CHAPTER 27

STUDY OF EROSION ALONG HOMER SPIT AND VICINITY, KACHEMAK BAY, ALASKA

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ABSTRACT

This is a progress report on the Homer Spit Beach Erosion Study. Information is presented regarding the rapid acceleration of the erosion processes due to the subsidence of the Homer Spit during the 27 March 1964 earthquake. The effect on existing groins both before and after the quake are discussed. Immediately after the quake, emergency measures were required to prevent wave and high water damage to existing structures on the Spit. The results concerning the effectiveness of these measures are presented for evaluation, along with the basic data gathered for the erosion study and some of the problems encountered.

INTRODUCTION

This is a progress report on the Kachemak Bay Beach Erosion Study, which encompasses all of the Homer Spit and adjacent shores. The Alaska District, U. S. Army Corps of Engineers, was authorized by Congress in August 1963 to make this study. The Alaska State Department of Natural Resources is cooperating and assisting in the study.

LOCATION

Kachemak Bay is located on the Kenai Peninsula near the mouth of Cook Inlet in what is commonly called Southcentral Alaska. The Homer Spit, which is about 4 miles long with a maximum width of a quarter of a mile, extends about half-way across the mouth of Kachemak Bay. Figure 1 shows a general orientation of the area. The economy of the area is almost entirely based on the seafood industry and tourism although lumber interests are considering locating a timber processing mill on the Spit.

GEOLOGY

The Homer Spit is a relatively straight spit composed of well rounded medium sized gravel mixed with some sand and silt. There is some question as to the geologic origin of the Spit with some geologists believing that it is a terminal moraine from an ancient glacier while others believe that it was founded by littoral processes. The present surface of the spit seems to support the latter belief as it is characterized by parallel beach ridges which clearly are littoral in origin. The source area of the material composing the spit surface is considered to be the main land

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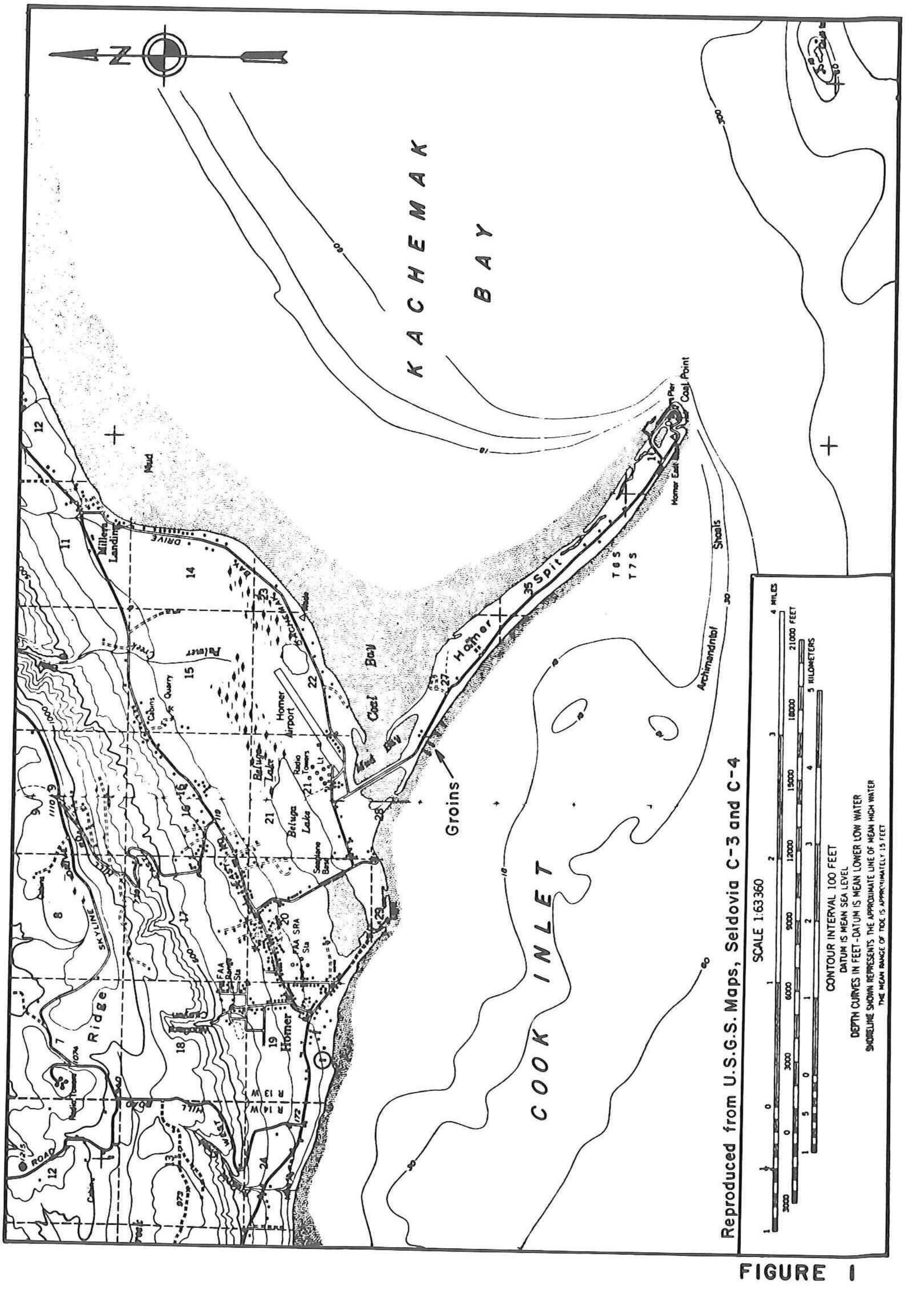

N
KACHEMAK
BAY
COOK INLET
Homer Spit
Groins
Coal Point
Homer
Homer Airport
Beluga Lake
Mud Bay
Coal Bay
Millers Landing
Skyline Ridge
Archimandritof Shoals
Reproduced from U.S.G.S. Maps, Seldovia C-3 and C-4
SCALE 1:63360
CONTOUR INTERVAL 100 FEET
DATUM IS MEAN SEA LEVEL
DEPTH CURVES IN FEET - DATUM IS MEAN LOWER LOW WATER
SHORELINE SHOWN REPRESENTS THE APPROXIMATE LINE OF MEAN HIGH WATER
THE MEAN RANGE OF TIDE IS APPROXIMATELY 15 FEET

FIGURE 1

to the west. The shoreline there is characterized by wave cut bluffs composed of a partially consolidated shale and sandstone, with peat and gravel overburden.

PROBLEMS PRE-QUAKE

Although the spit grew by widening from east to west, it has, during the past few decades, retreated slightly eastward near the base. Prior to the earthquake and resulting subsidence, material eroded near the base was serving to nourish the seaward sections of the outside beach. The pre-earthquake processes suggested an absence of sufficient nourishment of material from the source area. In addition to the erosion near the proximal end, the area downdrift of the last groin of the four that had been constructed to protect the highway, was undergoing severe erosion. The beach at the distal end of the spit was beginning to lose material.

PROBLEMS POST-QUAKE

Although a reconnaissance survey of the beach erosion of Homer Spit had begun prior to the earthquake of 27 March 1964, very little data had been gathered. The earthquake caused a subsidence ranging from approximately 3 feet on the mainland to about 6 feet at the distal end of the spit. This resulted in major changes in the source area and configuration of the spit. As an example, nearly 70 percent of the spit is now flooded during the higher high tides. Photograph Number 1 shows the end of the spit at higher high tide. In addition to flooding and the damages resulting therefrom, submarine landslides near the distal end of the spit destroyed the small boat harbor and deep draft wharf.

EROSION PROBLEM

In those areas eroding before the earthquake, the problem after subsidence was accelerated. Prior to subsidence one section of the spit had been protected from erosion by the placement of 4 timber groins. The groins are numbered consecutively from the base of the spit. All of the groins had, except the last one, filled and had become relatively stable. But shortly after subsidence, the beach on the downdrift side of the last groin began to erode. To prevent further erosion and damage to the nearby highway a timber bulkhead at the last, or No. 4 groin, was built and extended along the beach for approximately 600 feet. In addition two semi-adjustable timber groins were constructed and attached to the bulkhead, but the original groins, particularly Nos 3 and 4 were overly long and were trapping unnecessary quantities of material; therefore, to allow more material to migrate down the beach 50 foot sections were removed from groins 3 and 4. Photograph No. 2 shows the groins as they looked after modification. The removal of the 50 foot section allowed material not needed to by-pass the groin. The profiles of the fill between the groins illustrate

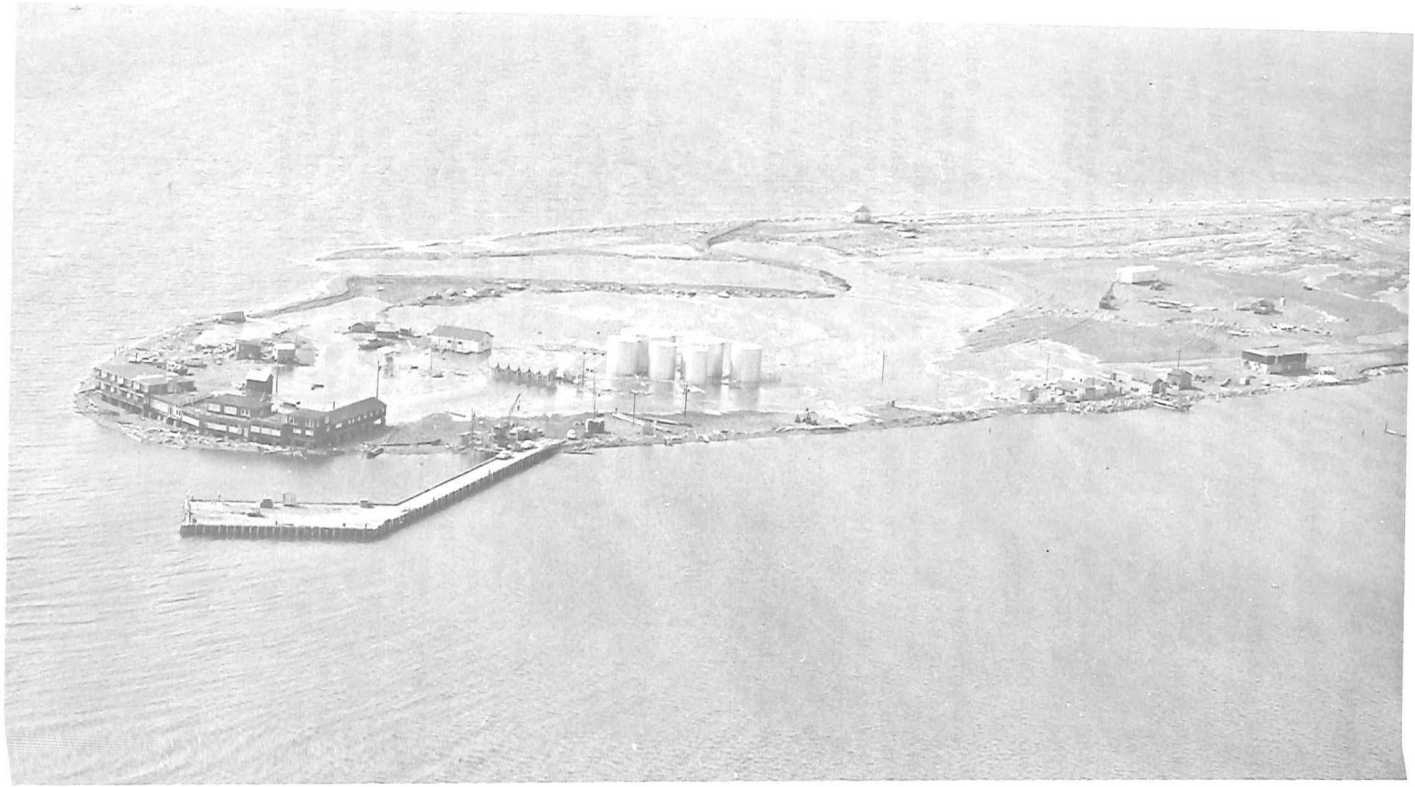


Photo No. 1. This photo of the outer end of Homer Spit was taken in April 1964 about one month after the 27 March 1964 earthquake. Occasionally the high tide is 2 to 3 feet higher than that shown in the photograph. Emergency repair had just been completed to the deep draft dock and the Lands End Hotel raised on cribbing.

Photo No. 2 - June 1965. Shows the timber groins as opened up by cutting with a chain saw.

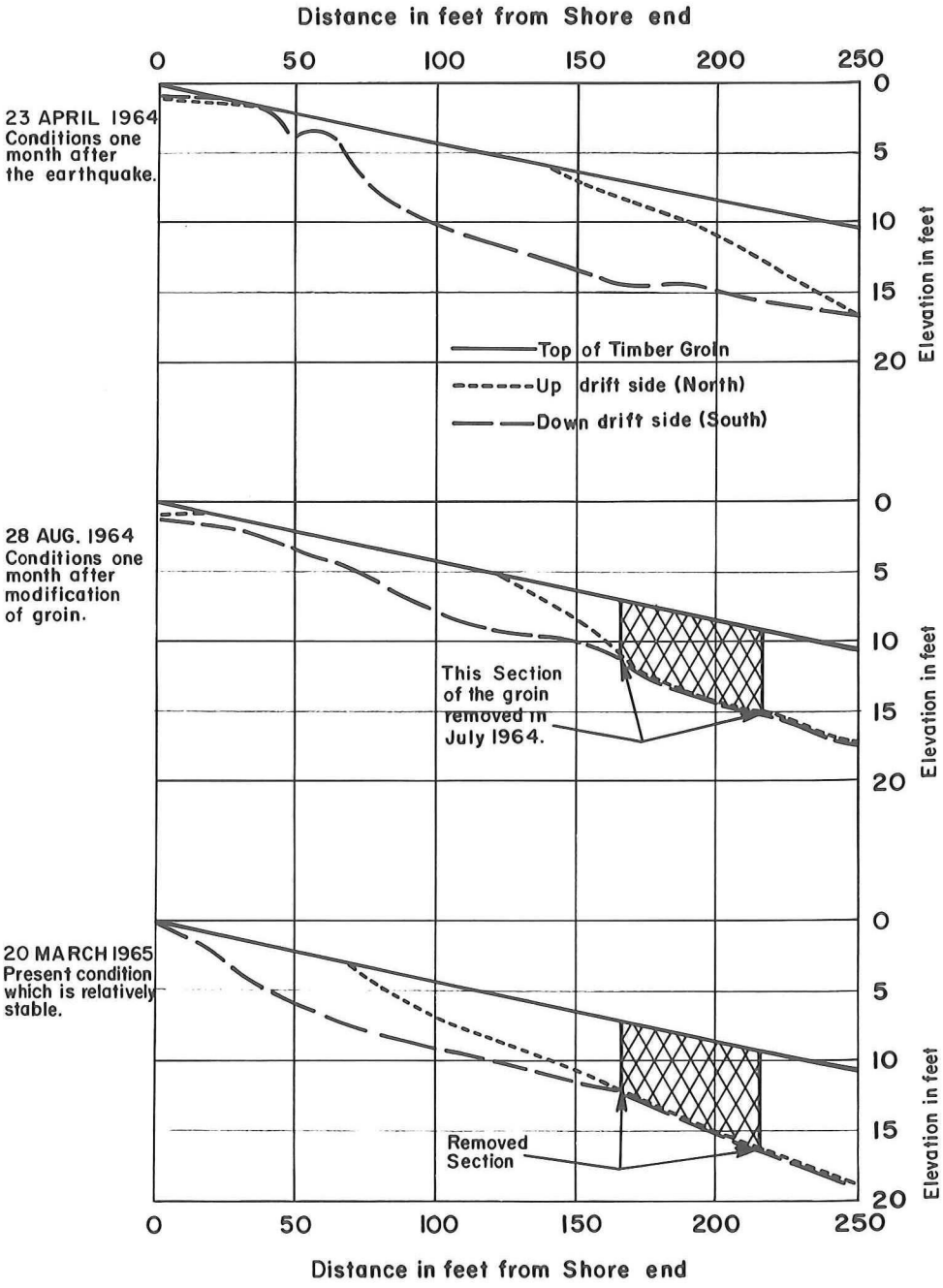
Photo No. 3 - June 1965. Shows the Lands End Hotel and gabions placed for erosion protection.

the changes in the fill configuration both before and after the modification was made. Figure 2 shows the changes that occurred on the third groin. It is interesting to note the profile of the groin on the weather side after modification more closely coincides with the natural beach slope of the spit than did the fill before modification. While the modification was accompanied by a recession of the fill at the proximal end of the groin, there was a general increase in fill along the lee side as well as a greater uniformity between the slope of the fill on the weathered and lee side. The examples are considered to illustrate the result of an overly long groin. The principle disadvantage being that of promoting of erosion along the lee side of the groin. The area between the new groins at first began to fill; however, because of a combination of hurried construction, design, and severe storms the 6th groin failed. The one cause of failure is believed to have been the bulkhead and groin were too high causing an undermining of the wall. Groin Number 5 and the bulkhead wall between it and groin Number 4 seem to be functioning satisfactorily, although some erosion is beginning to occur at the updrift junction of the groin and the bulkhead wall. This is being closely watched to determine if modifications may be desirable. In addition to erosion in the area of the groins, subsidence has caused the beach, in general along the spit, to recede. The recession is related to the higher stand of the sea upon the beach and, as such, the beach is adjusting to the new water level. Figure 3 3/ illustrates the processes of changes occurring in the beach configuration. Material secured from the beach face has, and is still, being carried onto the spit where it has formed a new frontal berm. In areas, as shown by Photographs 4 and 5, the berm has migrated onto and temporarily blocked the highway necessitating removal of the material from nearly one-half mile of highway by the State Highway Department. In order to prevent flooding of the Land's End Hotel it was jacked up about 8 feet and placed on cribbing. Photograph Number 3 shows the hotel on cribbing and the gabions which have been placed around and under it to prevent further undermining. At the present time the gabions, which are wire mesh rock-filled baskets, seem to be doing an effective job.

DATA GATHERED

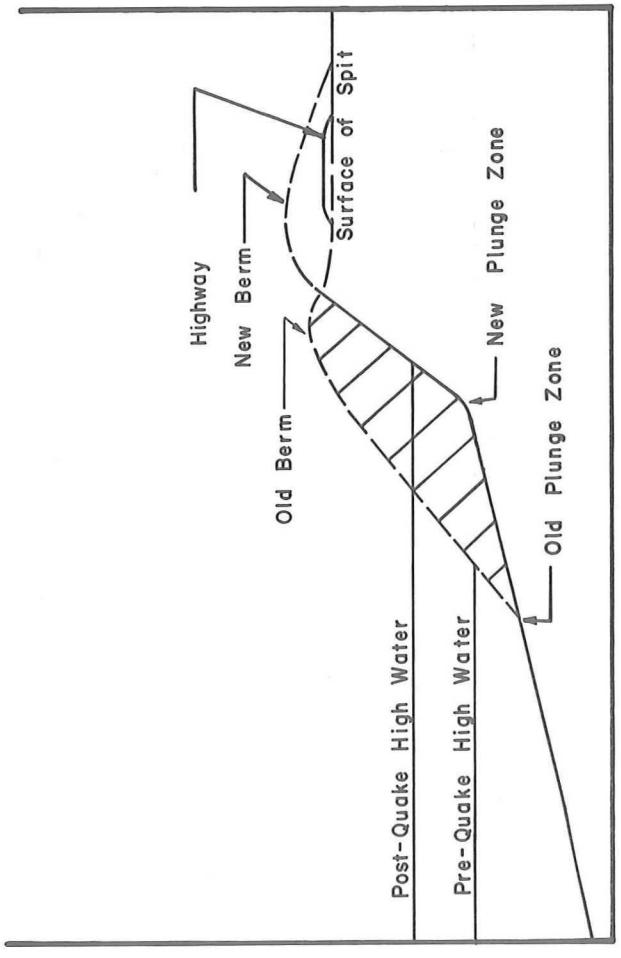
Since time is critical beach profiles are being made whenever possible in an attempt to define the changes along the beach as they have and are occurring. During the fall of 1964, twenty-five beach profiles were made. Some of these were rerun in April of 1965 and it is planned to rerun them again in the spring of 1966. With the help and cooperation of the Alaska State Department of Natural Resources, bottom samples were taken by a scuba diver at various depths along the profile lines. These samples will be analyzed for gradation, shape and origin. The latter will be determined, as nearly as possible, through correlation of petrographic analysis of material in the samples and source areas.

3/ Taken from an unpublished U.S.G.S. Professional Paper, Reference 4



THIRD GROIN FROM THE BASE OF THE SPIT

FIGURE 2



BERM ADJUSTMENT - HOMER SPIT

FIGURE 3

Photo No. 4 - June 1965. Shows the highway on Spit where combinations of high tides and waves have deposited material in a new berm. The Highway Department removes the material by either plowing to the side or banking it to another location.

Photo No. 5 - This was taken in June 1965 and shows the new berm being built up 500 feet down drift from the groin area. The spruce trees in the picture have been killed by the salt water.

CONCLUSIONS

While the study is far from being completed it is planned to continue gathering the data until the spring of 1966. At that time we plan to analyze all available data and summarize it into a report. The purpose of the study is to develop plans to stabilize the shore of Homer Spit against further erosion and determine the advisability and extent of Federal participation therein. In the event Federal participation and construction of corrective measures is not warranted, the report will be pointed toward giving advice on what can be done to minimize the erosion taking place and give guidance on what structures can be built without further aggravating the problem.

CREDITS

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