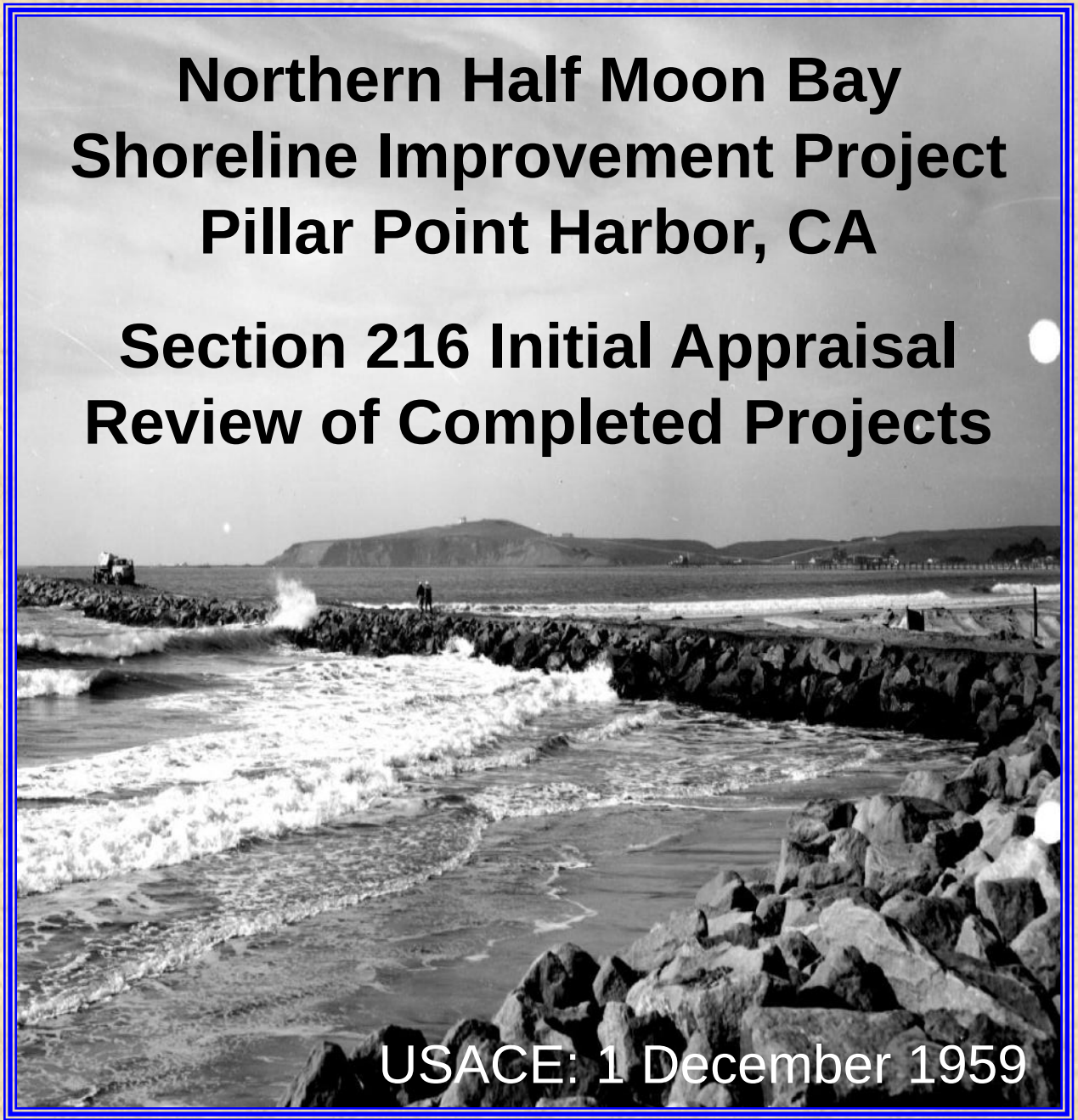
Northern Half Moon Bay Shoreline Improvement Project Pillar Point Harbor, CA

Section 216 Initial Appraisal Review of Completed Projects



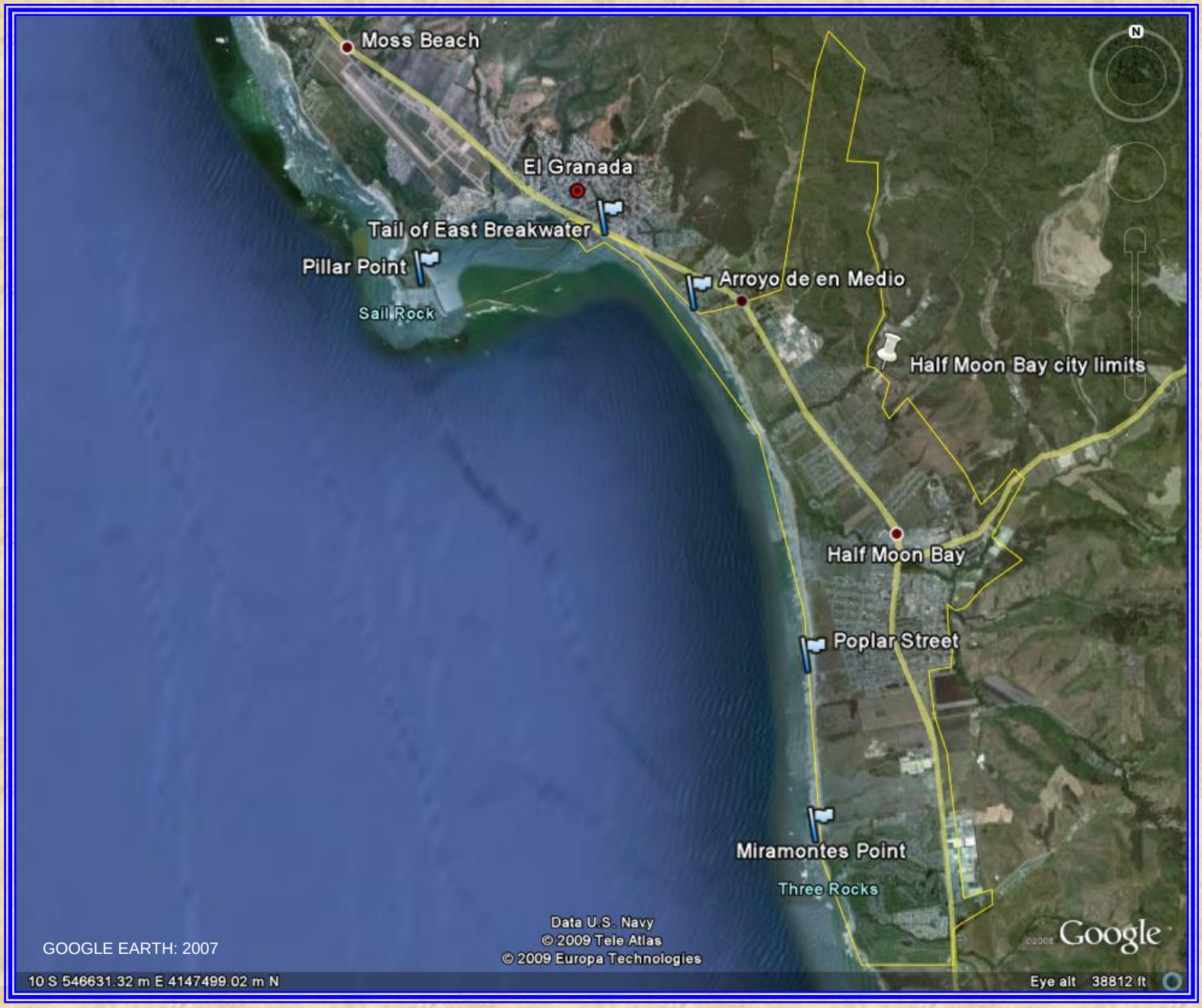
USACE: 1 December 1959

The purpose of this Initial Appraisal is to review the existing United States Army Corps of Engineers project at Pillar Point Harbor (authorized in 1948 with initial breakwater construction from 1959 to 1961) to determine whether it is appropriate for the Corps to participate in the resolution of documented shoreline erosion and structural damage along the northern open-ocean shoreline of Half Moon Bay.

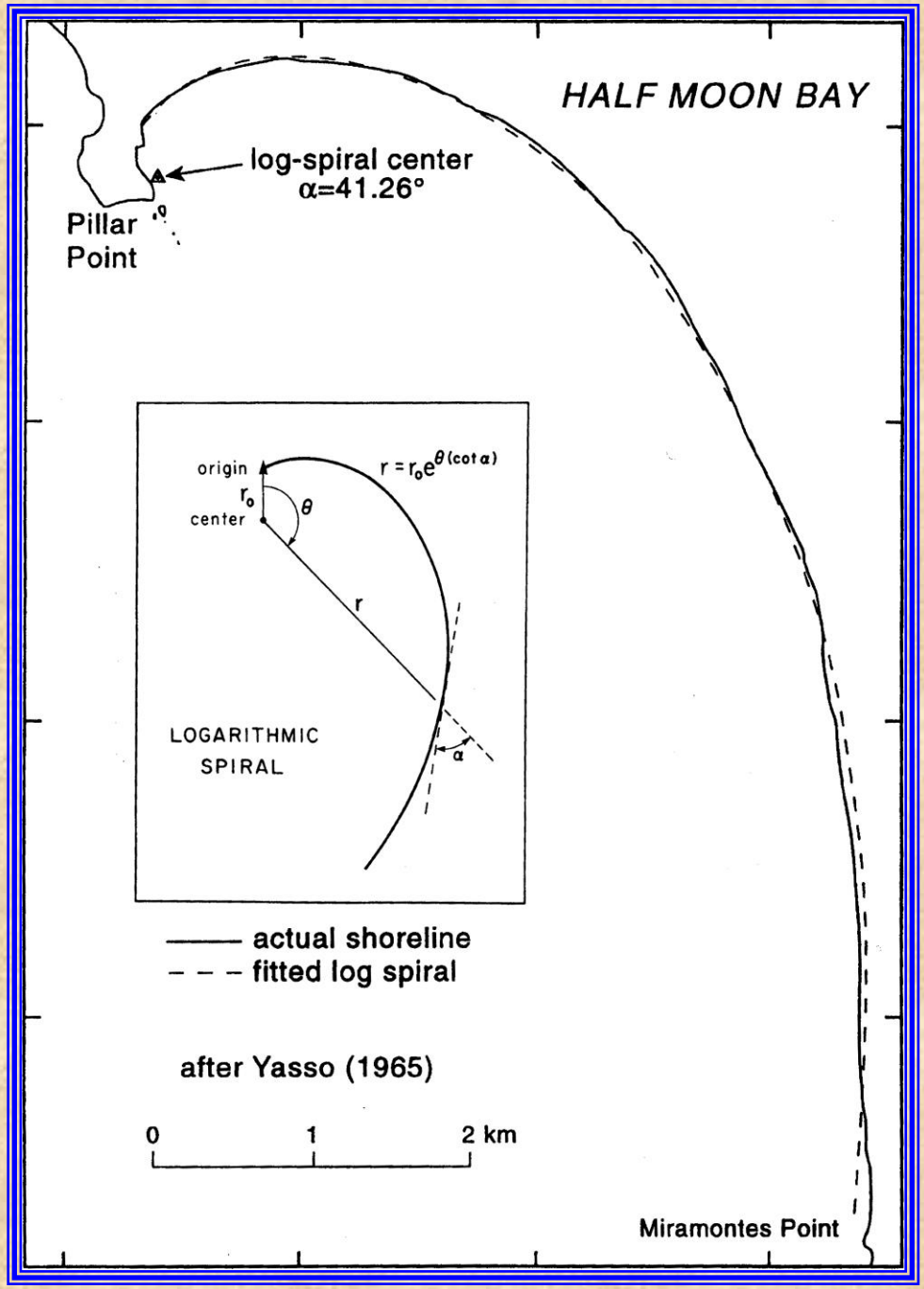
Corps participation will be based on two factors:

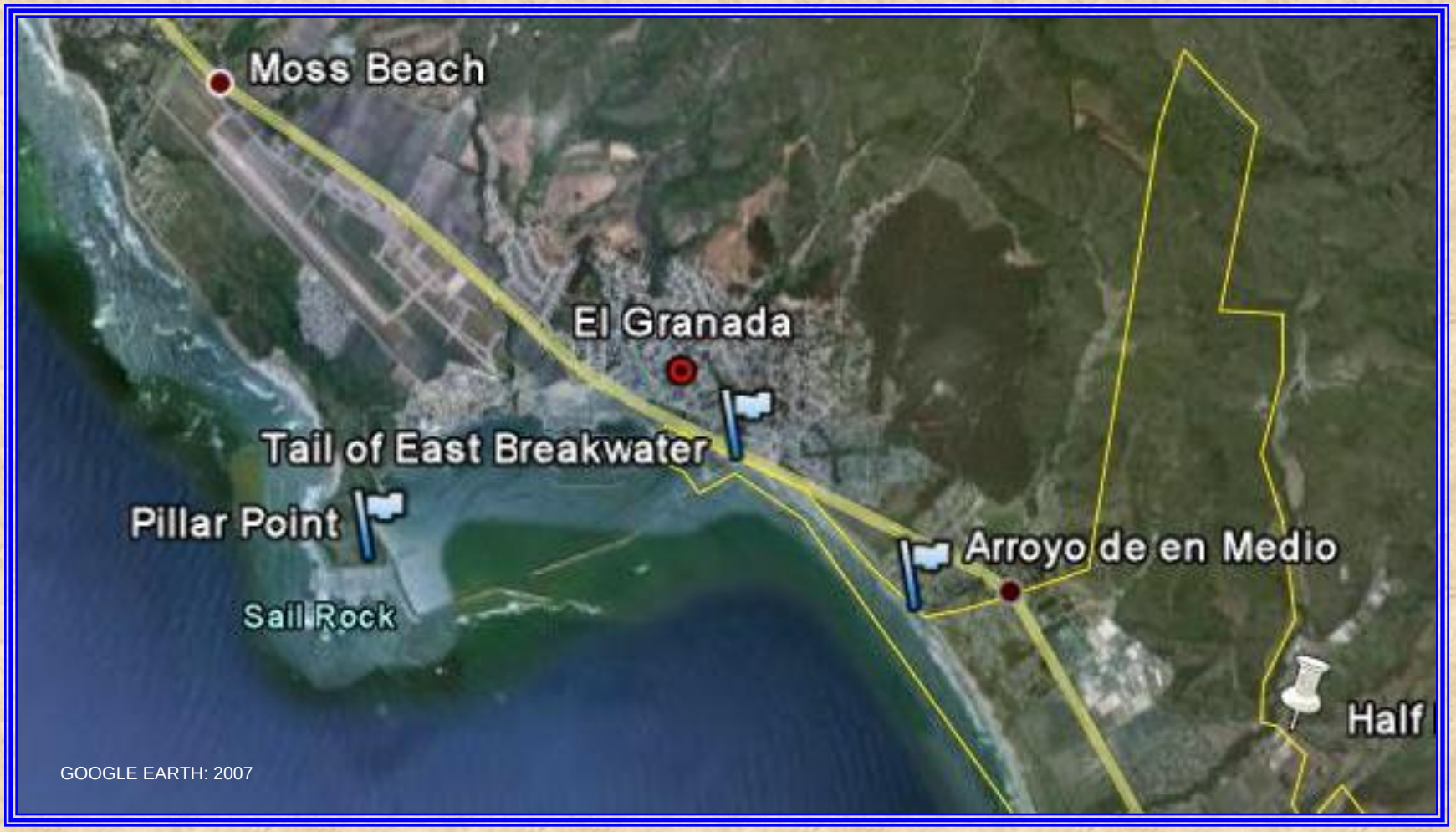
1. The extent of the post-construction shoreline change beyond the natural change that would have been expected without the Pillar Point Harbor project.
2. The economic viability of a potential project to mitigate for such physical changes.

Based on the evaluations of these factors, the Corps will determine Federal interest, and, if positive, will recommend a further study that could lead to the design and execution of a remedial project.



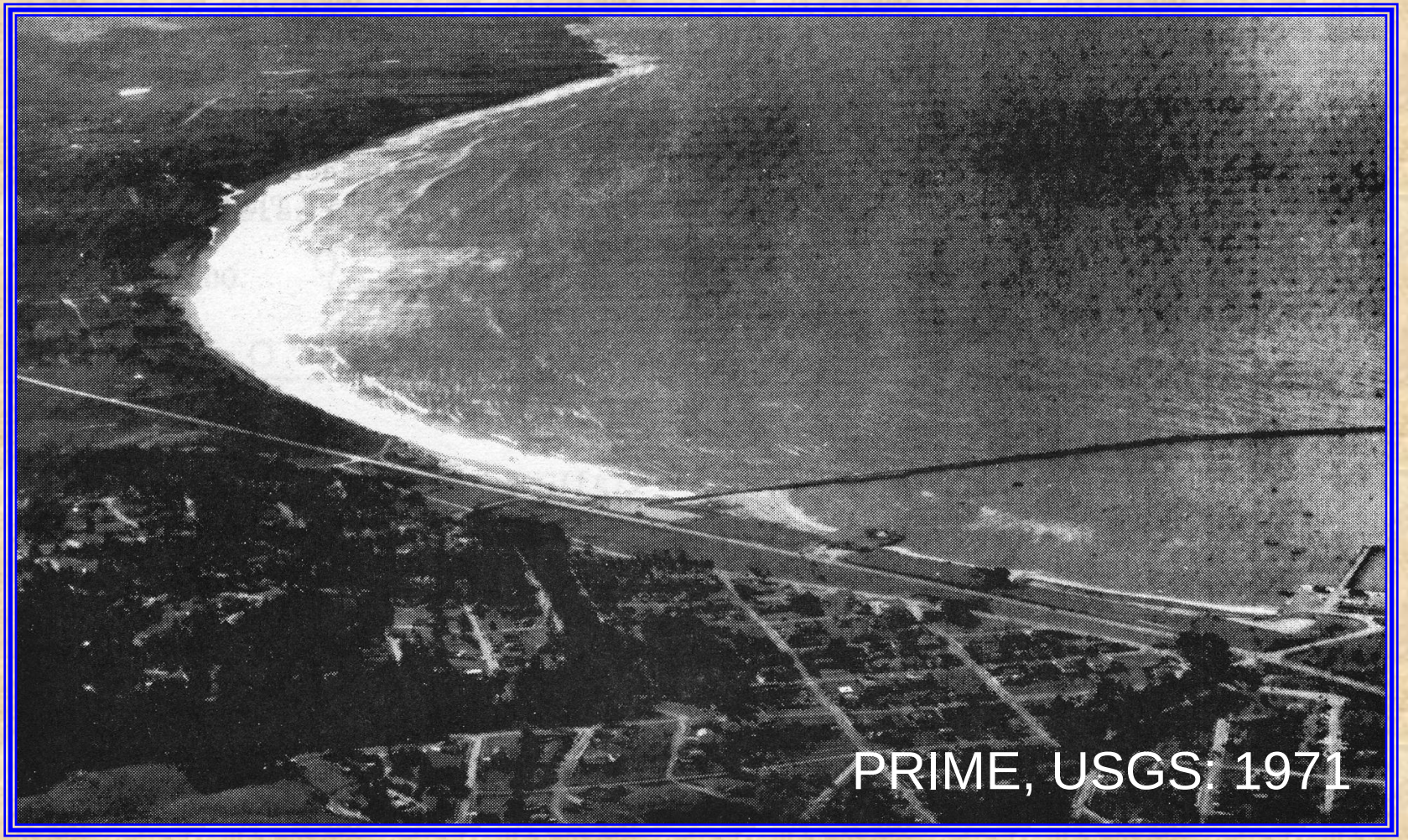
GOOGLE EARTH: 2007


HALF MOON BAY
log-spiral center
α=41.26°
Pillar
Point
origin
r_o
center
θ
$r = r_o e^{\theta(\cot\alpha)}$
r
α
LOGARITHMIC
SPIRAL
actual shoreline
fitted log spiral
after Yasso (1965)
0
1
2 km
Miramontes Point

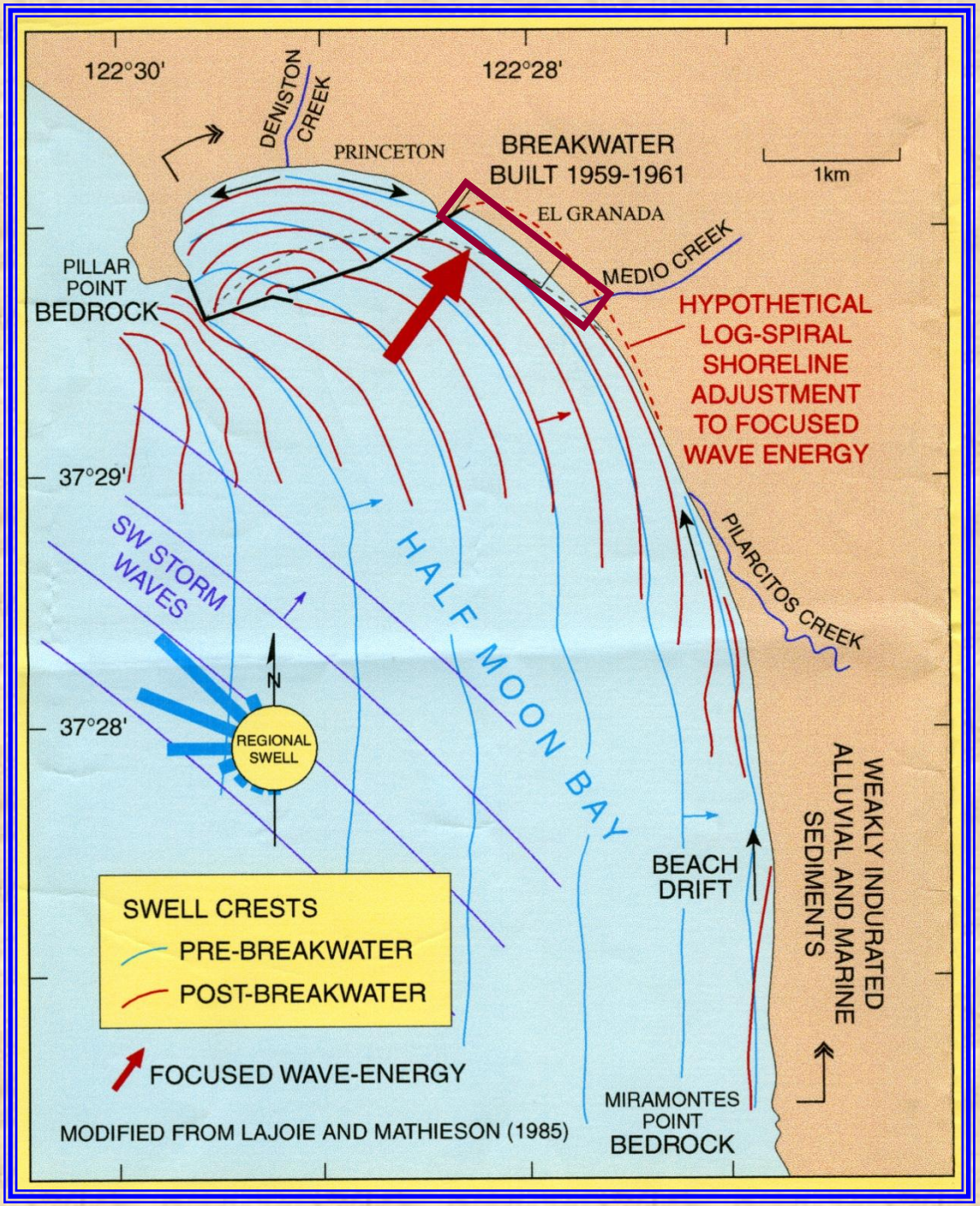

Moss Beach
El Granada
Tail of East Breakwater
Pillar Point
Sail Rock
Arroyo de en Medio
Half
GOOGLE EARTH: 2007

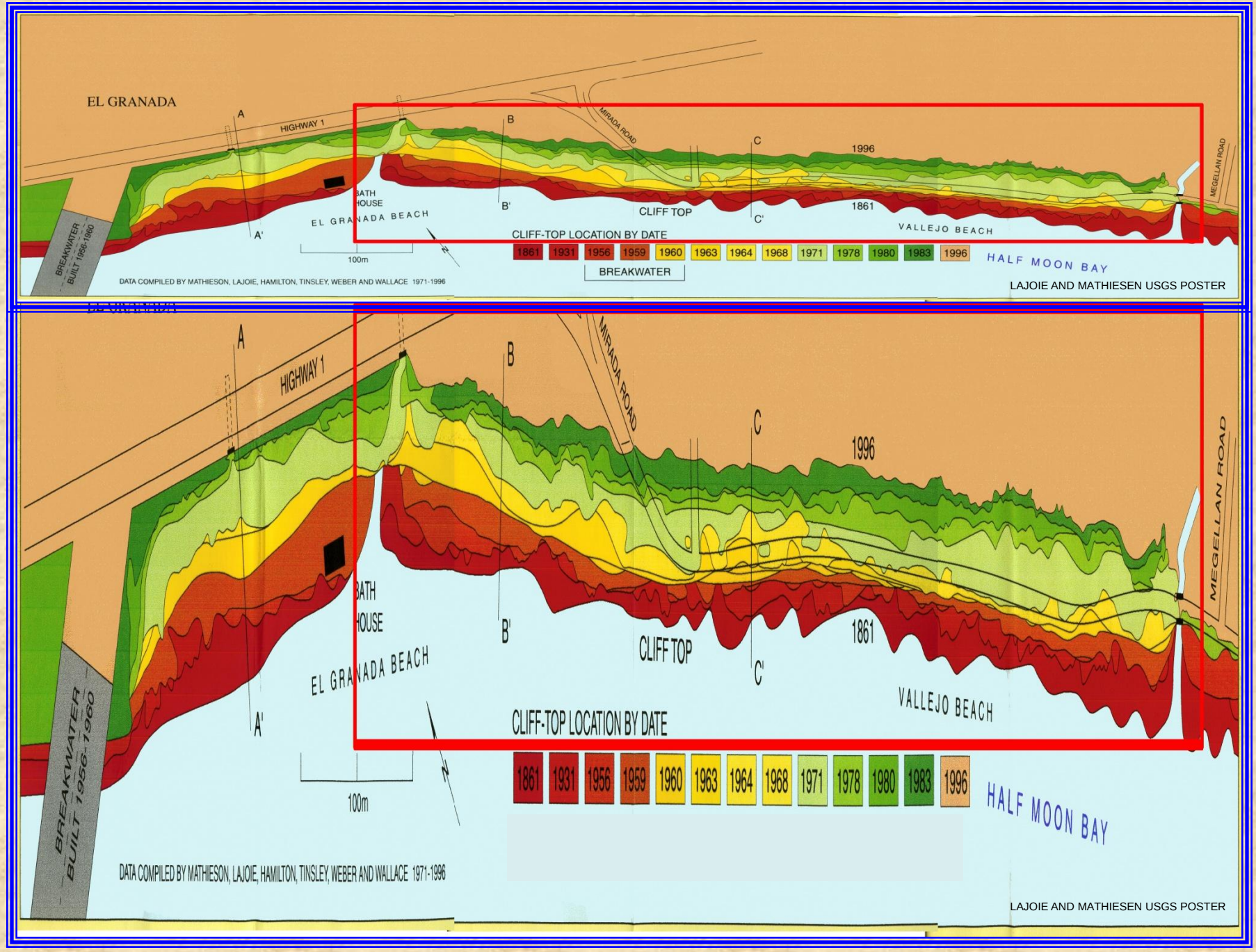
Northern Half Moon Bay Shoreline Conditions Relative to Construction at Pillar Point Harbor

Date	Event	Beach Condition
Prior to 1959	Natural Conditions	Broad sandy beach with cliff retreat of 3 in/yr and an erosion rate of ~30,000 yd^3/yr (throughout the Bay)
1959 to 1961	Two Outer Breakwaters Built	Transitional phase; erosion rates increasing
Post 1961	Various remedial actions including rubble-mound revetments	Narrowing of the beach with initial exposed sea-cliff retreat up to 80 in/yr and erosion rates up to ~75,000 yd^3/yr deposition on north side of East Breakwater


PRIME, USGS: 1971


LAJOIE, USGS, 1971


122°30'
122°28'
DENISTON CREEK
PRINCETON
BREAKWATER BUILT 1959-1961
1km
EL GRANADA
MEDIO CREEK
PILLAR POINT BEDROCK
HYPOTHETICAL LOG-SPIRAL SHORELINE ADJUSTMENT TO FOCUSED WAVE ENERGY
37°29'
SW STORM WAVES
HALF MOON BAY
PILARCITOS CREEK
N
37°28'
REGIONAL SWELL
BEACH DRIFT
WEAKLY INDURATED ALLUVIAL AND MARINE SEDIMENTS
SWELL CRESTS
PRE-BREAKWATER
POST-BREAKWATER
FOCUSED WAVE-ENERGY
MIRAMONTES POINT BEDROCK
MODIFIED FROM LAJOIE AND MATHIESON (1985)


EL GRANADA
HIGHWAY 1
A
A'
B
B'
C
C'
MIRADA ROAD
1996
1861
CLIFF TOP
EL GRANADA BEACH
VALLEJO BEACH
MEGELLAN ROAD
BREAKWATER
BUILT 1956-1960
100m
N
CLIFF-TOP LOCATION BY DATE
1861 1931 1956 1959 1960 1963 1964 1968 1971 1978 1980 1983 1996
BREAKWATER
HALF MOON BAY
DATA COMPILED BY MATHIESON, LAJOIE, HAMILTON, TINSLEY, WEBER AND WALLACE 1971-1996
LAJOIE AND MATHIESEN USGS POSTER

In conclusion, a preponderance of evidence substantiates the claim that the construction of the East Breakwater led to a dramatically increase in the erosion rate of the shoreline between the root of the breakwater and Arroyo de en Medio. Other causal effects, such as changes in weather patterns, are thought to have made a minor contribution at best to the increased erosion rate. Parts of the shoreline in question were protected by rock and concrete periodically dumped between 1959 and 1981. However, the erosion continued and a more substantial rubble-mound revetment was constructed in 1983 to protect Highway 1 where it passes within 30 ft of the cliff edge. Erosion of the unarmored shoreline continues.

Consequently, this Initial Appraisal supports the conclusion reached by an earlier USACE study (1971): *"The District Engineer finds that the erosion problem along the shores of El Granada Beach exists in two forms: (1) the direct erosion of material from the low bluffs immediately landward of the beach, and (2) the loss of littoral material from the beach backshore. He also finds that protective measures are required in the reach of coast from the Half Moon Bay East Breakwater to the mouth of the Arroyo de en Medio, approximately 4,600 feet to the southeast. No improvements are justified along the remaining coastline studied as the shoreline from Arroyo de en Medio to Miramontes Point is not eroding substantially at this time."*

Note that further study will be required in any future project to confidently prove and quantify the amount of change caused by the outer breakwaters.