

**FINAL REPORT FOR 2016
ON THE CONDITION OF THE MUNICIPAL BEACHES
IN
THE TOWNSHIP OF UPPER, CAPE MAY COUNTY, NEW JERSEY**



Aerial photograph at Corson's Inlet on September 2, 2016 showing the beach details at the inlet along with the growing sand shoals on the Ocean City side. The restored beach in Strathmere has its narrowest width at the northeastern most corner of Strathmere and the NJ State Park at the seaward end of Seaview Avenue.

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TABLE OF CONTENTS

Introduction	1
2016 Storm Activity	1
Engineered Beach Overview	2
Beach Monitoring Program Methodology	2
Figure 1. Specific Profile Site Descriptions	3
Individual Site Review	3
Table 1 Annual Sand Volume Changes	4
Table 2 Loss Volumes (June 2016 to December 2016)	4
Seaview Avenue, UT-6	5
Figure 2 a-c. Photos of Survey Line UT-6	6
Figure 3. UT-6 Cross Sections	7
Williams Avenue, UT-5	8
Figure 4 a-c. Photos of Survey Line UT-5	9
Figure 5. UT-5 Cross Sections	10
Tecumseh Avenue, UT-4	11
Figure 6 a-c. Photos of Survey Line UT-4	12
Figure 7. UT-4 Cross Sections	13
Jasper Avenue, UT-3	14
Figure 8 a-c. Photos of Survey Line UT-3	15
Figure 9. UT-3 Cross Sections	16
2400 Commonwealth Avenue, UT-2	17
Figure 10 a-c. Photos of Survey Line UT-2	18
Figure 11. UT-2 Cross Sections	19
First Avenue, UT-1 (NJBPN #120)	20
Figure 12 a-c, Photos of Survey Line UT-1	21
Figure 13. UT-1 Cross Sections	22
Figure 14. Bathymetry of Corson's Inlet (October 2016)	23
Figure 15. Sept. 2, 2016 aerial photograph of Corson's Inlet	24
Impact of Winter Storm Jonas	24
Summary and Conclusions	25

**Annual Report for 2016
To
The Township of Upper On the
Condition of the Municipal Beaches**

Introduction

2016 saw the completion of the Ludlam Island Shore Protection Project by the US Army Corps of Engineers (ACOE). Since work progressed from north to south, the Strathmere section was completed last year and the contractor worked largely within Sea Isle City during 2016. However, the dredge was brought back to Strathmere between November 2015 and June 9, 2016 to restore losses sustained during a northeast storm January 23 & 24, 2016. Just over 471,000 cubic yards of additional sand was added to the shoreline during this effort.

The ACOE completed the Ocean City Shore Protection Project from 34th to 59th Streets in the City. The recent history within the Corson's Inlet State Park confirms that very large sand volumes are in transit from the developed Ocean City shoreline into the park and south to the Corson's Inlet ebb-tidal shoals. In fact, inlet surveys have shown that the dry sand on the northern beach extends into the defined borrow area established for inlet dredging. The inlet shoals have grown in size and become very shallow since this beach restoration has taken place. In the time since June 2016 there has been about 102,000 cubic yards of sand lost largely along the mean high tide shoreline and offshore from the water's edge. The loss was pretty evenly split among the surveys done in June, repeated in September and concluded for the year in December 6, 2016.

The January northeaster had a presidential disaster declared in March 2016 following damage assessment in Cape May and Atlantic Counties and elsewhere along the NJ shoreline. The January storm was named "Jonas" by the weather channel and did impact Cape May County with tidal flooding that exceeded that seen during Hurricane Sandy. This event was far less damaging toward the northern shoreline, unlike Sandy.

The sediment distribution within the NJ Corson's Inlet State Park saw large volumes added to the northern beaches extending to the inlet channel beach and nearby shoals. On the Strathmere side, erosion occurred concentrated at the end of Seaview Avenue along the Park beach into the inlet channel. This loss was restored by the ACOE contractor by June 2016 and the beach has remained stable since.

2016 Storm Activity

The January storm Jonas was followed in early February by a lesser event named "Nacio" that added to the losses seen in the Jonas event. Following Nacio, there were no further major events until January 23, 2017. Several extended duration northeast wind events occurred, generating short period waves and abundant southerly littoral sand transport, but no serious beach erosion events. DR-NJ-4264 was declared on March 14, 2016 and resulted in the ACOE returning to pump sand onto Ludlam Island's beaches previously completed under the Shore Protection Project contract with Great Lakes Dredge and Dock, Inc. Once the ACOE assumes responsibility for a coastal shore protection project, FEMA steps away from consideration of beach losses to an engineered beach under Category "G" of their damage assessment processes. So long as the ACOE project agreement remains in force over the next 48 years, the ACOE will be responsible for project maintenance on their schedule established for this project. Severe storm events do trigger special congressional appropriations for repair work. The initial construction of this project was completed under PL 113-2 passed by Congress in early 2013 following Hurricane Sandy. Since this project was authorized but not yet constructed, it fell under PL 113-2 as 100% Federal cost for the initial construction. This was outstanding for the Township of Upper and NJ State funding budgets. ***"This project was determined to be eligible for P.L. 113-2 2013 Disaster Relief Appropriations Act (Hurricane Sandy) funds as an Authorized but Unconstructed (ABU) project. The term "authorized but unconstructed project" refers to previously authorized projects for which no physical construction has occurred as well as projects that contain elements where construction has not been***

completed. Additionally this project is considered an on-going ABU project under P.L. 113-2. Therefore, the remaining initial construction portions of the project are eligible to completed at 100% Federal with no sponsor payback.” <http://www.nap.usace.army.mil/Missions/Factsheets/Fact-Sheet-Article-View/Article/490784/new-jersey-shore-protection-great-egg-harbor-inlet-to-townsend-inlet-nj/>

Engineered Beach Overview

The review below was published in 2015, but bears repeating:

1. An initial beach nourishment project co-sponsored by the Township and the New Jersey Department of Environmental Protection (NJDEP) was completed in October 2001 that placed 461,000 cubic yards of sand on the beach.
2. This initial project was followed by a more comprehensive joint project in August of 2009. The extent of the work ran from the municipal boundary at Corson’s Inlet State Park (100 feet north of Seaview Avenue) and extended south to the boundary with Sea Isle City. A total of 688,000 cubic yards (CY) of sand was used to construct dunes and berm on approximately 9,000 feet of Ludlam Island’s shoreline.
3. Since completion of the 2009 project, there have been five Federal disaster declarations. The declarations include: November 2009 Northeast Storm (DR-NJ 1867); the March 2010 Northeast Storm (DR-NJ 1897); and a December 26, 2010 Northeast Storm (DR-NJ 1954). Following Hurricane Irene (DR-NJ 4021), there was yet another loss of 106,949 CY of sand from the Upper Township beaches. All individual disaster assessments were combined in 2011 and maintenance nourishment conducted in late fall of 2011 and completed in winter 2012.
4. Hurricane Sandy had an impact on this newly completed work and resulted in another Federal disaster declaration, (DR-NJ 4086).
5. This time the Ludlam Island Shore Protection Project under the control of the US Army Corps of Engineers (USACE) was implemented under Public Law 113-2. This project was authorized yet unconstructed as of Hurricane Sandy, so qualified for 100% federal funding under the congressionally approved public funding.
6. Work commenced in 2015 in Strathmere and worked south toward Townsend’s Inlet.
7. Northeast storm Jonas occurred January 23 & 24, 2016 and resulted in a federal disaster declaration in March 2016 (DR-NJ 4246) which allowed the USACE to return and touch-up the entire project with more sand derived from sites offshore.

The USACE project has provided over 3 million cubic yards of sand never previously present anywhere within the modern coastal zone either at the inlets or on the barrier island shoreline. This will provide a very large measure of long-term protection to this segment of the NJ coastline. There is an agreement to continue maintenance of the project for 48 additional years since its inception in 2015. The maintenance cycle will vary between 4 and 6 year intervals unless impacted by future major storms.

Beach Monitoring Program Methodology

The beach monitoring program extends back to June 1995 when the Township of Upper requested that the CRC design and establish a means to provide information on coastal zone management issues within the municipality. Initially, six sites were selected to survey and allow calculations to provide information on beach behavior. In 2009, three additional beach profile stations (UT-21, UT-31, and UT-7) were established in sections that did not have profiles to monitor sediment movement within groin compartments and along Corson’s Inlet. In 2009 it was decided to discontinue the 9 existing sites and monitor semi-annually the 200-foot spaced baseline cross sections used during construction of the 2009 Upper Township beach nourishment project to better quantify performance and meet monitoring requirements for FEMA category “G” engineered beach.

This process continued until the USACE took command of the project. FEMA always steps back from storm disaster reimbursement if the USACE is involved with shore protection projects, so the original six cross sections were resumed to provide the municipal governing body with direct information on beach performance since the USACE only monitors project annually IF funds are available. The following is a list of the surveys that are included in this report and the dates they were completed:

- Survey 60 November 10, 2015
- Survey 61 June 9, 2016
- Survey 62 September 13, 2016
- Survey 63 December 16, 2016

Specific Profile Site Descriptions

Figure 1 located below shows the locations of the 6 cross section locations used for this analysis.



Figure 1. Locations of the 6 beach profile stations for the engineered beach in Upper Township.

Individual Site Review

Each of the six traditional survey sites is reviewed for changes in beach topography and modifications to the USACE profile established following the Jonas northeaster. Beach volume and shoreline changes were calculated from for each semi-annual change between November 2015 and December 2016. Photos for each site are included to show the beach conditions during specific time frames throughout the year. Table 1, below, shows the impact of USACE restoration following NE Storm Jonas.

**Table 1 - Annual Sand Volume Change at the 6 Monitoring Profiles
November 2015 to December 2016**

Profile	Shoreline Change (feet)	Volume Change (yds³/ft)	Avg. Volume Change (yds³/ft)	Distance Between (feet)	Net Volume Change (yds³)
<i>Southern Township Boundary</i>					
UT-1	28	26.86			
			41.7	1,410	58,842
UT-2	57	56.61			
			50.3	2,938	147,753
UT-3	61	43.98			
			52.7	2,242	118,112
UT-4	105	61.39			
			79.9	1,323	105,701
UT-5	153	98.40			
			44.8	911	40,770
UT-6	-15	-8.90			
<i>Northern Township Boundary</i>					
			Total Volume Change =		471,179

The majority of the added sand took place between William and 2400 Commonwealth Avenue sites. This represents a post-storm compensation for an erosion event that took place while the contractor equipment was still present.

Table 2 - Loss Volumes Documented Between June 2016 and December 2016

Profile	Shoreline Change (feet)	Volume Change (yds³/ft)	Avg. Volume Change (yds³/ft)	Distance Between (feet)	Net Volume Change (yds³)
<i>Southern Township Boundary</i>					
UT-1	-29	-12.95			
			0.8	1,410	1,073
UT-2	-1	14.47			
			2.0	2,938	5,900
UT-3	-34	-10.45			
			-33.9	2,242	-76,021
UT-4	16	-57.36			
			-23.1	1,323	-30,602
UT-5	5	11.10			
			-3.3	911	-2,979
UT-6	-43	-17.64			
<i>Northern Township Boundary</i>					
			Total Volume Change =		-102,628

During the summer and fall of 2016, 102,628 cubic yards of material was lost, primarily from the zone around Tecumseh Avenue. However, the cross section clearly shows that the beach was stable (loss to -2.19 feet of elevation was just 2.531 yds³/ft. across 921 feet of survey, then between -2.19 and -9.40 feet elevation the loss offshore amounted to 54.832 yds³/ft. The entire 100,000 cy loss can be accounted for within this 2,500-foot zone and entirely in the offshore region.

◆ **Seaview Avenue, UT-6**

Originally established parallel with the south curb alignment of Seaview Avenue, this site has seen enormous sand volume changes over the years. It extends seaward onto the ebb-tidal shoals surrounding Corson's Inlet, so major fluctuations in sand volume are expected as shifts in inlet channel width, location and orientation occur. During periods of extreme sand loss, threats to private and public infrastructure have been quite real leading to the 2008 installation of a steel bulkhead and rock revetment from this site to the boundary with the State Park and westward to the Commonwealth Avenue beach access entrance. Currently, this structure is buried in sand with a wide, dry beach extending almost 400 feet seaward of its position on this profile. The annual comparison from October 2014 to November 2015 revealed a shoreline advance of 378 feet with a gain of 261.67 yds³/ft. of sand. Variations since then have been quite minor largely because the USACE returned in the spring of 2016 to restore losses inflicted by NE Storm Jonas in late January 2016.



2a. November 5, 2015



2b. June 10, 2016



2c. December 16, 2016

Figures 2a to 2c. Seaview Avenue survey site. View to the north.

Photograph 2a shows the extent of the new sand added by the ACOE. New fencing and access paths are in place.

Photograph 2b shows the same perspective in June following grass planting.

Photograph 2c was taken on December 16, 2016 as the grass had turned brown, but survived and sand accumulated at the fence line derived from the wide, dry beach.

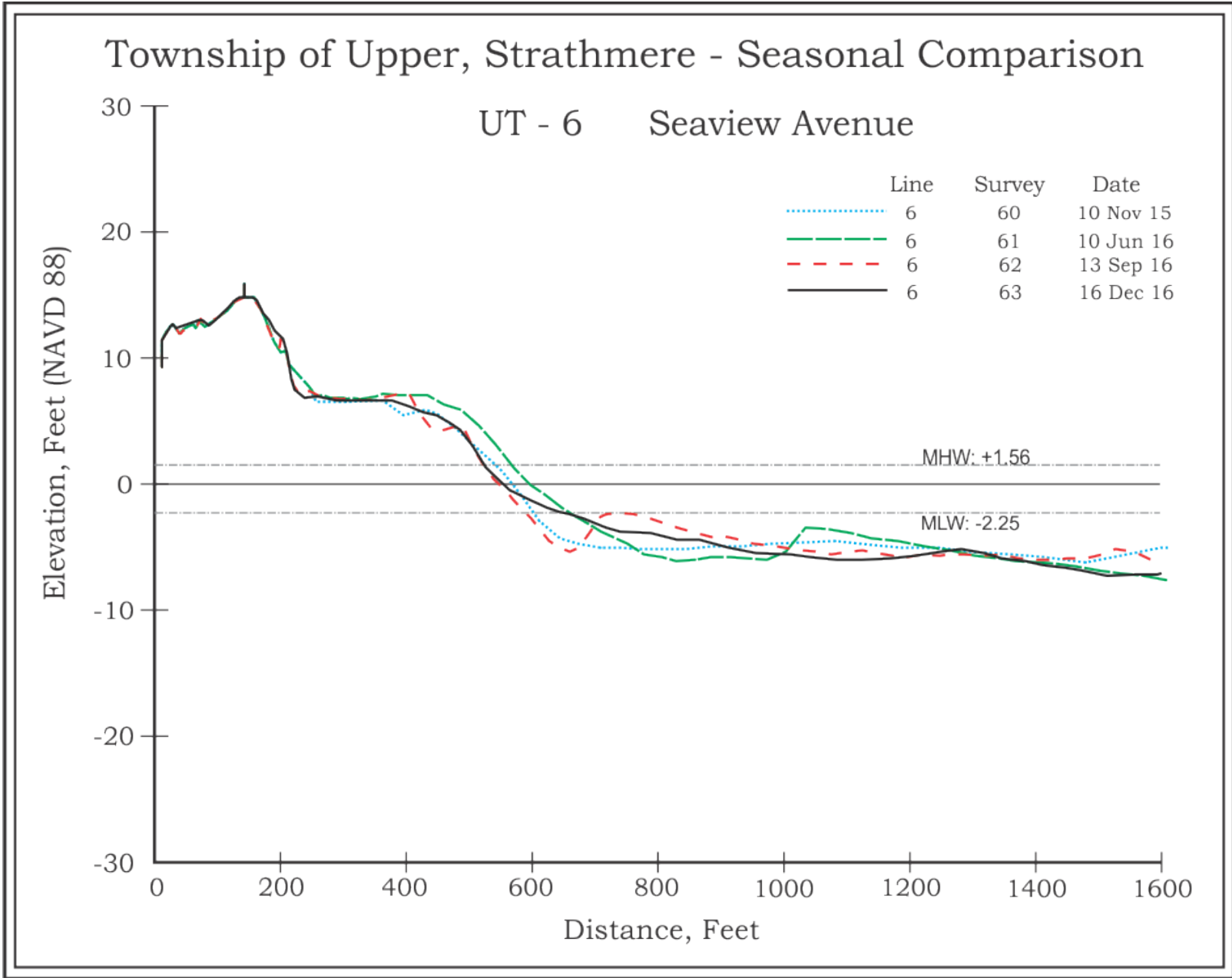


Figure 3. The November 2015 cross section saw sand volume added prior to June surveys followed by minor retreat in the beach face and zero elevation position. Bar migration offshore continued as recorded frequently at this location. The annual change was a -8.90 yds³/ft. loss in sand volume combined with a 15-foot shoreline retreat.

◆ **Survey Line UT-5, Williams Avenue, Strathmere**

This profile location has demonstrated an accretionary trend due to beach fill activities and natural patterns of sand migration. Northeast storms and ebb tidal flow moves sand from the inlet shoals, south, depositing the majority of sand between Williams and Tecumseh Avenues with a gradual taper further south to approximately Prescott Avenue. The wide beach present in November 2015 was added to by June 2016 as the USACOE sought to restore sand lost during NE Storm Jonas.

Following the USACOE effort, there was a series of minor adjustments in the beachface slope and bar position offshore.



4a. November 6, 2015



4b. June 3, 2016



4c. December 16, 2016

Figures 4a to 4c. UT-5 survey site on Williams Avenue.

Figure 4a shows the winter beach with the new USACE width.

Figure 4b was taken following storm damage repairs and the planting of the dune grass.

Figure 4c shows the winter beach at the dune grass position looking south.

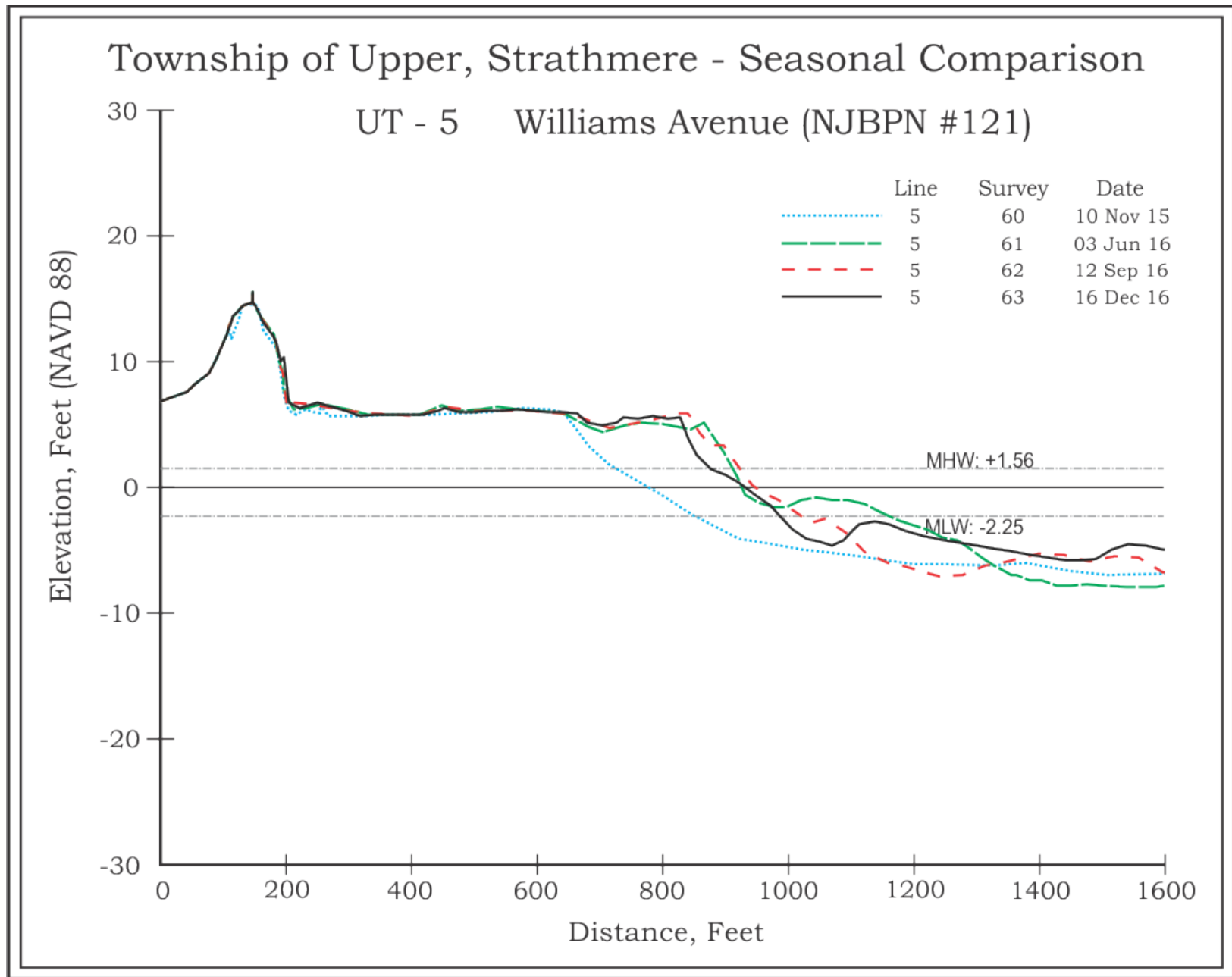


Figure 5. This site lies just south of the influence of the ebb-tidal delta for Corson’s Inlet, but not beyond the accretion generated by sand moving landward. The November 2015 to June 2016 comparison shows the effect of the USACE repair to the storm damage in January. This site gained 98.40 yds³/ft. while the shoreline advanced 153 feet.

◆ **Survey Location UT-4, Tecumseh Avenue, Strathmere;**

This profile location was established because the shoreline dynamics radically changed between Williams Avenue and Jasper Avenue sites due to the proximity of the Williams site to the ebb-tidal shoals of Corson's Inlet. Jasper Avenue performs as any mid-island beach usually does with losses mainly directed toward the south with cross-shore sand distribution the major component of change. Tecumseh Avenue lies mid-way between the two different beach configurations and was surrounded by obsolete timber bulkhead and timber groin arrays. These structures had been installed during a past history of shoreline retreat that demanded their installation. Today, these decayed structures are basically buried in the beach project sand.

The USACE sponsored beachfill was completed by July 2015 which significantly extended and elevated the dune and beachface seaward. The berm and upper beachface began to show signs of erosion by November 2015. The USACE's return to pump sand following NE Storm Jonas shows as a 106-foot advance in the berm position seaward due to the addition of 61.39 yds³/ft. in sand volume. Since June 2016, two subsequent surveys show marginal changes in either the sand volume or the shoreline position (Sept. 2016 to Dec. 2016 = -17.31 yds³/ft. and a retreat of 15 feet in the zero elevation position.



Figure 6a. November 10, 2015



Figure 6b. June 10, 2016



Figure 6c. December 16, 2016

Figure 6a is a view to the north along the seaward dune toe before Jonas hit the shoreline in late January 2016.

Figure 6b shows the newly planted grass following USACE restoration of the Jonas damage to the Ludlam Island beach project.

Figure 6c shows the same perspective by December 2016 with the beach fencing nearly buried as the wind has transported dry beach sand to the dunes.

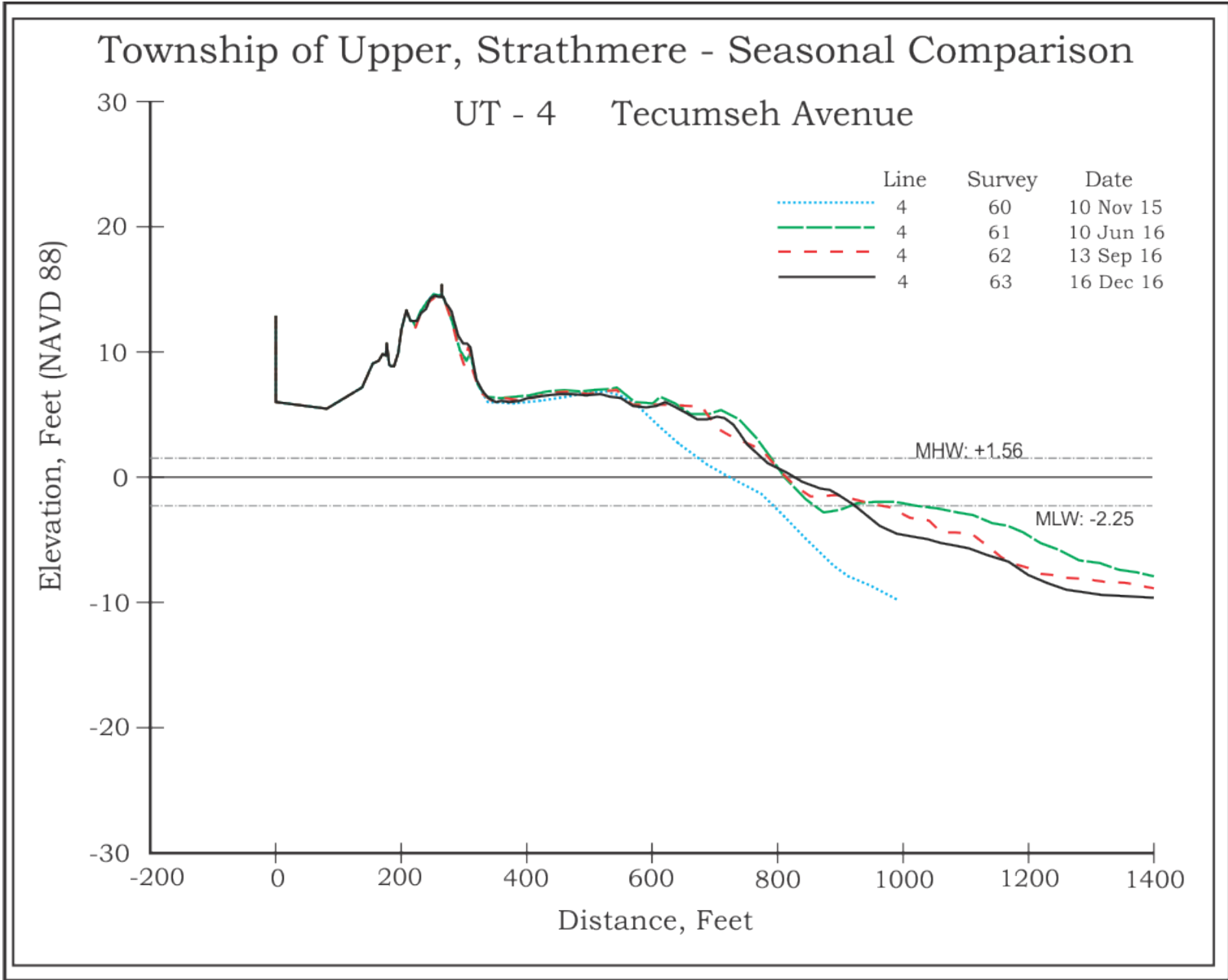


Figure 7. This site shows the results of adding sand following NE Storm Jonas to restore the project to design template. The addition amounted to 61.39 yds³/ft. by December 2016. Change since June was fairly minimal reflecting offshore bar migrations.

◆ **Survey Line UT-3, Jasper Avenue, Strathmere;**

Jasper Avenue is the first of three sites located along the traditional part of the island known as “Whale Beach”. This segment has been notoriously narrow and subject to repeated overwash to the bay. Storms through the 1990’s breached the dune here four times resulting in serious damage to a group of homes built east of Commonwealth Avenue immediately north and south of Jasper Avenue. Since the 2001 NJ State and local beach project, the situation has improved dramatically. Hurricane Sandy did not penetrate the dunes largely because of a final NJ State/local project in 2009.

By July 2015, the USACE sponsored beachfill was completed which elevated and extended the berm position seaward nearly 250 feet. By the final survey in November, erosion to the beachface of the engineered beach had already taken place. This cross section is the initial one in the four survey comparison below. By June of 2016 the USACE had completed storm restoration and the surveys show this as added width to the beach.

Dramatic berm development shows in the December cross section as a major crest elevation and a steep beachface.



8a. November 15, 2016



8b. June 10, 2016



8c. December 16, 2016

Photo 8a shows the new USACE dune with new plants and fencing.

Photograph 8b was taken following the USACE restoration following NE Storm Jonas, with sand building at the fence and plant growth underway.

Photograph 8c shows the deposit at the fence in one year. The dune's seaward slope has built up to the point where it shows below on the cross section.

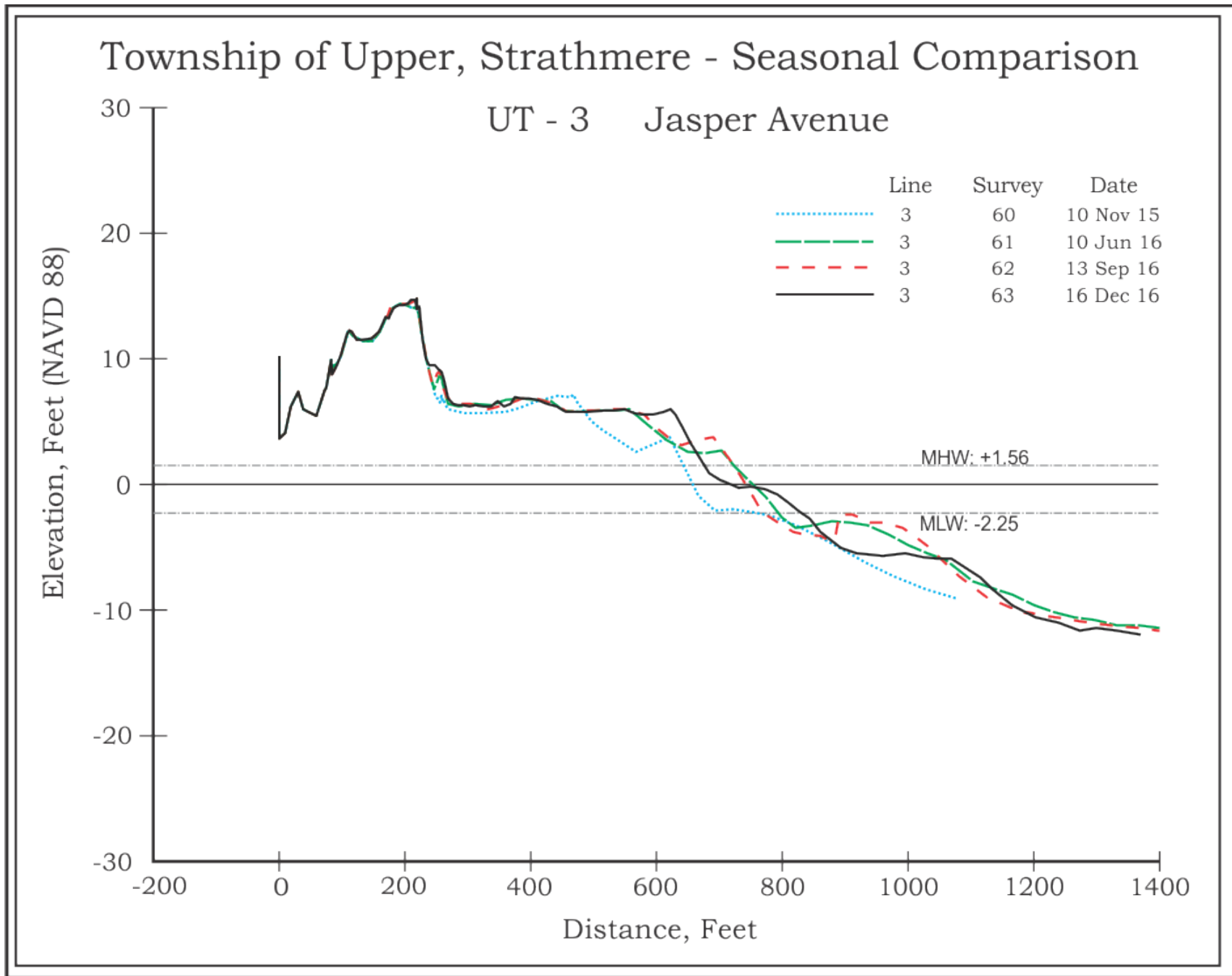


Figure 9. This site had 43.98 yds³/ft. added to the cross section as of the December survey. The most dramatic feature is the pronounced berm crest present in the December survey.

◆ **Survey Line UT-2, 2400 Commonwealth Avenue, Strathmere;**

This profile station is located in the southern section of the Township's oceanfront shoreline north of the Township border on the Strathmere beach. This is the typical "Whale Beach" cross section with a much wider dune today and at least 6 times the sand volume present seaward of the dune toe.

The USACE sponsored beachfill was completed by July 2015 which significantly extended and elevated the dune and beachface seaward. The berm and upper beachface showed signs of erosion by November 2015. The restoration was complete by June 2016 with a wider beach and an added 56.01 yds³/ft. placed at the site. The dune gained sand at the seaward toe while offshore little change occurred.



10a. November 10, 2015



10c. December 16, 2016



Figure 10b. June 10, 2016

Figure 10a is a view to the south along the dune crest after the federal project was complete.

Photograph 10b shows the dune toe in June with a substantial deposit of wind transported sand added at the fence. The plants are in place as well.

Photograph 10c is a view to the south along the wrack line seaward of the dune toe that shows near burial of the 4-foot high fencing.

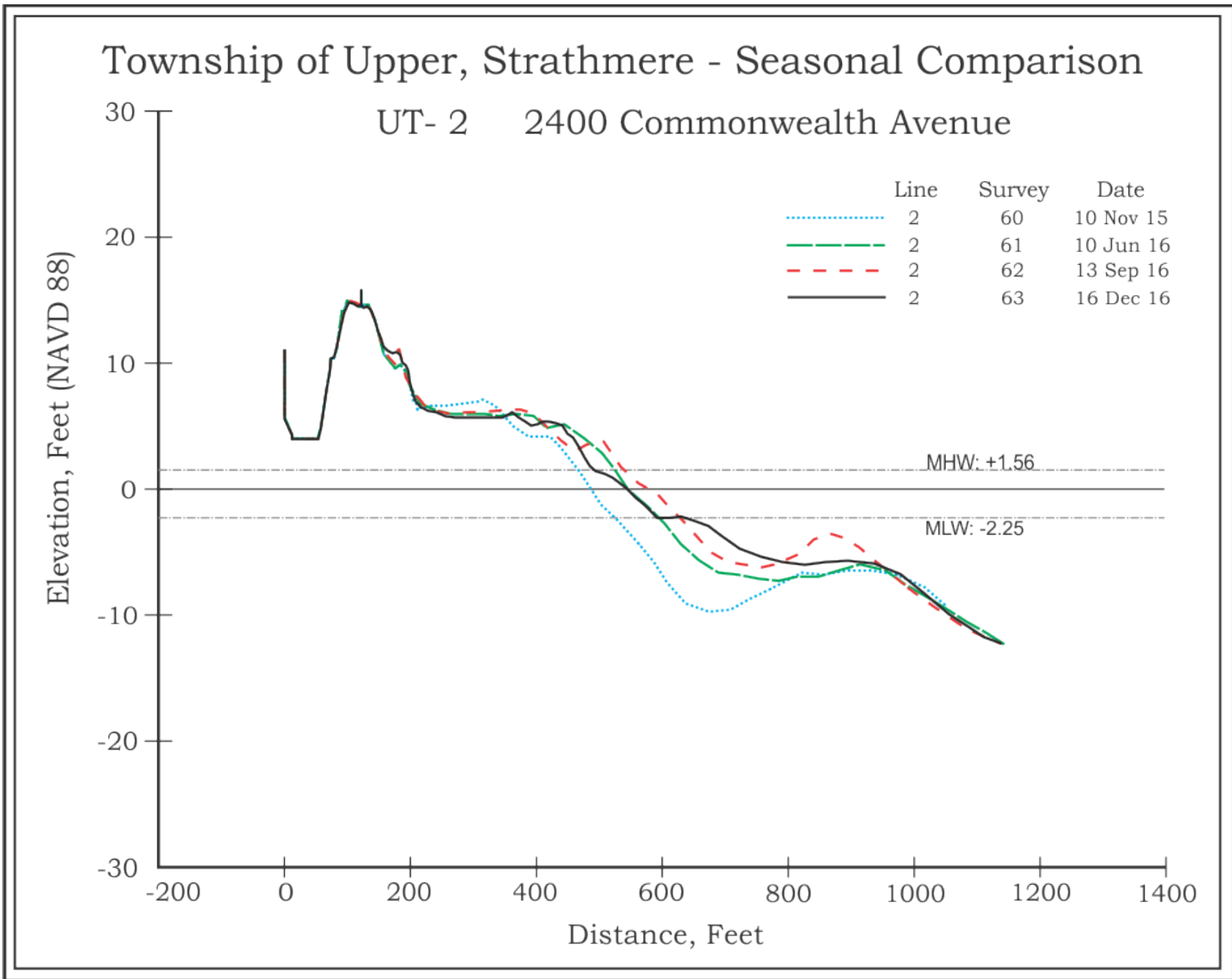


Figure 11. These cross sections demonstrate the sand volume added by June 2016 following NE Storm Jonas with details on the offshore bar system and additions to the dune toe shown above in the photographs.

◆ **Survey Line UT-1, First Street (NJBPN #120), Strathmere;**

This profile site is actually a few yards inside Sea Isle City, but was established in 1986 for a NJ State beach monitoring program. Acting as the southernmost site in Upper Township, this location was initially one where overwash could be expected during any moderate northeaster. In fact, the segment to the south of the site was so persistently overwashed, that the County undertook the installation of 10-foot diameter geo-textile tubes as dune core along 2,400 feet of the beach into Sea Isle City. Sandy made small breaches in the feature focused on the joints between the 300-foot long tubes. Sand was stripped off the crest of the tubes, but they did perform the best of any dune core yet constructed.

The USACE sponsored beachfill was completed by July 2015 which significantly extended and elevated the dune and beachface seaward. The berm and upper beachface showed signs of erosion by November 2015. The restoration was complete by June 2016 with a wider beach and an added 26.86 yds³/ft. placed at the site. The dune gained sand at the seaward toe while offshore bar position shifted among the latest three profile surveys. The September position was closer to shore and higher in elevation, but the bar returned to an identical configuration to that seen in June by the December survey.



12a. November 10, 2015



12b. June 10, 2016



12c. December 16, 2016

Photograph 12a shows the new dune fencing at the base of the USACE dune with two wrack lines indicating storm flood levels quite recently.

Photograph 12b shows the restored dune with new grass plants and the deposition of wind transported sand nearly to the top of the 4-foot fence.

Photograph 12c provides the winter view to the north across the dune and onto the beach. The fence continues to be increasingly buried in new sand added to the dune toe.

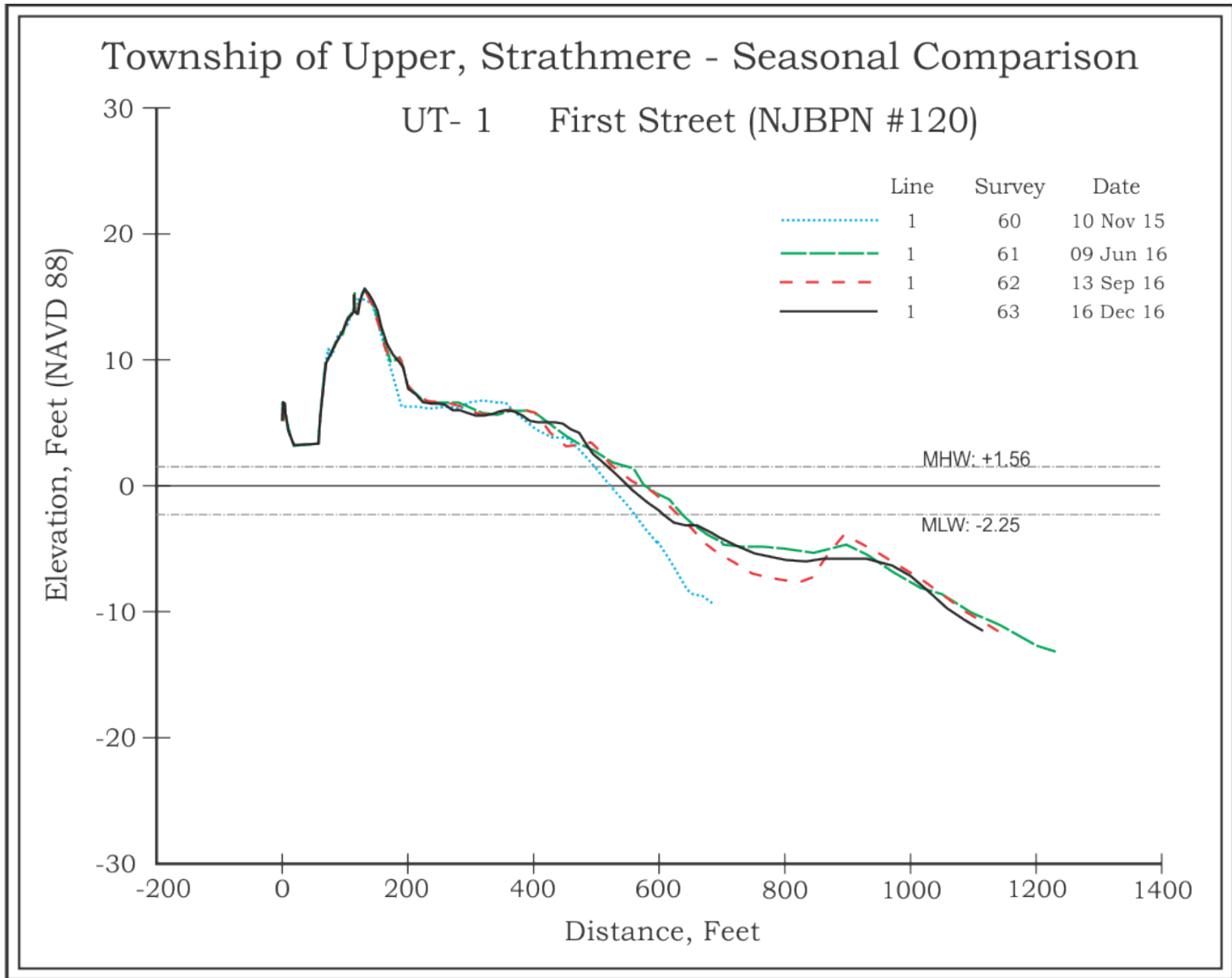


Figure 13. In spite of fewer cubic yards of repair sand (26.86 yds³/ft. & a 28-foot shoreline advance as of December 2016, this site really achieved a wider cross section at shallower depths offshore that just do not show in volume calculations because the shorter distance seaward reached in November 2015.

Corson's Inlet Bathymetry

The Division of Coastal Engineering has funded the CRC survey of Corson's Inlet ebb-tidal and nearby beaches twice annually since the 2009 beach project. The most recent survey, completed October 27, 2016, presents below as a map of the seafloor and beaches surrounding the inlet.

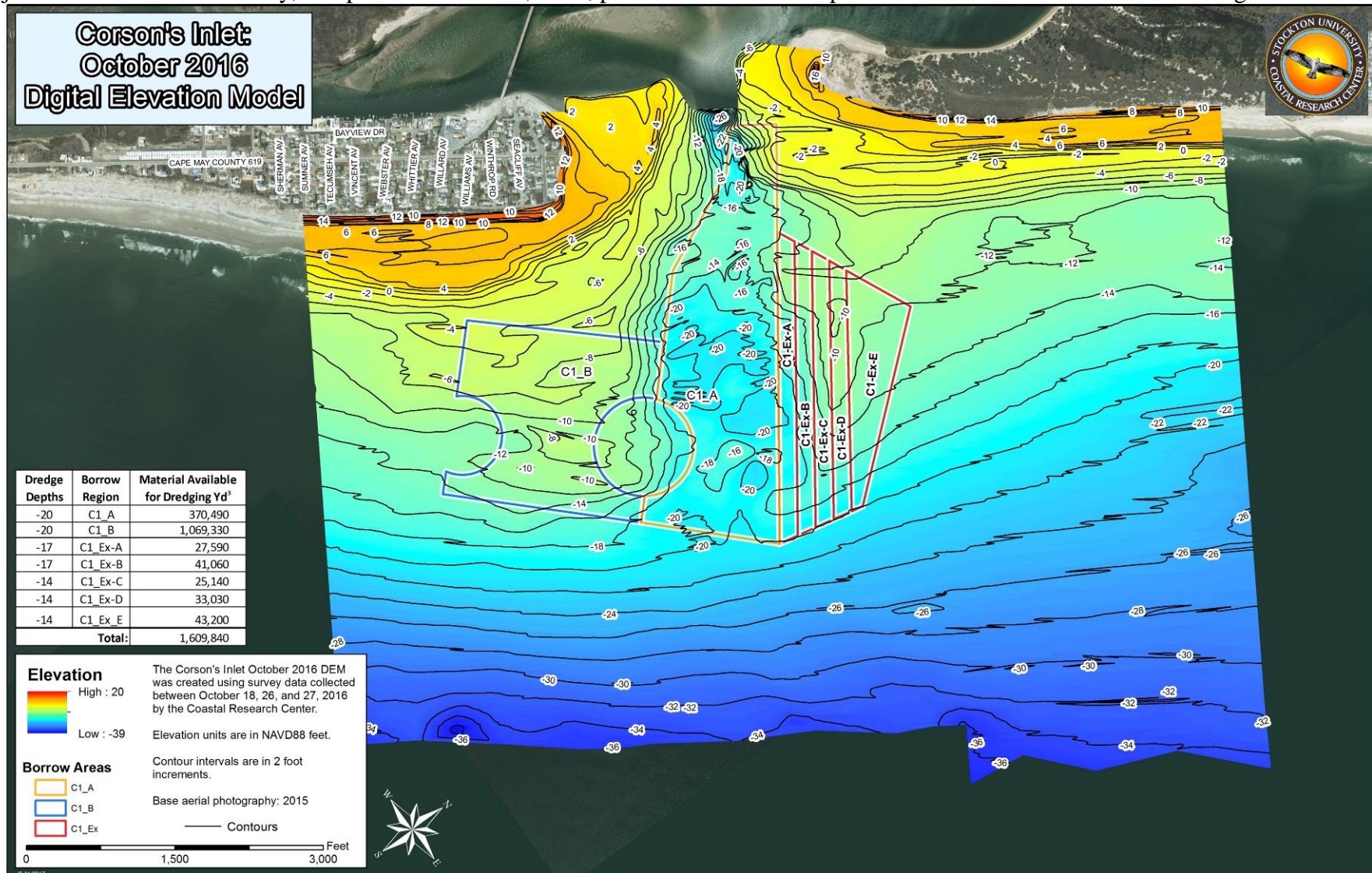


Figure 14. Bathymetry of Corson's Inlet from October 18, 26 & 27, 2016 showing the main channel exiting straight seaward with accumulating shoals along the northeast margin. A complex of shoals also extends seaward on the Strathmere side as well indicating an abundance of sand to maintain the inlet shoreline in Strathmere and the State Park. The line work within the inlet defines the approved sand borrow zones used for beach maintenance. The initial 2015 work brought in sand from offshore borrow sites meaning that the sand is new to the barrier system and increases the sediment budget by 3.4 million cubic yards.



Figure 15. Aerial photograph taken September 2, 2016 by Ted Kingston looking north, northeast across the wide central beaches of Strathmere showing where sand is accumulating in the zone between Williams and Tecumseh Avenues as a pronounced lobe extending several hundred feet seaward of the average shoreline trend. The sand coming south from Ocean City is clearly present as the long spit reaching the inlet as a barely submerged shoal. The northeast Strathmere shoreline has assumed a northeast perpendicular straight line shape signifying both wave and tidal current effects. Flood tidal currents do bring sand along this straight segment so long as the lobe remains in place with shoals to the seaward of it. The tidal currents in the inlet also show clearly as a straight-out exit for the moment.

Restoration Following the Impact of Winter Storm Jonas

Winter storm Jonas struck the New Jersey coast beginning January 22 and lasting through January 24, 2016. The storm arrived at a time where astronomical tides enhanced the impact of the storm surge resulting in record flooding throughout many locations in Cape May County, New Jersey. In addition to the flooding wind speeds were sustained at over 50 mph with gusts reaching over 70 mph recorded. Jonas, combined with an October northeast event, resulted in significant erosion to the 2015 USACE beach renourishment project on Ludlum Island. Strathmeres dune system remained intact as the beaches absorbed most of the wave energy causing beach berm erosion and flattening the beach face slope. The extent of the damage reached a degree of severity that the Cutter Suction Dredge Illinois re-pumped and repaired the beaches back to the USACE design template.

This repair work began January 3, 2016 and was completed April 21, 2016; this time utilizing the Corson's Inlet Borrow zone as the sand source. The improved beach width and elevation is readily apparent in the cross section plots while the dune growth and vegetation development shows in the site photographs.

- Inlet dynamics continue to play a significant role in shoreline stability in the vicinity of the Seaview Avenue site. Presently, the beach is quite stable with a major inlet channel extending parallel with the northern margin straight seaward through the ebb-tidal delta shoals. However, as sand arrives at the inlet from Ocean City's nourished beaches one can expect slow, but steady shifting of the main tidal channel toward Strathmere.
- Mr. Kingston continues to fly and photograph Corson's Inlet for the CRC and his latest view of Corson's Inlet is provided above (Figure 15).
- The remaining beaches have performed well, particularly in the absence of other than a one-year anniversary storm on January 23, 2017 without the flooding drama or excessive waves of Jonas.

Summary & Conclusions

2015 was capped with the federally sponsored US Army Corps of Engineers beach nourishment projects completion in Strathmere by July (Great Egg Harbor to Townsends Inlet). The source material for this project came from an offshore borrow zone and was funded under Public Law 113-2, the Disaster Relief Appropriations Act following Hurricane Sandy. Under this project, Ludlum Island and portions of Ocean City are eligible to be completed at 100% Federal expense with no sponsor payback initially. The elevation change map generated by the CRC (figure 14) between October 2014 and July 2015 calculated a gain of 1,473,740 cubic yards of sand. From July 2015 to October 2015 weather events took 431,600 cubic yards of material from the NJ State Park at Corson's Inlet.

The USACE returned to repair the storm damage from Jonas with sand derived from Corson's Inlet ebb-tidal delta borrow zone. The restored beaches continued in as-repaired condition into 2017 with minimal changes seen as of the December 2016 survey. A one year Jonas anniversary northeast storm occurred January 24, 2017 without significant impact. The spring survey will occur in the month of March 2017.