Finding Local Issues for Urban Students

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University of Houston

Presentation given at:
Urban Students, Urban Issues Workshop
Brooklyn, NY
March 9, 2008

Focus on Houston

- **Rivers:**
  - geologic evolution of the floodplain
  - effects of flooding on people
  - effects of people (land use) on flooding
- **Coastlines:**
  - geologic evolution of the coastal zone
  - effect of man-made structures
  - effects of storms and hurricanes
- **Groundwater:**
  - effects of local geology
  - role in causing subsidence
  - pollution, including super fund sites

Questions to be asked by students

1) "How do scientists know that?"

Science as Inquiry*

2) "Why should I [the student] care?"

Science in Personal and Social Perspectives*

** National Science Education Standards*

Some Science Education Standards

- ***Science in Personal and Social Perspectives:***

  Students must understand the relevance of science to:

  - **Society**: e.g. global warming, earth resources, taxes
  - **Local Community**: e.g. flood mapping, regional air quality, land use planning
  - **Individual**: e.g. price of gasoline, purchasing a house, hurricane preparedness, taxes, environmental quality

- ***Science as Inquiry:***

  Students need to develop the ability to conduct and understand scientific inquiries, emphasizing critical thinking and problem-solving skills.

HINT!!

Use articles from local newspapers as talking points/ topics for discussion!

3 beach houses in eye of legal storm

Photos by Carlos Javier Sanchez / Special to the Chronicle

The Texas General Land Office has filed a lawsuit against three beach house owners saying their homes are now on submerged land in the Gulf and must be torn down.

Lawsuit seeks homes' removal

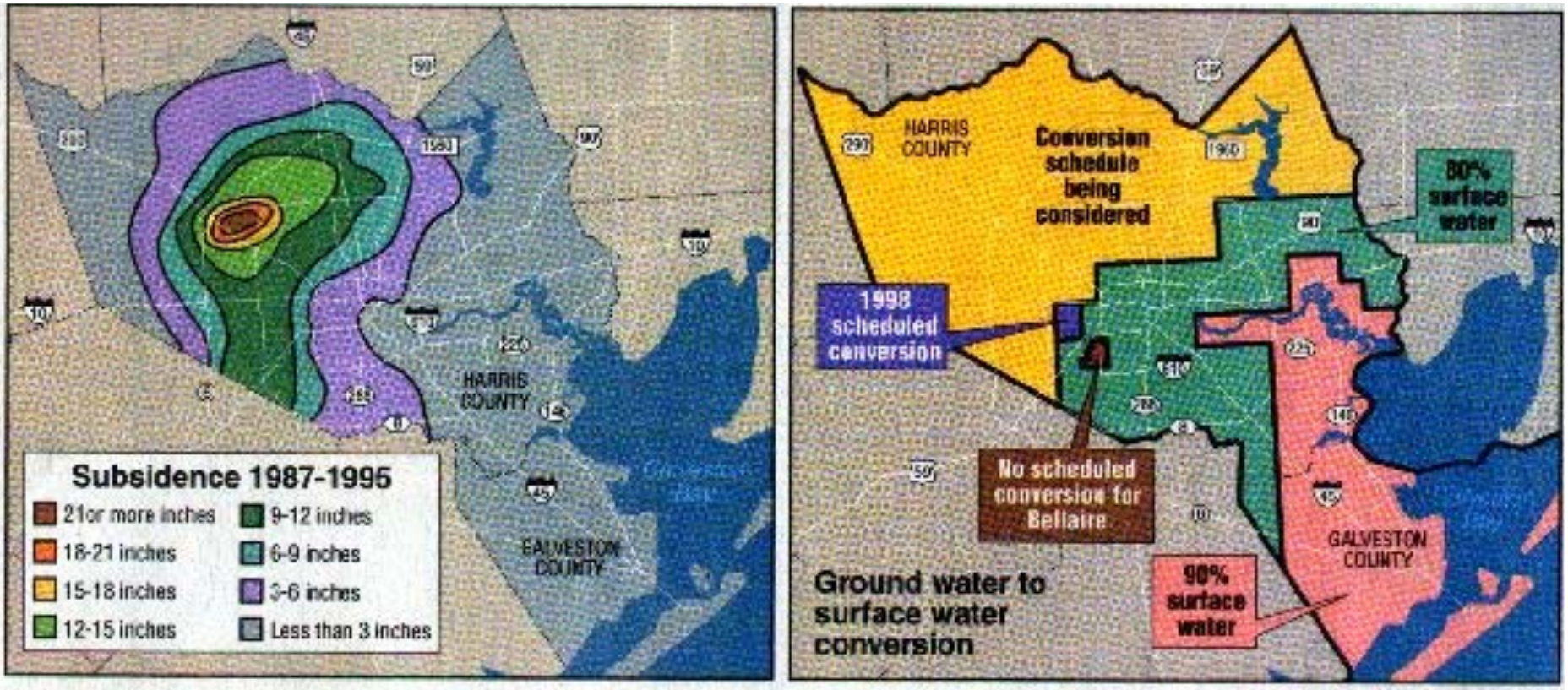
Owners deny they're on state land

'This project will be a tourist attraction.'

Buster Dean / Chronicle

Sunbathers Gail and Patrick Sinclair of New Orleans enjoy the 80-degree weather on Galveston's beach Tuesday while a pair of bulldozers move a 500-foot pipe into place under a beach replenishment project. When completed early next year, the $5.9 million project will create a new beach about 51 city blocks long and 100 feet wide.

Project turning Isle dreams into a beach



B.C. Cren/Chronicle

That sinking feeling hits northwest Houston

Subsidence causes 1.75-foot loss in 9 years

By TODD ACKERMAN
Houston Chronicle

Northwest Houston has supplanted southeastern Harris County and Galveston County as the fastest-sinking land in the coastal area, according to a national survey.

The survey shows that the Jersey Village area just southwest of FM

in the last nine years, the most since the Ship Channel area was subsiding at a rate of about a half-foot a year in the late '60s and early '70s.

"It's not quite as critical as those low-elevation areas were, but it's a concern," said Ron Neighbors, general manager of the Harris-Galveston Coastal Subsidence Dis-

would not only exacerbate subsidence and flooding in that area, it would lead to problems again where our efforts have currently halted subsidence."

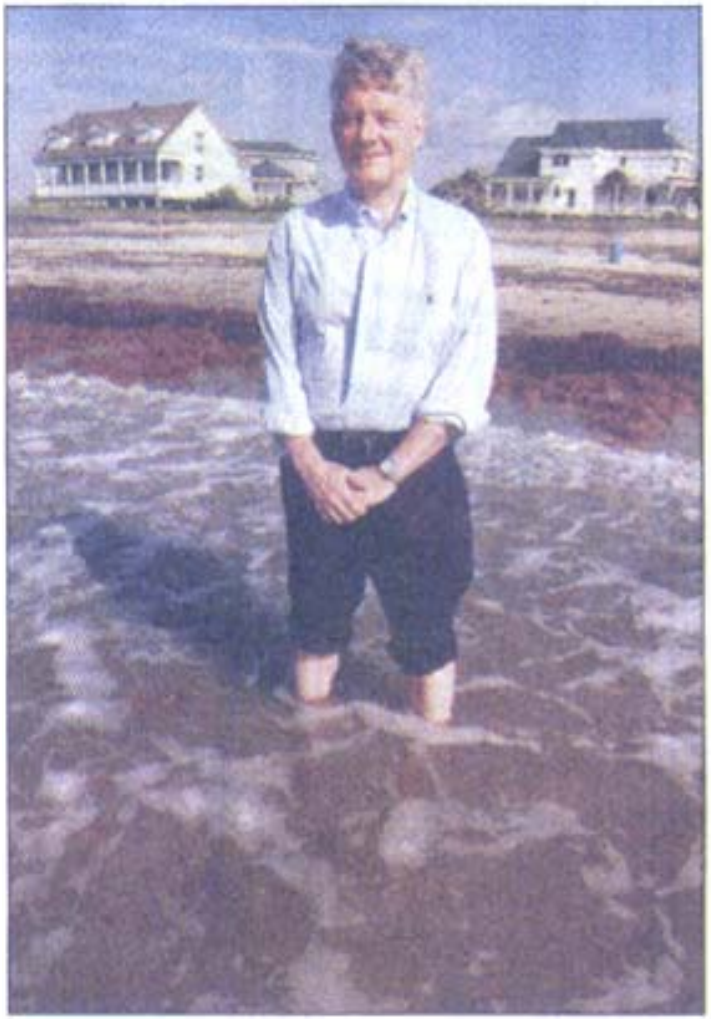
The Subsidence District is using the National Geodetic Survey's findings to reform its existing plan, which sets a timetable by which areas must convert from groundwater

water from the ground cause the soil to become more compact and sink.

It took considerable efforts by government and business to halt sinking in the Ship Channel area in southeast Harris County and Galveston. In the last nine years, the survey found, most of the area did not subside at all, and no part of it subsided more than one-fourth

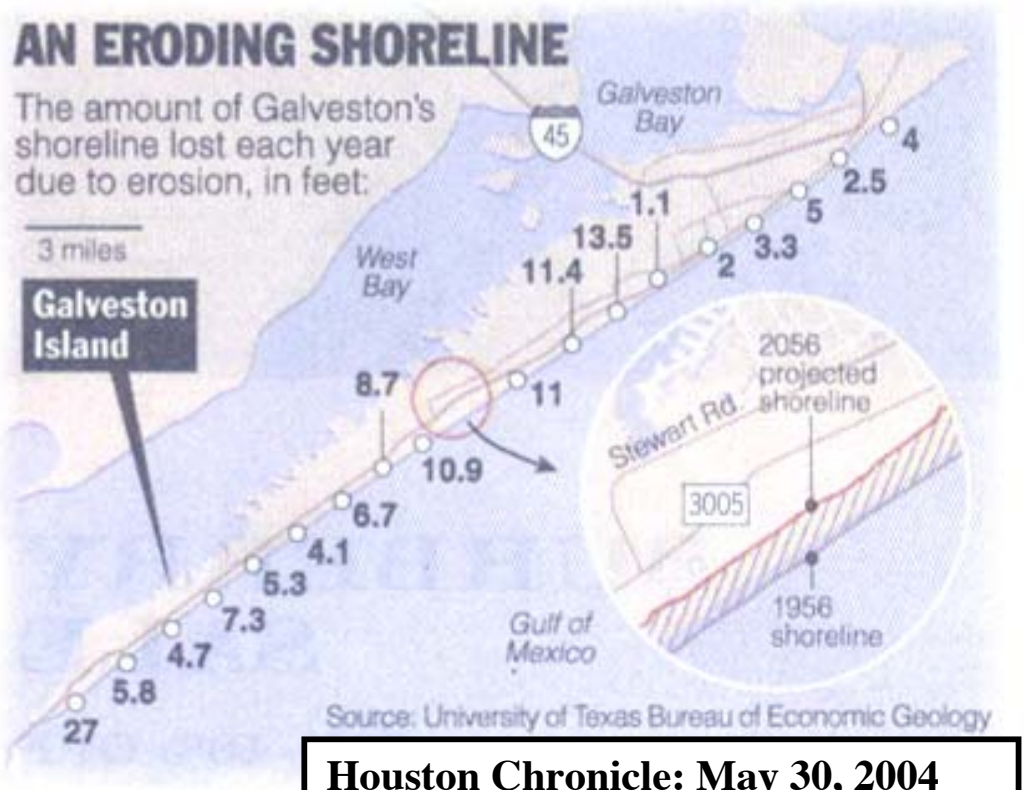
See SUBSIDENCE on Page 14A

Costs of a shrinking coast



Carlos Javier Sanchez / Special to the Chronicle

Jerry Mohn, in the surf on Pirates' Beach near his home on Galveston Island, loves where he lives but worries that his home may wind up on the beach.



Houston Chronicle: May 30, 2004

Quotes from the ***Houston Chronicle*** after major flooding in October, 1998

“If they’ll let me, I’ll rebuilt right here.”

“I’ve lived here 45 years and it’s never flooded, except in the streets.”

“They say this is a 100 year flood. I don’t guess I’ll see the next one anyway.”

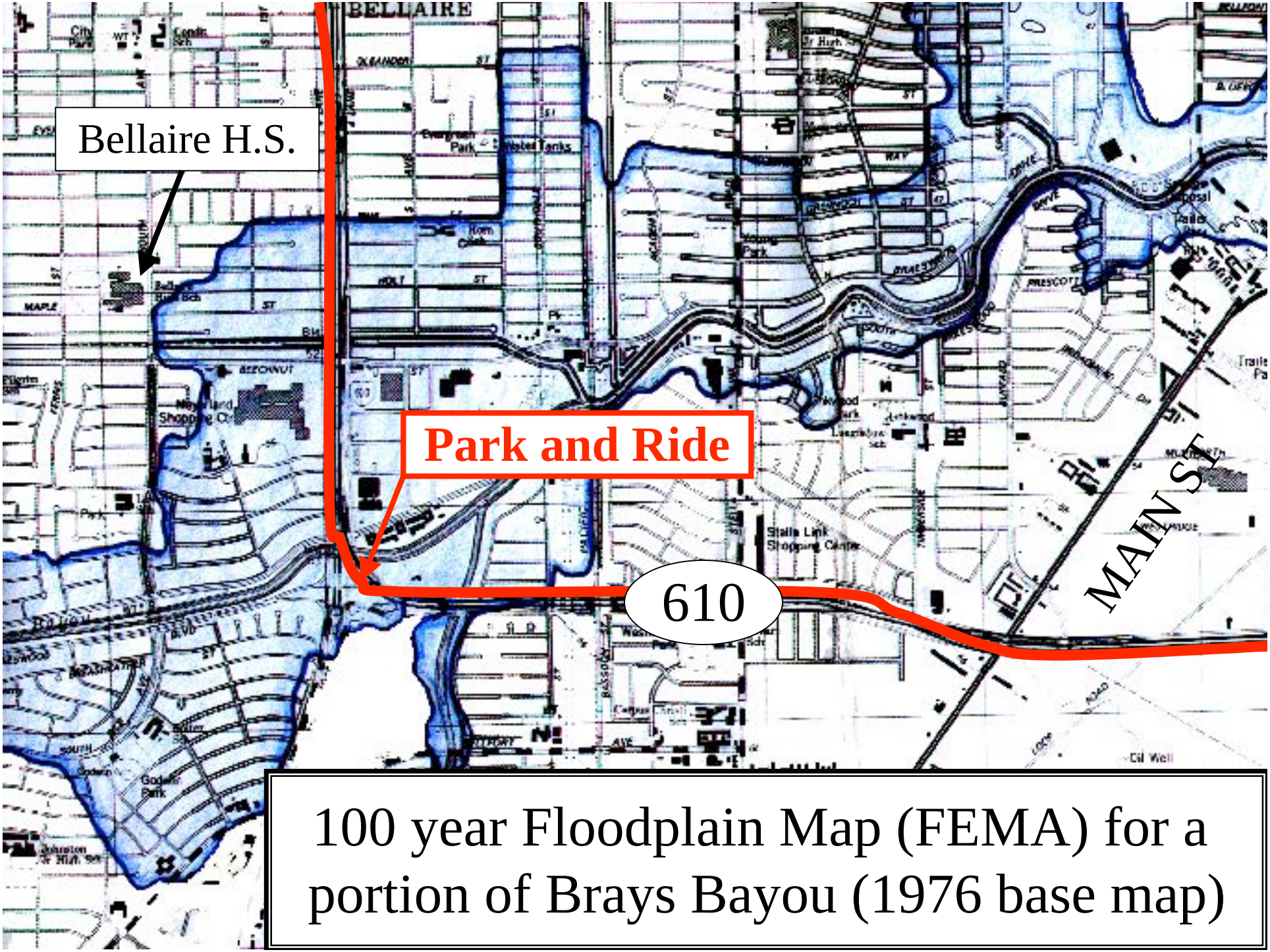
How Bad is Too Bad?

It depends on the **frequency** and **magnitude** of the event, and how and what you (or society) consider an **acceptable level of risk**!

Frequency is measured by:

1) Recurrence Interval

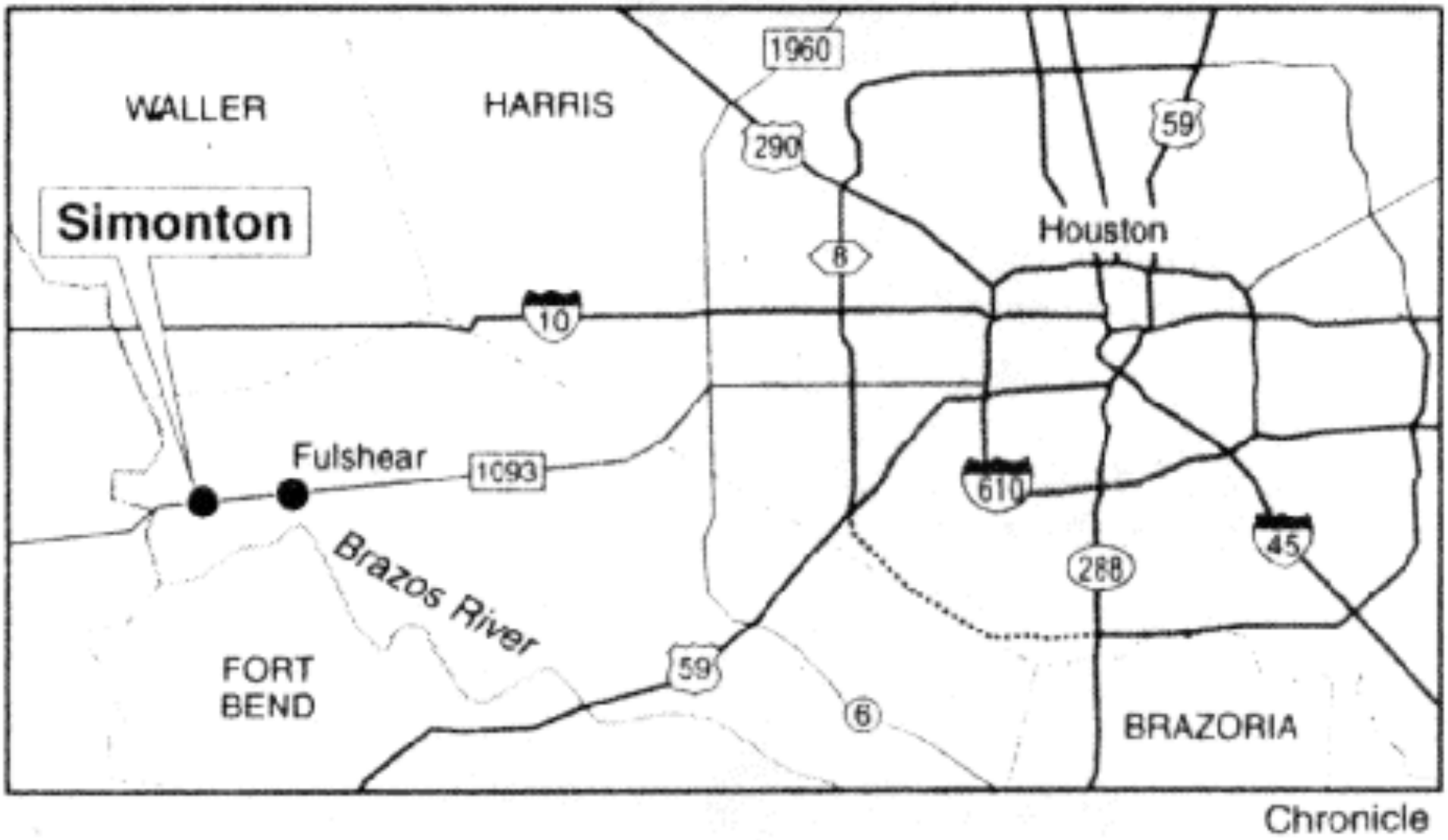
2) Exceedence Probability



100 year Floodplain Map (FEMA) for a portion of Brays Bayou (1976 base map)


NOTICE : THIS PROPERTY IS LOCATED
IN A FLOOD PRONE AREA AND IS
SUBJECT TO 1.5 - 5.75 FEET OF WATER
IN A 100 YEAR FLOOD EVENT.
W.R. Dupre'

Pick a Place Close to Home!



Pick a Place with a Problem!

SIMONTON'S CHOICE

John Everett / Chronicle

Fort Bend County resident Robert Houlihan looks at an aerial photograph of the Brazos River path that divides Austin and Fort Bend counties

Floods force city to pick property tax or deannexation

What is Simonton's Problem ?

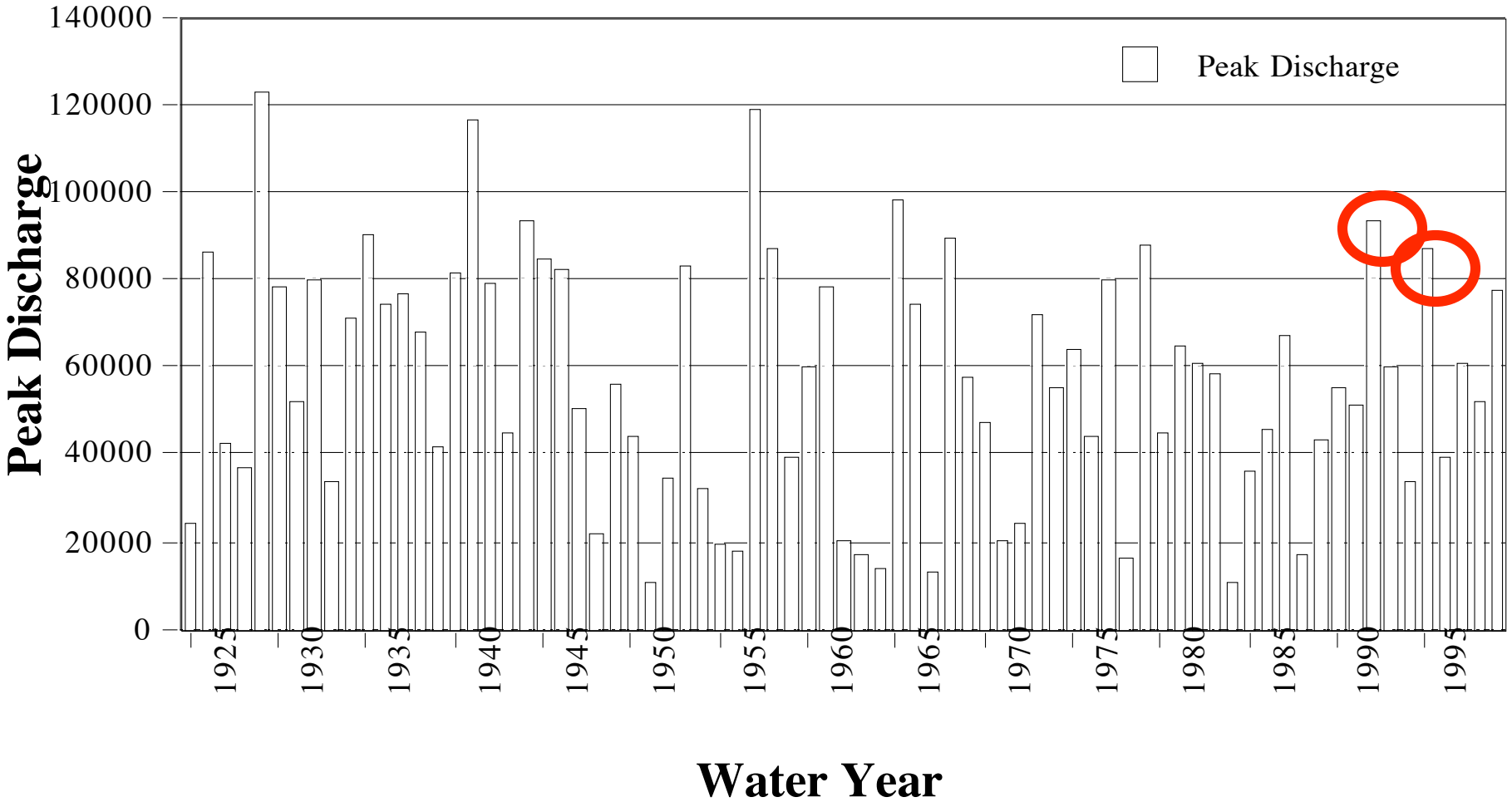
- **FLOODING**:

Simonton was incorporated in 1979. Major flooding in 1991 and 1994 caused $4.5 million in damage. *What is the probability of similar floods occurring in the future?*

- **EROSION**:

Significant erosion is locally occurring in the Simonton area. *What is the likely extent and probability of erosion occurring in the future?*

Peak Annual Daily Discharge Records
Brazos River at Richmond, TX



Annual Peak Daily Discharge Data (1923-2004) Given to Students

Year	Discharge (cfs)
1923	54,900
1924	64,800
1925	24,200
1926	86,900
1927	42,500
1928	36,800
1929	123,000
1930	78,800
1931	52,100
1932	80,500

etc. (N=82)

Annual Peak Daily Discharge Data (1923-2004) Ranked by Students

Year	Discharge (cfs)
1923	54,900
1924	64,800
1925	24,200
1926	86,900
1927	42,500
1928	36,800
1929	123,000
1930	78,800
1931	52,100
1932	80,500

etc. (N=82)

Water Year	Discharge (cfs)	Rank (m)	RI (yrs)	Probability (P)
1929	123000	1	-	-
1957	119000	2	-	-
1941	117000	3	-	-
1965	98800	4	-	-
1992	94000	5	-	-
1944	93800	6	-	-
1935	90900	7	-	-
1968	89600	8	-	-
1979	88100	9	-	-
1995	88100	9*	-	-

Recurrence Interval and Probabilities (1923-2004) Calculated by Students

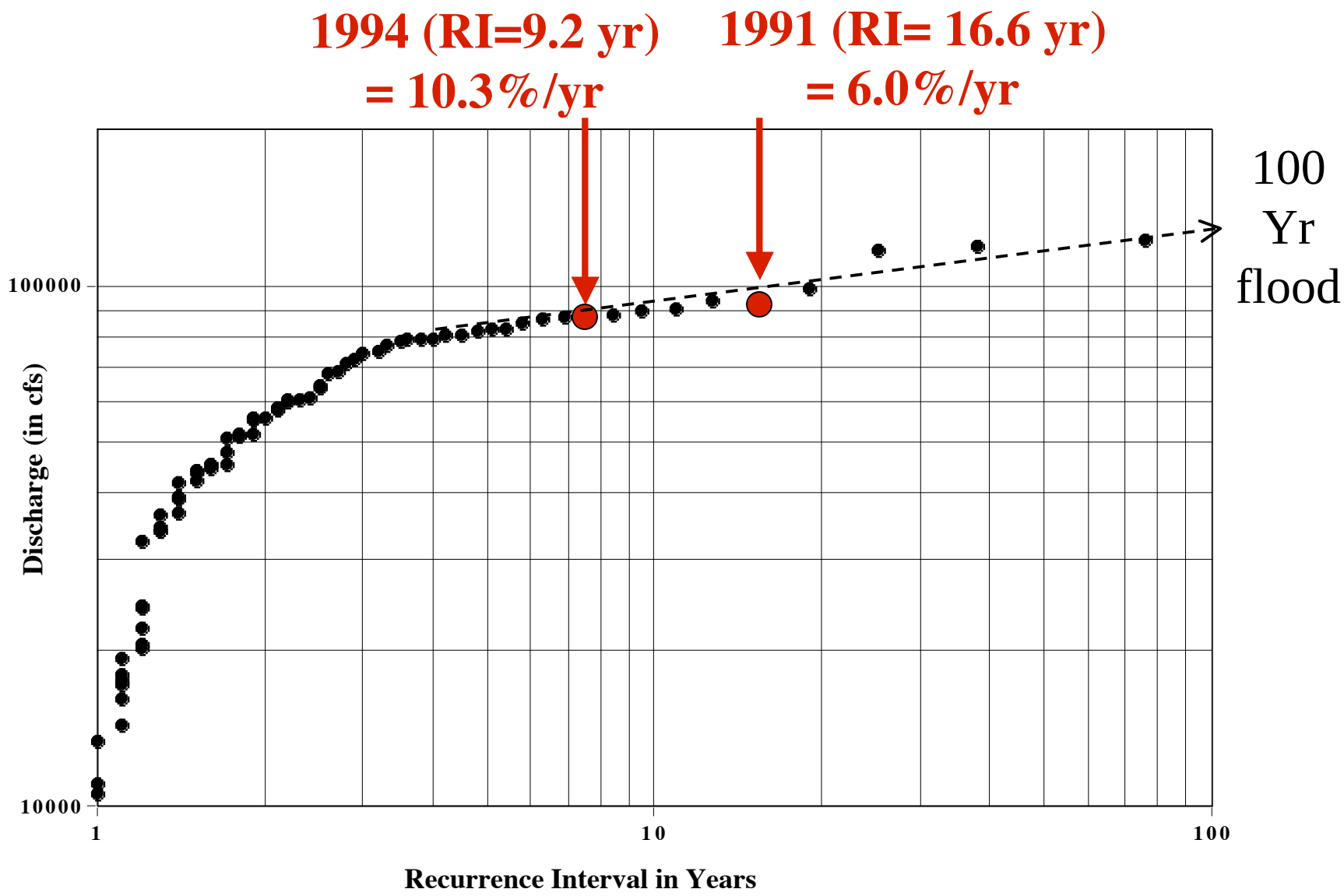
Year	Discharge (cfs)
1923	54,900
1924	64,800
1925	24,200
1926	86,900
1927	42,500
1928	36,800
1929	123,000
1930	78,800
1931	52,100
1932	80,500

etc. (N=82)

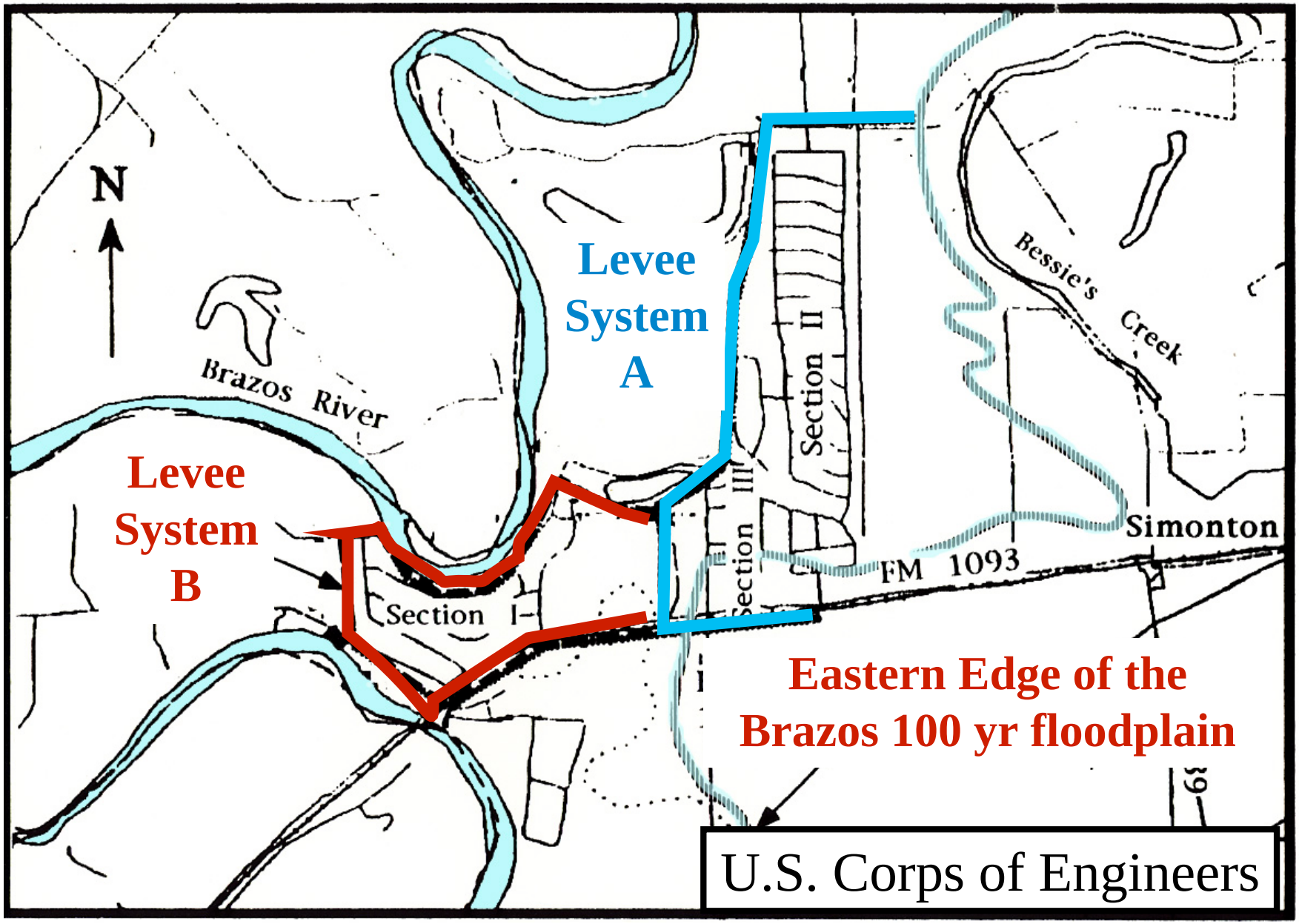
Water Year	Discharge (cfs)	Rank (m)	RI (yrs)	Probability (P)
1929	123000	1	83.0	1.2 %
1957	119000	2	41.5	2.4 %
1941	117000	3	27.7	3.6 %
1965	98800	4	20.8	4.8 %
1992	**94000**	**5**	**16.6**	**6.0 %**
1944	93800	6	13.8	7.2 %
1935	90900	7	11.9	8.4 %
1968	89600	8	10.4	9.6 %
1979	88100	9	9.2	10.8 %
1995	**88100**	**9***	**9.2**	**10.8 %**

RI = (82+1)/m = 83/m **P = m/83**

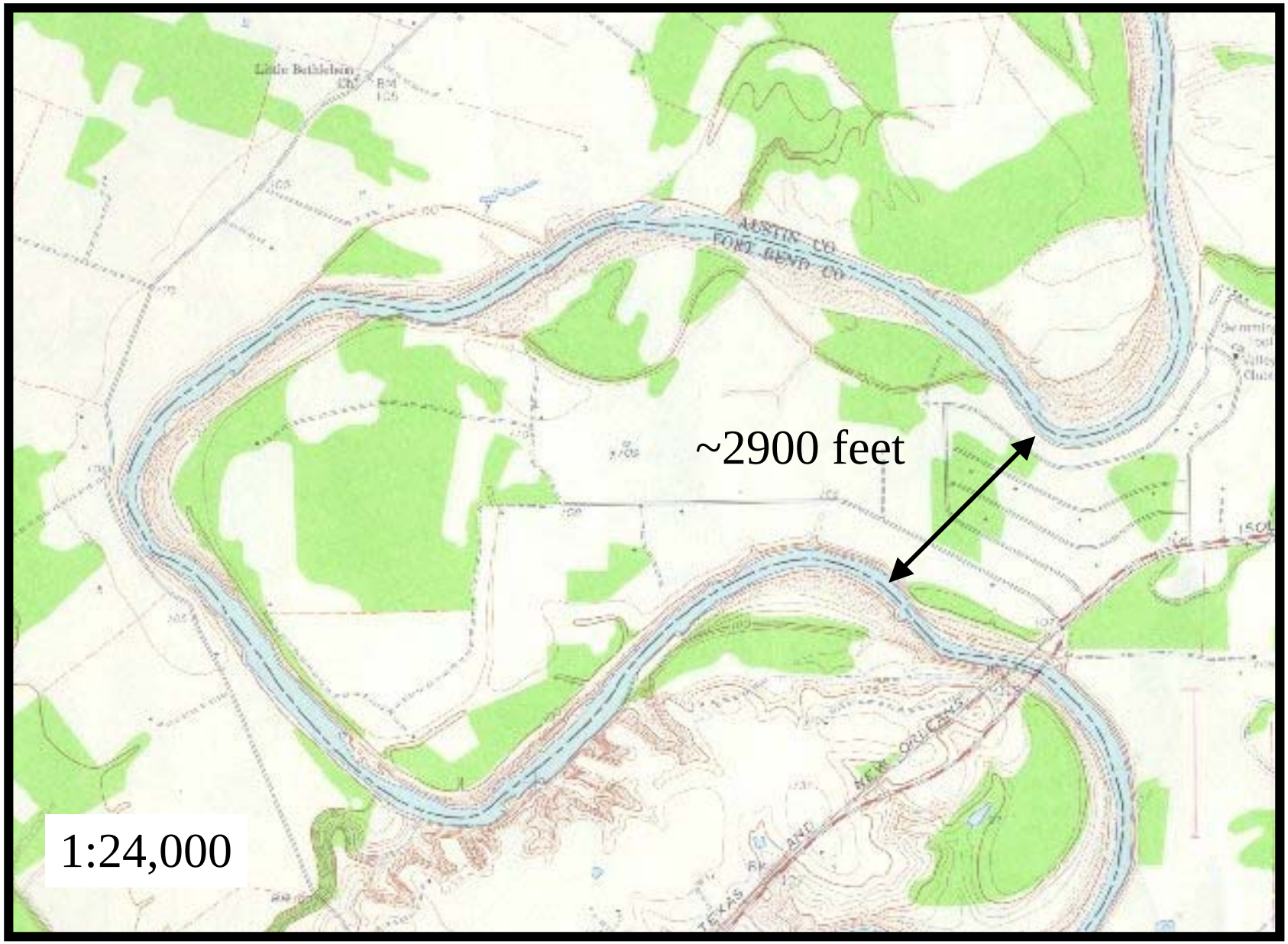
Recurrence Interval Graph-Brazos River



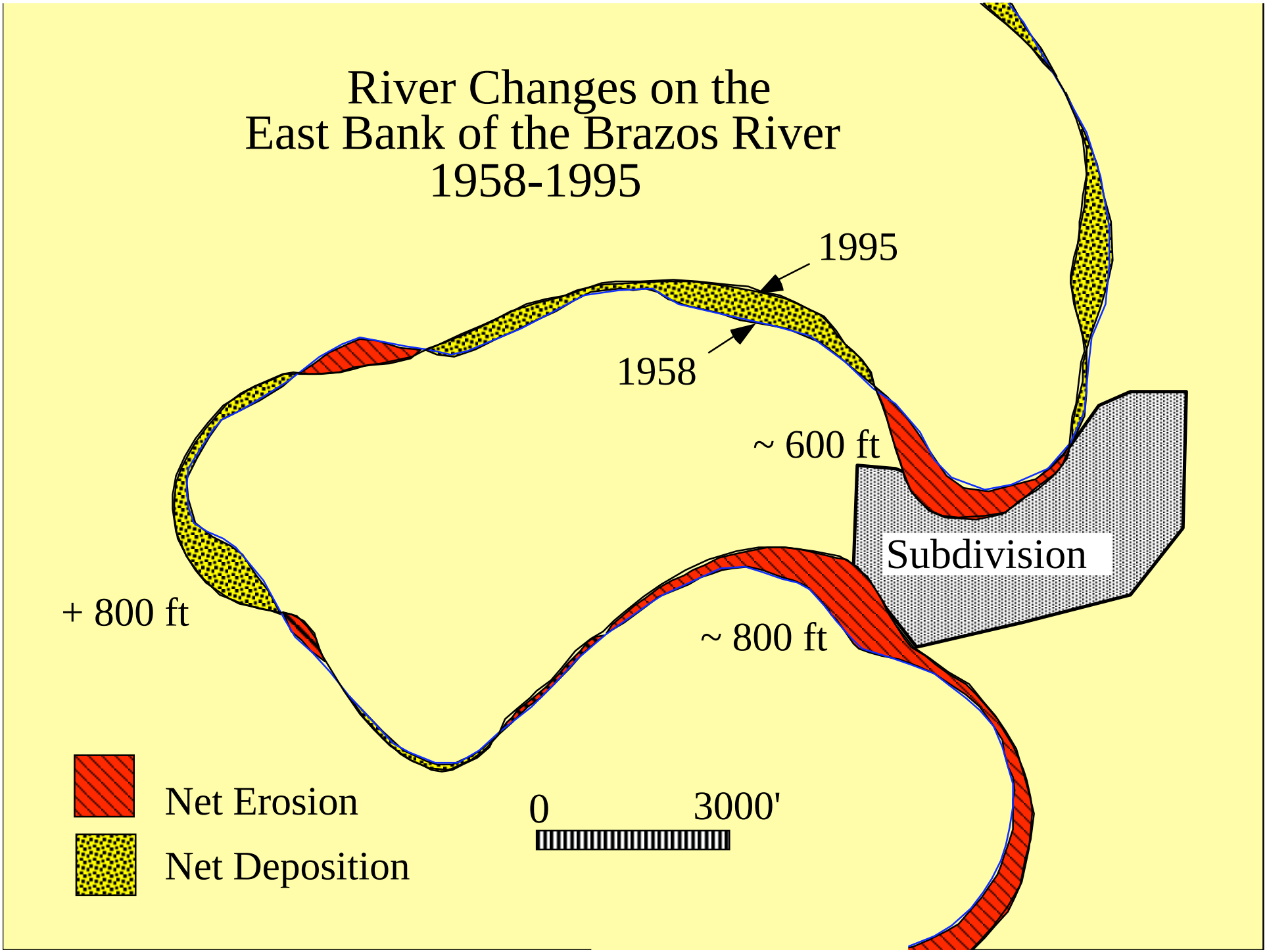
Are levees the answer?



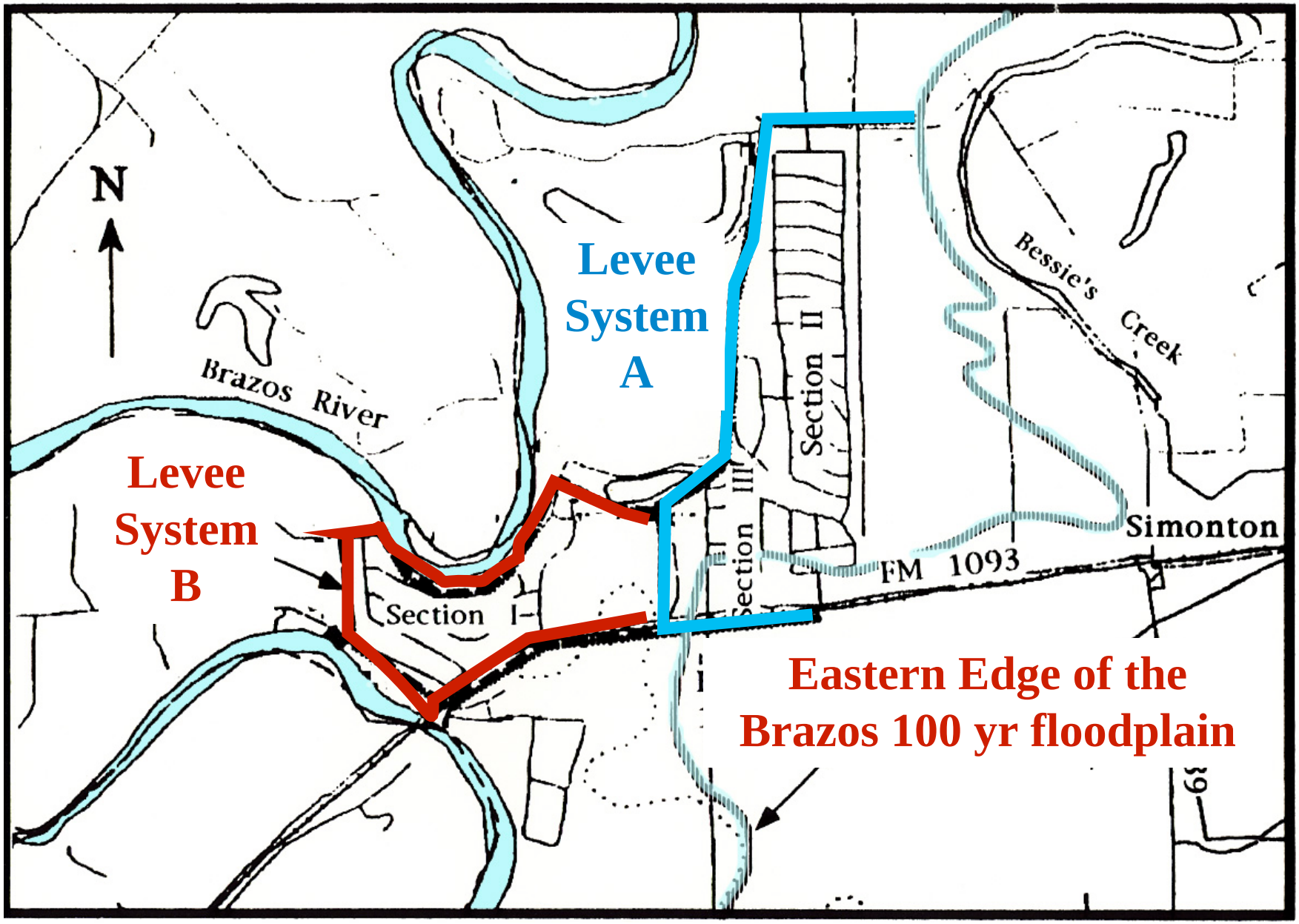
Simonton, 1958



Simonton, 1995


River Changes on the
East Bank of the Brazos River
1958-1995
1995
1958
~ 600 ft
Subdivision
+ 800 ft
~ 800 ft
Net Erosion
Net Deposition
0
3000'

Are levees the answer? Not for Section 1



How long before a Meander Cutoff occurs at Simonton?

If the neck was ~ **2900** ft wide in **1958** …

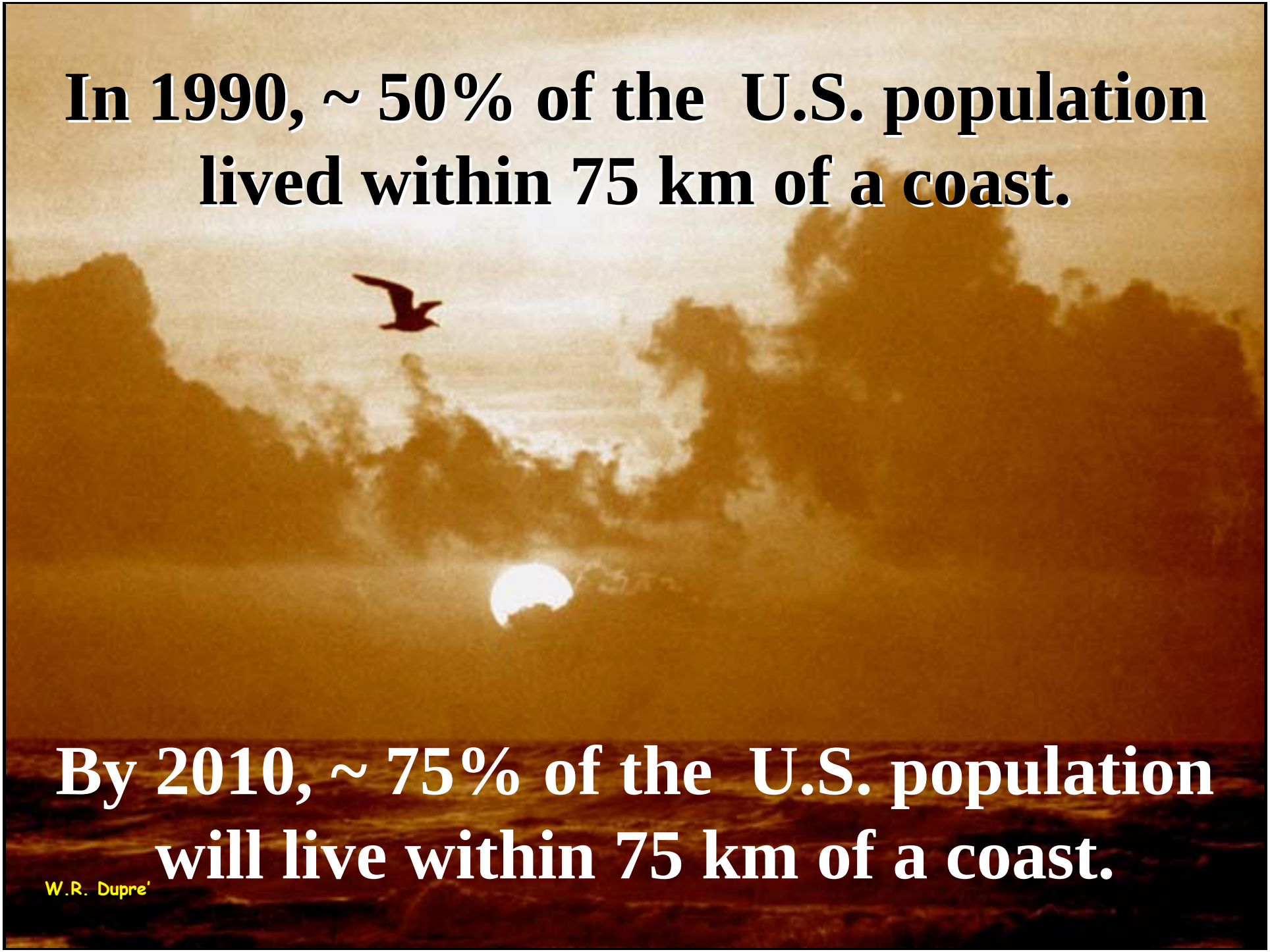
and the neck was ~ **1500** ft wide in **1995** …

then the neck has narrowed ~**1400** feet in 37 years,

giving an average erosion rate of ~ **38** ft/year.

Thus a meander cutoff might occur within ~40 yrs after 1995 (or by 2035)

Assumptions – potential errors?


In 1990, ~ 50% of the U.S. population lived within 75 km of a coast.
By 2010, ~ 75% of the U.S. population will live within 75 km of a coast.
W.R. Dupre'

Condomania:

To Build or Not to Build…that is the question…

- A development company (***Condos-R-Us®***) wants to build condos along an undeveloped stretch of beach near Freeport. They say it is an area of **net accretion**.

- An environmental group (***Sons-of-Beaches®***) states it is an area of **rapid erosion**.

- Who's right? What should we do??

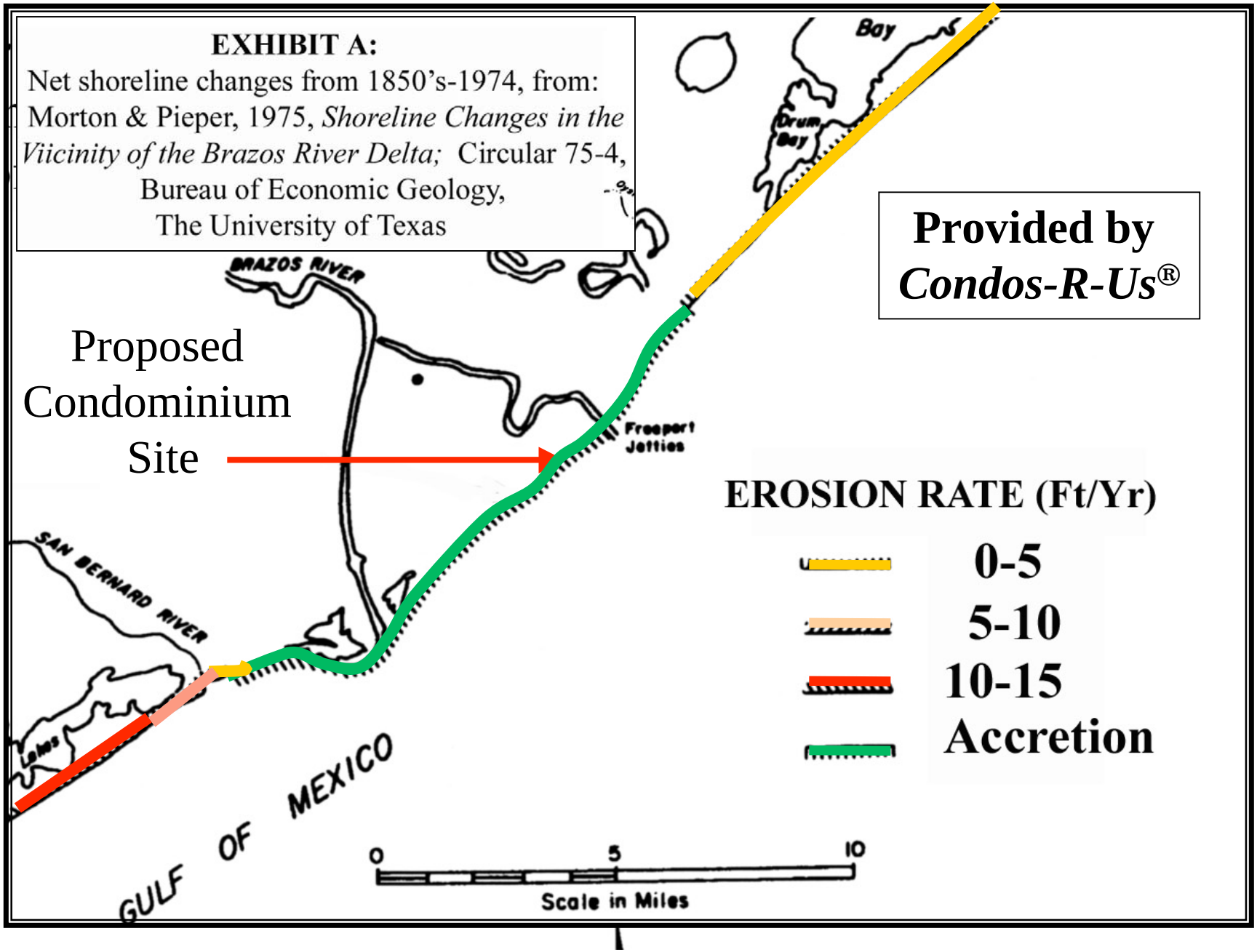
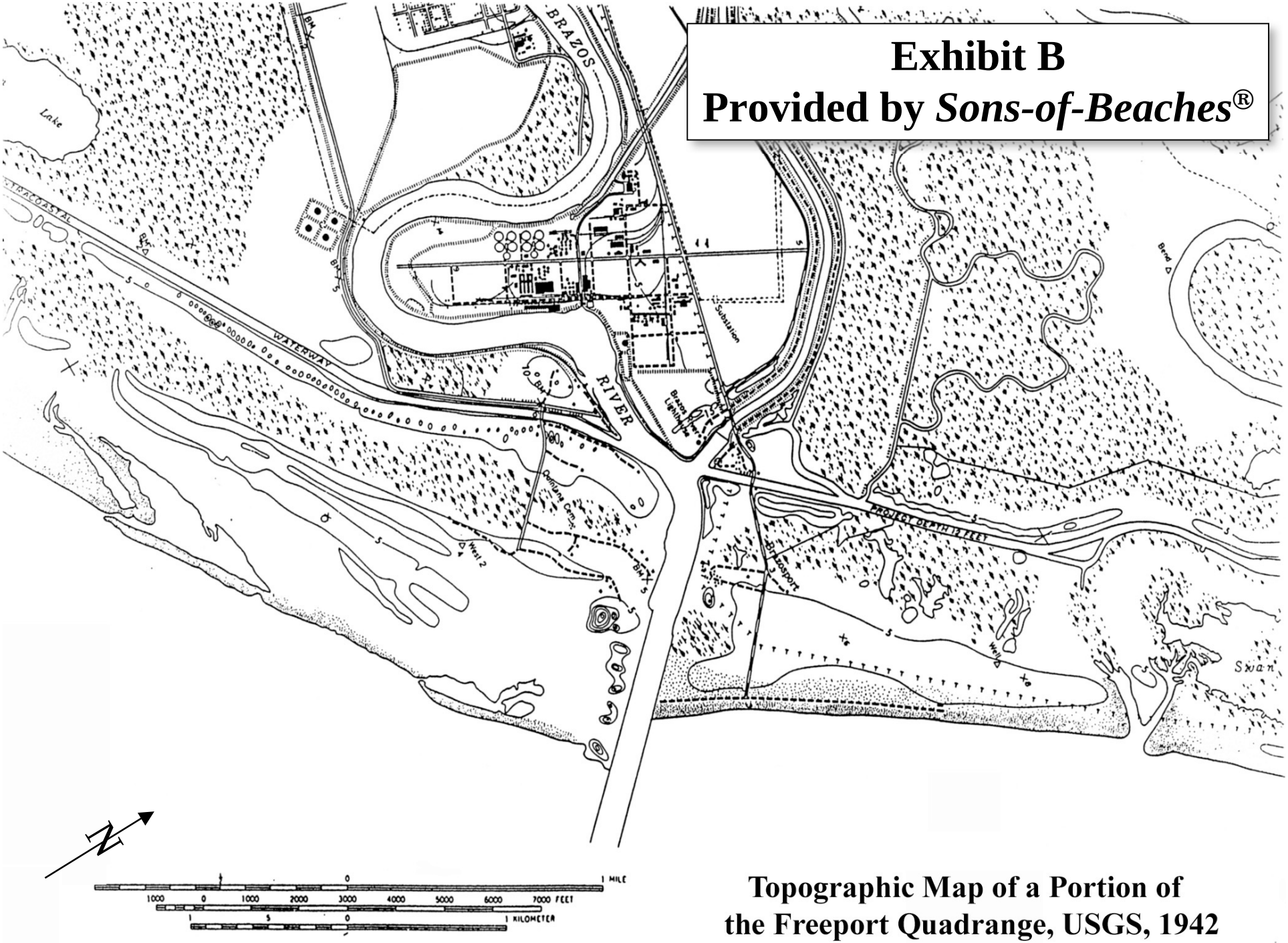


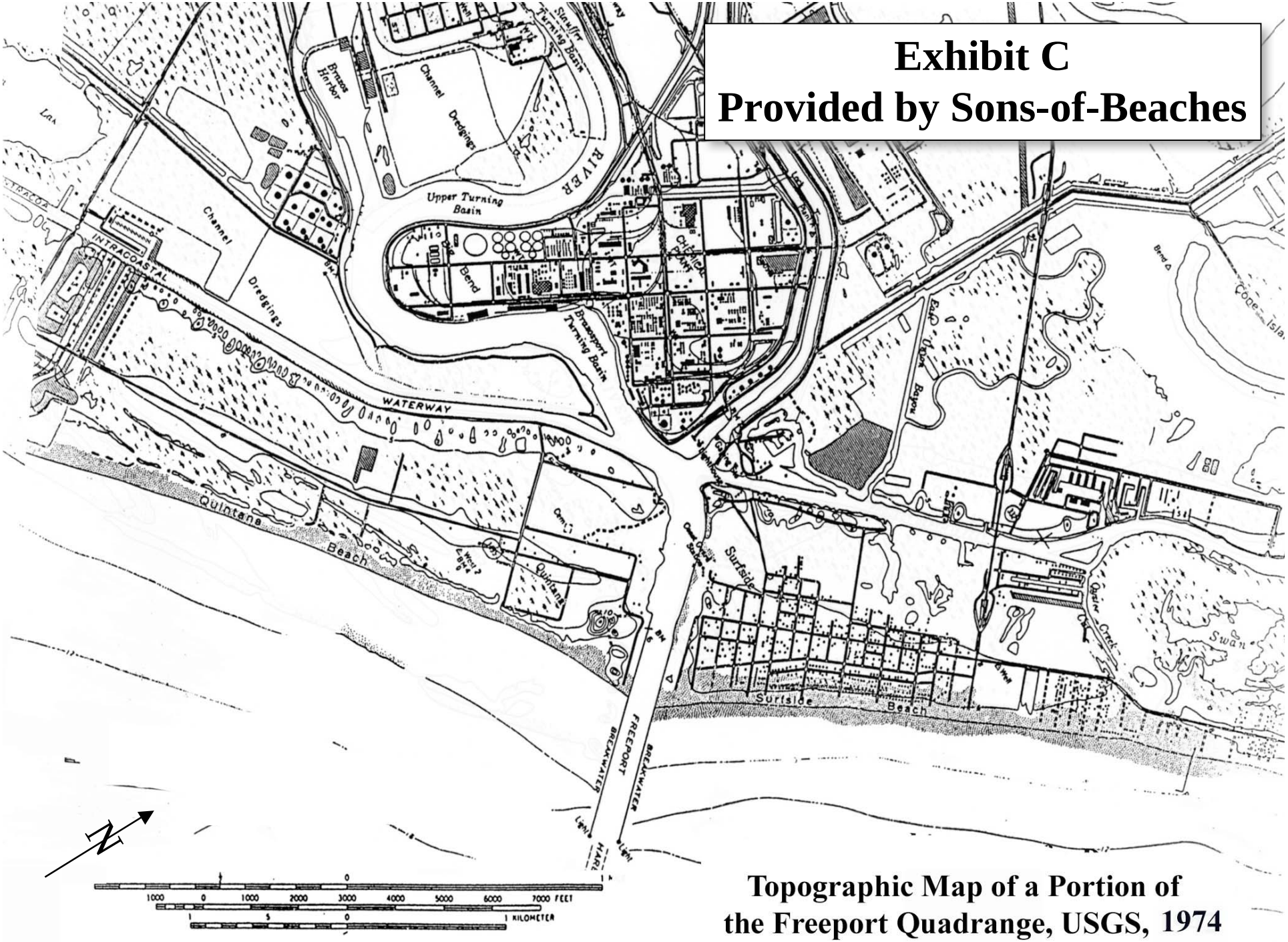
EXHIBIT A:
Net shoreline changes from 1850's-1974, from:
Morton & Pieper, 1975, *Shoreline Changes in the Viicinity of the Brazos River Delta;* Circular 75-4,
Bureau of Economic Geology,
The University of Texas
Provided by
Condos-R-Us®
Proposed
Condominium
Site
BRAZOS RIVER
SAN BERNARD RIVER
Freeport
Jetties
Drum
Bay
Bay
EROSION RATE (Ft/Yr)
0-5
5-10
10-15
Accretion
GULF OF MEXICO
0
5
10
Scale in Miles

Exhibit B
Provided by *Sons-of-Beaches®*

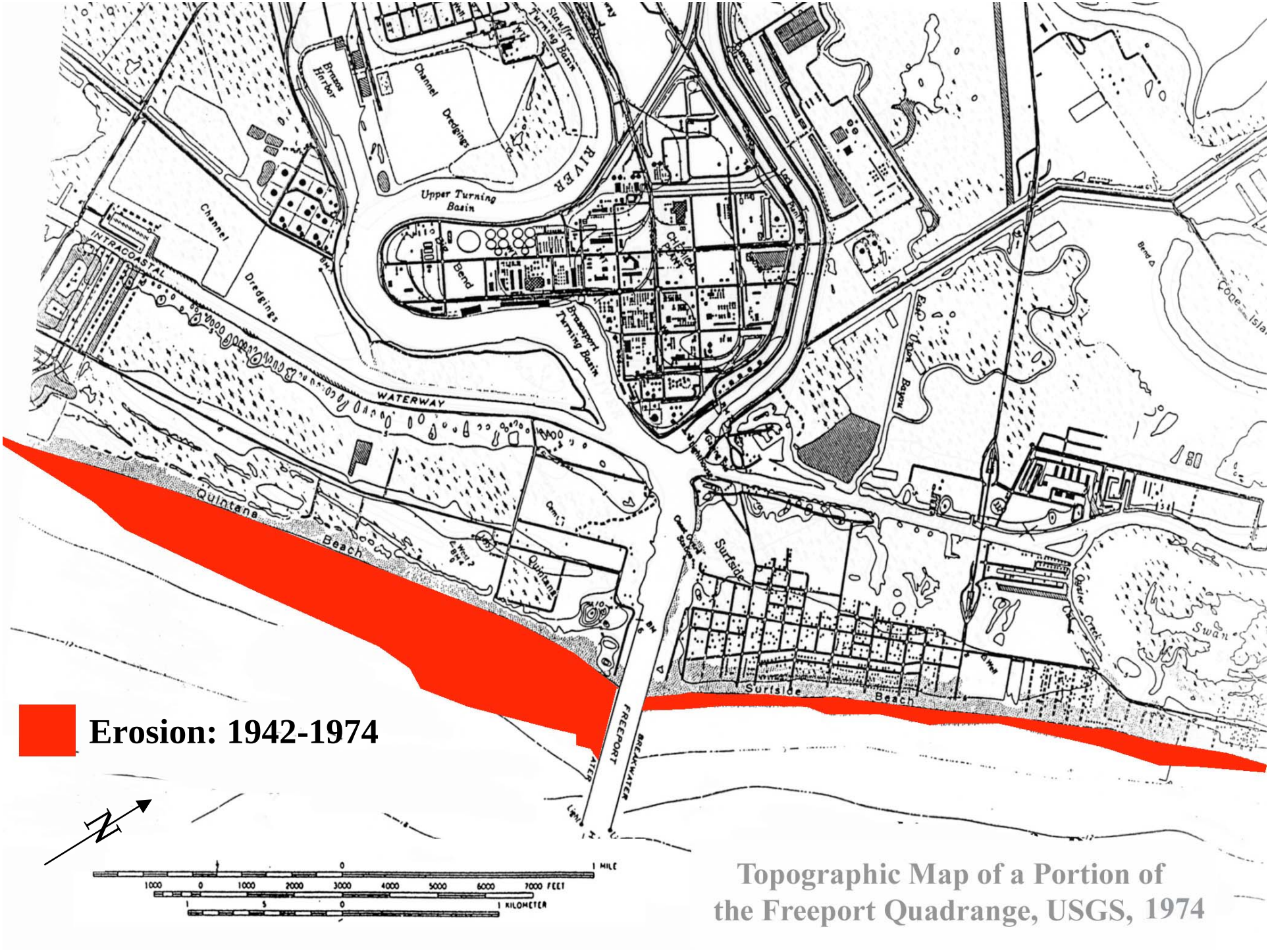


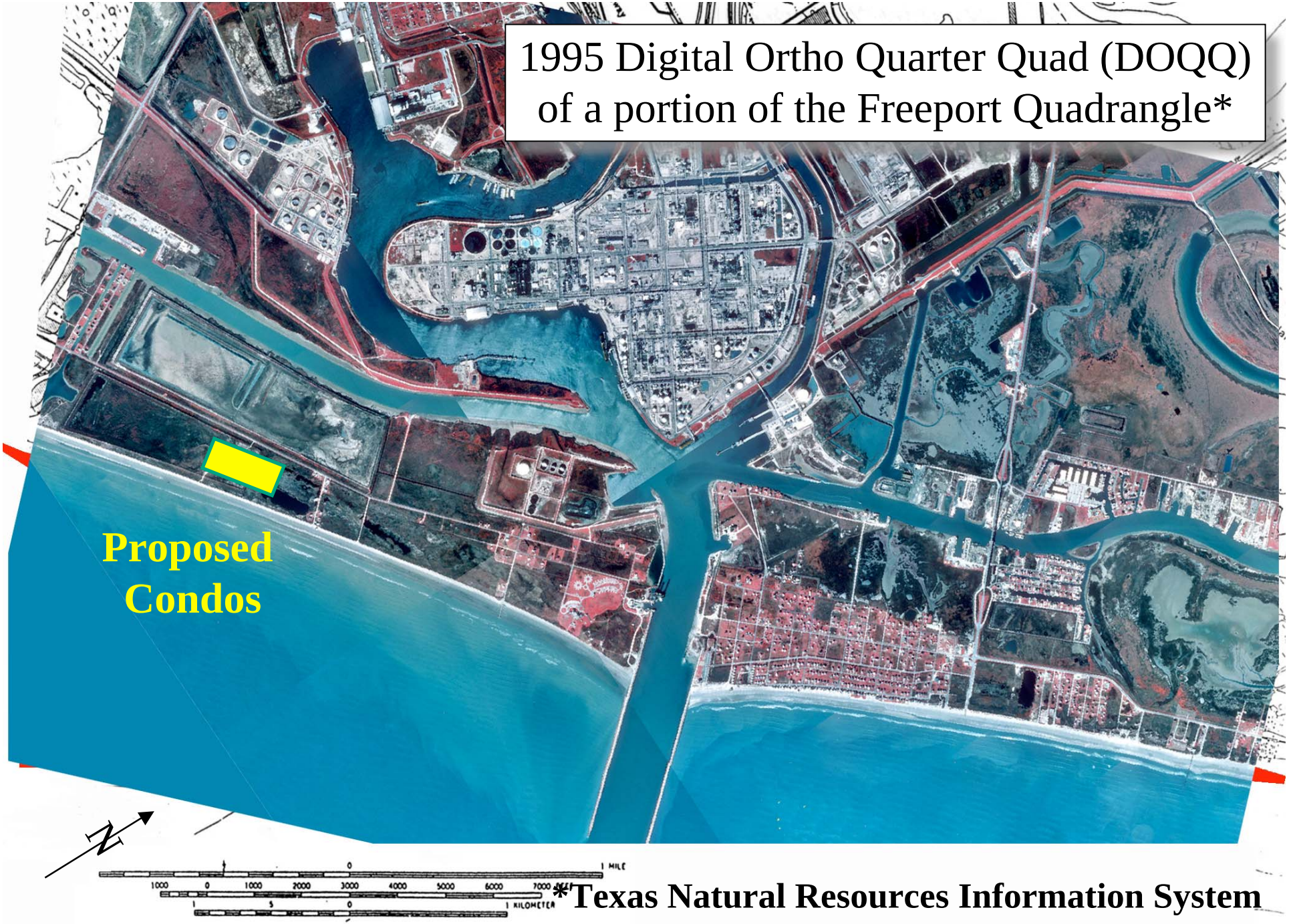
Topographic Map of a Portion of the Freeport Quadrange, USGS, 1942

Exhibit C
Provided by Sons-of-Beaches



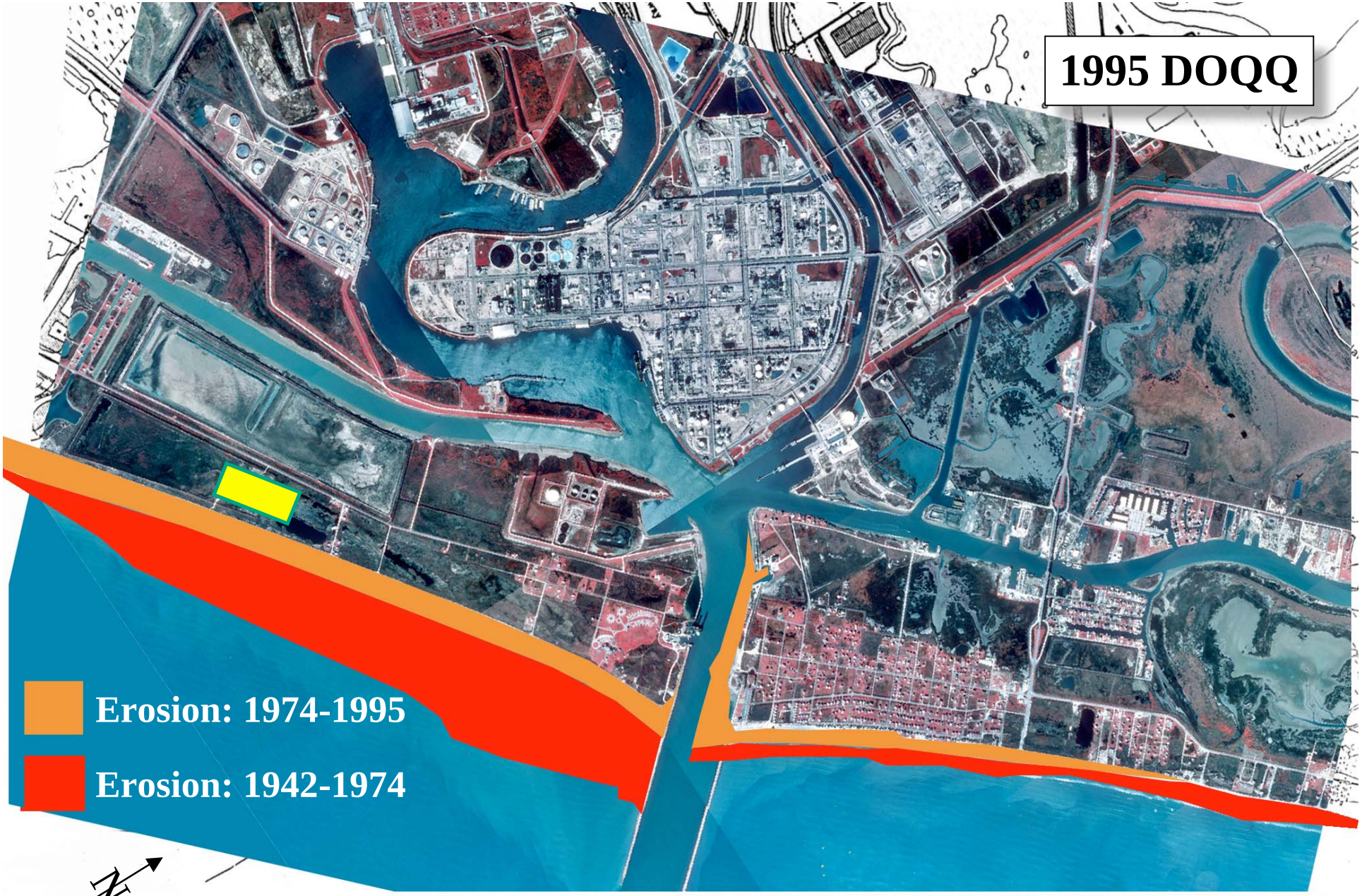
Topographic Map of a Portion of the Freeport Quadrange, USGS, 1974


Erosion: 1942-1974
Topographic Map of a Portion of
the Freeport Quadrange, USGS, 1974
Brazos Harbor
Channel Dredgings
Sunoffer Turning Basin
RIVER
Upper Turning Basin
Big Bend
CHEMICAL PLANTS
Brazosport Turning Basin
Channel
Dredgings
INTRACOASTAL
WATERWAY
Quintana Beach
Quintana
Surfside
Surfside Beach
Oyster Creek
Swan
Bryan Bayou
FREEPORT
BREAKWATER
1 MILE
7000 FEET
1 KILOMETER



*Texas Natural Resources Information System (TNRIS)

http://www.tnris.state.tx.us/



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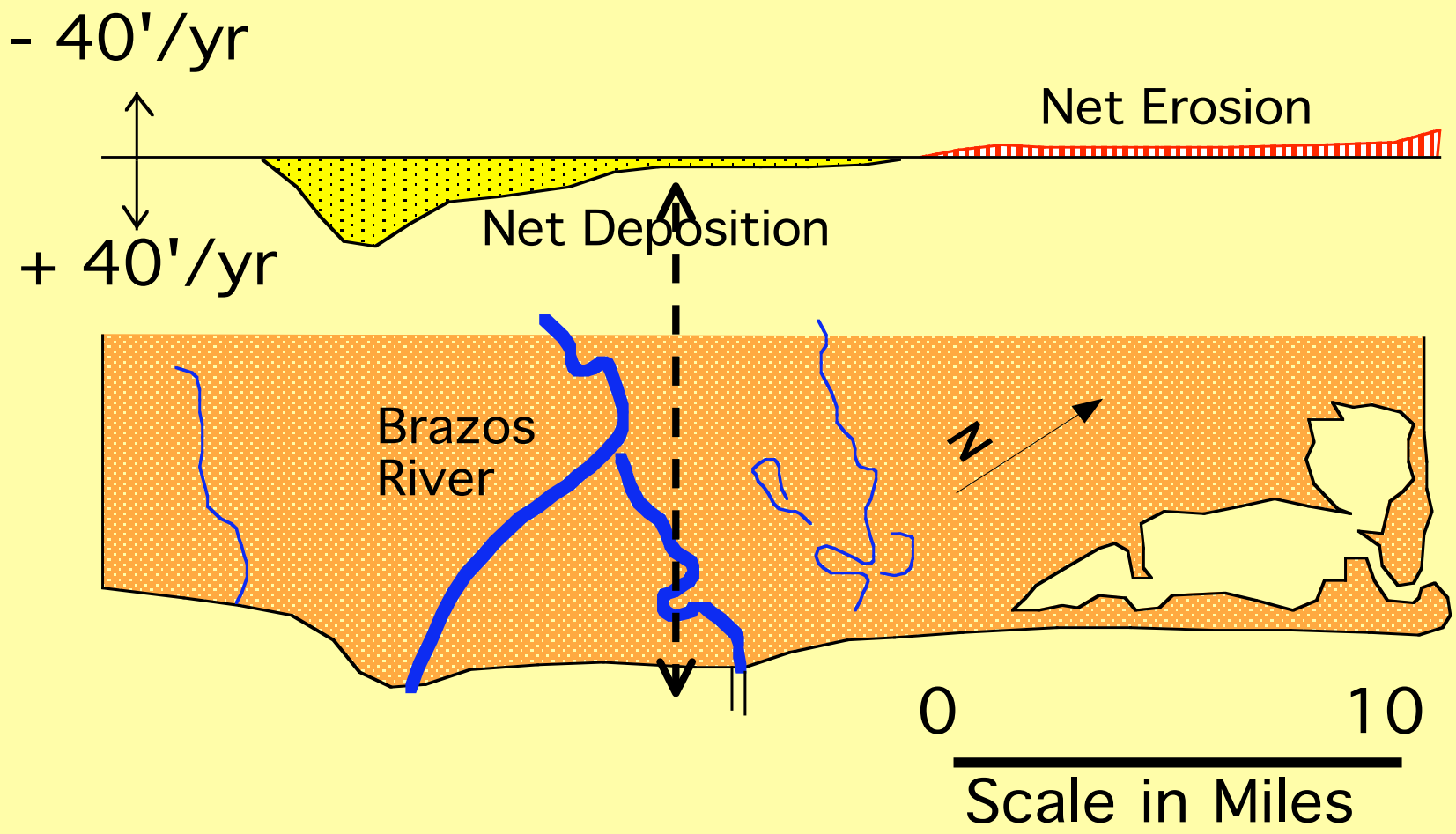
http://www.tnris.state.tx.us/

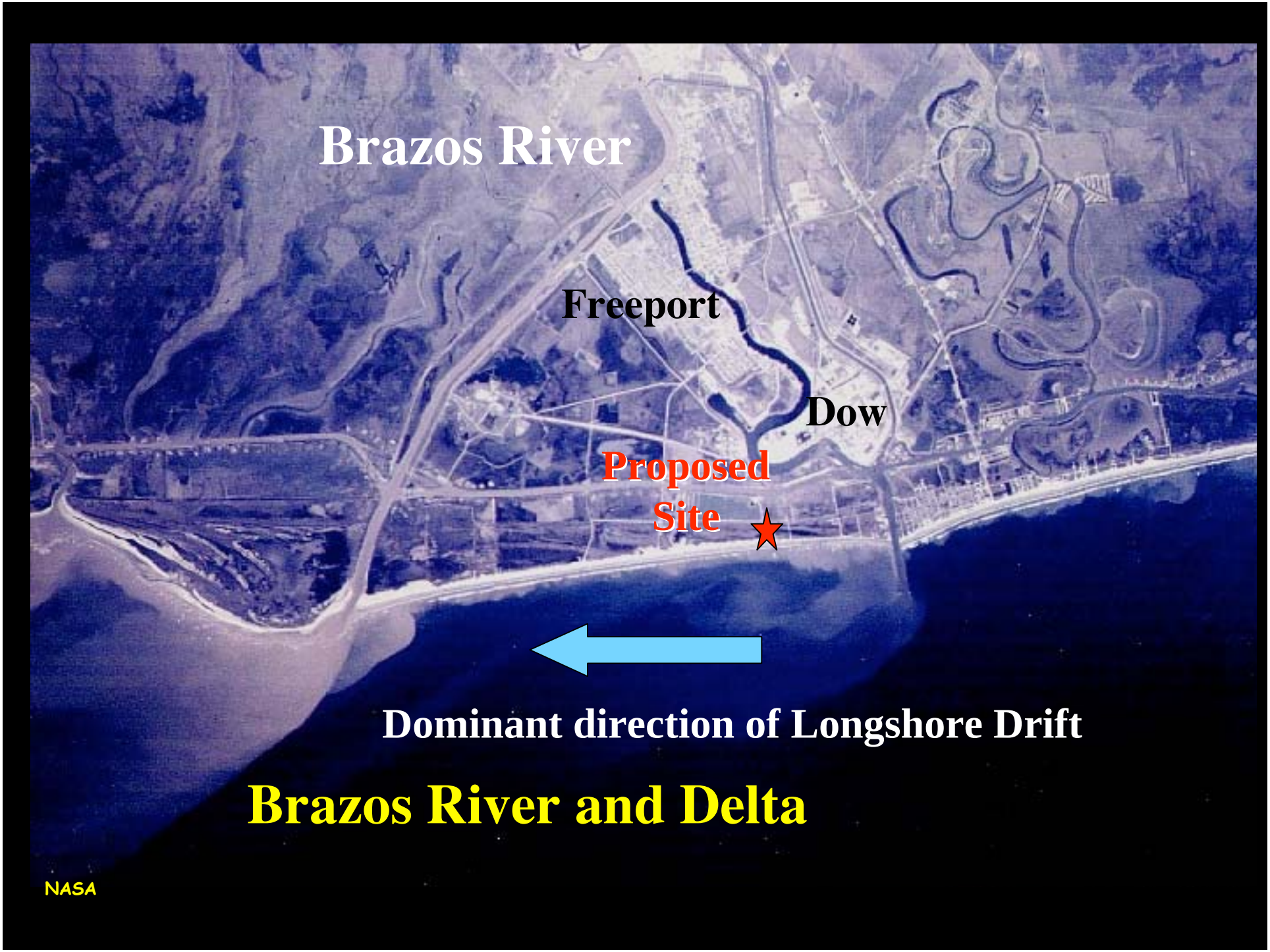
Rates of Shoreline Change: 1853-1974

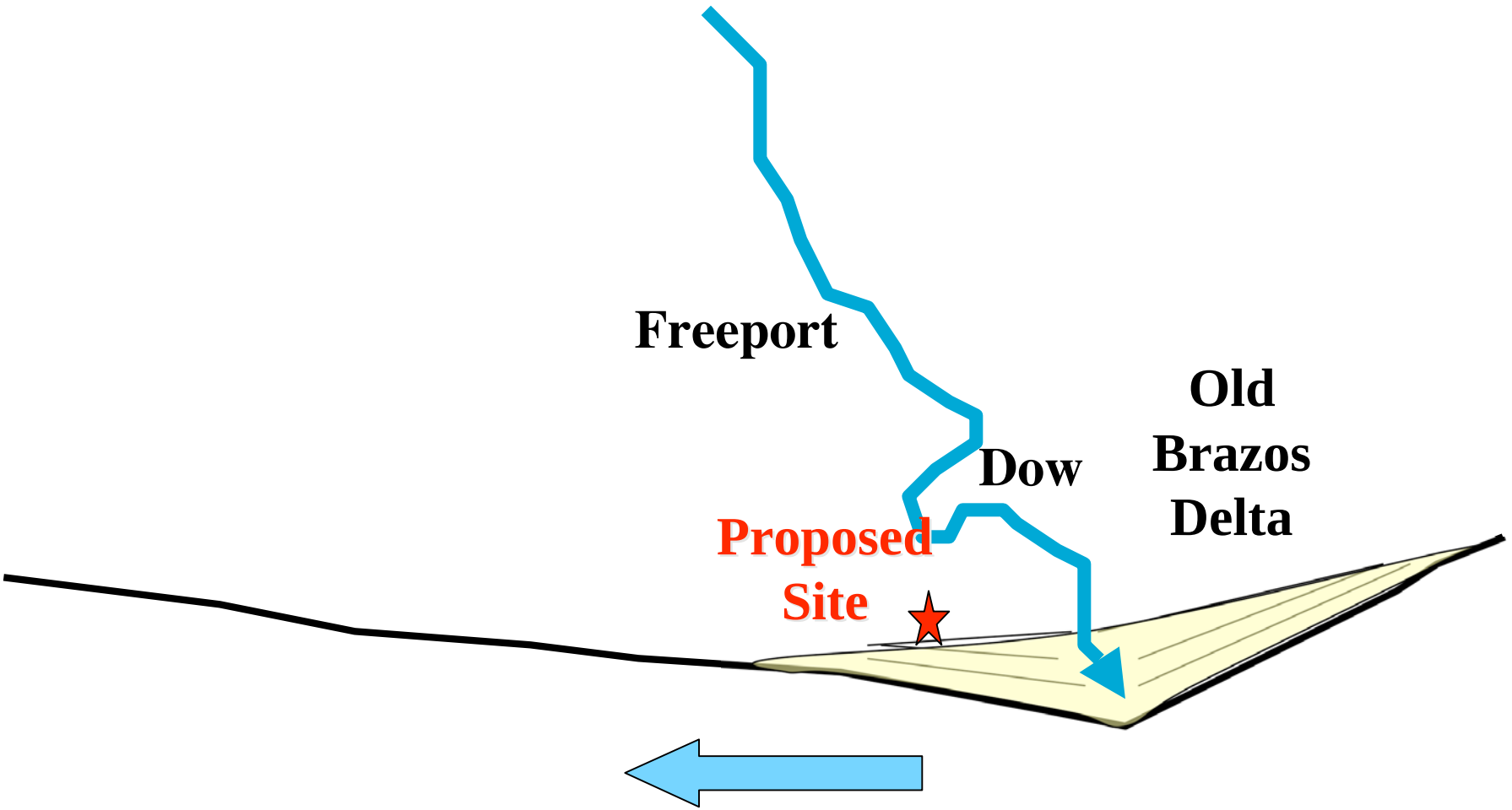
(based on Texas Bureau of Economic Geology data*)



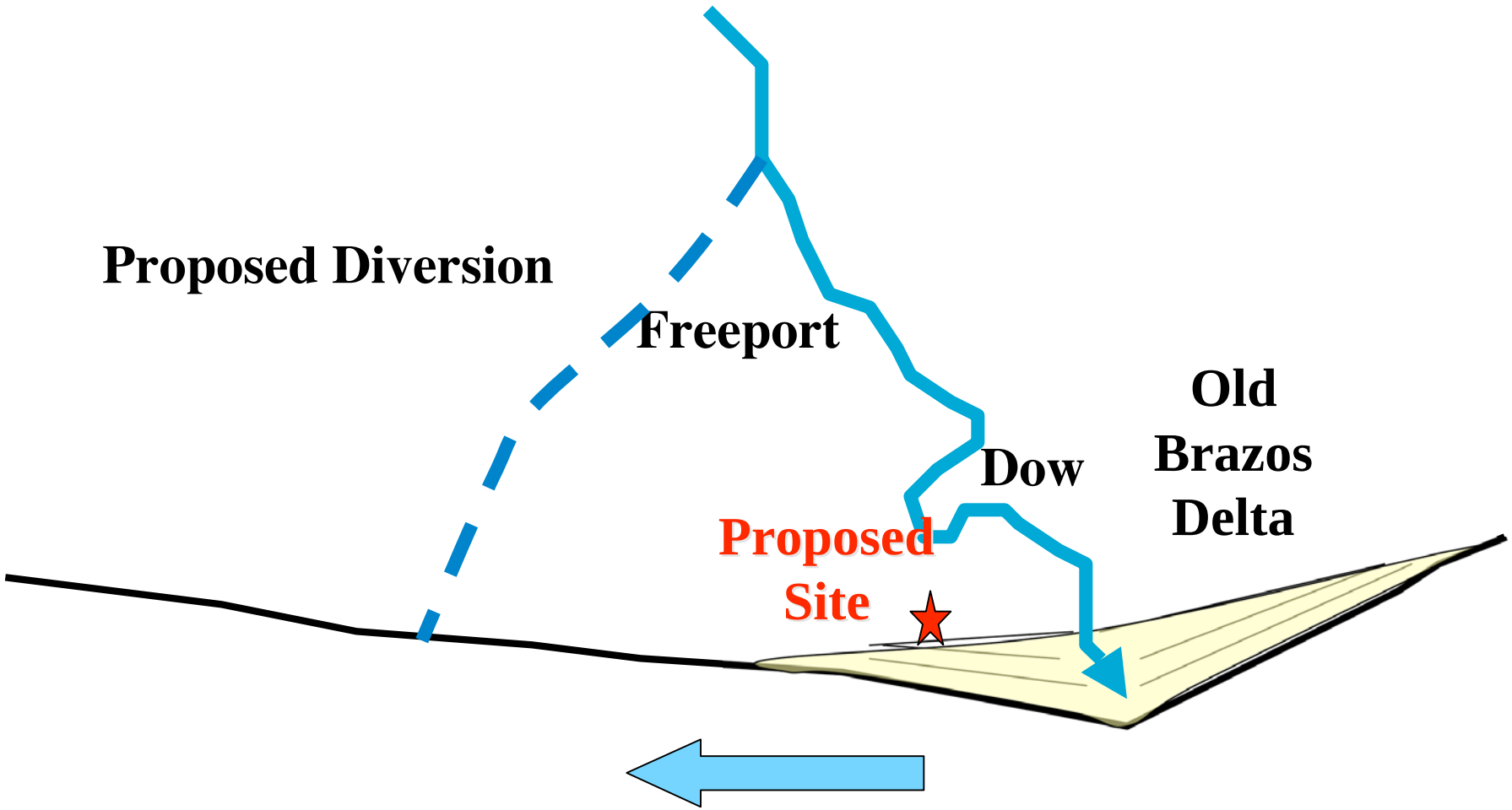
W.R. Dupre'

* Morton & Pieper, 1975

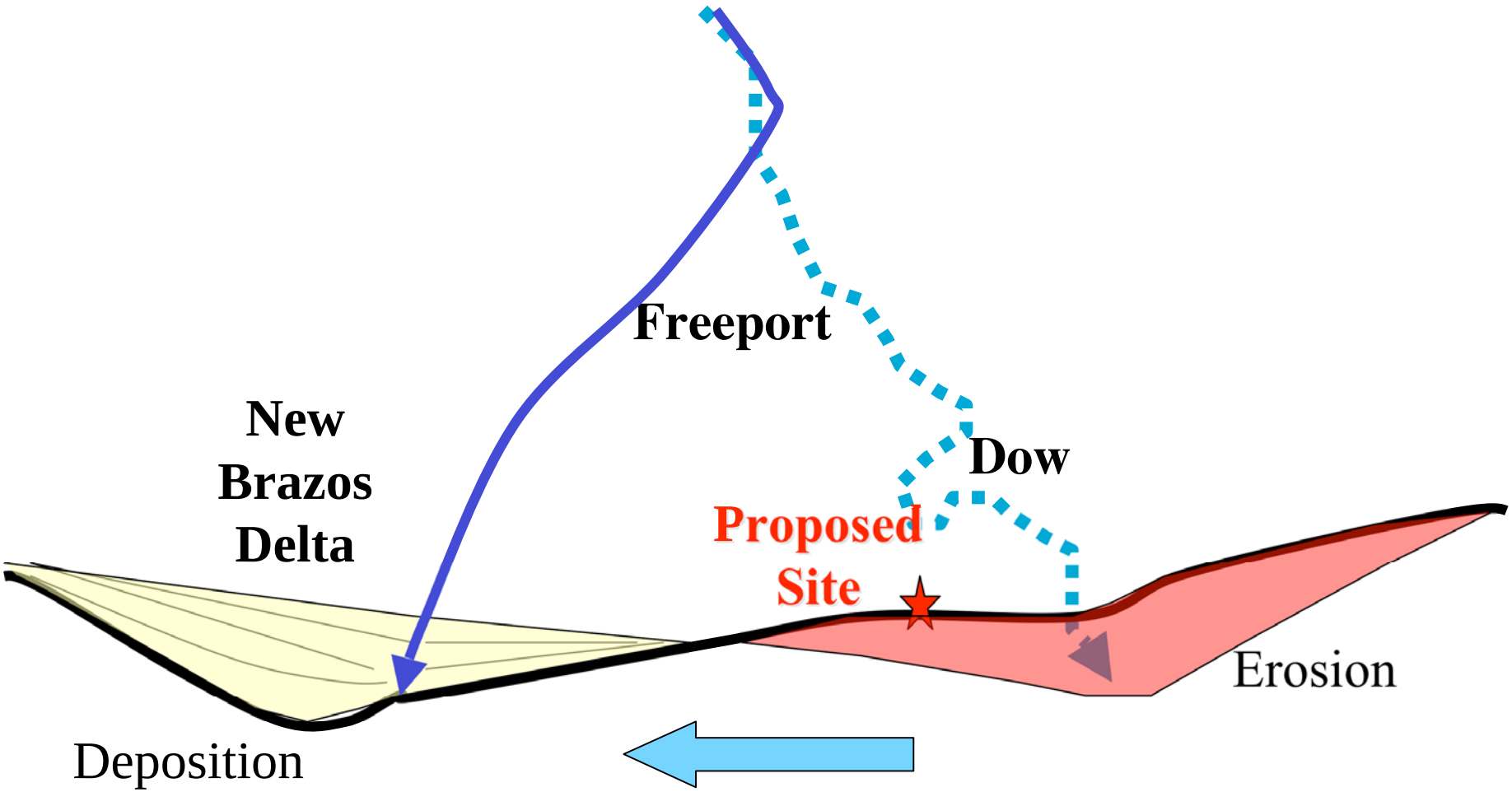

Brazos River
Freeport
Dow
Proposed
Site
Dominant direction of Longshore Drift
Brazos River and Delta
NASA



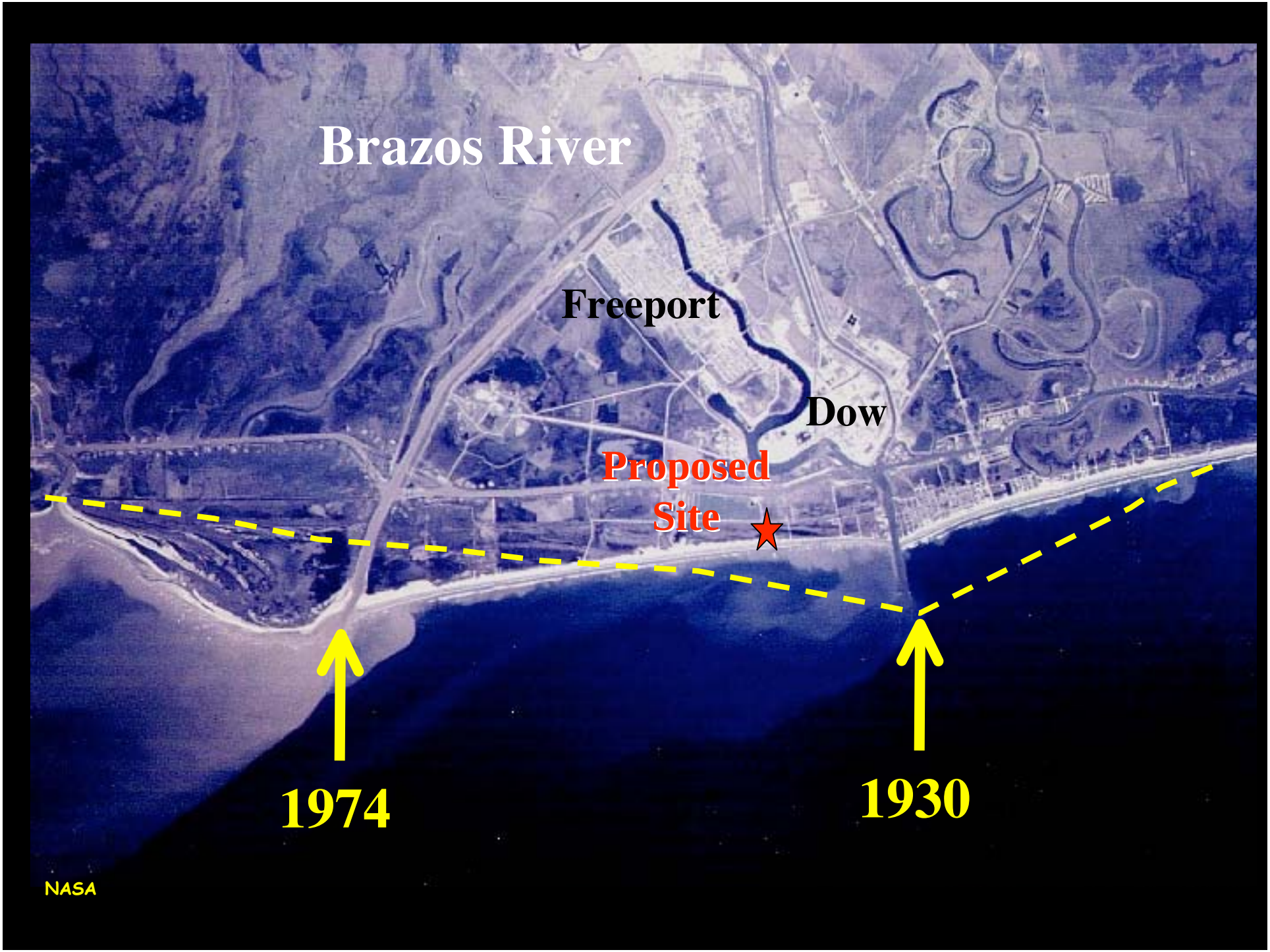
Brazos River and Delta circa 1930



Brazos River and Delta circa 1930

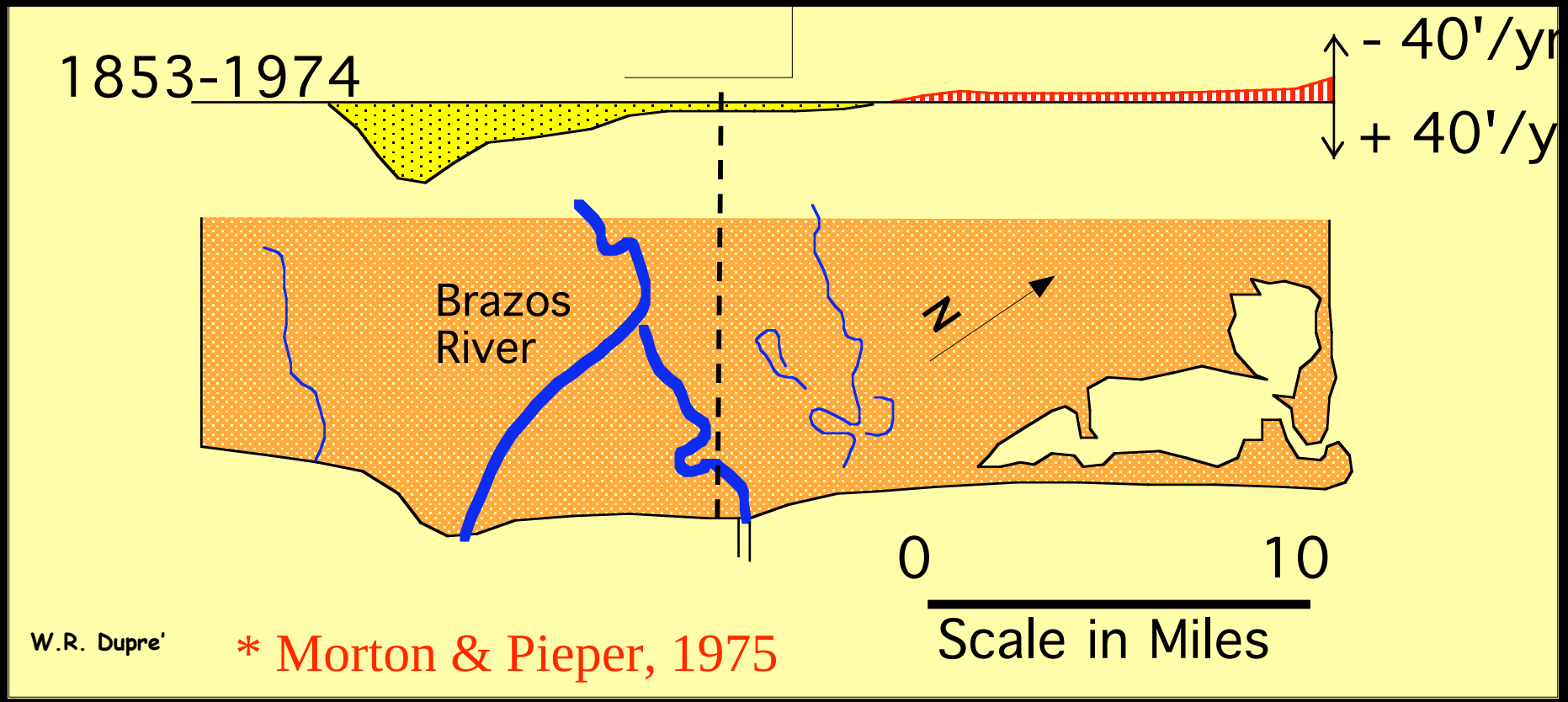


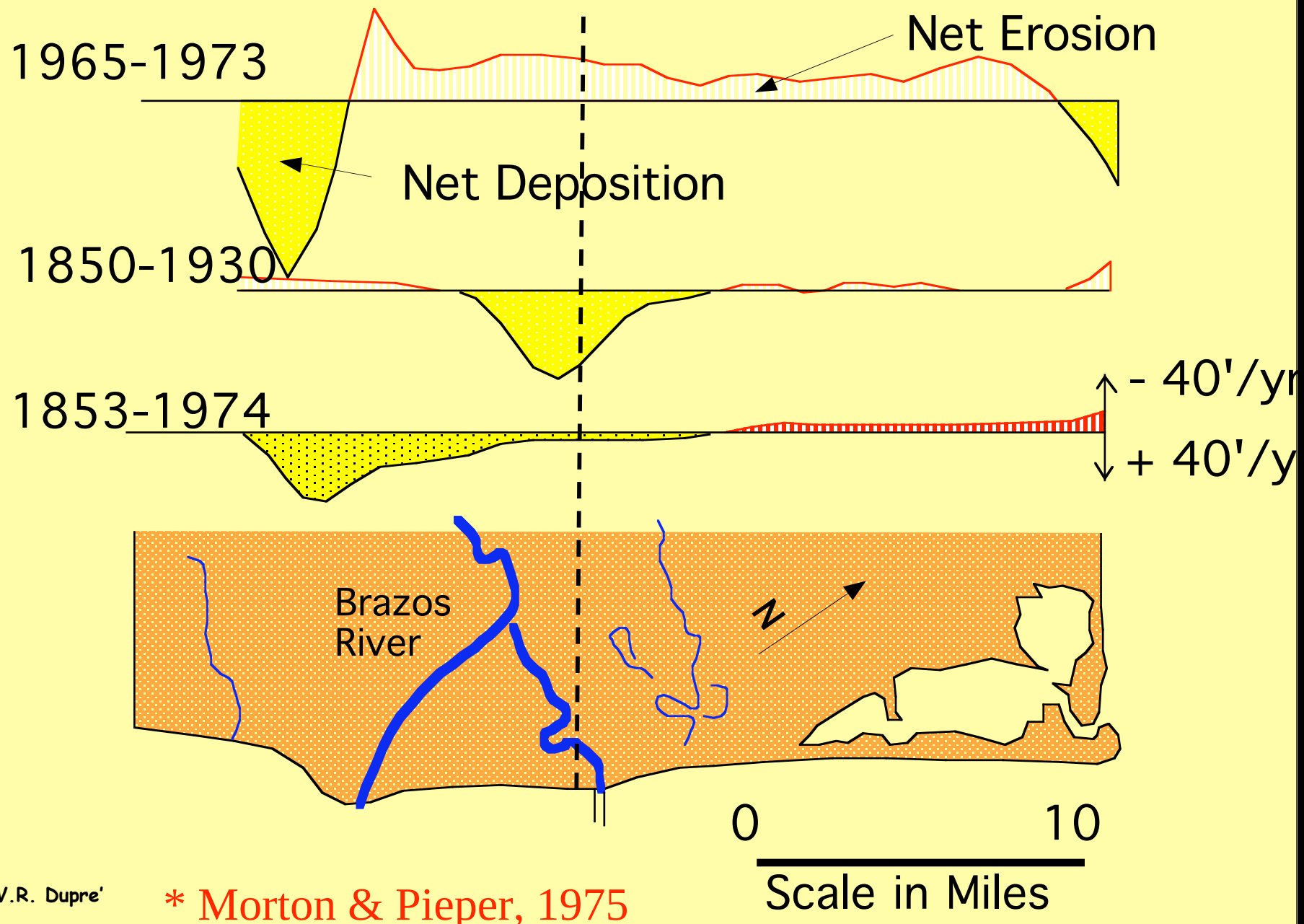
Brazos River and Delta circa 1974


Brazos River
Freeport
Dow
Proposed
Site
1974
1930
NASA

Rates of Shoreline Change: 1853-1974

(based on Texas Bureau of Economic Geology data*)





W.R. Dupre'

* Morton & Pieper, 1975

BEACH EROSION

Before state can help, some Surfside houses must be removed

Fighting the tides of change

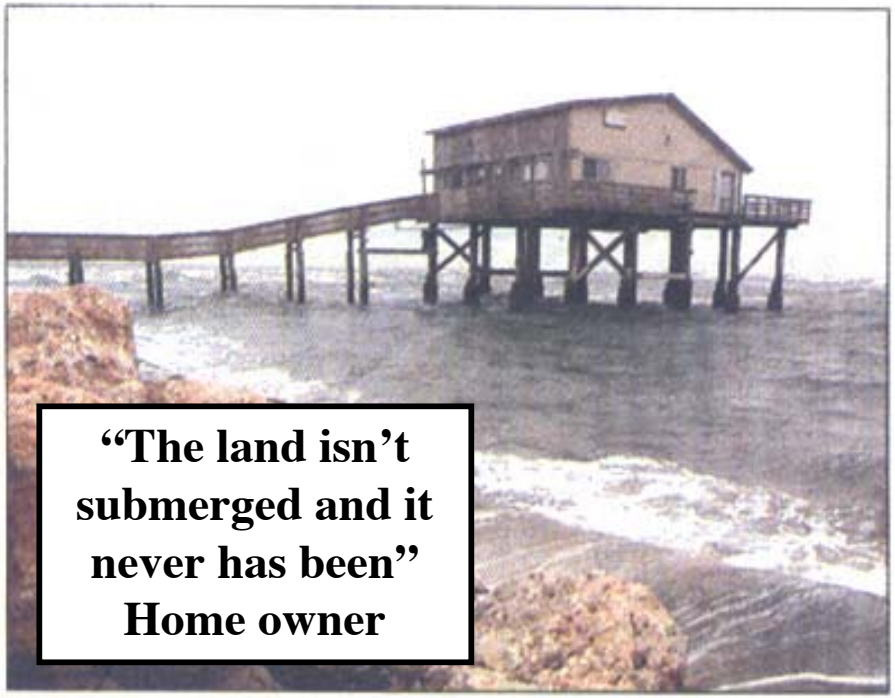
THEN: Surfside Beach property owners Macario Ramirez, right, and Karen Davidson look at an aerial photograph of the area in 1968 during a town meeting Sunday to discuss the erosion problem.

JAMES NIELSEN PHOTOS : CHRONICLE

NOW: The surf passes under a beach house in Surfside. Plans to restore the beach are on hold after hurricanes and high tide took away much of the sand meant for restoration. The state says 35 homes must be removed from an area that has become beach and surf.

Houston Chronicle Nov. 20, 2006

3 beach houses in eye of legal storm



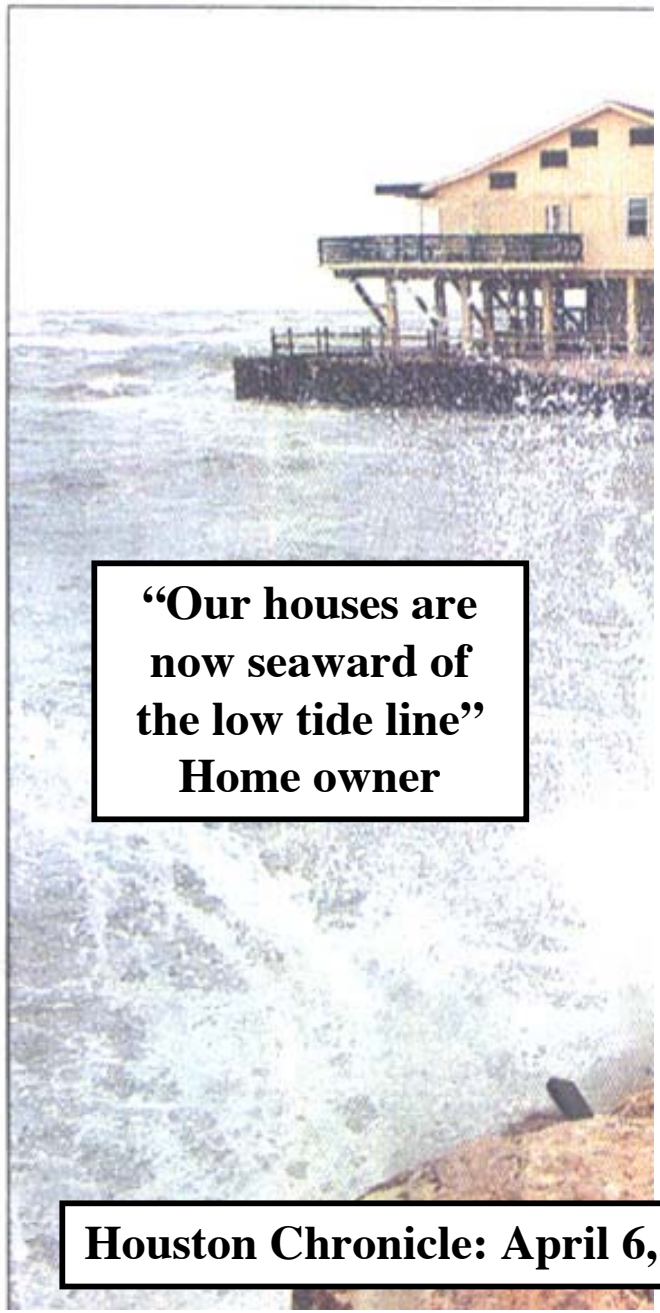
"The land isn't submerged and it never has been" Home owner

Photos by Carlos Javier Sanchez / Special to the Chronicle

The Texas General Land Office has filed a lawsuit against three beach house owners saying their homes are now on submerged land in the Gulf and must be torn down.

Lawsuit seeks homes' removal

Owners deny they're on state land



"Our houses are now seaward of the low tide line" Home owner

Houston Chronicle: April 6, 2004

Associated Press

'Everyone remembers the beach they went to as a kid growing up. Now when they go back, in a lot of cases, it no longer exists.'

Garry Mauro

Katie Oxford walks with her dogs along part of the eroded beach behind her home on Bolivar Peninsula. Oxford had to move her home back because of the erosion.

Has Texas the grit to save its sand?

Mauro seeks legislative help to prevent erosion of beaches

Houston Chronicle: March 2, 1997

Quotes from the Houston Chronicle

"We were amazed at how much beach was lost"

"Without some sort of plan, he[Texas land Commissioner] says, Texas beaches could eventually wash away with the tide. In some cases, they already have"

"…a state financial commitment is needed towards erosion prevention"

Beachfront houses suffer heavy damage

By KEVIN MORAN and CINDY HORSWELL
Houston Chronicle

GALVESTON – Friday's was an

escape the bayside portion of Sea Isle where perhaps 200 families were marooned by high tides much of the day Friday.

On the Gulf side of Sea Isle, slabs of some first-tier homes were com-

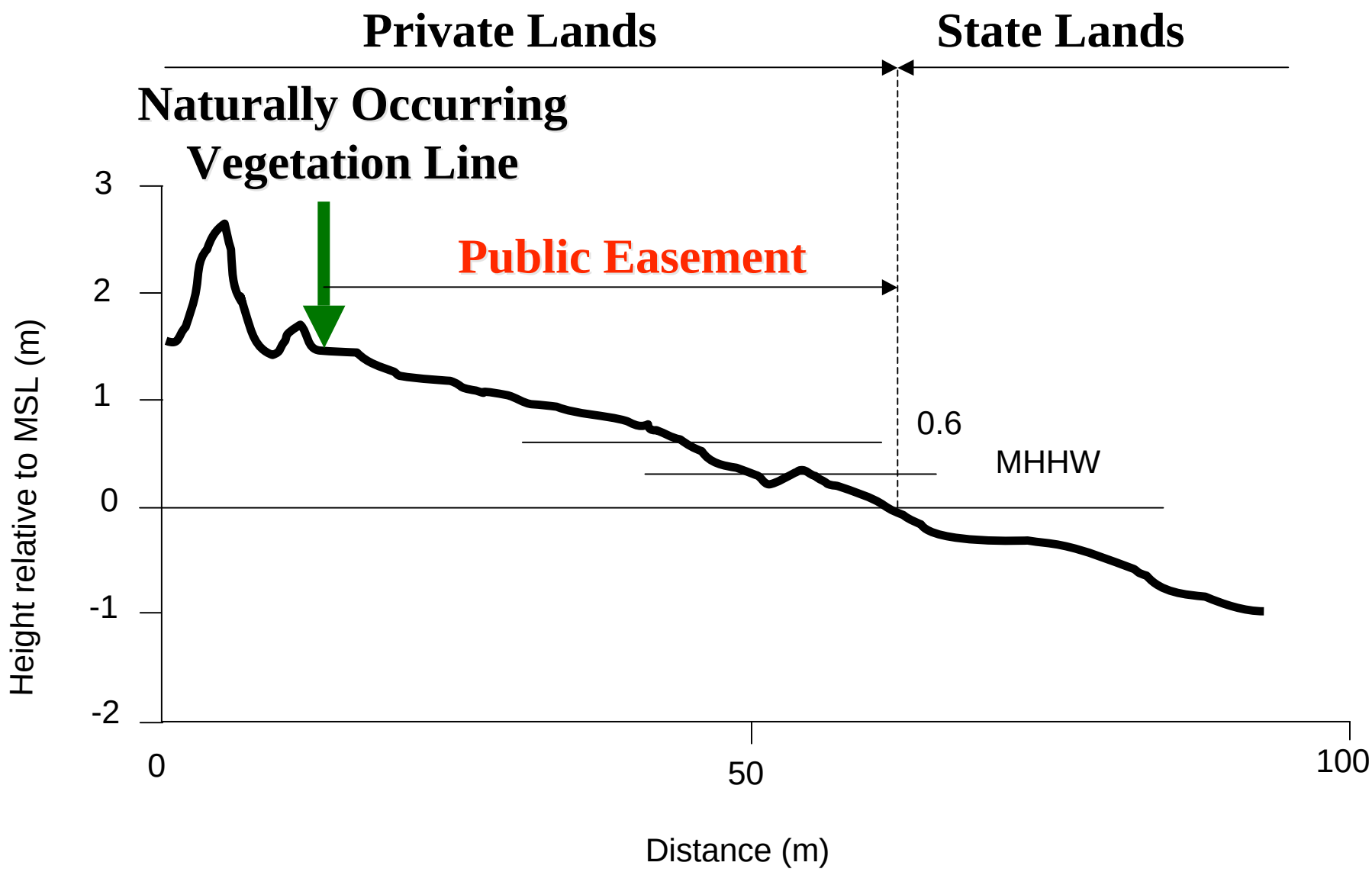
Fiction: *Our Beaches are Eroding*

Facts:

1) **Our Beaches are Moving!**

2) **Our Beachfront Land is Eroding.**

Texas Open Beach Act



West Galveston Beach after Hurricane Alicia


West Galveston Beach with “Geotubes”
Protecting the land but losing the beach