The Coastal Research Center

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NEW JERSEY'S DISTINCTIVE PUBLIC UNIVERSITY

Ms. Jill Gougher, Administrator
Borough of Stone Harbor
9508 Second Avenue
Stone Harbor, New Jersey 08247

June 22, 2017

Dear Ms. Gougher,

The Stockton University Coastal Research Center (CRC) completed the spring survey #49 between March 27 and June 12, 2017 the first of two scheduled seasonal surveys of the municipal beaches in 2017. This time separation was to allow the Army Corps dredging contractor to finish sand placement on the northern beaches. Semi-annual shoreline and sand volume changes were calculated between survey #48 (conducted in October 2016) and survey #49 to determine changes over the 2016 to 2017 winter storm season and the Corps project benefits to the Borough beaches.

The past three years since the US Army Corps of Engineers (USACE) undertook the restoration of the Borough shoreline following Hurricane Sandy saw repetitive minor to moderate northeast events dominated by the January 23, 2016 event the Weather Channel termed Jonas. Two events in 2017, the first on the one year anniversary of Jonas January 23, 2017 and the second on March 14, 2017 combined to take more sand from the beach leaving the dunes exposed to toe slope erosion.

However, the survey frequency did not allow before and after loss determination from these storms and the USACE return prior to the March 2017 survey to replenish the municipal project beaches. Therefore, this report elaborates on the restoration process with modest references to past storm damage. The October 2016 survey preceded all events except a September 28th to 30th low intensity storm which generated some beach adjustment which shows in the retreat of the beachface slope, but no serious damage.

The following is a list of the eight monitoring sites surveyed in the spring 2016 study, their corresponding locations and defined beach cell:

Profile Number	**Street Location**	**Beach Cell**
SH-82	82nd Street	North Boundary – 84th St. Groin
SH-90	90th Street	84th & 92nd Street Groins
SH-95	95th Street	92nd & 98th Street Groins
SH-103	103rd Street	98th & 106th Street Groins
SH-108	108th Street	106th & 111th Street Groins
SH-112	112th Street (paper)	111th & 114th Street Groins
SH-116	116th Street	114th & 122nd Street Groins
SH-123	123rd Street (paper)	122nd & the Terminal Groins

Stone Harbor Beach Performance

In the spring 2013, the USACE commenced emergency maintenance nourishment to restore the severely eroded beaches to full design template as part of its long term commitment to maintain Stone Harbor's storm damage reduction project beach.

The project placed 674,224 CY of sand on the beaches between about 80th Street and 123rd Street to restore the federal project dune and beach design template. The project was completed by August 2013 but suffered rapid erosion that continued over the winter and by May 2014 up to 75% of the emergency nourishment sand that was placed on the berm and nearshore was removed. Some sand remained in the system but was transferred well offshore. The 2014 summer season allowed for modest sand accumulation to recover some of the lost volumes. This trend continued through the winter and early spring of 2015. From October 2015 to May 2016, the Borough's 13,077 feet of oceanfront shoreline lost 385,692 cubic yards (CY) of sand.

Table 1 displays the semi-annual changes in shoreline positions and sand volumes from the recent survey #49 conducted in October 2017 to survey #48 from June 2017. Shoreline changes are calculated by comparing the zero datum positions in the recent survey to the previous survey. Sand volume changes are expressed in cubic yards of sand per linear foot of beachfront (yds^3/ft); the total beach volume change is calculated using this value. The distance (cell width) between groins along the beachfront of Stone Harbor was measured between the centerlines of adjacent groins. Each cell's net sand volume change is computed by multiplying each cross section volume change by its corresponding groin cell width.

Table 1
Stone Harbor Semi-Annual Comparison (48 & 49)
Shoreline and Sand Volume Changes
October 2016 to June 2017

Profile Number	Shoreline Change (feet)	Volume Change (yds^3/ft)	Cell Distance (feet)	Cell Volume Change (yds^3)
SH-82	100	43.08	1,381	59,493
SH-90	101	44.63	2,240	99,973
SH-95	99	29.64	1,680	49,790
SH-103	190	118.75	2,208	262,200
SH-108	159	123.87	1,433	177,507
SH-112	42	37.70	804	30,309
SH-116	25	26.99	2,273	61,339
SH-123	-3	29.62	1,058	31,337
		Total Volume Change =		**771,949**

The impact of the 2017 USACE work is seen with the central section of the Borough beaches dominating in sand volume placed. 57% of the 771,949 cubic yards of sand was placed at the 103rd and 108th Street beaches.

Table 2 displays the annual comparison of changes in shoreline positions and sand volumes for the entire study area between May 2016 and June 2017.

Table 2
Stone Harbor Study Area – Annual Comparison (47 v 49)
Shoreline and Sand Volume Changes
May 2016 to June 2017

Profile Number	Shoreline Change (feet)	Volume Change (yds^3/ft)	Cell Distance (feet)	Cell Volume Change (yds^3)
SH-82	74	57.07	1,381	78,819
SH-90	52	59.10	2,240	132,391
SH-95	71	62.46	1,680	104,938
SH-103	151	118.71	2,208	262,121
SH-108	145	133.93	1,433	191,925
SH-112	32	49.65	804	39,918
SH-116	-27	15.81	2,273	35,941
SH-123	0	41.65	1,058	44,067
		Total Volume Change =		**890,118**

The considerable volume loss last year (710,324 CY) was recovered as the USACE placed material onto the municipal shoreline. The annual gain was 890,118 cubic yards which indicates that natural accumulation added about 118,169 cubic yards to the system dominated by added accretion at the northern three sites as compared to the same results seen for the three sites in Table 1, above.

Communication with the State and the USACE provided the following information as to sand placement:

Proposed south Avalon/north Stone Harbor between 77th St and 105th St - 320,000 proposed from 107th Street to 77th Street. Filled between 103rd St and 123rd St = 376,685 cubic yards. (Erik Rourke, Programs and Project Management, USACE - Philadelphia District).

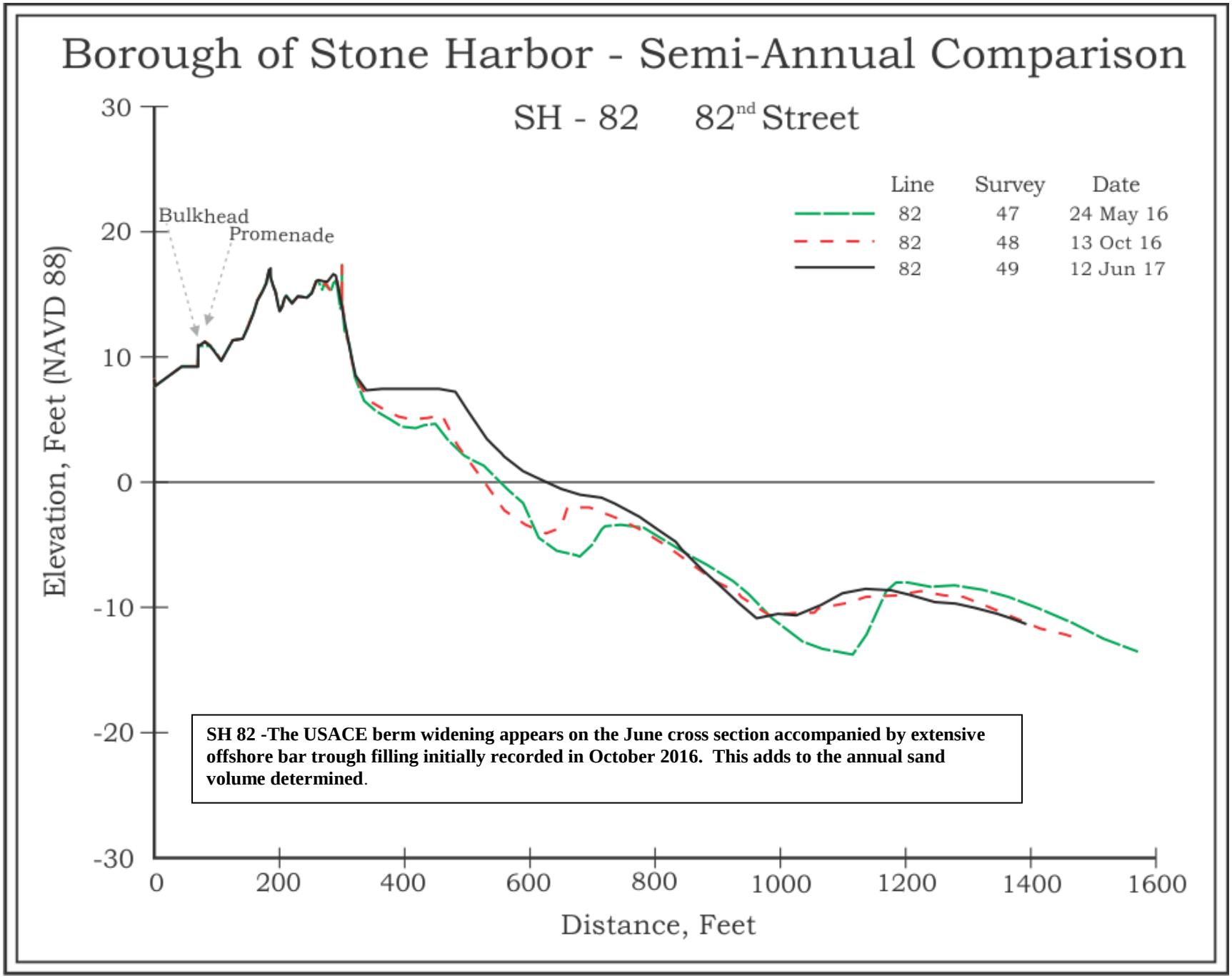
The sum of the sand volumes indicated by Mr. Rourke is 696,685 cubic yards and agrees well with the semi-annual findings based on the 8 CRC profiles given that the USACE surveys and the CRC surveys occurred at different times during the interval of sand placement and that the placement times were quite variable in themselves.

Individual Site Descriptions

Below is a review of data collected at each of the eight individual sites. The photos included for each location show visual observation changes from May 2016 to June 2017. Comparison plots are provided to show beach and nearshore profile changes from the spring 2016 to spring 2017.

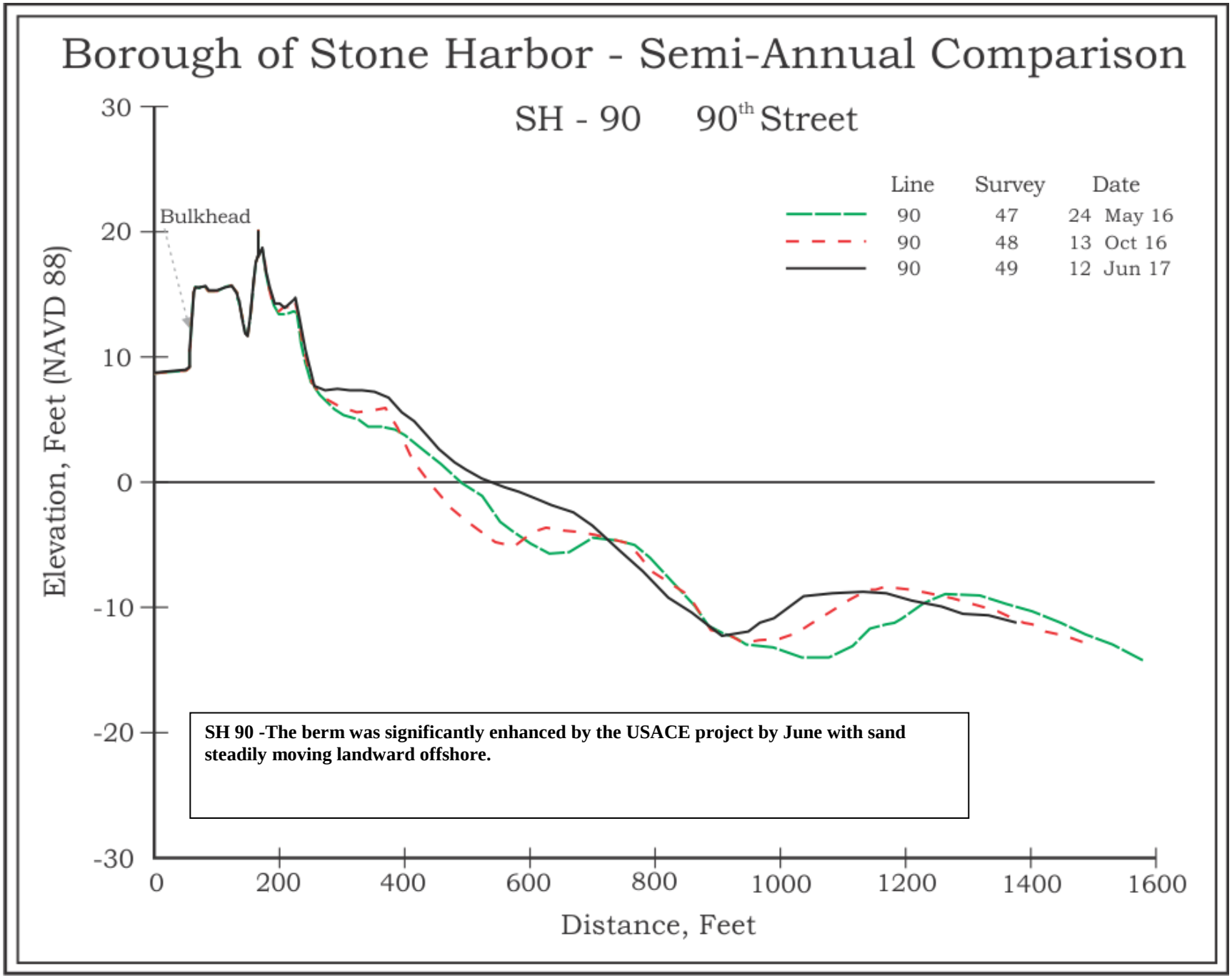
SH-82, located at 82nd Street, this beach received sand later in 2017 because of dredge availability issues plus the agency requirement that the federal sponsor of the project could not fund dredging sand from Hereford Inlet because of issues related to new interpretations of legislation creating the Coastal Barrier Resource Act of 1982 (CBRA). Federal agencies are no longer allowed to fund sand removal from a CBRA zone in spite of past waivers for beach nourishment given to the USACE initially in 2003. Therefore, the State of NJ funded the southern four sites' sand placement, while the USACE pumped sand south from Townsend's Inlet in April and May of 2017. The fill started in Avalon near 77th Street and continued south into 105th Street, while the State-funded work pumped from 103rd Street south to the terminal groin.

Figure 1. View to the south at 82nd Street. The photo on the left was taken on May 23, 2016, while the view on the right was done June 12,, 2017. The wider beach shows in the direct comparison with new fence poles in place for sand fencing following the USACE work.


Borough of Stone Harbor - Semi-Annual Comparison
SH - 82 82nd Street
Line Survey Date
82 47 24 May 16
82 48 13 Oct 16
82 49 12 Jun 17
Bulkhead
Promenade
Elevation, Feet (NAVD 88)
30
20
10
0
-10
-20
-30
0
200
400
600
800
1000
1200
1400
1600
Distance, Feet
SH 82 -The USACE berm widening appears on the June cross section accompanied by extensive offshore bar trough filling initially recorded in October 2016. This adds to the annual sand volume determined.

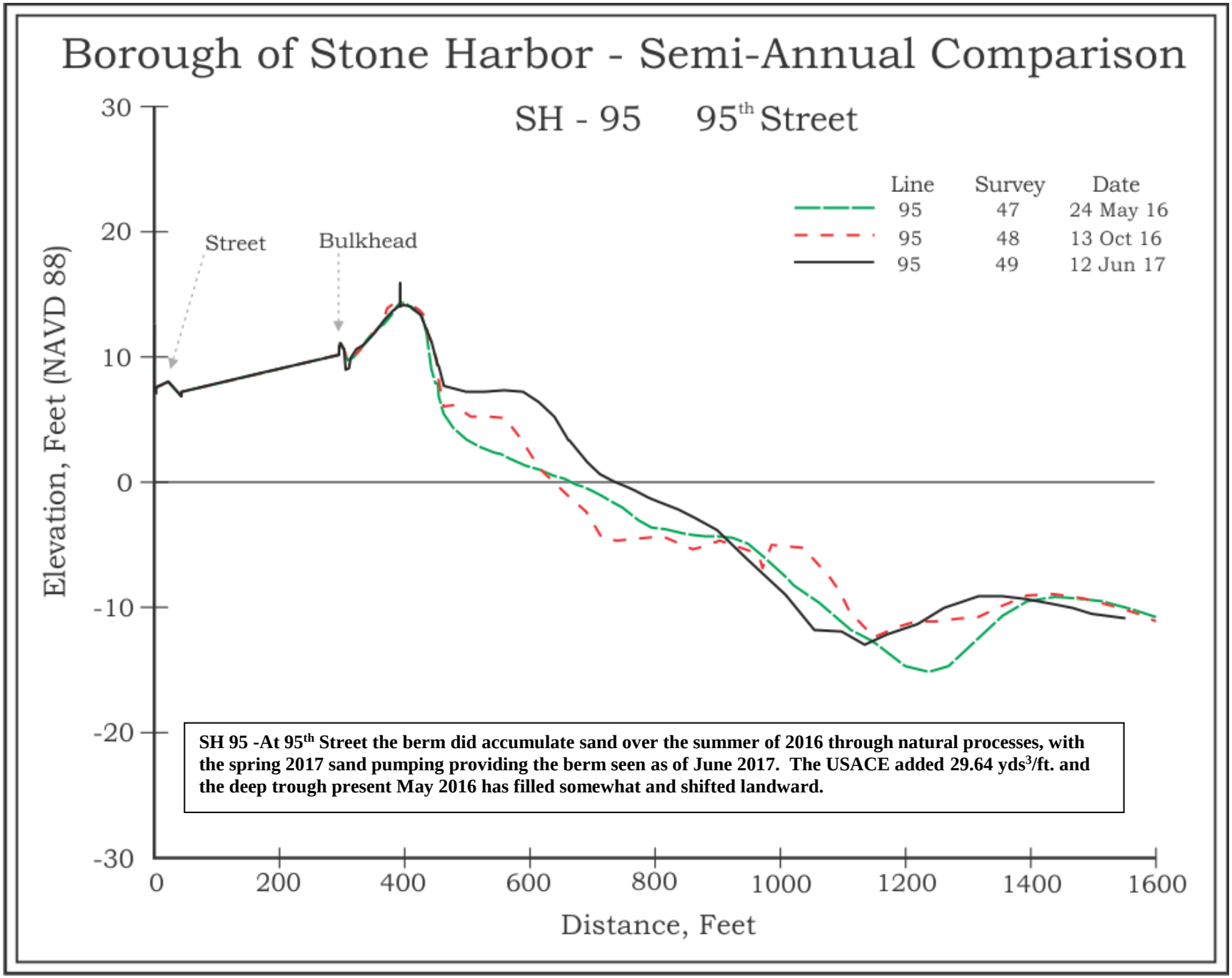
SH-90, located at 90th Street this beach also received sand during spring of 2017 adding 44.63 yds^3/ft. since last October's survey. The beach is wider by 101 feet and the dunes are now well protected. The sand partially filling the offshore bar trough did not come directly from pumping material, but either migrated south from Avalon, or was transferred offshore from the project by wave action by June 12th.

Figure 2. View to the north taken from the dune toe on May 23, 2016 (left). Photo on the right was taken on June 12, 2017. The wider beach is apparent because the storm water outfall line is buried by June 2017. Fortunately winter storm damage to the dunes was minimal.


Borough of Stone Harbor - Semi-Annual Comparison
SH - 90 90th Street
Line Survey Date
90 47 24 May 16
90 48 13 Oct 16
90 49 12 Jun 17
Bulkhead
Elevation, Feet (NAVD 88)
30
20
10
0
-10
-20
-30
0
200
400
600
800
1000
1200
1400
1600
Distance, Feet
SH 90 -The berm was significantly enhanced by the USACE project by June with sand steadily moving landward offshore.

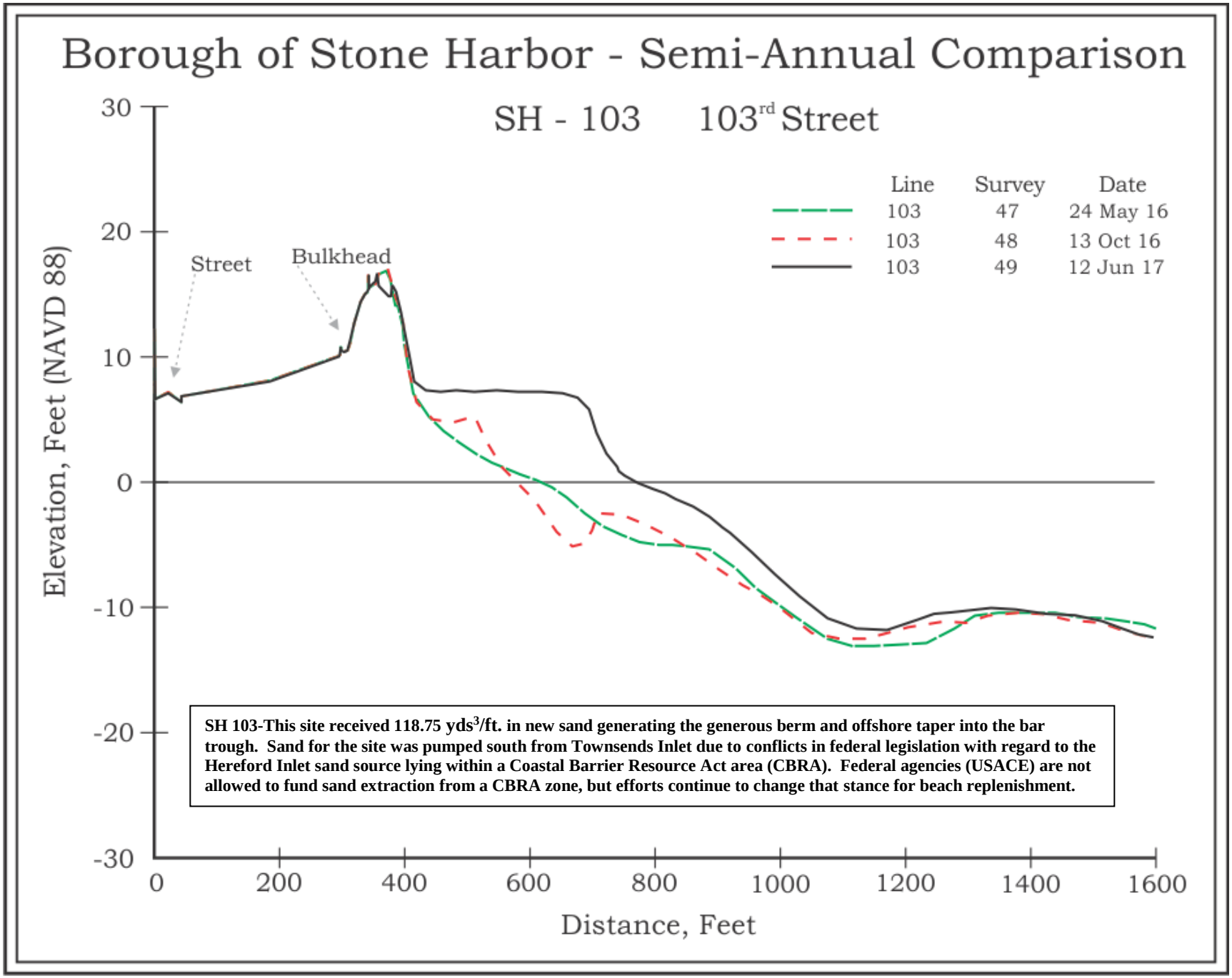
SH-95, located at 95th Street this site received sand by June 12, 2017 providing a 99-foot wider beach with 29.63 yds^3/ft. in sand volume recorded as being placed. The beach volume was larger (53.73 yds^3/ft.) because sand in the offshore adjusted to make the bar and trough feature more uniform and about as deep as it had been a year earlier.

Figure 3. View to the south at 95th Street of the beach taken on May 24, 2016 (left) following the construction of the new handicap accessible dune crossover. The photo on the right shows the profile on June 12, 2017 showing the wider beach from the same perspective as a year earlier.


Borough of Stone Harbor - Semi-Annual Comparison
SH - 95 95th Street
Line Survey Date
95 47 24 May 16
95 48 13 Oct 16
95 49 12 Jun 17
Street
Bulkhead
Elevation, Feet (NAVD 88)
30
20
10
0
-10
-20
-30
0
200
400
600
800
1000
1200
1400
1600
Distance, Feet
SH 95 -At 95th Street the berm did accumulate sand over the summer of 2016 through natural processes, with the spring 2017 sand pumping providing the berm seen as of June 2017. The USACE added 29.64 yds³/ft. and the deep trough present May 2016 has filled somewhat and shifted landward.

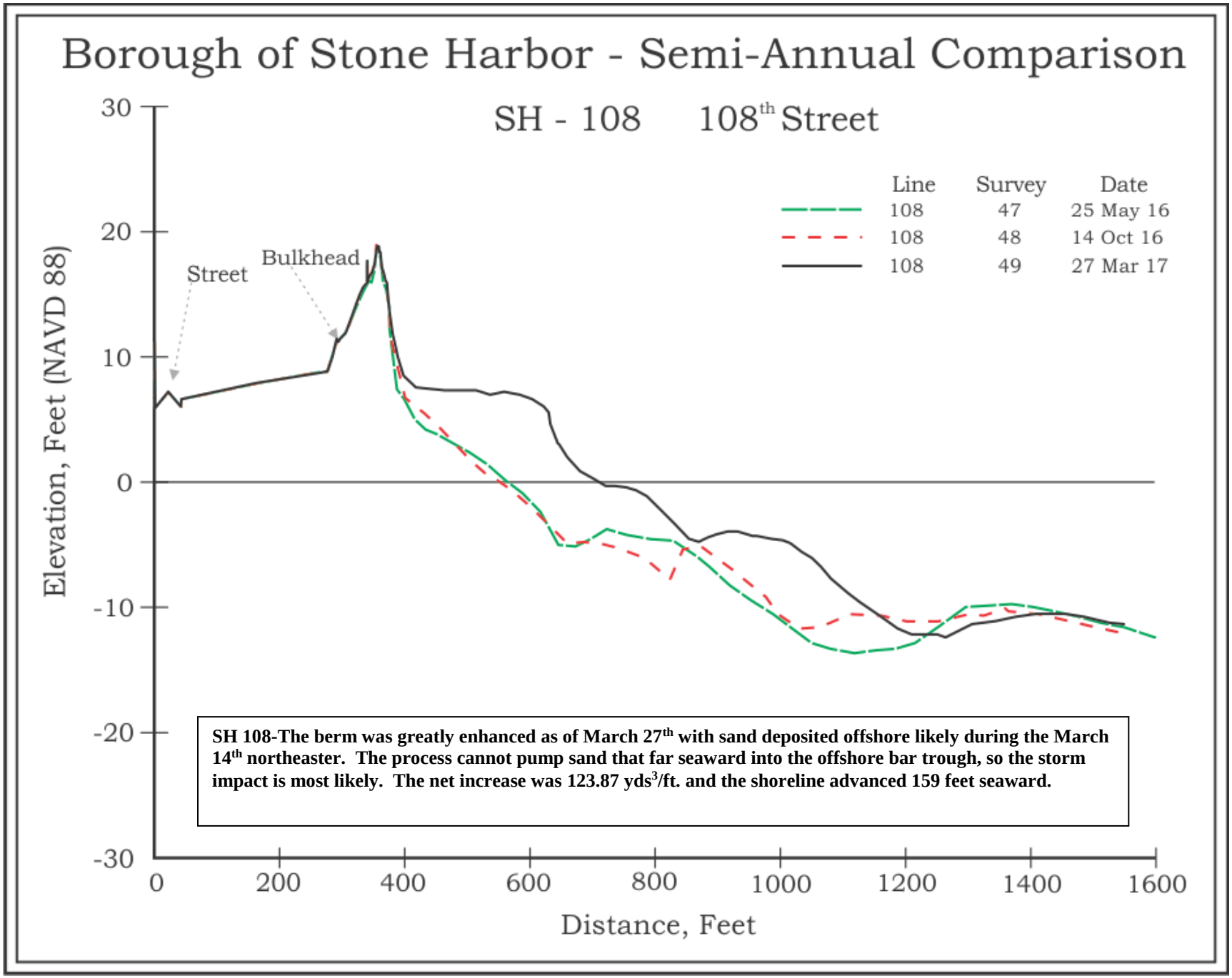
SH-103, the 103rd Street beach also received sand during the 2017 USACE project and shows as a sizable new berm (118.75 yds^3/ft.). The beach also shed sand seaward into the offshore trough as a thin sheet extending out seaward from the base of the beachface.

Figure 4. View to the north at 103rd Street taken May 24, 2016 (left). The photo on the right taken on June 12, 2017 shows final dune toe grading taking place following USACE project work completed between April and June of 2017 from southern Avalon to this beach section at 103rd Street. The southern beaches were completed earlier with sand derived from Hereford Inlet. This material came south from Townsends Inlet ebb-tidal delta.


Borough of Stone Harbor - Semi-Annual Comparison
SH - 103 103rd Street
Line Survey Date
103 47 24 May 16
103 48 13 Oct 16
103 49 12 Jun 17
Street
Bulkhead
Elevation, Feet (NAVD 88)
30
20
10
0
-10
-20
-30
0
200
400
600
800
1000
1200
1400
1600
Distance, Feet
SH 103-This site received 118.75 yds³/ft. in new sand generating the generous berm and offshore taper into the bar trough. Sand for the site was pumped south from Townsends Inlet due to conflicts in federal legislation with regard to the Hereford Inlet sand source lying within a Coastal Barrier Resource Act area (CBRA). Federal agencies (USACE) are not allowed to fund sand extraction from a CBRA zone, but efforts continue to change that stance for beach replenishment.

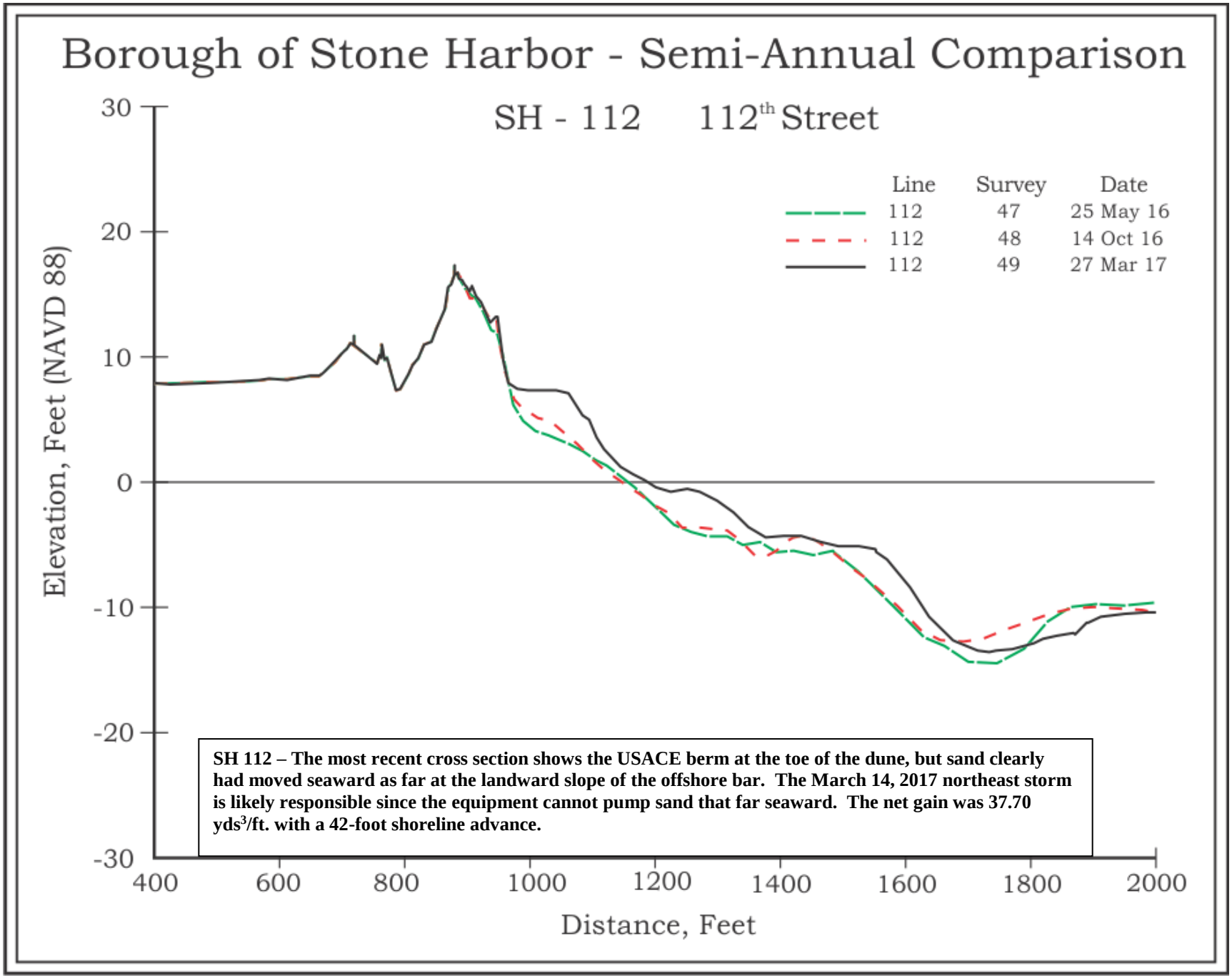
SH-108, the project beach at 108th Street was restored by March 27, 2017, but suffered some erosion during the March 14, 2017 northeast storm. The beach still contained 123.87 yds^3/ft. in new sand accompanied by a 159-foot shoreline advance seaward. But, as the picture on the right below and the cross section show, the erosion did have a negative impact. A huge volume of beach sand now lies offshore in the deep trough at the 1,000-foot distance seaward from the dune reference point.

Figure 5. View to the north taken on May 24, 2016 (left). Photo on the right, taken on March 27, 2017 shows a scarp cut into the new USACE berm following a March 14, 2017 northeast storm. Sand was moved into the swash with some retreat in the new profile. The project sand from 108th south came from Hereford Inlet, but funded by the State of NJ, not the USACE because CBRA regulations do not restrict State or local project funding. The work was completed earlier than that to the north as the dredge company needed to move equipment around.


Borough of Stone Harbor - Semi-Annual Comparison
SH - 108 108th Street
Line Survey Date
108 47 25 May 16
108 48 14 Oct 16
108 49 27 Mar 17
Street
Bulkhead
Elevation, Feet (NAVD 88)
30
20
10
0
-10
-20
-30
0
200
400
600
800
1000
1200
1400
1600
Distance, Feet
SH 108-The berm was greatly enhanced as of March 27th with sand deposited offshore likely during the March 14th northeaster. The process cannot pump sand that far seaward into the offshore bar trough, so the storm impact is most likely. The net increase was 123.87 yds3/ft. and the shoreline advanced 159 feet seaward.

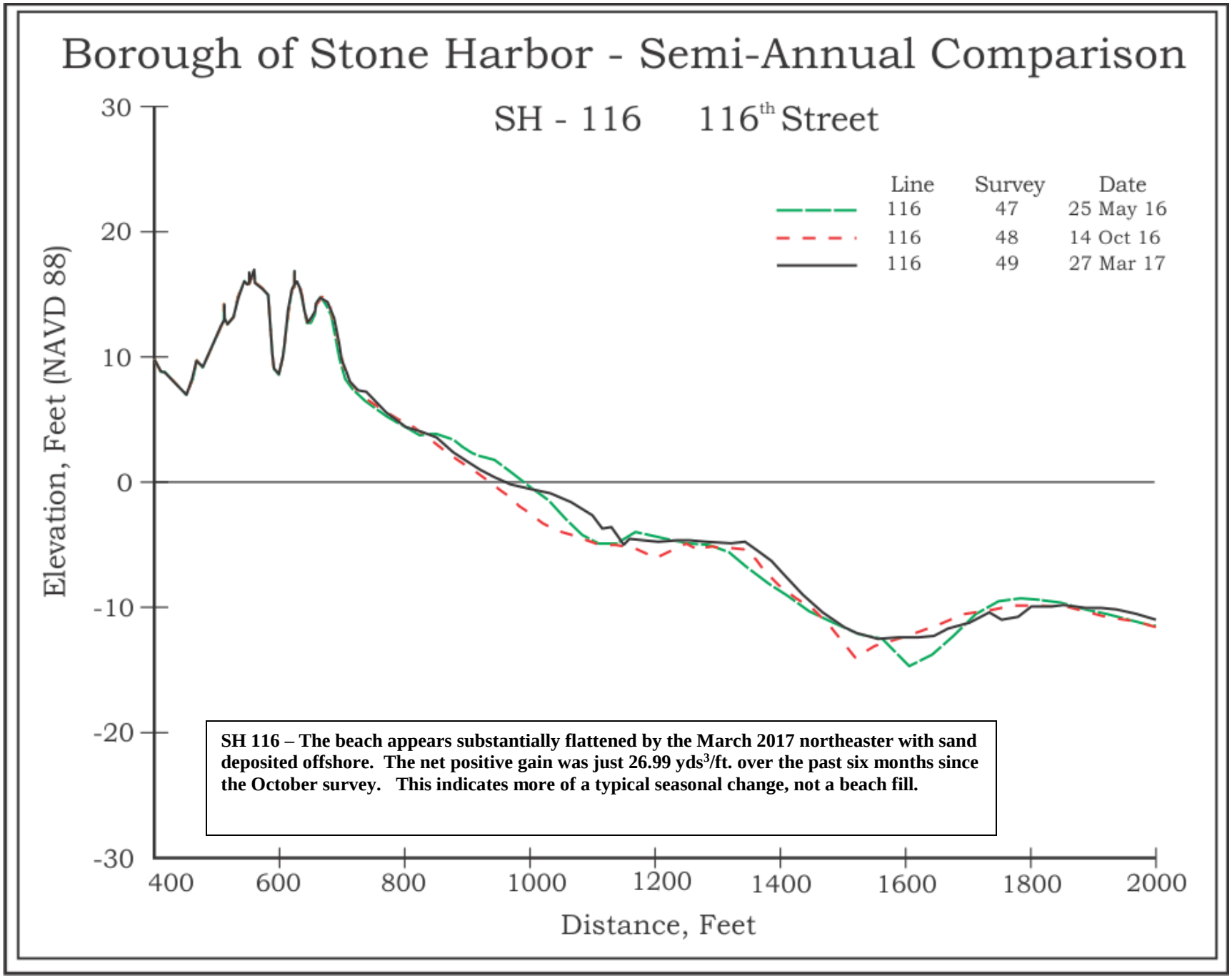
SH-112, the 112th Street beach re-nourishment was completed by March 27, 2017. Storm erosion in mid-March cut into the berm and shifted sand seaward into the offshore trough. The net gain was 41.64 yds^3/ft. with 32.51 yds^3/ft. still remaining on the beach between the dune and a point 1,435 feet seaward of the reference point in the dunes.

Figure 6. View to the south taken May 24, 2016 (left). By March 27, 2017, no changes to the dune were detected as a result of the USACE sand pumping, but the berm was wider with some loss evident as sand moved seaward partially filling the offshore bar trough (cross section figure below).


Borough of Stone Harbor - Semi-Annual Comparison
SH - 112 112th Street
Line Survey Date
112 47 25 May 16
112 48 14 Oct 16
112 49 27 Mar 17
Elevation, Feet (NAVD 88)
30
20
10
0
-10
-20
-30
400
600
800
1000
1200
1400
1600
1800
2000
Distance, Feet
SH 112 – The most recent cross section shows the USACE berm at the toe of the dune, but sand clearly had moved seaward as far at the landward slope of the offshore bar. The March 14, 2017 northeast storm is likely responsible since the equipment cannot pump sand that far seaward. The net gain was 37.70 yds³/ft. with a 42-foot shoreline advance.

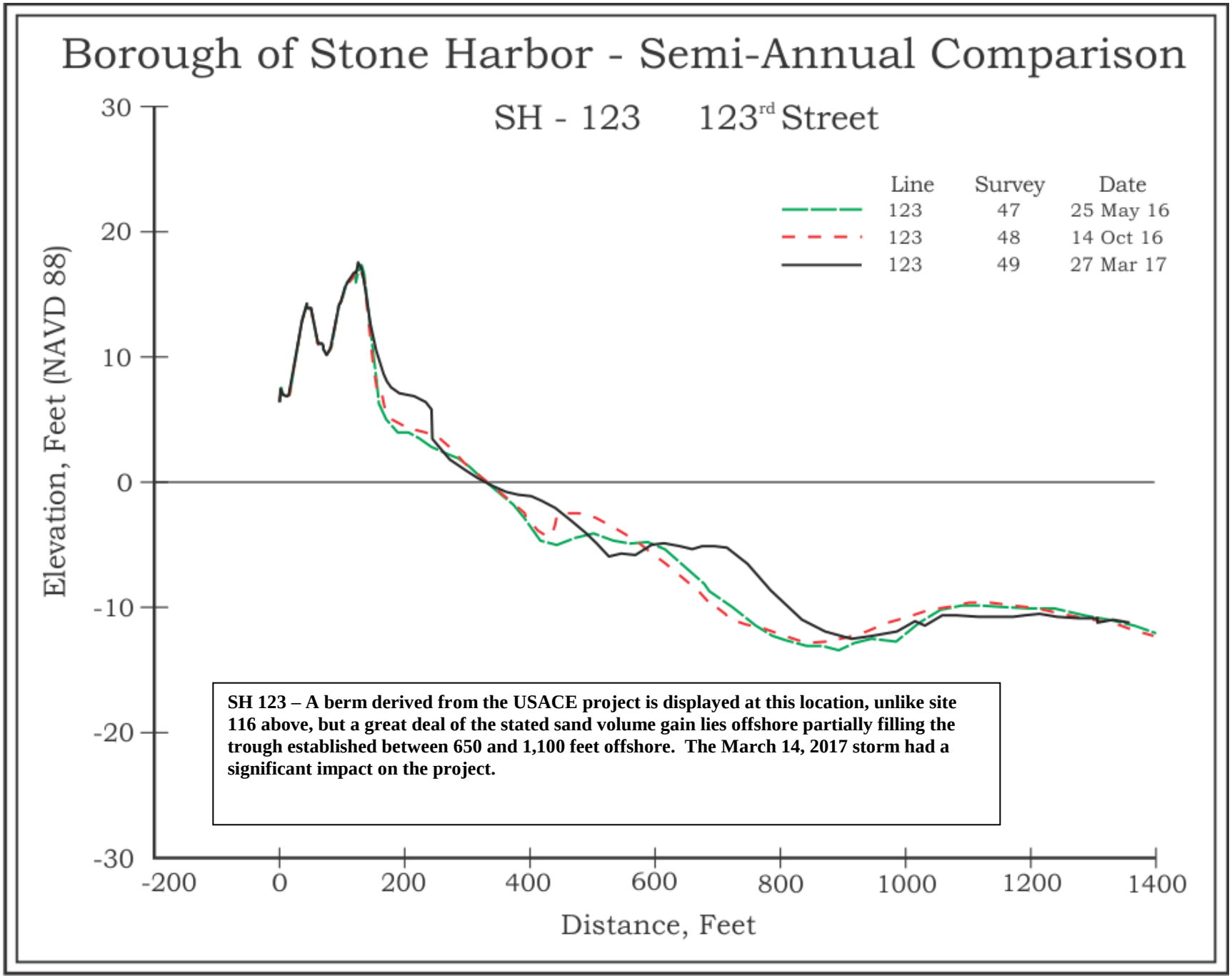
SH-116, remains a site subject to wide variations in the offshore bar and relatively rapid erosion on the beach. The dune itself remained structurally unscathed during the storm events of 2017. Loss did occur in the federal project leaving little evidence of a new berm on the beach and a net sand volume gain of just 26.99 yds^3/ft. since October 2016. The majority of this gain (28.59 yds^3/ft.) is seen between the berm crest on the beach and the offshore trough, some 1,400 feet seaward of the dune reference point.

Figure 7. View to the north at 116th Street taken on May 25, 2016 (left). March 27, 2017 (right) shows the stabilized foredune accompanied by seaward grass migration. The USACE project beach has been flattened out since it was built, most probably by the March 14, 2017 northeast storm. Dune damage was not observed and sand was seen filling the offshore trough region to some degree.


Borough of Stone Harbor - Semi-Annual Comparison
SH - 116 116th Street
Line Survey Date
116 47 25 May 16
116 48 14 Oct 16
116 49 27 Mar 17
Elevation, Feet (NAVD 88)
30
20
10
0
-10
-20
-30
400
600
800
1000
1200
1400
1600
1800
2000
Distance, Feet
SH 116 – The beach appears substantially flattened by the March 2017 northeaster with sand deposited offshore. The net positive gain was just 26.99 yds³/ft. over the past six months since the October survey. This indicates more of a typical seasonal change, not a beach fill.

SH-123, site 123 is located just north of the terminal groin and southern point. The USACE project was complete here as of March 27th and the impact of the March 14th northeast storm can be seen in the cross sections below. A berm remnant remains from the fill effort (9.41 yds^3/ft.) followed offshore with deposition of sand in the offshore trough (32.48 yds^3/ft.). So the majority of the new material already lies beyond the low tide line offshore.

Figure 8. View to the south taken on May 25, 2016 (left) shows the graded beach just prior to the 2016 season. By March 27, 2017 (right) a zigzag row of fence was installed a third the way up the seaward slope and a row of poles placed for the mooring of the ocean kayaks and catamarans commonly placed here during the summer. The net sand volume increase was 41.65 yds^3/ft. over the year accompanied by a -0.20-foot shoreline retreat.


Borough of Stone Harbor - Semi-Annual Comparison
SH - 123 123rd Street
Line Survey Date
123 47 25 May 16
123 48 14 Oct 16
123 49 27 Mar 17
Elevation, Feet (NAVD 88)
30
20
10
0
-10
-20
-30
-200
0
200
400
600
800
1000
1200
1400
Distance, Feet
SH 123 – A berm derived from the USACE project is displayed at this location, unlike site 116 above, but a great deal of the stated sand volume gain lies offshore partially filling the trough established between 650 and 1,100 feet offshore. The March 14, 2017 storm had a significant impact on the project.

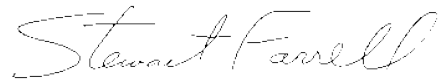
Summary

The return of the US Army Corps of Engineers made a great difference in the sand volume present on Stone Harbor beaches. In spite of a convoluted process of sand acquisition and pumping due to legal issues combined with dredge company problems the work was complete by mid-June. The northern beaches were filled from Townsend's Inlet under direct USACE supervision and payment, while the southern beaches were funded by the State of New Jersey and done earlier, prior to the March 27, 2017 survey date. However, one of two spring storms occurred March 14, 2017 and acted to transfer substantial sand volumes offshore into the offshore bar trough. The largest impact was seen at 116th Street where it was difficult to detect clear evidence for the new work in the profiles presented.

Over three quarters of a million cubic yards of inlet sand is now in place on Stone Harbor beaches and should provide a good measure of recreational benefit this summer and storm protection in the coming winter.

The CRC's next semi-annual report is scheduled in the fall 2017 to access the Borough beaches following the summer time period. Barring no major storms it is anticipated that the beaches will have a chance to recover some of the sand lost to the offshore troughs seen in the spring 2017 survey.

Sincerely,



Dr. Stewart Farrell
Executive Director
Coastal Research Center