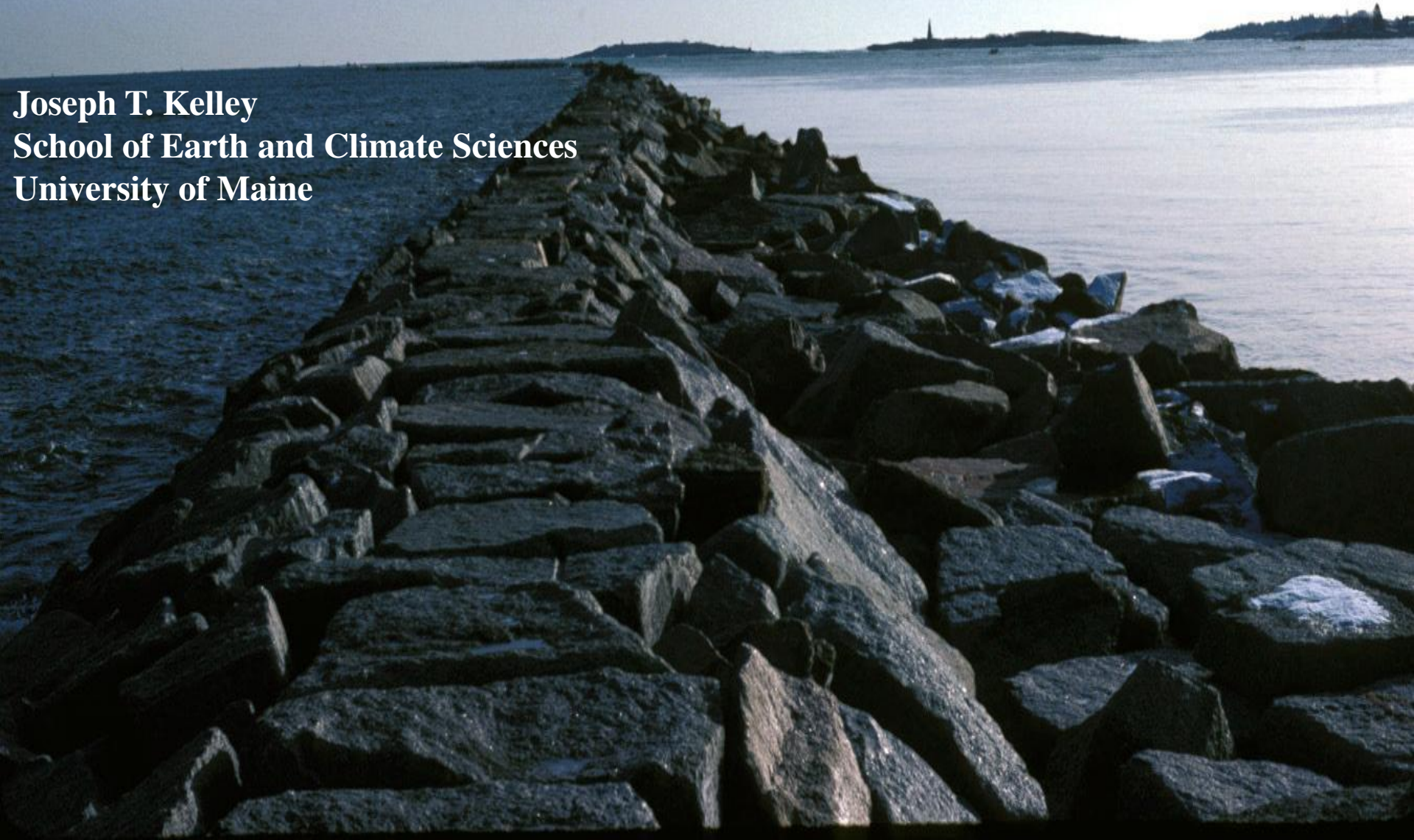
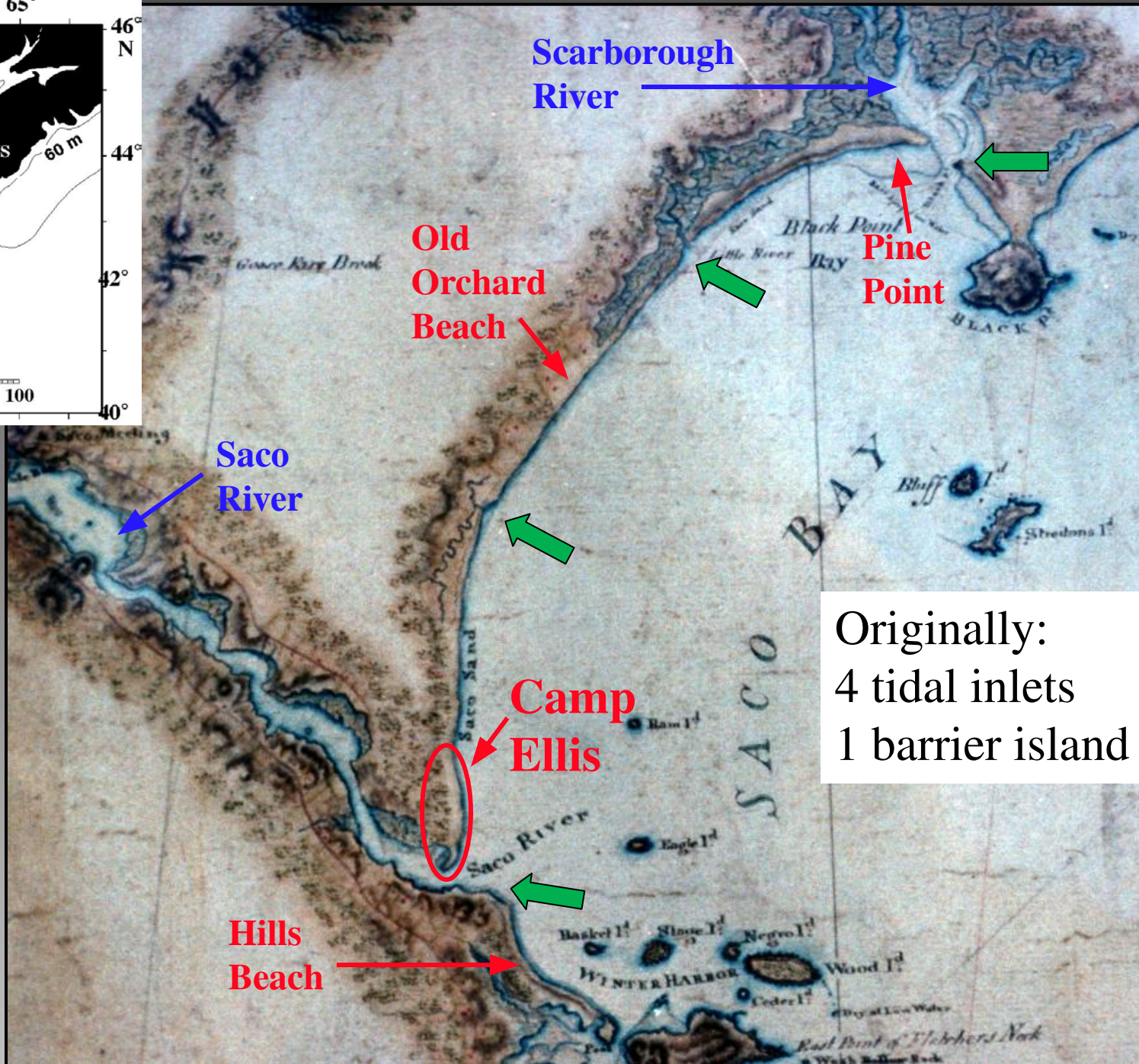
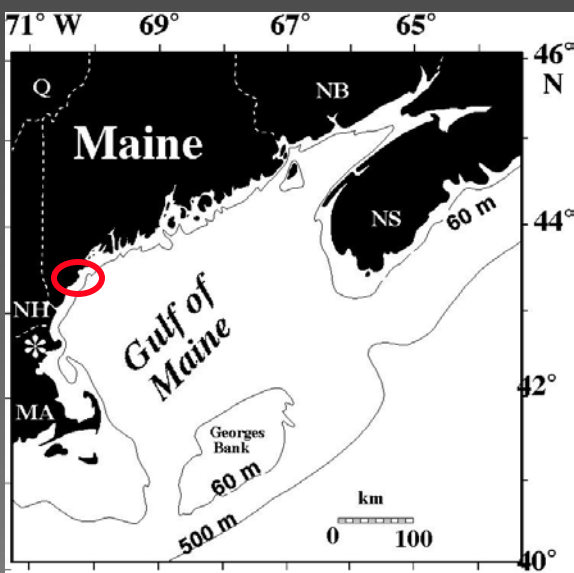


Brief History of Camp Ellis, Maine:

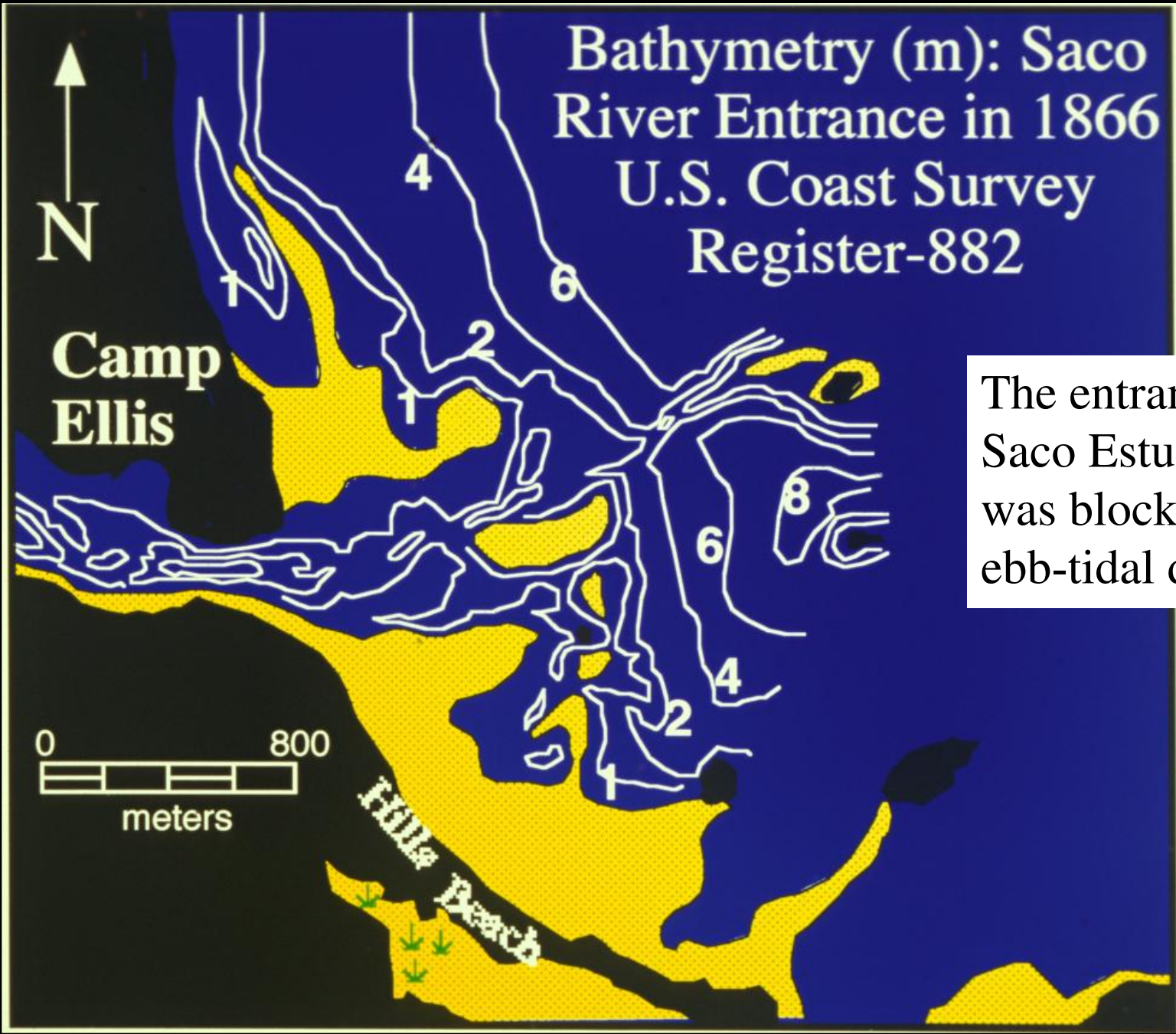
Joseph T. Kelley
School of Earth and Climate Sciences
University of Maine





Originally:
 4 tidal inlets
 1 barrier island

British
 Admiralty,
 ~1785



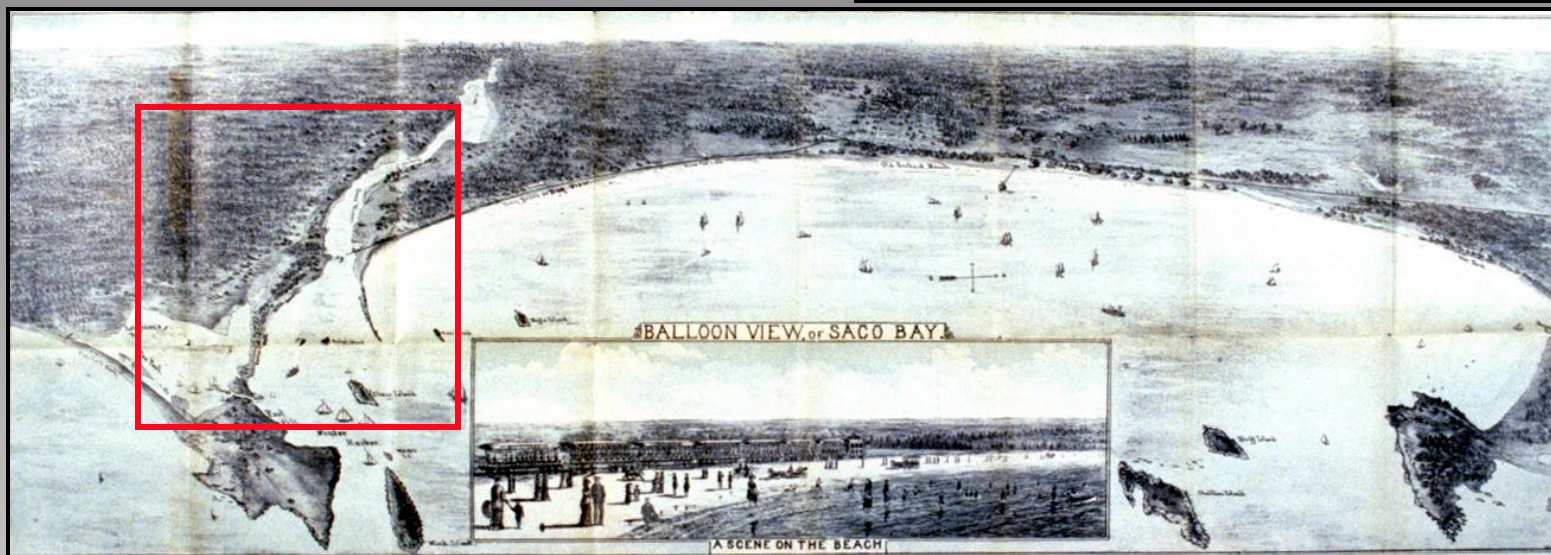
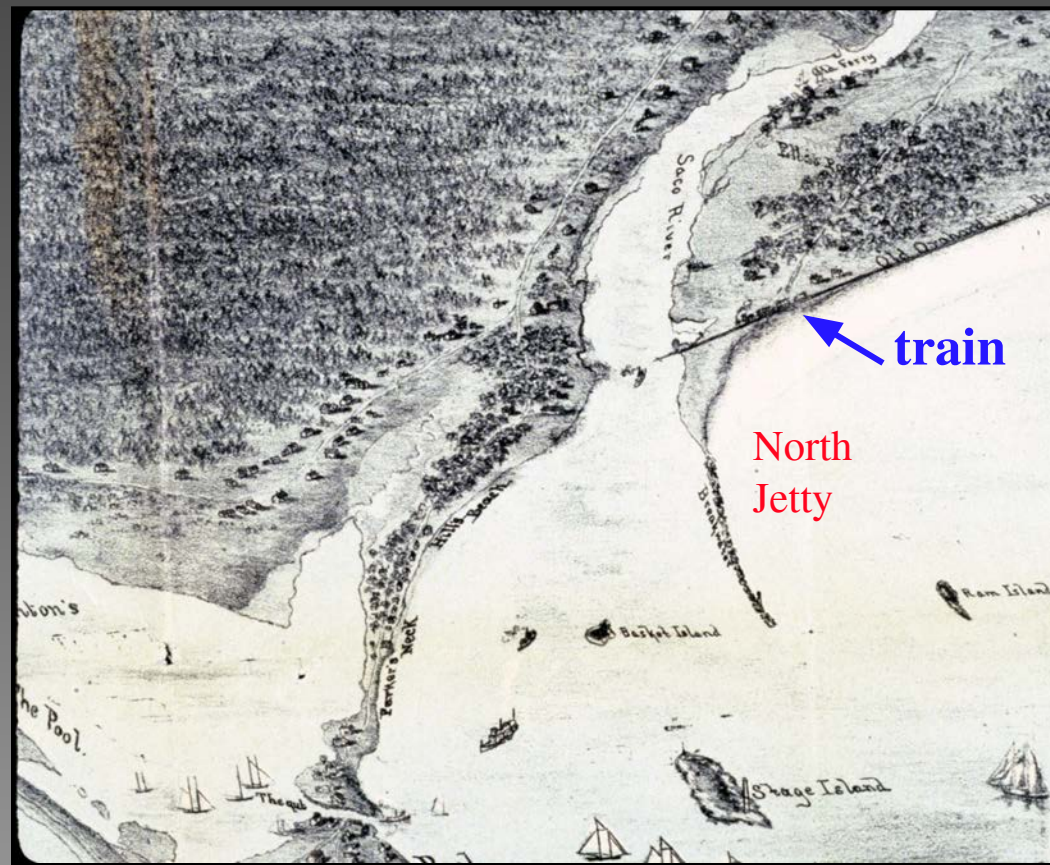
The entrance to the Saco Estuary was blocked by an ebb-tidal delta

Kelley et al., 2005 (after Barber, 1995, USACOE, 1955)

“Balloon’s Eye View” of Saco Bay: ca. 1880

Original north jetty,
no south jetty

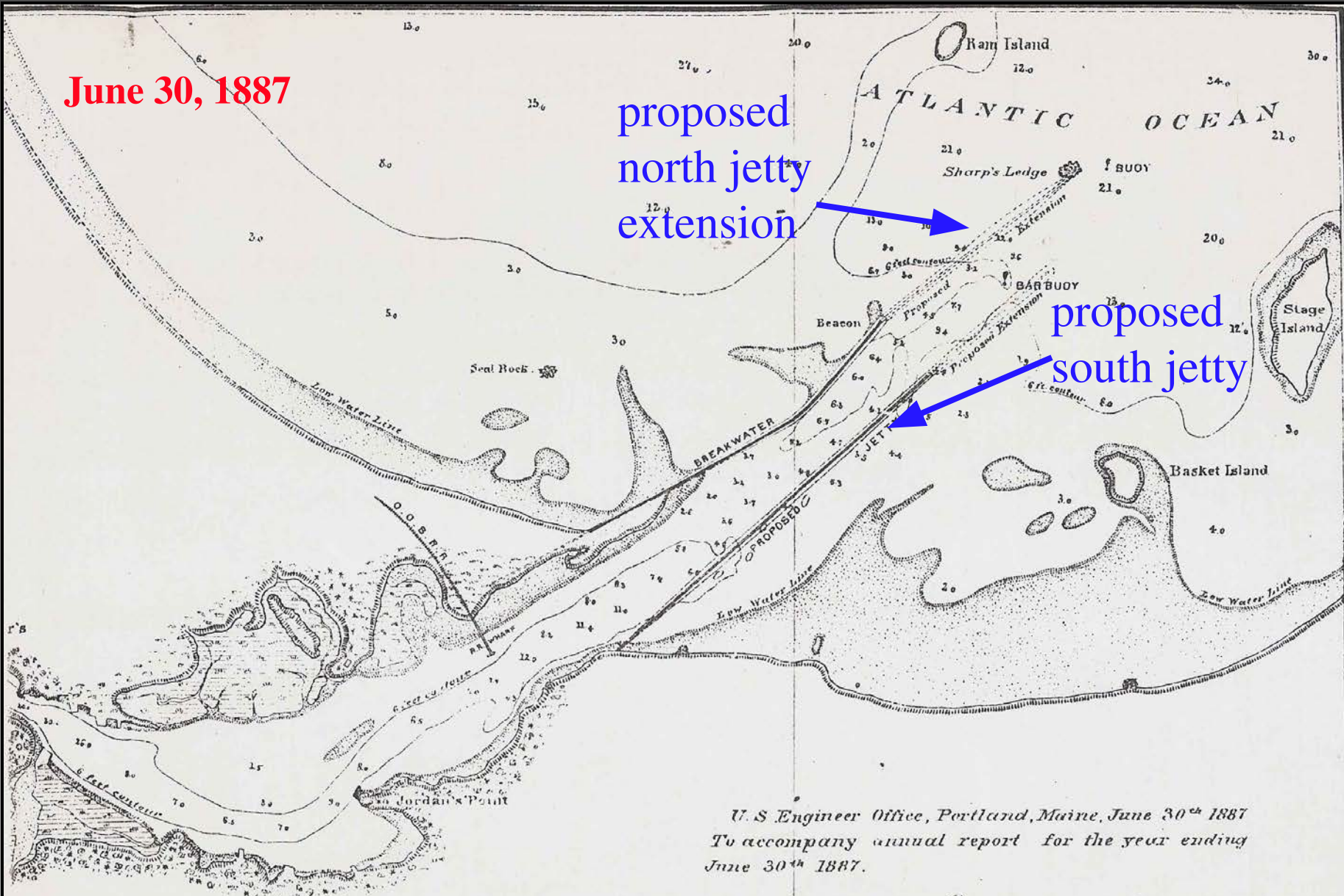
Note “Dummy” train
line on dunes.



June 30, 1887

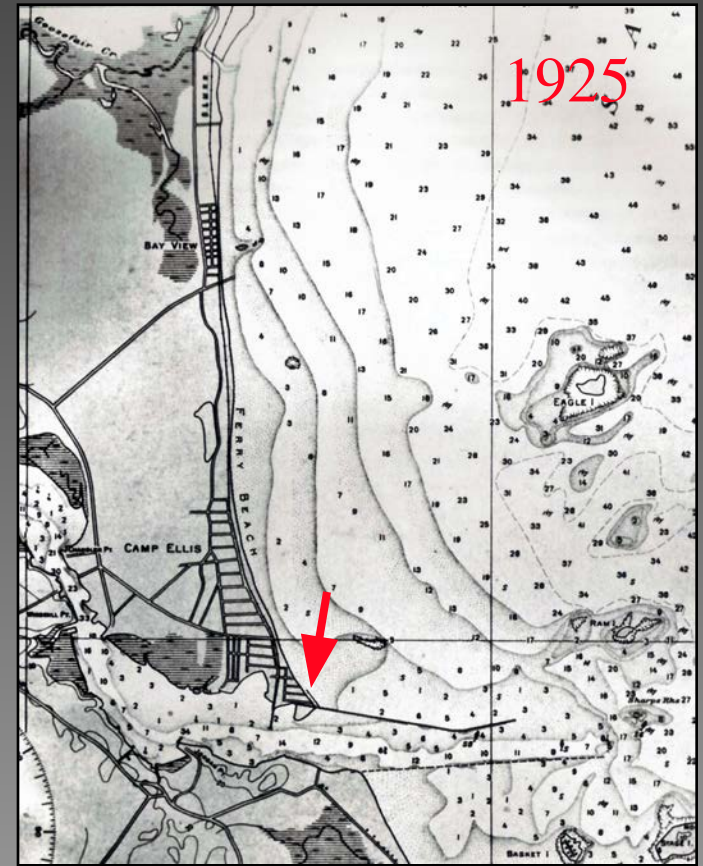
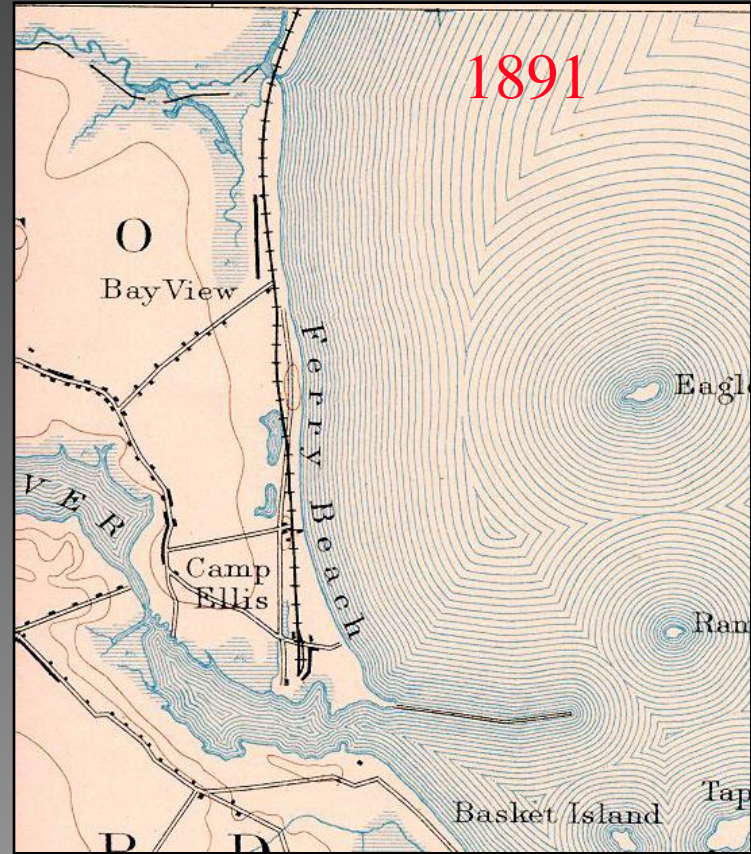
proposed
north jetty
extension

proposed
south jetty



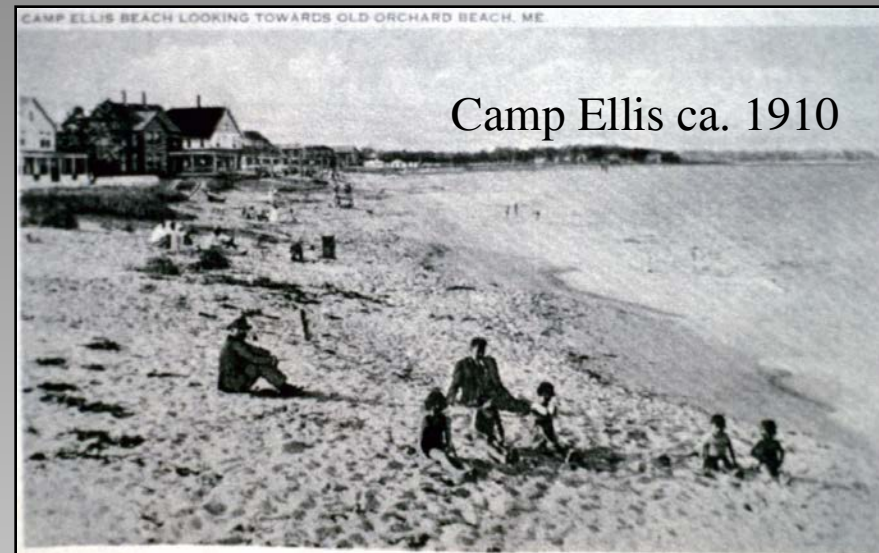
U.S. Engineer Office, Portland, Maine, June 30th 1887
To accompany annual report for the year ending
June 30th 1887.

Jared A. Smith
Major of Engineers, U.S. Army.



**Residential/Recreation Growth
in the Late 19th-Early 20th Century
on new land from
ebb tidal delta collapse**

**But erosion of temporary land
began soon**



1979



M. Moreau

**1910: Study of Camp Ellis
beach erosion**
**1912 : Construction of
22 m long spur jetty**

“a constant movement of
sand from north to south
along the ocean beach has
deposited material in front
of the original (river)
entrance channel”
USACOE, 1910



Industrial Period Ends

1940:

Last coal vessel up river

1958:

Mills all closed

Commerce: 1883

Number vessels: 40-50 schooners

Total Tonnage: 38,000 tons
(33,800 tons coal)

(USACOE, 1886, Cervone, 2001)

Commerce: 1909

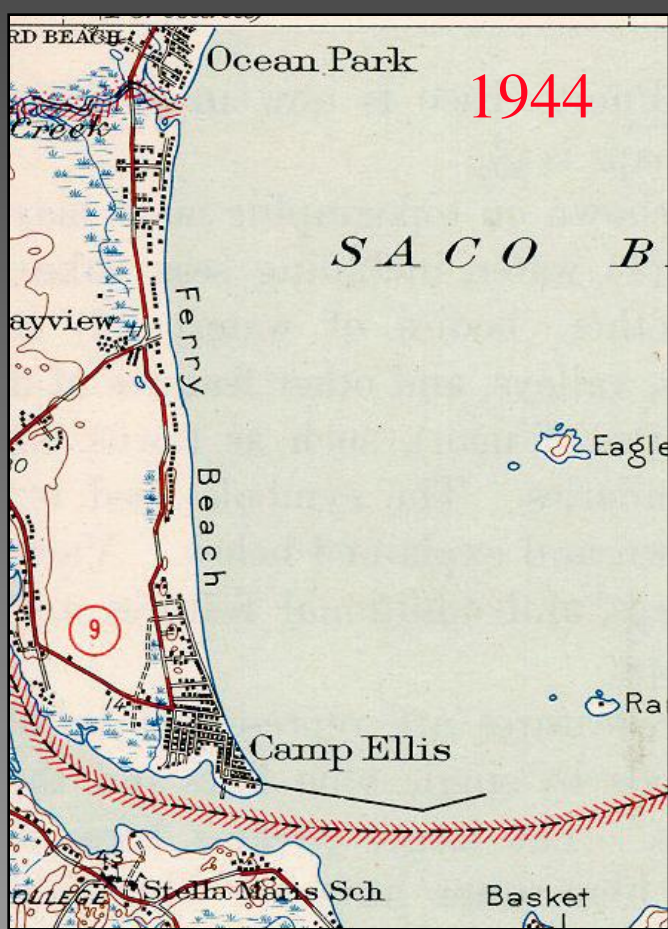
Coal, sand, cotton, iron, paving, pitch,
gravel, lime, cement, plaster, ashes, and ice

Total River Tonnage:
50,746 tons received (nothing shipped)

Total Rail Tonnage:
63,276 tons received (40,000 coal), **131,714 tons** shipped

(USACOE, 1910, Cervone, 2001)





1944

Residential Period

1940-55: Growth in residences, erosion

1953: Surf St Seawall (213 m)

1955: USCOE study: jetty not cause of beach erosion
 $5.9 \times 10^6 \text{ m}^3$ sand lost since 1869



1954

Surf St. Seawall

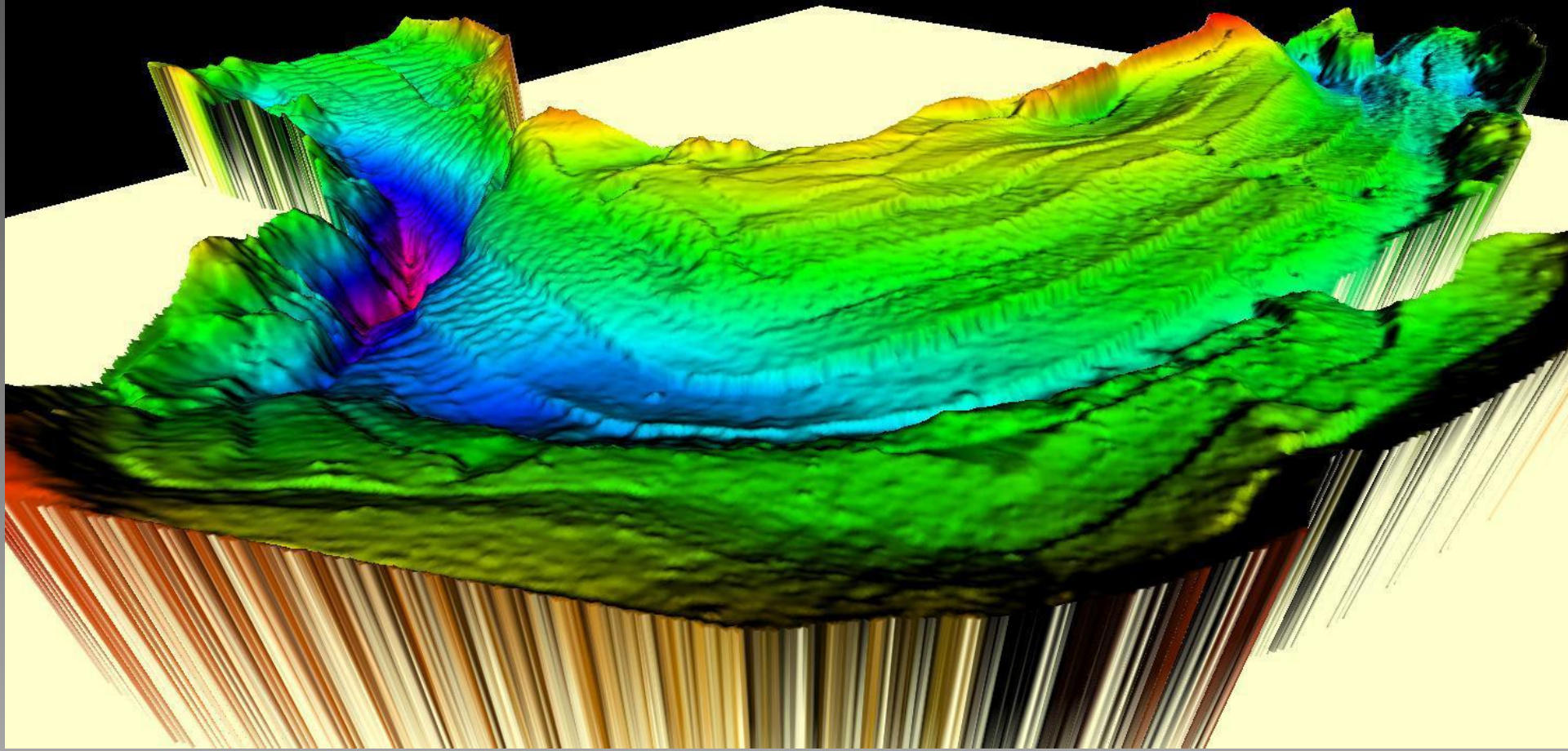
“The beach material is of glacial deposit origin...there is no natural source of material other than by local erosion within the confines of Saco Bay”

1955: USCOE

from Farrell, 1972



**The Army said that “holes” in the Saco Estuary proved no sand was coming downstream;
The holes was bedrock constrictions that led to scour**



Sand pours through the scour constrictions in large bedforms

1940-1957: Spit growth

Inlet narrowed by > 500 m since 1877

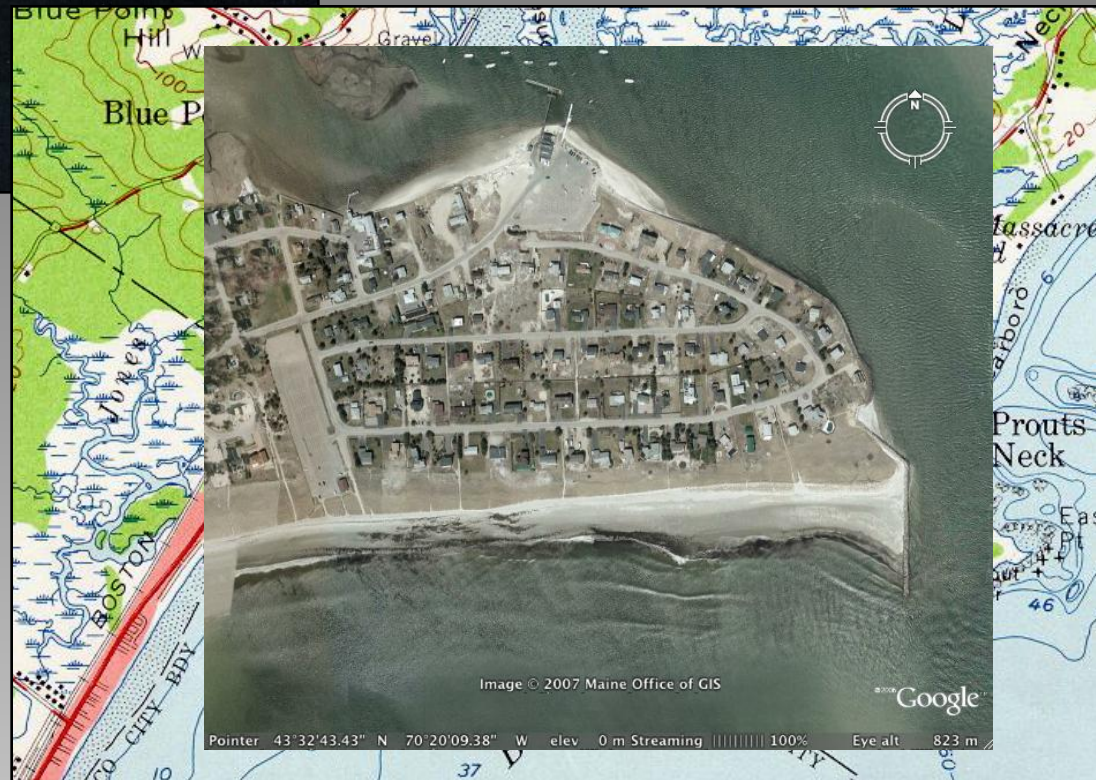
USACOE jetty in 1957, dredged sand put on spit

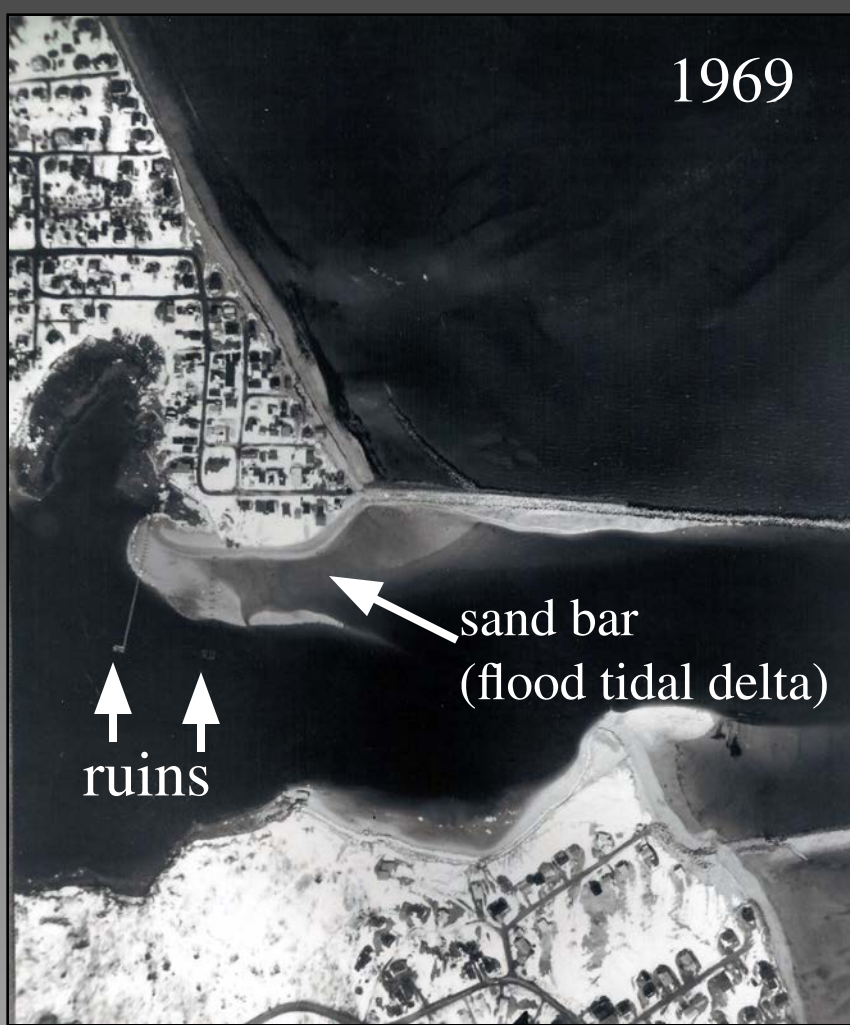


1940

from Farrell, 1972

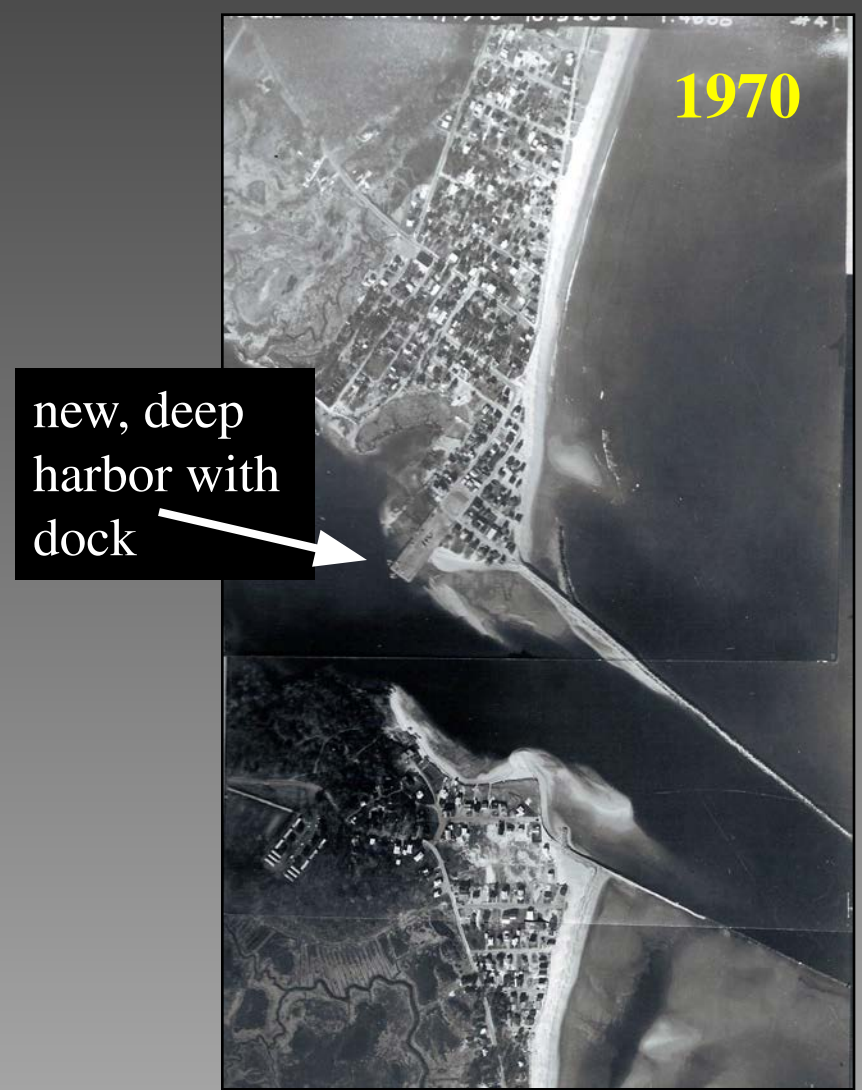
~ $5 \cdot 10^6$ m³ sand added to this area in last century, but no connection made between Camp Ellis erosion and Pine Point accretion by Army who was studying this.





1969: old anchorage in ruins
Sand accumulating near harbor;
decision needed to abandon harbor
or redevelop it.

Photos from Farrell, 1972



1970: new deep anchorage
dredged, new dock added,
Jetty raised, smoothed to
block sand entry

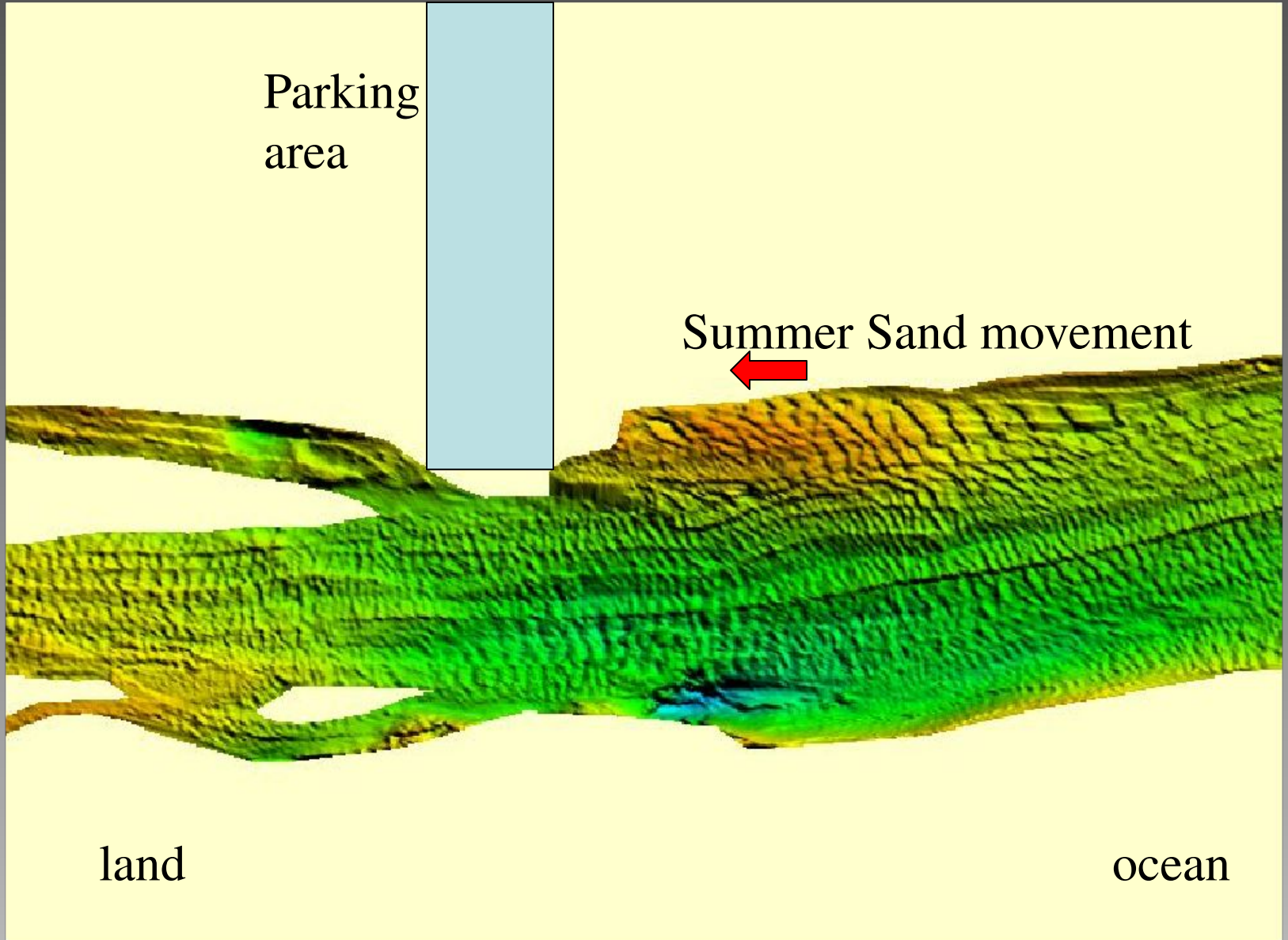
Parking
area

Summer Sand movement



land

ocean





(from Farrell, 1972)

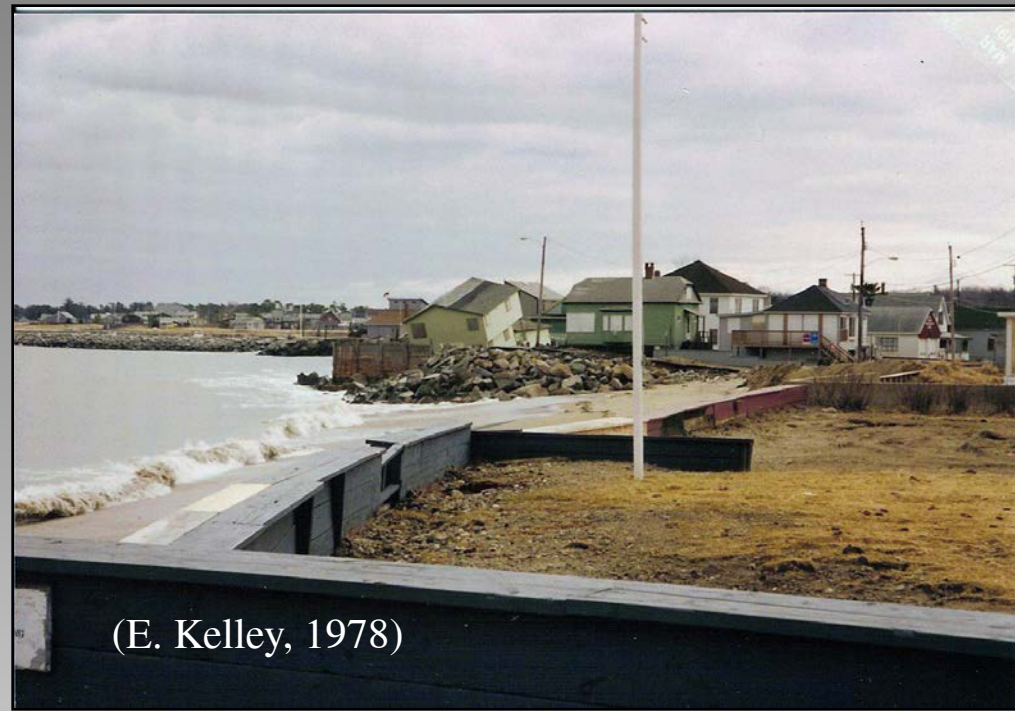
1969:
Camp Ellis beach eroded
Locals claim wave reflection

1978:
Storm of Century

1979
Adoption of Sand Dune Law



wave reflection from jetty



(E. Kelley, 1978)

Development Loss in the Beach System of Saco, Maine (1978-1998)

National Flood Insurance Program Claims

High-Hazard

- 1 Claim
- 2 Claims
- 3 Claims
- 4 Claims
- 5 Claims

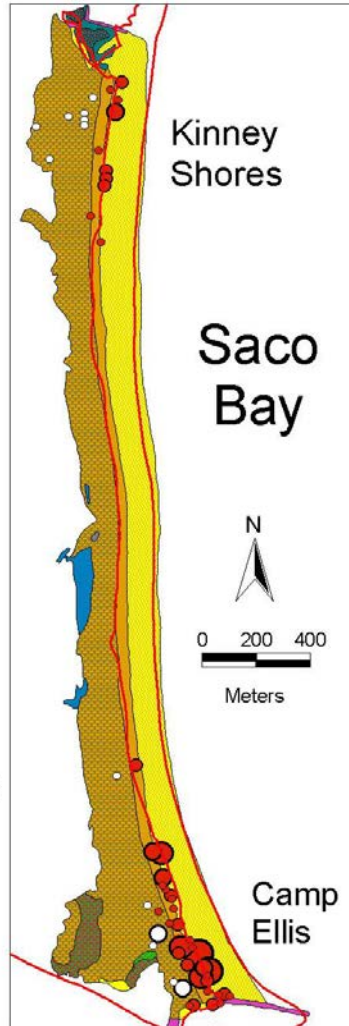
Hazard

- 1 Claim
- 3 Claims

— V Zone

Geologic Environments

- Sand Beach
- Low-energy Beach
- Tidal Channel
- Tidal Delta
- Frontal Dunes
- Back Dunes
- Engineering Structure
- Bedrock
- High Salt Marsh
- Low Salt Marsh
- Pond



Knisel, J. M. 2002. *Development Regulations in the Beach Systems of Maine: Some Outcomes of the Sand Dune Rules*. Orono, ME: School of Marine Sciences, University of Maine. M. S. thesis: draft.

Knisel, 2002

1983:

Maine's Sand Dune Law

- * No new seawalls
- * No rebuilding houses >50% damaged by storm
- * Set back behind dunes
- * 100 year sea-level rise considered in development



Ocean's ravages hurt Camp Ellis house market

● The location that made the area appealing now works against it.

By JILL HIGGINS
Staff Writer

SACO — On Pearl Street, a house toppled by an October storm sits smashed on the beach, its insulation flapping in the wind.

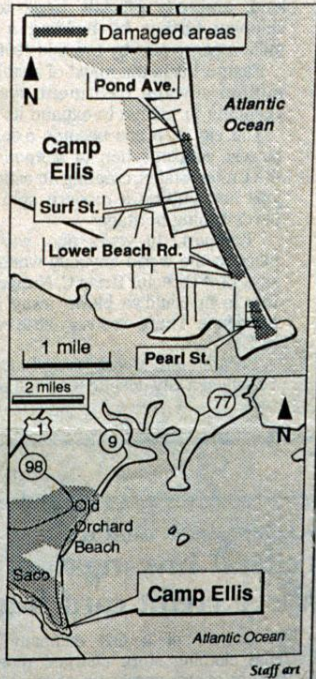
Over on Lower Beach Road, one homeowner has bought some time by moving his damaged house several feet away from the water's edge. The dilapidated seawall is regularly lapped by the tide.

Street signs that only a year ago pointed traffic around a one-way loop past the ocean are virtually useless now, because Eastern Avenue and Surf Street are mostly demolished.

Would you want to buy a house in this neighborhood?

Homeowners who are trying to sell their properties along the seashore here are facing the disheartening fact that Camp Ellis' ocean beauty is now a real estate beast.

While economic conditions are impeding property sales through-



1991



1990's

Loss of property continues

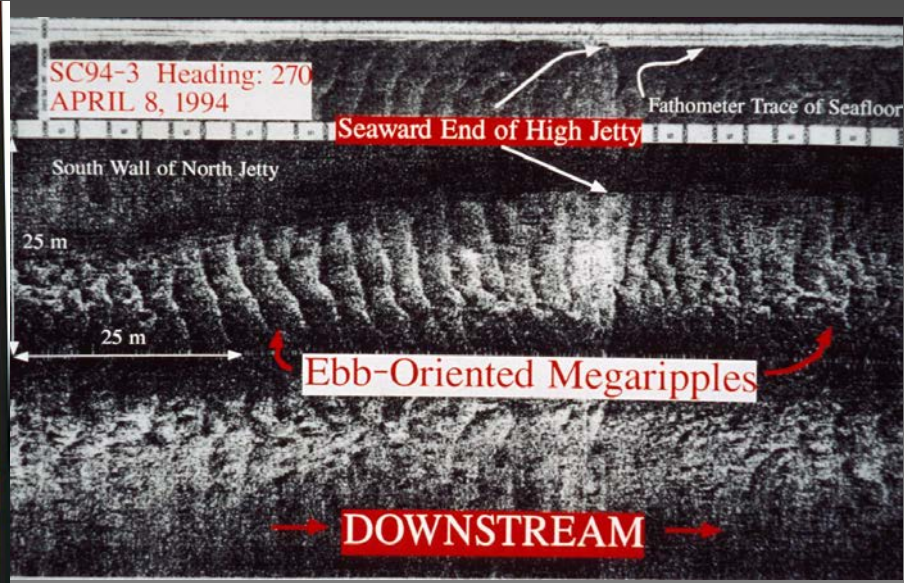
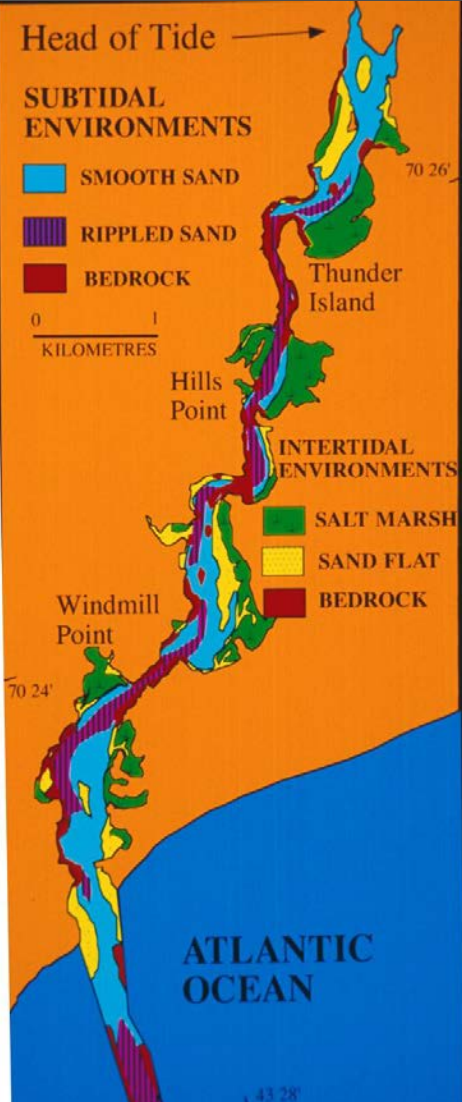
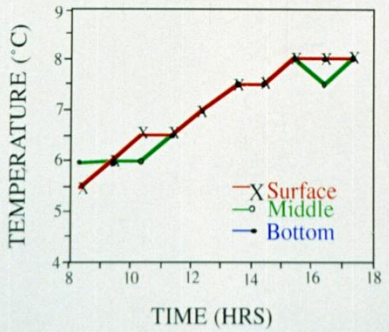
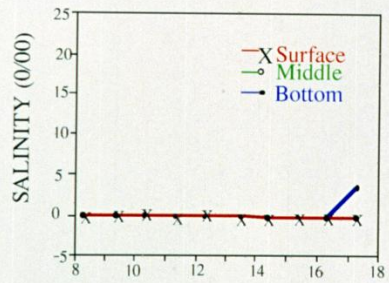
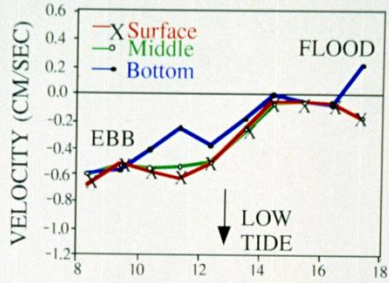
Blame focuses on Corps

SOS Camp Ellis forms

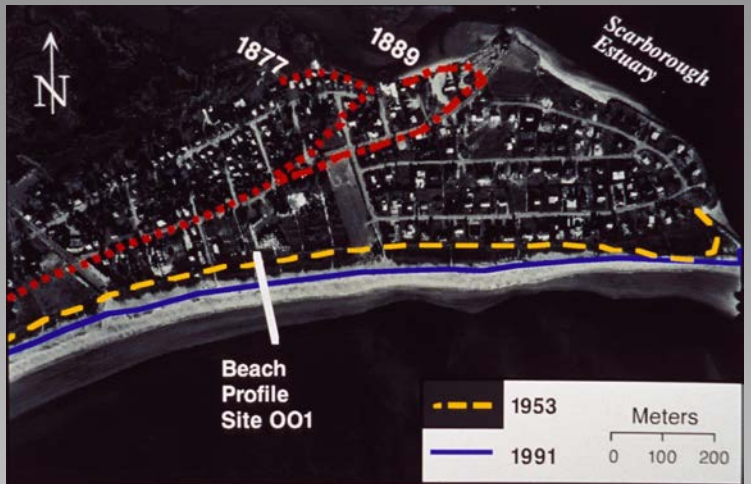
S. Dickson

STATION J: APRIL 30, 1993

RIVER-DOMINATED CONDITIONS



Saco R sources beach sand
 Sand moves from south to north
 Jetty began erosion trend



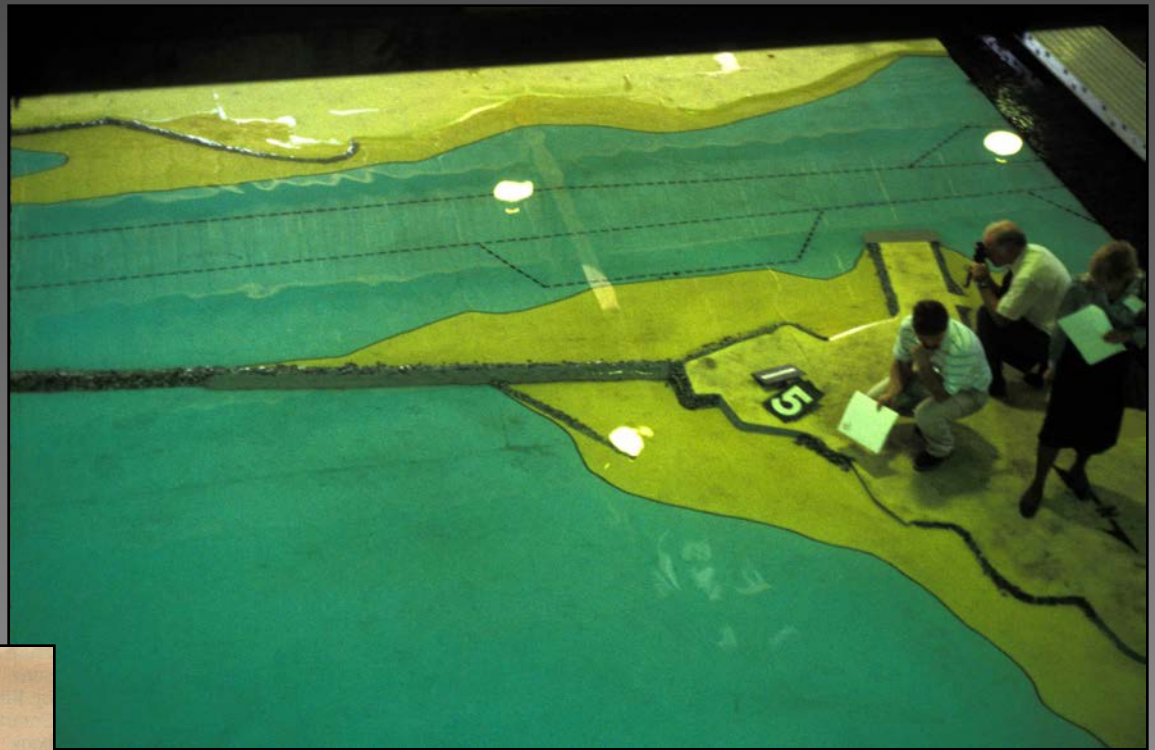
\$169,644 Sea Grant Project
 1 Ph. D. and 2 Masters theses

(from Barber, 1995, Manthorp, 1995, Kelley et al., 2004)

WEDNESDAY APRIL 5, 1995

Corps says no to new spur jetty

SOS vows to take fight to Congress



Army doubts need for study at Camp Ellis

● Saco officials say something must be done soon or the area will erode into the sea.

By JILL HIGGINS
Staff Writer

SACO — The regional commander of the Army Corps of Engineers said Friday that the city must prove the need for a study of Camp Ellis jetties in order to get federal

“This has a significance on the economy of the whole region. We have more to lose than just Camp Ellis.”

Sen. Bonnie Titcomb,
D-Casco

“The study also found that the navigation project may, to some extent, influence the coastal processes in the area”.

Col. Morris, NE Div. 1-14 -92

\$850,000 Corps Physical model built at WES in Mississippi

Camp Ellis model upsets residents

● Built by the U.S. Corps of Engineers to study beach erosion at Camp Ellis, the model contains several flaws, residents say.

They were invited by the U.S. Army Corps of Engineers, which built the \$380,000 model to study erosion at Camp Ellis. The total cost of the model is \$1.1 million.

11, 1992

By JILL HIGGINS
Staff Writer

SACO — Some residents of Camp Ellis say the government is wasting taxpayers' money on a scale model of the beachfront community that doesn't adequately address beach erosion.

Members of Save Our Shore Camp Ellis residents' group, visited the model at the Coastal Engineering Research Center in Vicksburg, Miss., last month.

● Sea walls and beach replenishment aren't the answers, Camp Ellis homeowners are told, but merely delay the inevitable.

By JILL HIGGINS
Staff Writer

GORHAM — Homeowners at Saco's Camp Ellis and other beach communities can best protect their homes from the sea by moving them inland.

That's the conclusion of a group of experts who spoke Friday at a symposium at the University of

Southern Maine. The experts said sea walls and beach replenishment programs can only delay the inevitable.

They said the greatest factor contributing to erosion throughout the coastal United States is the encroachment of houses, condominiums and hotels on fragile beach dunes.

But Jack Reynolds, whose summer house is at Camp Ellis, said most homeowners are unwilling to accept any edict to move their homes.

"I understand what (the experts) are saying," Reynolds said. "But I think you feel differently if it's your house that's being sacrificed for the common good."

"The physical model is useless. . . . It's a \$500,000 white elephant that squanders public money."

Joe Kelley, coastal

video tap they were to show a dotted line lap the shore. In one merged relation, a example Bastill during years.

Saco delays action on beach plan

● Councilors say a \$110,000 Camp Ellis erosion project should be paid for with federal and state funds.

Homes should be moved, experts say

"I understand what (the experts) are saying. But I think you feel differently if it's your house that's being sacrificed for the common good."

Jack Reynolds

Jeanne DeFranco of the state Department of Environmental Protection said the state is still reviewing options to help Camp Ellis residents. She was not optimistic after

hearing the experts.

In the past two years, four Camp Ellis homes have been destroyed by storms that brought heavy surf and major erosion to the beach. At least a dozen more homes are in immediate danger.

Offshore breakwaters, a solution being considered at Camp Ellis, can cause erosion elsewhere on the coast, said Robert Morton, a geologist with the Texas Geological Survey.

He warned that, while a Camp Ellis breakwater would protect homes there, nearby areas such as Pine Point in Scarborough could expect dramatic erosion.

Camp Ellis residents recently began planting dune grass to try to

prevent further damage, and the city of Saco has installed sandbags along the shore to break waves.

Orrin Pilkey, a coastal erosion expert from Duke University, said those efforts cannot be expected to be a long-term solution.

He said sandbags will eventually deteriorate and dune grass can only be effective on a beach with more sand than Camp Ellis has.

Another option, widely used at Miami Beach, is to dump tons of sand on the beach every couple of years.

"But you shouldn't look at replenishment as a one-time shot. It just doesn't work that way," said Pilkey, noting that such programs are costly.

Geologists want Camp Ellis sea wall torn down

By CHRISTINE KUKKA
York County Bureau

SACO — Since 1908, 41 beachfront homes have slipped into the sea at Camp Ellis beach.

And for the first time, government officials are considering that politically charged solution. They are balancing the perpetual cost of shoring up a sagging sea wall against the one-time cost of buying endangered homes and surrendering to the sea.

sea to gouge out sand around a sea wall instead of replenishing it.

The worst example of sea wall erosion in Maine is Camp Ellis, situated at the mouth of the Saco River, according to geologists and the Department of Environmental Protection

"Because of its location and orientation, Camp Ellis stands directly in the path of northeast storm wave energy," wrote oceanographer Marcel Moreau in his report on Camp Ellis erosion. "It has never been and never will be a safe place to build a he sand."

He issued his warnings — issued in a 1979 report — the federal Environmental Protection Agency recently funded construction of

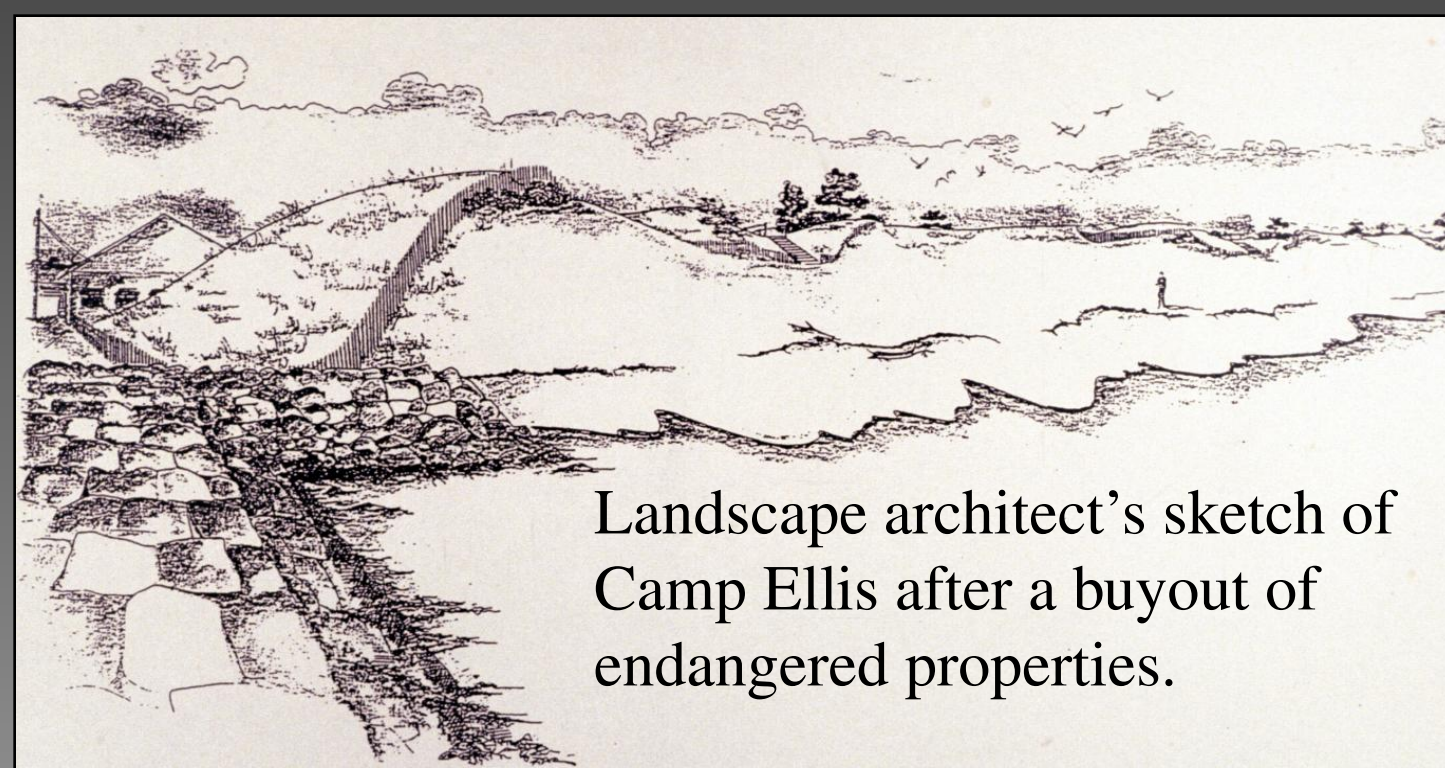
KENNEBEC JOURNAL AUGUSTA, MAINE

WEDNESDAY, SEPTEMBER 23, 1987 7

MAINE

Saco seawall in middle of political battle

See SEA WALL
Back page this section



Landscape architect's sketch of Camp Ellis after a buyout of endangered properties.

“I do not believe any more jetties or revetments should be constructed at Camp Ellis... the construction of new seawalls is prohibited in Maine...the impact of building large coastal structures can be unpredictable and far-reaching...currently the erosion problem is localized at Camp Ellis...I do not want to see the problem transferred to other areas. Large structures also are expensive to build and have high long-term maintenance costs. All these concerns make non-structural solutions much more desirable.”

Dean Marriott, Commissioner,
Maine Dep't. Environmental Protection, 1/28/92

SWEPT AWAY

By TED COHEN
Staff Writer

SACO — Battling the sea with a shovel was not Bob Lapointe's idea of retirement.

After a 34-year teaching career, Lapointe found a nice little piece of real estate along the Maine coast in Camp Ellis. The \$79,000 home that Lapointe bought along North Avenue — right off the ocean — became the fantasy he had long dreamed about.

The fantasy quickly eroded, much like his back yard. Lapointe spends several days a year cleaning tons of sand from his front yard that has washed up from the receding beach.

"Finding this house was the dream of a lifetime," he said. "But it's turned into a nightmare."

Lapointe is among property owners in Camp Ellis who are members of Save Our Shore, a group trying to find solutions to the devastating erosion that has claimed a number of streets and more than 30 houses in the small coastal community.

"How many more do we have to lose?" Lapointe asks. "The major is we need to slow down the erosion."

The U.S. Army Corps of Engineers 1897 built a long rock wall extending the shore to help keep the harbor of the mouth of the Saco River. Sand vlecting in the channel, making it un-

"How many mo



Many blame a granite jetty built i

Camp Ellis tiring in fight a

losing battle with the Atlantic, the city fathers of Saco have decided to take no more heroic measures to save the village of Camp Ellis. By Jeff Clark.

Brink



Plan 25A

120.4 m
124.9 m
152.4 m

USACOE

Plan 6 and Plan 25A Annual Cost Comparison	Plan 6 – Spur Jetty + Beachfill	Plan 25A – Spur + 2 Breakwaters + Beachfill
# of Renourishment Events	3+	2+
Amortization of First Cost	\$997,000	\$1,403,000
Maintenance of Structures	\$48,000	\$81,000
Renourishment of Beachfill	<u>\$262,000</u>	<u>\$190,000</u>
Total Annual Cost	\$1,307,000	\$1,674,000
Discount for FNP Sands (1/3)	<u>-\$87,000</u>	<u>-\$63,000</u>
Total Annual Cost with Discount	\$1,220,000	\$1,611,000

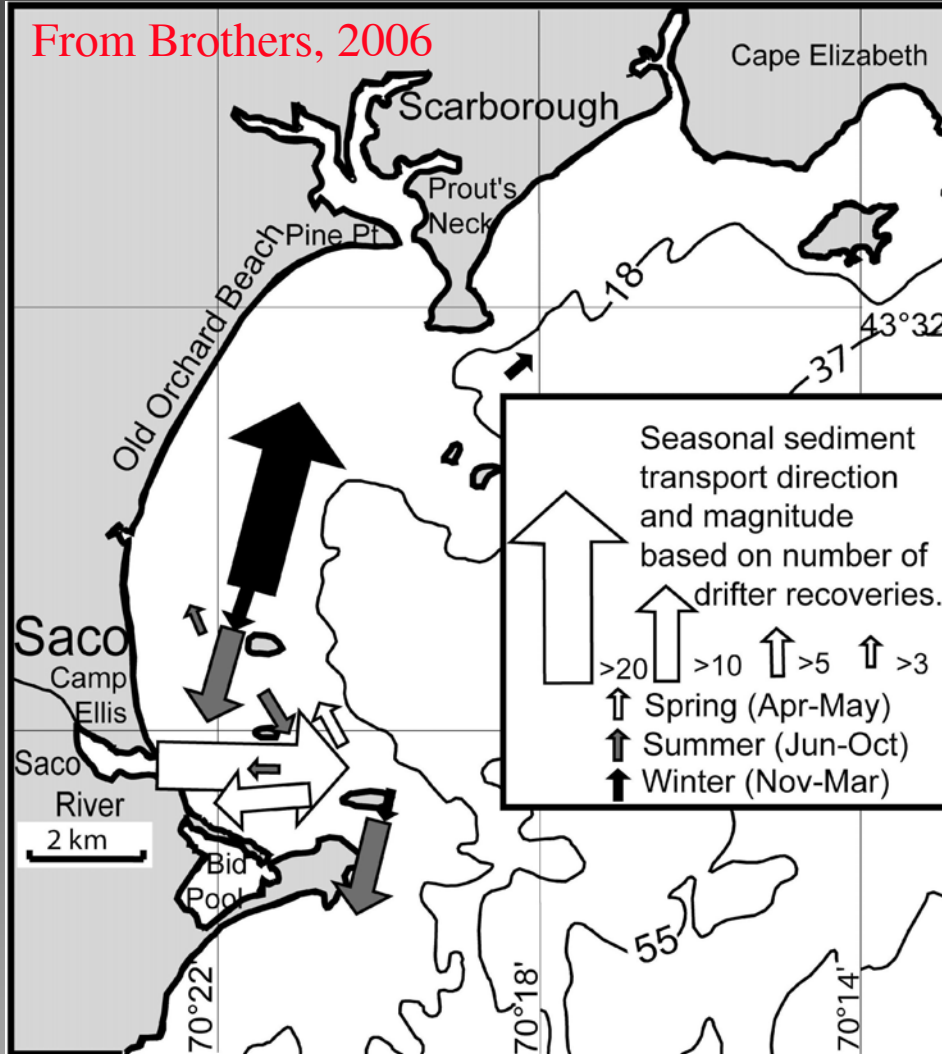


Plan 6

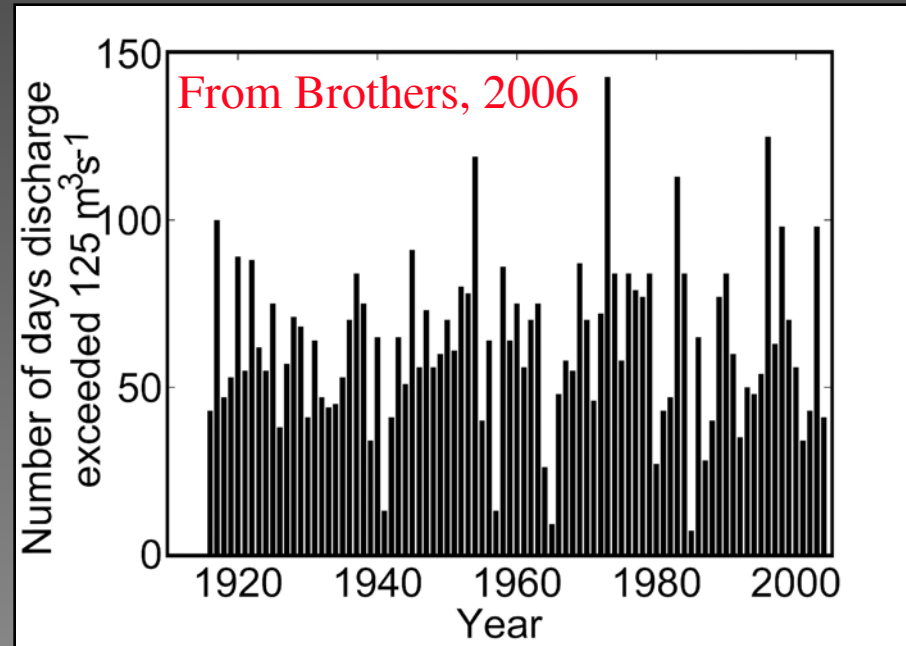
228.6 m

Plan 6 and Plan 25A Cost Comparison	Plan 6 – Spur Jetty + Beachfill	Plan 25A – Spur + 2 Breakwaters + Beachfill
Construction of Structures	\$8,170,000	\$13,700,000
Construction of Beachfill	\$5,230,000	\$5,230,000
Contingencies	\$2,620,000	\$3,760,000
Engineering & Design	\$280,000	\$340,000
Supervision & Administration	\$1,410,000	\$1,940,000
Monitoring	<u>\$150,000</u>	<u>\$150,000</u>
TOTAL	\$17,860,000	\$25,120,000

From Brothers, 2006



Brothers, 2008

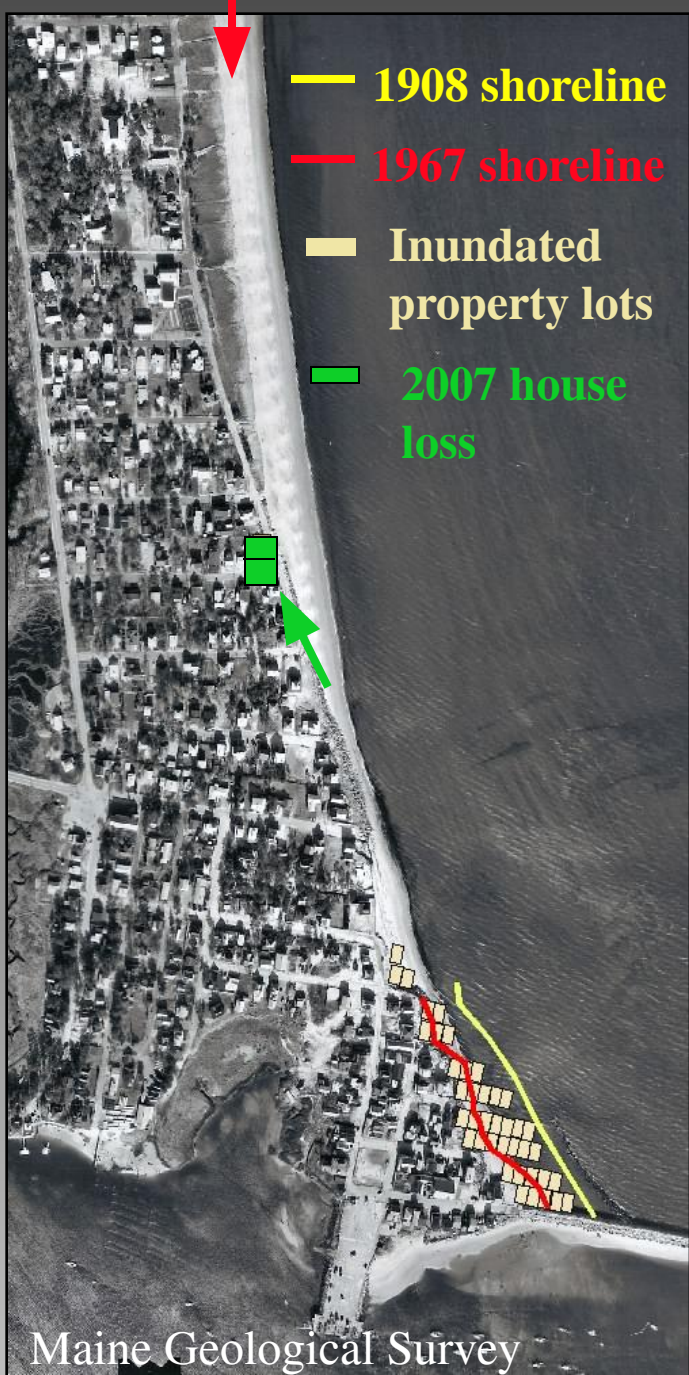


Number of days per year
Saco River contributes sand to
inner shelf

Sea Grant project (\$165, 518)

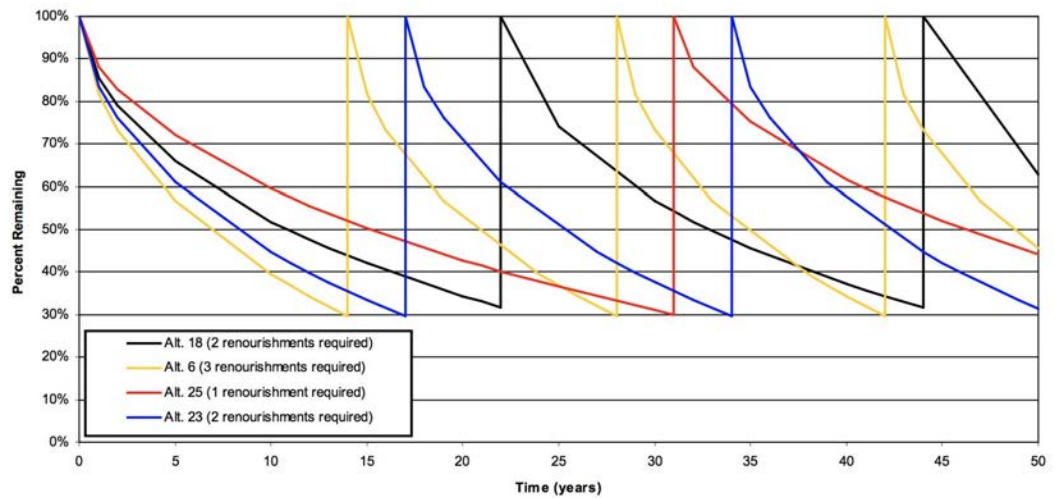
Sand exits river every spring

Complex, not understood pathways offshore





Beach Renourishment Requirements



**Figure ES-4
Recommendation**

**Beachfill – 3,250 Feet Long
365,000 CY – Selected Plan (6)
225,000 CY – Federally
Implementable Plan**

**750 LF Stone
Spur Jetty
(Both Plans)**



March, 2009



Before replenishment

June, 2019

After replenishment

