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Legal Issues with Beach Nourishment and Coastal Zone Management

Jim Selegean, Ph.D., P.E.
Detroit District

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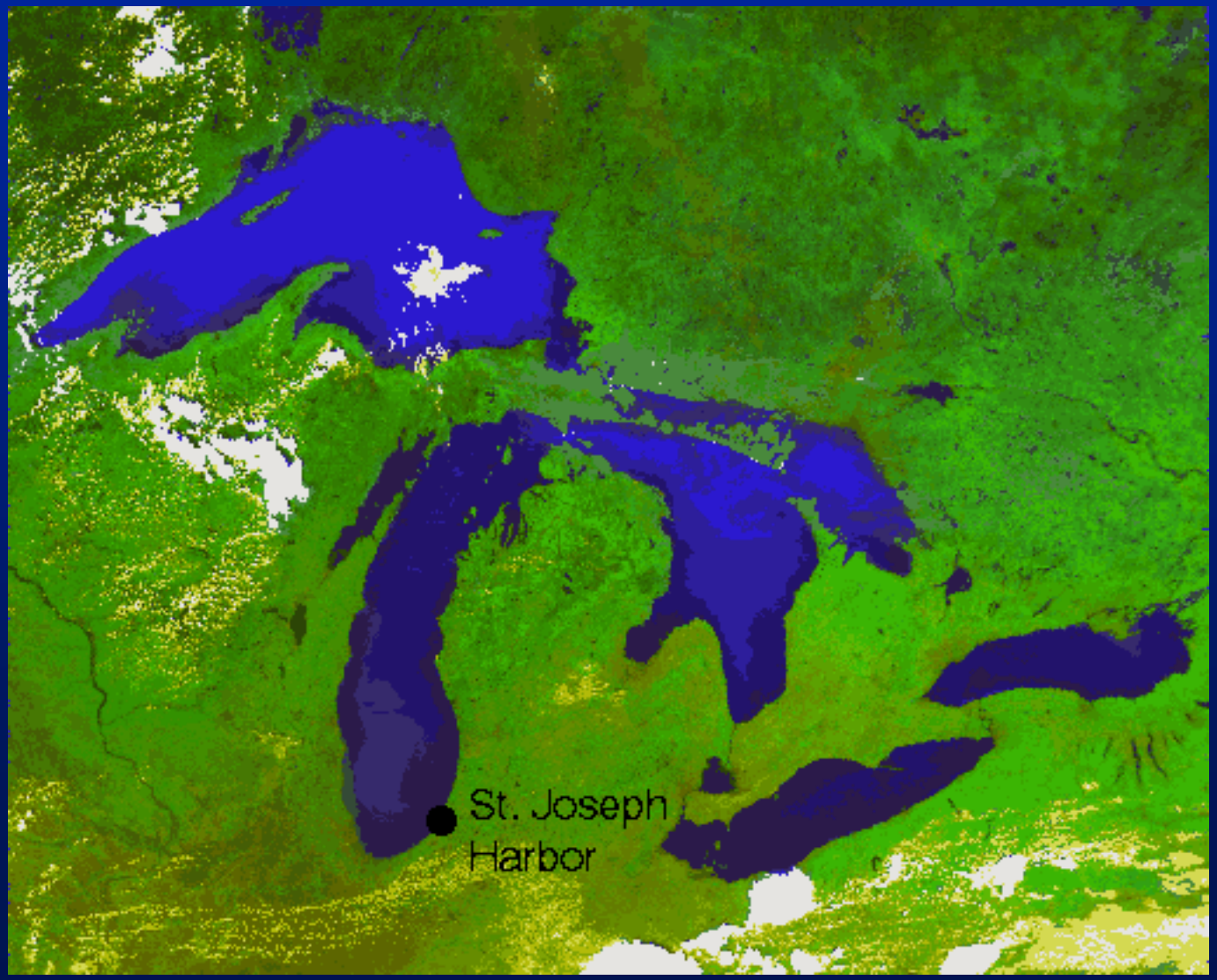
St. Joseph Site Map



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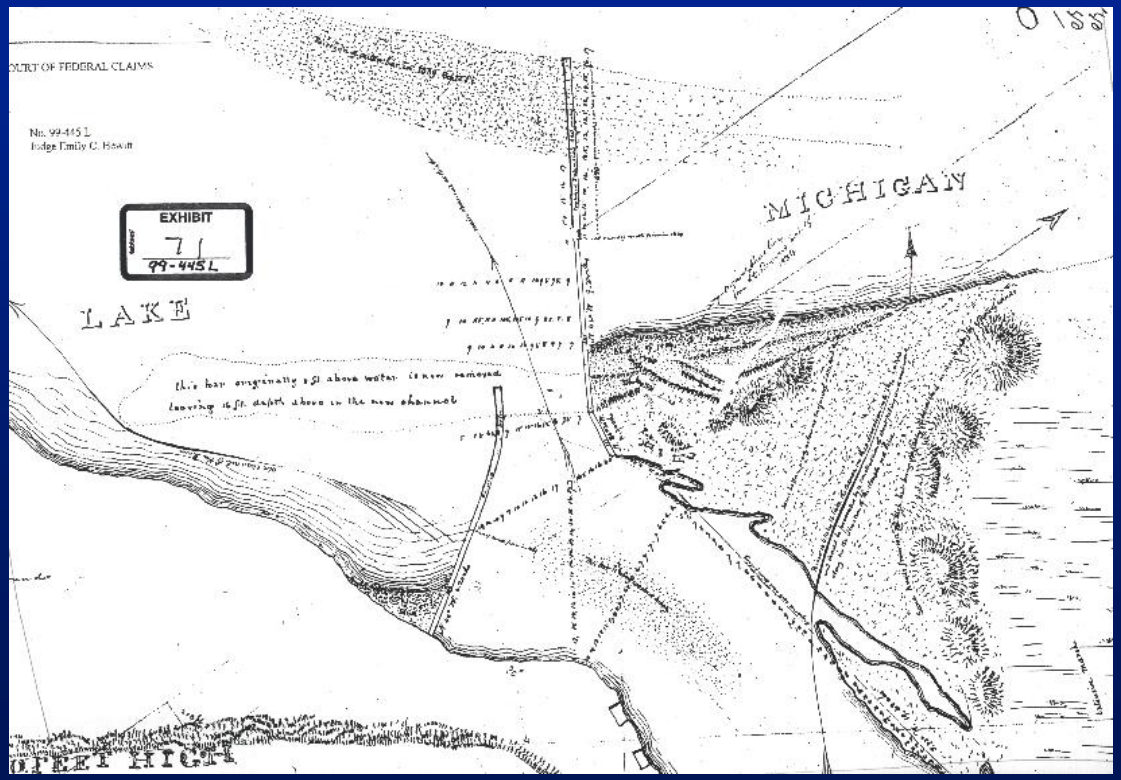
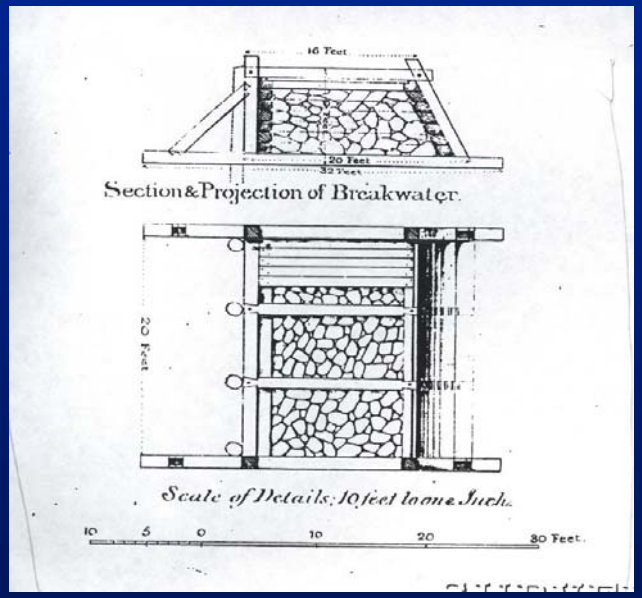
Early St. Joseph Harbor





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Numerous Jetty Extensions

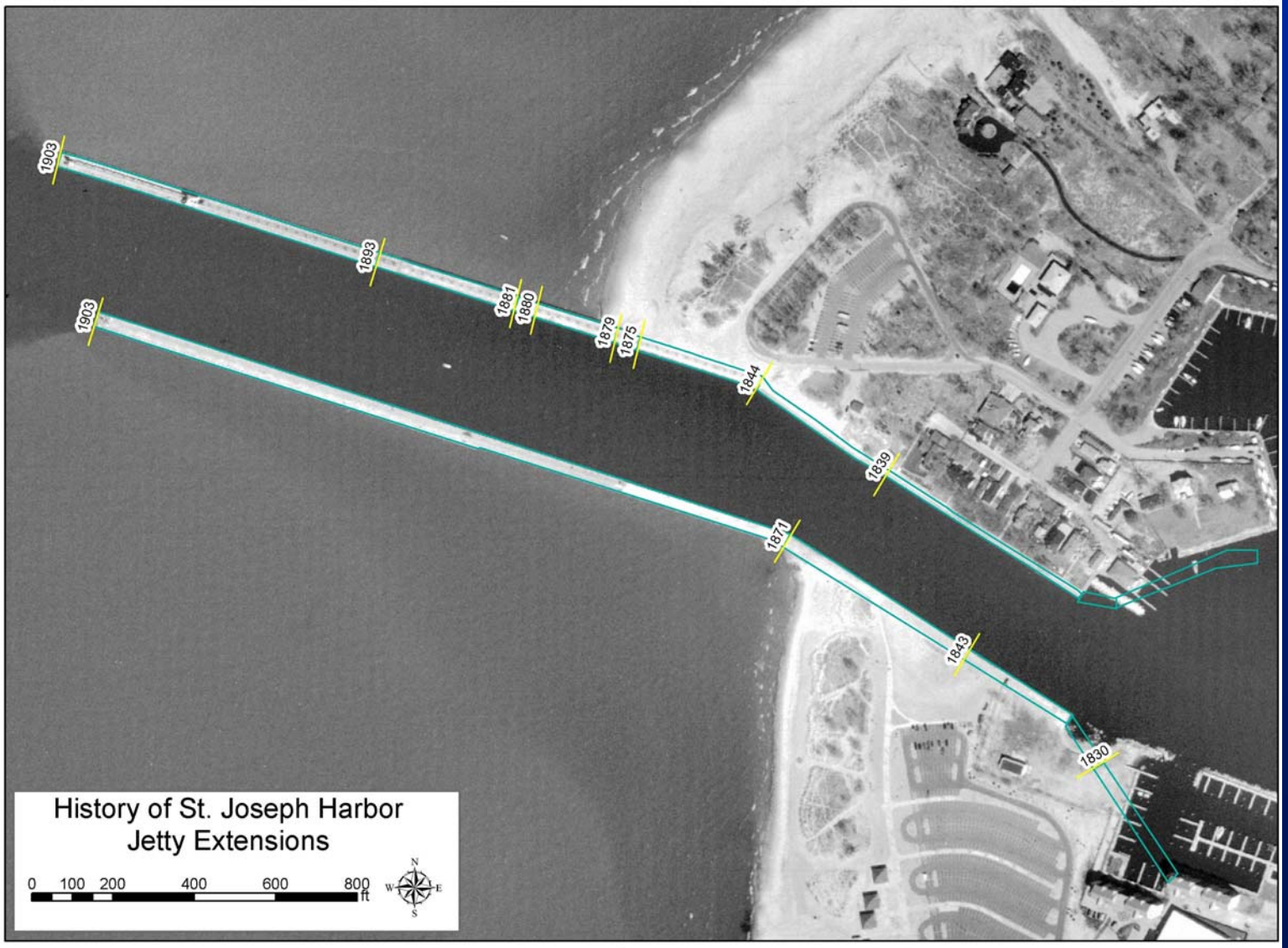

Figure 16.1(iii) History of St. Joseph harbor jetty extensions.

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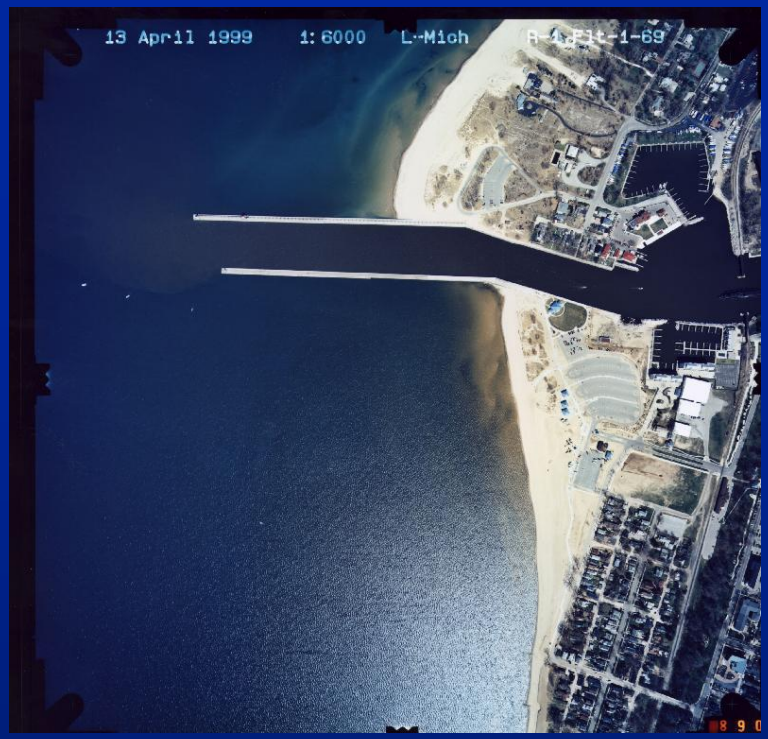
Modern St. Joseph Harbor



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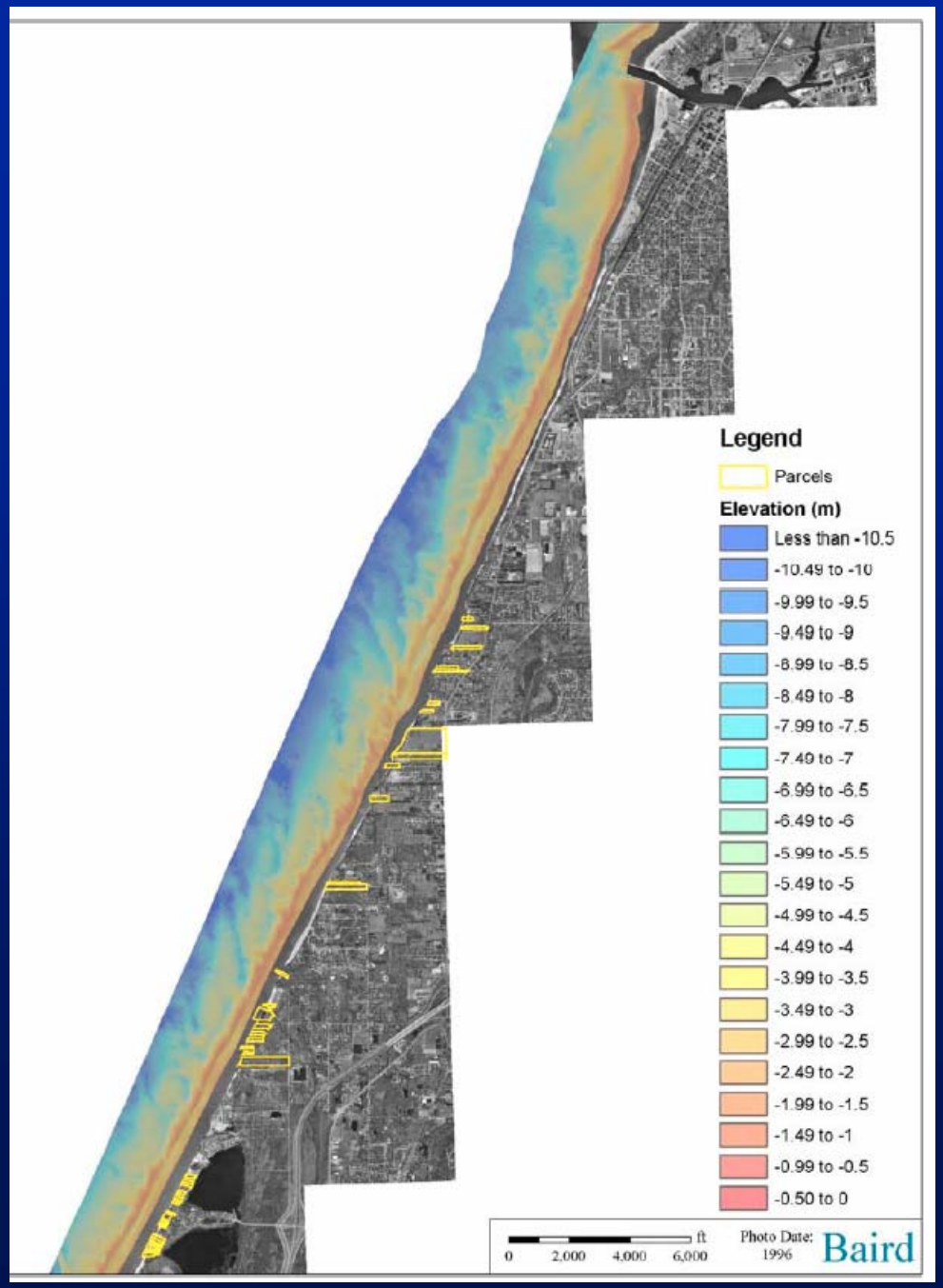
The Problem



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1973 Section 111 Study

- Stated that the Corps was 30% as fault for the erosion to the south of St. Joseph;
- The harbor blocked 110,000 cy/yr of sand;
- Very poor understanding of cohesive shorelines and their response to sediment supply;
- 1971-1991: Placed 90,000 cy/yr

  1991-Present: Placed 45,000 cy/yr
-

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Suit History

- 1999 - Complaint filed
- 2001 - Dismissed on Statute of Limitations;
- 2002 - overturned by appeals court
- 2003 - Supreme Court refuses to hear case and sends it back to Court of Claims
- 2003 - Plaintiffs files a Motion for Summary Judgment
- 2004 - Judge denies Motion for SJ
- Today – exchanging expert reports. Will likely go to trial within 6 months.

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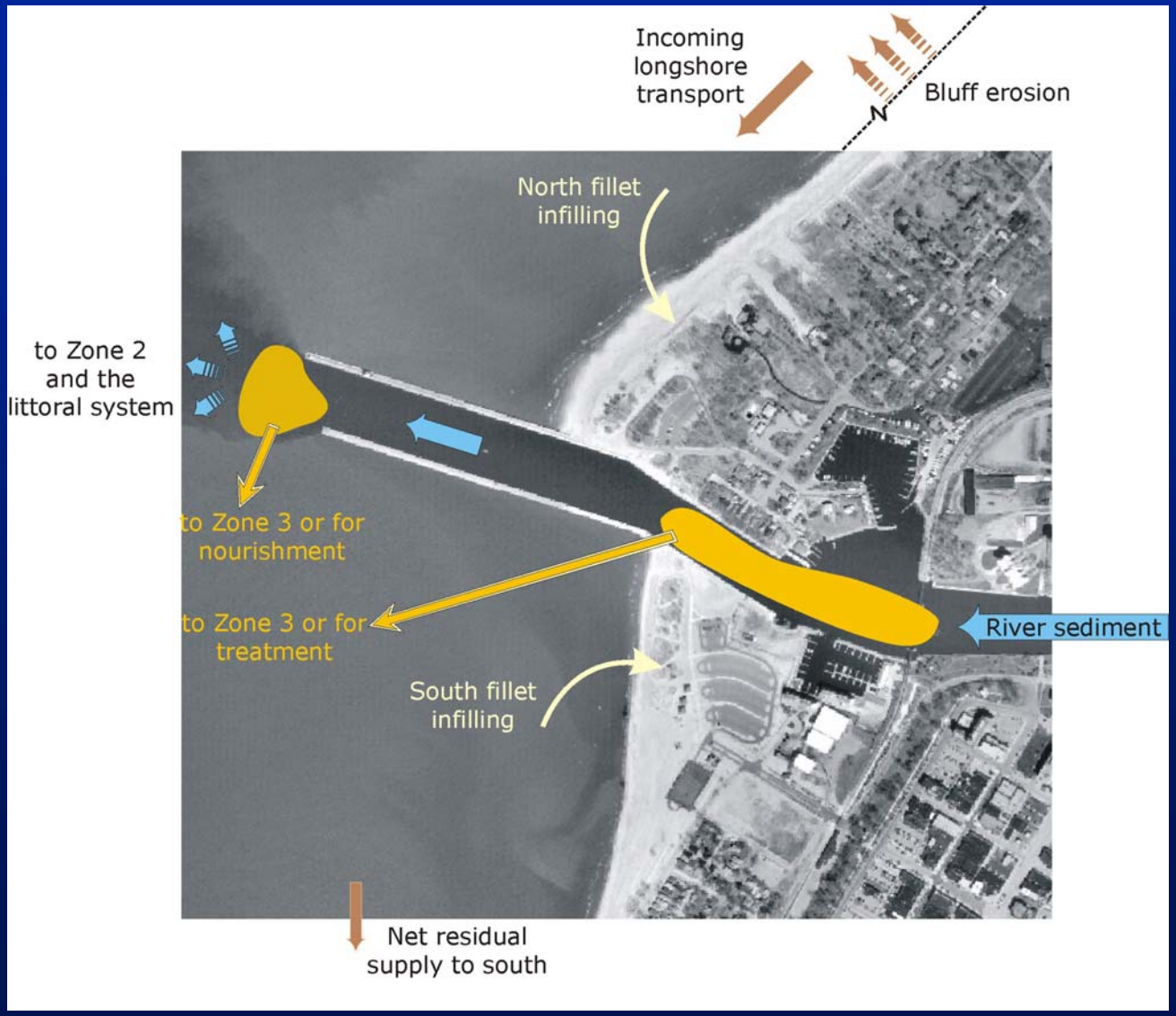
Science to Support our Case

Sediment Budget



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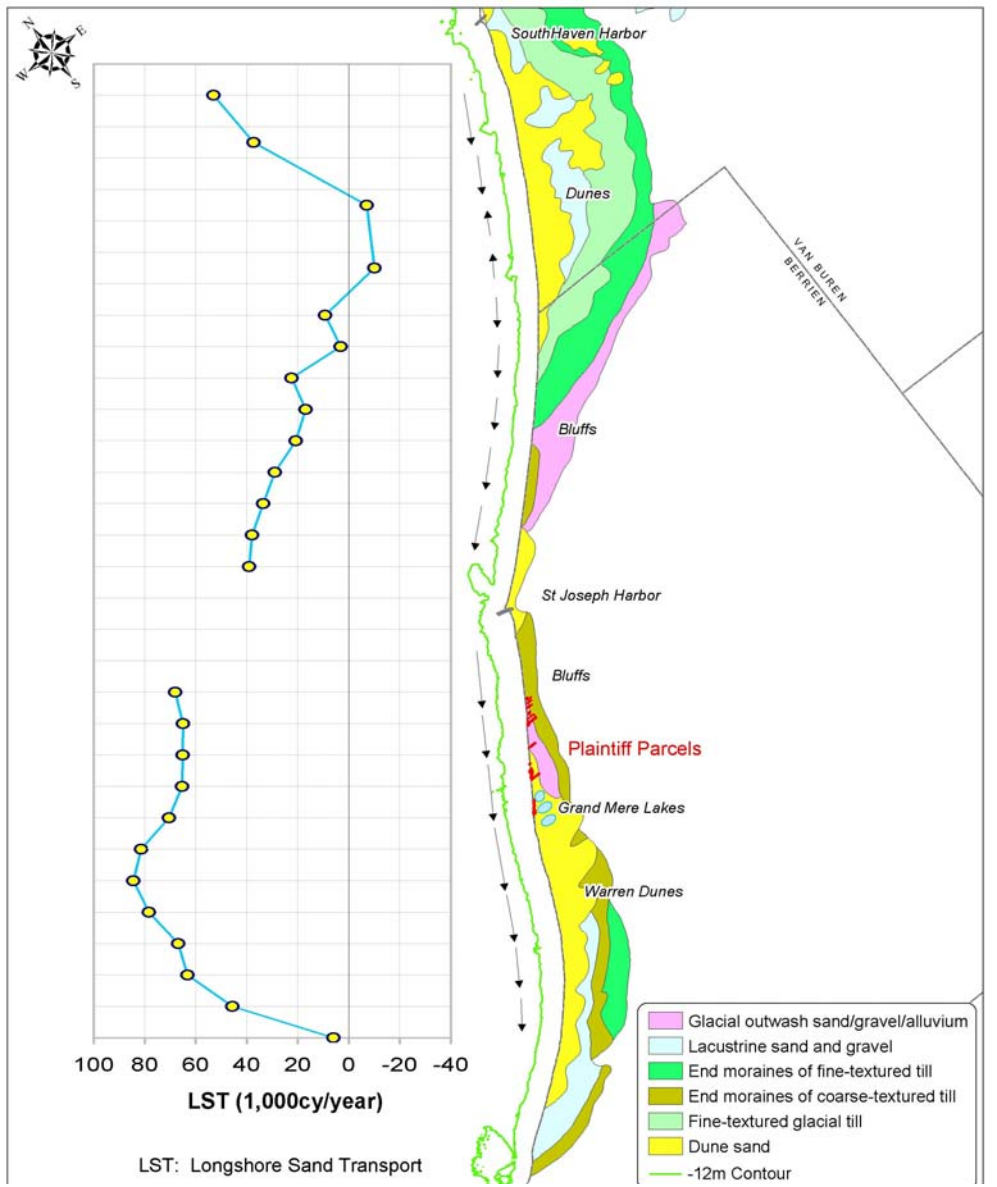
Science to Support our Case

Longshore Transport Rates

40,000 cy/yr



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Longshore Transport Rates

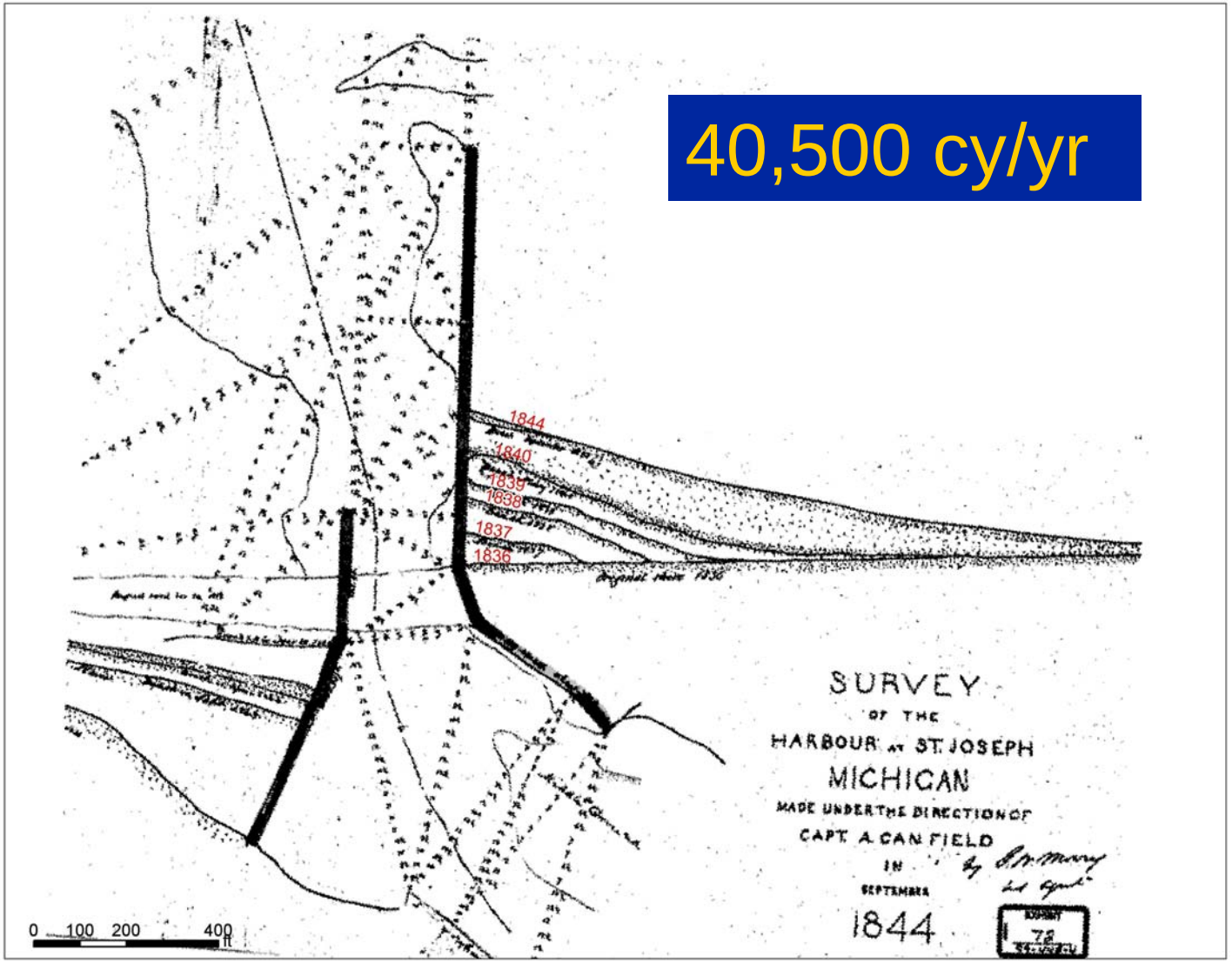

Figure 7(iii) Fillet beach changes from 1836 to 1844

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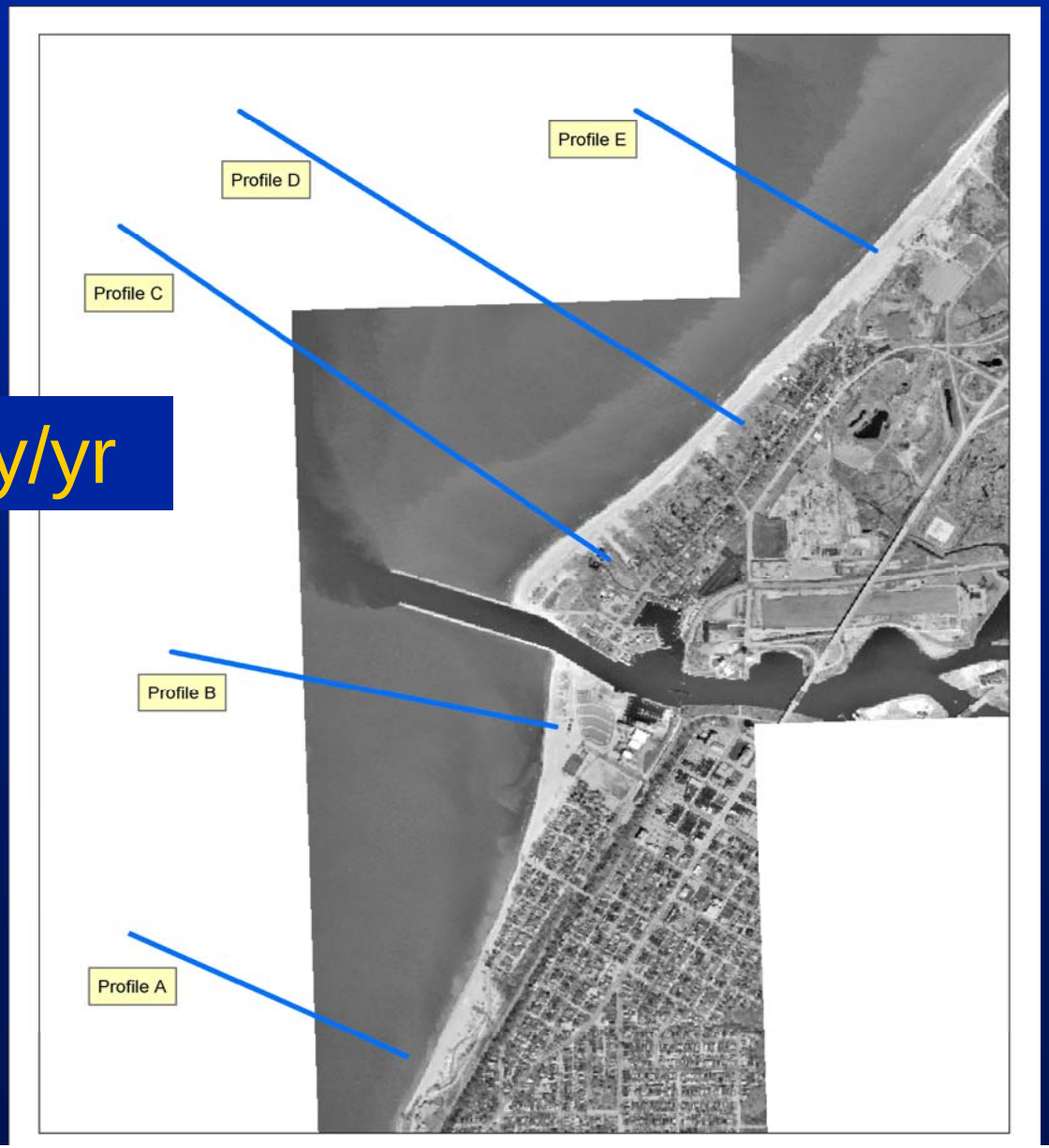
Longshore Transport Rates



48,000 cy/yr

Fillet growth + outer dredging, 1960-1996

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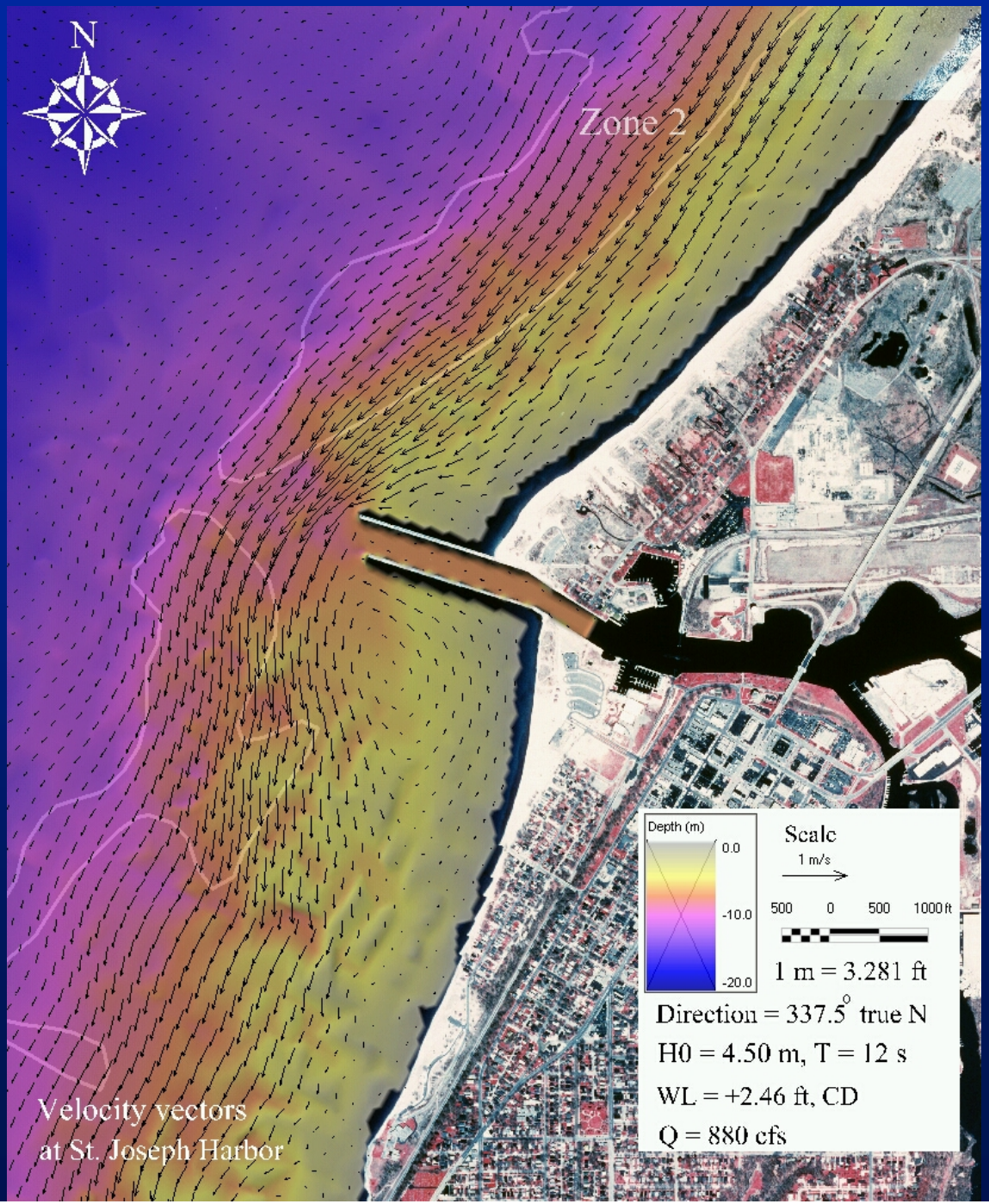
Longshore Transport Rates

Volume Eroded from Bluffs and Lakebed 1830-2002

50,000 cy/yr

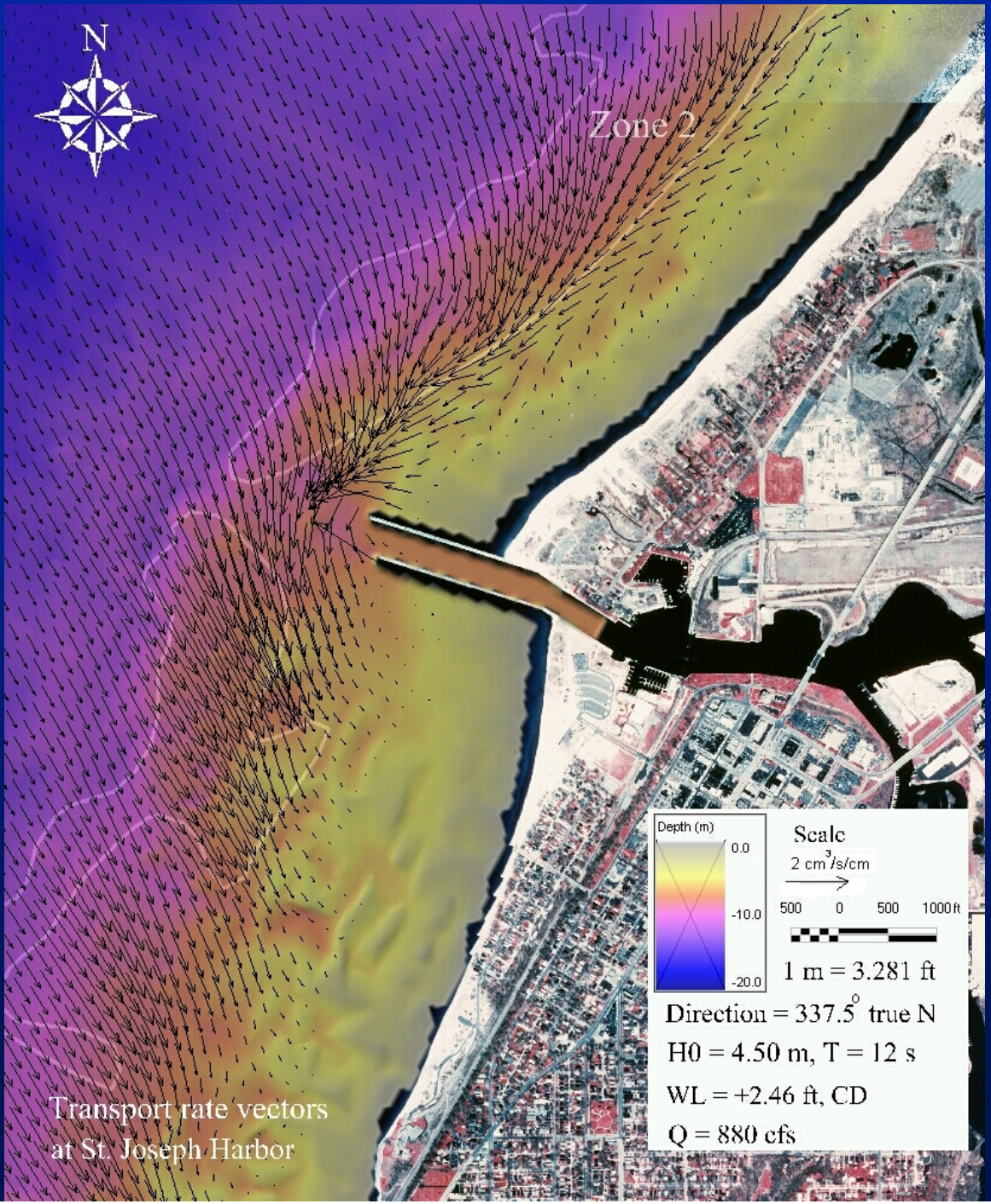
Longshore Current

North-West Waves



Sediment Transport Pathways

North-West Waves



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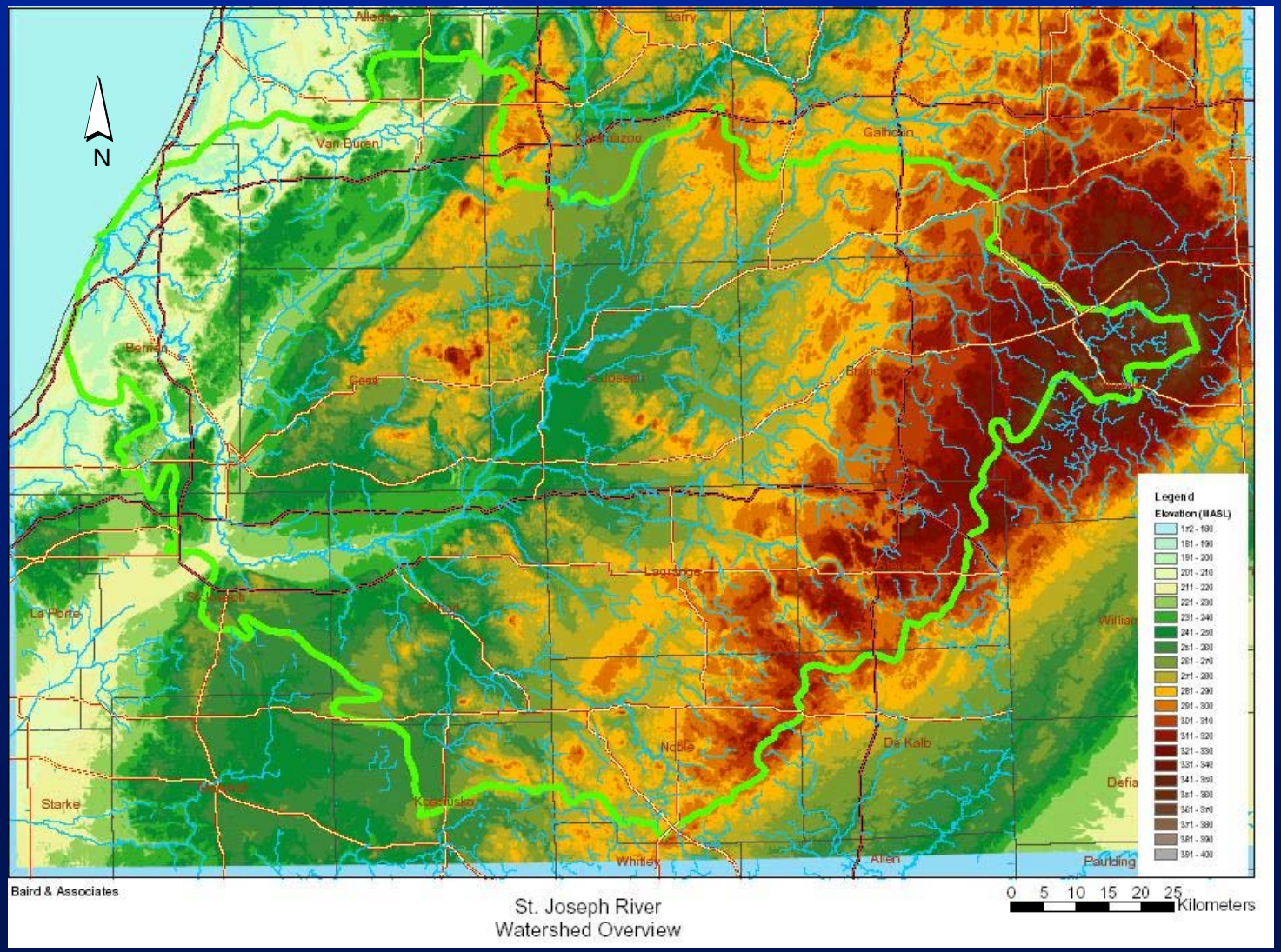
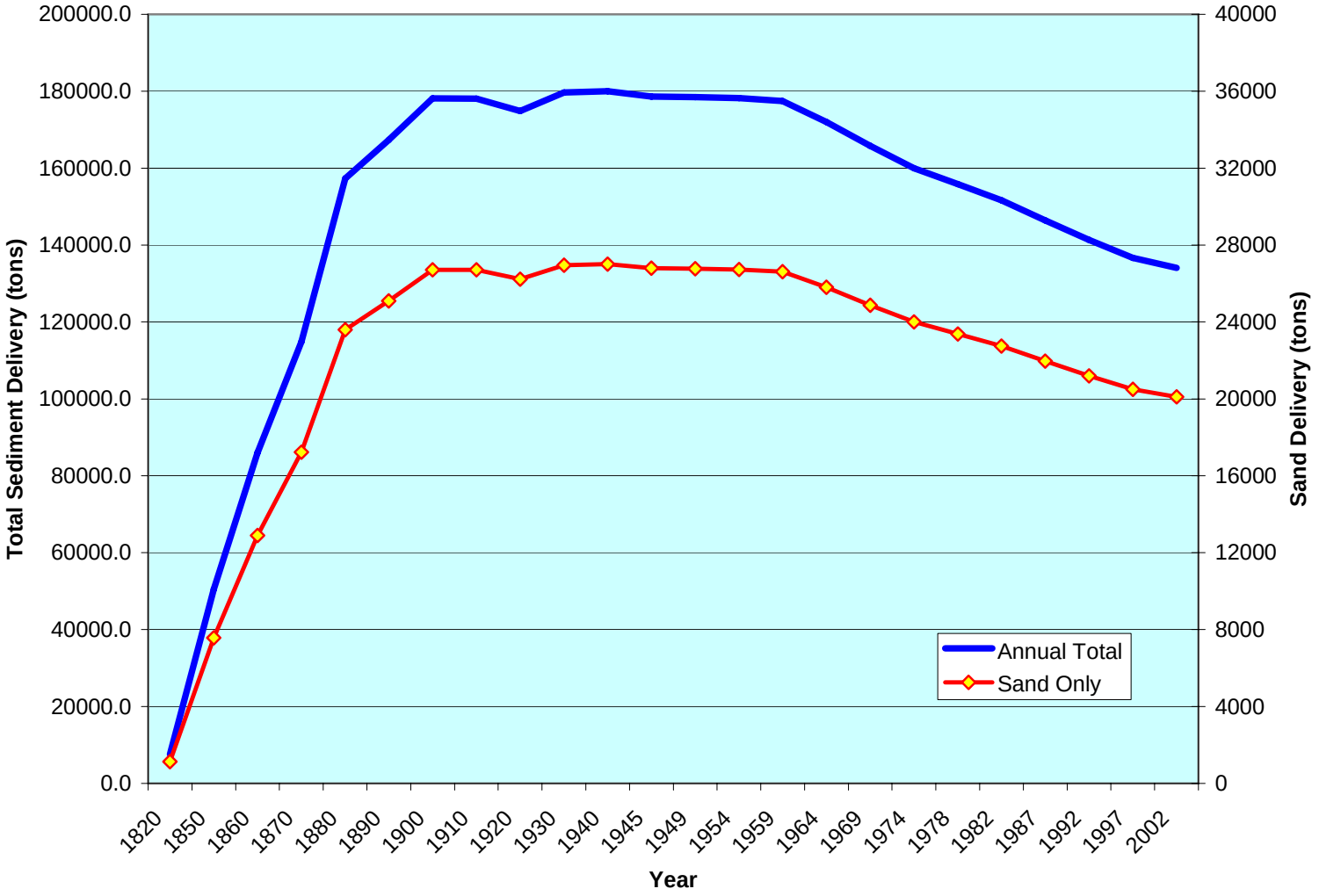
Watershed Modeling for Sediment Yield

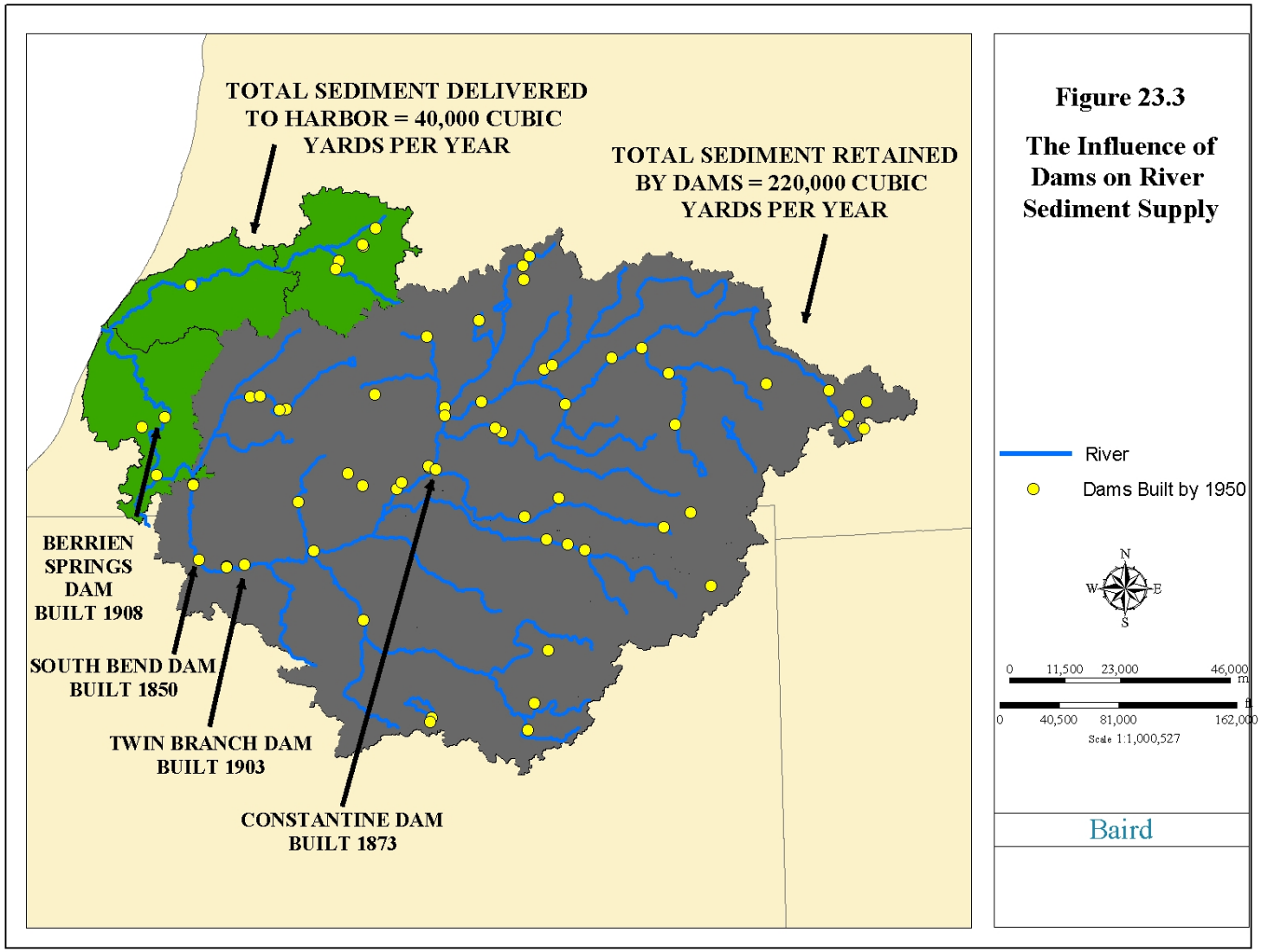


St. Joseph River
Watershed Overview

Sediment Delivery Estimates



Effect of Dams on Riverine Sediment



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Influence of Dams on Sediment Delivery

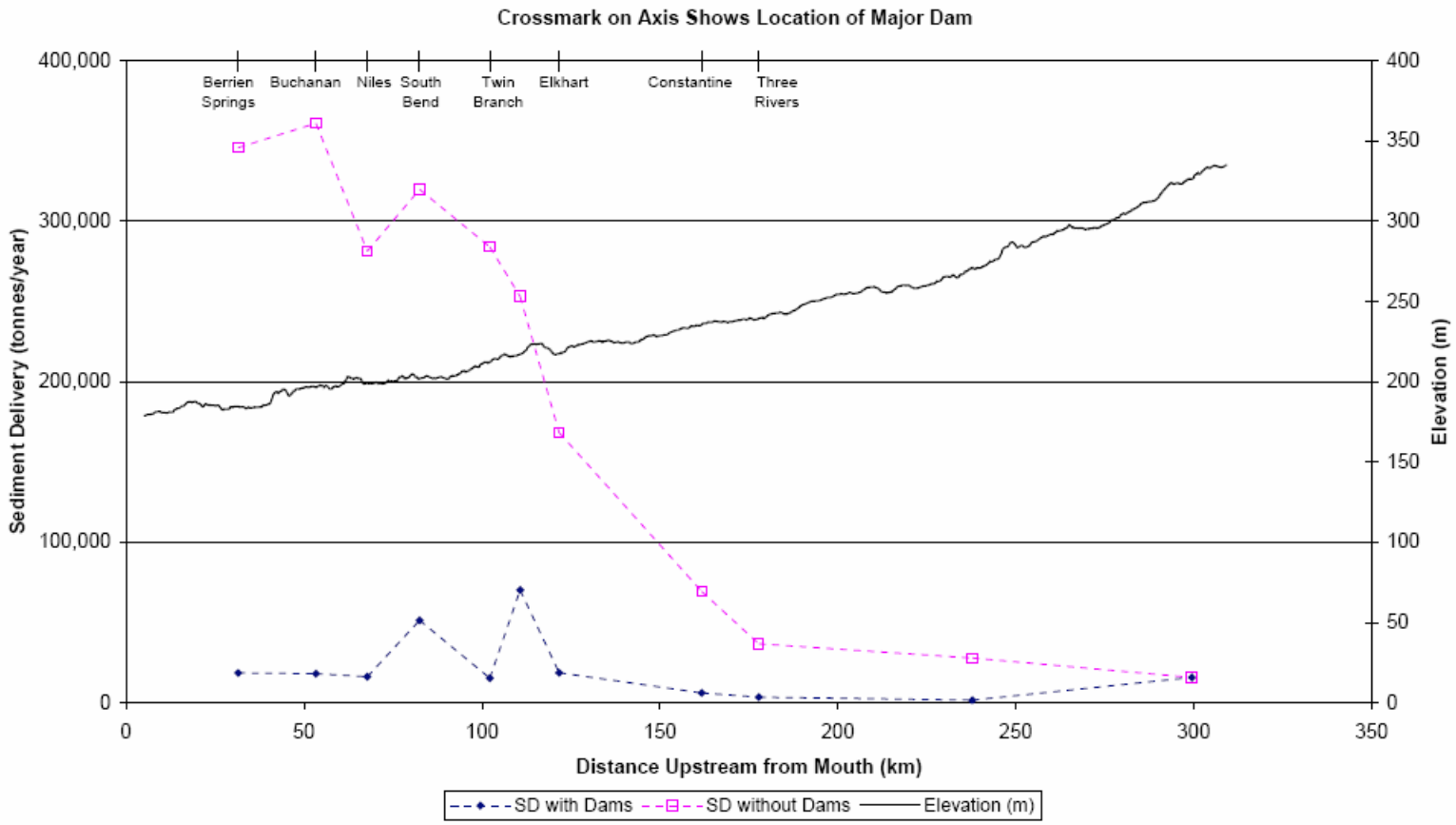

Figure 3.27 Effect of Dams on Watershed Sediment Delivery

~50% of Riverine Sand is Trapped with Inner-Harbor Fines

Sediment Budget Over Time

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Table 4.4 Long-term Sediment Budget Downdrift of St. Joseph Harbor (Sand Only)

Values in 1000 cuy/year unless otherwise stated	i	ii	iii	iv	v	vi		vii	viii	ix(a)	ix(b)	x	xi	xii	xiii	xiv	xv	xvi	xvii	xviii	xix	xx	xxi(a)	xxi(b)
						Dredging																	Impact of Harbor and Operations on Erosion of Downdrift Shores (negative is sand loss, positive is gain) [17]	
	Net Updrift supply [1]	North fillet infilling [2]	Total sand supplied by the river	River sand reaching the lake [3]	Updrift supply bypassing into the channel & downdrift [4]	Outer channel (a) [5]	Inner harbor (b)	Capital dredging (apparent volume)	Nourishment [6]	Zone 2a accumulation (apparent volume) [7]	Zone 2b accumulation (apparent volume) [7]	Zone 3 accumulation (apparent volume) [7]	Total sand delivered to downdrift [8]	Direct estimate of average total lakebed & bluff erosion [9]	Estimated potential outgoing LST at the downdrift limit of plaintiffs' properties [10]	Expected total lakebed and bluff erosion based on outgoing LST [11]	Sand trapped upstream of dams [12]	Shoreline protection (% of total) [13]	Average bottom slope	Direct estimate of average total lakebed and bluff erosion without shore protection [14]	Expected total erosion without shore protection [15]	Expected total erosion without shore protection and dams [16]	From Column xviii	From Column xix
Before 1836																								
1836 to 1875																								
1876 to 1903																								
1904 to 1945																								
1946 to 1969																								
1970 to 1991																								
1992 to 2005																								

1 Determined based on initial and long-term north fillet accretion rates and bluff erosion volumes north of the harbor from Benton and Hagar Counties. Average of the estimated range of from 40 to 60.
2 Determined based on fillet volume estimates using shoreline positions and profile/bathymetry surveys.
3 Estimated using land coverage info with SWAT model of watershed and RMA2/SED2D model of lower river and represents annual average volume of sand delivered by the river to the littoral zone.
4 Estimated based on HydroSed results and experiences of similar harbors.
5 Estimated average values of outer channel dredging based on dredge records. For the 1836 to 1875 period this was estimated as there was no dredge record.
6 USACE data.
7 Estimated based on 1907-1945-2001 lakebed survey comparisons (apparent volume means fine+sand).
8 Total sand delivered to downdrift calculated by adding columns iv, v, vi(a), viii plus half of columns ix(a) and ix(b) (because the figures in these two columns indicate the apparent volume).
9 Direct estimate bluff and lakebed erosion volumes calculated from historic bluff line and bathymetry analysis. For the period before 1836, a background erosion rate of 0.5 m/yr was assumed. The value for the 1836 to 1875 period was interpolated.
10 LST rate at the south end downdrift of plaintiffs' area estimated based on initial calibrated COSMOS results modified to include slope effect for periods after 1900.
11 Expected bluff and lakebed erosion volumes calculated by subtracting total sand delivered to downdrift (xi) from the estimated potential outgoing LST (xiii).
12 Estimated from the SWAT model.
13 Approximate percentage of shoreline protection in total length of 13,500 m (8.4 miles) from the harbor to the south end of plaintiffs' area as visible in the airphotos.
14 Excess outgoing LST due to steeper slopes subtracted from average bluff and lakebed erosion volume (xii).
15 Total sand delivered to downdrift (xi) subtracted from the pre-harbor potential outgoing LST (205) assuming that without shore protections the outgoing LST would have stayed at its pre-harbor level.
16 Expected total erosion without shore protection (column xix) minus half of the volume trapped by dams (column xv) assuming that only half of the total trapped volume would have reached the lake.
17 Difference between before 1836 value and the value of each period for column xviii and column xix.

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Beach Nourishment

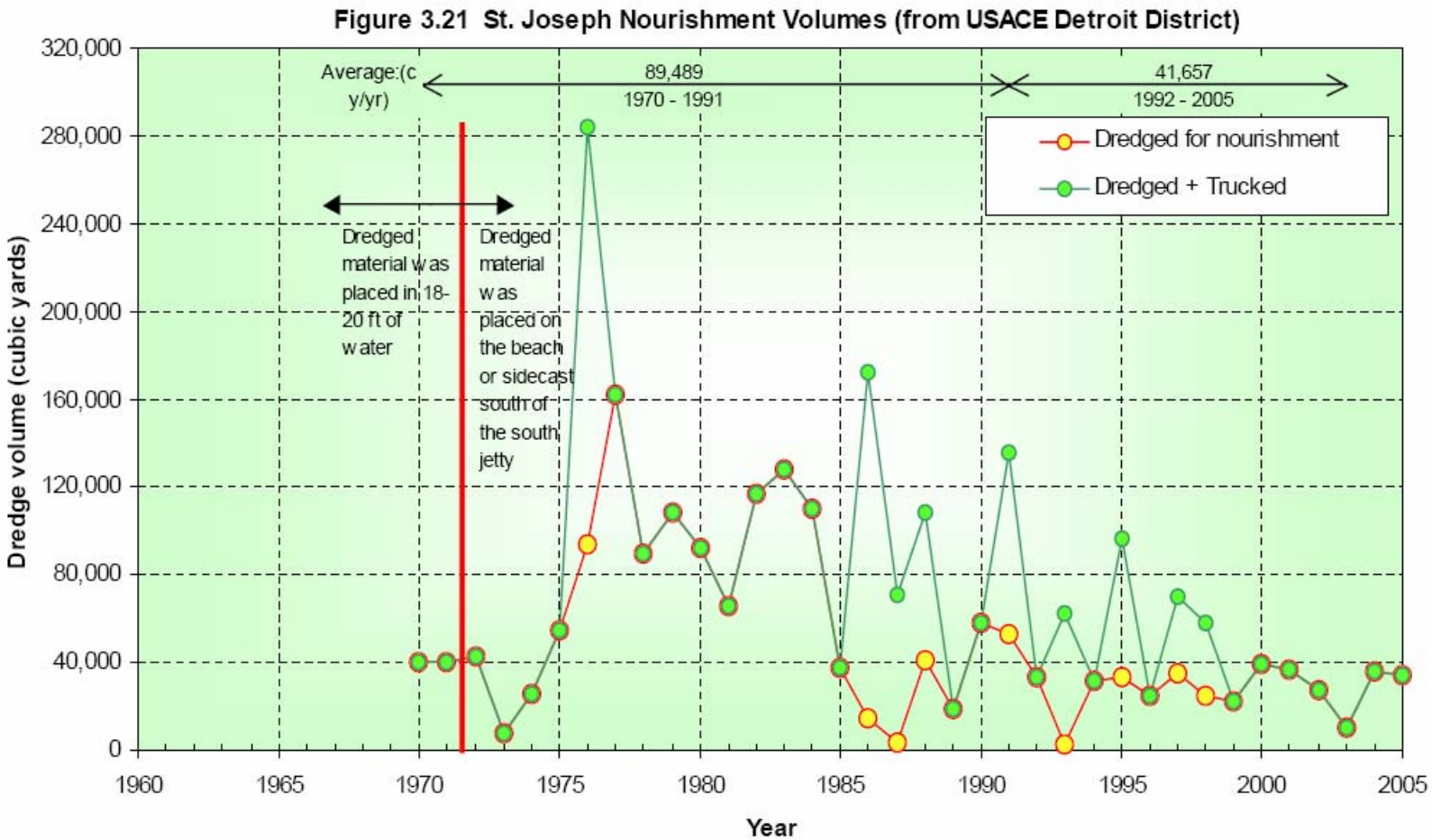

Figure 3.21 St. Joseph Nourishment Volumes (from USACE Detroit District)

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Sandy vs Cohesive Shore

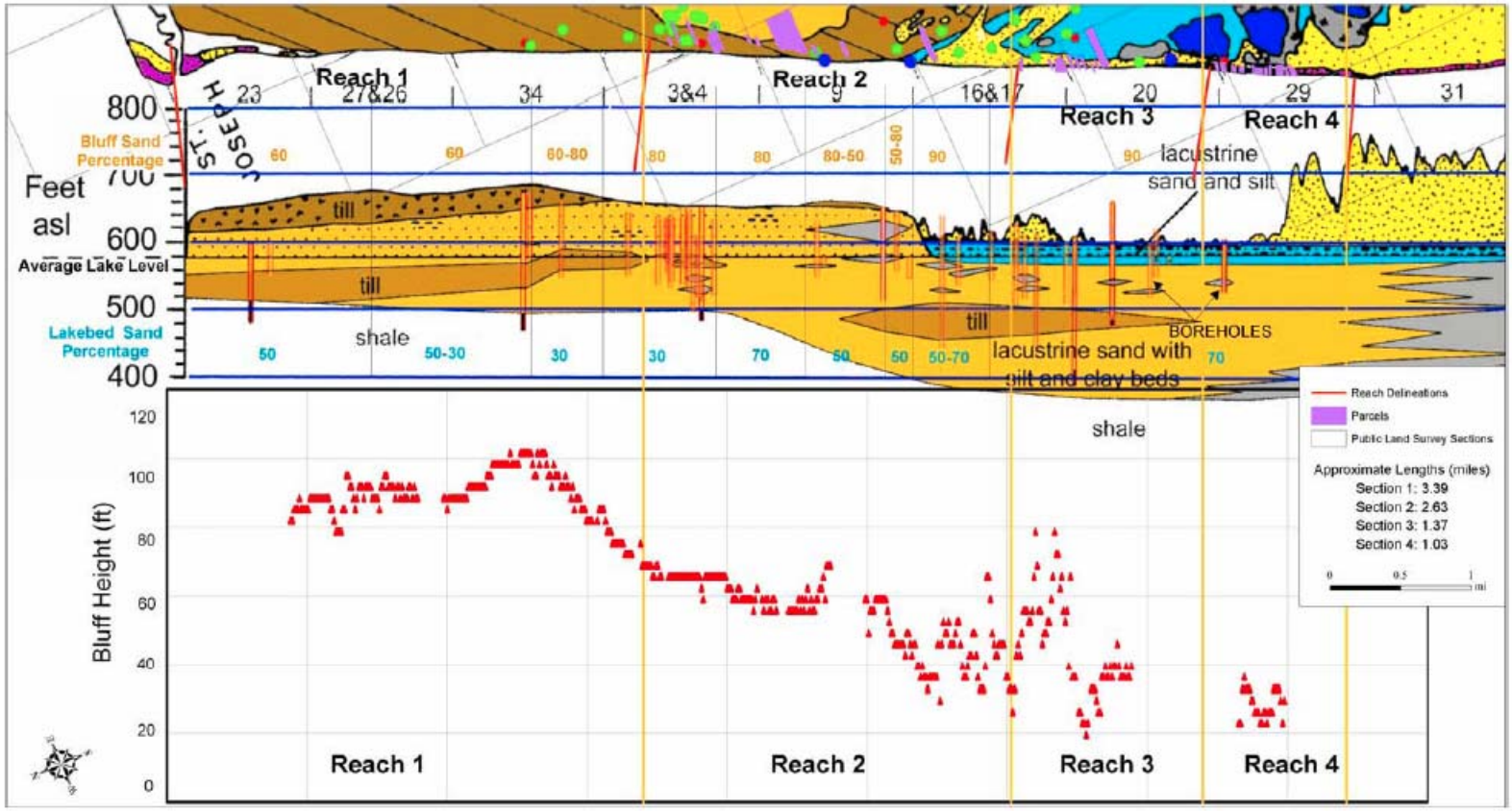

Figure 4.1 Stratigraphy with Bluff Heights

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Sandy vs Cohesive Shore

Sandy Shores

- Fully mitigated since 1970
- Pre-1970 Plaintiffs show no signs of increased erosion

Cohesive Shores

- Issue is complicated

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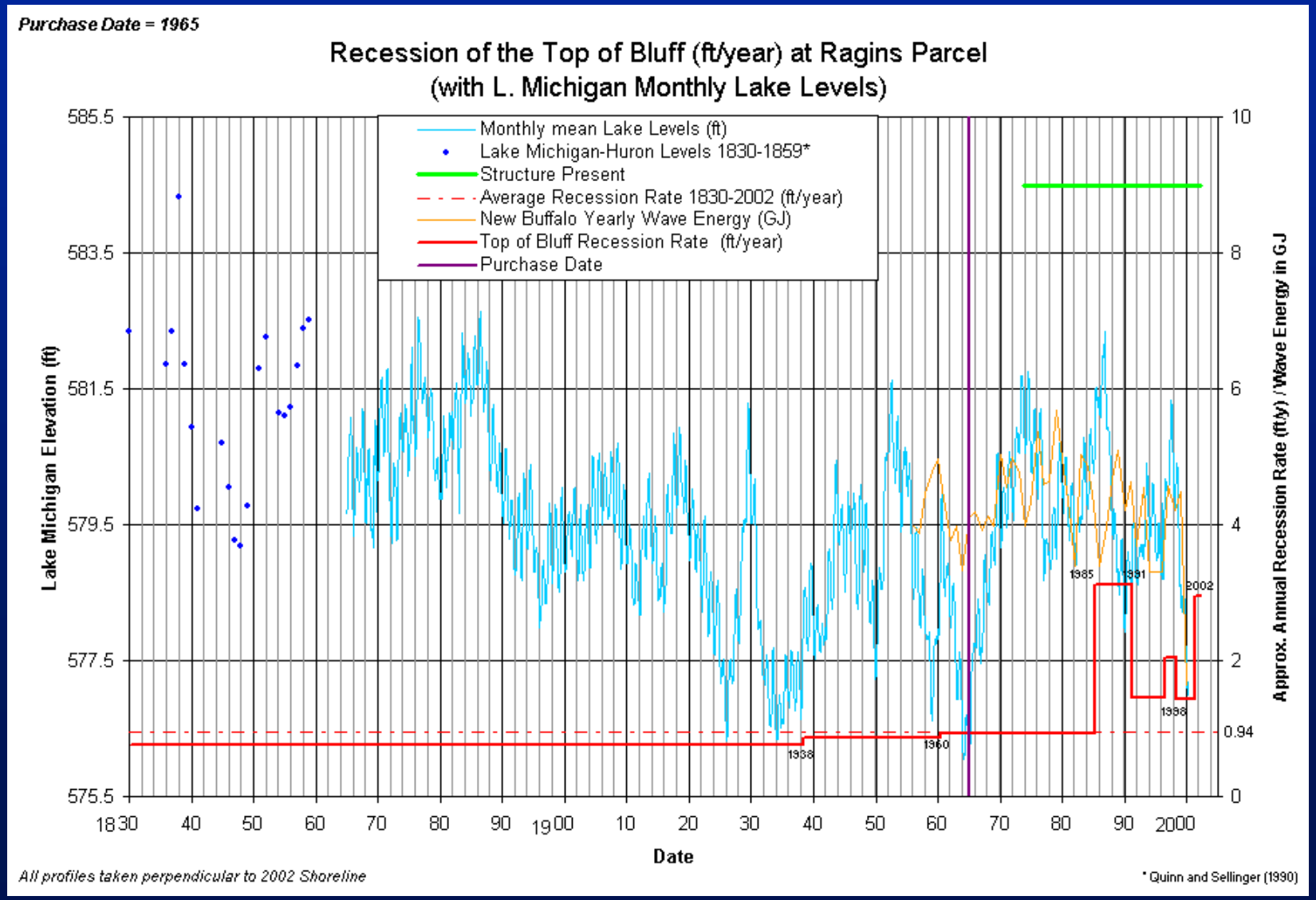
Pre-1970 Plaintiffs



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Sandy vs Cohesive Shore

Sandy Shores

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Cohesive Shores

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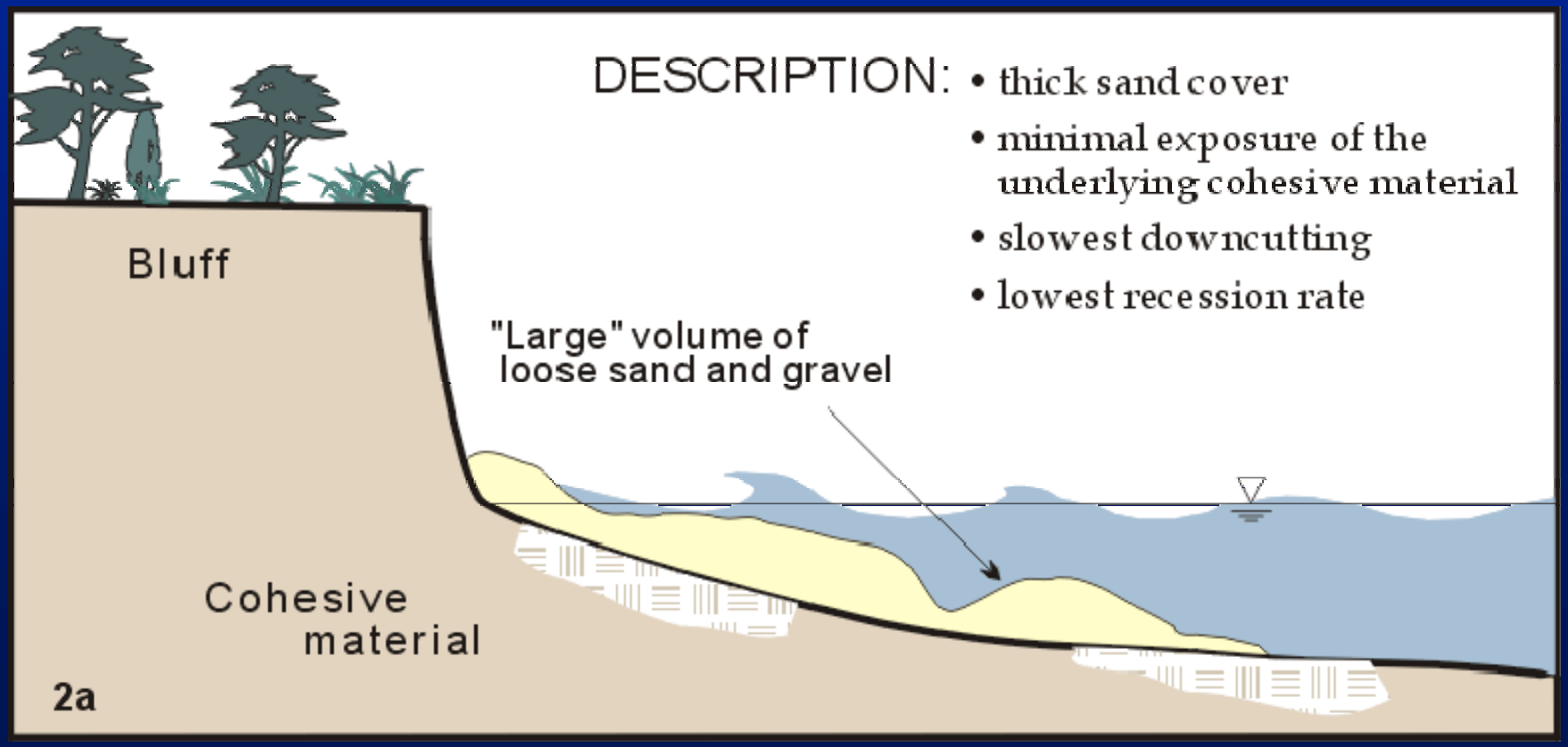
Sand Supply and Lake-bed Downcutting



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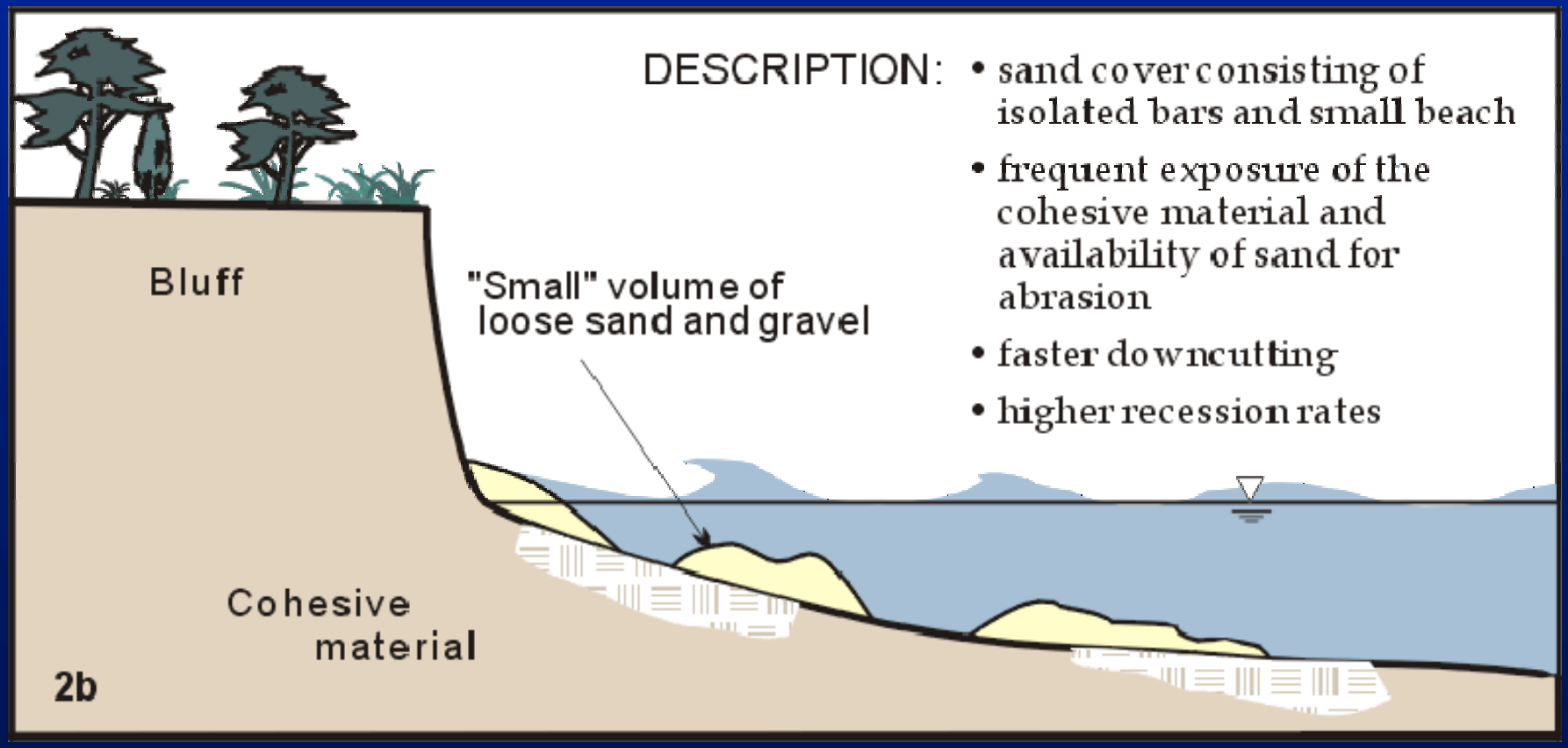
Sand Supply and Lake-bed Downcutting



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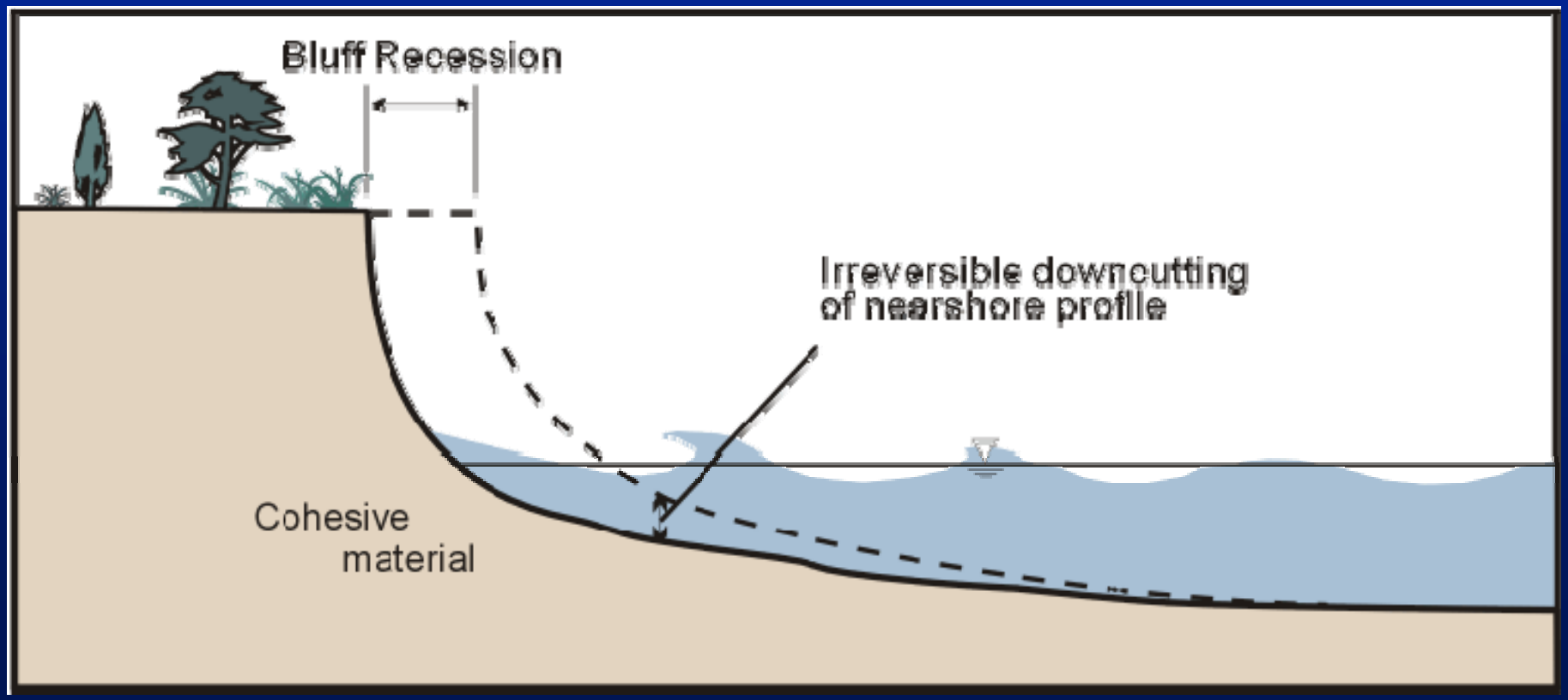
Sand Supply and Lake-bed Downcutting



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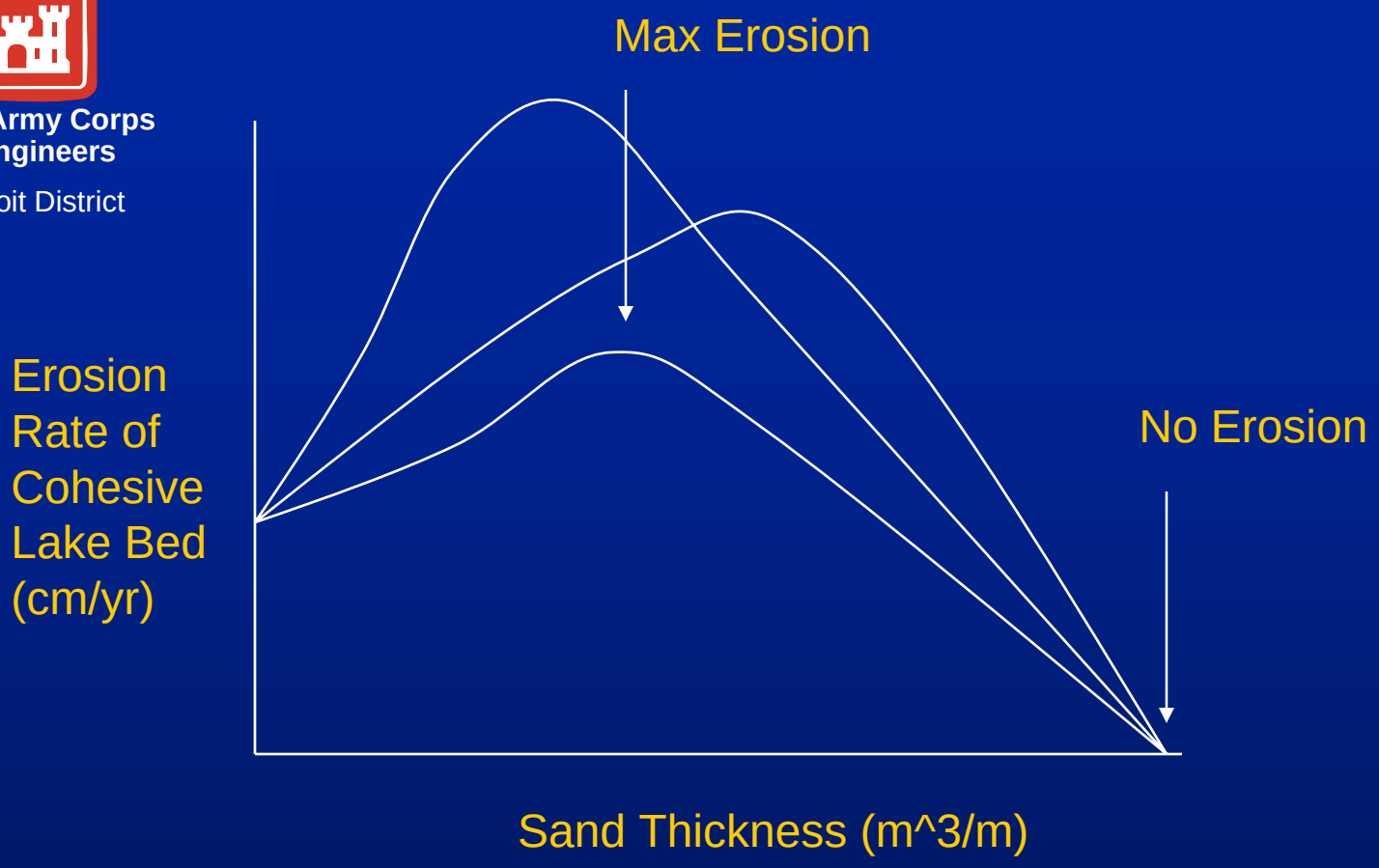

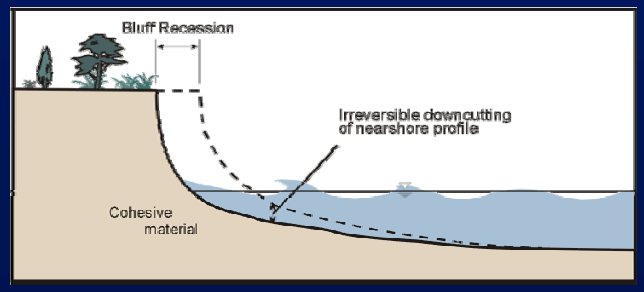

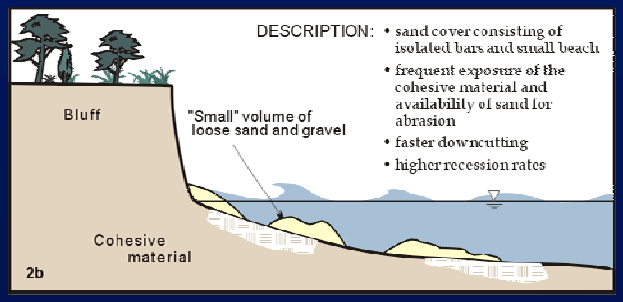

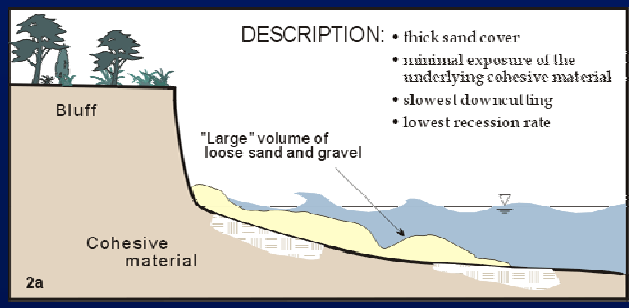

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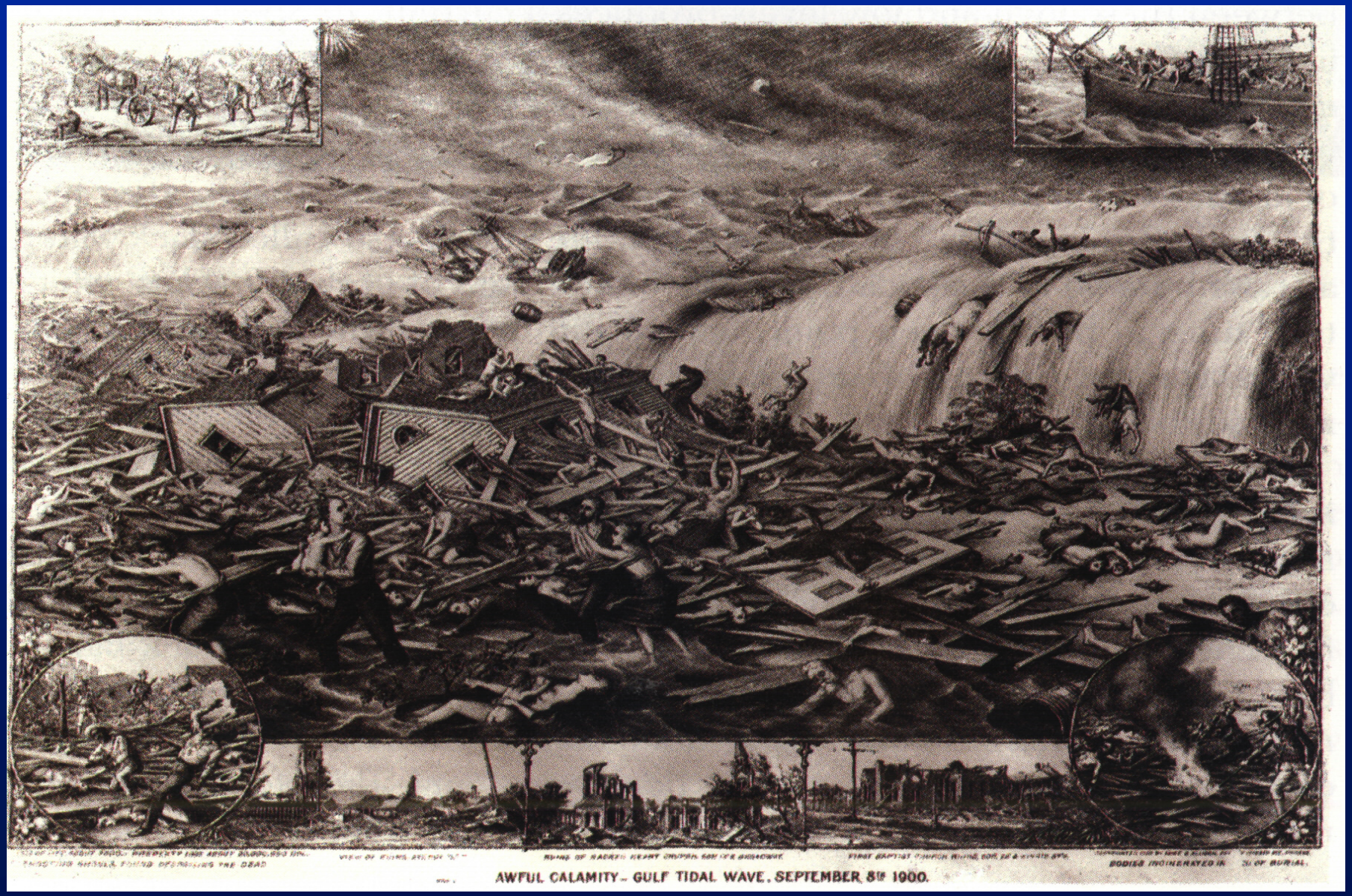
Summary

- Beach Nourishment and Statute of Limitations

- Responsibility for Riparian Shore Protection

The End