

**2016 ANNUAL REPORT - TO THE CITY OF NORTH WILDWOOD
ON THE
CONDITION OF THE CITY BEACHES**



Aerial view of North Wildwood looking northwest into Hereford Inlet on June 25, 2016 following Winter Storm Jonas. This northeast event caused significant erosion to the beachface and dune system along the inlet and northend oceanfront beaches, in the process exposing more of the rock revetment wall. The main channel is shown as the darker, smoother water running parallel to the North Wildwood Inlet beaches. (Aerial photo taken by Ted Kingston)

**PREPARED FOR: THE CITY OF NORTH WILDWOOD
901 ATLANTIC AVENUE
NORTH WILDWOOD, NJ 08260**

**PREPARED BY: THE STOCKTON UNIVERSITY COASTAL RESEARCH CENTER
30 WILSON AVENUE
PORT REPUBLIC, NJ 08241
February 25, 2017**

TABLE OF CONTENTS

Introduction	1
2016 Weather Events	1
Engineered Beach History/Performance	1
Oceanfront Beach Surveys	3
Figure 1. Location Map of six of the 54 profile stations	3
Figure 2. Digital Elevation Change Map June 2016 to October 2016	4
Figure 3. Digital Elevation Change Map October 2015 to October 2016	5
Figure 4. Digital Elevation Model October 2016	6
Individual Site Reviews	7
Figures 5-8. Site 04+00 photograph and cross sections	7
Figures 9-12. Site 20+00 photograph and cross sections	10
Figures 13-15. Site 40+00 photograph and cross sections	13
Figures 16-18 Site 52+00 photograph and cross sections	16
Figures 19-21. Site 58+00 photograph and cross sections	20
Figures 22-24. Site 64+00 photograph and cross sections	22
Winter Storm Jonas	25
Table 1: Oceanfront Volume/Shoreline Changes Post Jonas	26
Figures 25-27. photographs Post Jonas	26
Summary/Conclusions	28

2016 ANNUAL REPORT - TO THE CITY OF NORTH WILDWOOD ON THE CONDITION OF THE CITY BEACHES

Introduction:

This annual report presents the status of the beaches within the City of North Wildwood for 2016. North Wildwood maintains a 6,800-foot oceanfront beach and dune system as an engineered beach feature designed back in 2009 with New Jersey Department of Environmental Protection assistance. The nourishment history extends from 2009 through the present day punctuated by a series of storms classified as FEMA disaster events and therefore subject to Category “G” reimbursement for losses suffered from a declared storm event. The January storm was named “Jonas” by the weather channel and did impact Cape May County with tidal flooding that exceeded levels seen during Hurricane Sandy. The January northeaster had a presidential disaster declared on March 14, 2016 (DR-4264) following damage assessment in Cape May and Atlantic Counties and elsewhere along the NJ shoreline. Almost immediately following Jonas, the area was once again subjected to northeast winds (February 7th and 8th) during Winter Storm Nacio. Loss to beach elevation occurred as well as scarps cut into dunes that extended virtually the entire length of the North Wildwood coastline. The worst losses were observed at the north end beaches between 2nd and 5th Avenues, where beach and dune losses were extensive undermining the Gazebo and exposing the access manhole on the outflow pipe located at 3rd Ave. The dredged material that had been mined from Beach Creek (32,000 cubic yards) through a New Jersey Department of Transportation sponsored project in late 2015, which was placed on the northern oceanfront beaches, had been eroded and repositioned in the nearshore and offshore reaches of the profile limits. Another beach maintenance project had taken place in the form of a sand backpassing effort from the Wildwood storm drains conducted between March and mid-May of 2016, which also placed 171,000 cubic yards along the eroded dune scarp and on the beach at the north end of the oceanfront.

2016 Weather Events:

The winter began in mid-January with cold and northeast winds culminating in NE Storm Jonas January 23 and 24, 2016. Labeled a 10-year storm, this event cut into the dunes and stripped the beach elevation so that subsequent high tides still reached the dune scarp. A lesser storm (Nacio) occurred February 7th and continued the erosion of the dune toe, easily done because the berm was still reduced in elevation. Both storms occurred in coincidence with a spring tide, so tidal surge flooding was significant and impacted bayside residents still recovering from Sandy. Following winter storm Nacio, there were no further significant events until January 23, 2017.

North Wildwood Engineered Beach History/Performance:

The initial beach nourishment project was started following several years of development was co-sponsored by the City and the New Jersey Department of Environmental Protection (NJDEP) in fall 2009 and was just short of the completion when it was interrupted by the November 2009 northeast storm. The dredging company, Great Lakes Dredge and Dock, Inc. (GLDD), was forced off the beach by the storm (the third in a nine-storm series) on November 11, 2009 with under 70,000 cubic yards of sand left to pump. That storm produced a US Presidential disaster declaration (DSR-NJ 1867) on December 22, 2009. This allowed the Federal Emergency Management Agency (FEMA) to review the losses to the community including the new beach (covered under Category “G” loss to parks and recreation facilities). Since the project was funded initially by a cooperative agreement with the NJDEP (75% of cost) and the City (25% of cost), the project qualified for 75% of the cost to replace the sand lost to the storm as a recovery, when and if the City determined to restore the project. GLDD completed the initial 2009 fill project during the fall of 2009; placing 1,400,000 cubic yards (CY) of sand between a point 600 feet west along the Hereford Inlet shoreline

south-eastward to 2nd Avenue groin, then along the entire municipal oceanfront, finally tapering south 600 feet into the City of Wildwood. That winter had a particularly active storm season and as a result, the northeast beaches suffered substantial erosion as sand from the inlet area was moved to the area south of 6th Avenue. Another northeast storm in March 2010 removed an additional volume of sand impacting the southern end of the City (DR-NJ 1897). One final declaration occurred following a December 2010 snowstorm and northeaster. Hurricanes Irene (August 2011) and Sandy (October 2012) produced additional disaster declarations. The damage from Irene was compensated for by hauling 93,000 cubic yards of sand from the beaches of Wildwood Crest to the northern municipal shoreline. Hurricane Sandy damage was more extensive, but the City achieved cooperation with the contractor dredging sand from Hereford Inlet's borrow zone to restore Stone Harbor's beach damage and piggybacked onto that project to add over 150,000 cubic yards of sand to the erosion zone.

The 2013 beach hydraulic recovery project placed sand at the south end and north end of the North Wildwood engineered beach. The region in between was at or above design template and required no action to restore. In addition, natural recovery added to the placed sand totaling an amount of 283,285 cubic yards to the beach and the dunes. This means that the North Wildwood engineered beach recovered over half the 519,853 cubic yards of sand lost from the storm combination from the 2009 design template that was created originally. The placement of sand plus the natural recovery brought the beach back to just 236,578 cubic yards below the 1.4 million cubic yard initial sand volume placed in 2009 (83.1% of the initial fill). This reduced volume is largely because of limits placed on the initial project beach extents. The Endangered Species Program curtailed further work along the Hereford Inlet portion of the initial project for due to nesting Piping plovers, plus the City of Wildwood had requested that the project end at 65+38 some 762 feet less than the original project extent. This reduction in project extent reduced the sand quantity necessary to restore the full design template. Therefore, the re-defined North Wildwood beach project appeared to be near its revised design template as a result of both natural recovery and the sand placement volume calculated to restore the direct impacts of Hurricane Sandy by the end 2013.

Unfortunately rapid erosion occurred during the fall 2014 likely related to the 72 hours of onshore winds in October. By November the beach berm widths and elevations were dramatically reduced and the seaward dune slope exposed to wave run up in the recent project areas. At the northend waves cut into the dune slope along the seaward dune toe leaving a modest scarp. In front of the southern piers a similar trend occurred that intensified north to south. At 21st Street the dune remained stable and gained a veneer of sand but at 23rd Street a 2-3 foot high scarp was cut and by 26th Street the scarp increased to 6-7 feet as the seaward slope was cut landward to the crest. This erosion returned the beach to essentially its post-Sandy configuration.

2015 was bookended with beach restoration projects that began in the first quarter of the year with a backpassing project with source materials coming from excess sand seaward of the Wildwood stormwater outflow pipes that was truck hauled and placed on the eroded northern beaches of North Wildwood (35,364 cubic yards). During the fall the NJ Department of Transportation funded dredging of Beach Creek, located at the northwest corner of the barrier island off Herford Inlet, was completed with the sand mined from this project placed on the northern oceanfront portions of North Wildwood's beaches (approximately 32,000 cubic yards), between the 2nd Avenue jetty and 7th Avenue.

Following the northeast winter storms of early 2016 the City of North Wildwood conducted another emergency sand backpassing program. A joint program between the Cities of Wildwood and North Wildwood using high capacity trucks which hauled excess beach sand excavated from the City of Wildwood's beachfront storm drain outfalls. This work was completed by mid-May 2016 and can be seen in the profile information the CRC conducted in June (Survey 28).

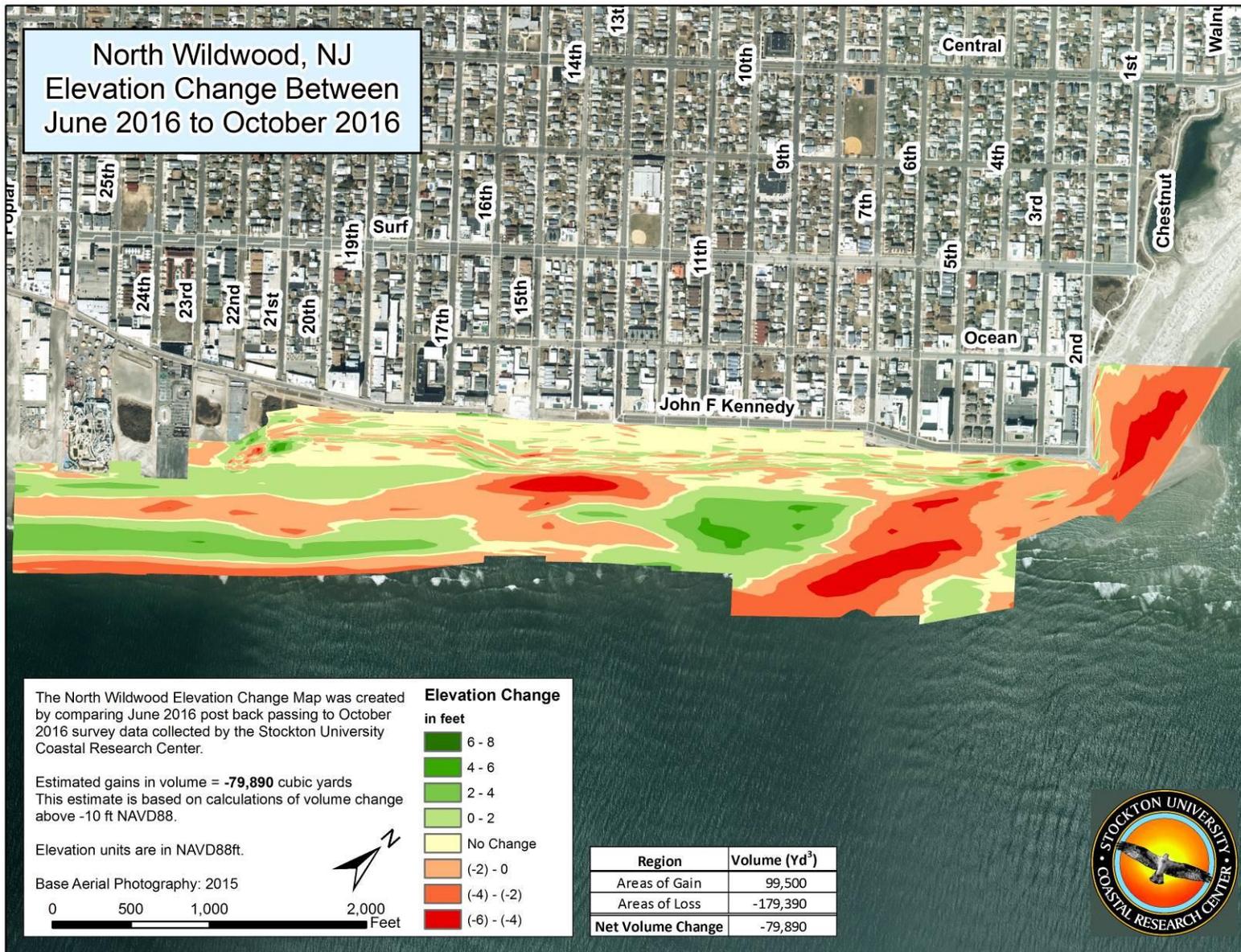
Oceanfront Beach Surveys:

The CRC surveyed shoreline changes at all 54 oceanfront profile stations two times in 2015 and two times in 2016 to determine annual and seasonal trends. These surveying activities continue a monitoring program that began in 2009 following the initial City/State beach restoration project. The profile stations are spaced 200-foot apart and were established to determine cumulative changes and performance of the beach restoration project. Figure 1 shows the locations of a few selected profile survey locations that were extracted from the 54 profile dataset: Lines **04+00**; **20+00**; **40+00**; **52+00**; **58+00**; and **64+00**. These sites were chosen to show the range of performance changes across the project. The two northern sites document changes in the historically erosional zone, the middle two sites show the changes in the mid-section of the island, and the southern two sites document the changes in around the four piers south of 21st Avenue. A discussion of the changes at each of these locations is provided in a later section of this report. The following is a list of the studies included in this report and the surveys:

- **Survey 25** **October 2015**
- **Survey 27** **March 2016 (Post Nacio)**
- **Survey 28** **June 2016 (Post Sand Backpassing)**
- **Survey 29** **November 2016**

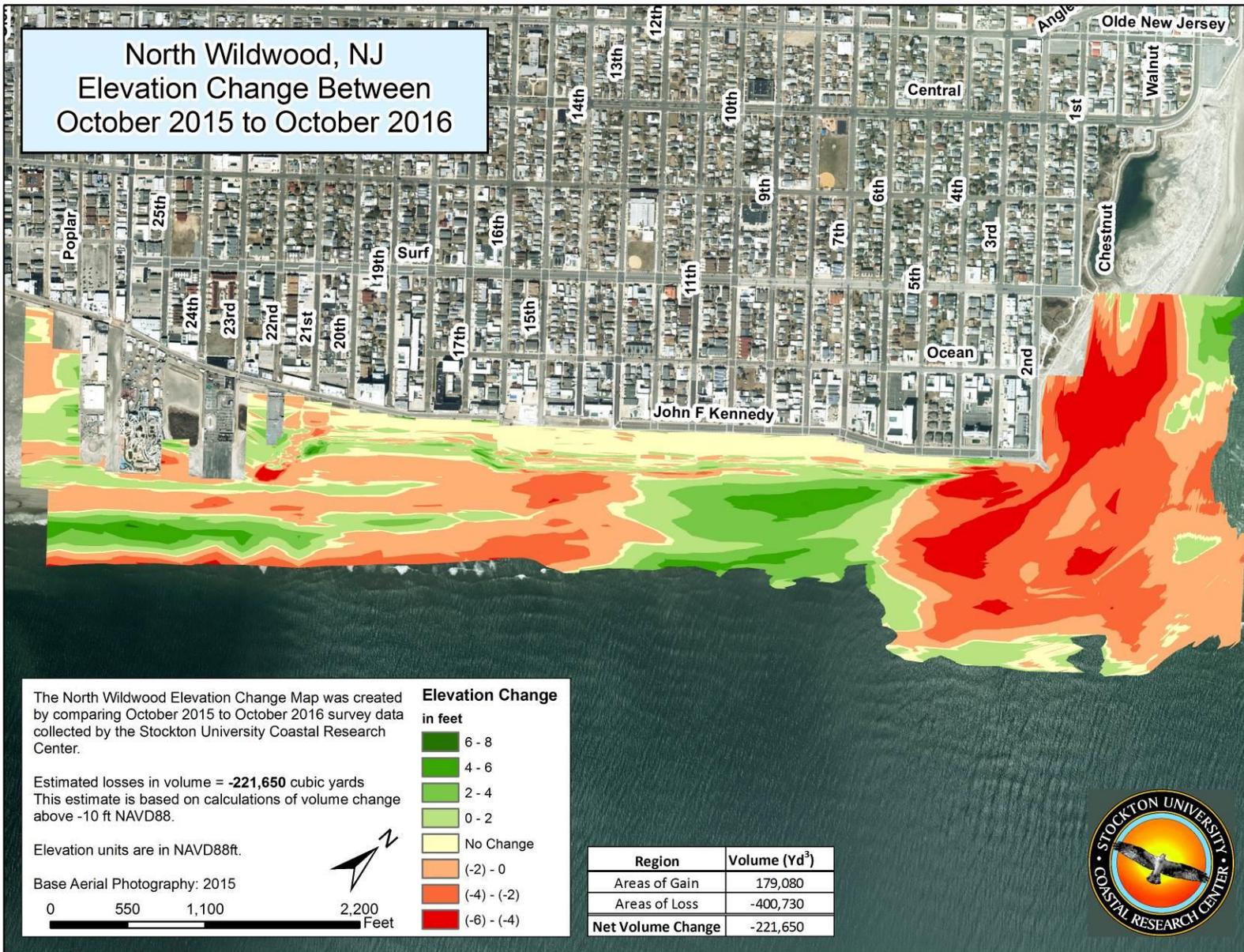


Figure 1. Shown above are locations of six representative profile sites of the 54 profile stations where shoreline changes were measured on the City’s oceanfront from October 2015 to November 2016. For each of the six profile stations descriptions and cross sections are provided to show typical changes over the year.



IB 12/16

Figure 2. A digital elevation change map for the North Wildwood City shoreline. This elevation difference map of the North Wildwood City engineered beaches shows the change in elevations between June 2016 and October 2016 surveys. There is a dark green area of accretion concentrated between 3rd and 4th Avenues directly related to the sand backpassing project. The reddish band that wraps around the northern offshore regions through to the surveyed inlet area located to the north of the 2nd Avenue jetty displays the significant losses experienced through the second half of 2016. A breakdown by region of sand volume gains vs losses is include in the volume change table on the map. Cumulative volume losses for this time period amounted to 79,890 cubic yards concentrated around the 2nd Avenue jetty south to 8th Avenue.



IB 12/16

Figure 3. A digital elevation change map for the North Wildwood City shoreline showing the conditions of the engineered beach between the fall 2015 survey through the fall 2016 survey. The shades of color intensify with the magnitude of the change both positive and negative, with the yellow color showing regions with no change over the time interval. Losses were concentrated in the northern portion of the island, around the 2nd Avenue groin apex, continuing into the inlet beaches. Overall 221,650 cubic yards of sand loss was recorded for this annual comparison.

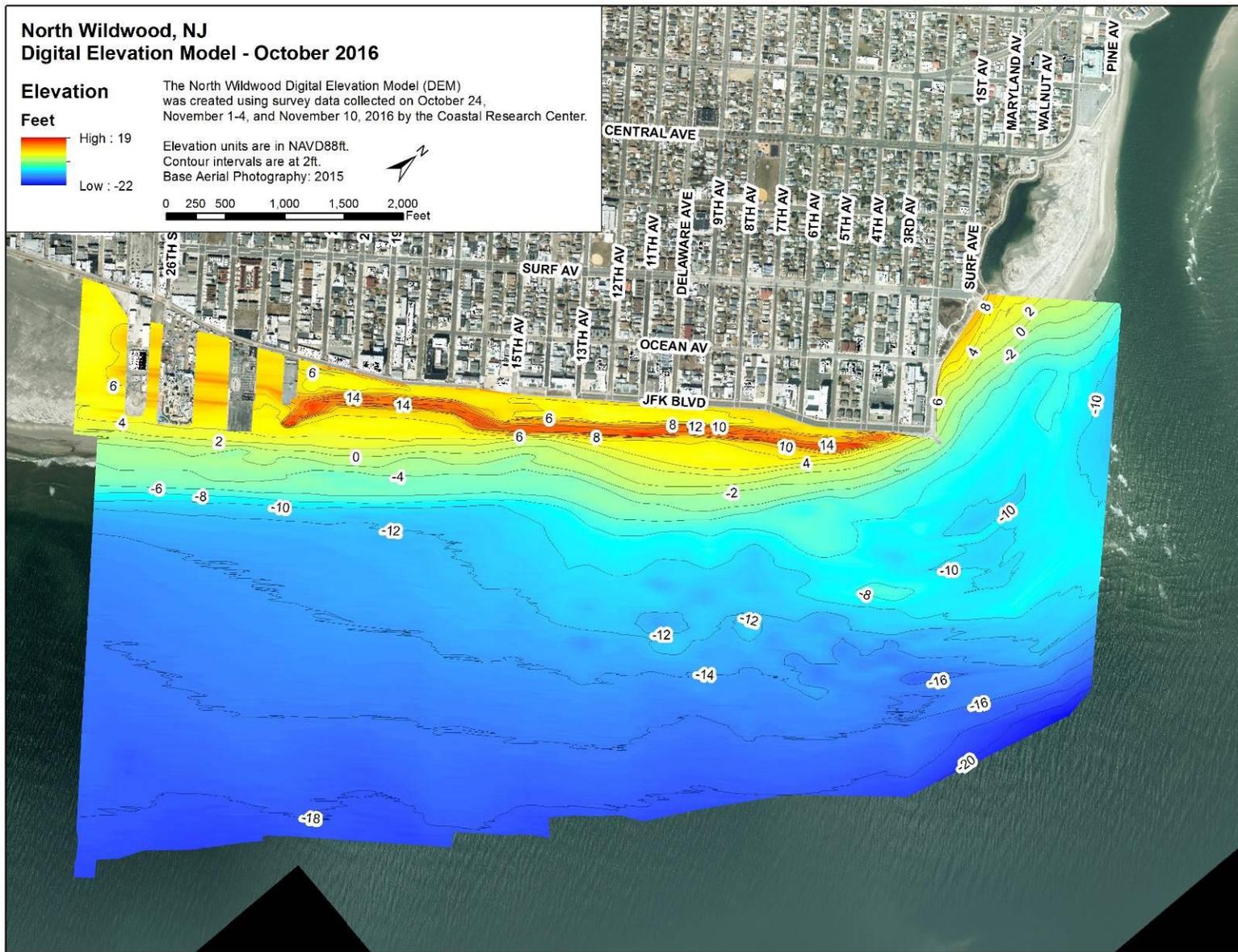


Figure 4. A digital elevation model for the North Wildwood City Shoreline. The higher elevations are colored red/orange and outline the dune and recreational beach regions. The green/blue colors represent the lower elevations nearshore and offshore. The lighter blue colors in the right portion of the map outline the inlet shoal position, and southern boundary of the main tidal channel, as of October 2016.

Individual Site Review:

This section describes the shoreline and volume changes documented at selected profile locations to show general trends in sediment movement along the City's beaches for 2016. Beach volume and shoreline changes were calculated from October 2015 to November 2016.

Site 04+00 (between 3th and 6th Avenues)

The site is located in the northern portion of the island adjacent to Hereford Inlet 400 feet south of the 2nd Avenue jetty. This area has typically been an erosional shoreline due to the proximity to the inlet and the direct impact from northeast storms.

2015 was bookended with beach restoration projects that began with a backpassing project with source materials coming from excess sand seaward of the Wildwood outflow pipes that were placed on the eroded northern beaches of North Wildwood (35,364 cubic yards). During the fall the much anticipated NJ Department of Transportation funded dredging of Beach Creek, located on the backside of Herford Inlet, was completed with the sand mined from this project placed on the northern oceanfront portions of North Wildwood's beaches (approximately 32,000 cubic yards), between the 2nd Avenue jetty and 7th Avenue.

2016 began with two serious winter storms, Jonas (January) and Nacio (February). The northern beaches and dune system, and offshore regions sustained severe damage, exposing the wooden bulkhead and gazebo to storm related damages. The completion of the sand backpassing project in May, from material harvested in Wildwood, modestly repaired the damages suffered earlier in the year. A final sand relocation to the dunecrest using existing material can be seen by the November 2016.



Figure 5. View from 5th Avenue looking north taken on October 3, 2015 following the northeast storm events and Hurricane Joaquin. A significant scarp in the seaward duneface is shown along with recreational beach elevation and shoreline losses observed.



Figure 6. View from 4th Avenue looking north taken on February 10, 2016. The primary dune and beachface has suffered severe erosion in the form of a large scarp. The gazebo and manhole access cover to the storm outflow pipe is completely exposed and extremely vulnerable to wave approach.

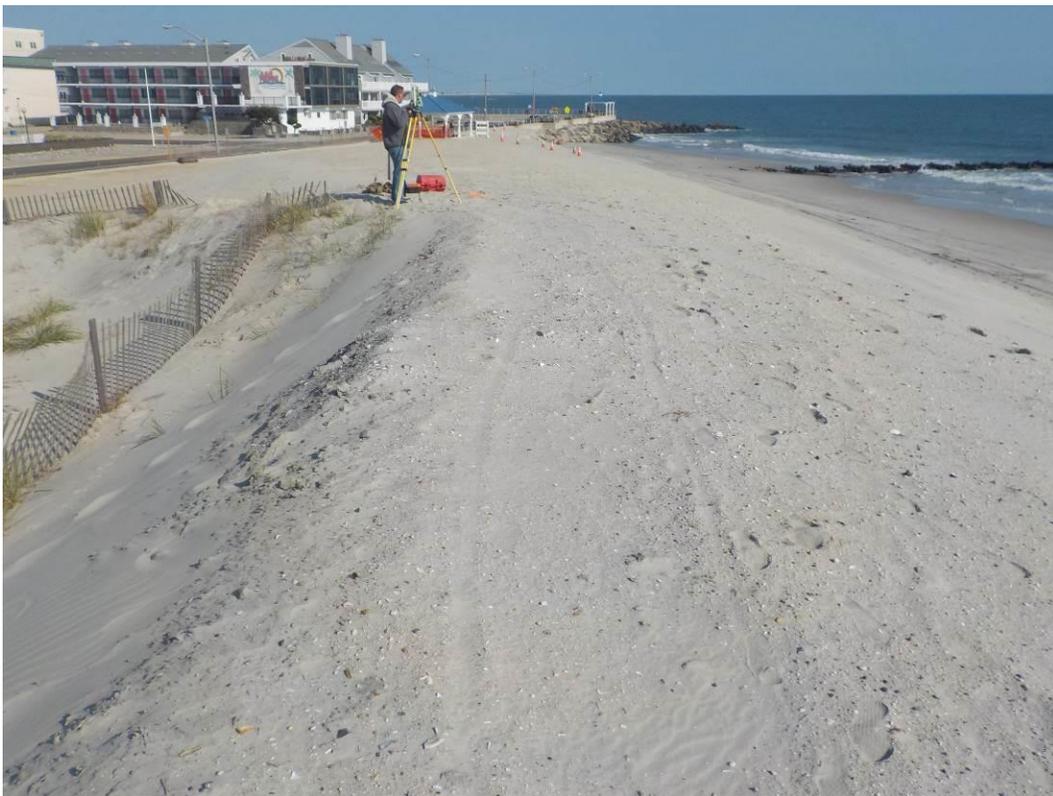


Figure 7. View from 6th Avenue looking north taken on November 2, 2016. The successful sand backpassing project from in front of Wildwoods outfall pipes in conjunction with sand relocation from the beach resulted in a fortified primary dune.

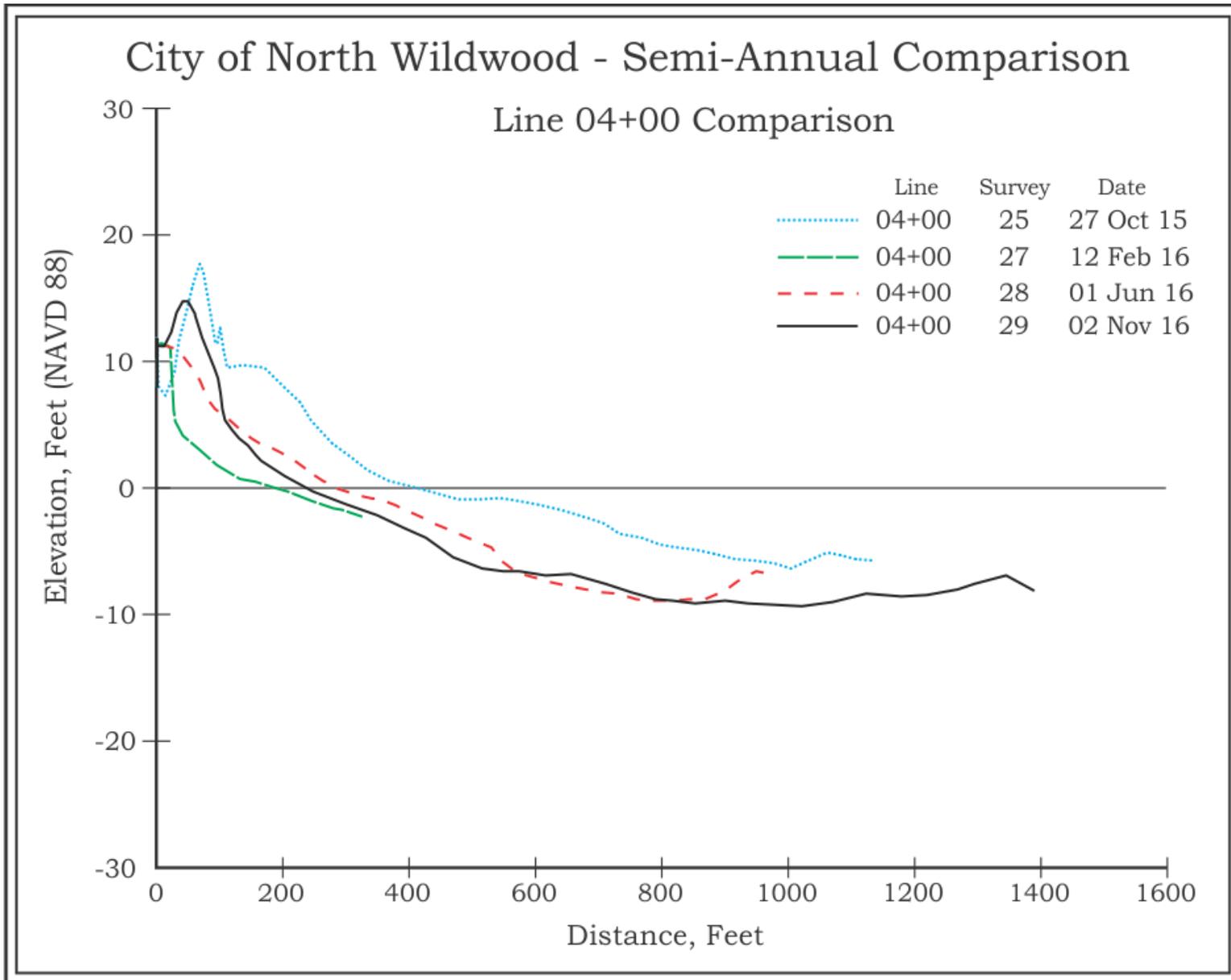


Figure 8. The material mined from Beach Creek that was placed on the northern portion of the island was completely wiped out from Winter Storms Jonas and Nacio. The dune and beachface was repaired in April using sand transported from the Wildwood storm water outfall pipes as shown in Survey 28. The annual comparison from the fall 2015 to the fall 2016 revealed a cumulative volume loss of 181.29 yds³/ft. and a shoreline retreat of 172 feet directly related to the early storms of 2016.

Site 20+00 (between 11th and 13th Avenues)

This site is located approximately 2,000 feet south of the inlet and has represented a transition zone (from erosion to deposition) in previous years. Hurricane Sandy had temporarily reversed this trend as the storm waves and surge severely eroded the beachface and recreational beach berm that reduced the overall dry beach width by 160 feet. The dune was unaffected by the storm due to the 400-foot wide beach attenuating the breaking waves and absorbing the energy before they reached the dunes. Despite the severe erosion the beach remained over 250 feet wide and supports recreational activities and continued to provide sufficient storm protection for the dune and oceanfront properties and infrastructure. The beach was still within the design template configuration parameters. As a result no sand was placed in this region during the 2013 maintenance project.

The profile site at 20+00 benefited from downdrift material from the northern end of North Wildwood beaches advancing its shoreline position and recreational beaches. However, from November 2013 through November 2014 the survey line at 20+00 and its surrounding areas were dominated by erosional processes. The berm, beachface, and nearshore region had lost material to the offshore. This erosional trend continued through the spring and fall surveys conducted by the CRC in 2015. The recreational beach and berm were significantly reduced with the material shifting outside our profile limits.

The effects of the two serious winter storms, Jonas (January) and Nacio (February) is documented at this profile site in the form of a dunescarp and eroded beachface. The completion of the sand backpassing project in April, from material harvested in Wildwood, modestly repaired the damages suffered earlier in the year. As littoral drift carried sand from the north, the berm and nearshore regions continued to gain position seaward by the final survey of 2016. Overall, from Survey 25 to Survey 29 the shoreline accreted 198 feet and recorded volume gains of 129.14 yds³/ft.



Figure 9. View to the north taken from the foredune at 13th Avenue on November 2, 2015. The beachface eroded slightly from the April survey. For the November 2014 to October 2015 comparison the shoreline position retreated 52 feet with material shifting offshore.



Figure 10. View to the north taken from the foredune at 12th Avenue on February 11, 2016. A large scarp developed on the seaward dune face as the beachface eroded following the early 2016 storm season.



Figure 11. View to the north taken from the foredune at 11th Avenue on November 2, 2016. The beachface and dune system has received material from the Wildwood backpassing project, restoring their respective positions and elevations.

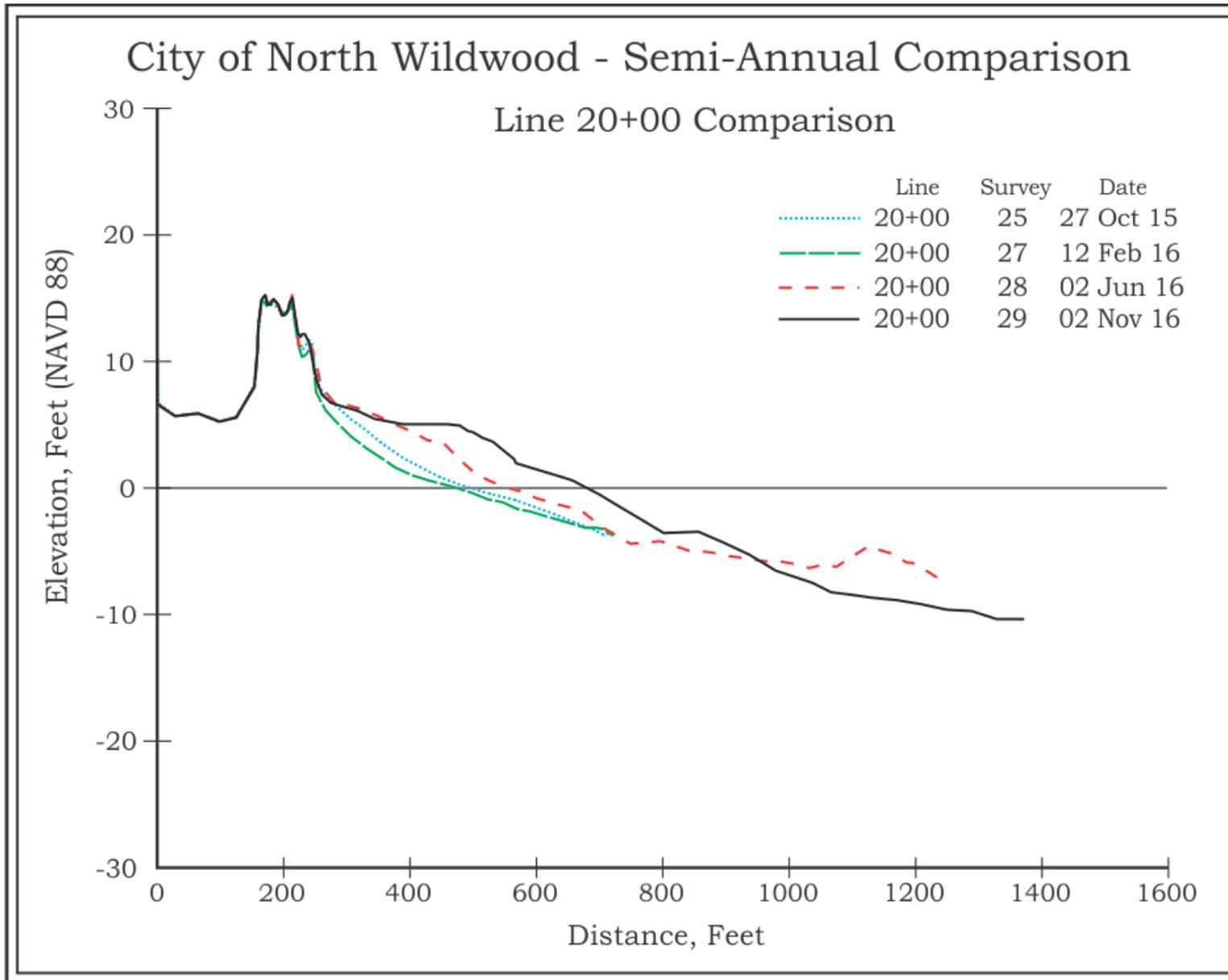


Figure 12. The dunetoe, beachface, and nearshore regions were dominated by erosion through Survey 27. Material from the sand backpassing effort repaired the dune and beachface by the June 2016 survey. As littoral drift carried sand from the north, the berm and nearshore regions continued to gain position seaward. Overall, from Survey 25 to Survey 29 the shoreline accreted 198 feet and recorded volume gains of 129.14 yds³/ft.

Site 40+00 (between 18th and 19th Avenues)

Positioned 4,000 feet south of the 2nd Avenue jetty, this site is located two blocks south of the lifeguard station in the mid-section of the City's oceanfront beaches. Following initial construction this region has remained relatively stable. The wide beach has protected the dune ridge, constructed during the initial project phase, from erosion through multiple storm events including Hurricanes Irene and Sandy. Waves and storm surge from Sandy and winter storm Saturn combined flattened the beachface slope and reduced the recreational beach berm width nearly 180 feet. Although the beach was severely eroded it absorbed the wave energy and effectively provided wave attenuation protecting the dune system, oceanfront properties and public infrastructure for wave damage during Sandy.

Both the primary dune and foredune remained stable through both the spring 2015 and fall 2015 surveys. Although the beachface and nearshore regions eroded throughout 2015, the upper recreational beach (approximately 250 feet from the seaward dunetoe) remained relatively stable.

Both the recreational beach and beachface suffered erosional processes as a result of NE Storms Jonas and Nacio, decreasing elevation and shoreline position. The primary dune however, did not receive damage from these events, and actually gained material at the seaward dunetoe by Survey 27. For the annual comparison between Surveys 25 and 29 the shoreline position retreat was 43 feet and the cumulative volume losses were recorded at 34.14 yds³/ft. along the profile.



Figure 13. View to the north from the beach located near 19th Avenue on October 30, 2015. The berm and recreational beach had eroded over 100 feet since the fall 2014 survey with sand shifting beyond the profile limits.

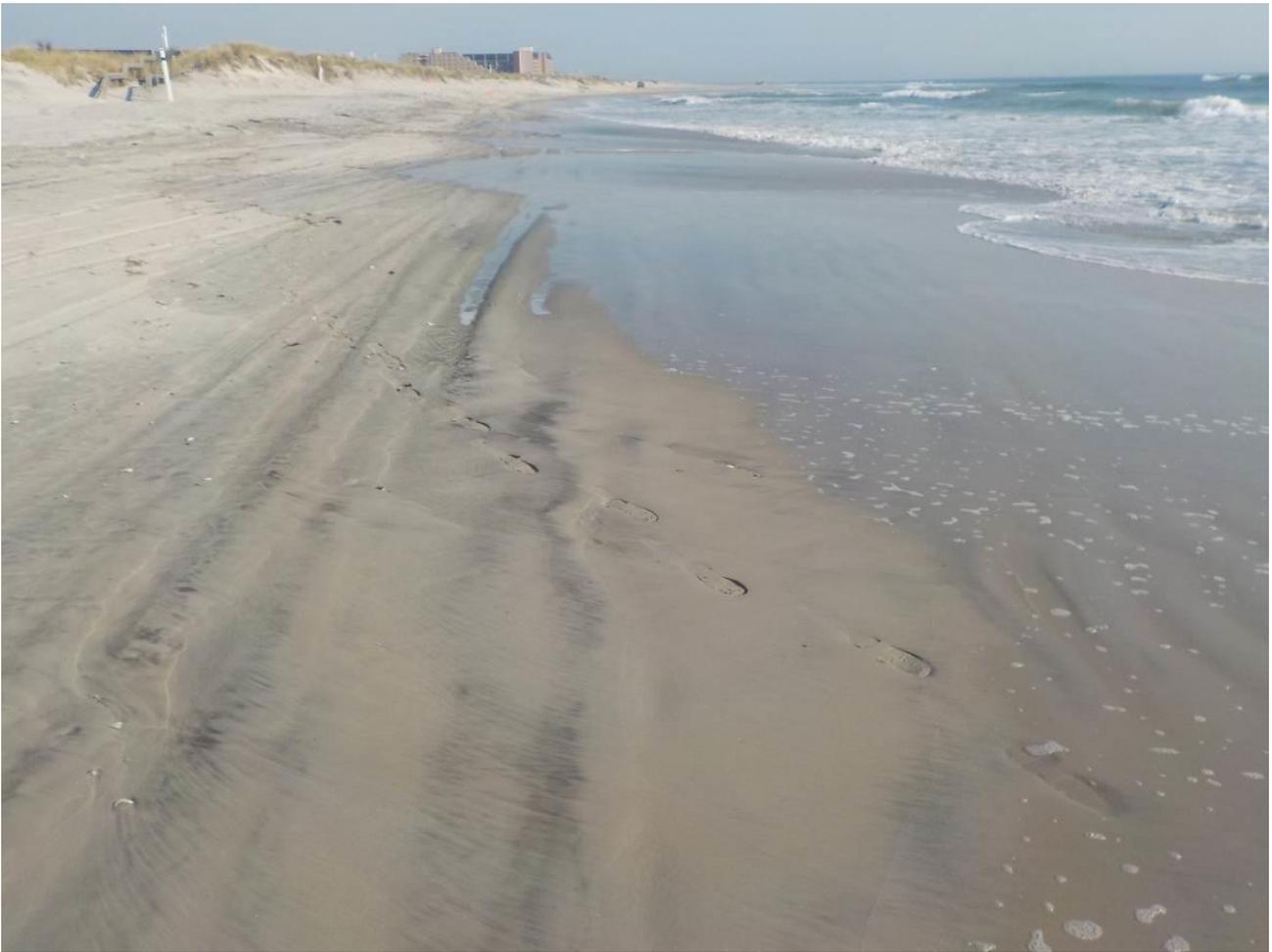


Figure 14. View to the north from the beach located near 18th Avenue on November 2, 2016. The berm and recreational beach has not fully recovered following the NE storm events at the beginning of the year.

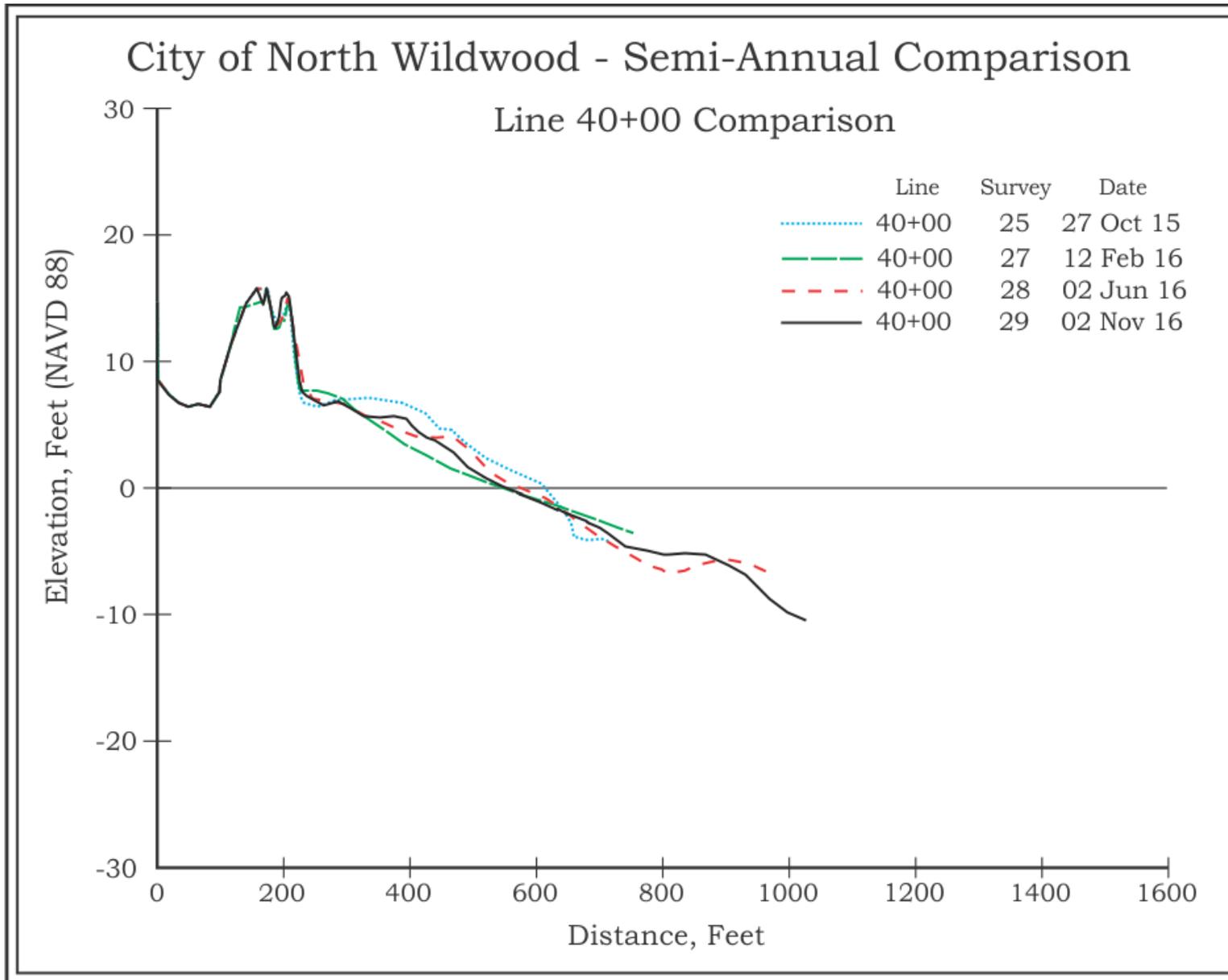


Figure 15. For the annual comparison (Survey 25 to Survey 29) the recreational beach and berm lost elevation and position as a result of the NE storm activity at the beginning of the year. However, throughout the 2016 survey seasons, the primary dune remained intact and unaffected by the storm events.

Site 52+00 (21st Avenue)

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

Located just north of the northern fill taper of the pier section for the 2013 project this site did not receive sand directly but likely benefited from sand lost from the project area. By the end of June 2013 the beachface accumulated sand that expanded the beach berm width nearly 40 feet. Sand also filled in the nearshore scour trough cut by Sandy and Saturn over the summer and fall as sand moved longshore and cross-shore towards this beach. The primary dune accreted sand through both the spring 2015 and fall 2015 surveys while the recreational beach and beachface eroded material during this time. By Survey 25 the nearshore and offshore regions experienced significant losses of sand beyond the end of the surveyed profile.

For this southerly location, the impacts of Winter Storms Jonas and Nacio were seen along the erosional beachface. This trend reversed itself and the shoreline accreted by the June 2016 survey, only to once again reduce shoreline position as material shifted offshore by Survey 29. The berm elevation increased by the final survey conducted in 2016. For the October 2015 to November 2016 comparison the net volume change was a gain of 2.41 yds³/ft. of sand with a shoreline position retreat of 57 feet.



Figure 16. View to the south taken from the beachface at 21st Avenue on April 23, 2015. The recreational beach and beachface began to erode at this time and continued throughout the remainder of 2015.



Figure 17. View to the north taken from the beachface at 21st Avenue on November 3, 2016. The photograph displays the primary dune system intact and unaffected by the storms of early 2016. The recreational beach elevation did suffer minor elevation losses by the June 2016 survey, which remained by the final November 2016 survey.

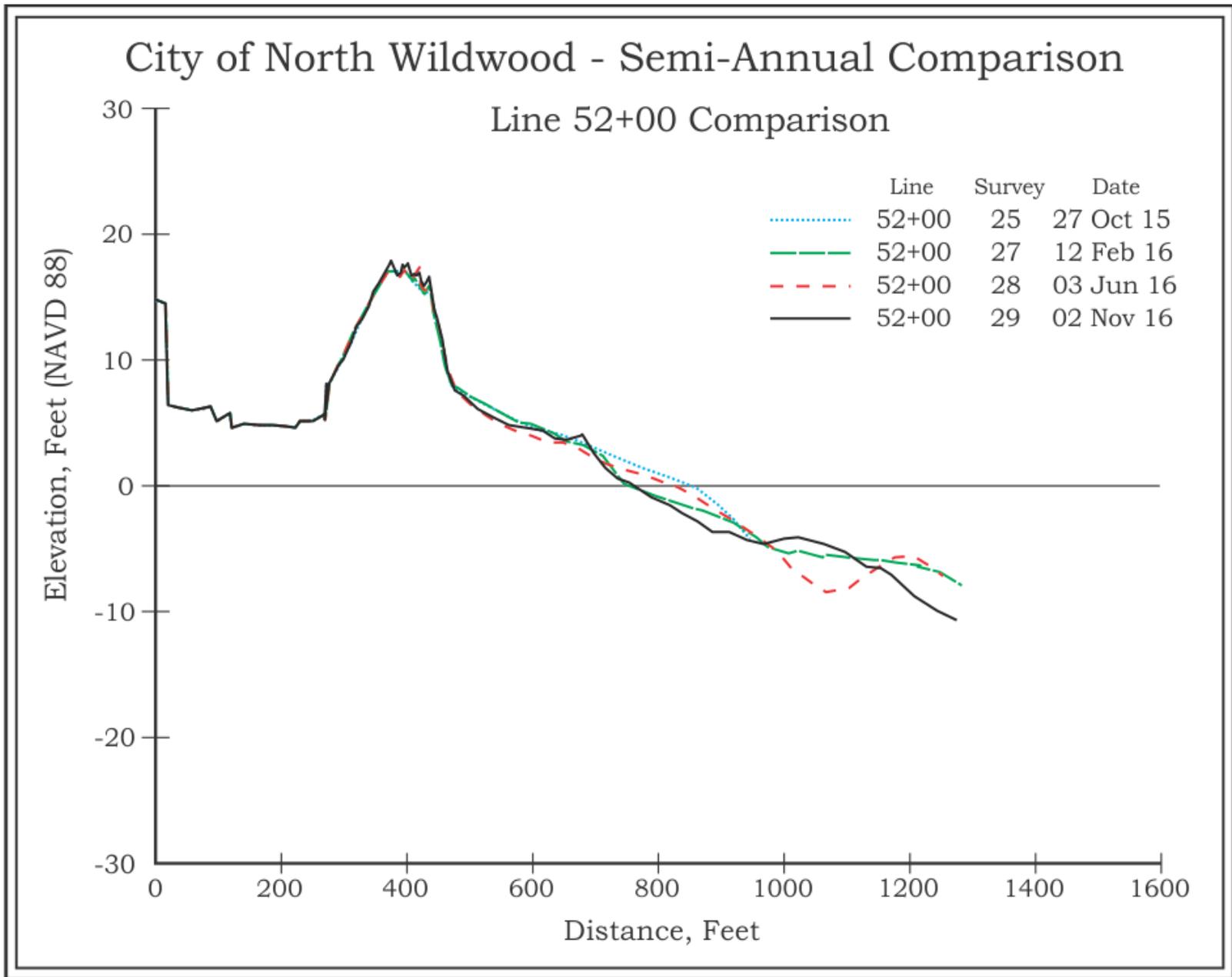


Figure 18. The recreational beach and beachface experienced an erosional trend following the February 2016 survey. NE Storms Jonas/Nacio had a negative impact on the beachface at this location. Calmer weather patterns allowed for the shoreline position accretion by June 2016, only to have this trend reversed by the final survey.

Site 58+00 (23rd Avenue)

This site is located in the southern section of the City's oceanfront where the engineered dune system was originally constructed seaward of the piers. The NJDEP mandated seaward jog in the dune system resulted in their vulnerability to the spate of frequent storms since 2009. With limited beach width seaward of the feature to attenuate wave action and absorb the energy before impacting the seaward slope the dune suffered severe erosion. During Sandy the proximity of the dunes seaward of the piers to the shoreline, made them no match for this event. Dunes were entirely washed away south of 22nd Avenue and the beachface and berm flattened by the storm waves and surge.

As a result of this damage the city initiated a beach maintenance project in 2013 to restore the engineered beach seaward of the piers. Norfolk dredging placed 67,508 cubic yards of sand in this region to rebuild the dune and beach to approximate design template. The dune was reconstructed to a crest elevation of 12 feet NAVD88 and approximately 100 feet wide at the toe. A recreational berm was built that extended over 100 feet seaward of the dune toe at elevation 7 NAVD88. Again rapid erosion followed the project and by the end of June 2013 a 2.5 foot high beach scarp was cut into the berm as the beachface retreated under the wave climate.

By the spring 2014 survey (April 25th) the dune had been eroded to a point where the City was forced to reposition this feature landward of the easternmost point of the piers. This allowed for a wider beach area seaward of the dune system to capture aeolian sand transported to the seaward dune slope.

During 2014 and into the 2015 winter months the recreational beach in front of the 24th Avenue pier began to erode and lose elevation. By the April 2015 survey the beach and beachface recorded an elevation loss of approximately 2 feet. The milder weather patterns over the summer months allowed for a minor shoreline advance by the October survey (Survey 25).

2016 began with significant erosion along virtually the entire profile at line 58+00 directly related to the January and February NE storm events. Shoreline retreat of 86 feet was recorded at this time as well as a cumulative volume loss of 14.48 yds³/ft. The upper portions of the beach continued to show modest recovery for the remainder of the survey year as material offshore began to migrate landward. For the annual comparison from fall 2015 to fall 2016, the shoreline retreated 85 feet and lost 14 yds³/ft. on the beachface and nearshore regions.



Figure 19. A close up view of the truncated primary dune looking to the south from the berm located near 23rd Avenue on October 30, 2015. The low elevation of the beach is clearly displayed, resulting in a small scarp to the seaward dune toe.



Figure 20. A view of the dune looking to the north from the shoreline located near 23rd Avenue on November 3, 2016. The low lying recreational beach and absence of a protective berm has rendered the dune vulnerable to wave approach. Notice the large scarp in the dune located to the north of the pier. This dune was initially designed to extend to points seaward of the timber pier and extend south past all the pier structures. This design was mandated by the Land Use Regulatory agency of the NJDEP. It failed to survive storm events and was re-positioned at a point parallel with the shoreline at the existing scarp.

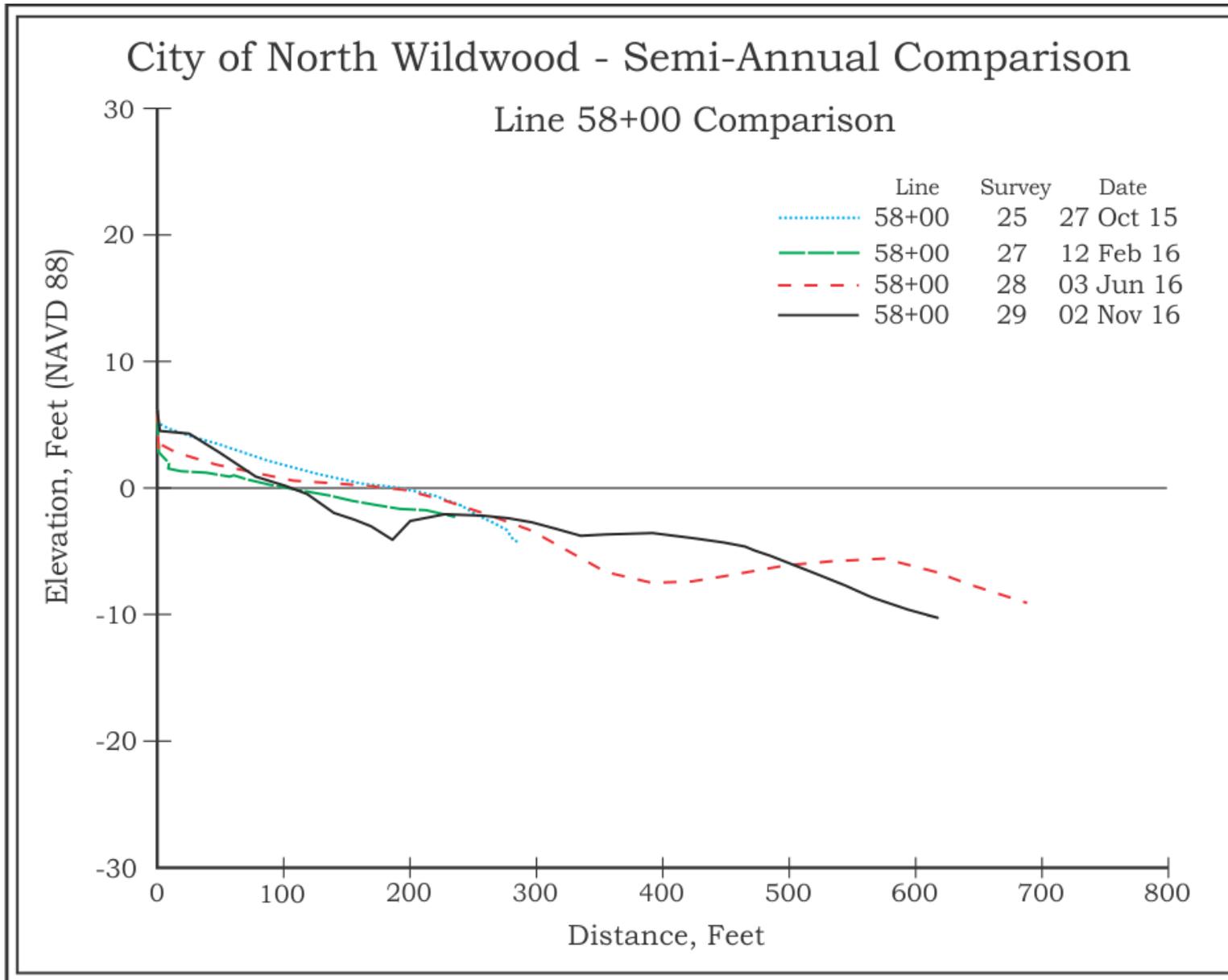


Figure 21. Considerable losses to the recreational beach, beachface, and nearshore had taken place between Surveys 25 and 27 due to the early storm of 2016. The upper beach portions of the profile continued to increase in elevation throughout the remainder of survey year. However, a large scour trough had formed in the nearshore area by the concluding survey.

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

This is the southern-most cross section of the selected profiles within the larger database. Located seaward of the Surfside Pier and Ocean Oasis Water Park and Beach Club this site represents conditions at the south end engineered beach and taper near the Wildwood and North Wildwood border. Initially the engineered beach design template placed the dune feature 30 feet seaward of the pier's steel bulkhead. A series of storm events that followed construction in 2009 resulted in multiple episodes of erosion followed by restoration efforts to maintain this section of dune. The beach seaward of the feature is narrow and prone to storm erosion.

Like the profile at Line 58+00 located to the north of the piers, by the spring 2014 survey (April 25th), the dune had been eroded to a point where the City was forced to reposition this feature landward of the easternmost point of the piers. This also allowed for a wider beach area seaward of the dune system to capture aeolian sand transported to the duneface. The early 2015 winter months eroded the recreational beach at this location. By the April 2015 survey the beach recorded an elevation loss of between 1 and 2 feet. The milder weather patterns over the summer months allowed for a minor shoreline advance by the October survey (Survey 25).

Once again, 2016 began with significant erosion along the entire profile at line 64+00 directly related to the January and February NE storm events. The shoreline retreat was recorded at 99 feet during this time interval as well as a cumulative volume loss of 14.35 yds³/ft. The upper portions of the beach continued to show modest recovery for the remainder of the survey year as material offshore began to migrate landward. For the annual comparison from fall 2015 to fall 2016, the shoreline retreated 48 feet and 30.30 yds³/ft. volume gains were recorded on the beachface and nearshore regions.



Figure 22. View to the north taken on April 28, 2014 near 26th Avenue showing the elevated dry beach seaward of the southerly piers. The dry beach was low, but of substantial width at this point in time.



Figure 23. View to the north taken on February 12, 2016 near 26th Avenue following winter storms Jonas and Nacio. The dry beach that was present less than two years ago has been eroded, leaving the ocean waves lapping at the base of the pier's steel bulkhead walls.

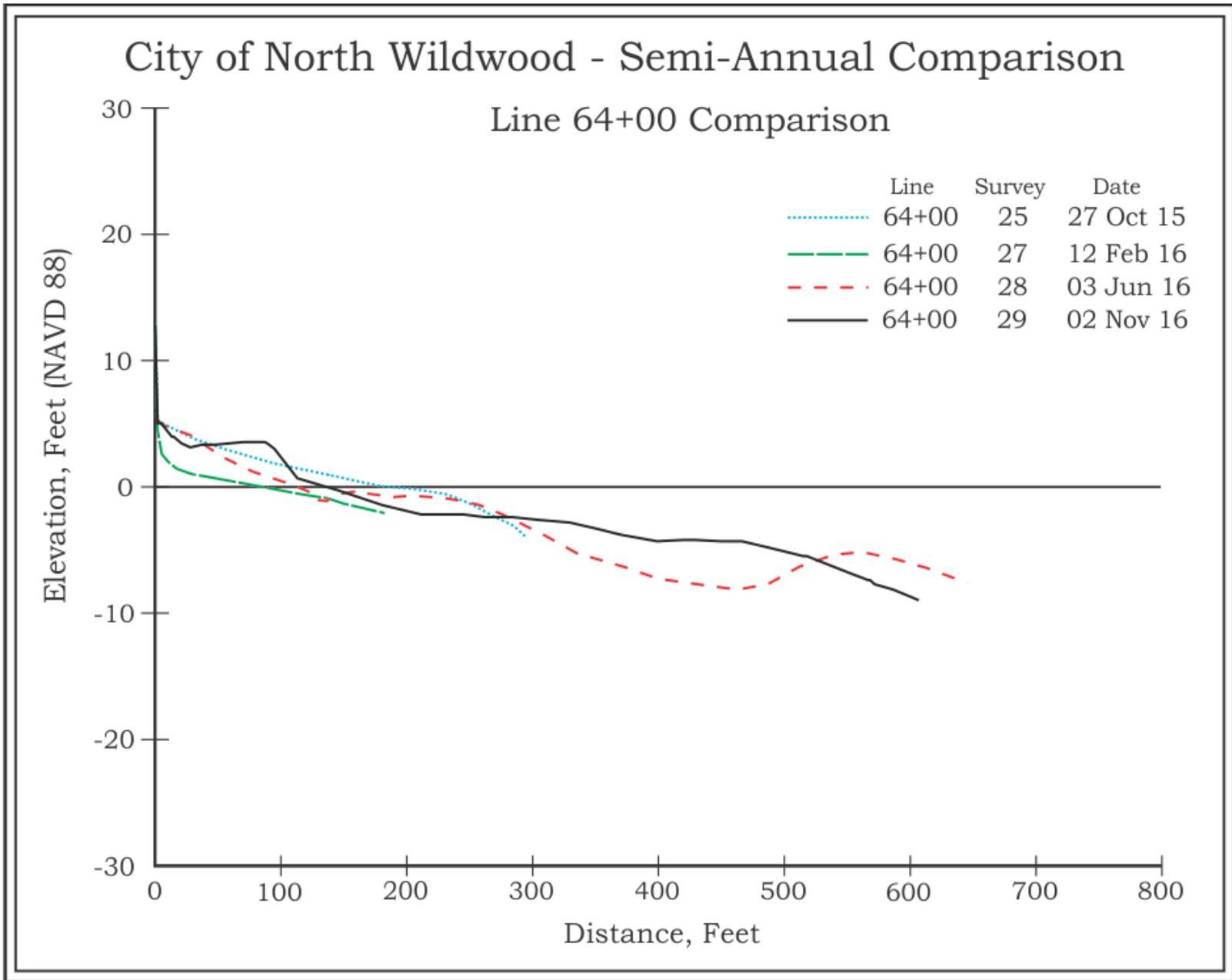


Figure 24. The erosional effects from Winter Storms Jonas and Nacio are recorded by Survey 27 in the form of a lowered profile from the beach through the nearshore. By June 2016 some of the recreational beach had returned raising the level of the upper beach. As sand continued to shift landward, a more pronounced berm had developed by the final survey conducted in 2016.

Winter Storm Jonas:

Table 1 below summarizes the shoreline and volume changes to North Wildwoods' oceanfront beaches recorded by the Coastal Research Center immediately following Winter Storm Jonas. Survey 25 (October 2015) was compared to Survey 26 (January 2016) and clearly displays the erosional zone at the northern portion between 2nd and 4th Avenues (Lines 00+00 to 08+00). The gains observed between lines 08+00 to 20+00 were a direct result of the NJ Department of Transportation funded placement of Beach Creek dredge materials in the immediate area. Continuing south, this erosional trend returned down to line 48+00 near 20th Avenue.

**Table 1
Survey of North Wildwood Beaches and Dunes following Northeast Storm, Subject for DR 4264**

NORTH WILDWOOD OCEANFRONT					
Survey 25 (October 2015) vs. Survey 26 (January 2016 - Post - Jonas) - (00+00 - 68+00)					
Profile	Shoreline	Volume	Avg. Volume	Cell	Net Volume
Number	Change	Change	Change	Distance	Change
	(feet)	(yds³/ft)	(yds³/ft)	(feet)	(yds³)
00+00	-82	-74.369			
			-111.5465	400	-44619
04+00	-178	-148.724			
			-62.474	400	-24990
08+00	75	23.776			
			52.726	400	21090
12+00	220	81.675			
			49.780	400	19912
16+00	31	17.884			
			7.839	400	3135
20+00	-28	-2.207			
			-9.335	400	-3734
24+00	-42	-16.462			
			-16.838	400	-6735
28+00	-47	-17.213			
			-16.113	400	-6445
32+00	-42	-15.013			
			-15.456	400	-6182
36+00	-34	-15.898			
			-17.607	400	-7043
40+00	-42	-19.315			
			-14.808	400	-5923
44+00	-41	-10.301			
			-13.485	400	-5394
48+00	-64	-16.668			
			-0.657	400	-263
52+00	-65	15.354			
			12.887	400	5155
56+00	-35	10.419			
			14.071	400	5628
60+00	-50	17.723			
			16.402	400	6561
64+00	-86	15.081			
			-10.572	400	-4229
68+00	-110	-36.225			

Total Sand Volume Loss = 115,556 cubic yards.



Figure 25. A close up view of the exposed seawall looking to the south at 2nd Avenue on January 25, 2016. Winter Storm Jonas eroded sand in this area completely exposing the wall at virtually all stages of the tide cycle.



Figure 26. View to the north following Jonas taken at 5th Avenue on January 25, 2016. The storm caused severe erosion to the beach and dune system creating the large scarp seen in the dune and the remainder of the sand from the Beach Creek dredge material pile.



Figure 27. A close up view of the dune looking to the north from the beach located near 22nd Avenue on January 27, 2016. Jonas caused severe erosion to the dune where a large scarp can be seen.

Summary/Conclusions:

A previously very mild winter essentially began in mid-January with cold and northeast winds culminating in NE Storm Jonas January 23 and 24, 2016. Labeled a 10-year storm, this event cut into the dunes and stripped the beach elevation so that subsequent high tides still reached the dune scarp. The CRC conducted an emergency survey to document the impact for emergency management purposes in anticipation of the disaster declaration. Winter Storm Jonas left its mark at the north end with significant erosion concentrated between 2nd and 4th Avenues. Total sand volume losses of 115,556 cubic yards to the oceanfront beaches from this event were recorded (Table 1).

As a result, another iteration of the beach backpassing project, with source materials coming from excess sand seaward of the Wildwood stormwater outflow pipes and truck-hauled and placed on the eroded northern beaches of North Wildwood (171,000 cubic yards), was implemented. This project was completed in mid-May and surveyed by the CRC in June 2016. Final sand relocation, using bulldozed existing material, can be seen by the November 2016 survey at the northern oceanfront beaches (profile 04+00), in the form of an elevated and reconfigured dune crest.

At the north end, inlet dynamics, orientation to the northeast and tidal flow exposes this region to near continuous erosional processes associated with its proximity to Hereford Inlet. Offshore, the shoal system on the south side of Hereford Inlet lost significant material continuously throughout 2016 (figures 2 and 3). Areas of sand gain were limited to the central portions of the area, between 5th Ave. and 12th Ave. as well as offshore between 21st Ave. and Poplar Ave. Unfortunately, these sand volume gains (179,080 cubic yards) were offset by the considerable losses (400,730 cubic yards) yielding a cumulative volume loss of 221,650 cubic yards from October 2015 to October 2016 (figure 3).

The common solutions between Wildwood's need to clear its eight storm drains on the beach and the sand loss erosion problem at the northern oceanfront beach in North Wildwood has made the sand backpassing operation a cost-effective and far easier methodology to accomplish than contracting with a major dredging company to mine sand from Hereford Inlet. However, permits should also be sought to continue hydraulic beach maintenance going forward on a 5-6 year schedule in the absence of either continued large scale sand recycling or the start of the anticipated US Army Corps of Engineers shore protection project.

The oceanfront engineered beach and inlet spring survey for 2017 will occur in mid-March, as conditions permit. If you have any questions regarding this report, please contact the Coastal Research Center at (609) 652-4245.