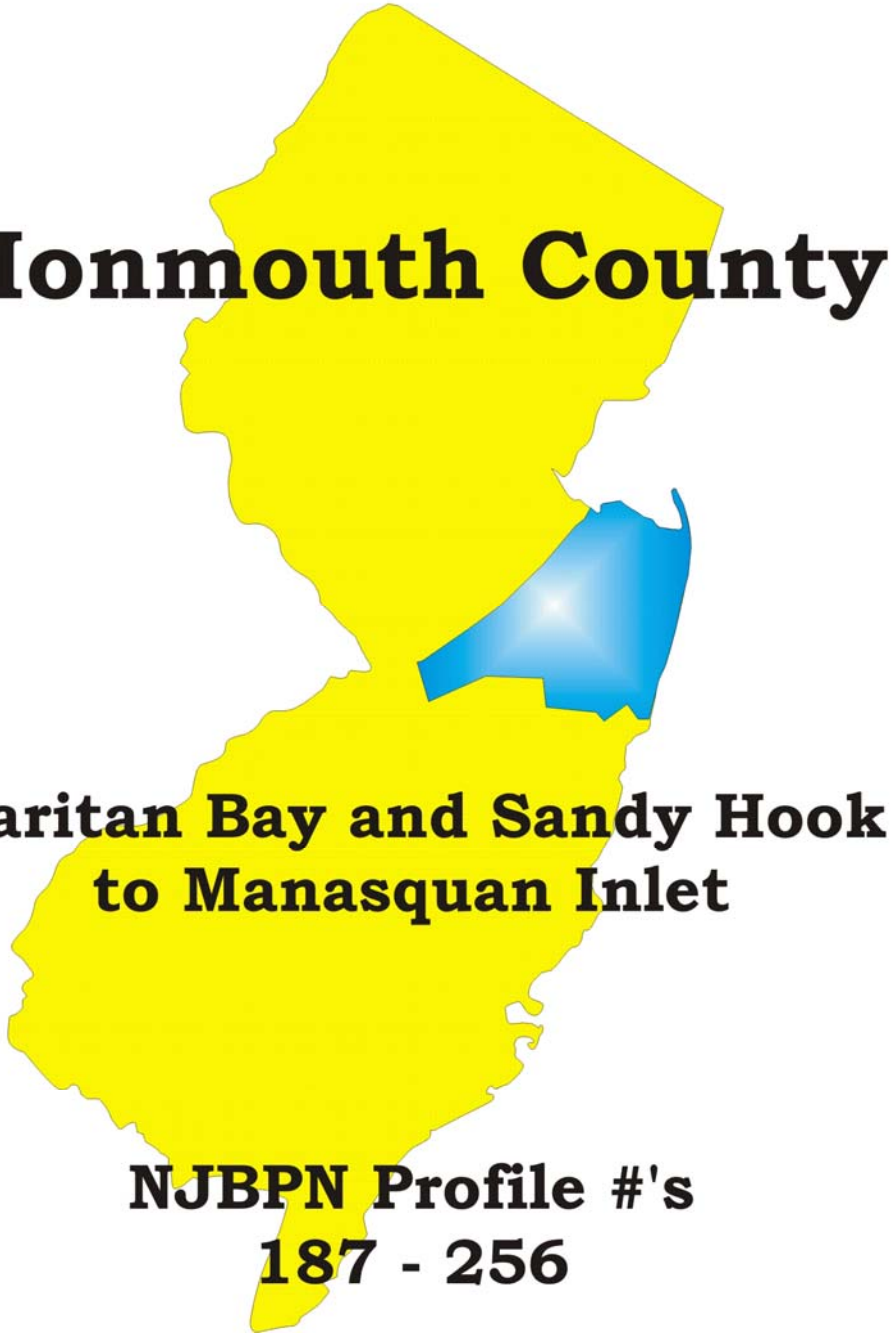
New Jersey Beach Profile Network

Monmouth County

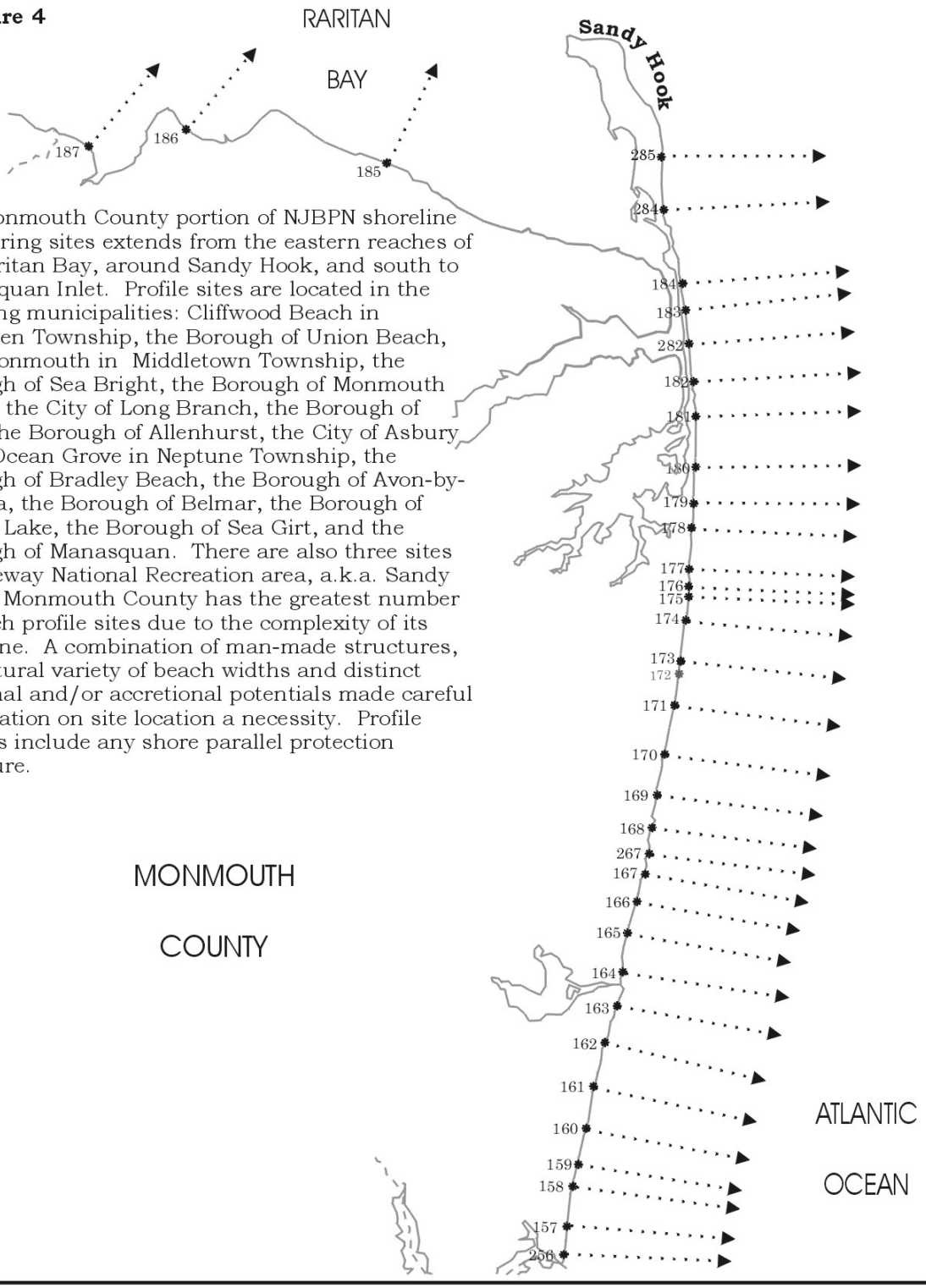


Raritan Bay and Sandy Hook to Manasquan Inlet

NJBPN Profile #'s 187 - 256

New Jersey Beach Profile Network
Monmouth County Profile Site Locations

Figure 4



The Monmouth County portion of NJBPN shoreline monitoring sites extends from the eastern reaches of the Raritan Bay, around Sandy Hook, and south to Manasquan Inlet. Profile sites are located in the following municipalities: Cliffwood Beach in Aberdeen Township, the Borough of Union Beach, Port Monmouth in Middletown Township, the Borough of Sea Bright, the Borough of Monmouth Beach, the City of Long Branch, the Borough of Deal, the Borough of Allenhurst, the City of Asbury Park, Ocean Grove in Neptune Township, the Borough of Bradley Beach, the Borough of Avon-by-the-Sea, the Borough of Belmar, the Borough of Spring Lake, the Borough of Sea Girt, and the Borough of Manasquan. There are also three sites in Gateway National Recreation area, a.k.a. Sandy Hook. Monmouth County has the greatest number of beach profile sites due to the complexity of its shoreline. A combination of man-made structures, the natural variety of beach widths and distinct erosional and/or accretional potentials made careful deliberation on site location a necessity. Profile surveys include any shore parallel protection structure.

Photoplate 1a. This photo was taken on November 12,2003 at NJBPN 185 (Raritan Bay at the Spy House Museum). The bay floor below -2.0 below low tide is seldom involved in changes, but the dune is easily cut by northeast storm waves on the bay.

Photoplate 1b. By November 29, 2005 there had been substantial damage done by a pair of northeast storms in mid-October. Erosion destroyed the vegetation and exposed waste rubble used as dune core when the park was upgraded. The beach remained at nearly the same width.

Photoplate 2a. Looking south from Cottage Road, Monmouth Beach in the Fall of 2003. The beach extended well seaward of the development south of the groin. The picture was taken April 2, 2003 and shows conditions about a year following maintenance sand placement.

Photoplate 2b. By June 14, 2005 shoreline retreat had exposed the groin again and forced the high tide line back to the rocks south of the groin. The beach continued to erode so that by the summer's end there was a scarp cut into the toe of the dunes north of the groin and well landward of this photograph.

TABLE 1
MONMOUTH COUNTY
ANNUAL BEACH VOLUME CHANGES
SPRING 2004 - SPRING 2005 & FALL 2004 - FALL 2005

		Survey 28 - 30	Survey 29 - 31
PROFILE SITE		**S2004-S2005**	**F2004 - F2005**
LOCATION		(volume expressed as cubic yards per foot)	
187:	Cliffwood Beach Park	-2.23	-2.14
186:	Union Beach	7.66	8.83
185:	Port Monmouth, Spy House Museum	4.39	1.04
285:	Gateway National R. A., Gunnison Beach	64.63	37.05
284:	Gateway National R. A., Parking Lot E	33.22	14.04
184:	Highland Beach, Gateway Entrance	-11.76	30.50
183:	Highland Beach, Via Ripa St.	-17.93	-5.13
282:	Sea Bright, Shrewsbury Way	9.93	-15.50
182:	Sea Bright, North of Route 520	-20.46	-23.86
181:	Sea Bright, Municipal Beach	-23.96	-24.42
180:	Sea Bright, Sunset Court	-41.54	-34.42
179:	Monmouth Beach, Cottage Rd.	-40.29	-36.15
178:	Monmouth Beach, Beach Club	-3.76	-13.82
177:	Long Branch, 404 Ocean Ave.	2.02	-0.47
176:	Long Branch, Seven Presidents Park	-24.00	-17.15
175:	Long Branch, North Broadway Ave.	-14.41	-18.96
174:	Long Branch, Morris Ave.	-11.60	-34.12
173:	Long Branch, West End Ave.	-14.99	-5.19
172:	Long Branch	** NO LONGER ACTIVE **	
171:	Elberon, Pullman Ave.	4.68	-26.87
170:	Deal, Roosevelt Ave.	7.55	34.80
169:	Deal, Darlington Ave.	4.46	2.75
168:	Allenhurst, Corlies Ave.	23.99	24.98
267:	Asbury Park, 7th Ave.	5.91	11.83
167:	Asbury Park, 3rd Ave.	-7.85	25.82
166:	Ocean grove, Ocean Pathway	14.68	7.20
165:	Bradley Beach, McCabe Ave.	-5.06	23.80
164:	Avon-By-The-Sea, Sylvania Ave.	17.25	-4.53
163:	Belmar, 5th Ave.	7.07	-18.06
162:	Belmar, 18th Ave.	36.08	4.58
161:	Spring Lake, Brighton Ave.	-18.91	-6.33
160:	Spring Lake, Salem Ave.	13.69	18.83
159:	Sea Girt, New York Ave.	23.71	19.23
158:	Sea Girt, Trenton Ave.	11.50	-3.29
157:	Manasquan, Riddle Way	-24.75	-8.97
256:	Manasquan, Pompano Ave.	20.56	0.79

TABLE 2
MONMOUTH COUNTY
ANNUAL SHORELINE CHANGES
SPRING 2004 - SPRING 2005 & FALL 2004 - FALL 2005

		Survey 28-30	29-31
PROFILE SITE LOCATION		**S2004-S2005**	**F2004 - F2005**
		(shoreline change expressed in feet)	
187:	Cliffwood Beach Park	-3.7	3.8
186:	Union Beach	20.0	18.8
185:	Port Monmouth, Spy House Museum	-5.0	0.6
285:	Gateway National R. A., Gunnison Beach	170.5	-24.6
284:	Gateway National R. A., Parking Lot E	31.6	22.7
184:	Highland Beach, Gateway Entrance	-11.5	-4.2
183:	Highland Beach, Via Ripa St.	4.5	-47.7
282:	Sea Bright, Shrewsbury Way	81.5	-31.0
182:	Sea Bright, North of Route 520	-26.8	-19.7
181:	Sea Bright, Municipal Beach	-35.1	-36.9
180:	Sea Bright, Sunset Court	-52.0	-46.0
179:	Monmouth Beach, Cottage Rd.	-62.1	-51.8
178:	Monmouth Beach, Beach Club	6.4	21.3
177:	Long Branch, 404 Ocean Ave.	69.9	11.0
176:	Long Branch, Seven Presidents Park	-3.1	-15.9
175:	Long Branch, North Broadway Ave.	3.1	-28.0
174:	Long Branch, Morris Ave.	9.7	-47.9
173:	Long Branch, West End Ave.	-3.1	15.7
172:	Long Branch	** NO LONGER ACTIVE **	
171:	Elberon, Pullman Ave.	-27.4	-38.6
170:	Deal, Roosevelt Ave.	32.3	98.0
169:	Deal, Darlington Ave.	-36.0	33.6
168:	Allenhurst, Corlies Ave.	10.9	23.0
267:	Asbury Park, 7th Ave.	-32.9	4.1
167:	Asbury Park, 3rd Ave.	-29.9	14.7
166:	Ocean grove, Ocean Pathway	15.5	-82.5
165:	Bradley Beach, McCabe Ave.	25.9	-77.6
164:	Avon-By-The-Sea, Sylvania Ave.	29.2	109.3
163:	Belmar, 5th Ave.	10.8	-41.1
162:	Belmar, 18th Ave.	31.7	36.0
161:	Spring Lake, Brighton Ave.	18.2	33.2
160:	Spring Lake, Salem Ave.	57.1	73.6
159:	Sea Girt, New York Ave.	37.0	40.5
158:	Sea Girt, Trenton Ave.	20.6	-3.9
157:	Manasquan, Riddle Way	62.4	11.9
256:	Manasquan, Pompano Ave.	34.1	-42.6

TABLE 3
MONMOUTH COUNTY
SEASONAL BEACH VOLUME CHANGES

PROFILE SITE LOCATION		Survey 28-29 S04-F04	29-30 F04-S05	30-31 S05-F05	28-31 S04-F05
		(volume expressed as cubic yards per foot of beachfront)			
187:	Cliffwood Beach Park	-1.64	-0.69	-1.86	-3.76
186:	Union Beach	-1.60	9.42	-0.45	7.15
185:	Port Monmouth, Spy House Museum	-1.21	5.51	-4.47	0.05
285:	Gateway National R. A., Gunnison Beach	48.82	12.91	24.92	90.36
284:	Gateway National R. A., Parking Lot E	13.00	21.30	-9.34	26.72
184:	Highland Beach, Gateway Entrance	-11.85	-2.35	6.66	18.45
183:	Highland Beach, Via Ripa St.	-5.67	-10.09	6.11	-12.97
282:	Sea Bright, Shrewsbury Way	15.85	-5.38	-9.90	0.42
182:	Sea Bright, North of Route 520	-2.82	-17.72	-5.83	-26.59
181:	Sea Bright, Municipal Beach	-15.86	-8.24	-16.73	-38.90
180:	Sea Bright, Sunset Court	-23.84	-18.03	-16.27	-57.99
179:	Monmouth Beach, Cottage Rd.	-40.31	-4.30	-34.16	-76.52
178:	Monmouth Beach, Beach Club	-0.02	-4.95	-8.55	-13.85
177:	Long Branch, 404 Ocean Ave.	9.88	-7.68	4.95	11.01
176:	Long Branch, Seven Presidents Park	-13.27	-10.96	-6.81	-29.81
175:	Long Branch, North Broadway Ave.	-1.70	-13.85	-3.88	-20.46
174:	Long Branch, Morris Ave.	8.05	-19.23	-15.02	-25.96
173:	Long Branch, West End Ave.	-26.21	13.42	-19.54	-34.18
172:	Long Branch		** NO LONGER ACTIVE **		
171:	Elberon, Pullman Ave.	20.85	-16.27	-11.47	-5.86
170:	Deal, Roosevelt Ave.	-17.58	25.34	8.91	16.45
169:	Deal, Darlington Ave.	-3.09	6.47	-3.58	0.70
168:	Allenhurst, Corlies Ave.	-8.50	32.45	-7.53	16.27
267:	Asbury Park, 7th Ave.	0.99	2.38	8.38	13.09
167:	Asbury Park, 3rd Ave.	-34.07	24.84	0.58	-7.36
166:	Ocean grove, Ocean Pathway	1.10	13.04	-7.29	8.10
165:	Bradley Beach, McCabe Ave.	0.47	-7.21	26.98	23.83
164:	Avon-By-The-Sea, Sylvania Ave.	12.78	2.92	-8.87	13.14
163:	Belmar, 5th Ave.	7.40	-1.09	-16.83	-9.57
162:	Belmar, 18th Ave.	23.83	12.16	-8.50	28.41
161:	Spring Lake, Brighton Ave.	-9.41	-8.92	2.39	-16.23
160:	Spring Lake, Salem Ave.	-5.95	17.96	-0.84	13.10
159:	Sea Girt, New York Ave.	16.53	5.91	11.57	36.24
158:	Sea Girt, Trenton Ave.	-7.94	17.47	-19.61	-7.82
157:	Manasquan, Riddle Way	-4.90	-17.20	10.65	-14.58
256:	Manasquan, Pompano Ave.	3.45	17.23	-15.67	4.19

TABLE 4
MONMOUTH COUNTY
SEASONAL SHORELINE CHANGES

PROFILE SITE LOCATION		Survey 28-29 S04-F04	29-30 F04-S05	30-31 S05-F05	28-31 S04-F05
			(shoreline change expressed in feet)		
187:	Cliffwood Beach Park	3.6	-7.3	11.1	7.4
186:	Union Beach	1.8	18.2	0.6	20.6
185:	Port Monmouth, Spy House Museum	-0.9	-4.1	4.7	-0.3
285:	Gateway National R. A., Gunnison Beach	236.6	-66.1	41.5	212.0
284:	Gateway National R. A., Parking Lot E	12.4	19.2	3.4	35.0
184:	Highland Beach, Gateway Entrance	-2.2	-9.3	5.1	-6.4
183:	Highland Beach, Via Ripa St.	38.0	-33.6	-14.2	-9.7
282:	Sea Bright, Shrewsbury Way	118.4	-36.9	5.9	87.4
182:	Sea Bright, North of Route 520	15.0	-41.8	22.1	-4.7
181:	Sea Bright, Municipal Beach	-3.9	-31.3	-5.6	-40.8
180:	Sea Bright, Sunset Court	-13.6	-38.3	-7.6	-59.6
179:	Monmouth Beach, Cottage Rd.	-35.7	-26.4	-25.4	-87.5
178:	Monmouth Beach, Beach Club	-11.1	17.6	3.7	10.1
177:	Long Branch, 404 Ocean Ave.	67.5	2.4	8.6	78.5
176:	Long Branch, Seven Presidents Park	5.9	-9.0	-6.9	-10.0
175:	Long Branch, North Broadway Ave.	22.2	-19.0	-8.9	-5.8
174:	Long Branch, Morris Ave.	32.8	-23.1	-24.9	-15.2
173:	Long Branch, West End Ave.	-40.7	37.7	-21.9	-25.0
172:	Long Branch		** NO LONGER ACTIVE **		
171:	Elberon, Pullman Ave.	38.2	-65.7	27.0	-0.4
170:	Deal, Roosevelt Ave.	26.1	6.1	91.9	124.1
169:	Deal, Darlington Ave.	-17.8	-18.2	51.9	15.9
168:	Allenhurst, Corlies Ave.	15.2	-4.2	27.2	38.1
267:	Asbury Park, 7th Ave.	17.2	-50.1	54.2	21.3
167:	Asbury Park, 3rd Ave.	-51.3	21.4	-6.7	-36.6
166:	Ocean grove, Ocean Pathway	6.4	9.1	-91.6	-76.1
165:	Bradley Beach, McCabe Ave.	102.3	-76.5	-1.1	24.7
164:	Avon-By-The-Sea, Sylvania Ave.	10.8	18.4	90.9	120.0
163:	Belmar, 5th Ave.	64.3	-53.5	12.4	23.2
162:	Belmar, 18th Ave.	25.1	6.6	29.4	61.1
161:	Spring Lake, Brighton Ave.	5.1	13.1	20.1	38.3
160:	Spring Lake, Salem Ave.	8.9	48.2	25.4	82.5
159:	Sea Girt, New York Ave.	28.8	8.2	32.4	69.3
158:	Sea Girt, Trenton Ave.	1.0	19.6	-23.5	-2.9
157:	Manasquan, Riddle Way	12.1	50.4	-38.5	23.9
256:	Manasquan, Pompano Ave.	47.9	-13.8	-28.7	5.4

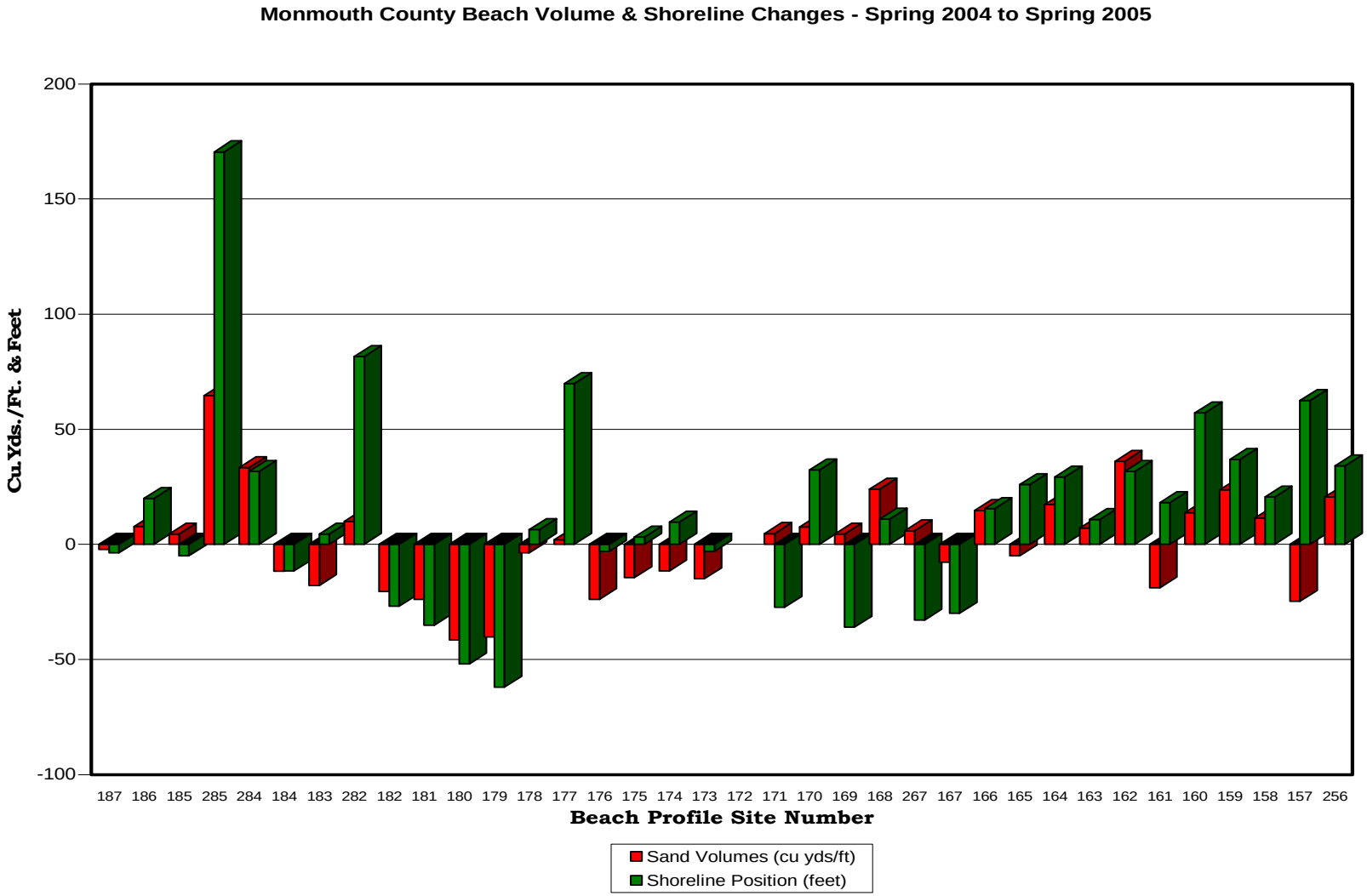


Figure 5a. The Monmouth County annual comparison from Spring 2004 to Spring 2005 shows loss increasing toward the south to Monmouth Beach, with gains in the Asbury Park to Manasquan Inlet region. Other changes were modest in size except for the Gunnison Beach in Sandy Hook Gateway National Seashore where deposition placed over 170 yds^3/ft.

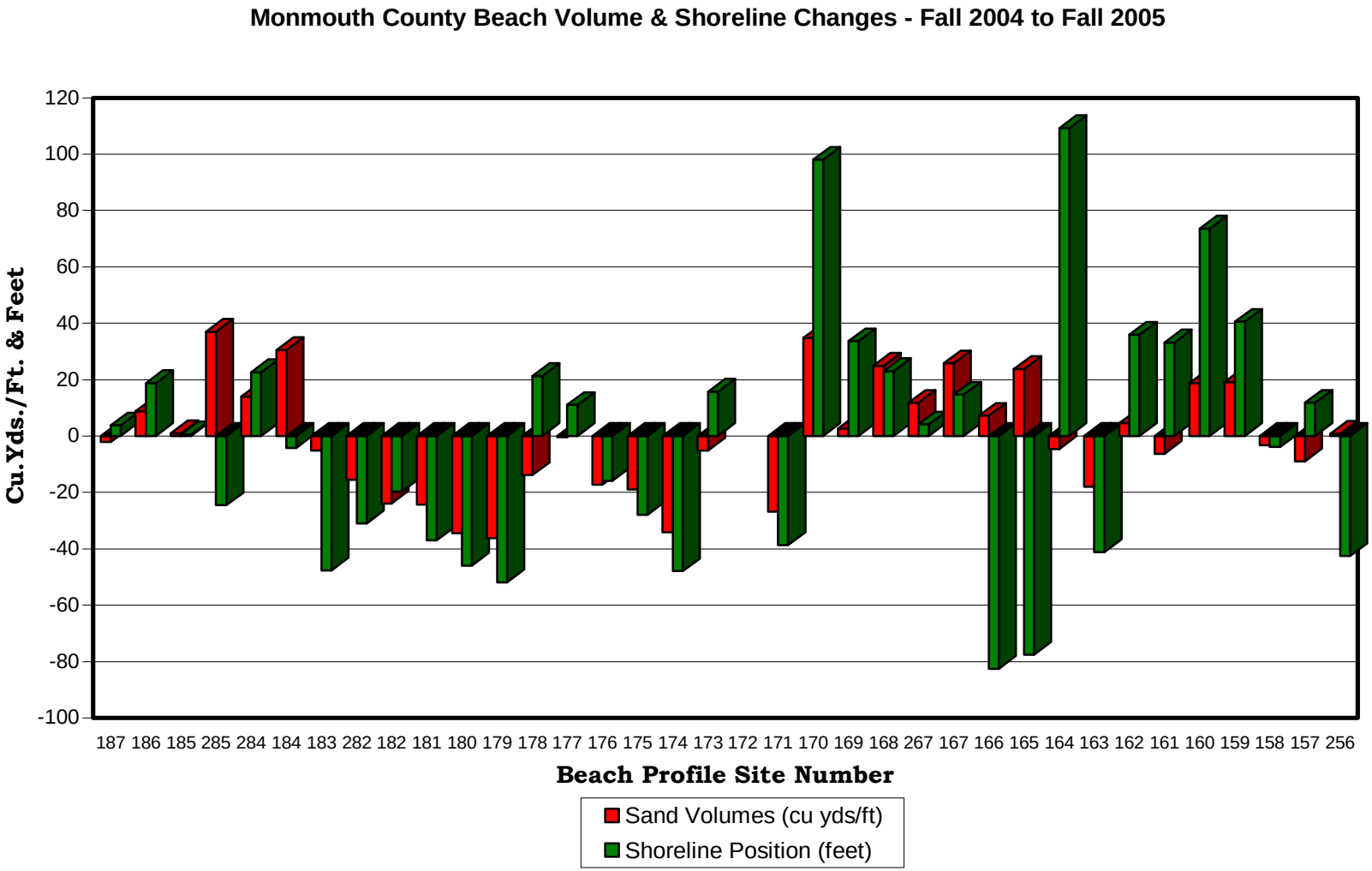


Figure 5b. A similar comparison but between the fall of 2004 and the fall of 2005 that shows minor shoreline retreat and beach volume loss north of Deal beach (#170) and modest gains south to Manasquan Inlet with three shoreline advances over 80 feet.

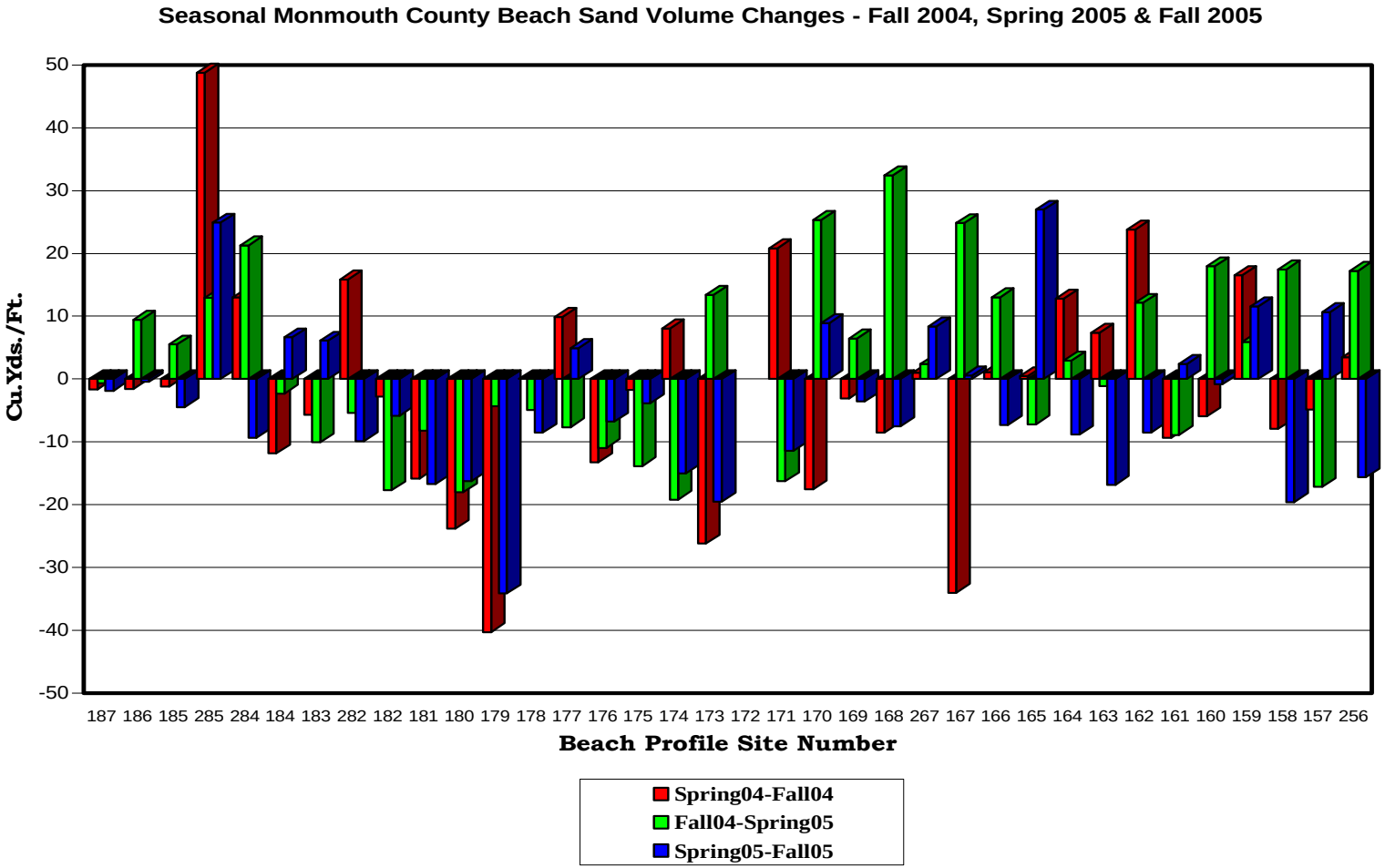


Figure 5c. Seasonal changes show that the large sand volume gain at Sandy Hook was actually during the summer of 2004 with gains most other times. From location #282 south to #173 there was steady loss with #179 the largest. Conditions reverse south of Long Branch favoring accretion the majority of the time. Sand appears to be moving north from Long Branch toward Sandy Hook with the tendency fading south of Deal and Allenhurst.

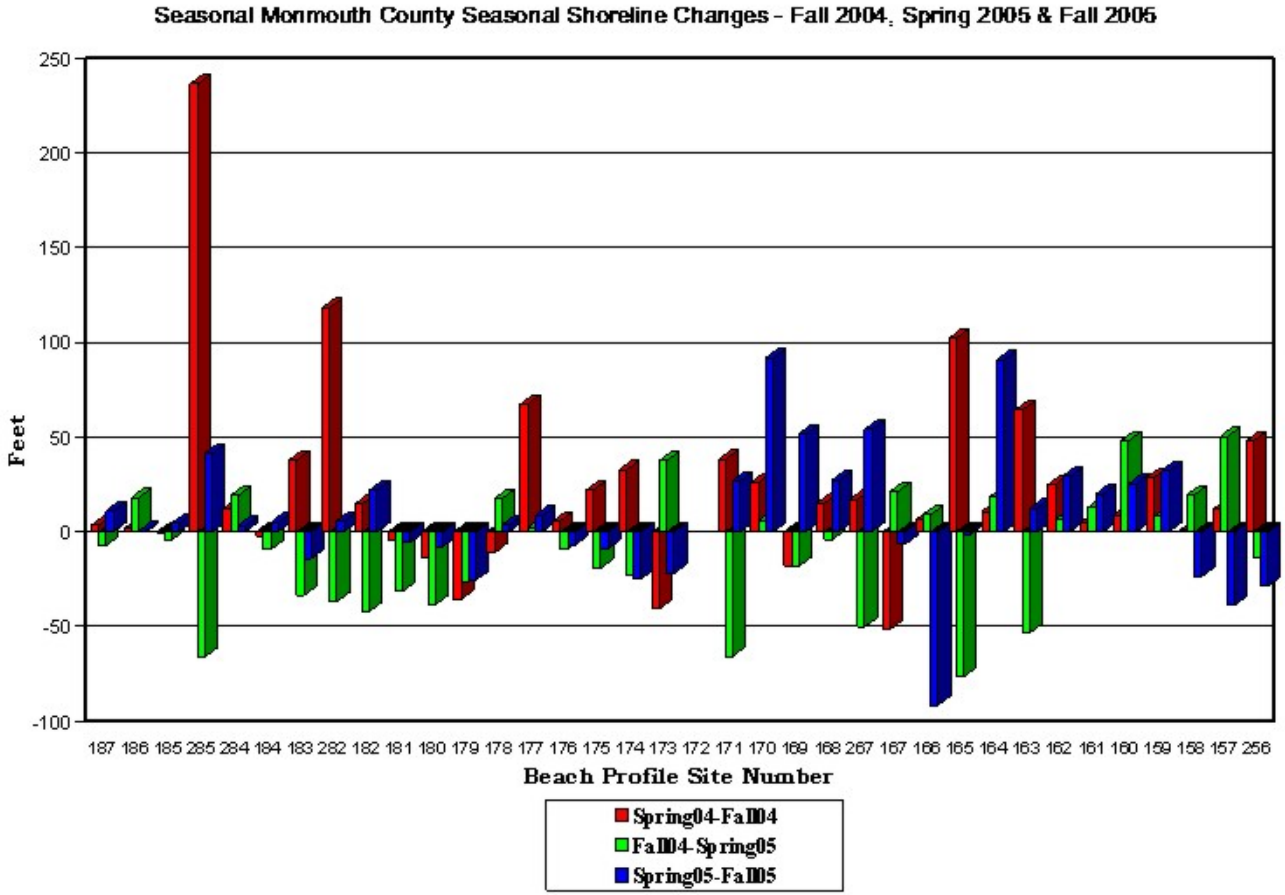


Figure 5d. The shoreline data follows seasonal patterns with retreat during the winter and an advance during each spring. The Gunnison shoreline advance accompanies the spring 2004 volume gain. More shoreline advances were observed south of #171 at Pullman Avenue Elberon.

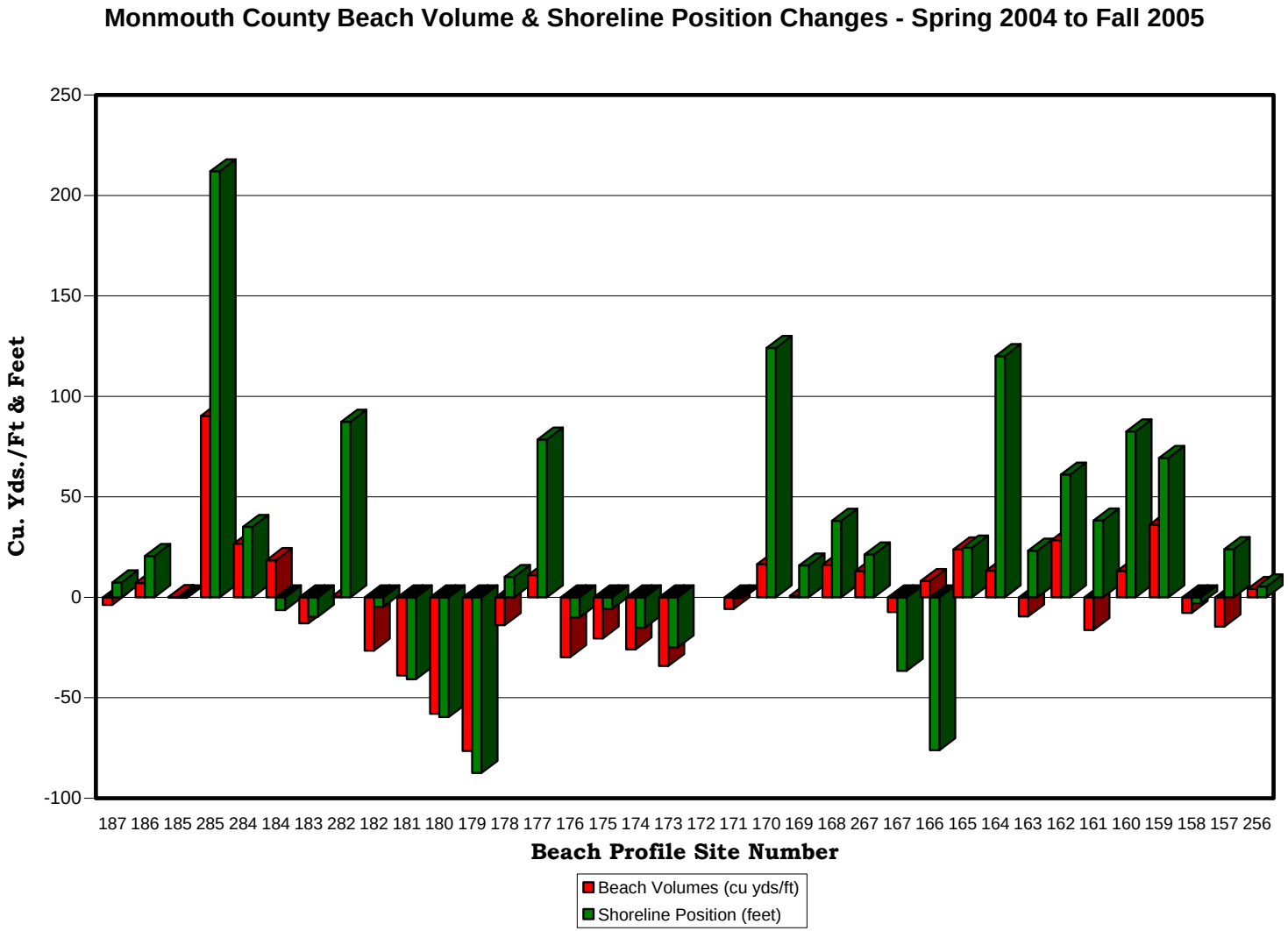


Figure 5e. The entire study interval of 18 months demonstrated modest loss or gain at all but the three "hot zone" sites at Monmouth Beach, which progressively increased losses south to Cottage Road in Monmouth Beach. Sand Hook's Gunnison Beach site bucked the trend with large gains.

SUMMARY OF INDIVIDUAL SURVEY STATIONS LOCATED IN MONMOUTH COUNTY

- **Profile #187 - Beach Park, Cliffwood Beach** (fig. 6)

The Cliffwood Beach Park profile begins on the landward side of Lenox Road, includes the curbs and street and continues over the reconstructed dune, across the beach and into the water over 500 feet from the shoreline. Dune grass has propagated and spread to cover most of the dune between the landward and seaward toe. Bayberry, beach plum and sumac have appeared on the landward slope spreading onto the primary dune crest and appear to be flourishing, limiting the dune grass coverage on the slope. A foredune ridge has developed seaward of the original dune created when the park was completed, but was impacted by erosion during the fall of 2005. Wave activity is normally limited to relatively severe events when northeast and northwest wind directions can generate waves across the local fetch available across Raritan Bay.

Some sand was blown into the trough between the foredune crest and the primary dune as the waves cut a scarp and caused a 10 to 12-foot retreat at the dune toe. There were two back-to-back northeast storms in October 2005, which may have produced this scarp. This erosion is seen at the Port Monmouth site (#185) as well. There was no change offshore beyond a 2-foot water depth. The past 18 months have produced a minor loss of 3.76 yds^3/ft. and a 7.4-foot shoreline advance.

- **Profile #186 - Union Avenue, Union Beach** (fig. 7)

At this site a PK nail along the centerline of Union Avenue is the current reference position, replacing the original reference disk located on a curbside utility pole destroyed when the pole was replaced during local improvement projects. The profile includes the curb, bayside parking lot, asphalt walkway and wooden bulkhead all constructed during the same improvement projects. This site originally consisted of a sandy beach that sloped gently from the sidewalk to the water lacking any dune system or hard structure for storm protection. Instead, today the hard structures provide adequate shore protection for the shore front property and infrastructure that occupy the area where dunes would naturally occur if the beach were free from development. The profile continues seaward from the base of the bulkhead across an apron of rock riprap that covers most of what little sandy beach remains, partially exposed at low tide.

Between the rock apron toe and the low water edge is a narrow 20-foot wide swash zone with another 20 feet of the beachface toe below the datum extending the slope to the seafloor where only very minor changes ever occur. This bay shoreline is also located in a low energy wave environment that only faces northeast. A tiny volume of sand (7.15 yds^3/ft.) appeared on the upper beachface during the winter of 2005. No change was observed offshore.

- **Profile #185 - Spy House, Port Monmouth** (fig. 8)

Profile #185 begins on the seaward side of Port Monmouth Road in front of the Spy House Museum at Bayshore Waterfront Park. The profile includes the park's grass yard and parking lot, continuing to the seaward dune crest where a relatively steep slope in the bluff and dune plunges 8 feet to the beach below. Dune grass has been largely replaced by other native species as ground cover on the seaward crest and along a portion of the upper seaward slope. From the dune toe, a narrow beach approximately 80 feet in width, at low tide, slopes towards the water's edge. The seafloor is flat from the beachface toe continuing out over 1000 feet to the limit of the survey. The seaward dune slope has experienced periodic episodes of erosion and retreat during the past 20 years. Beach losses and shoreline retreat are associated with these events. This erosion has been directly related to northeast storm wave activity due to this site shoreline orientation toward the northeast. This process repeated again as shown by the Nov. 29, 2005 survey. The dune was cut back by 7 feet, the upper beach reduced in elevation with a tiny deposit left on the lower beach. The pair of October 2005 northeast storms was the most likely candidate for this renewed

erosion. The volume loss was 4.47 yds^3/ft., four times that seen the prior two surveys. No change was observed offshore.

- **Profile #285 – Gunnison Beach, Sandy Hook, Monmouth County** (fig. 9)

This profile begins on the landward side of Atlantic Avenue, includes the sidewalk and promenade where comfort stations and gazebos are located. The profile continues across the large primary dune over an expanding foredune and onto a wide flat low elevation beach that extends approximately 600 feet from the foredune toe across the beach, then slopes upward to the berm. From the berm ridge the profile continues seaward changing dramatically as huge volumes of sand arrive from the south. The offshore portion frequently contains wide ridges close to the beach and even larger bars offshore. Beyond the bar the seafloor slope is steep dropping quickly to an elevation of –16 feet NGVD.

Due to the extreme width of this profile most of the stable primary dune has been omitted from the profile plot. The primary dune is 200 feet wide from landward toe to seaward toe with a crest elevation of about 15 feet NGVD. This dune is very stable with grasses and various native species providing ground cover. Large bayberry shrubs and other woody trees flourish along the primary crest and landward slope. A wide foredune field has accumulated seaward of the dune fencing installed approximately 200 feet seaward of the primary dune which is located on the plot about 700 feet seaward of the reference position. The upper beach upon, which this foredune developed, is relatively flat and stable despite a low elevation, 4 to 5 feet NGVD, it then rises steeply at the berm ridge to 8 feet NGVD.

From the berm seaward this site produces dramatic variations in nearshore and offshore bar bathymetry. This series of surveys starts with the berm located 1,500 feet from the reference position. During the summer and fall of 2004, 48.82 yds^3/ft. were added to the berm advancing the shoreline by 237 feet. Smaller volumes of sand were added each of the next two surveys leading to an 18-month total of 90.36 yds^3/ft. The shoreline remained approximately where it advanced to in the summer of 2004. This advance is probably attributable to the 2002 ACOE beach maintenance cycle that added sand near the end of the seawall and onto the southern part of the National Seashore beaches.

- **Profile #284 – Parking Lot E, Sandy Hook, Monmouth County** (fig. 10)

Profile #284 begins in a dense shrub and wooded area of the back dune at a utility pole with a reference disk attached since removed when underground utilities were installed. The profile crosses through this back dune area, over the primary and foredune ridges onto a wide dry upper beach. From the berm ridge the beachface slopes steeply into several feet of water. The dune is well developed with a thickly vegetated back dune area composed of large bayberry trees and other woody plants indigenous of a maritime forest, indicative of an extended period of stability. From the primary dune crest seaward to the foredune crest dune grass and other native non-grass species (i.e. Seaside Goldenrod, Poison Ivy, etc) combine to form abundant ground cover, which adds stability to this more recent accumulation. Sporadic dune grass rhizomes with a few early colonizing plants (i.e. Sea Rocket) inhabit the seaward foredune slope.

The spring 2004 beach was the narrowest of the series. Sand accumulated during both the winter 2004 and the spring 2005 surveys. The beach accumulated about 34 yds^3/ft. during the year. The summer of 2005 saw minor loss of about a third of the new sand. A berm was accumulating on the beach at the time of the November 2005 survey. The October northeast storms may have been the cause of the erosion seen, with the new berm part of the post-storm recovery.

- **Profile #184 – Highlands Beach, Sandy Hook, Monmouth County** (fig. 11)

This profile begins on the landward side of Hartshorne Drive, it includes the curbs and grass lot seaward of the road. The profile continues over the large rock seawall to reach the beach.

The location is the northernmost NJBPN site that actually received fill from the initial N.Y.C.O.E. Monmouth County beach nourishment project, completed here in the summer of 1996. There has been no effort made to establish a dune here. The seawall appears to occupy the natural dune location since sand accumulation along the rocks by aeolian accretion is actively colonized by dune grass and other early colonizing plant species. The first three cross sections indicate that little change took place between March 2004 and April 2005. The November 2005 cross section shows a marked removal of sand from the upper beach (storm activity amounting to –10.70 yds^3/ft.), but recovery since the storm events had rebuilt a berm (5.56 yds^3/ft.) from material deposited offshore (15.41 yds^3/ft.). The net change was a gain of 6.66 yds^3/ft. for the survey.

- **Profile #183 – Via Ripa Street, Sea Bright, Monmouth County** (fig. 12)

Profile #183 starts along the seaward side of Route 36. It includes an open lot seaward of Route 36 and the large seawall described above. A narrow swale formed between the seawall and a dune that formed around installed fences and dune grass plants. A 150-foot wide dry beach extends seaward from the dune toe to the berm ridge. The relative stability of this beach continued through the June 2005 survey. Loss following October northeast storms cut back to the dune, with a berm developing seaward as a month's recovery was restoring sand moved offshore by the storm events. The net change was a 12.97 yds^3/ft. loss and a 9.7-foot shoreline retreat.

- **Profile #282 – Shrewsbury Way, Sea Bright, Monmouth County** (fig. 13)

This profile starts along the landward side of Route 36 and includes the road, curbs and an open lot between Route 36 and the seawall. A small swale separates the dune from the seaward seawall toe. The primary dune has remained relatively stable since its formation shortly after the project's completion. Abundant dune grass mixed with a variety of other native non-grass plants (i.e. Seaside Goldenrod) has propagated providing ground cover that further stabilized this feature. A foredune ridge developed between November 1999 and May 2000, and continued to grow slowly in subsequent surveys. Dune grass rhizomes and early colonizing plants have spread seaward across much of the upper beach enhancing this foredune development. Limited use of this beach by the general public for recreational use and the lack of associated beach maintenance raking operations further promotes this spread of plants across the dry beach.

The same loss of beach width occurred prior to the October 2005 survey (the storms occurred October 14th and 16th) and produced a loss on the beach of 23.09 yds^3/ft. Offshore deposition put 13.40 yds^3/ft. and the survey captured a cross section of a large bar migrating onto the shoreline. This post-storm recovery is dramatic and evidence that even mild storms can produce a significant impact.

- **Profile #182 – Public Beach Lot, Sea Bright, Monmouth County** (fig. 14)

This site is located at the public beach just north of the Rumson Road (Route 520) and Route 36 intersection. The profile includes the public parking lot and seawall then continues seaward across a small dune onto a wide-open beach. Aeolian deposition collected around fencing installed near the seawall to form a small dune. Sand accumulation has been limited by the dunes' location near the seawall. At this site the seawall is offset landward by a westerly jog in the wall just a few hundred feet to the south. A few hundred feet to the north is a beach club with buildings occupying the footprint where dunes should be. The combination of these conditions creates a partially sheltered pocket beach where these structures limit effective aeolian sand transport to just an easterly wind direction.

Conditions remained reasonably constant until the October 2005 storm event when cross shore transport took 29.91 yds^3/ft. from the beach and deposited 23.12 yds^3/ft. offshore to the limit of the survey. This near balance between erosion and deposition proves that while the storm had impact, the material was carried only a short distance and placed where recovery would move it back to the beach. The bar near the zero elevation position is evidence of this process.

- **Profile #181 – Municipal Lot, Sea Bright, Monmouth County** (fig. 15)

Profile #181 includes the municipal parking lot, the boardwalk access ramp and promenade, which extend over the parking lot's bulkhead position. A small aeolian deposit accumulated along the seaward base of the bulkhead from sand blown across the wide swale that extends approximately 90 feet from the bulkhead to the landward toe of the primary dune. This dune was established after the initial beach project was completed and continued to accumulate sand each season, developing into three small but distinct ridge crests that eventually blended into one larger continuous feature by November 2002. Dune grass and a few other non-grass species have colonized the dune system providing ground cover and stabilization but no rhizomes or pioneer plants extend seaward of the seaward dune toe unlike the previous northern sites in this region.

The primary dune was reached in October as storm erosion reduced the beach elevation by 22.23 $yds^3/ft.$ with most of the lost sand deposited offshore. Since there was a short time between the storm and the survey, little recovery had occurred. A bar sits on the zero elevation line indicating that recovery was underway, but not complete. This site lost 38.90 $yds^3/ft.$ combined with a 41-foot shoreline retreat over the 18-month study.

- **Profile #180 – Sunset Court, Sea Bright, Monmouth County** (fig. 16)

The Sunset Court profile begins landward of the seawall and includes the road, concrete pad landward of the seawall and the seawall structure. At the seaward structure base a narrow swale separated the seawall and dune system. The dune was established after the initial beach project was completed with the installation of fences and planting of dune grass. Aeolian accretion occurred quickly around the fence installation rapidly forming a small dune. Dune grass along with some associated native plant species have propagated onto the upper beach resulting in additional sand collection and dune growth. The dune width as of December 2004 occupied a 60-foot wide footprint on the upper beach and extended 80 feet from the seawall to the seaward dune toe. The dune has not continued to grow seaward. The profile cross sections continued to show almost no change over almost 300 feet of upper beach until a pair of storms in October 2005 carved 30.98 $yds^3/ft.$ from the seaward 150 feet of the dry beach. The offshore deposit was 13.95 $yds^3/ft.$ and did not include all of the sand deposited beyond 15-foot water depths. The same characteristic hump of sand was positioned at the zero elevation line signifying recovery of sand following these two storms.

- **Profile #179 – Cottage Road, Monmouth Beach, Monmouth County** (fig. 17)

At Cottage Road the profile starts along the landward side of Route 36 and includes the road, curbs, sidewalk and seawall. The landward dune toe begins at the seaward base of the seawall and has grown seaward 80 feet with a continuing foredune accumulation. Dune grass propagation has developed a thick stand of grass over the region stabilizing the system and contributing to additional growth. A stable upper beach continues 40 feet seaward of the foredune toe.

The fall 2002 maintenance project added 203.93 yds^3/ft of sand to the profile, which extended the berm 250 feet and the shoreline position 240 feet. During the summer of 2003, 55.97 $yds^3/ft.$ in sand volume vanished. The following winter with another 26.37 $yds^3/ft.$ was lost. The summer of 2004 saw an additional 40.31 $yds^3/ft.$ taken (-122.99 $yds^3/ft.$ in the survey 26 to survey 29 comparison). The loss rate continued but at a low rate the winter of 2004 to 2005 (-4.30 $yds^3/ft.$), accelerating again to –34.16 $yds^3/ft.$ the next summer. The post construction losses total 161.11 $yds^3/ft.$ or 79% of the placement volume in late 2002. This site continues to be a place where erosion dominates. The October events took 33.06 $yds^3/ft.$ from the beach depositing some sand far offshore as a bar beyond the end of the survey. The photographs for #179 show the dramatic difference in this beach between the spring of 2003 and the fall of 2005.

- **Profile #178 – Monmouth Beach Club, Monmouth County** (fig. 18)

Profile #178 includes the municipal beach club parking lot and the club pavilion. The bulkhead and rock revetment structure was aligned along the seaward edge of the pavilion, which was buried by the dune here. Improvements to the beach club pavilion extended the width of the pavilion deck 20 feet seaward, covering a portion of the existing landward dune slope. The landward dune crest is less than 10 feet from the edge of the extended deck. Subsequent aeolian deposition along the dune toe raised the beach elevation 1 foot signaling a resumption of future growth. Dune grass propagation was limited here producing only modest ground cover and limited expansion onto the upper beach. Prolific seasonal recreational and associated maintenance activities also inhibit colonization and foredune expansion onto the upper beach.

This beach saw berm accretion during the early part of 2005 combined with sand transfer onto the beach from offshore. Here, the October storms took less sand off the beach with a bar deposited since the storms near the zero elevation line. The net change over 18 months was a loss of 13.85 yds^3/ft. with a shoreline advance of 10.1 feet.

- **Profile #177 – Ocean Avenue, Long Branch, Monmouth County** (fig. 19)

This site is now part of the Monmouth County park system known as Seven Presidents Park. Public access is good offering abundant space for recreational use. The profile starts on the landward side of Ocean Avenue and includes the curbs, road, sidewalk and concrete seawall. There has been no significant attempt to establish a dune system on the line at this site since completion of the A.C.O.E. nourishment project. In contrast, several hundred feet north and just to the south of this site dune establishment was successful. However, along the profile line and immediately adjacent the upper beach was relatively flat with only a small volume of sand accumulation ramped along the seaward base of the seawall. The remainder of the upper beach has been relatively stable for the first 200 feet seaward of the seawall providing abundant space for recreational use.

The 2004 profiles show seasonal variation between summer and winter profiles. The winter of 2004 – 2005 was fairly mild leading to the rapid development of a summer berm on the profile. By October 4, 2005 this berm had grown to large proportions containing 20.88 yds^3/ft. of additional sand by itself. Interestingly, 15.75 yds^3/ft. were transferred onto the beach from offshore yielding a net for the season of 4.95 yds^3/ft. gained. This was a classic example of cross-shore transport along the NJ shoreline.

- **Profile #176 – Seven Presidents Park, Monmouth County** (fig. 20)

This site was established near the main entrance to the park. The profile begins at the entrance to the beach and includes the road and an open sandy playground near the parking area. Since the site's establishment, a substantial dune has developed north and south of the profile line with abundant dune grass. However, this dune configuration is not represented in the cross section because the profile line is set between a playground and pump house that is effectively maintained clear of sand intrusion. The relatively small dune shown on the plot was formed by wind blown sand collecting along the chain link security fence around the pump station. This minor feature continues to accumulate a small volume of sand while scattered colonizing plants have begun to flourish. Unfortunately, the profile site selection pre-dated the dune development and to improve representation of the surrounding area would require moving the profile a hundred feet north or south.

The first 375 feet of the profile line shows almost no difference among the four surveys. Sand blown onto this flat part of the beach appears to pass through to the dunes. The beach accumulated a substantial berm by October 4, 2005, rising to +10-foot elevation as sand moved onto the beach from offshore. The net change was a loss of 29.81 yds^3/ft. with a shoreline retreat of 10 feet.

- **Profile #175 – Broadway Avenue, Long Branch, Monmouth County** (fig. 21)

At North Broadway Avenue the profile begins along the landward side of the promenade, it includes the promenade and bulkhead revetment. Wind blown sand continued to accumulate along the base of the bulkhead creating a ramp effect but no effort has been made to create a dune system. Dune grass propagation ends near the beginning of the promenade that begins several blocks north of this site at the southern limit of Seven Presidents Park. Here plants sparsely populate the beach, although there is a 100-foot wide stable upper beach upon which a dune system could be established. However, currently shore protection is limited to the promenade bulkhead revetment and the restored beach itself.

The beach reacted in a seasonal fashion with the October 2005 cross section showing the largest accumulation with a berm built to elevation +10.0 feet NGVD. Offshore sand moved onto the beach to create the berm. The beach gained 12.19 yds^3/ft. as the offshore lost 14.12 yds^3/ft. The shoreline remained nearly constant retreating only 6 feet.

- **Profile #174 – Morris Avenue, Long Branch, Monmouth County** (fig. 22)

Profile #174 starts along the west side of Ocean Avenue, includes the road, boardwalk, and rock seawall. During the summer of 1998, the Monmouth County beach nourishment project reached this location; the total placement volume was 217.7 yds^3/ft with an advance in the shoreline of 325 feet. A minor volume of sand collected on top of the rocks along the seaward base of the boardwalk and a larger volume accumulated along the seawall but no attempt at dune development has occurred since the project was finished. The upper beach is stable for 150 feet seaward of the seawall and should provide a sizable platform for dune growth but a significant recreational use and a lack of installed dune fence or dune grass hinders the formation of a dune. Unlike the Sea Bright and Monmouth Beach segments, the Long Branch beaches are open to the public with sufficient parking and abundant access points. Therefore, natural dune growth is hampered if not discouraged by beach maintenance practices.

Growth of a summer berm is ideally displayed using the June and October 2005 profiles. The spring 2005 shows the incipient berm at a low elevation and abundant sand offshore. By October, the berm had grown to an elevation of 8 feet as 25.14 yds^3/ft. moved onto the beach. This classic pattern was well documented along the Long Branch shoreline because the fall 2005 surveys were conducted prior to the mid-October northeast storms. This impact was shown along the Sea Bright shoreline because the surveys followed the storms by over a week. This feature at this site was most likely subject to considerable erosion by the storm events as well.

- **Profile #173 – West End Avenue, Long Branch, Monmouth County** (fig. 23)

The West End Avenue profile begins west of the asphalt promenade, includes the boardwalk, grass covered bluff and rock seawall. No dune development was attempted here since the project was completed. However, shore protection is adequate with the presence of the seawall and natural bluff that brings the boardwalk elevation overlooking this beach to an elevation of nearly 32 feet NGVD. The beach is heavily used for recreation with easy access and street parking allowed. This site is several blocks north of Lake Takananssee where the beach nourishment project work terminated.

Beach changes in 2004 were fairly small, but in 2005 the summer berm grew to considerable size similar to the other Long Branch sites. The transfer of sand from offshore was dramatic with 30.01 yds^3/ft. moved landward, but only 11.08 yds^3/ft. made up the berm by October 2005. The remainder most likely moved south into the area south of the ACOE project completed due to real estate issues preventing filling the Elberon to Allenhurst reach. These end effect losses have plagued this project's southern Long Branch beaches and resulted in project planning for a re-nourishment in the fall of 2006.

- **Profile #172 – Brighton Avenue, Long Branch, Monmouth County**

The site was abandoned in 1994 because of its proximity to Profile #173. During 2000, construction of a multi-unit-housing complex effectively eliminated the site.

- **Profile #171 – Pullman Avenue, Elberon, Monmouth County** (fig. 24)

At Pullman Avenue the profile starts along the north side of the street end and includes the street end, curb and large bluff. The bluff was reconstructed and dune grass planted on the seaward slope to stabilize the feature, after being severely eroded during northeast storm events in the early 1990's. Dune grass propagation has produced a relatively stable slope and rhizomes have spread from the toe towards the bulkhead and rock revetment that is the primary shore protection structure here. No stable dry beach has existed seaward of this revetment since the inception of the NJBPN program. This trend continued through June 2000 when the waves at low tide still reached the rocks. By November 2000, a large wedge of sand moved onshore to form the largest documented beach here since 1986. This deposit of sand eroded rapidly and by June 2001 the dry beach was gone. A smaller volume of sand migrated onshore during the summer of 2001 forming a small beach at the toe of the revetment during the November 2001 survey. However, this accumulation was also temporary and by May 2002 the site was devoid of any dry beach area along the seaward toe of the revetment. This beach configuration continued through September 2002. The base of the rocks was at the zero datum in both the June and November 2003 surveys. Bars were present offshore, but not in substantial volume. By June 2004 a wedge of sand had appeared on the rocks with a uniform slope seaward. This accretion continued through to November 2004 yielding a hundred feet of sand beach between the rocks and the zero datum.

By May 2005 the toe of the rocks was again at the zero elevation and no beach existed at the profile line. Sand migrated onto the shoreline from offshore recreating a dry beach with a 30-foot width. This configuration probably did not survive the winter storms and the cyclic nature of the deposition seaward of the rock-protected bluff here in Elberon will continue. Thus far no commitment has been made to complete this segment of the Monmouth County shoreline restoration. The net change over the past 18 months was a sand volume change of –5.86 yds^3/ft. and a shoreline change of –0.4 feet.

- **Profile #170 – Roosevelt Avenue, Deal, Monmouth County** (fig. 25)

The profile configuration at Roosevelt Avenue consists of a rock seawall that provides the only shore protection for the property landward of the wall. A well-manicured private lawn is landward of the seawall and extends for several hundred feet to the main residence. Since the establishment of this site, a lack of any dry beach area seaward of the wall has prevented any development of dunes.

The cross sections show that by October 2005 a dry beach had finally developed at this site. Natural processes deposited 29.97 yds3/ft. of sand during the summer with 13.32 yds^3/ft. transferred directly onshore from the offshore seafloor. The sand banked up to elevation +6.8 feet NGVD against the rocks and a bar was seen at the zero elevation moving even more sand onto the beach. The mid-October 2006 northeast storms most likely removed this deposit, but the presence of a dry beach helps make the case for some sand escaping from the south segment of the project as far as this site.

- **Profile #169 – Darlington Avenue, Deal, Monmouth County** (fig. 26)

Profile #169 begins at the seaward street end and includes the bluff. This site is somewhat unique because the uplands bluff is not completely armored with stone or wooden bulkheads common along the Elberon and Deal shoreline. However, wooden bulkheads have been installed in recent years to stabilize the slope on adjacent private properties. There is no dune system

present along this shoreline; shore protection is reliant on the rocks, bulkheads and the bluff itself.

A narrow dry beach has been present at the base of the bluff since the site was established and varies in width seasonally. Once again the fall 2005 cross section displayed the widest and highest beach of the series, with the sand derived from on-shore migration of sand between 400 and 700 feet from the reference. The 18-month sand volume change was only 0.70 yds^3/ft., which counters the idea of sand moving north from Asbury Park.

- **Profile #168 – Corlies Avenue, Allenhurst, Monmouth County** (fig. 27)

The Allenhurst beach extends approximately two thousand feet south from Deal to its southern border with Loch Arbour (the smallest beach community in New Jersey located north of the Deal Lake spillway flume and south of Allenhurst). The site is located just west of the top of the vertical concrete seawall protecting the bluff in Allenhurst. This beach is held in place by a large L-shaped groin positioned at the northern boundary with Deal. The groin forms a pocket beach that provides an area for recreational use but the beach width tapers towards the south. The profile is located just south of the end of the L-shaped groin extension but north of a smaller timber/rubble groin seaward of the pool club. At this site a concrete seawall armors the bluff with a boardwalk on the landward side and a dry sand beach seaward of the wall. There is no dune present along this section of beach. Therefore, storm protection for public infrastructure and private property is reliant upon the seawall.

Allenhurst/Loch Arbour did not receive any ACOE beach nourishment. Until 2005, there has been no real trend of accretion due to sand bypassing the terminal groin in Asbury Park. However, sand was coming around the groin because it has become necessary to extend the Deal Lake exit flume. The beach along this short shoreline segment varies with seasons gaining a berm as offshore bars migrate toward the beach providing the sand to the beach. There has been continuing evidence that sand is arriving on the Allenhurst beach (18-month gain of 16.27 yds^3/ft.), but the groin is effectively protecting the Asbury Park beach from eroding and moving north into Allenhurst and Deal.

- **Profile #267 – Seventh Avenue, Asbury Park, Monmouth County** (fig. 28)

The profile consists of a boardwalk established on a low grassy bluff. Initial beach nourishment was completed here between April 1999 and November 1999 adding 174.34 yds^3/ft of sand, which significantly expanded the beach width. Despite the enhanced beach conditions no effort was made by the city to establish a dune system through fence installation or dune grass planting. Aeolian transport moved some sand from the berm up onto the dry upper beach, which accumulated along the base of the boardwalk, increasing the beach elevation seaward of the boardwalk by over one foot, which slowly continues. This natural aeolian accretion along the boardwalk indicates that dune development would occur rapidly if fences were installed. In the absence of dune development the beach provides the only storm protection for the boardwalk, public infrastructure and property landward of the boardwalk. Although the beach does provide ample area for recreational use and is easily accessed by the general public a significant storm surge would allow storm waves to impact the boardwalk, resulting in potential infrastructure damage, property loss and street flooding. Generally, south of Allenhurst, Monmouth County beaches are open to the public. Beach access and parking is readily available in most towns, all of which supports a lucrative tourist industry, unlike many towns in central Monmouth County where beach access is limited and parking is restricted.

The upper beach has not changed much since the ACOE project was completed. Sand has blown landward, but not formed any wind-generated features. The berm varies with the season and since the fall 2005 survey followed the October northeast storms, the erosional scallop cut from the berm shows a sudden break in slope landward of the other three positions. Recovery had

built a low elevation berm in the time since the storms. The 18-month change in beach volume was –7.36 yds^3/ft. with a 21-foot shoreline advance seaward.

- **Profile #167 – Third Avenue, Asbury Park, Monmouth County** (fig. 29)

As seen at the previous site there was no dune development or effort to establish a dune on the Third Avenue beach in Asbury Park during this study interval. The NY District ACOE project was completed at this site prior to the October 1999 survey. The project placed 165.36 yds^3/ft creating a 145-foot wide berm at an elevation of 10.2 feet NGVD 29.

Sand has been transferred landward toward the boardwalk over the past 18-months, raising the elevation by a couple of feet close to the boardwalk. The City built a handicapped access ramp from the boardwalk to the beach that lies across the cross section line. Since that construction, sand has blown into the ramp partially filling in the lower section. The October 2005 storm scallop from the berm shows in the plots. The sand volume removed was 10.04 yds^3/ft. The net change was 0.58 yds^3/ft. between the reference and 880 feet offshore. This indicates a near perfect equilibrium between berm erosion and offshore deposition. The 18-month net change was a loss of 7.36 yds^3/ft.

- **Profile #166 – Ocean Pathway, Ocean Grove, Monmouth County** (fig. 30)

The cross section aligns with Pilgrim Pathway and crosses the floor of an open gazebo onto the beach. In contrast to Asbury Park, Ocean Grove has made substantial efforts to establish a dune system along the restored beachfront. Consequently, a small dune developed as sand accumulated around installed fence and subsequently dune grass was planted to help stabilize the sand. These efforts have continued for several years and combined with colonization of additional plant species including Rogosa Rose and Seaside Goldenrod culminating in a modest dune 50 feet in width at the toe with a crest elevation of 19 feet NGVD. Growth continued during most of the time shown in this study. The upper dry beach did not change in elevation as sand crossed it to add to the dune. The berm remained in narrow limits until the pair of October northeast storms. The erosion cut the berm back to the 310-foot mark and created a deep gully at the low tide line. Recovery created a small berm at the 390-foot position, but sand was deposited offshore at the highest elevation in the four cross section series. The 18-month sand volume change was a gain of 8.10 yds^3/ft.

- **Profile #165 – McCabe Avenue, Bradley Beach, Monmouth County** (fig. 31)

This profile includes the road, sidewalk, open lot, promenade and bulkhead. The wooden bulkhead supporting the seaward side of the promenade also provides shore protection for public infrastructure and property landward. The beach nourishment project was completed prior to the December 1999 survey and added 199.03 yds^3/ft to the cross section, pushing the berm 300 feet seaward of the bulkhead. Just prior to the October 2000 survey, the municipality installed a new dune fence and between October 2000 and May 2001 wind transported sand accumulated around the fence to form a small dune approximately 25 feet wide, which was subsequently planted with dune grass. Subsequent surveys have followed the growth of this dune to a feature that is a foot higher than the promenade and is about 60 feet wide at the base as of November 2005.

Three of four surveys maintain very similar positions for the berm, bars and offshore region with the exception of the November 2005 berm position. This survey followed a pair of northeast storms in October and a cut in the berm position at the 200-foot position from the reference reflects the erosion from those storms. Over the next three weeks, a bar formed from the sand moved offshore and its position is shown on the plot as a ridge approaching the base of the beachface. The net gain from the storms within the area surveyed was 26.98 yds^3/ft. and represents the majority of the 23.83 yds^3/ft. gain for the 18-month interval represented by these surveys.

- **Profile #164 – Sylvania Avenue, Avon-By-The-Sea, Monmouth County** (fig. 32)

The Avon profile is located just north of the Shark River Inlet and includes the road, sidewalk, bulkhead and boardwalk. Public access to the beach is easy with abundant street parking and boardwalk stairways. A lack of any natural dune development and no effort to establish a dune by the municipality has continued since the ACOE project was completed. Natural development is inhibited by regular maintenance grading and raking from the berm to the seaward base of the boardwalk. Consequently, shore protection for the infrastructure and shorefront properties is dependent on the beach width and the presence of an old bulkhead 15 feet landward of the boardwalk. The addition of 132.32 yds^3/ft of sand to the beach during the initial beach nourishment project pushed the berm ridge 300 feet seaward of the boardwalk. Sand has ramped up to the boardwalk over time, but little elevation change has been observed on the dry upper beach surface.

The set of four surveys in Avon ended prior to the October 2005 northeast storms. This demonstrates the impact of an exceptional summer of beach and berm accretion when the September 2005 survey is compared to any of the other three. The berm was 1.5 feet higher and 30 feet seaward of any other survey in the group. Offshore, the seabed elevation was reduced by almost 4 feet. The June to September comparison data show that on the beach the berm accumulated 23.44 yds^3/ft. while offshore the loss amounted to 32.66 yds^3/ft. resulting in a net loss of 8.87 yds^3/ft. for this site that season. The 18-month change was a gain of 13.14 yds^3/ft. and a shoreline advance of 120 feet. This situation definitely changed in mid-October as the two northeast storms made their impact. Timing of the survey date for the fall of 2005 saw about half of the Monmouth County profiles surveyed prior to the pair of storms, the rest following them. Since they were the only storms of that fall season, the cross sections provide a graphic demonstration of how even relatively minor storms impact the "summer" beach.

- **Profile #163 – Fifth Avenue, Belmar, Monmouth County** (fig. 33)

This site is located just south of the Shark River Inlet jetties. The profile includes the boardwalk but because beach access steps were attached to the seaward edge of the boardwalk at the profile line, the steps cover the small dune that has accumulated along the seaward base of the boardwalk not illustrated by the cross-section. This dune feature is less than 10 feet in width with a maximum crest elevation flush with the boardwalk at 13 to 14 feet NGVD. Seaside Goldenrod and dune grass sparsely colonized the feature. Any storm protection provided by this feature would be minimal.

This site did not receive any direct volume of sand from the nourishment project that was completed in the region between Shark River Inlet and Manasquan Inlet prior to the November 1997 survey.

The upper beach has been remarkably stable for the initial 200 feet seaward of the boardwalk. The berm ridge has been very stable, changing by less than 25 feet every 6 months. Offshore the transfer of sand onto the beach by September 2005 produced a 2-foot increase in water depth. The net change over 18 months was a small loss of 9.57 yds^3/ft. with a 23-foot shoreline advance.

- **Profile #162 – Eighteenth Avenue, Belmar, Monmouth County** (fig. 34)

The profile includes the road and boardwalk but this line also occurs at a boardwalk beach access, which crosses over the small dune along the seaward base of the boardwalk north and south of the site. As described at the previous site this dune feature is also minimal, less than ten feet in width with the crest elevation flush with the boardwalk at 13 to 14 feet NGVD. This site is used by large numbers of patrons for recreational activities much of the year, which inhibits natural dune growth seaward of the fenced region with no significant effort by Belmar to enhance this small dune feature by adding additional fence seaward of the current location. The beach nourishment project was completed here prior to November 1997.

Sand has been transported onto and off of the dry beach seasonally. The September cross section has the highest and most seaward berm position of the 4 surveys presented. This is the result of large volumes of sand transferred landward by the summer wave climate working efficiently to benefit beach accretion during the summer of 2005. The net sand volume increase was 28.41 yds^3/ft. with a 61-foot shoreline advance.

- **Profile #161 – Brighton Avenue, Spring Lake, Monmouth County** (fig. 35)

Unlike the Belmar sites, this profile includes a dune located between Ocean Avenue and the landward side of the boardwalk. The feature pre-dates the beach nourishment project and is well established with flourishing vegetation that provides stability. With a crest elevation of 21 feet NGVD this dune provides substantial storm protection for property and public infrastructure landward of the boardwalk but does nothing to protect the boardwalk from wave assault. The initial nourishment project was completed here by November 1997 and stability seems to have followed initial sand redistribution. The upper beach at the base of the boardwalk has an elevation of about 13 feet NGVD and slopes gently seaward for 200 feet to the berm position.

The municipality conducted beach bulldozing to add winter shore protection between the October 2004 and June 2005 surveys. The spreading of this ridge seaward in the spring resulted in a lower back beach elevation for the next two surveys (30 and 31). Summer accretion generated a large berm crest at the 330-foot position by September 2005. This is very similar to other profiles surveyed prior to a pair of mid-October northeast storms. The net change over 18 months was a loss of 16.23 yds^3/ft. (mostly offshore) and a 38-foot shoreline advance.

- **Profile #160 – Salem Avenue, Spring Lake, Monmouth County** (fig. 36)

The Salem Avenue profile includes the road and the dune between the boardwalk and an open grass lot along Ocean Drive, which was established over 60 years ago. The dune is stabilized with dune grass, which has flourished as a thick ground cover on the landward slope and crest. Along the seaward slope, grass coverage is sparse and the sand is relatively unconsolidated. A deposit of wind blown sand accumulates on both sides of the boardwalk and on the dune's seaward slope.

2005 saw considerable berm development and an 82-foot shoreline advance as sand moved onto this site. The dry beach elevation was reduced slightly between the boardwalk and the berm, but still remained at a 10-foot elevation. Little change occurred offshore as the entire cross section gained 13.10 yds^3/ft.

- **Profile #159 – New York Avenue, Sea Girt, Monmouth County** (fig. 37)

At New York Avenue the profile includes the sidewalk, road and street end parking along the west side of the boardwalk. A dune system is absent at this site despite the wide beach created by the beach nourishment project in 1997. Immediately south of the site a well-established dune has developed west of the boardwalk in front of the shorefront property but at the profile site and to the north, Ocean Avenue and street end parking occupy the location of the dune footprint. No attempt has been made to establish a dune seaward of the boardwalk. The beach is heavily used for recreational activity and is maintained as part of the municipal public beach system, consequently natural dune development is inhibited. Apparently Sea Girt pushed up a dune ridge to protect the boardwalk during the winter of 2003 – 2004 that was re-graded before the 2004 summer commenced. This site was surveyed immediately following two northeast storms that had significant impact on the accumulated "summer" beach profile configuration elsewhere along the NJ shoreline. Here the berm was cut back about 15 feet with a modest quantity of sand moved offshore as a deposit. In spite of the storms, the site gained 36.24 yds^3/ft. over the 18-month interval.

- **Profile #158 – Trenton Avenue, Sea Girt, Monmouth County** (fig. 38)

Profile line #158 is located between homes that were built near the landward toe of the natural dune. These property owners have nurtured a well-established dune crest with abundant and diversified plant species that help stabilize the feature. Accretion on the seaward slope has buried all but a few pilings of a bulkhead constructed for shore protection following bluff erosion during the December 1992 northeast storm, prior to the beach nourishment project. Sand has continued to accumulate along the seaward slope and toe between the boardwalk and buried bulkhead.

The berm and upper dry beach changed little if at all during 18 months, but at this site the northeast storm impact is more readily seen. The berm eroded back over 20 feet in a line parallel to the spring 2005 position. A trough was carved at the base of the beachface with sand deposited as a bar offshore. The net change was a loss of 19.61 yds^3/ft. for the 2005 summer season and a 7.82 yds^3/ft. loss for the 18-month study period.

- **Profile #157 – Riddle Way, Manasquan, Monmouth County** (fig. 39)

The Riddle way profile includes the asphalt promenade and small dune, established by the Borough of Manasquan prior to the beach nourishment project. The dune feature is approximately 60 feet wide at the toe and accumulated a small volume of sand along the seaward slope during the report period. Dune grass mixed with seaside goldenrod produce a modest ground cover across most of this feature providing sand stabilization.

The upper beach changed incrementally, but the impact of the mid-October northeast storms was a substantial cut into the summer berm. This beach lost 24.92 yds^3/ft. but the offshore gained 35.11 yds^3/ft. deposited as a bar. The 18-month change was a loss of 14.58 yds^3/ft. and a 24-foot shoreline advance based on data taken just 3 days following the second northeaster.

- **Profile #256 – Pompano Avenue, Manasquan, Monmouth County** (fig. 40)

The profile at Pompano Avenue beach in Manasquan is located about a thousand feet north of the Manasquan Inlet jetty and is the last cross section in the county. This profile includes the road, a steeply sloped lot between beachfront homes, the asphalt promenade and a small dune established just seaward of the walkway. The homes and the promenade occupy the footprint of the pre-development dune system. The Manasquan portion of the Monmouth County beach nourishment project was completed between the spring and fall of 1997.

The Pompano Avenue cross section saw small volumes of sand added to the dune on its seaward slope. The beach decreased in elevation slightly, but the major change was the impact on the berm from the October storms. This beach lost 33.34 yds^3/ft., but the offshore only gained 16.63 yds^3/ft. There was a substantial bar built 900 feet from the reference point, but the balance likely went into the ebb-tidal shoals surrounding the Manasquan Inlet.

SUMMARY OF MONMOUTH COUNTY:

A Cretaceous and early Tertiary-aged sedimentary bluff lies under and landward of most of Monmouth County's beaches. This bluff rises to 35 feet above the ocean in Elberon and gradually drops in elevation until it reaches sea level at Manasquan. The bluff does not exist at the oceanfront very far south of Monmouth County. There is a geologically modern feature, which extends to the north from Long Branch/Monmouth Beach ending at the Sandy Hook spit enclosing part of Raritan Bay. This 16-mile long peninsula developed over hundreds of years as the bluff-front coastline eroded and retreated due to wave attack during storms. Proximity to Long Island, New York creates a wave shelter that prevents maximum development of northeast storm waves resulting in sediment transport to the north from the rest of Monmouth County's

shoreline. This transport direction can vary with the winds over short periods of time, but in the long term the movement is from south to north ending at Sandy Hook.

Development commenced in earnest along the Monmouth County shoreline by 1870 with the construction of the New York and Long Branch Railroad. This access allowed tourism to develop and eventually permitted commuting to the urban north by full-time residents. The early tourist hotels built in Long Branch, Asbury Park, Ocean Grove and Spring Lake were set back from the edge of the bluff. The exact retreat rate of the bluff is unknown, but relatively soon, property owners were beginning to construct wooden walls at the base of the bluff, parallel to the shoreline and add timber groins on the beach perpendicular to the shoreline. Improvements in engineering design and better technology allowed more durable and larger projects to essentially armor the bluff shoreline with walls of concrete timber and rock. This essentially shut off the re-supply of beach sand because waves could no longer mine the bluff during storms.

The same effort was also applied to dividing the beach into cells separated by rock groins sometimes spaced under 700 feet apart. Groin design knew no limits during the 1960's and every Monmouth County shorefront municipality built at least one of these structures. Spaced frequently at every other street-end, the groins severely reduced the meager sand supply's ability to move in any direction except directly offshore during bigger storm events.

Little by little the Monmouth County beaches became very narrow with miles of shoreline without a sand beach of any kind. The ultimate armored shoreline was found in Sea Bright where a seawall was started by a railroad company to protect tracks laid parallel to the dunes at the end of the 19th Century. This wall had been rebuilt ever stronger during the 20th Century. Groins were also included about every quarter mile along the 12-mile shoreline. The only bathing beaches were found in tiny pockets tucked into the corner made by the seawall and one of the groins. This condition was found from Sandy Hook National Seashore south to Allenhurst.

The situation was slightly better from Asbury Park to the south, but storm damage to boardwalk and other public infrastructure was commonplace. The 1991 Halloween and 1992 December storms did substantial damage to the entire Monmouth County shoreline, piling the boardwalk into Ocean Avenue as splintered debris in Belmar, Avon-by-the-Sea, and Spring Lake. Damage to homes occurred in Manasquan as the ocean easily overtopped the beach and modest dune along that oceanfront. Even the Sea Bright seawall was not sufficient to prevent sand, debris and millions of tons of seawater from landing in Ocean Avenue.

By 1994 the State of New Jersey became serious about finding a solution to this shoreline loss and turned to a Federal project initially authorized in July of 1958 to undertake a Federal study to determine the best method of beach erosion control in Monmouth County. This work, modified under the Federal Water Resources Development Acts of 1986, 1988 and 1992 progressed through the three Federal phases leading to construction. The Federal lead agency is the New York District of the US Army Corps of Engineers with the local sponsor as the New Jersey Department of Environmental Protection. The NY Corps District carried the project through the Reconnaissance phase into the jointly sponsored Feasibility phase that chose a design plan. The State spent years in negotiations with local municipalities along the Monmouth County coast to generate detailed plans and define local and State financial and governance responsibilities. Real estate issues and public access to the federally funded project where likewise long, tedious and frequently frustrating. Finally the Army Corps approved the Planning and Engineering Design for construction and Congress authorized the funding to start construction of the nation's largest beach restoration project ever attempted.

The project consists of 21 miles of shoreline from the Township of Sea Bright to the Manasquan Inlet in Monmouth County, New Jersey. The protection is provided by the construction of a 100-foot wide beach berm at an elevation of 10 feet above mean low water (MLW). The project also called for notching existing stone groins and extending storm water outfall pipelines. The project includes periodic nourishment of the restored beaches on a 6-year cycle for a period of 50 years from the start of the initial construction.

Construction commenced following the January 1994 award of the initial contract for Monmouth Beach. Over the next six years 24.9 million cubic yards of sand were pumped from about a mile offshore to the beach at a cost of $210,000,000. Beach nourishment efforts have provided a vast supply of new sediment to the beaches of 9 out of 12 oceanfront municipalities. The earliest sites with sand added have responded well, requiring little augmentation since the project started. Some early maintenance work was done at Monmouth Beach due to sand losses when material migrated south toward Long Branch in 1997. General maintenance was complete in 2002 placing under 70 yds^3/ft. at most sites. Over the past nine years, the extensive shoreline advances and large increases in sand volume have provided tremendous increases in shore protection, vastly increased ecologic habitat and new recreational opportunities to all municipalities involved.

Prior to the project, the Sea Bright coastline was a virtual disaster with little sand, waves at the rock seawall at low tide for 70% of the 8-mile shoreline distance, and almost no recreation use. Fishermen did use the seawall to surf cast into the sea, but no other normal beach activity was possible. Nourished in 1995 and touched up during late 1997 in Monmouth Beach, and maintained in 2002 the eight cross sections between the entrance to the Sandy Hook Park and the Long Branch border provide the data that show that the project has performed far better than all expectations. Critics labeled it a giant boondoggle and predicted total loss of the sand within a year or two. Nature assisted the success by not sending any intense storm to impact the project, but the average change in sand volume for the eight cross sections listed below show low rates of sand loss. The numbers are expressed in cubic yards of sand per foot of shoreline, and then multiplied by the number of feet in eight miles for each survey.

+ 0.19 yds^3/ft	times 8 miles =	3,801.6	cy	Fall	1998
+ 0.02 yds^3/ft	times 8 miles =	844.8	cy	Spring	1999
– 3.05 yds^3/ft	times 8 miles =	-128,832.0	cy	Fall	1999
- 5.59 yds^3/ft	times 8 miles =	-236,121.6	cy	Spring	2000
- 3.28 yds^3/ft	times 8 miles =	-138,547.2	cy	Fall	2000
– 3.96 yds^3/ft	times 8 miles =	-167,270.4	cy	Spring	2001
- 5.51 yds^3/ft	times 8 miles =	-232,742.4	cy	Fall	2001
- 0.14 yds^3/ft	times 8 miles =	-5,913.6	cy	Spring	2002
+69.43 yds^3/ft	times 8 miles =	2,932,723.2	cy	Fall	2002
-13.51 yds^3/ft	times 8 miles =.	-570,662.4	cy	Spring	2003
-10.24 yds^3/ft	times 8 miles =	-432,537.6	cy	Fall	2003
- 5.16 yds^3/ft.	times 8 miles =	-217,958.4	cy	Spring	2004
-10.57 yds^3/ft	times 8 miles =.	-446,476.8	cy	Fall	2004
- 8.87 yds^3/ft.	times 8 miles =	-374,668.8	cy	Spring	2005
- 9.83 yds^3/ft.	times 8 miles =	-415,219.2	cy	Fall	2005

-2,457,522 cubic yards have been lost from the Sea Bright beaches since the fall of 2002, approximately the maintenance volume added at that time. These beaches lost only an average of 2.67 yds^3/ft. seasonally of their initial placement volumes for a net loss of 21.32 yds^3/ft from placement to the spring of 2002. Loss rates increased slightly following the maintenance fill in 2002, but averaged in the range of 5 to 10 cubic yards of sand lost per year per foot of shoreline for all eight profiles. The average loss rate from 1998 to 2005 (omitting the 2002 fill) was -5.638 yds^3/ft., converted to a loss in cubic yards across the 8 miles of shoreline; **the entire Sea Bright coast has lost 238,149 cy/year since 1998**. When the maintenance fill is included the Sea Bright shoreline lost 429,575 cubic yards since the project was completed 8 years ago (-53,697 cy/year). The placement volume was approximately 10,560,000 cubic yards, with 2,933,000 added in 2002. The Monmouth County beach restoration project has been one of the most successful ever attempted.

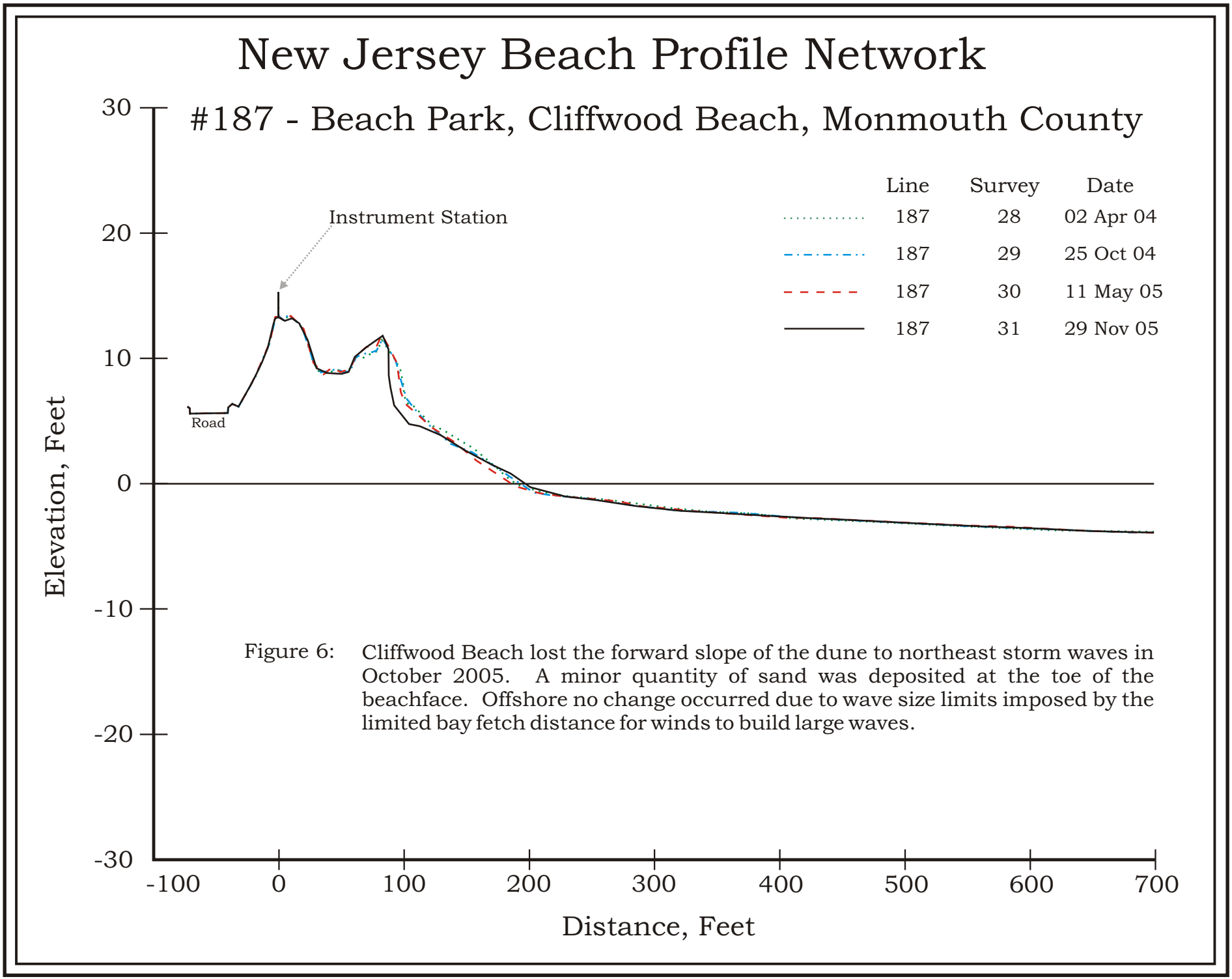


Figure 6: Cliffwood Beach lost the forward slope of the dune to northeast storm waves in October 2005. A minor quantity of sand was deposited at the toe of the beachface. Offshore no change occurred due to wave size limits imposed by the limited bay fetch distance for winds to build large waves.

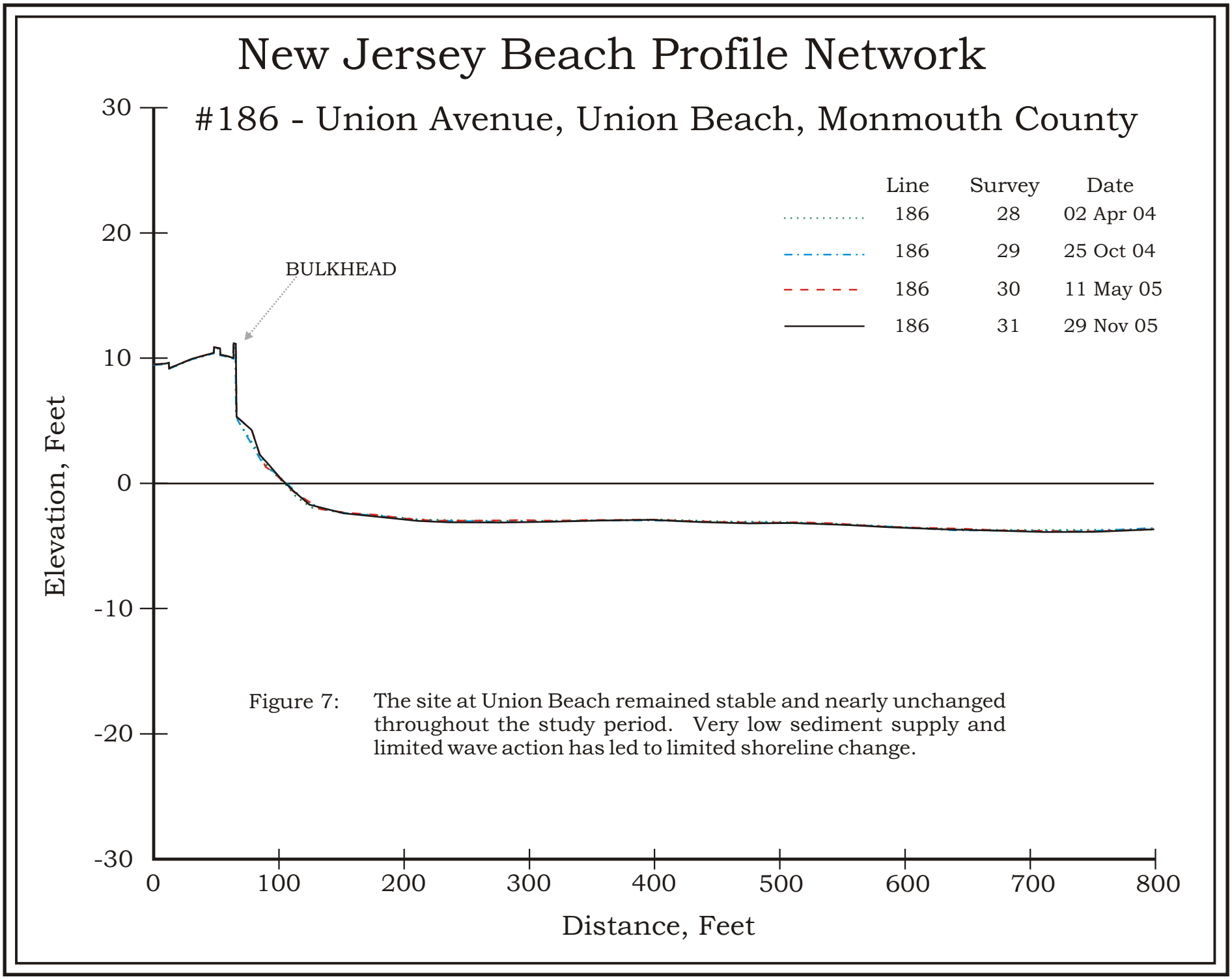


Figure 7: The site at Union Beach remained stable and nearly unchanged throughout the study period. Very low sediment supply and limited wave action has led to limited shoreline change.

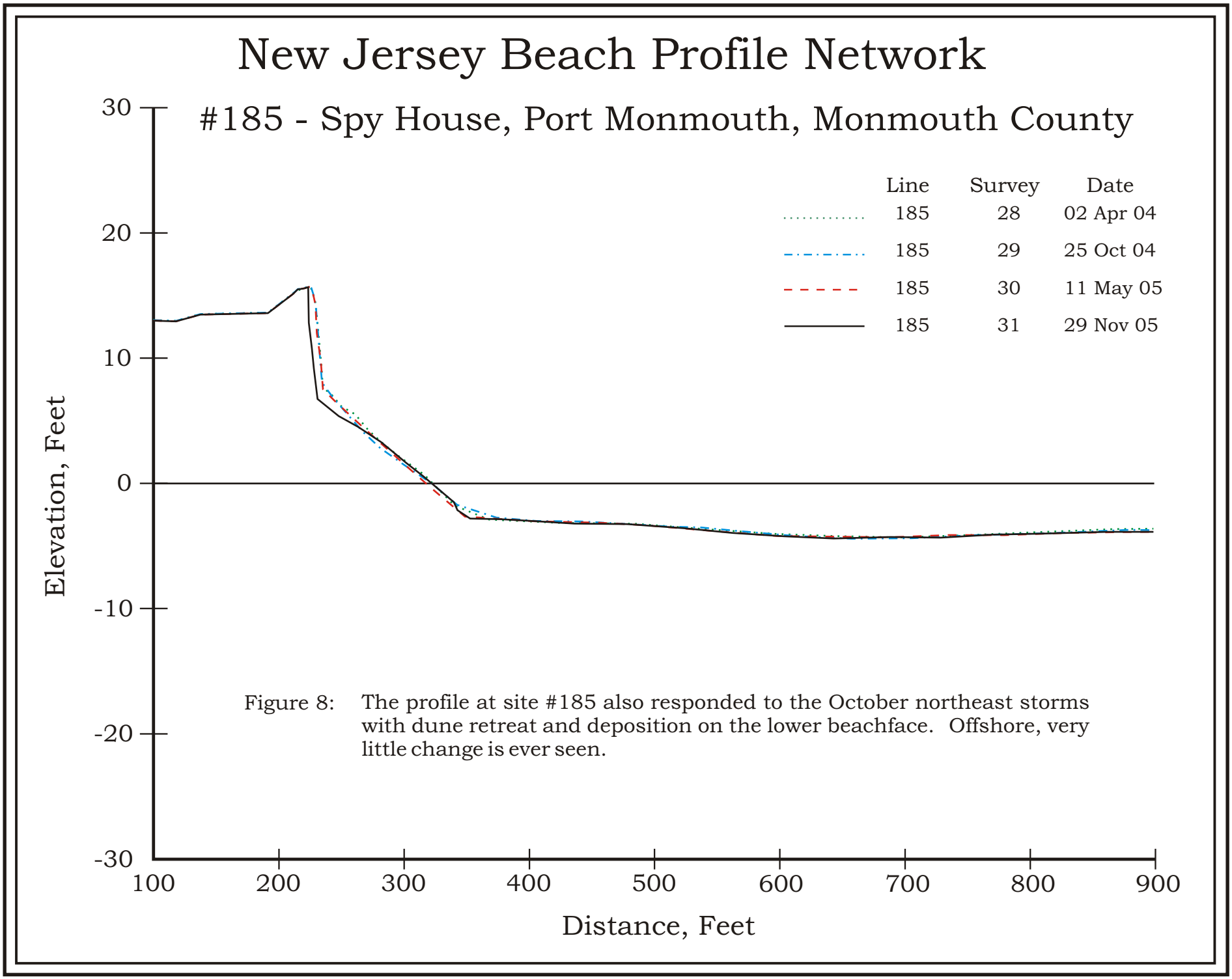


Figure 8: The profile at site #185 also responded to the October northeast storms with dune retreat and deposition on the lower beachface. Offshore, very little change is ever seen.

New Jersey Beach Profile Network

#285 - Gunnison Beach, Sandy Hook, Monmouth County

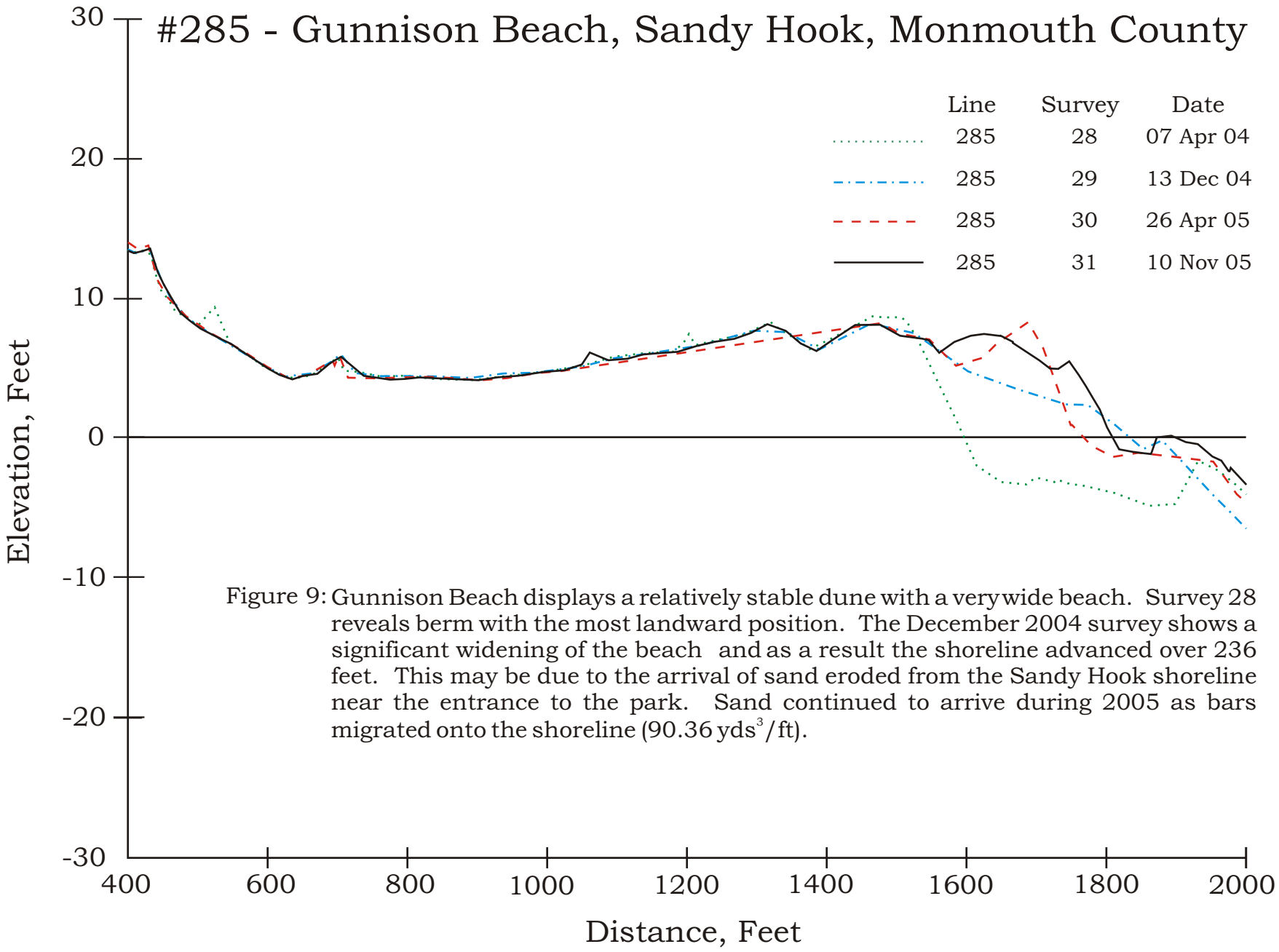


Figure 9: Gunnison Beach displays a relatively stable dune with a very wide beach. Survey 28 reveals berm with the most landward position. The December 2004 survey shows a significant widening of the beach and as a result the shoreline advanced over 236 feet. This may be due to the arrival of sand eroded from the Sandy Hook shoreline near the entrance to the park. Sand continued to arrive during 2005 as bars migrated onto the shoreline (90.36 yds^3/ft).

New Jersey Beach Profile Network

#284 - Parking Lot E, Sandy Hook, Monmouth County

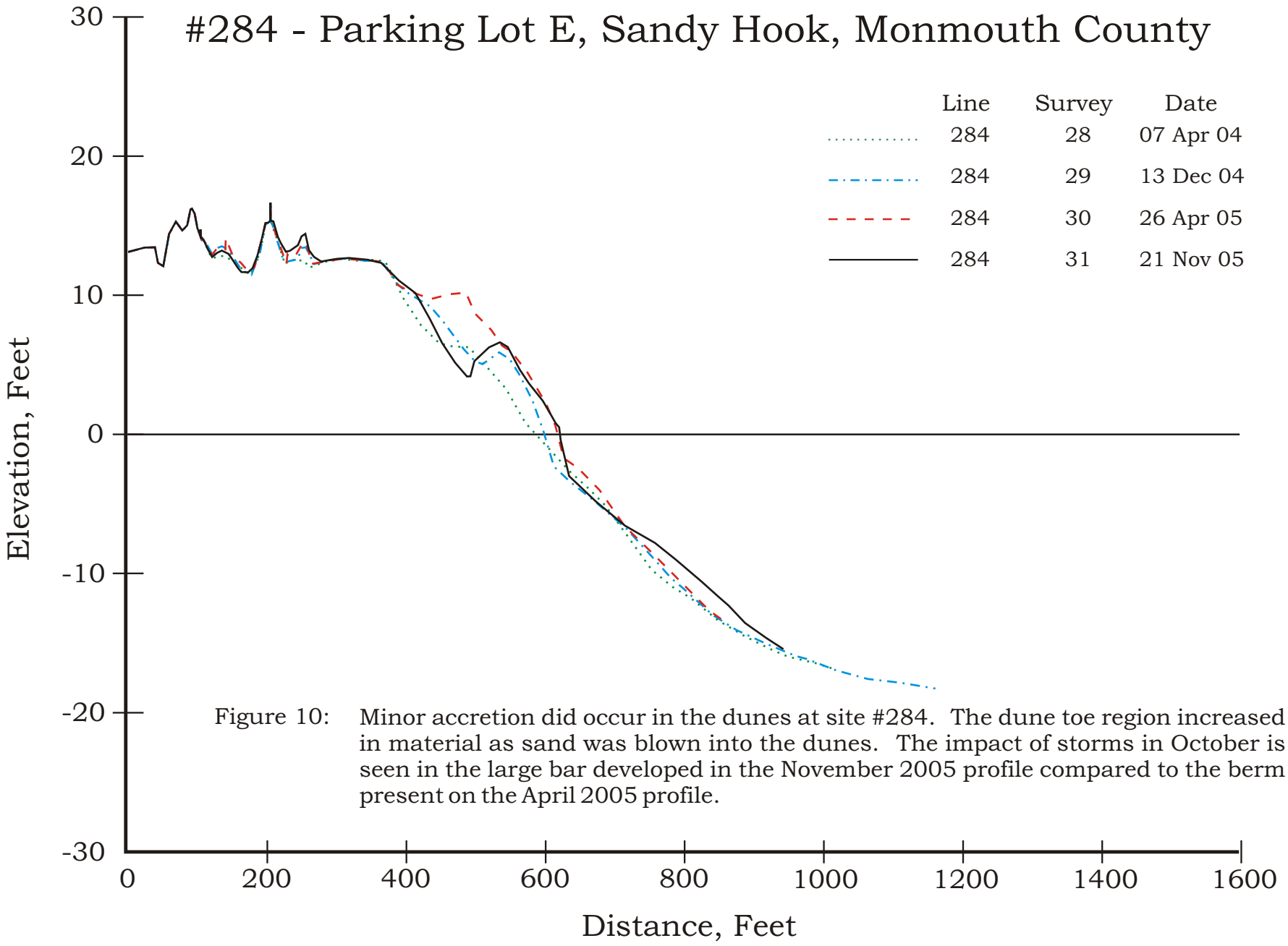


Figure 10: Minor accretion did occur in the dunes at site #284. The dune toe region increased in material as sand was blown into the dunes. The impact of storms in October is seen in the large bar developed in the November 2005 profile compared to the berm present on the April 2005 profile.

New Jersey Beach Profile Network

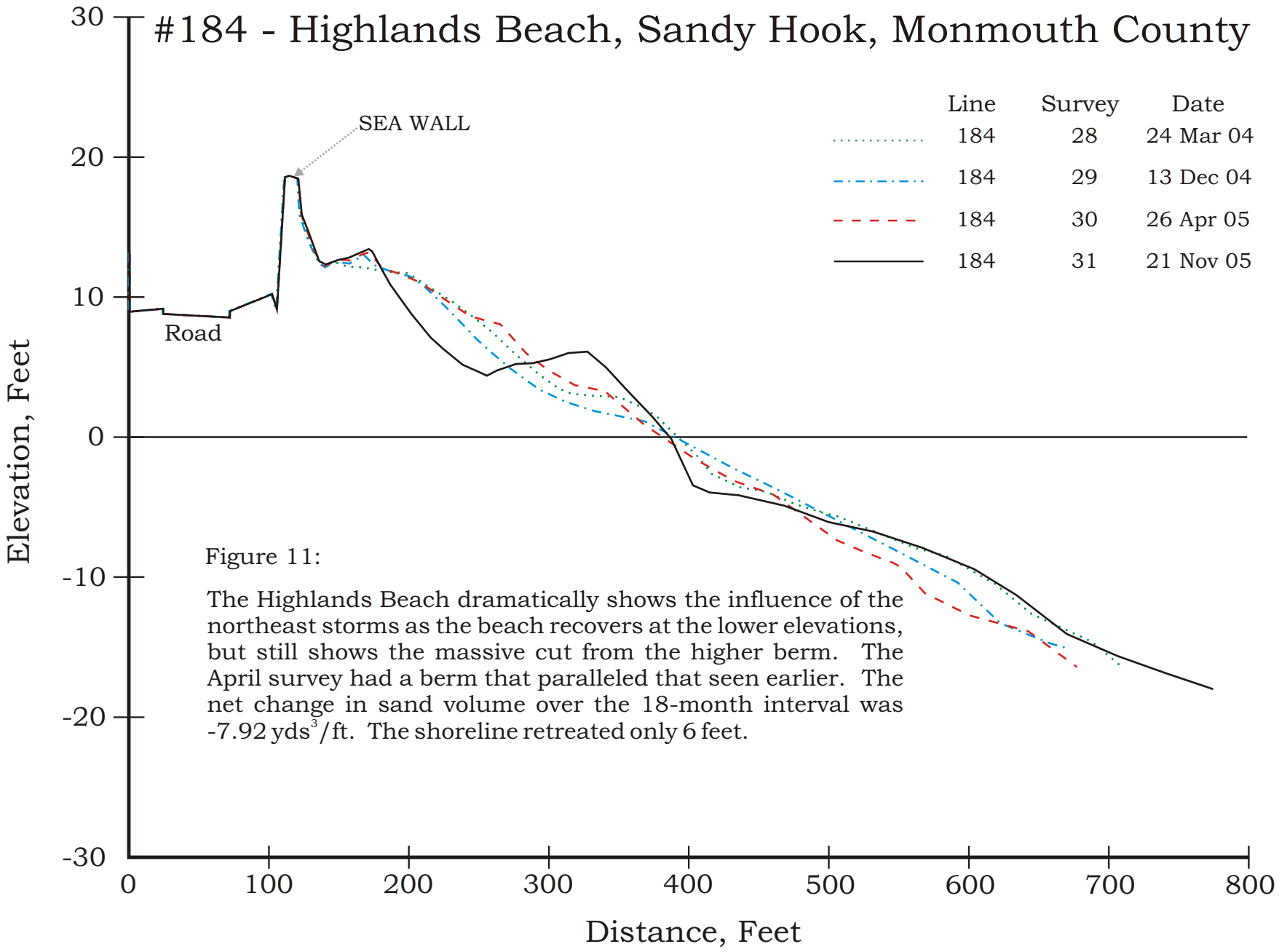


Figure 11:

The Highlands Beach dramatically shows the influence of the northeast storms as the beach recovers at the lower elevations, but still shows the massive cut from the higher berm. The April survey had a berm that paralleled that seen earlier. The net change in sand volume over the 18-month interval was -7.92 yds^3/ft. The shoreline retreated only 6 feet.

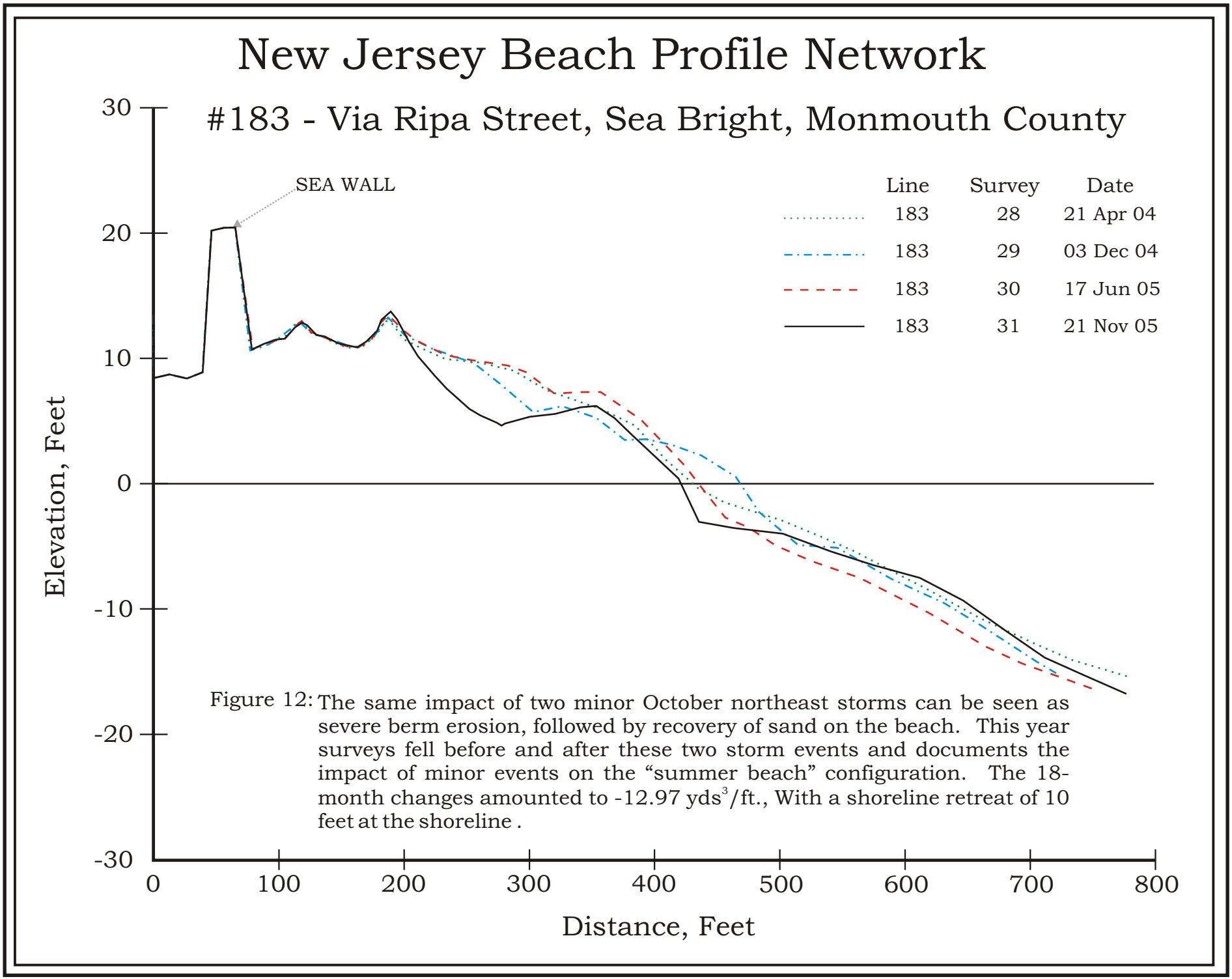


Figure 12: The same impact of two minor October northeast storms can be seen as severe berm erosion, followed by recovery of sand on the beach. This year surveys fell before and after these two storm events and documents the impact of minor events on the "summer beach" configuration. The 18-month changes amounted to -12.97 $yds^3/ft.$, With a shoreline retreat of 10 feet at the shoreline .

New Jersey Beach Profile Network

#282 -Shrewsbury Way, Sea Bright, Monmouth County

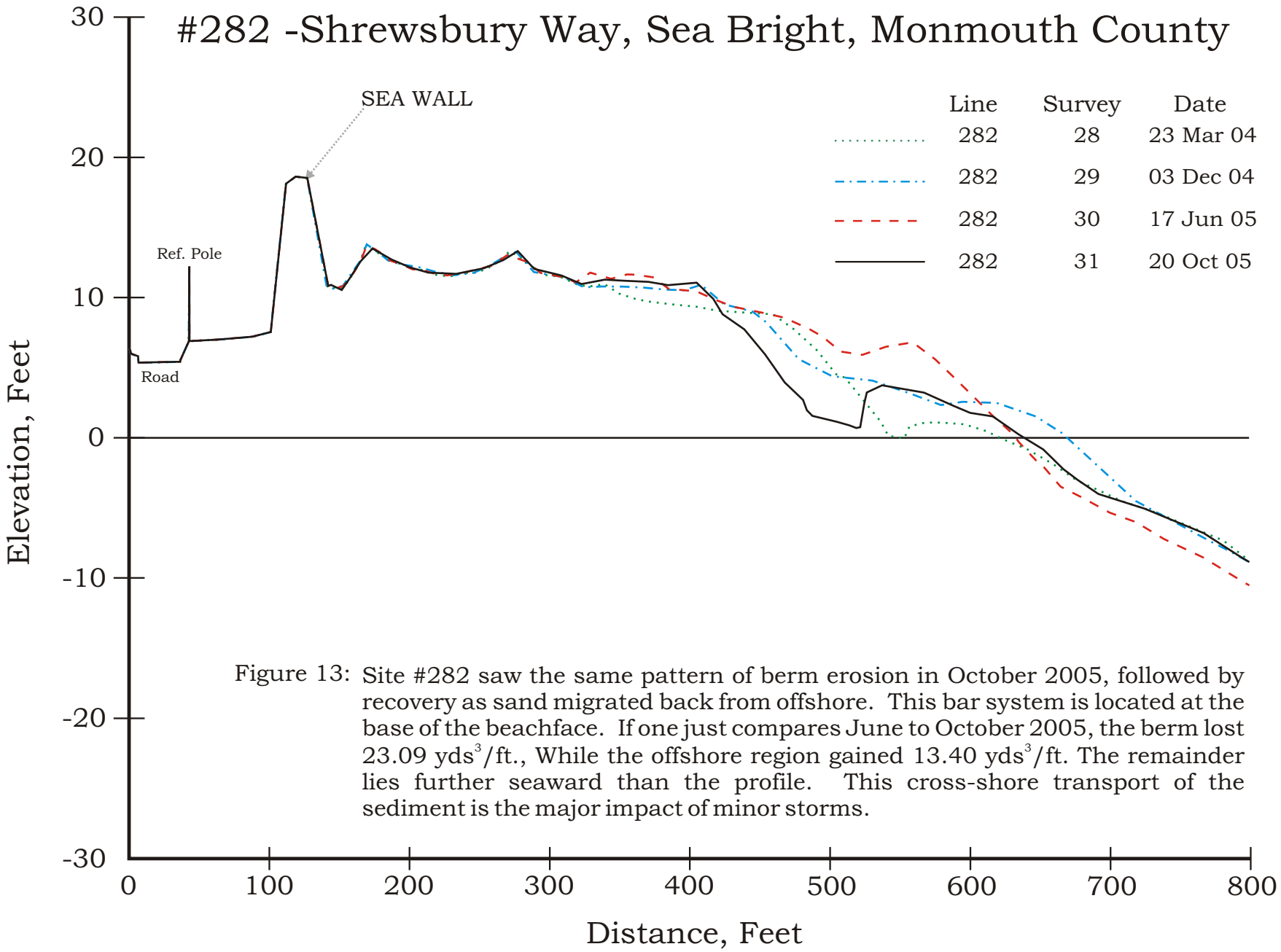


Figure 13: Site #282 saw the same pattern of berm erosion in October 2005, followed by recovery as sand migrated back from offshore. This bar system is located at the base of the beachface. If one just compares June to October 2005, the berm lost 23.09 $yds^3/ft.$, While the offshore region gained 13.40 $yds^3/ft.$ The remainder lies further seaward than the profile. This cross-shore transport of the sediment is the major impact of minor storms.

New Jersey Beach Profile Network

#182 - Public Beach Lot, Sea Bright, Monmouth County

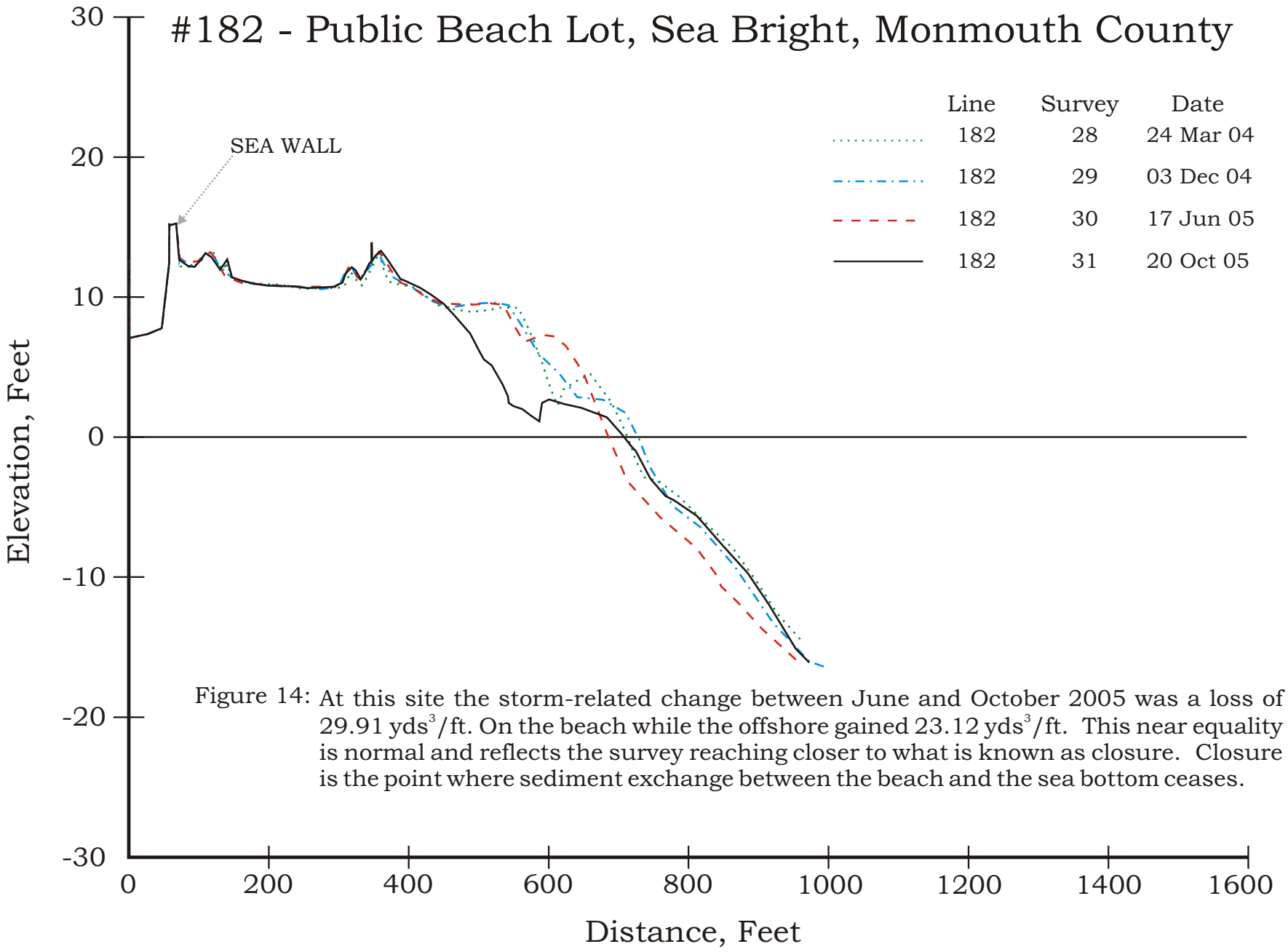


Figure 14: At this site the storm-related change between June and October 2005 was a loss of 29.91 yds^3/ft. On the beach while the offshore gained 23.12 yds^3/ft. This near equality is normal and reflects the survey reaching closer to what is known as closure. Closure is the point where sediment exchange between the beach and the sea bottom ceases.

New Jersey Beach Profile Network

#181 - Municipal Lot, Sea Bright, Monmouth County

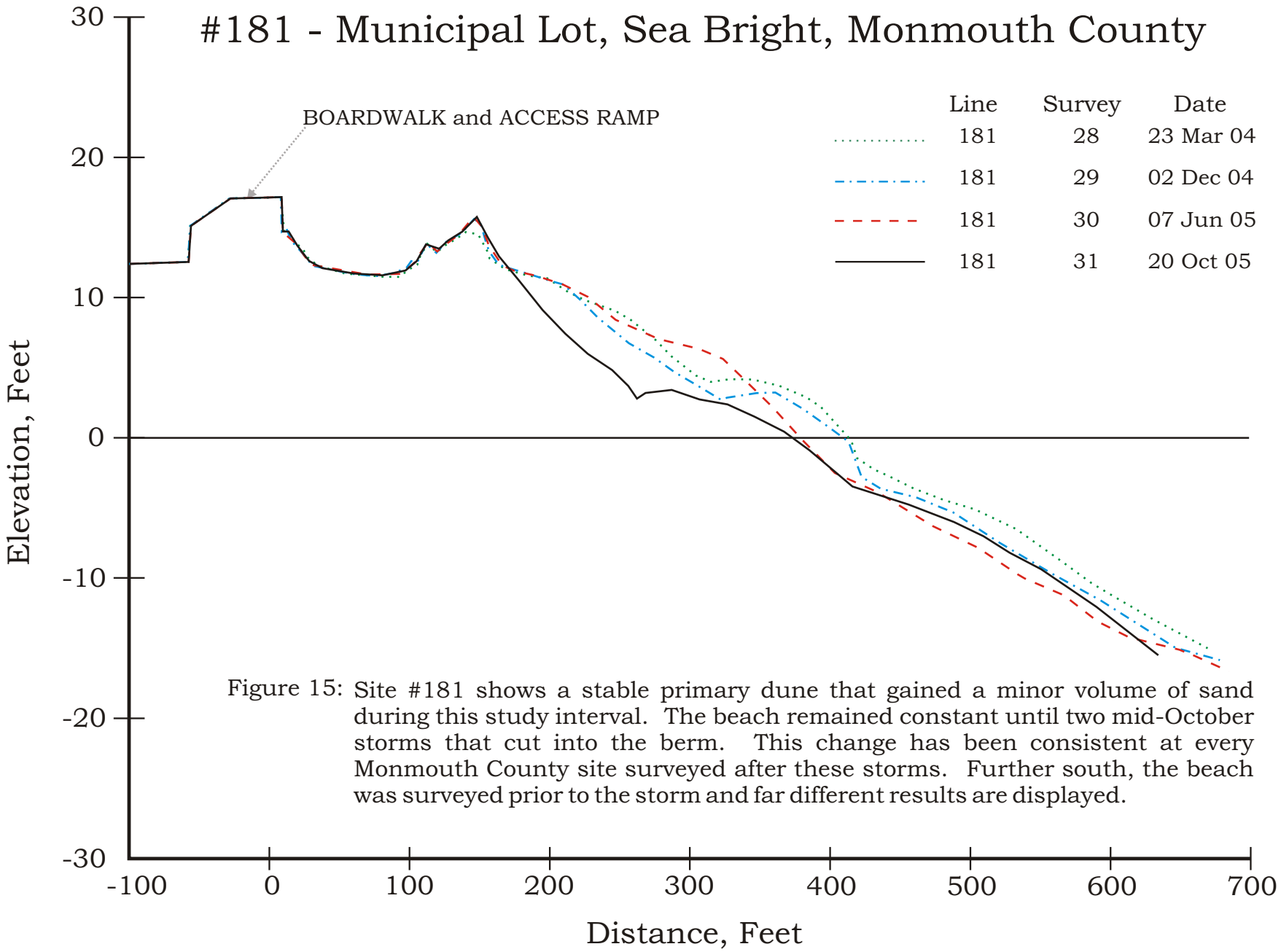


Figure 15: Site #181 shows a stable primary dune that gained a minor volume of sand during this study interval. The beach remained constant until two mid-October storms that cut into the berm. This change has been consistent at every Monmouth County site surveyed after these storms. Further south, the beach was surveyed prior to the storm and far different results are displayed.

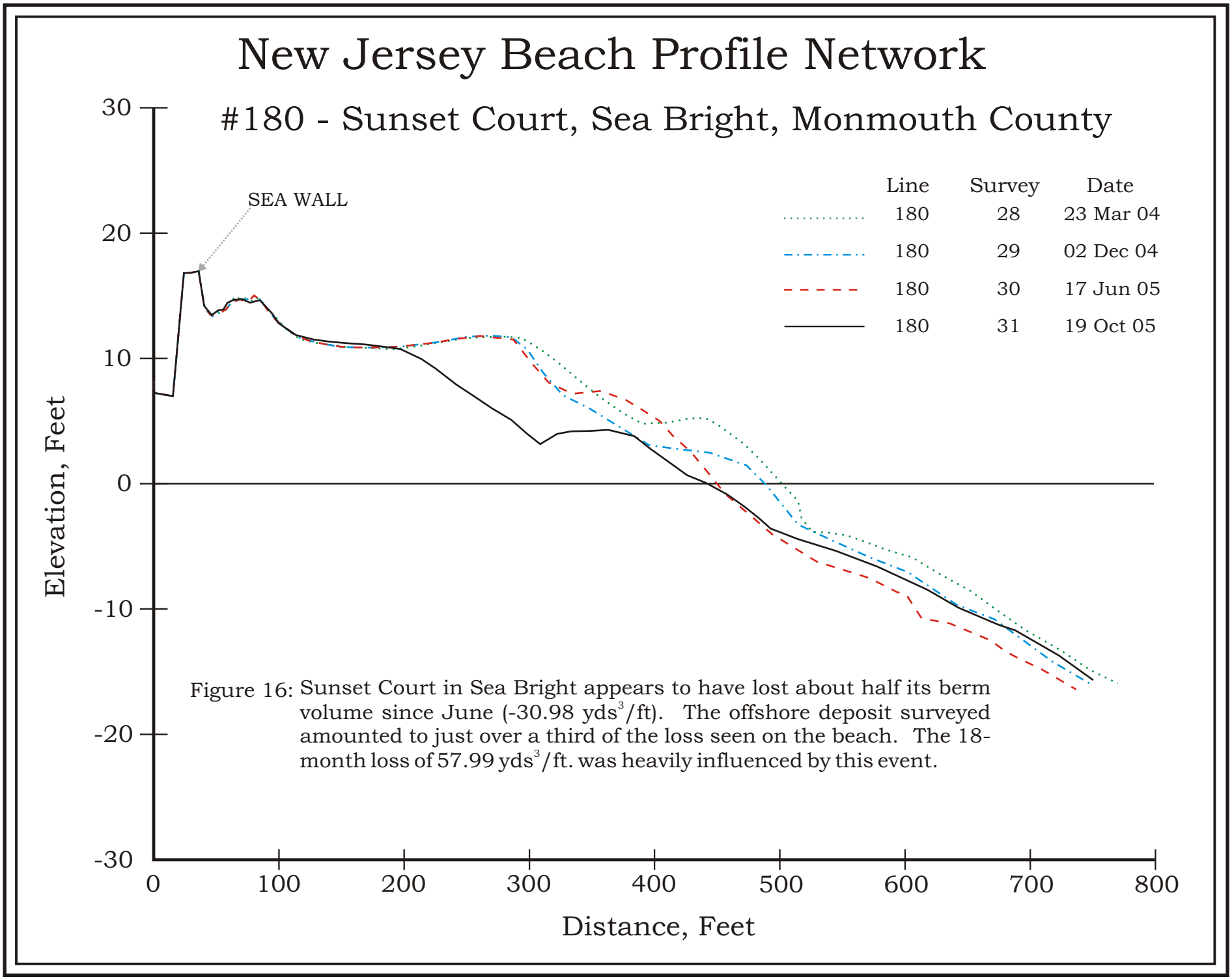


Figure 16: Sunset Court in Sea Bright appears to have lost about half its berm volume since June (-30.98 yds^3/ft). The offshore deposit surveyed amounted to just over a third of the loss seen on the beach. The 18-month loss of 57.99 yds^3/ft. was heavily influenced by this event.

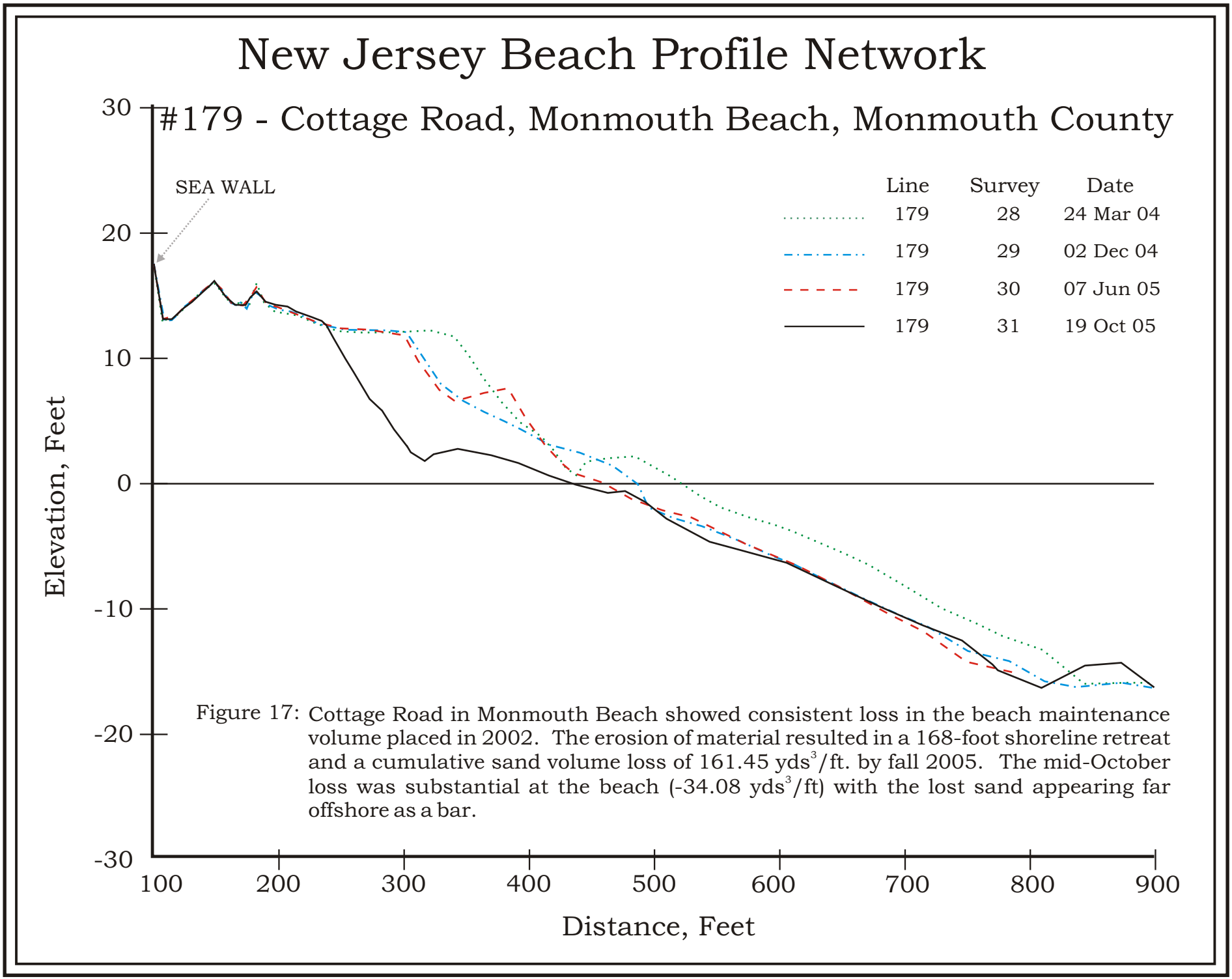


Figure 17: Cottage Road in Monmouth Beach showed consistent loss in the beach maintenance volume placed in 2002. The erosion of material resulted in a 168-foot shoreline retreat and a cumulative sand volume loss of 161.45 yds^3/ft. by fall 2005. The mid-October loss was substantial at the beach (-34.08 yds^3/ft) with the lost sand appearing far offshore as a bar.

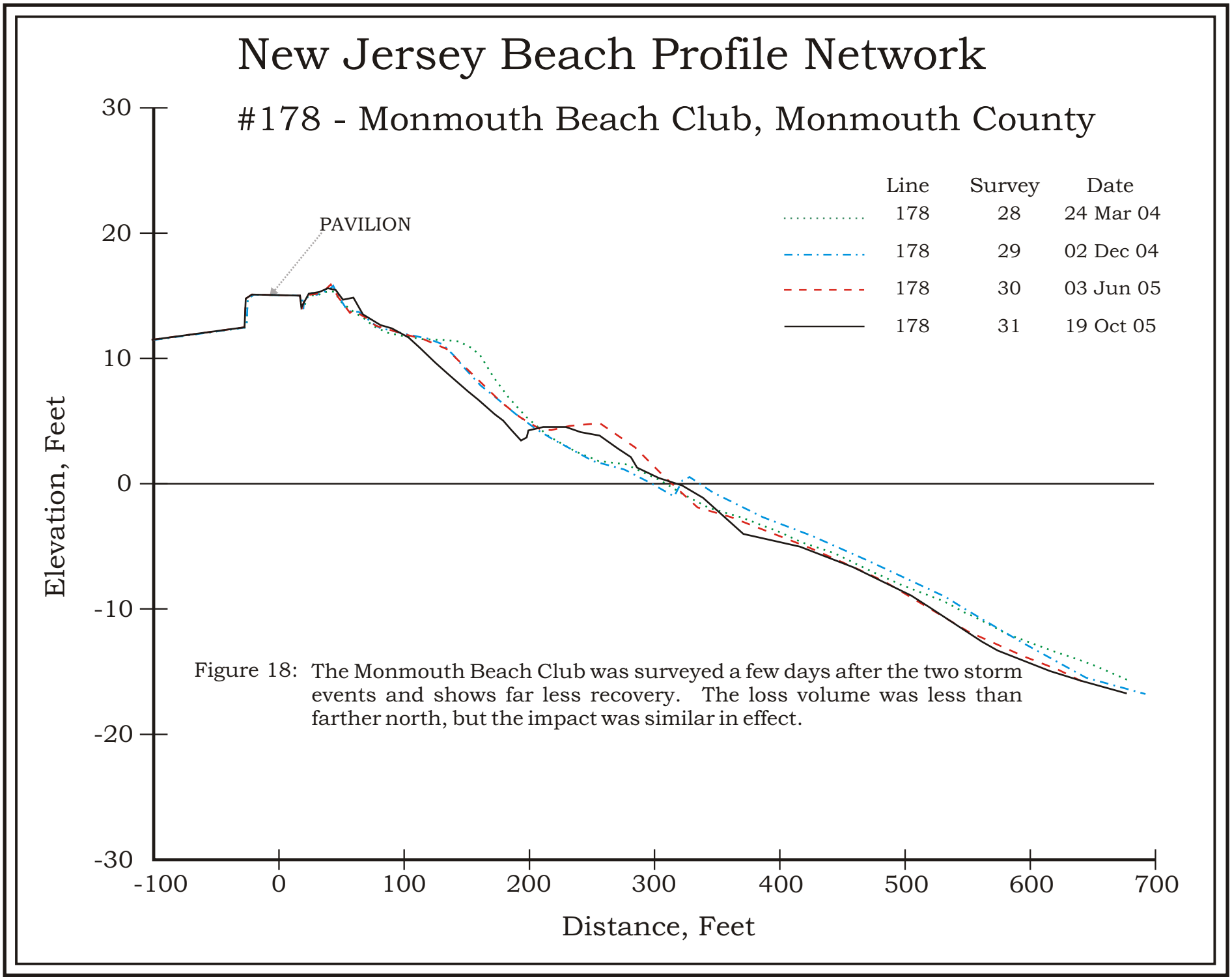


Figure 18: The Monmouth Beach Club was surveyed a few days after the two storm events and shows far less recovery. The loss volume was less than farther north, but the impact was similar in effect.

New Jersey Beach Profile Network

#177 - Ocean Avenue, Long Branch, Monmouth County

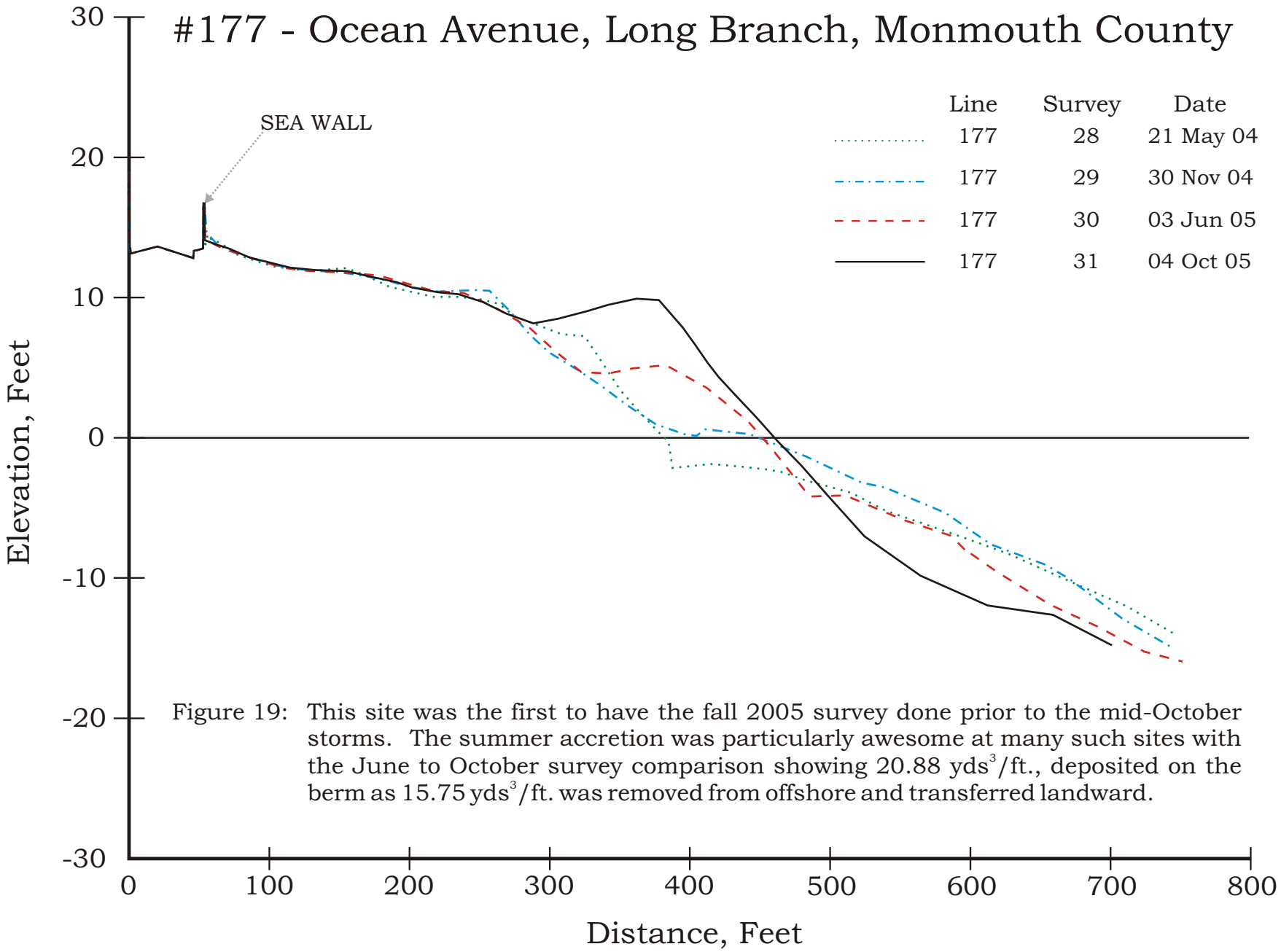


Figure 19: This site was the first to have the fall 2005 survey done prior to the mid-October storms. The summer accretion was particularly awesome at many such sites with the June to October survey comparison showing 20.88 yds^3/ft., deposited on the berm as 15.75 yds^3/ft. was removed from offshore and transferred landward.

New Jersey Beach Profile Network

#176 - Seven Presidents Park, Monmouth County

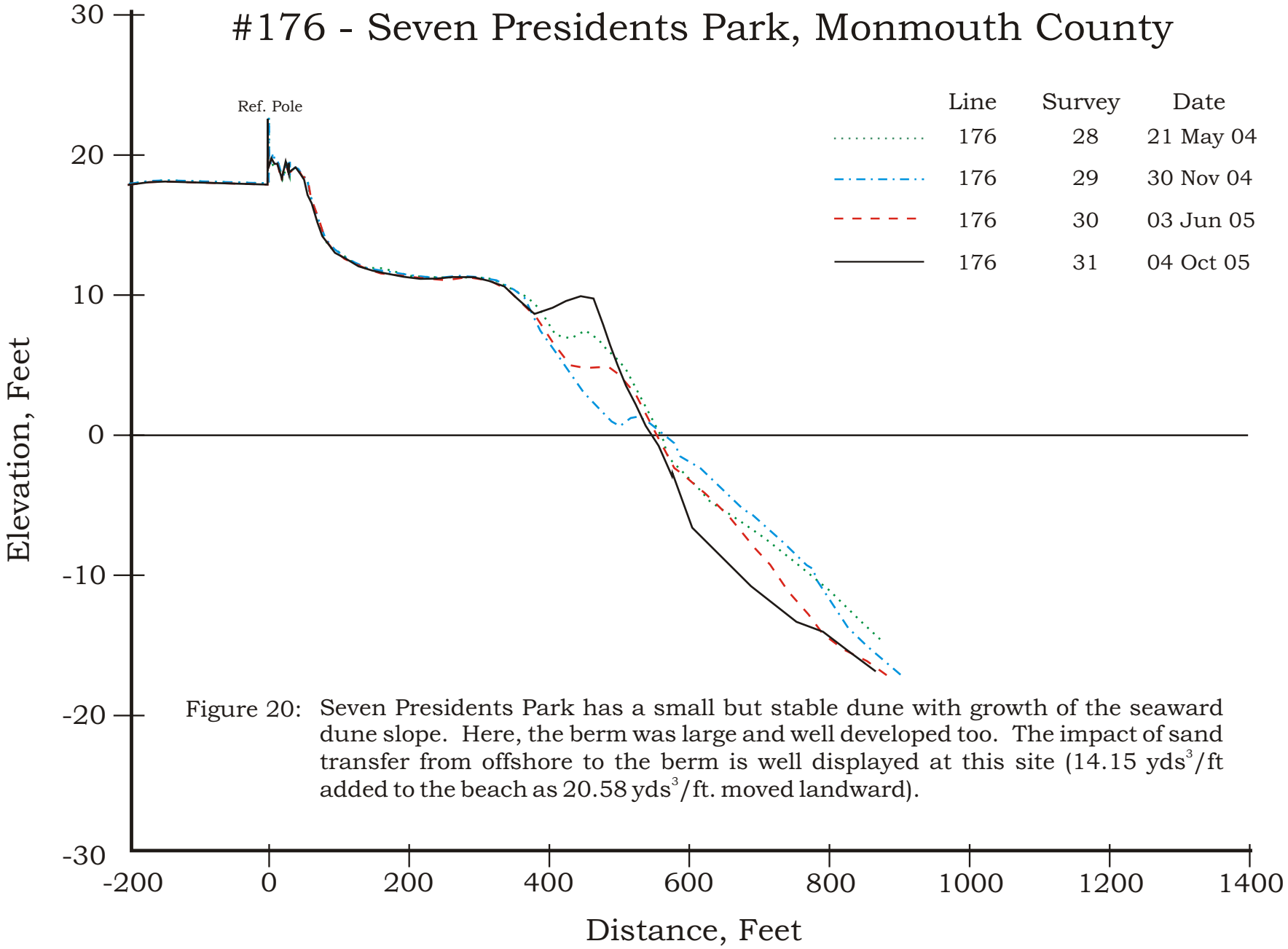


Figure 20: Seven Presidents Park has a small but stable dune with growth of the seaward dune slope. Here, the berm was large and well developed too. The impact of sand transfer from offshore to the berm is well displayed at this site (14.15 yds^3/ft added to the beach as 20.58 yds^3/ft. moved landward).

New Jersey Beach Profile Network

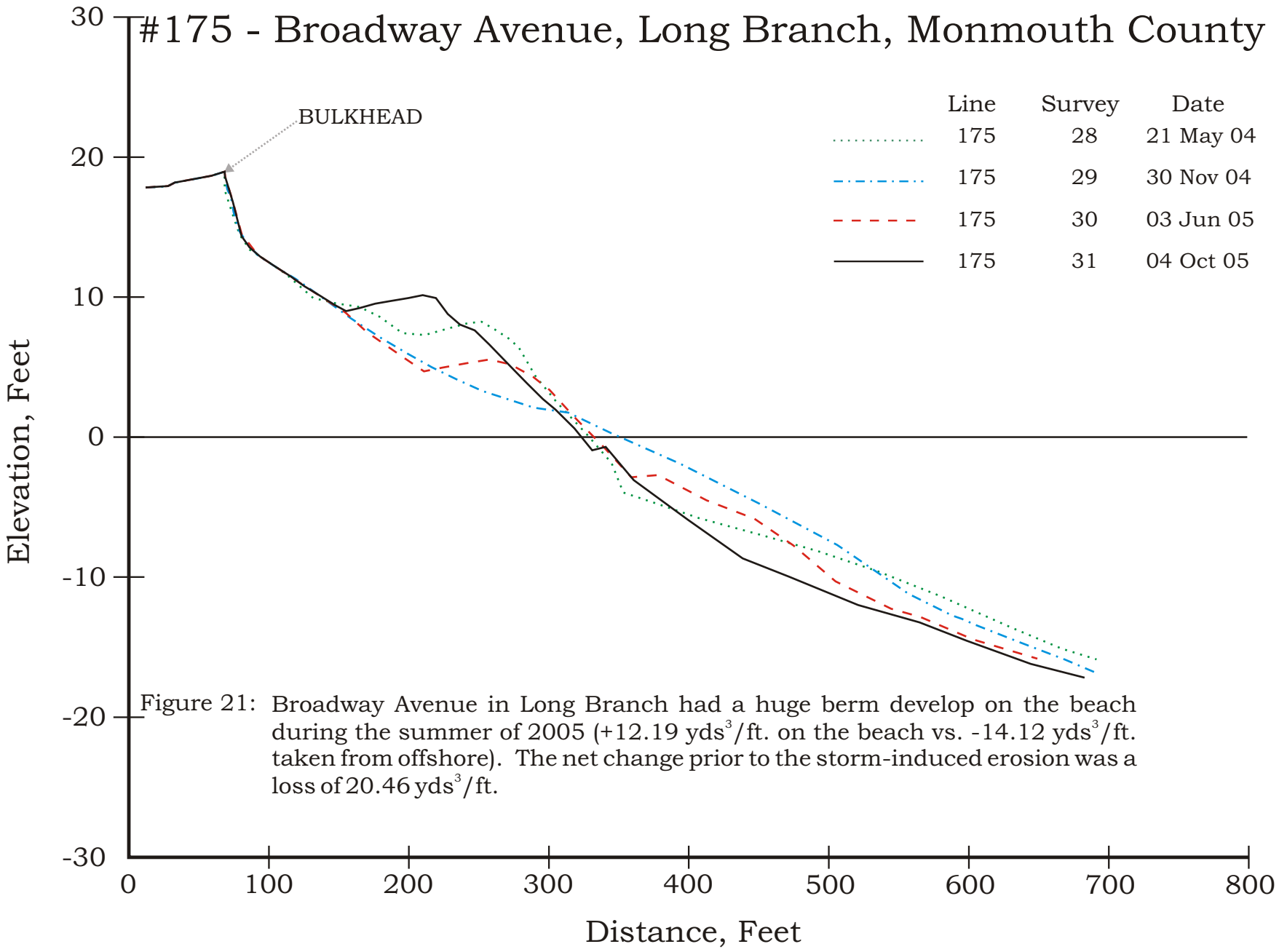


Figure 21: Broadway Avenue in Long Branch had a huge berm develop on the beach during the summer of 2005 (+12.19 yds^3/ft. on the beach vs. -14.12 yds^3/ft. taken from offshore). The net change prior to the storm-induced erosion was a loss of 20.46 yds^3/ft.

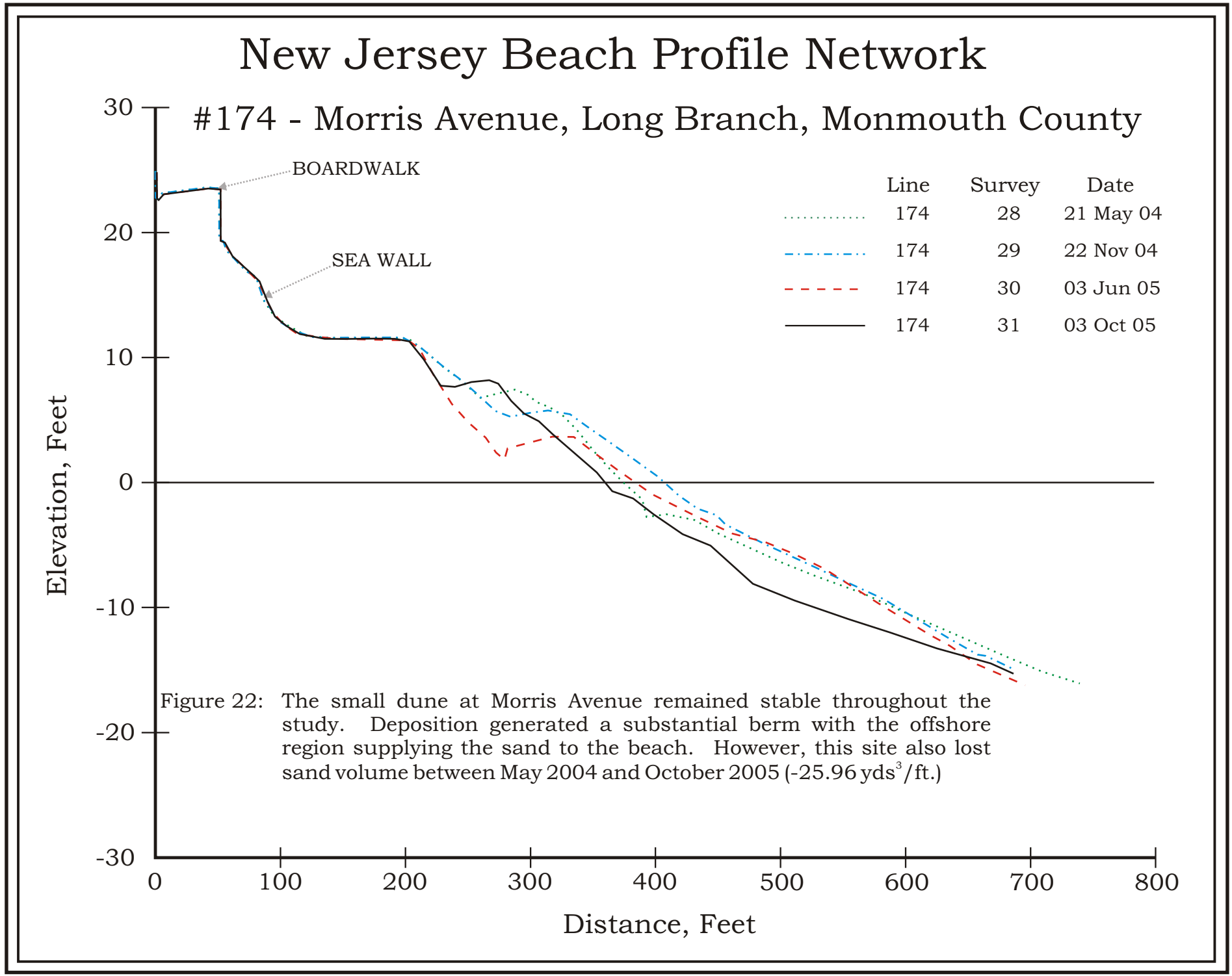


Figure 22: The small dune at Morris Avenue remained stable throughout the study. Deposition generated a substantial berm with the offshore region supplying the sand to the beach. However, this site also lost sand volume between May 2004 and October 2005 (-25.96 yds^3/ft.)

New Jersey Beach Profile Network

Figure 23:
This site lies at the south end of the beach restoration project. Sand built into a berm here as well, indicating that the seasonal phenomenon continued.

New Jersey Beach Profile Network

#171 - Pullman Avenue, Elberon, Monmouth County

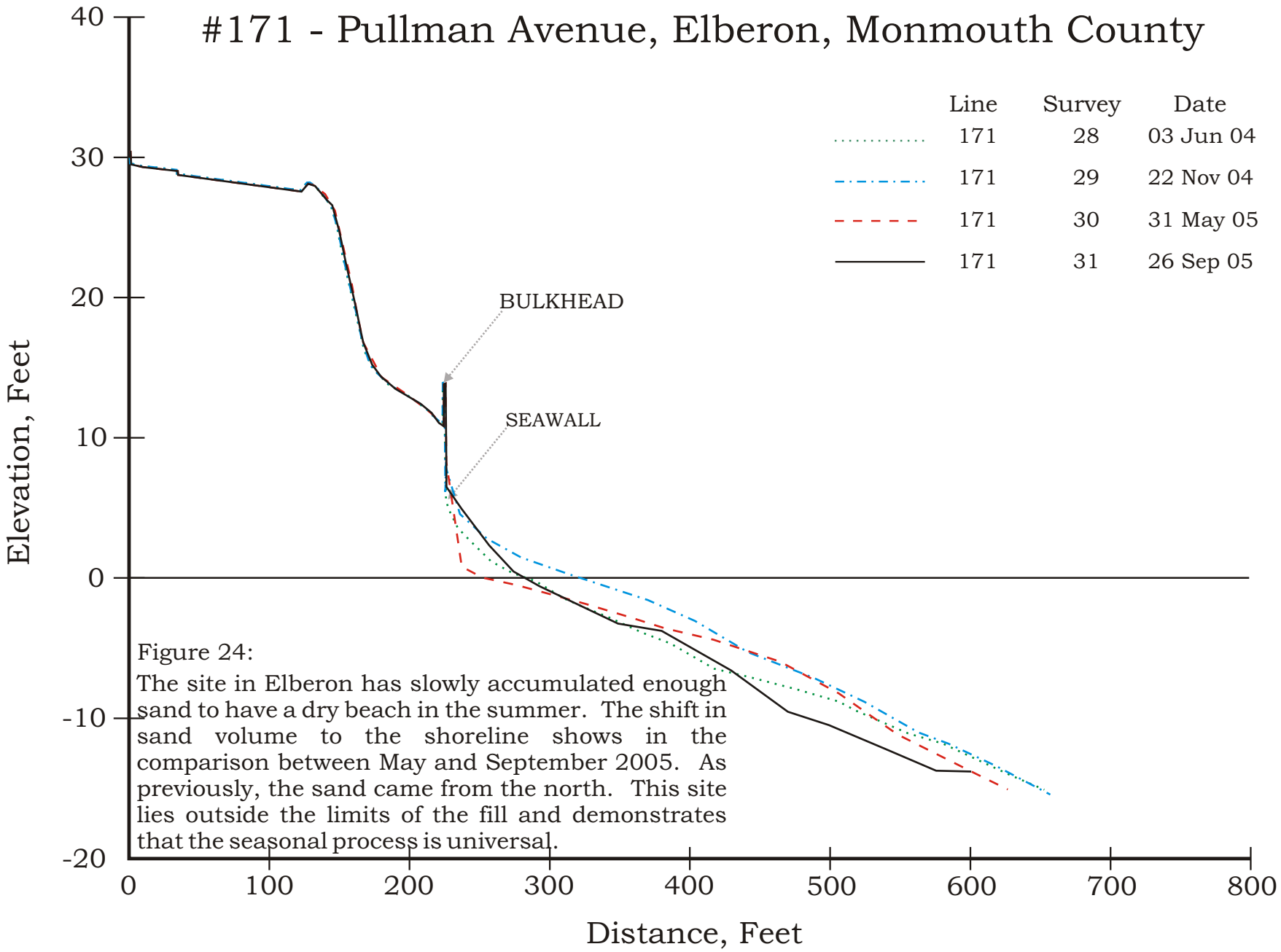


Figure 24:
The site in Elberon has slowly accumulated enough sand to have a dry beach in the summer. The shift in sand volume to the shoreline shows in the comparison between May and September 2005. As previously, the sand came from the north. This site lies outside the limits of the fill and demonstrates that the seasonal process is universal.

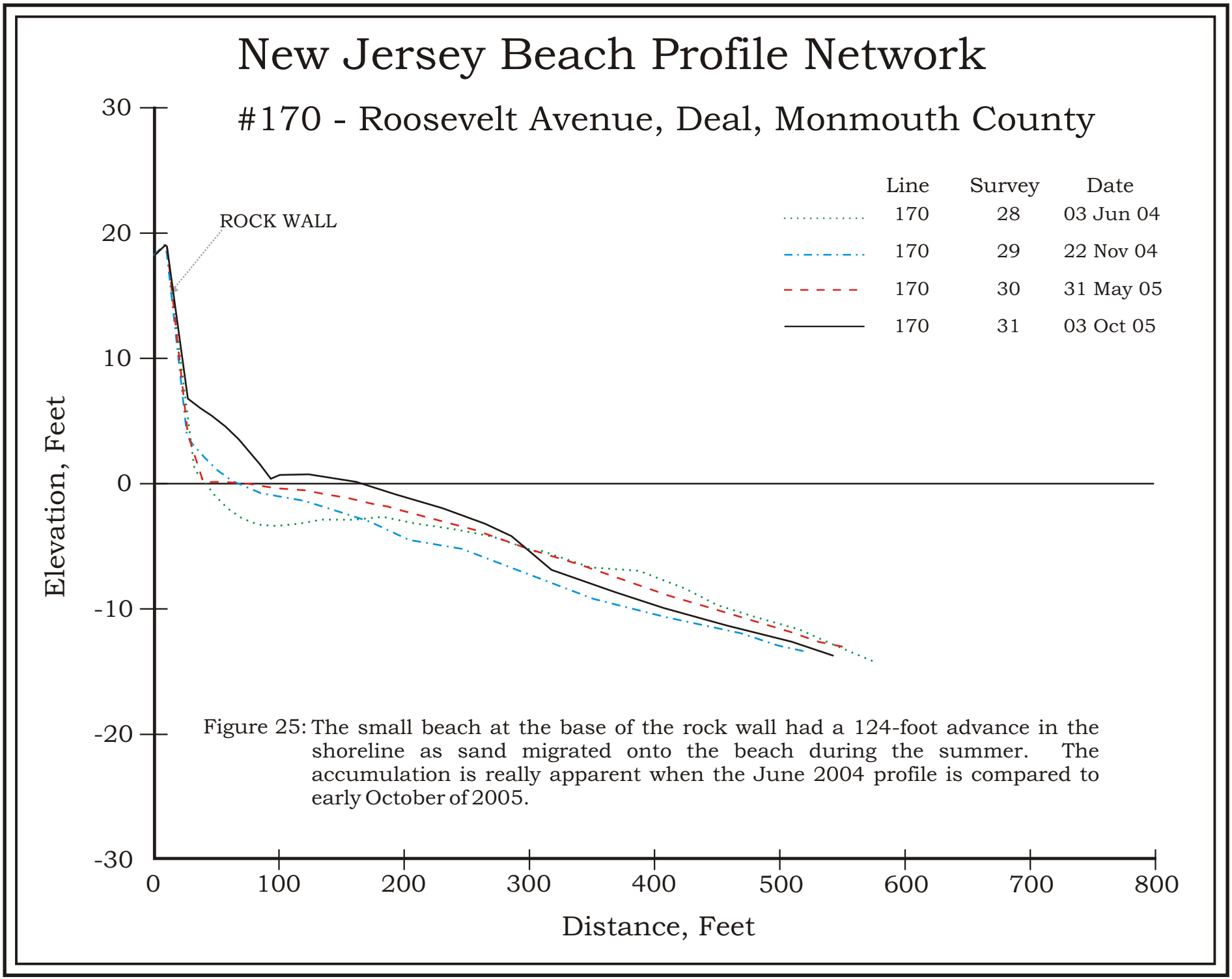


Figure 25: The small beach at the base of the rock wall had a 124-foot advance in the shoreline as sand migrated onto the beach during the summer. The accumulation is really apparent when the June 2004 profile is compared to early October of 2005.

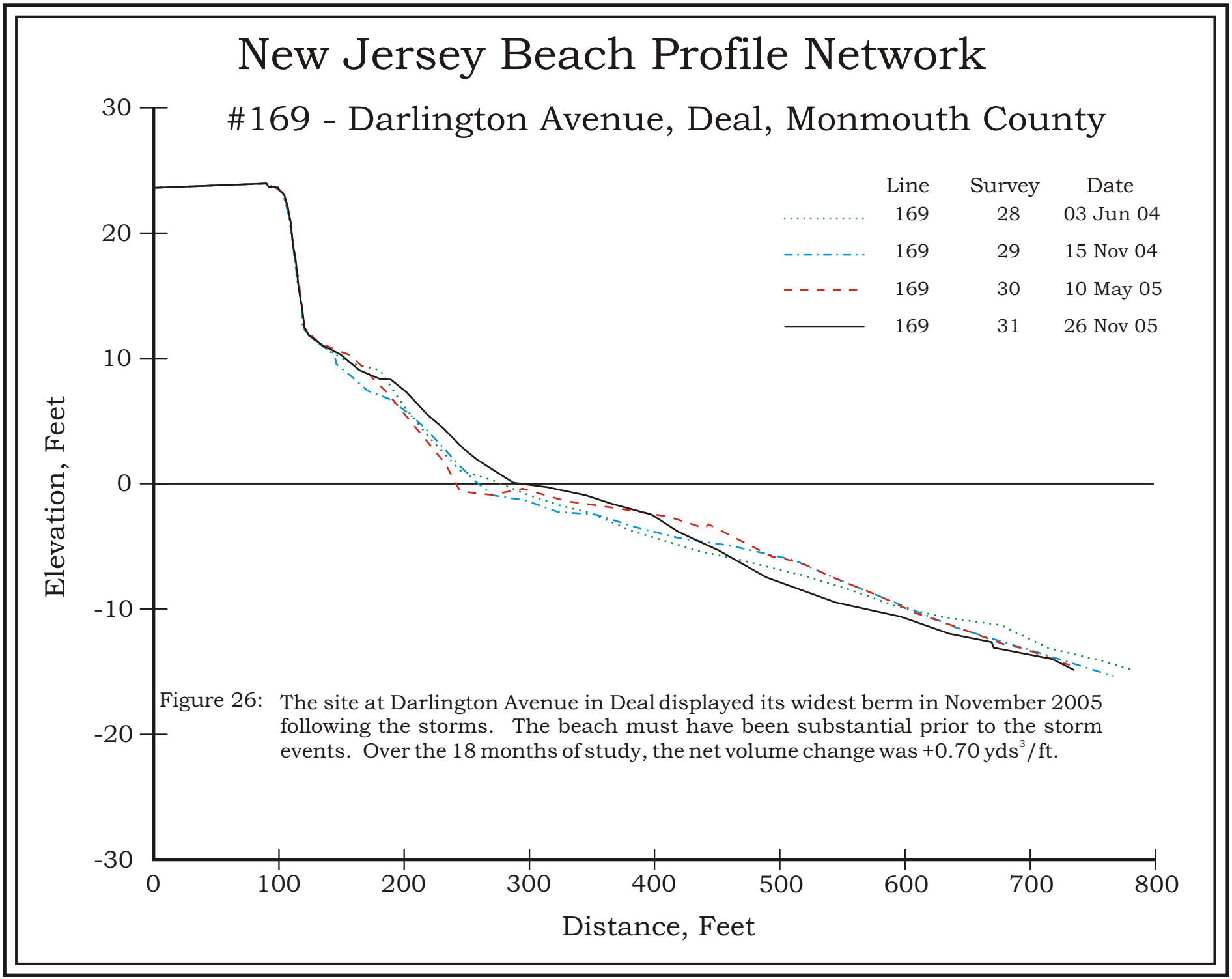


Figure 26: The site at Darlington Avenue in Deal displayed its widest berm in November 2005 following the storms. The beach must have been substantial prior to the storm events. Over the 18 months of study, the net volume change was +0.70 yds^3/ft.

New Jersey Beach Profile Network

#168 - Corlies Avenue, Allenhurst, Monmouth County

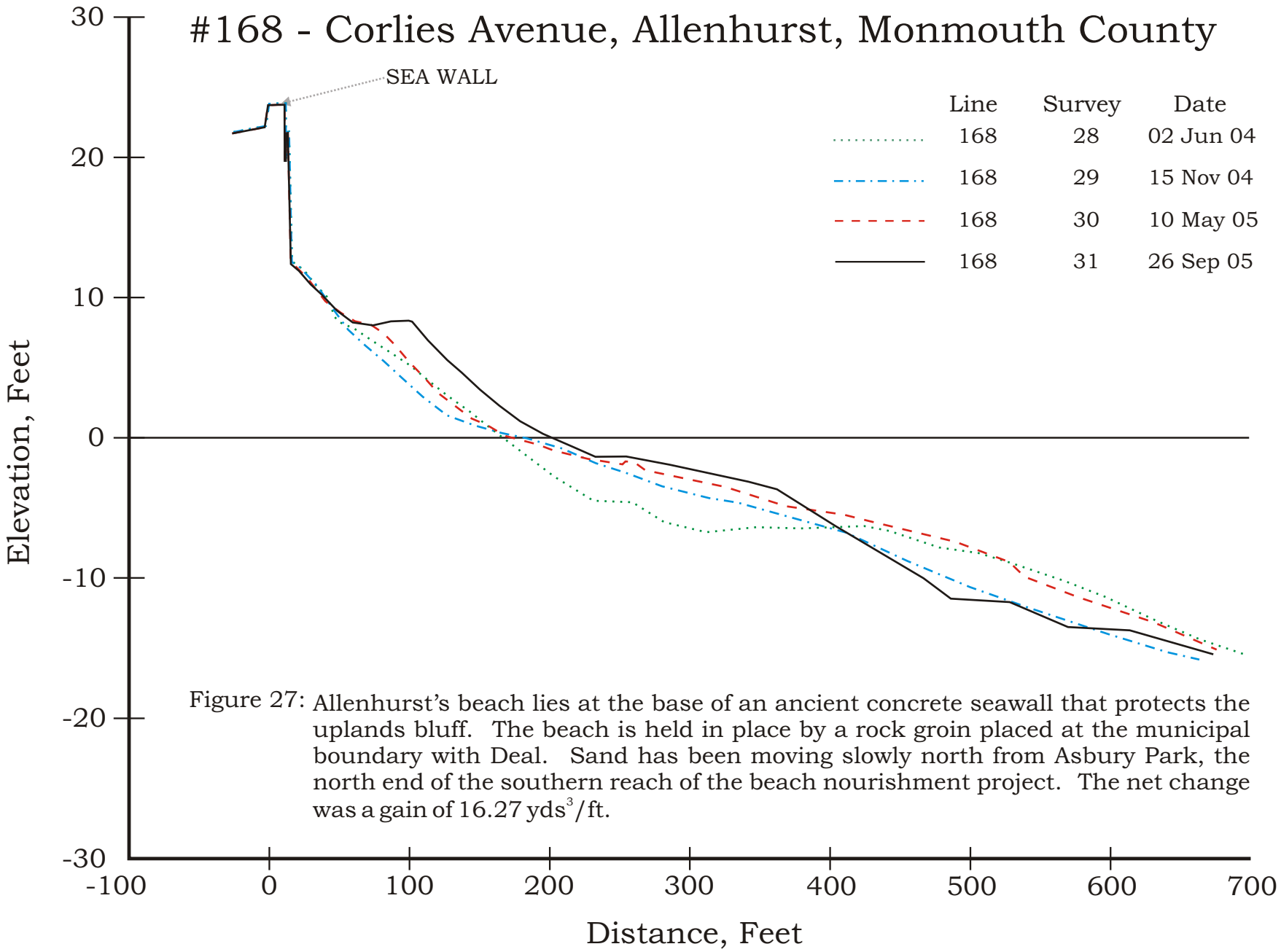


Figure 27: Allenhurst's beach lies at the base of an ancient concrete seawall that protects the uplands bluff. The beach is held in place by a rock groin placed at the municipal boundary with Deal. Sand has been moving slowly north from Asbury Park, the north end of the southern reach of the beach nourishment project. The net change was a gain of 16.27 yds^3/ft.

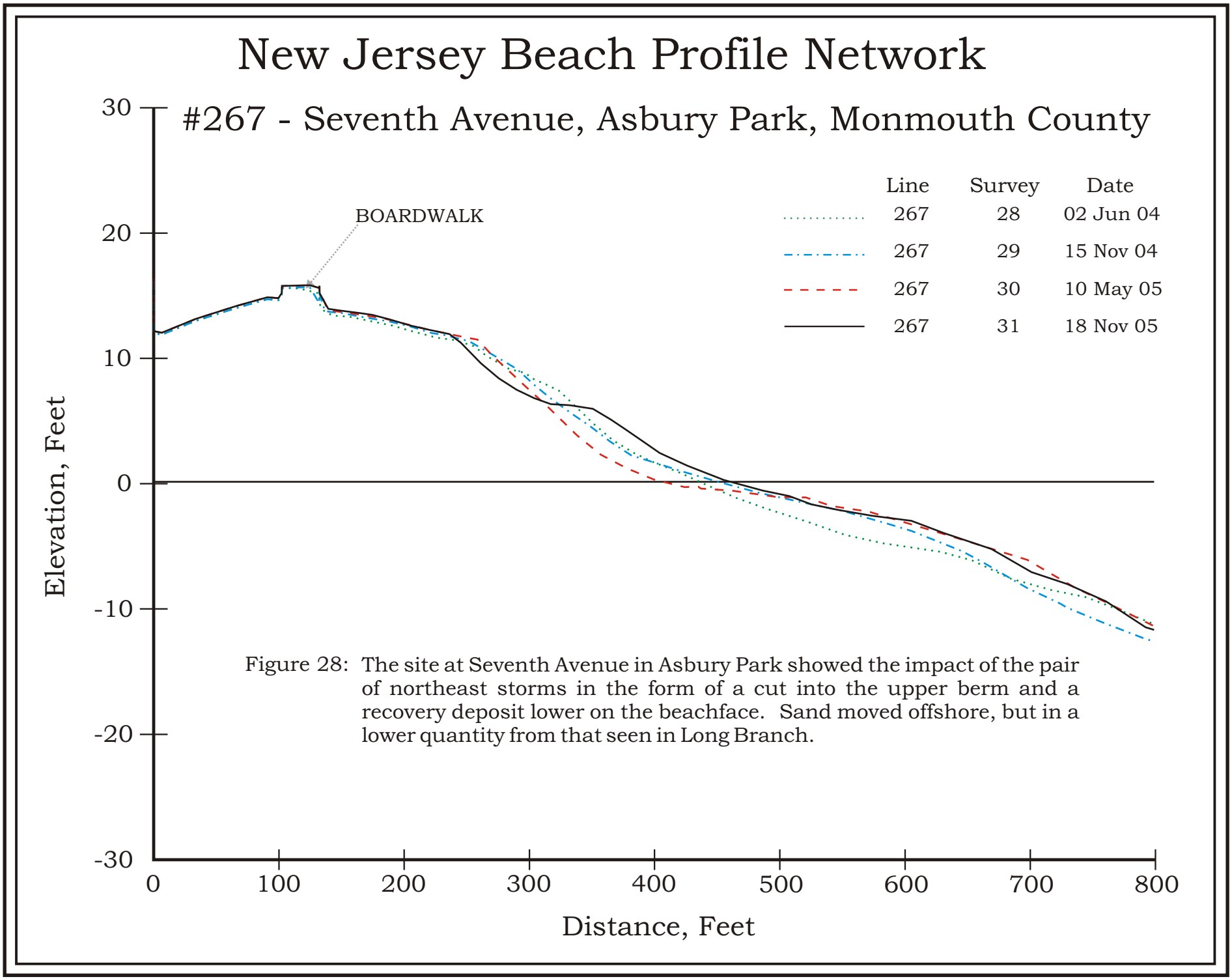


Figure 28: The site at Seventh Avenue in Asbury Park showed the impact of the pair of northeast storms in the form of a cut into the upper berm and a recovery deposit lower on the beachface. Sand moved offshore, but in a lower quantity from that seen in Long Branch.

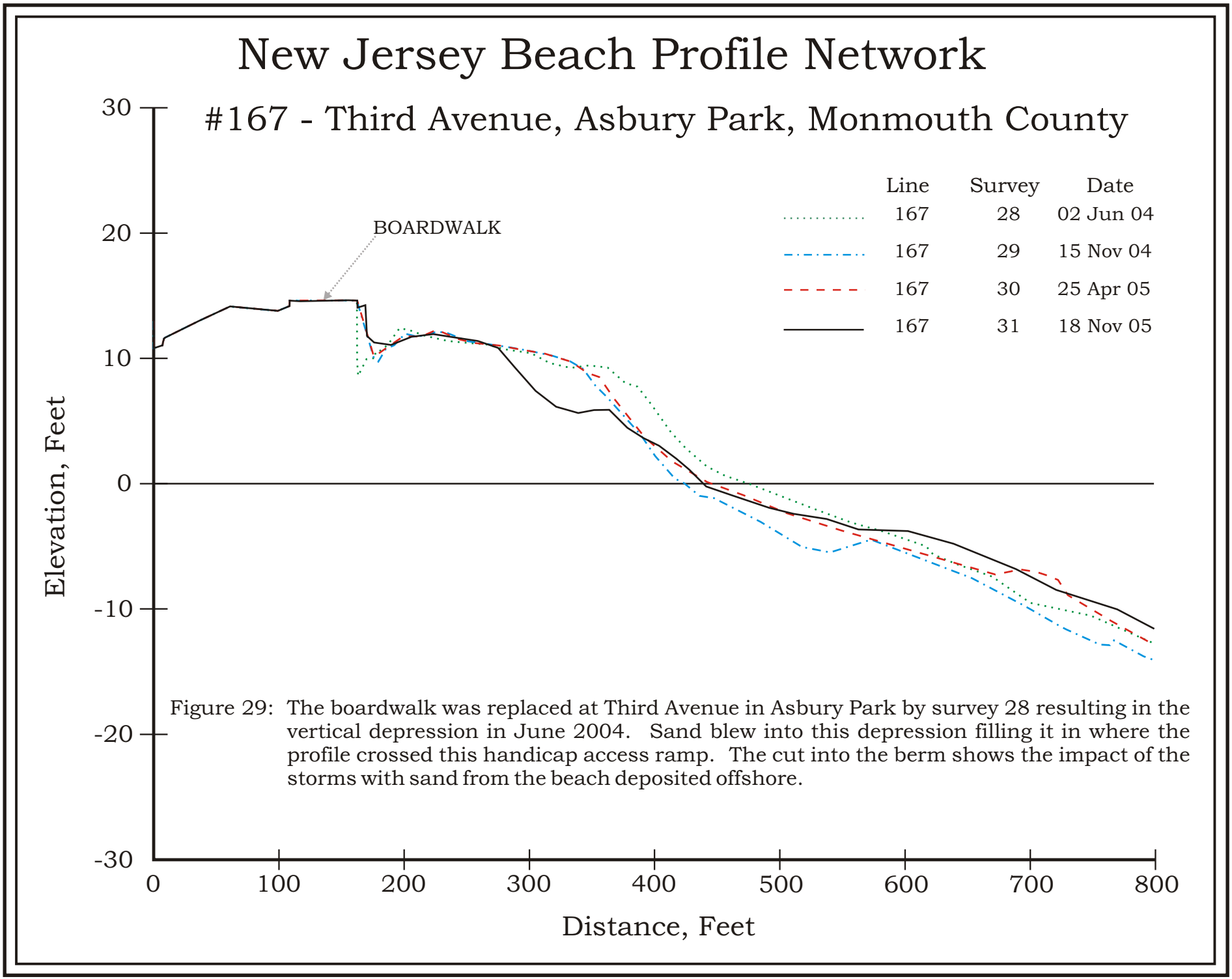


Figure 29: The boardwalk was replaced at Third Avenue in Asbury Park by survey 28 resulting in the vertical depression in June 2004. Sand blew into this depression filling it in where the profile crossed this handicap access ramp. The cut into the berm shows the impact of the storms with sand from the beach deposited offshore.

New Jersey Beach Profile Network

#166 - Ocean Pathway, Ocean Grove, Monmouth County

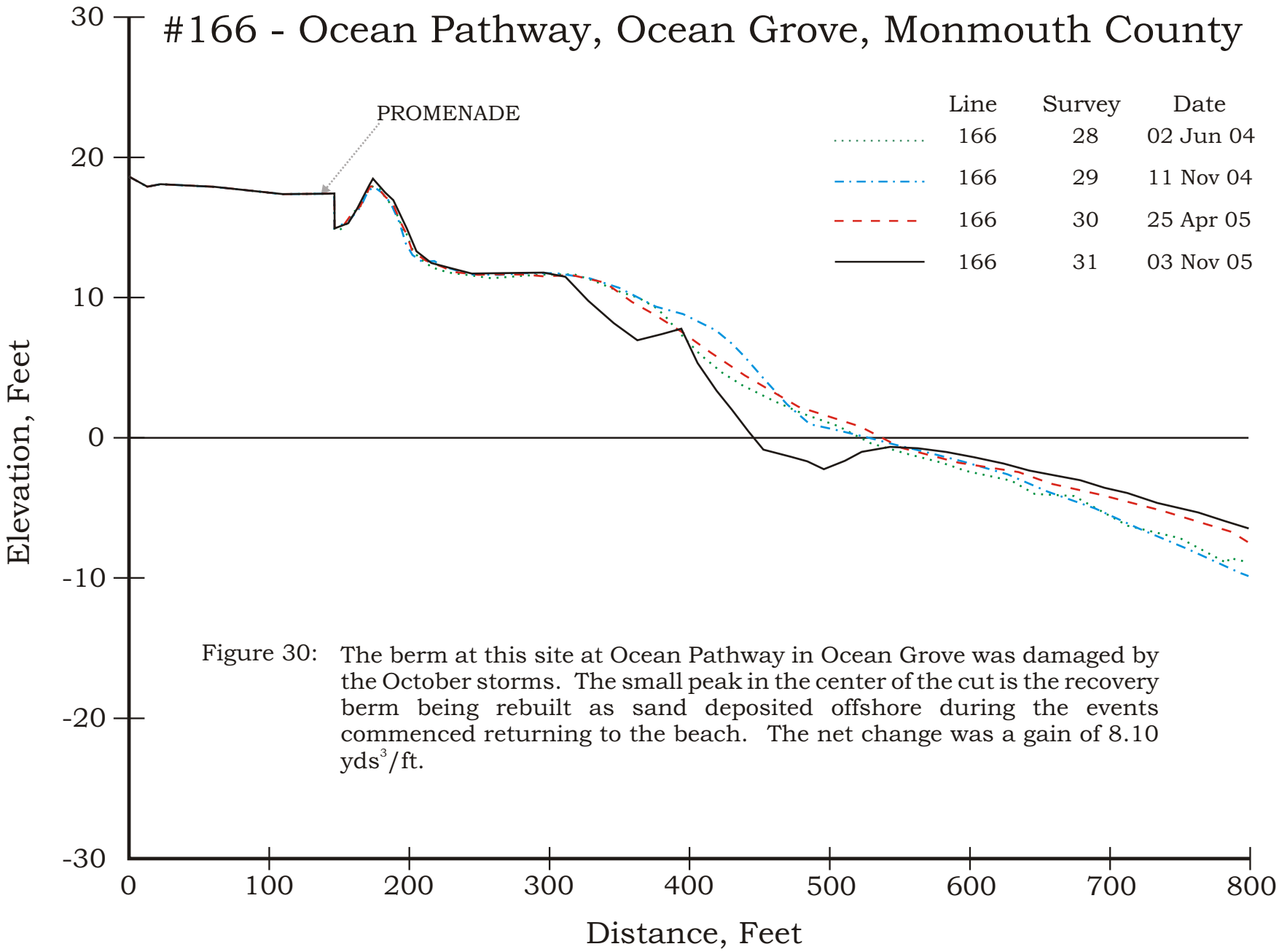


Figure 30: The berm at this site at Ocean Pathway in Ocean Grove was damaged by the October storms. The small peak in the center of the cut is the recovery berm being rebuilt as sand deposited offshore during the events commenced returning to the beach. The net change was a gain of 8.10 yds^3/ft.

New Jersey Beach Profile Network

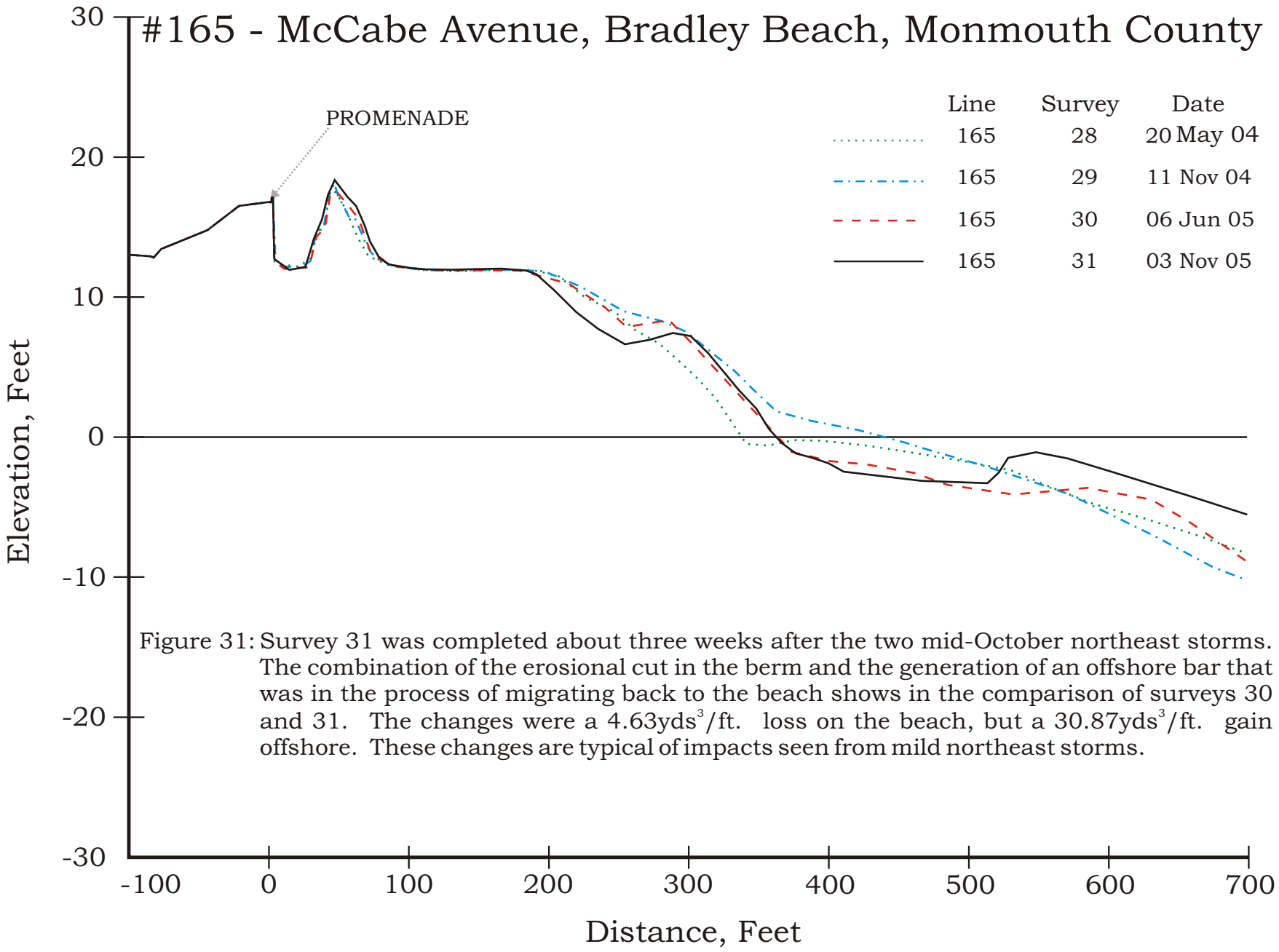


Figure 31: Survey 31 was completed about three weeks after the two mid-October northeast storms. The combination of the erosional cut in the berm and the generation of an offshore bar that was in the process of migrating back to the beach shows in the comparison of surveys 30 and 31. The changes were a 4.63yds^3/ft. loss on the beach, but a 30.87yds^3/ft. gain offshore. These changes are typical of impacts seen from mild northeast storms.

New Jersey Beach Profile Network

#164 - Sylvania Avenue, Avon By The Sea, Monmouth County

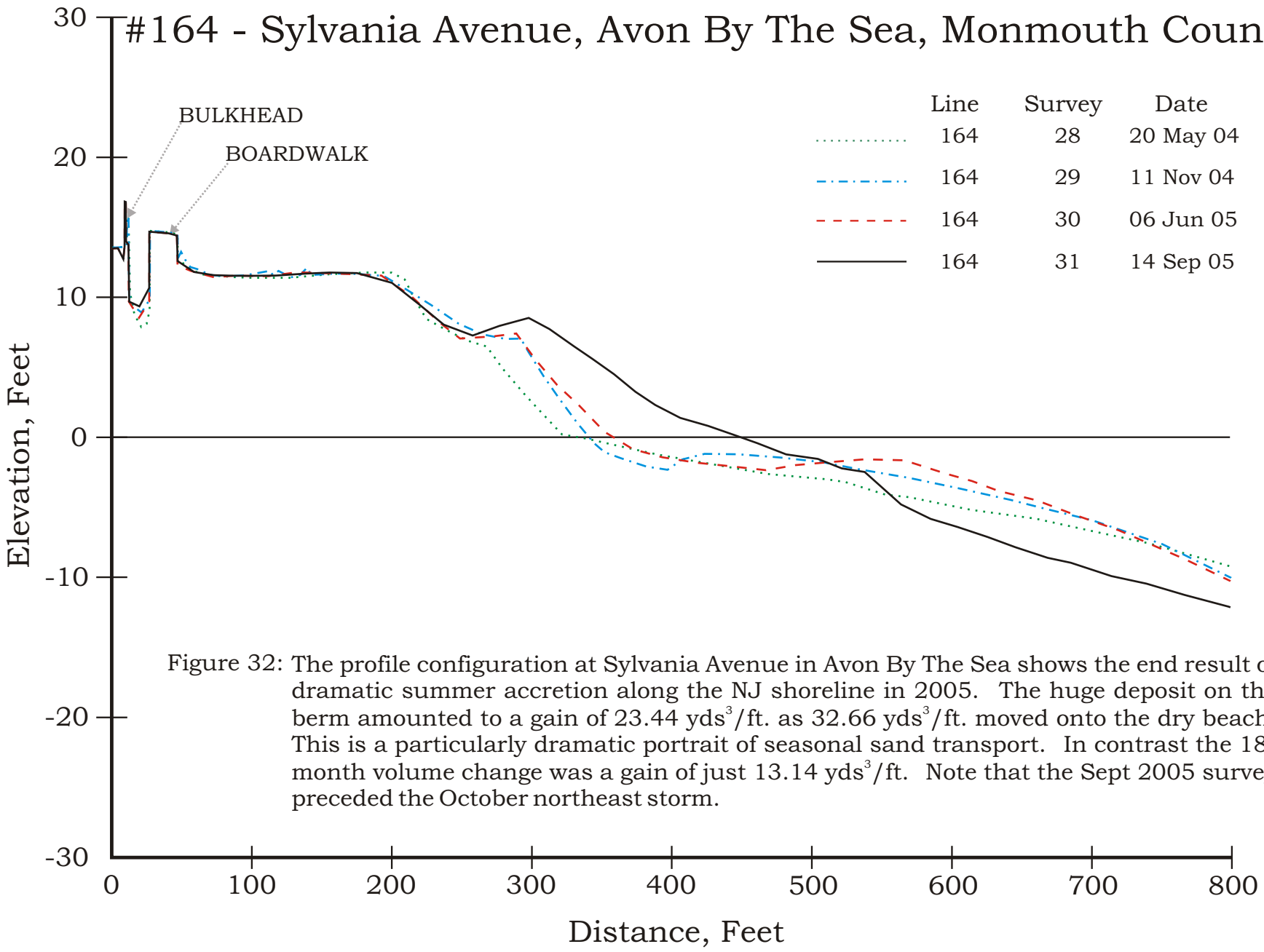


Figure 32: The profile configuration at Sylvania Avenue in Avon By The Sea shows the end result of dramatic summer accretion along the NJ shoreline in 2005. The huge deposit on the berm amounted to a gain of 23.44 yds^3/ft. as 32.66 yds^3/ft. moved onto the dry beach. This is a particularly dramatic portrait of seasonal sand transport. In contrast the 18-month volume change was a gain of just 13.14 yds^3/ft. Note that the Sept 2005 survey preceded the October northeast storm.

New Jersey Beach Profile Network

#163 - 5th Avenue, Belmar, Monmouth County

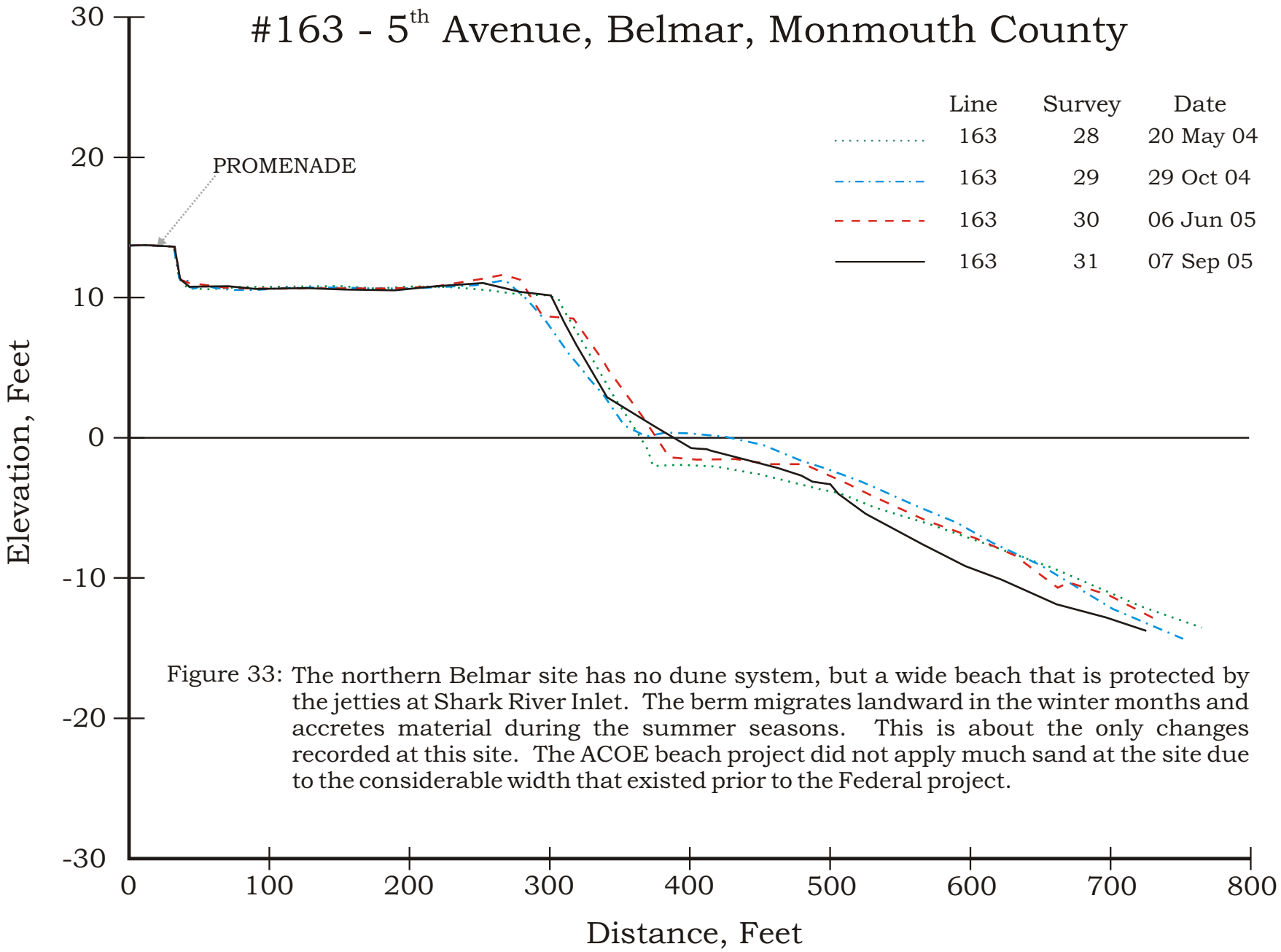


Figure 33: The northern Belmar site has no dune system, but a wide beach that is protected by the jetties at Shark River Inlet. The berm migrates landward in the winter months and accretes material during the summer seasons. This is about the only changes recorded at this site. The ACOE beach project did not apply much sand at the site due to the considerable width that existed prior to the Federal project.

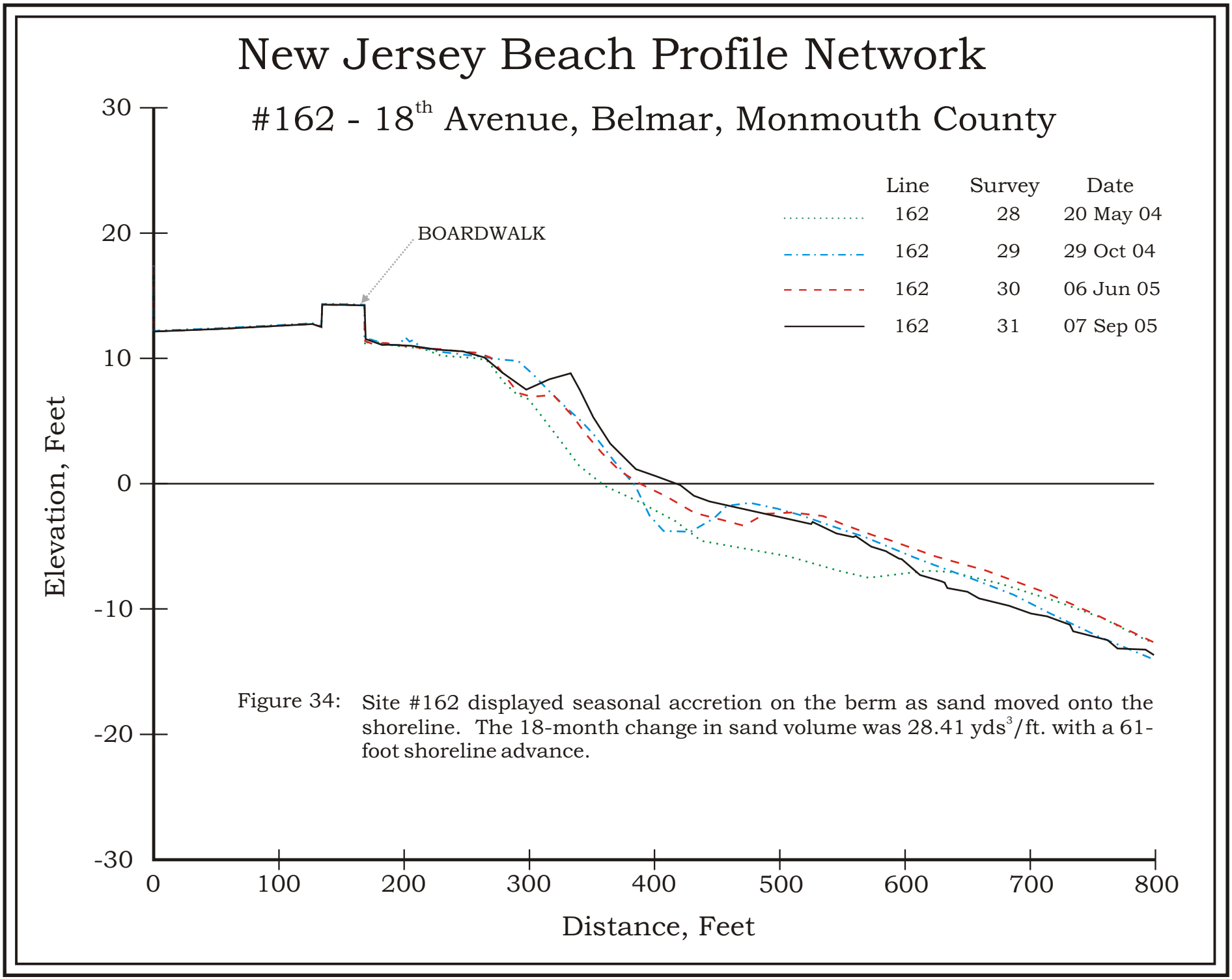


Figure 34: Site #162 displayed seasonal accretion on the berm as sand moved onto the shoreline. The 18-month change in sand volume was 28.41 yds^3/ft. with a 61-foot shoreline advance.

New Jersey Beach Profile Network

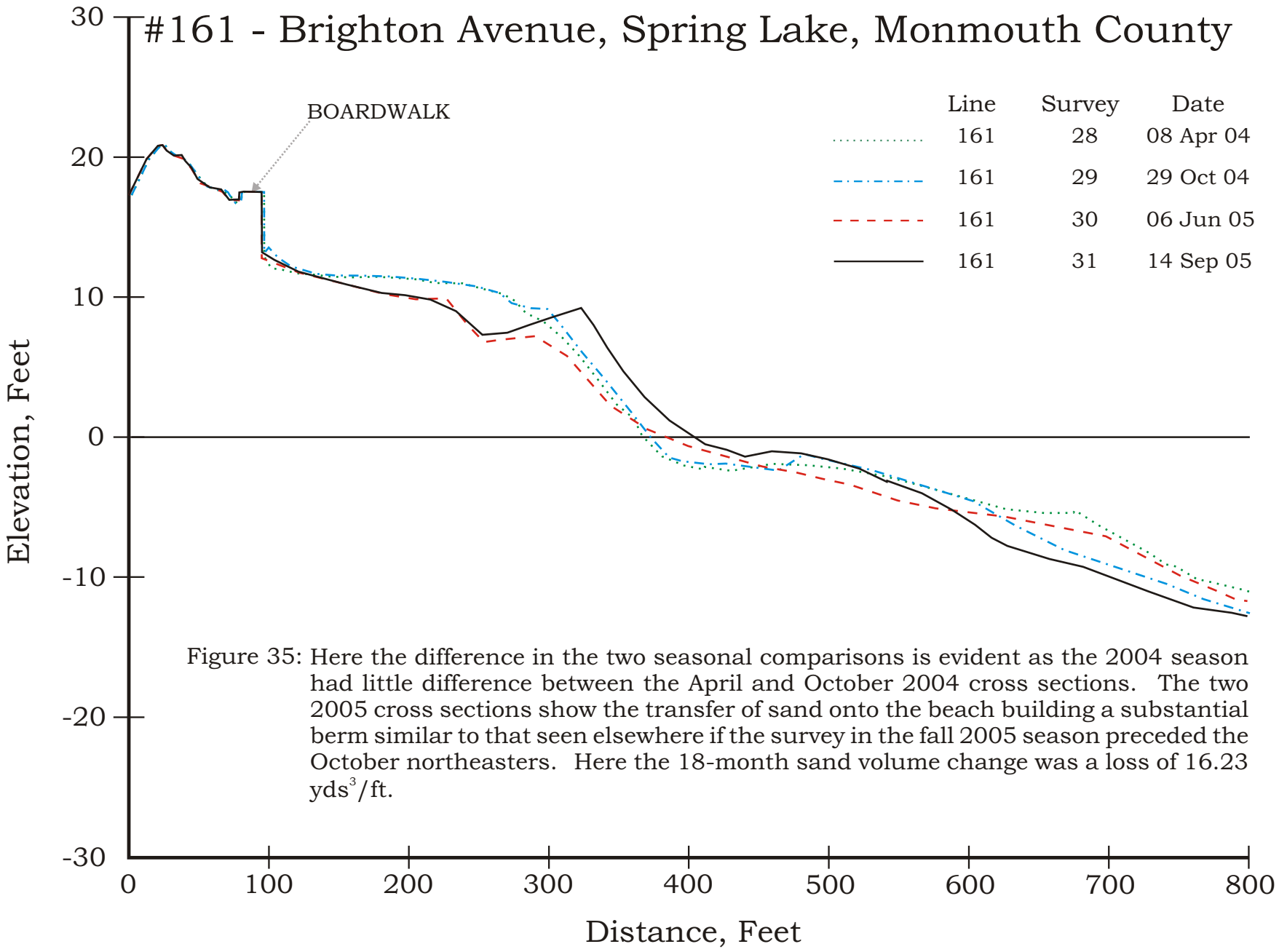


Figure 35: Here the difference in the two seasonal comparisons is evident as the 2004 season had little difference between the April and October 2004 cross sections. The two 2005 cross sections show the transfer of sand onto the beach building a substantial berm similar to that seen elsewhere if the survey in the fall 2005 season preceded the October northeasters. Here the 18-month sand volume change was a loss of 16.23 yds^3/ft.

New Jersey Beach Profile Network

#160 - Salem Avenue, Spring Lake, Monmouth County

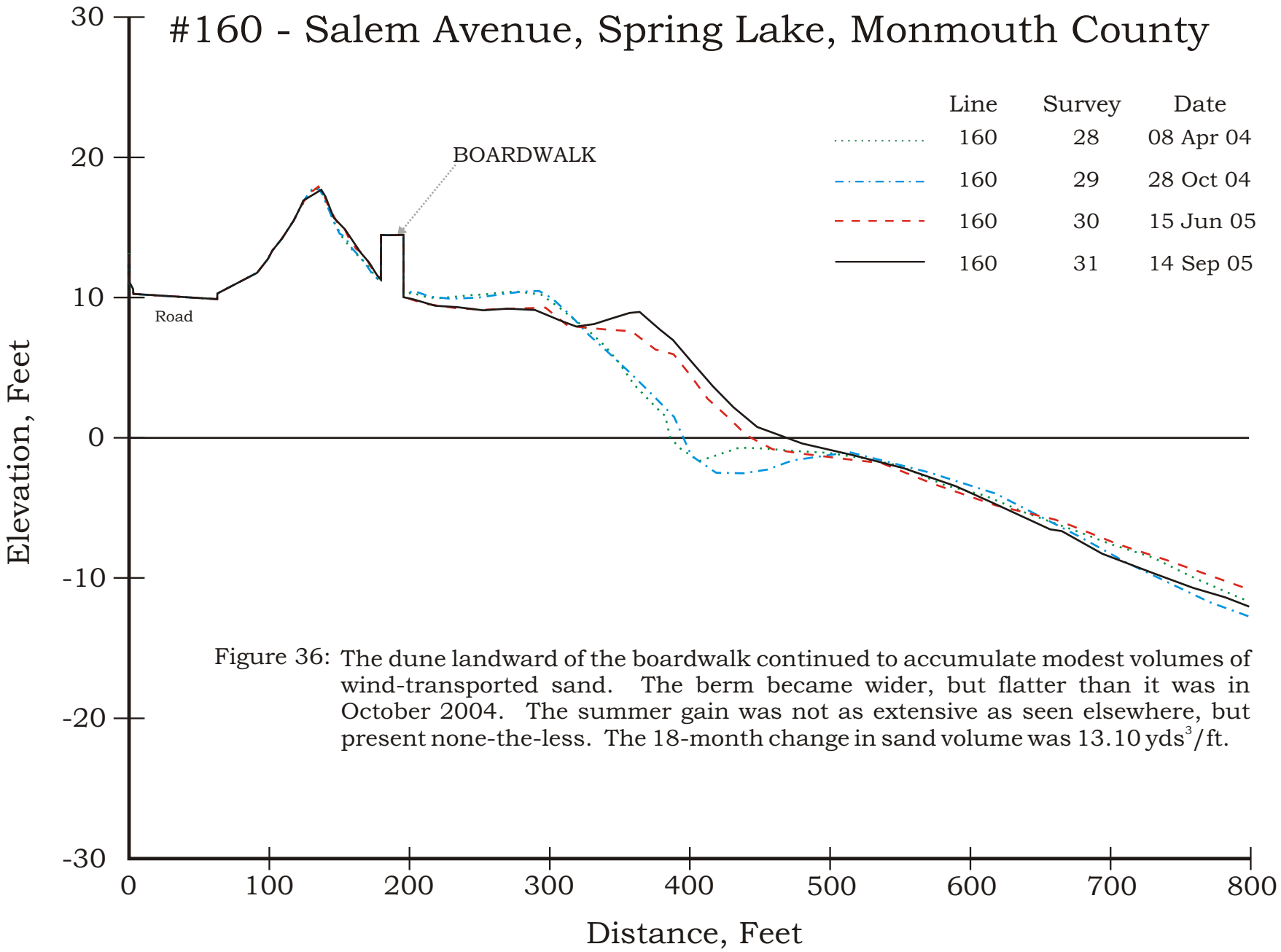


Figure 36: The dune landward of the boardwalk continued to accumulate modest volumes of wind-transported sand. The berm became wider, but flatter than it was in October 2004. The summer gain was not as extensive as seen elsewhere, but present none-the-less. The 18-month change in sand volume was 13.10 yds^3/ft.

New Jersey Beach Profile Network

#159 - New York Avenue, Sea Girt, Monmouth County

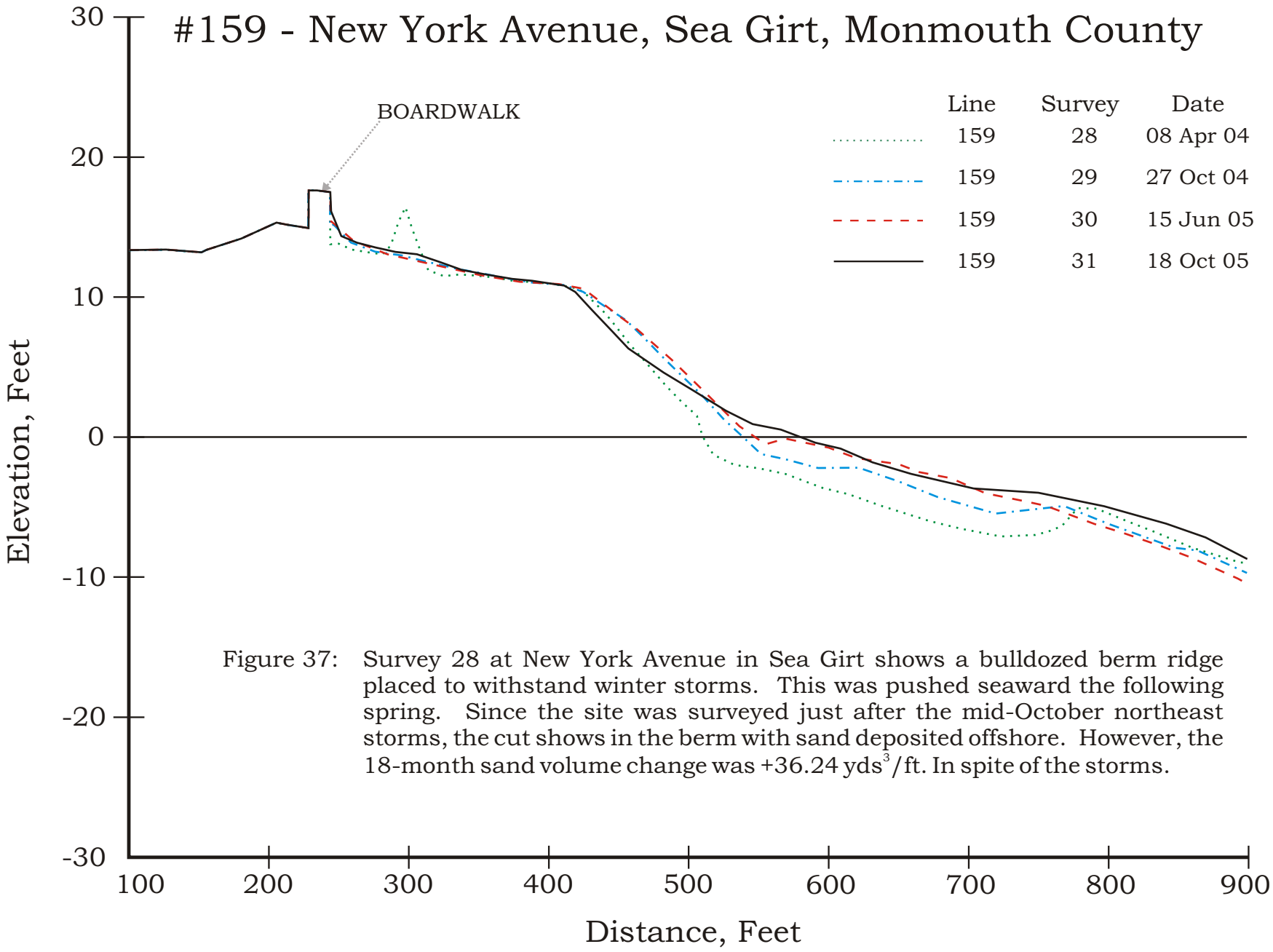


Figure 37: Survey 28 at New York Avenue in Sea Girt shows a bulldozed berm ridge placed to withstand winter storms. This was pushed seaward the following spring. Since the site was surveyed just after the mid-October northeast storms, the cut shows in the berm with sand deposited offshore. However, the 18-month sand volume change was +36.24 yds^3/ft. In spite of the storms.

New Jersey Beach Profile Network

#158 - Trenton Avenue, Sea Girt, Monmouth County

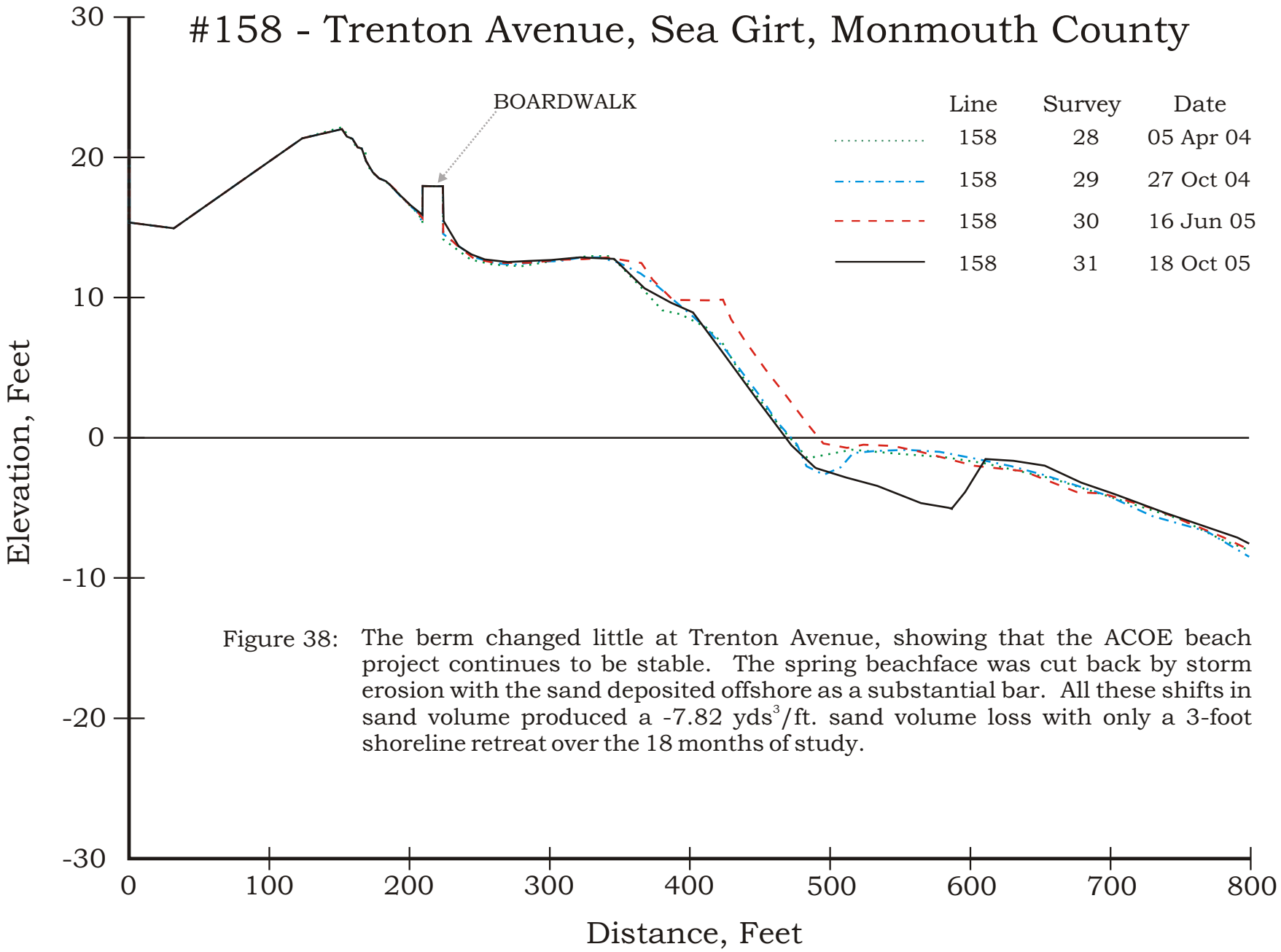


Figure 38: The berm changed little at Trenton Avenue, showing that the ACOE beach project continues to be stable. The spring beachface was cut back by storm erosion with the sand deposited offshore as a substantial bar. All these shifts in sand volume produced a -7.82 $yds^3/ft.$ sand volume loss with only a 3-foot shoreline retreat over the 18 months of study.

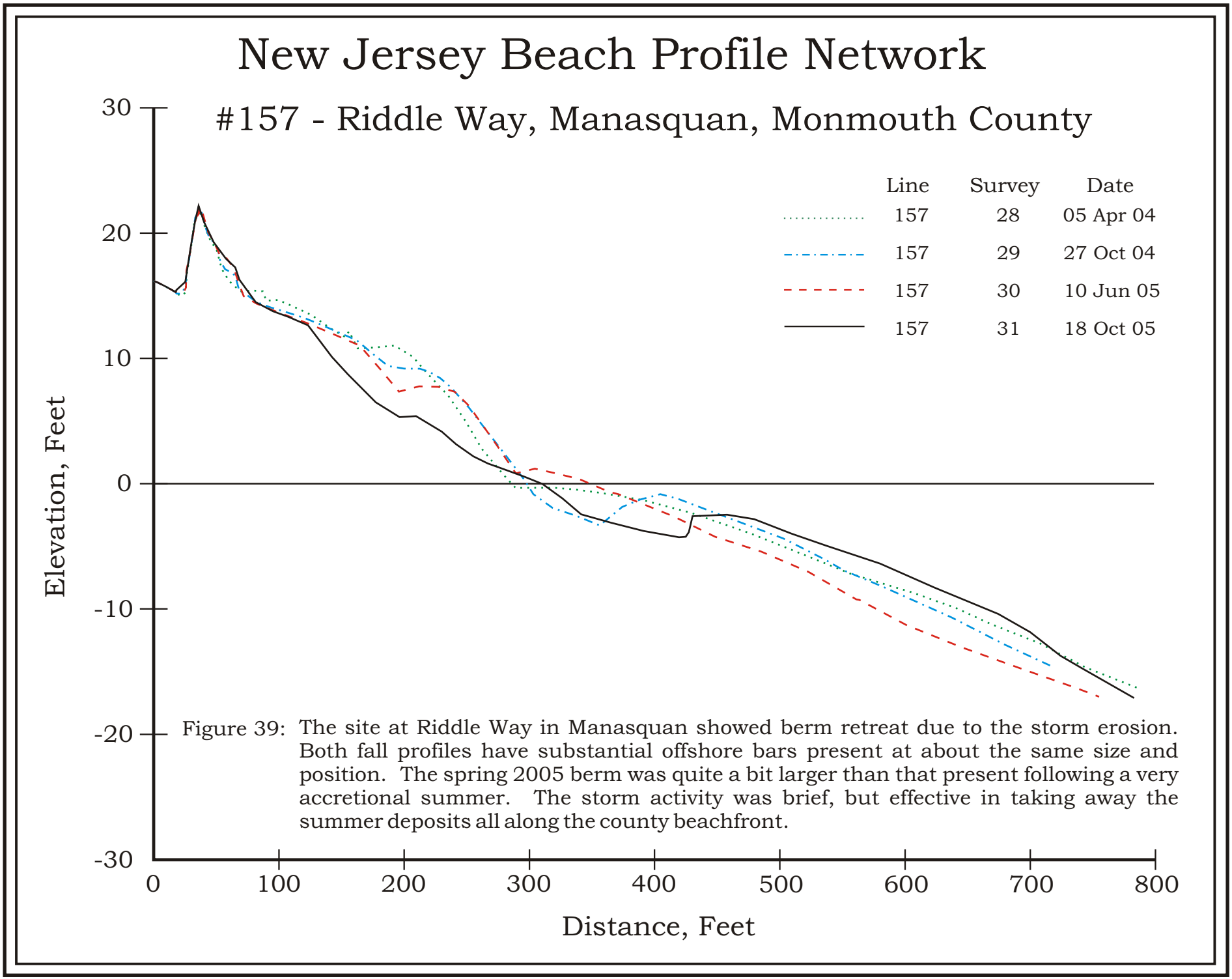


Figure 39: The site at Riddle Way in Manasquan showed berm retreat due to the storm erosion. Both fall profiles have substantial offshore bars present at about the same size and position. The spring 2005 berm was quite a bit larger than that present following a very accretional summer. The storm activity was brief, but effective in taking away the summer deposits all along the county beachfront.

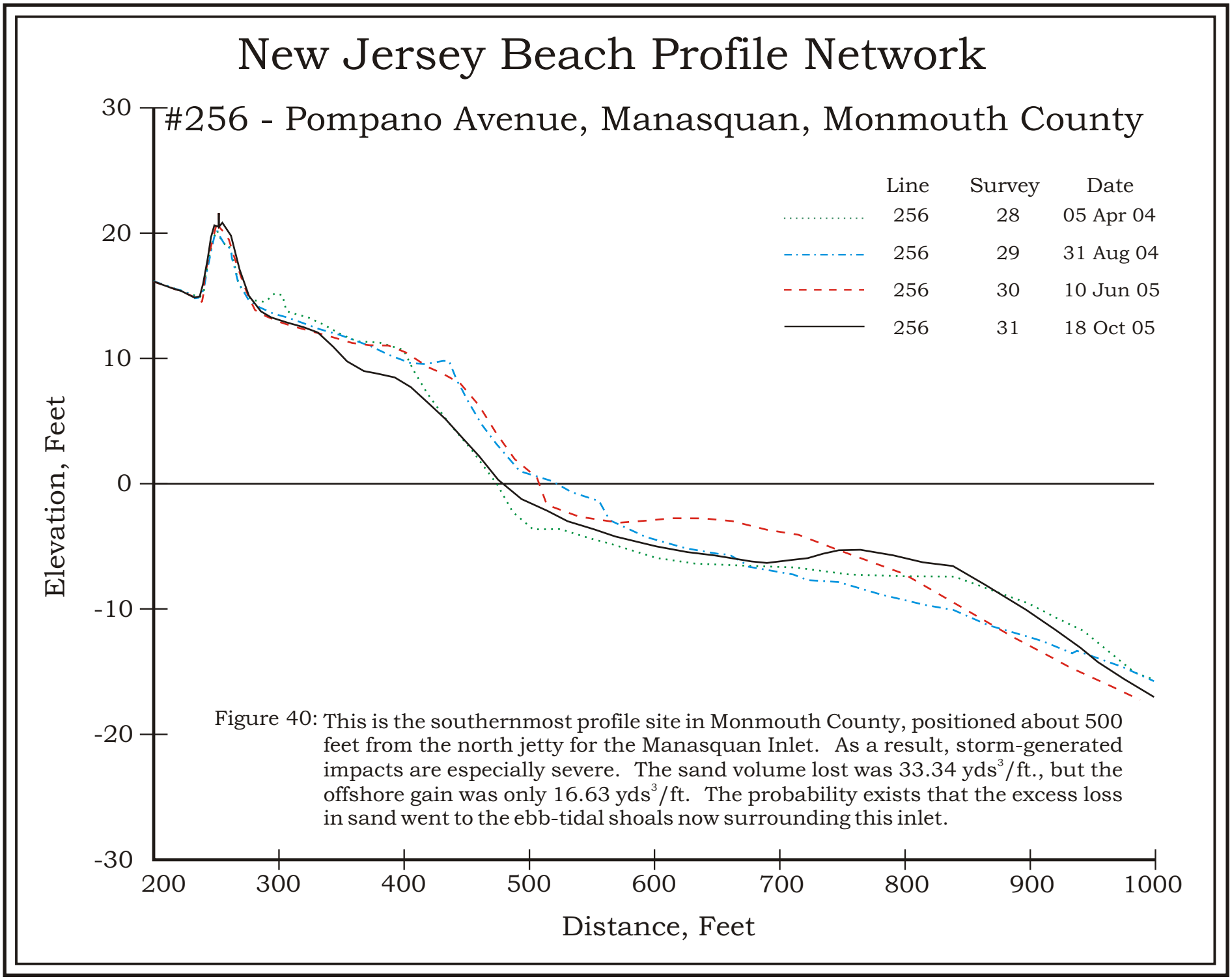


Figure 40: This is the southernmost profile site in Monmouth County, positioned about 500 feet from the north jetty for the Manasquan Inlet. As a result, storm-generated impacts are especially severe. The sand volume lost was 33.34 yds^3/ft., but the offshore gain was only 16.63 yds^3/ft. The probability exists that the excess loss in sand went to the ebb-tidal shoals now surrounding this inlet.