Sediment Budget Mini-Workshop

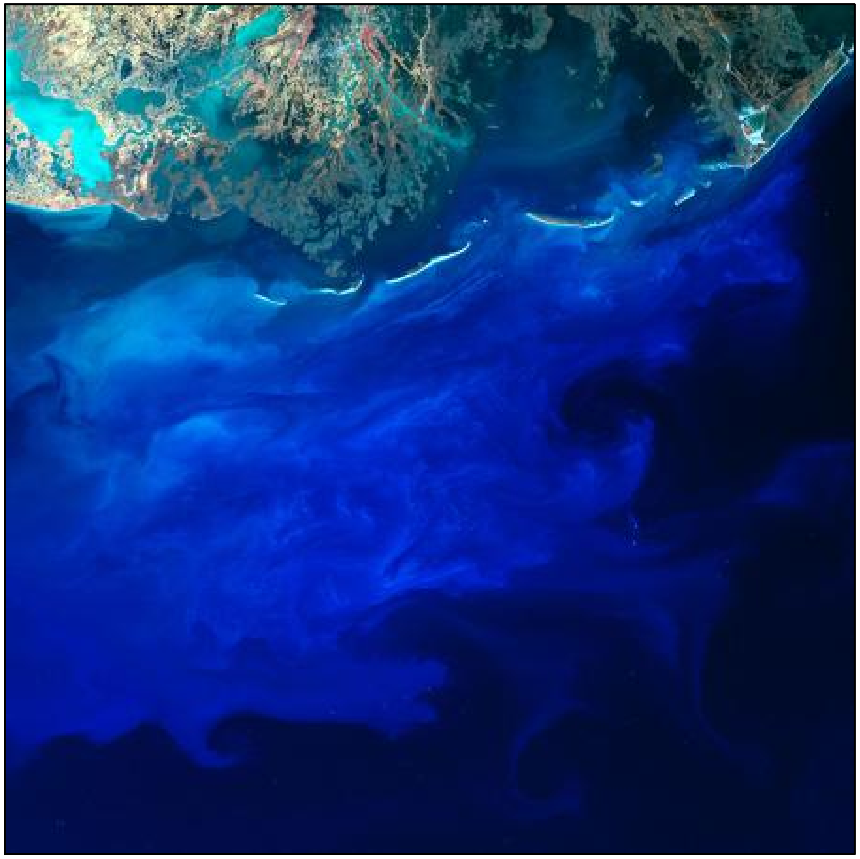
Overview of Morning Sessions
Sediment Budgets

1.	Sediment Budget Concepts and Methods	8:45-9:15
2.	Types of Sediment Budgets and Level of Analyses	9:15-9:40
3.	Sediment Budget Considerations for LA	9:40-10:00
		Break
4.	Sediment Budget Analysis System (SBAS)	10:20-10:40
5.	Hands-on SBAS	10:40-11:15

3. Sediment Budget Considerations for Louisiana

What processes should be considered when formulating regional and local sediment budgets in Louisiana?

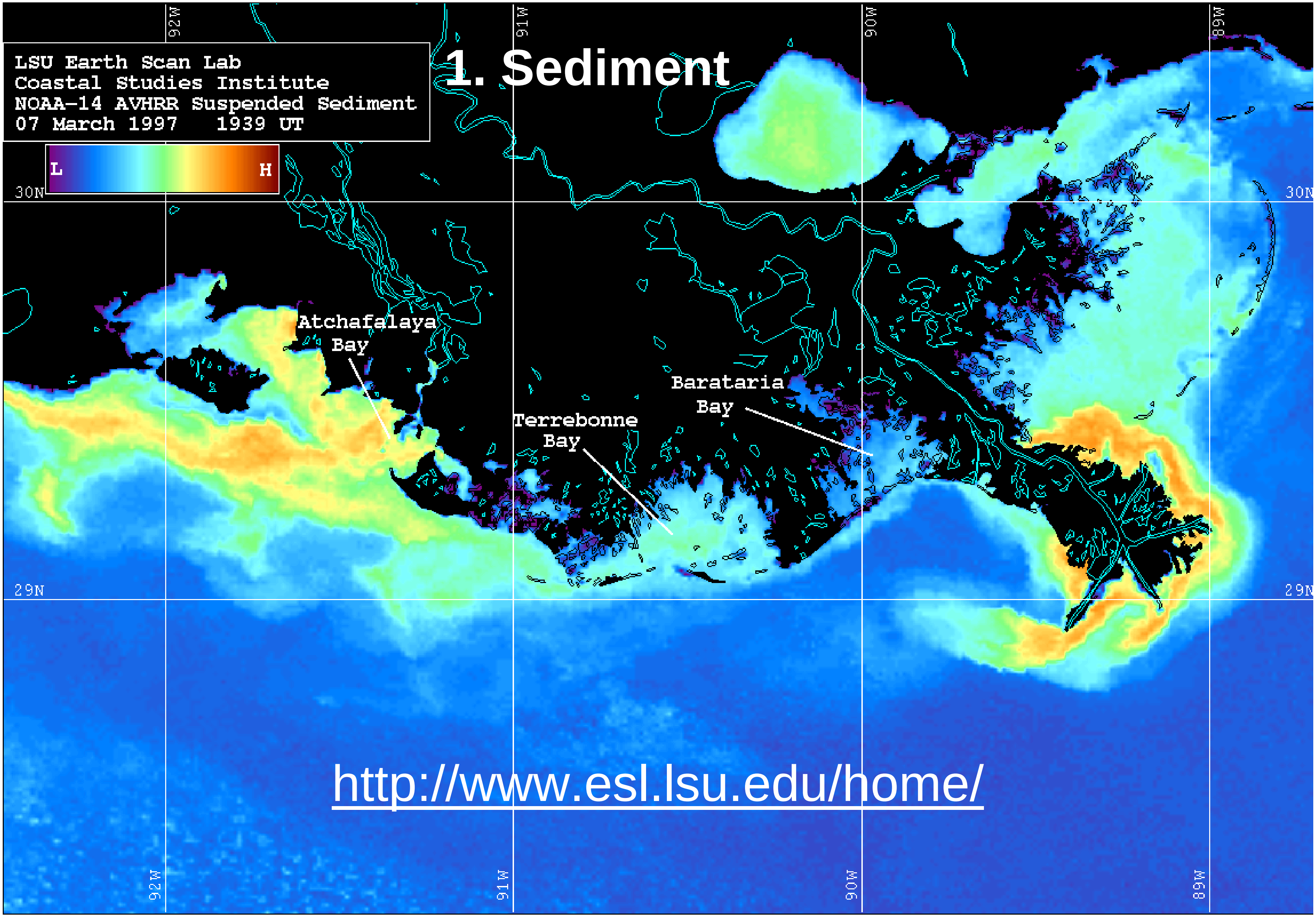
Overview of Conceptual LA Budget



Special Considerations in Louisiana

1. Mississippi and Atchafalaya Rivers = source of sediment = sand and fines
2. Relative Sea Level Rise – how to include?
3. Organic sediment creation = factor in healthy wetland budgets; how to calculate this?
4. Local RSLR may increase because
   - Increased weight on subsurface (e.g., beach fill or infrastructure) will increase consolidation of subsurface
   - Removal of subsurface fluids (water, gas, oil)

1. Sediment



http://www.esl.lsu.edu/home/

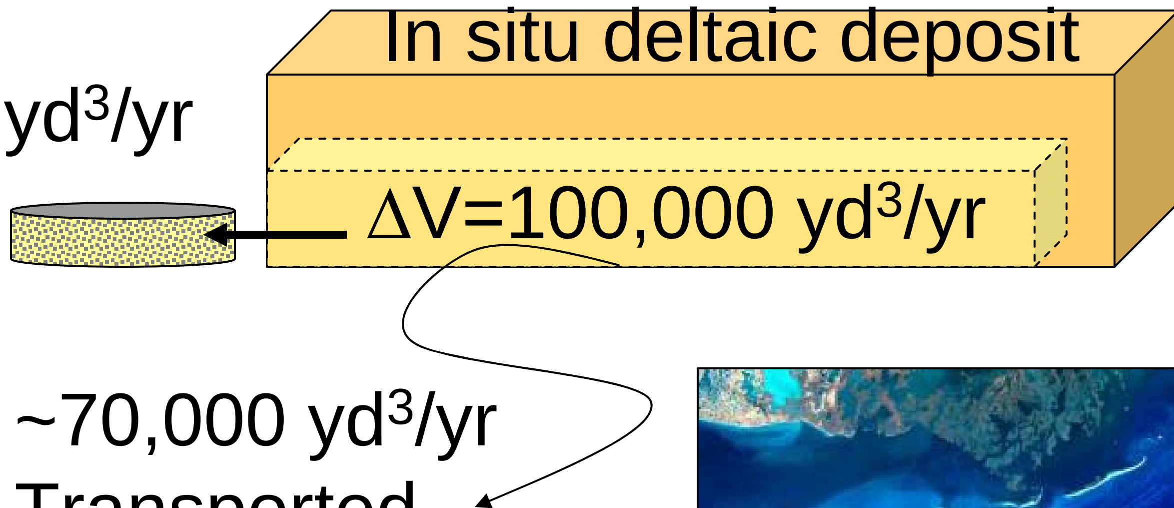
1. Incorporating Mixed Sediments (Sand and Fines) into Budget

List et al. (1991)…

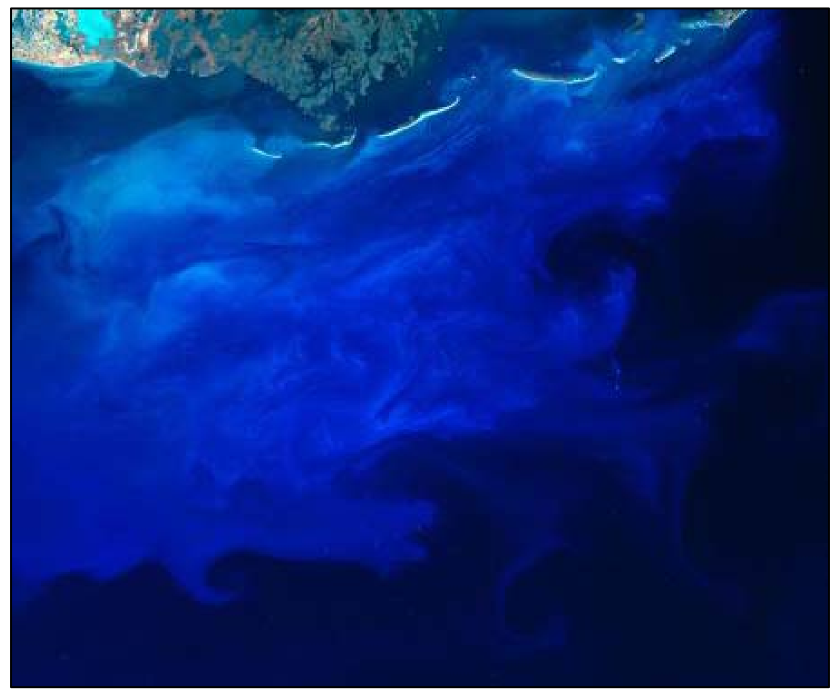
- 31% of in situ deltaic deposits represents sand
- 69% represents fines (clay, silt, and mud).
- If eroded, fines are likely suspended in the water column and transported out of the nearshore system.
- All deposited sediment is sand.

1. Incorporating Mixed Sediments (Sand and Fines) into Budget

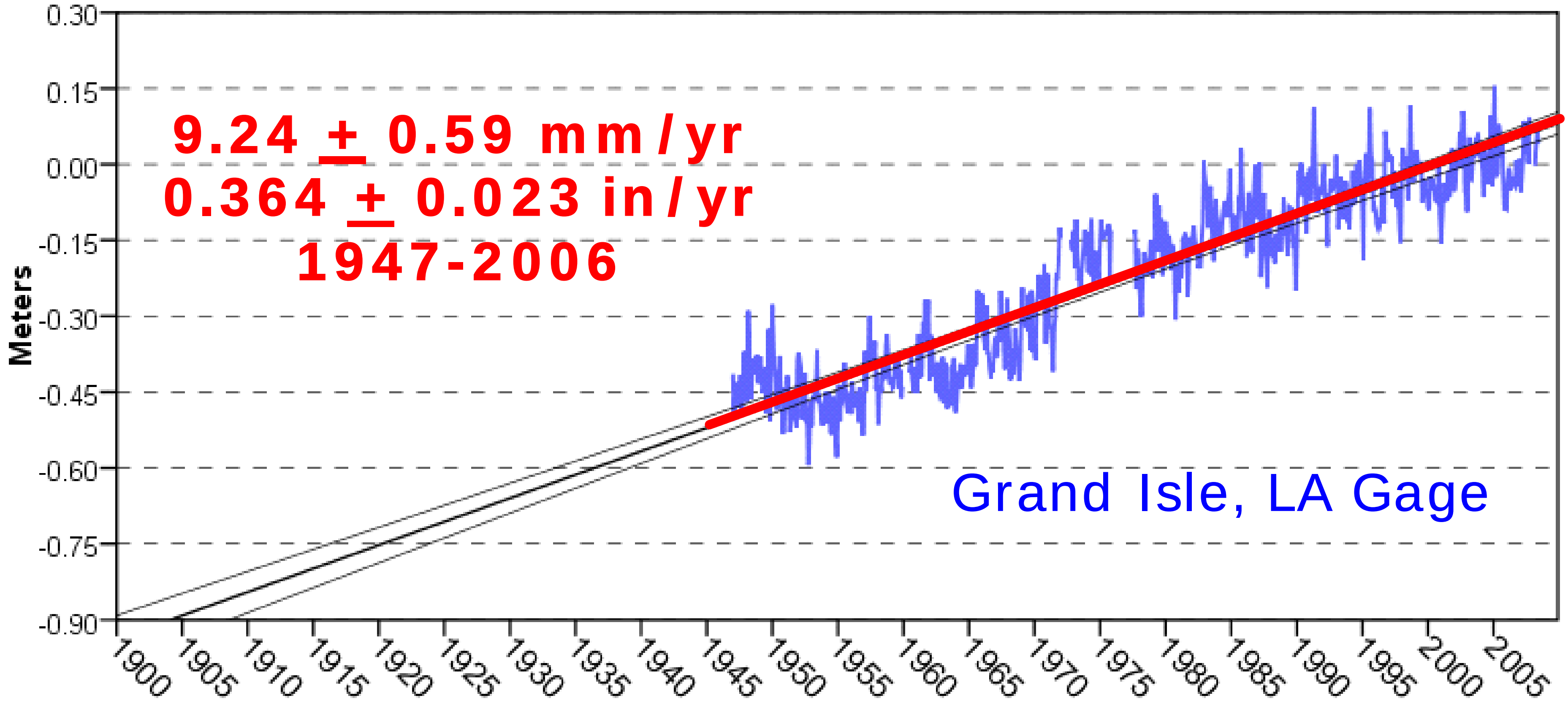
~30,000 yd^3/yr



~70,000 yd^3/yr
Transported
away via
suspension.



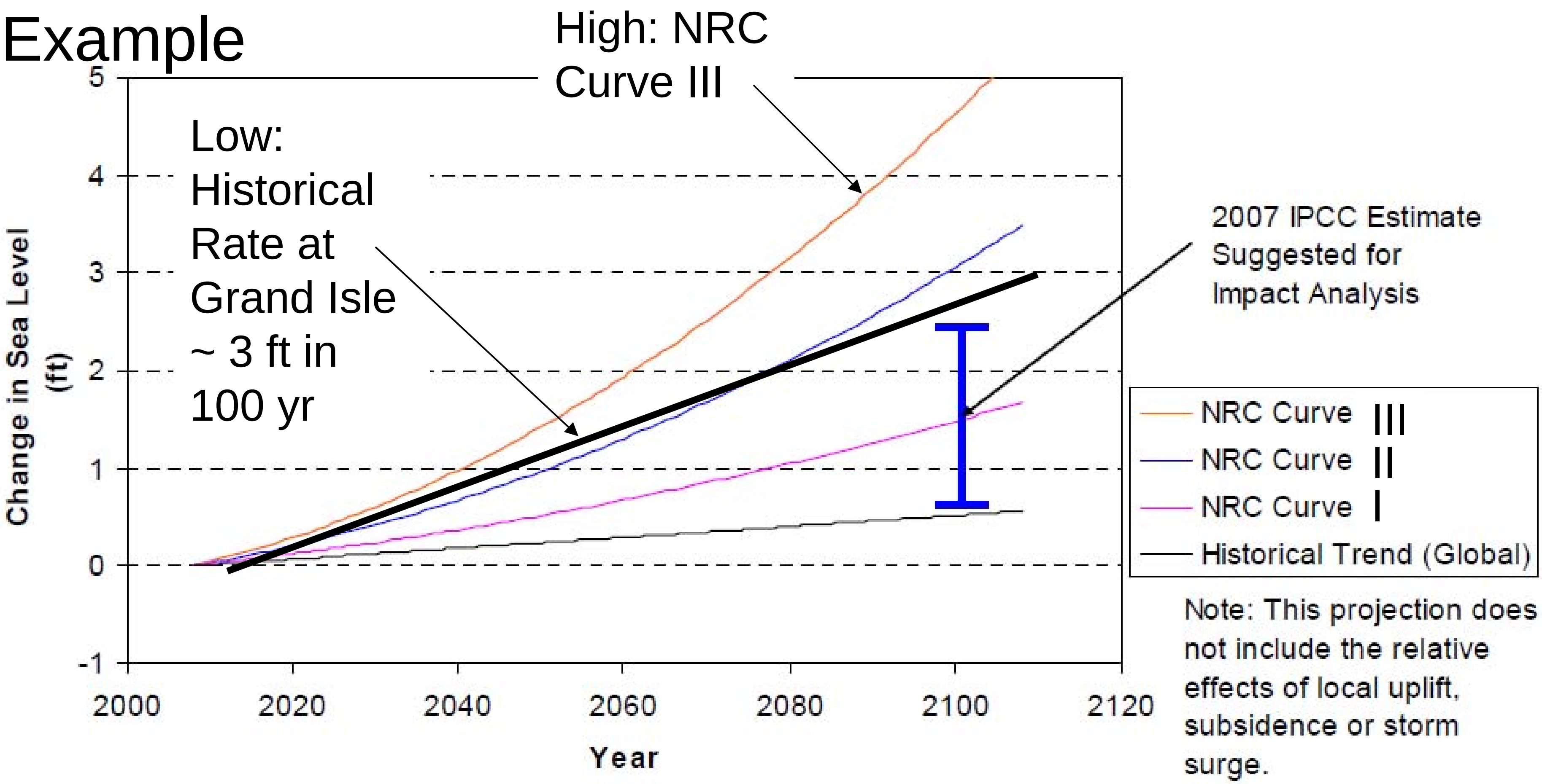
2. Relative Sea Level Rise in Louisiana



http://tidesandcurrents.noaa.gov/sltrends/sltrends_states.shtml?region=la

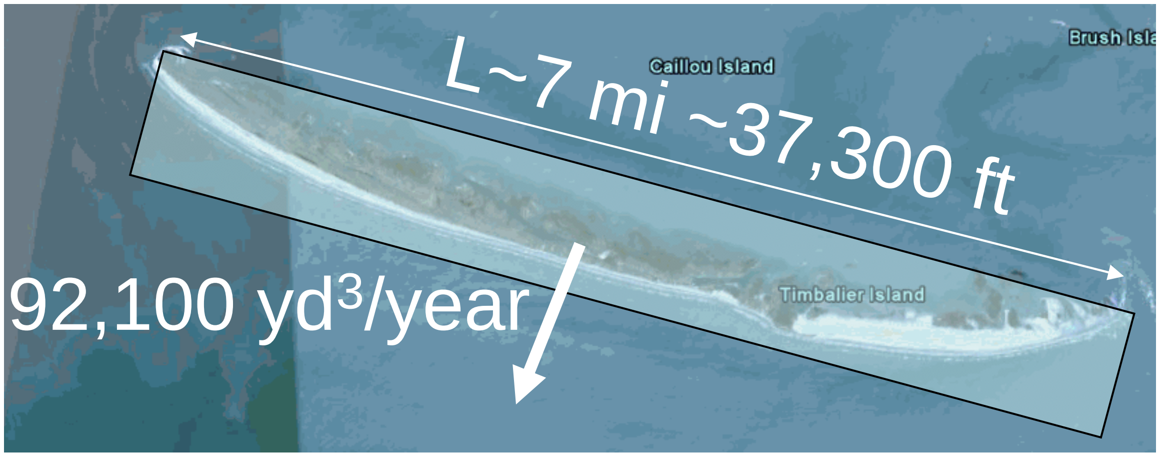
2. Corps Guidance for Incorporating SLR into Project Design

Example



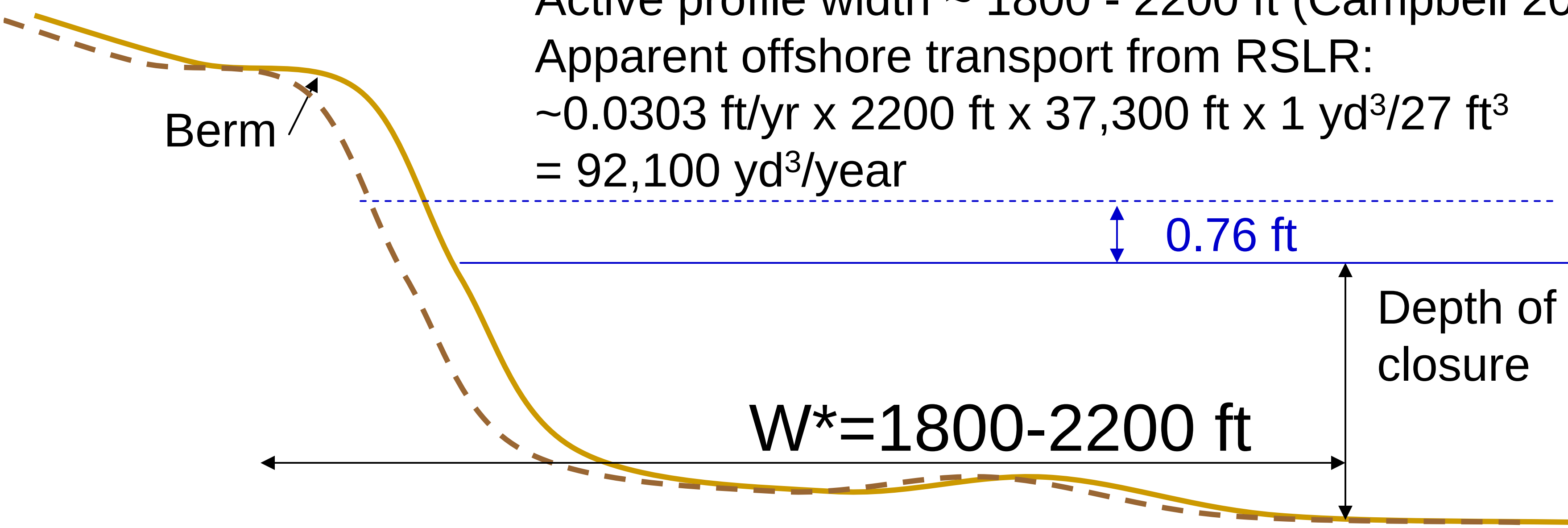
Note: This projection does not include the relative effects of local uplift, subsidence or storm surge.

2. Example with RSLR: Timbalier Island Low Estimate = Historical RSLR

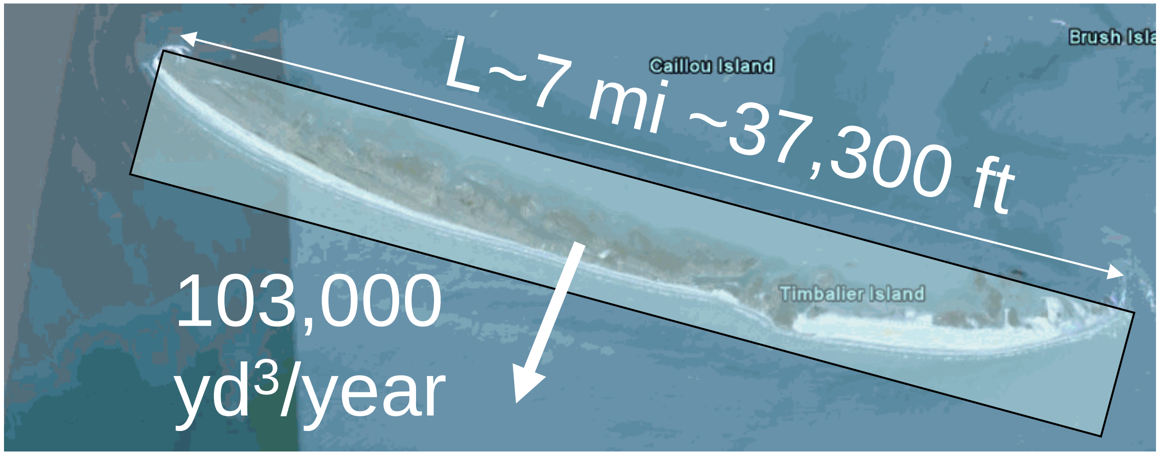


Calculate annual cross-shore losses to island from RSLR: 9.24 mm/year = 0.0303 ft/year

Active profile width ~ 1800 - 2200 ft (Campbell 2005)
Apparent offshore transport from RSLR:
~0.0303 ft/yr x 2200 ft x 37,300 ft x 1 yd^3/27 ft^3
= 92,100 yd^3/year



2. Example with RSLR: Timbalier Island High Estimate = Curve 3 from NRC (1987)



$$RSLR_{NRC\ curve\ 3} = e(t_2 - t_1) + 4.92(10^{-5})\ ft/yr^2(t_2^{\,2} - t_1^{\,2})$$

$$t_2 = 2035 - 1986 = 49\,yr; \quad t_1 = 2010 - 1986 = 24\,yr$$

$$RSLR_{NRC\ curve\ 3} = 0.0303(49 - 24) + 4.92(10^{-5})(49^2 - 24^2) = 0.85\ ft$$

Apparent offshore transport from RSLR for 25-year project
~0.85 ft/25 yr x 2200 ft x 37,300 ft x 1 yd^3/27 ft^3
= 103,000 yd^3/yr

3. Wetland Budget

New England Salt Marsh (from Redfield 1972)

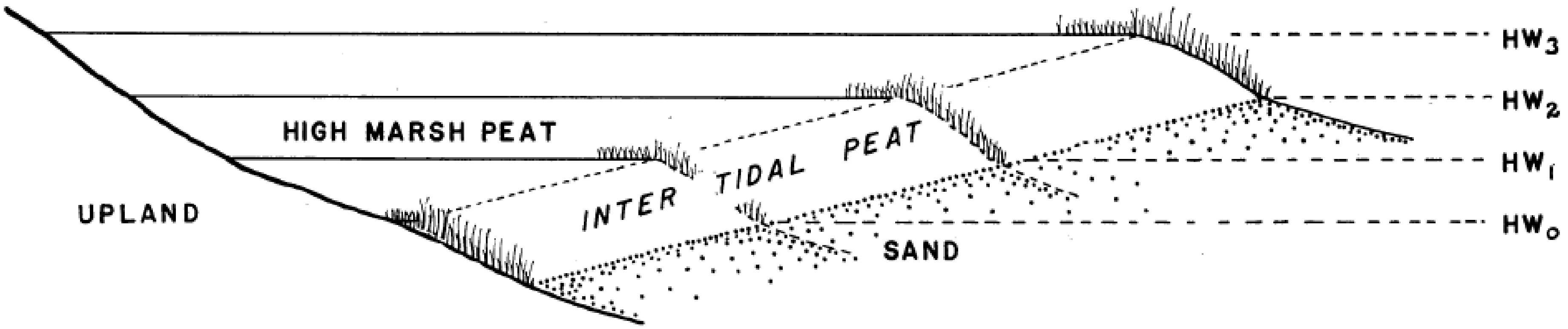


FIG. 8. Theoretical structure of salt marsh which is spreading over accumulating sediment on a sand flat and over the upland in the course of rising sea level. After Redfield and Rubin (1962).

3. Wetland Budget

Can keep pace with increasing sea level if:

- RSLR is “slow” ~ 3 mm/year

  = 0.0098 ft/year ~ 1 ft/century

  → Rate at which organic sediment is generated?
- “Sufficient” sediment supply
- Quiescent environment (little wave erosion)
- Proper salinity and nutrients available

Are these requirements met in Louisiana?

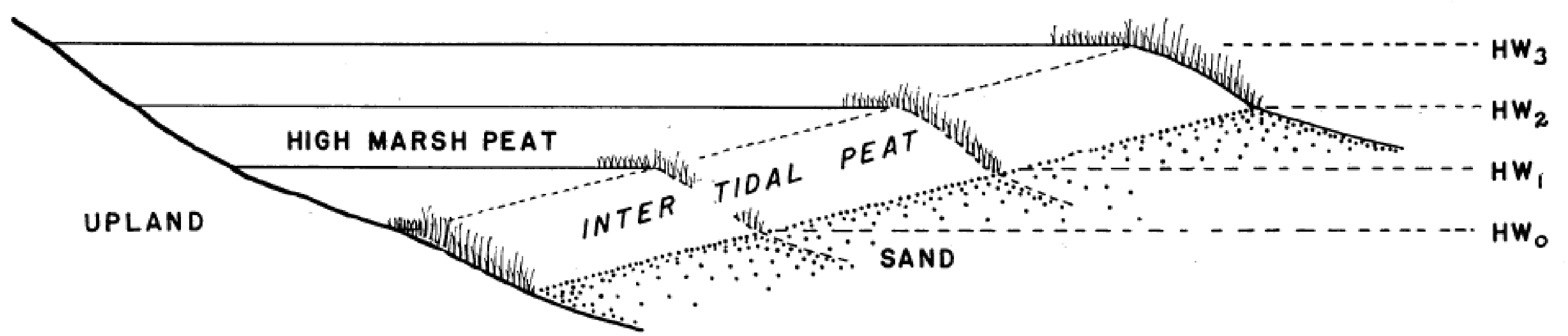


FIG. 8. Theoretical structure of salt marsh which is spreading over accumulating sediment on a sand flat and over the upland in the course of rising sea level. After Redfield and Rubin (1962).

3. Wetland Budget – Hypothetical for Louisiana to keep pace with RSLR

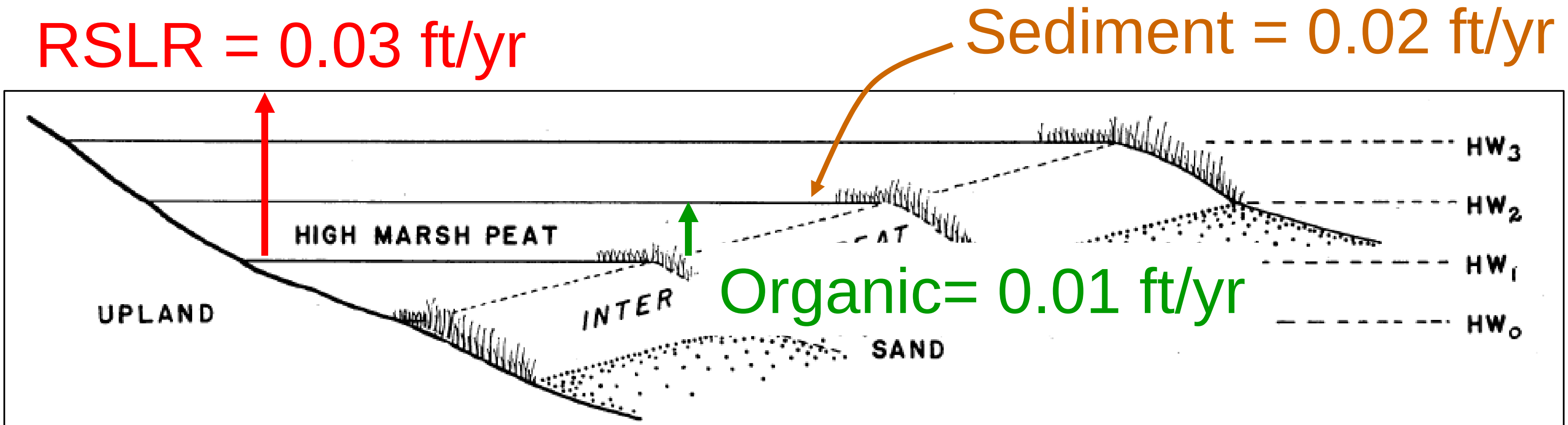
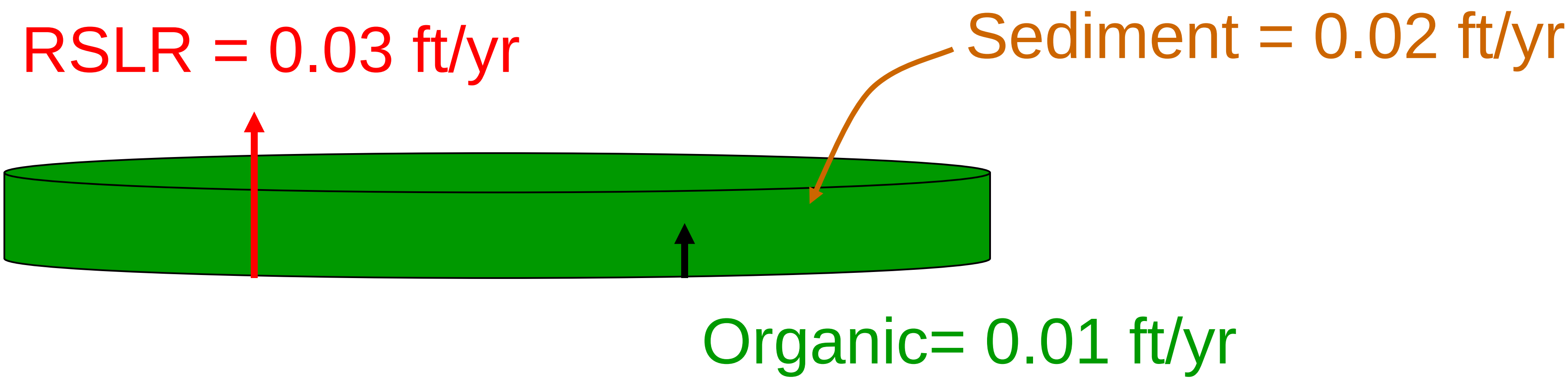


FIG. 8. Theoretical structure of salt marsh which is spreading over accumulating sediment on a sand flat and over the upland in the course of rising sea level. After Redfield and Rubin (1962).

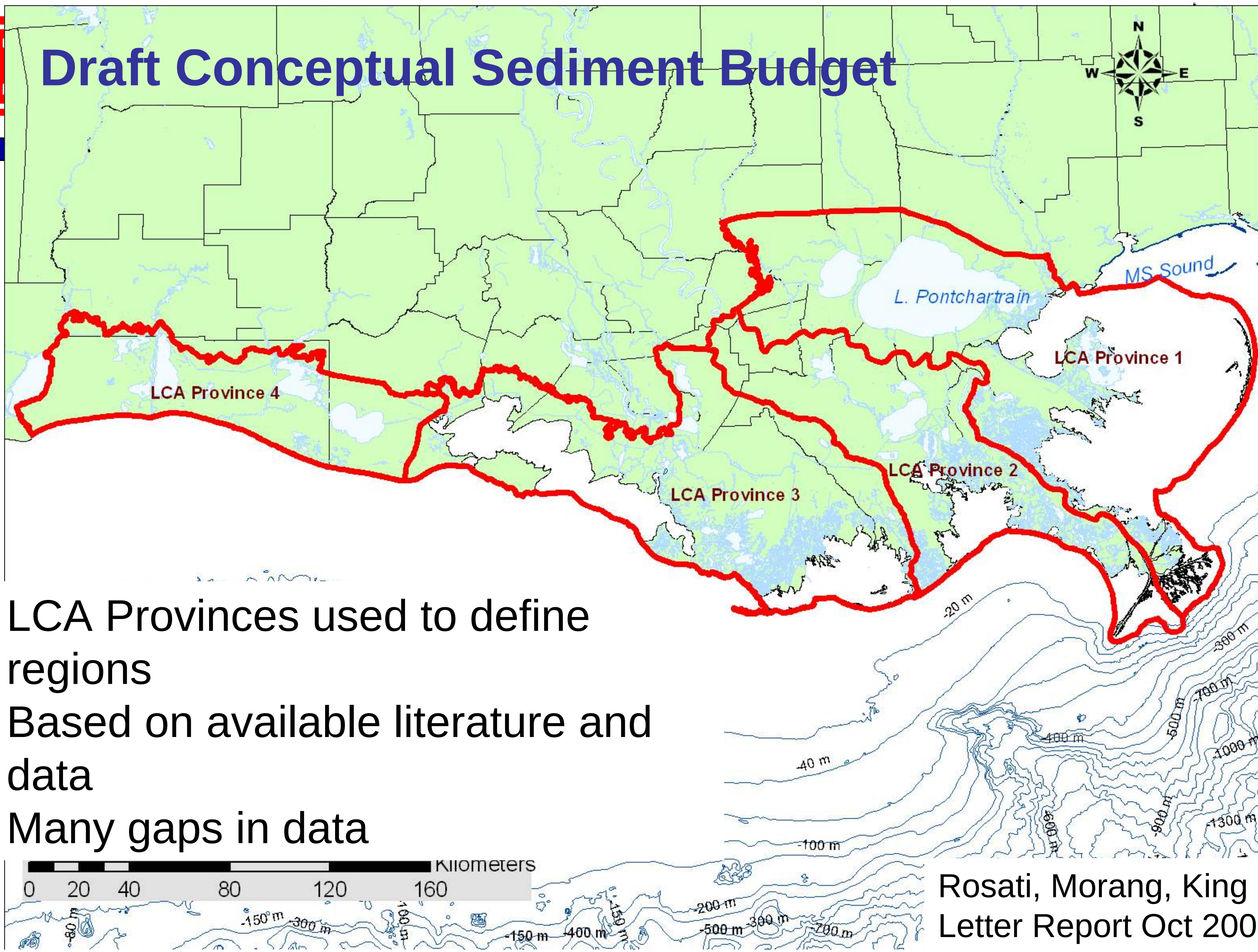
3. Wetland Budget – Hypothetical for Louisiana to keep pace with RSLR



Biloxi Marsh: 40,000 acres ~ 1,742,400,000 ft^2

Sediment required to keep pace with RSLR:
1,742,400,000 ft^2 x 0.02 ft/year ~ 1.3 Mill cy/year

Draft Conceptual Sediment Budget



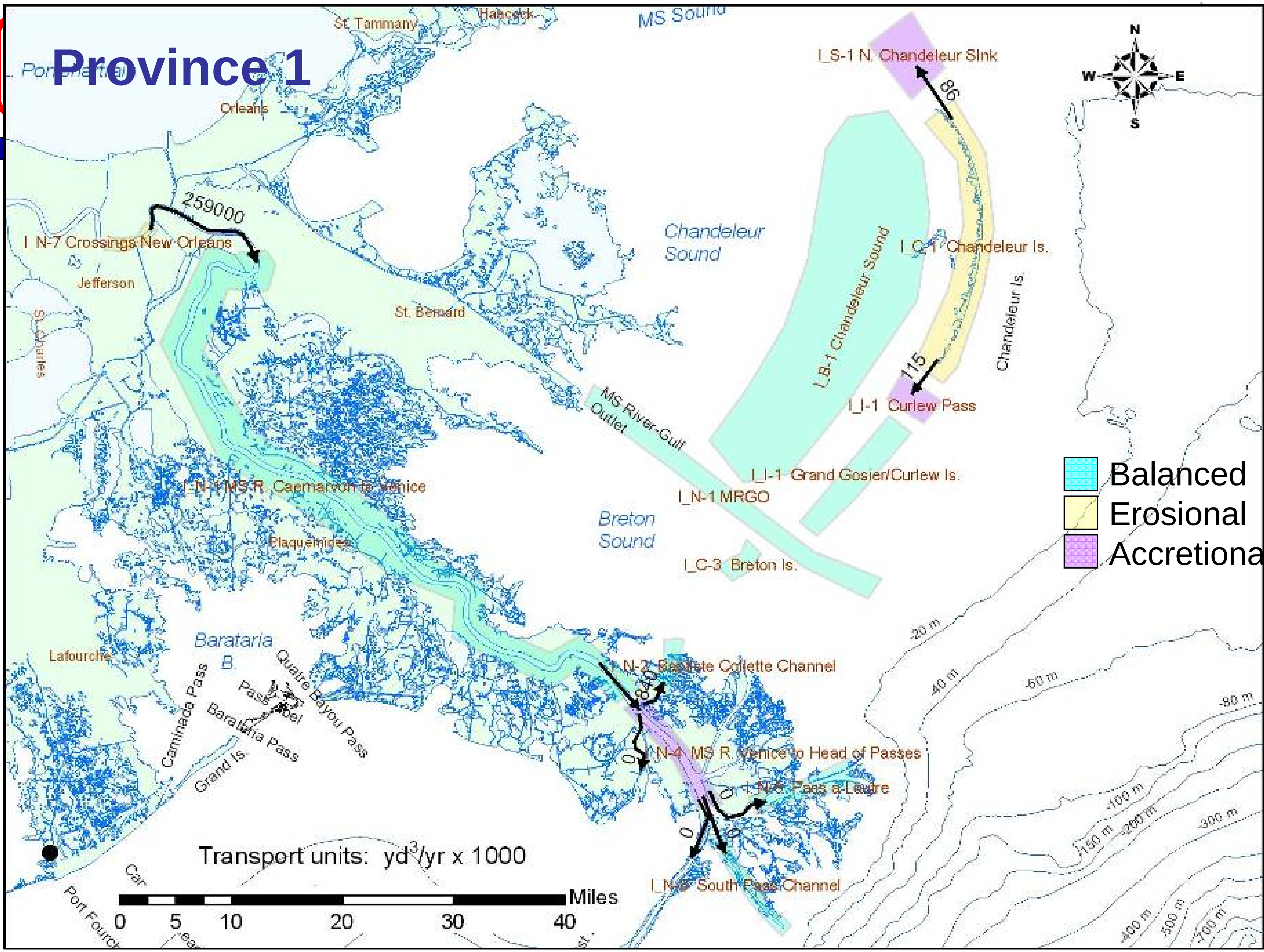
LCA Provinces used to define regions

Based on available literature and data

Many gaps in data

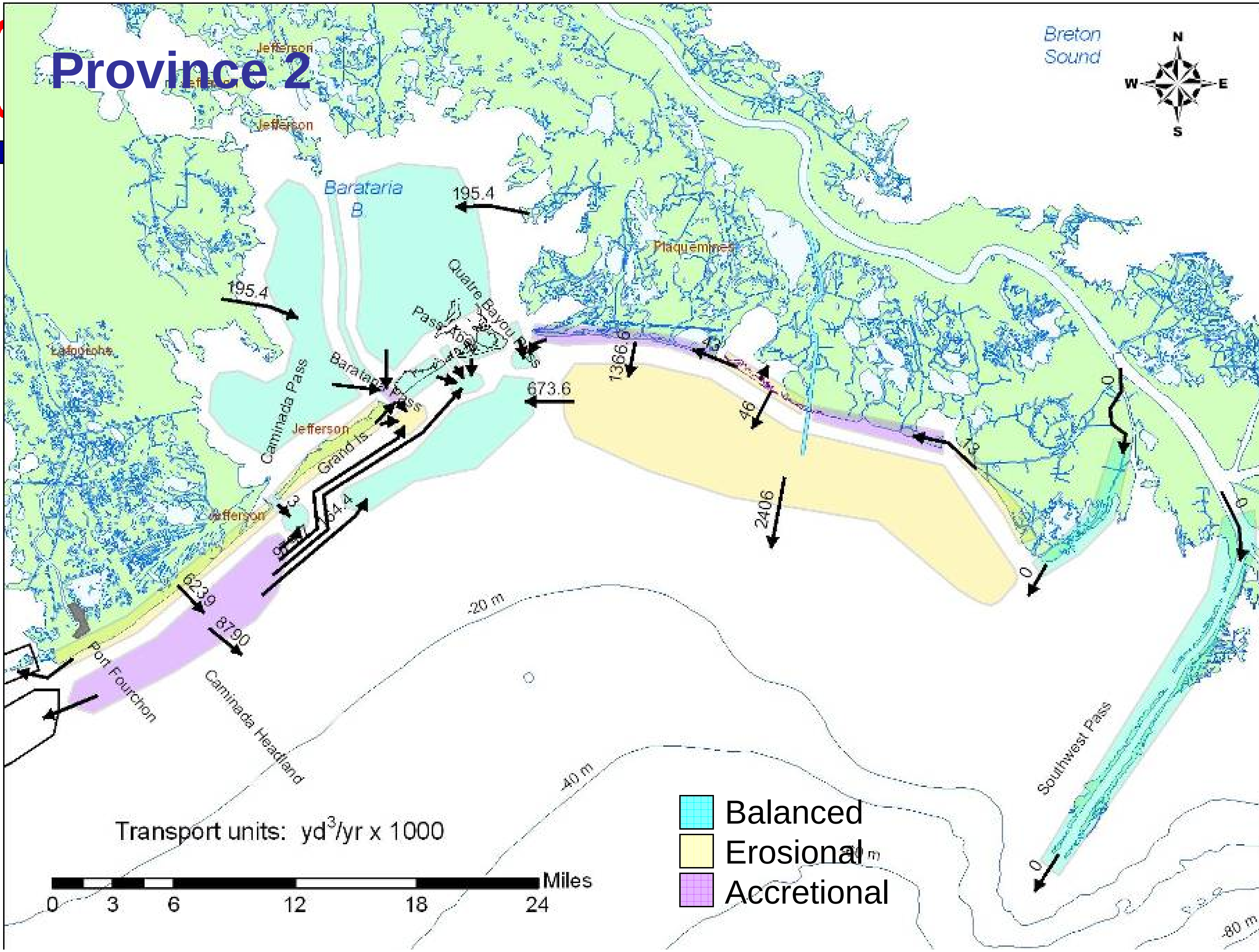
Rosati, Morang, King
Letter Report Oct 2008

Province 1

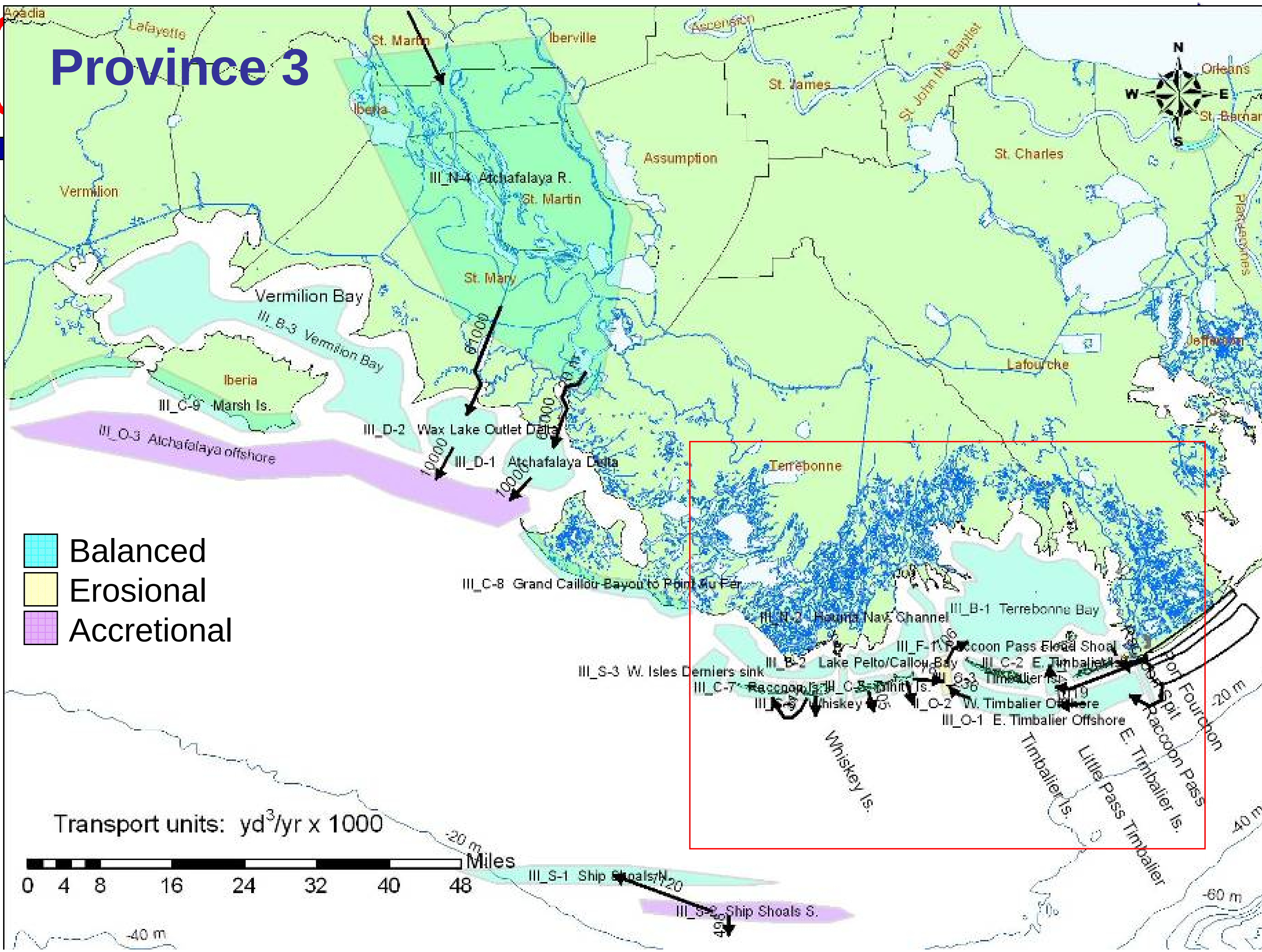


St. Tammany
Hancock
MS Sound
Orleans
I_S-1 N. Chandeleur Sink
86
259000
I_N-7 Crossings New Orleans
Jefferson
St. Charles
St. Bernard
Chandeleur Sound
I_B-1 Chandeleur Sound
I_C-1 Chandeleur Is.
Chandeleur Is.
115
I_I-1 Curlew Pass
MS River-Gulf Outlet
I_I-1 Grand Gosier/Curlew Is.
I_N-1 MRGO
I_N-1 MS R. Caernarvon to Venice
Breton Sound
Plaquemines
I_C-3 Breton Is.
Balanced
Erosional
Accretional
Barataria B.
Lafourche
Caminada Pass
Pass Abel
Quatre Bayou Pass
Barataria Pass
Grand Is.
I_N-2 Baptiste Collette Channel
840
0
I_N-4 MS R. Venice to Head of Passes
I_N-6 Pass a Loutre
I_N-8 South Pass Channel
Transport units: yd³/yr x 1000
Miles
0 5 10 20 30 40
-20 m
-40 m
-60 m
-80 m
-100 m
-150 m
-200 m
-300 m
-400 m
-500 m
-700 m
N
S
E
W

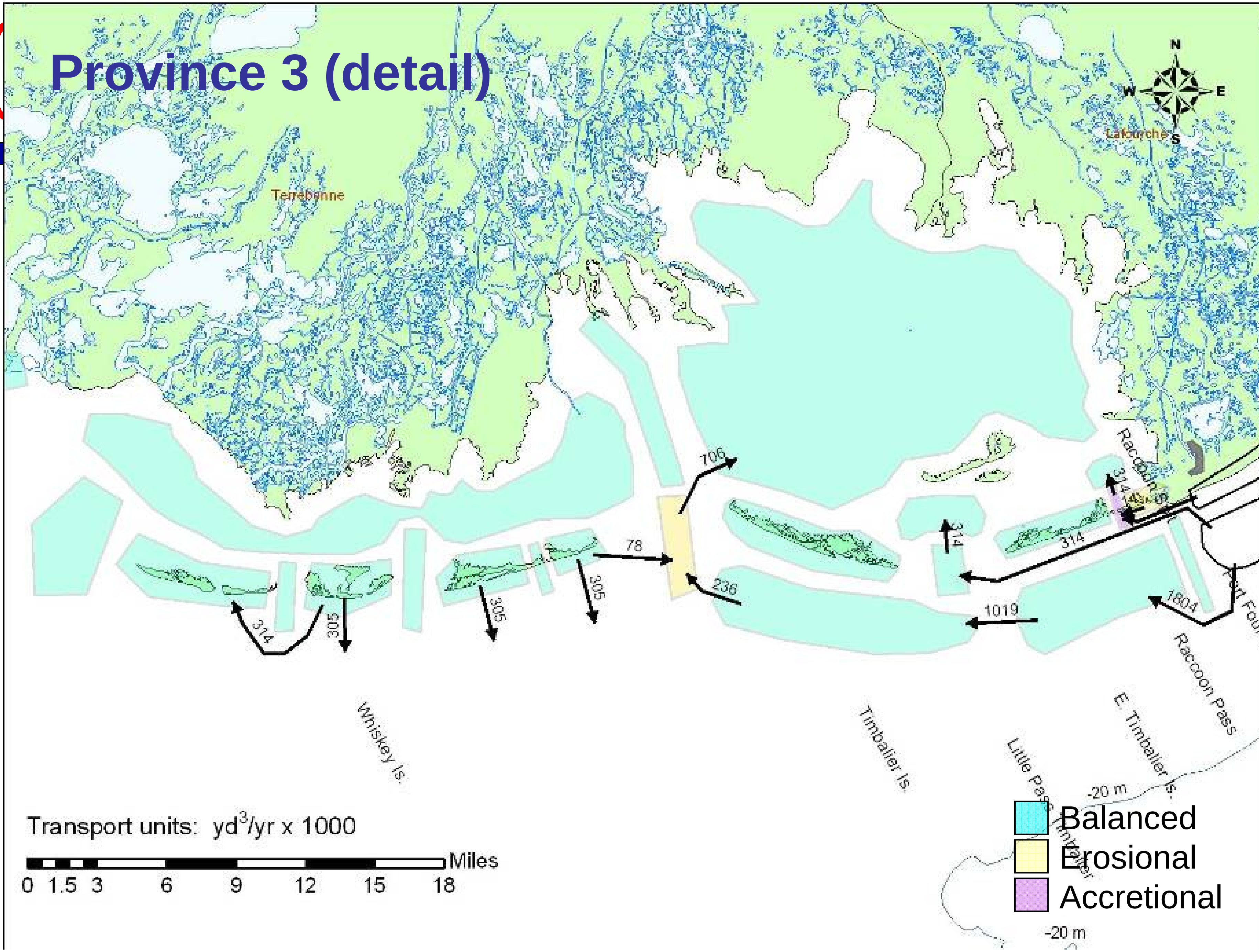
Province 2


Breton Sound
Barataria B
Plaquemines
Jefferson
Lafourche
Caminada Pass
Barataria Pass
Grand Is.
Quatre Bayou Pass
Pass Abel
Port Fourchon
Caminada Headland
Southwest Pass
195.4
195.4
673.6
1366.6
43
46
13
2406
6239
8790
0
0
0
0
-20 m
-40 m
-80 m
Transport units: yd3/yr x 1000
Miles
0 3 6 12 18 24
Balanced
Erosional
Accretional

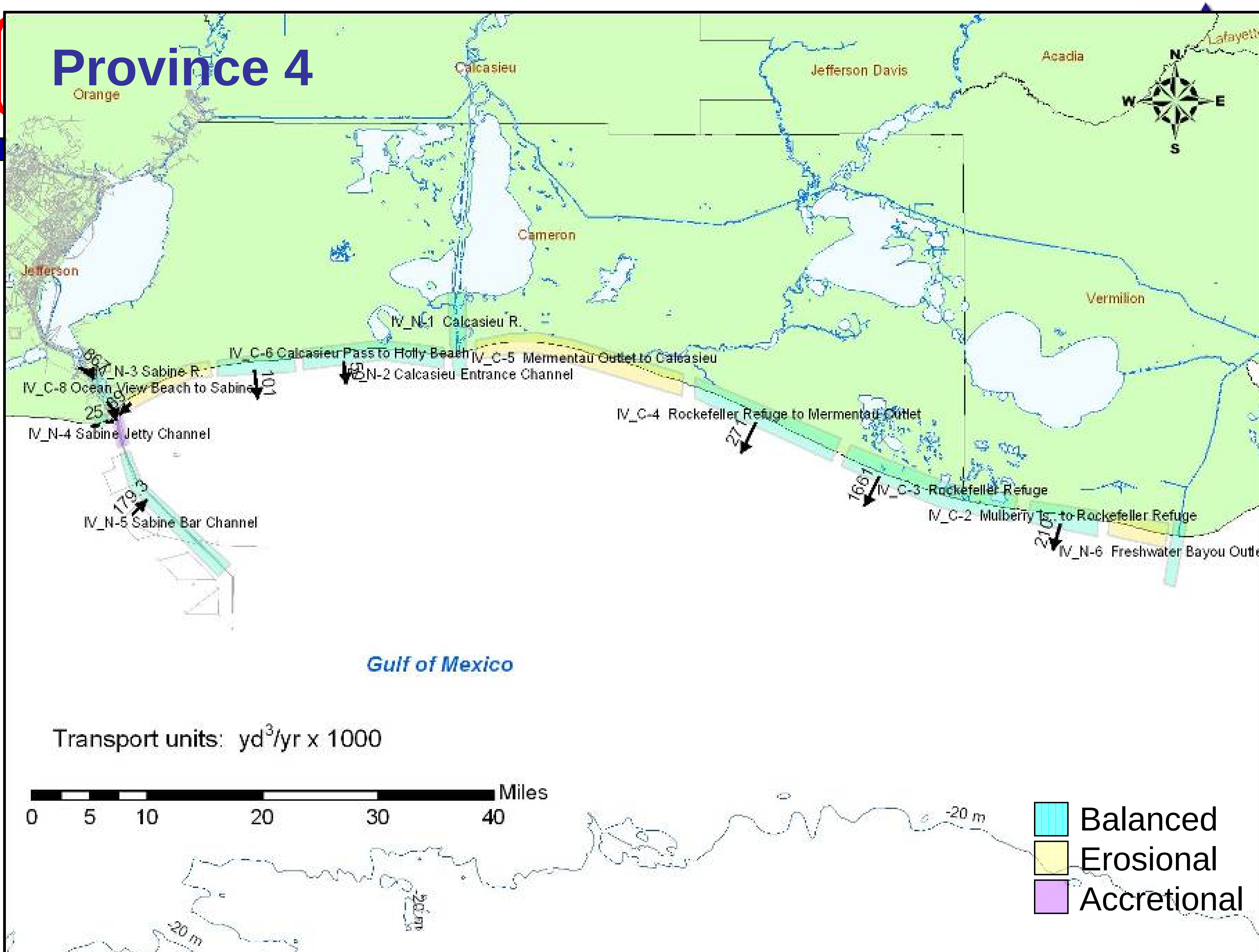
Province 3


Balanced
Erosional
Accretional
Transport units: yd³/yr x 1000
Miles
0 4 8 16 24 32 40 48
Vermilion Bay
III_B-3 Vermilion Bay
III_C-9 Marsh Is.
III_O-3 Atchafalaya offshore
III_D-2 Wax Lake Outlet Delta
III_D-1 Atchafalaya Delta
III_N-4 Atchafalaya R.
III_C-8 Grand Caillou-Bayou to Point Au Fer
III_B-1 Terrebonne Bay
III_N-2 Houma Nav. Channel
III_B-2 Lake Pelto/Caillou Bay
III_S-3 W. Isles Derniers sink
III_O-1 E. Timbalier Offshore
III_S-1 Ship Shoals N.
III_S-2 Ship Shoals S.
Whiskey Is.
Timbalier Is.
Little Pass Timbalier
E. Timbalier Is.
Raccoon Pass
Port Fourchon
Terrebonne
Lafourche
Assumption
St. Mary
St. Martin
Iberia
Vermilion
Lafayette
Iberville
St. James
St. Charles
Orleans
St. Bernard
Jefferson
-20 m
-40 m
-60 m

Province 3 (detail)



Province 4



Orange
Calcasieu
Jefferson Davis
Acadia
Lafayette
Jefferson
Cameron
Vermilion
N
S
E
W
IV_N-1 Calcasieu R.
IV_C-6 Calcasieu Pass to Holly Beach
IV_C-5 Mermentau Outlet to Calcasieu
IV_N-2 Calcasieu Entrance Channel
IV_N-3 Sabine R.
IV_C-8 Ocean View Beach to Sabine
IV_N-4 Sabine Jetty Channel
IV_N-5 Sabine Bar Channel
IV_C-4 Rockefeller Refuge to Mermentau Outlet
IV_C-3 Rockefeller Refuge
IV_C-2 Mulberry Is. to Rockefeller Refuge
IV_N-6 Freshwater Bayou Outlet
667
25
101
179.3
271
1661
Gulf of Mexico
Transport units: yd³/yr x 1000
Miles
0 5 10 20 30 40
-20 m
Balanced
Erosional
Accretional

Draft Conceptual Sediment Budget Findings and Recommendations

- Cross-shore sediment transport dominates coastal Louisiana.
- Considering the outer Gulf shoreline alone, the requirement to maintain the Gulf shoreline position with RSLR is

  ~ 3.2 to 4 Mill yd^3/year.
- East of Atchafalaya Bay, with present position of the Mississippi River Delta, the only source of sediment is through erosion of existing shorelines and wetlands.
- Mud accretion west of Atchafalaya not well understood.
- Target restoration for locations most likely to be sustained.