I. Introduction

This report details the findings of the consultant team portion of the North Carolina Coastal Resources Commission Terminal Groin Study. The study was initiated by the legislature under House Bill 709 (HB709) and mandated by Session Law 2009-479. It directed the Coastal Resources Commission (CRC) in consultation with the Division of Coastal Management (DCM), Division of Land Resources, and the Coastal Resources Advisory Council (CRAC) to study the use and applicability of a terminal groin as an erosion control device. The CRC is to present a report to the Environmental Review Commission (ERC) and the General Assembly by April 1, 2010. The CRC through DCM has contracted with a consultant team to perform the technical review portion of the study.

This report focuses on the data gathering and analysis performed by the consultant team for this study. The team selected was led by Moffatt & Nichol (M&N) and supported by Dial Cordy & Associates (Environmental Consultants), Dr. Christopher Dumas (Professor of Economics, University of North Carolina, Wilmington), and Dr. Duncan FitzGerald (Professor of Department of Earth Sciences – Coastal Marine Geology, Boston University). The M&N team gathered data and performed analysis with respect to the tasks outlined in HB709. Members of the Science Panel on Coastal Hazards, which advises the CRC and DCM with matters of scientific data pertaining to coastal topics and recommendations, provided input into the scoping of the study and selection of study sites; and reviewed and commented on the study methodology and reports.

Ultimately, the CRC will use the study as part of its charge to develop recommendations. This report is a fact gathering effort and does not advocate any policy with respect to the use of terminal groins. Policy recommendations and conclusions will be the responsibility of the CRC/CRAC. A list of the CRC, Science Panel and the CRC/CRAC steering committee are provided in Appendix A.

The chart shown in Figure I-1 illustrates the overall project structure.

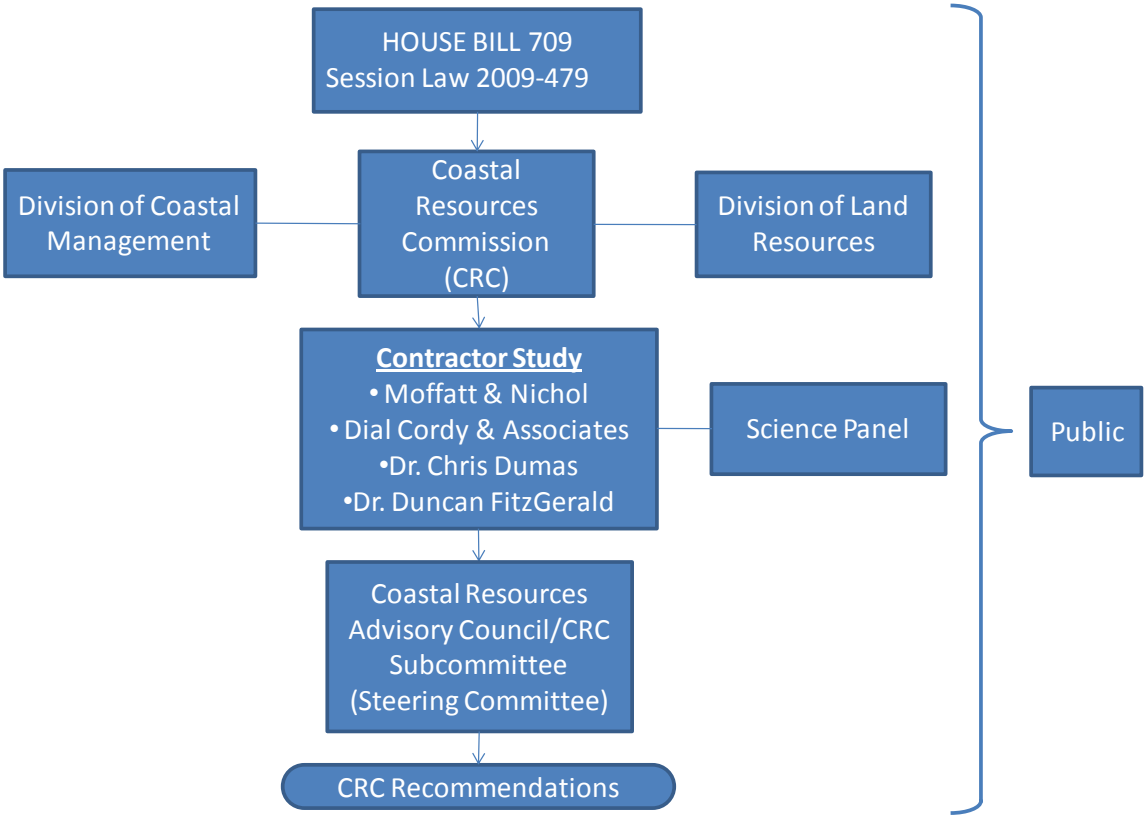

Figure I-1. Overall Project Structure

A. Session Law 2009-479 / House Bill 709

The General Assembly of North Carolina in Session Law 2009-479/House Bill 709 enacted an act to direct the Coastal Resources Commission (CRC) to study the feasibility and advisability of the use of a terminal groin as an erosion control device. A copy of the bill is included in Appendix B.

Section 2 stated that the CRC, in consultation with the Division of Coastal Management (DCM), the Division of Land Resources, and the Coastal Resources Advisory Commission (CRAC), shall conduct a study of the feasibility and advisability of the use of a terminal groin as an erosion control device.

The bill directs the CRC to 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.
(2) Scientific data regarding the impact of terminal groins on the environment and natural wildlife habitats.

(3) Information regarding the engineering techniques used to construct terminal groins, including technological advances and techniques that minimize the impact on adjacent shorelines.
(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.
(5) Information regarding the public and private monetary costs of the construction and maintenance of terminal groins.
(6) Whether the potential use of terminal groins should be limited to navigable, dredged inlet channels.

The study was divided into eight tasks. The first six tasks involved the gathering and analysis of information related to the six points of consideration in the legislation. The final two tasks were participation in the public input and meetings and the generation of a report for the CRC.

B. Public Consultation

Part of the objective of the study was to provide an open and transparent process. An important part of the overall study is the ability of the public to be informed and provide input. Presentations on the status of the study were made at the CRC Meetings, brief overviews provided at the public hearings, and active discussions on the data and analysis methods conducted at dedicated Science Panel Meetings, which were open to the public. A list of the associated meetings is provided in Table I-1.

Table I-1. Terminal Groin Study Meetings and Presentations

Meeting	Location	Date
Study Kick-off	New Bern	September 14, 2009
Science Panel Meeting	2728 Capitol Blvd., Raleigh	September 29, 2009
CRC Presentation	Atlantic Beach Sheraton	October 29, 2009
Science Panel Meeting	McKimmon Center, Raleigh	December 1, 2009
CRC Presentation	Hilton North Raleigh	January 13, 2010
Science Panel Meeting	2728 Capitol Blvd., Raleigh	January 19, 2010
--- Draft Report ---		February 1, 2010
Science Panel Meeting	2728 Capitol Blvd., Raleigh	February 8, 2010
Steering Committee Meeting to Develop Draft Recommendations for CRC	Cooperative Extension Office, New Bern	February 15, 2010
CRC Presentation	NH County Government Complex	February 17, 2010
--- Final Draft Report ---		March 1, 2010
Science Panel Meeting	2728 Capitol Blvd., Raleigh	March 12, 2010
Steering Committee Meeting to Develop Draft Recommendations for CRC	Cooperative Extension Office, New Bern	March 18, 2010
CRC Presentation	Sea Trail Plantation, Sunset Beach	March 25, 2010
--- CRC Report to ERC ---		April 1, 2010

Presentations, meeting minutes, public comments, and project information were regularly updated and maintained on a project website by DCM at www.nccoastalmanagement.net under the Terminal Groin Study heading in the 'What's New' section (see Figure I-2).

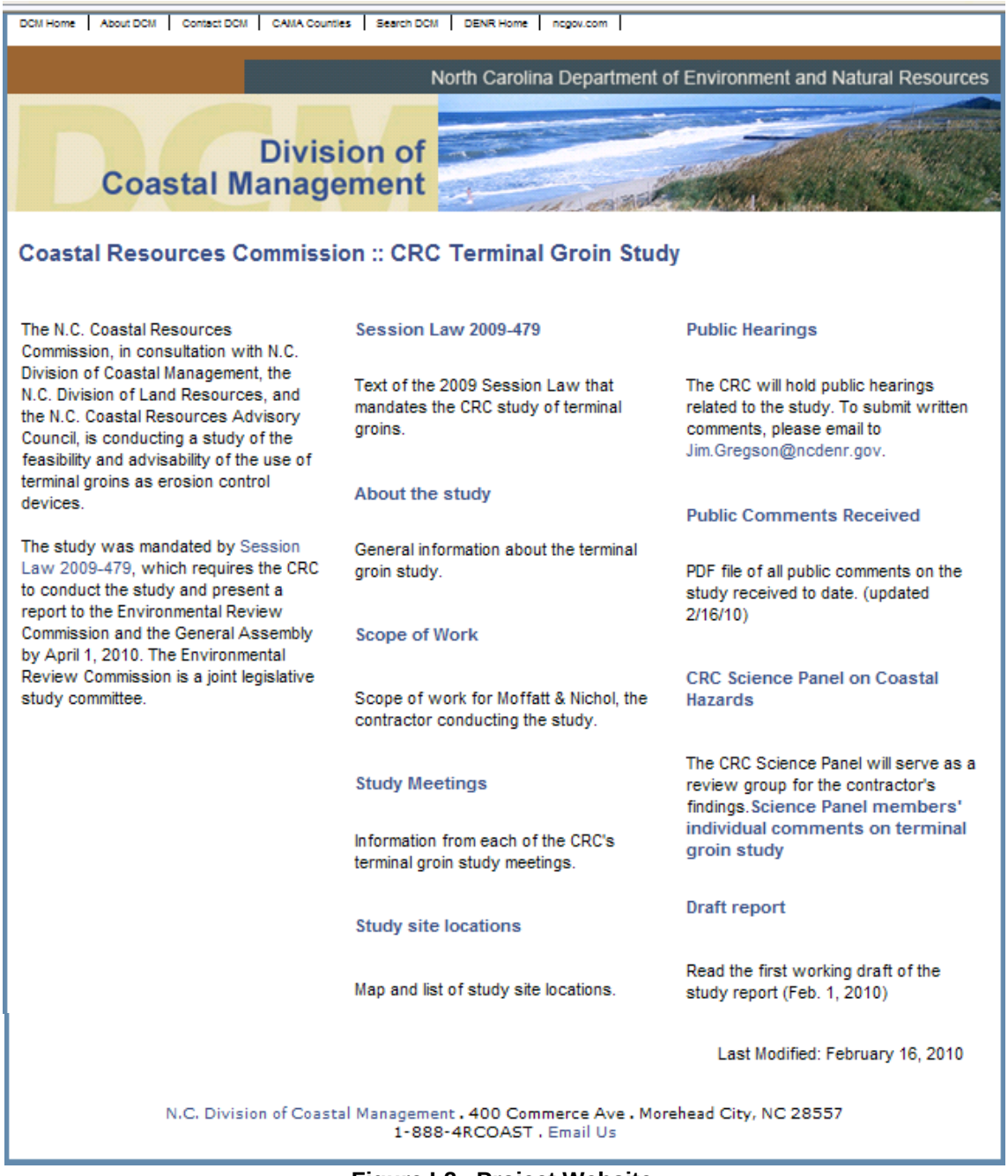

Figure I-2. Project Website

The legislation directs the CRC to conduct at least three public hearings. Five hearings were scheduled during the study process at various locations generally corresponding with a CRC meeting. The list of public hearings is given in Table I-2.

Table I-2. Public Hearings

Public Hearing Location	Date and Time	In Conjunction with CRC Meeting
Sheraton Atlantic Beach	Oct. 29, 2009 - 5 p.m.	Yes
Kill Devil Hills Town Hall	Dec. 16, 2009 - 5 p.m.	No
North Raleigh Hilton, Raleigh	Jan. 13, 2010 - 4:30 p.m.	Yes
New Hanover County Government Complex, Wilmington	Feb. 17, 2010 - 5 p.m.	Yes
Sea Trail, Sunset Beach	March 25, 2010 – 5 p.m.	Yes

In addition to the public hearings written comments could be submitted to the executive secretary of the CRC by email to jim.gregson@ncdenr.gov, or sent via mail to Jim Gregson, 400 Commerce Ave., Morehead City, N.C., 28557. The project website maintains a listing of these comments.

The study (this report) is to be submitted to the CRC by March 1, and the CRC is to report its findings and recommendations to the Environmental Review Commission and the General Assembly by April 1, 2010.

C. Selection of Study Sites

The initial list of potential study sites was developed by the study team with input from various individuals and concentrated on the Southeast due to environmental and other similarities. Northeastern sites were included only to be considered if necessary. Some 25 sites (Figure I-3) with terminal structures were part of the initial list along the Atlantic and Gulf coasts from New York to Florida. The objective was to select from this list a number of sites suitable for further analysis as part of the study. These selected sites would provide the basis for assessing the physical and environmental impacts of terminal groins in the study.

In consultation with the Science Panel, five sites were selected to be included in the study. These sites were selected based on three main criteria. First, whether the structure at the site fit the definition of a terminal groin; second, whether the site had similarity to potential North Carolina scenarios; and third, whether there was a reasonable expectation that a suitable quality and quantity of data was available for the location. For the purposes of this study, a terminal groin was defined as a structure built with the primary purpose to retain sand and not for navigation (jetty). Therefore, a terminal groin would be defined as a narrow, roughly shore- normal structure that generally extends only a short distance offshore.

Additionally, the sites were chosen to reflect a variety of structure and inlet size and characteristics. Most sites contain a single terminal groin, that is, a terminal groin not part of a groin field located adjacent to a tidal inlet. The general consensus and direction given by the Science Panel was to study only terminal groins adjacent to inlets. The House Bill had defined the study to include “the feasibility and advisability of the use of

a terminal groin as an erosion control device at the end of a littoral cell or the side of an inlet" and defined a littoral cell is as "any section of coastline that has its own sediment sources and is isolated from adjacent coastal reaches in terms of sediment movement." The decision as to where a littoral cell begins or ends along a barrier island is extremely difficult to pinpoint and can shift. An inlet provides a clearly defined location and is generally the location of a terminal groin.

Figure I-3. Potential Study Sites

The five sites selected for the study and discussed in detail in this report are the terminal groins at Oregon Inlet and Fort Macon (Beaufort Inlet) in North Carolina, and Amelia Island, Captiva Island and John's Pass in Florida. Figure I-4 illustrates the location of the selected study sites.

Figure I-4. Selected Study Sites

D. Limitations of Study

As with any study of this nature that has schedule and budgetary constraints, there are limitations with respect to the quantity and quality of available data and analysis procedures that should be understood. No new data collection efforts were undertaken for this study. Rather, available data (shoreline changes, nourishment and dredging activities, natural resources, etc.) were collected from as many sources as possible. Additionally, most of the data was originally collected for purposes other than determining the potential impact of a terminal groin.

The analysis procedures undertaken recognize the uncertainties associated with the underlying data, but detailed statistical analyses of the uncertainties were not performed. However, conclusions can still be drawn from the data and analyses as long as uncertainties are recognized. One cannot simply state in all cases that no conclusions can be made just because of underlying uncertainty (although in some cases this may be appropriate); as uncertainty will always exist in the analysis of coastal processes.