DESIGN MEMORANDUM
ON
HAMPTON BEACH
HAMPTON, NEW HAMPSHIRE

U. S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

22 January 1965

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CORPS OF ENGINEERS
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ADDRESS REPLY TO:
DIVISION ENGINEER

REFER TO FILE NO. NEDED-R

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PERTINENT DATA

1. A summary of physical features and costs for the existing beach protection and improvement project, as modified, at Hampton Beach, Hampton, New Hampshire, follows:

Features	Latest Approved Estimate (1 July 1964)		Present Estimate (January 1965)	
Completed existing project		$374,000		$374,000 (1)
Uncompleted project (as modified)				
Construction of an impermeable groin and periodic nourishment of the beach for an initial period of 10 yrs. from the year of the first nourishment operation				
(a) Groin	18,000		18,000	
(b) Sand fill - initial nourishment	200,000		262,000	
(c) Sand fill - future nourishment	500,000		500,000	
		$718,000		$780,000(2)
TOTAL PROJECT COSTS		$1,092,000		$1,154,000(3)

(1)	Federal share of completed work	$125,000
(2)	Federal share of uncompleted work	$390,000
	Non-Federal share of uncompleted work	$390,000
(3)	Federal share of total project costs	$515,000
	Non-Federal share of total project costs	$639,000

PROJECT AUTHORIZATION

2. The existing project at Hampton Beach was authorized by the River and Harbor Act of 3 September 1954 and is printed in House

Document No. 325, 83rd Congress, 2nd Session. The project is based on a report dated 14 August 1953 prepared by the Division Engineer, New England Division on a cooperative beach erosion control study of Hampton Beach, which recommended Federal participation equal to one-third the first cost of restoration, protection and improvement of 5,200 feet of Hampton Beach north of Haverhill Street by direct placement of sand fill to widen the beach to a 150-foot width with an added 25-foot widening along the northern 1,250 feet of the fill area. The State of New Hampshire completed the project during 1955 at a total cost of $374,234.59 and was subsequently reimbursed by the United States for one-third the cost and in the amount of $124,744.86.

3. The River and Harbor Act of 23 October 1962, printed in House Document No. 416, 87th Congress, 2nd Session, modified the existing project to authorize Federal participation in the costs of constructing an impermeable groin about 235 feet long and periodic nourishment of the beach for an initial period of 10 years from the year of the first nourishment operation with such Federal participation to be a Federal contribution of one-third the first costs of the groin construction and beach nourishment work; subject to the conditions that responsible local authorities:

(a) Obtain approval by the Chief of Engineers, prior to commencement of the work on the project, of detailed plans and specifications for the project and also the arrangements for prosecuting the work;

(b) Furnish assurances satisfactory to the Secretary of the Army that they will:

(1) Maintain the protective measures and provide periodic nourishment during the economic life of the project, as may be required to serve their intended purpose, with Federal assistance of one-third the costs of the groin construction and periodic beach nourishment work for an initial period of 10 years from the year of the first nourishment operation;

(2) Control water pollution to the extent necessary to safeguard the health of bathers;

(3) Maintain continued public ownership of the shores upon which the Federal participation is based, and their administration for public use during the economic life of the project.

Section 103 of the River and Harbor Act of 1962 amended previous acts authorizing Federal contributions toward the costs of authorized beach erosion projects by changing the contribution from one-third the costs of such work to one-half. No construction work has been started to date on the project modification authorized in 1962.

4. The State of New Hampshire by letter dated 4 March 1964 requested that the Corps of Engineers undertake the planning and construction of the modified project in conjunction with proposed improvement work at the authorized Hampton Harbor project. By Indorsements of 26 May 1964 and 8 January 1965, the Chief of Engineers authorized the New England Division of the Corps of Engineers to undertake the preconstruction planning and construction work in connection with the project.

INVESTIGATIONS

5. The basic data used in developing plans for the protection and improvement of Hampton Beach for use on the existing project, was prepared by the Division Engineer in a Beach Erosion Study dated 14 August 1953 and was printed in House Document No. 325, 83rd Congress, 2nd Session.

6. A subsequent report prepared by the Division Engineer dated 25 August 1960 and entitled "Shore of The State of New Hampshire, Beach Erosion Control Study" was printed in House Document No. 416, 87th Congress, 2nd Session, and contains additional data relative to the groin and periodic beach nourishment work.

7. In recent months the New England Division has made hydrographic surveys and taken borings within the Hampton Harbor area for the purpose of determining the suitability of this location for a source of beach material to use in the proposed nourishment and restoration work, and has taken profiles along Hampton Beach to develop shore line changes and rate of beach changes and to determine volumes of required beach nourishment.

LOCAL COOPERATION

8. The original requirements of local cooperation are stated in paragraph 3 above. These requirements have subsequently been revised to the extent that the local contribution has been changed from one-third to one-half of the project costs, and the Corps of Engineers rather than local interests will undertake the planning and

construction work as described in Paragraph 4. Mr. Russell B. Toby, Director, Division of Parks, New Hampshire Department Resources and Economic Development, acting for the State of New Hampshire, executed an assurance that the revised requirements of local cooperation will be met.

LOCATION OF PROJECT

9. Hampton Beach lies along the Atlantic Ocean about three miles north of the Massachusetts - New Hampshire state boundary line. It is a popular summer resort located at the northern end of a long sandy barrier bar fronting a wide salt marsh and is about one mile north of the entrance to Hampton Harbor. The beach and adjacent upland to the highway within the project limits is owned by the State of New Hampshire. For additional descriptive information, see the 1953 Beach Erosion Control Study.

PROJECT PLAN

10. The existing project was authorized in 1954 and was constructed by the State in 1955. The Government subsequently reimbursed the State for one-third of the costs. The project consists of the restoration, protection, and improvement of about 5,200 feet of shore starting at Haverhill St. and extending northerly thereof, by the direct placement of sand on the shore to widen the beach to a general width of 150 feet, with an additional width of 25 feet in the northerly 1200 foot long section, to a profile as shown on the map accompanying this report.

11. The existing project was modified by the River and Harbor Act of 1962 to provide the construction of a stone groin about 235 feet long located about opposite Church Street and about 800 feet southerly of the northerly end of the project, and for periodic beach nourishment to be effected by depositing sand on the beach at suitable intervals of time for an initial period of 10 years from the year of completion of the initial project as modified.

12. The Beach Erosion Study (page 19, Table 4) referred to in paragraph 6 shows the volumetric beach changes between Dec. 1955 to Jan. 1959 (it is noted that the project limits extend only from Range 2 to 28). These are summarized in the table shown below. Also shown are certain volumetric changes as compiled from the Jan. 1959 and Aug. 1964 surveys:

Table I

Volumetric Changes Dec. 1955 to Jan 1959

Volumetric Change (Cubic Yards)*

Location	Above Low Water	Low Water to 6 ft. Depth	6-12 ft. Depth	12-18 ft. Depth	Total
Northerly 2200' Sect.	(74,000)	49,000	51,000	52,000	78,000
Southerly 3000' Sect.	26,000	61,000	60,000	99,000	246,000
Net Change Throughout Project Limits	(48,000)	110,000	111,000	151,000	324,000

Volumetric Changes Jan. 1959 to Aug. 1964 (Cubic Yards)

Location	Above Low Water	Low Water to High Water	Low Water to 6-ft Depth	Total
Northerly 2200' Sect.	(35,000)	(7,000)	(31,000)	(73,000)

*Note: Accretion shown thus 574. Erosion shown thus (18,096)

During 1955 about 101,000 cubic yards of sand fill were placed by the State of New Hampshire along the shore beyond the limits of the Federal project, from the northernmost limit of the project to the tip of Great Boar's Head. Visual observation in 1959 indicated that all of this material had been lost by erosion.

13. A review of the above beach changes together with a visual comparison of the beach profiles taken in December 1955 (subsequent to the completion of the original project), in January 1959 and in August 1964, show in general that:

(1) Beach Changes December 1955 to January 1959.

a. The northerly 2200 foot beach section of the project eroded in the amount of about 74,000 cubic yards (annual loss of about 24,000 cubic yards) shoreward of the low water line, while accreting in the amount of about 152,000 cubic yards (annual gain of about 49,000 cubic yards) between the low water line and the 18 foot depth contour. In addition, during the same period another 101,000 cubic yards of fill placed by the State along the

adjacent shore northerly of the project was lost be erosion, which represents an annual loss from this source of about 34,000 cubic yards. It is believed that the material eroded from the above two sources, estimated to be at the annual rate of about 58,000 cubic yards, has drifted seaward and southerly as indicated by the annual gain of about 49,000 cubic yards between low water and the 18-foot contour within this section. It is noted that the above described erosion was greatest at the most northerly end of the project while diminishing progressively to a point 2200 feet southerly thereof where no substantial change has occurred.

b. The southerly 3000 foot beach section of the project shows accretion of about 246,000 cubic yards (annual gain of about 80,000 cubic yards) from the seawall out to the 18-foot depth contour.

(2) Beach Changes January 1959 to August 1964.

a. The northerly 2200 foot beach section of the project eroded by about 42,000 cubic yards (annual loss of about 7,000 cubic yards) shoreward of the low water line while the zone between the low water line to the 6 foot depth contour eroded in the amount of about 31,000 cubic yards (approximate annual loss of 5,000 cubic yards).

b. A visual comparison of the 1959 and 1964 profiles within the southerly 3000 foot section of the project shows continued accretion shoreward of the low water line throughout this area but at a lesser rate than between the 1955-1959 period. A typical profile throughout this area, compiled from the August 1964 survey, shows a berm width of about 120 feet to an elevation of 16.0, thence a slope of about 1 on 10 to elevation 7.0, thence a slope of about 1 on 30 to elevation 0.0.

14. The project plan under consideration includes the construction of a stone groin about opposite Church Street and the intitial nourishment of that portion of the beach now requiring material to restore it to its authorized size, namely the northerly 2200 feet of the project. It is proposed to obtain the required beach material by dredging within the Hampton Harbor area located about two miles southerly of the project.

15. Hampton Harbor is an existing navigation project authorized by the Chief of Engineers on 18 February 1964, under the general authority of Section 107 of the River and Harbor Act of 1960. The project includes the construction of two stone jetties at the harbor entrance, and dredging

a 150-foot wide entrance channel to a depth of 8 feet below mean low water. It is planned to start construction work on this project by about 1 March 1965 with completion by about 1 December 1965.

DEPARTURES FROM PROJECT DOCUMENT PLAN

16. The present project plan is essentially the same as that recommended in the authorizing document with minor variations thereto. These variations are as follows:

a. The project document (House Document No. 325, 83rd Congress, 2d Session) shows on Plate 8 a beach profile along the northerly section having a beach berm to elevation 13.0 with a fill slope of approximately 1 on 15 above elevation 7.0 and approximately 1 on 40 below elevation 7.0. The existing beach along the southerly 3000 foot section of the project, as shown by the August 1964 survey, shows a beach berm at about elevation 16.0, thence a slope of about 1 on 10 to elevation 7.0, thence a slope of about 1 on 30 to elevation 0.0. It is believed that any fill placed to restore the northerly section of beach will assume about the same profile now existing along the southerly section, therefore the design beach profile has been changed accordingly.

b. The project document (House Document No. 416, 87th Congress, 2d Session) shows on Plate No. 24 the recommended groin design. This design calls for a groin having a crest elevation of 15.0, and a length of about 235 feet with the top of its outer end at elevation 8.3. Recent detailed topographical survey of the proposed groin site shows ledge outcrop with a top elevation higher than elevation 8.0 existing at a location 190 feet to 235 feet from the seawall. It is therefore believed that the groin length can be shortened to 190 feet without significantly detracting from its effectiveness. The crest elevation of 15.0 has been raised to 17.0 in order to be one foot higher than the proposed beach berm elevation of 16.0 as described in Paragraph 16 a. above.

COST ESTIMATES

17. The current estimate of costs for the groin construction and initial beach nourishment work are based on present unit prices and on quantities from recent (1964) surveys. It is estimated that the groin will require 1350 tons of stone as compared to the 1300 tons estimated in the authorizing document (House Document No. 416). It is further

estimated that the restoration of the beach to its authorized dimensions, as modified slightly (see Paragraph 16), will require sand fill only along the northerly 2200 foot section, in an estimated amount of 110,000 cubic yards. It is proposed to obtain this material by hydraulic dredging in the Hampton Harbor area, a distance of about two miles from the job-site. Due to this distance it would be impracticable to pump the material from the dredging location to the site, therefore, it is proposed to pump the material to a land spoil area adjacent to the harbor and then transport it by truck to the beach. The use of Hampton Harbor (an authorized Federal Navigation Project - see Paragraph 15) as a source for the required beach material will improve considerably present navigation facilities within the harbor. The cost of beach fill by this method is estimated to be equal to or less than the cost from alternative land borrow pits.

18. The annual cost of periodic nourishment of Hampton Beach, for an initial period of 10 years from the year of the first nourishment, is estimated on the basis of all measured losses (shoreward of the low water line) of material placed, between December 1955 to August 1964, directly on the project area and including the material placed along the adjacent shore to the north (see Paragraphs 12 and 13). Measured losses during this period from these sources averaged 25,000 per year. It is estimated that the losses will be reduced 4,000 cubic yards per year by the proposed groin. Assuming future beach fill will be obtained from the Hampton Harbor area at an estimated cost of $2.38 per cubic yard results in an average annual cost of $21,000 c.y. @ $2.38 = $50,000 and a total estimated cost of $500,000 for the ten year period.

19. A breakdown of the estimated cost for protection and improvement of the beach follows:

Item	Latest Approved Estimate (1 July 1964)		Present Estimate January 1965
Groin - Furnishing & placing stone 1,300T x $10.77/T	14,000	1350T x $10.37/T	14,000
Contingency allowance	2,000		2,000
Engineering & Design	1,000		1,000
Supervision & Administration	1,000		1,000
Subtotal	$18,000		$18,000

Item	Latest Approved Estimate (1 July 1964)		Present Estimate January 1965
Initial Beach Nourishment			
Furnishg & placing sandfill 160,000 cy x $0.95	152,000	110,000cy x $1.85	203,000(1)
Contingency allowance	24,000		30,000
Engineering & Design	11,000		14,000
Supervision & Administration	13,000		15,000
Subtotal	$200,000		$262,000
Periodic Beach Nourishment (for 10 yrs.)			
Furnishing & placing sandfill 400,000 cy x $0.95	$380,000	210,000 cy x $1.81	$380,000
Contingency allowance	60,000		60,000
Engineering & Design	25,000		25,000
Supervision & Administration	35,000		35,000
Subtotal	500,000		500,000
Total Project Costs	$718,000		$790,000(2)

(1) Based on quantity of 110,000 cubic yards
(2) Federal share is 50% of total cost

SCHEDULE FOR DESIGN AND CONSTRUCTION

20. The improvement of Hampton Beach has been divided into three or more segments, namely, (1) groin construction, (2) initial beach nourishment and (3) perodic beach nourishment for an initial period of 10 years from the year of the first nourishment operation. It is considered that the groin and initial beach nourishment work should not be undertaken during the normal bathing season of 15 June to 15 September due mainly to possible hazard to bathers that such construction activities would impose. It is further considered that the groin should be completed before any sand fill is placed on the beach. For reasons of economy it is proposed to include

the groin work in a contract which includes the construction of two stone jetties on the authorized Hampton Harbor project. Present scheduling calls for bid opening on this contract work on or about 27 January 1965 with the groin work to be started in March 1965 and completed in April 1965. It is planned to advertise for bids on the intial beach nourishment work by April 1965 with the provision that the work be started early in September 1965 and be completed in December 1965. Work on the periodic beach nourishment will be scheduled if and when the need for such work is evident, probably not earlier than FY 1968.

21. Federal fund requirements for the above schedule are as follows:

Allotted to date	$109,000
Additional Funds required to complete groin and initial nourishment work	31,000
Additional Funds required to complete periodic nourishment work	250,000
	$390,000

The State of New Hampshire has contributed $140,000 as its 50 percent share of the cost of the groin and initial beach nourishment.

OPERATION AND MAINTENANCE

22. Maintenance of the authorized improvement is the responsibility of the State of New Hampshire to the extent that they will, (1) "Maintain the protective measure and provide periodic nourishment during the economic life of the project, as may be required to serve its intended purpose, with Federal assistance of one-half the costs of the groin construction and periodic beach nourishment work for an initial period of 10 years from the year of the first nourishment operation," (2) "Control water pollution to the extent necessary to safeguard the health of bathers", and (3) "Maintain continued public ownership of the shores upon which the Federal participation is based, and their administration for public use during the economic use of the project".

BENEFITS

23. The annual benefits expected to accrue from the improvement of Hampton Beach are essentially the same as reported by the Division Engineer to the Beach Erosion Board on 29 June 1961 and subsequently incorporated in the authorizing document. These annual benefits are summarized as follows:

Direct Damage Prevention		
Prevention of loss of beach material	$ 880.00	
Prevention of damages to existing seawall	8,480.00	
		$ 9,360.00
Recreation - increased beach use		74,250.00
Increased earning power		56,580.00
Total Benefits		$140,190.00

24. The total cost of the completed portion of the project is $374,000 and the estimated cost of the groin construction and initial nourishment work is $280,000 for a total sum of $654,000. The annual charges computed on a 50-year project life at an investment rate of 3.0 percent are as follows:

Interest and Amortization (.03887)	$25,421
Periodic nourishment of sand beach 21,000 c.y. @$2.38	50,000
Maintenance of groin 13 tons @ $10.00	130
	$75,551
Say	$75,550

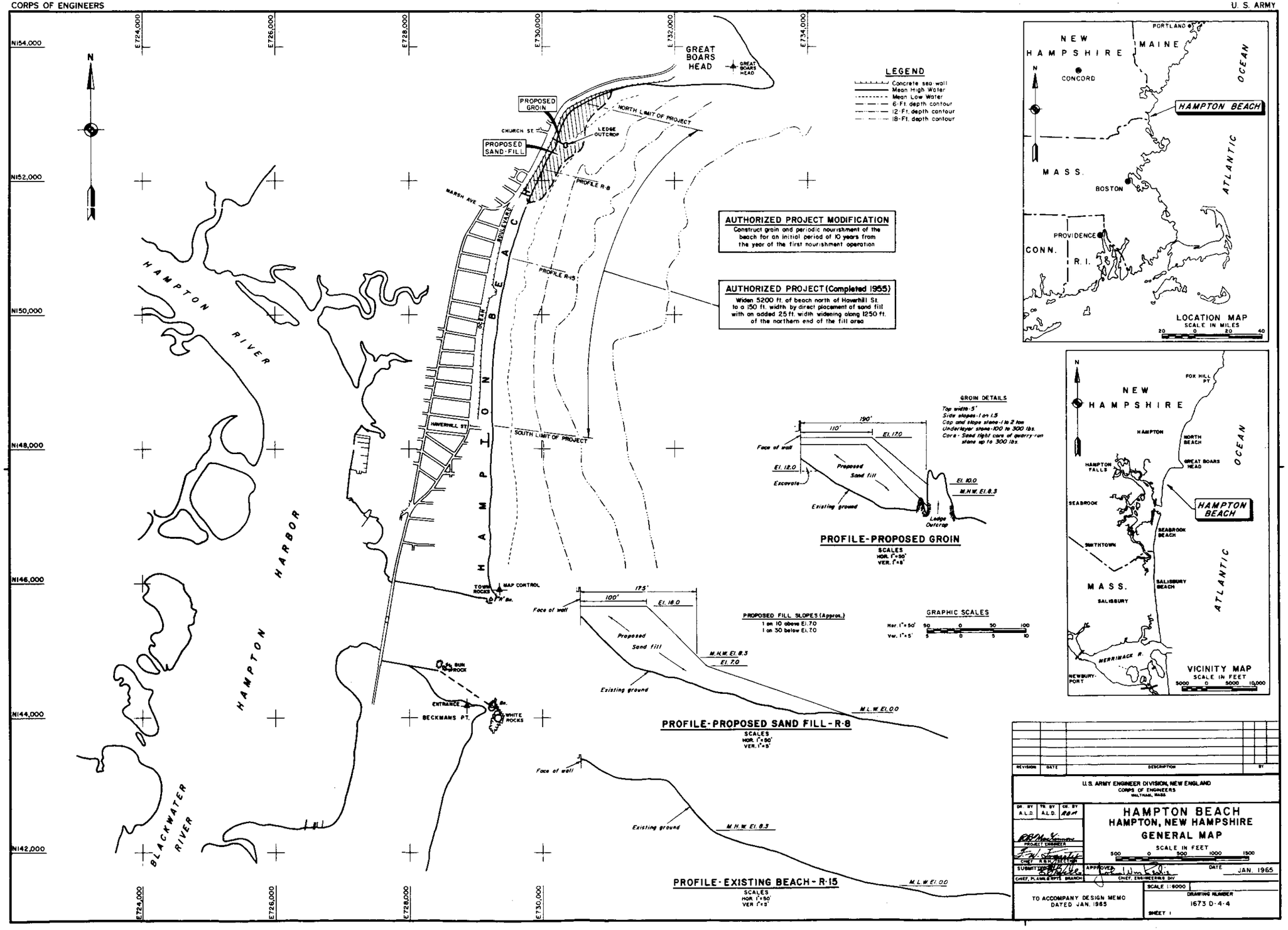
25. A comparison of estimated benefits of $140,190 to estimated annual charges of $75,550 yields a benefit-cost ratio of 1.9 to 1.

RECOMMENDATIONS

26. The plan of improvement proposed in this Design Memorandum provides for the construction of an impermeable groin and the periodic nourishment of the beach for an initial period of 10 years from the year of the first nourishment operation. The plan is essentially the same as that described in House Document No. 416, 87th Congress, 2nd Session, and authorized by the River and Harbor Act of 23 October 1962.

27. The project plan as described in this Design Memorandum will serve adequately the present and prospective needs of Hampton Beach and is economically justified. It is recommended that the authorized project be constructed as described herein.

1 Incl
Map

CORPS OF ENGINEERS

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