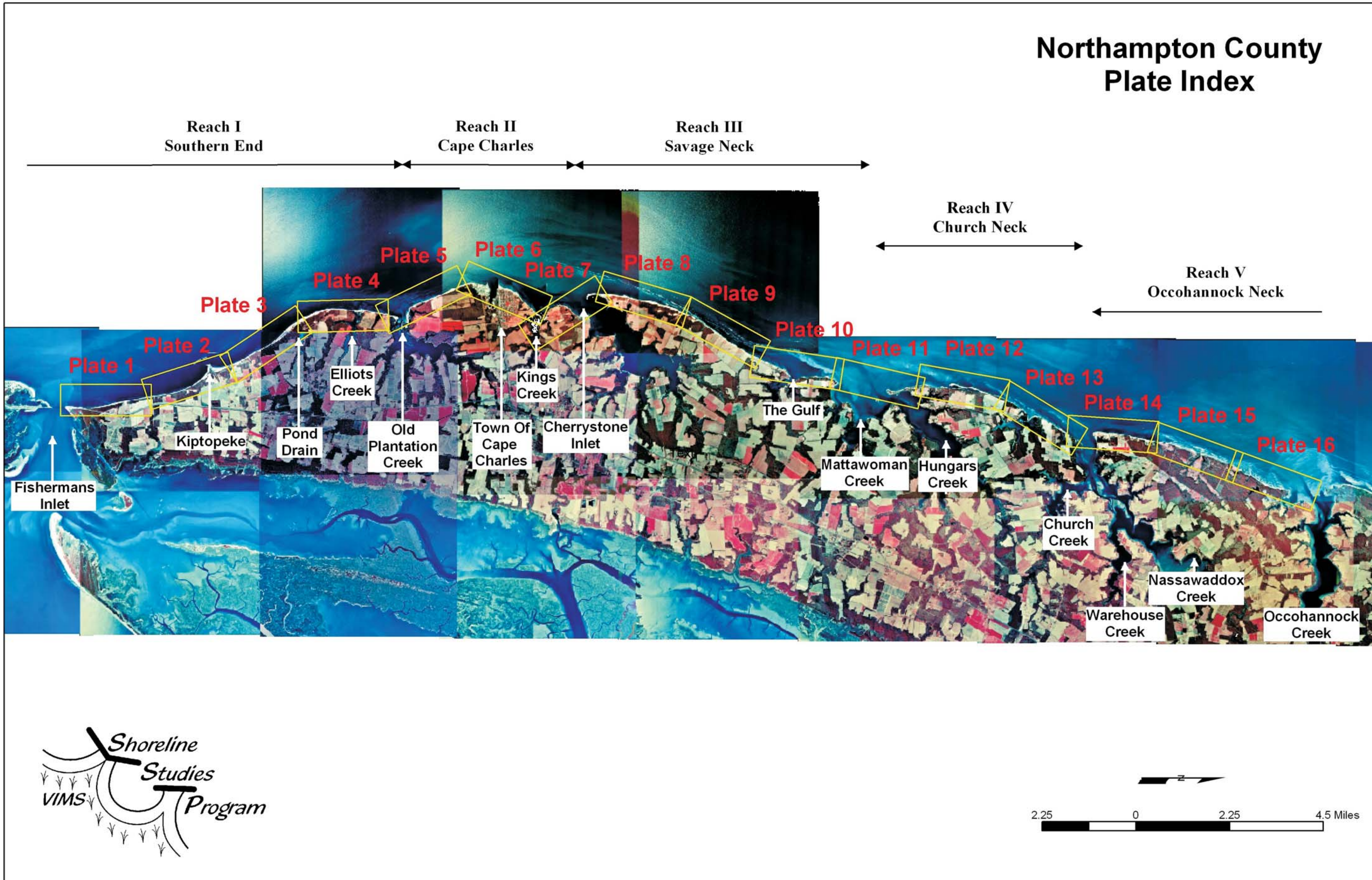


Figure 4. Index of shoreline plates.

IV. RESULTS

The figures referenced in the following sections are in Appendix A. Dune locations are shown on all photo dates for reference only. Dune sites and lengths are positioned accurately on the 2002 photo. Because of changes in coastal morphology, the actual dune site might not have existed earlier. Site information tables are in Appendix B. More detailed information about Chesapeake Bay dunes and individual dune sites in Northampton County can be found in Hardaway *et al.* (2001) and Hardaway *et al.* (2004). Since much of the dune data were collected several years ago and the beach and dune systems may have changed, this report is intended as a resource for coastal zone managers and homeowners; it is not intended for use in determining legal jurisdictional limits.

A. Reach I

Reach I begins at the southern end of the county where the Chesapeake Bay Bridge Tunnel connects to the mainland (Cape Charles) and extends northward to Old Plantation Creek. Reach I includes Plates 1, 2, 3, 4, and part of 5 and dune sites NH58, NH57, NH54, NH53, NH51, NH49, and NH48. The long-term (1938-2002) shoreline trend in Plate 1 shows recession from the south end (transects 0 to 6000), little or no change from transects 6000 to 8000, and slight recession from transects 8000 to 10500. Plate 1 includes dune sites NH58 and NH57.

Shoreline trends along Plate 2 with dune site NH53 shows continued shore recession from transects 0 to about 7000 as the shoreline adjusts to the Kiptopeke Ferry dock and offshore breakwaters at Kiptopeke State Park. Significant shoreline advance as the result of the Kiptopeke Ferry infrastructure occurs from transects 7000 to 11500. Shoreline recession picks up past transect 11500 and carries over to Plate 3 where recession "peaks" at about transect 2000 and lessens to about transect 5500. At about transect 6000 the shoreline enters an accretionary (NH51A) trend to transect 10500 near the outlet to Pond Drain.

The accretionary trend continues northward onto Plate 4 until about transect 1500 where shore recession begins. Shore recession continues across Plate 4, and "peaks" at transect 7000, which is Elliots Creek, and onto Plate 5. Plate 4 has dune sites NH51B, an extension of NH51A, and NH49 across Elliots Creek.

The general trend along the Reach I shoreline is a series of alternating retreats and advances. Construction of Kiptopeke State Park's dock and breakwaters had a rapid and profound effect on the littoral sand transport system. The larger sand fillet on the south side might indicate a net northward sand movement over time possibly due to the influence of incoming ocean swells.

B. Reach II

Reach II (Plates 5 and 6) begins at the mouth of Old Plantation Creek which has experienced significant changes though time. Plate 5 dune sites include NH48, NH46, NH45, NH43 and part of NH42. A spit has grown from the south side and has rotated extensively landward (eastward) on the north side spit. This recessionary trend continues to about transect 2000, where the 1989 shore intermittently advances to transect 5500 and the long-term trend becomes accretion. The large advance between transects 5500 to 8500 (Plate 6) from 1938 to 1949 is the result of a large quantity of dredge material being disposed from the dredging of Cape Charles Harbor and entrance channels. This material is clearly seen on the 1949 photo of Plate 6. Subsequent shore recession occurred as the sandy material has eroded.

A long-term accretionary trend extends from transects 0 to 2000 (Plate 6). Transects 4000 to about 6000 (Plate 6) is Cape Charles public beach which had a large beach fill project for 1988 that is reflected in shore advance in 1989 with subsequent recession as the shore adjusted. General shore recession occurs from transects 6500 to about 9000 then spit growth is seen at the mouth of Kings Creek where Reach II ends and Reach III begins. Dune sites shown on Plate 6 include NH42 south of Cape Charles Harbor, NH41A&B which are man-made dunes as part of the public beach, and NH40.

C. Reach III

Reach III is shown on Plates 7, 8, 9 and 10. The small peninsula between Kings Creek and Cherrystone Inlet appears to have had some dredge material (probably from Kings Creek dredging) placed on it some time between 1938 and 1949 thus causing a shoreline advance with subsequent erosion (Plate 7). The long spit on the north side of the mouth to Cherrystone Inlet gained its full "extension" in 1949 and has retreated and recurved eastward since. Here resides NH36 and part of NH35.

The long sandy coast shown on Plate 8 has 3 dune fields (NH33, NH34, and NH35) and has undergone a complex history of advance and retreat. Shoreline change is controlled, in large part, by the constantly shifting offshore bar system which can cause shore salients when bars weld to shore. On the northern end of the region shown on Plate 8 and on the south end of Plate 9, an erosional trend begins and continues toward the north end. The north end of NH33 exists along this coast. A noticeable nearshore slough or trough exists through time preventing any major bars from welding to the shore.

Along the coasts shown on Plate 9, significant long-term erosion has occurred; however a reduction in rate of loss begins near transect 9500. Beginning at the south end of the region shown on Plate 10, the shore becomes very stable except for erosion near the mouth of The Gulf. The shoreline from transects 0 to 5000 is known as Smith Beach and cottages can be seen along it as early as 1949. Development is mostly bay-front cottages, but many groins and bulkheads have been installed over time which force the erosion rate generally to zero. The shoreline along the Bay shore of Old Town Neck has varied through time becoming erosional toward transect 11000 where a spit into Mattawoman Creek has eroded. Three isolated dune sites, NH30, NH28 and NH27, are shown on Plate 10.

D. Reach IV

Reach IV is shown on Plates 11, 12 and 13. Plate 11 shows the mouths of Mattawoman Hungars Creeks. The narrow peninsula across the north side of Hungars Creek had an erosional trend on its distal end, but most of it has been relatively stable because this shore lies in the protective lee of an extensive offshore bar system. No dune sites are located on this thin spit, but imagery taken in 1938 and 1949, may indicate the presence of dune vegetation.

Plate 12 displays an array of shore attached spit growths. In 1938, a shore salient can be seen at about transect 5500. By 1949, this salient had become a spit between transects 4000 and 5000 with another spit forming to the north and extending southward to transect 8500. In 1989, another distinct spit had grown from transect 8000 to about transect 4000, and we have termed this spit as "Vaucluse" Spit. The previous spits had welded to the mainland shore.

Vaucluse Spit grew 1,300 ft in length between 1989 to 2002, a rate of 100 ft/yr. Dune fields NH17, NH18A, NH18B and NH19 developed on Vaucluse Spit over time. NH17 is located at the mainland attachment of the spit. Three small isolated dune sites NH20, NH21 and NH23 occur on the mainland. The progradation of Vaucluse Spit has had the effect of protecting the adjacent mainland coast from severe storm wave attack. The mobile sand spit and nearshore sand bar systems not only influence the impinging waves and shore change but also create and alter nearshore habitat of SAV.

Shoreline recession is the overall trend along the region shown on Plate 13 with intermittent accretional salients in 1989 and an extended salient continuing until 2002 at about transect 8500. This sandy salient provided the substrate for the growth of dune site NH13. Other isolated dunes occur on either side of the spits leading into Westerhouse Creek (NH14A, NH14B, NH15 and NH16). These dune sites are erosional remnants of larger past spit features.

E. Reach V

Reach V is Occohannock Neck and is shown on Plates 14, 15, and 16. Plate 14 starts at the erosional coast on the south side of Nassawadox Creek. An erosional trend occurs on the north side of Nassawadox Creek from transect 0, peaking at transect 2000, and decreases in rate to about transect 6000 where the coast is historically stable to the north end of Plate 14. Development of the coast known as Silver Beach began with a few small cottages in 1949; Today's Silver Beach extends from about transects 2500 to 8000. Bulkheading and groins are responsible for the stability of the coast in 1994 and 2002. Dune sites along the reach include sites NH8, NH10 and NH12.

The entire coast shown on Plate 15 had an overall recessional trend from 1949 to 1994. Shore stability from 1994 to 2002 is mostly due to extensive bulkheading along most of the reach. The northern end of Northampton County is shown in Plate 16. This coast shows intermittent recession and advance from transects 0 to 5000 and then becomes recessional into Killmon Cove. Dune sites NH4 and NH5 occur along this coast.

V. DISCUSSION: NEAR FUTURE TRENDS OF DUNE SITES

The following discussion is a delineation of shoreline trends based on past performance. Ongoing shore development, shore stabilization and/or beach fill, and storms will have local impacts on the near term. "Near Future" is quite subjective and only implies a reasonable expectation for a given shore reach to continue on its historic course for the next 10 to 20 years. In addition, the basis for the predictions are the shorelines digitized on geo-rectified aerial photography which have an error associated with them (see Methods, Section III). This data is intended as a resource for coastal zone managers and homeowners; it is not intended for use in determining legal jurisdictional limits.

A. Reach I

Dunes sites NH58 and NH57 are remnants of a once more continuous dune field. They will be subject to further shore recession and reduction in width and extent. Dune sites NH54 and NH53 are a direct result of the construction of the Kiptopeke Ferry and associated wharf and offshore breakwaters at Kiptopeke State Park. They have evolved almost to capacity and should at least remain stable for the near future.

Dune site NH51 (Figure 7), Plate 3, is part of a littoral sand mass that is accreting, perhaps as a result of the corresponding shore recession to the south (Plate 3) and to the north (Plate 4). Although sited on a recessional reach, dune site NH49 has been at least a spit at the mouth of Elliots Creek since 1938. Site NH48 is an isolated dune that has advanced into the mouth of Old Planation Creek and should continue that trend for the near future.

B. Reach II

Dune sites NH45 and NH46 are erosional remnants of a more continuous beach/dune reach seen in earlier imagery. Dune sites NH43 and NH42 (Figure 8) also are erosional remnants of a more extensive beach/dune system created by the disposal of a large amount of dredge material for the deepening of Cape Charles Harbor in the mid-1940s. Conventional thinking would indicate that the addition of such a large amount of sand would enhance and provide large volumes of sand to the southern, "downdrift" shorelines, possibly even causing more infilling to Old Plantation Creek. It appears, however, that the opposite has happened. The dredge material has moved mostly offshore to form a large shoal which, in turn, may have impacted the local wave climate. The sand fill has been reduced but remains a significant headland.

Dune sites NH41 and NH40 are part of the Cape Charles Public beach in 1987 and were created with beach fill, sand fencing, and dune grass plantings. Sand losses have reduced the size of those features since the 1988 beach fill, but a recent breakwater installation has at least slowed that trend.

C. Reach III

Dune sites NH36, NH35, NH34, and NH33 (Figure 9) are part of a long continuous beach/dune system extending from Tankards Beach to Cherrystone Inlet. The net alongshore drift is to the south as evidenced by the geomorphology of the Cherrystone Inlet spit. Dune sites NH36 and NH35 occur on the Cherrystone Inlet spit. This feature has changed dramatically over time and appears to be in the process of recurving and narrowing. A breach may occur in the future which would segment the spit leading to further reduction in dune size.

The shoreline along dune sites NH34 and NH33 has had history of advances and retreats due, in part, to the movement of the extensive offshore bar system. The eroding sand banks to the north at Tankards Beach have provided the material to the littoral system to the south. These dunes will continue to exist in a state of dynamic equilibrium given the present shore conditions. Although shoreline recession is the long-term trend, the massive, ancient, upland dune will continue to supply sand to the littoral system.

Dune site NH30 is an isolated remnant of a more extensive beach dune reach along the north end of Savage Neck. Shore protection with bulkheads and groins have reduced the size and extent of the site, but it is presently relatively stable. Dune sites NH28 and NH27 have developed on accretionary salients along Old Town Neck. Their future trend will be dictated by the behavior of the nearby offshore bar which appears to have widened and migrated landward since 1938.

D. Reach IV

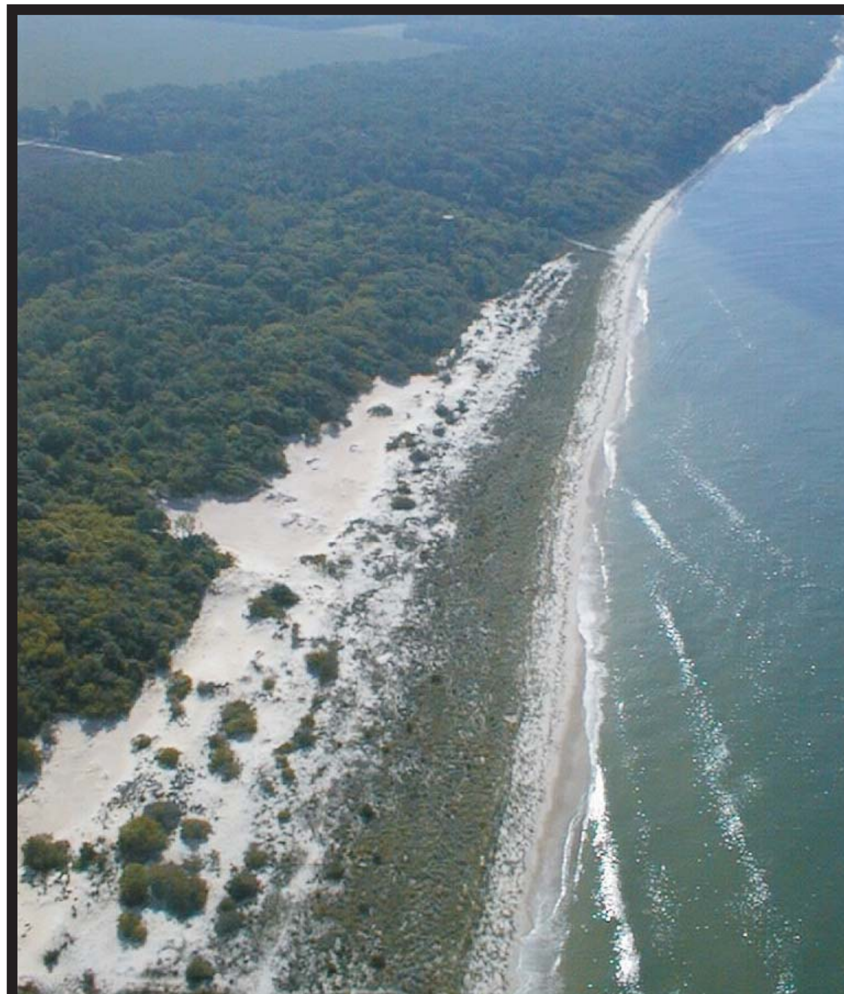
Dune sites NH23, NH21 and NH20 are isolated dunes that were once part of a more continuous beach/dune coast in 1949 which developed into more isolated salients by 1989. By 2002, NH21 and NH20 had fallen into the lee of the rapidly prograding Vaucluse Spit where they should remain stable for some time. Vaucluse Spit has had a history of growth and change and is home to NH19, NH18 and NH17 (Figure 10). The boundaries of these dunes are in constant motion as they are part of a continuous beach/dune system that is broken by intermittent washovers and peat exposures. Potential shoreline development to the north would likely reduce erosion rates locally if the shorelines are hardened, but it also may negatively impact downdrift shores by reducing sand supply.

Dune sites NH16, NH15 and NH14 reside on the spits that enter Westerhouse Creek from both the north and south. These sites were once more continuous beach/dune features but are now small and isolated, but relatively stable. Site NH13 is an interesting dune salient that was a linear feature in 1994 but since has advanced over 200 ft.

E. Reach V

Five dune sites were identified along Reach V, Occohannonk Neck. Site NH12 developed recently (since 1994) on a spit attached to the north shore at the mouth of Nassawadox Creek. Site NH10 (Figure 11) is a long-term stable dune field just north of the Silver Beach community. Site NH8 is a remnant of a once more extensive beach/dune system. Extensive shoreline hardening with mostly bulkheads to the north since 1989 (refer to Plate 15, transects 2500 to 10500) may have impacted the adjacent beaches by reducing their width possibly by wave reflection and scour.

Site NH5 evolved on a spit and washover fan that filled an unnamed tidal creek in 1949, but presently this section of coast appears to be erosional. Site NH4 is set within a long, curvilinear embayed coast that has been relatively stable over time possibly due to the transport of material eroded from the headland at Killmon Cove downdrift.



Aerial view of dune site NH51 and Picketts Harbor

Looking south along the dune crest of NH51 18 November 2003 Post Isabel

Looking south along the beach face of NH51 15 July 2004

Figure 7. Photos of dune site NH51 at Pond Drain, Plates 3 and 4.

Figure 8. Photos of dune site NH33 at Tankards Beach, Plate 8.

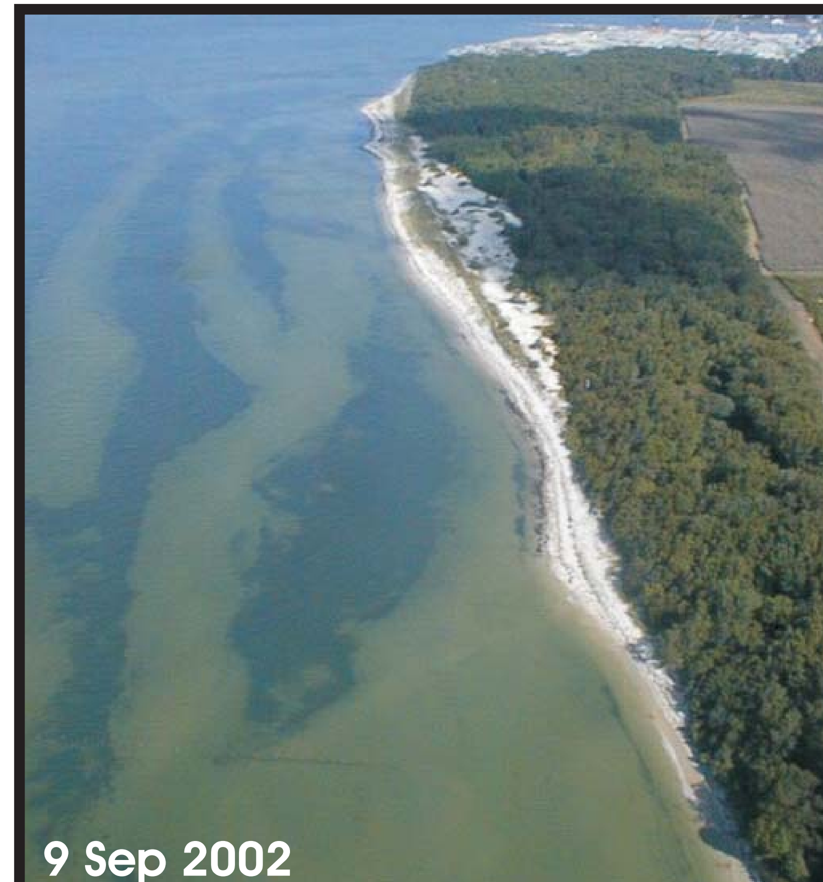


Figure 9. Photos of dune site NH42 south of Cape Charles, Plate 6.

Figure 10. Photos of dune site NH17 at Floyds Farm, Plate 12.

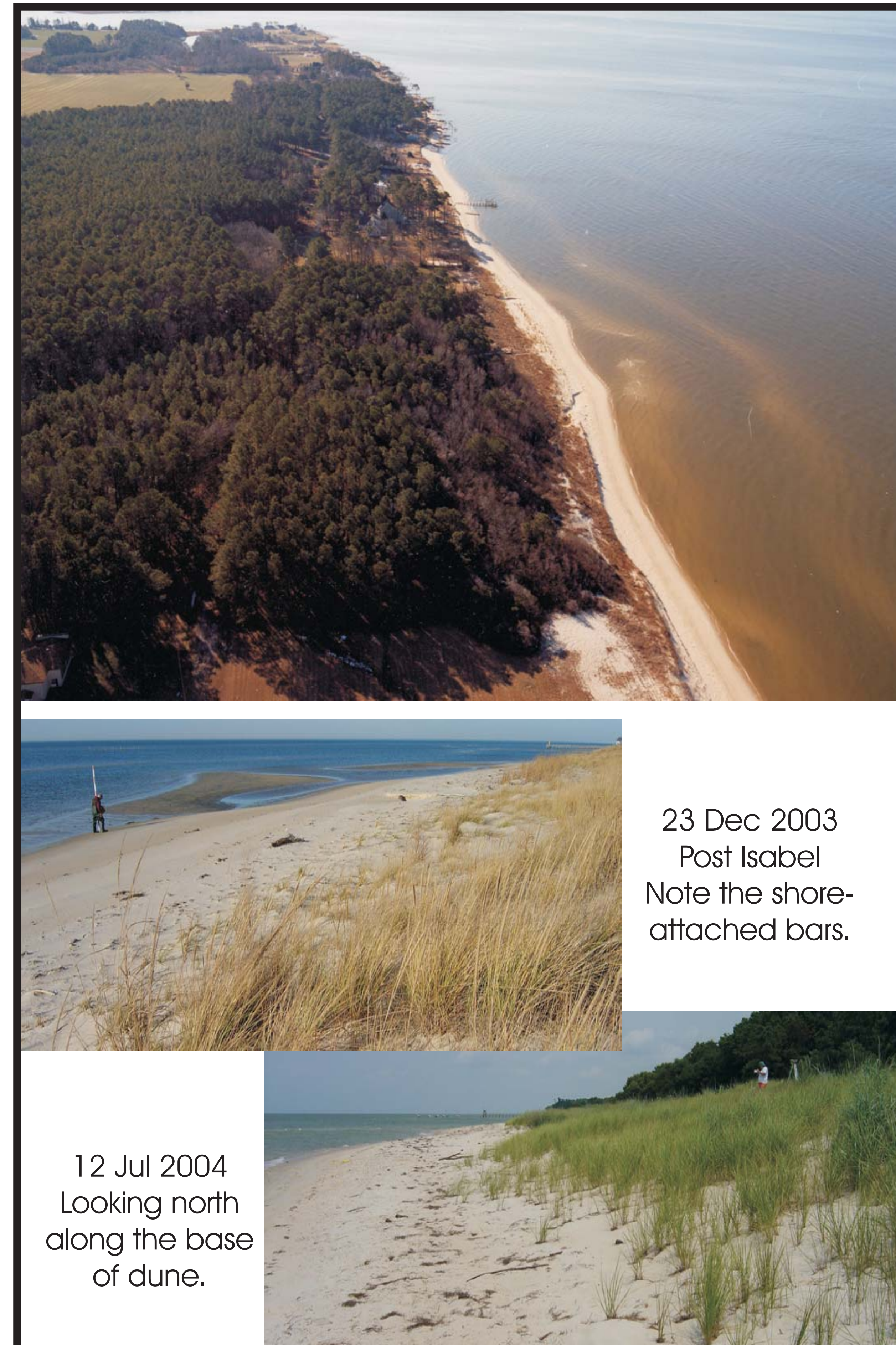


Figure 11. Photos of dune site NH10 at Silver Beach, Plate 14.

VI. SUMMARY

The Chesapeake Bay coast of Northampton County is very dynamic in terms of shoreline change and sediment transport processes. The overall net movement of sands along the coast is to the south except from the southern end of the Delmarva Peninsula at Cape Charles to about Old Plantation Creek where oceanic swell tends to cause a north-trending net transport. The Northampton County coast is rich in sand along the shoreline and nearshore due to high shoreline recession rates of sandy upland banks. The complex series of offshore sand bars migrate through time and influence the rate and patterns of shoreline change. Shoreline change can be accretionary which leads to the development of extensive modern dune fields.

Shoreline change rates are based on aerial imagery taken at a particular point in time. We have attempted to portray the same shoreline feature for each date along the coast of Northampton County. Every 500 feet along each baseline on each plate the rate of change was calculated. The mean or average rate for each plate is shown in Table 2 for five time periods with the long-term rate determined between 1938 and 2002. The total average and standard deviation (Std Dev) for the entire data set of individual rates is also given. The standard deviation shows the relative spread of values about the mean or average. Larger standard deviation values relative to the mean indicates a wider scatter of erosion rates about the mean while lower standard deviation values indicates erosion rates are concentrated near the mean (*i.e.* all the rates calculated for the entire plate were similar). For instance, on Plate 5 between 1938 and 1949, the standard deviation is more than double the average rate of change indicating that the overall rate is probably not indicative of the change on this section of shore. Indeed, the shoreline has been influenced by the placement of dredge material which has created large variations in shoreline position on the northern end of the baseline. Conversely, on Plate 11 between 1994 and 2002, the shoreline change was minimal (0.4 ft/yr) and the standard deviation was equally small (0.6 ft/yr) indicating that the spit north of Hungars Creek has been relatively stable during that time frame.

The largest erosion rates appear to have been in the time period 1989-1994. Some of the highest recession rates measured were -19.2 ft/yr, -16.0 ft/yr and -12.2 ft/yr in Plates 5, 13 and 15, respectively. This is reflected in the county average for that period with the highest recession rate of all the time periods, -7.1 ft/yr. Conversely, shore accretion or advance was most significant during the 1938-1949 time period with accretion rates of 14.7 ft/yr, 11.3 ft/yr. and 10.4 ft/yr for Plates 6, 5 and 12, respectively. Once again this is reflected in the county average for that time period being the only period of shore advance measured, 1.7 ft/yr. Overall, this indicates that what were extensive beach/dune shorelines in 1938 are now segmented by areas of recession and infrastructure on the upland coast.

These short term trends reflect wind and weather patterns that impacted the coast during those time periods. The long-term average may be a better measure for planning, but the short-term values indicate what can potentially happen. The long-term trend for Northampton County's bay shore, Plates 1 to 14 is about -1.0 ft/yr. No data existed for Plates 15 and 16 in 1938 so the long-term rate is calculated between 1949 and 2002. When these numbers are included in the long-term analysis, the rate becomes -3.0 ft/yr, overall.

However, rate data is complex; specific sites may not be representative of these average results. The abundance of sand shifting through the littoral system helps modify the county-wide, long-term erosional trend creating accretionary zones such as on Plates 2, 3, 6, and 12. The overall average rate for Plates 6 and 12 is positive, but the most recent rates depict erosional shores. Both of these Plates have special considerations that have influenced the rates. Plate 6 has been man-influenced by placement of sand on the shore from dredging of Cape Charles Harbor. Plate 12 reflects the growth and movement of shore attached spits through time. For specific sites, measuring the change in the shore position on the scaled maps in Appendix A and dividing by the number of intervening years will provide a rate of change at the shore location.

Developed shoreline areas are increasing in size and scope. Hopefully, the depiction of historic shorelines through aerial imagery and the delineation of shore change patterns in this report will indicate how the coast will evolve. These data can then be used to provide the basis for proper shoreline management plans and strategies. Dunes and beaches are a valuable resource that should be either maintained, enhanced, or created in order to abate shoreline erosion.

Table 2. Summary shoreline rates of change and their standard deviation.

Plate No.	Mean Shore Change 1938-1949 (ft/yr)	Std Dev (ft/yr)	Mean Shore Change 1949-1989 (ft/yr)	Std Dev (ft/yr)	Mean Shore Change 1989-1994 (ft/yr)	Std Dev (ft/yr)	Mean Shore Change 1994-2002 (ft/yr)	Std Dev (ft/yr)	Mean Shore Change 1938-2002 (ft/yr)	Std Dev (ft/yr)
Plate 1	1.4	2.2					2.2	3.4	-0.8	0.7
Plate 2	1.8	1.8					4.0	3.7	1.7	5.7
Plate 3	-6.8	12.0	-0.2	3.0	-8.9	12.3	1.0	9.4	1.8	6.3
Plate 4					-7.6	6.9	-0.8	6.3	-3.1	3.2
Plate 5	11.3	23.7	0.1	3.6	-19.2	17.7	-2.9	5.8	-0.3	6.0
Plate 6	14.7	37.7	-0.6	4.7	-5.2	11.5	-1.3	5.8	1.6	4.6
Plate 7	8.0	15.3	1.2	1.3	-8.6	11.7	-11.3	9.9	-0.4	1.2
Plate 8	-1.4	9.0	-2.9	1.9	6.3	6.0	-2.9	7.5	-1.9	1.7
Plate 9	-13.0	4.1	-3.6	1.7	-3.4	7.6	-3.1	5.8	-5.1	1.7
Plate 10	-2.2	2.5	0.8	1.7	-7.1	15.0	1.3	4.2	-0.3	1.0
Plate 11	-1.0	4.2	0.1	0.6	-2.9	3.3	0.4	0.6	-0.2	0.9
Plate 12	10.4	12.9	1.4	6.9	-1.4	29.3	-0.6	22.2	2.5	3.9
Plate 13	-2.3	9.4	-2.2	3.3	-16.0	12.5	-3.6	14.5	-3.5	4.0
Plate 14	-3.4	2.6	-0.9	1.3	-6.2	5.1	-1.1	3.3	-2.2	1.3
Plate 15			-2.5	1.4	-12.2	13.3	-3.2	4.0	-3.5*	1.7
Plate 16			-0.6	3.5	-8.7	10.6	-3.9	2.7	-2.0*	3.0
Total^	**1.7**	**17.1**	**-1.0**	**3.5**	**-7.1**	**14.8**	**-1.1**	**9.1**	**-1.0**	**4.3**

*1949-2002 imagery data used for long-term shore change rate.
^Entire data set for each imagery period used to determine average county shore change rate and standard deviation.

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Acknowledgments

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APPENDIX A

For each Plate shown on Figure 4 (Page 5), Appendix A contains geo-rectified aerial photography flown in 1938, 1949, 1989, 1994, and 2002. Also shown are the digitized shorelines, identified dune sites, and an arbitrarily created baseline. Another copy of the recent photo depicts the relationship of historical shorelines to the present. Finally, a plot shows only the relative locations of the shorelines while another one depicts the rate of shore change between dates. A summary of the average Plate rate of change in ft/yr as well as the standard deviation for each rate is also shown.

This data is intended as a resource for coastal zone managers and homeowners; it is not intended for use in determining legal jurisdictional limits.

Plate 1 - 1938 & 1949
Plate 1 - 1994
Plate 1 - 2002
Plate 1 - Shoreline Change

Plate 2 - 1938 & 1949
Plate 2 - 1994
Plate 2 - 2002
Plate 2 - Shoreline Change

Plate 3 - 1938 & 1949
Plate 3 - 1989 & 1994
Plate 3 - 2002
Plate 3 - Shoreline Change

Plate 4 - 1938
Plate 4 - 1989 & 1994
Plate 4 - 2002
Plate 4 - Shoreline Change

Plate 5 - 1938 & 1949
Plate 5 - 1989 & 1994
Plate 5 - 2002
Plate 5 - Shoreline Change

Plate 6 - 1938 & 1949
Plate 6 - 1989 & 1994
Plate 6 - 2002
Plate 6 - Shoreline Change

Plate 7 - 1938 & 1949
Plate 7 - 1989 & 1994
Plate 7 - 2002
Plate 7 - Shoreline Change

Plate 8 - 1938 & 1949
Plate 8 - 1989 & 1994
Plate 8 - 2002
Plate 8 - Shoreline Change

Plate 9 - 1938 & 1949
Plate 9 - 1989 & 1994
Plate 9 - 2002
Plate 9 - Shoreline Change

Plate 10 - 1938 & 1949
Plate 10 - 1989 & 1994
Plate 10 - 2002
Plate 10 - Shoreline Change

Plate 11 - 1938 & 1949
Plate 11 - 1989 & 1994
Plate 11 - 2002
Plate 11 - Shoreline Change

Plate 12 - 1938 & 1949
Plate 12 - 1989 & 1994
Plate 12 - 2002
Plate 12 - Shoreline Change

Plate 13 - 1938 & 1949
Plate 13 - 1989 & 1994
Plate 13 - 2002
Plate 13 - Shoreline Change

Plate 14 - 1938 & 1949
Plate 14 - 1989 & 1994
Plate 14 - 2002
Plate 14 - Shoreline Change

Plate 15 - 1949
Plate 15 - 1989 & 1994
Plate 15 - 2002
Plate 15 - Shoreline Change

Plate 16 - 1949
Plate 16 - 1989 & 1994
Plate 16 - 2002
Plate 16 - Shoreline Change

APPENDIX B

The data shown in the following tables were primarily collected as part of the Chesapeake Bay Dune: Evolution and Status report and presented in Hardaway *et al.* (2001) and Hardaway *et al.* (2004). Individual site characteristics may now be different due to natural or man-induced shoreline change.

An additional table presents the results of this analysis and describes each dune site's relative long-term, recent, and near-future predicted stability. This data results from the position of the digitized shorelines which have an error associated with them (see Methods, Section III).

Since much of the dune data were collected several years ago and the beach and dune systems may have changed, this report is intended as a resource for coastal zone managers and homeowners; it is not intended for use in determining legal jurisdictional limits.

These data were collected as part of the Chesapeake Bay Dune: Evolution and Status Report
(Hardaway *et al.*, 2001). Site characteristics may now be different due to natural or man-induced shoreline change.

Identified dune site information in Northampton County as of 2000.

Dune Site No.	Location^ Easting (Feet)	Northing (Feet)	Date Visited	Dune Shore Length (feet)	Primary Dune Site?	Secondary Dune Site?	Ownership*
4	2,741,960	447,360	27-Sep-1999	1,745	Yes	No	Private
5	2,740,280	444,170	27-Sep-1999	440	Yes	No	Private
8	2,737,010	433,300	27-Sep-1999	542	Yes	No	Private
10	2,736,760	431,420	27-Sep-1999	1,407	Yes	Yes	Private
12'	2,736,810	425,550		297	Yes		Private
13	2,735,940	421,250	27-Sep-1999	1,500	Yes	No	Private
14A	2,734,350	417,770	28-Sep-1999	450	Yes	Yes	Private
14B	2,734,370	417,690	28-Sep-1999	175	Yes	Yes	Private
15	2,734,990	417,090	28-Sep-1999	229	Yes	Yes	Private
16'	2,734,790	416,930		146	Yes		Private
17	2,731,590	411,450	27-Sep-1999	959	Yes	No	Private
18A	2,731,210	410,300	27-Sep-1999	800	Yes	No	Private
18B	2,731,040	409,430	27-Sep-1999	1,540	Yes	No	Private
19	2,730,650	406,950	27-Sep-1999	907	Yes	No	Private
20	2,731,180	406,700	27-Sep-1999	375	Yes	No	Private
21	2,731,110	406,210	27-Sep-1999	323	Yes	No	Private
23	2,730,910	404,070	27-Sep-1999	250	Yes	No	Private
27	2,730,400	391,450	27-Sep-1999	245	Yes	No	Private
28	2,730,410	390,100	27-Sep-1999	188	Yes	No	Private
30	2,730,180	386,400	27-Sep-1999	375	Yes	No	Private
33A	2,721,610	368,110	21-Sep-1999	2,680	Yes	Yes	Public
33B	2,722,190	370,550	21-Sep-1999	2,660	Yes	No	Public
33C	2,722,960	372,980	21-Sep-1999	2,850	Yes	No	Public
34	2,721,150	365,220	21-Sep-1999	3,272	Yes	No	Private
35	2,720,900	362,700	21-Sep-1999	1,824	Yes	No	Private
36	2,720,910	361,050	21-Sep-1999	1,636	Yes	No	Private
40	2,721,130	351,520	12-Apr-1999	359	Yes	No	Public
41A	2,720,540	349,850	12-Apr-1999	833	Yes	No	Public
41B	2,720,460	349,530	12-Apr-1999	600	Yes	Yes	Public
42	2,720,350	344,920	21-Sep-1999	1,527	Yes	Yes	Private
43	2,721,100	343,320	21-Sep-1999	1,959	Yes	Yes	Private
45	2,723,290	338,620	21-Sep-1999	479	Yes	No	Private
46	2,723,980	338,010	21-Sep-1999	208	Yes	No	Private
48	2,724,740	336,250	21-Sep-1999	703	Yes	Yes	Private
49	2,724,170	331,260	21-Sep-1999	1,193	Yes	No	Private
51A	2,727,070	322,410	21-Sep-1999	4,900	Yes	Yes	Private
51B	2,724,650	325,980	21-Sep-1999	4,100	Yes	No	Public
53	2,732,110	314,400	27-Sep-1999	2,100	Yes	Yes	Public
54	2,733,110	312,500	27-Sep-1999	2,800	Yes	Yes	Public
57	2,737,460	298,900	27-Sep-1999	3,800	Yes	Yes	Private
58	2,737,540	295,120	27-Sep-1999	300	Yes	Yes	Public

Dune site measurements in Northampton County as of 2000.

Dune Site Measurements									
	Dune	Primary Dune			Secondary Dunes				
	Shore	Crest	Distance from Crest				Distance From		
Site	Length	Elev	landward to back base	To MLW	2nd Dune Site	Crest Elev	Primary Crest to 2nd Crest	2ndCrest landward	2nd Crest seaward to 1st back base
No.	(feet)	(ftMLW)	(feet)	(feet)		(ftMLW)	(feet)	(feet)	(feet)
4	1,745	8.7	53	62	No				
5	440	8.4	28	65	No				
8	542	12.6	21	110	No				
10	1,407	9.8	27	82	Yes	14.0	42	49	15
12'	297								
13	1,500	8.7	48	87	No				
14A	450	4.8	28	65	Yes	6.5	56	14	28
14B	175	4.6	16	56	Yes	7.6	43	11	27
15	229	3.1	19	60	Yes	4.7	26	10	7
16'	146								
17	959	8.3	21	112	No				
18A	800	4.1	37	39	No				
18B	1,540	9.8	11	108	No				
19	907	5.6	108	65	No				
20	375	7.5	39	65	No				
21	323	6.6	11	75	No				
23	250	16.4	10	170	No				
27	245	11.8	31	162	No				
28	188	11.3	21	85	No				
30	375	9.1	37	121	No				
33A	2,680	11.3	42	120	Yes	19.4	150	25	109
33B	2,660	16.1	26	104	No				
33C	2,850	30.7	106	287	No				
34	3,272	11.6	29	82	No				
35	1,824	11.1	34	80	No				
36	1,636	6.9	13	80	No				
40	359	11.3	3	145	No				
41A	833	14.5	30	98	No				
41B	600	13.1	26	295	Yes	8.1	90	40	65
42	1,527	9.4	15	127	Yes	10.3	38	9	23
43	1,959	11.8	44	143	Yes	12.7	58	133	14
45	479	8.1	35	108	No				
46	208	6.6	21	118	No				
48	703	8.4	37	83	Yes	11.5	124	0	87
49	1,193	8.7	78	50	No				
51A	4,900	10.3	30	96	Yes	11.5	65	212	35
51B	4,100	14.6	78	110	No				
53	2,100	17.9	48	200	Yes	14.0	66	312	18
54	2,800	11.4	19	105	Yes	9.8	31	132	12
57	3,800	8.4	51	80	Yes	5.6	75	61	24
58	300	8.1	27	103	Yes	9.6	58	71	31

*Public ownership includes governmental entities including local, state, and federal;
otherwise ownership is by private parties.
^Location is in Virginia State Plane South, NAD 1927.
‘Sites were noted as dunes but were not photographed or surveyed.

Dune site parameters in Northampton County as of 2000.

		Dune Site Parameters									
		Fetch Exposure	Shoreline Direction of Face	Nearshore Gradient		Morphologic Setting		Relative Stability	Underlying Substrate	Structure or Fill
Site No.	Type	A	B	C		D		E	F	G
4	Natural	Open Bay	Northwest	Shallow	bars	Dune Field	Linear	Stable	Upland	
5	Natural	Open Bay	Northwest	Shallow	bars	Isolated	Linear	Erosional	Upland	
8	Natural	Open Bay	West	Medium	bars	Isolated	Linear	Erosional	Upland	
10	Natural	Open Bay	West	Medium	bars	Dune Field	Linear	Stable	Upland	
12'	Natural	Open Bay	South	Steep	bars	Creek Mouth Barrier/Spit		Erosional	Marsh/Ck Bottom	
13	Natural	Open Bay	Northwest	Medium	bars	Dune Field	Linear	Erosional	Upland	
14A	Natural	Riverine, Bay Inf	West	Medium	bars	Creek Mouth Barrier/Spit		Stable	Marsh/Ck Bottom	
14B	Natural	Riverine, Bay Inf	West	Medium	bars	Creek Mouth Barrier/Spit		Stable	Marsh/Ck Bottom	
15	Natural	Riverine, Bay Inf	Southwest	Medium		Creek Mouth Barrier/Spit		Stable	Marsh/Ck Bottom	
16'	Natural	Riverine, Bay Inf	North	Medium	bars	Creek Mouth Barrier/Spit		Stable	Marsh/Ck Bottom	
17	Natural	Open Bay	Northwest	Medium	bars	Dune Field	Linear	Stable	Upland	
18A	Natural	Open Bay	West	Medium	bars	Spit		Accretionary	Marsh/Ck Bottom	
18B	Natural	Open Bay	West	Medium	bars	Spit		Accretionary	Marsh/Ck Bottom	
19	Natural	Open Bay	West	Shallow	bars	Spit		Accretionary	Marsh/Ck Bottom	
20	Natural	Riverine, Bay Inf	West	Shallow	bars	Isolated	Linear	Stable	Upland	
21	Natural	Riverine, Bay Inf	West	Shallow	bars	Isolated	Shallow Bay	Stable	Upland	
23	Natural	Open Bay	Northwest	Shallow	bars	Isolated	Linear	Stable	Upland	
27	Man Inf	Open Bay	Northwest	Medium	bars	Isolated	Linear	Stable	Upland	Groins, Revetment
28	Man Inf	Open Bay	Northwest	Medium	bars	Isolated	Linear	Erosional	Upland	Bulkhead
30	Man Inf	Open Bay	Northwest	Medium	bars	Isolated	Linear	Stable	Upland	Revetment, Groins
33A	Natural	Open Bay	West	Medium	bars	Dune Field	Linear	Stable	Upland	
33B	Natural	Open Bay	Northwest	Medium	bars	Dune Field	Linear	Erosional	Upland	
33C	Natural	Open Bay	Northwest	Steep	bars	Dune Field	Linear	Erosional	Upland	
34	Natural	Open Bay	West	Medium		Dune Field	Linear	Erosional	Upland	
35	Natural	Open Bay	West	Shallow		Spit		Erosional	Upland	
36	Natural	Open Bay	West	Shallow		Spit		Accretionary	Marsh/Ck Bottom	
40	Man Inf	Open Bay	West	Shallow	bars	Isolated	Linear	Erosional	Upland	Groin,BH
41A	Man Made	Open Bay	West	Shallow	bars	Dune Field	Linear	Erosional	Upland	BH, Jetty,Beach Fill
41B	Man Made	Open Bay	West	Shallow	bars	Dune Field	Linear	Accretionary	Upland	BH, Jetty,Beach Fill
42	Natural	Open Bay	West	Medium	bars	Dune Field	Linear	Erosional	Upland	
43	Natural	Open Bay	Southwest	Medium	bars	Dune Field	Linear	Stable	Upland	
45	Natural	Open Bay	Southwest	Medium	bars	Creek Mouth Barrier/Spit		Erosional	Marsh/Ck Bottom	
46	Natural	Riverine, Bay Inf	South	Shallow	bars	Creek Mouth Barrier/Spit		Erosional	Marsh/Ck Bottom	
48	Man Inf	Open Bay	Northwest	Shallow	bars	Spit		Stable	Marsh/Ck Bottom	Revetment
49	Man Inf	Open Bay	West	Medium	bars	Creek Mouth Barrier/Spit		Erosional	Marsh/Ck Bottom	Revetment
51A	Natural	Open Bay	Southwest	Steep		Dune Field	Linear	Stable	Upland	
51B	Natural	Open Bay	West	Shallow	bars	Dune Field	Linear	Accretionary	Upland	
53	Man Inf	Open Bay	West	Steep		Dune Field	Linear	Stable	Upland	Breakwater
54	Man Inf	Open Bay	Southwest	Steep		Dune Field	Linear	Stable	Upland	Breakwater
57	Man Inf	Open Bay	West	Medium		Dune Field	Linear	Erosional	Upland	Revetment
58	Man Inf	Open Bay	West	Medium		Isolated	Salient	Erosional	Upland	Revetment

‘Sites were noted as dunes but were not photographed or surveyed.

Long term, recent stability, and future prediction of sediment erosion and accretion rates for dune sites in Northampton County.

Site No.	Long-Term Stability 1938-2002	Recent Stability 1994-2002	Near Future Prediction
4*	Accretionary	Stable	Stable
5*	Accretionary	Stable	Stable
8*	Erosional	Stable	Stable
10	Erosional	Stable	Stable
12	Erosional	Stable	Stable
13	Accretionary	Accretionary	Accretionary
14A	Erosional	Stable	Stable
14B	Stable	Stable	Stable
15	Erosional	Erosional	Erosional
16	Accretionary	Erosional	Erosional
17	Accretionary	Accretionary	Accretionary
18A	NA	Erosional	Erosional
18B	NA	Erosional	Erosional
19	NA	Erosional	Erosional
20	Accretionary	Erosional	Stable
21	Accretionary	Stable	Stable
23	Accretionary	Stable	Stable
27	Accretionary	Stable	Stable
28	Accretionary	Stable	Stable
30	Erosional	Stable	Stable
33A	Erosional	Erosional	Erosional
33B	Erosional	Erosional	Erosional
33C	Erosional	Stable	Stable
34	Erosional	Erosional	Erosional
35	Erosional	Erosional	Erosional
36	Erosional	Erosional	Erosional
40	Accretionary	Stable	Stable
41A	Accretionary	Stable	Stable
41B	Accretionary	Accretionary	Stable
42	Accretionary	Erosional	Erosional
43	Accretionary	Stable	Erosional
45	Erosional	Erosional	Erosional
46	Erosional	Stable	Erosional
48	Accretionary	Accretionary	Accretionary
49	Erosional	Erosional	Erosional
51A	Accretionary	Stable	Stable
51B	Erosional	Accretionary	Accretionary
53	Accretionary	Accretionary	Accretionary
54	Accretionary	Accretionary	Stable
57	Erosional	Stable	Erosional
58	Erosional	Erosional	Erosional

*Long-term rate is 1949-2002 since a 1938 shoreline was unavailable.