Modeling Alternatives for Erosion Control at Matagorda County, Texas, with GenCade

Ashley E. Frey

Research Civil Engineer
Coastal & Hydraulics Laboratory
Engineer Research & Development Center

On behalf of

The Project Team (Robert Thomas and James Rosati III)

And The GenCade Team (Kenneth Connell, Hans Hanson, Magnus Larson, Sophie Munger, Robert Thomas, Tanya Beck, and Rusty Permenter)

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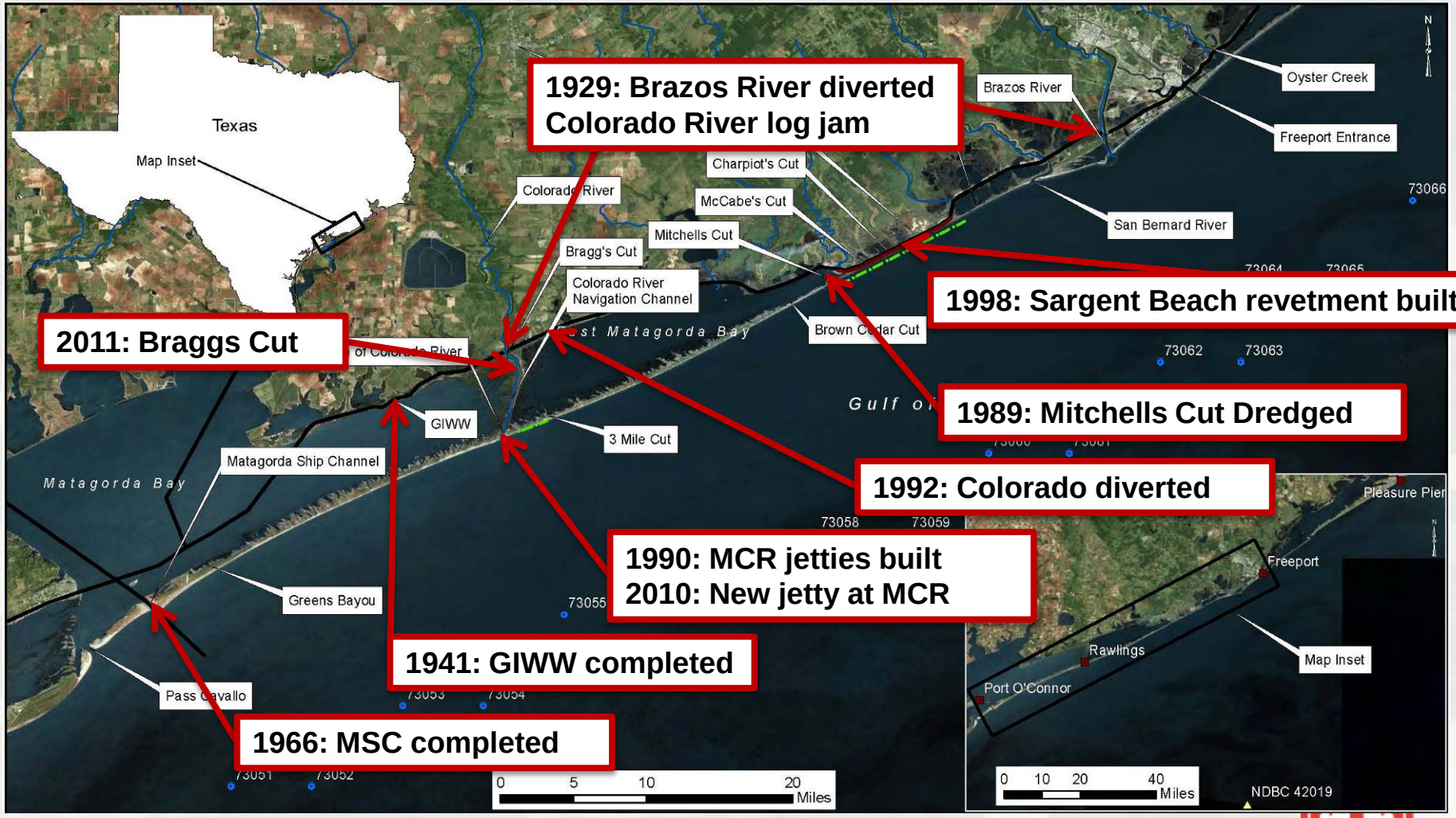
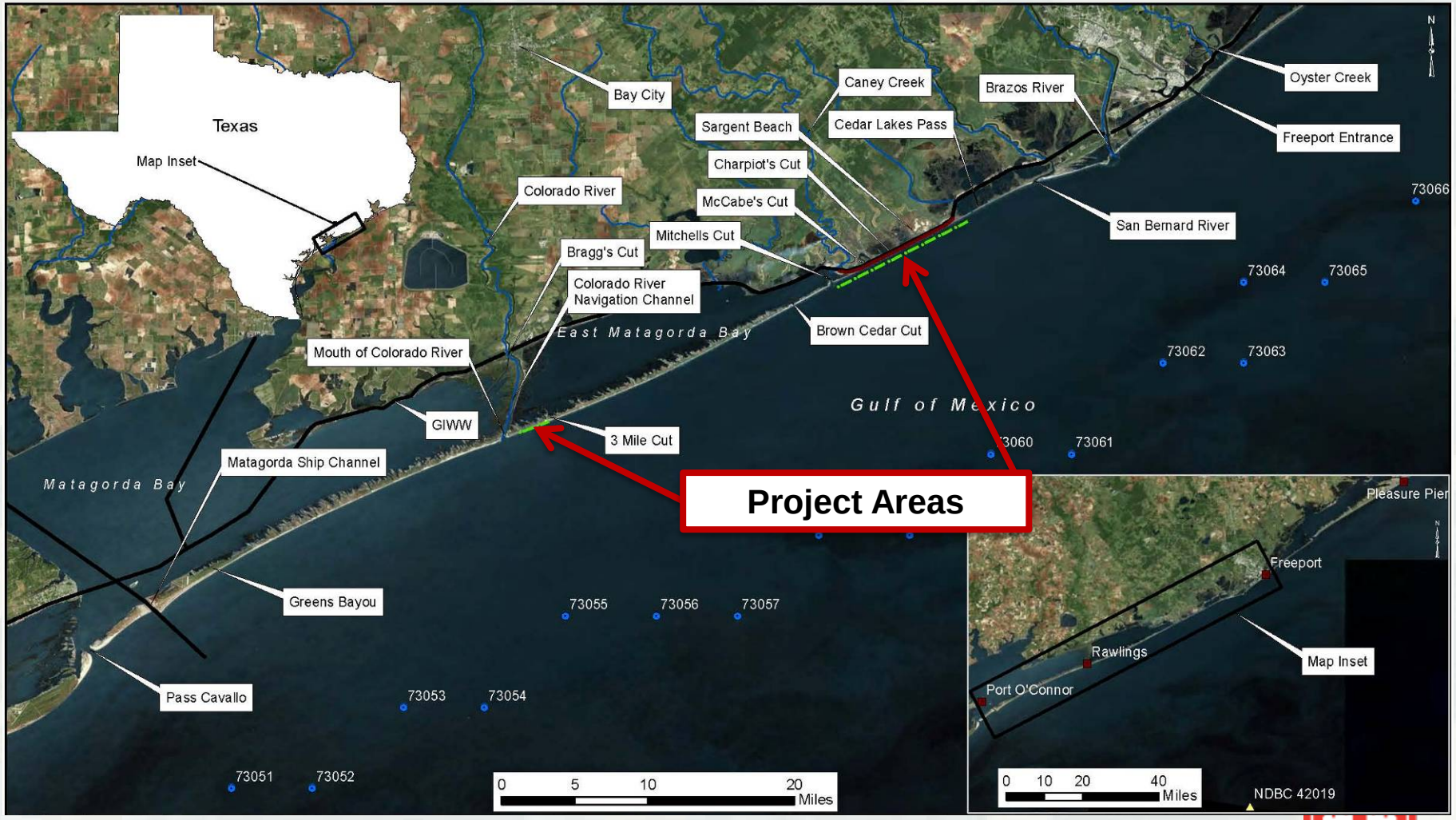
Outline

- Background Information and Introduction to Matagorda County, TX
- Problem Statement
- Introduction to GenCade
- GenCade Calibration to Measured Data
- Alternatives at Matagorda Peninsula
- Alternatives at Sargent Beach
- Summary and Conclusions

Overview and History



Overview and History



Problem Statement

- Sargent Beach – fastest eroding beach in Texas
- Matagorda Peninsula – breached by ephemeral inlets in past

Determine feasibility of structural solutions to reduce erosion

Sargent Beach

- protect the beach habitat
- protect Gulf Intracoastal Waterway

Matagorda Peninsula

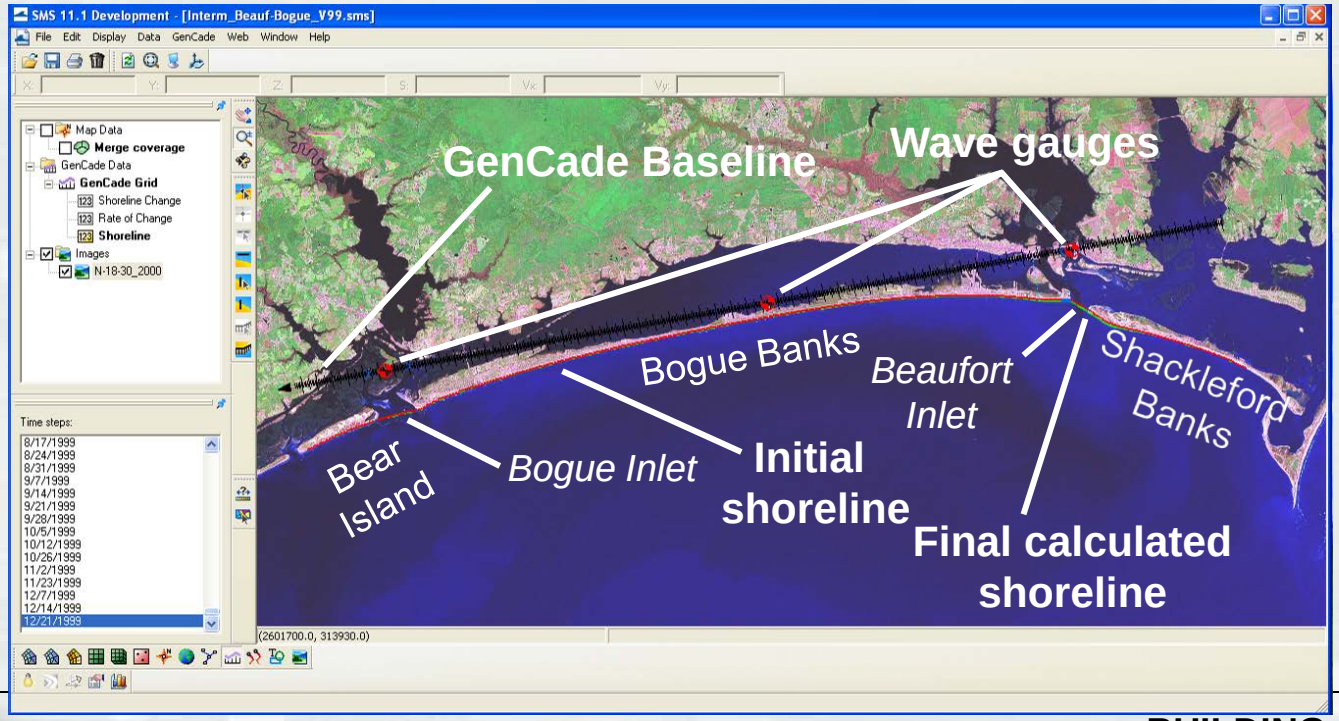
- protect beach habitat
- reduce storm damage
- reduce sediment impoundment along the MCR east jetty

How? GenCade

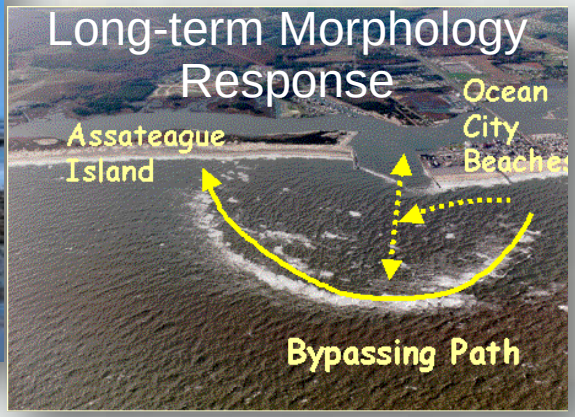
GenCade

What is GenCade?

- Integrated GENESIS and Cascade models for shoreline change and regional sediment calculation
- Connects inlets, navigation channels, ebb and flood shoals, and beaches in engineering activities in a regional framework.
- Decision-making support for planning, operation, and engineering.



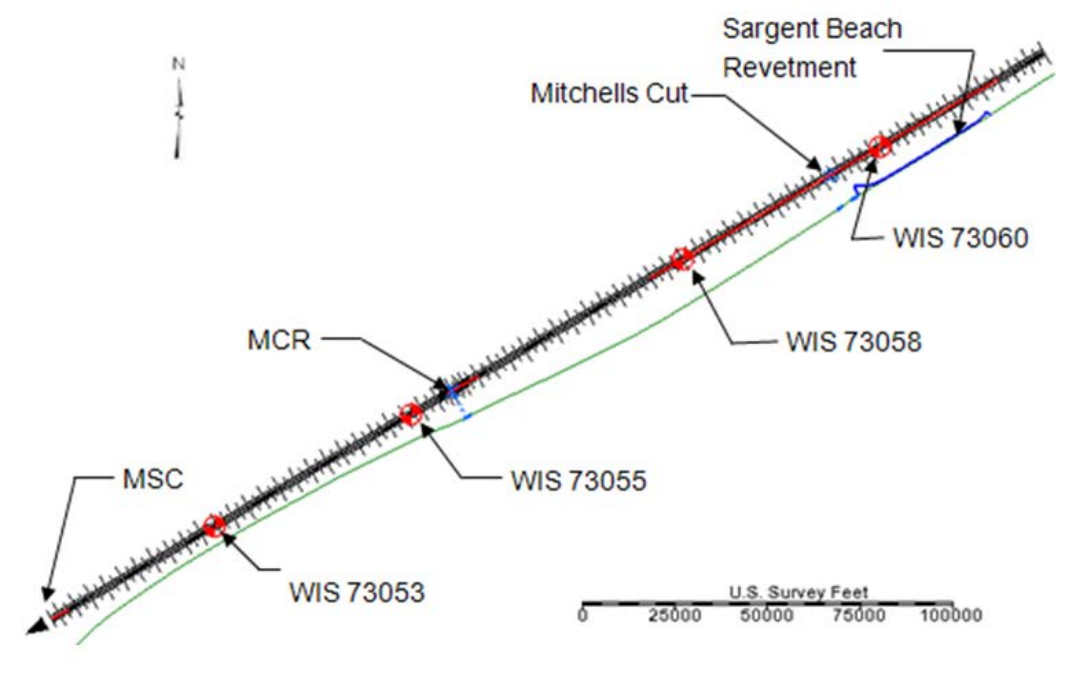
GenCade



Why GenCade?

- Sediment storage and transfer (bypassing, back-passing)
- Navigation channel maintenance
- Multiple interacting inlet dredging & placements on beaches
- Cumulative impacts
- Sources & sinks (shoal dredging and beach nourishment)
- Compatibility with data and previous calculations
- In SMS 11.1; PC, user-friendly interface for engineers & scientists

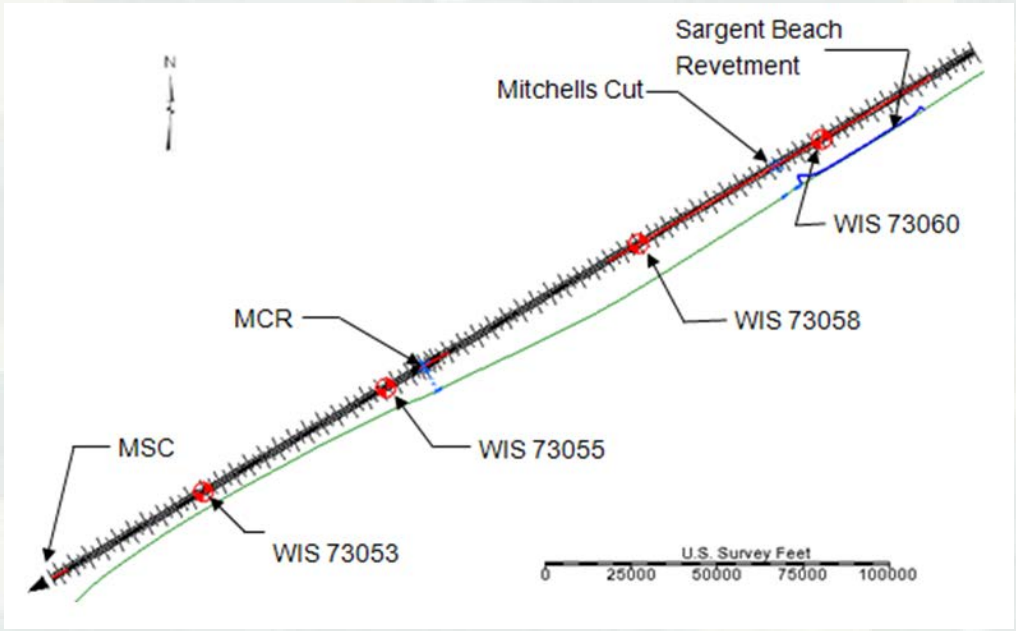
GenCade Calibration



GenCade Input

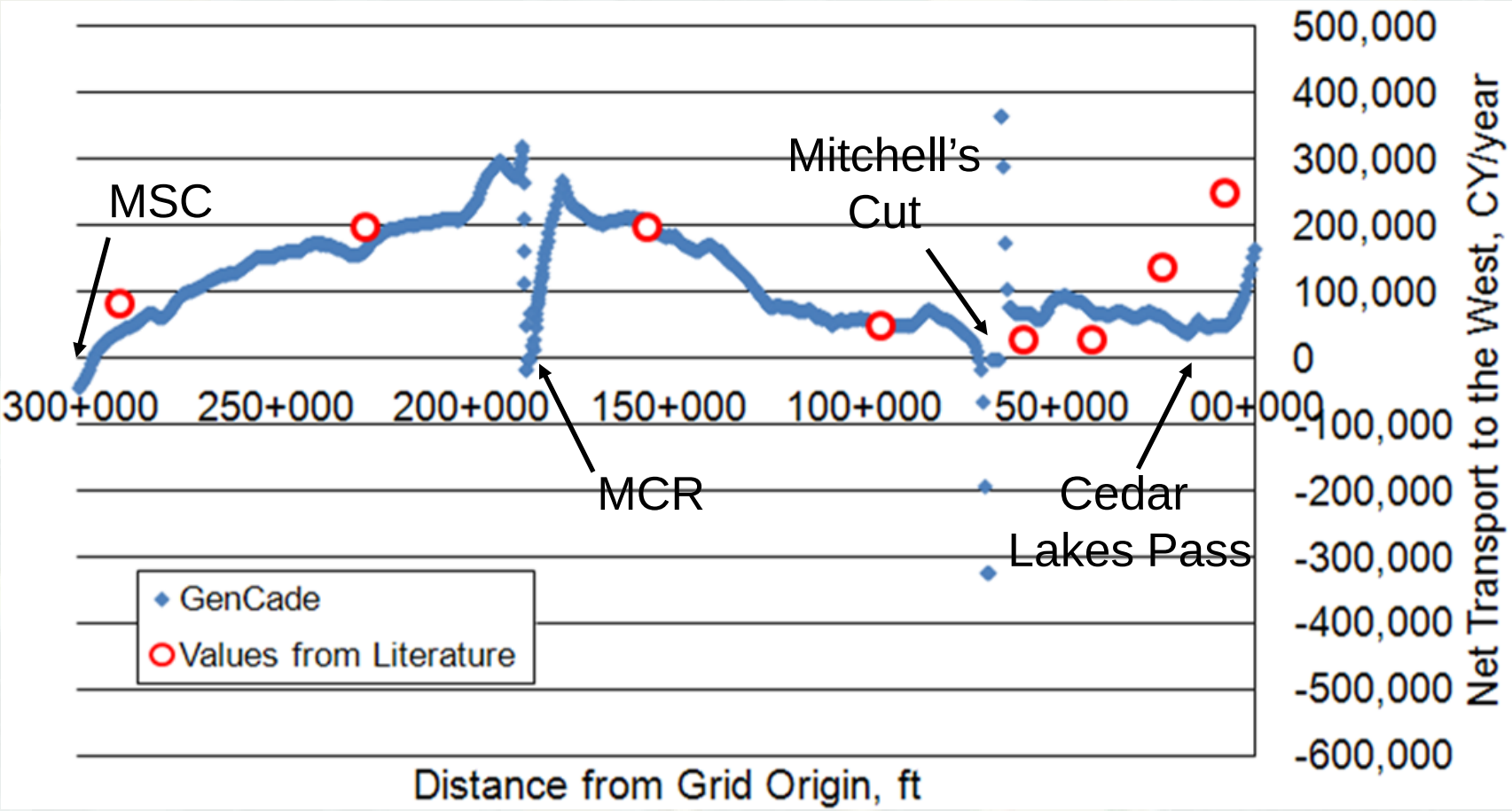
- 1995 and 2000 shorelines
- Waves (WIS 73060, 73058,73055, 73053)
- Sargent Beach revetment
- Mitchell's Cut and Mouth of the Colorado River

GenCade Calibration

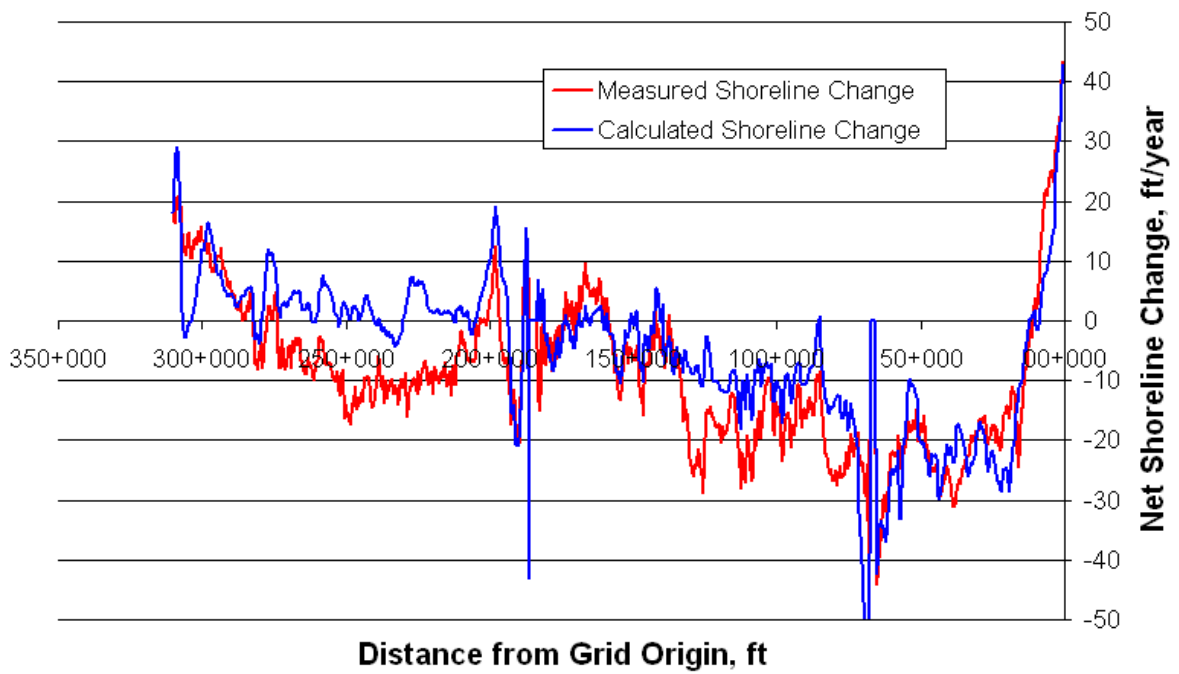


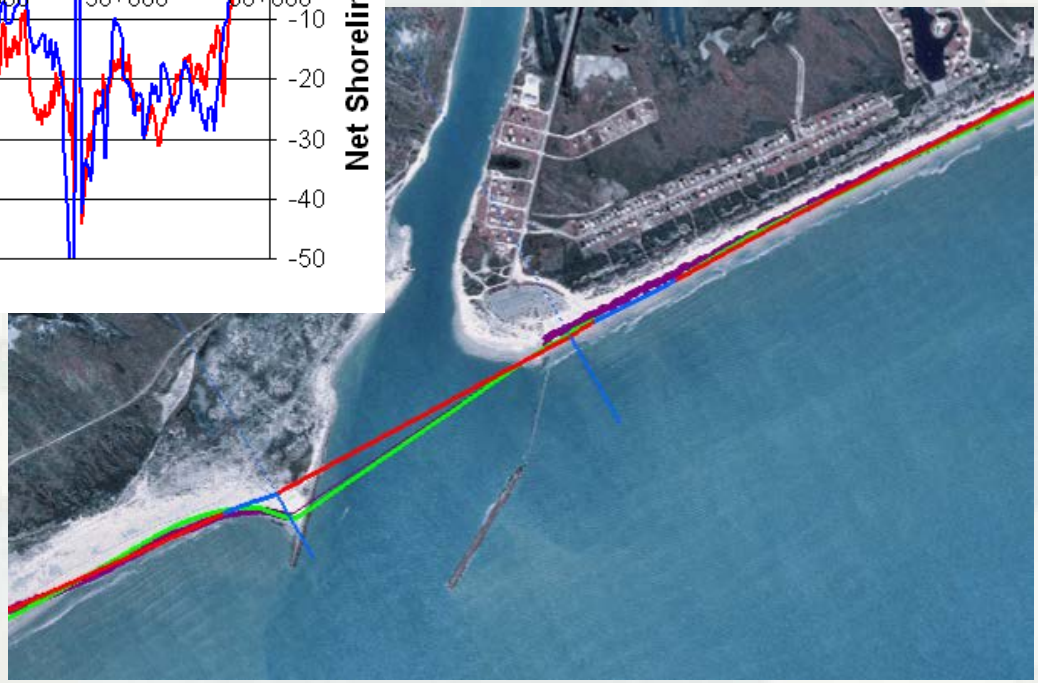
Parameter	Value
Start Date	1/1/1995 0:00
End Date	12/30/1999 0:00
Time Step	0.1 hr
Recording Time Step	168 hr
Effective Grain Size, mm	0.2
Average Berm Height, ft	3.3
Average Depth of Closure, ft	19.7
Left Lateral Boundary Condition, ft	217
Right Lateral Boundary Condition, ft	92
K1	0.2
K2	0.1
ISMOOTH (smoothing window)	11

GenCade Calibration: 1995-2000 Net Transport

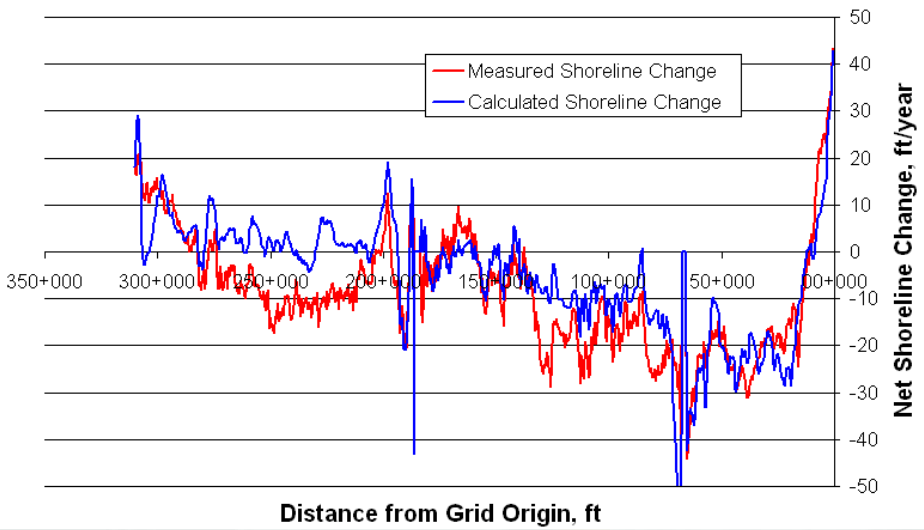


GenCade Calibration: 1995-2000 Measured Shoreline Change



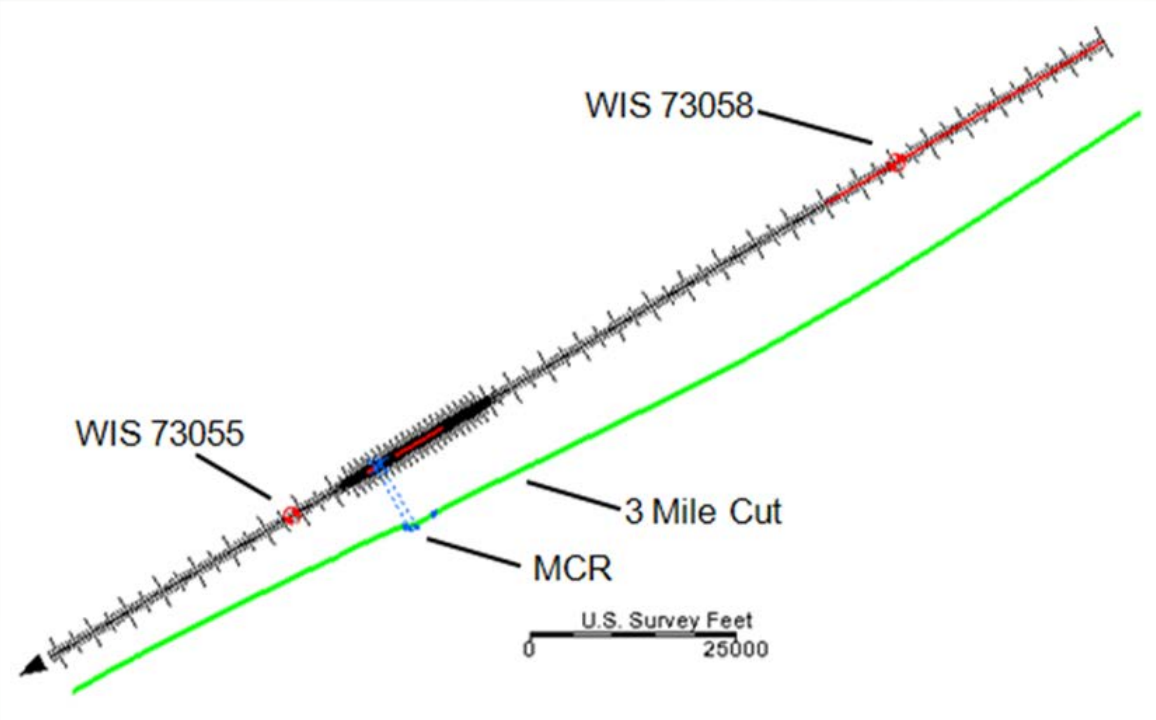


GenCade Calibration: 1995-2000 Measured Shoreline Change



Cell	Average Shoreline Change, ft/year		RMS Error, ft/year	Brier Skill Score
	Measured	Modeled		
SBR to Cedar Lakes	10.4	7.4	7.4	0.87
West of Cedar Lakes	-17.2	-22.3	6.5	0.86
Sargent: East of FM 457	-23.9	-22.3	4.5	0.97
Sargent: West of FM 457	-26.1	-24.5	4.7	0.97
West of Mitchells Cut	-18.6	-13.6	8.6	0.8
East of MCR	-5.7	-6.2	10.4	-0.1
MCR to MSC: North	-7.2	4.2	12.5	-0.57
MCR to MSC: South	6	6.7	6.9	0.54

Matagorda Peninsula Alternatives



- Shorter grid to speed up simulation time
- Smaller cell size between 3 Mile Cut and MCR
- 5 and 16 year long simulations

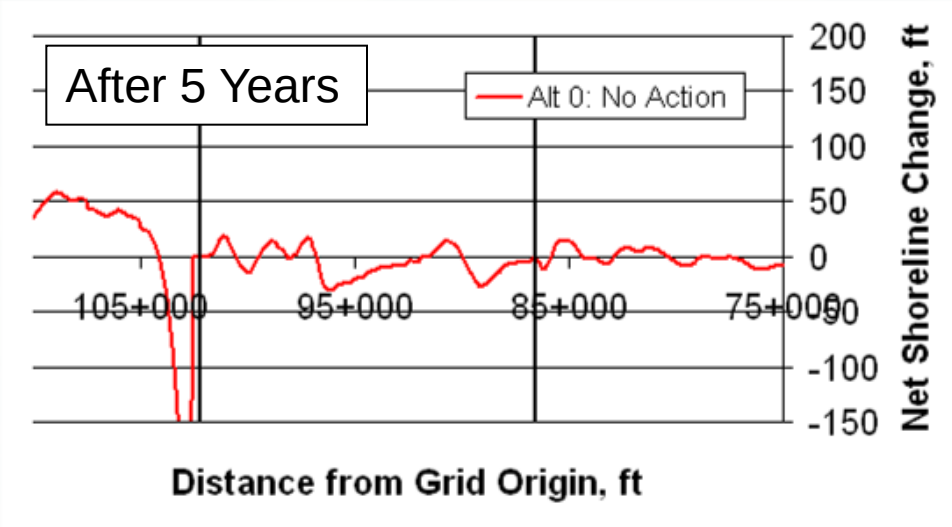
Matagorda Peninsula Alternatives

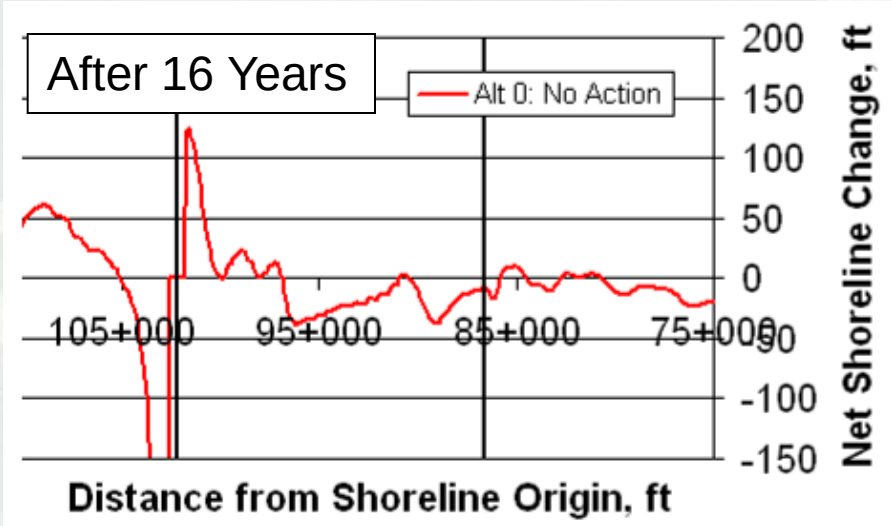
Alt 0: No Action

- No groins
- No beach fill
- Minimal bypassing around MCR

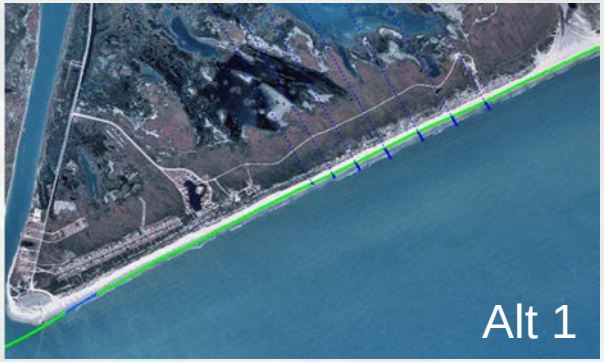
After 5 Years – Less than 50 ft of erosion or accretion between 3 Mile Cut and MCR

After 16 Years – Slightly more erosion, sediment building up east of MCR





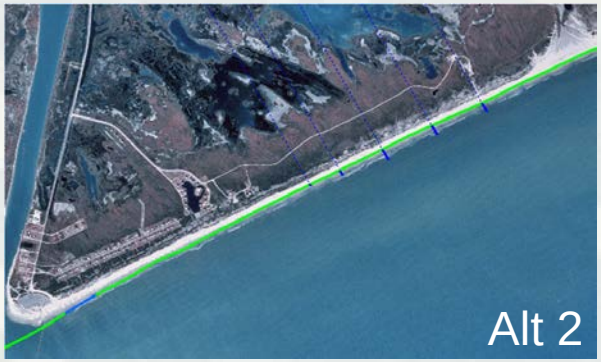
Matagorda Peninsula Alternatives



No beach fills

115,000 cy/yr of bypassing around MCR

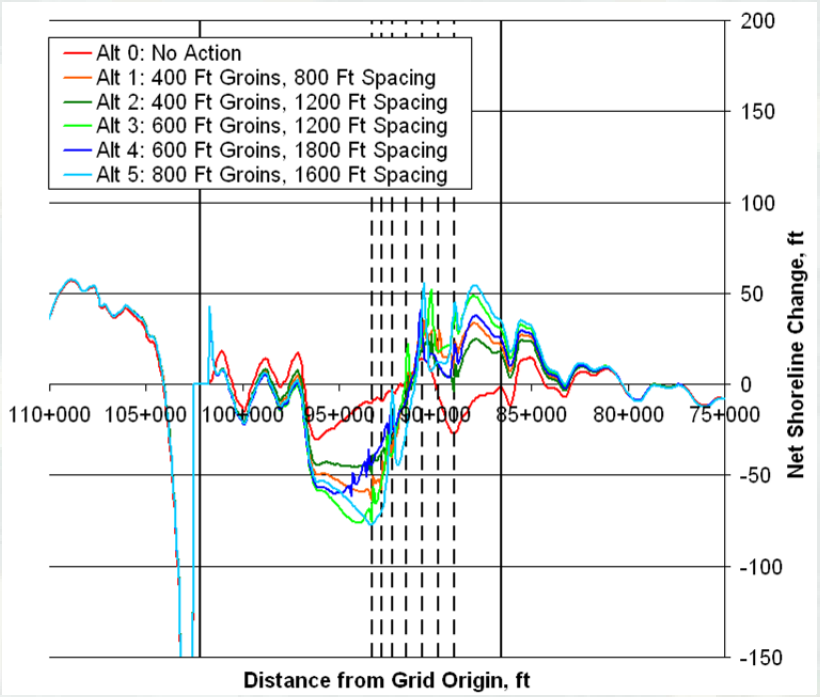
P = 0.3



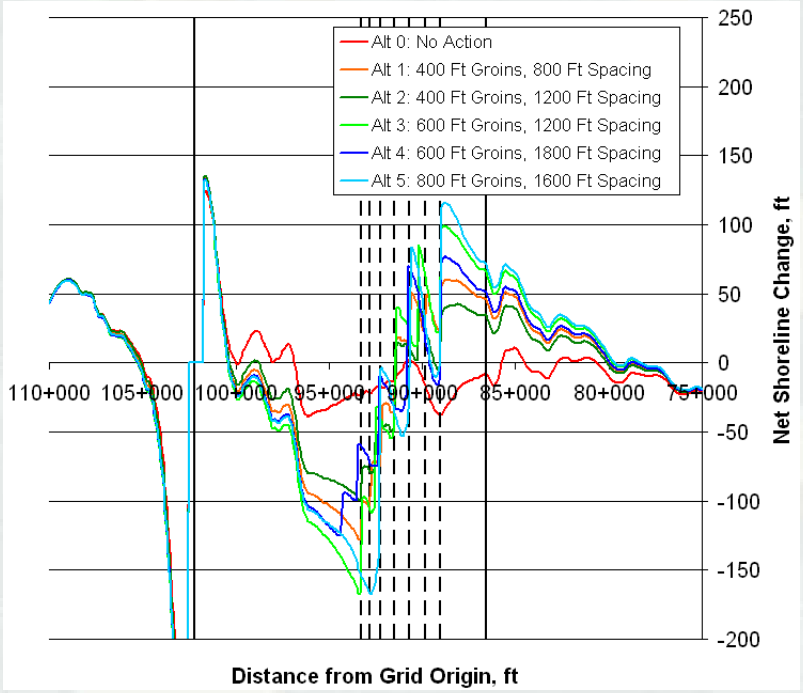
5 groins, 800 ft long,

Matagorda Peninsula Alternatives

After 5 Years



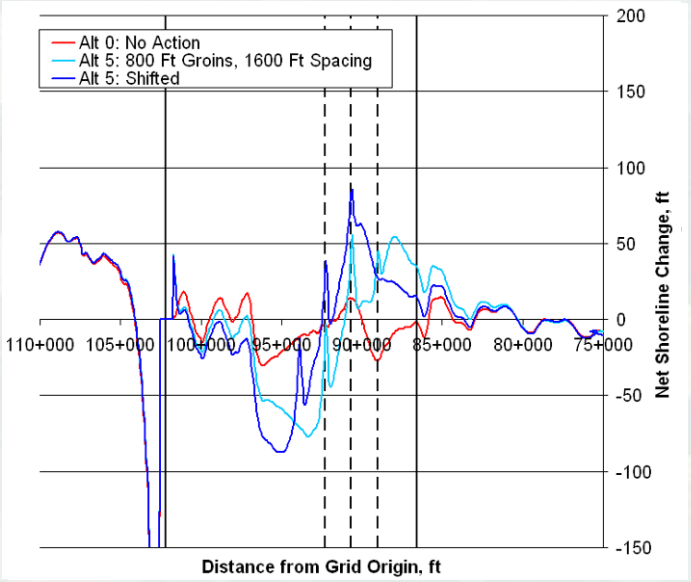
After 16 Years

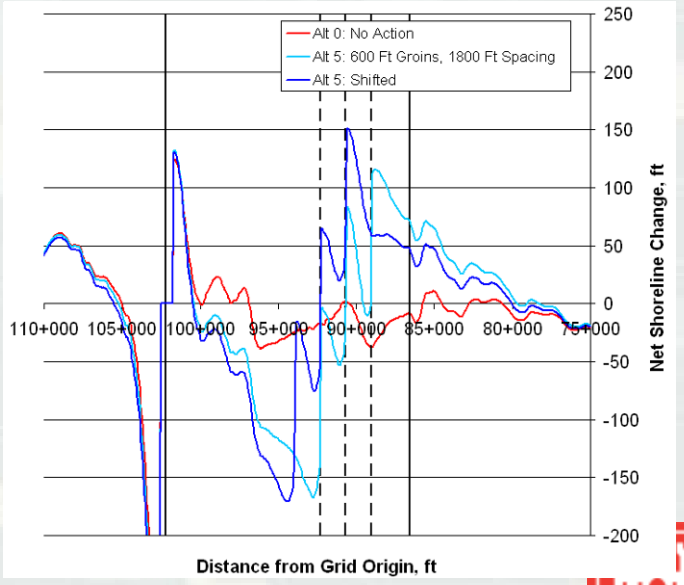


Based on preliminary simulations, Alt 5 was selected as the design alternative

Additional variations of Alt 5 were simulated

Matagorda Peninsula – Alt 5



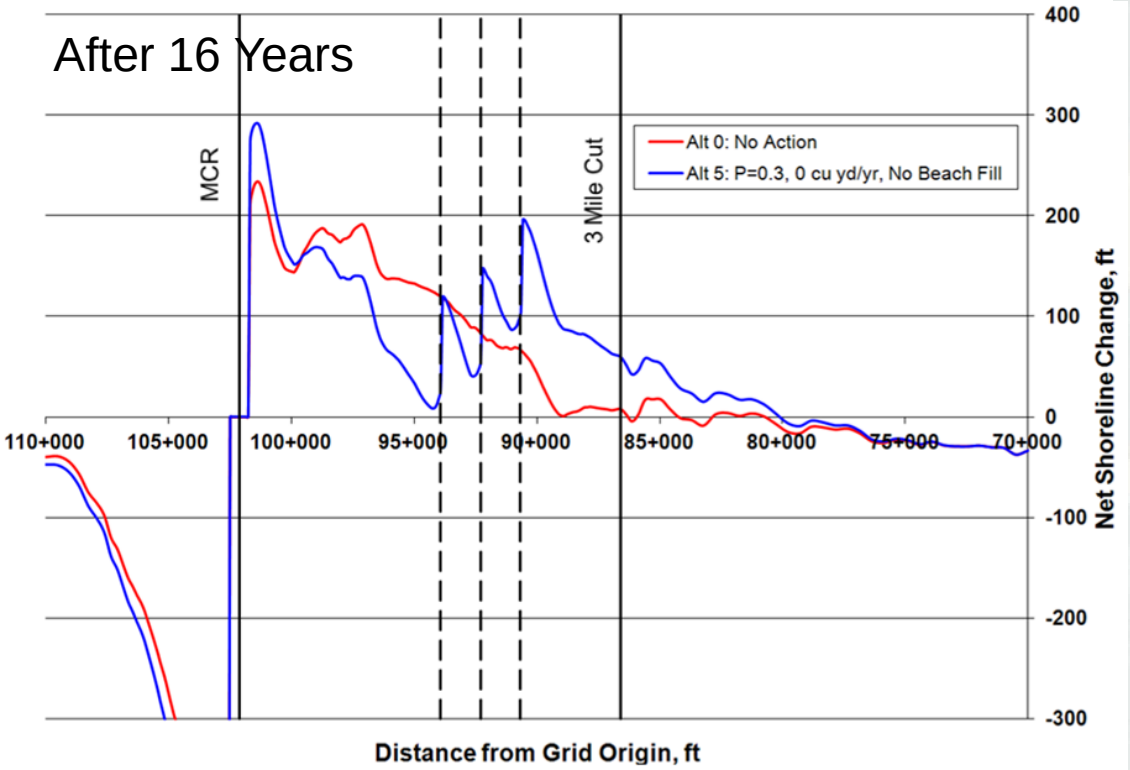


Matagorda Peninsula – Alt 5

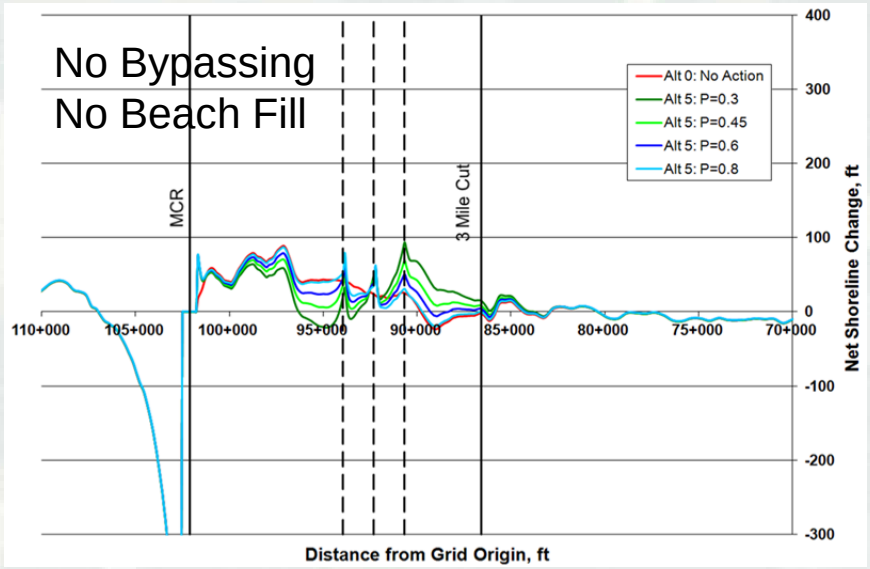
- Beach Fill (100 and 200 ft added width)

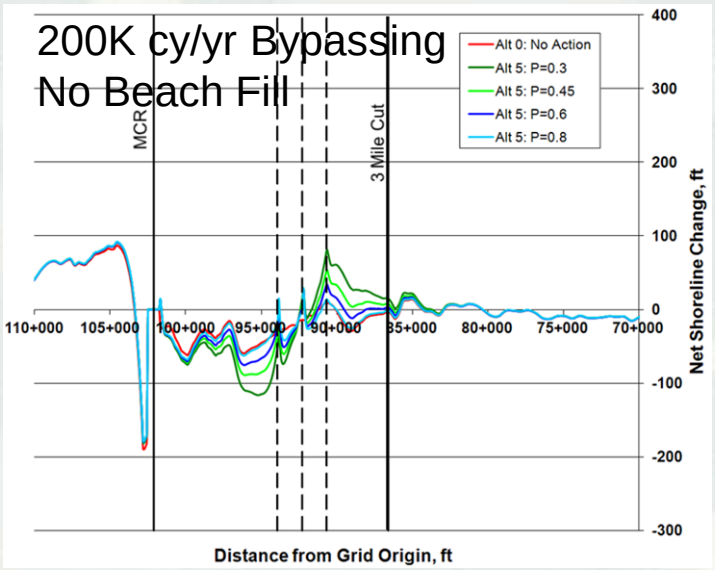
- Bypassing around MCR (0 cy/yr, 115,000 cy/yr, 200,000 cy/yr)

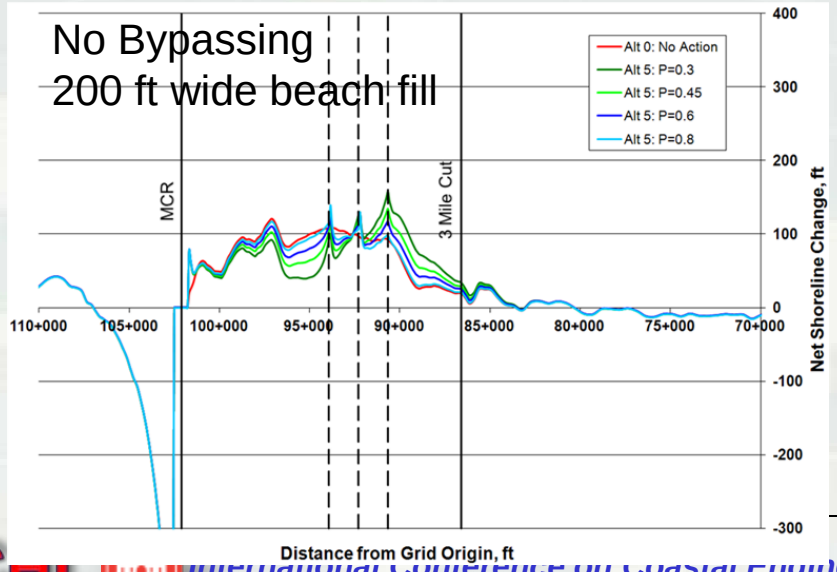
- Permeability of the groins (P = 0.3, 0.45, 0.6, 0.8)

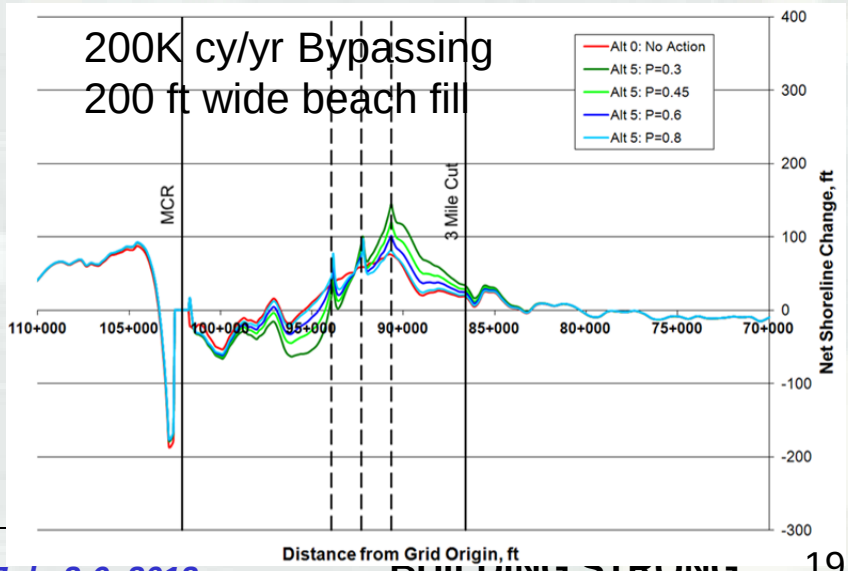


Matagorda Peninsula – Alt 5 (After 5 Years)

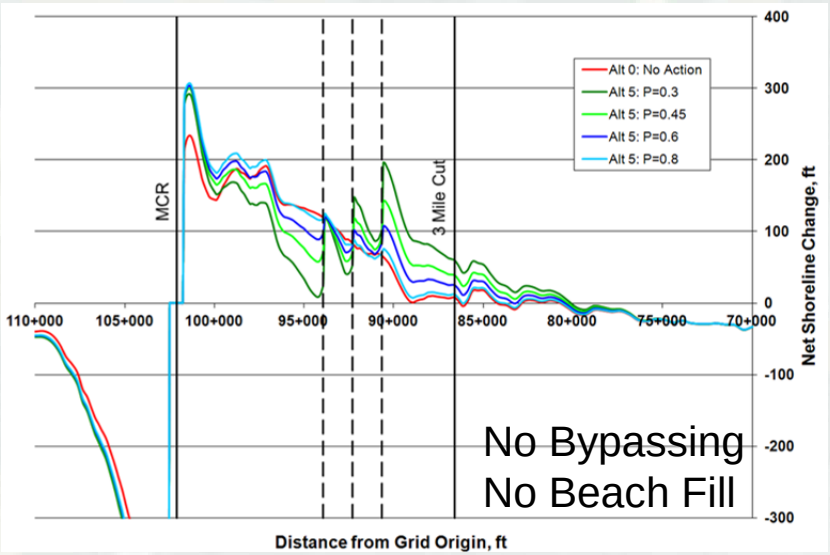


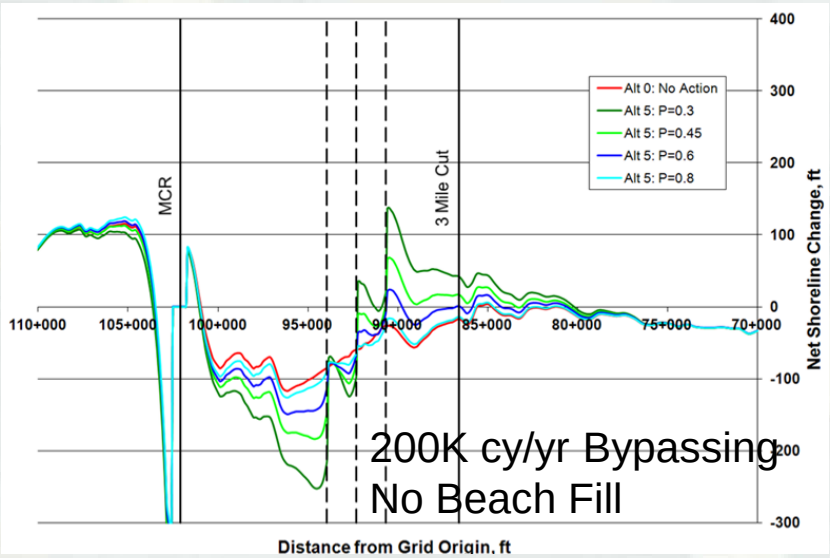


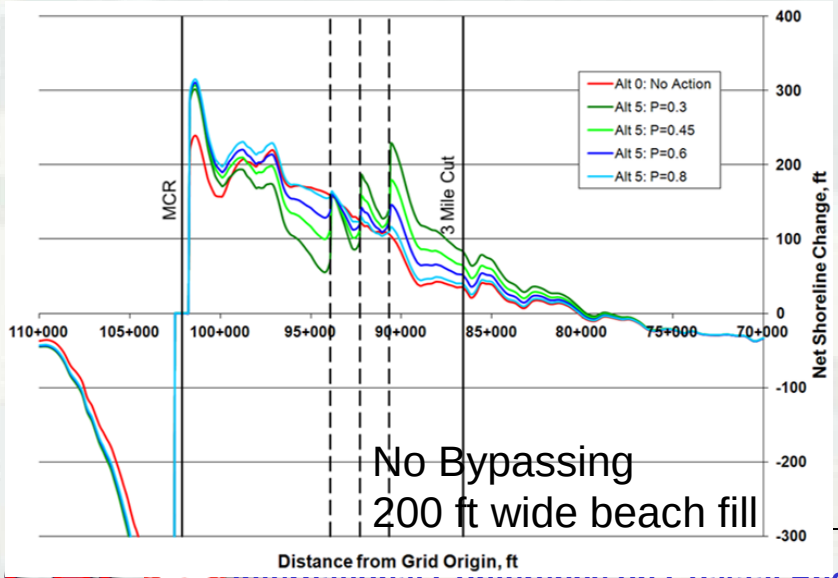


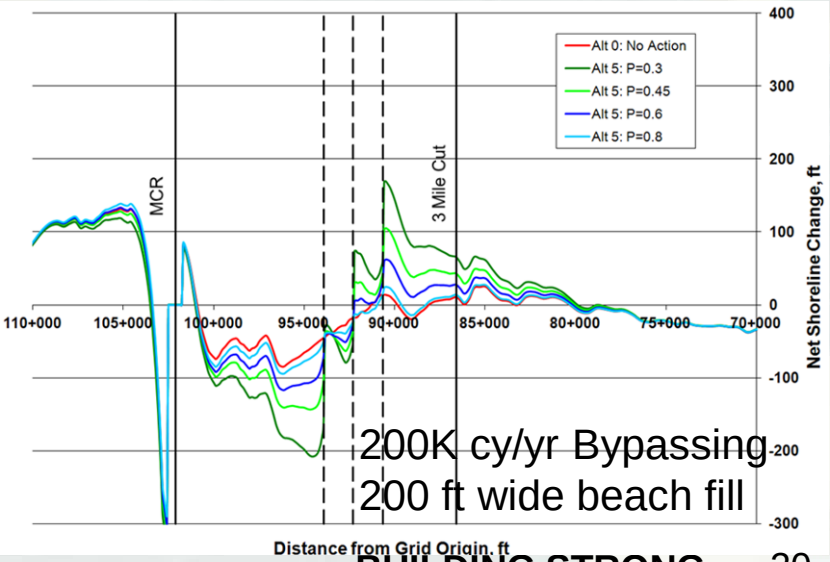


Matagorda Peninsula – Alt 5 (After 16 Years)









Matagorda Peninsula – Alt 5 Comparison

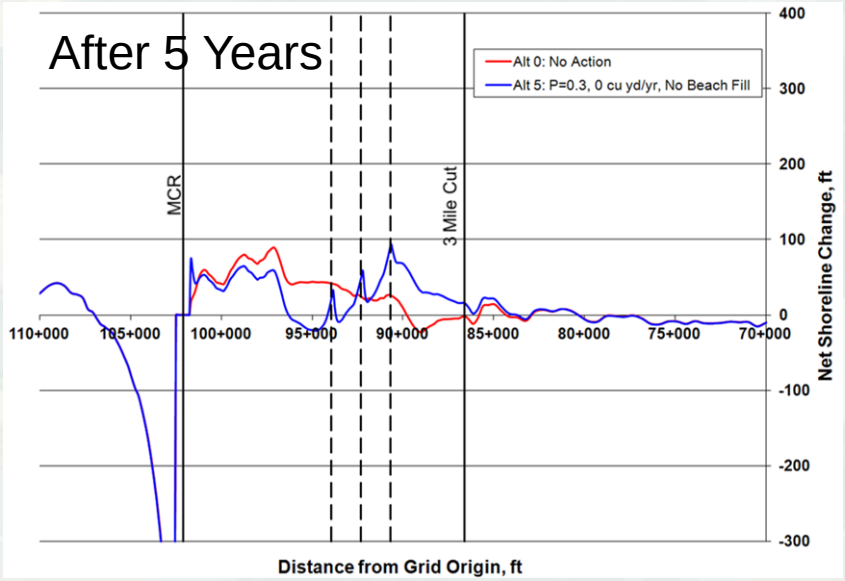
P = 0.3 for final design

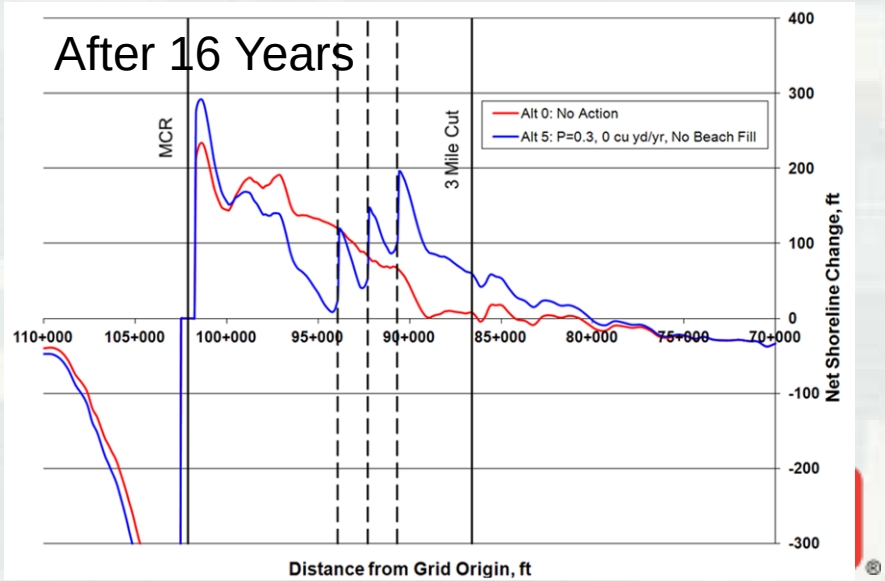
Compare No Action to
Alt 5 (no beach fill or bypassing)

After 5 years, greatest accretion to northeast of first groin (less than 100 ft)

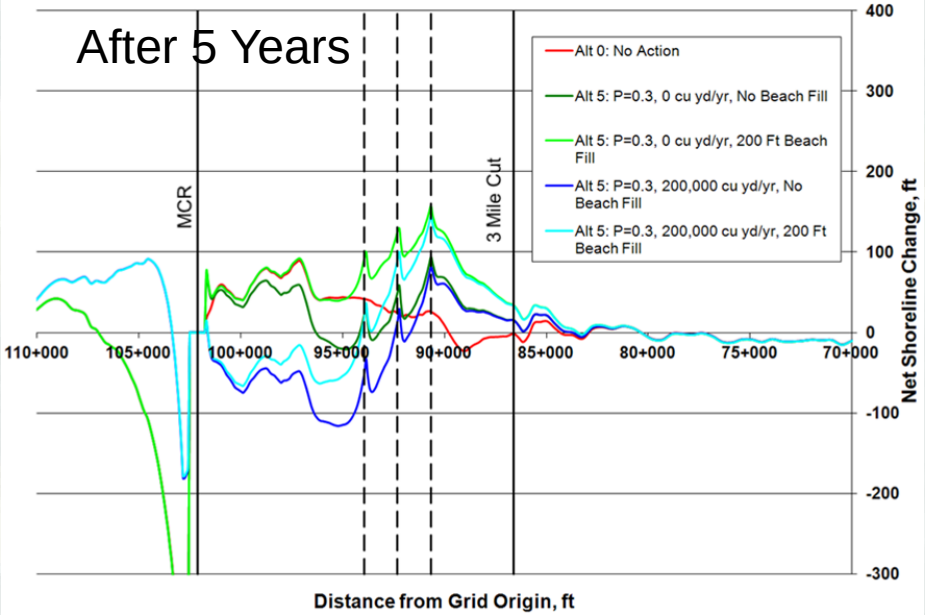
After 16 years, about 200 ft of accretion northeast of first groin

After 16 years, almost 300 ft of shoreline advance northeast of MCR



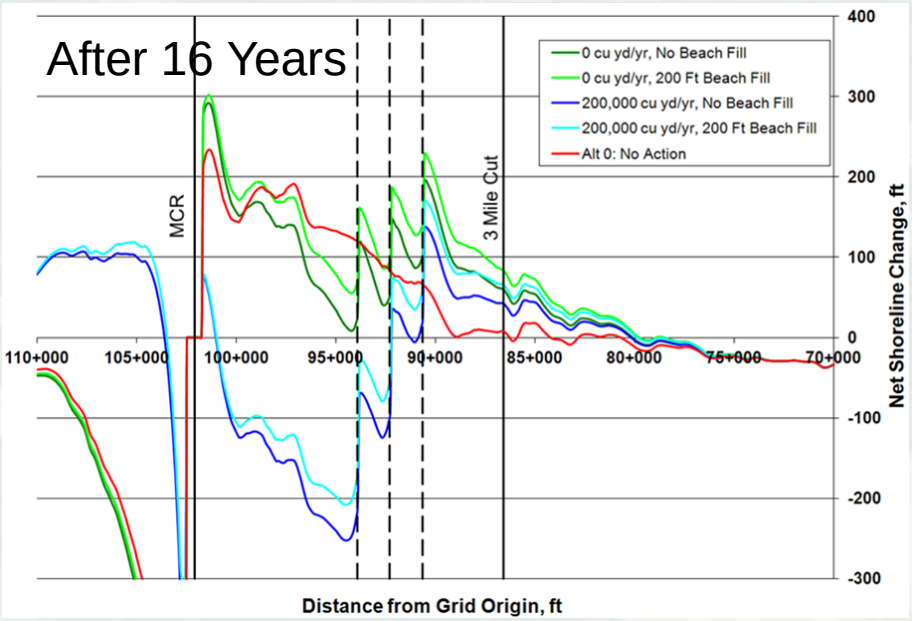


Matagorda Peninsula – Alt 5

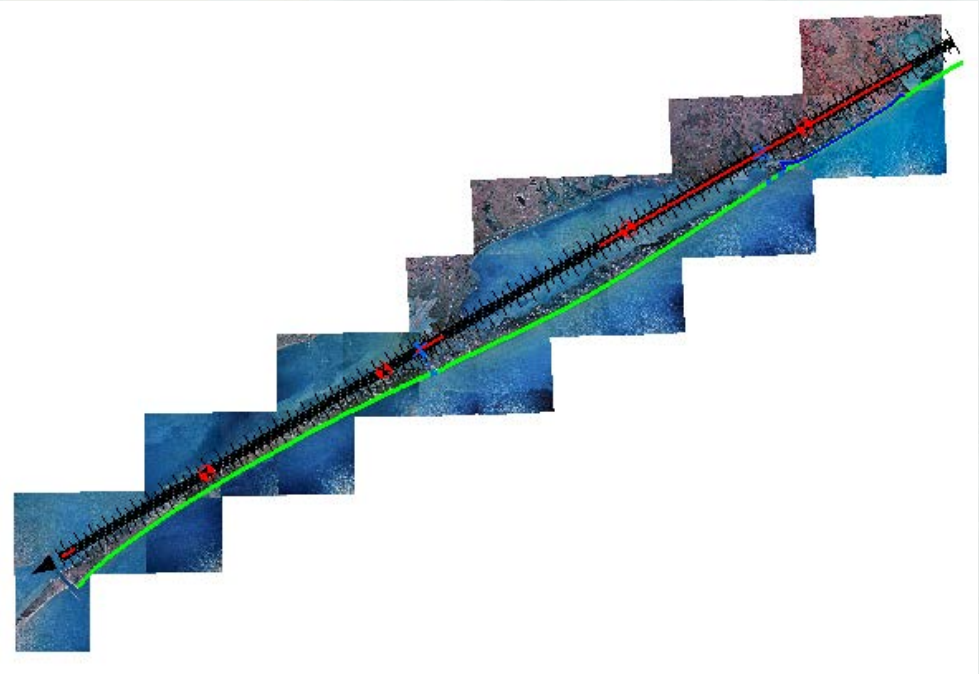


- With 200,000 cy/yr of bypassing, erosion occurs with and without beach fills
- All cases result in accretion northeast of first groin

- Bypassing between 0 and 200,000 cy/yr may provide best result



Sargent Beach Alternatives



Most Sargent Beach alternatives use same grid setup as the calibration

Breakwater alternatives required shorter grid due to computational time

Alt 0: No Action

Alt 1: 3 million cubic yard beach fill over 10 miles

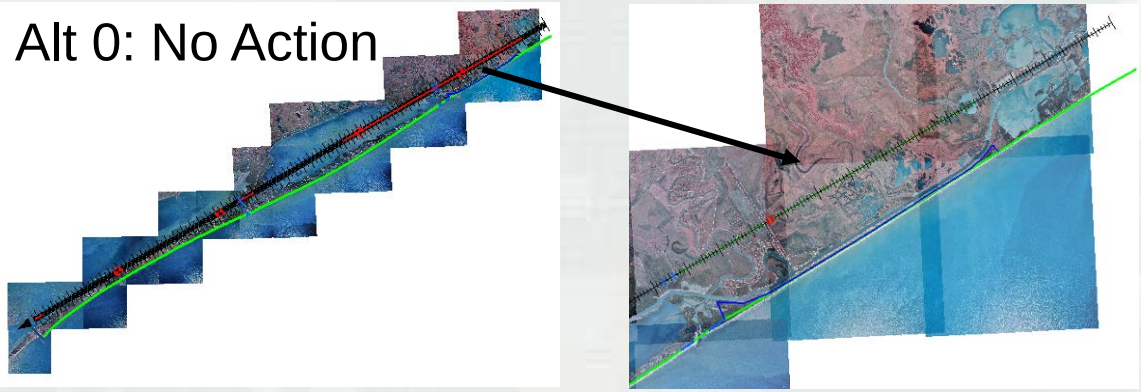
Alt 2: Single groin adjacent to Mitchell's Cut and beach fill from Alt 1

Alt 3: Groin field extending length of Sargent Beach and beach fill from Alt 1

Alt 4: Breakwaters

Alt 5: Transition Breakwaters

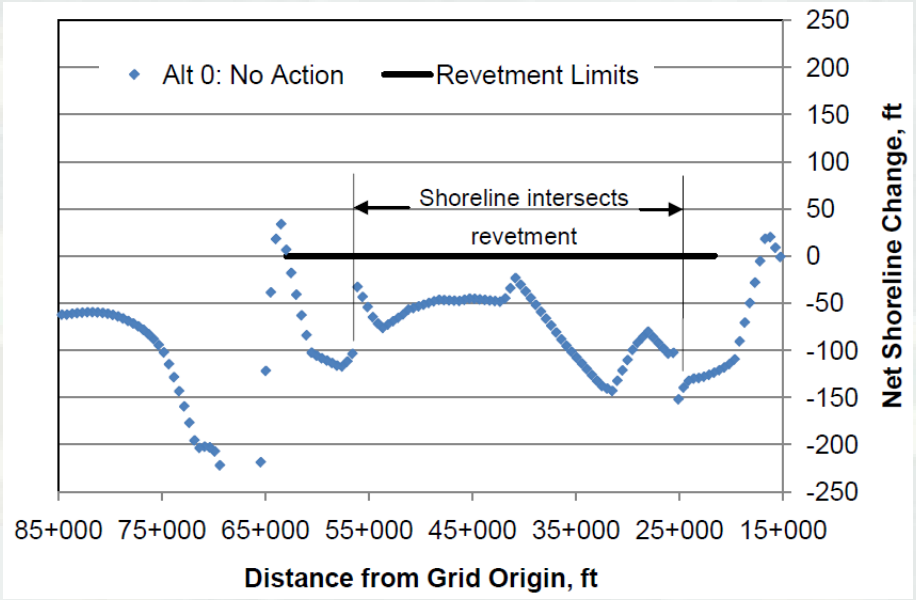
Sargent Beach Alternatives

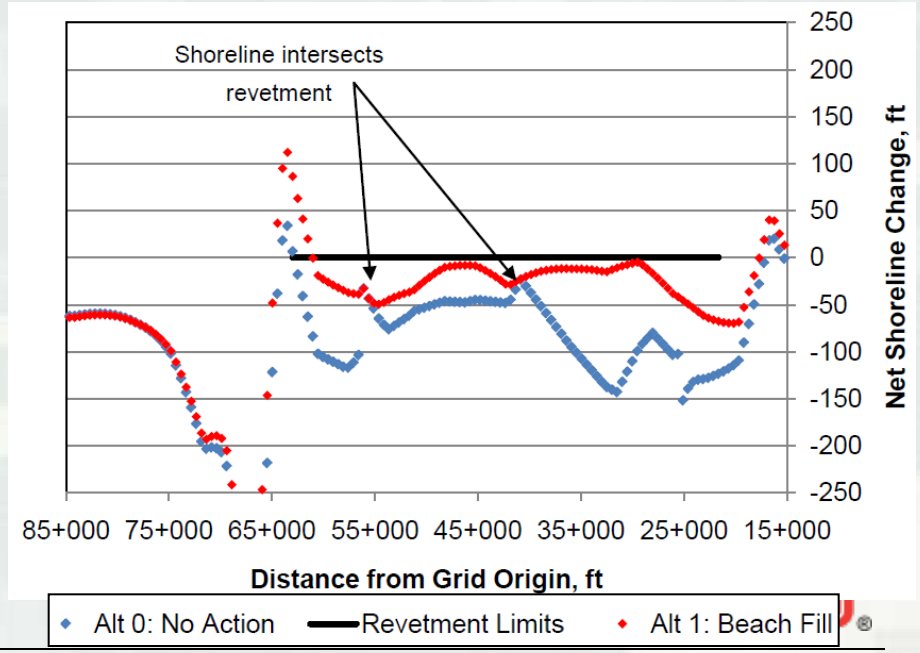


Alt 1: 3 million cubic yard beach fill over 10 miles

Placement density of 57 cy/linear foot

Added berm width of 100 ft



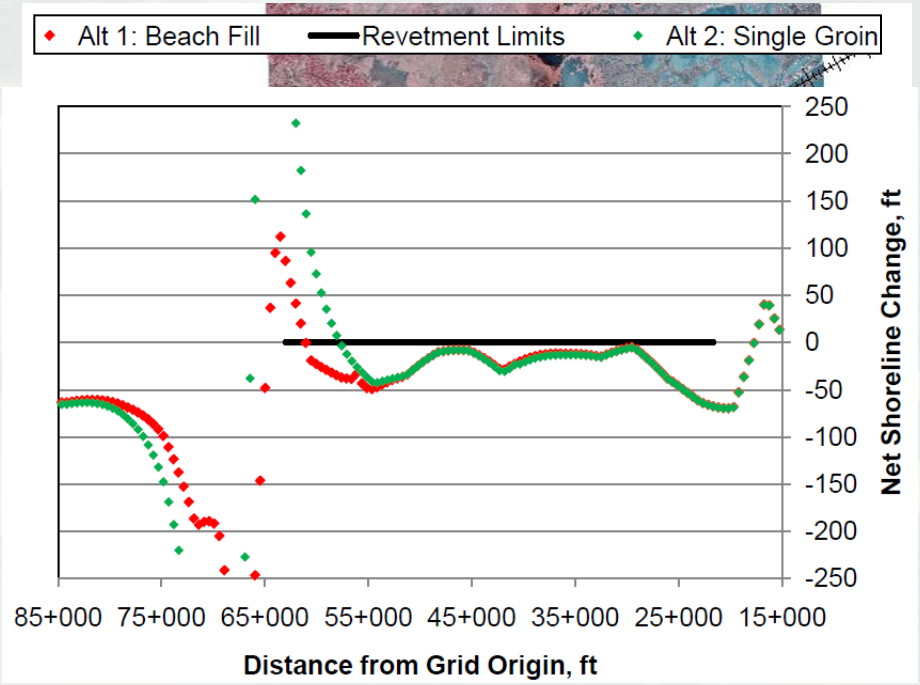


Sargent Beach Alternatives

Alt 2: Single Groin East of Mitchell's Cut plus Beach Fill

Beach fill identical to Alt 1

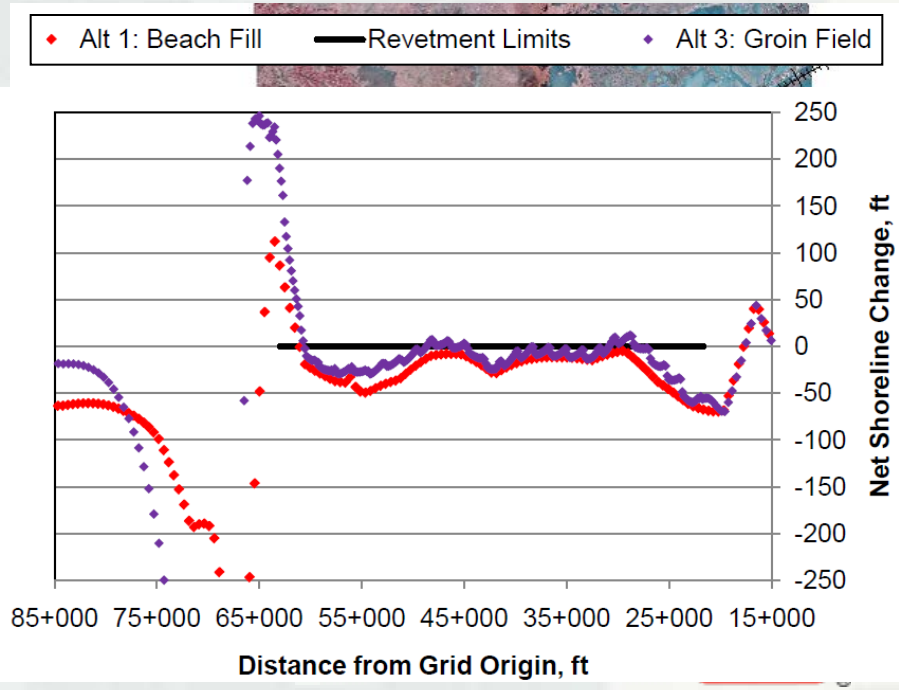
Unrealistically long groin to demonstrate maximum trapping capacity



Alt 3: Groin Field plus Beach Fill

Beach fill identical to Alt 1

Includes 28 groins of 600 ft spaced 1800 ft apart



Sargent Beach Alternatives

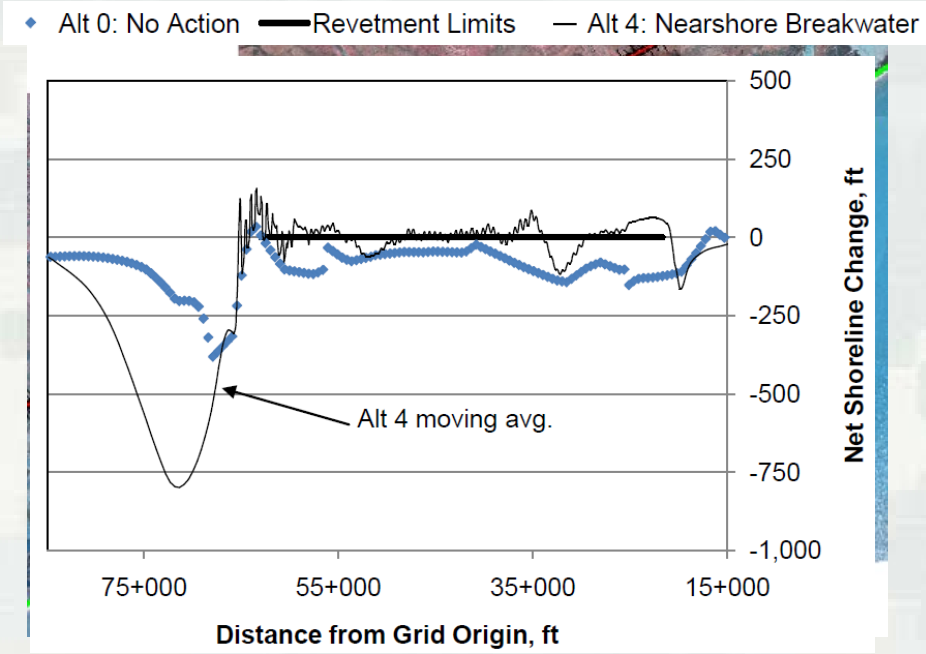
Alt 4: Breakwaters

Does not include beach fill

Average breakwater length of 220 ft

Average gap width of 330 ft

Total of 82 segments

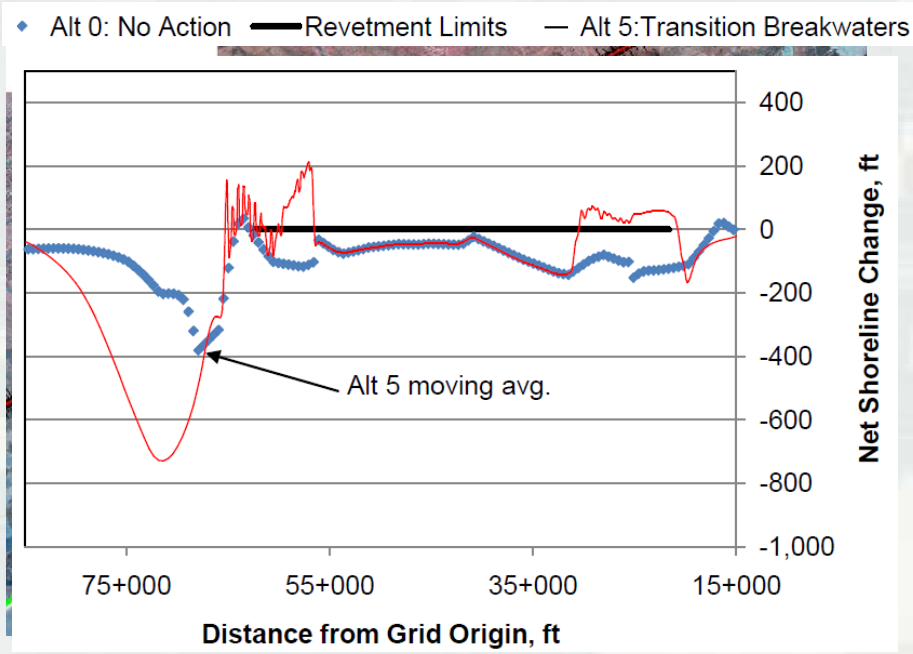


Alt 5: Transition Breakwaters

Does not include beach fill

Average breakwater length and gap width identical to Alt 4

Total of 35 segments, located at both ends of the revetment



Sargent Beach Alternatives (Continuing Work)

- Run GenCade simulations for 16 years similar to Matagorda Peninsula alternatives

- Vary breakwater configurations
  - Move breakwaters closer to shore
  - Modify breakwater lengths and gap size
  - Modify number of breakwaters and locations along the revetment

Summary and Conclusions

During calibration, GenCade correctly predicted shoreline change and net transport for the time period from 1995 to 2000

Groins provided the best structural alternative at Matagorda Peninsula

Of the groin configurations modeled at Matagorda Peninsula, three groins of 600 ft spaced 1800 ft apart produced the best results

Five alternatives were modeled for Sargent Beach

Breakwaters were chosen as the best alternative at Sargent Beach

Additional breakwater configurations are being simulated in GenCade

Questions?

Ashley Frey

Ashley.E.Frey@usace.army.mil