

**FINAL REPORT FOR 2019
ON CHANGES TO THE MUNICIPAL BEACHES
THE BOROUGH OF MANTOLOKING, OCEAN COUNTY, NEW JERSEY**



Aerial view looking north along Mantoloking following a moderate northeast coastal storm in January 2017. This storm caused extensive beach erosion exposing the steel wall installed following Sandy. (Aerial photo courtesy of Ms. Jenny Buck)



By 2019 the federal shore protection project was complete radically altering the Mantoloking oceanfront. The 22-foot elevation dune and the wider beach all provide massive storm protection and the steel wall is still present inside the dune.

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**Annual Report for 2019
On the
Mantoloking
Oceanfront Municipal Shoreline**

Executive Summary:

The Stockton University Coastal Research Center (CRC) resumed a 26-year monitoring effort along the municipal shoreline in Mantoloking with a fall 2019 survey of the five municipal profile sites within the Borough. This annual report provides a direct comparison of the beach conditions prior to the federal Northern Ocean County Shore Protection Project, the US Army Corps “as built” condition surveys, and a series conducted on November 4, 2019 by the CRC. The last pre-construction survey by the CRC was conducted in December 2017, but with the beach at Princeton Avenue renourished with 188.74 yds³/ft., which produced a shoreline advance of 255 feet at that site. This was the only location where the project had been completed by the end of 2017. Sand had been added at MANT-3 by 2017, but work was interrupted with the dredge moved south to Ortle Beach and Seaside to put sand in the most vulnerable locations first.

The US Army contractors surveyed their completed Mantoloking project July 25, 2019 and graciously provided the CRC with their data for “as-built” conditions. These USACE surveys were done at closer intervals and did not exactly align with the much older CRC locations. All but the site at 1117 Ocean Avenue were within a few feet of the Army Corps transects and with the extremely uniform and linear dune built for the project there is relative confidence that both surveys represent real differences in both shoreline and sand volume calculations.

The CRC was asked to return in the fall of 2019 and survey the five locations which resulted in the table 2 below showing the past 4 months of beach changes impacting the project.

2019 Storm Activity:

There were 3 minor storms during the spring of 2019 while the project was under construction. Any losses were compensated for during the final months of work. Since July 25, 2019, storm activity has been of a minor nature with northeast winds under 35 MPH in all cases. The massive amount of new sand is adjusting and has benefitted the Borough of Mantoloking particularly in the northern half of the borough oceanfront (Table 2).

USACE Northern Ocean County Storm Damage Reduction Project:

USACE’s Philadelphia District Commander Lt. Col. Michael Bliss summed the project’s goals as stated, *“The engineered dune and berm system will serve the vital purposes of reducing risk and helping to protect people and property.”* The project cost is approximately \$128 million the U.S. Army Corps of Engineers in partnership with NJDEP awarded the project to build beaches and dunes in northern Ocean County. Contractor Weeks Marine Inc. began pumping sand in Ortle Beach in summer 2017 initially working south towards Seaside. Work in Mantoloking commenced in fall 2017 and the impact at Princeton Avenue was previously presented in the CRC 2017 annual report.

The identified National Economic Development (NED) plan, which is the plan that maximizes beneficial contributions to the nation while meeting planning objectives, provides a degree of storm damage protection, which is greater than the cost of implementation. For Mantoloking that plan calls for a dune crest with elevation of 22ft NAVD88 with a crest width of 25 feet, dune slope is 1V:5H. The beach berm in front of the dune is 75 feet wide at elevation 8.5 feet NAVD88, beachface slope design is 1V:10H. This 75-foot distance is not the constructed berm width as the constructed berm width includes advanced nourishment to compensate for the offshore portion of the profile template. The constructed berm width will vary with existing conditions but will likely be more than double the design width. Example, the constructed berm width at Princeton Avenue extended approximately 150 feet from the seaward dune toe to the berm crest at elevation 8.5 feet NAVD88.

This method of construction known as “overbuilding method,” places the required design quantity at the proposed berm elevation, but with additional berm width added. The seaward slope of the construction berm is often equal to or steeper than the natural slope. The constructed berm is “overbuilt” so coastal processes can readjust the profile to a natural equilibrium state. This adjustment between slopes, known as compensating slopes, uses excess sand to achieve the desired beach and nearshore template. In this case, much of the overbuilt berm sand moves offshore to form the intended design profile nearshore while still achieving the 75-foot designed beach berm width that will support the expanded dune footprint.

This effect can be clearly seen in the three cross sections at Princeton Avenue (MANT-4). The retreat in the berm was significant, but nearly balanced by the deposition of sand offshore creating a shallower terrace seaward than existed previously.

Post-project monitoring captured this process as the constructed beach profile template adjusts over time to the local wave climate. Beach profile monitoring will help the officials assess short and long-term project performance, quantify shoreline and sand volume losses throughout the Borough and help guide planning of periodic nourishment intervals to maintain adequate storm protection for the community. Monitoring will allow the community to assess storm damages to the beach and dune to advocate for possible emergency nourishment to maintain community storm preparedness between regular scheduled maintenance cycles. However, the USACE seldom surveys its projects more frequently than annually depending on funding availability at the time.

Beach Monitoring Program Methodology:

There are five sites in the Borough that have been monitored by the CRC on a quarterly schedule over the last 26 years, ensuring a continuous and coherent data set, which provides the Borough with a valuable resource tool when determining coastal management issues. The monitoring shifted to semi-annual with the 2016 contract and continued with this schedule in 2017. The following is a list of the selected sites and locations:

- ◆ Mant-1: Beach access path at Carrigan Place
- ◆ Mant-2: Beach access path at 1041 Ocean Avenue
- ◆ Mant-3: 1117 Ocean Avenue (NJBPN site #153)*
- ◆ Mant-4: Princeton Avenue street end
- ◆ Mant-51: Beach access path at 1543 Ocean Avenue**

* 1117 Ocean Avenue established on private land in 1986 for the New Jersey Beach Profile Network

** Replaced Mant-5 formerly located on private property at 1547 Ocean Ave. following that property's sale.

CRC monitoring was halted during the USACE construction phase because changes were entirely based on project construction progress. The recent survey was conducted on November 4, 2019 to document changes in beach topography since the “as-built” surveys were completed.

USACE	Survey #100	July 25, 2019
Fall	Survey #101	November 4, 2019

Table 1 below shows the shoreline and sand volume changes at the five monitoring locations during the interval between fall 2017 and July 2019 following project completion. (comparing surveys #99 and #100). Shoreline changes shown measured in feet while sand volume changes are in cubic yards per foot (yds³/ft.). Individual profile changes averaged with adjacent sites and multiplied by the distance between sites determine a net cell volume change. Total volume change for the Borough is determined by summing the net cell volume changes.

Table 1
Shoreline & Sand Volumes Changes
December 21, 2017 to July 25, 2019

Profile Number	Shoreline Change (feet)	Volume Change (yds³/ft)	Avg. Volume Change (yds³/ft)	Distance Between (feet)	Net Volume Change (yds³)
<i>Northern Municipal Boundary</i>					
			145.929	294	42,903
Mant-1	145	145.93			
			180.672	3,033	547,978
Mant-2	224	215.42			
			165.631	2,584	427,991
Mant-3	38	115.85			
			44.329	2,789	123,632
Mant-4	-111	-27.19			
			70.107	2,164	151,712
Mant-51	130	167.40			
			167.404	495	82,865
<i>Southern Municipal Boundary</i>					
			Total Volume Change =		1,377,081

The post-construction comparison with prior surveys (except MANT-4 which had been substantially completed as of the 2017 reporting) shows vast advances seaward of the zero-elevation position and 160 to 215 added cubic yards of sand per foot of oceanfront shoreline. The total of 1,377,081 cubic yards of new sand represents material never previously on any existing NJ beach. The material was derived from offshore borrow sources that could never act naturally as sand resources. MANT-3 had a smaller shoreline advance because initial work pumping in material had commenced at the time of the 2017 survey. MANT-4 had essentially been completed and between December 2017 and July 25, 2019 saw 111 feet of shoreline retreat and a sediment budget loss of 27.19 yds³/ft. The 2017 cross section shows a berm slope well seaward of the design and post-placement adjustments produced the changes seen.

Table 2 shows shoreline and sand volume changes that occurred between July 25, 2019 (Survey #100) and November 4, 2019 (Survey #101). The shoreline and volume changes represent an assessment of changes to the Mantoloking shoreline in the four months since the USACE finished work.

Table 2
Shoreline & Sand Volumes Changes
July 25, 2019 to November 4, 2019

Profile Number	Shoreline Change (feet)	Volume Change (yds³/ft)	Avg. Volume Change (yds³/ft)	Distance Between (feet)	Net Volume Change (yds³)
<i>Northern Municipal Boundary</i>					
			38.539	294	11,330
Mant-1	-2	38.54			
			32.584	3,033	98,827
Mant-2	-4	26.63			
			23.611	2,584	61,010
Mant-3	9	20.59			
			6.593	2,789	18,388
Mant-4	1	-7.41			
			-3.887	2,164	-8,411
Mant-51	0	-0.37			
			-0.368	495	-182
<i>Southern Municipal Boundary</i>					
			Total Volume Change =		180,962

Table 2 shows that the net volume change since project completion was a continued gain of significance at three of five sites with single digit losses to the south. Shoreline changes were quite small between 4 feet landward to 9 feet seaward at the zero-elevation point. The net oceanfront Borough beach accumulation was 180,962 cubic yards, generally larger than previous gains seen over the past 2.5 decades excepting recovery volumes following severe storm events. This material likely represents project adjustments to the prevailing wave climate with or without sand transport into Mantoloking from the beaches to the north as indicated by the volume increases offshore. Wind transport did provide added sand at the dune toe.

Profile Site Descriptions:

For 2019, beach profiles combining USACE data and a fall CRC survey provided post beach restoration information. The fall 2017 profiles at Mant-3 and Mant-4 provided previews of changes to come following completion of the federal project, while the post-project surveys reveal the magnitude of the project impact. Photos from each site provide a visual record of changes during the construction interval.

- **Mant-1 Carrigan Place**

Mant-1 is located at the seaward end of Carrigan Place, along the municipal beach access path between the private residential properties at #911 and #915 East Avenue. Carrigan Place is located about 500 feet south of the Bay Head – Mantoloking boundary. The profile reference location is a fire hydrant located along the west curb of East Avenue. The cross-

section includes the road and beach access path on the landward dune toe between the oceanfront homes.

Following Sandy, work commenced to extend the rock revetment south from Bayhead to include this location. South of Lyman Street installation of a steel wall provided enhanced shore protection for properties and infrastructure in the absence of a wider beach and dune system. This all changed during 2018 into 2019 as the project reached this site. Today, the dune buries the rock revetment and the residents are building new dune walk-over paths and various crest of dune decks.



1a. December 21, 2017



1b. May 15, 2019



1c. November 4, 2019

Mant-1 Photographs 1a, 1b, and 1c show views to the north from the beach berm.

Photograph 1a The December 2017 survey show the seaward dune slope and width of the toe, partially restored through maintenance efforts covering the rock revetment. The beach width and elevation mimicked its fall 2016 appearance during the last era prior to beach nourishment.

Photograph 1b shows the toe of the new federal dune looking north with fencing installed. Sand is beginning to accumulate at the fence and should generate a foredune eventually.

Photograph 1c shows the new public dune cross over with the toe of the dune vegetated and fencing installed. The berm elevation is at 8.5 feet NAVD 1988 and has maintained its “as-built” condition.

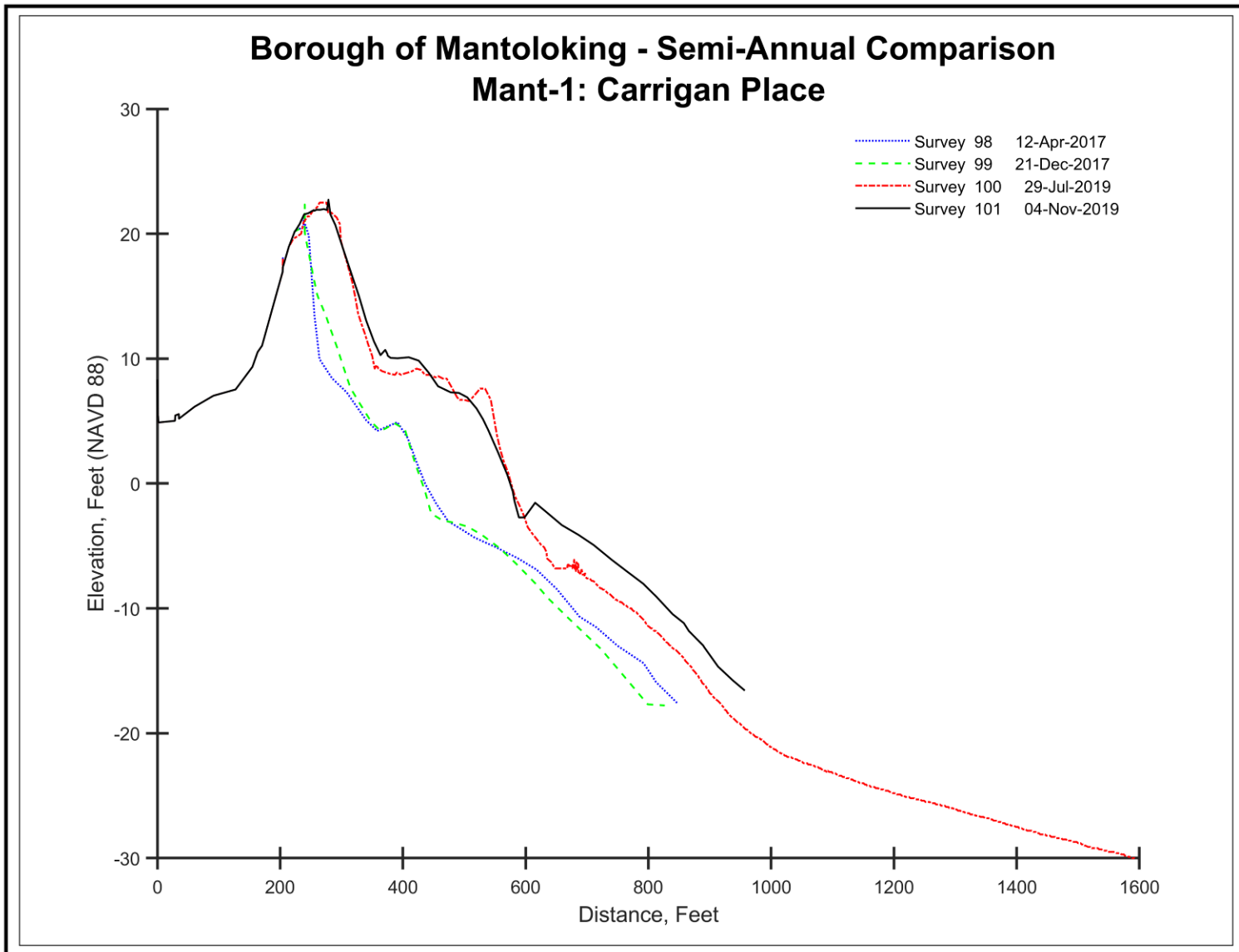


Figure 1d: The four cross sections display conditions from two 2017 surveys prior to the federal project and two 2019 surveys after project completion. The dune construction is the primary focus in size, if not in height, with the wider beach very evident as well. The beach/dune changes between the two 2017 and the 2019 surveys are about of the same consequence. Sand was added offshore since the project was completed as the as-built profile design adjusted. Sand may have moved south into northernmost Mantoloking as well generating this deposit offshore.

- **Mant-2 #1041 Ocean Avenue**

Mant-2 is located along Ocean Avenue on the municipal beach access path between the private residences at #1039 and #1041 Ocean Avenue. The site selection is because of its position approximately midway between Carrigan Place and the pre-existing New Jersey Beach Profile Network site located at #1117 Ocean Avenue and it has public accessibility. The profile starts at a reference location monument, midway along the access path 150 feet landward of the landward dune toe.

The vertical steel wall installed in September 2014 at approximately the location of the old dune crest, once cycled between erosional exposures and buried through maintenance efforts. The wall is now buried under the 22-foot elevation dune with several hundred feet of dry sand beach seaward of its position.

The “as-built” USACE surveys demonstrate the scope of beach protection added with 215.415 yds³/ft. added to the site since the CRC surveyed in December 2017. The shoreline moved 224 feet seaward. Since project completion, the sand volume increased by 26.63 yds³/ft. with a 4-foot shoreline retreat. Sand accumulated at the toe of the dune adding some volume. Beach sand moved seaward forming an offshore bar, as expected with the advanced nourishment added to the design effort. The post-project changes are encouraging because the scale of the northern Ocean County project is such that the regional sand budget should suffice to provide the needed balance in sand transport into or out of Mantoloking.



2a. December 21, 2017



2b. May 15, 2019



2c. November 4, 2019

Mant-2 Photographs 2a and 2b. All views are to the north.

Photograph 2a. Natural sand recovery occurred over the summer and fall as sand moved landward cross-shore from the offshore slope. Maintenance efforts moved sand onto the seaward dune slope covering the steel wall, restoring the seaward slope and a modest recreational beach.

Photograph 2b. shows the newly planted dune crest and installed fencing rows at the landward boundary and at the seaward toe. The beach width is much improved over Photo 2a.

Photograph 2c. One season of growth shows dramatic effect by November 4, 2019. The beach remains as built with a potential to add a fore dune along the seaward fence line.

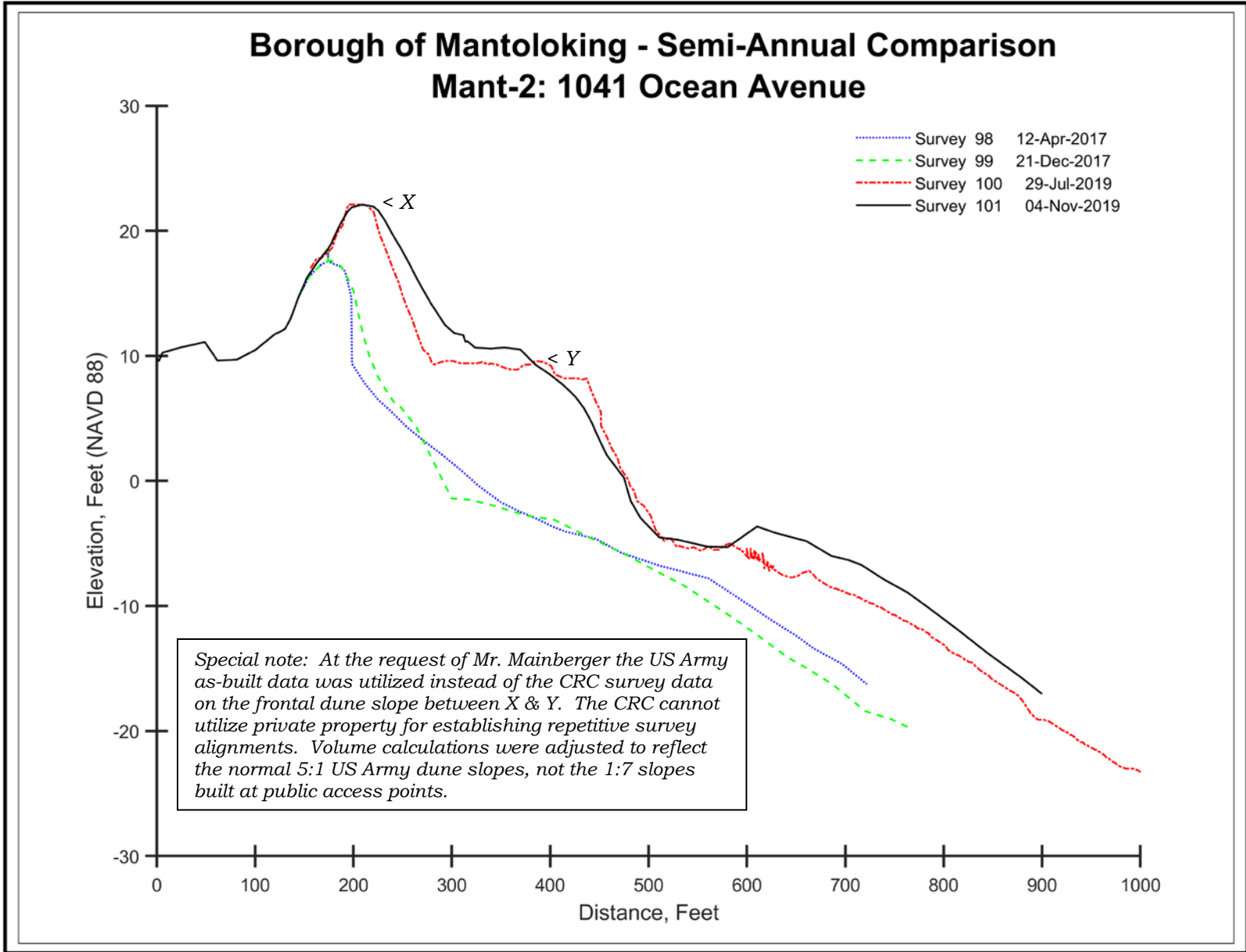


Figure 2d: The two profiles prior to the federal project show a much lower dune elevation with less than half the area at the base of the dune. The beach lies seaward of the dunes, while the beachface slope in 2017 commenced at the toe of the dune. The dune position was adjusted after July 2019, because the CRC profile line is not precisely on the same alignment as the USACE survey. As close as possible, but not exactly the same. Sand accumulated at the dune toe and as an offshore bar at the distal end of the survey.

- **Mant-3 #1117 Ocean Avenue**

The #1117 Ocean Avenue monitoring site is located on private property. This site, originally established in 1986, is included in the State of New Jersey's coastal monitoring program (NJBPN). The site was later included in the beach-monitoring program in Mantoloking because of the pre-existing data collected for the State at this location. The profile line was set along the former home's dune walkover to minimize damage to the dune vegetation. Positioned nearly in the center of the municipal shoreline, this site has shown to be vulnerable to dune erosion over the years.

Super storm Sandy's storm surge and waves completely breached this dune system. The net sand volume losses attributed to Sandy was 131.97 yds³/ft. of sand at this site. Following the storm, both restoration activities and natural recovery helped to restore a modest dune and beach width. To help prevent another complete storm breach the state installed a steel wall, completed in late 2014. The dune crest following these restoration efforts remained near 22 ft. (NAVD88) with dry beach widths that ranged from 75 to 125 feet.

This location had the single largest deviation in profile site locations with those of the USACE, but the linear dune toe and consistent dune cross section allowed reasonable adjustment to allow direct comparison with the Army Corps data. There was an increase in sand volume of 115.847 yds³/ft. accompanied by a 38-foot shoreline advance. This is due to progress already under way at the site in December 2017. Sand was added in the amount of 80.08 yds³/ft. and a shoreline advance of 212 feet had been recorded by Dec. 21, 2017. Adding the two-sand volume together achieves parity with the volume added to MANT-2 above.

Since July 25, 2019 the site added an additional 20.592 yds³/ft. accompanied by a 9-foot shoreline advance. The majority of the added sand was deposited offshore as a shallower terrace by adjustment.



3a. December 21, 2017



3b. May 15, 2019



3c. November 4, 2019

Mant-3 Photographs 3a & 3c show the view to the north from the seaward dune crest. Photo 3b is along the steel wall.

Photograph 3a By December, a combination of natural sand recovery over the past summer and an infusion of sand from the startup of the federal shore protection project in fall restored the seaward dune slope and added significant beach width.

Photograph 3b The completed beach shows high tide debris accumulating far from the dune toe as opposed to the pre-project situation.

Photograph 3c. By November 2019, the dune grass had gotten a decent start and the beach situation is excellent.

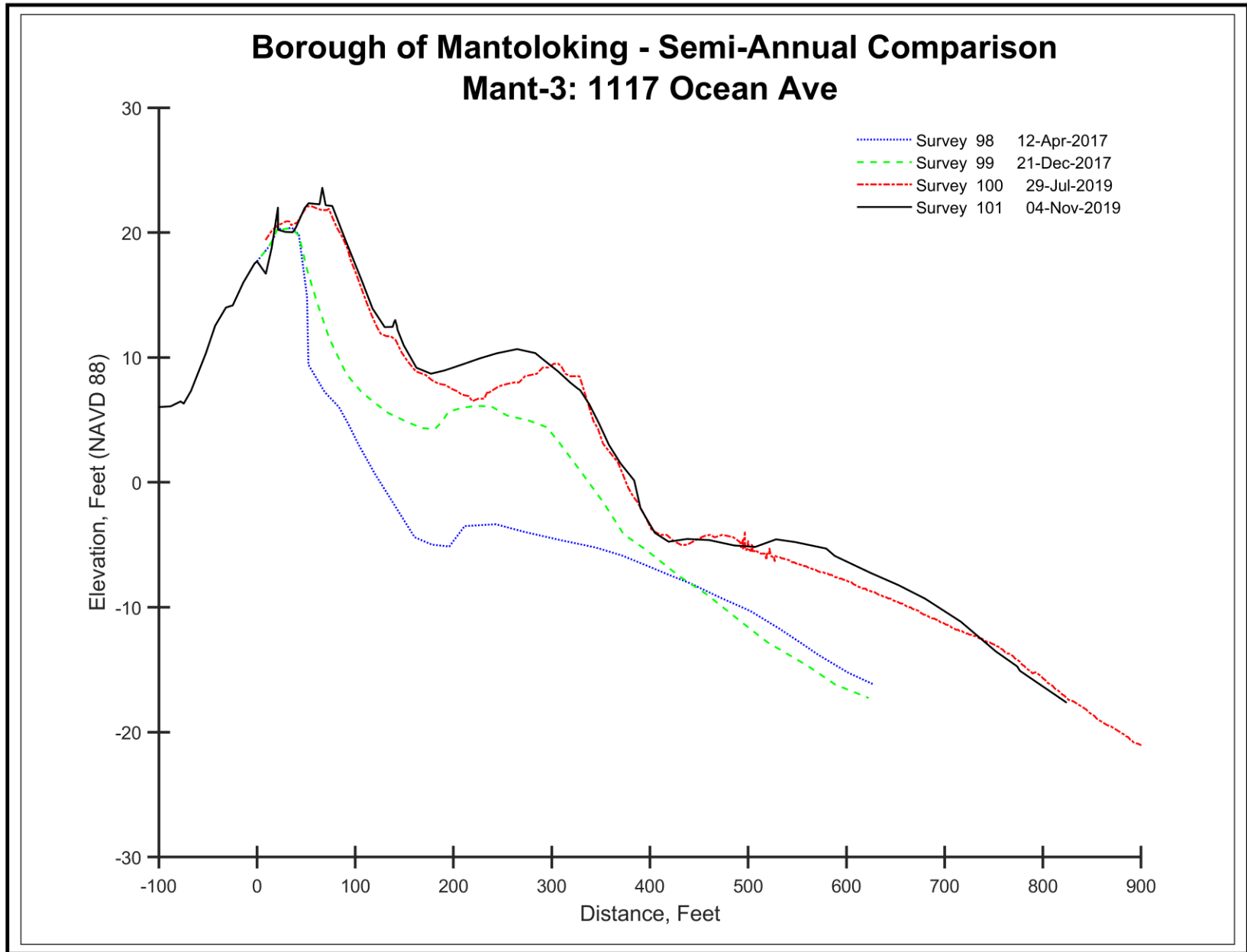


Figure 3d: The pre-federal project dune and beach is displayed in the April 2017 survey. By December 2017, sand placed during the early phase of the construction shows both a dune slope and a start in the beach portion of the project. The “as-built” survey from July 2019 shows the beach and offshore completed. By November 2019, sand had added to the beach elevation and accumulated offshore.

- **Mant-4 Princeton Avenue**

The Mant-4 beach profile is located at the seaward end of Princeton Avenue along the municipal dune walkover. This site is located approximately midway between the #1117 and #1543 Ocean Avenue sites, and readily accessible. Erosional concerns here include protection of the vertical access shaft for the Ocean County Utilities Authority (OCUA) sewage discharge line, located on the seaward dune slope, adjacent to the profile line. Following the 1992 northeast storm, Mantoloking installed individual geo-textile bags filled with sand around the street end and the access shaft at the municipal utility line.

During super storm Sandy, the surge and waves generated caused a dune breach, completely removed the dune and severely eroded the beach leaving the street pavement level with the sand where previously the dune existed. The dune breach caused significant overwash to cascade into the Borough at this street-end opening. At this location 76.32 yds³/ft. of sand loss occurred, attributed to Sandy. Following the storm restoration efforts rebuilt a smaller dune feature as the beach recovered. By fall 2014, installation of the steel wall reached this location. Crests elevation of the dune reached 19 feet while the wall top elevation is just under 15 feet NAVD88. The remaining beach width was insufficient to support further dune growth and left the existing feature subject to erosion from modest storm waves and surge.

Erosion of the seaward dune slope occurred over the winter of 2017. Waves removed 20 feet of width at the toe and cut away the sand covering the steel wall. Erosion left a steep 10-foot near vertical drop from the dune crest to the beach, with 5-6 feet of vertical relief along the wall exposed from top to base. During the same period sand accumulated nearshore to the offshore profile limits offsetting the onshore losses. By April 2017, the site accumulated a net 14.96 yds³/ft. of sand, despite the dune and beach erosion. This offshore sand deposit provided a source of sand for natural sand recovery and beach building as the weather pattern and wave climate shifted to favorable conditions for beach building in late spring and summer.

The USACE project started in this region during late fall, a massive quantity of sand placed by January 19, 2018 masked any natural changes that occurred since April. The dune volume nearly doubled while the crest elevation reached 22 feet and 30 feet wide with a dune toe width of 200 feet. The project dune expansion provided significant shore protection and should keep the steel wall buried for some time to come. The beach berm width went from approximately 40 feet to over 150 feet seaward of the dune toe but since the dune also expanded the net gain in width was over 250 feet. Sand accumulation continued across the nearshore to the profile limits with 173.65 yds³/ft. of sand added during the project. Comparing October 2016, to the post project survey, revealed an amazing annual transformation with the shoreline position advancing seaward 255 feet, 188.74 yds³/ft. of sand added. The project improvements will enhance shoreline stabilization while protecting property and infrastructure from storm events in this section of Mantoloking.



4a. January 19, 2018



4c. January 19, 2018



4b. April 12, 2017

Mant-4 Photographs 4a to 4c. All views are to the north from essentially the same location at Princeton Avenue.

Photograph 4a The Federal shore protection project, completed here by January 19, 2018, added a massive quantity of sand to this site that extended seaward to the profile limits. The dune more than doubled in size and beach width expanded seaward several hundred feet.

Photograph 4b By July 25, 2019 the grass had been planted and fencing installed. The situation did adjust considerably between the two dates 18 months apart in spite of the project reaching this location first.

Photograph 4c The public access pathway was complete by November 4, 2019 with fencing and handicap access rebuilt.

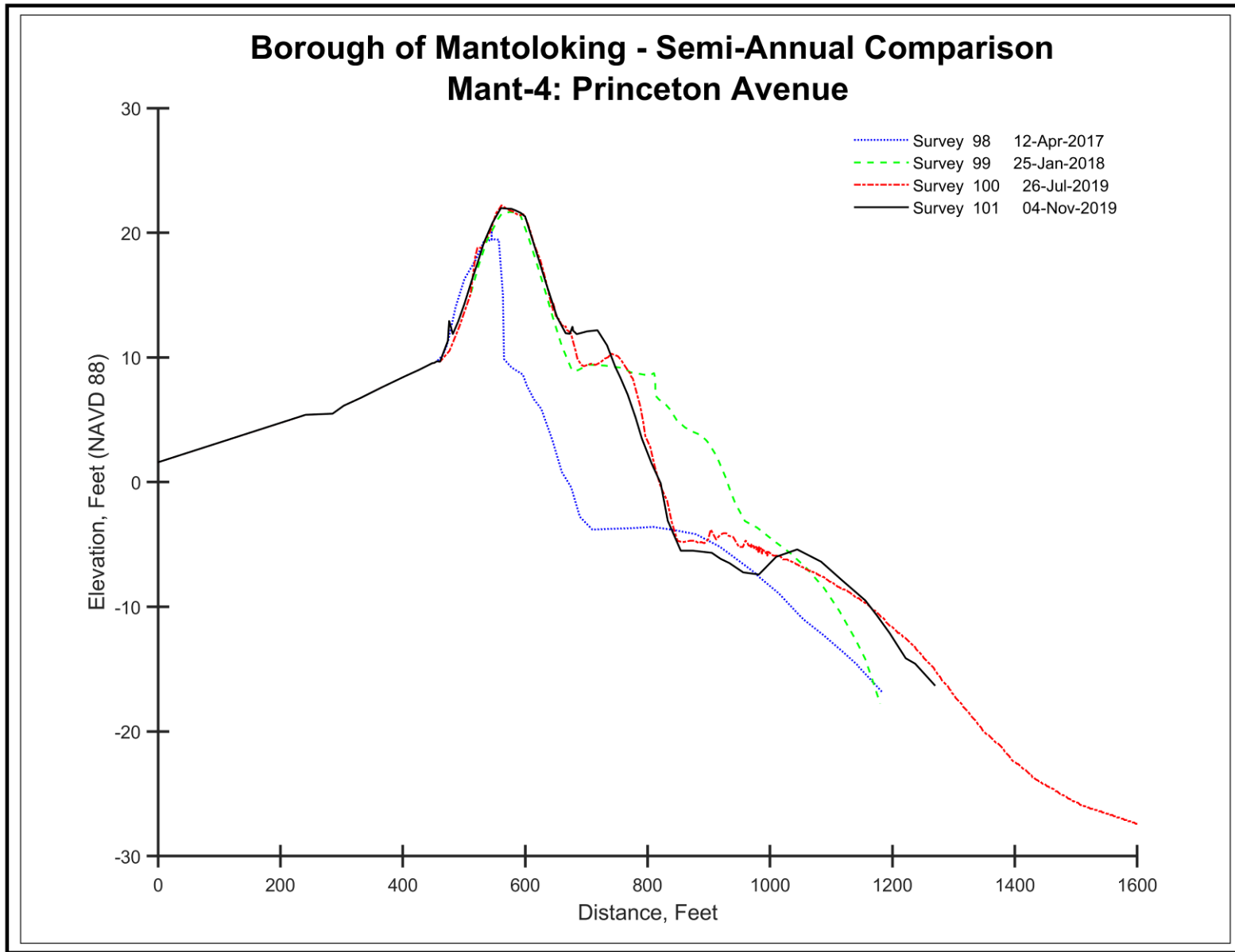


Figure 4d: The April 2017 survey shows the original Princeton Avenue dune with the January 2018 survey providing an early “as-built” condition view. Since then the dune has been planted and fenced. The beach accumulated sand at the dune toe and a significant bar formed offshore. The January 2018 beach extent diminished as the federal design construction profile was established.

- **Mant-51 #1543 Ocean Avenue**

This monitoring site was initially located on private property between the homes at #1547 and #1549 Ocean Avenue. Because of its proximity to the border with Brick Township, this location became the southernmost site for the Borough monitoring program. During 2005, new property owners limited accessibility to the private property and site resulting in the site relocation to the public access pathway between #1543 and #1539 Ocean Avenue. The shift in the line's location was 202 feet to the north.

Prior to the USACE project, the dune system along the southern 1,500 feet of Mantoloking is the widest and highest in the municipality. Homes are set back to the natural toe of the back slope of the dune. In November 2010, the dune was 180 feet wide at the toe and 90 feet along the crest with an elevation of 23 feet NAVD 88. Super storm Sandy's surge and waves rapidly eroded the narrow beach and cut away over half the dune but the dune elevation at the landward erosional scarp remained above 20 feet and prevented overwash, breaching and oceanfront property damage.

Today, the dune is approximately the same elevation, but the beach is far wider to the seaward dune toe. Sand volumes added amounted to 167.404 yds³/ft. and a 130-foot shoreline advance. Changes since the project saw a sand volume loss of 0.37 yds³/ft., all below the zero-elevation datum. Sand was added to the base of the dune toe as a wind deposit. The shoreline shifted just 0.34 feet landward.



5a. December 21, 2017



5b. April 12, 2017



5c. December 21, 2017

Mant-51 Photographs 5a to 5c. All views are to the north from the beach at 1543 Ocean Ave.

Photograph 5a Natural recovery onshore over the summer and fall months restored the beach width by December 2017, with the seaward dune slope regraded through maintenance activity. The ongoing USACE project activity and resulting seaward beach offset is visible in the far distance.

View 5b. The site with a completed dune and planted grass as of July 25, 2019.

View 5c The public access pathway and fencing was complete by November 2019 and the beach grass had a decent first summer growing start.

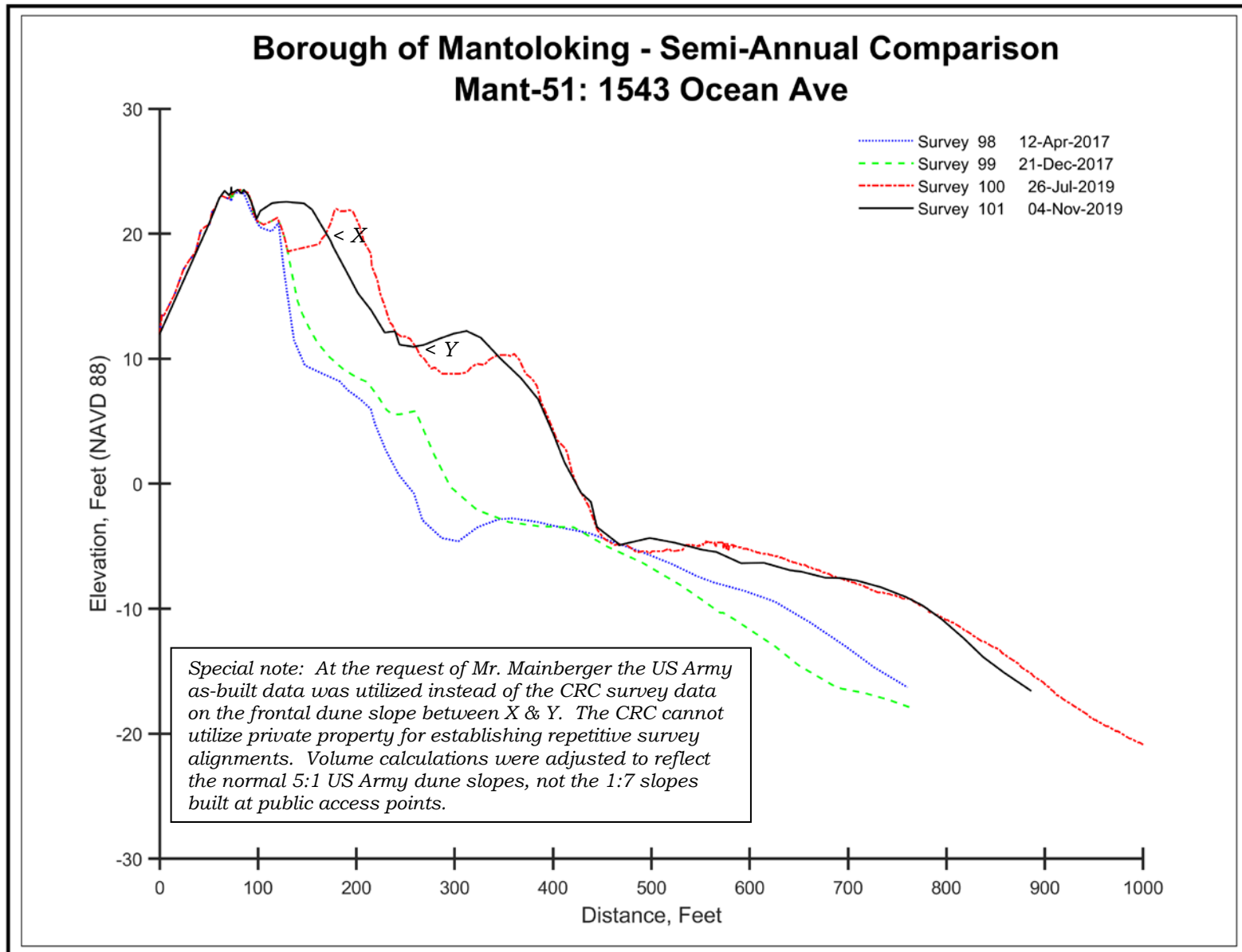


Figure 5d: The southern site did not see dune breaching during Sandy because of the greater width of the feature. The new federal dune expanded that profile substantially seaward. The beach accumulated an elevated berm by November 2019, with very few changes offshore.

Conclusions:

The 2017 Mantoloking annual report showed an initial gain in the municipal sand supply between April 2017 and December 2017 with the addition of 595,206 cubic yards of sand, derived from the USACE project start up. Sand placement started near Princeton Avenue and worked north including 1117 Ocean Avenue (Mant-3). The placement venue moved south and commenced in more vulnerable areas of Northern Ocean County, working north until again reaching Mantoloking in late 2018. The 3 sites not influenced by the project as of December 2017 (Mant-1, Mant-2 and Mant-51) showed typical long-term pre-construction patterns with modest sand volume and shoreline position changes.

By July of 2019, with everything in place the entire CRC post December 2017 comparisons yielded 1,558,043 cubic yards of new material. However, that volume should be added to the 595,206 cubic yards the CRC reported having been placed as of late 2017. The final placement sand volume thus amounts to 2,153,249 cubic yards based on the five CRC Mantoloking Borough cross sections. The USACE as-built data yields a larger number*2,571,591cy (+418,342 cy more than determined from the 5 Mantoloking survey locations). The CRC numbers cannot include the multiple months between work completed as of the CRC December 2017 fall survey, the winter of 2018 erosion, followed by USACE return to pump the remainder of the Borough beachfront and continue into Bay Head, finishing in 2019. The pending fall 2020 survey data would directly compare to the fall 2019 information yielding changes to the existing oceanfront conditions between 2019 and 2020.

**Data provided by Keith Watson, USACE Project Manager on 2/10/2019. Work was completed in 3 phases; 10/2017 through 12/2018. The CRC surveys stopped as of 12/2017, so do not count losses or repositioning of sand between 12/2017 and July 2019.)*

Additionally, following conversations with Mr. Mainberger concerning how the CRC and US Army survey data was employed to generate the sediment placement volumes in the Borough oceanfront, two seaward dune frontal slopes were altered to substitute the standard 5:1 seaward slope for the lower gradient slope built at the public access points along the oceanfront. Mant-2 and Mant-51 were affected because some CRC survey line lies adjacent to public access paths ever since 1992 and will continue to survey across the existing profile so the 2.5 decades of data remains consistent. The substitution of the US Army data is primarily for the purpose of defining the best possible comparisons with the sand volume provided by the project manager for the sand quantity on the Mantoloking beachfront as of July 26, 2019.

The year 2018 passed into history as the project worked its way north from Ortley Beach, back to Mantoloking and finishing in Point Pleasant Beach by summer 2019.

Please keep in mind that all of nearly two million cubic yards of sand the CRC shows as added to the Mantoloking shoreline were derived from sources over a mile offshore and never previously present on any NJ beachfront since thousands of years prior to European settlement. Also, the entire Northern Ocean County oceanfront received similar sand volumes on beaches, greatly expanding their storm wave, flood mitigation effect and the regional sediment budget in Ocean County. Littoral sand movements north or south take place in near equal amounts in this part of the Jersey shore, so long term loss is largely confined to shedding material offshore. Thus far, the general trend appears to be sand transport to the south into Mantoloking because the offshore bars generated thus far appear in the northern three cross sections and not in the

southern two. Sand will affect both Manasquan and Barnegat Inlet navigation, requiring more frequent dredging, but that material has been transferred back to the area beaches as a matter of policy to conserve the sand supply for the beach. This project has four decades of commitment for project maintenance ahead of it as well, so one should expect long-term storm protection benefits. Finally, that steel wall is still there buried deep inside the new dune.