ICCE '18 – Baltimore MD USA
Session: Beach Nourishment Projects
Tuesday – 31 July - 4:30-4:50 pm

Five Key Elements For A Sustainable Beach Nourishment Program

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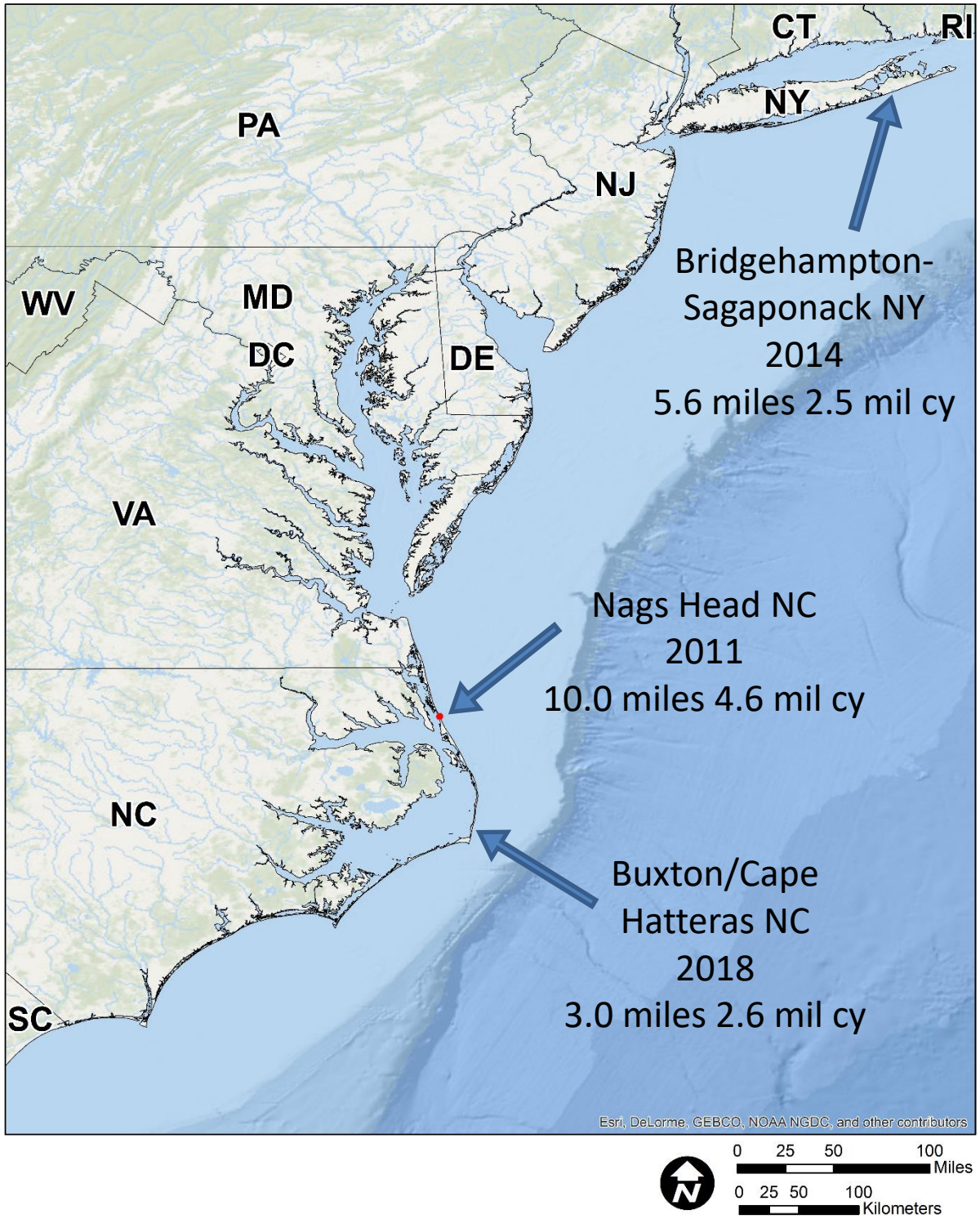
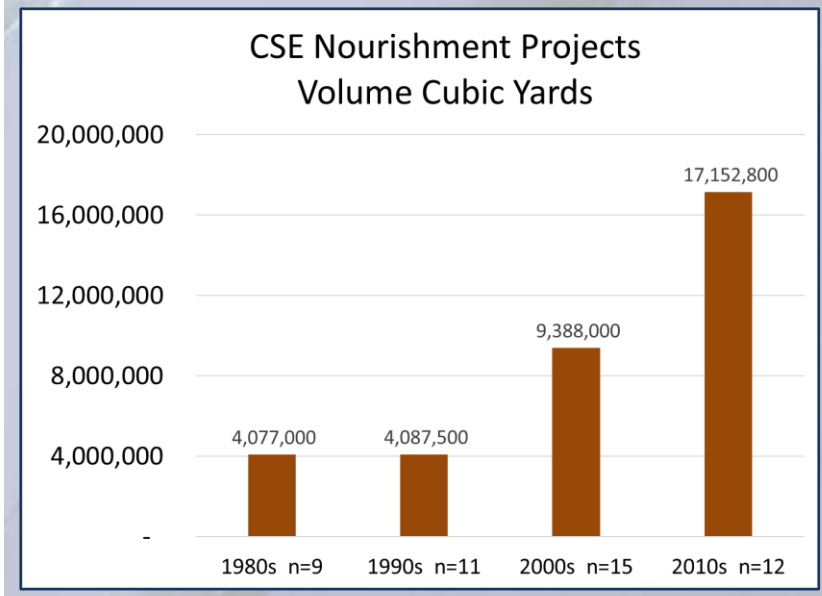
Based on Chap 38 in:
Young Y Kim (ed) **Handbook of Coastal Engineering – 2nd Edition**
World Scientific Singapore

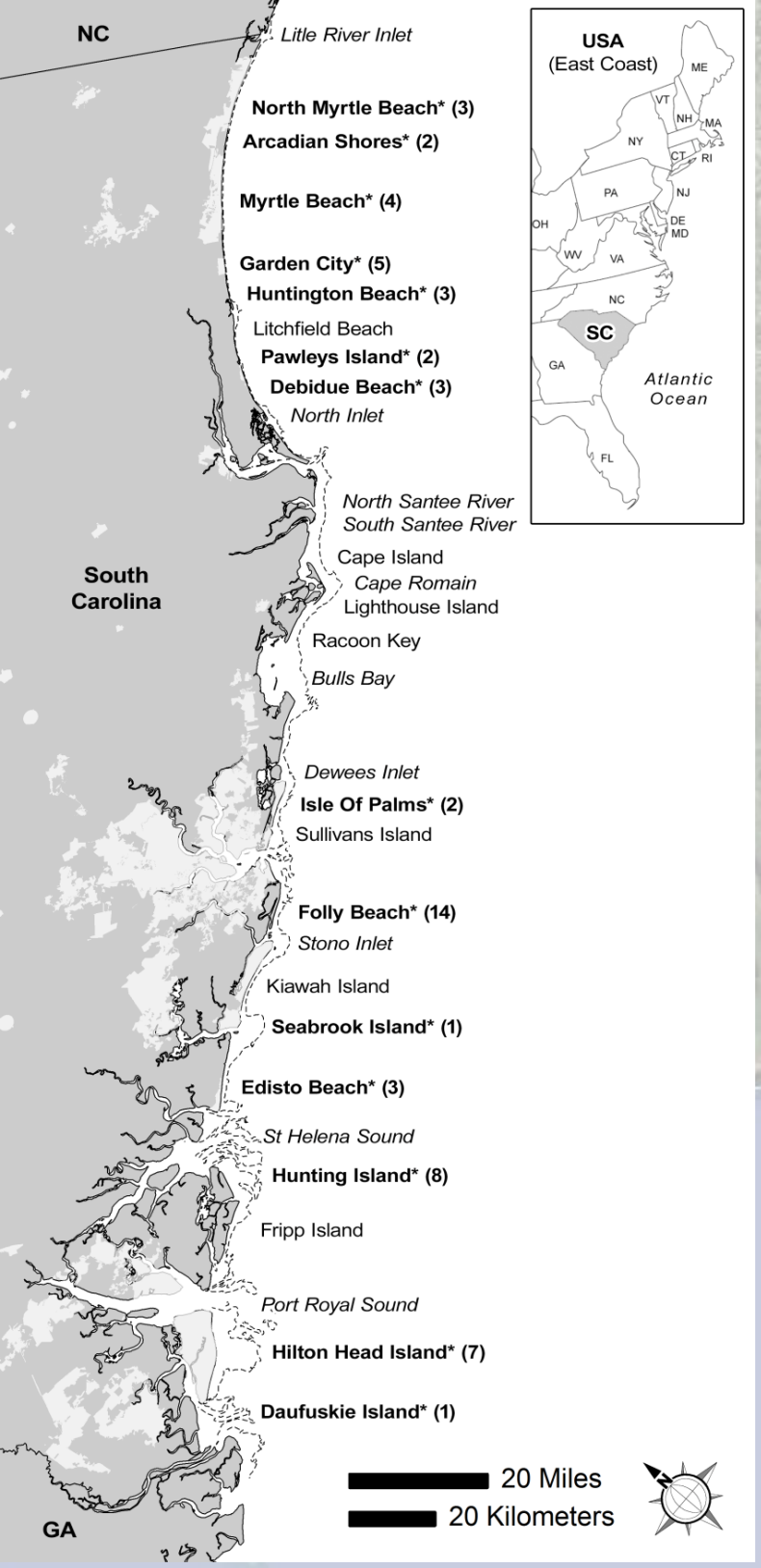
COASTAL SCIENCE & ENGINEERING



Outline

- Motivation
- Five Key Design Elements
  - Shoreline Inventory
  - Erosion Database
  - Conceptual Geomorphic Models
  - Target Beach Condition
  - Identify Borrow Area
- Sustainability





South Carolina USA

307 km Sandy Coast

35 Tidal Inlets

52% Developed and Managed

33% Nourished 1954 to Present

1980-2010

30.1 million m^3 Nourishment Volume

Source: Kana 2012 Shore & Beach

Importance of Preliminary Design

Build on Prior Knowledge

Rapidly Quantify the Problem

Establish a Project Scope and Scale

Provide a Realistic Budget to the Client

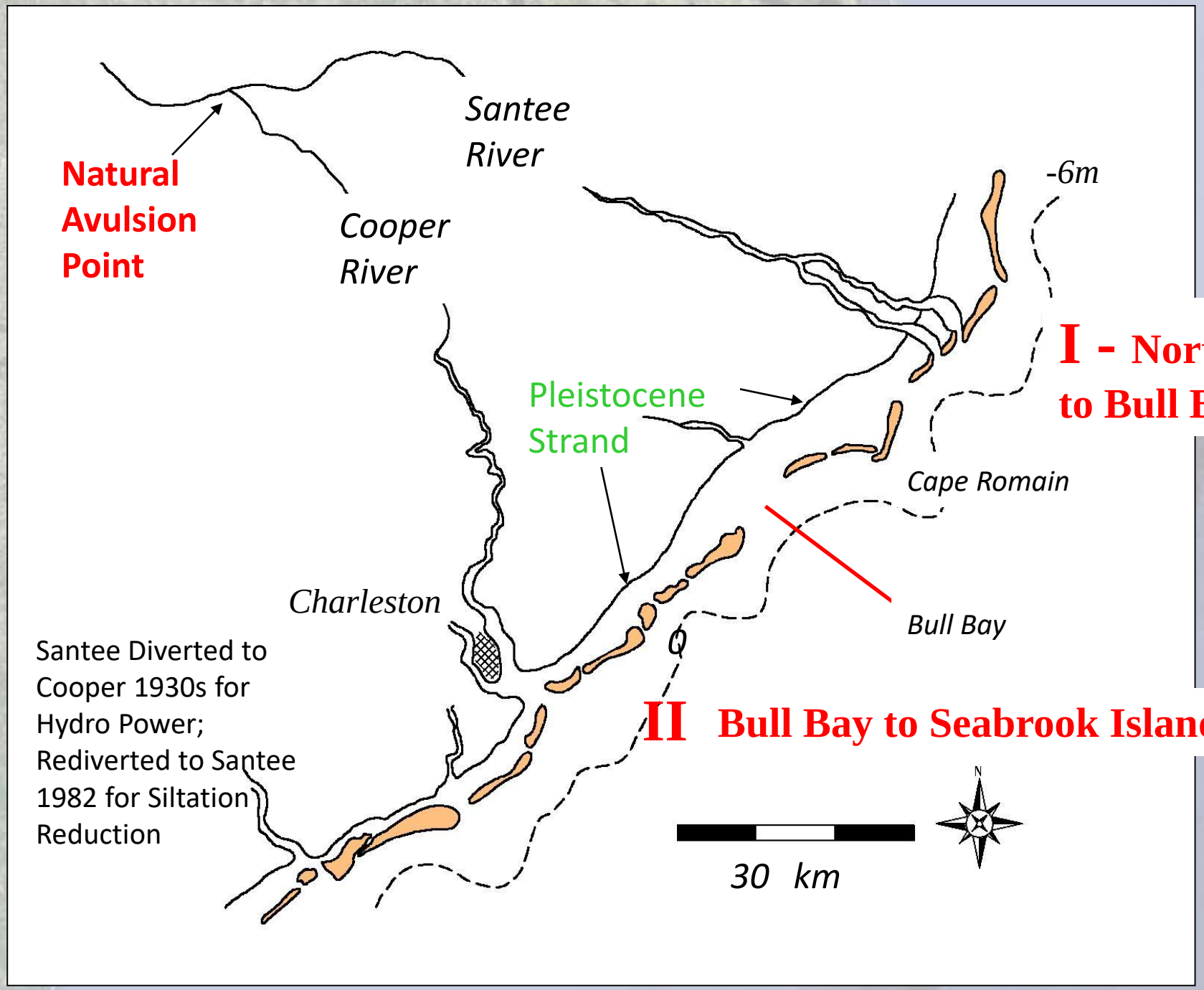
Formulations “Locked In” at Time of Permitting

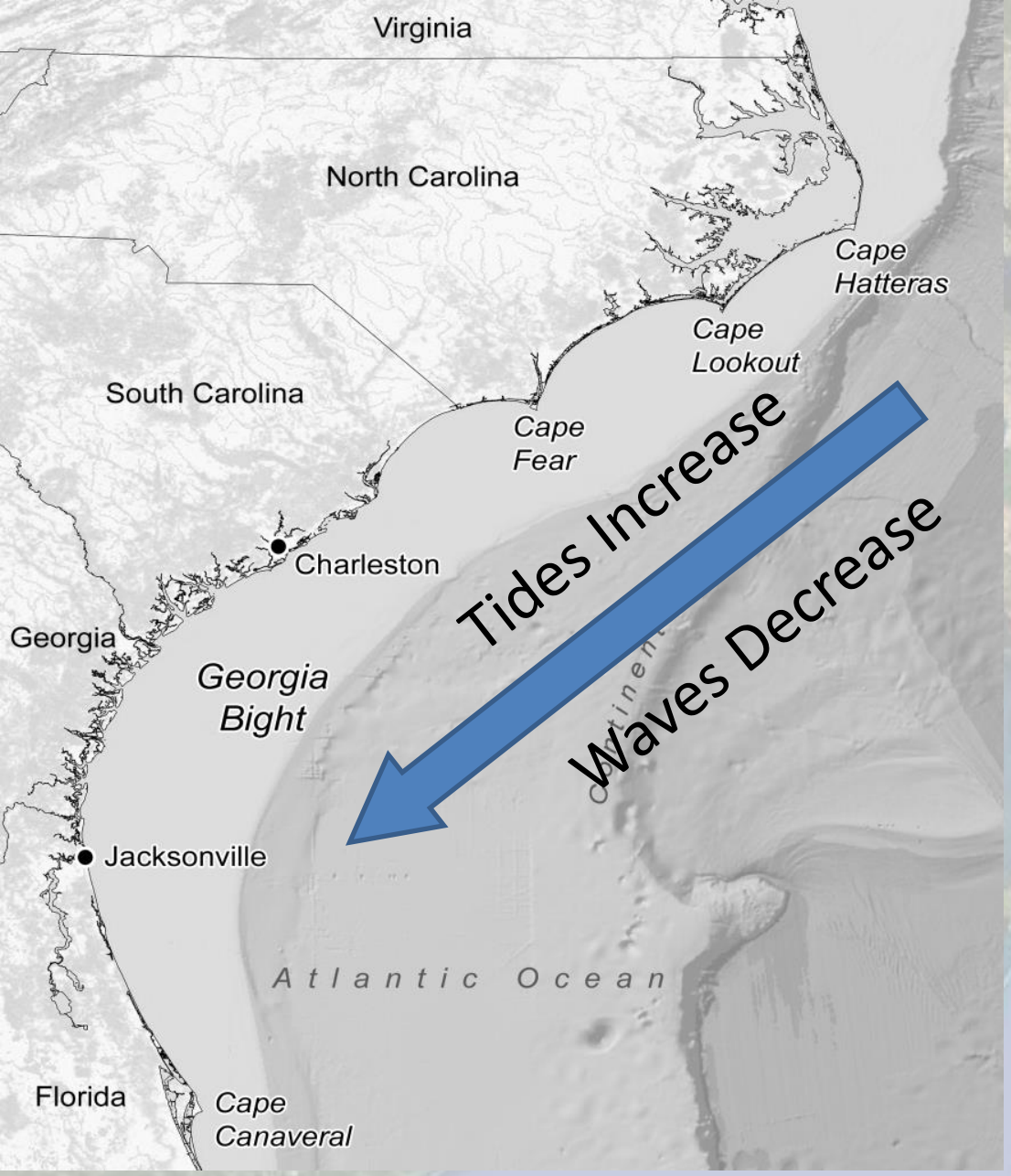
Key Design Element #1

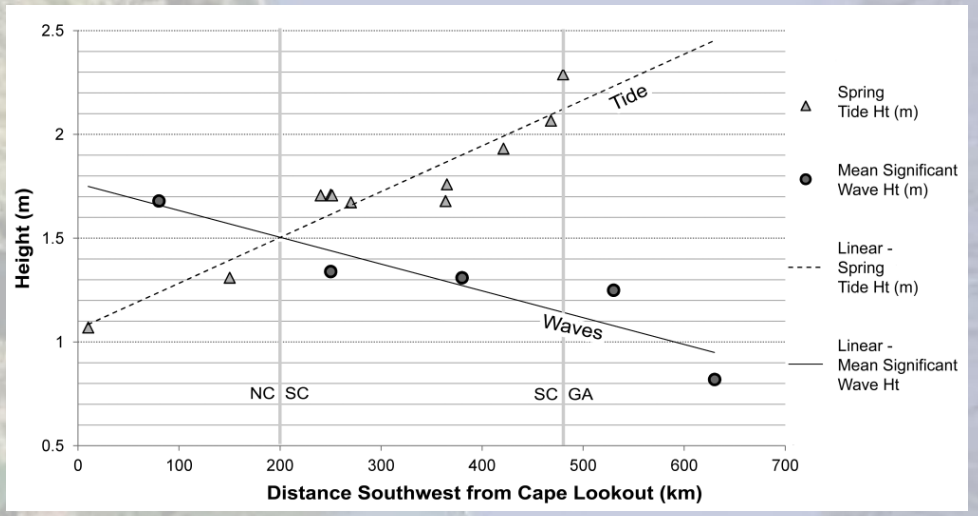
Shoreline Inventory

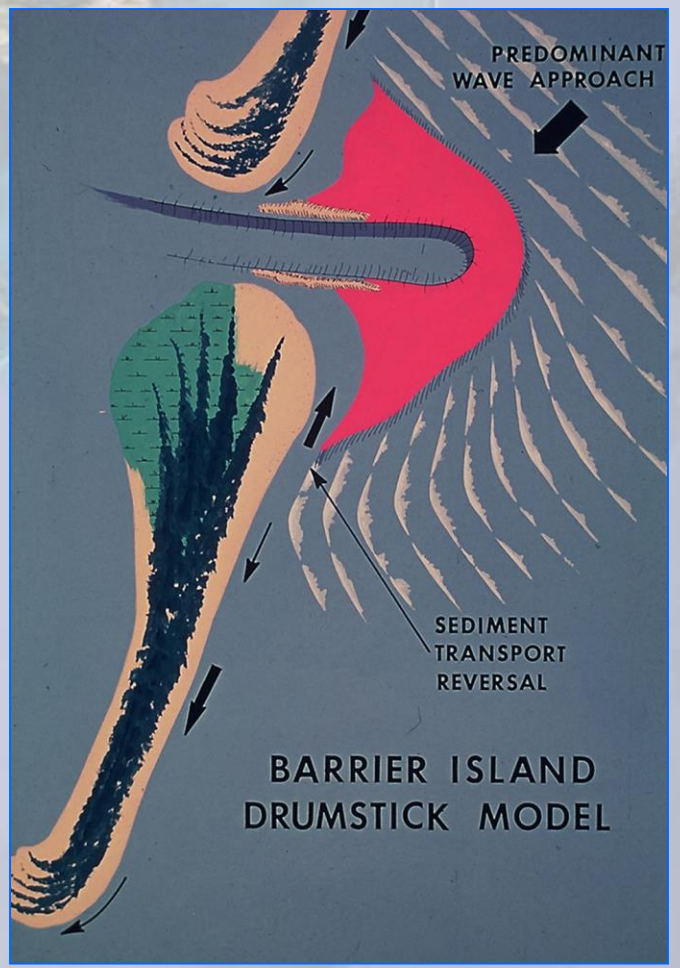
South Carolina Holocene Barrier Island Systems – Santee & Cooper River Basins

Mega Scale Geologic Controls & Sediment Sources



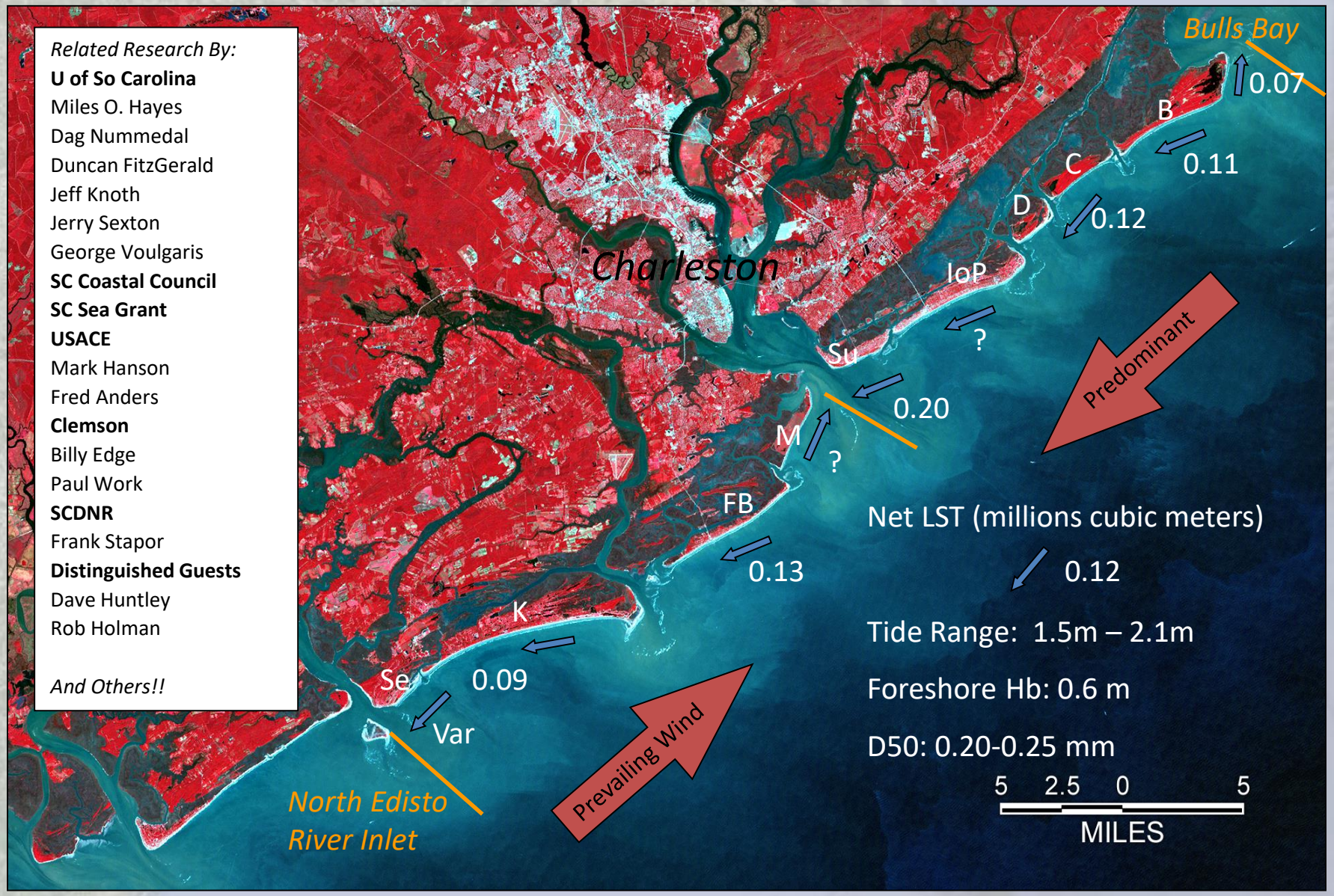






After Hayes 1976

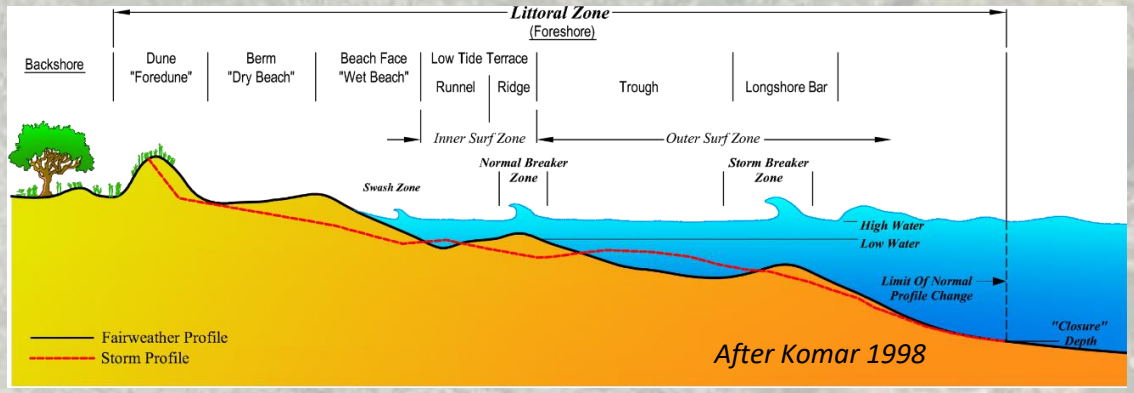
Net Longshore Transport Directions & Rates (in Millions m^3/yr)

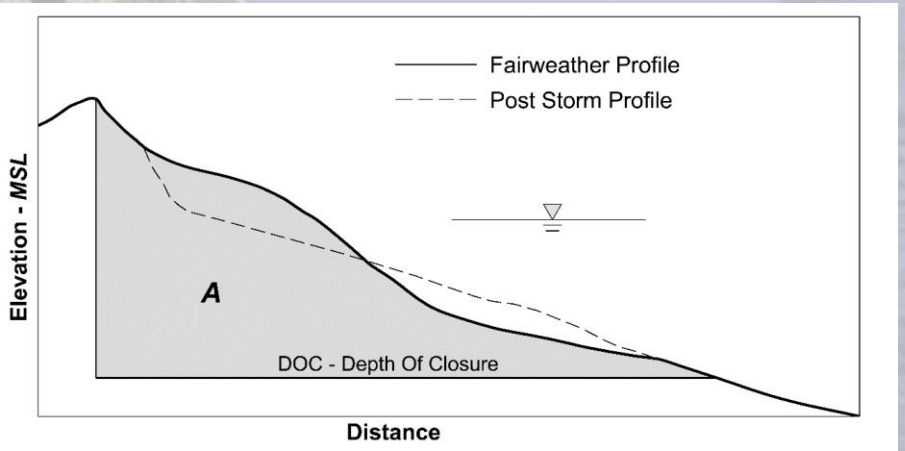


Key Design Element #2

Erosion Database

1980s – Before reliable beach surveys to closure…

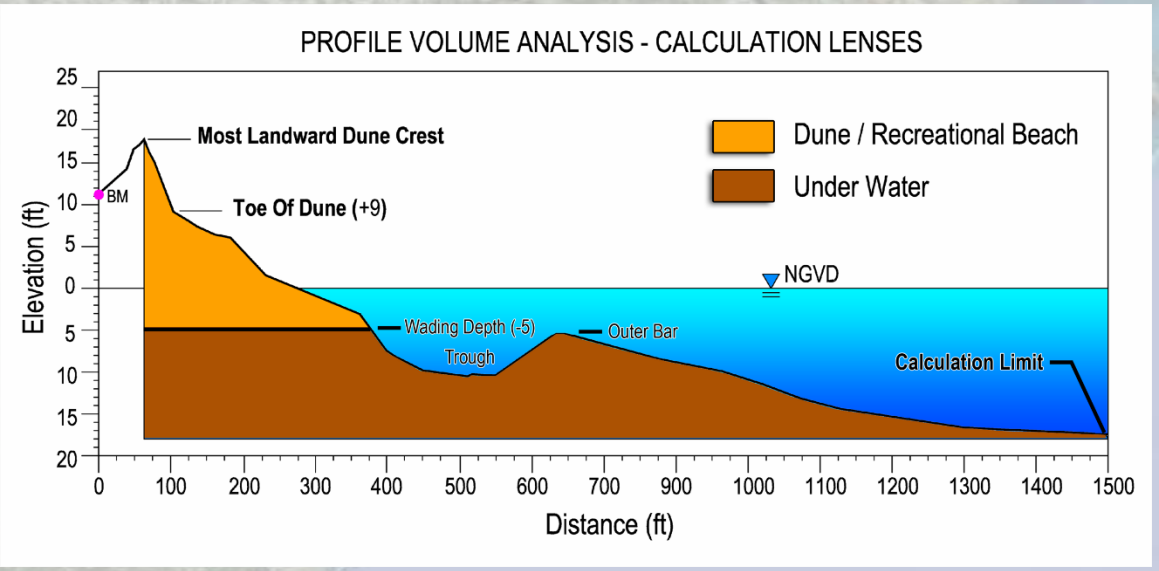


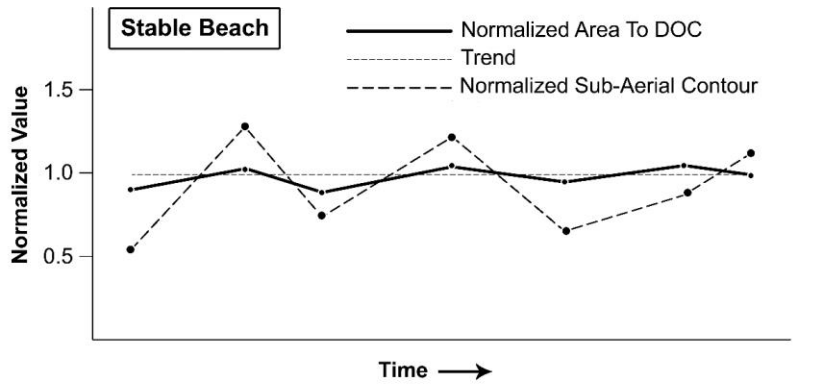


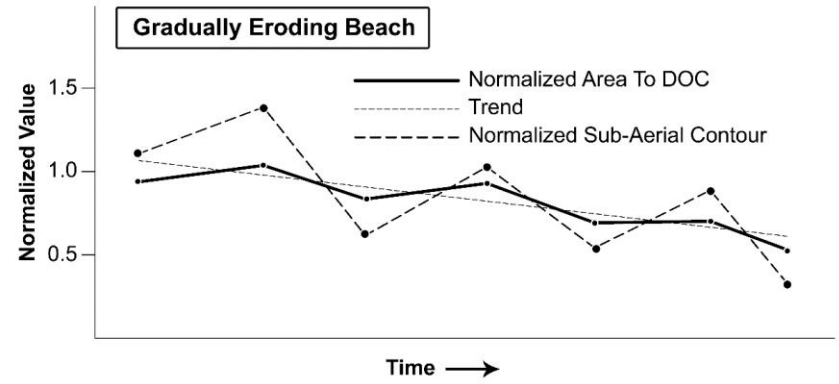
-Beach Cycle – Winter-Summer/Storm-Post-Storm

-Linear vs Volumetric Measures

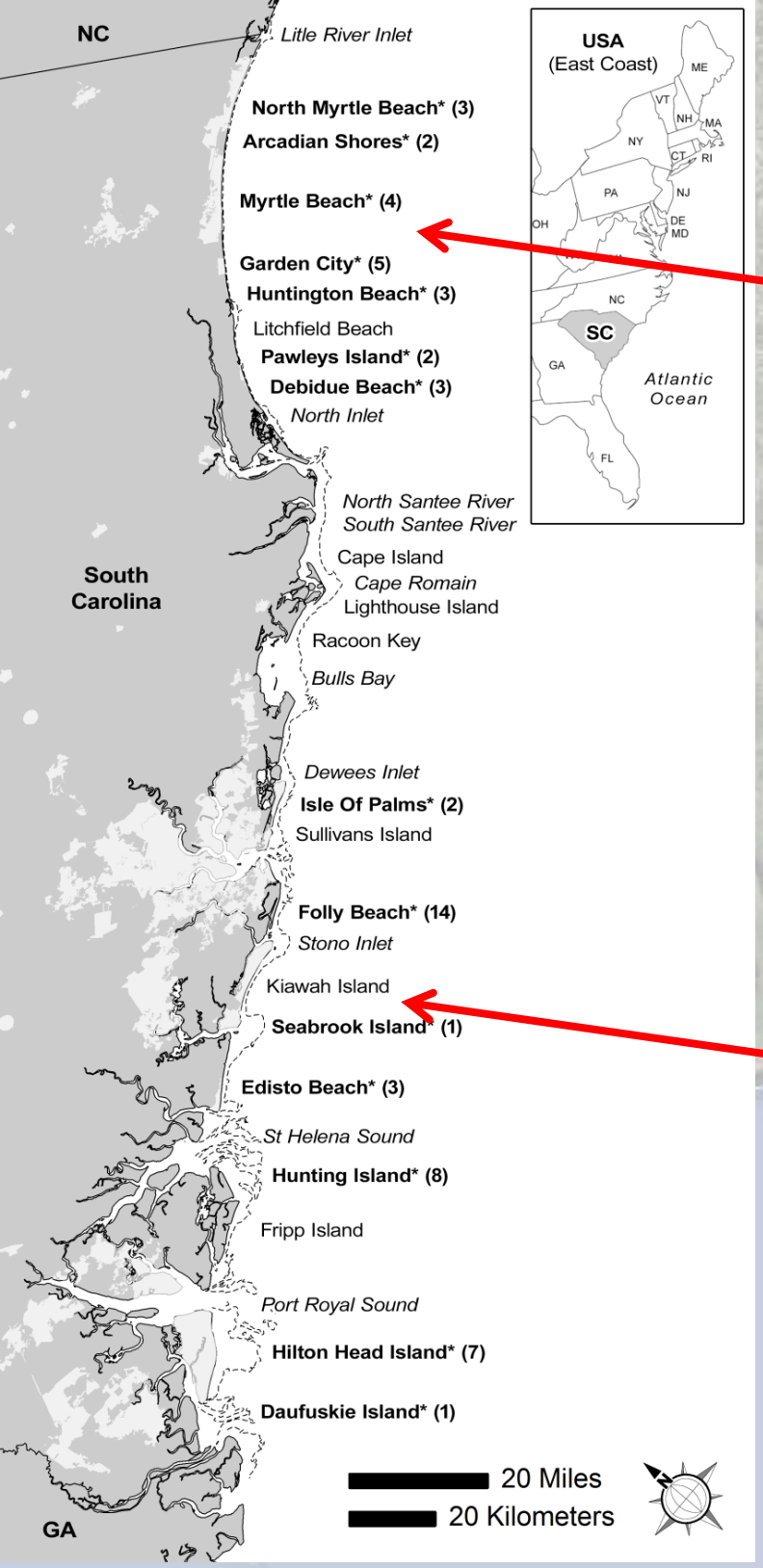
-Subaerial Surveys vs Profiling to DOC

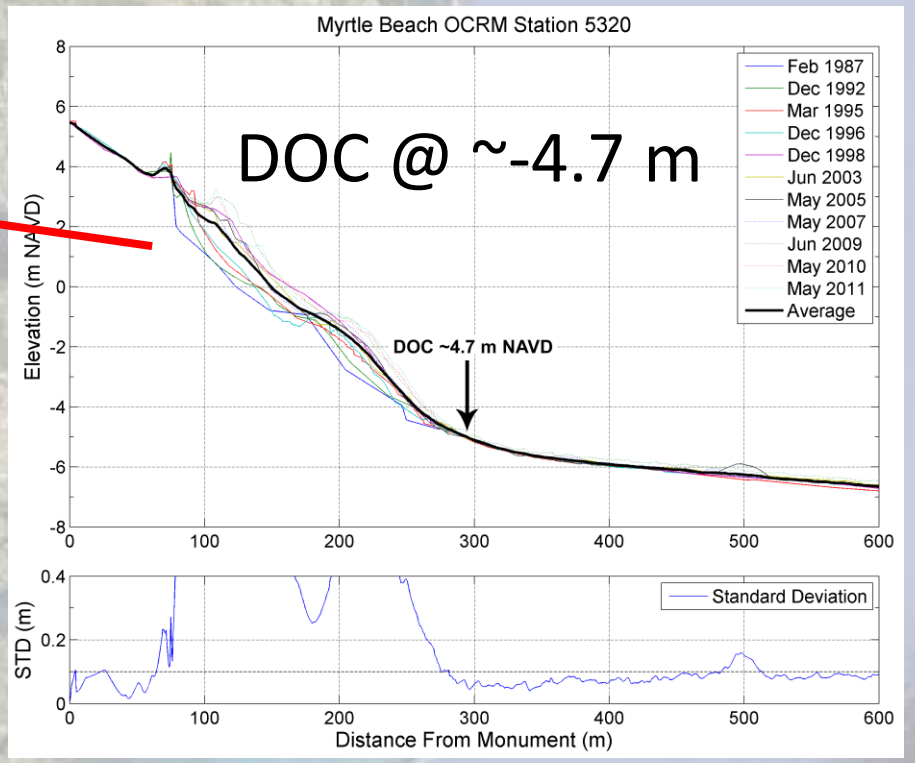


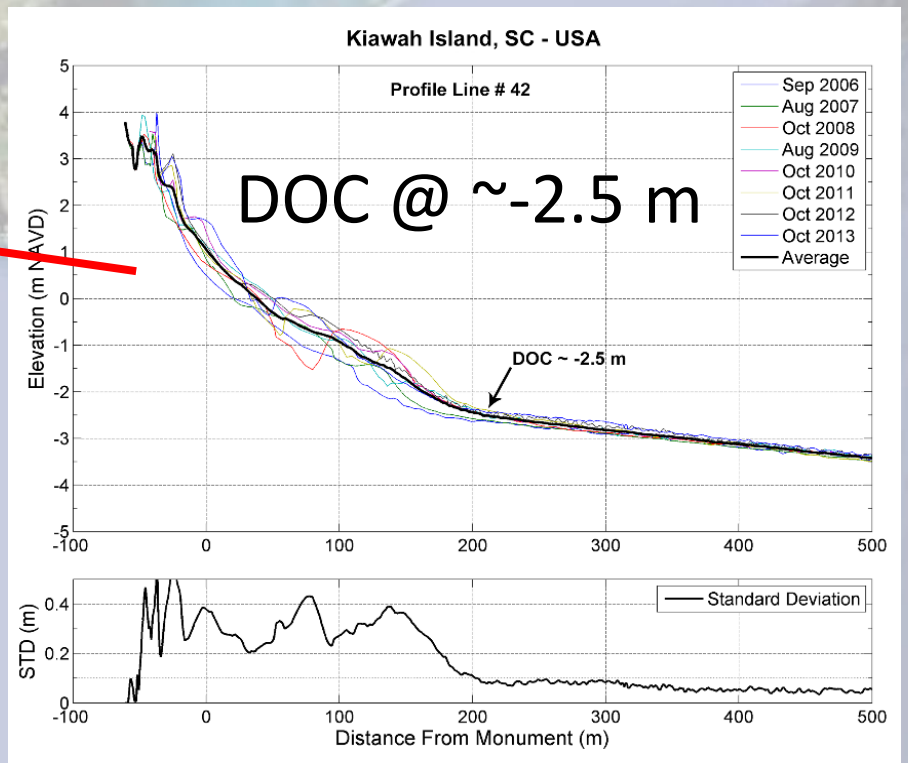




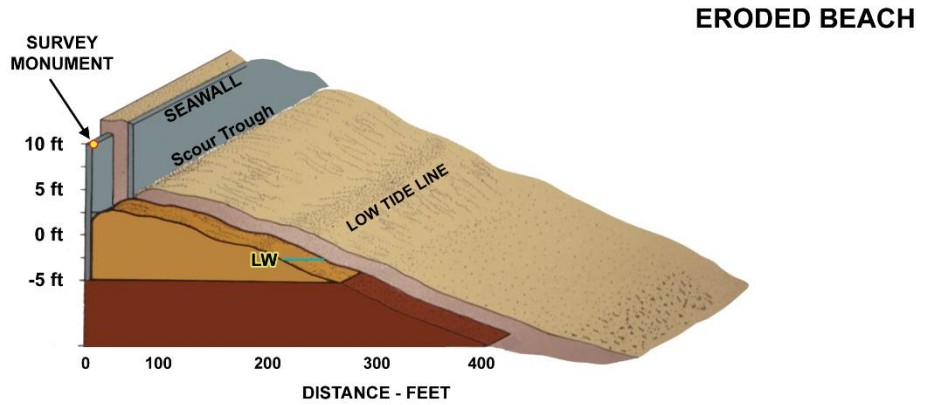
Determine Littoral Boundaries

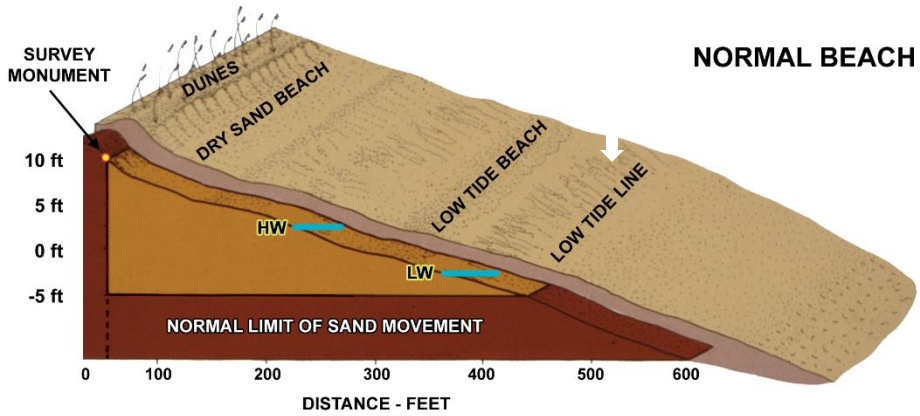


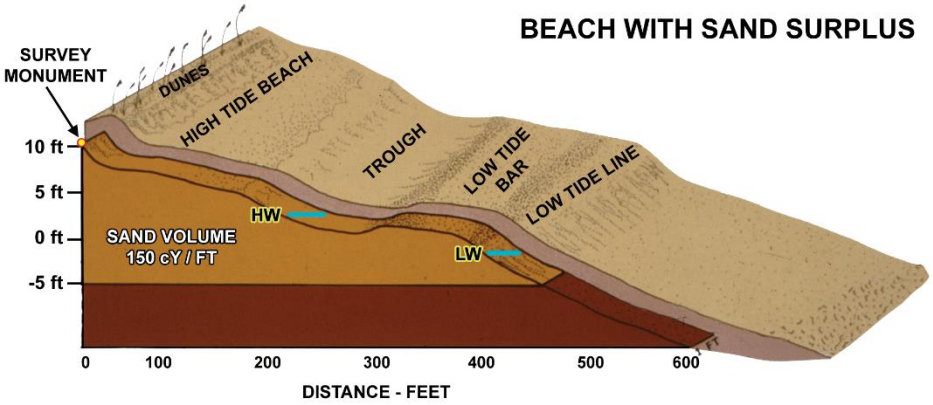




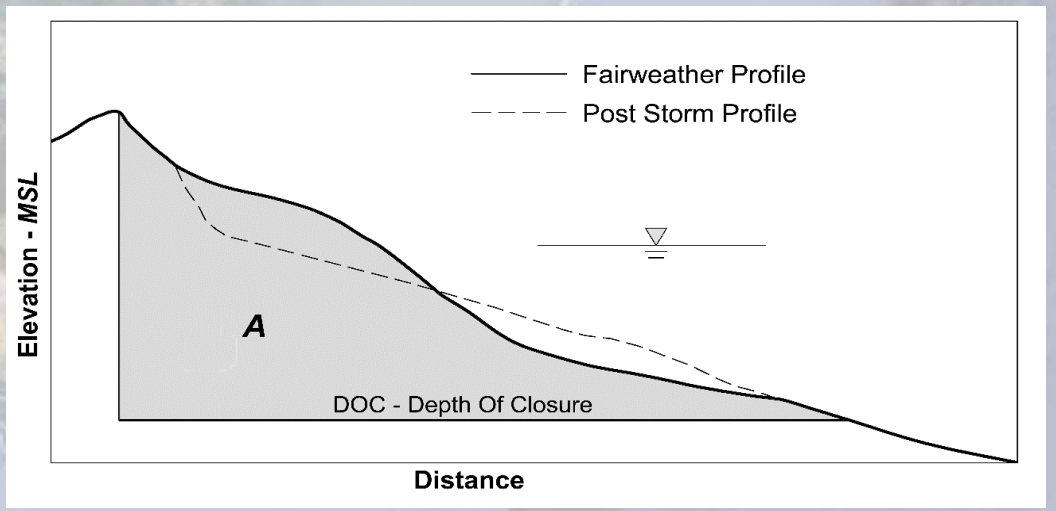
Beach Condition as Measured by Unit Profile Volumes





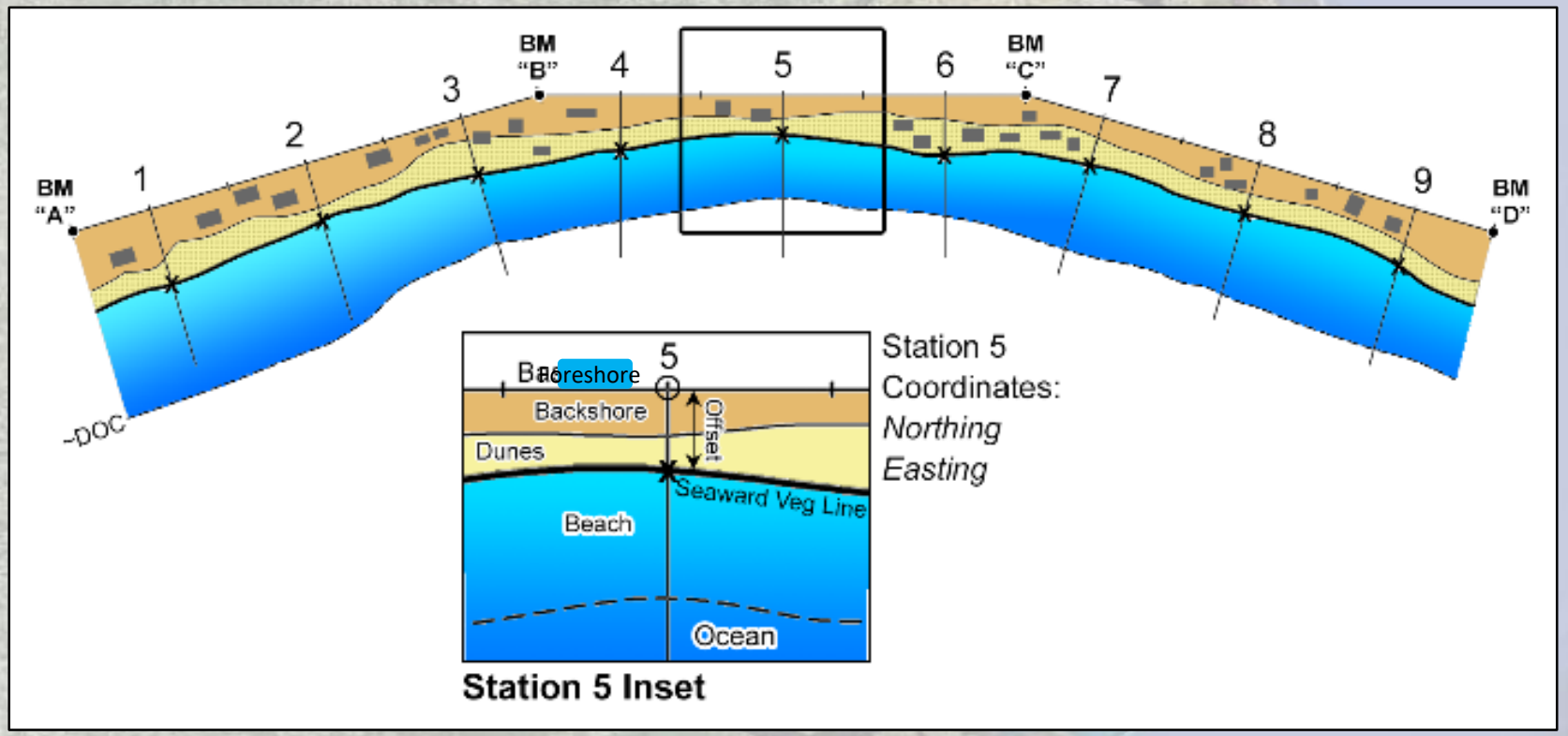


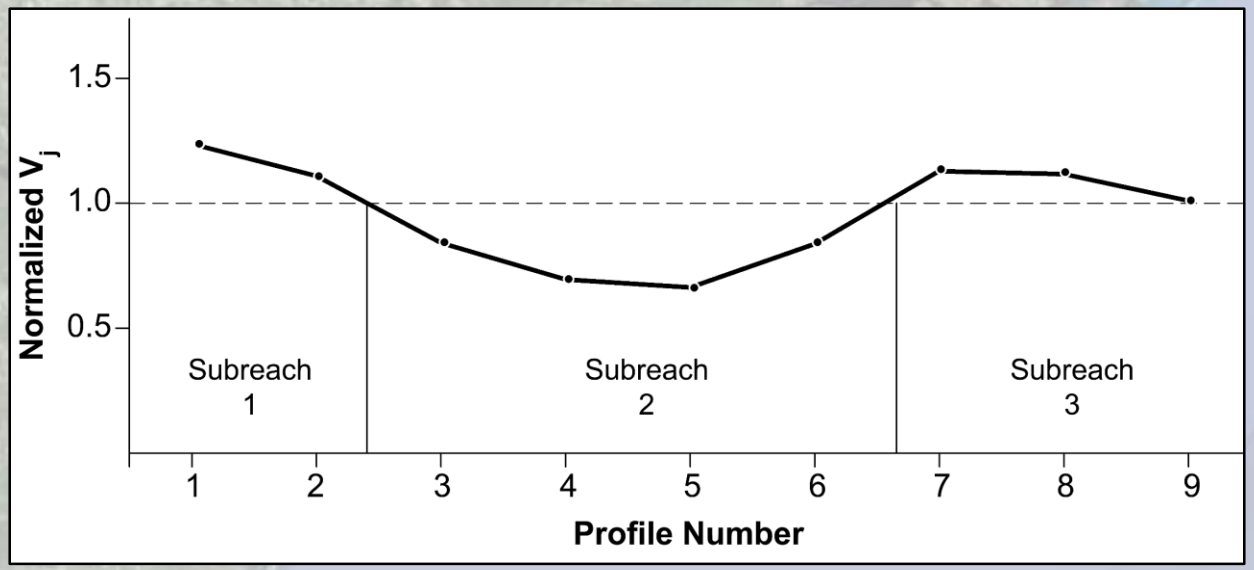
Convert Unit Area, A, to Unit Volume to DOC, V_e, for a simple measure of profile condition – irrespective of beach stage

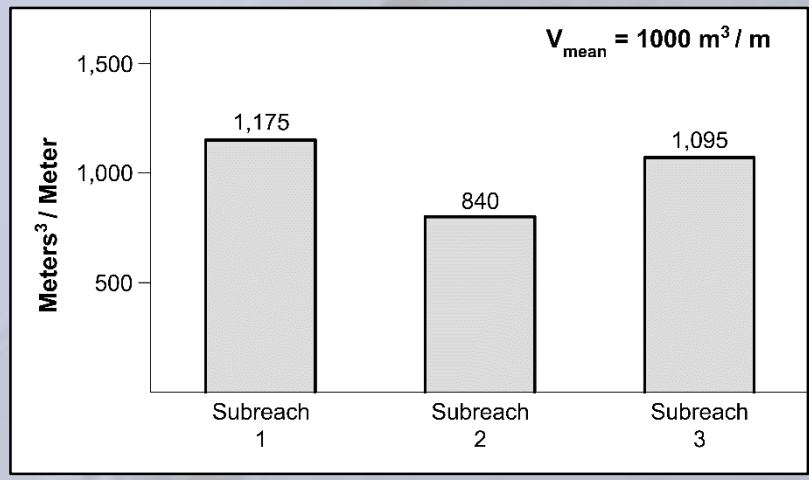


After Kana 1993

Determining Site Specific Sand Deficits



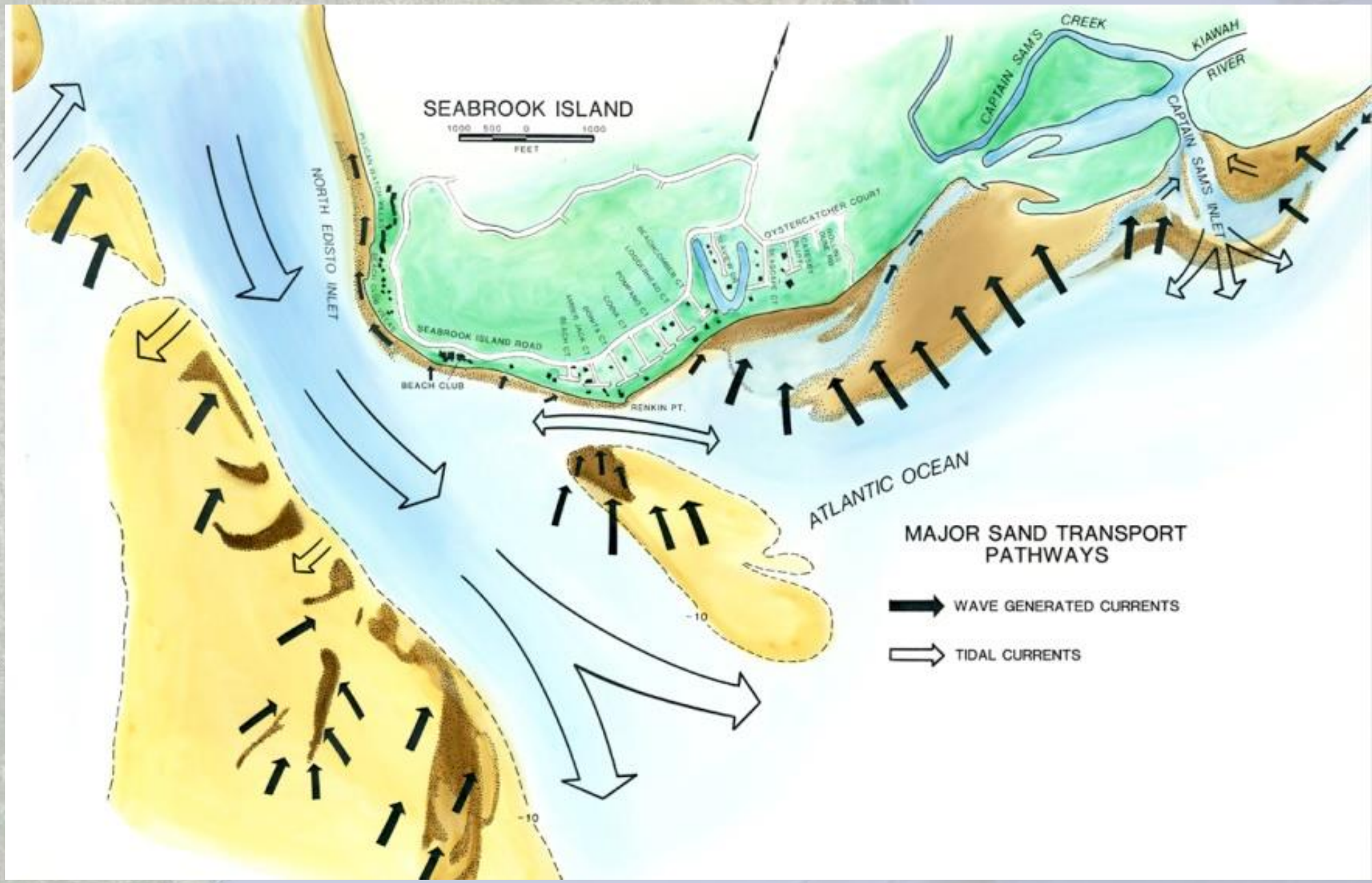




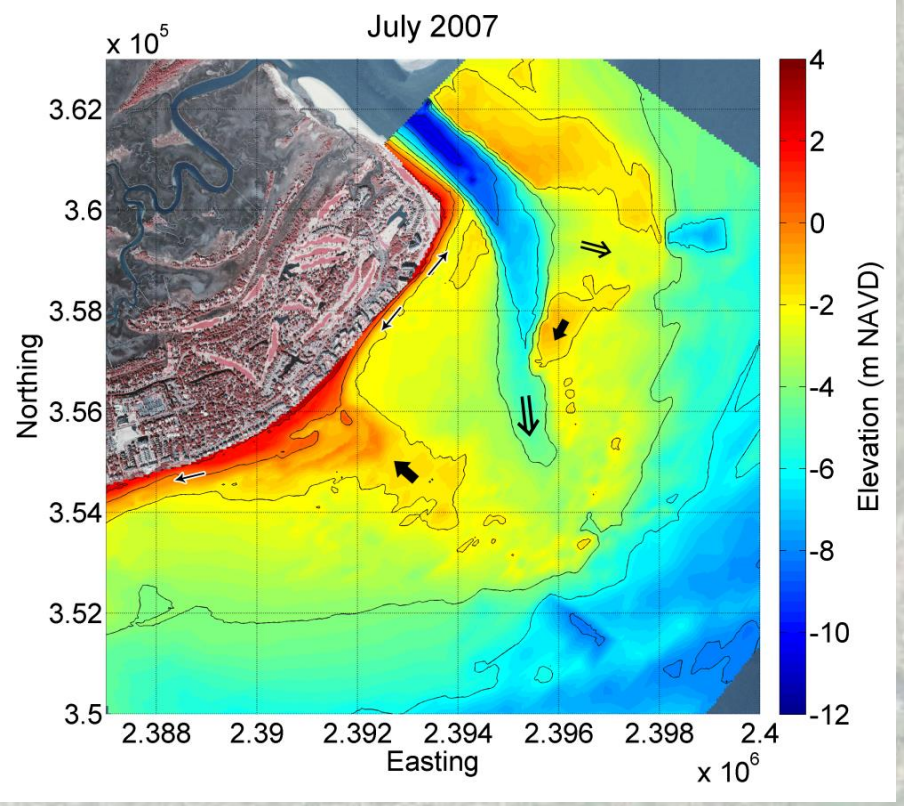
From Kana et al 2015 in Design of Coastal Structures and Sea Defenses (YC Kim ed)

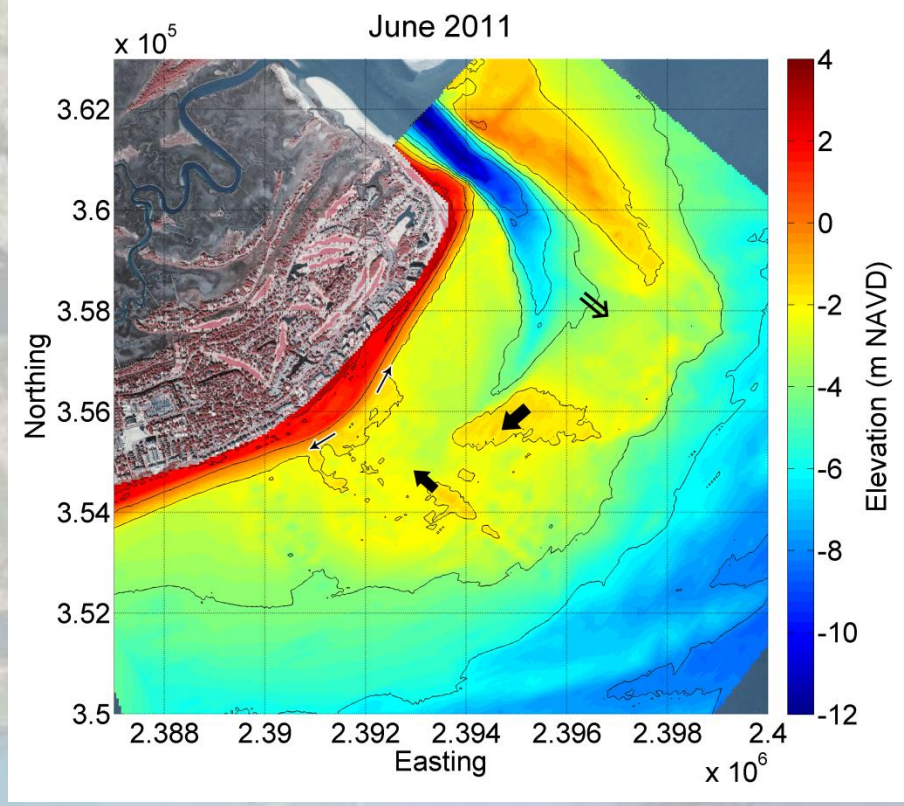
Key Design Element #3

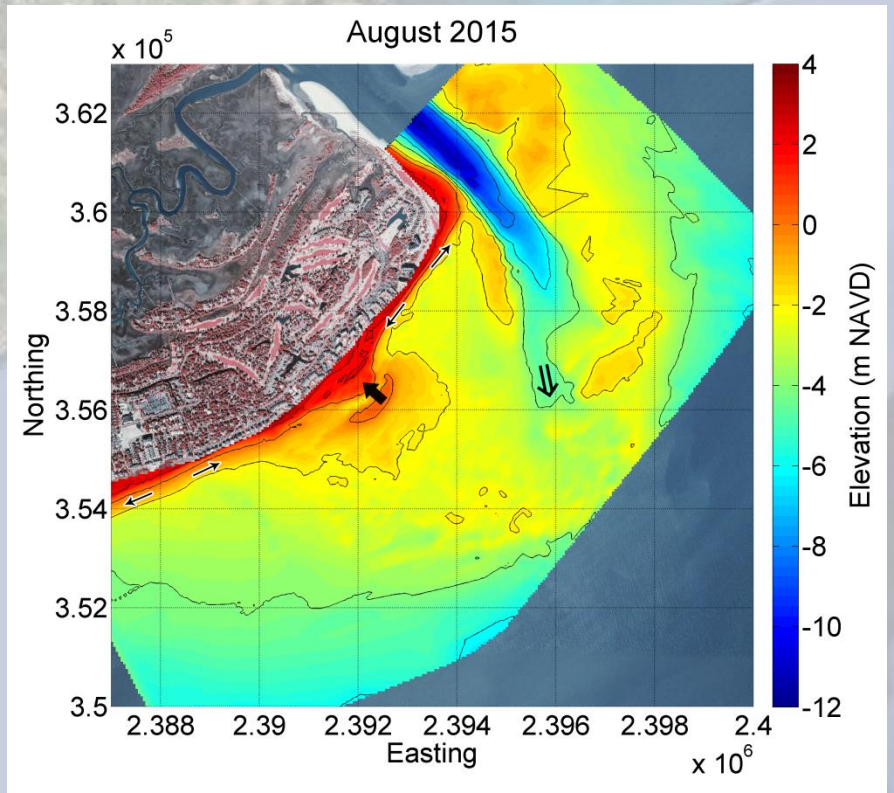
Geomorphic Models of Controlling Processes



After CSE 1984





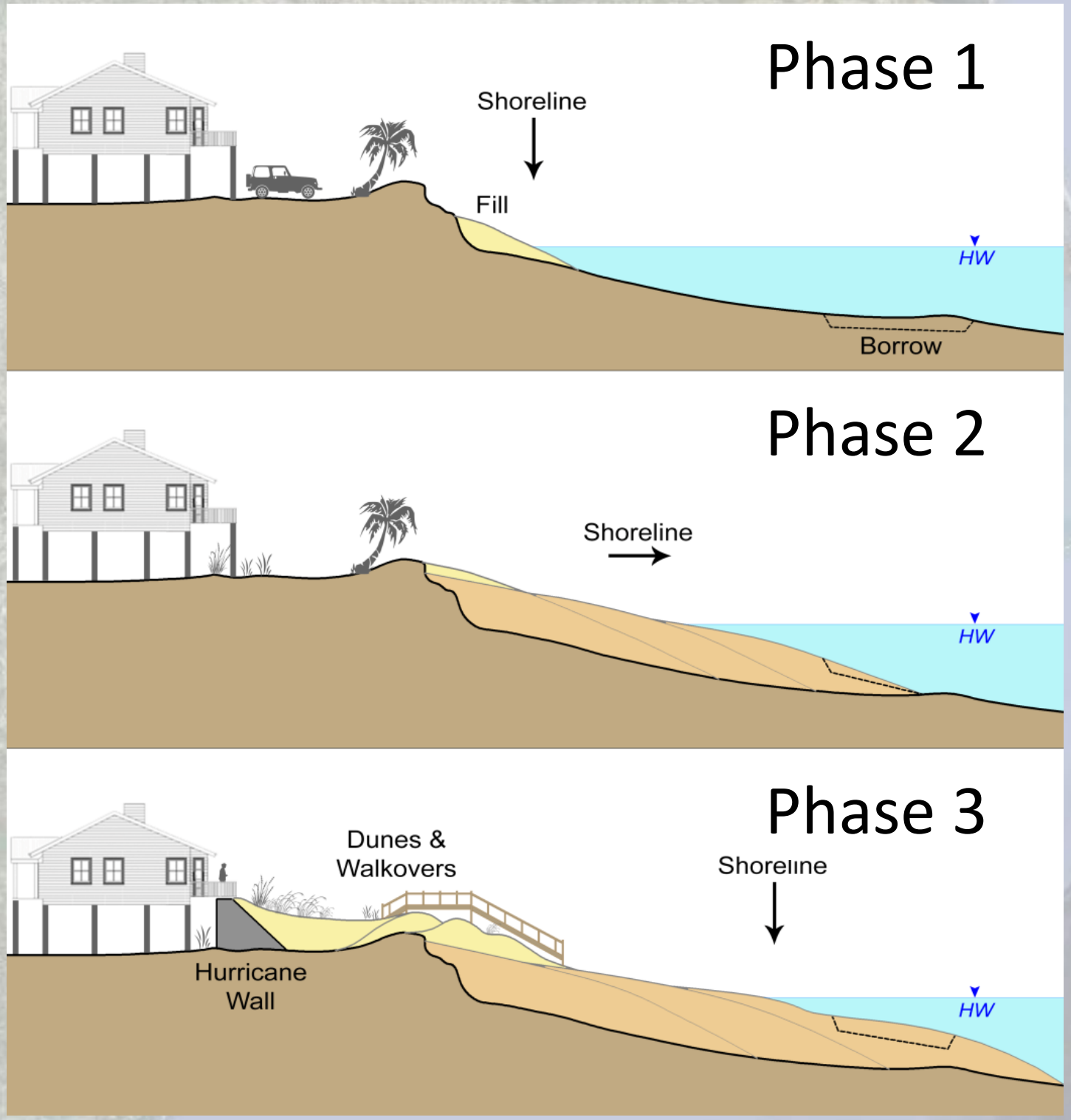


Decadal-scale Surveys Particularly Around Inlet Deltas

Dewees Inlet SC
Steven Traynum

Key Design Element #4

Define A Target Beach Condition



Performance
(*f* Volume)

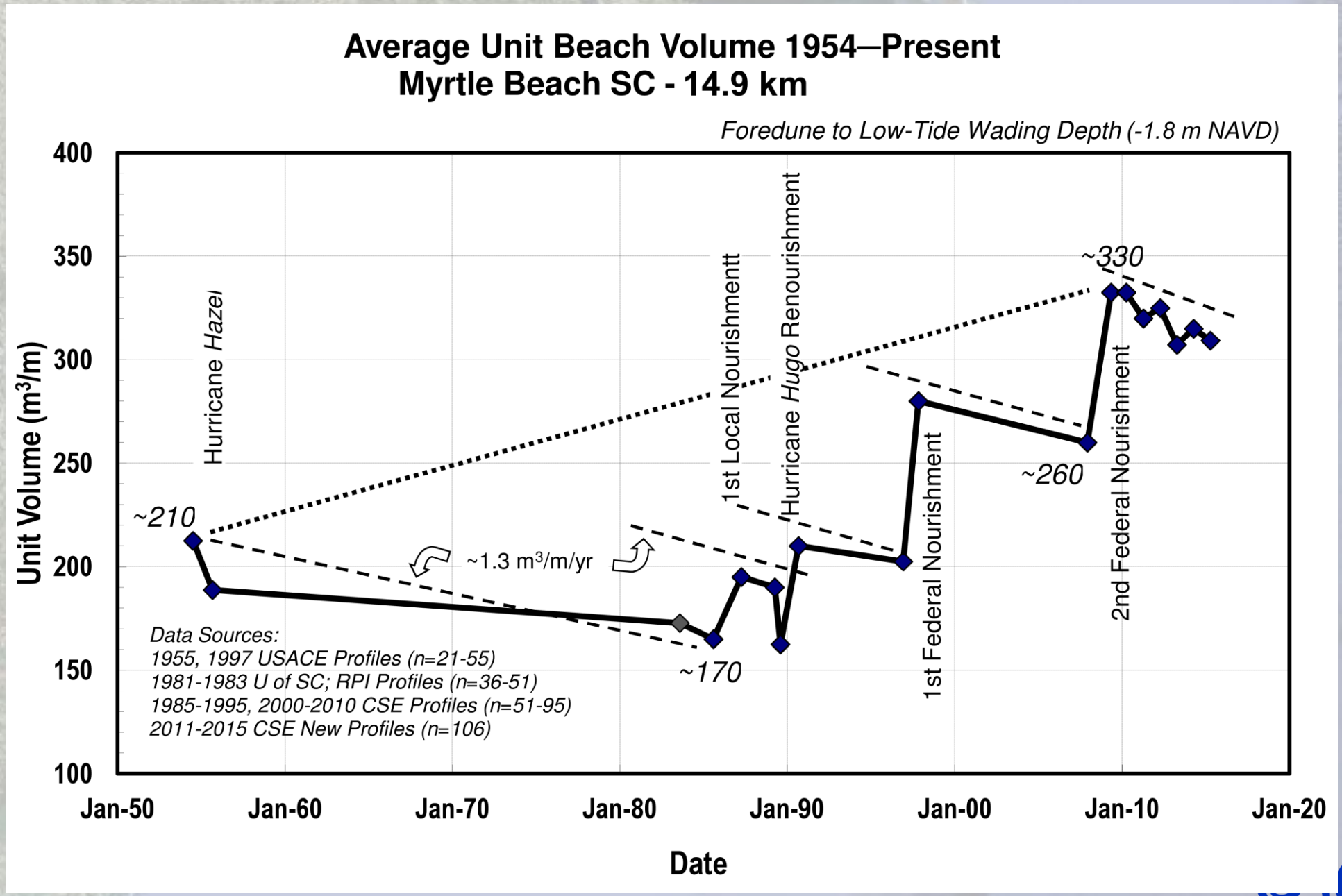
$/m

$$/m

$$$/m

After CSE 1984

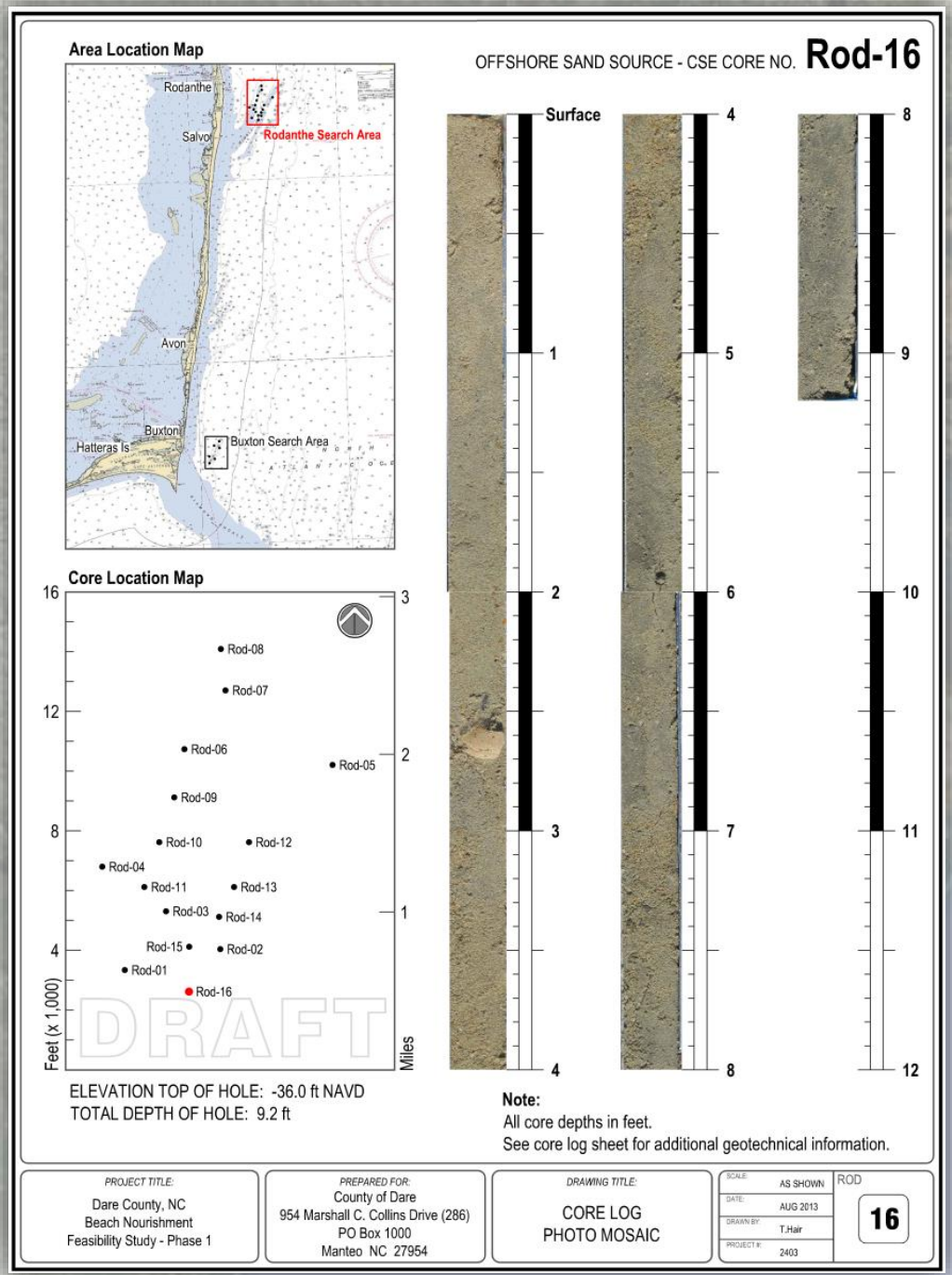
Sustained Increase in Beach Volume
Four Nourishment Events over 30 years

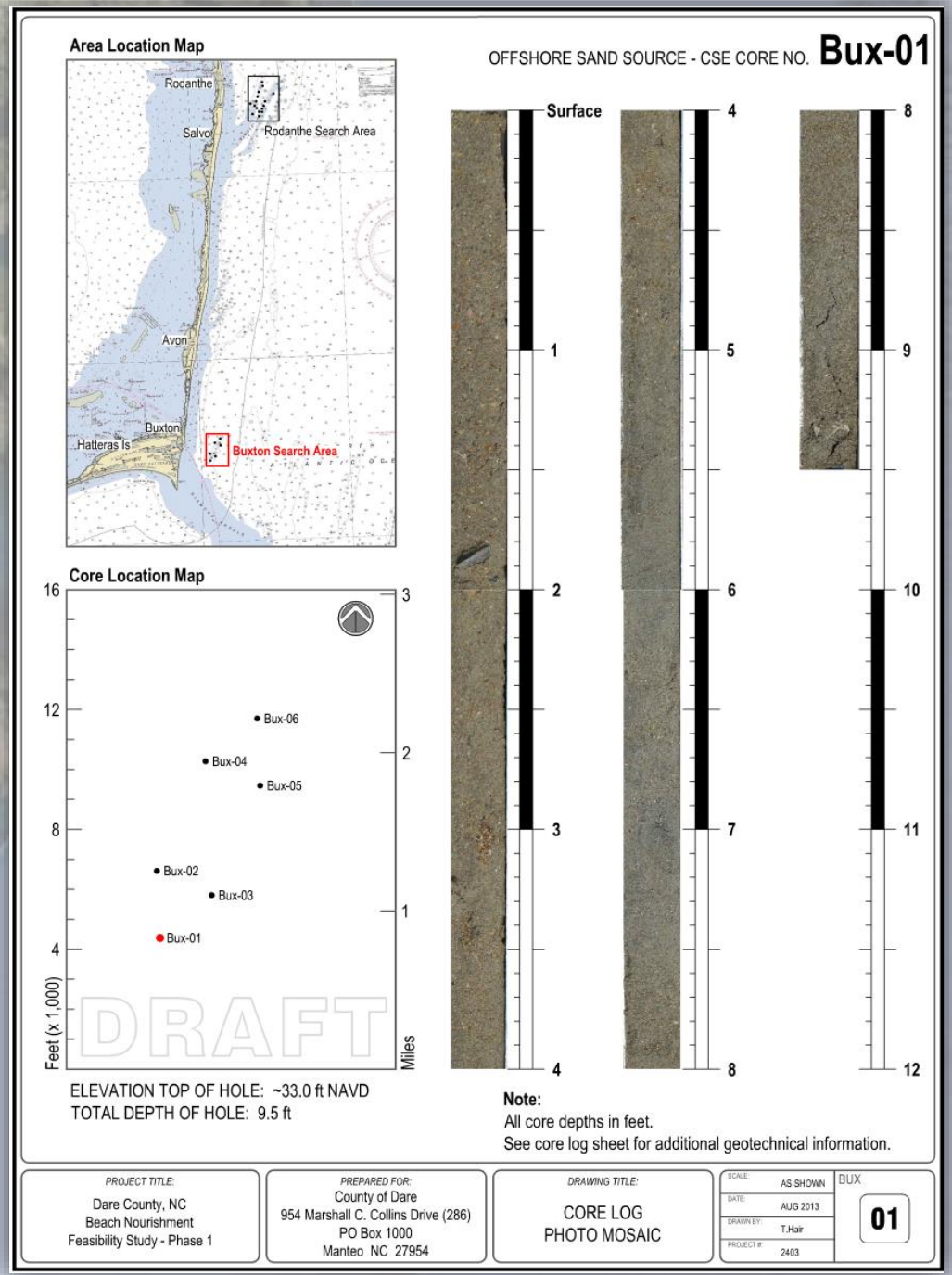


Key Design Element #5

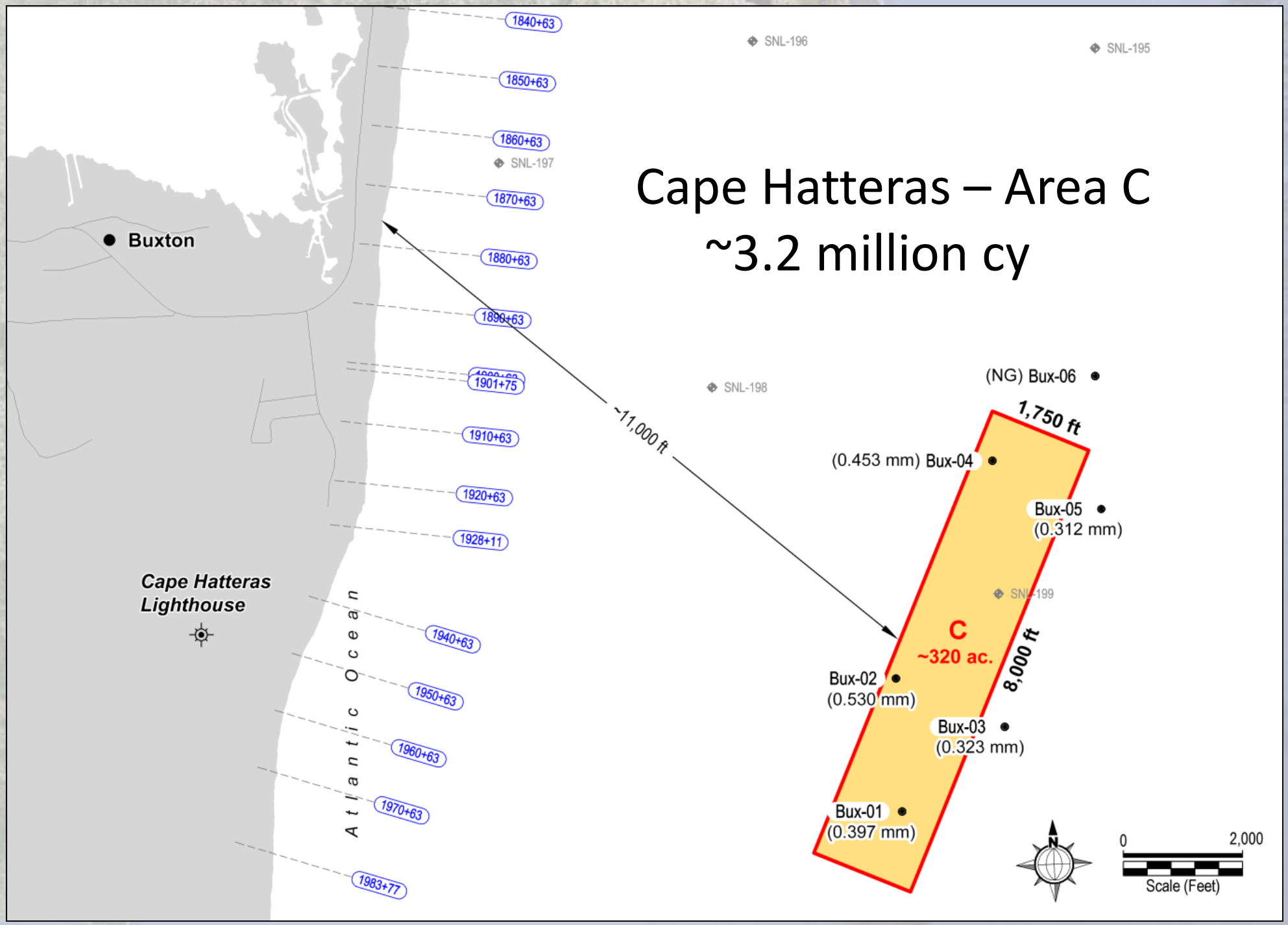
Identify Borrow Site

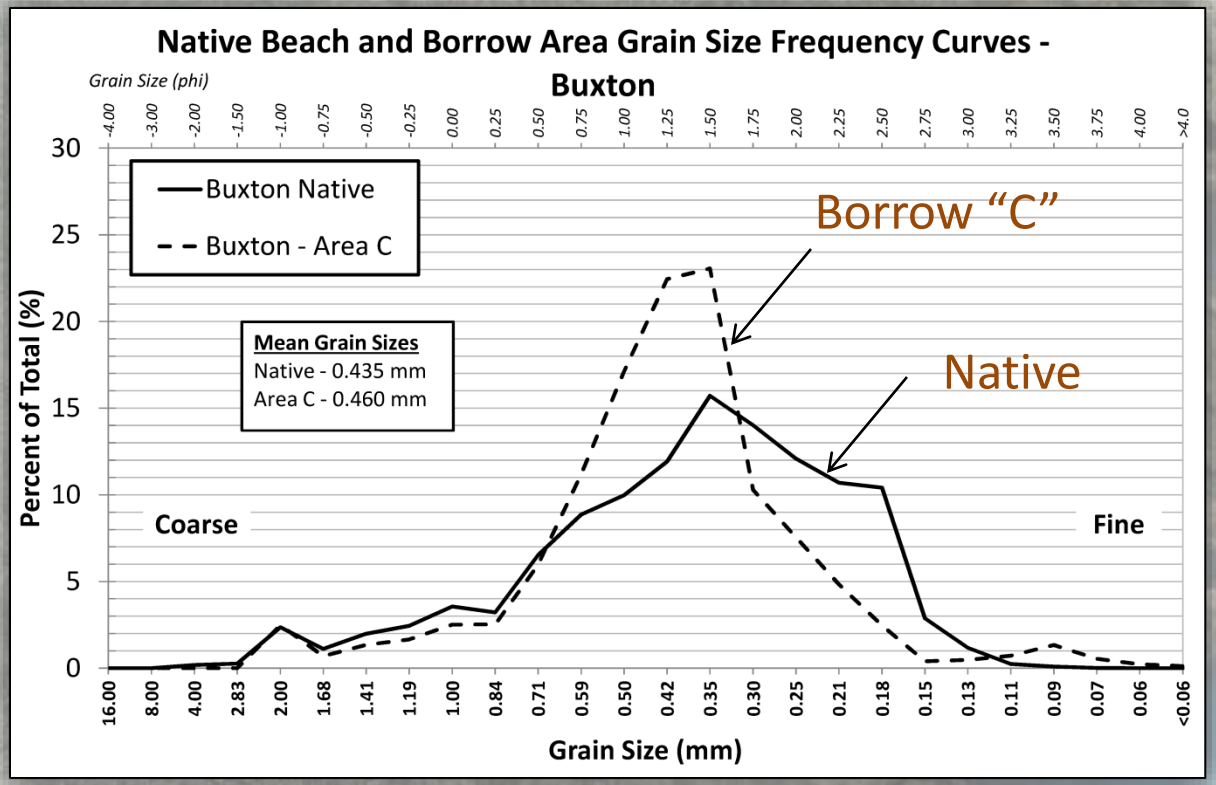
Sand Search & Confirmation Outer Banks - Cores ~ 8 ft long





Phase 1 - Potential Borrow Area





Native vs Borrow Sediments

Grain Size Distributions =

- The Proportions of Various Sand Sizes On the "Native" Beach and In the Borrow Areas

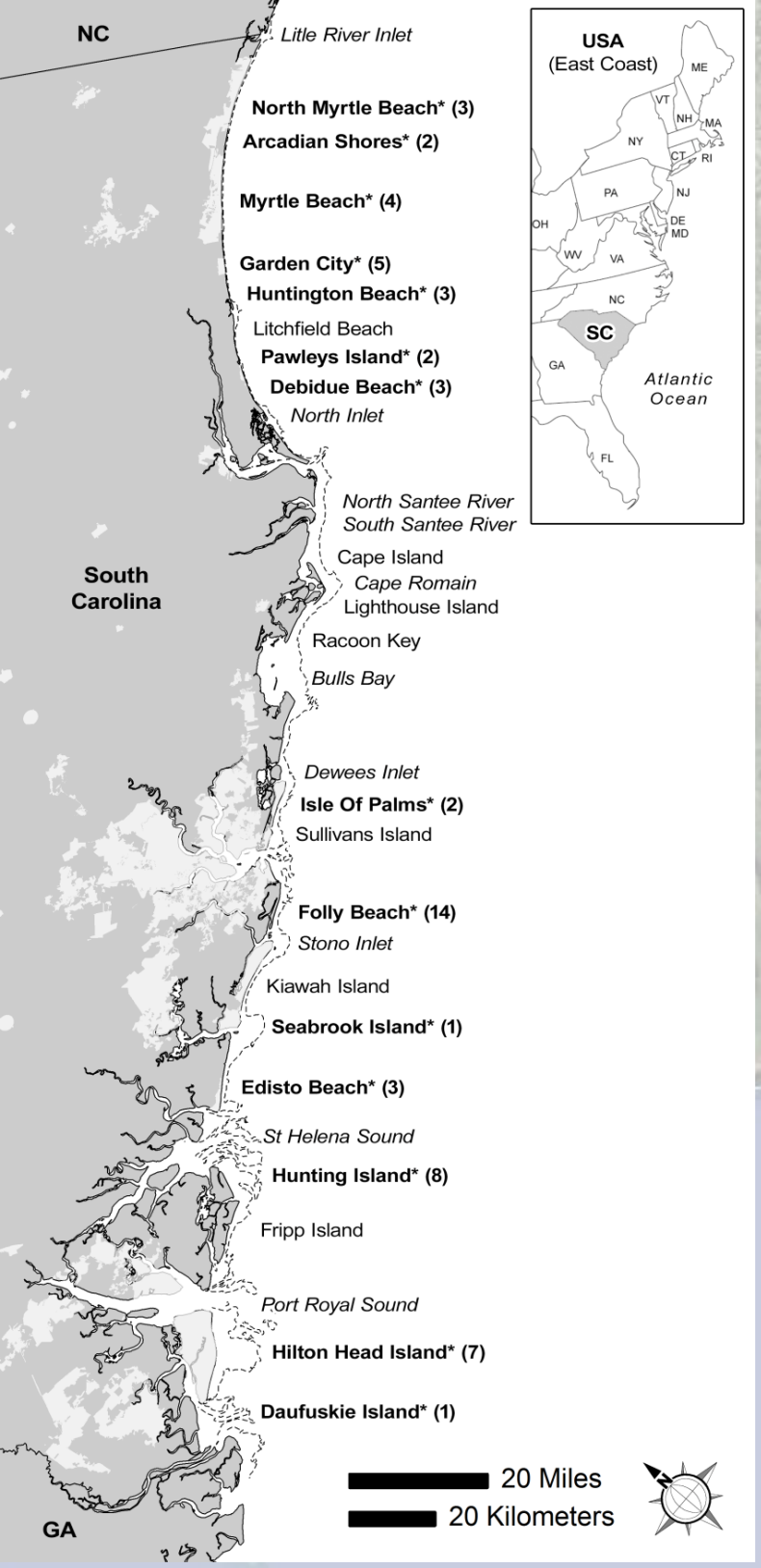
- A Perfect Borrow Source Matches The Native Sand

Phase 2 – Detailed Surveys to Confirm

- More Offshore Cores For Design
- More Beach Samples –

Goal – Match Sediments

Reduce Uncertainty



Sustainability
South Carolina USA

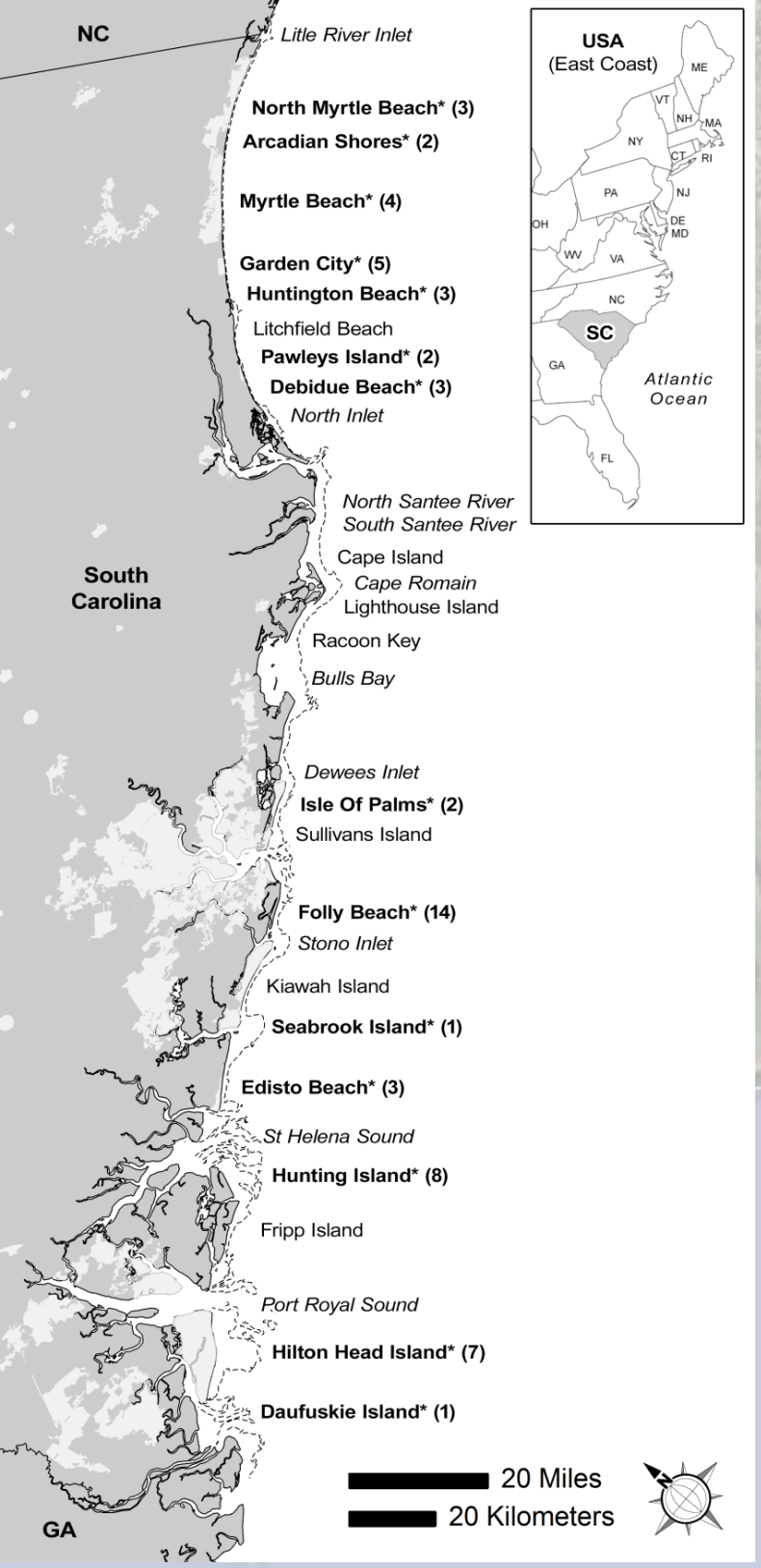
1980-2010

~80% of developed beaches wider

Average Annual Expenditures for Beach Improvement:
~$128 per meter per year

Present Value of Developed Oceanfront –
$16,000 – 165,000 per meter of beachfront

Source: Kana 2012 Shore & Beach



Key to Sustainability

Measure
Measure
Measure

Continually Update Costs, Impacts And Benefits

Source: Kana 2012 Shore & Beach