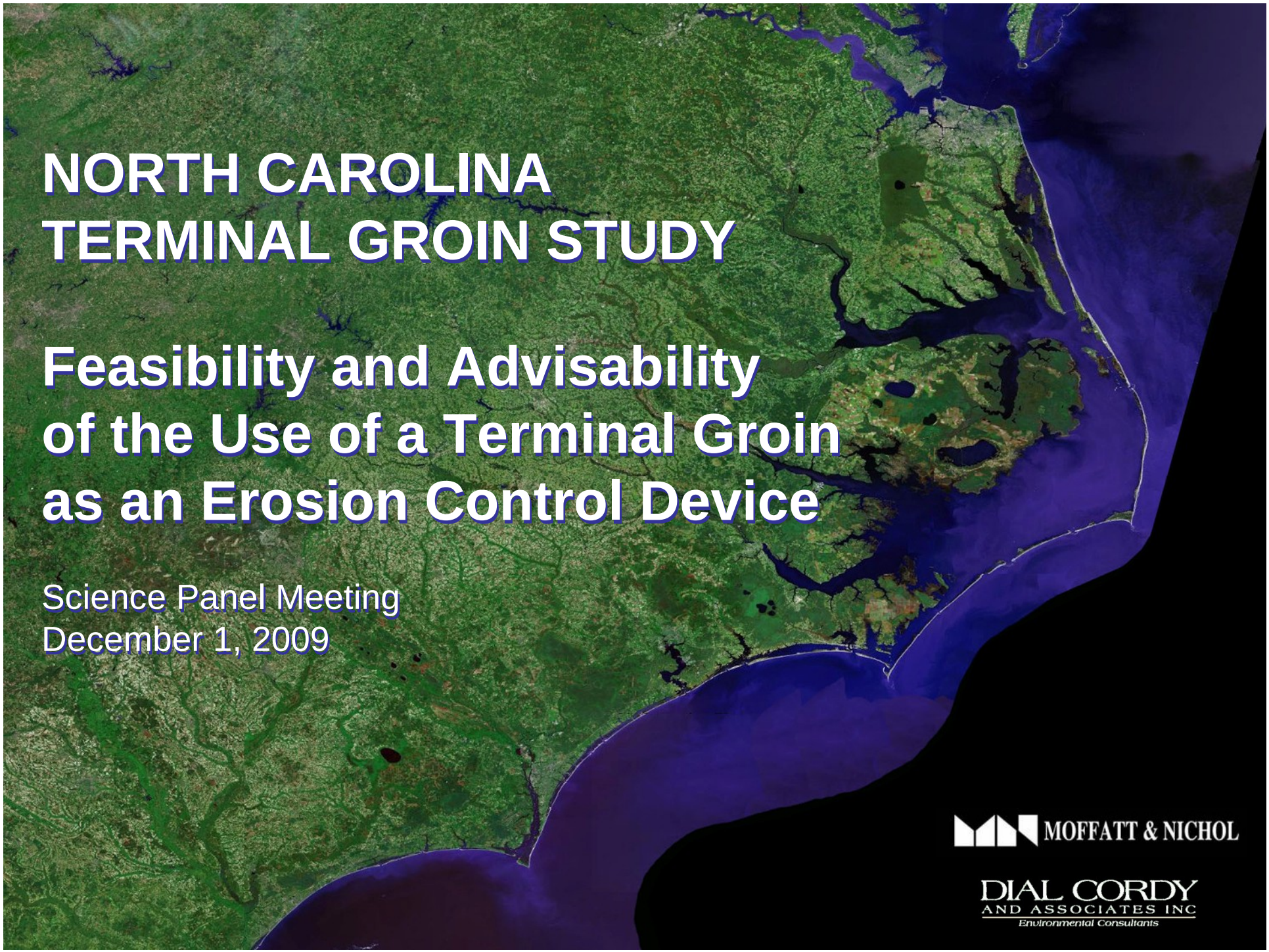


# NORTH CAROLINA TERMINAL GROIN STUDY

## Feasibility and Advisability of the Use of a Terminal Groin as an Erosion Control Device

Science Panel Meeting
December 1, 2009

MOFFATT & NICHOL

DIAL CORDY AND ASSOCIATES INC
Environmental Consultants

# Meeting Agenda

- Introductions
- Status of Data Collection
- Methodology Discussions:
  - Engineering Analysis of Effectiveness and Impacts
  - Environmental Analysis of Potential Impacts
  - Economic Analysis
  - Geologic Framework
- Next Steps

# Contractor Project Team Members

- Moffatt & Nichol – Coastal Engineering
- Dial Cordy and Associates, Inc. - Environmental
- Dr. Duncan FitzGerald (Boston University) – Coastal Geology
- Dr. Chris Dumas (UNCW) – Economics

# House Bill 709

**“An act to impose a moratorium on certain actions of the coastal resources commission related to temporary erosion control structures and to direct the Coastal Resources Commission to study the feasibility and advisability of the use of a terminal groin as an erosion control device.”**

# Overall Project Work Plan

**Task 1 – Coastal Engineering Analyses of Effectiveness and Impacts of Terminal Groins**

**Task 2 – Environmental Resource Analyses of Potential Effects of Terminal Groins**

**Task 3 – Construction Techniques to Limit Impacts**

**Task 4 – Economic Study of Impacts of Shifting Inlets**

**Task 5 – Initial Construction and Maintenance Costs**

**Task 6 – Locations Limitation Study**

**Task 7 – Public Input**

**Task 8 – Draft and Final Report**

# Selected Sites Based on September 29th Science Panel Meeting

**North Carolina**
- Oregon Inlet
- Fort Macon

**Florida**
- Amelia Island
- Captiva Island
- John's Pass

# Oregon Inlet, NC

# Fort Macon, NC


South Amelia Island, FL
2005

# Captiva Island, FL

# John’s Pass, FL

# Data Collection

- Data Collection for Selected Five Terminal Groins
- Found Available Data for All Five Sites
- Have Located and Gathered Data (Still Waiting on Some to be Transmitted) – Given Timeline Will Have to End This Process Soon and Use What We Have
- Assembled a Data Bibliography
- Assembled Draft Engineering Activities Log

# Data Collection

## Example Data Bibliography

**Captiva Island References**

| Title | Author | Source | Date |
|---|---|---|---|
| Biological Opinion Based on North Captiva Island, Lee County, FL. | USFWS | USACE Jacksonville District | 2007 |
| Captiva and Sanibel Islands 2005-2006 Beach Renourishment Project - 2 year Monitoring Assessment | Thomas Campbell, Steve Keehn | Coastal Planning & Engineering | 8/13/08? |
| Captiva and Sanibel Islands Beach Renourishment Project 2-yr Post-Construction Engineering Monitoring Report | Coastal Planning & Engineering, Inc. | | Jul-08 |
| Captiva Beach Renourishment - As Built Notes | Department of the Army | Layton Bedsole | 17-Jul-08 |
| Captiva Beach Renourishment - As Built Plans, North and South Segments, including profiles | Unknown | Unknown | Unknown |
| Captiva Island and Sanibel Island 47-year Program: Stages of Project Evolution | Steve Keehn, Alison Hagerup, Tom Pierro | ASBPA | Oct-06 |
| Coastal History Notes: Captiva Island | Todd L Walton, Jr. | Forida Cooperative Extension Service Marine Advisory Program: A Florida Sea Grant Publication | 1961? |
| Lee County, Florida Shore Protection Project (Gasparilla and Esterno Islands) | USACE | Andy Coburn | Jan-00 |

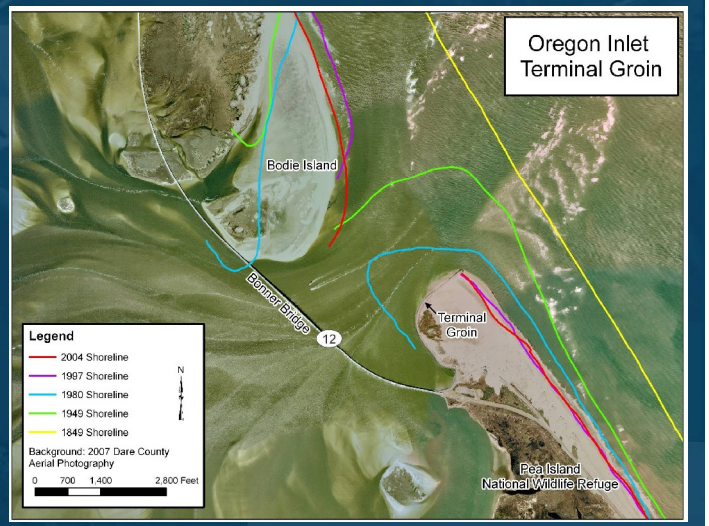
# Data Collection

## Example Engineering Activities Log

**ENGINEERING ACTIVITIES LOG FOR OREGON INLET**

| No | Date | Project Type | Description | Vol (cy) | Extent (ft) | Unit Vol (cy/ft) | Sand Source |
|---|---|---|---|---|---|---|---|
| 1 | 1950 | Dredging | USACE begins dredging to maintain a 14' X 400' channel through Oregon Inlet | | | | |
| 2 | April, 1963 | Bridge Opening | The 2.4-mile Bonner Bridge opens | | | | |
| 3 | 1984 | Dredging | USACE initiates a large scale hopper dredge of Oregon Inlet | | | | |
| 4 | 1990 | Beach Placement | Dredging near Bonner Bridge; placed on tip of Pea Island | 254,955 | 2,000 | 127 | Vicinity of Bonner Bridge |
| 5 | 1989 - March 1991 | Groin Construction | The project consisted of a terminal groin and revetment (3,125 and 625 ft long) starting at the US Coast Guard Station; the groin ranges in width btw 110 to 170 ft at the base and 25 ft at the landward end to 39 ft at the seaward end; the groin was designed to withstand a still water level of 8 ft above MSL and wave btw 9 and 15 ft. | | | | |
| 6 | April - November, 1991 | Beach Placement | USACE places fill on to the PINWE beach | 470,000 | | | |
| 7 | 1991 | Beach Placement | Placed on Pea Island (sta 45 to 55 & sta 85 to 100) | 282,600 | 2,500 | 113 | Oregon Inlet Navigation Span |
| 8 | 1991 - 1997 | Surveys | FRF's Oregon Inlet Monitoring Program surveys extended 6 km north and south of the inlet; survey lines spaced at 300 m intervals and extended offshore to the 9 m depth contour | | | | |
| 9 | 1992 | Beach Placement | Placed on Pea Island (sta 60 to 100) | 184,300 | 4,000 | 46 | Oregon Inlet Navigation Span and Ocean Bar |
| 10 | 1992 | Beach Placement | Placed on Pea Island (sta 80 to 134) | 1,078,000 | 5,400 | 200 | Oregon Inlet Navigation Span |

# Data Collection



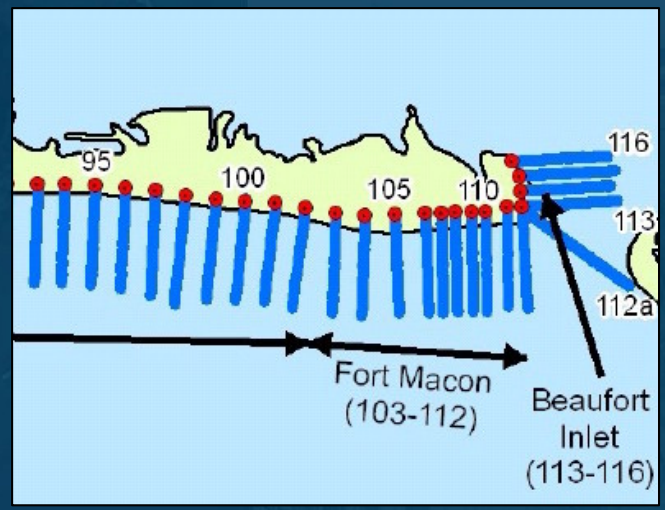

**Oregon Inlet**

- NCDOT Monitoring Reports
- USACE Dredging Data
- USCE Beach Placement Data
- DCM Historic Shorelines
- Aerials
- Wave and Tidal (Gage and Hindcast Data)
- Tropical Storm Track History
- Past Reports and Papers (USFWS, Journal and Conference Articles, USACE)

# Data Collection

**Fort Macon**

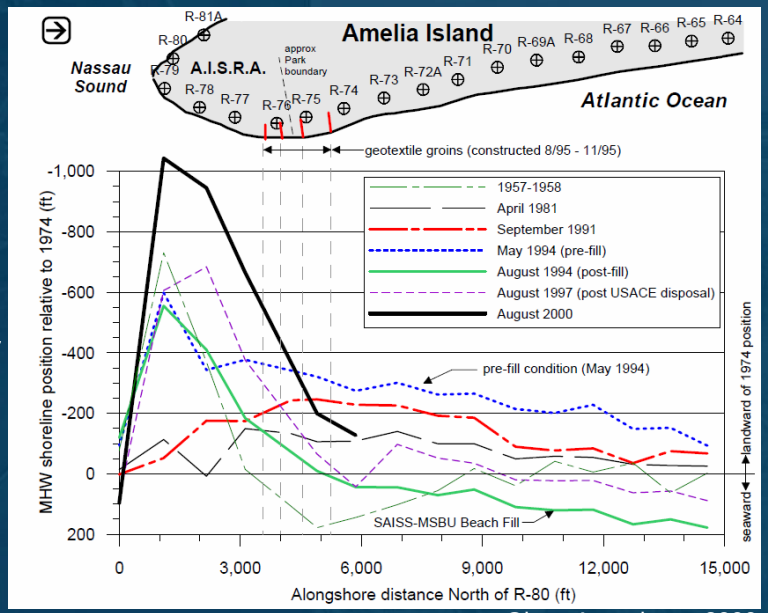
- Engineering Drawings for Terminal Groin
- USACE Dredging Data
- USACE Beach Placement Data
- Carteret County Beach Profile Monitoring Data
- Reports (Section 933 Report, MHC Harbor Study)
- DCM Historic Shorelines
- Aerials
- Wave and Tidal Data
- Tropical Storm Track History



# Data Collection

## Amelia Island

- Engineering and Environmental Reports Prepared by Design Engineers (Olsen Associates)
- Aerials
- Historic Shoreline Data, Pre and Post Construction Surveys
- Past Nourishment Data
- Wave and Tidal
- Tropical Storm Track History




Olsen Associates, 2000

# Data Collection

**Capitva Island**

- Past Beach Nourishment Data
- Reports (USACE, USFWS, Coastal History)
- Wave and Tidal Data
- Tropical Storm Track History
- Aerials

# Data Collection

**John's Pass**

- Wave and Tidal Data
- Tropical Storm Track History
- Aerials
- Reports and Articles (Florida Sea Grant, …)

# Coastal Engineering Analysis

**HOUSE BILL 709**

**Study Shall consider:**

**"(1) Scientific data regarding the effectiveness of terminal groins constructed in North Carolina and other states in controlling erosion. Such data will include consideration of the effect of terminal groins on adjacent areas of the coastline."**

# Coastal Engineering Analysis

## Overview of Methodology:

- **Data and Literature Review**
  - Physical Processes
    - Waves (Gage or WIS)
    - Tides
    - Sediment Transport
    - Storm History (NOAA Hurricane Tracks, Frequency)
  - Geology
  - Structure Characteristics
    - Dimensions, Porosity, Water Depth
  - Performance
    - Intended, Actual
    - Associated Works (Beach Nourishment, …)

# Coastal Engineering Analysis

- Assess Pre-Structure Conditions
  - Shoreline Position
  - Estimate Historic/Baseline Erosion Rate
  - Past Inlet Migration
  - Past Engineering Activities in Vicinity
- Assess Post-Structure Conditions
  - Shoreline Position
  - Erosion Rate
  - Associated or Post-Structure Engineering Activities
- Net Out Associated Beach Nourishment Activities (Relate Volumes to Shoreline Change/Linear Beach Erosion ~1.3 cy/ft – Look at Profiles)
- Dredging History of Inlet

# Environmental Analysis

**HOUSE BILL 709**

**Study Shall consider:**

**"(2) Scientific data regarding the impact of terminal groins on the environment and natural wildlife habitats."**

# Environmental Analysis

## Overview of Methodology:

**Environmental Analysis**

- Contacts
  - State and Federal Agencies
  - Non-Profit Organizations
  - Non-Governmental Organizations
  - Resource Experts
- Review Existing Data and Literature
- Report Preparation

# Environmental Analysis

## Contacts

| Representatives | North Carolina | Florida |
|---|---|---|
| State Agency | 20 | 27 |
| Federal Agency | 17 | 22 |
| Non-profit Organization | 8 | 6 |
| For-profit Organization | 13 | 8 |
| Individual | 4 | 0 |
| Total | 62 | 63 |

# Environmental Analysis

## Florida

### State Agency

- State Parks
- Department of Environmental Protection
  - Office of Coastal and Aquatic Managed Areas
  - Bureau of Beaches and Coastal Systems
- Sanibel-Captiva Conservation Foundation Marine Laboratory
- Fish and Wildlife Conservation Commission

### Federal Agency

- US Fish and Wildlife Service
- National Marine Fisheries Service
- USACE – Jacksonville
- USACE – Fort Meyers
- USACE – Tampa Bay

# Environmental Analysis

## North Carolina

### State Agency

- NC Division of Marine Fisheries
- NC Division of Coastal Management
- Cape Hatteras National Seashore
- NC Wildlife Resources Commission
- NC Natural Heritage Program
- NC National Estuarine Research Reserve
- NC Division of Water Quality
- Cape Lookout National Seashore
- NC Geological Survey
- Fort Macon State Park

### Federal Agency

- USACE – Coastal & Hydraulics Laboratory
- USACE Wilmington
- Federal Highways Administration
- US Fish and Wildlife Service
- US Army Engineer Research & Development Center
- National Marine Fisheries Service

# Environmental Analysis

## Other Organizations

- Audubon Chapters
- NC Coastal Federation
- Camp Lejeune Marine Base
- Captiva Erosion Prevention District
- Clearwater Marine Aquarium
- Consultants (PBS&J, Geodynamics, CP&E, and Olsen Associates)
- County Government: Carteret, Lee, Pinellas
- Sea Grant
- Universities (Wilmington, Chapel Hill, Duke Marine Lab., Western, NC State, Virginia Tech., Florida Institute of Technology, Miami, South Florida)

# Environmental Analysis

## Comparative Matrix

| Study Site | Sea Turtles | Shore-birds | Infauna | Fish | Hard-bottom | Sea-beach amaranth | Habitat Changes |
|---|---|---|---|---|---|---|---|
| Amelia Island | 1979-2005[a] | 1988-2004[d] | 1993[h] | 2003[n] | NA | NA | 2002-2006[w,x] |
| John's Pass | 1988-2005[a] | 2000[e] | 2009[i] | 2002[o] | 2002, 2005[p,s] | NA | NA |
| Captiva Island | 1979-2005[a, b] | 2006[f] | 2002[j] | 1993[b,p] | 1995[b], 2004[t] | NA | 1993[b] |
| Oregon Inlet | 1990-2008[c] | 1973-2008[g] | 1989[k] | 1989[q] | NA | 1991-2009[k,v] | 2008[y] |
| Fort Macon | 1982-2009[c] | 1970-2008[g] | 1997-1996[l], 2006[m] | 2001[r] | 2003[u] | 1991-2009[v] | 2003[u] |

# Environmental Analysis

## Data Reference Examples


[a] USACE - Historical sea turtle nesting data.

[b] Coastal Planning & Engineering, Inc. 1995. Environmental Assessment. Lee County, Fl..

[c] Data provided by NC WRC, Dr. Matthew Godfrey; Fort Macon State Park, Randy Newman.

[d] Amelia Island Shorebird Management Plan

[e] Dial Cordy & Associates. 2000. Resource Inventory for Johns Pass. Pinellas County, FL.

[f] USACE, Engineer Research and Development Center. September 2009. ERDC/EL TR-09-14.

[g] Data provided by NCWRC and Fort Macon State Park

[h] Continental Shelf Associates, Inc. 1993. Environmental Analysis. Amelia Island, Fl.

[i] Dial Cordy & Associates, Inc. and USACE – Jacksonville District. 2009. EA. Pinellas County, FL.

[j] Coastal Planning & Engineering, Inc. 2002. Joint Coastal Permit Application.

[k] USFWS. 1989. Environmental Assessment . Dare County, NC.

[l] Peterson C. H., et al. 1995. Beaufort Inlet Benthic Resources Survey. Wilmington, NC.

[m] Peterson C. H., et al. 2006. Journal of Experimental Marine Biology and Ecology (338). Pp 205-221.

[n] Dial Cordy & Associates. 2003. EA for the South Amelia Island Beach Stabilization Project

[o] Coastal Planning & Engineering, Inc. 1993. Redfish Inlet Management Plan.

[p] Dial Cordy & Associates, Inc. 2002. Final EA. Jacksonville, Fl.

[q] NCDOT Division of Highways. 1989. EA and FONSI. Dare County, NC

[r] Earth Tech Environment and Infrastructure of NC, Inc. 2001. Port of Morehead City Final EIS

[s] Coastal Planning & Engineering, Inc. 2005. Nearshore Hardbottom Mapping. Pinellas County, Fl.

[t] Coastal Planning & Engineering, Inc. 2002. Joint Coastal Permit Application.

[u] USACE– Wilmington District. 2003. Morehead City Harbor Section 933 Project. Carteret County, NC.

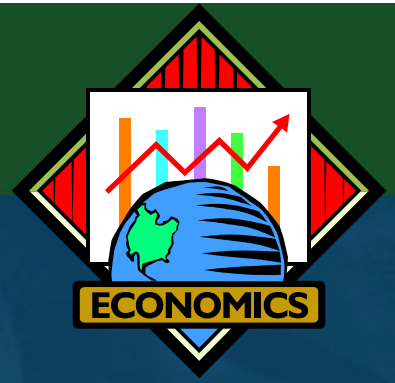
[v] Data provided by USACE– Wilmington District, Doug Piatkowski. Wilmington, NC.

[w] USFWS. 2004. Biological Opinion. Amelia Island, Nassau County, Fl.

[x] Olsen Associates, Inc. 2008. South Amelia island Shore Stabilization Project. Monitoring Report.

[y] NCDOT. 2008. NC 12 Replacement of Herbert C. Bonner Bridge Final EIS

# Economic Analysis




**HOUSE BILL 709**

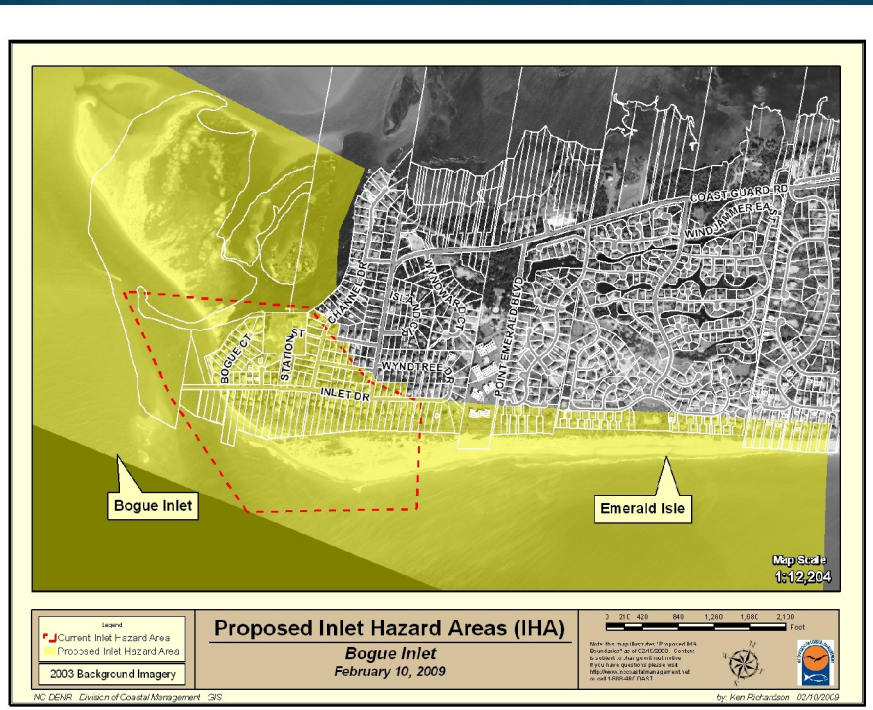
**Study Shall consider:**

**"(4) Information regarding the current and projected economic impact to the State, local governments, and the private sector from erosion caused by shifting inlets, including loss of property, public infrastructure, and tax base."**

# Economic Analysis

## Overview of Methodology:

- **Use Proposed Inlet Hazard Areas to Define Regions at Risk "From Erosion Caused by Shifting Inlets"**
  (Oregon Inlet Exception with Bonner Bridge)
- **Assemble Property Value, Tax, and Infrastructure Data in These Areas**



# Economic Analysis

- **Scenario Model**
- **Assess 30-year Scenarios**
  - **“No Action” - Use DCM Erosion Rates to Assess Loss**
  - **“Terminal Groins” - Use Weighted Erosion Rate for Based on Average of Five Study Sites**
  - **“Sea Level Rise” – Shift 30-year Eroded Shoreline for 1.5 Feet and 3.28 Feet (1 Meter) Sea Level Rise Scenarios**
- **Present Data as Statewide Aggregate**

# Economic Analysis

- **Discuss**
  - **Relative Impact of Ocean View, Risk, etc. on Property Values Based on NC Existing Studies**
  - **Recreation Value of Beaches Based on Existing NC Studies**
- **Clearly State All Assumptions and Limitations (e.g. Not a Cost/Benefit Study)**
- **Navigation Impacts Will Not Be Considered**

# Geologic Framework

## Discussion Led by Dr. Duncan FitzGerald

# Reports

**Task 8 – Draft and Final Report of Study**

- Draft Report (February 1, 2010)
- Final Report (March 1, 2010)

**Report to General Assembly**

- April 1, 2010
- Findings of the Study and Commission Recommendations Will Be Submitted to the ERC for Consideration and Further Action

# Next Steps

- Finalize Data Collection
- Continue Analysis Based on Today's Input
- Next Public Hearing – December 16th, 2009 – Kill Devil Hills
- Next CRC Meeting and Public Hearing – Raleigh (January 13th, 2010)
- Next Science Panel Meeting – January 19, 2010 at 2728 Capitol Blvd., Rm. 1H120, Raleigh

  (Feb. 8 and Mar. 12, 2010)