

**FINAL REPORT FOR 2020  
ON CHANGES TO THE MUNICIPAL BEACHES  
THE BOROUGH OF MANTOLOKING, OCEAN COUNTY, NEW JERSEY**



*View to the north from the public access pathway at 1041 Ocean Avenue, Mantoloking, New Jersey on November 23, 2020. This provides a compact view of the dune, with new private dune crest decks, the little foredune growing at the seaward dune toe and the wide beach seaward of the dunes.*

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**Annual Report for 2020**  
**On the**  
**Mantoloking**  
**Oceanfront Municipal Shoreline**

**Executive Summary:**

Coastal Research Center (CRC) at Stockton University completed a 27<sup>th</sup> year monitoring effort along the municipal shoreline in Mantoloking with a fall 2020 survey of the five municipal profile sites within the Borough. The annual report provides a direct comparison of the beach conditions prior to the federal Northern Ocean County Shore Protection Project using the December 2017 transect survey data; the US Army Corps of Engineers (USACE) “as built” condition surveys, and the CRC-surveys from Nov. 4, 2019 and Nov. 23, 2020. In 2017 the beach at Princeton Avenue had already been renourished with 188.74 yds<sup>3</sup>/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.

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. Four of the CRC transect locations were close to USACE lines, except the site at 1117 Ocean Avenue. The extremely uniform and linear dune built for the project provided relative confidence that both the CRC and the USACE surveys represent real differences in both shoreline and sand volume calculations. Surveys 101 and 102 were conducted by the Coastal Center along the transect lines established 27 years ago.

**2020 Storm Activity:**

One tropical system (Isaias) took a path skimming the Florida coast then moving inland in North Carolina Aug. 4, 2020, passing west of the Jersey Shore in 2020 with 55-65 MPH winds. It passed by rapidly leaving time for only one high tide and did minimal damage. There were 4 minor storms during the spring of 2020 that flattened the beachface slope but did no significant damage. Any losses were recovered during the summer of 2020 with summer conditions persisting until the late November 2020 surveys were completed.

**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 Ortley 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 design is utilized because the hydraulic placement/mechanical grading methodology can only proceed to the low tide line where the slurry discharge distribution stops at the water’s edge. This leaves later wave action to redistribute the sand into the preferred slope based on wave periods, wave heights and sand grainsizes. The berm erodes and retreats somewhat as sand moves seaward to generate an offshore terrace where the bar system appears later on.

This effect can be clearly seen in the three cross sections at Carrigan Place (MANT-1). The retreat in the berm was significant, but nearly balanced by the deposition of sand offshore creating a shallower terrace seaward than existed immediately following sand placement (survey 100, page 6).

**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 27 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. CRC monitoring was suspended during the USACE construction phase in 2018, resuming as an annual survey in the fall of the past two years. 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.

USACE	Survey #100	July 25, 2019
Fall	Survey #101	November 4, 2019
Fall	Survey #102	November 23, 2020

Table 1 was reproduced from last year’s report to emphasize the vast volume of new sand placed on the Mantoloking Borough shoreline. The Borough has 11,359 feet of oceanfront beach and dividing the volume in Table 1 by that distance yields the fact that every foot of the Borough beach gained 121.23 cubic yards of sand per foot of oceanfront. Equivalent to 10, 12 cubic yard trucks dropping their loads confined to one foot of beachfront. That represents 113,500 truck trips to Mantoloking to deliver the same quantity of sand.

Shoreline changes shown measured in feet while sand volume changes are in cubic yards per foot (yds<sup>3</sup>/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**

<b>Profile Number</b>	<b>Shoreline Change (feet)</b>	<b>Volume Change (yds<sup>3</sup>/ft)</b>	<b>Avg. Volume Change (yds<sup>3</sup>/ft)</b>	<b>Distance Between (feet)</b>	<b>Net Volume Change (yds<sup>3</sup>)</b>
<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>					
			<b>Total Volume Change =</b>		<b>1,377,081</b>

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 yds<sup>3</sup>/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 Nov. 4, 2019 (Survey #101) and November 23, 2020 (Survey #102). The shoreline and volume changes represent an assessment of changes to the Mantoloking shoreline in the year the CRC resumed surveying the oceanfront.

**Table 2**  
**Shoreline & Sand Volumes Changes**  
**November 4, 2019 to November 23, 2020**

<b>Profile Number</b>	<b>Shoreline Change (feet)</b>	<b>Volume Change (yds<sup>3</sup>/ft)</b>	<b>Avg. Volume Change (yds<sup>3</sup>/ft)</b>	<b>Distance Between (feet)</b>	<b>Net Volume Change (yds<sup>3</sup>)</b>
<i>Northern Municipal Boundary</i>					
			9.551	294	2,808
Mant-1	-6	9.55			
			4.646	3,033	14,090
Mant-2	3	-0.26			
			-12.866	2,584	-33,244
Mant-3	-46	-25.47			
			-13.814	2,789	-38,526
Mant-4	-20	-2.16			
			-16.190	2,164	-35,035
Mant-51	-37	-30.22			
			-30.224	495	-14,961
<i>Southern Municipal Boundary</i>					
			<b>Total Volume Change =</b>		<b>-104,869</b>

Last year's report showed that since the as-built USACE surveys the beachfront accumulated an additional 180,962 cubic yards of sand entirely between Carrigan Place and 1117 Ocean Avenue site (Mant-3) between July 25<sup>th</sup> and Nov. 4<sup>th</sup> of 2019. This equals an added 15.93 yds<sup>3</sup>/ft. added to each foot of the oceanfront beach. This material likely represents additions from 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.

Table 2 illustrates the annual changes since Nov. 4, 2019 where 104,869 cubic yards of sand were lost from the Borough oceanfront by November 23, 2020. The beach berm retreated generating most of the loss with sand transported offshore beyond the survey distance combined with transport from the Borough oceanfront into Toms River Township (-30.22 yds<sup>3</sup>/ft. lost from Mant-51). Sand was still being added to the Carrigan Place site with minimal loss seen at Mant-2.

### **Profile Site Descriptions:**

For 2020, beach profiles combining 2017 data, USACE as-built data, and two fall CRC surveys provide a post-beach restoration illustration of relative stability. 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 and the subsequent adjustments seen in 16 months.

- **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 sheet pile 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 these sites. Today, the 22-foot elevation dune buries the rock revetment which remains as a last line of defense.



**1a. December 21, 2017**



**1b. November 4, 2019**



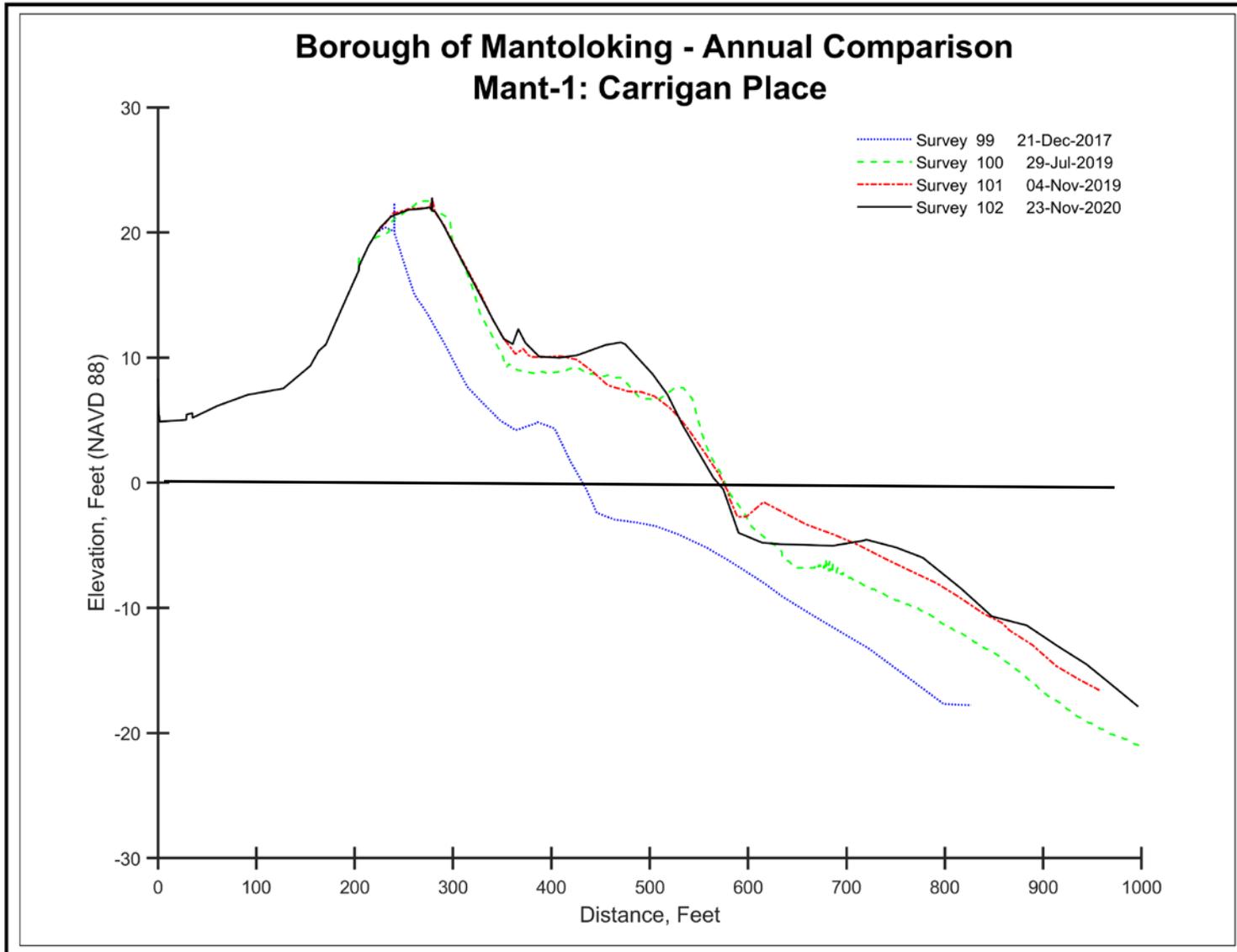
**1c. November 23, 2020**

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

*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 were similar to its fall 2016 appearance during the last era prior to beach nourishment.*

*Photograph 1b. 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.*

*Photograph 1c. is essentially the same view a year later where the dune grass has developed and the owner to the north has a dune deck added.*



**Figure 1d: The four cross sections display conditions from the last pre-construction survey in 2017, the USACE as-built survey and two subsequent CRC surveys in 2019 and 2020. The dune construction is the primary focus in size, if not in height, with the wider beach very evident as well. Since construction, sand moved onto this location, likely from Bay Head, adding mostly to the offshore bar system. The berm developed a large crest in Nov. 2020 with a tiny foredune appearing at the project dune’s seaward toe.**

- **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 was because of its position is 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 installation started in September 2014 at approximately the location of the old dune crest. The profile cycled between erosional wall exposures and burial 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 yds<sup>3</sup>/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 yds<sup>3</sup>/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 immediate post-project conditions showed sand moving into Mantoloking from Bay Head with considerable quantity deposited offshore. The site went modestly negative in sand volume by Nov. 2020 losing just 0.26 yds<sup>3</sup>/ft. with a 3-foot shoreline advance seaward.



**2a. December 21, 2017**



**2b. November 4, 2019**



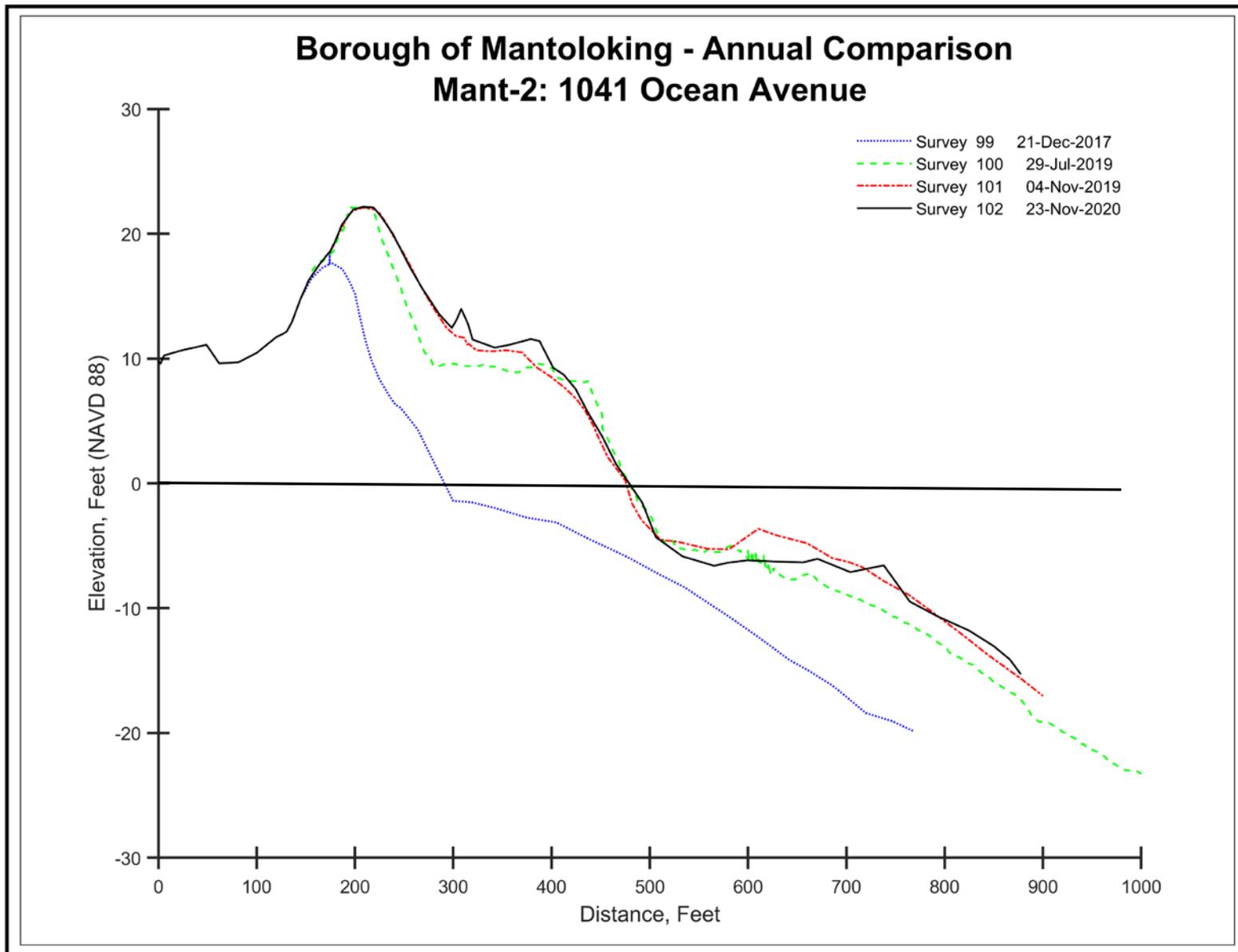
**2c. November 23, 2020**

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

*Photograph 2a. the 2017 beach was far narrower with a restored dune from maintenance efforts moving sand onto the seaward dune slope covering the steel wall, restoring the seaward slope and a modest recreational beach.*

*Photograph 2b. 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.*

*Photograph 2c. shows what growth took place in the dune grass in one year. The dune decks are appearing at oceanfront properties, while the beach width has been maintained.*



**Figure 2d: The profile prior to the federal project shows a much lower dune elevation with less than half the area at the base of the dune. The beach flat berm beach width is now 100 feet, while the beachface slope in 2017 commenced at the toe of the dune. Sand added as a foredune ridge at the USACE dune toe, a berm appeared in 2020 and a bar system has developed offshore from sand accumulated after construction was completed.**

- **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.

To prevent a reoccurrence of the Hurricane Sandy 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.

There was an increase in sand volume of 115.847 yds<sup>3</sup>/ft. accompanied by a 38-foot shoreline advance following the USACE project. This is due to progress already under way at the site at the time of the December 2017 survey. Sand was added in the amount of 80.08 yds<sup>3</sup>/ft. and a shoreline advance of 212 feet had been recorded by Dec. 21, 2017. The combined intervals of sand deposition equal the volume added to MANT-2 above.

Between July 25, 2019 and November 4, 2019, the site added an additional 20.59 yds<sup>3</sup>/ft. accompanied by a 9-foot shoreline advance. During the following year Mant-3 lost 25.47 yds<sup>3</sup>/ft. accompanied by a 46-foot shoreline retreat. This loss was primarily in the beach berm where the entire beachface slope retreated landward. A small foredune did increase in size at the seaward toe of the primary dune however. Little to no change occurred offshore.



**3a. December 21, 2017**



**3b. November 4, 2019**



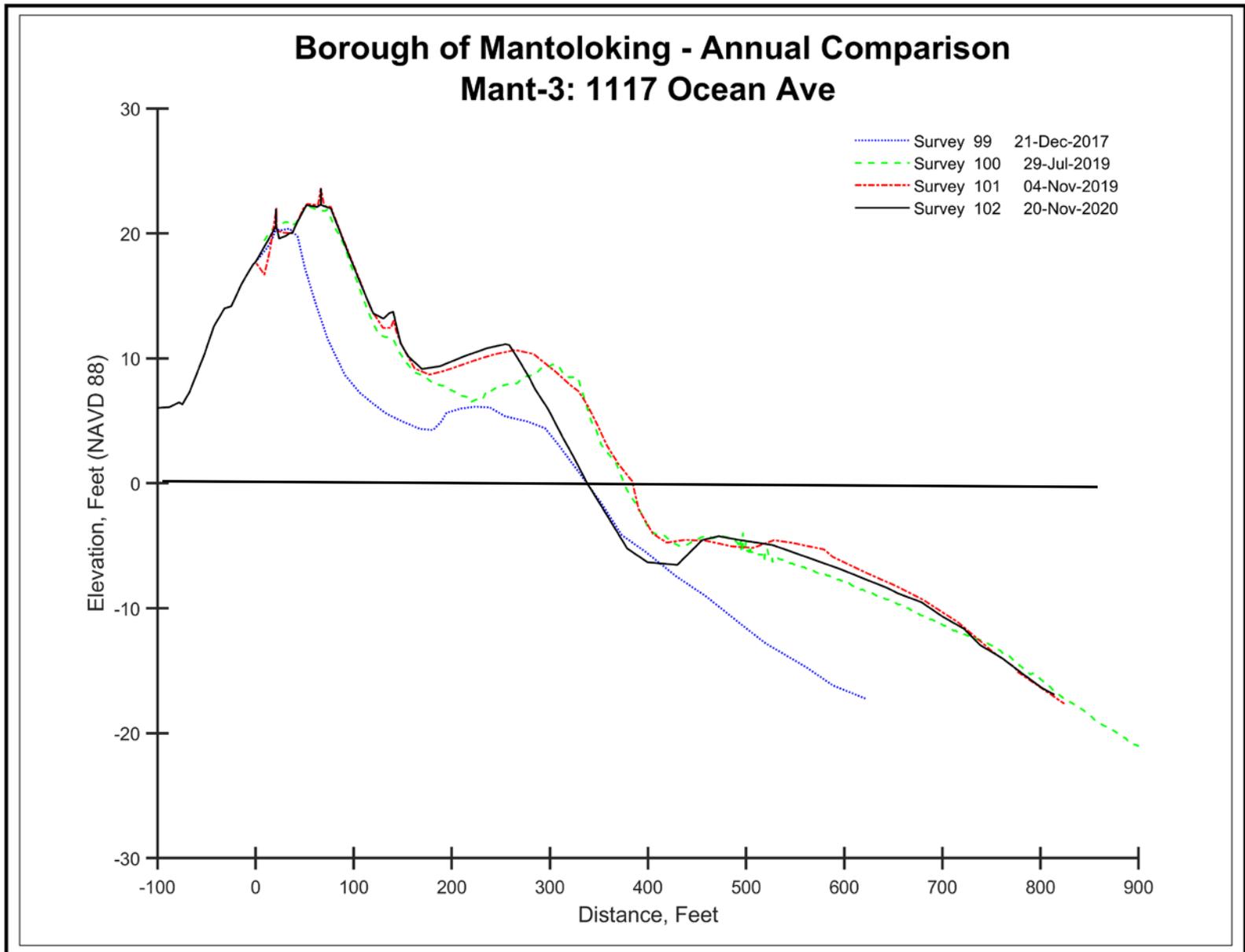
**3c. November 20, 2020**

*Mant-3 Photographs 3a, 3b & 3c show the view to the north from the seaward dune crest.*

*Photograph 3a. By December 2017, a combination of natural sand recovery over the 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 vigorous young dune plants and a wide, dry beach.*

*Photograph 3c. By November 2020, the dune grass had gotten an excellent start and the beach situation remains good.*



**Figure 3d: The pre-federal project dune and beach is displayed in the December 2017 survey, but by December 2017, sand had been placed during the early phase of the construction as 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 but was followed by berm retreat totaling 46 feet by Nov. 2020. The sand volume loss was 25.47 yds<sup>3</sup>/ft.**

- **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 is readily accessible.

At this location 76.32 yds<sup>3</sup>/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 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 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 yds<sup>3</sup>/ft. of sand added during the project.

Since the January 2018 survey where sand had been deposited as a very wide beach berm, the completed project saw considerable retreat in the January 2018 zero-elevation position (111 feet). With deposition further seaward reducing the net sand volume loss to 27.19 yds<sup>3</sup>/ft. with the comparison to July 2019. Since then the site has lost 9.42 yds<sup>3</sup>/ft. with a 19-foot further shoreline retreat landward. The offshore slope remained stable and a small foredune developed at the primary dune's landward toe.



**4a. January 19, 2018**



**4b. November 4, 2019**



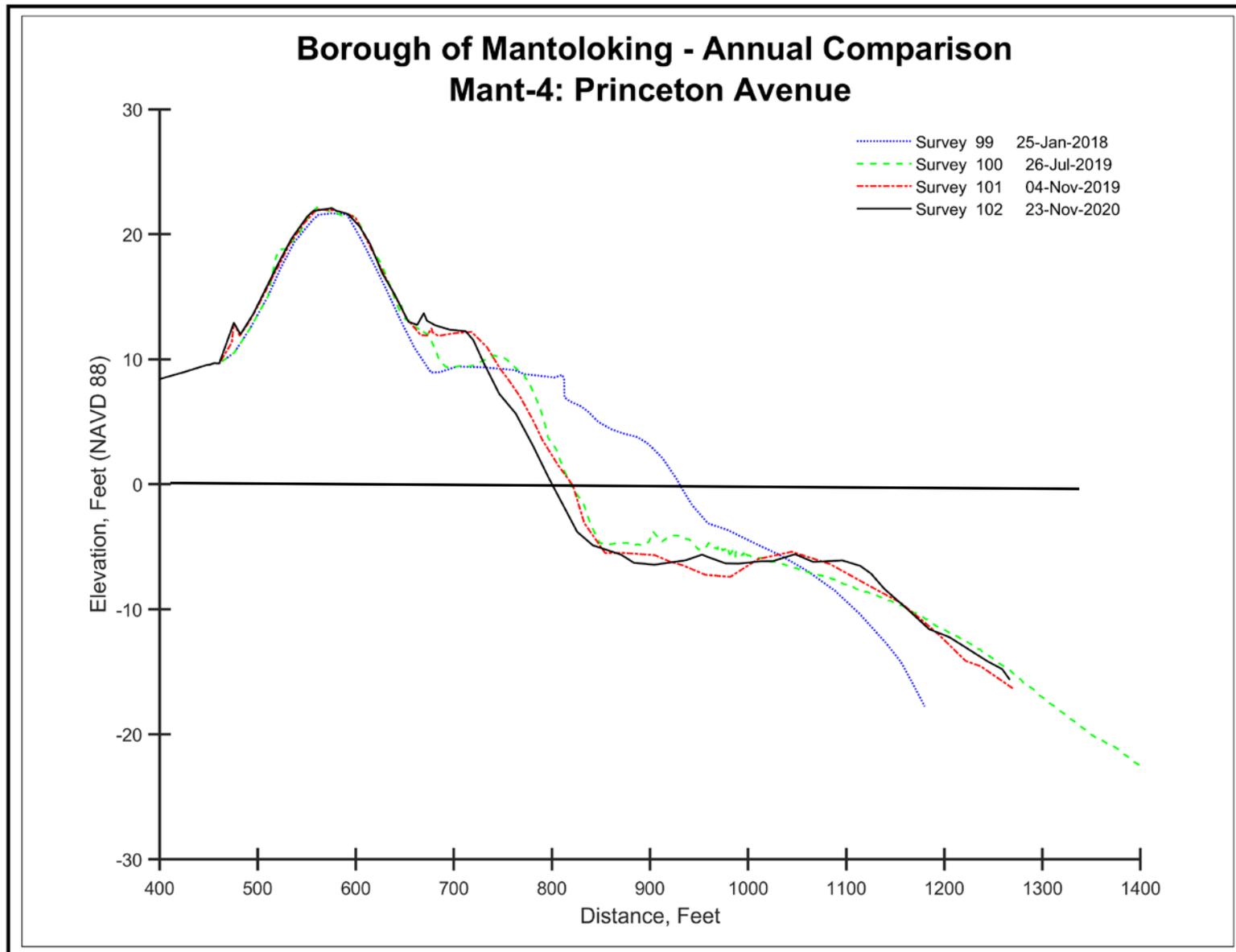
**4c. November 20, 2020**

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

*Photograph 4a. The Federal shore protection project, partially 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 Nov. 4, 2019 the grass had been planted and fencing installed. The highly expanded beach berm adjusted considerably between Jan. 2018 and July 2019 18 months apart because the sand placement ceased here and moved south to Ortleigh Beach, then worked north again.*

*Photograph 4c. The public access pathway was complete by November 23, 2020 with fencing and handicap access rebuilt.*



**Figure 4d: The Jan. 2018 survey shows the partially completed Princeton Avenue dune and very wide berm. By July 2019 the berm had adjusted to the current width with sand deposited offshore. Since then the dune has been planted and fenced. The beach accumulated sand at the dune toe and a significant bar formed offshore. A small foredune developed at the seaward primary dune toe. Modest sand volume losses (-2.16 yds<sup>3</sup>/ft.) and a 20-foot shoreline retreat occurred by Nov. 2020.**

- **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 curtailed accessibility to the private property and the site resulting in the its 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 was the widest and highest in the municipality. Homes are set back to the natural toe of the back slope of the dune. 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, following the USACE project construction 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 yds<sup>3</sup>/ft. and a 130-foot shoreline advance. Between July 2019 and November 2019, the site lost 0.37 yds<sup>3</sup>/ft. with no change to the zero-elevation shoreline position. A year later (Nov. 23, 2020) the site lost 30.22 yds<sup>3</sup>/ft. accompanied by a 37-foot shoreline retreat. All the loss volume came from berm retreat that also produced the 37-foot shoreline retreat. The small foredune was also present at this site too. Across the entire Mantoloking oceanfront, the offshore remained very constant since July 2019. This means sand losses are transferred parallel to the individual site north or south along the shorefront and not further offshore.



**5a. December 21, 2017**



**5b. November 4, 2019**



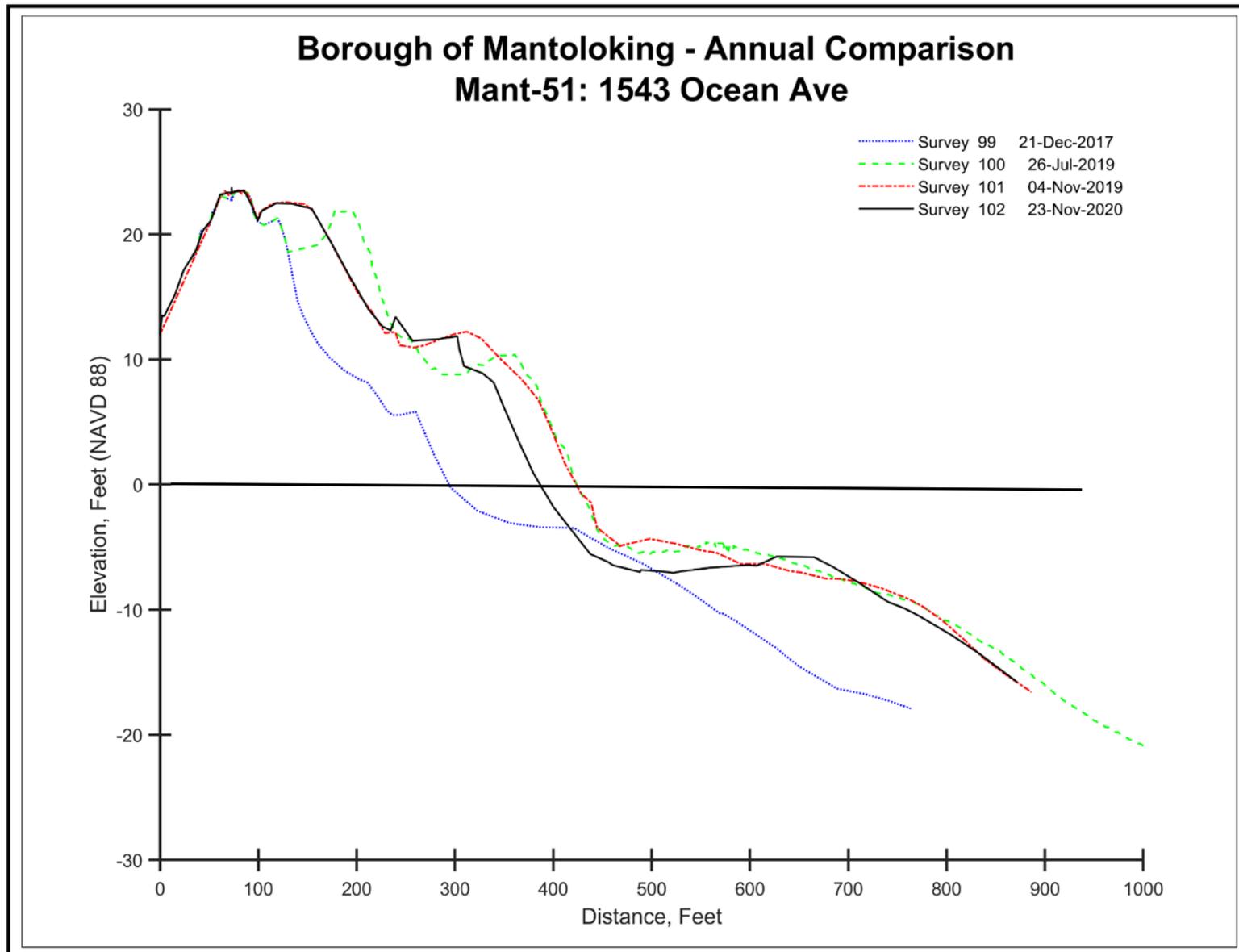
**5c. November 23, 2020**

*Mant-51 Photographs 5a to 5c. All views are to the north from the beach access or the berm 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 Nov. 4, 2019.*

*View 5c. There has been considerable wind transport into the dune as of Nov. 23, 2020. New dune decks have appeared along the Borough oceanfront as well.*



**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. Berm retreat occurred between Nov. 2019 and Nov. 2020 reducing the dry beach width by about 30%. Offshore there was little change indicating littoral transport south away from Mantoloking.**

## **Conclusions:**

Between December 2017 and July 2019, the use of the US Army Corps of Engineers as-built beach surveys compared to the last survey completed by the CRC at the five sites found that 1,377,081 cubic yards of new sand had been pumped onto the Mantoloking shoreline from source sites offshore. The entire northern Ocean County project has been sustained by sand supplies never previously available to the modern or historical oceanfront to provide added shore protection. When the sand volume placed prior to the December 2017 CRC surveys is included in the total placement count, the Borough received 2,153,249 cubic yards of sand between April 2017 and July 2019. The US Army “as-built” sand volume was given as 2,571,591 cubic yards of material (Keith Watson, communication).

The CRC surveys stopped as of December 2017 and did not resume until Nov. 4, 2019 so the 418,342-cubic yard difference is understandable as well as the fact that the USACE survey density was many times the CRC five individual sites in the Borough.

The past year shows very little shift of beach sand offshore with the bar system and offshore slopes remaining very consistent across the Borough oceanfront. Sand appears to still be arriving in Mantoloking from Bay Head but is leaving for Toms River Township to the south from the southern two locations (Mant-4 and Mant-51). This is to be expected given the frequency of northeast storm events not being entirely reversed in their littoral transport ability by southeast winds during the summer season. This section of the New Jersey oceanfront does come the closest to near balance in sand transit direction with a seasonally variable nodal zone of no net long shore transport usually positioned within the northern Ocean County shorefront.