

**FINAL REPORT FOR 2018
ON THE CONDITION OF THE MUNICIPAL BEACHES
IN
THE TOWNSHIP OF UPPER, CAPE MAY COUNTY, NEW JERSEY**



Above is an aerial view of Strathmere, taken December 11, 2018, showing the relationship between the shoreline orientation between Williams Avenue and the tip of the sand spit in the inlet. This alignment is currently truncating the dune between its northern end and Seaclyff Avenue. This time, there does not appear to be a subsidiary ebb-tidal channel causing this erosion. (Photo by Ted Kingston).

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**Annual Report for 2018
To
The Township of Upper On the
Condition of the Municipal Beaches in Strathmere**

Introduction

The Stockton University Coastal Research Center (CRC) surveyed the municipal shoreline quarterly, to document the annual changes for 2018. The survey comparisons provide data to evaluate seasonal shoreline and sand volume changes. This year the CRC continued with the seasonal survey schedule of selected cross sections. Seasonal surveys at these six sites allow the Township to compare the as-built US Army Corps of Engineers (USACE) project conditions to subsequent storm events and general changes to the Strathmere beaches independent of the USACE. Data collected at the six oceanfront beach profile locations cover the municipal beaches from Seaview Avenue to 1st Street. This coverage extends the length of the USACE engineered beach in Strathmere.

The USACE Ocean City to Townsends Inlet Shore Protection Project initially placed approximately 1.54 million cubic yards of sand on the Strathmere end of Ludlam Island. An additional 4.09 million cubic yards of sand were placed on the southern Ocean City and Sea Isle City beaches. The early portion of 2018 was storm-free with cold weather. March 2, 2018 initiated a series of 7 northeast storms that occurred weekly until late April which, while not terribly severe, produced shoreline changes along the northern beach in Strathmere. Two storms continued the process in May, (Mother's Day and the day prior to Memorial Day). The summer months produce modest shoreline accretion, with sand loss commencing again in October. Storm frequency was low and those that did occur were mild thus far.

2018 Storm Activity

Northeasters occurred on March 2nd, March 7th, March 12th, March 20th, April 15th, May 13th and May 27th. Maximum winds were 50 to 55 MPH on March 2nd and 20th generating minor tidal flooding with some beach erosion. There were no coastal Atlantic hurricanes this past year, because the storms formed in the Gulf of Mexico or went well out to sea in the Atlantic.

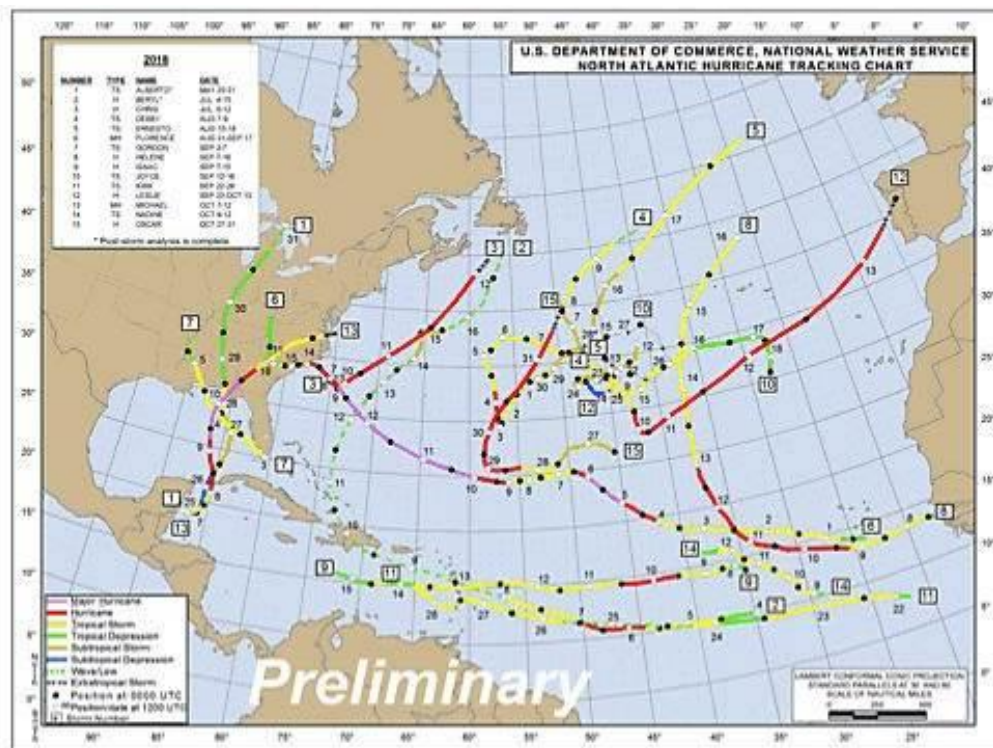


Figure 1. National Hurricane Center plot of the 2018 hurricane tracks in the Atlantic and Gulf of Mexico.

A major Atlantic hurricane made landfall perpendicular to the coast and went inland to dissipate in North Carolina. One Gulf coast hurricane impacted western Florida's panhandle and the state of Alabama.

Engineered Beach Overview

The USACE project has provided over 3 million cubic yards of sand never previously present anywhere within the modern NJ 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 47 additional years (its inception was in 2015). The maintenance cycle will vary between 4 and 6-year intervals unless impacted by future major storms.

This federal project superseded initial beach nourishments first completed with NJ State funding in 1984, followed by a second NJ State/local project in 2001. In 2009, the State and the two Ludlam Island municipal governments partnered in a massive project pumping sand from Corson's Inlet along the entire Strathmere shoreline well into Sea Isle City. The USACE authorized an island-wide Shore Protection Project, that went to construction in 2015, first in southern Ocean City, then in Strathmere, finishing in 2016 at Townsend's Inlet in Sea Isle City.

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 quantify performance and meet monitoring requirements for a 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 projects annually IF funds are available.

Each site is located in specific regions of the Strathmere shoreline. UT-1 is positioned at the Sea Isle City border on the mid-island straight shoreline. UT-2 is also located on the mid-island portion of Ludlam Island. UT-3 is in a transition zone between straight shoreline orientation and the increasing influence from Corson's Inlet. UT-4 is central in the transition zone, while UT-5 is at a location where inlet processes and offshore waves tend to faithfully deposit sand maintaining a wide beach. UT-6 is located at Seaview Avenue at the northeast corner of development where dramatic shoreline changes, driven by inlet dynamics, frequently produce severe erosion, interspersed with extensive sand deposition creating a wide beach with a broad sandy expanse extending into Corson's Inlet opening as the NJ State park lands. The following is a list of the surveys that are included in this report and the dates they were completed:

- Survey 68 March 16, 2018
- Survey 69 June 8, 2018
- Survey 70 September 4 & 5, 2018
- Survey 71 December 7, 2018

Specific Profile Site Descriptions:

Figure 2 located below shows the locations of the 6 cross section locations used for this analysis.



Figure 2. 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 a northeaster January 23, 2016. Beach volume and shoreline changes were calculated from each seasonal change between December 2017 and December 2018. Photos for each site are included to show the beach conditions during specific time frames throughout the year. Table 1, below, shows the annual sand volume change at the six monitoring profile locations.

**Table 1 - Annual Sand Volume Change at the 6 Monitoring Profiles
December 2017 to December 2018**

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	-17	-1.81			
			1.7	1,410	2,345
UT-2*	2	5.14			
			-3.9	2,938	-11,590
UT-3	-1	-13.03			
			-46.0	2,242	-103,228
UT-4	-110	-79.06			
			-141.8	1,323	-187,650
UT-5	-266	-204.62			
			-168.4	911	-153,427
UT-6	-305	-132.22			
<i>Northern Township Boundary</i>					
Total Volume Change =					-453,551

*UT-2 was compared between December 2017 and September 2018 because the December survey was not done. The northern three sites suffered severe shoreline retreat and massive sand volume losses as the Strathmere inlet shoreline shifted landward along a north-northeast axis toward land. The southern three sites remained stable, with just 11,590 cubic yards of lost sand volume across 4,348 feet of beachfront. Williams Avenue site suffered the worst shoreline retreat losing half the beach width present in 2017. The Seaview Avenue site lost the entire dry beach width with about 40% of the dune compromised. However, the majority of the sand volume lost at the three northern sites occurred below the zero elevation datum.

UT-4 (-13.99 yds³/ft. above; -65.07 yds³/ft. below)
UT-5 (-67.75 yds³/ft. above; -136.86 yds³/ft. below)
UT-6 (-57.02 yds³/ft. above; -75.20 yds³/ft. below)

The beach retreated as the offshore region became deeper by over a foot in large areas of the shoals associated with Corson's Inlet seaward of Strathmere. The latest aerial photography (December 11, 2018; Figure 3) seems to indicate that this sand has accumulated further seaward and as a continuous band of white water completely surrounding the inlet entrance at sea. This is called the ebb-tidal delta deposit and is controlled by the interaction of the ebb-tidal current flows and incoming waves over intervals of time measured in months.



Figure 3. The entirety of the Corson's Inlet ebb-tidal delta shows in this December 11, 2018 aerial photograph with white water breaking from Peck's Beach in the State park around to Williams Avenue in Strathmere. As of this date, there was no main channel entrance into the inlet. Minor shoals appear between the Strathmere portion of the State Park land and almost to Williams Avenue, but these are still at a considerable distance offshore. (Photo by Ted Kingston)

Table 2 - 4th Quarter Sand Volume & Shoreline Changes for 2018
September 5th to December 10th 2018

Profile	Shoreline Change (feet)	Volume Change (yds ³ /ft)	Avg. Volume Change (yds ³ /ft)	Distance Between (feet)	Net Volume Change (yds ³)
<i>Southern Township Boundary</i>					
UT-1	-4	-2.05			
			0.8	1,410	1,158
UT-2*	-13	3.70			
			-7.8	2,938	-22,943
UT-3	-22	-19.31			
			-8.0	2,242	-18,037
UT-4	-33	3.22			
			-19.9	1,323	-26,271
UT-5	-21	-42.94			
			-26.7	911	-24,306
UT-6	-62	-10.42			
<i>Northern Township Boundary</i>					
Total Volume Change =					-90,399

UT-2* was compared between June and September 2018.

The final quarter of 2018 saw continued shoreline retreat at all six locations with the southern two sites having the least landward shift. Two sites gained sand, but the loss documented at UT-5 was the largest contributor to the 90,399 cubic yard sand volume deficit. This amounts to approximately 20% of the annual loss seen. Looking at the northern three sites for where the sand was being eroded one sees that the largest loss was at UT-6 and that only UT-5 lost sand below the zero elevation datum.

UT-4 (-5.29 yds ³ /ft. above;	+8.51 yds ³ /ft. below)
UT-5 (-12.73 yds ³ /ft. above;	-30.21 yds ³ /ft. below)
UT-6 (-37.55 yds ³ /ft. above;	+27.13 yds ³ /ft. below)

The offshore region appears to have stabilized at the current elevation with bar migration again moving landward adding to the reserve of material offshore. These parameters will be closely monitored into 2019 to determine what is happening around Corson's Inlet.

◆ Seaview Avenue, UT-6

This site is located adjacent to Corson's Inlet making it highly vulnerable to rapid beach changes from inlet dynamics and northeast storms. With the federal project recently completed the dune and beach system continues to provide storm protection for the inlet and oceanfront facing properties. The beach template constructed here for the USACE project was actually narrower than the 2009 State design.

Starting in March 2018, the beach began to retreat along a line extending from south of Williams Ave. toward the inlet along a north-northeast direction. The September 29, 2017 photograph below shows that line which became more pronounced as the weekly spring 2018 northeast storms progressed.

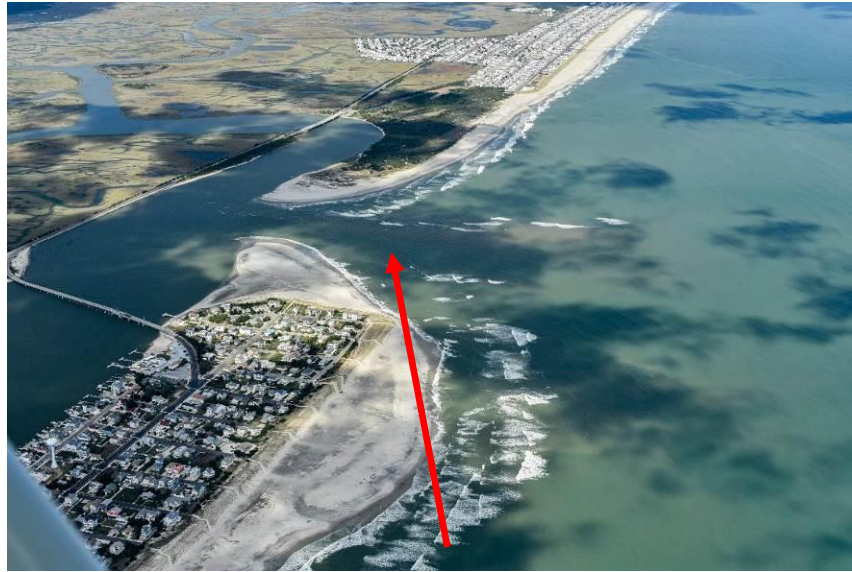


Figure 4. View of Corson's Inlet Sept. 2017 looking along the northern oceanfront where the new dunes at Seaview Avenue are in close proximity to the water's edge over a year ago. This alignment has shifted landward to the point where the dune at Seaview has been affected along a considerable extent cut back in the worst areas to the dune crest.



Figure 5. View of Corson's Inlet on December 11, 2018 showing the extent of dune erosion along the same alignment which appeared in September 2017. The impact on the northeast corner municipal dune system is evident. This time there is no subsidiary tidal channel along the beach, but also the offshore bar system lies well seaward as seen in the breaking wave pattern.

The details on the ground surveys are below.



6a. December 1, 2017



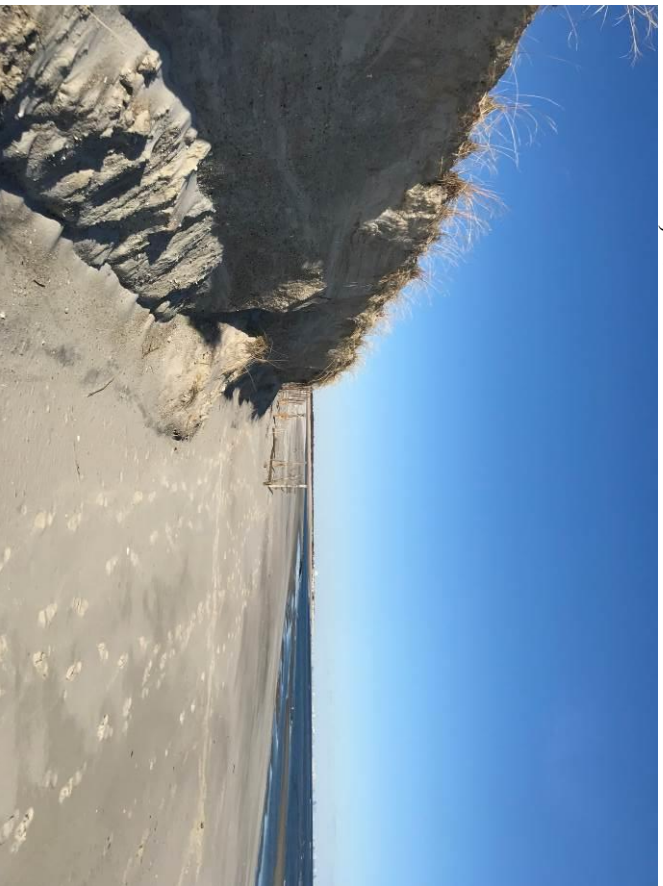
6b. June 8, 2018

Figures 6a to 6c. Seaview Avenue survey site. View to the north.

Photograph 6a On December 1st, the beach was still quite wide with exposed offshore sand flats showing at low tide.

Photograph 6b shows the same perspective in June with a healthy crop of dune grass present, with the dune still undamaged

Photograph 6c was taken on December 7, 2018 with an extensive scarp cut into the dunes at Seaview Avenue and a wet beach to the dune toe. Sand transfer from the southern, wider beach is being used to retard the dune loss currently.



6c. December 7, 2018

Township of Upper, Strathmere - Seasonal Comparison

UT - 6 Seaview Avenue

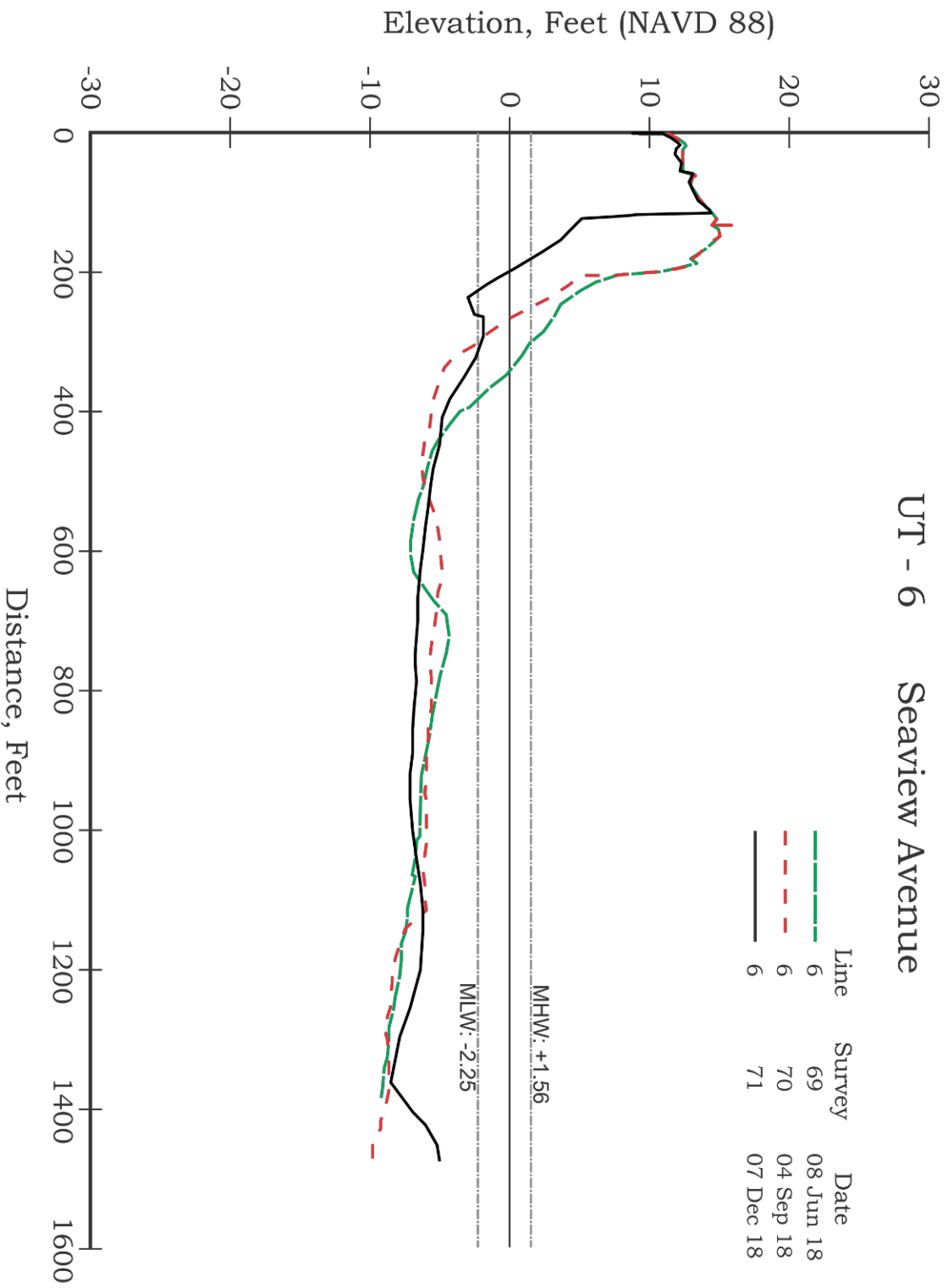
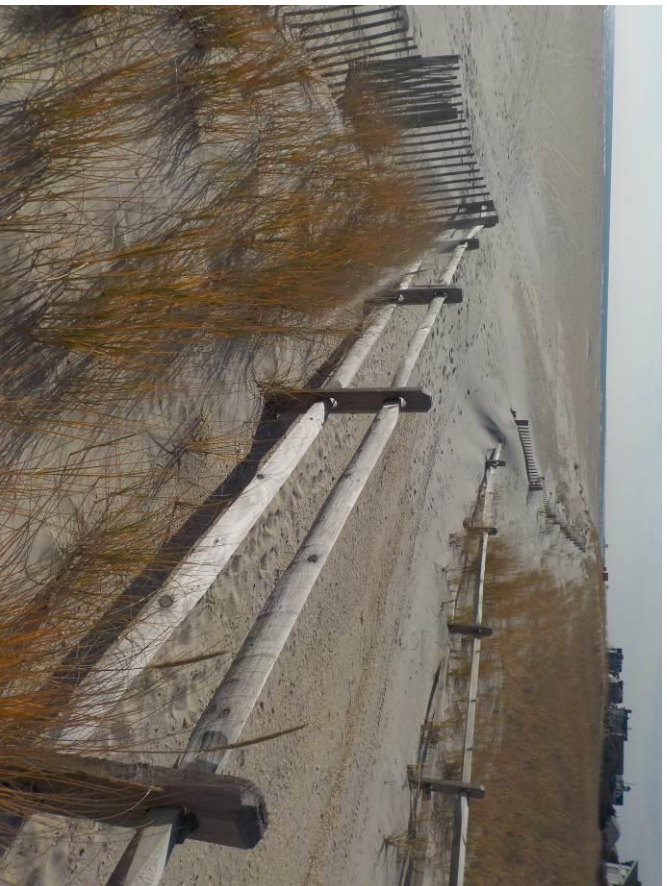


Figure 7. Between June and September the beach retreated nearly 70 feet and became much steeper in slope. The interval to December 7, 2018 produced continued retreat into the dune slope impacting the crest elevation. This problem usually involves a subsidiary tidal channel close to the water's edge that allows tidal flow to scour sand from the beach. There was a small bar at the base of the beachface and a larger feature a thousand feet further seaward that would not appear on the beach any time soon. Beach sand from the south is currently being added to the scarped areas of the dune toe to retard loss on a daily basis. This will not preclude storm attack, if moderate events occur during the spring of 2019.

◆ Survey Line UT-5, Williams Avenue, Strathmere

This site was initially nourished in 1984 and is located near the southern limit for direct inlet influences. The site has been monitored since 1986 as part of the NJBPN program and included in the municipal monitoring project. Sand is intermittently added to the beach in this region as tidal delta bars accumulate off adjacent ebb shoals and migrate landward under favorable conditions to attach themselves to the shoreline providing influxes of sand periodically.

The Williams Avenue site received limited fill volumes during the beach nourishment projects but has increased the beach width fairly consistently. Following all construction as of September 12, 2016, the beach extended 720 feet seaward of the dune toe to the MHW line with a dry recreational beach berm width of 640 feet. As of June 2018, the beach width was 475 feet between the dune toe and the berm crest. This dramatically changed by September 2018 when erosion pushed the shoreline landward by 125 feet. An additional 70 feet of landward movement occurred by December 7, 2018 leaving half the dry beach width remaining. The total sand loss volume between June and December was 122.10 yds³/ft. making this site the worst performer of the six locations. The photography from the air does show that the shoreline retreat was along the alignment shown in Figures 3 and 4 above taking dry sand away from Williams Avenue. However, immediately south of Williams Avenue, the beach widens rapidly to the earlier values seen in June (Figure 4).



8a. December 1, 2017



8b. June 8, 2018



8c. December 10, 2018

Figures 8a to 8c. UT-5 survey site on Williams Avenue.

Figure 8a shows the winter beach from the pedestrian access pathway to the beach. Note the sand accumulation along the dune toe fencing plus a wide beach seaward.

Figure 8b was taken in June looking south from the dune.

Figure 8c is a view of the beach following 200 feet of shoreline retreat since June 2018.

Township of Upper, Strathmere - Seasonal Comparison

UT - 5 Williams Avenue (NJBPN #121)

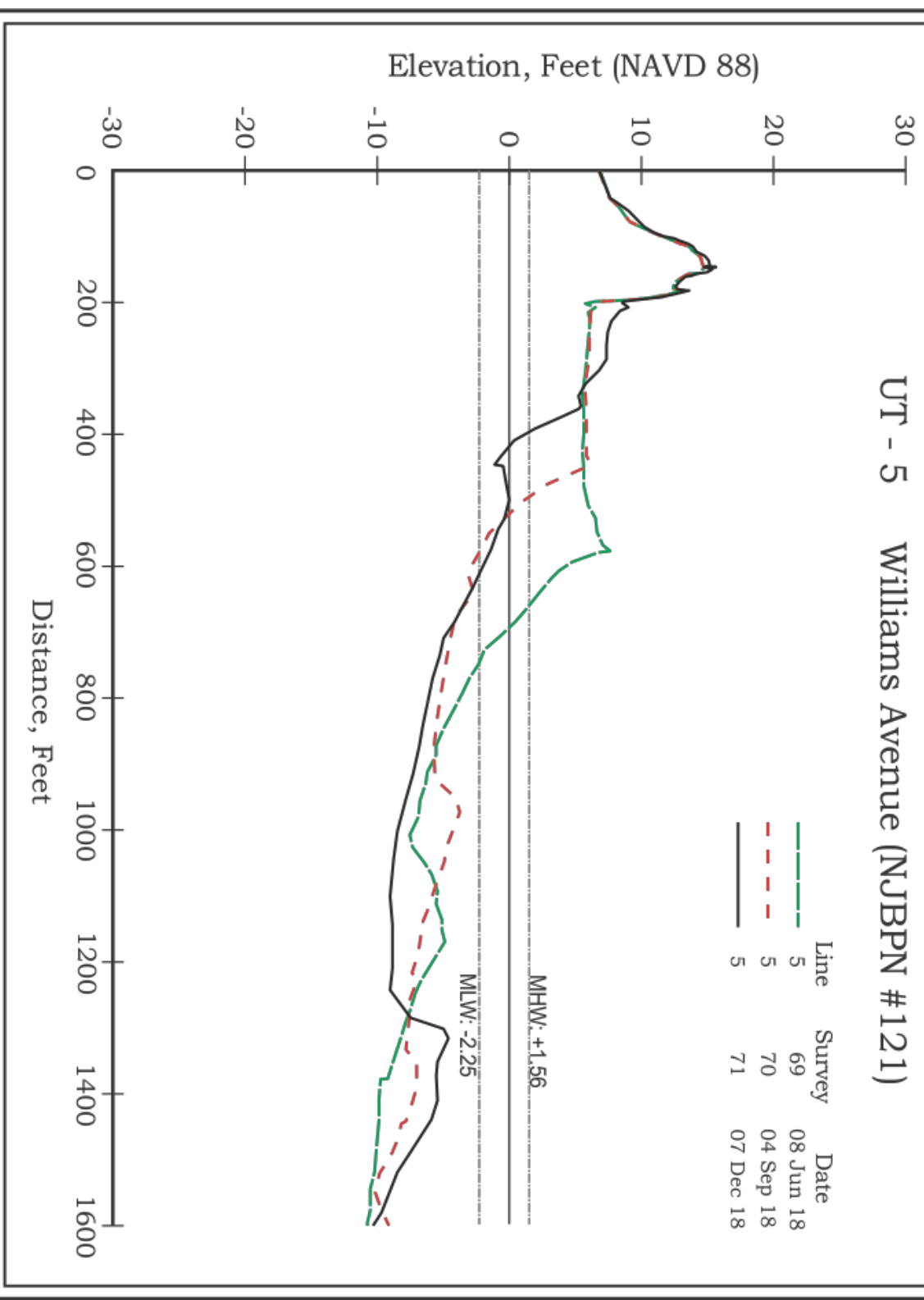


Figure 9. This site lies just south of the influence of the ebb-tidal delta for Corson's Inlet, but not beyond the accretion generated by sand moving landward. The June to September retreat in the berm took a third of the dry beach width. The bar offshore moved 200 feet closer to land. The retreat continued into December with another 70 feet of retreat, a bar just off the beach and a large new bar present 1,200 feet from the dunes. Sand was deposited on the dry beach to the dune toe.

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

This profile location was established because the shoreline dynamics radically change between Williams Avenue and Jasper Avenue sites related to the influence of 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 Jonas, the beach has been quite stable. During 2018 the shoreline retreated during the summer months because the beachface became much steeper following the spring northeast storm series (retreat of 55 feet). Between September and December 2018 the shoreline retreated an additional 20 feet from the berm crest to the water's edge. Offshore, sand present in June, moved onto the beach by September and saw retreat across the extent of the beachface by December.

Sand volume losses were most severe between September and December (-42.94 yds³/ft.), but showed summer to December loss of 16.70 yds³/ft. largely related to offshore shifts in the bar system.

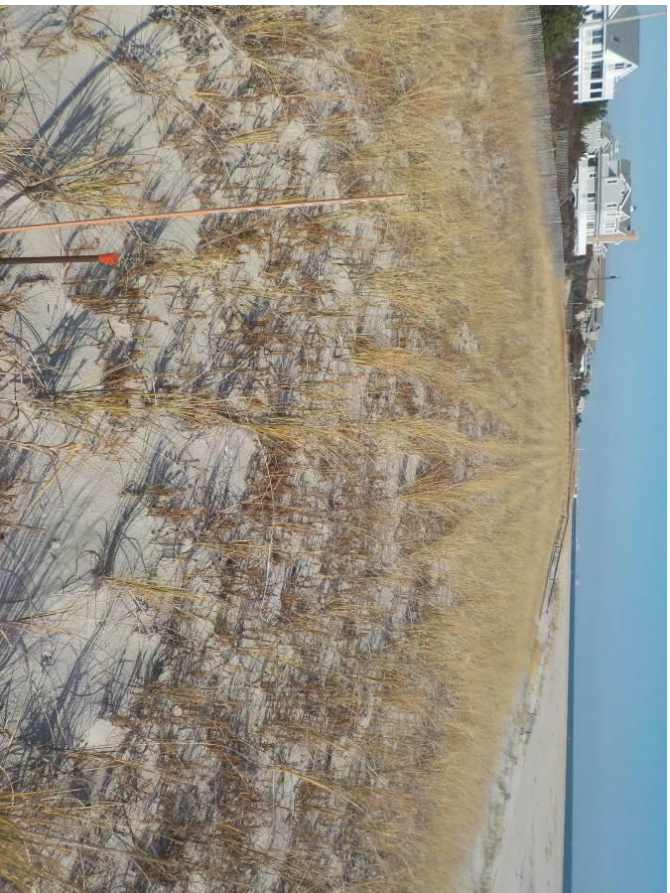


Figure 10a. December 1, 2017



Figure 10c. December 10, 2018



Figure 10b. June 8, 2018

Figure 10a is a view to the north along the dune crest during the winter.

Figure 10b shows the planted dune grass and stable recreational beach during the summer of 2018.

Figure 10c shows the same perspective by December 2018. The fencing along the dune toe was virtually completely buried by accretional sands. A large lobe appears landward beyond the fence line indicating significant local deposition.

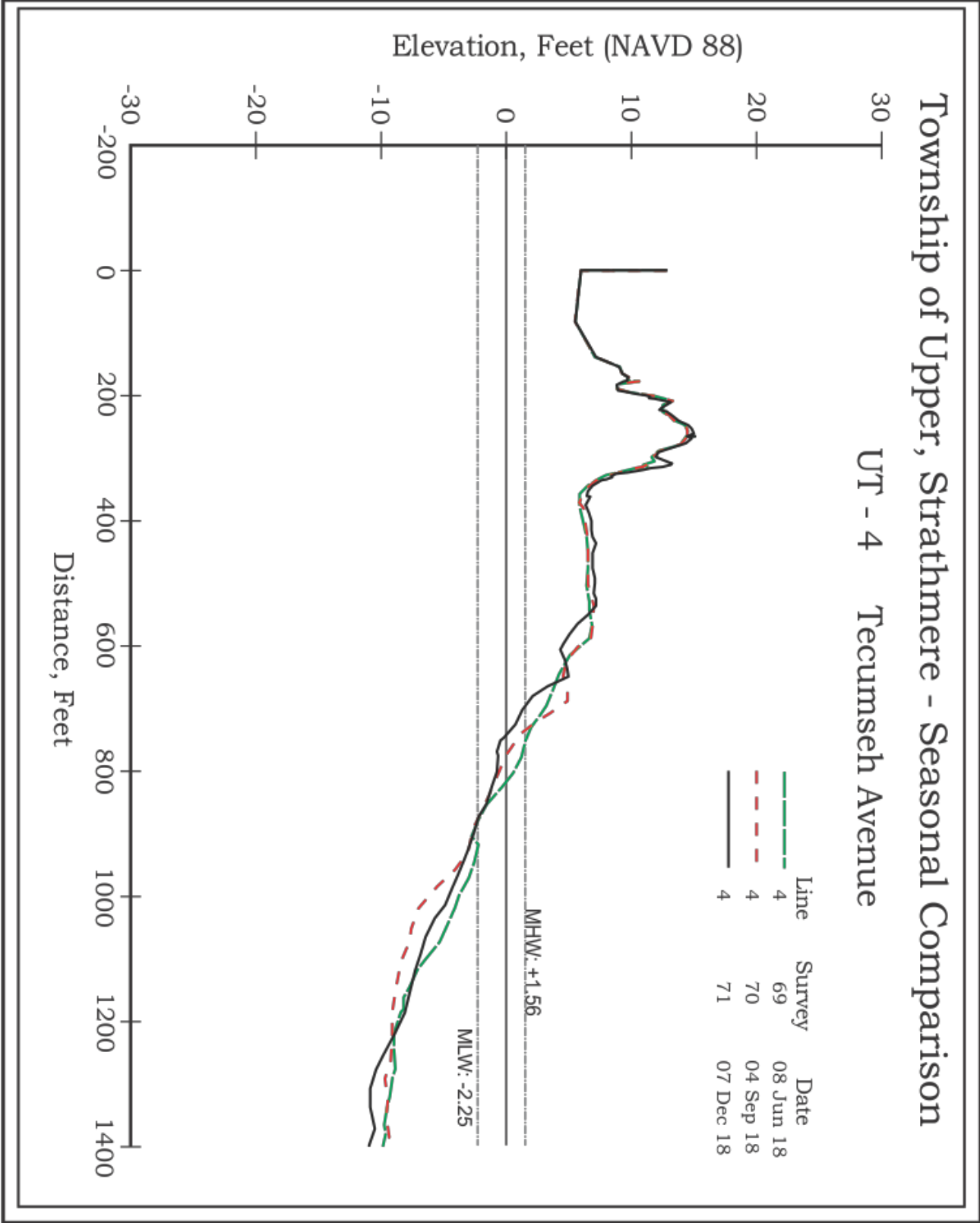


Figure 11. The dune and recreational beaches remained relatively consistent over 2018 with modest alterations in the beachface and offshore slope. The dunes gained sand and the dry beach grew fractionally higher across the entire width seaward of the dunes.

◆ **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 once was 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. Following June of 2016 the USACE had completed the northeast storm “Jonas” restoration and by September 2016, the beach extended 450 feet seaward from the dune toe to the MHW line.

The site displayed wild gyrations in berm elevations and offshore trough scouring during 2018. In June the offshore trough was nearly 10 feet deep with an 8-foot high offshore bar poised to move onto the beach. The bar’s sand mass appears to have completely filled in the trough by September and built a sharp peak of a berm on the beach. The December survey captured a cross section more medial between the two extremes with a small mound offshore and a more uniform beach slope. Little change occurred in the dunes or dry back beach zone. The sand volume change was $-21.66 \text{ yds}^3/\text{ft.}$ during the fall 2018 season, while between June and December the sand volume decreased by just $3.25 \text{ yds}^3/\text{ft.}$



12a. December 1, 2018



12c. December 10, 2018



12b. June 8, 2018

Photo 12a is a view to the north along the dune crest during the winter. The tops of the foredune fence are barely exposed at this time as a result of wind-generated sand transport into the dunes.

Photograph 12b shows the view to the north taken from the foredune perspective where a new fence line has been installed on top of the post-beach nourishment effort in 2016.

Photograph 12c shows the deposit at the new foredune fence in 5 months. A foredune has built up to the point where it shows below on the cross section.

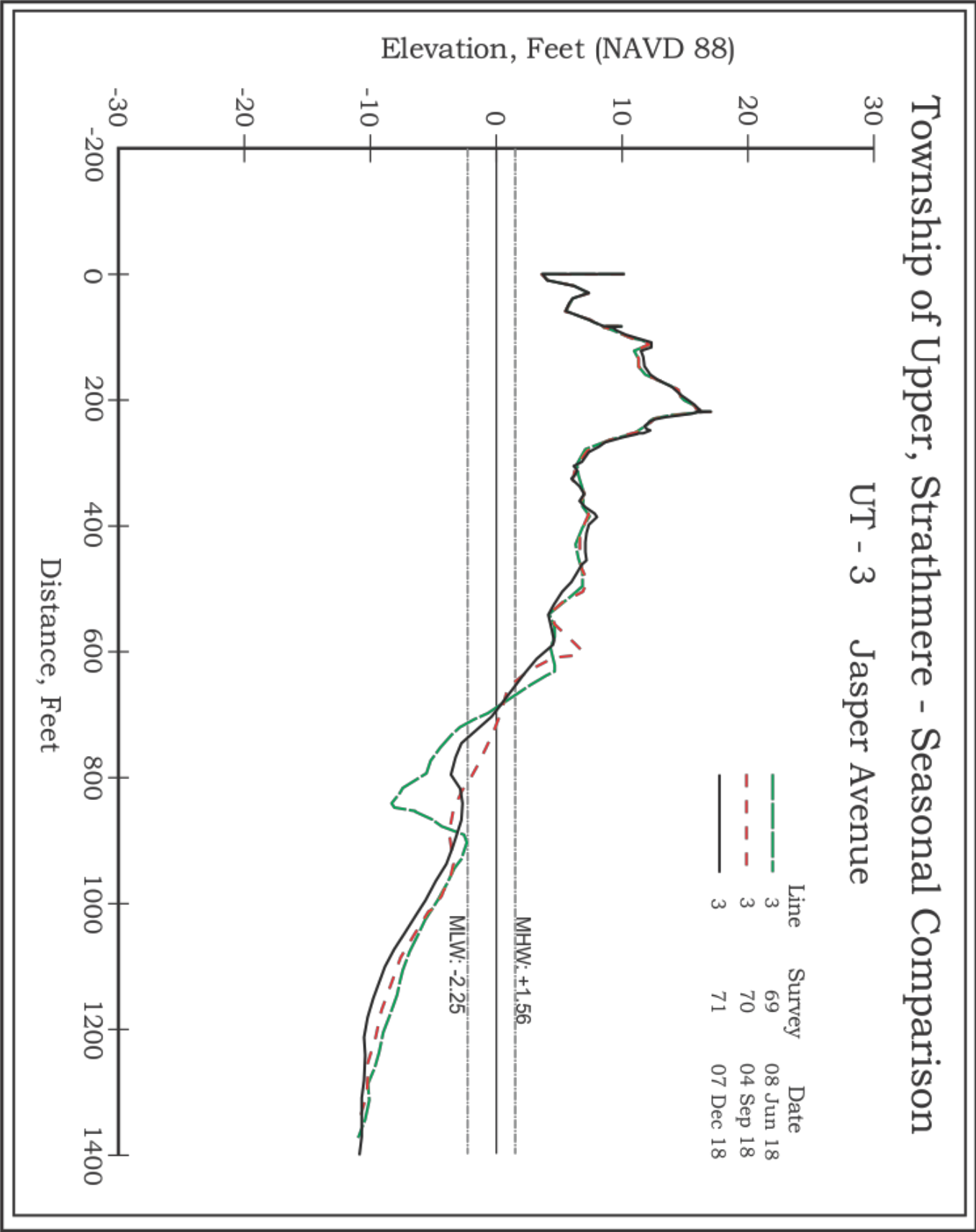


Figure 13. At Jasper Avenue the dunes and back beach areas did not change much over the past year, but major shifts in bar trough depth and position made for most of the sand volume changes observed.

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

This site is located directly seaward of the residence at 2400 Commonwealth Avenue in the southern segment of the Strathmere shoreline. This region has been more resilient than First Avenue with no documented episodes of dune breaching or overwash during the CRC monitoring for the Township. The state, local and federal beach nourishment efforts have significantly enhanced the beach and dune. Current dune crest elevation is 15 feet NAVD 88 and 160 feet in width at the toe. The beach extends an additional 300 feet seaward from the dune toe to the MHW line and the beach berm crest is maintained at 6 feet NAVD 88.

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 post-Jonas northeast storm restoration was complete by June 2016 with a wider beach and an added 56.01 yds³/ft. placed at the site.

Between June and September 2018 the bar moved toward the shoreline and a classic summer berm developed on the beach. Unfortunately, no December survey exists due to bad weather coming in December 10th forcing the team off the beach without completing this profile. The return trip was forgotten in the crush to complete multiple other surveys. The seasonal changes were positive and the site has been very stable. The spring 2019 survey will be contrasted with the September 2018 profile.



14a. December 1, 2017



Figure 14b. June 8, 2018

Figure 14a is a view to the south from the instrument position on the new foredune slope.

Photograph 14b shows the dune toe in June with a substantial deposit of wind transported sand completely burying the line of fence. The plants are doing well with root extensions migrating seaward.

Photograph 14c is a view to the south along the seaward dune crest displaying the overall width of the healthy dune system. The foredune fence has enhanced this system by continuing to add wind transported sand. This is the September survey view.



14c. September 4, 2018

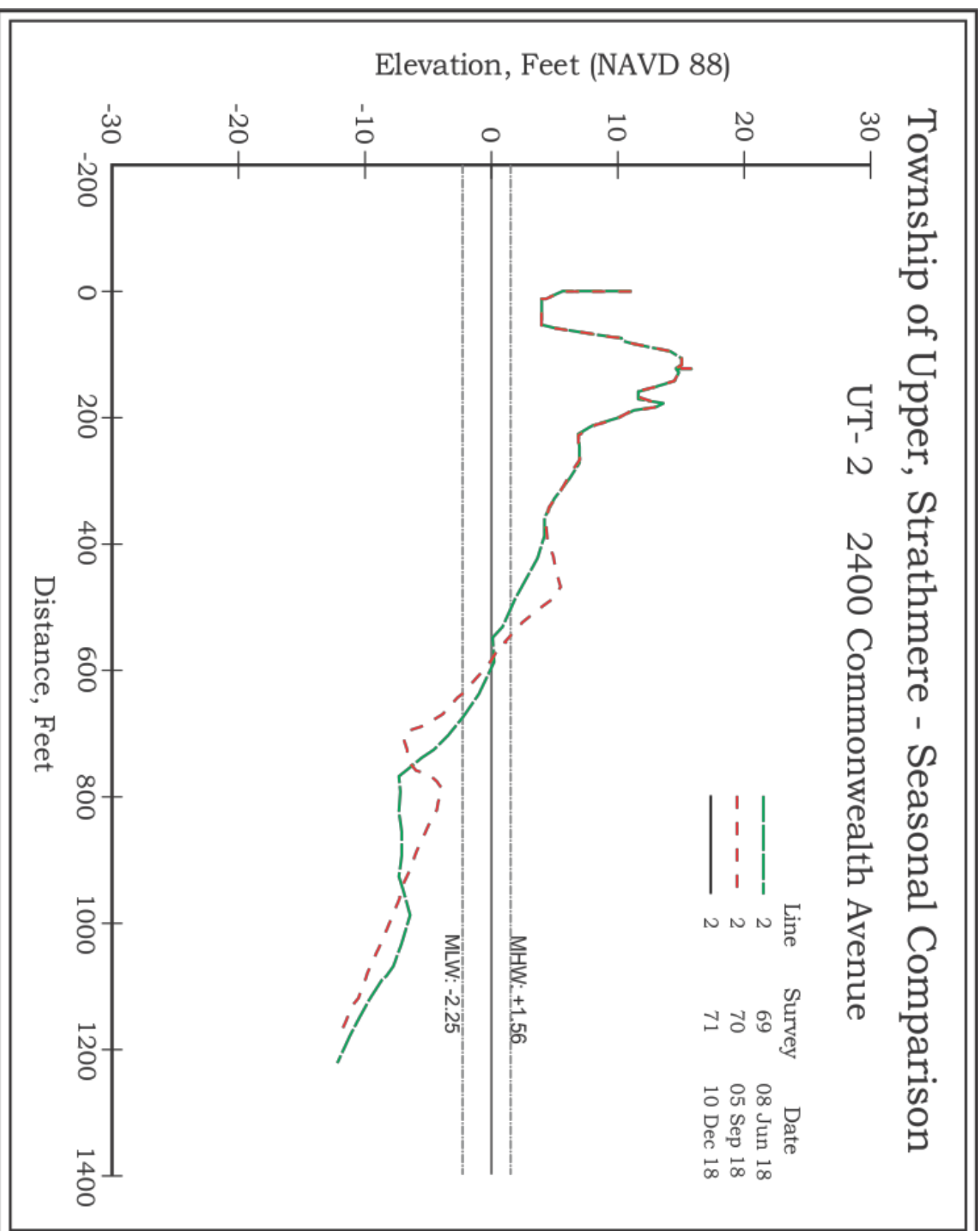


Figure 15. The cross sections display June to September conditions where sand was added to the berm building a classic summer feature. Sand to do this clearly came from just offshore as the bar migrated 200 feet closer to the beach. The December survey was overlooked at this site, so no data exists.

♦ **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 over-washed, 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.

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 post-Jonas disaster declaration restoration was complete by June 2016 with a wider beach and an added 26.86 yds³/ft. placed at the site.

A similar June to September berm development occurred here as seen at UT-2. Bar migration was less, but the bar was smaller in volume. The December cross section falls short of the bar system due to increasing wave intensity on the 10th of December ultimately forcing the crew to not attempt UT-2 that day. By December the berm had been reduced (-4.23 yds³/ft. above the zero datum), and sand was transported offshore (2.18 yds³/ft. added).

The June profile was still reflecting storm damage during the spring 2018 storm series, so the beach gained 5.30 yds³/ft. as offshore material moved onto the beach seasonally (-5.23 yds³/ft.) when the December profile is compared to the one done in June. The net change June to December was just 0.07 yds³/ft. with a 8-foot shoreline retreat.



16a. December 1, 2017



16b. June 8, 2018

Photograph 16a shows the dune fencing at the landward crest and a buried row at the seaward toe of the USACE dune.

Photograph 16b shows the dune with grass plants and the deposition of wind transported sand covering the top of the 4-foot fence. Tiny bits of the original fence show along the right margin.

Photograph 16c provides the fall view to the north across the dune and onto the beach. The fence is fully buried in new sand added to the dune toe.



16c. September 4, 2018

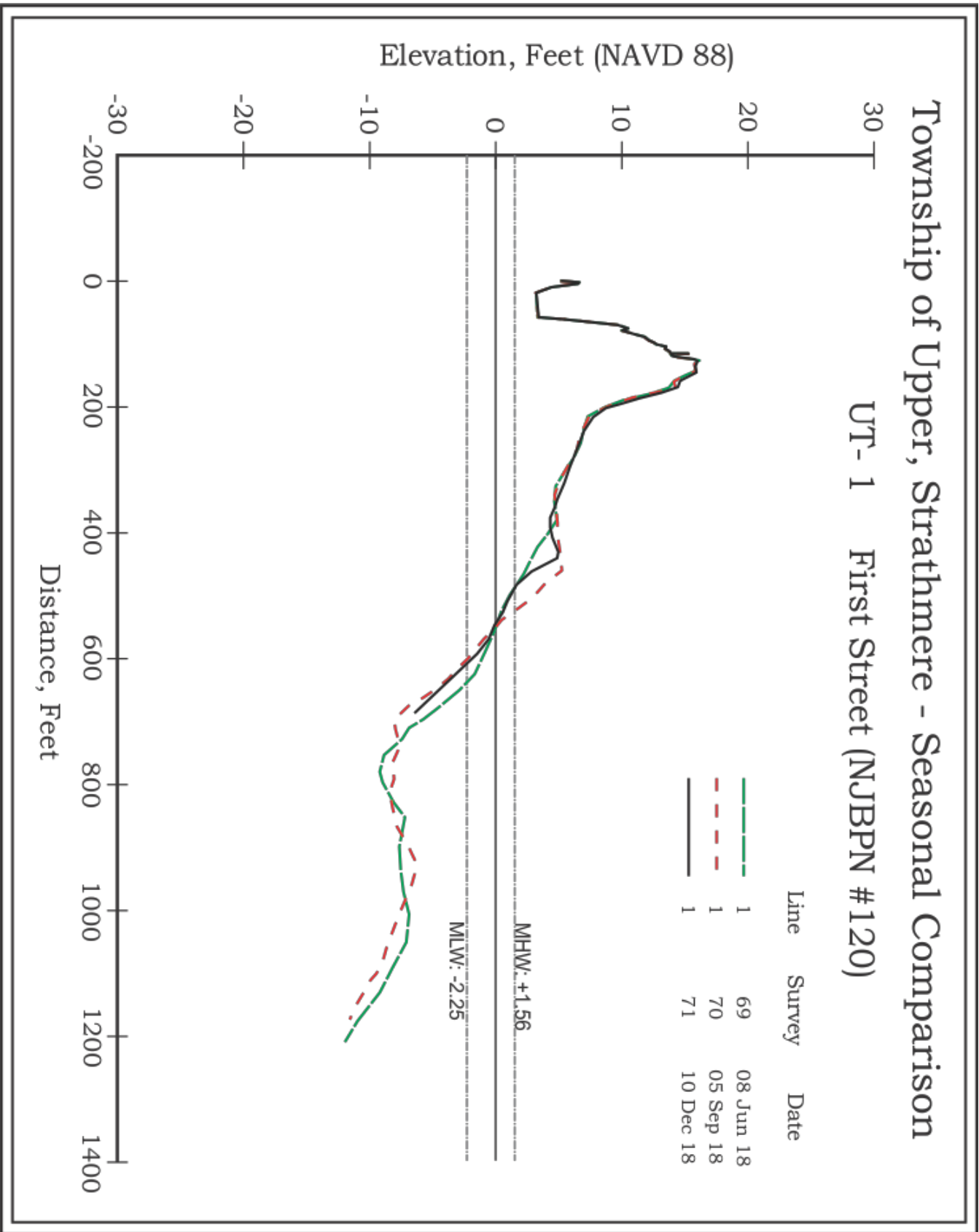


Figure 17. Overall, this site remained relatively stable throughout the 2018 survey year. A substantial summer berm developed by September, which did not entirely vanish by December. Minor sand addition was seen in the dunes.

Summary & Conclusions

The federal project placed approximately 1.54 million cubic yards of sand on the north end of Ludlam Island, including the Strathmere oceanfront beaches. The USACE returned (following the 2015 federally sponsored US Army Corps of Engineers beach nourishment projects completion in Strathmere) to repair the storm damage from Jonas with sand derived from Corson's Inlet ebb-tidal delta borrow zone. Since the Jonas Federal Disaster Declaration, there have been multiple northeast storms, particularly between March 2nd and May 29th 2018. There were three in December 2018, but almost nothing much since (up to March 28, 2019), none of which had conditions much above mild to moderate in tidal flooding or wave action.

Erosion along the Williams Avenue to the State Park oceanfront beach was apparent in December 2017, and got progressively worse during 2018 (cover photograph). Recently, the Upper Township public works commenced in harvesting sand from the berm near Jasper Avenue (UT-3) and truck hauling it north to place the piles at the toe of the dune scarp shown on the cover page. This inexpensive operation provides a buffer to normal to mild northeast waves from carving continuously into the near vertical sand cliff producing more collapse and dune loss. The process depends on larger quantities of inlet shoal sand accumulating closer to the beach where it can add to the beach system between Seaview and Williams Avenues widening the distance between the water's edge and the dune toe. Trucking enough sand north to dramatically alter the relationship between wave erosion and sand accumulation is not likely to be completely successful over time. The USACE is not scheduled to return for a maintenance operation for several years unless there is a Presidential Disaster Declaration for a serious storm.

Inlet tidal dynamics continue to play a significant role in shoreline stability in the vicinity of the Seaview Avenue site. Sand piles deposited at the dune scarp are at least a means to slow erosion rates in anticipation of improved sediment supplies reaching the location and in sufficient mass where the material efficiently blocks northeast waves and contribute to increasing the beachfront sand supply in excess of wave scouring.