenue. This would eventually permit the ebbing tidal flow to push the latest deposit of sand (derived from the 2019 transfer of sand stock from Wildwood) extending northwest from the 2nd Ave. jetty for four city blocks, back out to sea where it would accrete on the oceanfront beaches.

The two air photographs (Figure 2), were retained from last year's report to show the northeast corner of the City from March 1995 prior to major oceanfront changes and from August 2016 just prior to the most recent sand losses. In the 1995 view, the beach width at the north end of the City's oceanfront was close to 1,000 feet in width and when retreat commenced in that time frame, the loss rate did not appear to depend on storm frequency or seasonality for loss evaluation. The exact duplication of the 1995 configuration is not necessary, but the restriction of the flood-tidal flow direction by the island's location is important in forcing the sand to accumulate preferentially near the oceanfront beach. Waves then can move the shallow deposits onto the beach starting as offshore bars.

The 1995 shoal island was opposite the end of Surf Avenue, while the current shoal island lies two diameters to the northwest of the ideal position. The ebb currents move sand to the southeast, but the entire island mass is slow to follow individual tide cycles. Movement since 2011 has been in the range of 1,500 to 2,000 feet to the southeast in the direction of the ebb tidal flow. The constriction of the channel adjacent to North Wildwood needs to increase to cause the sand to deposit at or just east of the end of the 2nd Avenue jetty.



Figure 2. (Presented last year, but significant still). The northeast quadrant of the City of North Wildwood between March 1995 and August 2016 shows that oceanfront erosion appears related to large changes in shoal position and exposure at low tide in Hereford Inlet. In 1995, an exposed island sat between Central and Surf Avenues forcing a branch of the main tidal channel against the North Wildwood shoreline. There was no beach at the inlet shore until southeast of Surf Avenue. There was an extensive exposed sand flat system attached to the beach front bar system extending into the inlet. The ebb-tidal currents exited in proximity to the oceanfront beach and deposited sand in transport where wave action could easily move it to the beach bar system, and eventually onto the dry beach.

Oceanfront Beach Surveys:

The CRC surveyed shoreline changes at all 54 oceanfront profile stations two times in 2019 to determine annual and seasonal trends. These surveying activities continue a monitoring program that began in 2009 following the initial City/State beach restoration project. The profile stations are spaced 200-feet apart and were established to determine cumulative changes and performance of the beach restoration project. Figure 3 shows the locations of 10 selected profile survey locations that were extracted from the 54-profile dataset: Lines **00+00; 02+00; 04+00; 06+00; 20+00; 40+00; 52+00; 58+00; 60+00; and 64+00**. These sites were chosen for 2019 to show the range of performance changes across the project. The four northern sites document changes in the historically erosional zone, the middle three sites show the changes in the mid-section of the island, and the southern three sites document the changes in around the four pier sites south of 21st Avenue. A discussion of the changes at each of these locations is provided in a later section of this report. The following is a list of the studies included in this report and the respective survey dates are:

- Survey 33 June 13, 2018
- Survey 34 October 25, 2018
- Survey 35 June 6, 2019
- Survey 36 October 25, 2019

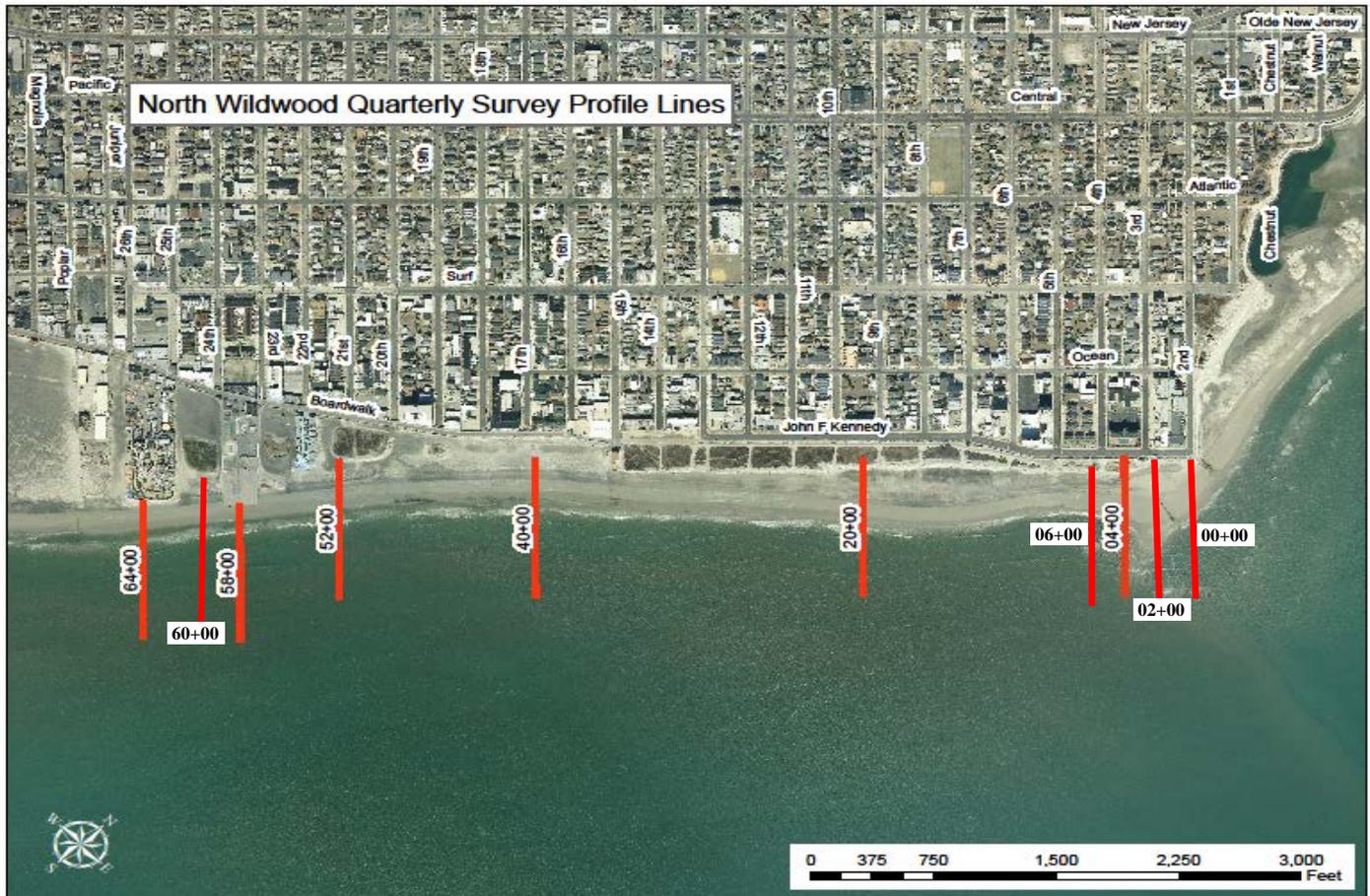


Figure 3. Shown above are locations of ten representative profile sites of the 54 profile stations where shoreline changes were measured on the City’s oceanfront from October 2018 to October 2019. For each of the ten profile stations descriptions and cross sections are provided to show typical changes over the year. This year surveys were included at the jetty, 200 feet, 400 feet, and 600 feet south of the jetty in the set of profiles. In addition, 6 survey lines are completed along the inlet beach in Hereford Inlet. They are spread non-uniformly from the 2nd Avenue jetty to Central Avenue northwest of the jetty. Four go at 200-foot spacing from the jetty to 600 feet northwest, another at 1,200 feet and the final survey line at 2,400 feet northwest at the end of Central Avenue.

Last year, the comparison between the sand volume on the beach in the fall of 2016 versus the quantity present in October 2017 showed the concentration of losses focused on the northernmost 2,000 feet of oceanfront beach. The sum of losses reached 182,968 cubic yards by site 20+00, located between 9th and 10th Avenues. During the same time interval, the southern 4,800 feet of oceanfront beach actually gained 51,846 cubic yards, most likely derived from sand eroded from the northern beach. This year the losses were concentrated between 600 and 2,000 feet south of the inlet jetty and generally decreased to the south. The annual net loss on the oceanfront based on a selection of 10 transects from the 54 profile lines was -193,426 cubic yards.

Table 1										
North Wildwood Beach Fill										
Shoreline and Sand Volume Changes Since Sandy Recovery										
July 2013 to November 2019										
Profile	Shoreline	Volume	Avg. Volume	Distance	Dune/Beach					
	Change	Change	(cu yds./ft.)	Between	Losses					
	(feet)	(cu yds./ft.)	(cu yds./ft.)	(feet)	(cu yds)					
<i>Hereford Inlet Shoreline</i>										
-6+00										
			0.00	200	0	0				
-4+00										
			0.00	200	0	0				
-2+00										
			0.00	200	0	0				
-0+00										
		Arc = 90.0								
0+00	-60	-32.76	-16.38	-7,532	-7,532	-7,532				
			-89.39	200	-17,878	-25,410				
2+00	-214	-146.02								
			-177.60	200	-35,520	-60,930				
4+00	-282	-209.18								
			-231.22	200	-46,243	-107,173	North end & Inlet losses		4th Ave.	
6+00	-352	-253.25								
			-250.88	200	-50,176	-157,349	-50,176			
8+00	-357	-248.51								
			-256.46	200	-51,292	-208,641	-101,468			
10+00	-383	-264.41								
			-258.34	200	-51,667	-260,308	-153,135			
12+00	-413	-252.26								
			-239.93	200	-47,986	-308,294	-201,121			
14+00	-407	-227.60								
			-206.13	200	-41,225	-349,519	-242,346			
16+00	-387	-184.65								
			-190.51	200	-38,102	-387,621	-280,448			
18+00	-389	-196.37								
			-165.17	200	-33,034	-382,553	-275,380			
20+00	-349	-133.97								
			-134.46	200	-26,892	-409,445	-302,272			
22+00	-321	-134.95								
			-129.72	200	-25,944	-408,497	-301,324			
24+00	-345	-124.49								
			-121.15	200	-24,230	-432,727	-325,554			
26+00	-344	-117.81								
			-116.08	200	-23,216	-431,713	-324,540	Net Deposit Offshore	11th Ave.	
28+00	-304	-114.35								
			-108.51	200	-21,702	-453,415	-346,242			
30+00	-235	-102.67								
			-95.54	200	-19,107	-450,820	-19,107			
32+00	-227	-88.40								
			-98.21	200	-19,642	-470,462	-38,749			
34+00	-256	-108.02								
			-105.47	200	-21,094	-471,914	-40,201			
36+00	-245	-102.92								
			-89.07	200	-17,813	-489,727	-58,014			
38+00	-212	-75.21								
			-74.86	200	-14,972	-486,886	-55,173			
40+00	-180	-74.51								
			-63.97	200	-12,794	-499,680	-67,967			
42+00	-161	-53.43								
			-62.22	200	-12,444	-499,330	-67,617			
44+00	-165	-71.01								
			-68.07	200	-13,613	-512,943	-81,230			
46+00	-140	-65.12								
			-53.15	200	-10,630	-509,960	-78,247			
48+00	-122	-41.18								
			-42.18	200	-8,436	-518,396	-86,683			
50+00	-67	-43.18								
			-36.97	200	-7,394	-525,790	-94,077			
52+00	-113	-30.76								
			-50.97	200	-10,193	-535,983	-104,270			
54+00	-119	-71.17								
			-73.35	200	-14,669	-550,652	-118,939			
56+00	-138	-75.52								
			-80.14	200	-16,028	-566,680	-134,967			
58+00	-160	-84.76								
			-85.61	200	-17,121	-583,801	-152,088			
60+00	-174	-86.45								
			-90.33	200	-18,065	-601,866	-170,153			
62+00	-176	-94.20								
			-88.84	200	-17,767	-619,633	-187,920			
64+00	-138	-83.47								
			-58.68	200	-11,735	-631,368	-199,655	South	Juniper Ave	
66+00	-97	-33.88								
			-28.38	200	-5,676	-637,044	-205,331			
68+00	16	-22.88								
			-11.44	200	-2,288	-639,332	-207,619			

Table 1 is a compilation of all beach changes since July 2013 after hydraulic restoration of Hurricane Sandy damages to the beach. The post-Sandy restoration cross sections at 200-foot spacing are compared to those taken in November 2019 to show all losses since 2013, including any sand volumes added through sand back passing or the amount pumped onto the beach from Beach Creek dredging in 2015. Each 200-foot cell's sand volume is added to the last one to give an accumulated total sand volume change along the oceanfront. Three zones are defined as the northern zone (107,173 cubic yard loss); the middle zone where major losses occurred (324,540 cy.); and the southern zone with the piers where 199,655 cubic yards of sand were lost over the past 6 years.

Table 2 below shows just the past six months of change following the spring back pass operation which added 157,000 cubic yards to the northern beaches by Memorial Day 2019. In the past 6 months the northern zone lost 43,995 cubic yards of sand; the mid-section lost 99,037 cubic yards; and the southern zone just 13,214 cubic yards with multiple cross sections gaining material in small net volumes. The negative number is due to mid-section carry over onto survey lines 30+00 and 32+00 generating 12,876 cy of the entire negative volume.

Sand on the North Wildwood oceanfront traditionally migrates south into the City of Wildwood and from there into Wildwood Crest, then on to Lower Township. Sand shed from the northern zone of the North Wildwood city beaches first adds to the mid-section, and then moves into the southern zone around the piers. So long as Hereford Inlet sand remains stuck in the ebb-tidal shoals at the inlet mouth, the sand supply on the oceanfront beaches is trapped in this endless cycle of southerly transport without any input from Hereford Inlet.

This knowledge ultimately led the US Army Corps of Engineers to present sand back passing on a large scale from beaches south of North Wildwood as their primary methodology in dealing with shoreline stability. They figured that taking millions of yards of sand from Hereford Inlet would eventually create such an expansive dry beach zone in Wildwood and Wildwood Crest that demands to remove the excess would cost more than it was worth to hydraulically feed the North Wildwood beach from Hereford Inlet. Hydraulic placement was cheaper versus back passing large volumes, but the addition of inlet sand would exacerbate the sand surplus problems south of North Wildwood. The recent letter from Interior Secretary Bernhardt reversing the 2013 interpretation of the terms excluding beach nourishment funding by federal entities from a CBRIS (in this case Unit NJ-09), may encourage the Philadelphia Corps District to consider at least an initial restoration of the North Wildwood beach using Hereford Inlet sand.

Table 2										
North Wildwood Beach Fill										
Shoreline and Sand Volume Changes Due to Storms										
June 2019 to November 2019										
Profile	Shoreline Change (feet)	Volume Change (cu yds./ft.)	Avg. Volume (cu yds./ft.)	Distance Between (feet)	Dune/Beach Losses (cu yds)					
<i>Hereford Inlet Shoreline</i>										
-6+00			0.00	200	0	0				
-4+00			0.00	200	0	0				
-2+00			0.00	200	0	0				
-0+00			0.00	200	0	0				
0+00	-58		Arc = 90.0 -16.52	-8.26	-3,798	-3,798	-3,798			
2+00	-90	-60.98	-38.75	200	-7,750	-11,548				
4+00	-84	-88.64	-74.81	200	-14,962	-26,510				
6+00	-91	-86.21	-87.43	200	-17,485	-43,995	North end & Inlet losses	4th Ave.		
8+00	-88	-76.53	-81.37	200	-16,274	-60,269	-16,274			
10+00	-88	-76.88	-76.71	200	-15,341	-75,610	-31,615			
12+00	-109	-66.67	-71.78	200	-14,355	-89,965	-45,970			
14+00	-92	-69.00	-67.84	200	-13,567	-103,532	-59,537			
16+00	-89	-53.33	-61.17	200	-12,233	-115,765	-71,770			
18+00	-83	-56.52	-54.93	200	-10,985	-126,750	-82,755			
20+00	-77	-46.47	-51.50	200	-10,299	-126,064	-82,069			
22+00	-73	-48.14	-47.31	200	-9,461	-135,525	-91,530			
24+00	-78	-45.85	-47.00	200	-9,399	-135,463	-91,468			
26+00	-84	-40.01	-42.93	200	-8,586	-144,049	-100,054			
28+00	-75	-35.68	-37.85	200	-7,569	-143,032	-99,037	Net Deposit Offshore	11th Ave.	
30+00	-70	-34.24	-34.96	200	-6,992	-150,024	-106,029			
32+00	-51	-24.60	-29.42	200	-5,884	-148,916	-5,884			
34+00	-32	-12.10	-18.35	200	-3,670	-152,586	-9,554			
36+00	-26	-3.09	-7.60	200	-1,519	-150,435	-7,403			
38+00	-29	0.39	-1.35	200	-270	-150,705	-7,673			
40+00	-40	-0.49	-0.05	200	-10	-150,445	-7,413			
42+00	-41	-2.13	-1.31	200	-262	-150,707	-7,675			
44+00	-39	-2.23	-2.18	200	-436	-150,881	-7,849			
46+00	-22	-11.21	-6.72	200	-1,344	-152,225	-9,193			
48+00	-60	-11.68	-11.45	200	-2,289	-153,170	-10,138			
50+00	-37	-9.09	-10.39	200	-2,077	-155,247	-12,215			
52+00	-48	-3.97	-6.53	200	-1,306	-156,553	-13,521			
54+00	-20	-1.48	-2.73	200	-545	-157,098	-14,066			
56+00	-39	1.04	-0.22	200	-44	-157,142	-14,110			
58+00	-5	-1.89	-0.43	200	-85	-157,227	-14,195			
60+00	4	-1.94	-1.92	200	-383	-157,610	-14,578			
62+00	14	2.40	0.23	200	46	-157,564	-14,532			
64+00	49	5.43	3.92	200	783	-156,781	-13,749			
66+00	-16	-0.08	2.68	200	535	-156,246	-13,214	South	Juniper Ave	
68+00	65	7.50	3.71	200	742	-155,504	-12,472			
			3.75	200	750	-154,754	-11,722			

Back Pass Operations:

The past four years of major sand harvesting effort using Wildwood City sources commenced in the spring of 2016. By Memorial Day 165,000 cubic yards had been placed in a beach berm parallel to the dune toe from 3rd Avenue, south toward 8th Avenue.

Following the March 14, 2017 northeast storm, the City commenced hauling sand from the stormwater discharge points in the City of Wildwood using heavy trucks to move material to the erosion zone at 3rd Avenue. The estimate from truck logs indicated placement of about 190,000 cy of sand by mid-May 2017.

In 2018, material was again harvested (153,375 cu. yds.) from the storm water outfall areas and berm between discharge points and truck hauled up to the zone of serious erosion. Distribution was more regional in this year.

During 2019, 157,000 cubic yards of sand were extracted from the Wildwood stormwater discharge area with placement along the dune toe between 12 and 5 Avenues, concentrating in the middle sections. Sand moved both into the Hereford Inlet North Wildwood shoreline up to Surf Avenue and to the south back toward Wildwood in about equal quantities.



Figure 4. City of Wildwood oceanfront beach July 21, 2019 six weeks after conclusion of the 2019 back passing effort. The stormwater discharge points lie at the heads of each of the excavations at elevations well below the sand surface elevation. Burial means little effective stormwater discharge. They were originally built ending at the water's edge just past low tide. This view presents 20 – 25 years of evidence for shoreline accretion in the City of Wildwood.



Figure 5. December 7, 2019 view into Hereford Inlet including the northern zone of the North Wildwood oceanfront. Note that new sand has been deposited from the jetty at 2nd Ave. toward the northwest to a point seaward of the prime bird nesting area west of Surf Avenue. The shoal island and its trailing sand bar lie between 500 and 1,000 feet seaward into the inlet from the City beaches.

While a major hydraulic beach restoration project might serve the City's immediate future needs, this prospect has the issue that Hereford Inlet is part of the Coastal Barrier Resources System NJ-09, that has definite restrictions on spending federal funds to move sand outside the CBRS to North Wildwood. While congressional assistance has produced some progress in resolving this problem, there is no current authority given to the US Army Corps to extract sand from Hereford Inlet shoals for either Stone Harbor or North Wildwood beaches. This is why the USACE has elected to focus its project for the Wildwoods on sand back-passing in a larger scale because of this restriction on available sand supplies.

The State of NJ and any local or county entity is free to take sand from the CBRS area in Hereford Inlet with appropriate state and federal permits, but the cost to North Wildwood is fixed at 25% of the project cost instead of 8.75% if federal money was involved with a USACE effort and a NJ State partnership. The 2009 initial beach restoration effort was a State and local partnership without federal funding. FEMA reimbursed the City at 75% of expenses for repair efforts made following several federal storm disaster declarations starting with the Veteran's Day storm of 2009.

Individual Site Review:

This section describes the shoreline and volume changes documented at selected profile locations to show general trends in sediment movement along the City's beaches for 2019. Annual beach volume and shoreline changes were calculated from October 2018 to October 2019.

Site 00+00 (at the inlet jetty)

The first profile line was included to show the additions to the offshore region in the immediate vicinity of the Hereford Inlet jetty. This line starts at the oceanfront side of the jetty and extends perpendicular to the seawall into the ocean. There is no high tide beach present, with the first data points as of October 2019 presently just

below zero elevation NAVD 88. The best condition among the four surveys occurred in June 2019 when the starting beach elevation point was at 2.0 feet NAVD 88.



Figure 6. View to the south taken November 7, 2019 showing that the waves at low tide still reach the revetment. The slope offshore is relatively gentle, but not suitable for recreational use.

The site is currently not useable for recreational purposes other than watching the sea from the gazebo or fishing. Expected back passing of sand should provide a narrow dry beach for the coming summer season.

North Wildwood - Semi-Annual Comparison

Line 00+00 Comparison

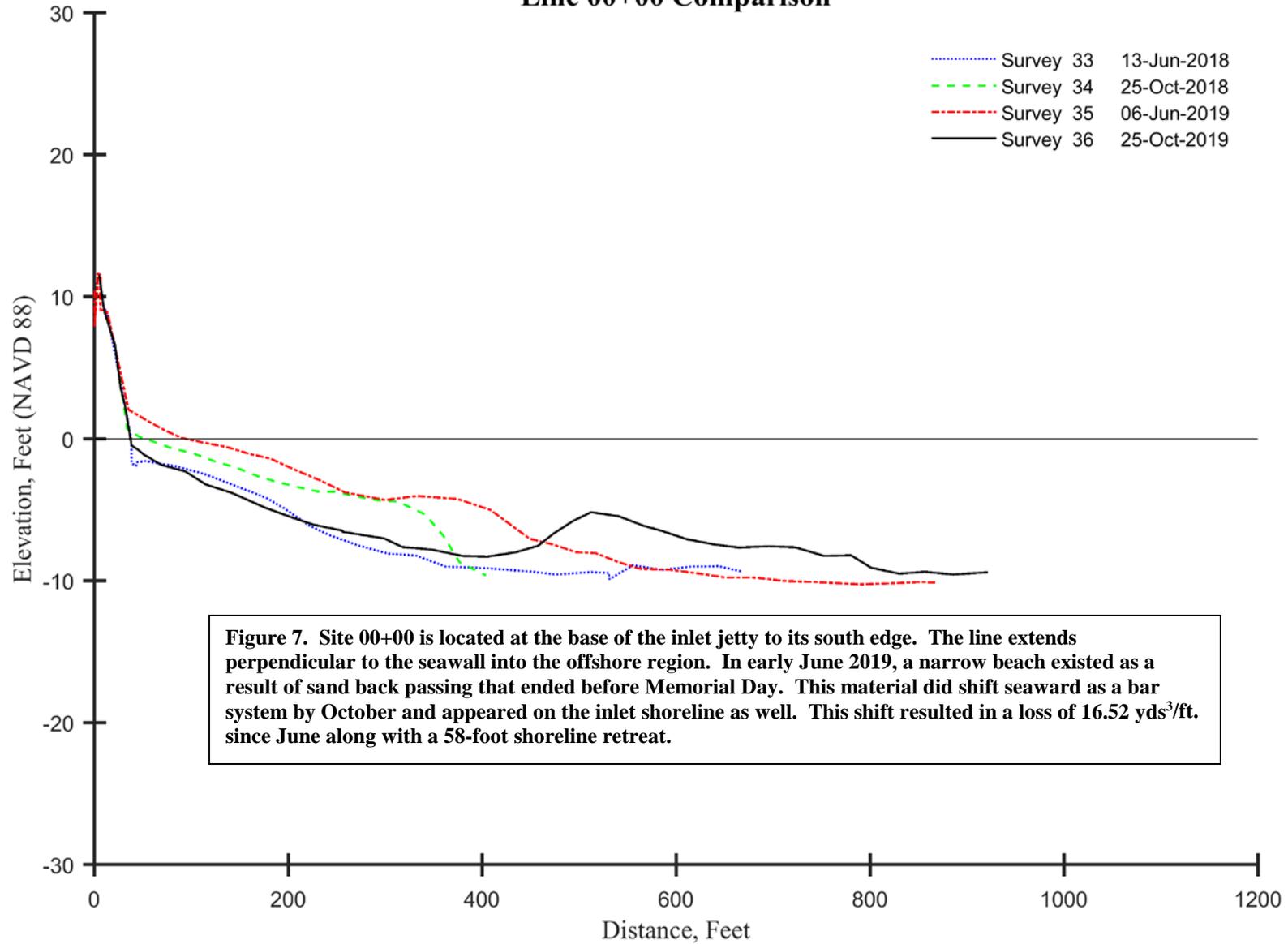


Figure 7. Site 00+00 is located at the base of the inlet jetty to its south edge. The line extends perpendicular to the seawall into the offshore region. In early June 2019, a narrow beach existed as a result of sand back passing that ended before Memorial Day. This material did shift seaward as a bar system by October and appeared on the inlet shoreline as well. This shift resulted in a loss of 16.52 yds³/ft. since June along with a 58-foot shoreline retreat.

Site 02+00 (about 100 feet south of the inlet gazebo)

Located 200 feet south of the 2nd Ave. jetty, this site replicates conditions seen to the north. Sand placement by June 2019 had the effect of generating a dry sand beach along the bulkhead revetment that did not last until the fall survey in 2019. An 8-foot drop in elevation occurred at the revetment placing the October survey's starting point elevation just above zero.



Figure 8. The view toward the jetty from the lower beach near low tide shows that there is no dry beach as of October 2019.

North Wildwood - Semi-Annual Comparison

Line 02+00 Comparison

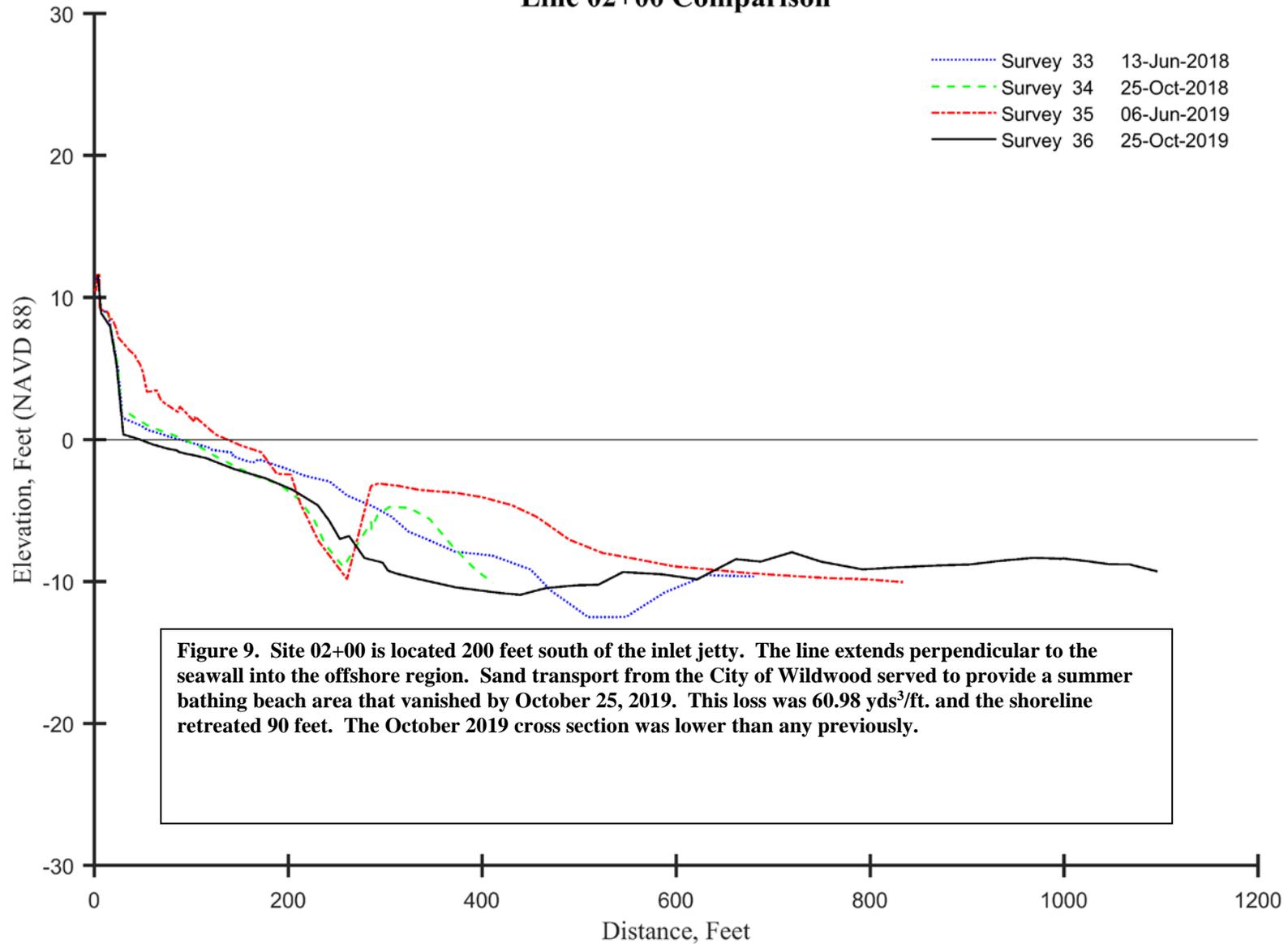


Figure 9. Site 02+00 is located 200 feet south of the inlet jetty. The line extends perpendicular to the seawall into the offshore region. Sand transport from the City of Wildwood served to provide a summer bathing beach area that vanished by October 25, 2019. This loss was 60.98 yds³/ft. and the shoreline retreated 90 feet. The October 2019 cross section was lower than any previously.

Site 04+00 (between 3th and 4th Avenues)

The site is located in the northern portion of the island adjacent to Hereford Inlet 400 feet south of the 2nd Avenue jetty. This area has typically been an erosional shoreline due to its proximity to the inlet and the direct impact from northeast storms. An offshore bar was present in the fall of 2018 indicating sand accumulation offshore related to inlet geomorphic changes which may prove positive to the north end beach. This beach received substantial sand placement during the spring 2019 back pass effort creating a decent-sized recreational beach during the summer. However, by late October the majority of that new material was gone, moved either into Hereford Inlet or transferred south along the remaining oceanfront. This process repeated the events recorded during 2018. *Sand placed here during episodes of back-passing show in the October 2017 and June 2018 survey data, but the beach was eroded to a narrow strip by October 2018.*

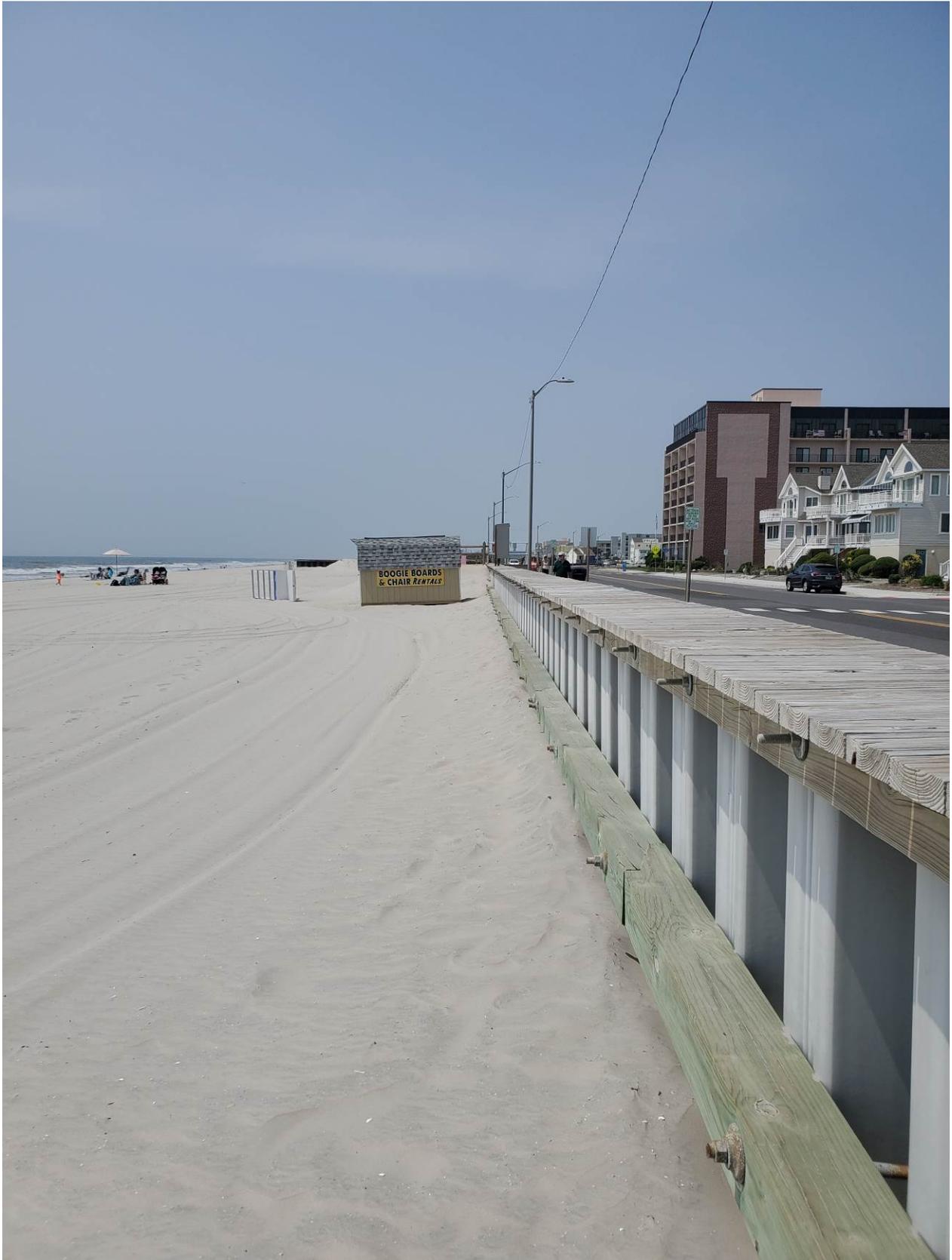


Figure 10. View to the south taken from directly in front of the cap on the new bulkhead that starts just south of the 3rd Avenue gazebo after conclusion of back passing on June 6, 2019. By October, the site was wet to the bulkhead with a complete loss of the bathing area.

North Wildwood - Semi-Annual Comparison

Line 04+00 Comparison

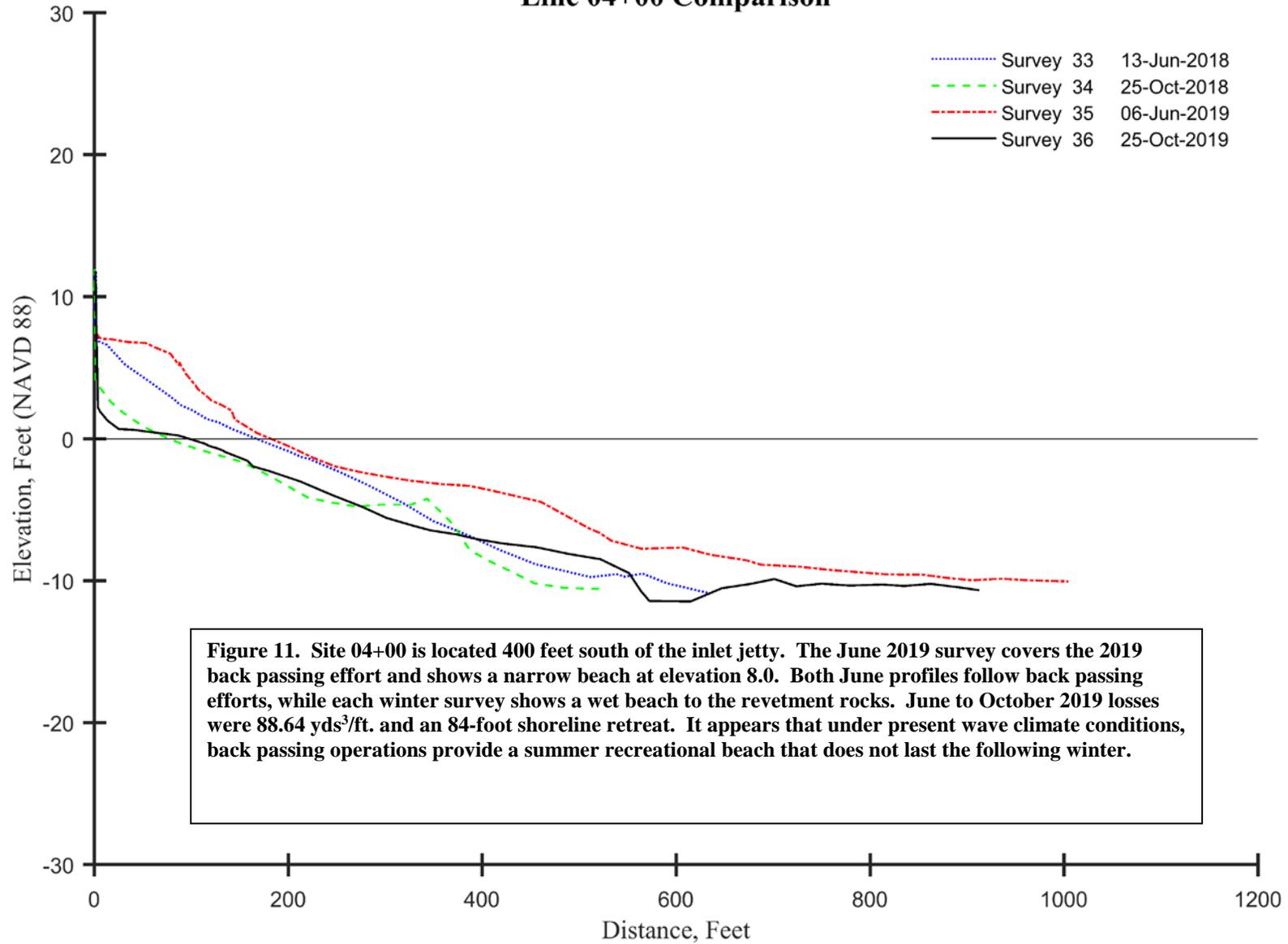


Figure 11. Site 04+00 is located 400 feet south of the inlet jetty. The June 2019 survey covers the 2019 back passing effort and shows a narrow beach at elevation 8.0. Both June profiles follow back passing efforts, while each winter survey shows a wet beach to the revetment rocks. June to October 2019 losses were 88.64 yds³/ft. and an 84-foot shoreline retreat. It appears that under present wave climate conditions, back passing operations provide a summer recreational beach that does not last the following winter.

Site 06+00 (approximately at 4th Avenue)

The third of the northern survey sites is located at the end of 4th Avenue where the new bulkhead was completed in early 2018. By 2018 all traces of the 2009 dune system had eroded away, replaced by material trucked in from Wildwood. The survey profiles (Figure 13) show the extreme contrast between the site with back passed sand present and after a storm season reduced the profile to a wet beach to the bulkhead. The same processes inflicted the same results at 06+00 as seen to the north and the prior year.

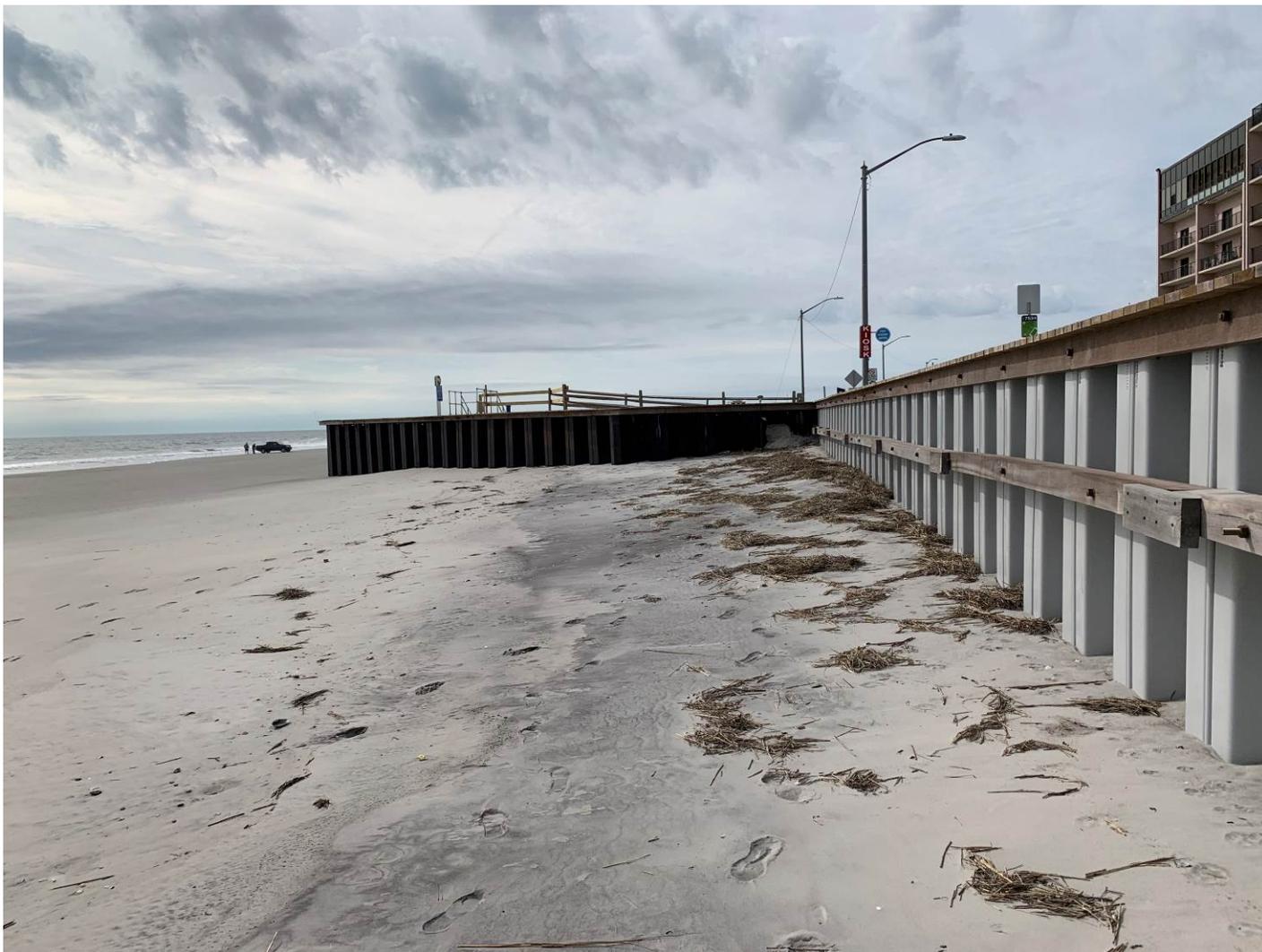
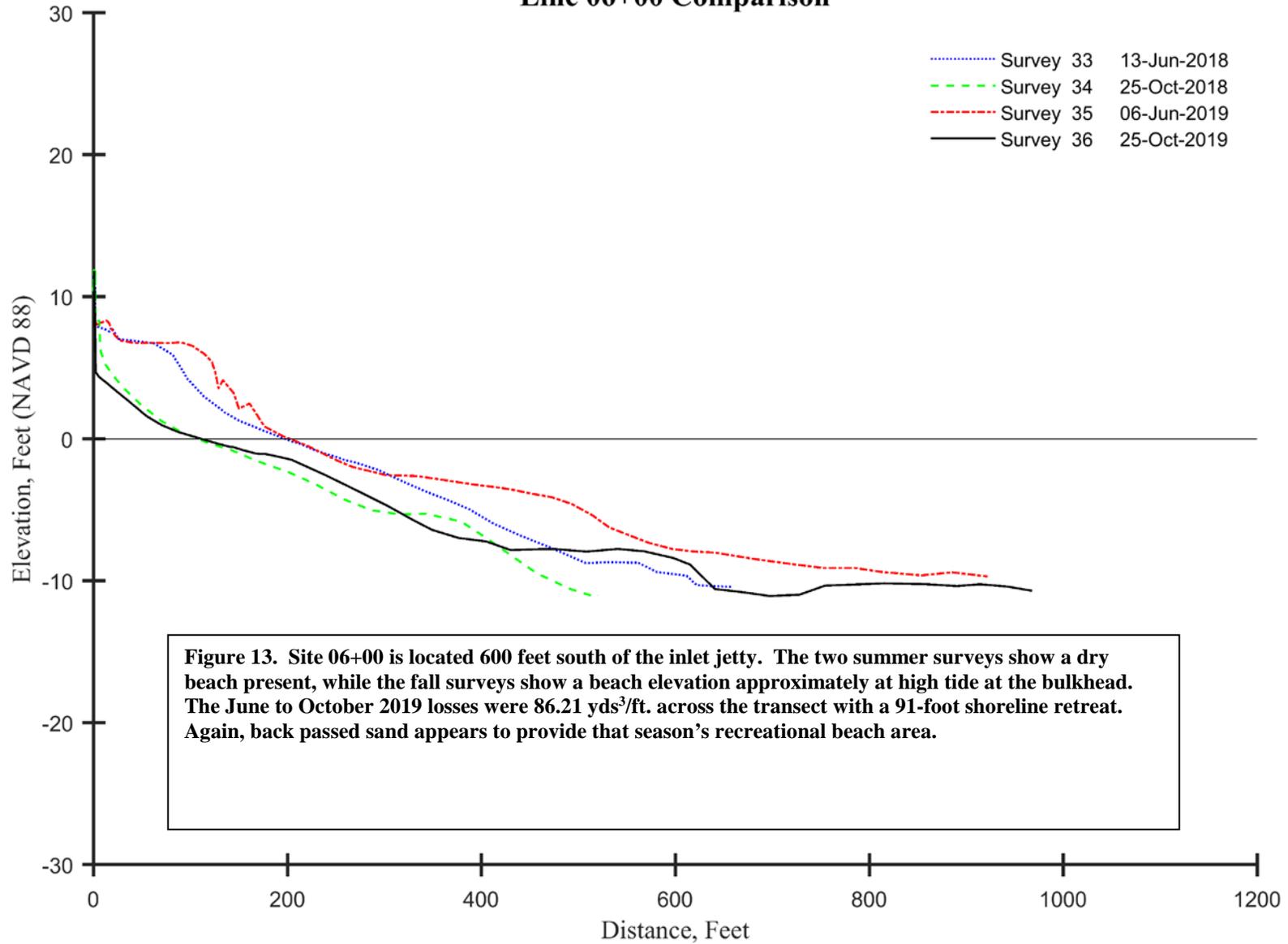


Figure 12. Site 06+00 is on the beach in proximity where the new bulkhead starts. The wrack material indicates that high tide just reaches the bulkhead at this location as of October 25, 2019. This is the contrast with the view of site 04+00 taken in June just after back pass operations for 2019 were complete.

North Wildwood - Semi-Annual Comparison

Line 06+00 Comparison



Site 20+00 (between 9th and 10th Avenues)

This site is located 2,000 feet south of the inlet jetty and is near the transition from erosion to stability and even accretion from time to time. Dune erosion has occurred here during storms, but frequently has resolved with wind transport and deposition after the storm event. Beach retreat was most dramatic between June and October 2018, after the spring series of northeast events had concluded with a minor event the day prior to Memorial Day 2018. The beach loss has an impact on both the dune stability and the available recreational space between 8th and 15th Streets. The pattern of beach retreat through 2019 indicates that the transport of sand south toward Wildwood has continued, but the appearance of sand offshore at the Hereford Inlet jetty might show changes at the inlet that could prove beneficial to the oceanfront beach in general.



Figure 14. Last fall's picture showed a low beach scarp seaward of the dunes, while this view demonstrates the severity of the entire dune losses since June 2019.

North Wildwood - Semi-Annual Comparison

Line 20+00 Comparison

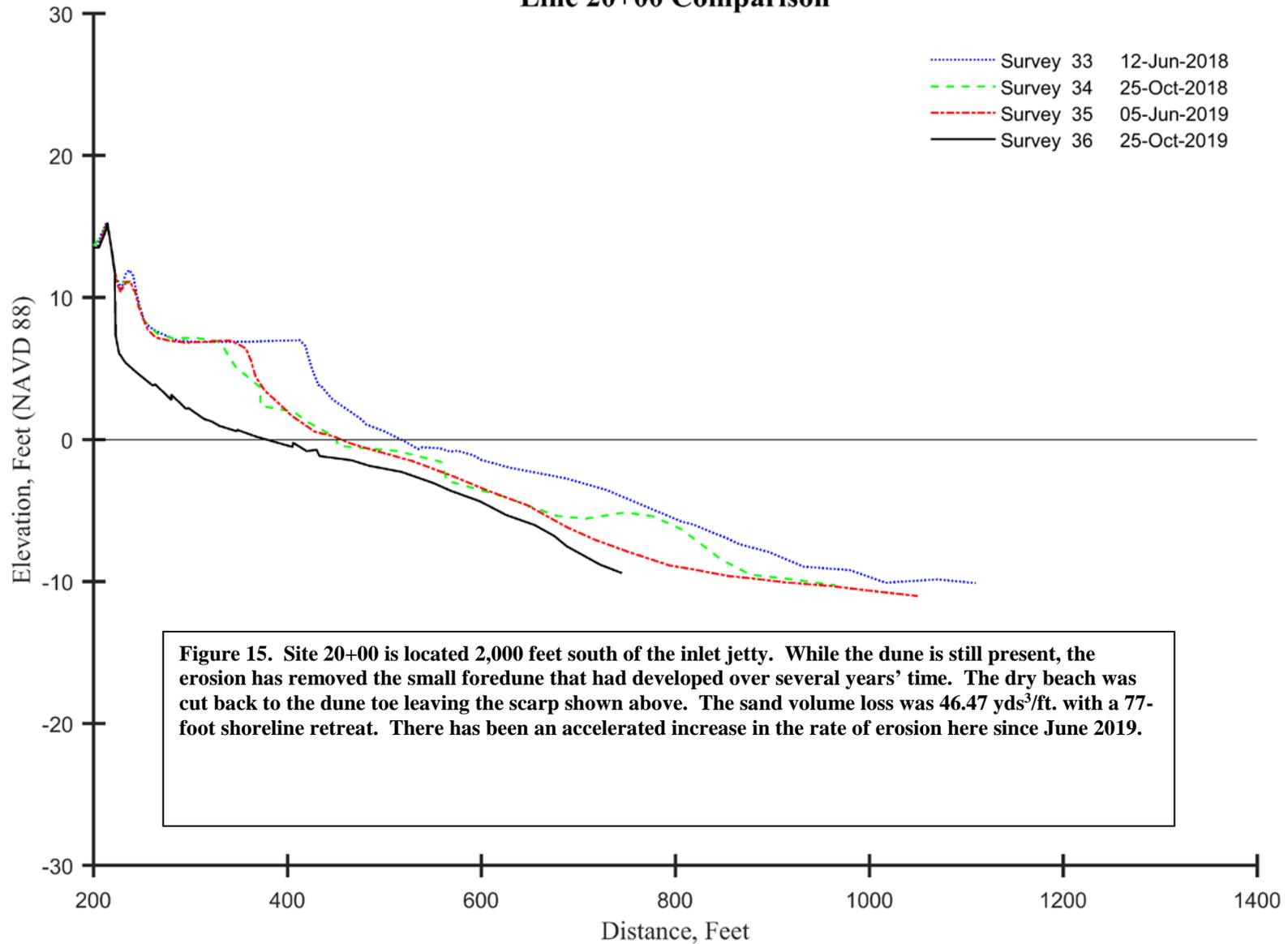


Figure 15. Site 20+00 is located 2,000 feet south of the inlet jetty. While the dune is still present, the erosion has removed the small foredune that had developed over several years' time. The dry beach was cut back to the dune toe leaving the scarp shown above. The sand volume loss was 46.47 yds³/ft. with a 77-foot shoreline retreat. There has been an accelerated increase in the rate of erosion here since June 2019.

Site 40+00 (17th Avenue)

Positioned 4,000 feet south of the 2nd Avenue jetty, this site is located two blocks south of the lifeguard station in the mid-section of the City's oceanfront beaches. Following initial construction in 2009 this region has remained relatively stable. The dry sand expanse has diminished over the past decade, leaving the visitor's use area dependent on wave run-up conditions.

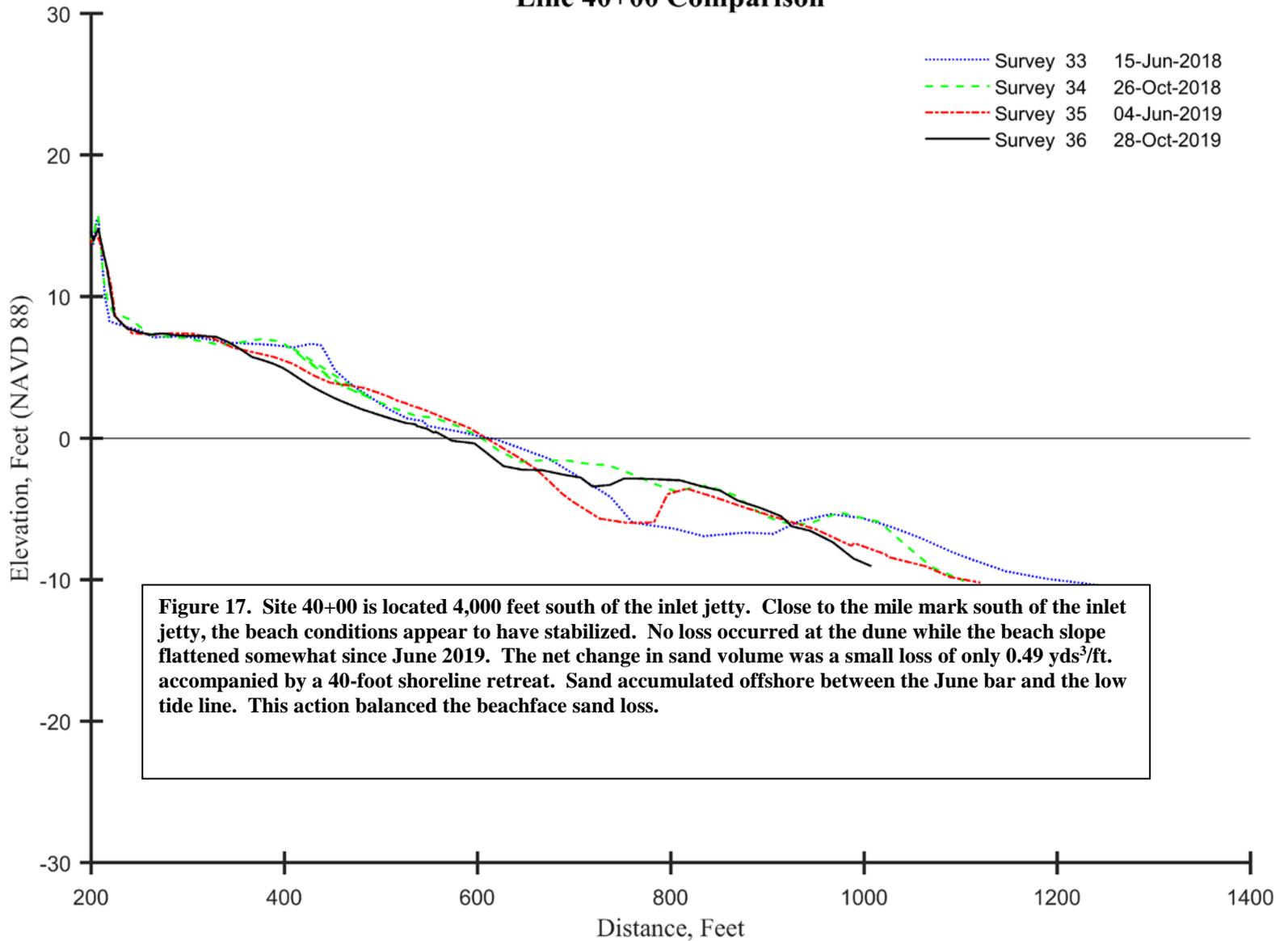
The beach narrowed over the past year with a flatter slope into the ocean. There was a modest offshore bar present these 12 months.



Figure 16. View to the south along the upper beach on October 25, 2019. Beach flattening has moved the wet/dry surf line close to the dunes. While no erosion of the dunes has occurred yet, the narrow beach where the most visitors tend to gather presents a space problem for the coming season.

North Wildwood - Semi-Annual Comparison

Line 40+00 Comparison



Site 52+00 (21st Avenue)

Several hundred feet of dry beach still protected the dune system at this location and to the north, to the south the beach width seaward of the dune was diminished significantly from the initial project design. Immediately south of this location, the engineered dune was initially built with a seaward jog in its alignment from just seaward of the boardwalk to run seaward of the eastern ends of the timber and Morey's piers in North Wildwood.

This element of the original 2009 project was abandoned following Hurricane Sandy which wiped out the dune across the zone occupied by the three ocean piers. Morey's Surfside Pier installed a steel bulkhead fronting their pier, extended along the northeast side for about 100 feet. A new dune system was created landward of the pier ends combining an island dune originally present between the Morey's pier and the adjacent timber pier. No dune was replaced south of Morey's Surfside pier. The beaches seaward of the piers extend seaward of normal high tide, so can limit sand hauling during high tides in the coming project to move material to the northern beach zone.



Figure 18. View to the south taken from the dune toe at 21st Avenue on October 28, 2019. The view along this part of the dune system shows a wider beach extending north and south from where the project design had the dune shift seaward in order to pass seaward of the three piers and the fourth structure at the Wildwood boundary. The start of the dune shift seaward commences just south of this survey line. The landward position has saved this dune from wave attack.

North Wildwood - Semi-Annual Comparison

Line 52+00 Comparison

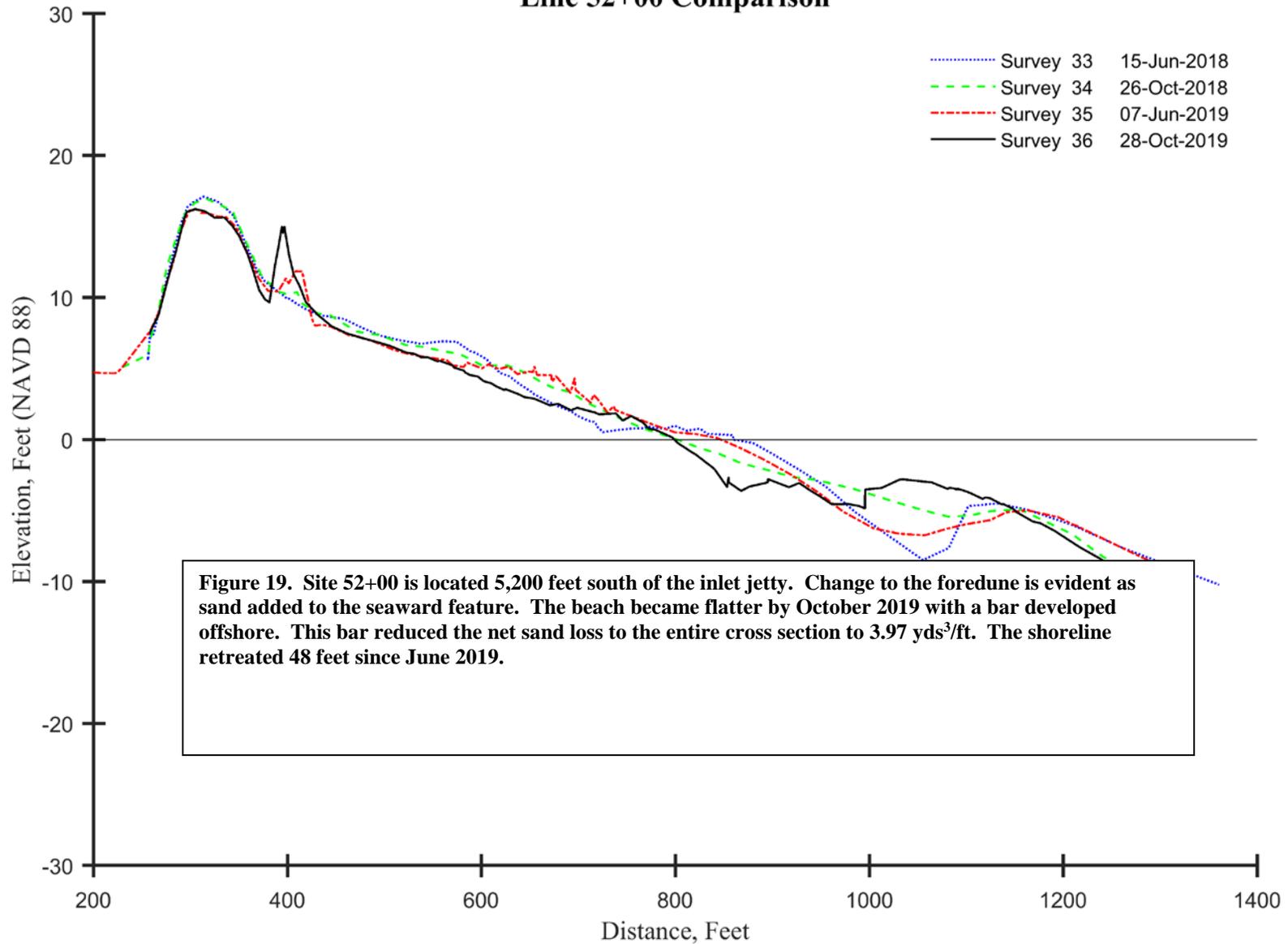


Figure 19. Site 52+00 is located 5,200 feet south of the inlet jetty. Change to the foredune is evident as sand added to the seaward feature. The beach became flatter by October 2019 with a bar developed offshore. This bar reduced the net sand loss to the entire cross section to 3.97 yds³/ft. The shoreline retreated 48 feet since June 2019.

Site 58+00 (Between 23rd & 24th Avenues)

This site is located in the southern section of the City's oceanfront where the engineered dune system was originally constructed seaward of the piers. The original NJDEP project permits mandated a seaward jog in the dune system, which resulted in their vulnerability to the spate of frequent storms since 2009.

An effort was made in 2013 to restore the dune, but events in 2014 forced re-positioning the dune system landward between the piers and including a large vegetated island dune that had existed between Morey's Surfside Pier and the adjacent timber pier. The dune was merged with the landward end of the northeast side bulkhead wall put in for defense of the seaward end of the Surfside Pier. Sand was placed beside each timber pier as well to mitigate storm waves reaching boardwalk development. The view below documents the loss of beach elevation causing the pier ends to be positioned below normal high tide.



Figure 20. The northern timber pier lies in the surf zone after shoreline retreat. The flat beach is wide and would accumulate sand if it were available to move onto the shoreline. This view was taken October 30, 2019.

North Wildwood - Semi-Annual Comparison

Line 58+00 Comparison

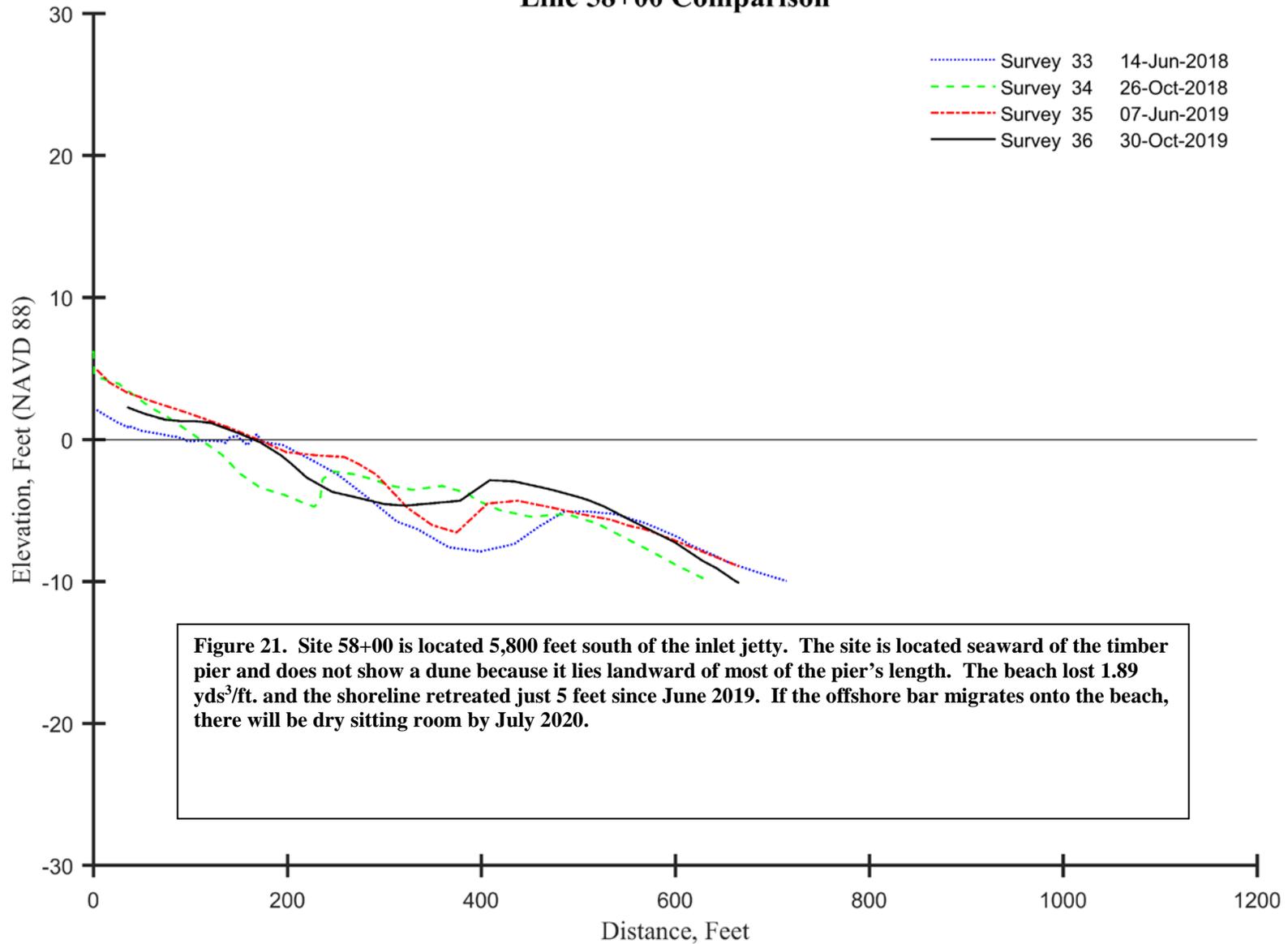


Figure 21. Site 58+00 is located 5,800 feet south of the inlet jetty. The site is located seaward of the timber pier and does not show a dune because it lies landward of most of the pier's length. The beach lost 1.89 yds³/ft. and the shoreline retreated just 5 feet since June 2019. If the offshore bar migrates onto the beach, there will be dry sitting room by July 2020.

Site 60+00 (24th Avenue)

In an effort to better define the beach zone where piers dominate in North Wildwood, this site was included to show the changes to enhance dune protection since Hurricane Sandy. The main feature is an old dune island likely developed around beach raking debris left in a variety of places when the North Wildwood beach was much wider. In the 1990's multiple island dunes existed from 15th Avenue south to here because sand accumulated among the debris and plant seeds always accompanied the grass stems and other organics washed up onto the shoreline. These germinated, established and trapped more sand enhancing these features. The majority of these dune island features are long eroded away as the beachfront retreated between 1994 and 2009. During 2019 the beach elevation was at the minimum during the June 2018 survey. Elevations improved up to the June 2019 survey, then decreased slightly.

No picture was taken at this location.

North Wildwood - Semi-Annual Comparison

Line 60+00 Comparison

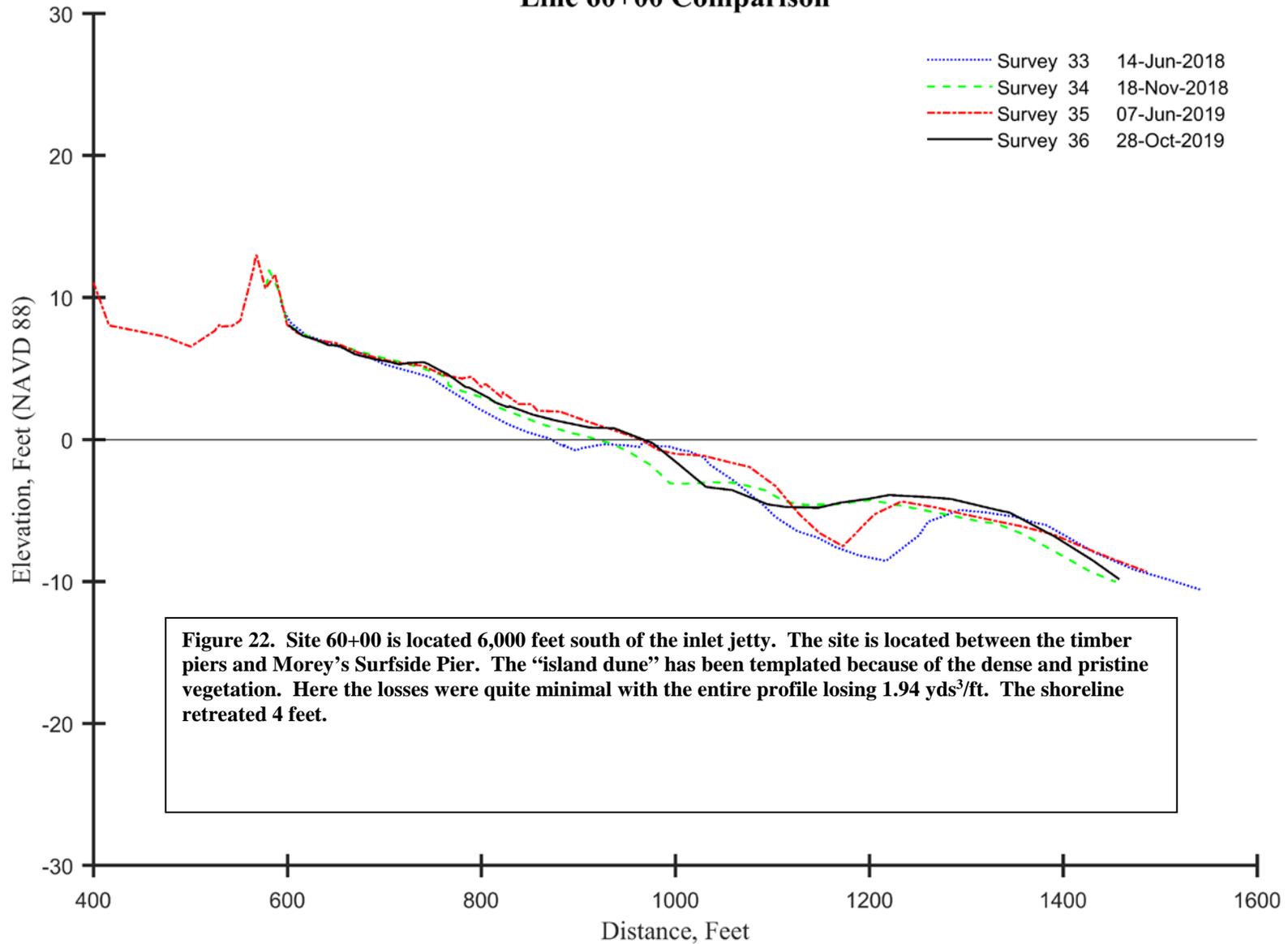


Figure 22. Site 60+00 is located 6,000 feet south of the inlet jetty. The site is located between the timber piers and Morey's Surfside Pier. The "island dune" has been templated because of the dense and pristine vegetation. Here the losses were quite minimal with the entire profile losing 1.94 yds³/ft. The shoreline retreated 4 feet.

Site 64+00 (between 25th and 26th Avenues)

This is the southern-most cross section of the selected profiles within the larger database. Located seaward of the Surfside Pier and Ocean Oasis Water Park and Beach Club this site represents conditions at the south end engineered beach and its taper near the Wildwood and North Wildwood border. Initially the engineered beach design template placed the dune feature 30 feet seaward of the pier's steel bulkhead. A series of storm events that followed construction in 2009 resulted in multiple episodes of erosion followed by restoration efforts to maintain this section of dune. Following Hurricane Sandy this dune location was moved landward to connect between piers leaving this steel structure as the sole protection for the water park. The beach seaward of the feature is narrow and prone to storm erosion.

Like the profile at Line 58+00 located to the north of the piers, by the spring 2014 survey (April 25th), the beach and dune had eroded to a point where the City was forced to reposition this feature landward of the easternmost point of the piers. No dune was replaced south of Surfside Pier because the City of Wildwood declined to allow the original design to be re-established. The proximity to Ocean Oasis also mitigated against dune success due to the location in even mild storm wave activity.



Figure 23. View to the north taken on October 28, 2019 near 26th Avenue showing the beach at the Surfside Pier's seaward end steel bulkhead. Waves easily reach the bulkhead making a dry berm unlikely until the shoreline advances about 100 feet further seaward. Little change has occurred at the bulkhead in over a year with summer accumulations allowing minor beach use immediately seaward of the steel wall.

North Wildwood - Semi-Annual Comparison

Line 64+00 Comparison

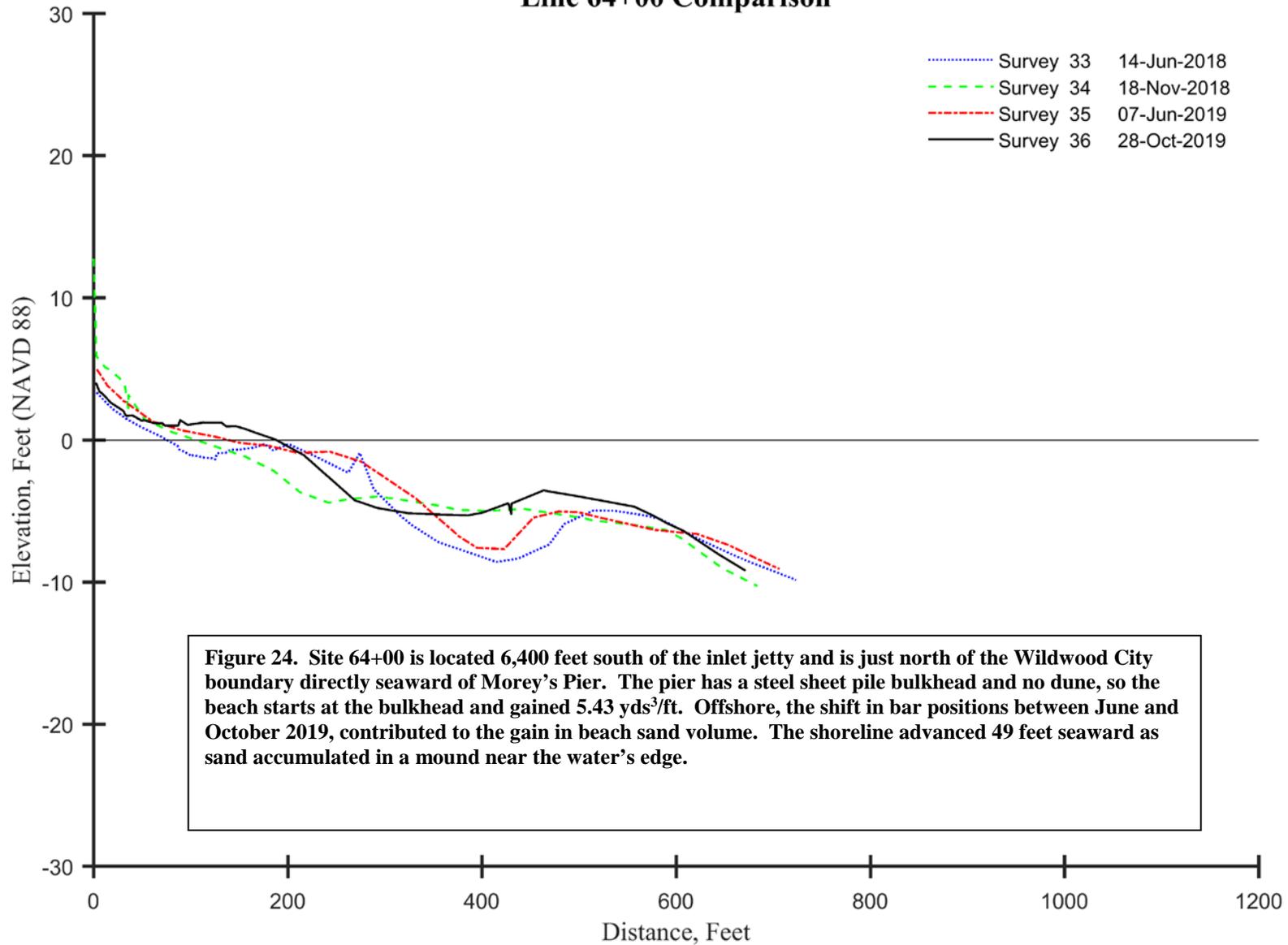


Figure 24. Site 64+00 is located 6,400 feet south of the inlet jetty and is just north of the Wildwood City boundary directly seaward of Morey's Pier. The pier has a steel sheet pile bulkhead and no dune, so the beach starts at the bulkhead and gained 5.43 yds³/ft. Offshore, the shift in bar positions between June and October 2019, contributed to the gain in beach sand volume. The shoreline advanced 49 feet seaward as sand accumulated in a mound near the water's edge.

Summary/Conclusions:

While northeast storms were infrequent and mild, multiple episodes of low velocity northeast winds helped to generate frequent episodes of wave erosion at the North Wildwood coastal oceanfront focused on the zone between 12th and 2nd Avenues. Wave and tidal action moved the past season's sand back pass supply either into Hereford Inlet extending a bar northwest past Surf Avenue or south toward the Wildwood City boundary. The outcome has been a growing need for a hydraulic fill to regenerate a full beach design template cross section similar to that put in place in 2009.

Sand back passing can supply material at a low cost per cubic yard, but the rate and volume of material moved per day is far less than that of a large hydraulic dredge operating in close proximity to the beachfront being supplied with sand.

Permits should be sought to conduct hydraulic beach maintenance going forward on a 5-6-year schedule in the absence of either continued City funding of large-scale sand recycling or further delay in the start of the anticipated US Army Corps of Engineers shore protection project. The NJ Div. of Coastal Engineering should be approached to renew the 2009 project scope, that even if done to the level of half (750,000 cy) the initial sand volume (1.45 million cy), would reset the stage so that a stable oceanfront shoreline could be maintained using the sand back-passing methodology to, perhaps, greatly extend the time between hydraulic dredge projects.