CHAPTER 74

MAINTENANCE OF SANTA CRUZ HARBOR, CALIFORNIA, USA

by

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ABSTRACT

In planning and operating coastal harbors subjected to shoaling, it is imperative that the characteristics and regime of the sediments which deposit in the harbor entrance be quantified to the maximum extent possible in order that the economic impacts of the channel shoaling and along adjacent shores may be evaluated.

This paper presents a brief progress report on the study of a coastal harbor in an area subjected to shoaling. This study represents the input of many engineers and researchers in the United States.

INTRODUCTION

Santa Cruz Harbor is located at the northern end of Monterey Bay on the California Pacific Coast (Figures 1 and 2). Harbor elements include an entrance channel 100 feet wide and 20 feet deep protected by jetties as well as interior channels and turning basins. The harbor serves as the home port for recreation and commercial fishing vessels. The main (west) jetty is 1,200 feet in length and protected with 28-ton concrete quadripods. The major navigation features of the harbor were completed in 1964.(1)

Inasmuch as the harbor is located in an area of considerable littoral movement, the Federal project authorization included provisions for sand by-passing at the harbor entrance. The harbor entrance has generally been maintained with contract hydraulic cutter pipeline-type dredges. Recently an experimental eductor type sand by-passing system was installed by the US Army Waterways Experiment Station, Vicksburg, Mississippi, and evaluated.

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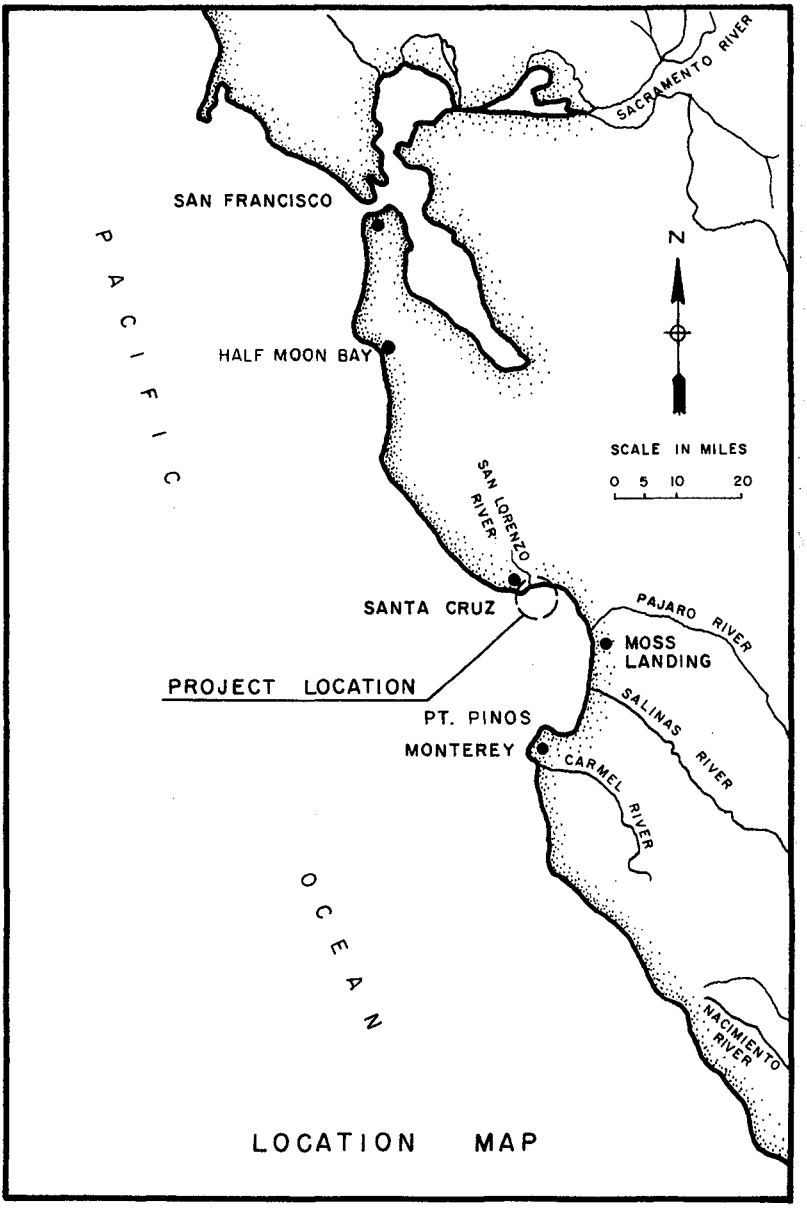

Figure 1. Location Map

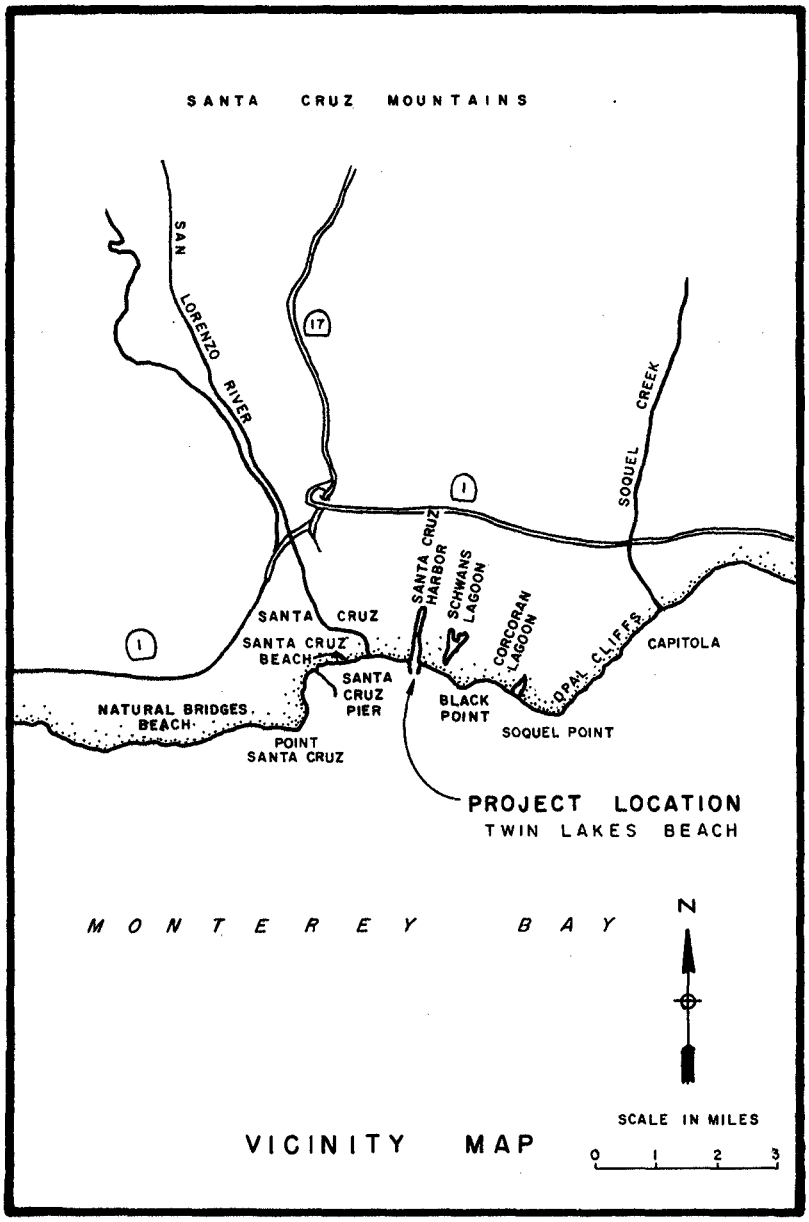

Figure 2. Vicinity Map

In order to quantify the coastal proecesses at Santa Cruz, an extensive prototype data collection program was initiated. This information includes beach and hydrographic surveys, LEO measurements[2] aerial photography, alongshore energy flux measurments, wave heights[3],[4] at other locations along Monterey Bay, and offshore wave measurements.

CHARACTERISTIC ENTRANCE SHOALING

Shoaling of Santa Cruz Harbor entrance has been documented in a report entitled, "Santa Cruz Harbor Shoaling Study, Santa Cruz Harbor, California," by Walker, et al, of Moffatt & Nichol, Engineers.[5] Walker found that the harbor entrance shoaling followed a relatively predictable pattern as shown on Figure 3. It should be noted that the harbor entrance experiences only relatively light shoaling until approximately October and relatively rapid shoaling until March or April when the pattern is repeated. Areas of deposition are similarly characteristic.

WAVE REGIME

In order to understand and quantify the movements of sediments at coastal locations, it is necessary to understand and quantify the offshore and nearshore wave regime, with particular emphasis on the determining of the direction and quantity of coastal littoral sediments. Traditionally this has been done through the use of deepwater wave hindcasts followed by appropriate transformation of these deepwater waves to the nearshore area. These nearshore wave characteristics were then translated to littoral drift calculations through the use of relations between the wave energy and the expected alongshore transport. Although these methods are useful in understanding coastal phenomena, they necessitate a complex chain of calculations which are difficult to make and which must often be made with insufficient information.

In order to better understand the littoral regime and to provide a usable technique of quantifying littoral processes at a specific location through in situ measurement, Seymour et al, of the California Department of Navigation and Ocean Development, and the representatives of the Scripps Institute of Oceanography, developed a device for directly measuring the alongshore energy flux (sxy). This device was installed at Santa Cruz Harbor and values of sxy are being calculated routinely. Very preliminary results by Douglas Pirie et al of the San Francisco District of the US Army Corps of Engineers indicate that quantities dredged at Santa Cruz Harbor are related to the sxy values at Santa Cruz as calculated by Seymour.

CONCLUSIONS

Improved technology appears to have provided a path for a major breakthrough in quantifying the alongshore sediment movement which results in shoaling at harbor entrances. If the results of these improved methodologies are substantiated through longterm coastal measurements, a powerful new tool will have been provided coastal engineers.

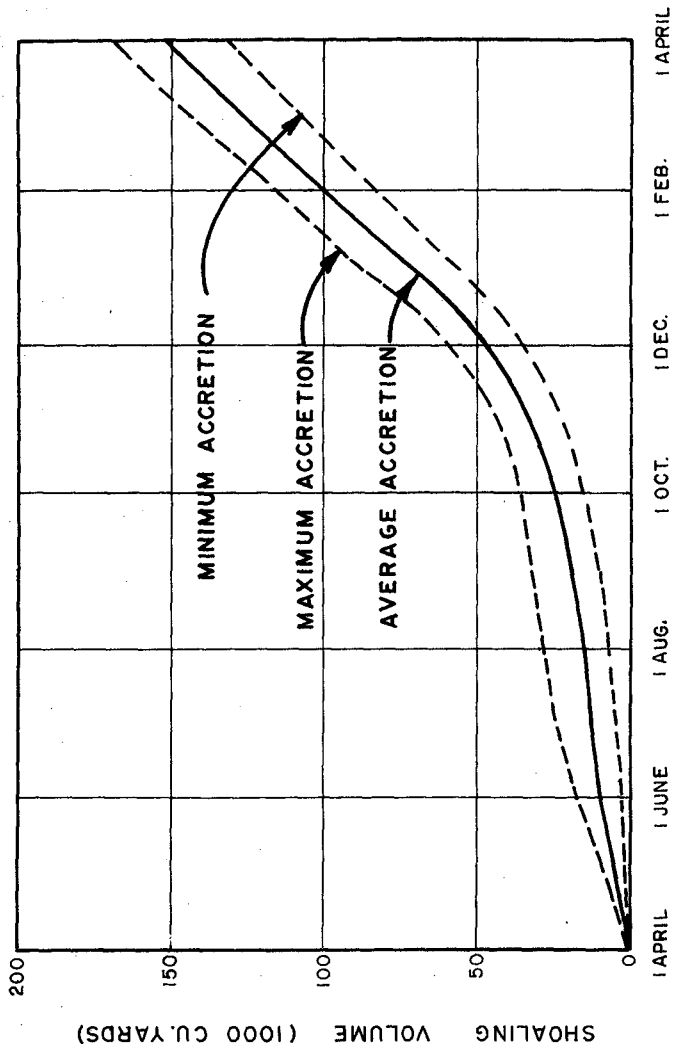

Figure 3. Average, Maximum, and Minimum Monthly Cumulative Rates of Accretion Between Dredging Episodes, 1972 to 1977

ACKNOWLEDGEMENTS

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