Appendix C
Profile Surveys

Profile Nomenclature

Profiles have been collected along the Long Island shore since the 1940s by the U.S. Army Engineer District, New York, and State and local agencies. From 1995 to 1998, a comprehensive survey program consisting of cross-shore profiles taken every 300 m (1,000 ft) between Fire Island Inlet to Montauk Point has been sponsored by the Atlantic Coast of New York (ACNY) Monitoring Program (Morang, Rahoy, and Grosskopf 1999).[1] These profiles include a mixture of short (wading-depth) and long (-30 ft National Geodetic Vertical Datum (NGVD)) lines. A series of long profiles from 1979 have recently been inspected and digitized. Some 1979 lines, when their locations coincide with modern lines, have been included in the plots below.

At the initiation of the ACNY program in 1995, a uniform numbering convention was adopted by the New York District and the New York State Department of State. The profiles between Moriches and Shinnecock inlets are in the Westhampton Reach and are labeled with a prefix "W." Originally, the easternmost Westhampton profile line was W44, but in Spring 1998, lines W45 to W50 were added to provide more comprehensive coverage (see Figure 29 of main text).

Profiles east of Shinnecock Inlet are in the Ponds Reach and are labeled with a "P." The western part of the Ponds Reach is a barrier spit that encloses the east half of Shinnecock Bay. The spit extends from the inlet northeast for 6 km until it joins Long Island proper at Halsey Neck. Beyond Halsey Neck, the shoreline runs past a series of low morainal ridges and shallow ponds. Two additional lines, SH1 and SH2, were added in Spring 1998.

[1] References cited in this appendix are located at the end of the main text.

Data Analysis

Profile data were provided by the New York District in two-dimensional (X-Z) or three-dimensional (X-Y-Z) form. Plots reproduced below were made with the Coastal Engineering Research Center's (CERC's) Beach Morphology and Analysis Package (BMAP) software.[2] Only the lines with multiple survey dates are presented below, organized from west to east.

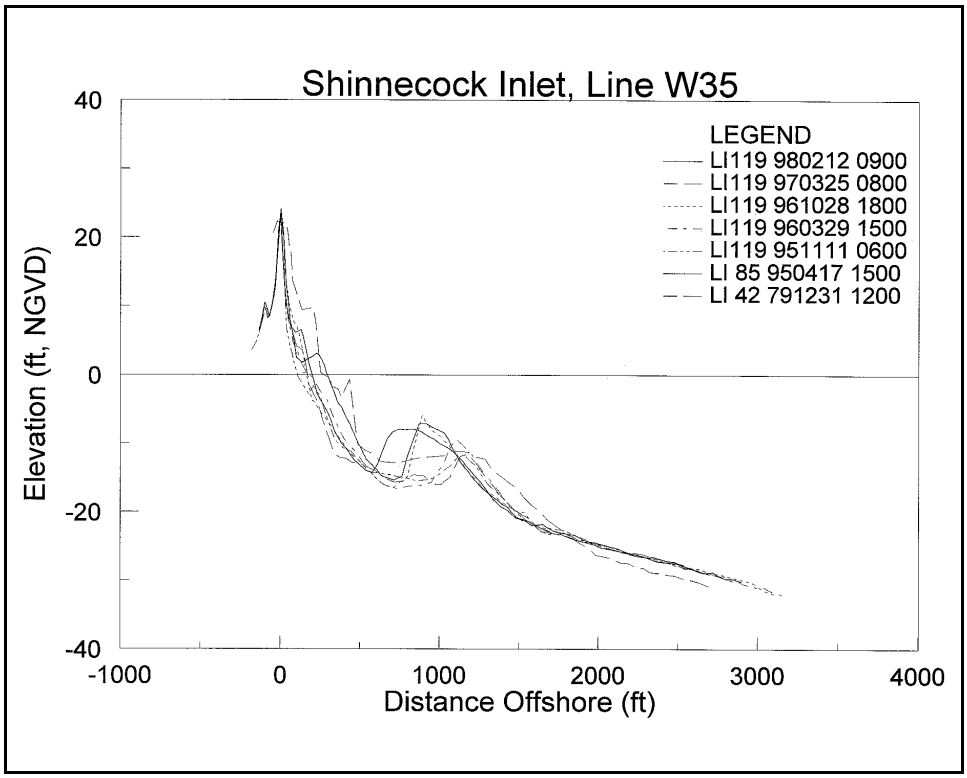

Figure C1. Profile line W35 (Profiles further west along Westhampton Beach resemble this line)

[1] BMAP software can be downloaded from the CERC web page.

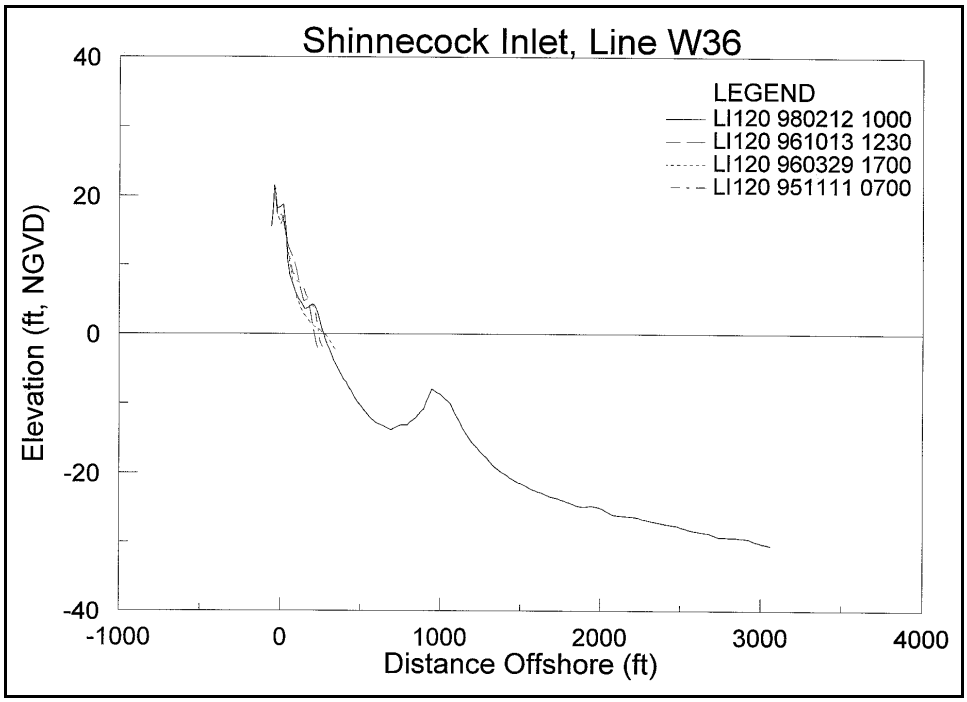

Figure C2. Profile line W36

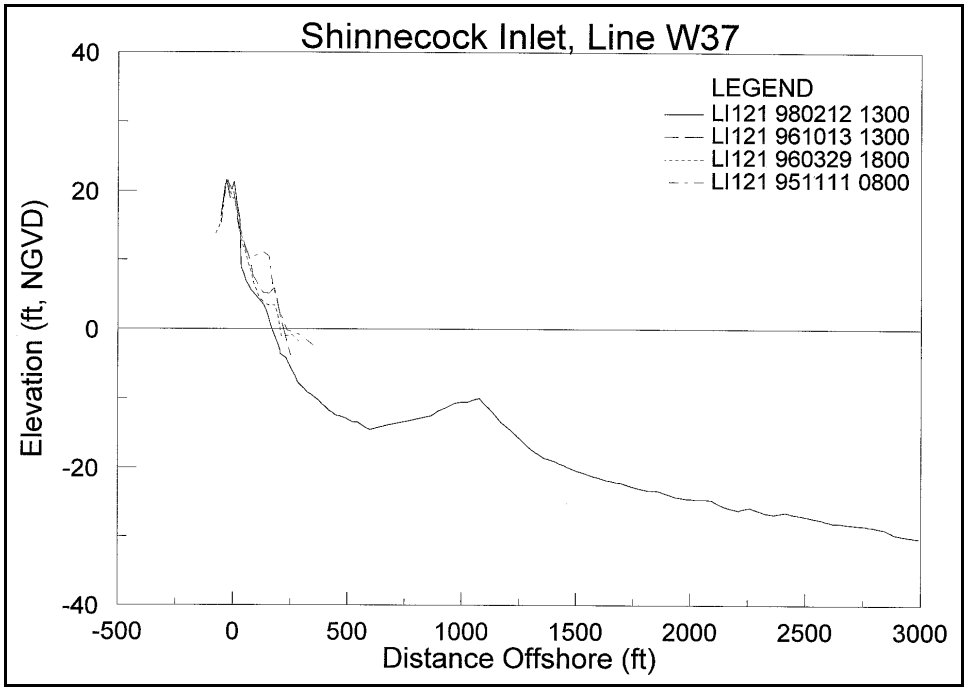

Figure C3. Profile line W37

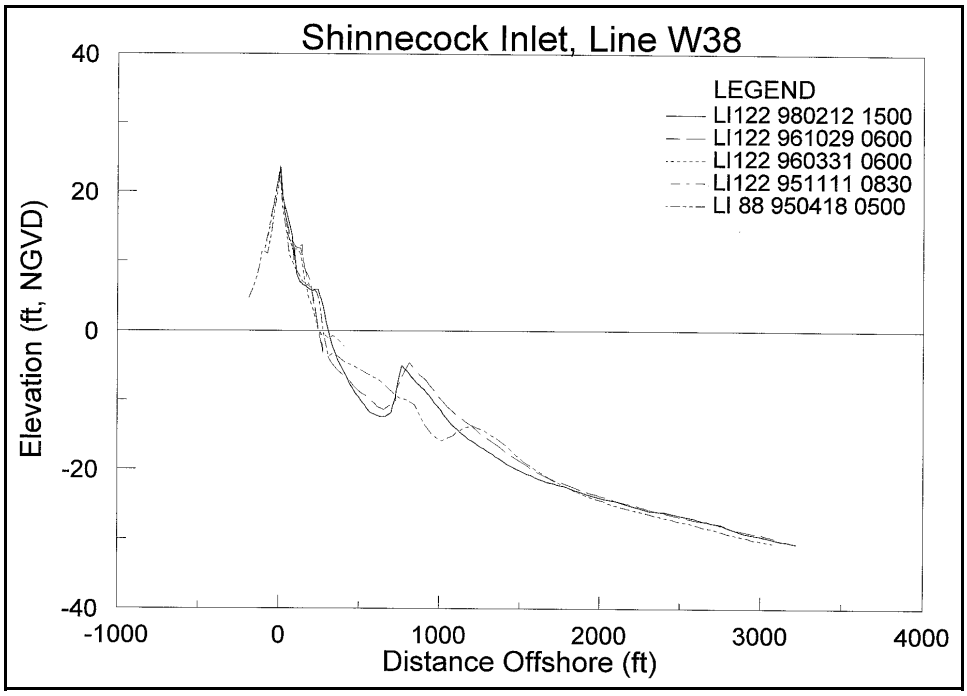

Figure C4. Profile line W38

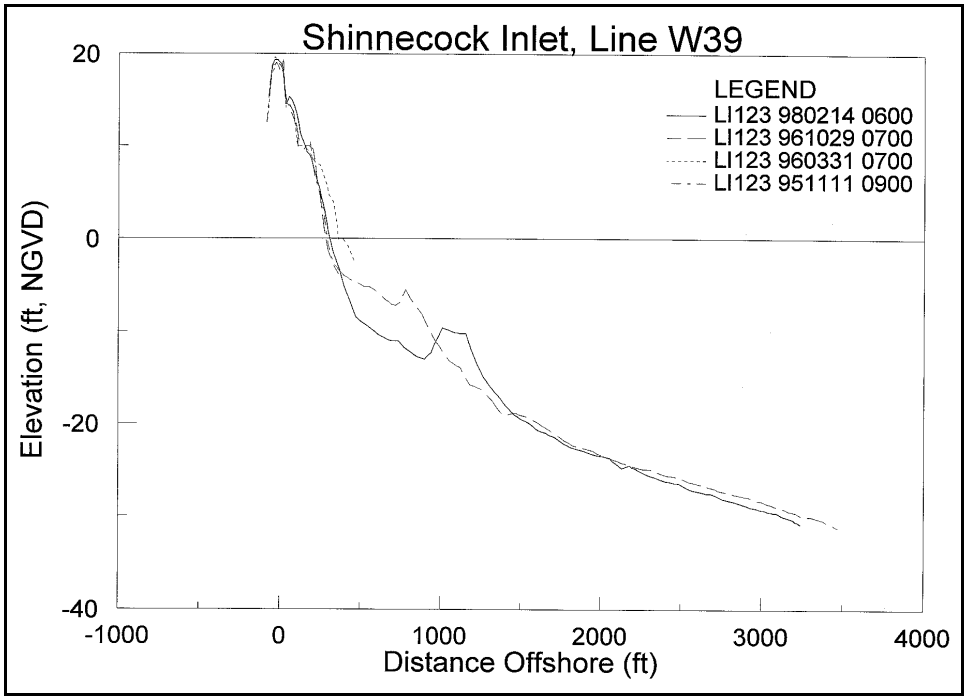

Figure C5. Profile line W39

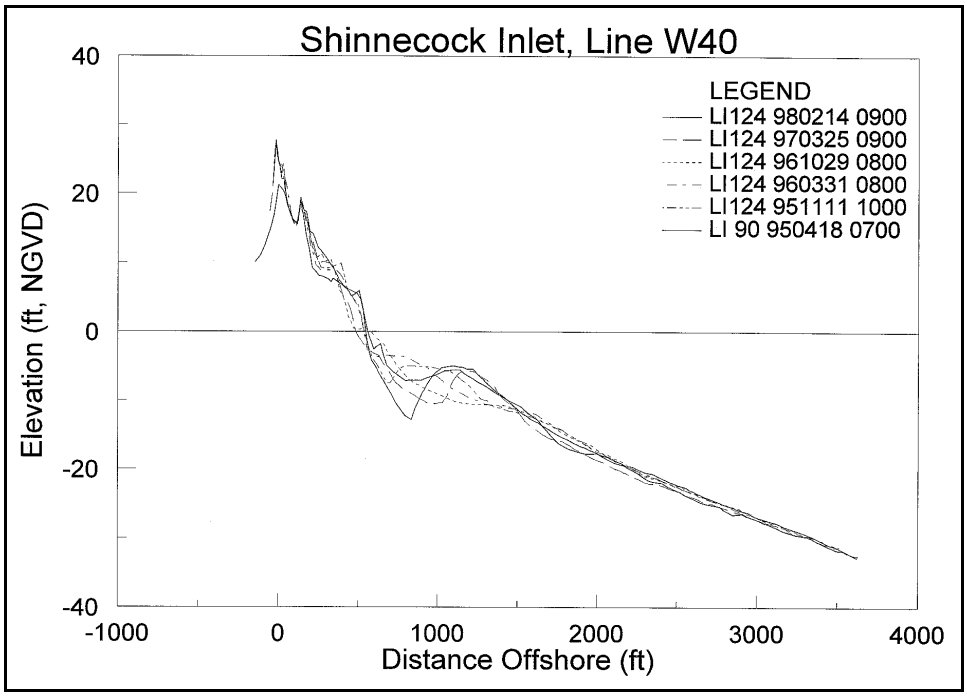

Figure C6. Profile line W40 (west edge of ebb shoal)

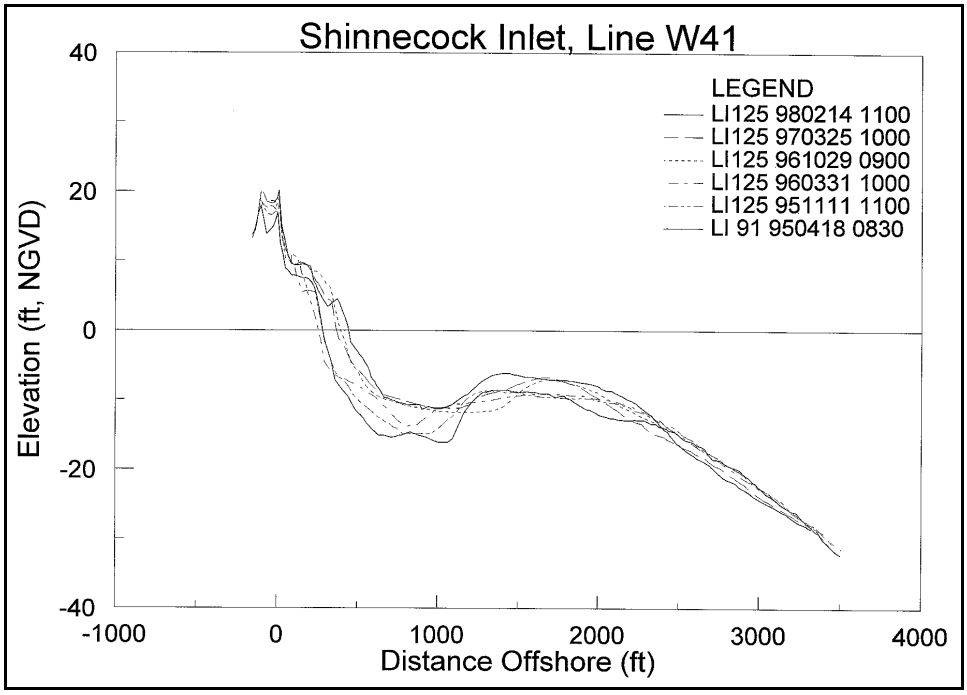

Figure C7. Profile line W41

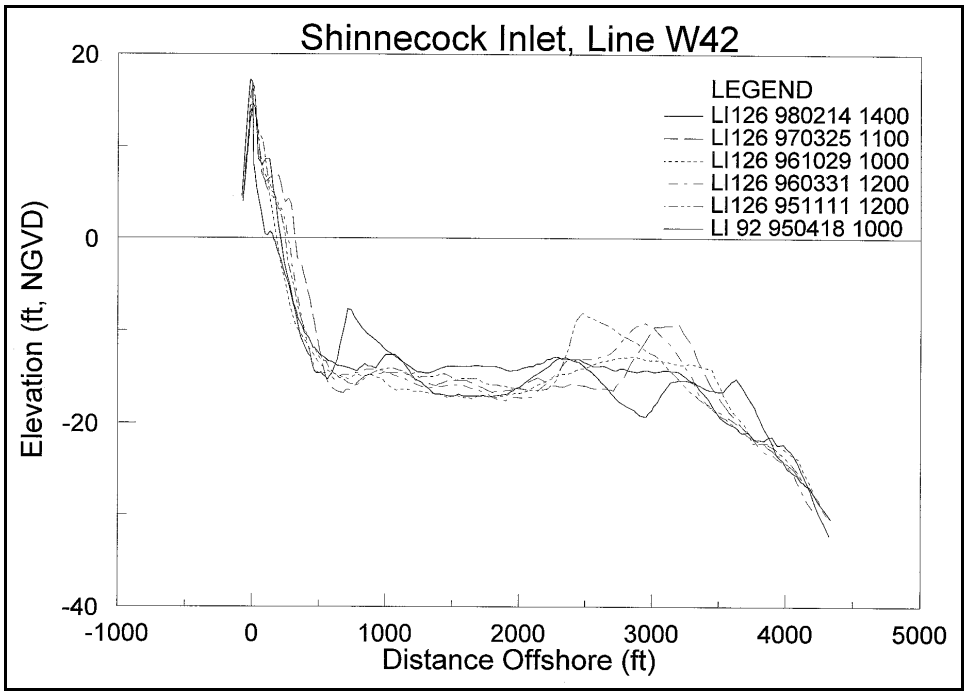

Figure C8. Profile line W42

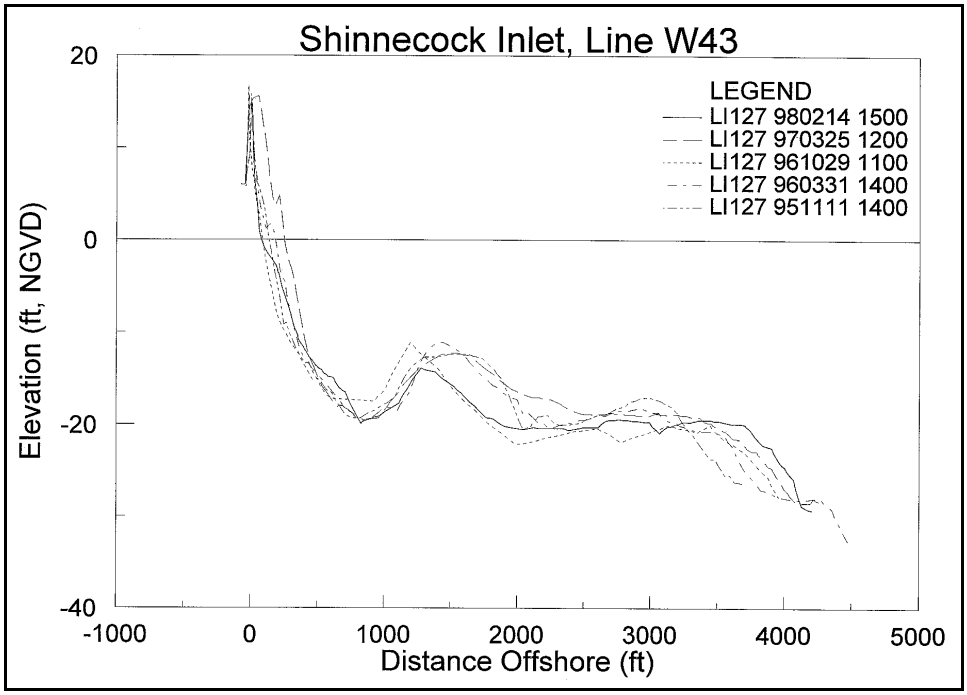

Figure C9. Profile line W43

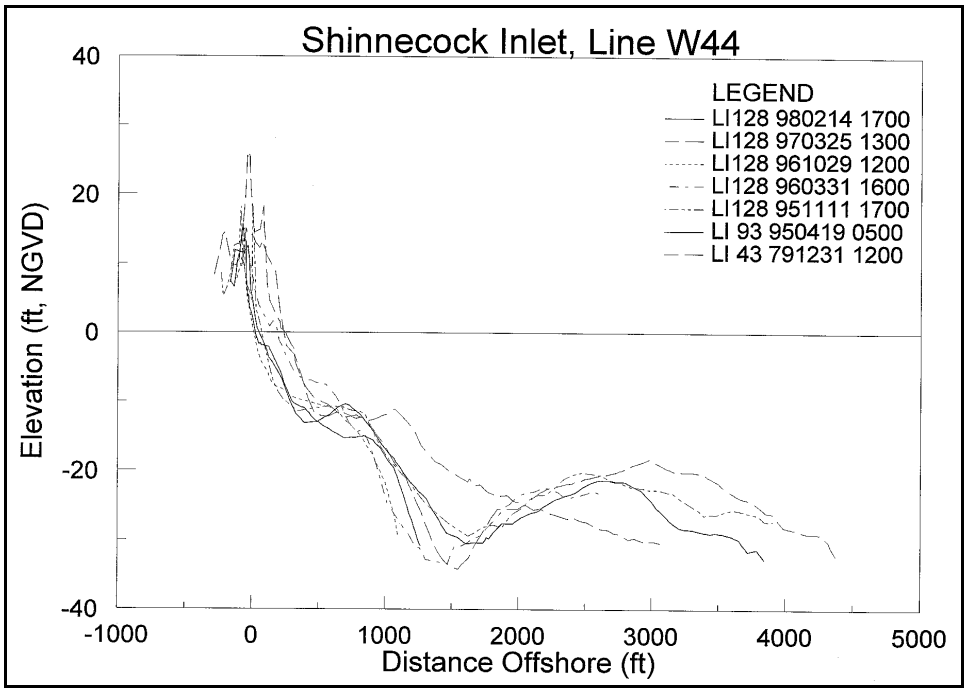

Figure C10. Profile line W44 (Easternmost line in the Westhampton Reach)

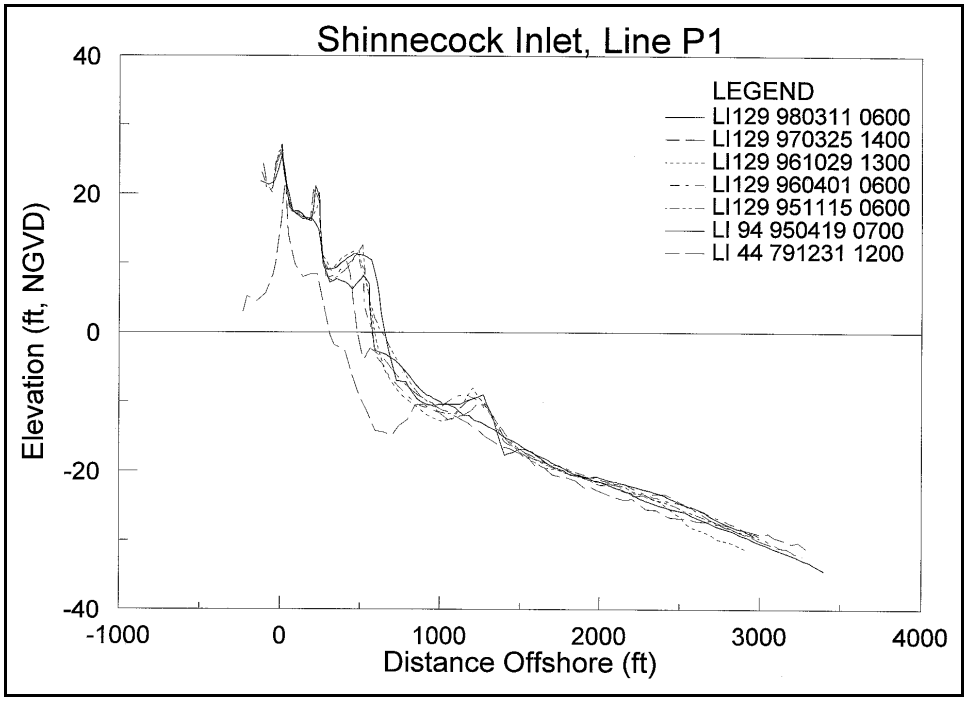

Figure C11. Profile line P1 (Westernmost line in Ponds Reach. Recent curves show shoreline advance compared with 1979)

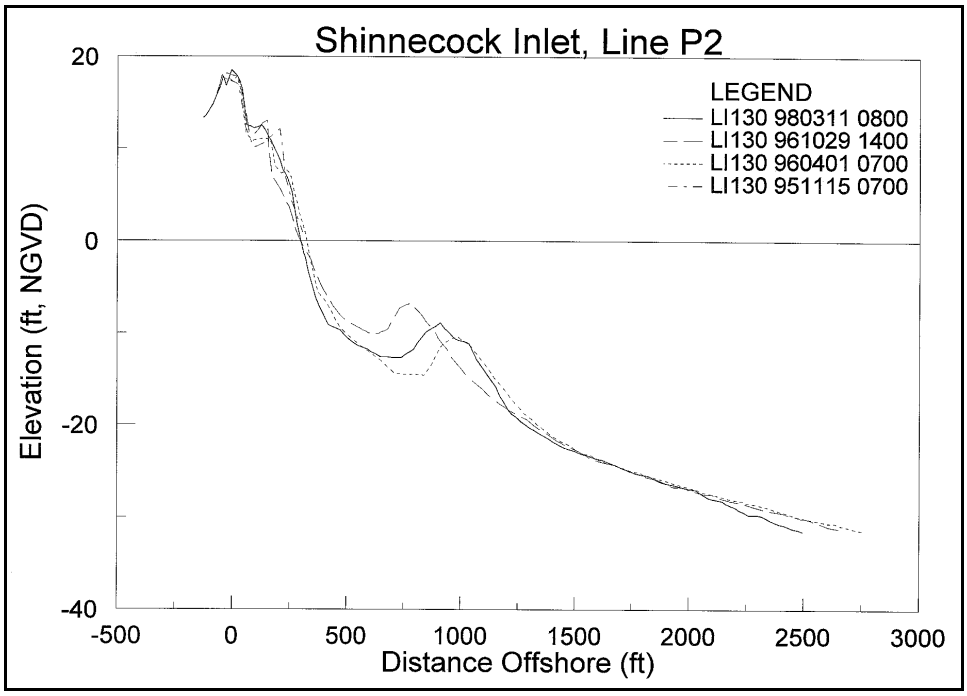

Figure C12. Profile line P2

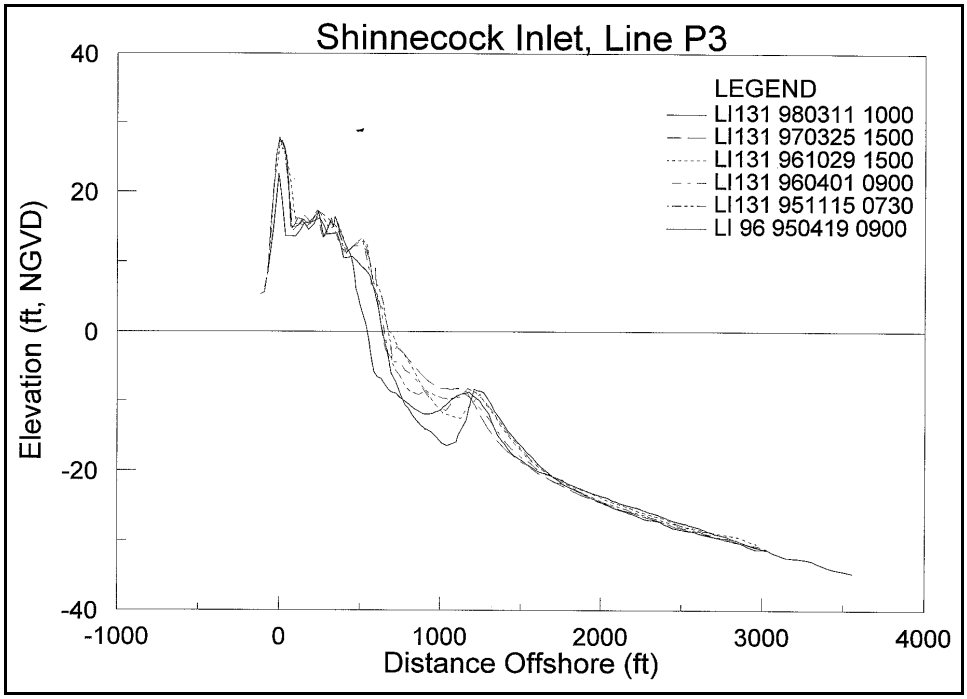

Figure C13. Profile line P3

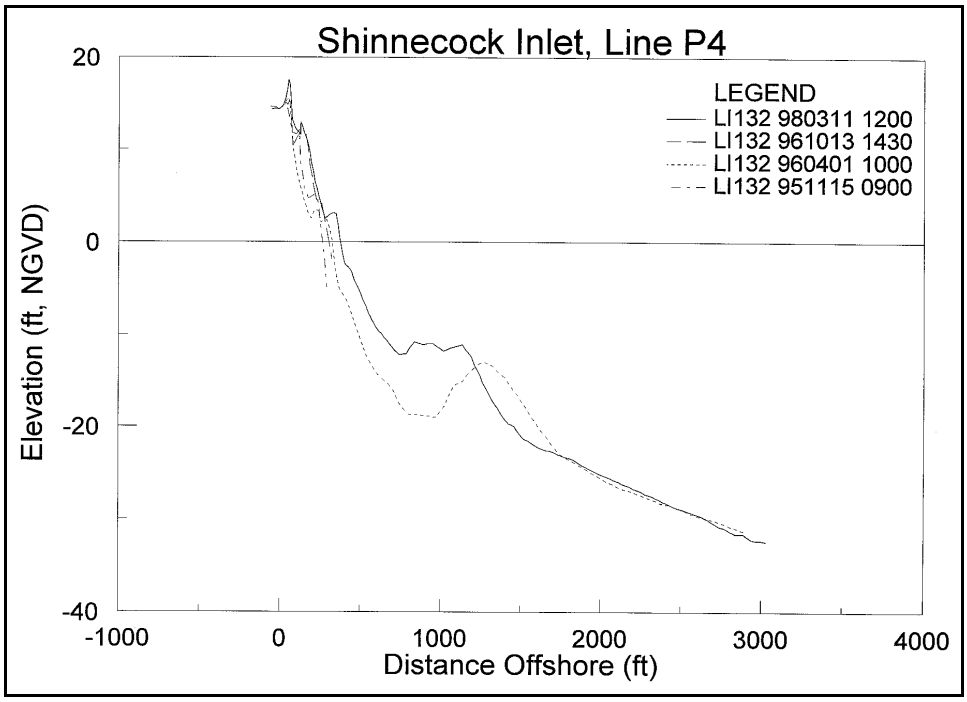

Figure C14. Profile line P4

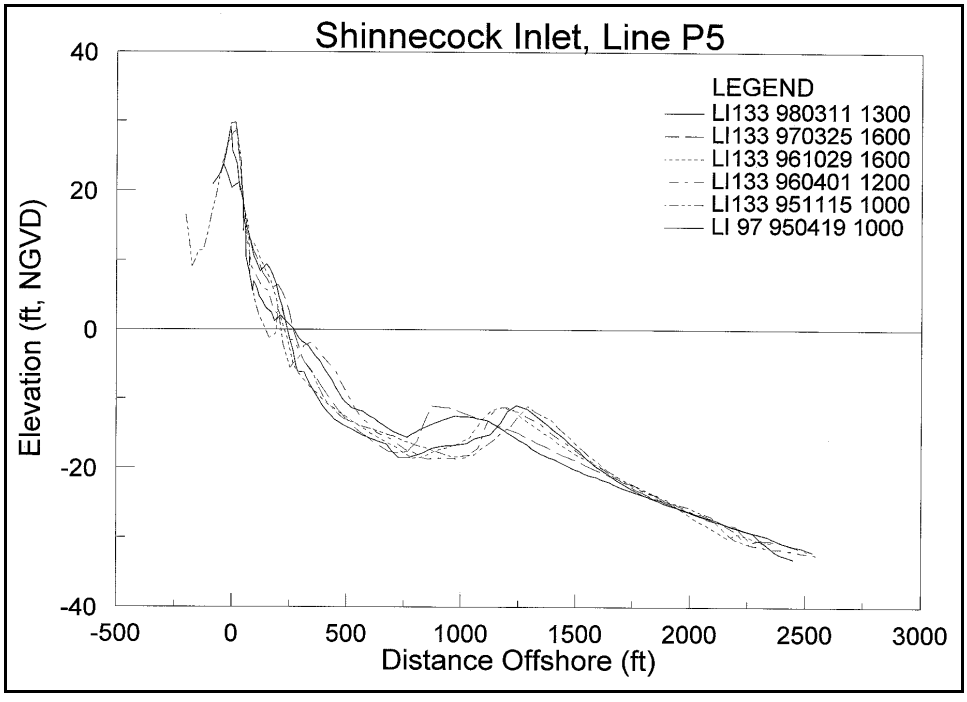

Figure C15. Profile line P5

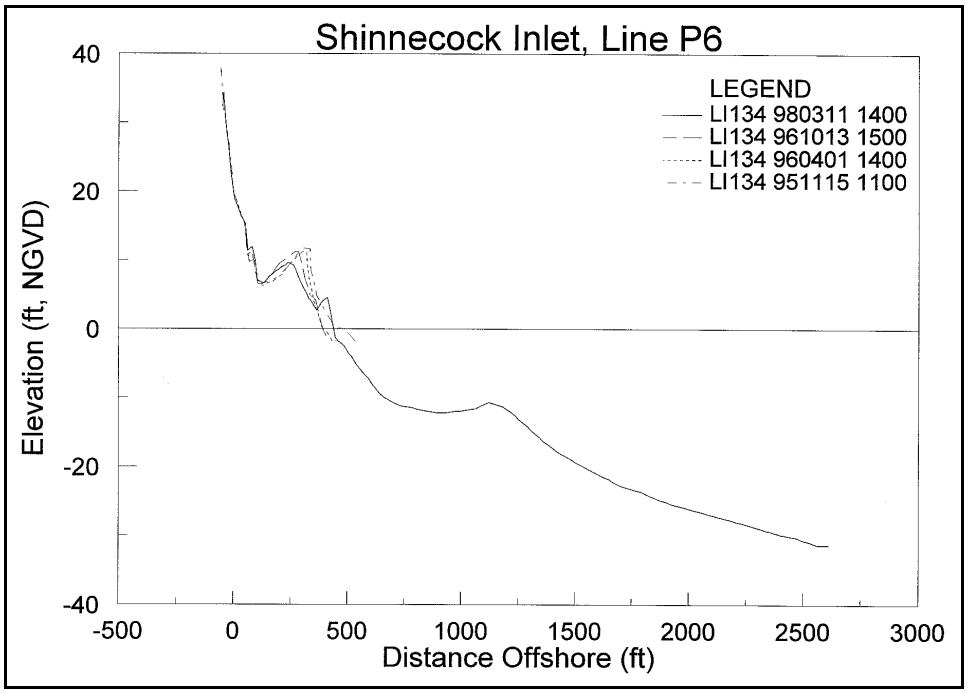

Figure C16. Profile line P6

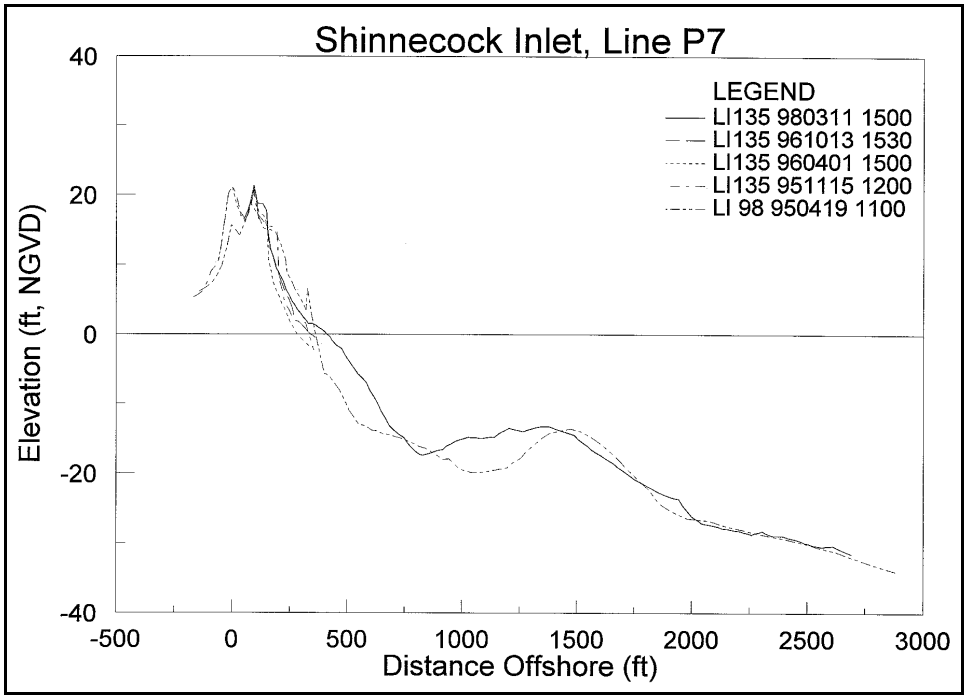

Figure C17. Profile line P7

Appendix D
Event and Activity Chronology

Table D1 lists engineering, natural, and cultural events that have occurred at or near Shinnecock Inlet. Early hurricanes are listed, although for most of them, no information is available describing their morphologic effects on Long Island beaches. There were few inhabitants on the south-shore beaches before the early 1900s; therefore, there are no first-hand accounts describing beach erosion and damage. Early newspaper accounts emphasized damage to boats and commercial structures in or near the towns where the papers were published. Data on beach fills are probably incomplete because many agencies have been involved over the decades and records have been lost. Some sources provide conflicting information. Readers who have additional information are encouraged to contact the author at the Coastal and Hydraulics Laboratory, U.S. Army Engineer Waterways Experiment Station (WES), Vicksburg, MS.

Table D1
Event and Activity Chronology, Shinnecock Inlet, New York

Date	Event [1]	Description	Source
15 Aug 1635	Hurricane	Effect on Long Island unknown. Much coastal flooding and property destruction in New England, as described in the *History of Plymouth Plantation, 1620-1647* by William Bradford and in the *Journal* by Governor John Winthrop.	Appendix G of U.S. Army Corps of Engineers (USACE) 1958a; Wood 1976
3 Aug 1638	Hurricane	Effect on Long Island unknown. Devastating effects in New England, as described in the *History of Plymouth Plantation, 1620-1647* by William Bradford and in the *Journal* by Governor John Winthrop.	Appendix G of USACE 1958a
29 Aug 1667	Storm (hurricane?)	Effect on Long Island unknown. Much flooding on Manhattan Island, as documented in *The Iconography of Manhattan Island* by J. N. Phelps Stokes. "Two small barkes ... were broken to pieces upon the Towne side, for want of good tackle. Much Tobacco and Salt damnified in Cellars."	Appendix G of USACE 1958a
22 May 1720	Storm	Effects on Long Island unknown. "A storm, described as the most terrible 'in the Memory of man' visits New York, destroying life and property." (From *The Iconography of Manhattan Island* by J. N. Phelps Stokes).	Appendix G of USACE 1958a
29 Jul 1723	Hurricane	Effects on Long Island unknown. The storm was probably a hurricane, causing much damage on Manhattan Island. "A north-east storm of wind and rain broke up the wharfs from one end of the City to the other, drove all Vessels ashore, except three, and broke three Sloops to pieces: the Tide higher than ever known here." (From *The Iconography of Manhattan Island* by J. N. Phelps Stokes).	Appendix G of USACE 1958a
30 Oct 1723	Hurricane	Effects on Long Island unknown. Much damage recorded in Rhode Island.	Appendix G of USACE 1958a
1755	Inlets	Seven inlets reported to be open east of Fire Island. Shinnecock Inlet probably open before 1755, according to Osborne (1970).	Leatherman and Joneja 1980
19 Aug 1788	Hurricane	Reported to be a "most terrifying storm." Probably a hurricane, it may have caused an opening in Moriches Bay. Much flooding in New York City. From the *Daily Advertiser* (20 August), "The ravages it committed on the battery were remarkable: - In the more exposed parts, the facing was torn away - and a considerable extent of solid stone work, seven feet in thickness, was totally demolished by the impetuosity of the sea."	Leatherman and Joneja 1980; USACE 1958a

(Sheet 1 of 12)

Note: References cited in this appendix are located at the end of the main text.

[1] Shinnecock Inlet dredging is listed when majority of dredged sand was placed on the beach or in the surf zone. Sand sources of locally funded renourishment often not specified; could be trucked from upland site, dredged from back bay, or dredged from offshore.

[2] Event log prepared by Research Planning Institute as part of 1981 south-shore sediment budget (Covell, Dow, and Kana 1981). Numerous permits are listed for dredging in Moriches and Shinnecock bays and possibly within the inlets, but no details available regarding actual dredge volumes or disposal.

[3] Engineering data sent by facsimile on 3/10/97 by Mr. William Lifford, Suffolk County Department of Public Works (courtesy Ms. Julie Rosati, WES) and notes acquired at Suffolk Co. offices by Andrew Morang, Nov. 1998.

[4] Engineering data sent by facsimile on 2/20/97 by Ms. Thelma Georgeson, Mayor, Village of Quogue, NY (courtesy Ms. Julie Rosati, WES).

[5] Hurricane category refers to the Saffir-Simpson scale from 1 to 5.

Table expanded from:

Morang, A., 1998. "Atlantic Coast of New York Monitoring Project, Report 1, Analysis of Beach Profiles, 1995-1996." Draft report prepared for U.S. Army Engineer District, New York, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

Table last updated: 17 March 1999

Table D1 (Continued)

Date	Event [1]	Description	Source
23-24 Dec 1811	Storm	"The greatest blizzard of all time" caused severe damage to barrier islands. The *History of Long Island* by Benjamin F. Thompson described it as, "Great Storm - On the night of the 23[D] December, 1811, commenced one of the most remarkable snowstorms and gales of wind ever experienced together, upon Long Island. It came from the north-east, and swept over Long Island with dreadful violence. An immense amount of property was destroyed, and many lives lost. ... It is supposed that more than sixty vessels were cast ashore upon the north side of Long Island."	Leatherman and Joneja 1980; USACE 1958a
22-23 Sep 1815	Hurricane	One of the most violent storms to strike Long Island, comparable with the 1938 hurricane. Flooding in the vicinity of Hook Pond equal to or greater than the 9- to 11-ft inundation in 1938. "The dunes were flattened along the coast and the shoreline was altered. Mecox Bay was filled with the sea so that it flowed backwards over the mill at Water Mill." (From *The Hurricane of 1938 on Eastern Long Island* by Clowes). Agustus Griffin, who kept a diary, wrote on 23 September, "After 11 A. M. Wind Shifted -- - S. W. and blew with uncommon violence, taking in its course in this and other places of 20 miles around, thousands of trees up by the roots ... It was one of the most Destructive Storms that the East end of Long Island ever felt - and perhaps many parts of Connecticut."	Clowes 1939; Appendix G of USACE 1958a
3 Sep 1821	Hurricane	As reported in the *New-York Spectator* of 7 September, "The tide on the Long Island shore was four inches higher than recollected by the oldest inhabitant; and much damage was done to mills and milldams, and some flour and grain were destroyed." 21 lives lost on boats that floundered.	Appendix G of USACE 1958a
1829	Inlet	Shinnecock Inlet shown open near the east end of the bay according to Osborne (1970)	Leatherman and Joneja 1980
1838	Barrier morphology	U.S. Coast and Geodetic Survey (USC&GS) chart T-58 shows mainland at Quogue connected to barrier by low marsh, suggesting no open waterway between Quontuck and Shinnecock bays. Bay shoreline is smooth along Tiana Beach, and the island is rather narrow compared with present configuration.	Leatherman and Joneja 1980
Pre-1854	Inlet	USC&GS chart shows Shinnecock Inlet open south of Rampasture, about 2.4 miles west of present location. Islands in this area now may represent former flood shoal. Closed by May 1889.	Leatherman and Joneja 1980
8 Sep 1869	Hurricane	The *Sag Harbor Express* reported this to be the most severe storm since 1815. Damage was greatest in the east, and at Napeague Harbor, many fishing vessels were destroyed. A three-masted schooner with a cargo of coal came ashore 8 miles west of Montauk Point. The severity of the gale only lasted from 20 to 25 min. Coney Island was nearly submerged, and the bathing houses swept into the bay.	Appendix G of USACE 1958a
18-19 Aug 1879	Hurricane or tropical storm	Much property and crop damage, trees uprooted. Many small boats damaged.	Appendix G of USACE 1958a

(Sheet 2 of 12)

Table D1 (Continued)

Date	Event [1]	Description	Source
3 Feb 1880	Storm	High surf along south shore. Damage to Concourse at Coney Island.	Appendix G of USACE 1958a
12 Mar 1888	Blizzard of '88	Blizzard of 1888 caused over 400 deaths, including 200 in New York City alone. Snowfall averaged 40-50 in. over southeastern New York State and southern New England, with drifts to 30-40 ft. Highest reported drift was 52 ft in Gravesend, NY. 80 mph wind gusts were reported, although the highest official report in New York City was 40 mph and 54 mph at Block Island. From Chesapeake Bay through the New England area, over 200 ships were either grounded or wrecked, resulting in the deaths of at least 100 seamen. Melting snow after the storm caused severe flooding, especially in Brooklyn, which it was susceptible to because of topography. Effects on Long Island beaches not reported.	Lott 1993
24 Aug 1893	Hurricane	*The Sun* on 25 August reported, "From all quarters of storm-swept Long Island come tales of havoc wrought by the gale. Forests were uprooted and stripped, houses blown down, highways turned into roaring rivers, and miles of farm land inundated and the crops destroyed." Southampton: 17 men lost on a tug. East Moriches: 45 yachts and fishing boats sunk. Babylon: waves washed over Fire Island, causing great damage along the shore for miles (beach erosion?). Great South Bay: 200 vessels sunk. The *New York Times* reported the storm was exceptionally severe at Coney Island, with waves sweeping 600 ft inland to a height of 30 ft, washing over the elevated train station. Hog Island, a popular resort off Rockaway Beach, was destroyed by the storm.	Appendix G of USACE 1958a; *New York Times* 18 March 1997
10 Oct 1894	Hurricane	Many boats destroyed. Landfall around Moriches.	Leatherman and Joneja 1980; Appendix G of USACE 1958a
1896	Peconic Canal tide gates	Automatic tide gates built at south end of Shinnecock and Peconic Canal to keep Shinnecock Bay water level high and prevent erosion of banks and growth and decay of vegetation.	Whitford 1906
1893-1933	Inlet closed	Osborne (1970) stated Shinnecock Inlet closed this period. 1889-1890 USC&GS charts provide evidence of different inlets into Shinnecock Bay, all of which closed by 1891. One of the former openings was opposite Shinnecock Neck. Another was slightly west of Ponquogue Point. Two others were east and west of Gull Island, opposite East Quogue. 1903 and 1904 U.S. Geological Survey (USGS) (Sag Harbor Quadrangle) showed no inlets into either Moriches or Shinnecock bays.	Leatherman and Joneja 1980
1896	Inlet cut	As part of the Shinnecock and Peconic Canal project, a channel 30 ft wide, 6 ft deep cut through the barrier island dunes with the purpose of increased flushing of Shinnecock Bay to relieve stagnant conditions. Local inhabitants donated services. Dunes said to be 20-30 ft high. "...It proved a failure, the waves quickly forming the dunes again, so that few traces of the channel now remain."	Whitford 1906
24-25 Oct 1897	Extratropical storm	The *New York Times* of 26 October reported, "A Terrific Northeaster....Buildings were undermined and destroyed, roads washed out, lowlands flooded, peninsulas made into islands and new inlets gouged out by the terrific bombardment of the high seas, and railroad traffic was interrupted."	Appendix G of USACE 1958a

(Sheet 3 of 12)

Table D1 (Continued)

Date	Event [1]	Description	Source
16 Sep 1903	Hurricane	Widespread flooding at Coney Island. Geologic effects or damage to south shore not recorded, but "the northeast winds driving extremely high tides in our bays and coves." (From the *Sag Harbor Express* of 15 October)	Leatherman and Joneja 1980; USACE 1958a
14-15 Sep 1904	Hurricane	Many trees destroyed, fishing boats driven ashore, and buildings at Bridgehampton damaged. Much of Coney Island flooded, with the surf rolling unbroken up Orient Boulevard as far as Neptune Avenue. Geologic effects along south shore not recorded.	Leatherman and Joneja 1980; USACE 1958a
4 Mar 1931	Storm (northeaster); Moriches Inlet breach	The *New York Times* of 5 March reported, "High Tide and Gale Lash Atlantic Seaboard; Long Island Homes Undermined by Raging Sea. .. A high tide, fostered by an offshore gale and a full moon tore away great sections of beachfront yesterday in Long Island." The gale reportedly led to reopening of Moriches Inlet. By 1933, inlet 1,300 ft wide. Original opening about 3,600 ft east of present inlet (see USACE 1958b, Plate A1). Migrated west until stabilized by revetment in 1947. Much flooding at Rockaway Beach, Jamaica Bay.	Leatherman and Joneja 1980; USACE 1958a,b
8-9 Sep 1934	Hurricane	Widespread wind damage, many boats washed ashore, but no reports of south shore geologic effects. Liner *Morro Castle* caught fire and abandoned off New Jersey, 134 deaths.	USACE 1958a
17 Nov 1935	Storm (northeaster)	Cottages destroyed at Southampton, some flooding.	USACE 1958a
1937	Long Island Intracoastal Waterway Federal Project	River and Harbor Act, approved 26 Aug 1937: 1. Channel from Great South Bay opposite Patchogue to south end of Shinnecock Canal, ≈33.6 miles x 100 x 6 ft (at mlw). Completed 1940. 2. Central basin to head of navigation in Patchogue R.: 100 x 8 ft.	USACE 1958b
21 Sep 1938	Great New England Hurricane - Shinnecock Inlet breach	Category 3.[5] One of the most devastating storms in New England history, resulting in 680-700 deaths. Caused massive washovers all along south shore of Long Island. Eye crossed over Moriches Bay. High water levels: 1. Moriches Bay: 15.7 ft above mlw recorded at Hart Cove. 2. Shinnecock Bay: 7.2 ft above mlw estimated at south end of Shinnecock canal. No ocean water levels were recorded, but computations indicate the water level was about 10 ft above msl. Lowest recorded barometric pressure was 27.94 in. Max. wind speed of 82 miles per hr. recorded on Block Island. Clowes (1939) described four inlets opening to Shinnecock Bay: 1. Near Warner's Islands, 0.5 miles east of Ponquogue Point, 40.5 miles east of Fire Island lighthouse. Closed 1938? 2. Opposite Cormorant Point, 41.6 miles east of lighthouse. By 1939, over 700 ft wide. Still open. 3. Opposite Shinnecock Hills, 43.3 miles east of lighthouse. Closed 1938? 4. Opposite Shinnecock Indian Reservation, 44.2 miles east of lighthouse. Closed 1938?	Allen 1976; Leatherman and Joneja 1980; Rappaport and Fernandez-Partagas 1995; USACE 1958a, 1958b

(Sheet 4 of 12)

Table D1 (Continued)

Date	Event [1]	Description	Source
1939	Shinnecock bulkhead construction	Suffolk County constructed 1,470-ft bulkhead on west side of inlet: timber piles, riprap, gabions, and 20 short spur jetties. Purpose: retard westward inlet migration. Construction underway by Feb 1939 as seen on aerial photos. Total cost about $80,000.	Nersesian and Bocamazo 1992; USACE 1958a, 1958b, 1971, 1988
1939	Dune rehabilitation	Suffolk County, with support from Works Progress Administration, undertook 68 miles of dune rehabilitation. Consisted of snow fencing, brush, and beach grass. Hydraulic fill placed for 4 miles in Westhampton and Southampton, but this method was discontinued because of high cost. Drag-lines, bulldozers, and cranes also used. As a result, 9 of 10 inlets opened by the 1938 hurricane were closed. Total cost about $1,000,000, incl. $250,000 financed by the WPA.	USACE 1958a
Sep 1940	Tidal prism	Prism of 375,000,000 ft^3 (10,600,000 m^3, 13,900,000 yd^3), with mean current velocity of 3.5 ft/sec. Measurement method or party conducting study unknown.	Memorandum for the Chief, Engineering Division by S. Gofseyeff, 5 Dec 1951 (New York District archives)
1941	Shinnecock Inlet morphology	Inlet widened to the east to about 1,000 ft, inner and outer bar formed, tortuous channel connected ocean to Shinnecock Bay. Controlling depth only 4 ft.	Nersesian and Bocamazo 1992
1941	Tidal prism	Prism of 330,000,000 ft^3 (9,300,000 m^3, 12,200,000 yd^3). Measurement method or party conducting study unknown.	Memorandum for the Chief, Engineering Division by S. Gofseyeff, 5 Dec 1951 (New York District archives)
1943	Bay dredging	Channel dredged by USACE from Shinnecock Bay to L. I. Intracoastal Waterway at request of U.S. Navy.	USACE 1958b
Sep. 14, 1944	Hurricane	Category 3. Caused 390 deaths in northeast U.S. (344 on ships at sea). Passed just east of Montauk Point. Effects of this storm not as severe as the 1938 hurricane, but still it "Ravaged barrier islands." Wind gusts up to 55 mph from northeast recorded at Fire Island. Ocean tide of 8.4 ft above msl at Jones Inlet approximately the time the predicted tide would have been at msl. In Moriches Bay at Westhampton Beach, tide reached 5.8 ft above msl, about 5 ft above predicted. Severely damaged dunes that had been repaired after the 1938 hurricane, and 25,000 ft of dunes were lowered. 63 sluiceways counted by Suffolk Co. officials.	Leatherman and Joneja 1980; Rappaport and Fernandez-Partagas 1995; Parkman 1978: USACE 1958b
1947	Shinnecock revetment repair	800-ft stone revetment on west side and 130-ft stone groin added to north end by N.Y. State, Suffolk County, and Town of Southampton.	USACE 1958b, 1971, 1988; RPI Event Log 1981[2]
1947	Dune repair	465,000 yd^3 hydraulic fill, beach grass, sand fence. Exact location not specified (Town of Southampton), but possibly in conjunction with revetment repair.	USACE 1958a
1948	West of Shinnecock placement	40,200 yd^3 dredged from commercial docks, placed on ocean beach west of inlet. Suffolk County.	Suffolk Co. Planning Department 1985

Table D1 (Continued)

Date	Event [1]	Description	Source
25 Nov 1950	Storm (northeaster)	Peak storm-tide elevations ≈3.5 ft at Swan R. at East Patchogue and at Connetquot R. near North Great River (both draining into Great South Bay). In N.Y. Harbor, tides higher than during 1938 and 1944 hurricanes. Ocean tide levels above msl: Jones Inlet: 9.4 ft Oak Beach: 9.1 ft Shinnecock Inlet: 5.1 ft Montauk Point: 5.2 ft Coast Guard reported 20-ft waves at Jones Inlet. Suffolk Co. authorities reported that all dunes having top elevations of less than 12 ft were breached. Three breaks (washovers) occurred east of Quogue, opening into Shinnecock Bay. A new inlet formed at Westhampton beach (closed using bulldozers). Revetment on west side of Shinnecock Inlet was damaged because of erosion.	Leatherman and Joneja 1980; Schubert and Busciolano 1994; USACE 1958a, 1995
Sep (?) 1951	Shinnecock Inlet dredging	110,500 yd^3. Channel 2,000 x 200 x 9 ft through "inner sand bar" (flood shoal?). Disposal on beach west of inlet. Suffolk County.	Dent 1951; Suffolk Co. Planning Department 1985; USACE 1958b, 1971
Nov 1951 - Mar 1952	Tiana beach placement	120,000 yd^3 hydraulic fill (source unknown). Grass planted. NY State?	RPI Event Log 1981 [2]
Jul 1952 - May 1954	Shinnecock jetties	N.Y. State, Suffolk County, and Town of Southampton built stone jetties on both sides of inlet: East jetty: 1,461 ft with 700-ft riprap revetment. West jetty: 846 ft (extended in 1954 to 946 ft). Width of inlet fixed at 800 ft. Cost of works: $1,264,390	USACE 1958a, 1958b, 1971, 1988; Nersesian and Bocamazo 1992; RPI Event Log 1981 [2]
6-7 Nov 1953	Storm	Storm center moved inland near New York City. Estimated wave heights about 20 ft along south shore. Coincidence of the storm passage with predicted high tide resulted in extremely high levels. Numerous homes in Fire Island area were damaged. From Fire Island Inlet to about 2½ miles east, the ocean broke through the barrier island into the bay at five locations. Two major breaks in the barrier near Smith Point caused inundation of Mastic Beach and heavy property damage. At Westhampton Beach, the ocean broke through the barrier in eight places. Between Democrat Point and Moriches, the dunes were cut back from 10 to 50 ft. Jetties at Moriches and Shinnecock inlets damaged. "A sand bar was formed approximately 500 feet offshore from Shinnecock Inlet, and the inlet shoaled to over half way across from west to east."	USACE 1958b (p. G-19)
31 Aug 1954	Hurricane Carol	Category 3. Crossed Long Island approx. at Moriches Bay. Wind gusts of up to 96 mph recorded at Westhampton Beach. Max. height of ocean tide 6.9 ft above msl at Jones Inlet and 6.6 ft at Oak Beach. Suffolk Co. Highway Dep. estimated the ocean tide to be 10.4 ft above msl at Shinnecock Inlet. Damage in eastern Long Island greater than in west: a. Shinnecock: Carol devastated east jetty and bayside revetment. Land adjacent to east jetty flooded by storm surge and dunes washed away. Revetment damage caused by ebb flow of surge from bay. West of inlet, large zone of overwash extended clear across barrier island. Ten breaks in dunes between Quogue and inlet. b. Westhampton Beach: two deep 1,000-ft breaches across barrier, 14 homes destroyed. c. Southampton: 26 washovers. d. Moriches: Damage to jetties also severe. Inlet shoaled and rendered impassible for navigation. The President of the United States designated Suffolk Co. as a major disaster area.	Nersesian and Bocamazo 1992; Rappaport and Fernandez-Partagas 1995; Parkman 1978; USACE 1958a

(Sheet 6 of 12)

Table D1 (Continued)

Date	Event [1]	Description	Source
11 Sep 1954	Hurricane Edna	Category 3. The eye of the storm passed between Nantucket and Martha's Vineyard, Massachusetts at 2:30 PM. Because Edna arrived at low tide, high storm tides did not form. Maine suffered the greatest storm damage and deaths.	USACE 1958b
13 Aug 1955	Hurricane Diane	Category 1. Diane caused little damage as it moved into the continent; but long after its winds subsided, it brought floods to Pennsylvania, New York, and New England that killed 200 persons and cost an estimated $700 million in damage.	USACE 1958b; NOAA web page *www.aoml.noaa.gov/general/lib/*
Dec 1956	Dune rehabilitation	Hydraulic dredge purchased by Suffolk Co. for use in dune rehabilitation and channel dredging. Dunes east of Shinnecock Inlet raised to elevation of 20 ft above msl for distance of 5,000 ft. 343,400 yd^3 placed at cost of $170,000.	Suffolk Co. Planning Department 1985; USACE 1958a
Nov - Dec 1958	Westhampton beach fill	380,000 yd^3 hydraulic fill (source unknown). NY State?	RPI Event Log 1981 [2]
12 Sep 1960	Hurricane Donna	Category 4 in Florida, downgraded to 2 at Long Island. The storm made landfall in eastern Long Island, New York. When it did this, the eye was reported to be 50 miles wide, with a central pressure of 28.55 in. and winds of 95 mph at Block Island, Rhode Island. Caused numerous washovers and extensive property damage. Peak gusts 97 mph at La Guardia airport. High water 8.4 ft NGVD at the Battery and 8.35 ft at the Battery. Donna's impact was reduced in New England mainly because she made landfall during low tide.	Leatherman and Joneja 1980; Parkman 1978; Rappaport and Fernandez-Partagas 1995; USACE 1995b
1960	Federal project adopted	Existing project at Shinnecock Inlet adopted by the River and Harbor Act of July 14, 1960 (House Document No. 126, 86th Congress, 1st Sesssion). "This provides for an entrance channel 10 feet deep and 200 feet wide, from that depth in the Atlantic Ocean to Shinnecock Bay, thence an inner channel, 6 feet deep and 100 feet wide to the Long Island Intracoastal Waterway, rehabilitation of existing jetties and revetments, seaward extension of the west jetty about 900 feet, and construction of a fixed by-passing facility to transfer sand from the east side of the inlet to the west side." Authorized for three project purposes: 1. Navigation 2. Water quality 3. Beach erosion Although adopted, no funds appropriated and no Federal work conducted.	Ann. Rept. of Chief of Engr. 1961; United States 1959
1961	Sediment budget	Beach Erosion Board study concluded 300,000 yd^3/year to west.	Taney 1961a
1961	Cost estimate	$3,551,000 estimate to complete work.	Ann. Rept. of Chief of Engr. 1962
6-8 March 1962	Ash Wednesday Storm	Responsible for over 75 breaks (washovers) between Fire Island Inlet and Southampton. The largest breach, about 400 m wide, was at Westhampton Beach. In the Moriches to Shinnecock Reach, large stretches of Dune Road and 46 houses were destroyed. Notable offset at Shinnecock Inlet: west side eroded, accretion along east side. President of the U.S. declared the south shore a disaster area eligible for Federal aid. Under authority of Public Law 875, 81st Congress, the USACE performed engineering and construction of emergency shore protection and rehabilitation. 2,210,000 yd^3 sand pumped onto beaches, mostly from back bays.	Leatherman and Joneja 1980; USACE 1963
1962	Tiana beach placement	134,700 yd^3 dredged from Tiana beach channel, placed on barrier and on beach. Suffolk Co. (approx. 4 km west of inlet)	Suffolk Co. Planning Department 1985

(Sheet 7 of 12)

Table D1 (Continued)

Date	Event [1]	Description	Source
1964-1966	Westhampton groins	11 groins built by New York District along Westhampton Beach ≈10 km west of inlet	USACE 1988
1965	East Hampton groins	Two groins built by New York District at East Hampton (east of inlet). In addition, two smaller groins built by New York State.	USACE 1988
1968	Shinnecock Inlet dredging	270,300 yd^3. Disposal on beach west of inlet. Suffolk County.	Suffolk Co. Planning Department 1985
1969	Shinnecock Inlet dredging	113,000 yd^3. Disposal on beach west of inlet. Suffolk County.	Suffolk Co. Planning Department 1985
1969-1970	Westhampton groins	Four more groins built west of 11-groin field at Westhampton Beach by New York District.	USACE 1988
1972	Ponquogue dredging	14,000 yd^3 dredged from near Ponquogue Bridge, placed on barrier island. Suffolk Co.	Suffolk Co. Planning Department 1985
1973	Shinnecock Inlet dredging	250,900 yd^3. Disposal on beach west of inlet. Suffolk County.	Suffolk Co. Planning Department 1985
1973	West of Shinnecock fill	176,300 yd^3 dredged from commercial docks, placed on ocean beach west of inlet. Suffolk County.	Suffolk Co. Planning Department 1985
1975	Ponquogue dredging	103,500 yd^3 dredged from Intracoastal waterway near Ponquogue, placed on ocean beach. Suffolk County. (Work approx. 2½ km west of inlet)	Suffolk Co. Planning Department 1985
9-10 Aug 1976	Hurricane Belle	Peak storm-tide elevations ≈ 4.0 ft at Swan R. at East Patchogue.	Schubert and Busciolano 1994
1977	Ponquogue dredging	10,000 yd^3 dredged from near Ponquogue Bridge, placed on barrier island. Suffolk County.	Suffolk Co. Planning Department 1985
6-8 Feb 1978	Blizzard of '78	Northeaster deposited record amounts of snow and caused overwash and beach erosion along entire northeast United States. Because of shore orientation, Long Island was less severely affected than Massachusetts coast. Peak storm-tide elevations ≈ 3.5 ft at Swan R. at East Patchogue and at Connetquot R. near North Great River.	Schubert and Busciolano 1994
1983	Sediment budget	RPI study commissioned for Reformulation Plan: 367,000 yd^3/year enters control volume; 247,000 yd^3/year leaves; approx. 100,000 yd^3/year deposited on ebb shoal. (Note: RPI study considered unsatisfactory by New York District reviewers. Computations and conclusions have therefore not been used for planning or design.)	Research Planning Institute, 1983
1983	West revetment repair	Revetment near commercial docks repaired by Suffolk County Department of Public Works	Mr. Tom Rogers, Suffolk Co. Dep. of Public Works (Personal Communication, 1/15/99)
Feb-Mar 1983	West of Shinnecock placement	42,500 yd^3 predominately sand dredged from commercial docks, placed on beach west of inlet. Suffolk County.	Suffolk Co. Dep. Pub. Works[3]

Table D1 (Continued)

Date	Event [1]	Description	Source
1984	Shinnecock Inlet Dredging	*Currituck* removed 176,000 yd^3 emergency dredging from various locations in inlet to -14 ft mlw. Disposal west of inlet at -10 ft mlw.	Project notes, Construction Div., New York District (Mr. Don Braun, Personal Communication, 11/13/95)
28-30 Mar 1984	Northeaster	Near-hurricane winds caused storm tides 5-6 ft above normal, with max. tide 7.1 ft NGVD at Sandy Hook.	Moffatt & Nichol 1996
27 Sep 1985	Hurricane Gloria	Category 3. Peak storm-tide elevations >4 ft at Swan R. at East Patchogue and at Connetquot R. near North Great River. Overall damage less than expected.	Schubert and Busciolano 1994; USACE 1995b
1988	Tiana Cove (Bay?) placement	22,000 yd^3 predominately mud	Suffolk Co. Dep. Pub. Works[3]
1988	Shinnecock Inlet deposition basin	Revised project design called for the navigation channel to be enveloped by a deposition basin 2,700 × 800 ft, to be dredged to -20 ft mlw.	USACE 1988
Dec 1988 - Jan 1989	West of Shinnecock placement	83,200 yd^3, 100 percent sand (hopper barge in surf zone), emergency work by Suffolk County.	Suffolk Co. Dep. Pub. Works[3]
1990	Quogue dune restoration	1,600 yd^3 coarse fill from upland source placed along 855 ft of dune. Most lost in 1991-'92 storms.	Village of Quogue[4]
1990	West of Shinnecock placement	106,000 yd^3 (details unknown, probably non-Federal). NOTE: may be same dredge material disposal as listed below - records conflicting.	New York District project notes (Ms. Christina Rasmussen, Personal Communication, 1997)
7 Jun 1990	Cost-share agreement, navigation project improvements	Local Cooperation Agreement executed with New York State Dep. of Environmental Conservation. Cost allocation 69 percent Federal and 31 percent non-Federal.	Report of the Sec. of the Army on Civil Works Activities for FY 1990
1-23 Oct 1990	Shinnecock Inlet dredging	668,000 yd^3 dredged from deposition basin (ebb shoal). Disposal: 1. 138,000 yd^3 west of west jetty. 2. 77,000 yd^3 to fill scour hole by west jetty (channel side). 3. 193,000 yd^3 stockpiled on east side of inlet to use as fill behind revetment. 4. 260,000 yd^3 at Ponquogue Beach. Sand placed in scour hole lost within 1 year.	Project notes, Construction Div. , New York District (Mr. Don Braun, Personal Communication, 11/13/95)
1990 - 1993	Shinnecock Inlet deposition basin	Basin anticipated to fill with ≈ 425,000 yd^3 in 18 months. Unexpected result: less infilling than expected. From 1990-1993, <200,000 yd^3 was found in area, but not in prescribed basin.	Ms. Lynn Bocamazo, New York District (Personal Communication, 12/10/97)
19 Aug 1991	Hurricane Bob	Category 2. Eye passed 25 miles east of Montauk Point. Max. sustained winds 115 mph. Worst impact in eastern Long Island, but damage limited because storm passage coincided with low tide.	Schubert and Busciolano 1994; USACE 1995b

Table D1 (Continued)

Date	Event [1]	Description	Source
30-31 Oct 1991	Halloween Northeaster	Incl. 3, possibly 4 high tides. Extensive beach erosion and overwash along mid-Atlantic seaboard. Peak storm-tide elevations: 4.63 ft NGVD at Swan R. at East Patchogue; 4.7 ft at Connetquot R. near North Great River	Schubert and Busciolano 1994
10 Dec 1991	Cost-share agreement, jetty reconstruction	Local Cooperation Agreement executed with New York State Dep. of Environmental Conservation.	Report of the Sec. of the Army on Civil Works Activities for FY 1992
11-14 Dec 1992	Northeastern	Intense storm affected mid-Atlantic and northeast coast of United States, producing gale-force winds and gusts over hurricane strength. Caused extensive coastal flooding and beach erosion all along New Jersey and New York. Breached Westhampton Beach at two locations (Pikes Inlets), which later had to be artificially closed by USACE. Peak storm-tide elevations (11-12 Dec): 4.23 ft NGVD at Swan R. at East Patchogue; 4.0 ft at Connetquot R. near North Great River; 7.96 ft at the Battery.	Schubert and Busciolano 1994; USACE 1995b
1992	West of Shinnecock placement	12,000 yd^3 (details unknown, non-Federal).	New York District project notes (Ms. Christina Rasmussen, Personal Communi-cation, 1997)
1992	Pikes Beach placement	53,000 yd^3 - source: Intracoastal waterway	New York District project notes (Ms. Christina Rasmussen, Personal Communi-cation, 1997)
1992	Ponquogue placement	8,000 yd^3 (details unknown, probably non-Federal).	New York District project notes (Ms. Christina Rasmussen, Personal Communi-cation, 1997)
21 May 1992 - Nov 1994	Jetty repair	Rehabilitation of jetties, including rebuilding east and west tips to bring jetties back to original, pre-Federal length. New underlayer and bedding stone added to some areas along with new facing stone.	Report of the Sec. of the Army on Civil Works Activities for FY 1992; 1995
1992-1994	Tidal prism	Field studies conducted by Coastal Engineering Research Center using acoustic Doppler current profilers. Prism based on flooding phase of tide: 21-23 July 1992: 24,300,000 m^3 (31,800,000 yd^3) 15 Sep 1993: 38,600,000 m^3 (50,500,000 yd^3) 20-21 July 1994: 33,200,000 m^3 (43,400,000 yd^3)	Memorandum for Record, 28 June 1995
12-14 Mar 1993	Storm (now called *Storm of the Century*)	Massive storm affected 26 eastern States and about 50 percent of the Nation's population. Passed almost directly over New York City, dropping 10-20 in. snow. Widespread coastal flooding. Total death toll in U.S. over 270. From Chesapeake Bay through New England, over 200 ships were either grounded or wrecked, resulting in the deaths of at least 100 seamen. On the Saffir-Simpson scale for hurricane strength, it equated to a Category 3 hurricane based on storm surge and minimum pressure. At least 18 homes fell into the sea on Long Island because of the pounding surf, and the storm caused further erosion of south-shore beaches, which had been weakened by the Dec. 1992 northeaster.	Kana 1995; USACE 1995; Lott 1993

Table D1 (Continued)

Date	Event [1]	Description	Source
1993	Quogue dune restoration	Restoration after 1992 northeaster: 1,000 yd^3 fill from upland source placed along 150 ft of dune. Snow fences installed. 600 yd^3 fill from upland source placed along 100 ft of dune. Planted with grass.	Village of Quogue [4]
1993	West of Shinnecock placement	284,000 yd^3 (details unknown, probably non-Federal). NOTE: may be same fill as listed below.	New York District project notes (Ms. Christina Rasmussen, Personal Communication, 1997)
29 Jan - 14 May 1993	Shinnecock Inlet dredging	475,000 yd^3 dredged from deposition basin (ebb shoal). Contract 92C0032. Disposal: 1. 371,000 yd^3 west of west jetty 2. 104,000 yd^3 to fill scour hole	Project notes, Construction Div., New York District (Mr. Don Braun, Personal Communication. 11/13/95)
Mar 1993	Dune Road repair	Stone placed parallel to road. Beach filled between road and stone row.	Mr. Bill Daley, NY State Dep. Environmental Conservation, (Personal Communication, 12/10/97)
Sep 95	Dune Road repair	1,359 yd^3 placed by NY State	Mr. Mohabir Persaud, NY State Dep. of State (Personal Communication, 9/3/96)
Nov 95	Dune Road repair	1,435 yd^3 placed by NY State	Mr. Mohabir Persaud, NY State Dep. of State (Personal Communication, 9/3/96)
1996	Quogue dune restoration	1,500 yd^3 coarse fill from upland source placed along 91 ft of dune.	Village of Quogue [4]
5-14 Jul 1996	Hurricane Bertha	Landfall near Wilmington, NC, $270 million in damage. Some erosion but no damage reported on Long Island	Ms. Diane Rahoy, New York District (Personal Communication, 12/28/98)
5-6 Sep 1996	Hurricane Fran	Little damage reported on Long Island	
Oct 1996	Dune Road repair	Northeaster caused erosion west of Shinnecock west jetty. State of NY repaired Dune Road with 14-16,000 yd^3 trucked sand.	Mr. Bill Daley, NY State Dep. Environmental Conservation (Personal Communication, 12/10/97)

Table D1 (Concluded)

Date	Event [1]	Description	Source
Nov 1996	Cores	Five cores (1 40-ft and 4 20-ft cores) taken at -6 m depth offshore of updrift fillet. Some clay layers detected. Proposed Punaise dredging tests cancelled.	Alpine Ocean Surveys, Inc., NY State Dep. of State
1997	Westhampton Beach fill	3,808,000 yd^3 - Westhampton Interim project. Dredged from offshore.	New York District project notes (Ms. Christina Rasmussen, Personal Communication, 1997)
Feb-Mar 1997	Channel dredging	250,000 yd^3 placed west of west jetty. Material dredged from eastern flood shoal channel.	NY State Dep. of Environmental Conservation (Mr. Bill Daley, Personal Communication, 12/10/97)
27 Jun - 11 Jul 1998	Shinnecock Inlet dredging	Phase 1: Government dredge *Currituck* removed 35,000 yd^3 from entrance channel and deposition basin from above -14 ft contour. Placed in surf zone of west beach starting 500 ft and ending 1,800 ft from west jetty.	Project notes, Construction Div., New York District (Adam Devenyi, Personal Communication, 08/09/98)
13-25 Sep 1998	Shinnecock Inlet dredging	Phase 2: Weeks Marine dredge *Beach Builder* removed 405,000 yd^3 from entrance channel and deposition basin from above -22 ft contour. Material specified to be placed on west beach between west jetty and 3,500 ft west, forming a berm 225 ft wide and 9.5 ft high. Berm to be built between dune line and water. (Note: more sand may have been removed than originally planned, and final berm may have been wider than 225 ft.)	Project notes, Construction Div., New York District (Mr. Adam Devenyi, Personal Communication, 10/05/98)

(Sheet 12 of 12)

Appendix E
Bibliography of Books and Memoirs Pertaining to Meteorology, the 1938 Hurricane, and the Long Island Coast

Allen, E. S. (1976). *A wind to shake the world*. Little Brown & Co., New York.

Bennett, H. H. (1939). "A permanent loss to New England: Soil erosion resulting from the hurricane," *Geographical Review* 29, 196-204.

Bennett, J. P., ed. (1998). *The 1938 hurricane as we remember it, Volume II, A collection of memories from Westhampton Beach and Quogue Areas.* Quogue Historical Society, Quogue, NY, and Westhampton Beach Historical Society, Westhampton Beach, NY (Searles Graphics, Inc., East Patchogue, NY).

Brickner, R. K. (1988). *The Long Island Express, Tracking the Hurricane of 1938.* Hodgins Printing Co., Batavia, NY (with historical data by David M. Ludlum).

Brooks, C. F. (1939). "Hurricanes into New England: Meteorology of the storm of September 21, 1938," *Geographical Review* 29, 119-127.

Clowes, E. S. (1939). *The Hurricane of 1938 on Eastern Long Island.* Hampton Press, Bridgehampton, Long Island, NY.

Federal Writers' Project. (1938). *New England Hurricane, a factual, pictorial record.* Written and compiled by members of the Federal Writers' Project of the Works Progress Administration in the New England States, Hale, Cushman & Flint, Boston, MA.

Field, V. R. (1997). *Wrecks and rescues on Long Island, the story of the U.S. Lifesaving Service.* Van R. Field, Center Moriches, NY.

Hendrickson, R. G. (1996). *Winds of the fish's tail*. Amereon Ltd., Mattituck, NY.

Howard, D. A. (1939). "Hurricane modification of the Offshore Bar of Long Island, New York," *Geographical Review* 29, 400-415.

Johnson, M. C. (1983). *Fire Island 1650's-1980's*. Shoreland Press, Mountainside, NJ (Third printing April 1992).

Minsinger, E. E., ed. (1988). *The 1938 hurricane, an historical and pictorial summary,* Blue Hill Observatory, East Milton, MA.

Paton, R. S. (1931). "Moriches Inlet: A problem in beach evolution," *Geographical Review* 21, 627-632.

Perry, M. B., and Shuttleworth, P. D., ed. (1988). *The 1938 hurricane as we remember it, a collection of memories from Westhampton Beach and Quogue*. Quogue Historical Society, Quogue, NY (Prepared by the Quogue Historical Society on the fiftieth anniversary of the 1938 hurricane).

Shaw, O. (1939). *History of the storms and gales on Long Island*; and Quick, D., *The Hurricane of 1938*. Long Island Forum, Bay Shore, NY (limited edition of 500 copies).

Sheard, B. (1998). *Lost voyages, two centuries of shipwrecks in the approaches to New York.* Aqua Quest Publications, Locust Valley, NY.

Whitford, N. E. (1906). *History of the canal system of the State of New York together with brief histories of the canals of the United States and Canada.* Brandow Printing Co., Albany, NY.

Wood, F. J. (1976). *The strategic role of Perigean spring tides in nautical history and North American coastal flooding, 1635-1976.* U.S. Department of Commerce, National Oceanic and Atmospheric Administration, U.S. Government Printing Office, Washington, DC.

Appendix F
Adjustment of 1933 Hydrographic Data to Modern Datum

Adjustment for Sea-Level Rise

Battery, (Manhattan) sea-level trend (from National Oceanic and Atmospheric Administration Internet site):
2.72 mm/year = 0.107 in./year = 0.0089 ft/year

Time interval: 1998 - 1933 = 65 years

Adjustment: 2.72 mm/year × 65 years = 177 mm = 0.177 m = 0.58 ft

Note: Water now is 0.177 m *higher* than in 1933; *add* 0.177 m (0.58 ft) to water depths (i.e., if in 1933, a sounding point was -10.0 ft, it now would be -10.58 ft assuming no changes in seabed) - see Figure E1a.

Datum

At Shinnecock: mlw to National Geodetic Vertical Datum (NGVD) (1929 adj.): 1.10 ft

Note: NGVD is 0.335 m (1.10 ft) *higher* than mlw; *add* 0.335 m (1.10 ft) to water depths (Figure E1b).

Total Correction

0.177 + 0.335 = **0.512 m**
0.58 + 1.10 = **1.68 ft** (Figure E1c)

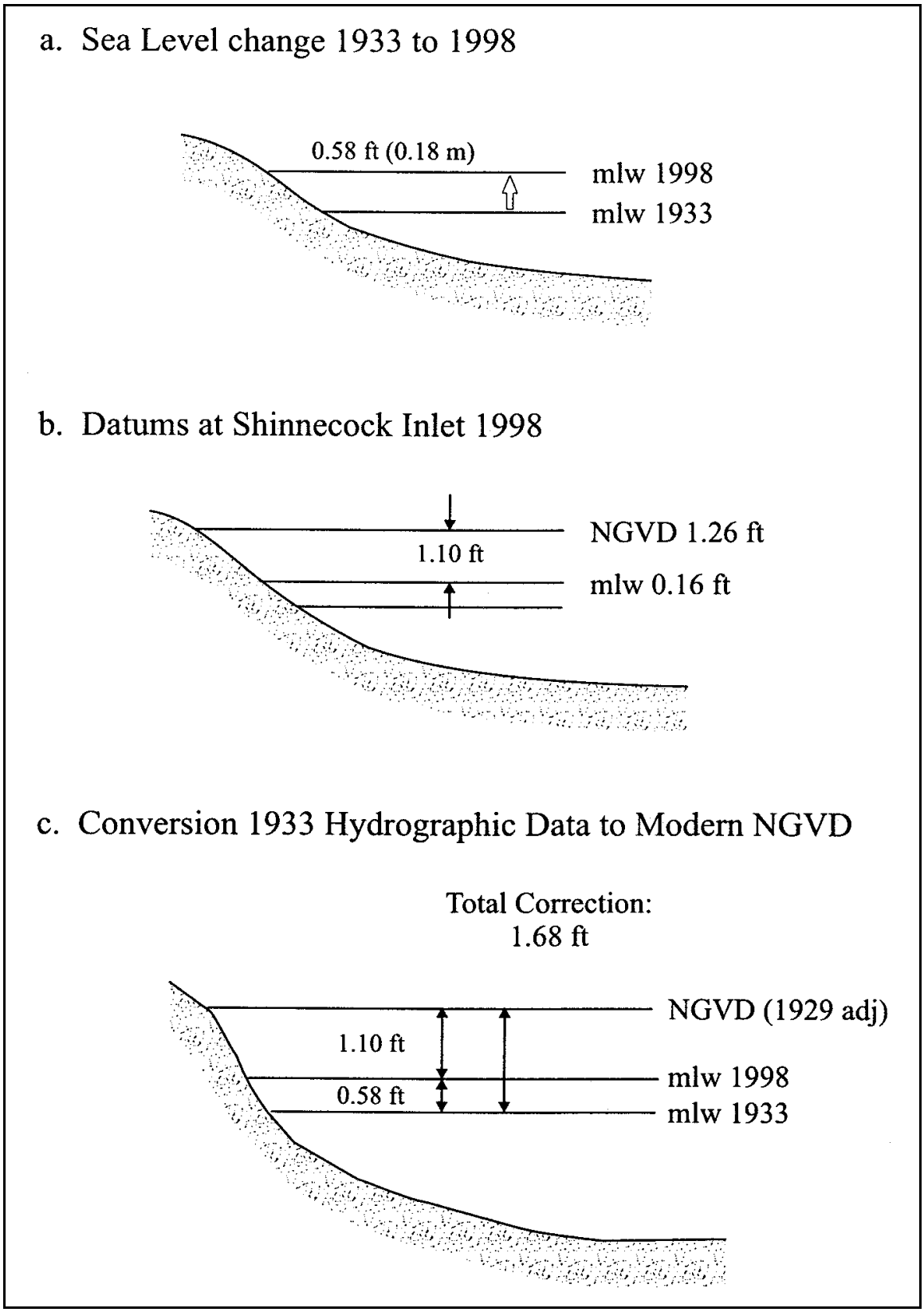

Figure F1. Conversion of 1933 hydrographic data to NGVD at Shinnecock Inlet

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. AGENCY USE ONLY *(Leave blank)*	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED
	June 1999	Final report

4. TITLE AND SUBTITLE
Shinnecock Inlet, New York, Site Investigation; Report 1, Morphology and Historical Behavior

5. FUNDING NUMBERS
WU 32930

6. AUTHOR(S)
Andrew Morang

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
U.S. Army Engineer Waterways Experiment Station
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

8. PERFORMING ORGANIZATION REPORT NUMBER
Technical Report CHL-98-32

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)
U.S. Army Corps of Engineers
Washington, DC 20314-1000

10. SPONSORING/MONITORING AGENCY REPORT NUMBER

11. SUPPLEMENTARY NOTES
Available from National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161.

12a. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution is unlimited.

12b. DISTRIBUTION CODE

13. ABSTRACT ***(Maximum 200 words)***

Shinnecock Inlet is the easternmost of six permanent inlets in the barrier island chain that follows Long Island's south shore. Shinnecock Inlet is located in eastern Long Island in Suffolk County, near the town of Southampton, and connects the Atlantic Ocean to Shinnecock Bay. The inlet was formed during the Great New England Hurricane of 21 September 1938, when high waves and a storm surge overwashed the barrier.

The morphologic history of the inlet can be divided into three phases: (a) 1938 to 1939 - breach and natural inlet; (b) 1939 to 1951 - inlet stabilized on the west wide only with a stone and timber revetment; (c) 1952 to present - inlet stabilized in its present location with stone jetties. Since 1939, an oval-shaped ebb shoal has grown out into the Atlantic Ocean. The total volume of sand that accumulated in the shoal between 1938 and 1998 was 8,453,000 yd^3, representing an average growth rate of 141,000 yd^3/year. In contrast, the flood shoal has lost sand since 1938, largely as a result of dredging the navigation channels in the back bay. After the jetties were built in 1952, the thalweg has been stable. The minimum cross section, 1,6000 m^2 (17,000 ft^2), occurs about 150 m north of the tip of the east jetty.

14. SUBJECT TERMS

Aerial photographs	Jetties
Coastal inlets	Long Island
Dredging	Morphology
Ebb shoal	New York
Flood shoal	Shinnecock Inlet
Hurricanes	

15. NUMBER OF PAGES
220

16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
UNCLASSIFIED	UNCLASSIFIED		