

**FINAL REPORT FOR 2019
ON THE CONDITION OF THE MUNICIPAL OCEANFRONT BEACHES
THE BOROUGH OF AVALON, CAPE MAY COUNTY, NEW JERSEY**



View of the Avalon oceanfront November 9, 2019 as the 2019 beach maintenance work was underway by Great Lakes Dredge & Dock under contract by the US Army Corps of Engineers. The dredge was in the Townsend's Inlet borrow zone and pumping sand onto beaches in the vicinity of 17th Street. PHOTO by Ted Kingston.

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**ANNUAL REPORT FOR 2019 - TO THE BOROUGH OF AVALON
ON THE
CONDITION OF THE MUNICIPAL BEACHES**

Introduction:

The 2019 annual report provides the results and analyses from the fall 2018 to fall 2019 survey datasets from the 36 years of oceanfront surveys for Avalon. This report will examine the changes since the recent US Army Corps of Engineers-sponsored beach restoration, the 2nd to 3rd quarter versus the 3rd to 4th quarter comparisons, and the fifth year of evaluation of conditions in the ebb-tidal shoals of Townsends Inlet immediately following the US Army maintenance this past fall.

Recent Fill Projects:

2013: Post-Hurricane Sandy restoration; USACE with 336,359 cubic yards.
2015: Avalon restored the engineered beach; 740,000 cubic yards.
2016: Avalon undertook a back-pass operation; 50,000 cubic yards.
2017: Maintenance of Avalon & Stone Harbor; USACE with 944,000 cubic yards.
2018: Avalon undertook a back-pass operation; 53,000 cubic yards.
2019: Maintenance of Avalon; USACE with 571,351 cubic yards.

TOTAL of SAND MOVED TO THE ENGINEERED BEACH SINCE 2013: 2,694,710 cu. yds.

Monitoring Program:

The CRC monitored the ten oceanfront cross sections four times in 2019 on a seasonal timeline. These surveying activities continue a monitoring program dating back to 1981. The five northern sites are located within the engineered beach project area while the southern five sites cover the accretional region including the natural exclusion area and sand back-passing borrow zones. Monitoring provides details on natural sediment movement along the Borough's Atlantic shoreline and surveying has continued through multiple beach restoration projects that started in 1987 with a local/state sponsored project. These data focus on project performance evaluation. Each topographic beach profile starts at a fixed reference position landward of the dune. The repetitive surveys for each profile include changes to the dune, beach and nearshore. The following is a list of quarterly studies included in this report and the dates of the surveys:

- Survey 148 December 6 & 7, 2018; 4th Quarter
- Survey 149 March 18 & 19, 2019; 1st Quarter
- Survey 150 May 29 - 30, 2019; 2nd Quarter
- Survey 151 September 24 & October 1, 2019; 3rd Quarter
- Survey 152 December 3 & 9, 2019; 4th Quarter

Winter Storm Impacts:

The 2018-2019 winter months started with three December 2018 storms on the 9th, 16th, and the 21st. January and February 2019 were cold and dry without storm events. In March a storm occurred on the 22nd and again April 2nd and 3rd. Mothers' Day was the final northeaster of the season on May 12th. None of these storms were beyond mild events, but the wave action did cut deeply into the very northeastern beaches in Avalon. The US Army Corps of Engineers returned with Great Lakes as the contractor to dredge ebb-shoal sand from Townsend's Inlet in the fall of 2019. The contrast between the third quarter beach review and that for the fourth quarter serves to illustrate the positive impact of that effort. Since the restoration effort was completed in December 2019, there have been few northeast events with most storms moving northwest of the area, leaving the ocean in a less violent mood this winter thus far.

Quarterly Beach Changes in 2019:

Oceanfront beaches were surveyed quarterly to depict both seasonal and annual changes, erosional and recovery rates and to assist in storm damage assessments and project performance assessments. Table 1 below shows the individual profile site trends in sand volume change quarter by quarter during 2019.

Table 1
2019 Oceanfront Beach Profile
Quarterly Sand Volume Changes at Each Survey Line Location

Profile	Winter	Spring	Summer	Fall
Number	12/18 - 3/19	3/19 - 5/19	5/19 - 9/19	9/19 - 12/19
	(yds³/ft)	(yds³/ft)	(yds³/ft)	(yds³/ft)
8th Street Jetty				
AV-9	-7.56	7.80	-31.69	144.46
AV-12	-31.70	14.93	-32.44	218.46
AV-17	-19.23	-11.01	-14.88	118.12
AV-23	-4.77	-12.68	-5.63	5.70
AV-28	-18.72	5.00	-3.90	4.69
AV-35	9.62	-14.73	20.08	-6.02
AV-44	3.12	8.50	2.83	0.28
AV-58	4.93	5.46	9.63	-0.93
AV-70	-5.14	7.52	0.44	-7.77
AV-78	1.23	-5.40	9.26	0.75
Quarterly Volume Change (yds³) =	-74,035	21,993	2,362	539,362

The first quarter sand loss volume was less than last year due to a lower storm frequency. The spring accumulation of sand within the survey envelope was skewed to the southern five sites with modest losses at the engineered beach. The third quarter saw a near balance between northern beach losses and southern beach gains that yielded a net plus of 2,362 cubic yards across the entire Avalon oceanfront. The USACE maintenance effort in the fourth quarter dominated the picture with over a half million cubic yards of new sand added to the beach between 9th and 23rd Streets.

Table 2 below shows the third quarter changes at each profile location where sand eroded from the engineered beach shoreline but deposited in almost equal volumes south of 28th Street. Shoreline position changes (zero datum NAVD88) are measured in feet. Profile volume changes were averaged with adjacent sites to calculate an average volume change then multiplied by the distance between sites to determine a net cell volume change

in cubic yards. Summation of each cell volume change provides the total change in sand volume for the Avalon oceanfront beaches during the third quarter.

Table 2
2019 Oceanfront Beach Profile
Third Quarter Sand Volume Change

Profile Number	Shoreline Change (feet)	Volume Change (yds³/ft)	Avg. Volume Change (yds³/ft)	Cell Distance (yds³/ft)	Net Volume Change (yds³/ft)	Cumulative Volume (yds³/ft)
8th Street Jetty						
			-31.686	500	-15,843	-15,843
AV-9	-55.3	-31.69				
			-32.062	840	-26,932	-42,775
AV-12	-69.1	-32.44				
			-23.660	1400	-33,124	-75,899
AV-17	-52.8	-14.88				
			-10.256	1680	-17,230	-93,129
AV-23	-43.6	-5.63				
			-4.767	1400	-6,673	-99,802
AV-28	-22.5	-3.90				
			8.091	2025	16,383	-83,419
AV-35	-58.2	20.08				
			11.456	2510	28,753	-54,666
AV-44	-20.7	2.83				
			6.228	3925	24,443	-30,223
AV-58	76.0	9.63				
			5.032	3360	16,906	-13,317
AV-70	10.0	0.44				
			4.849	2240	10,862	-2,455
AV-78	48.8	9.26				
			9.263	520	4,817	2,362
Volume Change for Beaches Between the Jetty & 78th St. =					2,362	(yds³)

The third quarter beach changes were distributed between modest losses from 9th to 28th Streets followed by even more modest gains in sand from 35th to 78th Streets. The net positive volume of 2,362 cubic yards is essentially in balance between erosion in the north and deposition to the south in Avalon.

Table 3 on the following page shows the fourth quarter volume change for 2019. The US Army Engineers commenced a maintenance effort in the fall, finishing as the survey was conducted. The three northern profile sites received sand directly (9th to 17th Streets), while sediment distribution further south to the Stone Harbor boundary varied around little to no change. Generally, the loss factor to the south was about 35,600 cubic yards across 16,000 feet of oceanfront between 28th and 78th Streets (about 2.16 yds³/ft.).

Table 3
Oceanfront Beach Profile
Fourth Quarter Sand Volume Change September 2019 to December 2019

Profile Number	Shoreline Change (feet)	Volume Change (yds³/ft)	Avg. Volume Change (yds³/ft)	Cell Distance (yds³/ft)	Net Volume Change (yds³/ft)	Cumulative Volume (yds³/ft)
8th Street Jetty						
			144.457	500	72,229	72,229
AV-9	262.6	144.46				
			181.459	840	152,425	224,654
AV-12	347.0	218.46				
			168.290	1400	235,605	460,259
AV-17	184.6	118.12				
			61.908	1680	104,005	564,264
AV-23	-14.8	5.70				
			5.195	1400	7,272	571,537
AV-28	-38.8	4.69				
			-1.254	2025	-2,538	568,998
AV-35	42.5	-7.20				
			-3.461	2510	-8,686	560,312
AV-44	51.3	0.28				
			-0.327	3925	-1,282	559,031
AV-58	-68.8	-0.93				
			-4.350	3360	-14,616	544,415
AV-70	-12.2	-7.77				
			-3.509	2240	-7,859	536,556
AV-78	-0.9	0.75				
			0.752	520	391	536,947
Volume Change for Beaches Between the Jetty & 78th St. =					536,947	(yds³)

The final quarter of 2019 saw 564,264 cubic yards added to the beach between the jetty at Townsend's Inlet to 23rd Street site. A small amount was added further south up to the 35th Street's sand volume loss. The 70th Street loss exceeded the tiny gains seen at 44th, 58th and 78th Streets. The result of the maintenance effort was a restoration of the engineered beach to design specifications.

Table 4
Annual Beach Changes
December 2018 to December 2019

Profile Number	Shoreline Change (feet)	Volume Change (yds ³ /ft)	Avg. Volume Change (yds ³ /ft)	Cell Distance (yds ³ /ft)	Net Volume Change (yds ³ /ft)	Cumulative Volume (yds ³ /ft)
8th Street Jetty						
			110.325	500	55,163	55,163
AV-9	202.4	110.33				
			150.257	840	126,216	181,378
AV-12	270.9	190.19				
			132.173	1400	185,042	366,420
AV-17	94.4	74.16				
			26.771	1680	44,975	411,395
AV-23	-96.4	-20.61				
			-17.023	1400	-23,832	387,564
AV-28	-73.4	-13.43				
			-2.659	2025	-5,384	382,179
AV-35	21.0	8.11				
			12.267	2510	30,789	412,968
AV-44	45.9	16.42				
			20.150	3925	79,087	492,055
AV-58	-45.2	23.88				
			10.412	3360	34,983	527,038
AV-70	10.5	-3.06				
			4.601	2240	10,305	537,343
AV-78	-22.5	12.26				
			12.257	520	6,374	543,716
Annual Volume Change for Oceanfront Beaches =					543,716	cu. yds.

The annual sand volume change does parallel that from the fourth quarter because of the federal work effort. The 539,632 cubic yards of added sand seen in the 3rd to 4th quarter comparison matches well with the 543,716 computed for the annual change, meaning that the federal project increased the beach's sand supply by 539,632 cy plus about 4,000 cubic yards provided by nature in one year. The USACE pay volume was reported to be 571,351 cubic yards of sand within the project envelope. There were no moderate or severe northeast storms and only a few mild ones with just 2 Atlantic hurricanes in 2019 passing anywhere near the mid-Atlantic coastline.

Individual Site Review:

This section describes the changes documented at each of the cross-section locations. The objective is to show with cross sections and photographs how the individual sites performed. The dominating theme in 2019 was the latest federal shoreline maintenance sand placement and a very low storm frequency with no serious events.

AV-9 - Ninth Street

In 2017, the US Army Corps contractor placed 144 yds³/ft. on the 9th Street profile as of the first quarter survey in March 2017. Since the project started at the north end of the oceanfront beach, the progress of work moved south completing the effort by May 24, 2017. Between March and September 2019 sand accumulated on the

berm with modest beach width improvement. Sand loss during the third quarter amounted to 31.69 yds³/ft. accompanied by a 55-foot shoreline retreat.

The US Army Corps returned to Townsend's Inlet in the fall of 2019 and placed 144.46 yds³/ft. of inlet sand on the 9th Street beach producing a 263-foot shoreline advance which dramatically shows in the plots (Figure 2). This beach gains and loses fill sand to a point where the inlet jetty act to shield the site from direct wave impact reducing further losses. The rock revetment also angles northwestward from 11th Street to the point where the inlet jetty attaches to the inlet rock wall. The revetment between 11th and 8th Streets is seldom exposed for this reason.



1a. March 18, 2019



1b. October 1, 2019

Photographs 1a to 1c. 9th Street view to the south.

View 1a shows the dune where sand has all but buried the newest row of fencing by March 2019. The beach was approaching the rock revetment to the south, but no damage yet at this site.

View 1b was taken in October following additional beach retreat exposing the rocks to the south. Traces of fence remain unburied.

View 1c This view from early December shows the massive expanse added to the beach width by the USACE maintenance effort. The beach surface was extended back to a small scarp cut into the dunes. The erosion had just about reached that new row of fence seen in the picture directly above.



1c. December 3, 2019

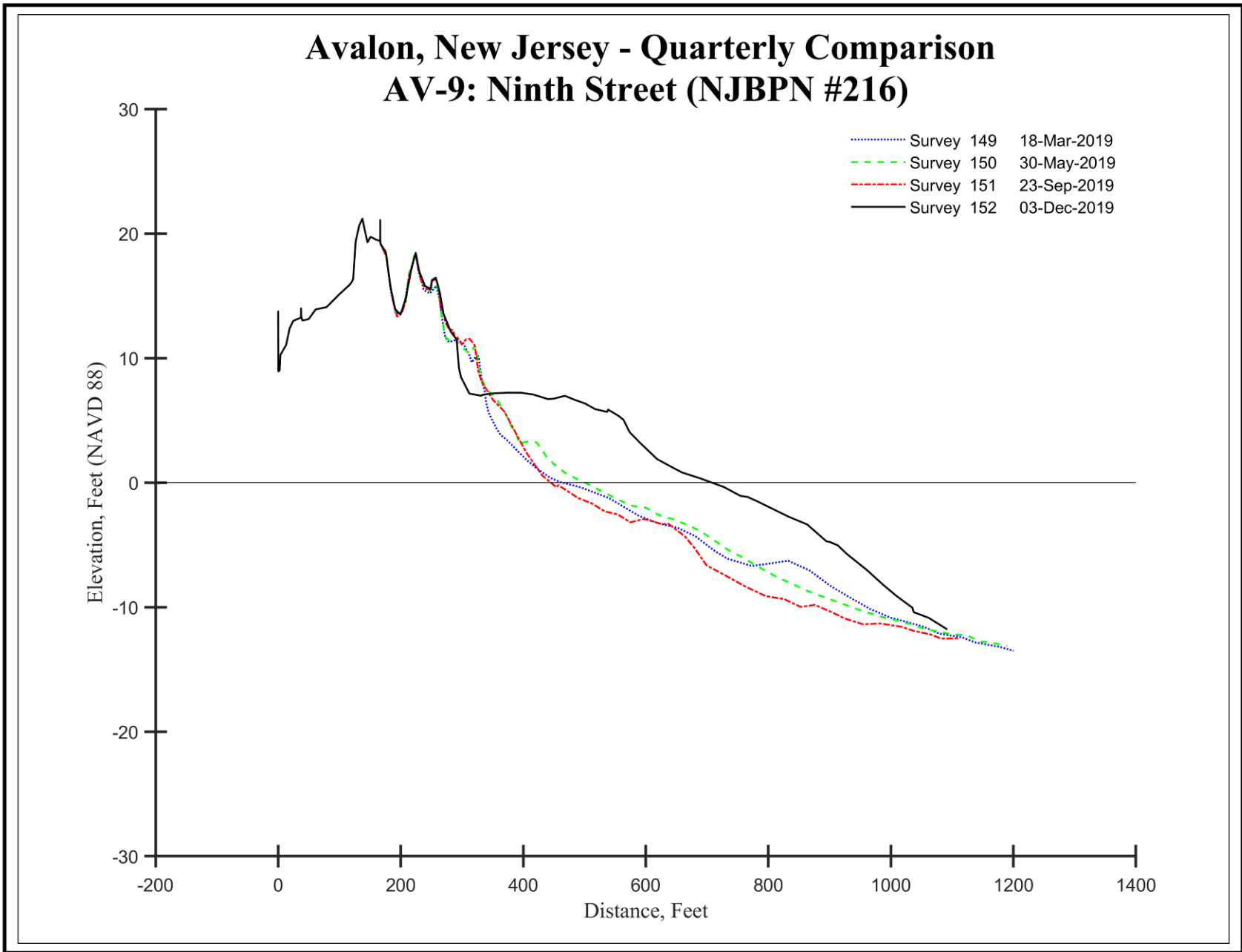


Figure 2. At 9th Street conditions did continue to retreat between March and September 2019, then expanded with the USACE sand placement completed just prior to the December 3, 2019 survey. 144.50 yds³/ft. were put on the beach extending the shoreline 263 feet seaward.

AV-12 - Twelfth Street

Sand placed by the USACE by March 2017 added 259 yds³/ft. expanding the beach width by 385 feet. Unlike the 9th Street site, the beach from 11th to 17th absorbs the most direct assault by storm energy combined with a general lack of sand sources to resupply the beachfront after loss events occur. The 2018 annual sand volume loss was 83.27 yds³/ft., with a 125-foot shoreline retreat. The USACE placement volume minus this loss leaves 176 cubic yards of sand remaining on this profile location.

This location lost 32.44 yds³/ft. by the end of the third quarter of 2019 with a 69-foot shoreline retreat prior to the arrival of the USACE in the fall of 2019. The project placed 218.46 yds³/ft. in new sand adding 347 feet to the beach width. The largest sand volume was placed here among the three sites in our study receiving material in 2019.



3a. March 18, 2019



3b. May 30, 2019



3c. December 3, 2019

Photographs 3a to 3c. 12th Street Views to the south.

View 3a shows 12th Street as the beach was becoming narrower, but not yet impacting the dunes. The 2017 project work was still intact.

View 3b was taken just after Memorial Day where storm and normal waves had begun to truncate the seaward edge of the newly planted dune from 2017.

View 3c was taken after the latest federal maintenance was complete, but the damage to the dune scarp had not been addressed by grading. The April 2017 work was augmented by the fall 2019 effort greatly expanding the beach width.

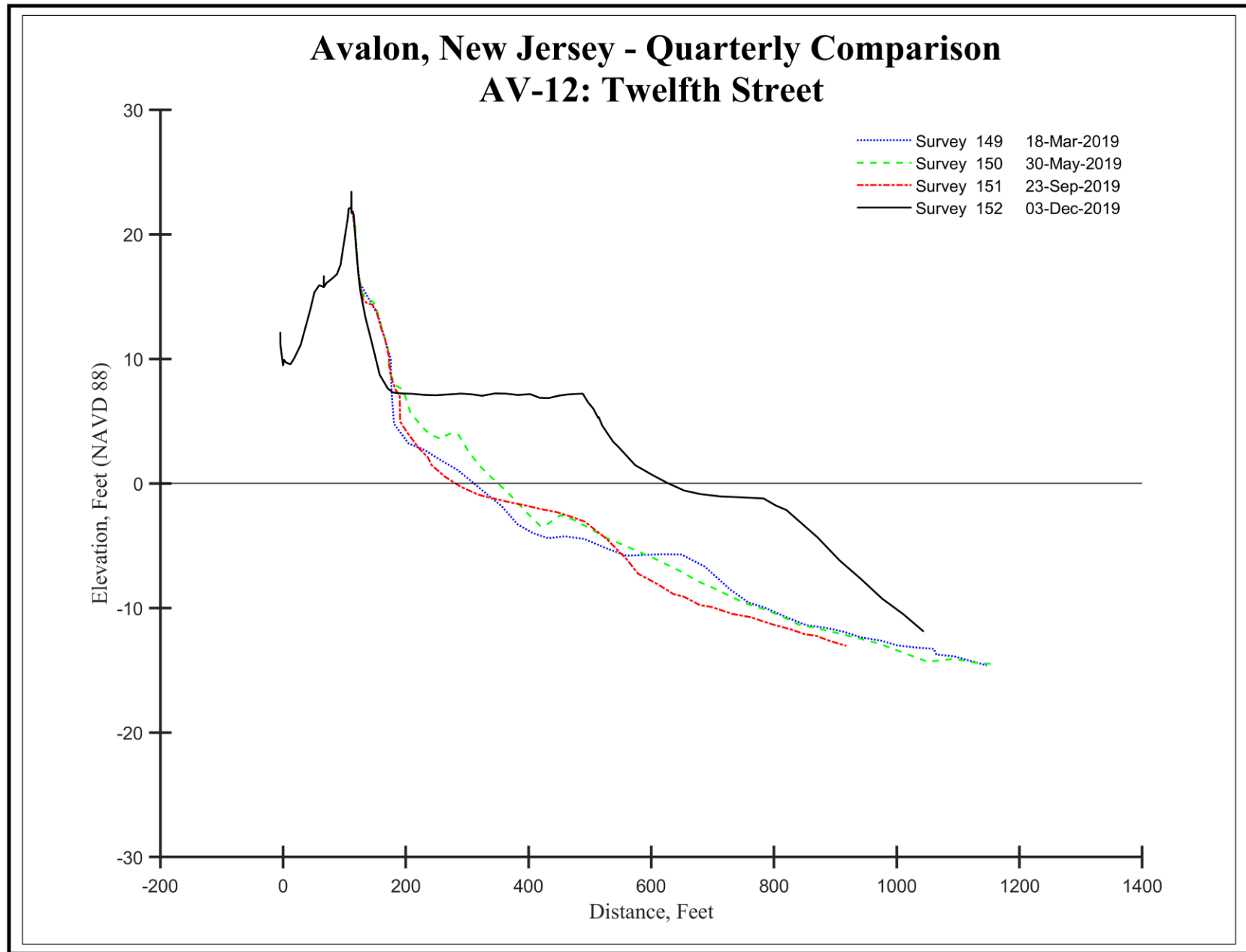


Figure 4. Progressive retreat took the March shoreline back to the September position following modest summer accretion. The USACE work shows as the massive berm in place for the December 3, 2019 survey. 218.46 yds³/ft. in new sand was placed pushing the zero elevation shoreline position seaward by 347 feet.

AV-17 - Seventeenth Street

The profile is located at the southern terminus of a rock revetment which extends to here from 8th Street.

The 2018 annual sand volume loss was 78.71 yds³/ft. The USACE placed 219.18 yds³/ft. by May 2017, so the remaining volume is 140 cubic yards, with material transferred to the dune 's seaward toe this summer by the wind.

The third quarter of 2019 saw a sand volume loss of 14.88 yds³/ft., declining from larger amounts at the two northern sites. The zero-elevation position retreated 53 feet. The 2019 USACE fill volume was 118.12 yds³/ft. advancing the shoreline by 185 feet. The 17th Street location was the southernmost site receiving maintenance fill in 2019 with the ending taper winding up between 17th and 23rd Streets.



5a. March 18, 2019



5b. September 23, 2019



5c. December 3, 2019

Photographs 5a to 5c. 17th Street, view to the south.

View 5a shows the foredune crest and the 2017 beach present at 17th Street.

View 5b By September, the grass had advanced into the ridge between the fences. The beach remained in decent condition as the new dune ridge continued to grow.

View 5c By December 2019, the new beach width produced greater protection for this site.

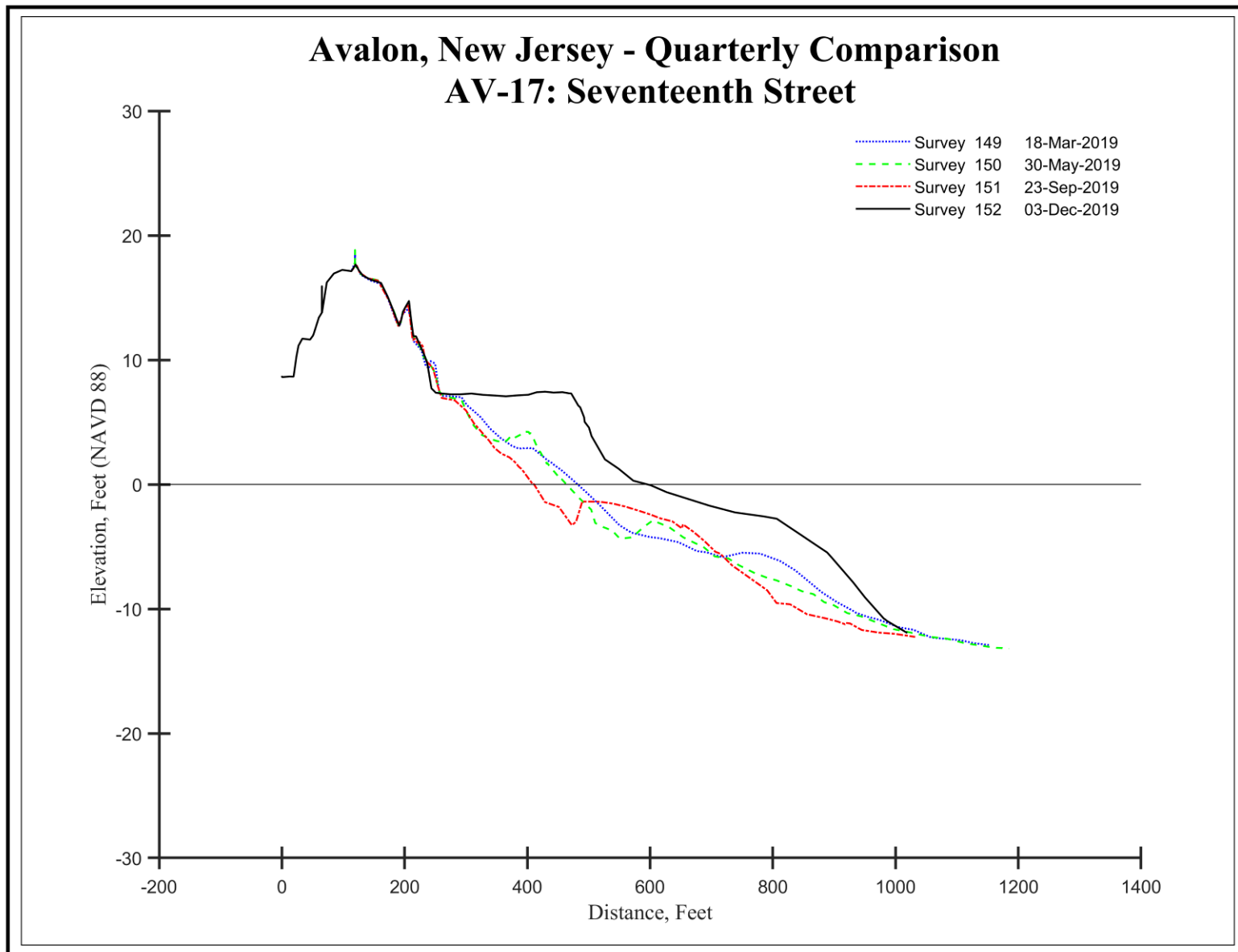


Figure 6. The first three quarters of 2019 saw minor beach retreat by September, but there was a sizable offshore bar about to attach to the beachface. The federal work added 118.12 yds³/ft. in sand volume moving the shoreline 185 feet seaward.

AV-23 - Twenty Third Street

The 23rd Street cross section is located seaward of the Avalon boardwalk near the southern end of the engineered beach and federal project. The 2017 project, complete as of May 2017, provided a 235-foot wider berm at an 8-foot elevation. The project added 120.69 yds³/ft. to this part of the Avalon oceanfront.

The 2018 annual beach volume change was 42.49 yds³/ft. with a 33-foot shoreline retreat. The difference leaves 79 cubic yards of the 2017 project sand left on the 23rd Street beachfront.

The third quarter of 2019 saw a 5.63 yds³/ft. sand loss volume at 23rd Street, declining further from the value seen at 17th Street. This shoreline retreated 44 feet in the quarter.

The 2019 USACE project did not place sand at this site. The beach did gain back the loss seen in the 3rd quarter (5.70 yds³/ft.), but the shoreline continued to retreat (-15 feet). Based on all past performances for newly placed fill, the 23rd Street site will receive new sand supplies both on the beach and offshore, documented in the spring 2020 survey.



7a. March 18, 2019



7b. September 23, 2019



7c. December 3, 2019

Photographs 7a to 7c. 23rd Street, views to the north.

View 7a The March view shows the fencing installed after the 2017 federal project had become 75% buried. Sand has gathered at the fence creating a foredune. The beach remained wide with the 21st Street stormwater pipeline still buried.

View 7b By September the beach was narrower with more of the stormwater discharge pipeline exposed.

View 7c In December, just the tips of the 4-foot sand fence was showing, while the beach had narrowed considerably. The federal project did not directly place sand at this site, but material will migrate quickly into the region.

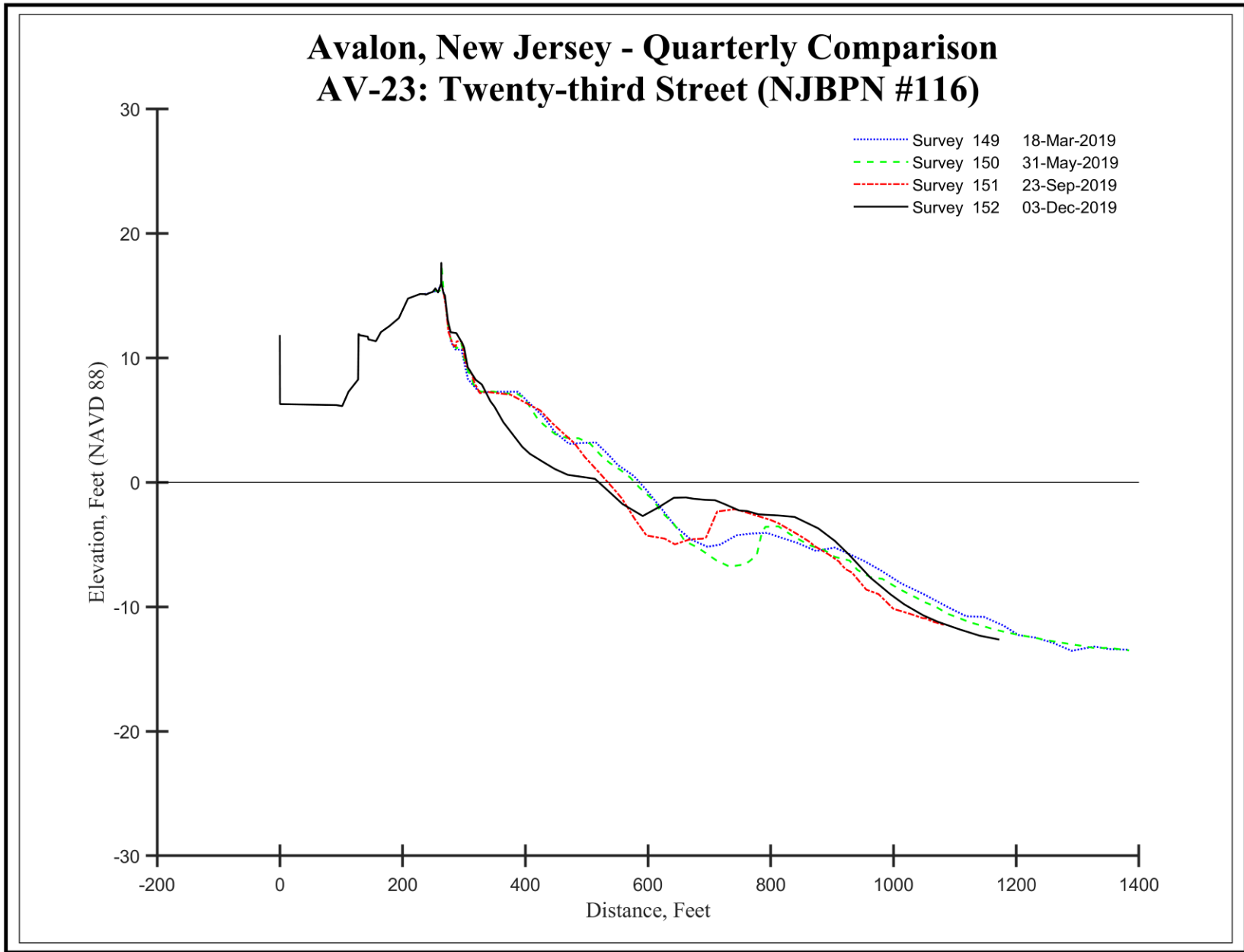


Figure 8. The 2019 events did not negatively impact the dune at 23rd Street, but the beach retreated and lowered in elevation substantially. An offshore bar developed in March, grew larger through May and September, eventually leading to the mass of material about to migrate onto the shoreline by December. The annual comparison found that the beach lost 33.95 yds³/ft. while offshore gained a net volume of 11.66 yds³/ft. as the bar system accumulated sand. The shoreline retreated 96 feet in 2019.

AV-28 - Twenty Eighth Street

The 28th Street location is generally just south of the nodal point between chronic erosion and regular sand deposition in Avalon. This beach only received 37.41 yds³/ft., largely from sand moving to this location from the southern limit of pumping completed in 2017.

The 2018 annual change was a loss of 35.76 cubic yards of sand with an 88-foot shoreline retreat. The beach ended that year just 2 cubic yards of sand left from the material that moved into the area immediately following the 2017 USACE project.

No sand was added in 2019. The third quarter saw 3.90 yds³/ft. in sand volume loss with a 23-foot shoreline retreat by September 2019. Following the federal project later in the fall, the beach and offshore gained 4.69 yds³/ft., but the shoreline retreated 39 feet. Sand will migrate to this location during the first 6 months after the 2019 project was complete.



9a. March 18, 2019



9b. September 23, 2019



9c. December 4, 2019

Photographs 9a to 9c. 28th Street, views to the north.

View 9a shows the beach in the spring of 2019 with a reasonably wide beach and little storm debris deposited at the dune toe.

View 9b shows the 28th Street beach following the summer season as the beach width retreated substantially without dune damage.

View 9c. The sand fencing has been buried as the seaward dune slope accumulated wind transported material. The high tide line is only 50 feet from the dune toe in spite of the completion of the federal beach restoration project to the north. Littoral transport should provide added sand quickly.

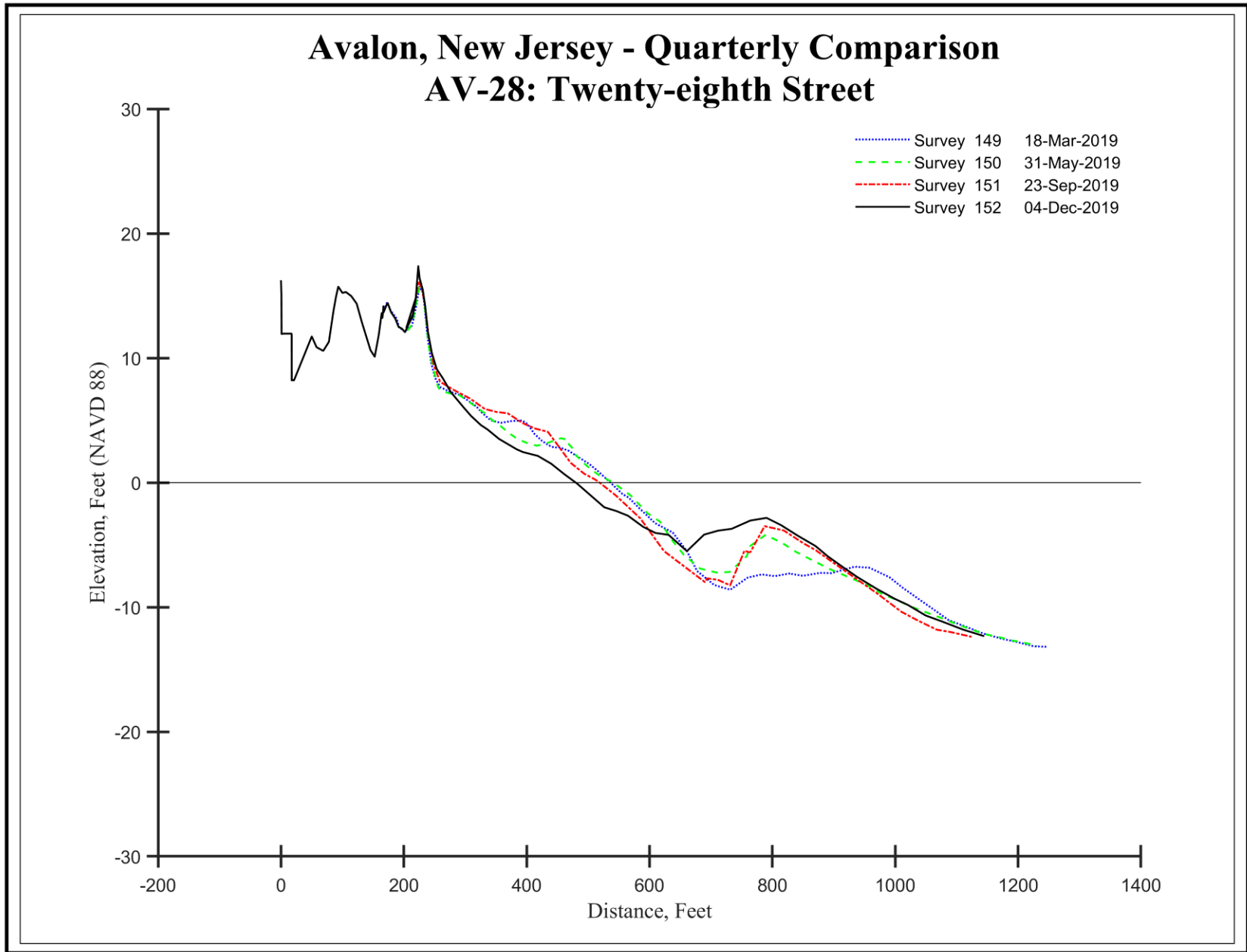


Figure 10. The 28th Street site was south of the USACE sand template for 2019. The photographic evidence for beach retreat shows in the four cross sections as it lost 20.36 yds³/ft. in sand volume during 2019 while the offshore region gained 5.74 yds³/ft. in an offshore bar which progressively advances landward and increases in sand volume during 2019.

AV-35 - Thirty Fifth Street

35th Street has been a depositional zone for decades and recently has been used as a sand source to augment the erosional beaches in the 12th to 15th Street area. The “borrowing” area is the lower beachface and any nearby bar exposed at low tide that harvesting of sand can occur.

The 2018 annual change was a loss of 19.81 yds³/ft. with a 54-foot shoreline retreat. No sand has been placed this far south on the Avalon beachfront since such activities commenced in 1987.

The third quarter of 2019 saw 20.08 yds³/ft. in sand volume added, likely derived from the losses observed further north. The shoreline did retreat 58 feet from the summer position. The fourth quarter saw a minor sand volume loss of 7.20 yds³/ft., but the shoreline advanced 43 feet from the September position because the zone of sand gain was right at the zero-elevation position on the profile (small bar migration onto the beach; Figure 12).



11a. March 18, 2019



11b. September 23, 2019



11c. December 4, 2019

Photographs 11a to 11c. 35th Street, views to the north.

View 11a. The 35th Street site is developing a sizable foredune seaward of the last such feature generated a decade ago. Beach debris raking went a bit too close to the foredune slope here in March.

View 11b. By September all traces of the raking had vanished and grass was moving downslope onto the beach.

View 11c. Sand continued to add to the foredune with a beach wide enough to provide a continuous supply. The 2017 nourishment project sand is likely that seen in the offshore bar systems from 23rd Street south to here.

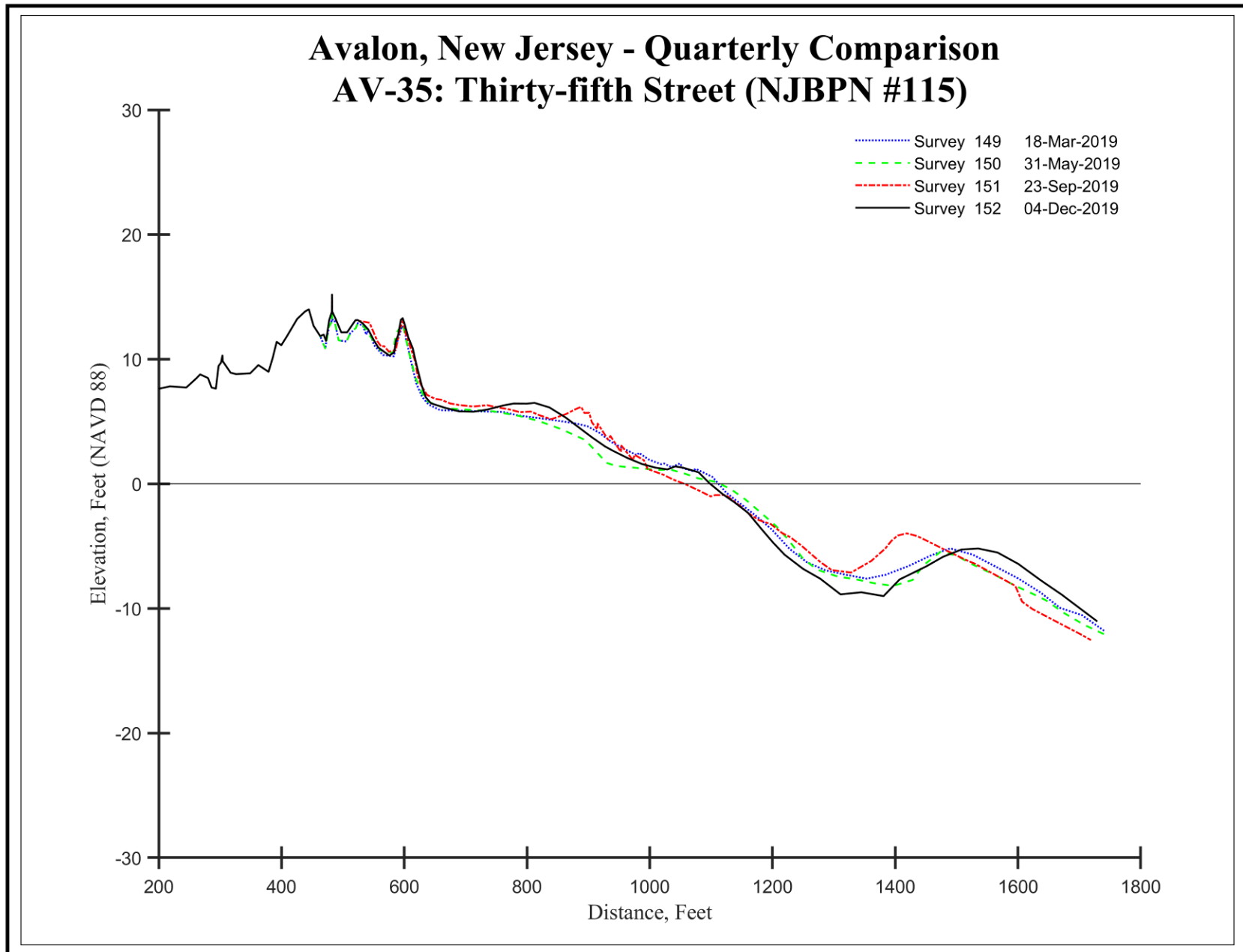


Figure 12. 35th Street location also saw an offshore bar develop during 2019, but it did not migrate nearly as dramatically toward the shoreline as did the bar on the three sites to the north. Little change occurred on the beach with minor sand volume added to the dunes.

AV-44 - Forty Fourth Street

This site is located within an exclusion zone in the Avalon “High Dune Area” established by the NJ Endangered Species Program to govern how and where Avalon could harvest beach sand for back pass operations. Their goal was to create a habitat not under repetitive excavation that could impact food sources for piping plover chicks hatching in the spring of the year. As a result, and despite the abundance of available sand accumulating in this region annually no sand has been harvested from this survey site during the Borough’s multiple sand back-passing programs.

The 2018 annual accumulation of sand amounted to 21.27 yds³/ft. with a 130-foot shoreline advance. The third quarter of 2019 produced a tiny 2.83 yds³/ft. in sand volume gain, but the zero-elevation beach position retreated 21 feet landward as a new nearshore sand bar moved onto the shoreline creating a runnel trough right at the zero elevation. The fourth quarter saw an even smaller sand volume gain of 0.28 yds³/ft., but a 51-foot shoreline advance as another small nearshore sand bar was attaching to the beachface (Figure 14).



13a. March 18, 2019



13b. September 23, 2019



13c. December 4, 2019

Photographs 13a to 13c. 44th Street, views to the south.

View 13a shows the view to the south across the expanding foredune with the beach in the distance.

View 13b is the same view in September showing more of the beach and seaward edge of the foredune slope.

View 13c shows the seaward dune toe slope with grass plants migrating down the slope. Beach widths have remained constant over time.

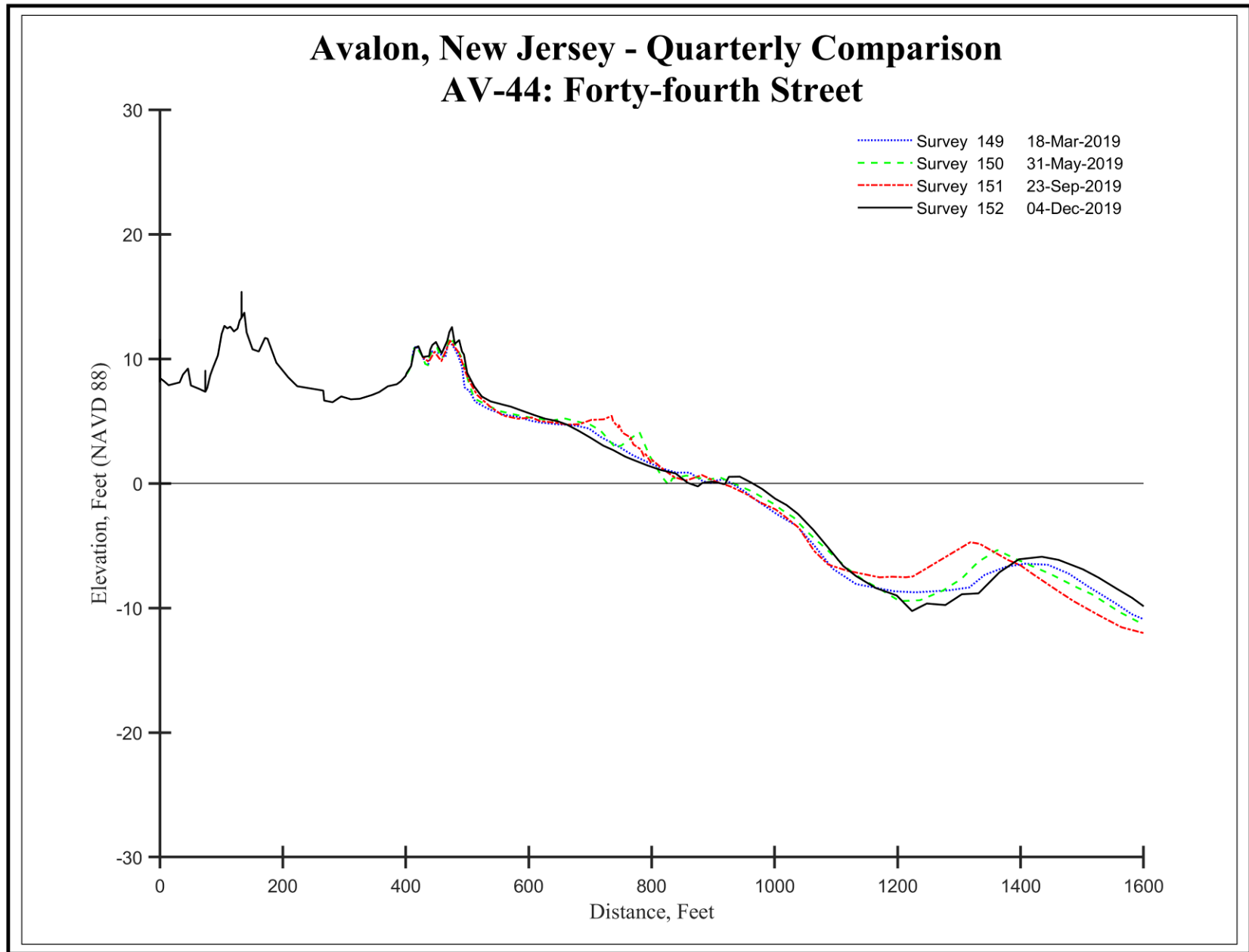


Figure 14. Dune growth was substantial at the seaward dune slope extending seaward across the back-beach zone by December 2019. The offshore bar system varied in position without substantial migration toward the shoreline. The sand volume grew by 16.42 yds³/ft. over the past year as the shoreline moved 46 feet seaward, largely because a small bar was in the act of adding to the beach just at the zero-elevation position.

AV-58 - Fifty Eighth Street

The 58th Street site maintains sand accumulation on the dune and adds to the general beach width over the years. No sand was harvested from the southern back-pass borrow zone in the past three cycles.

For the 2018 year the site gained 14.01 yds³/ft. with a 72-foot shoreline advance.

During the third quarter of 2019 the site gained 9.63 yds³/ft. as the beach advanced 76 feet seaward due to a significant accumulation of a berm at the seaward edge of the dry beach. In the fourth quarter 58th Street lost 0.93 yds³/ft. in sand volume with 69 feet of shoreline retreat as the summer berm was pushed landward onto the back beach and the bar system was attempting to add a small nearshore feature to the beach, positioned at the time of the survey a couple hundred feet from the zero-elevation position.



15a. March 18, 2019



15b. September 23, 2019



15c. December 3, 2019

Photographs 15a to 15c. 58th Street, views to the north along the seaward dune toe.

View 15a Sand accumulated on the foredune slopes adding volume and by March had buried the existing grasses.

View 15b demonstrates just how fast the American beach grass grows back following sand accumulation, even burial. The view point is essentially identical with that from March.

View 15c The December view is looking north along the seaward dune toe at the expanse of dry beach at this site.

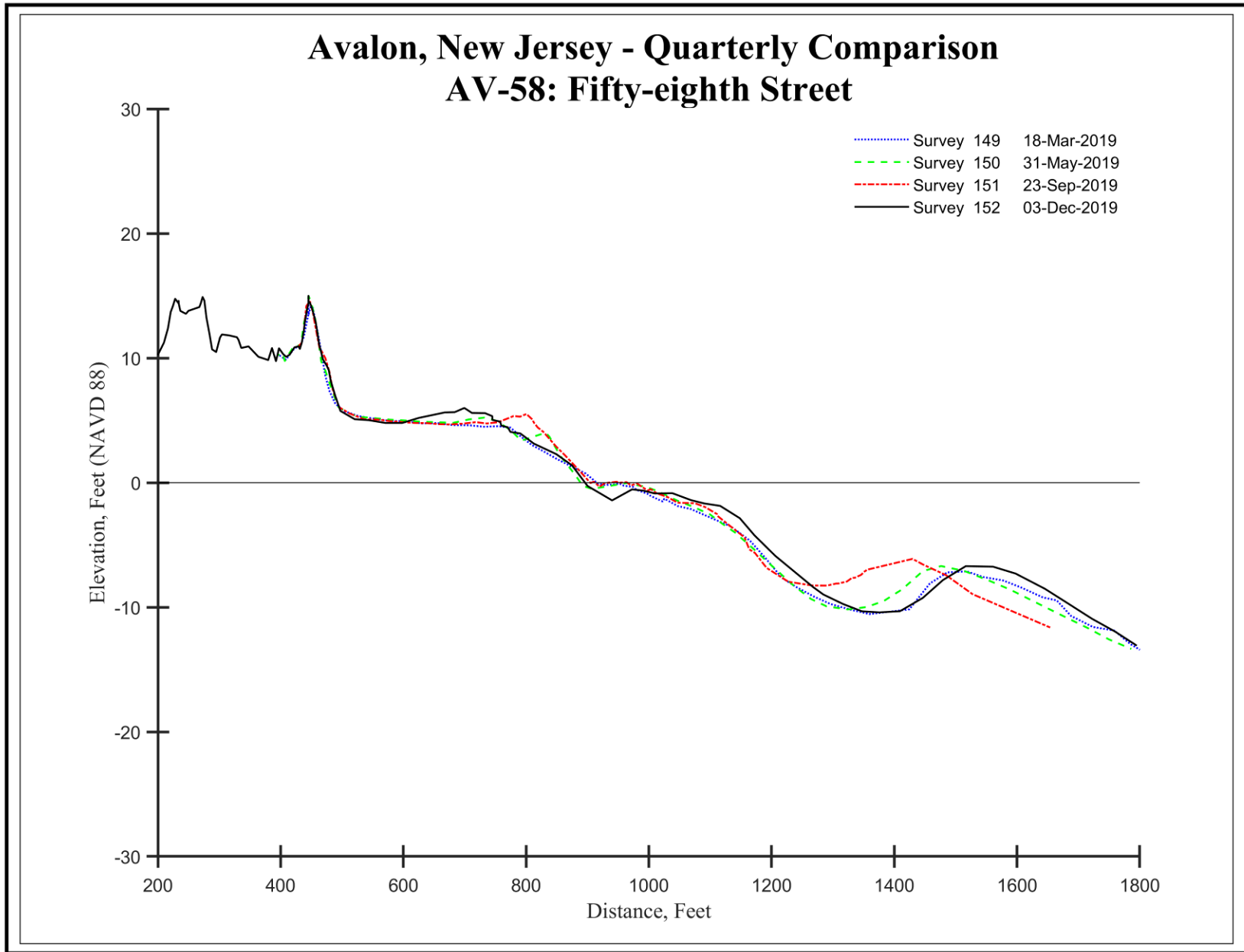


Figure 16. Sand has been added to the seaward dune ridge producing essentially a new primary dune at 58th Street. The beach's shoreline position retreated 45 feet during 2019 as the berm crest shifted landward, but higher in elevation over earlier positions at the same spot. The same pattern of offshore bar shifting occurred at 58th as was seen at 44th Street. Again, small swash bars attached to the beachface more than once.

AV-70 - Seventieth Street

The 70th Street dune has increased its mass over time as sand deposited in the seaward ridge raising its elevation and extending it inland up the main dune's seaward slope.

The 2018 annual sand volume decreased by 1.74 yds³/ft. as the shoreline retreated 21 feet from its December 2017 position.

The third quarter of 2019 saw just 0.44 yds³/ft. in sand accumulation while the shoreline advanced 10 feet seaward. Fourth quarter conditions did not favor further sand deposition with a loss of 7.77 yds³/ft. and a 12-foot shoreline retreat. As seen at 58th Street, the summer berm was pushed landward onto the dry beach adding sand between the berm crest and the dune toe but forcing the shoreline landward somewhat.



17a. March 18, 2019



17b. September 23, 2019



17c. December 3, 2019

Photographs 17a to 17c. 70th Street, views to the south along the dune toe.

View 17a shows the dune toe and beach conditions following a relatively mild winter storm season. No dune damage occurred.

View 17b is a view along the dune toe showing the expanse of dry beach.

View 17c illustrates the new foredune, growing into a new primary dune seaward of the original feature.

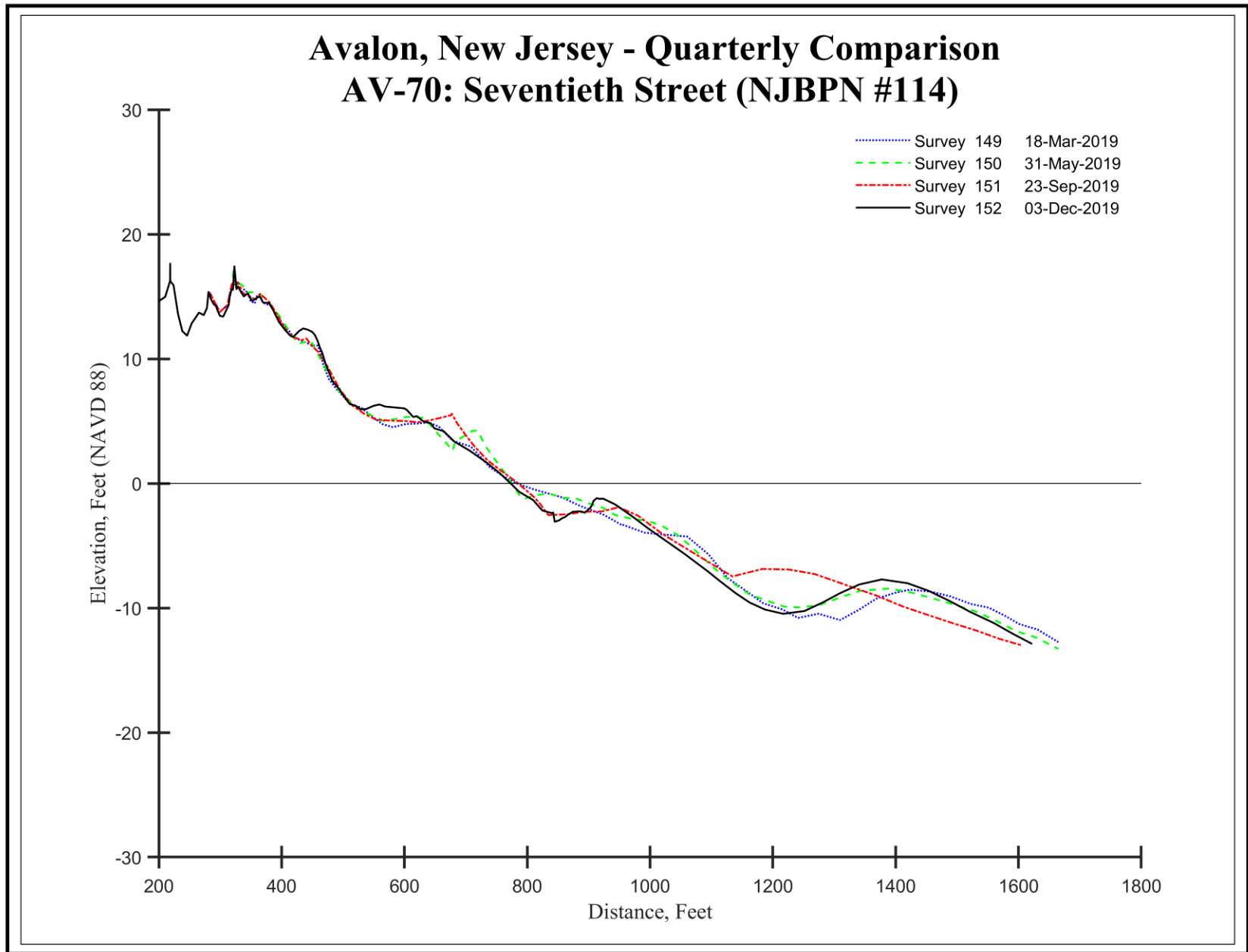


Figure 18. This site gained sand in the dunes at the emerging site of a new primary dune ridge. The beach had its highest berm ridge in December 2019 as the summer of sand accretion was shifted landward. The offshore region remained active, particularly close to the zero-elevation location. The distant bar shifted landward by summer’s end, then returned to earlier positions. The sand volume declined by 3.06 yds³/ft. and the shoreline advanced 11 feet seaward.

AV-78 - Seventy Eighth Street

This site is located near the boundary with Stone Harbor and is within the placement taper for the Stone Harbor federal nourishment project. The site did receive direct sand placement during 2017, probably between the March and June surveys. Since the project was completed, the beach lost sand volume during three of the four seasonal comparisons in 2018. The April survey saw a loss of 13.51 yds³/ft., likely storm related; followed by a 10.38 yds³/ft. loss by June 2018. The summer months produced a gain of 16.82 yds³/ft., but the fall season saw loss return at the rate of 5.54 yds³/ft.

The annual result was a sand volume loss of 10.38 yds³/ft. with a shoreline retreat of 14 feet.

During the third quarter of 2019, 78th Street gained 9.26 yds³/ft. as the shoreline advanced 49 feet seaward. Further sand accumulation slowed producing a fourth quarter gain of only 0.75 yds³/ft. with a 1-foot shoreline retreat.



19a. March 18, 2019



19b. September 23, 2019



19c. December 3, 2019

Photographs 19a to 19c. 78th Street, views to the north.

View 19a demonstrates that the southern beaches are minimally affected during mild winters without moderate storms.

View 19b is a mid-September view of the summer beach looking north along the toe of the seaward dune ridge.

View 19c is a December view of the dunes, beach and oceanfront expanse of the protection these extensive features provide Avalon residents.

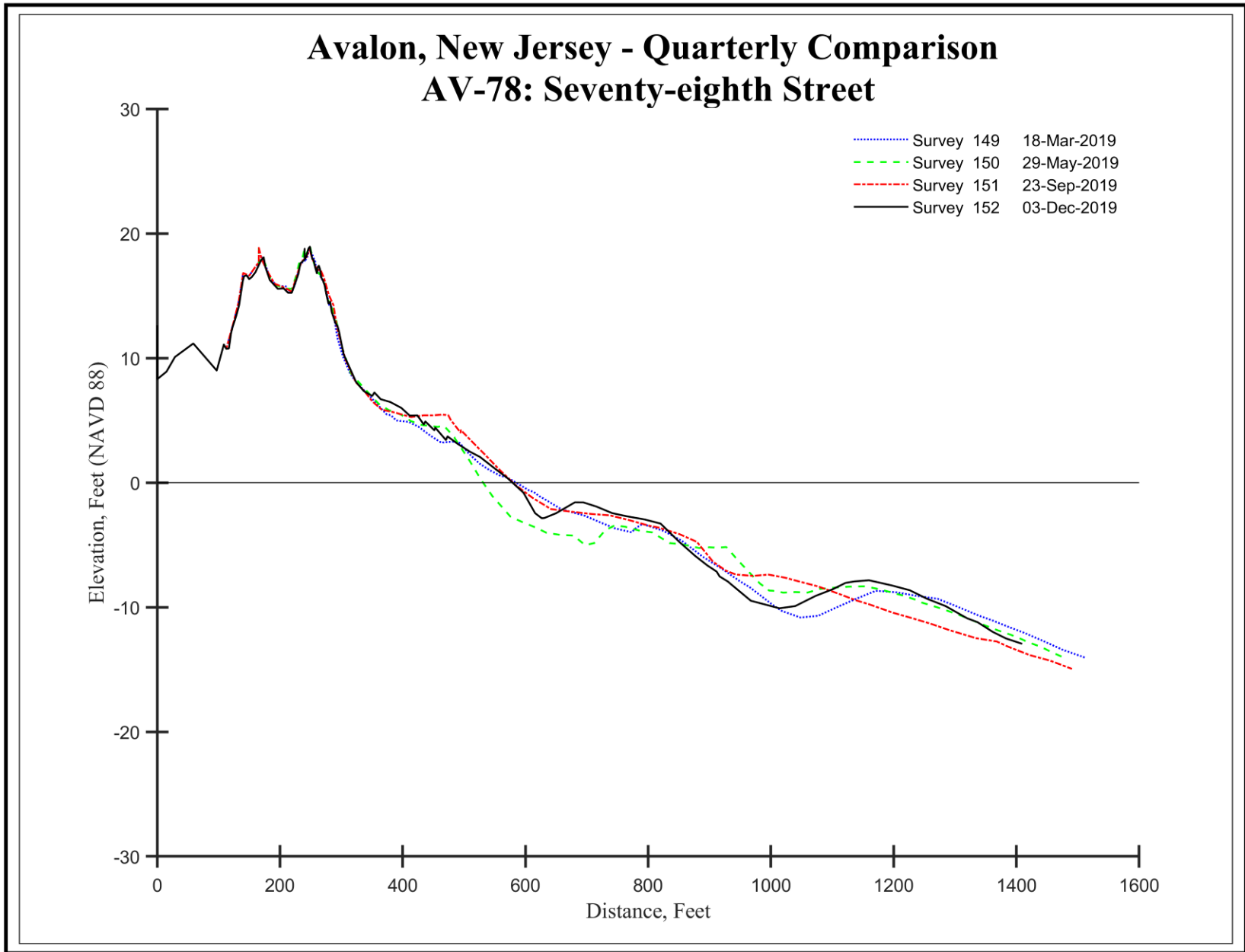


Figure 20. The primary dune is over 200 feet wide at the base with another 200 feet to the water's edge. Sand was pushed toward the dune toe by December after accumulating on the berm by mid-September. Offshore, the main bar moved landward by September, then shifted back to the earlier positions in December 2019. The shoreline retreated 23 feet in 2019 while the sand volume increased by 12.26 yds³/ft.

Summary of Avalon's Oceanfront Beaches:

The USACE performed a maintenance effort in 2017 adding 940,000 cubic yards of sand between 9th and 23rd Streets with sand moving onto the 28th Street site by June. Stone Harbor was included in this operation as well both from Townsend's borrow zone as well as from Hereford Inlet under NJ State funding.

The USACE returned in the fall of 2019 and added 564,264 cubic yards of sand between the jetty and a point south of 17th Street to restore early erosion to their 2017 effort. This volume was derived from the closed end area calculations based on the 9th, 12th, 17th and 23rd Street cross sections. Sand will move toward 35th Street and will likely add material to 23rd and the 28th Street profile transects.

March and April 2019 each produced one mild northeast storm with a final event on Mother's Day for the third year in a row. Summer accretions were muted with the most natural material seen on the beaches in mid-September. Fall storms were few and served to shift berm crest sand landward as an enhanced elevation ridge and re-position the southern site offshore bars to their normal winter/spring positions.

Sand volume changes were significantly reduced from those seen in 2018 (-348,000 cubic yards, across the entire Borough oceanfront) after subtracting the impact of the federal beach restoration (about 34,600 cubic yards were lost from non-nourished sites).

Since the CRC also conducts similar beach surveys in Stone Harbor, their annual review seems to corroborate sand transfer in considerable quantity from the southern beaches of Avalon, south into the offshore regions of Stone Harbor oceanfront. There were far less than robust sand volume gains between 35th and 78th Street in Avalon between June and December 2019 while the offshore regions, particularly between 82nd and 108th Streets in Stone Harbor gained twice the sand quantities lost from their beachface above the zero-elevation position. This was the most pronounced sand transfer between the Boroughs seen in years.

Townsend's Inlet Bathymetric Survey:

The USACE's contractor's dredge arrived in Townsend's Inlet ebb-shoal borrow zone in the fall of 2019. They did not depart until December preventing a winter bathymetric survey of the entire inlet. However, the land survey crew did survey the beach transects normally attached with offshore boat surveys on both the Sea Isle City and Avalon sides of the inlet. The after-dredging contractor surveys were requested from the USACE project manager and were provided to the CRC. Repetitive southeast storm tracks during January into February 2020 prevented the CRC from conducting the bathymetric surveys of the areas adjacent to the borrow zone. Therefore, the assessment of the Townsends Inlet situation is based on the post-dredging information as compared to the fall of 2018 survey for this year's analysis.

Last year the discussion included the Coastal Barrier Resources Act issue where the federal government agencies were prohibited from extracting any sand from the ebb-shoals of Hereford Inlet (NJ Unit 09) in the CBRS. After several local meetings including one with the NJ Congressional representative Mr. Jeffery Van Drew, a meeting was arranged with the Secretary of the Interior David Bernhardt about this problem. The Secretary determined that the prohibition was not expressed in the law and drafted a letter lifting the ban. Thus far the entire array of agencies has not agreed that this result shall be the course of action going forward.

A digital elevation map (DEM) was prepared showing the Townsend's Inlet shorelines, the beach data into water to about 10-foot depths combined with the bathymetric information obtained by Great Lakes dredging company following completion of the Avalon 2019 sand pumping in December. A comparison map was also generated to show the changes in the inlet since the last survey was completed in the fall of 2018.

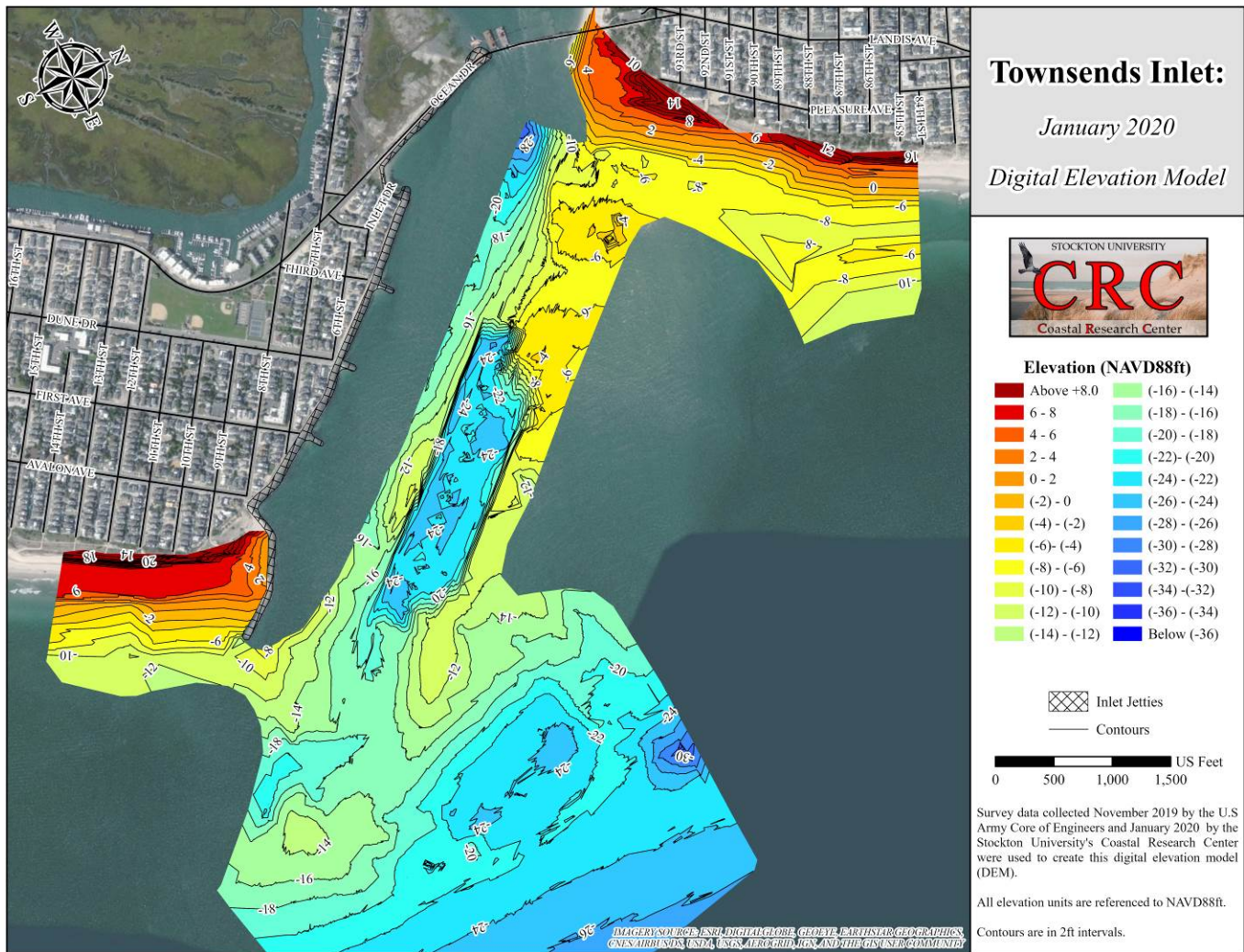


Figure 21. This Digital Elevation Model (DEM) combines post-dredging surveys by the contractor working on the USACE beach maintenance effort for the Avalon oceanfront completed by early December 2019, augmented by CRC shoreline surveys on both the Sea Isle City and northernmost Avalon beaches in January 2020. The dredging footprint is immediately evident in the center of the inlet channel. It is interesting that the majority of the ebb-shoals immediately seaward of Sea Isle City’s beaches was not disturbed and the outer shoals of the ebb-delta were left intact.

Weather difficulties and then the onslaught of the Corona virus epidemic prevented the CRC from completing the inlet bathymetry to the Avalon inlet shoreline and further seaward on the Sea Isle City side. The data provided by the Philadelphia Army Corps district did illustrate the dredging footprint very well and it was smaller than expected. The sand mining started inside the ebb-delta lobe which allows sand accumulation to continue where it could assist Avalon’s beach sediment supply naturally. The Sea Isle City side deposition was also not eliminated leaving material available to fill the excavation now at -24-foot elevations.

Next, the 2019 combined bathymetric and topographic data was compared to similar November 2018 information obtained by the CRC as part of this inlet monitoring effort. The comparison only shows where the 2019 dataset overlapped with the 2018 information because that is the limit for direct comparison models. Areas of deposition greater than 0.2 feet vertically are in green, areas of plus or minus 0.2-foot vertical change are in yellow, while areas of greater than 0.2 feet of vertical erosion are in red shades.

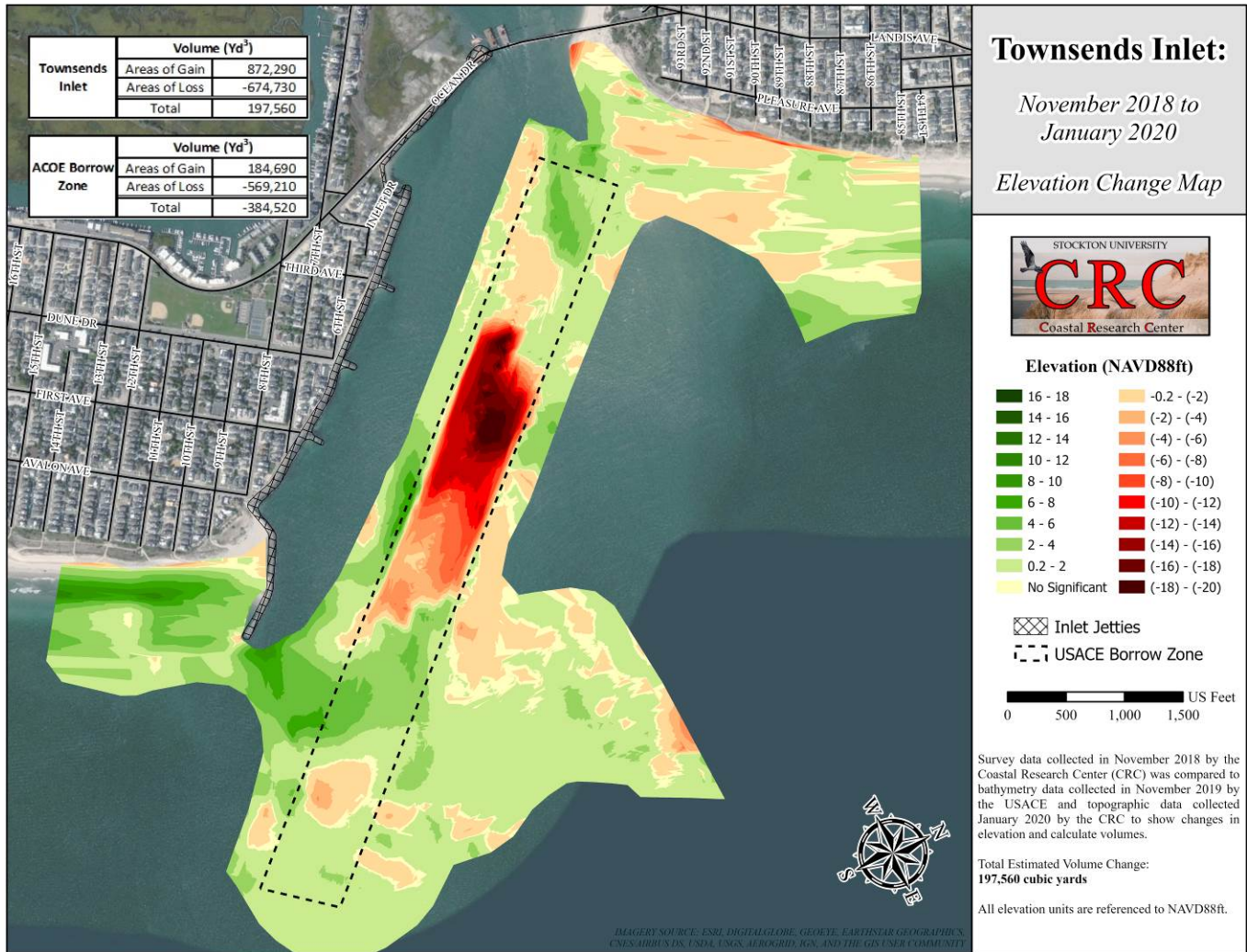


Figure 22. Digital comparison between surveys completed in November 2018 with the 2019 data where overlap exists. Again, the excavation footprint is extremely clear with areas of deposition evident as well. The beachfront in Avalon displays the deposition of the inlet material with 10 to 12 feet of new material added at the maximum value for fill. However, sand was deposited to the northeast of the tip of the Avalon jetty as well (+6 to 8 feet vertically in spots).

The USACE excavation for sand deposited on the Avalon oceanfront shows as deep red areas mirroring the DEM footprint above in Figure 21. Between Nov. 2018 and Dec. 2019 deposition of sand was extensive around the ebb-tidal delta seaward of the Avalon jetty tip. Up to 10 feet of vertical accretion took place directly to the northeast of the jetty itself. The 10 to 12 feet of deposition on the surveyed part of the Avalon beachfront is the result of sand placement by the federal maintenance project. The pattern of erosion and accretion on the Sea Isle City side of the inlet was the result of a year of sand bar accumulation and migration to the south toward the inlet. Some beach erosion occurred between 87th and 92nd Streets in Sea Isle.

The entire area of this survey showed a net gain of 197,560 cubic yards of sand, attributable in part to the excavated sand from the borrow zone being placed on the Avalon beachfront and surveyed as accretion. However, areas of sand volume gain were extensive at 872,290 cubic yards, which was more volume than the entire sand volume pumped from the borrow zone. The authorized borrow area in Townsend's Inlet saw a sand loss of 569,210 cubic yards since Nov. 2018 (not the direct pre-dredging to post-dredging survey computation reported as the placement volume on the beach of 571,351 cubic yards). This CRC comparison information is in surprising agreement with the reported sand placement volume for reasons that might be attributable to chance or just the yearlong timing between the CRC surveys.

Townsend's Inlet Conclusions:

The Townsend's Inlet sand supply depends on losses from Sea Isle City. The USACE derived the Sea Isle beach sand from offshore which is a net benefit to the current NJ beach environment, but the supply transferred to the inlet is a function of northeast storm frequency and intensity, neither of which has been present at severe levels since NE Storm Jonas in January 2016. The need to transfer Townsend's Inlet sand as far south as Stone Harbor's northern beaches in 2017 because of the CBRS issues puts a serious drain on the inlet borrow zone resource and resupply. Avalon requires approximately 300,000 cubic yards of new sand on the northern 2,000 feet of its oceanfront every other year because of changes to the main tidal channel position and configuration back in 1978. Townsend's Inlet is capable of supplying between 500,000 and 700,000 cubic yards every three years pumped from the authorized borrow area in the inlet, but the 2017 effort that included Stone Harbor beaches makes the inlet not an inexhaustible resource.

This recent maintenance effort, focused solely on Avalon's needs, did not severely impact either the sand volume available or the geomorphic arrangement of the shallow shoal areas vital to inlet stability in the zone where sand accumulates as the "ebb-tidal delta" deposit. The accumulation of 10 to 12 feet of material in proximity to the inlet jetty in Avalon is particularly good news. This supply should continue to grow despite the flood or ebb-tidal currents moving sand into the new borrow zone excavation. The -24-foot depths will fill in from both wave transfer as the swell washes across the delta and as the tidal current flows move sand along the channel bed on each flood or ebb tidal episode.