CHAPTER 61

Beach Nourishment at Virginia Beach, Virginia

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ABSTRACT

Aspects of the Federal beach erosion control project at Virginia Beach, Virginia are described with particular emphasis directed to the sources, characteristics, costs, methods of placement and quantities of material periodically placed on the beach following project inception The beach response to nourishment is analyzed on the basis of yearly survey records compiled from data gathered by the sea-sled direct leveling technique The quantity of annual nourishment material required to maintain present beach dimensions is determined to be approximately 141,000 cubic yards

INTRODUCTION

In the present appraisal, information gathered by a comparison of bathymetric surveys is used as a basis for evaluating the beach response and annual sand nourishment requirement at Virginia Beach, Virginia Survey data gathered by the sea-sled direct leveling technique and collected annually over seventeen identical ranges for a three-year period (1966-1969) were employed in the appraisal

DESCRIPTION OF STUDY AREA

Virginia Beach, as shown in figure 1, is located on the east coast of Virginia, about 19 miles east of Norfolk, Virginia and 3 5 miles south of Cape Henry which is the south point of the entrance to Chesapeake Bay The shoreline in the area bears South 12°36' East

The existing Federal beach erosion control project here extends from Rudee Inlet to 49th Street and includes the 3 3 miles of coastline treated in this paper (figure 2) A concrete bulkhead and promenade, within the limits of the project, was constructed by local interests in 1927 It extends from 7th to 35th Street and is supported on two rows of piling generally parallel to the shore A wooden bulkhead, constructed by local interests, extends from 35th to 49th Street

Tides at Virginia Beach are semidiurnal The mean range of tide is 3 4 feet and the spring range is 4 1 feet

Waves reaching the area are predominately from the southeastern quadrant during the summer and from the northeastern quadrant during the winter The greatest yearly percentage of waves arrive from the

east-northeast and range between 1 and 6 feet Calms prevail approximately 19 percent of the time Available evidence suggests that the predominant direction of the littoral drift in the area is from south to north An analysis of winds and waves reaching Virginia Beach indicates that the predominant energy applied to the shore is from the northeast quadrant However, observations and surveys of the jetties at Rudee Inlet and an experimental groin at Seventh Street clearly suggest a net northerly drift This anomaly with respect to the direction of the littoral movement has been attributed to the possible assistance of a tidal eddy extending for some distance south of the Chesapeake Bay entrance

DESCRIPTION OF EXISTING FEDERAL BEACH EROSION CONTROL PROJECT

The existing Federal beach erosion control project at Virginia Beach includes (a) artificial placement of suitable sand fill on the ocean shore to provide and maintain a beach berm having a width of approximately 100 feet at elevation 5 4 m s l with a 1 on 15 foreshore slope extending to the natural bottom and (b) a deferred system of groins to be constructed if experience indicates that it is more economical than periodic sand nourishment The project is now being maintained with dredging equipment owned by the Virginia Beach Erosion Commission, a state agency

Nearly $200,000 is being expended annually to maintain the project of which 50 percent is borne by the Federal Government

BORROW AREA

Material for beach nourishment during the study period was dredged from the Owl Creek Estuary (Fig 2) The remaining available material in this area is estimated to be sufficient to supply the annual nourishment requirements through 1970 For a source of future nourishment material, the Virginia Beach Erosion Commission has acquired state-owned lands on the south side of Owl Creek containing approximately 500,000 cubic yards of fine sand This will provide sufficient material to nourish the beach for approximately four years, or to early 1975 at the heretofore proposed annual rate of 130,000 cubic yards

The median diameter of nourishment material during the period 1964 - 1969 was 26 mm as compared to 31 mm for natural material found on the beach

EQUIPMENT USED

Figure 3 shows the normal layout of dredging plant equipment when operating in the Owl Creek borrow area It includes a 10-inch hydraulic cutterhead dredge, a 10-inch floating booster station at

the foot of Mediterranean Avenue, and a fixed booster station at Seventh Street The pipeline is 15,000 feet long when discharging at its farthest point, usually between 21st Street and 22nd Street A 12-inch dredge has just been purchased for the purpose of keeping Rudee Inlet open and will also be available to pump sand on Virginia Beach

COST

For dredging work only, Table 1 indicates the cost per cubic yard of placing material on Virginia Beach during the period of investigation

Table I
Cost of Beach Nourishment

FY 1966	$1 41
FY 1967	1 51
FY 1968	2 91
FY 1969	0

QUANTITIES OF MATERIAL DREDGED

Table 2 indicates the quantities of new source material pumped by the dredge annually during the study period

Table II
Quantities of New Material Pumped on Beach

FY 1966	117,000 cubic yards
FY 1967	119,000 cubic yards
FY 1968	6,000 cubic yards
FY 1969	0

COMPARISON OF SURVEYS

Comparison of the 1966, 1967, 1968 and 1969 surveys, which were made using an identical method over the nearshore and offshore profiles, yields what is thought to be an accurate indication of beach response in the project area and is summarized in Table III

The nearshore profile over which surveys were made extends from the bulkhead line for a distance of 400 feet oceanward Including berm material which was in excess of design dimensions, the deficiency in the design berm of 150,000 cubic yards that existed in June 1966 was reduced to 110,000 cubic yards in 1967 The deficiency in the design berm for July 1968 was 209,000 cubic yards or an increased deficiency of 99,000 cubic yards over July 1967 Similarly, a deficiency in the design berm for June 1969 of 330,000 cubic yards represents an increase of 121,000 cubic yards over July 1968

The offshore profile, as defined for survey purposes, extends from the bulkhead line to the 25-foot depth contour Including excess berm material, there was an indicated loss of approximately 392,000 cubic

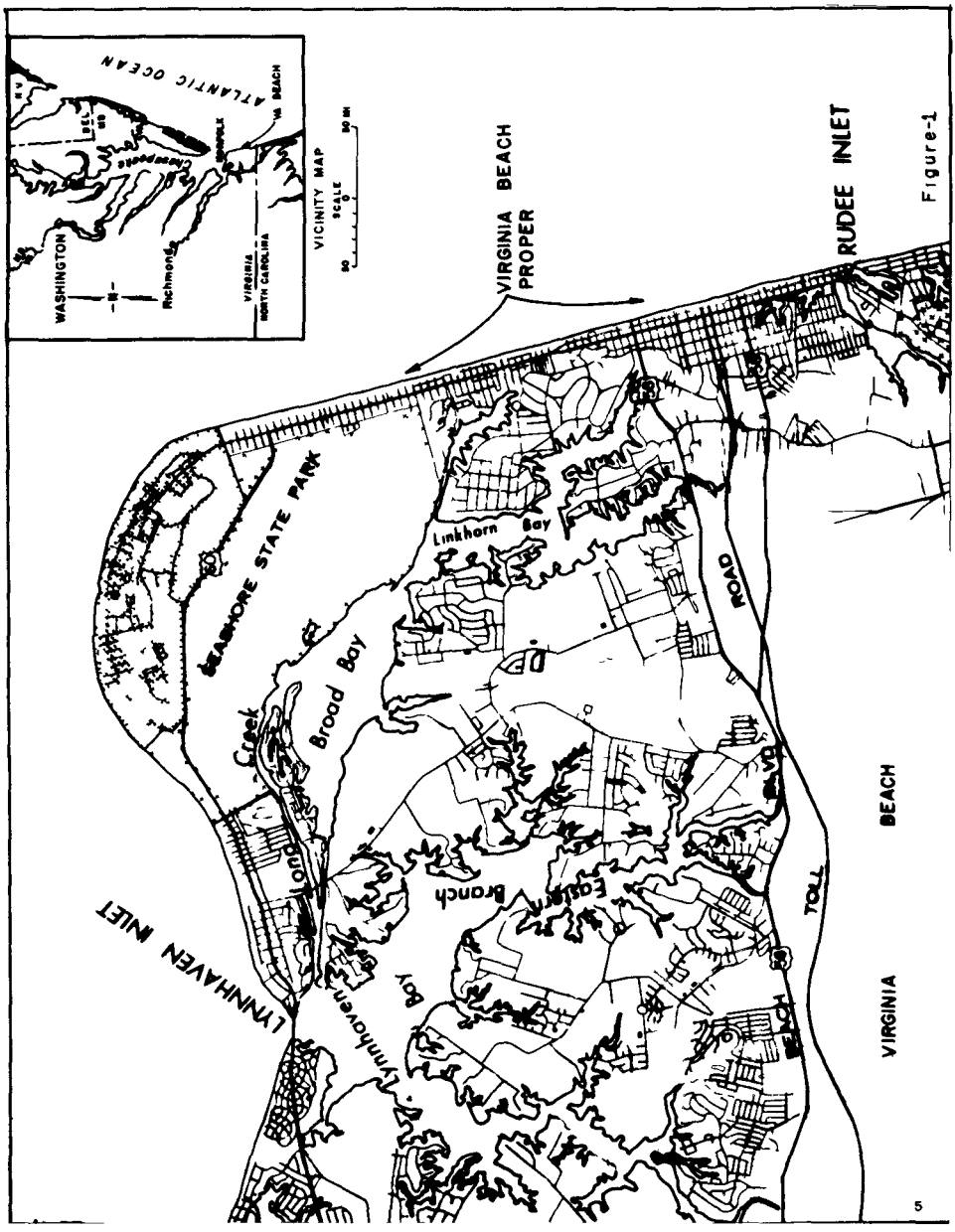
yards of material frrm the offshore area between 1966 and 1967 This is equivalent to 0 30-foot over the entire project Between 1967 and 1968 there was an indicated gain of 7,600 cubic yards which is a negligible gain over the entire project In 1969, the offshore profiles indicated a loss of 221,000 cubic yards of material from the previous year This is equivalent to 0 20-foot over the entire project

Overall, during the three-year period, 1966-1969, the net loss of material over the nearshore profile has been 179,000 cubic yards while the net loss over both profiles was 605,000 cubic yards During the same period, a total of approximately 242,000 cubic yards of suitable material has been placed on the beach On the basis of the foregoing figures, there has been an apparent loss of 847,000 cubic yards or an average annual loss of approximately 282,000 cubic yards of material in the problem area Total nearshore losses of 179,000 cubic yards indicate an average annual loss of approximately 141,000 cubic yards in the project area Consequently, a quantity of suitable nourishment material, totaling at least 141,000 cubic yards should be placed in the project area to maintain present beach dimensions

Table III

Fiscal Year	Suitable Material Pumped On Beach (Cubic Yards)	Deficiency from Design Berm (Nearshore) (Cubic Yards)	Net Change in Nearshore from Previous-Year (Cubic Yards)	Net Change in Nearshore & Offshore from Previous Year (Cubic Yards)	Net Change in Offshore Area (Cubic Yard
1966	117,000	150,000			
1967	119,000	110,000	+ 41,000	- 392,000	- 433,000
1968	6,000	209,000	- 99,000	+ 8,000	+ 107,000
1969	0	330,000	- 121,000	- 221,000	- 100,000

As indicated in Table III, although a state of erosion or accretion may occur on the beach during any given year, an opposite condition may result in the offshore reaches As more survey data becomes available, the relationship between nearshore and offshore profile changes can possibly be determined


ATLANTIC OCEAN
WASHINGTON
Richmond
VIRGINIA
NORTH CAROLINA
VICINITY MAP
VIRGINIA BEACH PROPER
RUDEE INLET
SEASHORE STATE PARK
Linkhorn Bay
Broad Bay
Creek
Lynnhaven Bay
LYNNHAVEN INLET
ROAD
TOLL
VIRGINIA BEACH
Figure-1

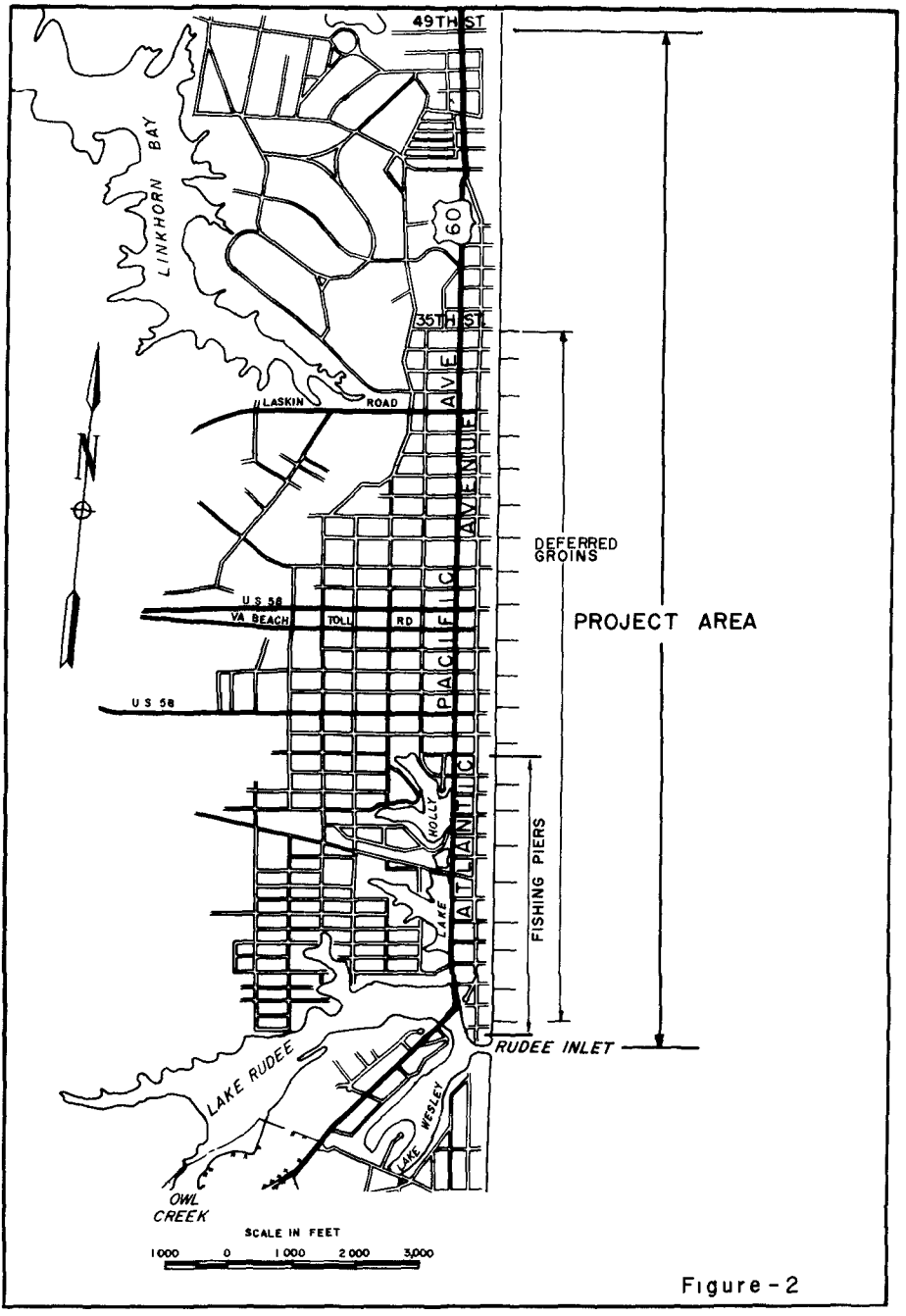

49TH ST
LINKHORN BAY
60
35TH ST
LASKIN ROAD
ATLANTIC AVENUE
PACIFIC AVENUE
N
DEFERRED GROINS
PROJECT AREA
U S 58
VA BEACH TOLL RD
U S 58
HOLLY LAKE
FISHING PIERS
RUDEE INLET
LAKE RUDEE
LAKE WESLEY
OWL CREEK
SCALE IN FEET
1000 0 1000 2000 3000

Figure - 2

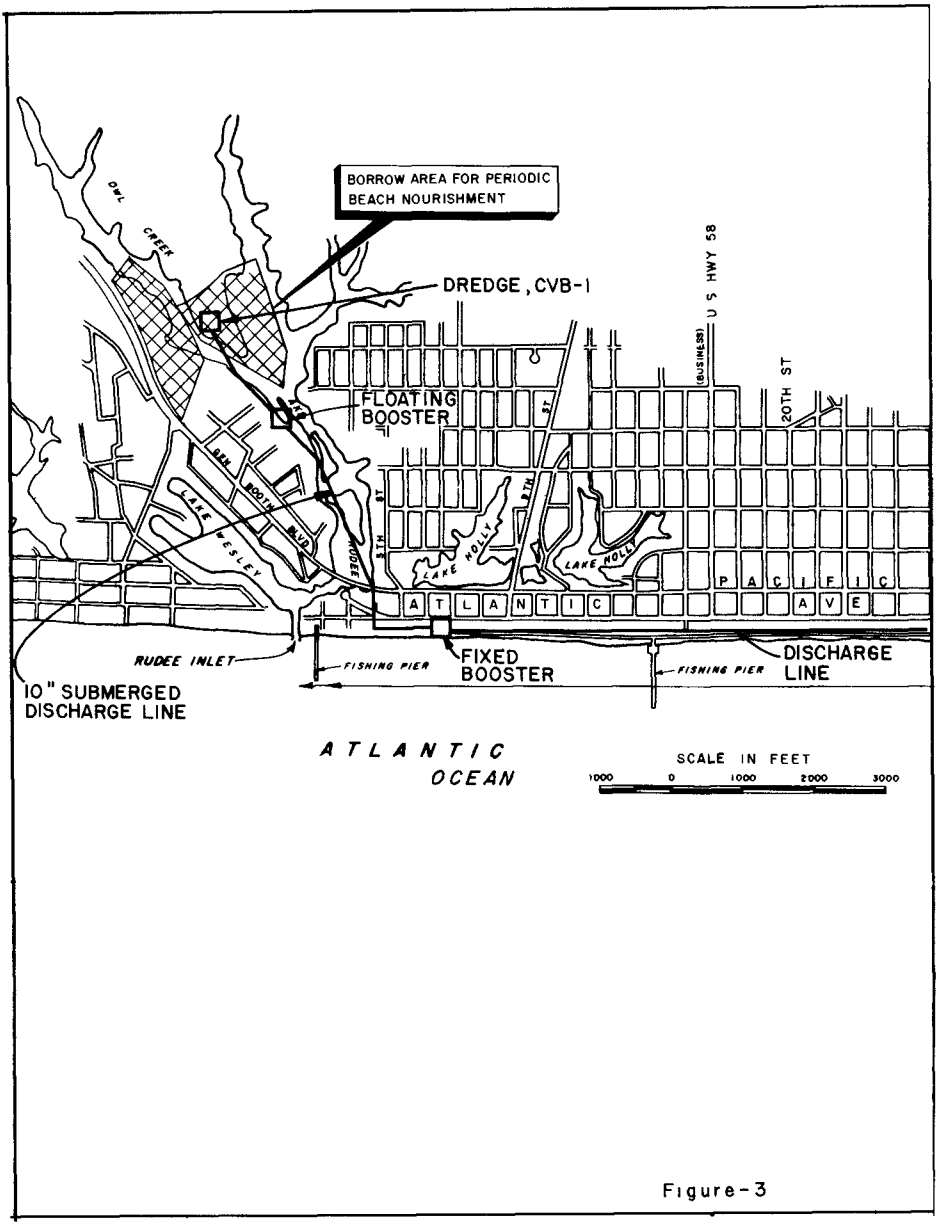

BORROW AREA FOR PERIODIC BEACH NOURISHMENT
DREDGE, CVB-1
FLOATING BOOSTER
U S HWY 58 (BUSINESS)
20TH ST
OWL CREEK
LAKE WESLEY
LAKE HOLLY
LAKE HOLLY
PACIFIC AVE
ATLANTIC
RUDEE INLET
FISHING PIER
FIXED BOOSTER
FISHING PIER
DISCHARGE LINE
10" SUBMERGED DISCHARGE LINE
ATLANTIC OCEAN
SCALE IN FEET
1000 0 1000 2000 3000

Figure-3