PROBLEMS OF THE NEW JERSEY BEACHES

BY

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It is common knowledge that ocean beaches which are intensively used for recreation rarely are self-maintaining in a satisfactory condition at the desired location. The New Jersey beaches are a somewhat notorious example of the truth of that statement; as a matter of fact, beach preservation has become one of the State's most serious and difficult problems. By definition, a problem exists when it is found by experience that something which is desirable also is difficult to retain or to acquire, as it certainly would be foolish to exert much effort and expend funds in substantial amounts to preserve or to create something that has neither monetary nor intangible value. Thus, New Jersey's beaches give rise to problems not only because they are difficult to maintain, but also because they have great values in three interrelated categories: The intangible value that makes them attractive to people for recreation; the tangible dollar value that results from the payments that people are willing to pay for services or goods received from others at the beach; and the value of the beach as a protector of property from damage during storms.

It is widely known that the New Jersey beaches are very popular, but the extent and depth of this public approval and the reasons for its existence are generally taken for granted and usually are not analyzed.

Although these ocean beaches long have been the favorite resort area for large numbers of people, popularity is often fickle. It is therefore desirable to consider the reasons for this public favor before concluding that the beaches will be as popular in the future as they have been in the past.

The area that is within easy travel distance from the New Jersey beaches via express highways, railroad, and air transport includes the monstrous thing sometimes called "Megalopolis," which is considered to extend through the New York-Northeastern New Jersey metropolitan area, the Trenton-Lehigh Valley area, the Philadelphia-Camden-Chester-Wilmington area, and the Baltimore-Washington region. Megalopolis is already virtually a continuous mass of buildings and humanity, and the experts predict that it will accumulate many additional buildings, streets, roads - and people. It is estimated that there is a present population of over 25,000,000 in the Megalopolis region that is within easy travel time to the New Jersey beaches. These people inhabit cities that have a summertime climate (aptly described by Rudyard Kipling "You have to pick spots in India to find more oppressive weather.") that literally drives people to places where they can find relief. The Atlantic Ocean fortunately has a delightful water temperature, during the summer, of about 70 degrees Fahrenheit - warm enough to be comfortable, yet cool enough to be invigorating. Furthermore, its waters tend to make air temperatures more cool than those in the hinterland, and they almost always generate a sea breeze. Finally, the beaches of New Jersey are clean fine white sand, they slope gently out to sea, the surf is rarely violent during the summer months, and dangerous currents are uncommon. In short, there is a great and growing need for a recreational resource in this region for a very large number of people, and the New Jersey beaches can satisfy that need. A glance at the following table shows how intensively the resource is used.

Table 1

IMPORTANCE OF NEW JERSEY OCEAN BEACHES

Permanent population of beach communities	262,000
Summer population of beach communities	1,357,000
Daily beach use (week days)	543,442
Daily beach use (week ends)	896,466
Total beach use during season (June 15 - Sept. 7)	57,279,000

This vast flood of people who come to the beaches for relief from the heat and noise and polluted air of the great cities of the region spend a great deal of money on food, lodgings, amusements, constructing and maintaining summer homes, and the like. Official State figures show the following:

Table 2

DOLLAR VOLUME OF BUSINESS AT NEW JERSEY SEASHORE BEACHES

Year	Volume	% Increase over preceding year
1964	$1,928,000,000	+ 5.9
1963	1,821,000,000	+ 8.2
1962	1,684,000,000	+ 2.5
1961	1,643,000,000	+ 0.1
1960	1,641,000,000	- 10.4
1959	1,831,000,000	+ 14.7

It is of interest to compare the dollar value of this seashore recreation industry with the incomes of selected other New Jersey business activities.

Table 3

COMPARISON OF DOLLAR VALUES OF RECREATION BUSINESS AND SELECTED OTHER BUSINESSES

Source	Amount 1960	Amount 1964
Manufacturing	$8,354,000,000	$9,980,000,000
Seashore Recreational	1,641,000,000	1,928,000,000
Construction	1,235,000,000	1,608,000,000
Agriculture	296,000,000	277,000,000
Fishing	10,000,000	9,000,000

The foregoing figures show quite conclusively that the New Jersey beaches are a valuable asset, in terms both of the intangible benefits they give to the people who visit them and the tangible and very large monetary return they make to the economy of the State. Furthermore, they show that the recreation business generated by the ocean beaches is second only to manufacturing as a source of income for the State. However, the third category of value - the protection that the beaches give to property during storms - is not so impressive. In general, the beaches of New Jersey are, at many localities, too narrow to have a significant effect on wave heights during times of great storms, and there are few sections where natural dunes exist to serve as a last line of defense. As a consequence, New Jersey beach resorts are particularly vulnerable to damage during hurricanes and the so-called extra-tropical storms. The storm of March 1962 is an example of one of the latter, and its effects on New Jersey were particularly devastating.

Table 4

LOSSES DUE TO MARCH 1962 STORM - VIRGINIA TO NEW YORK

Item	Totals	New Jersey	
		Loss	% of Total
Deaths	28	14	50
Injuries	1,575	1,303	83
Dwellings destroyed	1,324	932	70
Dwellings damaged	65,833	49,251	75
Other buildings destroyed	273	215	79
Other buildings damaged	3,120	1,928	62
Total loss (dollars)	$234,111,000	$122,746,000	52

The tabulation shows that New Jersey suffered more damage during this great storm than did other states. It might be thought that this was due to the long shoreline involved, but when this is taken into account, it is seen that New Jersey was indeed vulnerable.

Table 5

LOSSES DUE TO MARCH 1962 STORM PER MILE OF BEACH

State	Amount
New Jersey	$ 760,000
Maryland	490,000
Delaware	420,000
Virginia	260,000
New York	275,000

The losses suffered during this one great storm although certainly the greatest due to a single event, are unfortunately not unique. There has been a succession of damaging storms throughout recorded history, but those of the past did not cause damages as great as those that took place more recently because there was less property to be damaged. Nevertheless, the average annual losses, computed by the Army Engineers for the several sections of the shoreline that they have examined, are very large.

Table 6

AVERAGE ANNUAL DAMAGES DUE TO STORMS

Section	As Estimated: Source	As Estimated: Price Level	As Estimated: Amount	Adjusted to 1962 price level
Raritan Bay-Sandy Hook Bay	HD 464-87-2	1960	$1,074,000	$1,140,000
Sandy Hook to Barnegat Inlet	HD 361-84-2	1953	319,000	440,000
Barnegat Inlet to Cape May Point	HD 208-86-1	1957	1,092,000	1,300,000
Cape May Point to Maurice River	HD 196-87-1	1960	50,000	53,000
			T O T A L	$2,933,000

These severe losses are due in part to the intrinsically high value of the seashore to millions of people. This develops great economic pressure to build intensively all along the coast, and as close to the actual shoreline as real estate availability and local regulations permit. Thus, there is more property available to suffer damages, and much of it is located closer to the shoreline than were the older developments.

A large part of the storm damages is sustained by summertime residents, and for the most part the losses are not covered by insurance. Nevertheless, after each storm, damaged homes are repaired or new dwellings built, often better than before. This convincing demonstration of the desire of people to continue to live at the seashore, despite adversities, inspires city officials to restore public property and businessmen to repair the damages that their establishments suffered, and the community soon has recovered fully. Despite the fact that such recoveries have taken place many times in the past, almost anyone who visited the seashore shortly after the March 1962 storm and then did not return until the summer of 1965 would be amazed to discover that there were virtually no scars remaining to show that the area had been terribly mauled just three years earlier. There are some who find this fact astonishing. They regard the person who rebuilds in an area known to be vulnerable as somewhat foolish, not appreciating the high value that these persistent people place on the pleasures and benefits that they and their families receive as a result of living at the seashore. People who so appreciate the benefits of living at the beach are willing to spend commensurate sums of money, if necessary, to continue to receive these benefits. To make sure that the amounts that they must expend thus are minimal, they see to it that government does all that it can within its fiscal and technical resources to prevent or minimize future damages. These are the socio-economic aspects of New Jersey's beach problem. The technical aspects of that problem are at least as interesting.

Reliable surveys of the New Jersey shoreline have been made at intervals since that of 1839-1842. In the approximately 125 years of record accumulated since then, it has been found that the net result of the action of the waves, winds, and currents has been a recession of the shoreline. This loss has not been uniform all along the frontage, nor has the rate of erosion been the same year after year. It is not necessary, for the purposes of this examination of the New Jersey beach problem, to go into the details of the changes of shoreline. The following tabulation provides the essential information, in terms of the average annual losses of sand from the several well-defined sections of the shoreline.

Table 7

NEW JERSEY BEACHES

AVERAGE ANNUAL LOSS OF SAND

Section	Cubic Yards Total	Cubic Yards/ Mile
Raritan Bay-Sandy Hook Bay	83,000	5,000
Sandy Hook to Mantoloking	729,000	23,000
Mantoloking to Barnegat Inlet	300,000	15,000
Barnegat Inlet to Cape May Point	1,576,000	21,000
Cape May Point to Maurice River	18,000	1,000
Total	2,706,000	

Figure 1 shows the locations of these reaches. Raritan Bay-Sandy Hook Bay is the frontage extending west from the base of Sandy Hook to Staten Island; Mantoloking is about two miles south of Bay Head; and Maurice River empties into Delaware Bay at about longitude 75°.

It is seen that the losses per mile in New York Harbor and in Delaware Bay are relatively low in comparison with those experienced along the ocean shoreline, but the most important point to be noted from the tabulation is the large net annual loss of sand. It is obvious that it is necessary to replace this quantity of sand annually, or to take measures to reduce the loss and make up the difference by artificial nourishment, just to hold the beaches in their generally unsatisfactory present condition. To make them wider, as is desirable to accommodate the increasing numbers of people who come to the beaches of New Jersey, requires additional sand.

Thus, the supply of sand is the crux of the problem, and unfortunately sand is scarce.

There are no obvious external sources of supply of sand. It is unlikely that the beaches of Long Island can nourish the beaches of New Jersey, as the Hudson River and its deep canyon doubtless are effective barriers to such movement. Similarly, the New Jersey beaches are isolated from the beaches of Delaware by the broad expanse of the Delaware. Furthermore, there is a "nodal" region between Barnegat and Manasquan Inlets, and the predominant direction of littoral drift north of this region is to the north, and that to the south of the region is to the south. Thus, even if material from Long Island or Hudson River could reach the Sandy Hook peninsula, it would inevitably be drawn back to the north and not contribute to the nourishment of the beaches to the south. Similarly, any detritus brought down by the Delaware cannot nourish the New Jersey beaches because of the predominance of the forces that cause material to move southward towards Delaware Bay, rather than from Delaware Bay.

The drainage area of the streams discharging into the ocean or its coastal bays and sounds amounts to approximately 1,700 square miles. Of this total, only 121 square miles drains directly into the ocean. The 40-inch annual rainfall is well-distributed throughout the year, the terrain is low and slopes are thus gentle, and there are numerous swampy areas. As a result, the rivers and creeks are sluggish and carry little sediment, but even if they did, most of the material would be trapped in the bays and sounds and not be available for beach nourishment. Thus, the New Jersey beaches probably do not receive detritus brought down by the Hudson and the Delaware, nor do they gain material from the beaches to the north and to the south of the State, nor is there any appreciable contribution of sand from the New Jersey hinterland. The only other possible external source of nourishment for the beaches is the ocean floor itself, and there is no evidence that this takes place. In the absence of an external source of supply, it necessarily follows that the average annual loss of sand shown in Table 7 of about 2.7 million cubic yards is the total, or gross, loss as well as the net loss. (Net loss is defined as the difference between the gross loss and the inflow from external sources.) This is significant, as it means that there is no sand, other than that being eroded from the beach, available for accumulations on the updrift sides of groins and jetties.

In view of the narrow beaches that exist along most of the shoreline, the lack of an external source of sand supply to nourish the beaches naturally, the scarcity of effective dunes, and the great value of property in the resort communities, the policy of the State consists of working cooperatively with local governments and the United States towards the construction of barriers in the form of bulkheads, seawalls, or dunes as a last line of defense against inundation and wave forces; adequate beaches to protect the barriers during storms and to serve bathers during the summer vacation season; and groins and inlet stabilization works to conserve the sand. In the latter connection, it is of course realized that groins cannot prevent the loss of sand from the beach, but they do reduce the rate of loss. The inlet stabilization works are expected to prevent further migration of the inlets, also to trap the littoral drift in locations where it can be restored to the beaches rather than be lost at sea or carried to remote parts of the lagoon system. These sand conservation measures are important, as the unit prices of artificial nourishment of the beaches are high and likely to become higher as nearby borrow areas in the interior lagoons are depleted. Ultimately, the time may come when there is no more sand available in the lagoons, and it then will be necessary to find sand on the mainland or offshore. The latter source may be found more economic than the mainland or even the more remote portions of the lagoons. It is understood that the Army Engineers propose an experiment with the direct pumpout hopper dredges of the Philadelphia District to explore the possibilities of utilization of offshore sources and provide costing experience. The State looks forward to this experiment.

The great storm of March 1962 caused so much damage and the beaches were so adversely affected that an accelerated program of shore protection work was necessary. Operations were commenced a few days after the end of the storm and in a little over three years (to June 30, 1965) the following work had been accomplished:

Table 8

Shore Protection Work Accomplished After March 1962 Storm

(To June 30, 1965)

Item		Amounts
Groins		86 new structures 11 extensions 20 repaired
Bulkheads and Seawalls		66,937 linear feet
Beach Fill		8,898,000 cubic yards
Dunes		80,730 linear feet (2,169,000 cubic yards)
Costs and Fund Sources		
Federal		$11,744,000
State	$6,880,000	
Local	6,660,000	
Total Non-Federal	13,540,000	13,540,000
	TOTAL	$25,284,000

It is seen that this crash program was in accordance with the general policy stated above, except that it did not include any work on inlet stabilization. It may be of interest to consider a few examples of the work accomplished. The most extensive program of groin construction took place on Long Beach Island, where a total of 60 of these structures was built. Some of these have been in place for 18 months, and others were completed only recently. Figures 2 and 3 show the excellent condition of the beach at typical groins in August 1965. All of the groins were visited on the same date, and all showed similarly satisfactory results; there can be no doubt that this system of groins has been beneficial to the beaches of Long Beach Island. Similar results were obtained at Lavalette, which is in the so-called nodal region. Nine groins were completed along the frontage of this community by January 1965; by May 1965, most of them were nearly buried. However, erosion to the north of the most northerly groin of the system subsequently began, and by August 1965 the condition shown on Figure 4 had developed. The beach elsewhere in the locality was in excellent condition. Although it is contemplated that beach fills will be placed on Long Beach Island and in the Lavalette vicinity as necessary, none has been placed since construction of the groins. In this connection, it should be noted that both Long Beach Island and the Lavalette locality have been artificially nourished in the past. It will be of interest to compare the rates of loss of sand experienced without groins with those that will be found with the groin systems in place.

Figure 5 shows the dune that was constructed by the Army Engineers at Sea Isle City soon after the March 1962 storm. By the judicious use of snow fences and grass plantings, also control of passages of bathers across the dune, the dune has become higher and broader than it was after completion of the construction and it is presently a fairly effective barrier. Figure 6 shows an example (located at Stone Harbor) of another type of barrier, consisting of a timber bulkhead with a revetment at its toe. Figure 7 shows a massive sea wall at Cape May City. Also apparent in this photograph is an earlier steel bulkhead, and this in turn was preceded by a timber bulkhead. The photographs show that there is little, if any, beach in front of these structures.

Unfortunately, there are more examples of narrow or non-existent beaches than there are of wide beaches in New Jersey. Experience has proven that seawalls and bulkheads and dunes, although a necessary part of coastal protection, are not competent in themselves to protect buildings and other structures unless there is also an adequate beach in front of the barrier. It is of course futile to protect property at a beach community if there is no beach for the people to use for bathing and sunning. In brief, although the work accomplished since March 1962 at a cost of over $25 million certainly has been beneficial, there remains an urgent need for wider beaches at nearly every resort community for both protective purposes and better to serve the needs of recreation. The technical problem can be succinctly stated as one where there is a need for better beaches throughout the year at a cost that can be justified by the benefits. A cooperative investigation is underway with the Army Engineers that hopefully will provide new answers. It is expected that the study will point up the need for conservation of the sand, which certainly can be considered an irreplaceable resource. Perhaps the investigation pertaining to the stabilization of the inlets will show that much sand can be conserved by the applicable measures involved in inlet stabilization, and it is hoped that it will realistically appraise the relative economics of groins with a perhaps reduced requirement for artificial nourishment as compared with the artificial nourishment requirements without groins. Also, it may be found that offshore sand dredged up by means of the direct pumpout hopper dredges may so reduce the unit price of sand on the beaches as to prove a factor in determining the best method for providing adequate beaches.

In summary, the New Jersey beaches are a priceless recreational asset for millions of people who live in Megalopolis and often swelter in humid heat there. Much property has been developed to serve these people, and the returns on the investment are huge. However, both the beaches and the improvements are in jeopardy whenever there is a great storm. It has been found that barriers alone are inadequate to protect the property, and of course, barriers without an adequate beach are futile; there is no reason for the existence of most of the coastal communities if there are no beaches for the people to bathe from. There is therefore a need for wider beaches, but the sand to produce these and maintain them is in short supply. Studies are underway to develop the most economic means to produce the desired beaches as a cooperative endeavor between the Army Engineers and the State.

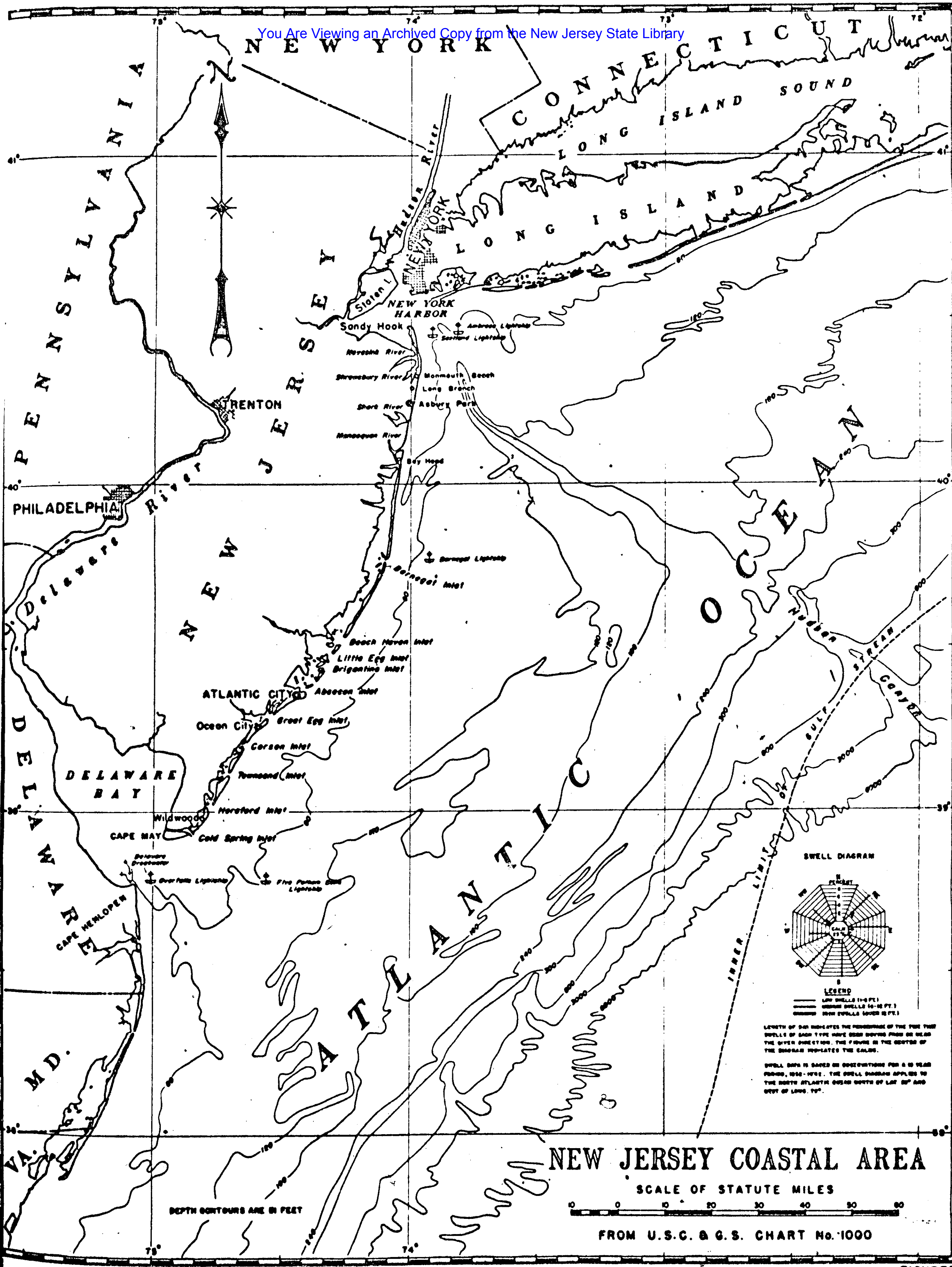
NEW JERSEY COASTAL AREA
SCALE OF STATUTE MILES
10 0 10 20 30 40 50 60
FROM U.S.C. & G.S. CHART No. 1000
DEPTH CONTOURS ARE IN FEET
NEW YORK
CONNECTICUT
PENNSYLVANIA
NEW JERSEY
LONG ISLAND SOUND
LONG ISLAND
NEW YORK
Hudson River
Staten I.
NEW YORK HARBOR
Sandy Hook
Ambrose Lightship
Scotland Lightship
Navesink River
Shrewsbury River
Monmouth Beach
Long Branch
Shark River
Asbury Park
Manasquan River
Bay Head
TRENTON
PHILADELPHIA
Delaware River
Barnegat Lightship
Barnegat Inlet
Beach Haven Inlet
Little Egg Inlet
Brigantine Inlet
ATLANTIC CITY
Absecon Inlet
Ocean City
Great Egg Inlet
Corson Inlet
Townsend Inlet
Hereford Inlet
Wildwood
CAPE MAY
Cold Spring Inlet
DELAWARE BAY
Delaware Breakwater
Overfalls Lightship
Five Fathom Bank Lightship
CAPE HENLOPEN
DELAWARE
MD.
VA.
ATLANTIC OCEAN
Hudson Canyon
GULF STREAM
INNER LIMIT OF
SWELL DIAGRAM
LEGEND

FIGURE 1

FIGURE 2

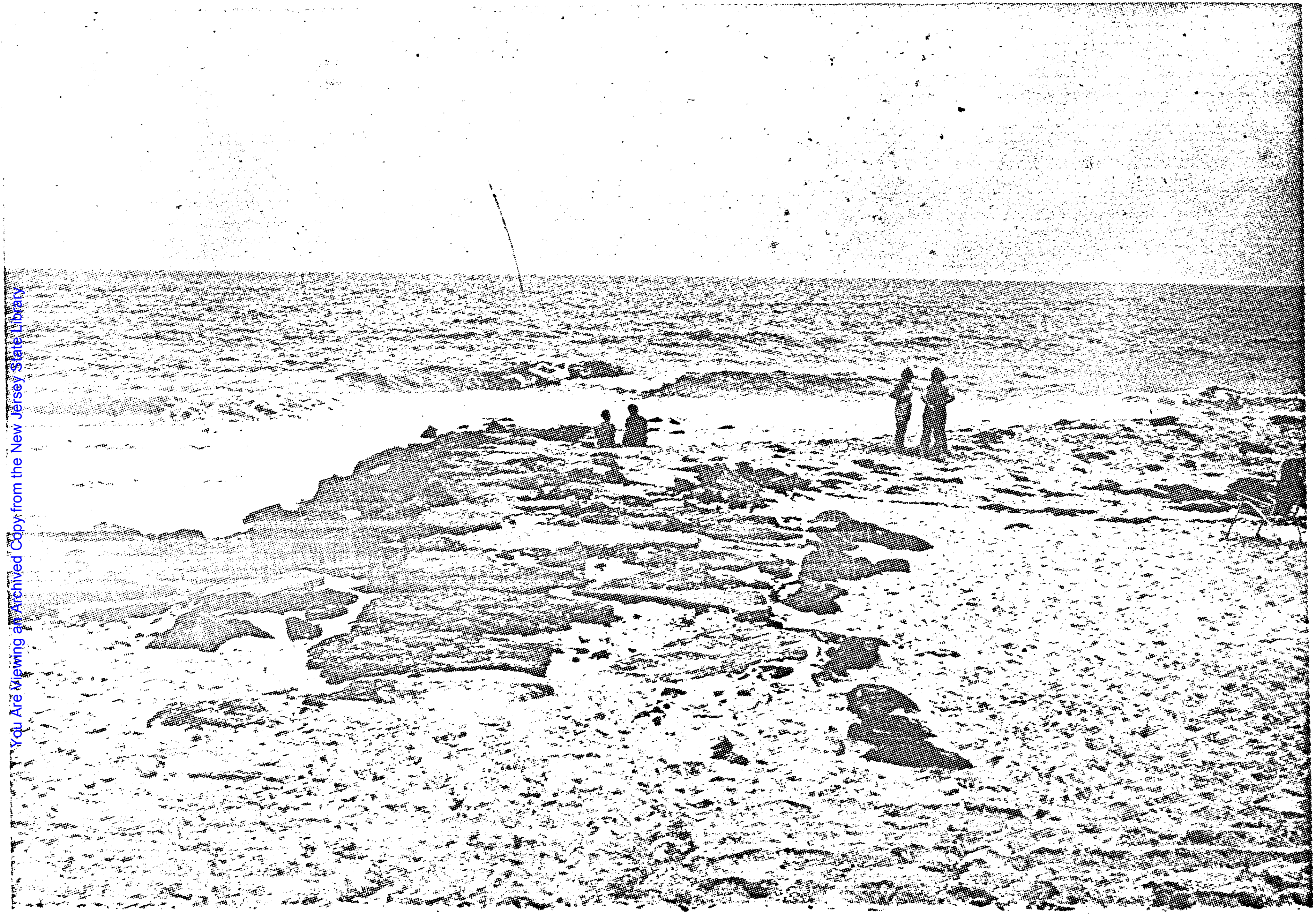

FIGURE 3

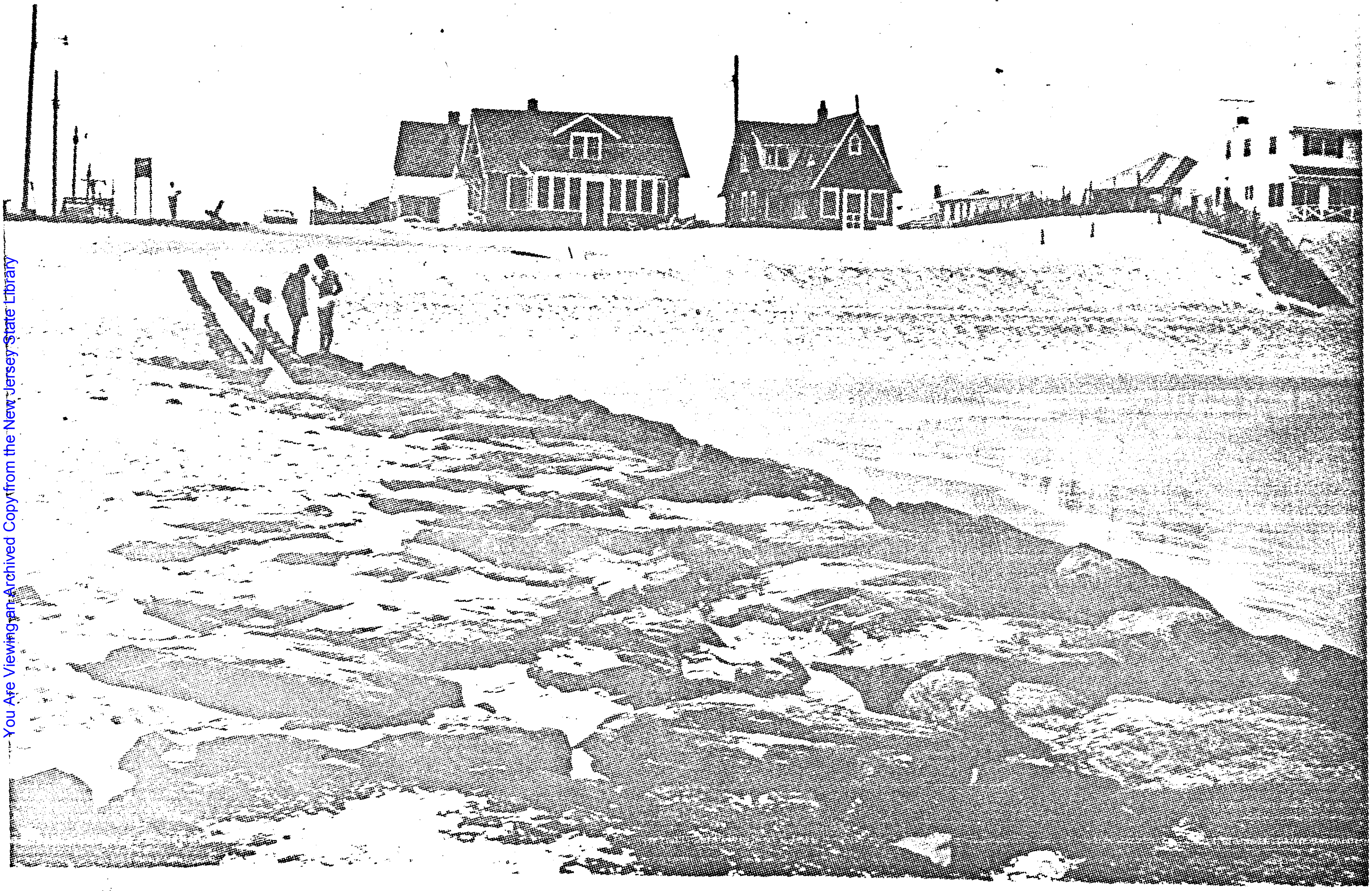

FIGURE 4

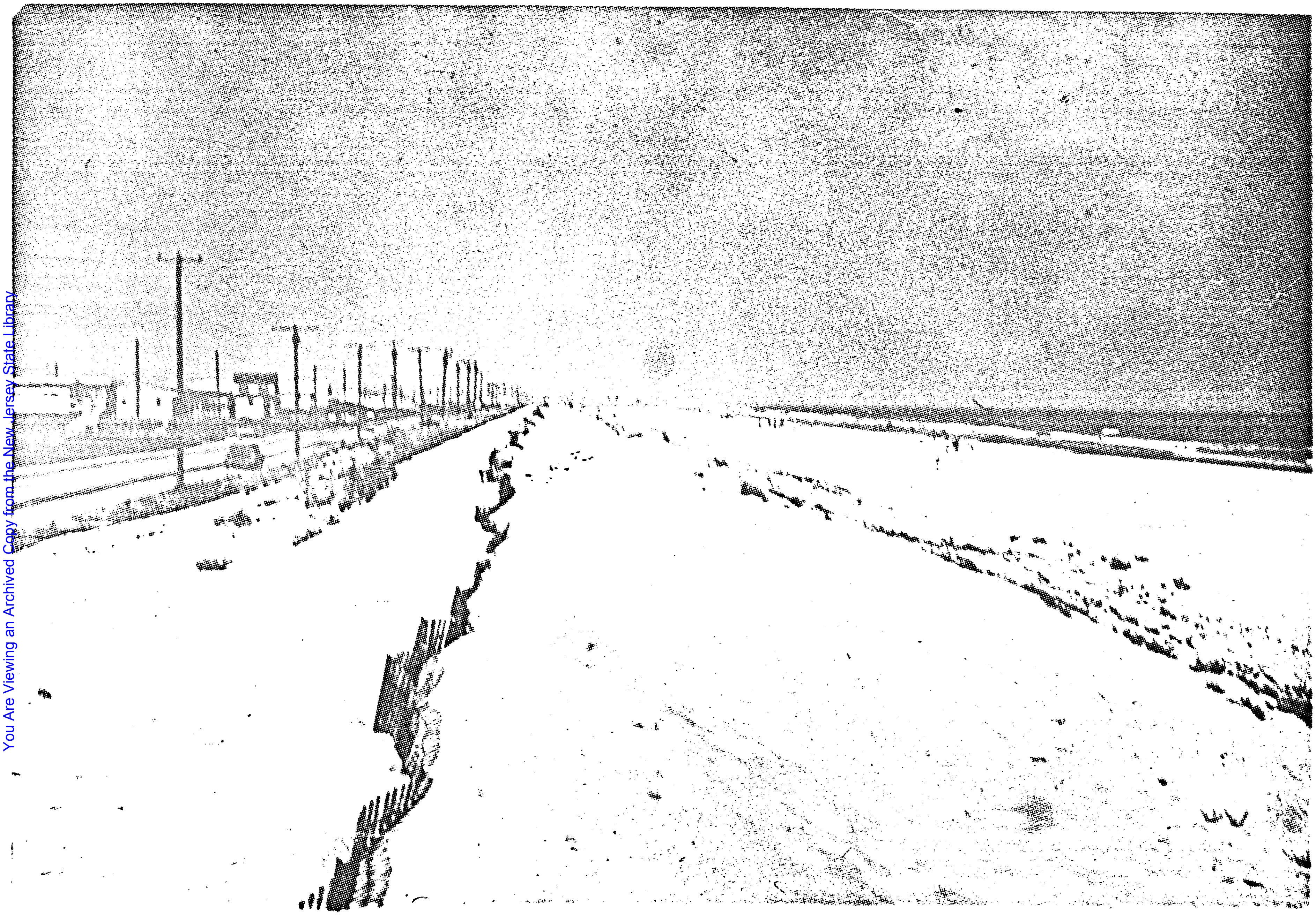

FIGURE 5

FIGURE 6

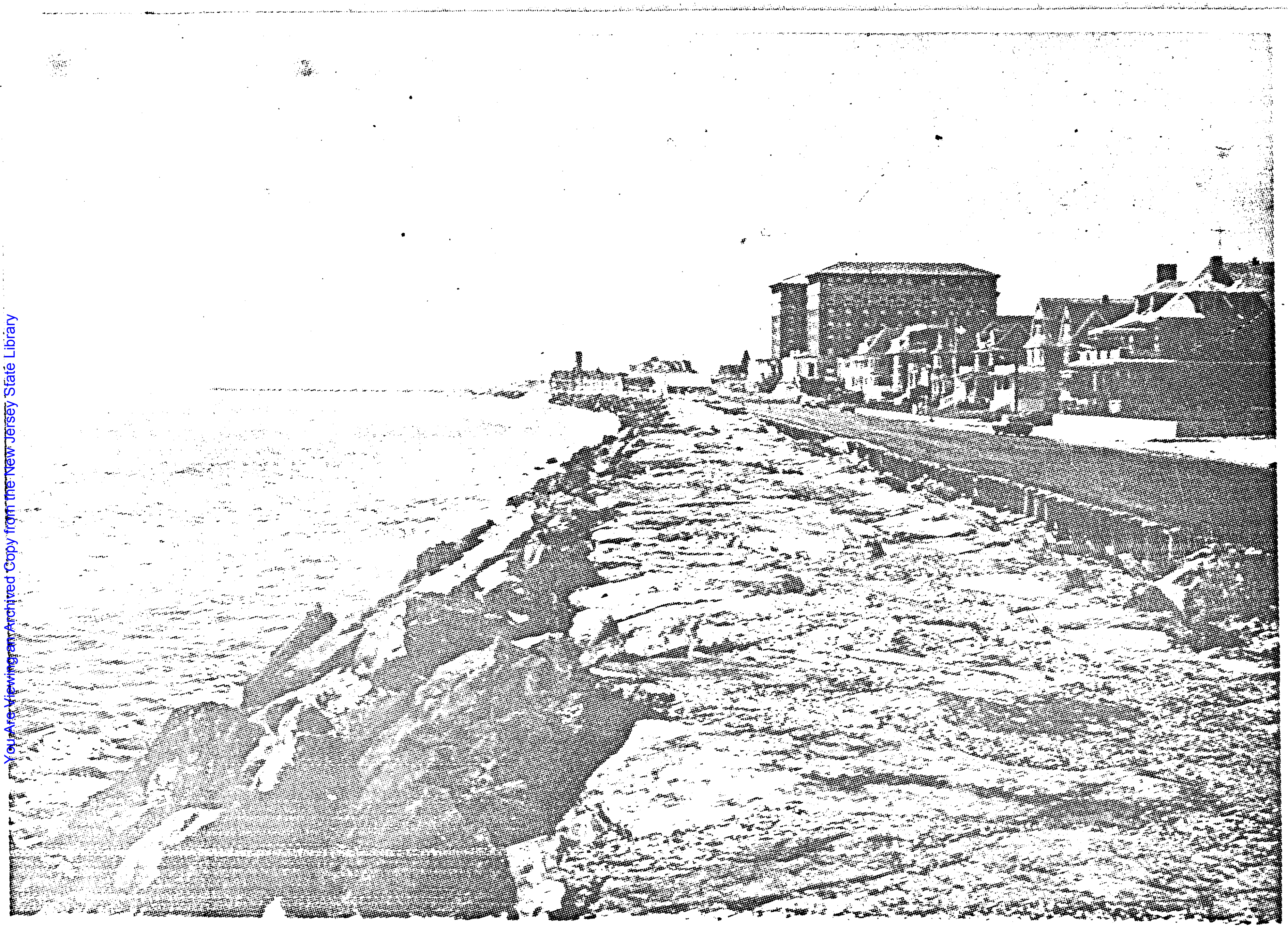

FIGURE 7