MID-CURRITUCK BRIDGE STUDY

OTHER PHYSICAL FEATURES TECHNICAL REPORT

WBS ELEMENT: 34470.1.TA1
STIP NO. R-2576
CURRITUCK COUNTY
DARE COUNTY

Prepared by
Parsons Brinckerhoff
434 Fayetteville Street, Suite 1500
Raleigh, North Carolina 27601

for the

NORTH CAROLINA Turnpike Authority

Raleigh, North Carolina

November 2011

PAGE INTENTIONALLY LEFT BLANK

Table of Contents

Table of Contents (concluded)

List of Tables

List of Figures

MID-CURRITUCK BRIDGE STUDY
OTHER PHYSICAL FEATURES
TECHNICAL REPORT

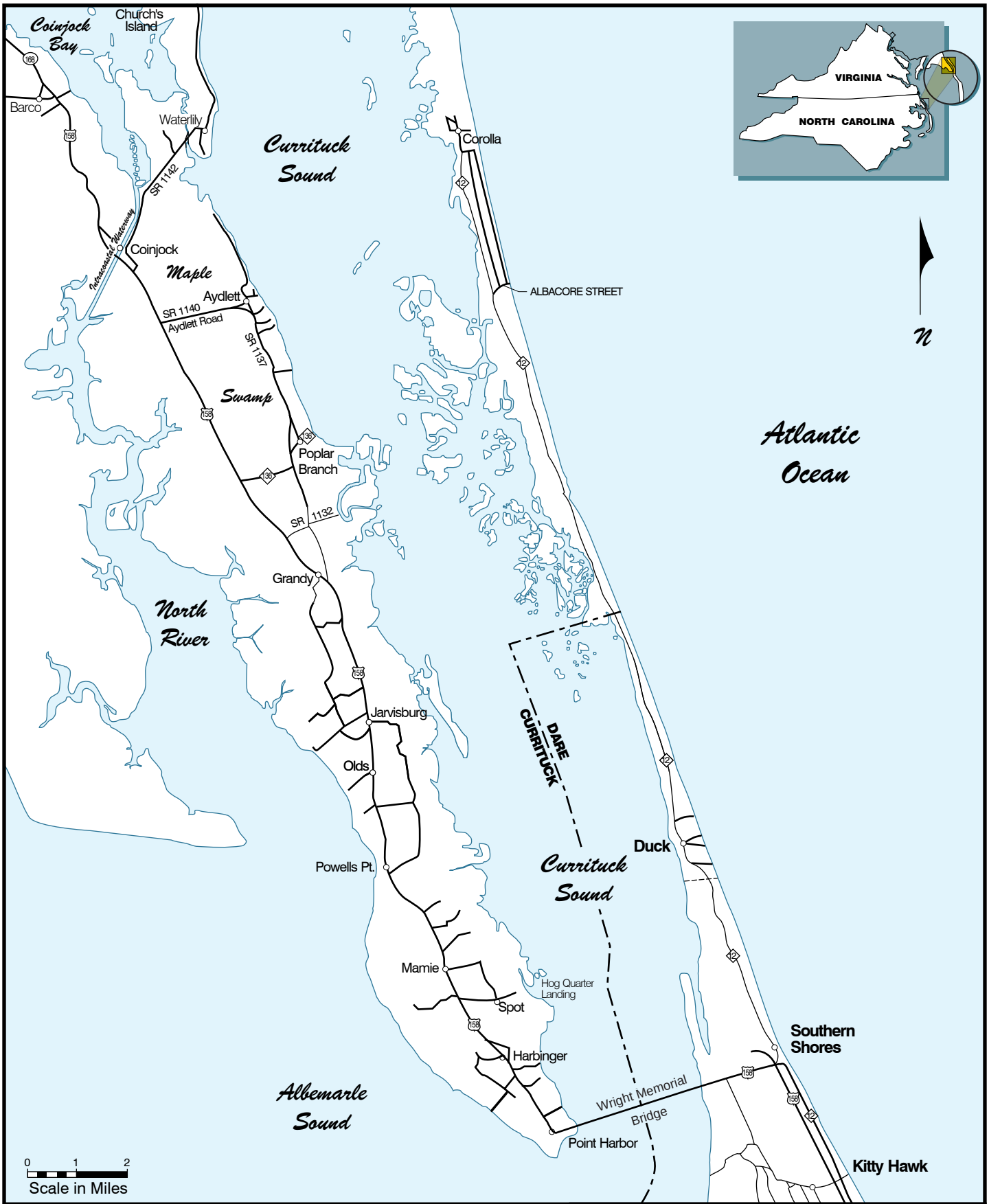
1.0 Introduction and Summary

The North Carolina Turnpike Authority (NCTA), a division of the North Carolina Department of Transportation (NCDOT), in cooperation with the Federal Highway Administration (FHWA), is preparing a Final Environmental Impact Statement (FEIS) to evaluate proposed improvements in the Currituck Sound area. The proposed action is included in NCDOT's 2009-2015 *State Transportation Improvement Program* (STIP), the North Carolina Intrastate System, the North Carolina Strategic Highway Corridor Plan, and the Thoroughfare Plan for Currituck County.

The project area is in northeastern North Carolina and includes the Currituck County peninsula on the mainland and its Outer Banks, as well as the Dare County Outer Banks north of Kitty Hawk (see Figure 1-1). The project area is south of the Virginia Beach-Norfolk, Virginia (Hampton Roads) metropolitan area. The project area encompasses two thoroughfares: US 158 from NC 168 to NC 12 (including the Wright Memorial Bridge) and NC 12 north of its intersection with US 158 to its terminus in Currituck County. US 158 is the primary north-south route on the mainland. NC 12 is the primary north-south route on the Outer Banks. The Wright Memorial Bridge connects the mainland (southern end of Currituck County) with the Dare County Outer Banks.

This technical report presents the details of impact assessments related to the following topics:

- Energy;
- Accelerated Sea Level Rise;
- Visual Quality;
- Hazardous Materials and Underground Storage Tanks; and
- Floodplains.



LEGEND

— - — County Boundaries

Project Area

Figure

1-1

1.1 Project Description

The proposed action responds to three underlying needs in the project area:

- The need to substantially improve traffic flow on the project area's thoroughfares (US 158 and NC 12);
- The need to substantially reduce travel time for persons traveling between the Currituck County mainland and the Currituck County Outer Banks; and
- The need to reduce substantially hurricane evacuation times from the Outer Banks for residents and visitors who use US 158 and NC 168 as an evacuation route.

Given the needs described above, the purposes of the proposed action are:

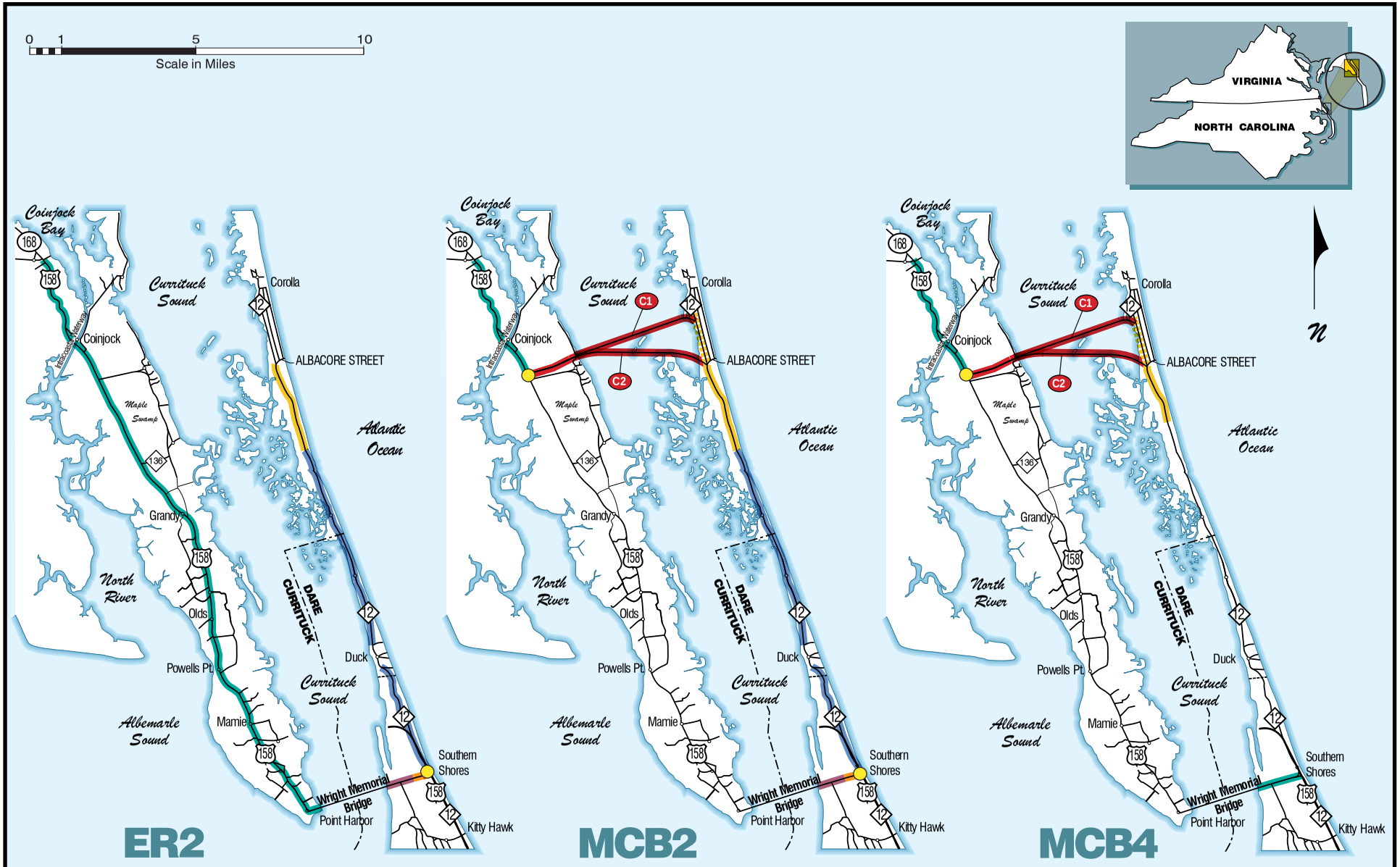
- To substantially improve traffic flow on the project area's thoroughfares. Thoroughfares in the project area are NC 12 and US 158;
- To substantially reduce travel time for persons traveling between the Currituck County mainland and the Currituck County Outer Banks; and
- To reduce substantially hurricane clearance time for residents and visitors who use US 158 and NC 168 during a coastal evacuation.

An improvement is considered substantial as opposed to minor if the improvement is great enough to be largely noticeable to typical users of the transportation system and if the improvement offers some benefit across much of the network, as opposed to offering only a few localized benefits. Alternatives that provide only minor or no improvement, as opposed to substantial improvement, would not meet the above purposes.

An alternatives screening study was conducted for the project. Its findings were discussed with federal and state environmental resource and regulatory agencies in a series of Turnpike Environmental Agency Coordination (TEAC) meetings in 2006, 2007, 2008, and 2009. Based on discussions at TEAC meetings, and written comments received from the agencies and public, the *Alternatives Screening Report* (Parsons Brinckerhoff, 2009) for the proposed project identified three alternatives to be carried forward for detailed study in the DEIS along with the No-Build Alternative. The DEIS detailed study alternatives identified are ER2, MCB2, and MCB4. MCB2 and MCB4 also include two bridge corridor alternatives, C1 and C2. The Preferred Alternative is MCB4/C1 with design refinements to reduce potential impacts.

1.1.1 DEIS Detailed Study Alternatives

The detailed study alternatives assessed in the DEIS are shown on Figure 1-2. These same alternatives also are assessed in the FEIS and this technical report. They are described below:



LEGEND

- Eight Lanes (Super-street)
- Six Lanes (Super-street)
- Four Lanes
- Four Lanes (Only with C1)
- Three Lanes
- Mid-Currituck Bridge
- Third Outbound Lane (Contraflow of an existing lane is an option)
- C1 / C2 Bridge Corridor Alternatives
- Interchange

NOTE: Existing 3-lane segment of NC 12 in Duck is unchanged.

DEIS Detailed Study Alternatives

Figure

1-2

- ER2

  - Adding for evacuation use only, a third outbound evacuation lane on US 158 between NC 168 and the Wright Memorial Bridge as a hurricane evacuation improvement or using the existing center turn lane as a third outbound evacuation lane; in either case one inbound lane on the Wright Memorial Bridge and on the Knapp (Intracoastal Waterway) Bridge would be used as a third outbound evacuation lane;

  - Widening US 158 to a six-lane super-street between the Wright Memorial Bridge and Cypress Knee Trail that widens to eight lanes between Cypress Knee Trail and the Home Depot driveway;

    Constructing an interchange at the current intersection of US 158, NC 12, and the Aycock Brown Welcome Center entrance, including six through lanes on US 158 starting at the Home Depot driveway and returning to four lanes just south of Grissom Street; and

  - Widening NC 12 to three lanes between US 158 and a point just north of Hunt Club Drive in Currituck County (except where NC 12 is already three lanes in Duck) and to four lanes with a median from just north of Hunt Club Drive to Albacore Street.

- **MCB2**

  - Constructing a two-lane toll bridge across Currituck Sound, as well as approach roads and/or bridges and an interchange at US 158;

  - Adding for evacuation use only, a third outbound evacuation lane on US 158 between NC 168 and the Mid-Currituck Bridge as a hurricane evacuation improvement or using the existing center turn lane as a third outbound evacuation lane; in either case one inbound lane on the Knapp (Intracoastal Waterway) Bridge would be used as a third outbound evacuation lane;

  - Widening US 158 to a six-lane super-street between the Wright Memorial Bridge and Cypress Knee Trail and an eight-lane super-street between Cypress Knee Trail and the Home Depot driveway;

  - Constructing an interchange at the intersection of US 158, NC 12, and the Aycock Brown Welcome Center entrance, including six through lanes on US 158 starting at the Home Depot driveway and returning to four lanes just south of Grissom Street; and

  - Widening NC 12 to three lanes between US 158 and a point just north of Hunt Club Drive in Currituck County (except where NC 12 is already three lanes in Duck); and to four lanes with a median from just north of Hunt Club Drive to NC 12's intersection with the Mid-Currituck Bridge.

- **MCB4**

  - Constructing a two-lane toll bridge across Currituck Sound, as well as approach roads and/or bridges and an interchange at US 158;

  - Adding for evacuation use only, a third outbound evacuation lane on US 158 between NC 168 and the Mid-Currituck Bridge as a hurricane evacuation improvement or using the existing center turn lane as a third outbound evacuation lane; in either case one inbound lane on the Knapp (Intracoastal Waterway) Bridge would be used as a third outbound evacuation lane;

  - Adding for evacuation use only, a third outbound evacuation lane on US 158 between the Wright Memorial Bridge and NC 12 as a hurricane evacuation improvement or using the existing center turn lane as a third outbound evacuation lane; in either case one inbound lane on the Wright Memorial Bridge would be used as a third outbound evacuation lane; and

  - Widening NC 12 in Currituck County to four lanes with a median from Seashell Lane to NC 12's intersection with the Mid-Currituck Bridge.

The unique characteristic of a super-street, included along US 158 east of the Wright Memorial Bridge with ER2 and MCB2, is the configuration of the intersections. Side-street traffic wishing to turn left or go straight must turn right onto the divided highway where it can make a U-turn through the median a short distance away from the intersection. After making the U-turn, drivers can then either go straight (having now accomplished the equivalent of an intended left turn) or make a right turn at their original intersection (having now accomplished the equivalent of an intention to drive straight through the intersection).

For MCB2 and MCB4, two design options are evaluated for the approach to the bridge over Currituck Sound, between US 158 and Currituck Sound. Option A would place a toll plaza within the US 158 interchange. The mainland approach road to the bridge over Currituck Sound would include a bridge over Maple Swamp. With Option B, the approach to the bridge over Currituck Sound would be a road placed on fill within Maple Swamp. Aydlett Road would be removed and the roadbed restored as a wetland. Traffic traveling between US 158 and Aydlett would use the new bridge approach road. A local connection would be provided between the bridge approach road and the local Aydlett street system. The toll plaza would be placed in Aydlett east of that local connection so that Aydlett traffic would not pass through the toll plaza when traveling between US 158 and Aydlett. No access to and from the Mid-Currituck Bridge would be provided at Aydlett.

Also, for MCB2 and MCB4, there are two variations of the proposed bridge corridor (see Figure 1-2) in terms of its terminus on the Outer Banks. Bridge corridor C1 would connect with NC 12 at an intersection approximately two miles north of the Albacore Street retail area, whereas bridge corridor C2 would connect with NC 12 approximately one-half mile south of this area. The length of the proposed Mid-Currituck Bridge

would be approximately 7.0 miles with bridge corridor C1, whereas it would be approximately 7.5 miles with bridge corridor C2.

When impacts differ for the three alternatives (ER2, MCB2, and MCB4) between the mainland approach road design options (Option A and Option B) and/or the two bridge corridors (C1 and C2), the names of the alternatives are augmented with suffixes for the mainland approach road design option and/or the bridge corridor. For example, MCB2 with mainland design Option B and the C1 corridor is referred to as MCB2/B/C1. In situations where impacts differ between the bridge corridors but the design option on the mainland is not relevant to the comparison, only the corridor suffix is used (e.g., MCB2/C1). When differences are confined to the mainland design options, only the design option suffix is used (e.g., MCB2/A). If no suffix is provided (e.g., MCB2), then the reader can assume that impacts would be identical irrespective of the mainland design option or corridor alternative used.

1.1.2 Preferred Alternative

The Preferred Alternative is MCB4/C1 with Option A (Figure 1-3). It also includes several design refinements to reduce impacts, in response to government agency and public input and comments. These refinements include:

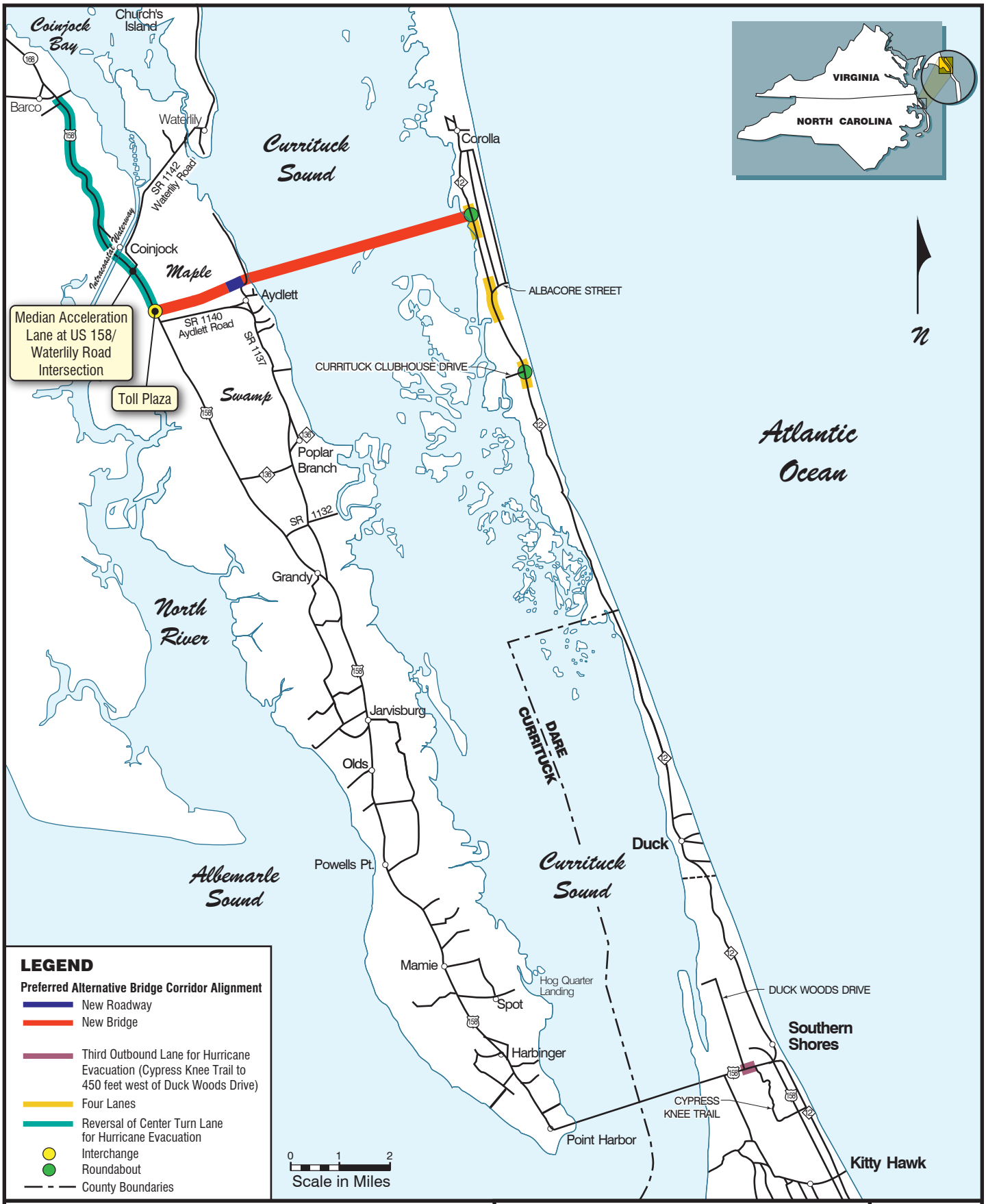
- Provision of a median acceleration lane at Waterlily Road. This safety feature would allow left turns to continue to be made at Waterlily Road and US 158. Bulb-outs for u-turning vehicles also would be provided at the re-aligned US 158/Aydlett Road intersection and the US 158/Worth Guard Road intersection to provide greater flexibility for local traffic in turning to and from existing side streets near the US 158/ Mid-Currituck Bridge interchange.

- Reducing the amount of four-lane widening along NC 12 from that with MCB4/C1 from approximately 4 miles to approximately 2.1 miles, plus left turn lanes at two additional locations over approximately 0.5 mile. The 2.1 miles of NC 12 widening would be concentrated at three locations: the bridge terminus, the commercial area surrounding Albacore Street, and Currituck Clubhouse Drive.

- Constructing roundabouts on NC 12 instead of signalized intersections at the bridge terminus and Currituck Clubhouse Drive.

- Terminating the bridge in a roundabout at NC 12 also allowed the C1 bridge alignment to be adjusted to remove curves and thereby reduced its length across Currituck Sound by approximately 250 feet (from approximately 24,950 feet [4.7 miles] to 24,700 feet).

- Provision of marked pedestrian crossings along NC 12 where it would be widened. They would be placed at locations identified by Currituck County plans (Albacore Street, Orion's Way, and Currituck Clubhouse Drive), as well as at North Harbor View Drive and the bridge terminus (one across NC 12 and one across the bridge approach road).



Preferred Alternative

Figure
1-3

Hurricane evacuation clearance time reduction features include:

- On the mainland, reversing the center turn lane on US 158 between the US 158/Mid-Currituck Bridge interchange and NC 168.

- On the Outer Banks, adding approximately 1,600 feet of new third outbound lane to the west of the NC 12/US 158 intersection to provide additional road capacity during a hurricane evacuation. The additional lane would start at the US 158/Cypress Knee Trail/Market Place Shopping Center intersection and end approximately 450 feet west of the Duck Woods Drive intersection, a total distance of approximately 1,600 feet. From this point, the new lane would merge back into the existing US 158 westbound lanes over a distance of approximately 300 feet.

1.2 Summary of Impacts

Impacts related to energy, accelerated sea level rise, visual quality, hazardous materials and underground storage tanks, and floodplains can be summarized as follows:

1.2.1 Energy

The energy used in constructing, operating, and maintaining any of the detailed study alternatives likely would be greater than operating and maintaining existing roads in the project area. There would be, however, a substantial long-term future traffic operations energy use reduction resulting from a nearly 13 percent decrease in millions of vehicle-miles traveled (VMT) and reductions in congestion (52.5 percent and 39.2 percent, respectively) with MCB2, MCB4, and the Preferred Alternative. ER2 would see reductions in congested VMT only (22.2 percent). The benefit arising from the reduction in future VMT and congested VMT would in part offset the energy used to construct, operate, and maintain any of the detailed study alternatives. Differences in energy use related to the construction of the detailed study alternatives are reflected in differences in their cost (Caltrans Transportation Laboratory, July 1983). More energy would be expended as construction costs increase. Based on construction cost, construction of ER2 would use the least energy, with the more expensive bridge alternatives requiring 2.0 to 2.8 times the construction energy use of ER2. The Preferred Alternative would require 1.8 times the construction energy use of ER2. Decreases in potential operating energy use would result from both decreasing millions of VMT and reducing congestion.

1.2.2 Accelerated Sea Level Rise

When considering various accelerated sea level rise scenarios (ranging in height from 6 to 59 centimeters [2.4 to 23.2 inches] between now and year 2100), it was found that portions of the existing project area road network (including those sections of US 158 and NC 12 improved by any of the detailed study alternatives) would be:

- Regularly inundated (roadways permanently under water for 1.5 to 2.5 miles) or

- At-risk during a storm surge (roadways temporarily flooded for 3.8 to 7.7 miles).

Portions of MCB2, MCB4, and the Preferred Alternative (see Figure 1-2) at the Mid-Currituck Bridge interchange area with US 158 and the road across Maple Swamp with MCB2/B and MCB4/B would be at-risk during a storm surge. Areas along the C1 and C2 bridge corridors for MCB2, MCB4, and the Preferred Alternative that likely would be inundated with up to 59 centimeters (23.2 inches) of sea level rise would be bridged.

A Mid-Currituck Bridge would be a useful asset in reducing the impact of sea level rise on the project area's road system. Under all sea level rise scenarios considered, NC 12 would be breached by inundation near the Currituck/Dare County line; thus, a Mid-Currituck Bridge would become the only route on and off the Currituck County Outer Banks. ER2 and the road improvements associated with MCB2, MCB4, and the Preferred Alternative would experience the same levels of inundation and impact from the storm surge as the existing roads that they improve.

Impacts to the Preferred Alternative also were considered in the context of a planning factor of a 1-meter (39.4-inch) sea level rise. The Preferred Alternative would not be affected by 1 meter of sea level rise.

1.2.3 Visual Quality

The project area is divided into two regional landscapes (the mainland and the Outer Banks) and eight landscape units. The characteristics of the landscape units are described from the perspective of 15 visually sensitive locations. Visual quality in each visually sensitive location is defined in terms of visual character, visual quality, and the presence of visually sensitive resources. Existing visual quality is defined by vividness, intactness, and unity.

The visual impact assessment examines how the addition of the features associated with the detailed study alternatives would change the visual character of the project area, the extent of the change, and whether the change can be considered adverse. No changes to the visual features of the project area would occur with the No-Build Alternative.

1.2.3.1 ER2

Wider pavement would be introduced along US 158 from NC 168 to the Wright Memorial Bridge (approximately 25 miles). Some roadside vegetation would be removed to provide for the additional lane, thereby opening up some views of the road to residences along US 158 and to drivers on US 158. Although some utility lines would be moved, no new substantial vertical attributes, such as poles or barriers are proposed. Thus, no adverse visual change would occur for residential or on-road viewers.

A super-street and an associated interchange east of the Wright Memorial Bridge would be introduced into the views of business patrons along US 158, pedestrians and bicyclists on multi-use paths along US 158, and users of US 158. Principal viewers of the interchange would be users of the Aycock Brown Welcome Center (which would

overlook the interchange), businesses near the interchange, a multi-story hotel, and users of US 158. The super-street would be the only street of such a large scale on the Outer Banks. The interchange would be the only interchange on the Outer Banks. Although these structures would serve a useful purpose in terms of serving travel demand in this landscape unit, neither is what one would expect to see in a beach vacation area like the Outer Banks, with its mostly low density development.

Wider pavement and new drainage features would be introduced along NC 12. Roadside vegetation would be lost to provide for the drainage features. Although no high quality views would be lost, the overall character of the unit along NC 12 would be changed by the loss of vegetation and the wider pavement. Some of the sense of intimacy and isolation associated with this section of NC 12 would be lost with this change.

1.2.3.2 MCB2

The loss of vegetation along US 158 (although only from NC 168 to the Mid-Currituck Bridge, approximately 5 miles), change in views with the introduction of a super-street and an associated interchange east of the Wright Memorial Bridge, and loss of vegetation along NC 12 discussed for ER2 also would occur with MCB2. In addition, the existing landscape would be substantially changed with the introduction of a US 158/ Mid-Currituck Bridge interchange along US 158. Existing agricultural features would be lost and new human-made vertical elements would be introduced. Homes and businesses in this area would be relocated. One home close to Aydlett Road would remain withMCB2/A only and the US 158 interchange would be a notable presence and an adverse change at this home. MCB2/B would displace this home.

With MCB2/A, as the Mid-Currituck Bridge enters Aydlett from Maple Swamp, it would transition to an earthen berm in Aydlett. The berm would be noticeable from homes south of the bridge, and would replace existing woods. Unless the trees are cut down by the property owners as timber, the berm would be obscured by trees from homes north of the berm except close to the shore of Currituck Sound.

With MCB2/B, the proposed Mid-Currituck Bridge approach corridor would enter Aydlett near the existing ground elevation. It would include a toll plaza (including an employee parking lot and plaza support buildings) and an elevated realignment of Narrow Shore Road to take it over the toll plaza. These features would replace existing forest views within the community from both north and south of the toll plaza. Drivers on the relocated Narrow Shore Road would have views of the back yards of homes. The toll plaza would be lighted at night and those lights would be seen by homes to the south. Within 10 years of bridge opening it is expected that the toll plaza would be narrowed to a two-lane road and the lights removed. Tolls would be collected electronically only (i.e., no on-site cash collection) after that time.

With either MCB2/A or MCB2/B, the bridge crossing Currituck Sound would be a notable change in the high quality view of Currituck Sound to Aydlett residents. Essentially, the 180 degree panorama of Currituck Sound would be split, with the bridge

becoming a new and substantial human-made element that bisects the view. This adverse change with MCB2 and MCB4 would be greatest for homes near the bridge where it would be a more dominant presence.

With the C1 Outer Banks terminus for either MCB2/C1 or MCB4/C1, the bridge would be introduced to panoramic views of Currituck Sound at the planned subdivision of Corolla Bay and to a lesser extent the existing subdivision of Monteray Shores. The C1 bridge corridor would have the greatest adverse impact to Corolla Bay views since it would pass through the subdivision, introducing views of NC 12 to the subdivision in addition to obscuring views of Currituck Sound. Removal of vegetation between the bridge and the adjoining Corolla Bay and Monteray Shores subdivisions would introduce views of the bridge from the subdivisions. With the C2 Outer Banks terminus, a viewing platform in Currituck Sound associated with the TimBuck II commercial area would be displaced and views of the natural vegetation and the sound from a TimBuck II outdoor recreation area would be replaced by the bridge approaching the shore at a 45 degree angle. This would create an adverse visual change with either MCB2/C2 or MCB4/C2.

1.2.3.3 MCB4

Like MCB2, the existing landscape would be substantially changed with the introduction of the US 158/Mid-Currituck Bridge interchange along US 158. Also, like MCB2, as the Mid-Currituck Bridge would extend through Aydlett, it would be within views on the shore and of Currituck Sound. The changes in Aydlett described for MCB2/A and MCB2/B would apply to MCB4/A and MCB4/B. The change and the adverse change described for the C1 and C2 bridge termini under MCB2 also would occur with MCB4. Wider pavement and new drainage features would be introduced along NC 12 for approximately 2 (with C2) to 4 (with C1) miles south of the bridge terminus with the associated loss of vegetation described under ER2.

1.2.3.4 Preferred Alternative

Like MCB2 and MCB4, the existing landscape would be substantially changed with the introduction of the US 158/Mid-Currituck Bridge interchange. Also, like MCB2 and MCB4, as the Mid-Currituck Bridge would extend through Aydlett, it would be within views on the shore and of Currituck Sound. The changes in Aydlett described for MCB2/A and MCB4/A would apply to the Preferred Alternative.

Like MCB2/C1 and MCB4/C1, there would be an adverse change at the Outer Banks terminus of the Preferred Alternative. Once on land, the bridge approach with the Preferred Alternative would remove vegetation between the bridge and the adjoining Corolla Bay and Monteray Shores subdivisions. This would introduce views of the bridge from the subdivision. Wider pavement (including road widening and new left turn lanes) and new drainage features would be introduced along NC 12 south of the bridge terminus for approximately 2.6 miles, with the associated loss of vegetation described under ER2.

1.2.4 Hazardous Materials and Underground Storage Tanks (UST)

Studies identified 25 underground storage tank sites and five junkyards (one junk yard is on one of the 25 underground storage tank sites) along the corridors of the detailed study alternatives. The risk of increased project cost or schedule resulting from affecting any of these sites ranges from negligible to medium. One junkyard is a low to medium risk and one junkyard (the one with a UST) is a medium risk. The rest of the sites have a negligible to low or low risk. All of the detailed study alternatives could potentially affect the two low to medium and medium risk sites. ER2 would affect 25 negligible to low or low risk sites; MCB2 would affect 14 such sites; and MCB4 and the Preferred Alternative each would affect 11 such sites. Detailed soil and groundwater assessments on each of the properties identified (in the current surveys or additional surveys in the future) would be made after selection of an alternative for implementation and before right-of-way acquisition. The results would be used to determine any need for remediation of contaminates in the soil or groundwater and that need would be taken into consideration during right-of-way acquisition.

1.2.5 Floodplains

The Mid-Currituck Bridge component of MCB2/A, MCB4/A, and the Preferred Alternative would bridge the two major hydraulic features in the project area, Currituck Sound and Maple Swamp. MCB2/B and MCB4/B would bridge Currituck Sound only except for two 180-foot-long bridges for wildlife passage in Maple Swamp. ER2 would not cross these two features. MCB2/A and MCB4/A would encroach on fill for a portion of the total tidally-influenced 100-year floodplain, including 9.8 acres on the mainland and 0.6 acre at the C1 Outer Banks terminus of the Mid-Currituck Bridge. The Preferred Alternative also would encroach on fill for a portion of the total tidally-influenced 100-year floodplain, including 9.8 acres on the mainland and 0.5 acre at the Outer Banks terminus of the Mid-Currituck Bridge. With MCB2/B and MCB4/B, the mainland number would be 22.1 acres. The proposed widening of the roadways along both the US 158 and NC 12 corridors (with all detailed study alternatives, including ER2) would occur at-grade and, therefore, would not result in obstruction or alteration of flood flows or flood elevations.

The only obstruction or alteration of flood flows or flood elevations associated with the detailed study alternatives would occur as a result of fill placed in Maple Swamp with MCB2/B and MCB4/B. Hydraulic modeling results show that the MCB2/B and MCB4/B fill in Maple Swamp would result in an approximate 0.2-foot increase in the maximum water surface elevation for the 100-year storm from the downstream (north) face of the proposed fill. Modeling results also showed that the MCB2/B and MCB4/B fill would result in an approximate 1.3-foot decrease in the maximum water surface elevation for the 100-year storm at the upstream (south) face of the proposed fill. Option B was not selected for inclusion in the Preferred Alternative.

ER2, MCB2/A, MCB4/A, and the Preferred Alternative would not create a significant encroachment on the 100-year floodplain as defined in 23 CFR 650, Subpart A (Location and Hydraulic Design of Encroachments on Floodplains). There would not be a

significant potential for interruption or termination of a transportation facility which is needed for emergency vehicles or provides a community's only evacuation route with any of the detailed study alternatives. MCB2/B and MCB4/B would involve a significant encroachment on the 100-year floodplain (as a significant alteration to a water course) in the project area and would create significant risk. Option B was not selected for inclusion in the Preferred Alternative.

2.0 Energy

For transportation projects, energy usage is predominantly influenced by the amount of fuel used.

According to the Energy Information Administration (2006), transportation is the second largest source (28.2 percent) of energy consumption in the United States. In North Carolina, the transportation sector is the largest (27.5 percent) source of energy consumption. Petroleum (e.g., gasoline, diesel fuel, jet fuel) is the predominant source (98 percent) of transportation energy use in North Carolina.

Transportation energy use is generally discussed in terms of direct and indirect energy. Direct energy involves all energy consumed by vehicle propulsion. This energy is a function of traffic characteristics such as volume, speed, distance traveled, vehicle mix (e.g., cars and trucks with varying miles per gallon of fuel consumption), and thermal value of the fuel being used. Indirect energy consumption involves the non-recoverable, one-time energy expenditure involved in constructing the physical infrastructure associated with the project.

Energy usage associated with the No-Build Alternative and detailed study alternatives, including the Preferred Alternative, would include:

- Construction Use

  Energy would be used for the manufacture and delivery of project components and by construction equipment needed to build the detailed study alternatives. For the No-Build Alternative, there would be no construction-related energy use.

- Maintenance Use

  The bridges associated with the detailed study alternatives would require routine maintenance for approximately 40 years, after which a major rehabilitation program would be expected. The road components that are additions to the existing road network (e.g. wider pavement) would require routine maintenance annually and major maintenance every 12 years. With the No-Build Alternative, existing roads would be maintained at current levels of energy use.

- Motor Vehicle Use

  MCB2, MCB4, and the Preferred Alternative include a Mid-Currituck Bridge. The bridge would reduce travel distance for many travelers. Vehicle-miles traveled (VMT) and congested VMT in year 2035 on US 158 and NC 12 in the project area are shown in Table 2-1. These numbers indicate that a Mid-Currituck Bridge would reduce VMT in the project area by nearly 13 percent over the No-Build Alternative or

Table 2-1. Millions of Vehicle-Miles Traveled (VMT) in 2035

Alternative	Vehicle-Miles Traveled		Congested Vehicle-Miles Traveled	
	Total (in millions)	Percent Reduction from No-Build	Total (in millions)	Percent Reduction from No-Build
No-Build	663.9	—	66.1	—
ER2	663.9	0.0%	51.4	22.2%
MCB2	578.3	12.9%	31.4	52.5%
MCB4	578.3	12.9%	40.2	39.2%
Preferred Alternative	578.3	12.9%	40.2	39.2%

ER2. Congestion also increases fuel use. MCB2 would offer the best combination of reductions in total millions of VMT and millions of congested VMT in 2035.

Differences in energy use related to the construction of the detailed study alternatives are reflected in differences in their cost (Caltrans Transportation Laboratory, July 1983). The higher the cost, the more energy that would be expended. Project cost (excluding right-of-way costs for which no energy would be used in their expenditure) for the detailed study alternatives, including the Preferred Alternative, from lowest to highest cost would be:

- ER2: $262.1 to $322.9 million;
- Preferred Alternative: $483.2 to $561.8 million (1.8 times the energy use of ER2);
- MCB4/B/C1: $527.1 to $627.8 million (2.0 times the energy use of ER2);
- MCB4/B/C2: $542.9 to $647.7 million (2.0 times the energy use of ER2);
- MCB2/B/C1: $619.7 to $735.5 million (2.3 times the energy use of ER2);
- MCB4/A/C1: $631.0 to $745.5 million (2.4 times the energy use of ER2);
- MCB2/B/C2: $635.8 to $755.9 million (2.4 times the energy use of ER2);
- MCB4/A/C2: $647.1 to $765.2 million (2.4 times the energy use of ER2);
- MCB2/A/C1: $723.7 to $853.5 million (2.7 times the energy use of ER2); and
- MCB2/A/C2: $740.5 to $872.9 million (2.8 times the energy use of ER2).

These costs, except those for the Preferred Alternative, assume the construction of a third outbound emergency lane for reducing hurricane evacuation clearance times.

Using the center lane for emergency outbound travel was selected for inclusion in the Preferred Alternative as the means for reducing hurricane evacuation clearance times, so the cost of constructing a third outbound emergency lane is not included. However, the cost for the Preferred Alternative includes higher environmental mitigation costs than for the DEIS detailed study alternatives based on the advanced mitigation planning that has occurred in coordination with environmental resource and regulatory agencies during development of the Preferred Alternative.

The following can be observed from the discussion above:

- The energy used in constructing, operating, and maintaining any of the detailed study alternatives, including the Preferred Alternative, likely would be greater than operating and maintaining existing roads under the No-Build Alternative.

- There would be a substantial long-term future traffic operations energy use reduction resulting from a nearly 13 percent decrease in millions of VMT and reductions in congested VMT with MCB2, MCB4, and the Preferred Alternative. ER2 would result in reductions in congested VMT only.

- The benefit arising from the reduction in future VMT and congested VMT would in part offset the energy used to construct, operate, and maintain any of the detailed study alternatives.

3.0 Accelerated Sea Level Rise Resulting from Climate Change

This assessment considers the potential effect of accelerated sea level rise resulting from climate change on the No-Build Alternative and the detailed study alternatives. Its findings are based on a comparison of the road network in the project area to sea level rise maps prepared for the report: *The Potential Impacts of Global Sea Level Rise on Transportation Infrastructure Phase 1—Final Report: the District of Columbia, Maryland, North Carolina and Virginia* (ICF International, August 2008). Metric units (centimeters) of sea level rise were used in that study and therefore are used in this assessment. English equivalents are provided. In response to comments on the DEIS, an additional assessment assuming 1 meter (39.4 inches) of sea level rise also was conducted in the area of the detailed study alternatives.

3.1 Findings Based on Sea Level Rise Maps

The sea level change study was designed to produce rough estimates of how future accelerated sea level rise and increased storm surge resulting from climate change could affect transportation infrastructure. The study's major purpose is to aid policy makers, specifically at the US Department of Transportation.

The sea level change study utilized the predictions of future global sea level elevations from the United Nations Intergovernmental Panel on Climate Change (IPCC). In 2001, IPCC projected a range of 9 to 88 centimeters (3.5 to 34.6 inches) of global average sea level rise by the year 2100 (in IPCC's Third Assessment Report) for a range of green-house gas emissions scenarios. In 2007, the IPCC released updated projections for global average sea level rise ranging from 18 to 59 centimeters (7.1 to 23.2 inches) over a similar time period (in the Fourth Assessment Report).

The sea level change study developed a series of North Carolina maps for different eustatic (uniformly global) sea level rise scenarios of 6, 6.5, 13, 17.5, 21, 30, 31, 48.5, and 59 centimeters (2.4, 2.6, 5.1, 6.9, 8.3, 11.8, 12.2, 19.1, and 23.2 inches). The sea level change study used digital elevation models to evaluate the elevation in coastal areas. Tidal surfaces were created to describe the current and future predicted sea water levels. These models were used to identify land and in turn transportation infrastructure that, without protection, will be regularly inundated by the ocean or will be at-risk of periodic inundation, as a result of storm surge, under each sea level rise scenario. These terms are defined as:

- Regularly inundated: areas that would be permanently under water under a given sea level rise scenario; and

- At-risk: areas that could be temporarily flooded as a result of the storm surge under a given sea level rise scenario.

The regularly inundated areas are described in the sea level change report as all the areas falling between the National Oceanic and Atmospheric Administration's (NOAA) mean higher high water (the sea level change study's definition of sea level in 2000) and the projected sea level under each sea level rise scenario (mean higher high water in 2000 plus each sea level rise scenario increment). The at-risk areas are the areas that fall between the adjusted mean higher high water and NOAA's highest observed water level plus the additional sea level rise projected for the particular scenario (highest observed water level in 2000 plus each sea level rise increment, e.g., 6 centimeters [2.4 inches]). This is the sea level change study's definition of storm surge. Potential changes in storm intensity and resultant surge because of climate change were not considered by the sea level change study.

This assessment used seven of the nine sea level change study maps (6, 13, 17.5, 21, 31, 48.5, and 59 centimeters [2.4, 5.1, 6.9, 8.3, 12.2, 19.1, and 23.2 inches]). The seven maps used in this assessment are presented in Appendix A. The two not used were within a centimeter of other maps and thus were not considered necessary to this assessment. Table 3-1 shows the extent of the effect of sea level rise on the project area's road system in terms of regular inundation (permanently under water). Table 3-2 shows the extent of the effect of sea level rise on the project area's road system in terms of it being at-risk during the storm surge. All bridge decks in the project area, including the Mid-Currituck Bridge, are higher than water elevations associated with the highest amount of sea level rise (59 centimeters [23.2 inches]).

The maps in Appendix A illustrate that the bulk of the NC 12-accessible Currituck County Outer Banks served by the project would not be inundated by the sea level rise levels mapped.

The following can be observed from the information in the two tables:

- Under any sea level rise scenario, portions of the existing road network (including those sections of US 158 and NC 12 improved by any of the detailed study alternatives) would be regularly inundated (roadways permanently under water for 1.5 to 2.5 miles) or at-risk during a storm surge (roadways temporarily flooded for 3.8 to 7.7 miles).

- With MCB2/B and MCB4/B, as currently proposed, the road through Maple Swamp would be at-risk from a storm surge by 2100 if the total sea level rise between now and 2100 were to exceed approximately 30.5 centimeters (12 inches). Option B was not selected for inclusion in the Preferred Alternative.

- With all scenarios, Outer Banks sections of US 158 and NC 12 south of a Mid-Currituck Bridge's Outer Banks terminus would be regularly inundated by the ocean (1.0 to 1.4 miles). The primary locations for this inundation would be just south of

Table 3-1. Extent of Road System in Regularly Inundated Areas (in miles)

	Centimeters (inches) of Sea Level Rise						
	6 (2.4)	13 (5.2)	17.5 (6.9)	21(8.3)	31 (12.2)	48.5 (19.1)	59 (23.2)
Existing Project Area Network	1.5	1.6	1.7	1.8	2.1	2.3	2.5
Mainland							
US 158 from NC 168 to Mid-Currituck Bridge terminus	0.5	0.6	0.6	0.6	0.8	0.9	1.0
US 158 from Mid-Currituck Bridge terminus to Wright Memorial Bridge	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mid-Currituck Bridge Project	Regularly inundated (permanently under water) areas are in Maple Swamp. With MCB2/A, MCB4/A, and the Preferred Alternative's bridge across Maple Swamp, the bridge deck would be a minimum of 16 feet (488 centimeters) above the existing ground elevation. With MCB2/B and MCB4/B's road across Maple Swamp, the road surface would be a minimum of 5 feet (152 centimeters) above the existing ground elevation. Thus, in neither case would the project across Maple Swamp be regularly inundated, even with as much as 59 centimeters (23.2 inches) of sea level rise.						
Outer Banks							
US 158 and NC 12 from Wright Memorial Bridge to C1 Mid-Currituck Bridge terminus	1.0	1.0	1.1	1.1	1.2	1.3	1.4
US 158 and NC 12 from Wright Memorial Bridge to C2 Mid-Currituck Bridge Terminus	1.0	1.0	1.1	1.1	1.2	1.3	1.4
NC 12 north of C1 Mid-Currituck Bridge Terminus	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NC 12 north of C2 Mid-Currituck Bridge Terminus	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C1 Mid-Currituck Bridge Terminus (including the Preferred Alternative)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C2 Mid-Currituck Bridge Terminus	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Note: Adding the numbers of the individual road segments may not result in the totals indicated because of rounding.

Table 3-2. Extent of Road System in At-Risk Areas (in miles)

	Centimeters (inches) of Sea Level Rise						
	6 (2.4)	13 (5.2)	17.5 (6.9)	21(8.3)	31 (12.2)	48.5 (19.1)	59 (23.2)
Existing Project Area Network	3.8	4.4	4.9	5.1	5.6	6.8	7.7
Mainland							
US 158 from NC 168 to Mid-Currituck Bridge terminus	1.7	1.7	1.7	1.7	1.7	1.7	1.7
US 158 from Mid-Currituck Bridge terminus to Wright Memorial Bridge	0.3	0.4	0.5	0.6	0.7	1.1	1.3
Mid-Currituck Bridge Project	At-risk areas during a storm surge are in Maple Swamp. With MCB2/A, MCB4/A, and the Preferred Alternative's bridge across Maple Swamp, the bottom of the bridge spans would be a minimum of 3 feet (91.4 centimeters) above the current base flood elevation (4 feet [122 centimeters]) and thus would not be at-risk even with as much as 59 centimeters (23.2 inches) of sea level rise. With MCB2/B and MCB4/B's road across Maple Swamp, the road surface would be a minimum 1 foot (30.5 centimeters) above the current base flood elevation. Thus, with MCB2/B and MCB4/B, as proposed, the road through Maple Swamp would be at-risk for flooding by 2100 if the sea level rise between now and 2100 were to exceed approximately 30.5 centimeters (12 inches).						
Outer Banks							
US 158 and NC 12 from Wright Memorial Bridge to C1 Mid-Currituck Bridge terminus	1.8	2.3	2.6	2.7	3.0	3.7	4.1
US 158 and NC 12 from Wright Memorial Bridge to C2 Mid-Currituck Bridge Terminus	1.8	2.3	2.6	2.7	3.0	3.7	4.1
NC 12 north of C1 Mid-Currituck Bridge Terminus	0.0	0.0	0.0	0.0	0.1	0.4	0.5
NC 12 north of C2 Mid-Currituck Bridge Terminus	0.0	0.0	0.0	0.0	0.1	0.4	0.5
C1 Mid-Currituck Bridge Terminus (including the Preferred Alternative)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C2 Mid-Currituck Bridge Terminus	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Note: Adding the numbers of the individual road segments may not result in the totals indicated because of rounding.

the Dare/Currituck County line and on US 158 east of the Wright Memorial Bridge. On NC 12, the area of inundation would be shore-to-shore, creating a breach in the Outer Banks. This is the case for any of the seven sea level rise scenarios considered. Should this inundation occur, a Mid-Currituck Bridge would become the only way on or off the Currituck County Outer Banks. An additional 1.8 to 4.1 miles of NC 12 in this section of US 158 and NC 12 would be at-risk from storm surge.

- The length of NC 12 north of the NC 12 terminus of a Mid-Currituck Bridge at-risk or inundated would be zero with the C1, C2, or Preferred Alternative terminus under all sea level rise scenarios. Thus, the Mid-Currituck Bridge terminus would be positioned to serve the entire length of NC 12 in Currituck County with even the highest sea level rise scenario.

- US 158 on the Currituck County mainland south of a Mid-Currituck Bridge would not be inundated under any of the sea level rise scenarios and would be at-risk from the storm surge for 0.3 to 1.3 miles.

- On the Currituck County mainland, US 158 north of a Mid-Currituck Bridge terminus and south of NC 168 would experience 0.5 to 1.0 miles of inundation and an additional 1.7 miles would be at-risk from the storm surge. In addition, for travelers to and from the project area, additional lengths of US 158 and NC 168 west and north of the project area would be inundated and/or at-risk with any of the sea level rise scenarios.

The key finding from the above observations is that a Mid-Currituck Bridge would be a useful asset in reducing the impact of sea level rise on the project area's road system. Under all seven sea level rise scenarios, NC 12 would be breached by inundation near the Currituck/Dare County line and a Mid-Currituck Bridge would become the only route on and off the Currituck County Outer Banks. ER2 and the road improvements associated with MCB2, MCB4, and the Preferred Alternative would experience the same levels of inundation and impact from the storm surge as the existing roads that they improve.

Finally, all components of the detailed study alternatives would likely be replaced before year 2100 and as such would never experience the highest sea level rise. The Mid-Currituck Bridge could stay in service up to 75 years and would experience most sea level rise between now and 2100. Year 2035 is the project's design year and also reflects the design life of the road components of the detailed study alternatives. The worst-case sea level rise scenario of 59 centimeters (23.2 inches) would see in 2035 approximately 13 centimeters (5.1 inches) in sea level rise (North Carolina Coastal Resources Commission's Science Panel on Coastal Hazards, 2010, Figure 2 on page 11), which is reflected in the 13 centimeters (5.1 inches) data generated by the FHWA study.

3.2 Findings Based on 1 Meter of Sea Level Rise

Studies, forums and workshops about sea level rise in the Mid-Atlantic region and along the North Carolina coast have occurred since the IPCC's Fourth Assessment Report in 2007. Many of the materials published and released from these sources acknowledge that a sea level rise of 1 meter (39.4 inches) is plausible. This includes materials from the North Carolina Sea Rise Forum hosted by the North Carolina Department of Environment and Natural Resources in January 2010, and the Climate Change Adaptation Workshop hosted by the North Carolina Interagency Leadership Team in March 2010. In addition, two publications recommend using a sea level rise of 1 meter for planning and policy purposes in North Carolina for the year 2100, including the *North Carolina Sea Level Rise Assessment Report* prepared by the North Carolina Coastal Resources Commission's Science Panel on Coastal Hazards in March 2010, and *Coastal Sensitivity to Sea Level Rise: A Focus on the Mid-Atlantic Region* prepared by the US Climate Change Science Program in January 2009.

To assess the potential impacts to the Preferred Alternative from a 1-meter sea level rise, the topographic data used to develop project preliminary designs was used to generate a map that shows elevations of 1 meter (39.4 inches) or less in the vicinity of the Preferred Alternative. The Preferred Alternative was then overlaid on this map to assess potential impacts from 1 meter in sea level rise. Figure 3-1 shows these elevations in relationship to the Preferred Alternative. The following can be observed from this analysis:

- On the Currituck County mainland, the sections of US 158 that would be improved by the Preferred Alternative would be unaffected by 1 meter (39.4 inches/3.3 feet) of sea level rise. Existing topographic elevations along US 158 in the area to be improved with the Preferred Alternative range from a low of approximately 5 to 6 feet near Waterlily Road to a high of approximately 12 to 13 feet just south of the proposed US 158/Mid-Currituck Bridge interchange.

- For the bridge across Maple Swamp, the top of the bridge deck would be a minimum of 16 feet (488 centimeters or 4.9 meters) above the existing ground elevation, so it would not be inundated by 1 meter of sea level rise. The top of the Mid-Currituck Bridge deck would be even higher, generally at 23 feet above sea level or higher. At its east end approaching the Outer Banks, it would be as low as 17 feet.

- The bottom of the Maple Swamp bridge spans would be a minimum of 5 feet (152.4 centimeter or 1.5 meters) above the current base flood elevation (4 feet [122 centimeters or 1.2 meters]) and thus would not be at-risk even if the base flood elevation rose from 1.2 meters to 2.2 meters. The bottom of the Currituck Sound bridge spans would be higher at 16 feet above sea level, or 7 to 10 feet above the storm surge elevation of 6 to 9 feet.

LEGEND

- Proposed and Improved Existing Road
- Proposed Bridges and Other Structures
- 1.0 Meter or Less in Elevation

Preferred Alternative's Corridor with One Meter or Less in Elevation

Figure

3-1

- The fill section between the Maple Swamp Bridge and the Mid-Currituck Bridge would be a minimum of 21 feet above sea level, so it would be unaffected by 1 meter (39.4 inches) of sea level rise and an associated increase in the storm surge elevation.

- On the Currituck County Outer Banks along the sections of NC 12 that would be improved by the Preferred Alternative, there would be no inundation resulting from a 1-meter sea level rise at the bridge terminus. Existing topographic elevations along NC 12 range from 7.0 to 16.9 feet.

- The elevation of existing US 158 in Dare County is greater than 1 meter where approximately 1,600 feet of new third outbound lane would be added for hurricane evacuation. The additional lane, thus also would be at an elevation greater than 1 meter.

The components of the Preferred Alternative would likely be replaced before year 2100 and as such would never experience the highest sea level rise. The Mid-Currituck Bridge could stay in service up to 75 years and would experience most sea level rise between now and 2100. Year 2035 is the project's design year and also reflects the design life of the road components of the detailed study alternatives, including the Preferred Alternative. A 1-meter sea level rise scenario would see in 2035 approximately 17 centimeters (6.7 inches) in sea level rise (North Carolina Coastal Resources Commission's Science Panel on Coastal Hazards, 2010, Figure 2 on page 11), which is similar to the 17.5 centimeters (6.9 inches) data generated by the FHWA study.

As indicated above, the Preferred Alternative would not be affected by 1 meter of sea level rise.

4.0 Visual Quality

4.1 Visual Resource Assessment Parameters and Criteria

FHWA provides guidance in preparing visual resource discussions and impact assessments in its documents *Visual Impact Assessment for Highway Projects* (FHWA, 1988) and *Environmental Impact Statement—Visual Impact Discussion* (FHWA, 1990). FHWA methods define resources at the following geographic levels:

- Regional Landscape

  Regional landscapes are discussed in terms of their landform, topography, or land cover components, which include water, vegetation, and manmade development.

- Landscape Unit

  Landscape units are within the regional landscape and are essentially "outdoor rooms" that correspond to places or districts that are named (i.e., Outer Banks). Landscape units are usually enclosed by clear landform or land cover boundaries.

- Visually Sensitive Locations

  Visually sensitive locations are locations of specific interest to persons within the landscape unit. Attributes of these locations are described in terms of visual character, quality, and visually sensitive resources. These descriptors are:

  – Visual Character

    Visual character is discussed in terms of landform, water, vegetation, and manmade development found within the visually sensitive locations.

  – Visual Quality

    Visual quality is described in terms of the vividness, intactness, and unity. Visual quality of a location is considered high when the components that make up visual character exhibit striking characteristics that convey high visual quality. Visual quality is described as moderate when its characteristics are generally appealing but are typical as opposed to striking. The term moderate also is used when typical manmade elements have been introduced to natural views. Visual quality is described as low when manmade elements introduce distractions (such as signs, billboards, or major utilities) or multiple land uses of a non-complimentary design and character that creates a cluttered appearance.

Vividness is defined as: The memorability of the visual impression received from contrasting landscape elements as they combine to form a striking and distinctive visual pattern.

Intactness is defined as: The integrity of visual order in the natural and man-built landscape, and the extent to which the landscape is free from visual encroachment.

Unity is defined as: The degree to which the visual resources of the landscape join together to form a coherent, harmonious visual pattern. Unity refers to the compositional harmony or compatibility between landscape elements.

– Visually Sensitive Resources

Visually sensitive resources are those that are noted because of their potential to be important for historic or recreational reasons.

This visual impact assessment for the project and its detailed study alternatives is complex for these reasons:

- The project area is large;
- The project possesses several very different landscape types;
- Project area property owners and local governments hold the visual quality of the project area in high regard; and
- Visual quality is a part of the project area's appeal to tourists, particularly on the Outer Banks.

4.2 Existing Project Area Visual Resources

Visual resources vary among the various parts of the project area, particularly between the mainland and the Outer Banks. The mainland viewshed is largely comprised of agricultural and forested lands that are punctuated by residences, roadside businesses, and billboards along US 158. Although the mainland viewshed provides pleasant views, the economy and identity of the mainland is not dependant on its viewshed. Conversely, the Outer Banks part of the project area is heavily reliant on its visual resources and scenic quality for its economy and identity. As a result, the areas are addressed separately in the following discussion.

4.2.1 Regional Landscapes

According to the United States Geological Survey, both the mainland and Outer Banks portions of the project area lie within the Coastal Plain Physiographic Province of North Carolina. However, the mainland and Outer Banks are distinctly different in their vegetation coverage, land coverage, and development patterns.

4.2.1.1 Mainland Regional Landscape

The mainland regional landscape (see Figure 4-1) is a peninsula that is bounded on the north by the community of Barco, on the south by the Albemarle Sound, on the west by the North River, and on the east by Currituck Sound. The mainland is generally flat, with topographic variances ranging between mean sea level (MSL) and seven feet above MSL. US 158 is the principal roadway on the mainland and lies on top of a long ridge that runs from Barco to the Wright Memorial Bridge. US 158 represents the higher elevations on the mainland. The manmade land uses of agriculture, residential, commercial, and light industrial are primarily along US 158, though some of these land uses also are in the small communities (e.g., Aydlett) located east of US 158. North to south oriented deciduous forest covered swamplands exist within the mainland regional landscape and extend from behind the land uses along US 158 to the North River and Currituck Sound.

4.2.1.2 Outer Banks Regional Landscape

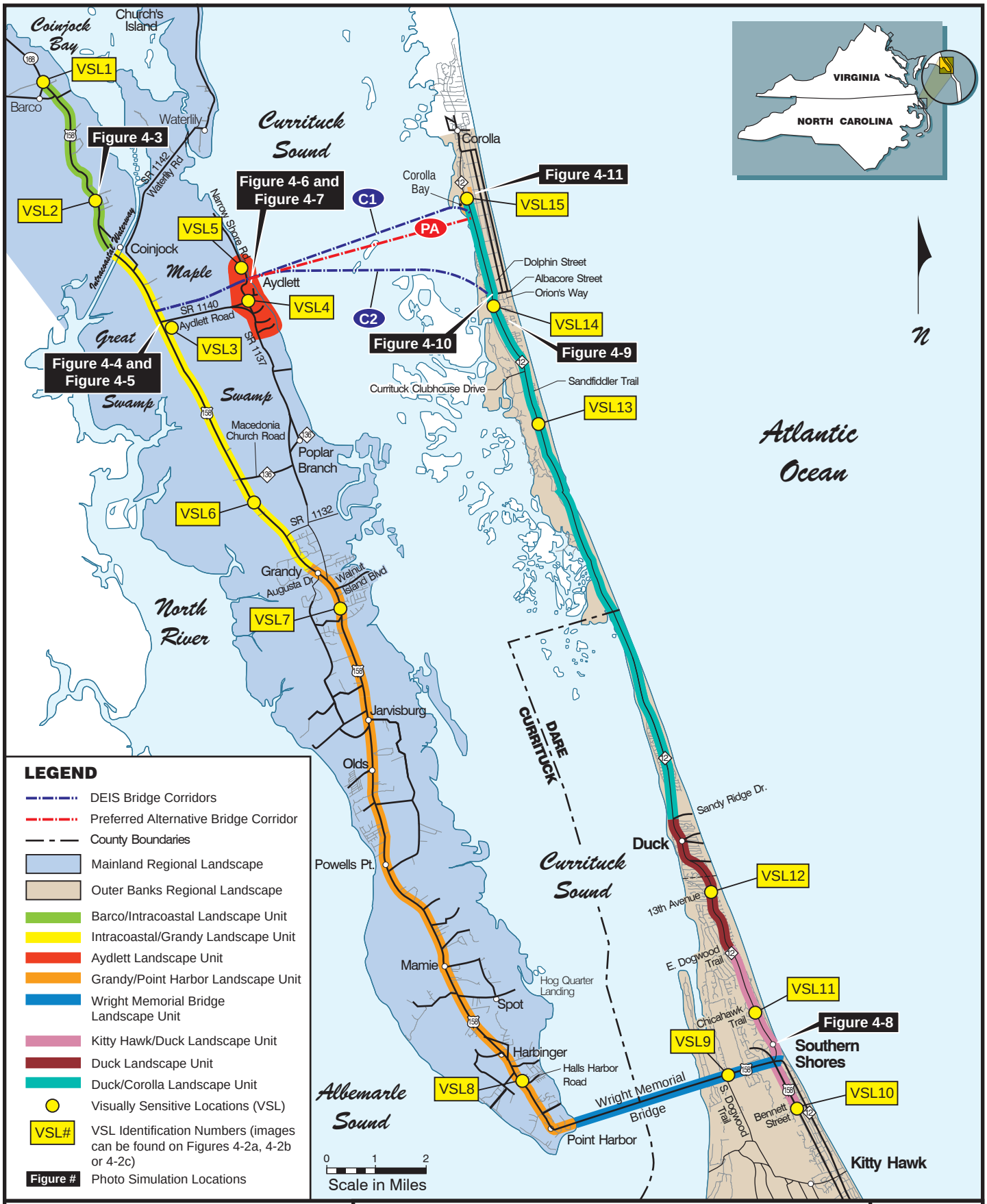
The Outer Banks regional landscape (see Figure 4-1) is a peninsula that is bounded on the south by Bennett Street in Kitty Hawk, on the east by the Atlantic Ocean, on the north by the northern limit of the community of Corolla, and on the west by Currituck Sound. The topography of the Outer Banks varies between Kitty Hawk and Corolla. The area between Kitty Hawk and the Town of Duck (mid-point) has rolling topography as a result of the presence of sand dunes. From the Town of Duck to the community of Corolla, the topography is generally flat with a few intermittent hills and dunes along the shoreline on the east. NC 12 is the principal roadway on the Outer Banks. Other roadways include residential streets to the west and east of NC 12. Manmade land uses on the Outer Banks are largely residential and include single- and multi-family residences and resort type developments. The majority of Outer Banks residential units are rental properties, and thus their level of occupancy fluctuates weekly and seasonally. Commercial uses are present in Kitty Hawk, Southern Shores, Duck, and Currituck County. However, Southern Shores, Duck, and Currituck County have far fewer commercial uses than Kitty Hawk, and the amount of commercial uses appear to dwindle as one travels from Kitty Hawk northward along NC 12. Vegetation on the Outer Banks includes: shrubs, ranging in size from one- to 10-feet high; beach and dune type grasses; deciduous trees (mostly in the Town of Duck); and sparse stands of evergreen trees between Duck and Corolla.

4.2.2 Landscape Units

The following landscape units are found within the regional landscapes discussed above and are shown on Figure 4-1.

4.2.2.1 Barco/Intracoastal Landscape Unit

The Barco/Intracoastal landscape unit runs from approximately 1 mile north of the intersection of NC 168 and US 158 in Barco to the northern terminus of the Knapp (Intracoastal Waterway) Bridge. It is characterized as an approximate 4.5-mile-long, 2,500-foot-wide, generally flat, north-northwest to south-southeast trending upland



Project Area Regional Landscapes, Landscape Units & Visually Sensitive Locations

Figure 4-1

ridge, with an apex of approximately 7 feet above Mean Sea Level (MSL). Land coverages in this landscape unit, by order of their prevalence, include agricultural, forested, residential, commercial, and light industrial uses along US 158. Most of the structures lie within 500 feet of the US 158 pavement. Two large deciduous forested swamps (Maple Swamp and Great Swamp) flank the developed areas along US 158 to the east and west.

4.2.2.2 Intracoastal/Grandy Landscape Unit

The Intracoastal/Grandy landscape unit runs from the southern terminus of the Knapp (Intracoastal Waterway) Bridge to the intersection of Augusta Drive and US 158 in the northern part of Grandy. This landscape unit is approximately 7.3 miles long, is oriented north-northwest to south-southeast, and is characterized by generally flat topography. The Intracoastal/Grandy landscape unit is an upland ridge between two large deciduous forested swamps (Maple Swamp and Great Swamp) with US 158 running along the crest of the upland. The swamp on the east side of US 158 ends just north of Grandy, and the landscape unit from this point south is more "open," having less trees and more structural development from the east side of US 158 to the mainland bank of Currituck Sound. Land uses in this landscape unit are primarily agricultural and forested, with a very loose juxtaposition of residential and very sparse commercial and light industrial uses that increase in density at the landscape unit's southern end.

4.2.2.3 Aydlett Landscape Unit

The Aydlett landscape unit is an approximate 0.3 square mile area within the northern portion of the community of Aydlett, and it is characterized by flat topography, dense deciduous forest, lawns and other grassy areas, and low density rural residential subdivisions. The forest lies to the west and extends in an east-west direction almost to Currituck Sound. Low density residential development is the most prevalent land use within the landscape unit and one small farm is present in the west portion. This landscape unit is bordered on the east by the Currituck Sound.

4.2.2.4 Grandy/Point Harbor Landscape Unit

The Grandy/Point Harbor landscape unit extends from the intersection of Augusta Drive in the northern part of Grandy to the western terminus of the Wright Memorial Bridge. This landscape unit is characterized as an approximate 13.6-mile-long north-northwest to south-southeast trending upland ridge that varies in width from 0.25 mile to 1.5 miles, with generally flat topography. This landscape unit has the densest development of the mainland regional landscape. Land coverages in this landscape unit, by order of their prevalence, include residential, commercial, light industrial and agricultural uses along US 158. Most of the structures lie within 250 feet of US 158.

4.2.2.5 Wright Memorial Bridge Landscape Unit

The Wright Memorial Bridge landscape unit is an approximate 4.3-mile-long west-east trending corridor that starts at the western terminus of the Wright Memorial Bridge and extends east to the western limits of the US 158/NC 12 intersection on the Outer Banks at

Kitty Hawk. Approximately 2.8 miles of this landscape unit is the Wright Memorial Bridge over Currituck Sound. The land area of this landscape unit is characterized by generally flat topography in the western portion, with slightly hilly topography in the eastern portion that is the remnant of coastal dunes. Deciduous forest is throughout the entire land area. Commercial land uses and offices flank the US 158 in this area, with very limited, but high density single-family residences immediately north of US 158 approximately 0.5 mile east of the Wright Memorial Bridge's eastern terminus. A multi-use path is present east of the Wright Memorial Bridge on the north side of US 158.

4.2.2.6 Kitty Hawk/Duck Landscape Unit

The Kitty Hawk/Duck landscape unit is approximately 3 miles long in a northwest to southeast trending area that runs along NC 12 on the Outer Banks from the intersection of US 158 and Bennett Street to the intersection of East Dogwood Trail and NC 12. This landscape unit also includes a multi-use path that is adjacent to NC 12 beginning in Southern Shores near US 158. The topography of this landscape unit is somewhat hilly. Vegetation coverage is primarily shrubs, with a few low deciduous and evergreen trees. Residential structures comprise the most notable visual feature, with a dense mixture of single and multi-family residences. Commercial land uses are to the east of NC 12 in this landscape unit's central area and the north side of US 158 in its southern endpoint.

4.2.2.7 Duck Landscape Unit

The Duck landscape unit is an approximate 3.9-mile-long northwest to southeast trending area that runs along NC 12 on the Outer Banks from the intersection of East Dogwood Trail and NC 12 to Sandy Ridge Drive (the northernmost road in Duck). A multi-use path is adjacent to NC 12 south of the Duck business district. Through the business district of Duck, the path joins to bicycle lanes marked on the NC 12 pavement. The path resumes its separation from NC 12 north of the Duck business district. The topography of this landscape unit is hilly, with relatively dense vegetation coverage as compared to other areas of the Outer Banks. Vegetation coverage is comprised primarily of low deciduous and evergreen trees that, in general, do not exceed a height of 25 feet. Residential structures, which are comprised primarily of single-family residences, are widespread and screened by vegetation. Duck's relatively limited commercial uses are dotted along NC 12, with greater density as NC 12 moves close to the sound in the middle of the town.

4.2.2.8 Duck/Corolla Landscape Unit

The Duck/Corolla landscape unit is an approximate 13.5-mile-long northwest to southeast trending area that runs along NC 12 on the Outer Banks from the intersection of Sandy Ridge Drive and NC 12 to the vicinity of the Corolla Bay subdivision. A multi-use path is separate but parallel to NC 12 from north of the Duck business district to the Dare County line. North of the Dare County line, the path continues on local streets with connections between subdivisions. The path is again adjacent to NC 12 north of Albacore Street. The topography of this landscape unit includes minor hills to generally flat areas, with vegetation coverage comprised of medium to high shrubs (up to 8 feet tall). Single- and multi-family residences are a notable visual feature and widespread

throughout the landscape unit. Some residential areas include curvilinear roads with loose spacing, while other residential areas include grid network roads with dense to very dense arrangements. Commercial uses in this landscape unit are nearly exclusively in a cluster that is along NC 12 between Albacore Street and Dolphin Street.

4.2.3 Visually Sensitive Locations

The following visually sensitive locations (VSL) are found within the landscape units described above and are shown on Figure 4-1. These are discussed by number, and their respective images are included on Figure 4-2. They are considered representative locations of the landscape units in which they are located.

4.2.3.1 VSL1

VSL1 is at the northernmost extent of the mainland regional landscape, within the Barco/Intracoastal landscape unit and is approximately 0.3 mile north of the US 158/NC 168 intersection.

- Visual Character. The visual character of VSL1 is characterized by generally flat topography that is covered with service oriented commercial uses and sparse rural single-family residences, all of which flank US 158 with agricultural uses beyond. Non-agricultural vegetation in this location is comprised of primarily deciduous trees with smaller bushes and maintained grass in residential and commercial areas.

- Visual Quality. The vividness of this visually sensitive location is moderate because of the commercial and residential uses being within otherwise agricultural views that include open agricultural field vistas and occasional breaks to the Currituck Sound. The intactness of the location is moderate because of the encroachment of manmade items such as roadside billboards, commercial signage, and utility lines within the location. Unity of the location is moderate because although the commercial and residential uses exist along US 158, their presence is softened by the larger agricultural uses nearby.

- Visually Sensitive Resources. The visually sensitive resources in this location include the deciduous trees and agricultural uses.

- Viewer Groups. The viewer group within this location is represented by residents within a limited number of residential uses within the area and the travelers on US 158 (see Figure 4-2a, Photograph 1).

4.2.3.2 VSL2

VSL2 is within northern portion of the mainland regional landscape, within the southern part of the Barco/Intracoastal landscape unit and is approximately 2 miles south-southeast of the US 158/NC 168 intersection.

- Visual Character. The visual character of VSL2 is characterized by generally flat topography that is covered with sparse rural single-family residences, commercial,

VSL1

VSL2

VSL3

VSL4

VSL5

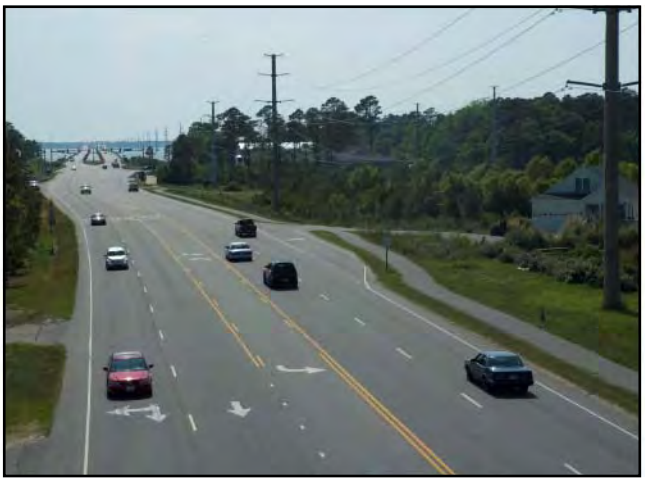
VSL6

(Source: Google Earth 2008)

	Visually Sensitive Location Photographs	**Figure** 4-2a

VSL7
(Source: Google Earth 2008)

VSL8
(Source: Google Earth 2008)



VSL9

VSL10
(Source: Google Earth 2008)

VSL11

VSL12
(Source: Google Earth 2008)

Visually Sensitive Location Photographs

Figure
4-2b

VSL13

VSL14

VSL15

	Visually Sensitive Location Photographs	**Figure** 4-2c

forest, and agricultural uses. Non-agricultural vegetation in this location is comprised of deciduous trees with smaller bushes and maintained grass in residential and commercial areas.

- Visual Quality. The vividness of this visually sensitive location is moderate to high. Although service oriented commercial uses are along the west side of US 158, the east side has agricultural and forest views that include open vistas. The intactness of the location is moderate because of the distraction by the commercial uses, their signage, and utility lines. Unity of the location is moderate because the visual presence of the residential and commercial uses is softened by the agricultural and forest views to the east of US 158.

- Visually Sensitive Resources. The visually sensitive resources in this location include agricultural uses and forested areas.

- Viewer Groups. The viewer group within this location is represented by residents within a limited number of residential uses within the area and travelers on US 158 (see Figure 4-2a, Photograph 2).

4.2.3.3 VSL3

VSL3 is within the northern portion of the mainland regional landscape, in the northern part of the Intracoastal/Grandy landscape unit at the intersection of US 158 and Aydlett Road.

- Visual Character. The visual character of VSL3 is characterized by generally flat topography that is covered with very sparse residential uses and a larger presence of agricultural uses. Non-agricultural vegetation in this location is comprised of primarily deciduous forest within swamps.

- Visual Quality. The vividness of this visually sensitive location is moderate to high because of negligible disruptions to the open agricultural views and forested areas. The intactness of the location is moderate to high because of very little encroachment by manmade uses. Unity of the location is moderate to high because the agricultural and forested areas blend and complement each other.

- Visually Sensitive Resources. The visually sensitive resources in this location include the deciduous forest and agricultural uses.

- Viewer Groups. The viewer group within this location is represented by residents within a limited number of residential uses within the area and travelers on US 158 (see Figure 4-2a, Photograph 3).

4.2.3.4 VSL4

VSL4 is within the northeastern portion of the mainland regional landscape. It is in the southern part of the Aydlett landscape unit on Narrow Shore Drive south of where a Mid-Currituck Bridge would pass through the unit.

- Visual Character. The visual character of VSL4 is characterized by flat topography that includes single-family residences on approximately one-acre lots, a farmstead with a small agricultural use, and forested areas. Non-agricultural vegetation in this location is comprised of primarily deciduous forest to the west and north. Currituck Sound in nearby to the east.

- Visual Quality. The vividness of this visually sensitive location is generally moderate, as it represents a typical rural community. The intactness and unity of the location is generally moderate, because of a mixture of forest, agricultural, and single-family home uses. However, the panoramic views of Currituck Sound are high for all three measures of visual quality.

- Visually Sensitive Resources. The visually sensitive resources in this location include the deciduous forest, a small agricultural use, and Currituck Sound.

- Viewer Groups. The viewer group within this location is represented by residents within the community (see Figure 4-2a, Photograph 4).

4.2.3.5 VSL5

VSL5 is within the northeastern portion of the mainland regional landscape, in the northern part of the Aydlett landscape unit at the intersection of Lighthouse View and Foreman Drive. VSL5 is just north of the where a Mid-Currituck Bridge would pass through Aydlett.

- Visual Character. The visual character of VSL5 is characterized by flat topography that has a mild decline to the west. It includes single-family residences in small subdivisions. A deciduous forest is to the north, south, and west, with small stands of trees and individual trees throughout. Currituck Sound is to the east.

- Visual Quality. Similar to VSL4, the vividness of this visually sensitive location is moderate from the perspective of development, as it represents a typical rural community. The intactness and unity of the location is moderate, because of a mixture of forest, agricultural, and single-family subdivisions. However, the panoramic views of Currituck Sound are high for all three measures of visual quality.

- Visually Sensitive Resources. The visually sensitive resources in this location include the deciduous forest and Currituck Sound.

- Viewer Groups. The viewer group within this location is represented by residents within the subdivisions (see Figure 4-2a, Photograph 5).

4.2.3.6 VSL6

VSL6 is within the central portion of the mainland regional landscape, in the southern part of the Intracoastal/Grandy landscape unit at a point that is approximately 0.3 mile south of Macedonia Church Road.

- Visual Character. The visual character of VSL6 is characterized by flat topography. It is covered mainly by agricultural uses and deciduous forest and is punctuated by a very sparse pattern of single-family rural residences. Deciduous forest ranges from very near the US 158 right-of-way to approximately 0.3 mile to the east and west of the northwest-southeast trending US 158.

- Visual Quality. The vividness of this visually sensitive location is moderate to high because of negligible distractions to the open agricultural views and forested areas. The intactness of the location is moderate to high because of minimal encroachment by manmade features. Unity of the location is moderate to high in that the agricultural and forested areas blend and complement each other.

- Visually Sensitive Resources. The visually sensitive resources in this location include the deciduous trees and agricultural uses.

- Viewer Groups. The viewer group within this location is represented by residents within a limited number of residential uses within the area and travelers along US 158 (see Figure 4-2a, Photograph 6).

4.2.3.7 VSL7

VSL7 is within the central portion of the mainland regional landscape, in the northern part of the Grandy/Point Harbor landscape unit at a point that is approximately 0.5 mile south of Walnut Island Boulevard.

- Visual Character. The visual character of VSL7 is characterized by flat topography. It is covered by open grass areas, woods comprised of deciduous trees, a loose juxtaposition of single-family residences and commercial uses along US 158, with tract-type residential development that is visible approximately 0.1 mile from the east of the US 158 right-of-way.

- Visual Quality. The vividness of this visually sensitive location is moderate because of the commercial and to a lesser extent residential uses within the views of the grass area and deciduous tree areas. The intactness of the location is low to moderate because of the encroachment of manmade features such as commercial signage and utility lines within the location. Unity of the location is low to moderate because the commercial and residential uses along US 158 appear to have no cohesive design attributes.

- Visually Sensitive Resources. The visually sensitive resources in this location include the deciduous trees and grass areas.

- Viewer Groups. The viewer group within this location is represented by residents within a limited number of homes within the area and travelers along US 158 (see Figure 4-2b, Photograph 7).

4.2.3.8 VSL8

VSL8 is within the southern portion of the mainland regional landscape, in the southern part of the Grandy/Point Harbor landscape unit at the intersection of Halls Harbor (a street) and US 158.

- Visual Character. The visual character of VSL8 is characterized by flat topography. It is covered by a near equal mix of open grass areas and deciduous trees, a very loose juxtaposition of single-family residences and commercial uses along US 158.

- Visual Quality. The vividness of this visually sensitive location is moderate because of the generally low number of commercial uses being within the views of the grass area and deciduous tree areas. The intactness of the location is moderate because of the encroachment of manmade features such as commercial signage and utility lines within the location. Unity of the location is moderate because although the commercial and residential uses along US 158 appear to have no cohesive design attributes, they are less imposing because of their lower numbers.

- Visually Sensitive Resources. The visually sensitive resources in this location include deciduous trees and grass areas.

- Viewer Groups. The viewer group within this location is represented by residents within a limited number of homes within the area and travelers along US 158 (see Figure 4-2b, Photograph 8).

4.2.3.9 VSL9

VSL9 is within the southern portion of the Outer Banks regional landscape at the intersection of US 158 and South Dogwood Trail.

- Visual Character. The visual character of VSL9 is characterized by generally flat topography with a mild rise to the east. It is covered by commercial uses and, to a far less extent, single-family residences. Deciduous forest is to the north and south of US 158 and has commercial, office and residential land uses scattered throughout. The US 158 right-of-way at the interface of the Wright Memorial Bridge provides an open view of Currituck Sound. The openness of views is slightly constrained near South Dogwood Trail because of tall deciduous trees, but views begin to open as one travels east toward the US 158/NC 12 interchange. The Aycock Brown Welcome Center is to the east of VSL9, at the US 158/NC 12 intersection.

- Visual Quality. The vividness of this visually sensitive location is moderate. This is because although the commercial, office, and residential uses appear to be well maintained, their lack of a constant design theme, juxtaposition, and number tends to detract. The intactness of the location is low, because of the visual distraction of

the multitude of land use types. The unity of this location is also low because the commercial, office, and residential uses do not appear to be compatible with each other, and to a lesser extent, with their surroundings.

- Visually Sensitive Resources. The visually sensitive resources in this location include the deciduous forest and Currituck Sound.

- Viewer Groups. The viewer group within this location is represented by residents within the homes along the north portion of US 158 and interspersed amongst wooded areas along the south of US 158, shoppers at businesses, and travelers along US 158 (see Figure 4-2b, Photograph 9).

4.2.3.10 VSL10

VSL10 is within the southern portion of the Outer Banks regional landscape, in the southern part of the Kitty Hawk/Duck landscape unit at the US 158/Bennett Street intersection in Kitty Hawk.

- Visual Character. The visual character of VSL10 is characterized as a roadway dominated landscape within an urbanized coastal setting. The US 158/NC 12 intersection exists to the north of this visually sensitive location, with commercial, hotel, and residential uses nearby. The topography in the area is generally flat with grass and tall bushes along the roadway and some exposed sandy areas. Two-story single-family residences are present in tracts that flank the east and west sides of US 158, most facing away from US 158 at various distances. Views of the ocean are found through the east-west trending side street openings (i.e., Fonk Street).

- Visual Quality. The vividness of this visual survey area is low to moderate. This is because of the mixture of land uses, relatively low amount of vegetation and the traffic on US 158 in the otherwise coastal setting. The intactness and unity of the location is low to moderate, because there are many conflicting land uses, and therefore a number of conflicting view attributes.

- Visually Sensitive Resources. The taller bushes and grass along US 158 are the visually sensitive resources. To a smaller extent the views through the side street opening may be considered visually sensitive resources as well, albeit transient views by drivers on US 158.

- Viewer Groups. The primary viewer group within this location is represented by residents in the communities that flank US 158, and travelers along US 158 (see Figure 4-2b, Photograph 10).

4.2.3.11 VSL11

VSL11 is within the southern portion of the Outer Banks regional landscape, in the central part of the Kitty Hawk/Duck landscape unit at the intersection of NC 12 and Chicahawk Trail.

- Visual Character. The visual character of VSL11 is characterized as primarily a residential area within a coastal setting. The topography in the area is flat to mildly hilly, with exposed sandy areas and relatively scarce vegetation along NC 12. More dense vegetation with average heights of 8 feet range from the edge of NC 12 to approximately 250 feet west. The scarcity of vegetation allows for a very open feel to this location. Two-story single-family residences are present on the east and west sides of the northwest-southeast trending NC 12, and although the beach is close to NC 12 in this area, the dunes, as seen from NC 12, prevent views of the ocean.

- Visual Quality. The vividness of this visually sensitive location is moderate because although residential uses are present, their spacing and set backs (approximately 100 feet) allow for an equal share of views of the beach environment. Beach housing and dunes also characterize the Outer Banks and views of beach homes add to the desirable character of the area sought by tourists. The intactness and unity of the location is moderate to high, because there are not many conflicting land use types, and therefore a very low level of conflicting view attributes.

- Visually Sensitive Resources. The visually sensitive resources in this location include the openness of the area and relatively low lying shrubs. Since the ocean cannot be seen from NC 12 at this location, it is not considered a visually sensitive resource.

- Viewer Groups. The primary viewer group within this location is represented by residents in the communities that closely flank NC 12 and travelers in motor vehicles, on bicycles, or on foot on NC 12 (see Figure 4-2b, Photograph 11).

4.2.3.12 VSL12

VSL12 is within the southern portion of the Outer Banks regional landscape, in the central portion of the Duck landscape unit, at the intersection of NC 12 and Thirteenth Street.

- Visual Character. The visual character of VSL12 is characterized by mildly hilly topography with single-family residential development lining NC 12 and extending away from NC 12 to the east and west. Vegetation that is comprised mainly of oak trees of varying heights line NC 12 and partially shield homes from views of NC 12.

- Visual Quality. The vividness of this visually sensitive location is moderate because of the relatively similar design themes of the structures and their setting within the vegetation. The intactness of the location is moderate, because of how the structures have been integrated into the area's natural vegetation. The unity of this location is high because the residential and commercial structures are compatible with each other and their surroundings.

- Visually Sensitive Resources. The visually sensitive resources in this location are the trees.

- Viewer Groups. The primary viewer group within this location is represented by residents in the communities that closely flank NC 12, and travelers in motor vehicles, on bicycles, or on foot on NC 12 (see Figure 4-2b, Photograph 12).

4.2.3.13 VSL13

VSL13 is within the northern portion of the Outer Banks regional landscape, within the northern portion of the Duck/Corolla landscape unit, approximately 650 feet south of the intersection of NC 12 and Sandfiddler Trail.

- Visual Character. The visual character of VSL13 is characterized by generally flat topography with some minor berms and dunes, multi-family and single-family residential uses, and vegetation that is comprised mainly of scrub, large shrubs, and pine trees that appear not to exceed a height of approximately 30 feet. Single-family residences based on a street network are to the east of NC 12. Multi-family residences are to the west of NC 12, but these are far less densely arranged and are on a curvilinear street network that is designed around a golf course. The views of the residences to the east of NC 12 are obscured by vegetation (bushes and trees). The residences on the west side on NC 12 are highly visible, but views of the golf course that they surround are blocked by a sand berm between NC 12 and the golf course.

- Visual Quality. The vividness of this visually sensitive location is moderate. There is no visible common theme to the residences to the east of NC 12, and some empty lots exist. Although the views to the west of NC 12 are open, the berm acts as a visual barrier, so the only views are of multi-family residences beyond the golf course, which are not softened by vegetation or common design elements. The intactness of the location is moderate because of the dissimilar look of the residences and the abundance of vegetation on the east of NC 12, and lesser concentration on the west of NC 12. The unity of this location is also moderate because the east and west sides of NC 12 exhibit drastically different developmental patterns.

- Visually Sensitive Resources. The visually sensitive resources in this location include the bushes and trees.

- Viewer Groups. The primary viewer group within this location is represented by residents in the communities that flank NC 12, and travelers in motor vehicles, on bicycles, or on foot on NC 12 (see Figure 4-2c, Photograph 13).

4.2.3.14 VSL14

VSL14 is within the northern portion of the Outer Banks regional landscape, within the northern portion of the Duck/Corolla landscape unit, approximately 400 feet north of the intersection of NC 12 and Orion's Way/Watch Drive.

- Visual Character. The visual character of VSL14 is characterized by flat topography with some minor sand hills, residential, commercial and public utility uses and vegetation that is comprised mainly of scrub, large shrubs, and sand dune type

grasses. Within the foreground view there is a large pond that is irrigated with spray fountains. Within the middle to background views there is a large beach themed commercial area (west-northwest and north), a public water tank and its facility (west-southwest), and a package waste water treatment plant (southeast). Each of these are screened or obscured to varying extents by lower story (under 10 feet high) vegetation. The location itself includes high-end residences that have a common beach theme, and their common pool/clubhouse area.

- Visual Quality. The vividness of this visually sensitive location is generally moderate. Although there is a visible common theme to many of the residential and commercial structures, these lie within a viewshed that is punctuated by other uses that are out of context (i.e. the water tank and cellular telephone antennae). The intactness of the location is moderate, because the visual distraction of the out of context land uses is softened by the lower vegetation screening. The unity of this location is also moderate because of the presence of a number of different land use types and their partial compatibility. This location includes views of Currituck Sound from the TimBuck II commercial area. Those views are high in terms of vividness, intactness, and unity.

- Visually Sensitive Resources. The visually sensitive resources in this location include the scrub, large shrubs, and sand dune type grasses.

- Viewer Groups. The primary viewer groups within this location are the travelers on NC 12 and residents (see Figure 4-2c, Photograph 14).

4.2.3.15 VSL15

VSL15 is located within the northern portion of the Outer Banks regional landscape, within the northernmost portion of the Duck/Corolla landscape unit, at the southern end of the Corolla Bay subdivision.

- Visual Character. The visual character of VSL15 is characterized by flat topography with vegetation that is comprised mainly of lower deciduous and evergreen trees (under 20 feet high), scrub, large bushes, sand dune type grasses and marsh plants. The location itself is under development for single-family beach houses and commercial uses. At the time of the field work for the visual resources assessment (April 2008) one residence was complete, one was approximately 85 percent complete, and one was in the framing stage.

- Visual Quality. The vividness of this visually sensitive location is high. The location includes views of Currituck Sound that are visible through the trees and a density of vegetation that provides for a calm natural feel to the location. The intactness of the location is high, because of the near lack of visual distractions. The unity of this location is high because all of the items within the view appear compatible.

- Visually Sensitive Resources. The visually sensitive resources in this location include the deciduous and evergreen trees, scrub, large bushes, sand dune type grasses, marsh plants and Currituck Sound.

- Viewer Groups. Although, in its existing condition the Corolla Bay subdivision is not complete, it could eventually be fully developed. Thus, viewer groups would be primarily tourists renting the vacation homes to be built on Currituck Sound and travelers in motor vehicles, on bicycles, or on foot on NC 12 (see Figure 4-2c, Photograph 15).

4.3 Visual Impacts

The following paragraphs describe the impacts of the detailed study alternatives in each landscape unit based on the representative unit characteristics presented for each VSL. The No-Build Alternative would have no visual impact.

4.3.1 Barco/Intracoastal Landscape Unit as Represented by VSL1

Impacts would be identical here for all detailed study alternatives except the Preferred Alternative. If reversing lanes were the hurricane evacuation improvement option used, there would be no visual change. The Preferred Alternative includes reversing lanes for hurricane evacuation and not a third outbound emergency lane. If a third outbound emergency lane is provided with the other detailed study alternatives, the paved surface of US 158 would be widened by 12 feet, generally on the east side of the road. The third outbound lane is illustrated on Figure 4-3. The addition of the lane would not remove any notable visual features. Some roadside vegetation would be removed, opening up views of the road and from the road for some of the residences along US 158. Additionally, no new substantial vertical attributes, such as poles or barriers are proposed with the third lane, although some utility lines would be moved. Thus, no substantial visual change would occur for viewers.

4.3.2 Barco/Intracoastal Landscape Unit as Represented by VSL2

Impacts would be identical here for all detailed study alternatives except the Preferred Alternative. The Preferred Alternative includes reversing lanes for hurricane evacuation and not a third outbound emergency lane. Like the area discussed in Section 4.3.1, if reversing lanes for the hurricane evacuation improvement, there would be no visual change. If a third outbound emergency lane is provided, the paved surface of US 158 would be widened by 12 feet. For the same reasons discussed in Section 4.3.1, no substantial visual change would occur for viewers.

4.3.3 Intracoastal/Grandy Landscape Unit as Represented by VSL3

The impacts would differ substantially between ER2 and the alternatives that include a Mid-Currituck Bridge (MCB2, MCB4, and the Preferred Alternative).

Photo Simulation

Existing/No-Build Alternative

Note: Reversing the existing center turn lane during an emergency is an alternative to adding the emergency lane shown.

View of US 158 Third Outbound Emergency Lane for ER2, MCB2, and MCB4 North of Intracoastal Waterway

Figure
4-3

ER2 would involve only hurricane evacuation improvements on US 158. Like the area discussed in Section 4.3.1, if reversing lanes for the hurricane evacuation improvement, there would be no visual change. If a third outbound emergency lane is provided, the paved surface of US 158 would be widened by 12 feet. For the same reasons discussed in Section 4.3.1, no substantial visual change would occur for viewers.

With MCB2 and MCB4 (either bridge approach Option A or Option B on the mainland) and the Preferred Alternative, the portion of this landscape unit near Aydlett Road would be substantially changed with the introduction of the US 158/Mid-Currituck Bridge interchange (see Figure 4-4 and Figure 4-5). Existing features would be lost and new manmade vertical elements would be introduced. With the MCB2/A, MCB4/A, and Preferred Alternative interchange, the existing centerline of US 158 would be shifted approximately 11 feet to the east and the existing US 158 would be changed from a five-lane roadway to a four-lane divided roadway in this location. The southbound US 158 on-ramp to the Mid-Currituck Bridge would extend 300 feet to the west of the existing US 158 centerline, and the maximum height of the interchange would be approximately 30 feet above existing grade at the crest of the southbound US 158 on-ramp to the Mid-Currituck Bridge. From its highest point at the interchange, this ramp would continue eastward and would drop in height to approximately 10 feet as it enters Maple Swamp. Other ramps, bridge maintenance buildings and equipment yards, as well as toll collection facilities would be introduced into views.

With the MCB2/B and MCB4/B interchange, the existing centerline of US 158 would be shifted up to approximately 450 feet to the east and again US 158 would be changed from a five-lane roadway to a four-lane divided roadway in this location. The relocated US 158 would be the highest point on the interchange at approximately 24.5 feet above existing grade where it would pass over two ramps leading to and from the Mid-Currituck Bridge. The MCB2/B and MCB4/B interchange would use less land than the MCB2/A, MCB4/A, and Preferred Alternative interchange because it would not also include the toll plaza. Some homes and businesses in this area would be relocated. With MCB2/A, MCB4/A, and the Preferred Alternative, one home close to Aydlett Road would remain and the interchange would be a notable presence and an adverse change. The home would be displaced with MCB2/B and MCB4/B. The interchange would be a substantial change for an area defined in Section 4.2.3.3 as having high visual quality. MCB2, MCB4, and the Preferred Alternative would have no components south of the bridge's interchange with US 158 and no visual change.

4.3.4 Aydlett Landscape Unit as Represented by VSL4 and VSL5

No components of ER2 would be present in this landscape unit and thus no visual change would occur. Visual change would occur in this landscape unit with MCB2, MCB4, and the Preferred Alternative. The change would differ between Option A and Option B.

View of US 158/Mid-Currituck Bridge Interchange for MCB2/A, MCB4/A, and the Preferred Alternative

Figure
4-4

**View of US 158/
Mid-Currituck Bridge Interchange
for MCB2/B and MCB4/B**

Figure
4-5

4.3.4.1 MCB2/A, MCB4/A, and the Preferred Alternative

For MCB2/A, MCB4/A, and the Preferred Alternative within Maple Swamp, the highest point (the top side railing on the bridge deck) of the bridge through Maple Swamp would be approximately 18 feet, with a typical height in the swamp of approximately 12 feet. This bridge would be visible from Aydlett Road in areas where recent logging of this forested swamp has occurred.

With MCB2/A, MCB4/A, and the Preferred Alternative, the Mid-Currituck Bridge and its approach would be introduced into Aydlett views. As the bridge over Maple Swamp enters Aydlett from Maple Swamp, it would transition onto an earthen berm in Aydlett (see Figure 4-6). The bridge's maximum height on the berm would be approximately 23 feet at the point over the bank of Currituck Sound. This elevation is necessary for roadway clearance for the undercrossing of Narrow Shore Road. The berm would be noticeable from residences south of the bridge. It would replace existing woods. Unless the forest was logged, the berm would be obscured by trees from homes north of the berm except close to the shore of Currituck Sound.

4.3.4.2 MCB2/B and MCB4/B

With MCB2/B and MCB4/B, Aydlett Road would be closed and restored to a natural condition. Thus, there would be no views of the fill across Maple Swamp from Aydlett Road.

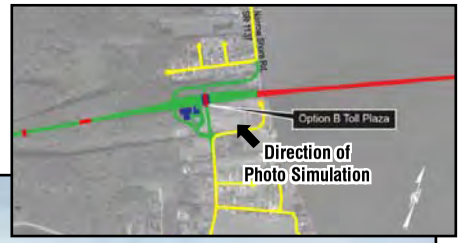
The Mid-Currituck Bridge, like MCB2/A and MCB4/A, would be introduced into Aydlett views. However with MCB2/B and MCB4/B, the proposed Mid-Currituck Bridge approach corridor would enter Aydlett from Maple Swamp near the existing ground elevation. It would include a toll plaza and an elevated realignment of Narrow Shore Road to take it over the toll plaza (see Figure 4-5 and Figure 4-7). These features would affect the community visually. Views to the south from homes along Lighthouse View would no longer be of the forest, but rather would be replaced by views of relocated Narrow Shore Road on top of an up to 21-foot-tall earthen berm. Drivers on the relocated Narrow Shore Road would have views of the back yards of homes along Lighthouse View. The toll plaza would be to the south of the berm, but views of the plaza from the homes along Lighthouse View mostly would be blocked by the berm. The toll plaza and elevated realigned Narrow Shore Road would be in view from homes to the south, replacing the existing forest view. The toll plaza and employee parking lot would be lighted at night and those lights would be seen by homes to the south. The night-time lighting of the toll plaza was expressed as a concern at an October 12, 2009 meeting with citizens from Aydlett, particularly as it relates to star gazing hobbyists who recognize Aydlett as an uncommon dark sky location. Light control would be a consideration in developing the final design of a toll plaza in Aydlett. It is expected that within 10 years of bridge opening toll collection would be done electronically. At that time the toll plaza would be narrowed to a two-lane road and the lights removed.

Existing/No-Build Alternative

Photo Simulation

View of Mid-Currituck Bridge Entering Currituck Sound from Aydlett for MCB2/A, MCB4/A, and the Preferred Alternative

Figure
4-6



Existing/No-Build Alternative

Photo Simulation

View of Mid-Currituck Bridge Approach in Aydlett for MCB2/B and MCB4/B

Figure

4-7

4.3.4.3 Option A and Option B

With either Option A or Option B, the bridge crossing Currituck Sound would represent a notable change in the high quality view of Currituck Sound to Aydlett residents. Essentially, the 180 degree panorama of Currituck Sound would be split (see Figure 4-6), with the bridge becoming a new and substantial manmade element. This adverse change with either MCB2, MCB4, or the Preferred Alternative would be greatest for homes near the bridge where it would be a more dominant presence.

4.3.5 Intracoastal/Grandy Landscape Unit as Represented by VSL6

No components of MCB2, MCB4, or the Preferred Alternative would be in this portion of the landscape unit, and thus no visual change would occur. ER2 would involve hurricane evacuation improvements on US 158. If reversing lanes for the hurricane evacuation improvement, there would be no visual change. If a third outbound emergency lane is provided, the paved surface of US 158 would be widened by 12 feet, generally 6 feet on both the east and west sides of the road. The addition of the lane would not remove any notable visual features. Some roadside vegetation would be removed on both sides of US 158, opening up views of the road and from the road for some of the residences along US 158. Thus, like the area discussed in Section 4.3.1, if reversing lanes were the hurricane evacuation improvement option used, there would be no substantial visual change.

4.3.6 Grandy/Point Harbor Landscape Unit as Represented by VSL7

No components of MCB2, MCB4, or the Preferred Alternative would be in this landscape unit and thus no visual change would occur. ER2 would involve only hurricane evacuation improvements on US 158. Like the area discussed in Section 4.3.5, if reversing lanes for the hurricane evacuation improvement, there would be no substantial visual change.

4.3.7 Grandy/Point Harbor Landscape Unit as Represented by VSL8

Like the unit discussed in Section 4.3.5, no components of MCB2, MCB4, or the Preferred Alternative would be in this landscape unit and thus no visual change would occur. ER2 would involve only hurricane evacuation improvements. Like the area discussed in Section 4.3.5, if reversing lanes were the hurricane evacuation improvement option used, there would be no substantial visual change.

4.3.8 Wright Memorial Bridge Landscape Unit as Represented by VSL9

Impacts would be similar for ER2 and MCB2.

With ER2 and MCB2, US 158 would be widened to a super-street with six to eight through traffic lanes and various turn lanes. An interchange would be built at the

intersection of US 158 and NC 12. The visual change of the super-street and interchange would be notable, including:

- Wider pavement on US 158, from the existing 60 feet to 148 feet (including the median) over most of the length of the super-street and wider in the interchange area.

- Vegetation on both sides of US 158 would be taken, but would not open views of the super-street nor would it open views from the super-street because existing vegetation continues beyond the area taken.

- The interchange would be approximately 45 feet high at the bridge where US 158 would cross the access road to NC 12 with ER2 and approximately 47 feet high with MCB2. The approach fills for the US 158 bridge would be held back by retaining walls. With MCB2, the interchange would be mostly contained within the existing right-of-way. More new right-of-way would be required with the ER2 interchange—a larger interchange because it would need to serve more traffic than the interchange with MCB2.

- The existing multi-use path on the north side of US 158 and the planned pedestrian path on the south side of US 158 would be replaced in a similar location in relation to the US 158 pavement.

Principal viewers of the changes in this landscape unit for the super-street would be businesses along US 158, pedestrians, and bicyclists on the multi-use paths, and users of US 158. Principal viewers of the interchange would be users of the Aycock Brown Welcome Center, which would overlook the interchange; businesses near the interchange; a multi-story hotel; and users of US 158. The super-street would be the only street of such a large scale on the Outer Banks. The interchange would be the only interchange on the Outer Banks. Although they would serve a useful purpose in terms of serving travel demand in this landscape unit, neither feature is what one would expect to see in a beach vacation area like the Outer Banks, with its mostly low density development.

MCB4 and the Preferred Alternative would involve hurricane evacuation improvements in this landscape unit. The length of the improvements would be less with the Preferred Alternative, as described in Section 1.1. If reversing lanes were the hurricane evacuation improvement option used, there would be no visual change. If a third outbound emergency lane is provided, as with the Preferred Alternative, the paved surface on the north side of US 158 would be widened by 12 feet. In some locations, no widening would occur because a right turn lane is already present that could serve as part of the third outbound lane. The addition of the lane would not remove any notable visual features. Some vegetation would be removed but would not open up views of or from the road. Additionally, no new substantial vertical attributes, such as poles or barriers, are proposed with the third lane. Thus, no substantial visual change would occur for viewers.

4.3.9 Kitty Hawk/Duck Landscape Unit as Represented by VSL10

No components of MCB4 or the Preferred Alternative would be in any portion of this landscape unit and thus no visual change would occur. Under Alternatives ER2 and MCB2, US 158 would be widened from Bennett Street northward to the US 158/NC 12 interchange in order to accommodate ramps for the US 158/NC 12 interchange. The widening would require the removal of some of the dense shrubs that screen the residences along US 158 from the roadway. Although, most of these residences have their backs to US 158, the removal of the screening vegetation would mean that these residents would have unimpeded views of US 158 and views motorists would have of private backyard spaces would be unimpeded.

4.3.10 Kitty Hawk/Duck Landscape Unit as Represented by VSL11

No components of MCB4 or the Preferred Alternative would be in any portion of this landscape unit and thus no visual change would occur. The visual change would be identical with ER2 and MCB2 in that the components of these two alternatives would be identical in this landscape unit. Under Alternatives ER2 and MCB2, NC 12 would be widened to become a three-lane roadway with an 8- to 10-foot wide multi-use path, replacing the existing path. (See Figure 4-8.) Another notable feature would be drainage features to accommodate run-off from the wider pavement and resolve existing NC 12 drainage problems. In the southern portion of Southern Shores (as shown on Figure 4-8), these features would consist of 21-foot-wide infiltration strips. Further north in this landscape unit where the terrain is not as flat, narrower drainage ditches would be provided that would drain to new dry infiltration basins. An example of narrow ditches are shown later on Figure 4-9.

Permanent drainage easements would entail purchases for the infiltration strips and ditches outside the NC 12 right-of-way. Infiltration basins in this landscape unit would involve the purchase of vacant lots. In both cases vegetation would be cleared, opening up views of and from the wider road. No new vegetation other than grass could be placed in the drainage features. No new vertical elements would be introduced to views.

Although no high quality views would be lost, the overall character of the unit along NC 12 would be changed by the loss of vegetation and the wider pavement. Some of the sense of intimacy and isolation associated with this section of NC 12 would be lost with this change.

4.3.11 Duck Landscape Unit as Represented by VSL12

No components of MCB4 or the Preferred Alternative would be within this landscape unit and thus no visual change would occur. The visual change would be identical with ER2 and MCB2 in that the components of these two alternatives are identical in this landscape unit. Under Alternatives ER2 and MCB2, NC 12 would be widened to become a three lane roadway with an 8-foot wide multi-use path, replacing the existing path. Another notable feature would be drainage features to accommodate run-off from the wider pavement and resolve existing NC 12 drainage problems. Drainage ditches

Photo Simulation

Existing/No-Build Alternative

View of NC 12 Widening to Three Lanes for ER2 and MCB2 in the Southern Shores Portion of Dare County

Figure 4-8

Photo Simulation

Existing/No-Build Alternative

View of NC 12 Widening to Four-Lanes with ER2, MCB2, and MCB4 South of Albacore Street in Currituck County

Figure
4-9

would be provided that would drain to new, dry infiltration basins. An example of narrow ditches is shown on Figure 4-9.

Permanent drainage easements would be purchased for the ditches outside the NC 12 right-of-way. Infiltration basins in this landscape unit would involve the purchase of vacant lots and some lots with existing homes. Vegetation would be cleared or the homes removed, opening up views of and from the wider road. No new vegetation other than grass could be placed in the drainage features. To accommodate new drainage ditches, retaining walls would be introduced on both sides of NC 12 from Jay Crest Road to Plover Drive (SR 1417) for the 3,330 feet south of the Duck commercial district because the terrain on either side of NC 12 is higher than the road. The walls would range in height from 3 feet to 12 feet.

Although no high quality views would be lost, like the unit discussed in Section 4.3.10, the overall character of the unit along NC 12 would be changed by the loss of vegetation and the wider pavement. Some of the sense of intimacy and isolation associated with this section of NC 12 would be lost with this change, particularly in the area where retaining walls also would be introduced.

4.3.12 Duck/Corolla Landscape Unit as Represented by VSL13

This discussion focuses on the widening of NC12 in this landscape unit. Section 4.3.13 and Section 4.3.14 focus on the visual impact of the Mid-Currituck Bridge termini at the end of bridge corridor C2, C1, and the Preferred Alternative, respectively.

From the perspective of widening NC 12, the characteristics of the detailed study alternatives vary within this landscape unit as follows:

- ER2—Widening NC 12 to three lanes between US 158 and a point just north of Hunt Club Drive in Currituck County and to four lanes with a median from just north of Hunt Club Drive to Albacore Street.

- MCB2—Widening NC 12 to three lanes between US 158 and a point just north of Hunt Club Drive in Currituck County and to four lanes with a median from just north of Hunt Club Drive to the NC 12 intersection with the Mid-Currituck Bridge.

- MCB4—Widening NC 12 to four lanes with a median from Seashell Lane to the NC 12 intersection with the Mid-Currituck Bridge.

- Preferred Alternative—Widening NC 12 to four lanes with a median in three areas: the Mid-Currituck Bridge terminus, the Albacore Street area, and the Currituck Clubhouse Drive area.

The four lane road with a median and dry infiltration basins is illustrated on Figure 4-9.

In addition, where removed by the widened pavement, existing multi-use paths would be replaced with a new 8-foot-wide paths. Where no path currently exists (in Currituck County from Spindrift Trail to Dolphin Street), widened road would be placed so that a

path could be built in the future. The wider pavement would be confined to the existing right-of-way. The three-lane widening would occur where the existing right-of-way is 60 feet wide and the four-lane widening would occur where the existing right-of-way is 100-feet wide. Like other parts of NC 12, permanent drainage easements would be purchased for narrow infiltration strips or ditches, as illustrated on Figure 4-9. In Dare County, infiltration basins also would be provided. Vacant land would be used where possible. In Dare County, basins would not be needed because surrounding subdivisions generally do not drain to NC 12 but have their internal drainage handling systems so less water needs to be accommodated along NC 12. No new vertical elements would be introduced to views.

Like other locations on NC 12, vegetation would be cleared for the drainage features, opening up views of and from the wider road. No new vegetation other than grass could be placed in the drainage features. Although no high quality views would be lost, like the other units along NC 12, the overall character of the unit along NC 12 would be changed by the loss of vegetation and the wider pavement. Some of the sense of intimacy and isolation associated with this section of NC 12 would be lost with this change.

4.3.13 Duck/Corolla Landscape Unit as Represented by VSL14

This section focuses on the impact of the C2 corridor's Mid-Currituck Bridge terminus with MCB2 and MCB4. The C2 corridor is not a part of the Preferred Alternative. Here, NC 12 would be relocated to intersect with the bridge approach road. The intersection of Crown Point and NC 12 would be relocated, as shown on Figure 4-10. The nature of the visual impacts in this area with ER2 and the C1 bridge terminus would be the same as those described in Section 4.3.12.

Coming from Currituck Sound as MCB2/C2 and MCB4/C2 approach the VSL14 area, the bridge would make a gradual turn to the south near the TimBuck II commercial area. The bridge's height (top of deck side rails) would be 23 feet at a location of 500 feet from the sound shoreline, and 21 feet at the shoreline, with a gradual drop to grade as the bridge transitions to NC 12 just north of the Southern Outer Banks Water System facility west of NC 12. As the bridge terminus transitions to NC 12, existing vegetation would be bridged at the west end of TimBuck II and the bridge introduced to views from TimBuck II. The bridge would approach the shore at a 45 degree angle, obscuring views of the sound from TimBuck II. A viewing platform that extends into Currituck Sound from TimBuck II would be displaced. The western part of TimBuck II is used for outdoor recreation, including the platform and a miniature golf course. Thus, the introduction of the bridge at this location with either MCB2/C2 or MCB4/C2 would be an adverse change since the views of the sound and surrounding vegetation are a positive asset for TimBuck II users.

Travelers on Mid-Currituck Bridge would enjoy views of Currituck Sound. At this location, travelers would see marsh islands to the south as they approach the Outer Banks.

Existing/No-Build Alternative

Photo Simulation

View of Mid-Currituck Bridge Terminus on NC 12 for MCB2 and MCB4 near TimBuck II Commercial Area in Currituck County (C2 Corridor Only)

Figure
4-10

With both MCB2/C2 and MCB4/C2, views from homes east of NC 12 would change, as illustrated on Figure 4-10, as would views of travelers on NC 12. Although different, the quality of views from these homes would not change and thus there would be no notable visual change.

4.3.14 Duck/Corolla Landscape Unit as Represented by VSL15

This section focuses first on the impact of the C1 corridor's Mid-Currituck Bridge terminus with MCB2 and MCB4, as shown on Figure 4-11. Next, the impact of the Preferred Alternative is discussed. ER2 would terminate before reaching this location, as would MCB2/C2 and MCB4/C2. As a result, there would be no visual changes from these alternatives in this area.

MCB2/C1 and MCB4/C1 would touch down at the south end of the developing Corolla Bay subdivision. As the Mid-Currituck Bridge approaches this location (Figure 4-11), it would make a gradual turn to the south as it transitions to NC 12. Similar to the bridge terminus C2 option, the bridge's height (top of deck side rails) would be 23 feet at a location of 500 feet from the sound bank, and 21 feet at the bank, with a gradual drop to surface grade as the bridge transitions to NC 12. Again, NC 12 would be relocated to intersect with the bridge approach road. The bridge would approach the shore at an approximately 45 degree angle.

The bridge crossing Currituck Sound with MCB2/C1 or MCB4/C1 would represent an adverse change in the high quality view of Currituck Sound from Corolla Bay and to a lesser extent north Monteray Shores. The bridge would end within the Corolla Bay subdivision and would be approximately 900 feet from the nearest home with a sound view in Monteray Shores. The 180 degree panorama of Currituck Sound would be split, with the bridge becoming a new and substantial manmade element. The side of the bridge would be exposed to Corolla Bay viewers because of the bridge's angle of approach. Vegetation would be removed between the bridge and the adjoining Corolla Bay and Monteray Shores subdivisions. This would introduce views of the bridge from the subdivisions. In addition, views to the east of some Corolla Bay lots would be changed with the realignment of NC 12 to meet the bridge's approach. Buffering vegetation between approximately six Corolla Bay lots and NC 12 would be removed and NC 12 moved closer to the lots.

For the Preferred Alternative, the bridge terminus was moved south of the C1 terminus included in MCB2 and MCB4. The Preferred Alternative would terminate in the undeveloped Phase II portion of the Corolla Bay subdivision. Visual impacts would be similar to, but not the same as, MCB4/C1. The refined C1 bridge corridor would intersect the Outer Banks almost perpendicular to the shore (at an approximately 80 degree angle towards Corolla Bay), as opposed to the original C1 bridge corridor which intersected the Outer Banks at an approximately 45 degree angle towards Corolla Bay. The refined C1 bridge corridor also would intersect the Outer Banks in a forested area that is within the currently unimproved Phase II of Corolla Bay. The nearest Corolla Bay lot would be approximately 300 feet away from the bridge. The original C1 bridge

Existing/No-Build Alternative

Photo Simulation

View of Mid-Currituck Bridge Terminus on NC 12 for MCB2 and MCB4 at Corolla Bay Subdivision in Currituck County (C1 Corridor Only)

Figure
4-11

corridor passed through Phase I of Corolla Bay. To the south of the bridge is Monteray Shores. The nearest home in that community would be approximately 500 feet away from the bridge with the Preferred Alternative, as opposed to approximately 900 feet away with the original C1 bridge corridor. Vegetation would block views of the bridge from both subdivisions once the project is on land. The bridge over water would be seen from homes along the shoreline and, as with the original C1 bridge corridor, the 180 degree panorama of Currituck Sound would be split with the bridge, and it would be a substantial new manmade element.

Travelers on Mid-Currituck Bridge would enjoy panoramic views of Currituck Sound, including both shorelines and marsh islands south of the bridge.

4.4 Mitigation

Much of the visual change associated with the project cannot be substantially mitigated because the change is associated with the introduction of wider pavement, new drainage features, and the MCB2, MCB4, and Preferred Alternative bridge- and interchange-related structures and fills. Their presence and the associated visual changes cannot be hidden. As a part of final design for the Preferred Alternative, a landscaping plan would be developed. NCTA also would coordinate with local stakeholders to identify cost effective opportunities for a Context Sensitive Design that utilizes materials and themes that reflect the local history, architecture and culture of Currituck County. Sensitivity to their context will be considered in bridge- and interchange-related structure design with the Preferred Alternative.

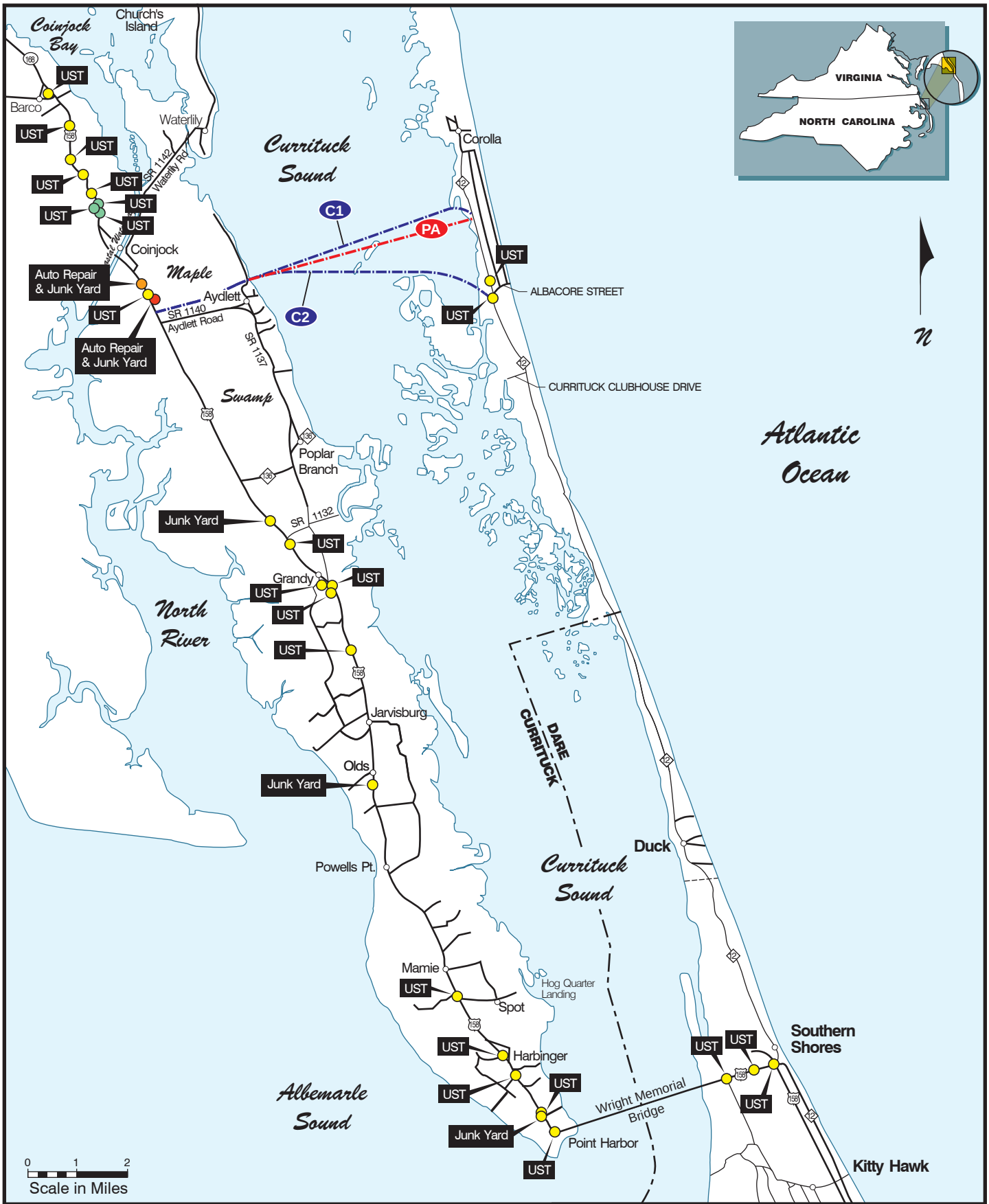
5.0 Hazardous Materials and Underground Storage Tanks

Surveys were conducted to identify GeoEnvironmental (hazardous material and underground storage tank) sites in the project area. Details on the outcome of those surveys are included in Appendix B. A Geographical Information System (GIS) database was consulted to identify known sites in relation to the project area. Field surveys were conducted on December 10, 2007, January 8, 2008, and October 14, 2008. A search of appropriate environmental agencies' databases was performed to assist in evaluating sites identified during the field surveys. No additional contaminated properties were identified during the field reconnaissance and regulatory agencies' records search over those identified from the GIS database. Twenty-nine sites were identified within the corridors studied. The locations of the 29 sites are shown on Figure 5-1.

Of the 29 sites, 25 presently contain or formerly contained petroleum underground storage tanks (USTs). Five sites contain automotive junkyards, including one of the sites with a UST and four without USTs. No hazardous waste sites or apparent landfills were identified within the detailed study alternatives' corridors.

Table 5-1 shows the number of sites that potentially could be affected by each detailed study alternative, the risk of a substantial increase in project cost and/or scheduling associated with affecting the site, and the type of site. The items listed as low to medium and medium are two of the five automotive junkyards, including the one with a UST. The other three junkyards are considered a low risk. The risk associated with the UST only sites is negligible to low or low. Table 5-1 indicates that the difference between the detailed study alternatives is in the number of low potential for impact sites that would be affected. The most notable difference between ER2 and MCB2, MCB4, and the Preferred Alternative occurs on US 158 and is associated with widening US 158 to provide the third emergency evacuation outbound lane. The number of sites potentially affected would be the same with either bridge approach Option A or Option B on the mainland. The No-Build Alternative would not affect any sites.

Soil and groundwater assessments on each of the properties identified would be made after selection of an alternative for implementation and before right-of-way acquisition. The results would be used to determine any need for remediation of contaminates in the soil or groundwater and that need would be taken into consideration during right-of-way acquisition. The discovery of additional sites not recorded by regulatory agencies and not reasonably discernable during the project reconnaissance could occur. If additional sites are discovered, soil and groundwater assessments would be conducted on those sites as well.



LEGEND

- DEIS Bridge Corridors
- Preferred Alternative Bridge Corridor
- County Boundaries

Contamination Sites

- Negligible to Low Impact
- Low Impact
- Low to Medium Impact
- Medium Impact

GeoEnvironmental Sites

Figure 5-1

Table 5-1. GeoEnvironmental Monetary and Scheduling Impact

Alternative	No. of Sites Affected	GeoEnvironmental Monetary and Scheduling Impact				Type		
		Negligible to Low	Low	Low to Medium	Medium	UST	Junk-yard	Junk-yard and UST
ER2	27 (3)[1]	3 (0)	22 (3)	1 (0)	1 (0)	22 (3)	4 (0)	1 (0)
MCB2/C1	16 (8)	3 (0)	11 (6)	1 (1)	1 (1)	14 (6)	1 (1)	1 (1)
MCB2/C2	16 (8)	3 (0)	11 (6)	1 (1)	1 (1)	14 (6)	1 (1)	1 (1)
MCB4/C1	13 (5)	3 (0)	8 (3)	1 (1)	1 (1)	11 (3)	1 (1)	1 (1)
MCB4/C2	13 (5)	3 (0)	8 (3)	1 (1)	1 (1)	11 (3)	1 (1)	1 (1)
Preferred Alternative	5	0	3	1	1	3	1	1
Total Project Corridors	29	3	24	1	1	24	4	1

[1]The first number indicates the number of GeoEnvironmental sites that would be affected assuming the construction of a third outbound lane for hurricane evacuation. The number in parentheses is the impact if improving hurricane evacuation clearance times is accomplished by reversing the existing center turn lane. For the Preferred Alternative, only one number is shown because it assumes reversing the center turn lane is implemented to reduce hurricane evacuation clearance times (i.e., adding a third outbound lane is not part of the Preferred Alternative except for a short distance on US 158 on the Outer Banks, which would not affect GeoEnvironmental sites).

6.0 Floodplains

Flood elevations in the project area are provided by Flood Insurance Rate Map (FIRM) panels prepared by the Federal Emergency Management Agency (FEMA). (See Figure 6-1.) Unlike upland riverine floodplains, the flood levels in the project area are primarily dependent on barometric pressure and the correlated storm surge height. The project area is subject to coastal flooding caused by both hurricanes in the summer and fall months and nor'easters in the winter and spring, both of which can raise water levels substantially via storm surge. Tidal surges propagate into shore with the storm, and then retreat as the storm passes through the area. The storage that occurs in the project area floodplains is during the interval between the surge and the ebb of the storm-induced tide.

Based on the information provided in the FIRM panels, the following flood elevations apply:

- Currituck Sound

  This area is mapped mostly as Zone VE (includes stillwater elevation plus wave action) with a base flood elevation that varies from 6 feet near the mainland to 9 feet in Currituck Sound as wave heights increase. At the western side of the Outer Banks, Zone VE becomes Zone AE (includes no wave action) and the base flood elevation decreases to 5 feet.

- Maple Swamp

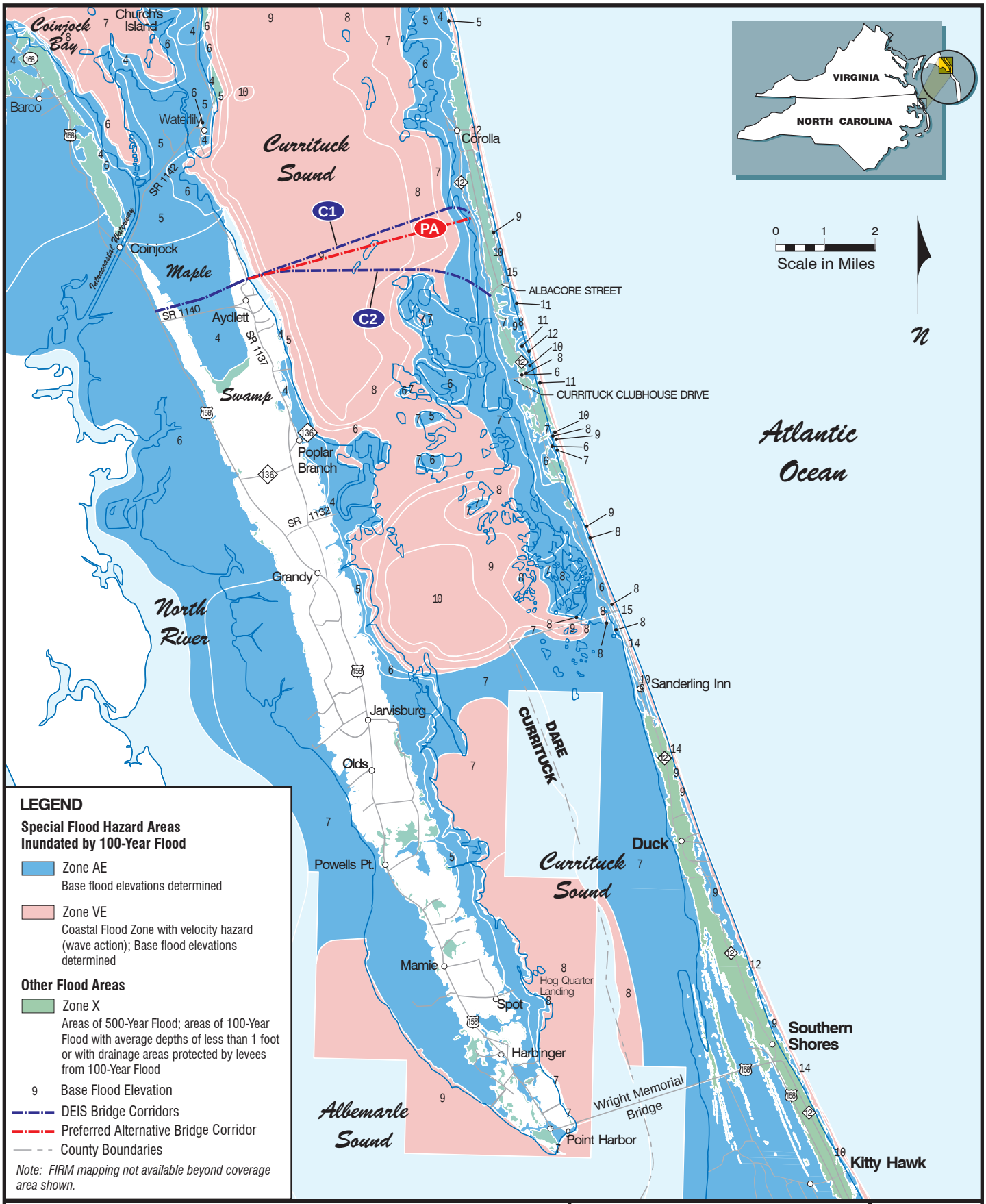
  This area is mapped as Zone AE with a 100-year base flood elevation of 4.2 feet (North American Vertical Datum of 1988 [NAVD88]).

- US 158 Corridor on Mainland

  Most of US 158 within the project area is outside of the mapped Flood Hazard Area. However, in some locations the roadway is within Flood Hazard Areas mapped as Zone AE, and in these locations the base flood elevation varies between 6 and 7 feet.

- NC 12 Corridor on Outer Banks

  Much of NC 12 within the project corridor is within the mapped Flood Hazard Area. Almost all of these areas are mapped as Zone AE with base flood elevations ranging from 5 feet to 9 feet. In a few isolated spots where NC 12 is very near to the eastern edge of the Outer Banks and next to the Atlantic Ocean, it briefly passes through areas mapped as Zone VE with base flood elevations up to 12 feet.



Floodplains

Figure
6-1

According to the Flood Insurance Study (FIS) for Currituck County, prepared by FEMA and dated December 16, 2005, the estimated flood elevations are based on tidal storm surges resulting from hurricanes, tropical storms, and nor'easters.

6.1 Mid-Currituck Bridge Encroachment on the Floodplain (MCB2, MCB4, and the Preferred Alternative)

The proposed Mid-Currituck Bridge would not cross any streams with associated floodplains, and with MCB2/A, MCB4/A, and the Preferred Alternative would bridge the two major hydraulic features in the project area: Currituck Sound and Maple Swamp. MCB2/B and MCB4/B would only bridge Currituck Sound. MCB2/B and MCB4/B would generally cross Maple Swamp on fill with two 180-foot long bridges at the west and east ends of the Maple Swamp crossing provided for wildlife passage. ER2 would not cross these two features and no fill would be placed in the 100-year floodplain.

MCB2/A and MCB4/A would involve:

- 9.8 acres of fill in the 100-year floodplain related to two US 158/Mid-Currituck Bridge interchange ramps west of US 158; and
- 0.6 acre of fill at the C1 Outer Banks terminus of the Mid-Currituck Bridge.

MCB2/B and MCB4/B would involve:

- 2.9 acres of fill associated with the west side of the US 158/Mid-Currituck Bridge interchange;
- 19.2 acres of fill associated with the proposed fill in Maple Swamp; and
- 0.6 acre of fill at the C1 Outer Banks terminus of the Mid-Currituck Bridge.

The Preferred Alternative would involve:

- 9.8 acres of fill in the 100-year floodplain related to two US 158/Mid-Currituck Bridge interchange ramps west of US 158; and
- 0.5 acre of fill at the Outer Banks terminus of the Mid-Currituck Bridge.

The low-superstructure elevation of the bridge or short bridges over Maple Swamp likely would vary between elevation 9.3 feet and 15.0 feet. The low-superstructure elevation of the bridge over Currituck Sound likely would be at elevation 16 feet, which is 16.4 feet above Mean Sea Level. A single navigation span likely would be higher. Therefore, both bridges would provide a substantial amount of freeboard above the 100-year base flood elevation: over 5 feet for the Maple Swamp Bridge (where the base flood elevation is 4 feet), and at least 7 feet for the Currituck Sound Bridge (where the base

flood elevation varies between 6 feet and 9 feet). This elevation includes wave height where applicable.

6.2 NC 12 and US 158 Encroachment on the Floodplain (ER2, MCB2, MCB4, and the Preferred Alternative)

The proposed widening of NC 12 and US 158 with all the detailed study alternatives would not alter the existing profiles of these roadways. The widening would occur at-grade. Therefore, the widening would not result in an obstruction to flood flows or an alteration of existing flood flow patterns. At the interchange of US 158 and NC 12 on the Outer Banks (only included in ER2 and MCB2), there would be fill for construction of ramps. This interchange, however, would not be in the 100-year floodplain.

6.3 Hydraulic Analyses

Initial hydraulic analyses were conducted in 2009 to determine whether the detailed study alternatives would affect 100-year flood elevations. Two options were considered at that time: Option A and Option B. With Option A, the mainland approach road to the bridge over Currituck Sound would include approximately 1.5 miles of bridge over Maple Swamp. No significant impacts to flood flows or elevations were presumed for Option A because the bridge would be built above the base flood elevations mapped by the Federal Emergency Management Agency (FEMA). Therefore, it was concluded that detailed hydraulic modeling was not necessary for Option A. With Option B, the approach to the bridge over Currituck Sound would be a road placed on fill within Maple Swamp with five wildlife crossing structures, and Aydlett Road would be removed and the roadbed restored as a wetland. Because the fill in Maple Swamp associated with Option B could potentially alter flood flows and elevations, the impacts of placing this fill on the 100-year Base Flood Elevations caused by tidal storm surge were analyzed. Hydraulic modeling results in 2009 showed an approximate 0.2-foot increase and 0.75-foot decrease in maximum water surface elevations north and south of the proposed fill, respectively, as compared to existing 100-year tidal storm surge elevations.

Additional hydraulic studies in Maple Swamp were conducted in 2010 in response to DEIS comments. The 2010 modeling included:

- Use of a more detailed August 2010 location survey for the Mid-Currituck Bridge project area. The survey included more topographic transects and cross-sections for Maple Swamp;
- Consideration of 2009 and 2010 logging within Maple Swamp; and
- Hydraulic modeling of Option A's bridge across Maple Swamp.

The US Army Corps of Engineers (USACE) Unsteady Network Program's (UNET) (Hydraulic Engineering Center-River Analysis System [HEC-RAS]) one-dimensional, unsteady flow model was used in both 2009 and 2010 to simulate storm surge events for the 100-year storm. Like any model, UNET has computational restrictions and limitations. In addition to being a one-dimensional model, it is driven by gravitational, frictional, and rainfall mechanisms. Coastal storm surge systems are dynamic, pressure-driven, and wind-driven systems, which would be better analyzed by using a detailed, two-dimensional model capable of considering these meteorological forces. UNET, however, is appropriate for planning level approximations of the types of systems in the project area and, thus, was selected to evaluate potential impacts in Maple Swamp.

Storm surge hydrology was developed based on a peak stillwater elevation of 6 feet North American Vertical Datum of 1988 (NAVD88) for the 100-year storm in conjunction with guidance provided in Hydraulic Engineering Circular (HEC) 25 (Douglass and Krolak, 2008). The downstream end of Maple Swamp, where the tidal storm surge enters the swamp, is mapped as Zone AE with a 100-year Base Flood Elevation of 6 feet NAVD88 in the area's Digital Flood Insurance Rate Map (DFIRM 134428). Based on the mapped FEMA base flood elevations, a peak storm surge elevation of 6 feet NAVD88 was used to develop the 100-year storm hydrograph for the downstream boundary condition, in conjunction with guidance provided in HEC 25 (Douglass and Krolak, 2008).

6.4 Hydraulic Impacts to Floodplain

The Mid-Currituck Bridge across Currituck Sound and MCB2/A and MCB4/A's bridge across Maple Swamp would not affect flood elevations because they would be built above the mapped base flood elevations. This finding was affirmed for Maple Swamp in the October 2010 hydraulic modeling.

Similarly, proposed widening of the roadways along both the US 158 and NC 12 corridors would occur at grade and, therefore, would not result in obstruction or alteration of flood flows or flood elevations. Base flood elevations in the project area are the result of tidal surges, not fluvial flooding sources. Therefore, for ER2, MCB2/A, MCB4/A, and the Preferred Alternative, neither the increases in runoff because of the expansion of paved surfaces, nor the up to 10.4 acres of fill in the 100-year floodplain resulting from bridge construction (MCB2, MCB4, and the Preferred Alternative) would have an effect on base flood elevations in the project area. The fill area would be very small in relation to the total area affected by the surge. Since no significant impacts to flood flows or flood elevations are presumed for these alternatives, it was determined that detailed hydraulic modeling was not necessary.

Again, since base flood elevations in the project area are the result of tidal surges, the up to 2.5 acres of fill (excluding that in Maple Swamp) in the 100-year floodplain resulting from bridge construction with MCB2/B and MCB4/B would not have an effect on base

flood elevations in the project area. The fill area would be small in relation to the total area affected by the surge.

The fill in Maple Swamp associated with MCB2/B and MCB4/B, however, could potentially obstruct or alter flood flows and elevations. Therefore, the impacts of placing the MCB2/B and MCB4/B fill in Maple Swamp on the 100-year Base Flood Elevations caused by tidal storm surge were analyzed in 2009 and 2010.

Hydraulic modeling results show that the MCB2/B and MCB4/B fill in Maple Swamp would result in an approximate 0.2-foot increase in the maximum water surface elevation for the 100-year storm at the downstream (north) face of the proposed fill. The 0.2-foot increase would taper to zero change in maximum water surface elevation for the 100-year storm at a point approximately 5,600 feet north of the proposed fill. Based on a visual inspection of available 2-foot contour mapping and satellite images, the area of effect for this rise in water surface elevation includes one residential property (and associated farm buildings) and portions of farm fields along the western edge of the swamp. These properties are east of US 158, between the proposed fill and Young Road.

Modeling results also showed that the MCB2/B and MCB4/B fill would result in an approximate 1.3-foot decrease in the maximum water surface elevation for the 100-year storm at the upstream (south) face of the proposed fill. This decrease in water surface elevation would become negligible approximately 5,500 feet south of the proposed fill. The 0.2-foot increase and 1.3-foot decrease in maximum water surface elevations, as well as reported lengths of impact are approximations. The results of the presented study may be within the computational limitations of the UNET model to approximate the hydraulics of this system. They do indicate, however, that the fill in Maple Swamp associated with MCB2/B and MCB4/B could potentially obstruct or alter flood flows and elevations. Option B was not selected for inclusion in the Preferred Alternative.

6.5 Significant Encroachment

FHWA policies and procedures for the location and hydraulic design of highway encroachments on floodplains are defined in 23 CFR 650, Subpart A (Location and Hydraulic Design of Encroachments on Floodplains). With respect to floodplain highway encroachments, it is the policy of the FHWA "to avoid significant encroachments, where practicable." According to 23 CFR 650, Subpart A:

> "Significant encroachment' shall mean a highway encroachment and any direct support of likely base flood-plain development that would involve one or more of the following construction or flood-related impacts:
>
> (1) A significant potential for interruption or termination of a transportation facility which is needed for emergency vehicles or provides a community's only evacuation route;
>
> (2) A significant risk, or;

(3) A significant adverse impact on natural and beneficial flood-plain values."

ER2, MCB2/A, MCB4/A, and the Preferred Alternative would not involve a significant encroachment on the 100-year floodplain as defined in Title 23 *Code of Federal Regulations* Part 650, Subpart A (Location and Hydraulic Design of Encroachments on Floodplains). MCB2/B and MCB4/B would involve a significant encroachment since they would be considered a significant alteration to a water course by Currituck County.

6.5.1 Transportation Facility Interruption

The C1, C2, and Preferred Alternative Mid-Currituck Bridge corridors do not meet the definition of "significant encroachment" from the perspective of transportation facility interruption as the project would lie above the storm surge elevation. On the Outer Banks, the bridges would generally terminate (except for 0.5 acre at the C1 Outer Banks terminus) in Zone X (areas of 0.2 percent annual chance flood, areas of 1 percent chance flood with average depths of less than 1 foot, or with drainage areas less than 1 square mile). Areas exist along NC 12 and US 158 to which the bridge connects that are within the Flood Hazard Area (100-year floodplain, or 1 percent annual chance flood), but as previously noted, the widening of these roadways would be at-grade so that there would be no increase in the risk of transportation facility interruption.

Currituck and Dare counties recognize the risks associated with the storm surge and each has developed an emergency management program that tracks storms and orders the voluntary evacuation of the entire Outer Banks prior to a storm surge. Currituck and Dare counties also have helicopters to transport patients to area hospitals if NC 12 is breached as a result of a storm.

6.5.2 Significant Risk

ER2, MCB2/A, MCB4/A, and the Preferred Alternative would not create a significant risk beyond that associated with development on the Outer Banks and the mainland that exist today. Risks on the Outer Banks and mainland are associated with storms and their consequences. Given the tidal nature of the flooding in the project area, the nominal footprint of the bridge within this very wide floodplain, and the height of the bridges over the floodplain elevations, it is anticipated that the impact of the Mid-Currituck Bridge and where applicable, associated road widening and interchanges on flood elevations, would be negligible. This conclusion would apply to MCB2/B and MCB4/B, too, except for the potential impact of the fill in Maple Swamp, which as indicated above, would be considered by Currituck County to be a significant alteration to a water course. It also would result in an approximate 0.2-foot increase in the maximum water surface elevation for the 100-year storm from the downstream (north) face of the proposed fill. The area of effect for this rise in water surface elevation includes portions of residential properties and farm fields along the western edge of the swamp.

6.5.3 Impact to Beneficial Floodplain Values

Natural and beneficial floodplain values associated with the project area are:

- On the Outer Banks, serving as a buffer (therefore flood control) to protect mainland shoreline areas by dampening tidal surges; and

- Providing wildlife habitat.

ER2, MCB2/A, MCB4/A, and the Preferred Alternative would not have a significant adverse impact on natural and beneficial floodplain values. As noted above, it is anticipated that the impact of these alternatives on flood elevations would be negligible. The bridge components of MCB2/A, MCB4/A, and the Preferred Alternative generally would bridge floodplains and their wildlife habitat. The road widening components of all the detailed study alternatives would be confined to the existing right-of-way except for infiltration basins and ditches, and generally would pass through areas already disturbed by development.

MCB2/B or MCB4/B could potentially affect natural and beneficial floodplain values in two different ways: 1) changes in flood flows and elevations for the 100-year storm; and 2) anticipated changes to existing groundwater and drainage patterns. As described above, changes associated with the 100-year tidal storm surge include an approximate 0.2-foot increase and 0.75-foot decrease in maximum water surface elevations north and south of the proposed fill, respectively.

Storm surge events for the 10-year storm also were simulated, using the USACE UNET (HEC-RAS) model to evaluate the impacts of placing the MCB2/B or MCB4/B fill in Maple Swamp on existing drainage patterns. As previously discussed, a peak stillwater elevation of 6 feet NAVD88 was used to develop the downstream boundary condition for the 100-year storm surge simulations since this is the base flood elevation where the storm surge enters the northern end of the swamp shown on the DFIRM. This is approximately 2 feet higher than the base flood elevation shown near the proposed fill in the DFIRM. Maple Swamp is mapped as Zone AE with a 10-year stillwater elevation of 2.5 feet NAVD88 in the area's Flood Insurance Study (FIS). Based on the comparison between base flood elevations for the 100-year event, a 1-foot difference in flood elevations between the proposed fill area and the entrance to Maple Swamp was estimated for the 10-year storm surge. Therefore, a peak stillwater elevation of 3.5 feet NAVD88 was used to develop the 10-year storm surge hydrograph for the downstream boundary condition in conjunction with guidance provided in HEC-25. Hydraulic modeling results for existing conditions showed very little response to the 10-year tidal surge in Maple Swamp. Similar results were obtained for the proposed fill. Therefore, the wetness of the swamp is likely controlled by the rise and fall of the groundwater table since it is close to the ground surface rather than tides.

Thus, the addition of fill proposed for MCB2/B and MCB4/B could result in changes to existing groundwater and drainage patterns in Maple Swamp for non-tidal storm surge situations, which also would affect natural and beneficial floodplain values. Option B was not selected for inclusion in the Preferred Alternative.

7.0 References

Caltrans Transportation Laboratory. July 1983. *Energy and Transportation Systems*. Prepared for the Federal Highway Administration.

Douglass, Scott L. and Joe Krolak. 2008. *Highways in the Coastal Environment: Second Edition*, Hydraulic Engineering Circular (HEC) 25. FHWA Publication Number: NHI-07-096.

Douglass, Scott L. and Joe Krolak. 2008. *Highways in the Coastal Environment - 2nd Edition*. Federal Highway Administration Publication No. FHWA-NHI=07-096.

Energy Information Administration. 2006. "Energy Consumption by Sector, Ranked by State, 2006." http://www.eia.doe.gov/emeu/states/sep_sum/plain_html/rank_use.html.

Federal Emergency Management Agency (FEMA). September 2006. "Digital Flood Insurance Rate Map (FIRM) panels for Currituck and Dare Counties" (Digital Flood Insurance Rate Map No.134428).

Federal Highway Administration. 1988. *Visual Impact Assessment for Highway Projects.* Office of Environmental Policy, Washington, DC.

Federal Highway Administration. 1990. *Environmental Impact Statement-Visual Impact Discussion*. Office of Environmental Policy, Washington, DC.

ICF International. August 2008. *The Potential Impacts of Global Sea Level Rise on Transportation Infrastructure Phase 1—Final Report: the District of Columbia, Maryland, North Carolina and Virginia.* Prepared for the US DOT Center for Climate Change and Environmental Forecasting, Washington, DC.

North Carolina Coastal Resources Commission, Science Panel on Coastal Hazards. March 2010. *North Carolina Sea Level Rise Assessment Report.*

North Carolina Department of Environment and Natural Resources, Division of Coastal Management. January 2010. North Carolina Sea Rise Forum, various forum materials at http://dcm2.enr.state.nc.us/slr.html.

North Carolina Interagency Leadership Team. March 2010. Climate Change Adaptation Workshop, various workshop materials at http://www.climatechange.nc.gov/pages/ClimateChange/CC_Workshop_Archive.html.

Parsons Brinckerhoff. 2009. *Alternatives Screening Report*. Prepared for the North Carolina Turnpike Authority, Raleigh, NC.

US Climate Change Science Program. January 2009. *Coastal Sensitivity to Sea Level Rise: A Focus on the Mid-Atlantic Region* at http://epa.gov/climatechange/effects /coastal/sap4-1.html.

Appendix A

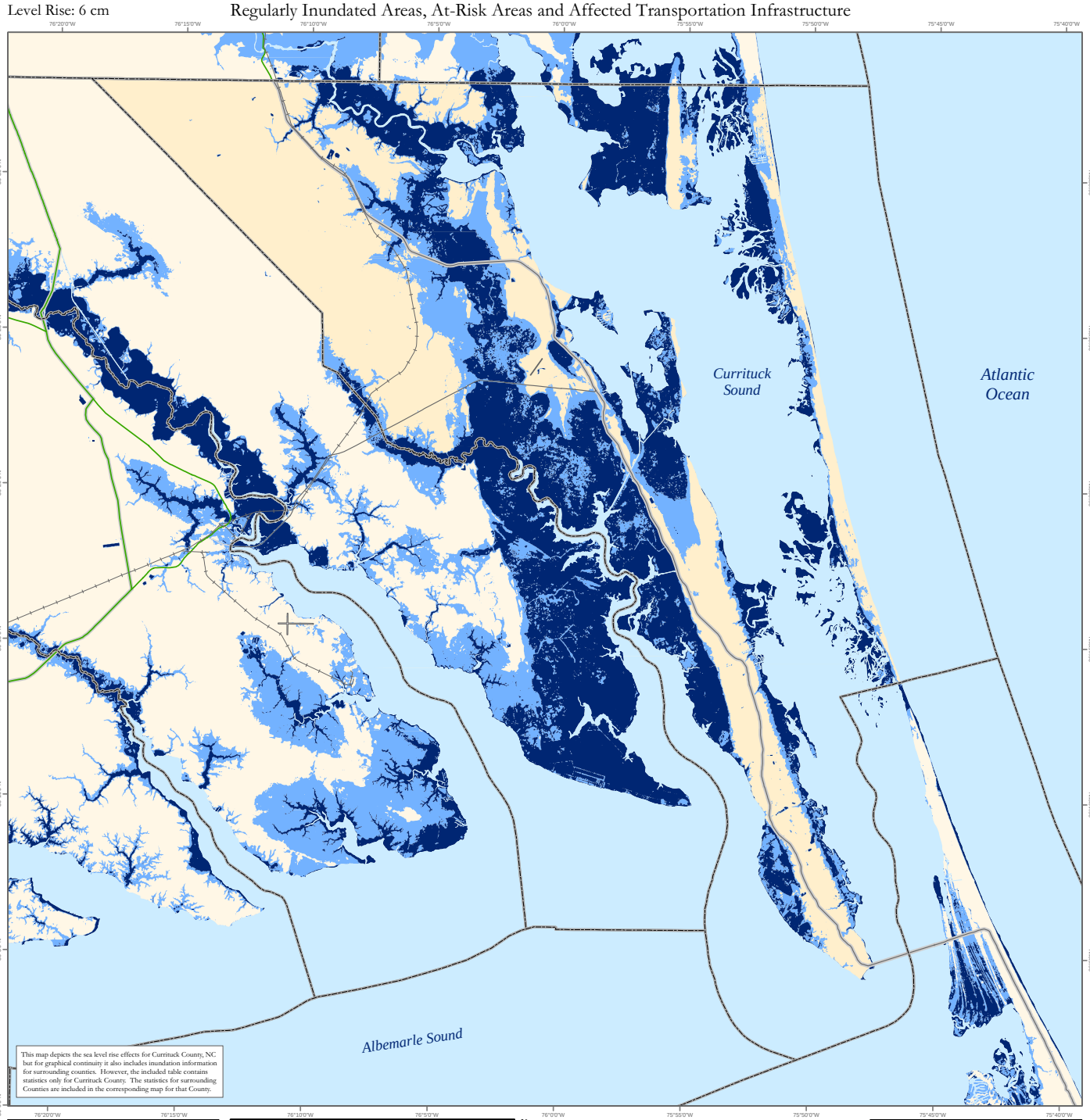
Sea Level Rise Maps

Source: ICF International. August 2008. *The Potential Impacts of Global Sea Level Rise on Transportation Infrastructure Phase 1—Final Report: the District of Columbia, Maryland, North Carolina and Virginia.* Prepared for the US DOT Center for Climate Change and Environmental Forecasting, Washington DC.

Eustatic Sea
Level Rise: 6 cm

Currituck County, NC

Regularly Inundated Areas, At-Risk Areas and Affected Transportation Infrastructure



- Regularly Inundated Area
- At-Risk Area
- Airport Runway
- Ports Property Area
- Interstate Highway
- Non-Interstate Principal Arterial
- Minor Arterial
- NHS (indicated by background)
- Railroad

N

Potentially Impacted Transportation Network

Type	Inundated	At-Risk
Roads (km)		
Interstate Highways	0.0	0.0
Non-Interstate Principal Arterials	0.0	0.0
Minor Arterials	1.3	20.2
National Highway System Features	1.1	15.5
Other Transportation Types (km)		
Railroads	0.3	3.2
Potentially Impacted Land Area (acres)		
Total Impacted Area	59,160	32,421
Airport Property Area	0	10
Airport Runway Area	0	0
Ports Property Area	0	0

Notes:
The methodologies and source data used to generate these maps are discussed in *The Potential Impacts of Global Sea Level Rise on Transportation Infrastructure: Study Goals, Methodologies, and Recommendations.* This report also lists summary statistics for the transportation infrastructure affected according to this analysis. These maps are presented as an *estimate* of areas that, without protection, may regularly be inundated or may be at-risk of periodic inundation due to storm surge, under the methodologies used in this study. These maps are not intended for navigational or engineering purposes, and are meant to provide a rough idea of the areas and transportation facilities that might be affected under the scenarios and methodologies used in this study.

***Eustatic** sea level rise refers to the change in sea level created by any volumetric increase in the oceans worldwide, primarily due to thermal expansion and ice melt.

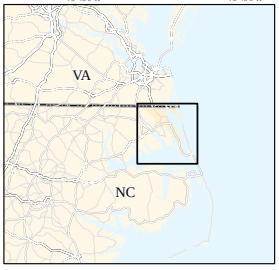
Sources:
Interstates, Non-Interstate Principal Arterials, Minor Arterials, and NHS - National Highway Planning Network.
Rails - Federal Railroad Administration.
Ports - Digitized from Digital Orthophoto Quadrangles clipped to the mean high water line.
Airport Property and Runways - Tele Atlas.

Coordinate System: UTM 18 N - North American Datum 1983

1:160,000

0 2 4 6 8 10 Kilometers

0 2 4 6 8 10 Miles

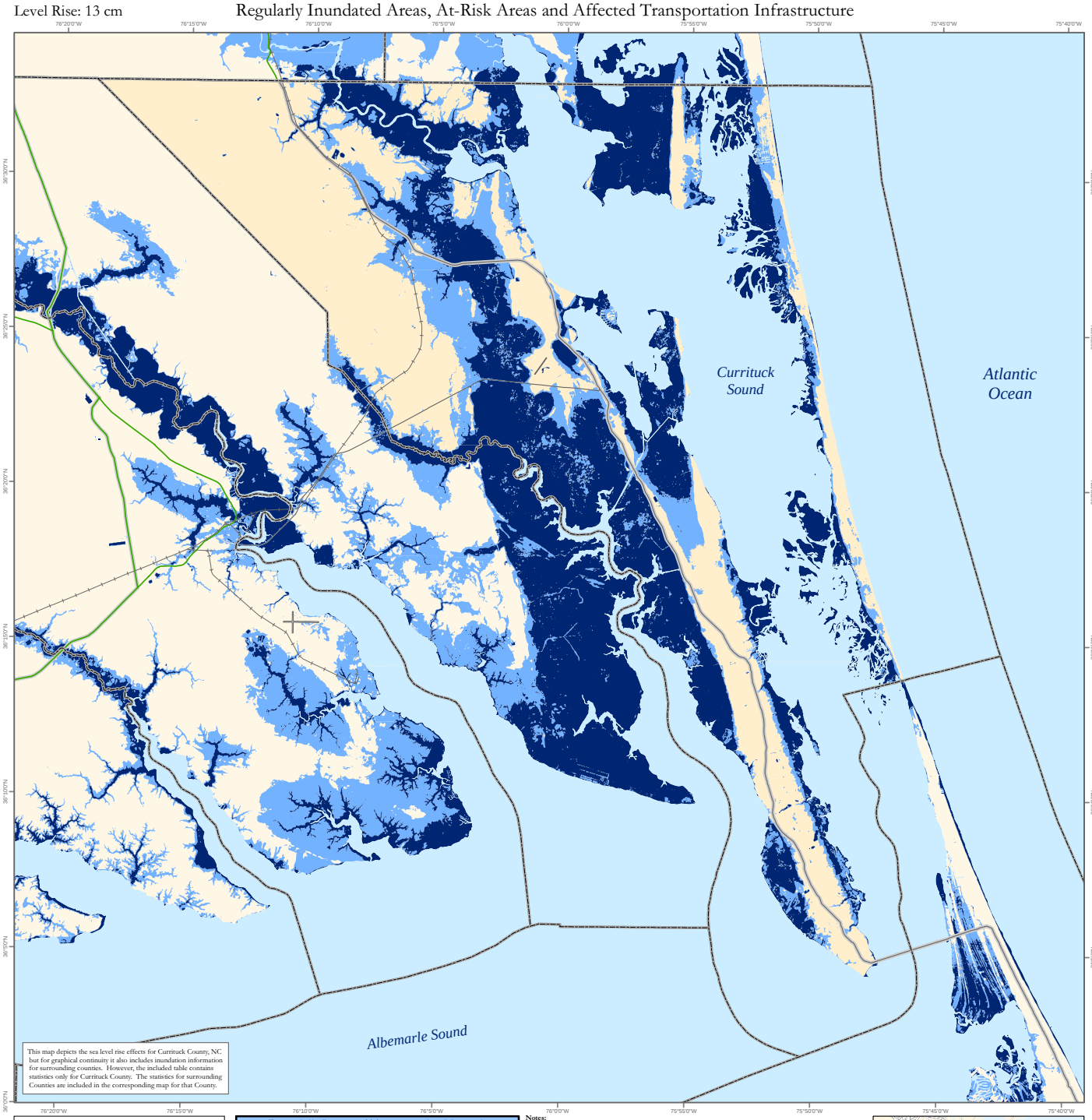


ICF20080605CJH053 - 6 cm

Eustatic Sea
Level Rise: 13 cm

Currituck County, NC

Regularly Inundated Areas, At-Risk Areas and Affected Transportation Infrastructure



- Regularly Inundated Area
- At-Risk Area
- Airport Runway
- Ports Property Area
- Interstate Highway
- Non-Interstate Principal Arterial
- Minor Arterial
- NHS (indicated by background)
- Railroad

N

Potentially Impacted Transportation Network

Type	Inundated	At-Risk
Roads (km)		
Interstate Highways	0.0	0.0
Non-Interstate Principal Arterials	0.0	0.0
Minor Arterials	2.2	20.6
National Highway System Features	1.9	15.9
Other Transportation Types (km)		
Railroads	0.3	4.5
Potentially Impacted Land Area (acres)		
Total Impacted Area	64,734	28,824
Airport Property Area	0	11
Airport Runway Area	0	0
Ports Property Area	0	0

Notes:
The methodologies and source data used to generate these maps are discussed in *The Potential Impacts of Global Sea Level Rise on Transportation Infrastructure: Study Goals, Methodologies, and Recommendations.* This report also lists summary statistics for the transportation infrastructure affected according to this analysis. These maps are presented as an *estimate* of areas that, without protection, may regularly be inundated or may be at-risk of periodic inundation due to storm surge, under the methodologies used in this study. These maps are not intended for navigational or engineering purposes, and are meant to provide a rough idea of the areas and transportation facilities that might be affected under the scenarios and methodologies used in this study.

***Eustatic** sea level rise refers to the change in sea level created by any volumetric increase in the oceans worldwide, primarily due to thermal expansion and ice melt.

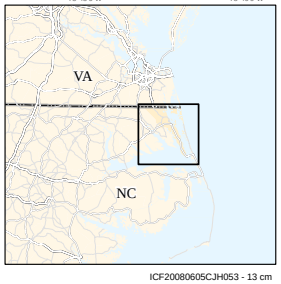
Sources:
Interstates, Non-Interstate Principal Arterials, Minor Arterials, and NHS - National Highway Planning Network.
Rails - Federal Railroad Administration.
Ports - Digitized from Digital Orthophoto Quadrangles clipped to the mean high water line.
Airport Property and Runways - Tele Atlas.

Coordinate System: UTM 18 N - North American Datum 1983

1:160,000

0 2 4 6 8 10 Kilometers

0 2 4 6 8 10 Miles

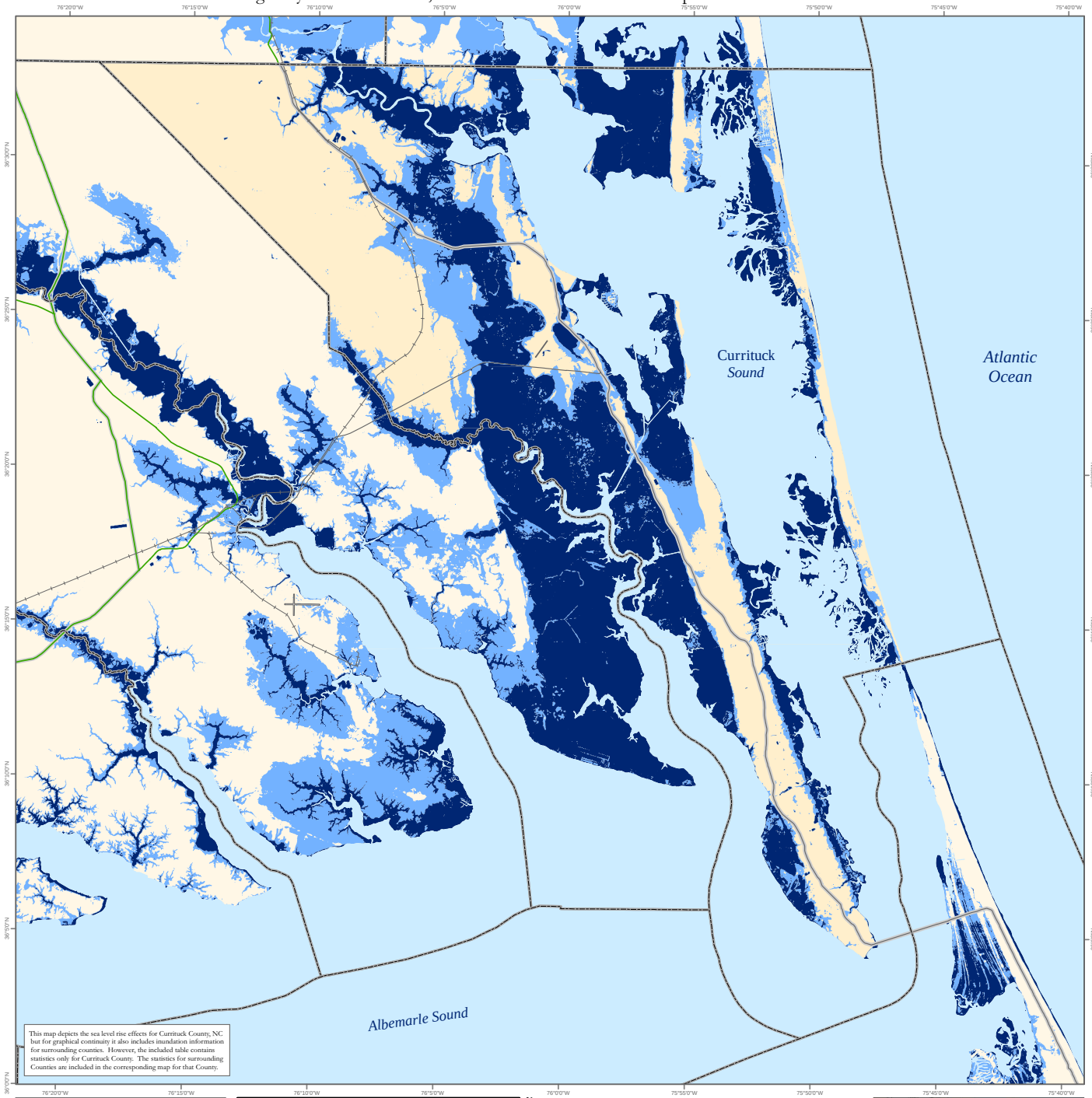


ICF20080605CJH053 - 13 cm

Eustatic Sea
Level Rise: 17.5 cm

Currituck County, NC

Regularly Inundated Areas, At-Risk Areas and Affected Transportation Infrastructure



- Regularly Inundated Area
- At-Risk Area
- Airport Runway
- Ports Property Area
- Interstate Highway
- Non-Interstate Principal Arterial
- Minor Arterial
- NHS (indicated by background)
- Railroad

N

Potentially Impacted Transportation Network

Type	Inundated	At-Risk
Roads (km)		
Interstate Highways	0.0	0.0
Non-Interstate Principal Arterials	0.0	0.0
Minor Arterials	2.9	20.9
National Highway System Features	2.4	16.0
Other Transportation Types (km)		
Railroads	0.4	5.2
Potentially Impacted Land Area (acres)		
Total Impacted Area	67,221	27,669
Airport Property Area	0	12
Airport Runway Area	0	0
Ports Property Area	0	0

Notes:
The methodologies and source data used to generate these maps are discussed in *The Potential Impacts of Global Sea Level Rise onTransportation Infrastructure: Study Goals, Methodologies, and Recommendations.* This report also lists summary statistics for the transportation infrastructure affected according to this analysis. These maps are presented as an *estimate* of areas that, without protection, may regularly be inundated or may be at-risk of periodic inundation due to storm surge, under the methodologies used in this study. These maps are not intended for navigational or engineering purposes, and are meant to provide a rough idea of the areas and transportation facilities that might be affected under the scenarios and methodologies used in this study.

***Eustatic** sea level rise refers to the change in sea level created by any volumetric increase in the oceans worldwide, primarily due to thermal expansion and ice melt.

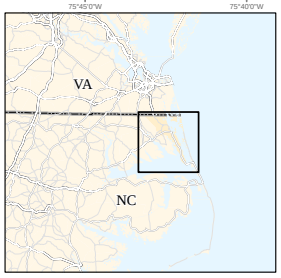
Sources:
Interstates, Non-Interstate Principal Arterials, Minor Arterials, and NHS - National Highway Planning Network.
Rails - Federal Railroad Administration.
Ports - Digitized from Digital Orthophoto Quadrangles clipped to the mean high water line.
Airport Property and Runways - Tele Atlas.

Coordinate System: UTM 18 N - North American Datum 1983

1:160,000

0 2 4 6 8 10 Kilometers

0 2 4 6 8 10 Miles

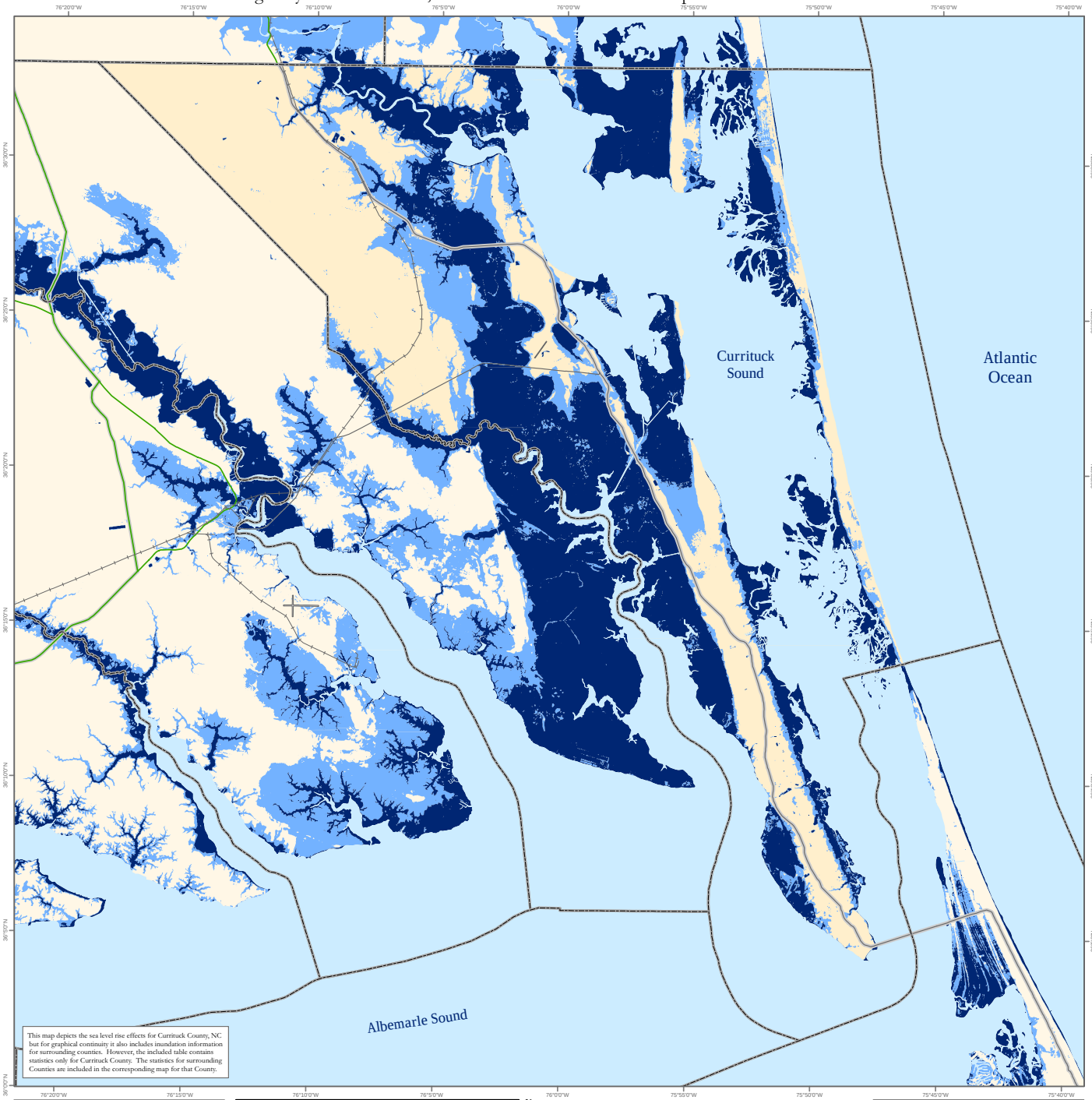


ICF20080605CJH053 - 17.5 cm

Eustatic Sea
Level Rise: 21 cm

Currituck County, NC

Regularly Inundated Areas, At-Risk Areas and Affected Transportation Infrastructure



- Regularly Inundated Area
- At-Risk Area
- Airport Runway
- Ports Property Area
- Interstate Highway
- Non-Interstate Principal Arterial
- Minor Arterial
- NHS (indicated by background)
- Railroad

N

Potentially Impacted Transportation Network

Type	Inundated	At-Risk
Roads (km)		
Interstate Highways	0.0	0.0
Non-Interstate Principal Arterials	0.0	0.0
Minor Arterials	3.5	21.1
National Highway System Features	2.9	16.1
Other Transportation Types (km)		
Railroads	0.5	5.6
Potentially Impacted Land Area (acres)		
Total Impacted Area	68,715	27,275
Airport Property Area	0	12
Airport Runway Area	0	0
Ports Property Area	0	0

Notes:
The methodologies and source data used to generate these maps are discussed in *The Potential Impacts of Global Sea Level Rise onTransportation Infrastructure: Study Goals, Methodologies, and Recommendations.* This report also lists summary statistics for the transportation infrastructure affected according to this analysis. These maps are presented as an *estimate* of areas that, without protection, may regularly be inundated or may be at-risk of periodic inundation due to storm surge, under the methodologies used in this study. These maps are not intended for navigational or engineering purposes, and are meant to provide a rough idea of the areas and transportation facilities that might be affected under the scenarios and methodologies used in this study.

***Eustatic** sea level rise refers to the change in sea level created by any volumetric increase in the oceans worldwide, primarily due to thermal expansion and ice melt.

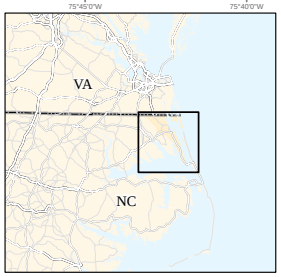
Sources:
Interstates, Non-Interstate Principal Arterials, Minor Arterials, and NHS - National Highway Planning Network.
Rails - Federal Railroad Administration.
Ports - Digitized from Digital Orthophoto Quadrangles clipped to the mean high water line.
Airport Property and Runways - Tele Atlas.

Coordinate System: UTM 18 N - North American Datum 1983

1:160,000

0 2 4 6 8 10 Kilometers

0 2 4 6 8 10 Miles

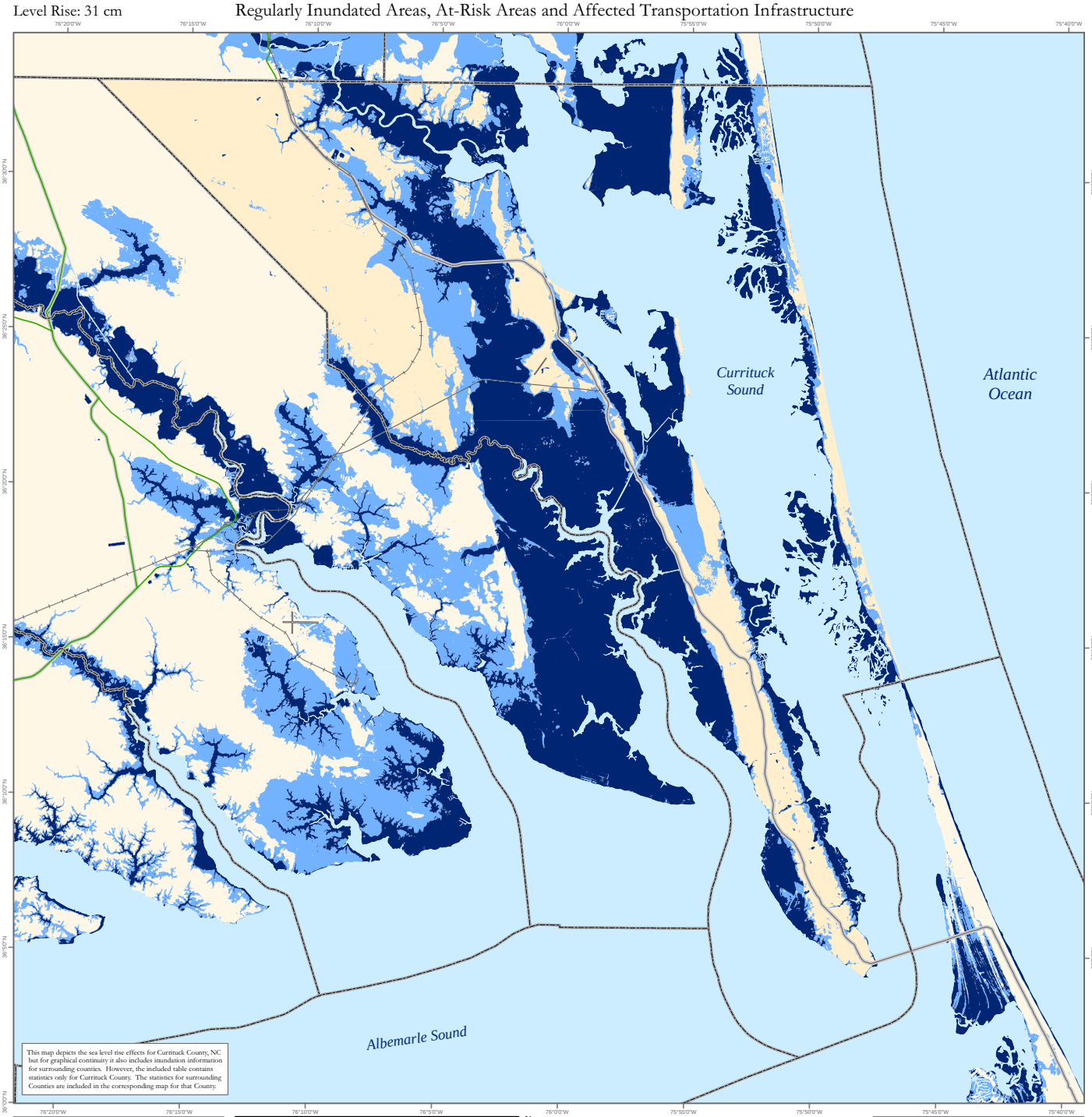


ICF20080605CJH053 - 21 cm

Eustatic Sea
Level Rise: 31 cm

Currituck County, NC

Regularly Inundated Areas, At-Risk Areas and Affected Transportation Infrastructure



- Regularly Inundated Area
- At-Risk Area
- Airport Runway
- Ports Property Area
- Interstate Highway
- Non-Interstate Principal Arterial
- Minor Arterial
- NHS (indicated by background)
- Railroad

N

Potentially Impacted Transportation Network

Type	Inundated	At-Risk
Roads (km)		
Interstate Highways	0.0	0.0
Non-Interstate Principal Arterials	0.0	0.0
Minor Arterials	5.7	21.3
National Highway System Features	4.8	15.9
Other Transportation Types (km)		
Railroads	0.6	6.8
Potentially Impacted Land Area (acres)		
Total Impacted Area	71,799	27,754
Airport Property Area	0	14
Airport Runway Area	0	0
Ports Property Area	0	0

Notes:
The methodologies and source data used to generate these maps are discussed in *The Potential Impacts of Global Sea Level Rise onTransportation Infrastructure: Study Goals, Methodologies, and Recommendations.* This report also lists summary statistics for the transportation infrastructure affected according to this analysis. These maps are presented as an *estimate* of areas that, without protection, may regularly be inundated or may be at-risk of periodic inundation due to storm surge, under the methodologies used in this study. These maps are not intended for navigational or engineering purposes, and are meant to provide a rough idea of the areas and transportation facilities that might be affected under the scenarios and methodologies used in this study.

***Eustatic** sea level rise refers to the change in sea level created by any volumetric increase in the oceans worldwide, primarily due to thermal expansion and ice melt.

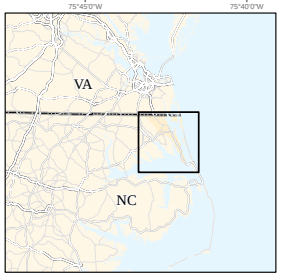
Sources:
Interstates, Non-Interstate Principal Arterials, Minor Arterials, and NHS - National Highway Planning Network.
Rails - Federal Railroad Administration.
Ports - Digitized from Digital Orthophoto Quadrangles clipped to the mean high water line.
Airport Property and Runways - Tele Atlas.

Coordinate System: UTM 18 N - North American Datum 1983

1:160,000

0 2 4 6 8 10 Kilometers

0 2 4 6 8 10 Miles

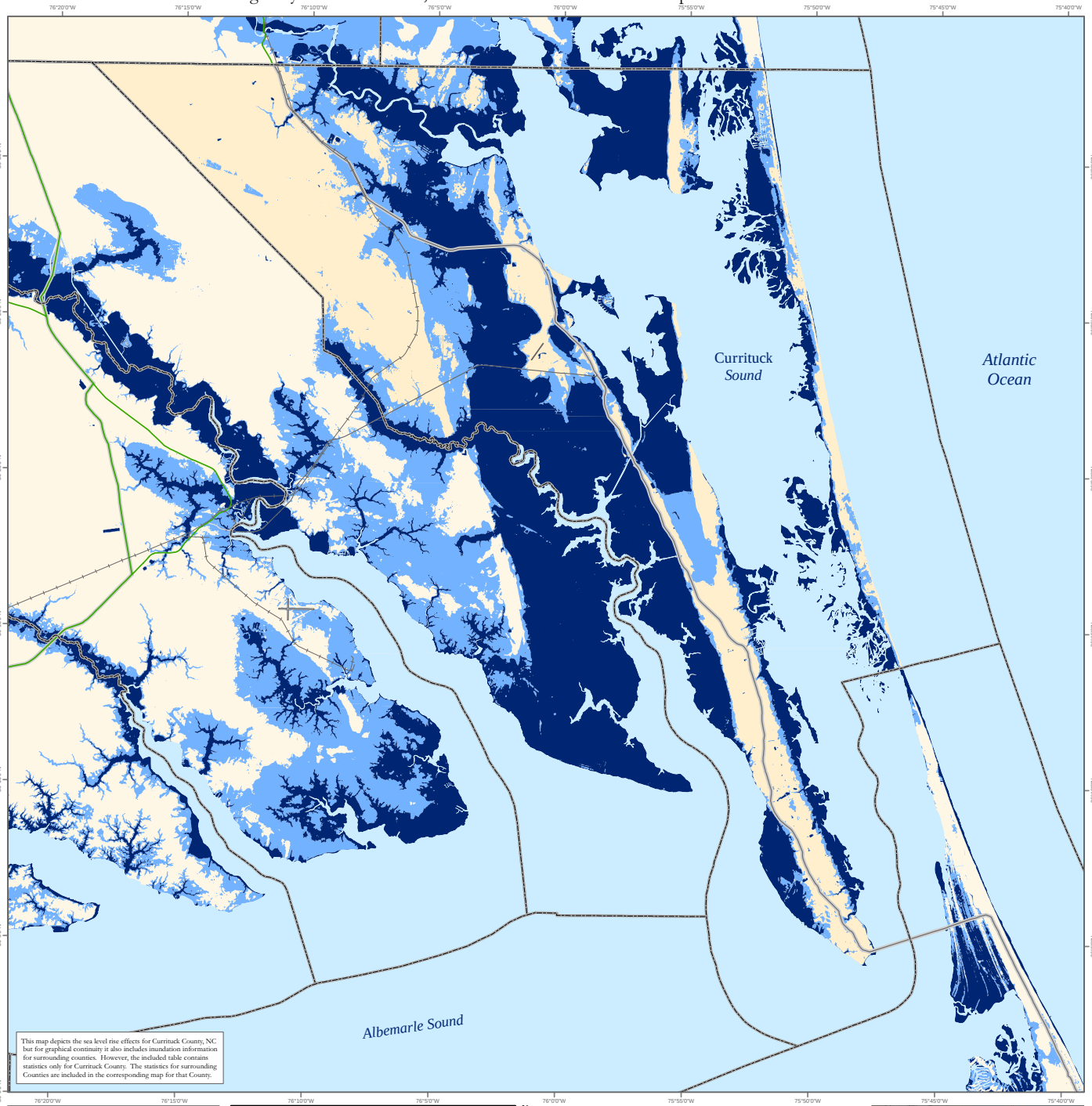


ICF20080605CJH053 - 31 cm

Eustatic Sea
Level Rise: 48.5 cm

Currituck County, NC

Regularly Inundated Areas, At-Risk Areas and Affected Transportation Infrastructure



- Regularly Inundated Area
- At-Risk Area
- Airport Runway
- Ports Property Area
- Interstate Highway
- Non-Interstate Principal Arterial
- Minor Arterial
- NHS (indicated by background)
- Railroad

N

Potentially Impacted Transportation Network

Type	Inundated	At-Risk
Roads (km)		
Interstate Highways	0.0	0.0
Non-Interstate Principal Arterials	0.0	0.0
Minor Arterials	8.6	23.7
National Highway System Features	7.1	17.6
Other Transportation Types (km)		
Railroads	0.9	8.4
Potentially Impacted Land Area (acres)		
Total Impacted Area	75,525	30,914
Airport Property Area	1	16
Airport Runway Area	0	0
Ports Property Area	0	0

Notes:
The methodologies and source data used to generate these maps are discussed in *The Potential Impacts of Global Sea Level Rise on Transportation Infrastructure: Study Goals, Methodologies, and Recommendations.* This report also lists summary statistics for the transportation infrastructure affected according to this analysis. These maps are presented as an *estimate* of areas that, without protection, may regularly be inundated or may be at-risk of periodic inundation due to storm surge, under the methodologies used in this study. These maps are not intended for navigational or engineering purposes, and are meant to provide a rough idea of the areas and transportation facilities that might be affected under the scenarios and methodologies used in this study.

***Eustatic** sea level rise refers to the change in sea level created by any volumetric increase in the oceans worldwide, primarily due to thermal expansion and ice melt.

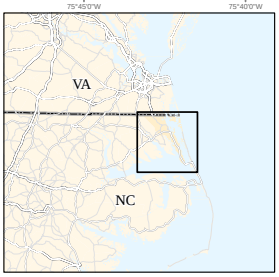
Sources:
Interstates, Non-Interstate Principal Arterials, Minor Arterials, and NHS - National Highway Planning Network.
Rails - Federal Railroad Administration.
Ports - Digitized from Digital Orthophoto Quadrangles clipped to the mean high water line.
Airport Property and Runways - Tele Atlas.

Coordinate System: UTM 18 N - North American Datum 1983

1:160,000

0 2 4 6 8 10 Kilometers

0 2 4 6 8 10 Miles

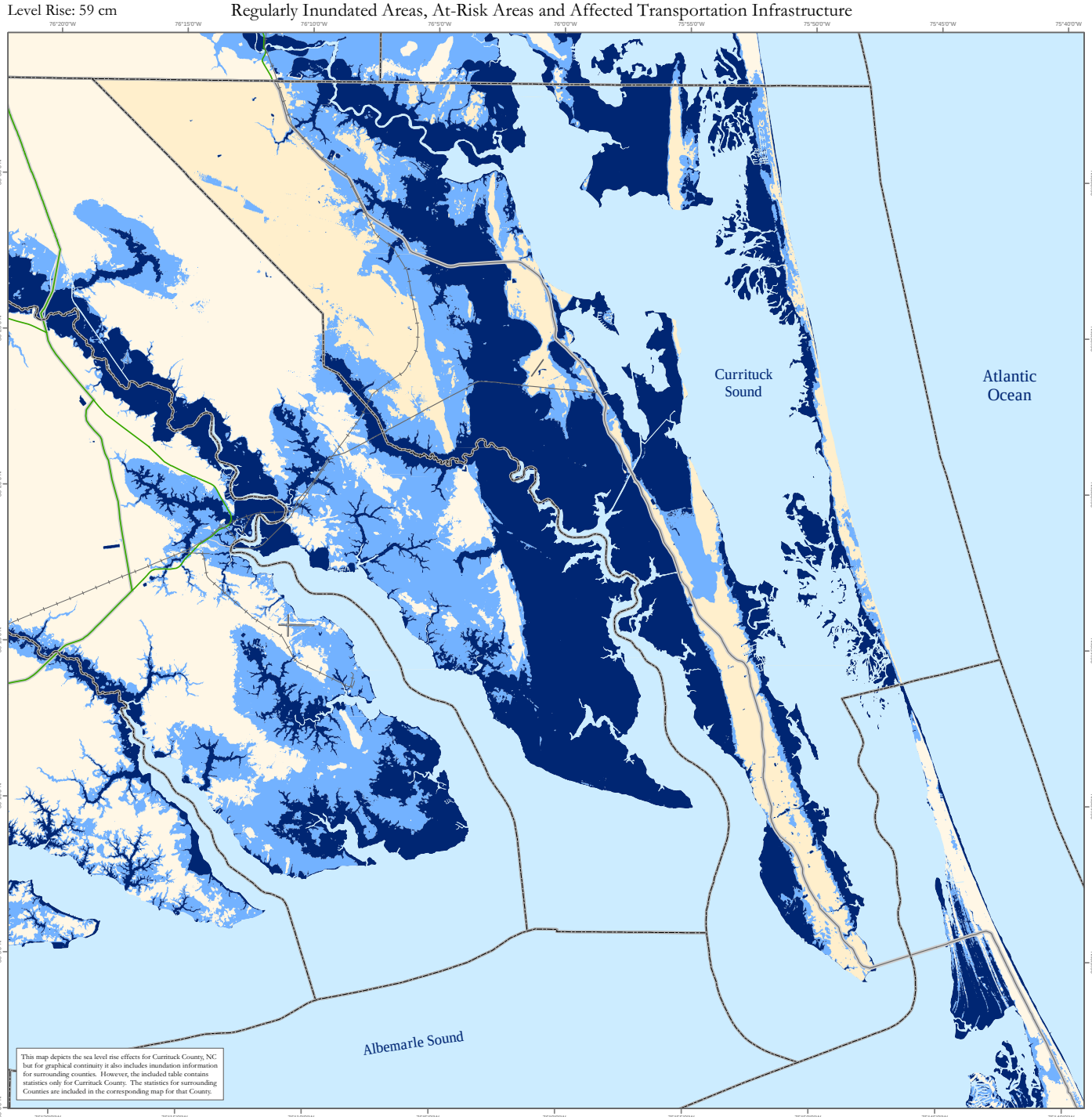


ICF20080605CJH053 - 48.5 cm

Eustatic Sea
Level Rise: 59 cm

Currituck County, NC

Regularly Inundated Areas, At-Risk Areas and Affected Transportation Infrastructure



- Regularly Inundated Area
- At-Risk Area
- Airport Runway
- Ports Property Area
- Interstate Highway
- Non-Interstate Principal Arterial
- Minor Arterial
- NHS (indicated by background)
- Railroad

N

Potentially Impacted Transportation Network

Type	Inundated	At-Risk
Roads (km)		
Interstate Highways	0.0	0.0
Non-Interstate Principal Arterials	0.0	0.0
Minor Arterials	10.9	24.3
National Highway System Features	8.8	17.7
Other Transportation Types (km)		
Railroads	1.0	9.6
Potentially Impacted Land Area (acres)		
Total Impacted Area	77,723	32,642
Airport Property Area	1	18
Airport Runway Area	0	0
Ports Property Area	0	0

Notes:
The methodologies and source data used to generate these maps are discussed in *The Potential Impacts of Global Sea Level Rise on Transportation Infrastructure: Study Goals, Methodologies, and Recommendations*. This report also lists summary statistics for the transportation infrastructure affected according to this analysis. These maps are presented as an *estimate* of areas that, without protection, may regularly be inundated or may be at-risk of periodic inundation due to storm surge, under the methodologies used in this study. These maps are not intended for navigational or engineering purposes, and are meant to provide a rough idea of the areas and transportation facilities that might be affected under the scenarios and methodologies used in this study.

***Eustatic** sea level rise refers to the change in sea level created by any volumetric increase in the oceans worldwide, primarily due to thermal expansion and ice melt.

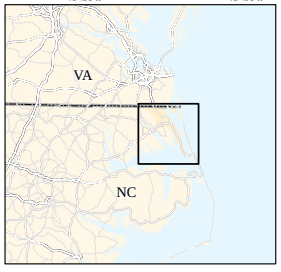
Sources:
Interstates, Non-Interstate Principal Arterials, Minor Arterials, and NHS - National Highway Planning Network.
Rails - Federal Railroad Administration.
Ports - Digitized from Digital Orthophoto Quadrangles clipped to the mean high water line.
Airport Property and Runways - Tele Atlas.

Coordinate System: UTM 18 N - North American Datum 1983

1:160,000

0 2 4 6 8 10 Kilometers

0 2 4 6 8 10 Miles



ICF20080605CJH053 - 59 cm

Appendix B

Hazardous Materials Reports

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION

MICHAEL F. EASLEY
GOVERNOR

LYNDO TIPPETT
SECRETARY

January 8, 2008

MEMORANDUM TO: Jennifer Harris, PE
Staff Engineer
N.C. Turnpike Authority

FROM: Terry W. Fox, LG
GeoEnvironmental Project Manager
Geotechnical Engineering Unit

TIP NO: R-2576
WBS: 34470.1.TA1
COUNTY: Currituck
DESCRIPTION: Mid-Currituck Bridge, from Coinjock to Corolla

SUBJECT: **GeoEnvironmental Impact Evaluation**

Purpose

This report presents the results of a geoenvironmental impact evaluation conducted along the above referenced project. The main purpose of this investigation is to identify properties within the project study area that are or may be contaminated and therefore result in increased project costs and future liability if acquired by the Department. Geoenvironmental impacts may include, but are not limited to, active and abandoned underground storage tank (UST) sites, hazardous waste sites, regulated landfills and unregulated dumpsites.

Techniques/Methodologies Used

The Geographical Information System (GIS) was consulted to identify known environmentally impacting sites in relation to the project corridor. GeoEnvironmental Section personnel conducted a field reconnaissance survey along the 9.9 mile project corridor on December 10, 2007. A search of appropriate environmental agencies' databases was performed to assist in evaluating sites identified during this survey.

Findings

Underground Storage Tank (UST) Facilities

Based on our study, eleven (11) sites presently, or formerly containing petroleum underground storage tanks (UST's) were identified within the project limits.

Hazardous Waste Sites

No Hazardous Waste Sites were identified within the project limits.

Landfills

No apparent landfills were identified within the project limits.

Other GeoEnvironmental Concerns

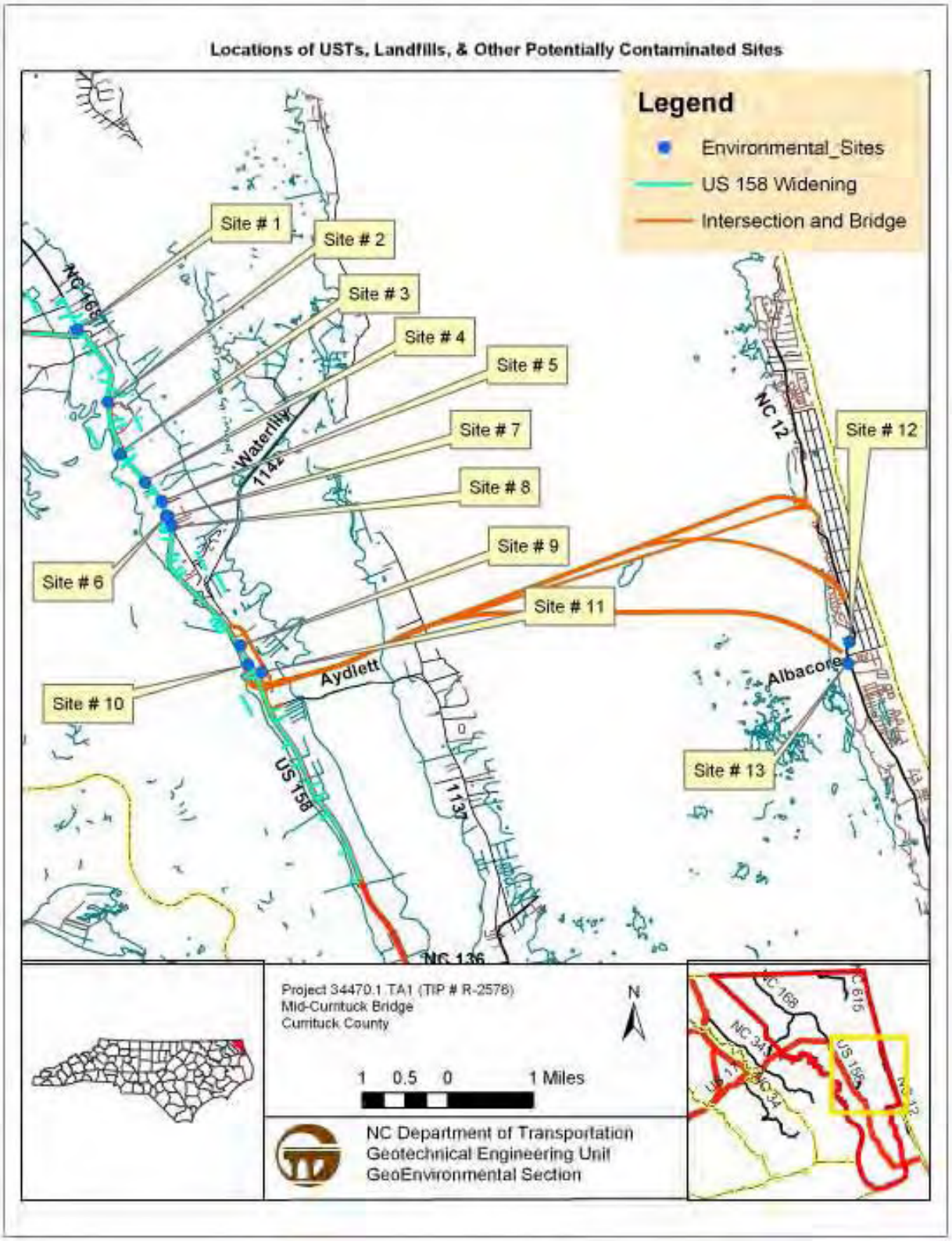
Two (2) other GeoEnvironmental Concerns (automotive junkyards) were identified within the project limits.

Anticipated Impacts

Eleven (11) possible UST facilities and two (2) automotive junkyards were identified within the proposed project corridor. We anticipate medium to non-existent monetary and scheduling impacts resulting from this site.

The GeoEnvironmental Section observed no additional contaminated properties during the field reconnaissance and regulatory agencies' records search. The GeoEnvironmental Section will provide soil and groundwater assessments on each of the above properties after identification of the selected alternative and before right of way acquisition. Please note that discovery of additional sites not recorded by regulatory agencies and not reasonably discernable during the project reconnaissance may occur. The GeoEnvironmental Section should be notified immediately after discovery of such sites so their potential impact(s) may be assessed.

TWF/CEH


Locations of USTs, Landfills, & Other Potentially Contaminated Sites
Legend
Environmental_Sites
US 158 Widening
Intersection and Bridge
Site # 1
Site # 2
Site # 3
Site # 4
Site # 5
Site # 6
Site # 7
Site # 8
Site # 9
Site # 10
Site # 11
Site # 12
Site # 13
NC 168
Waterlily
1142
NC 12
Aydlett
Albacore
US 158
1137
NC 136
Project 34470.1.TA1 (TIP # R-2576)
Mid-Currituck Bridge
Currituck County
N
1 0.5 0 1 Miles
NC Department of Transportation
Geotechnical Engineering Unit
GeoEnvironmental Section

Known and Potential GeoEnvironmental Impact Sites

1) **Property Name**
7-Eleven 20996
3948 Caratoke Hwy
Barco, NC 27917

Property Owner:
7-Eleven Inc.
P.O. Box 711
Dallas, TX 75221

Facility ID #: 0-011789
Incident #: 20049

UST Owner:
7-Eleven Inc.
P.O. Box 711
Dallas, TX 75221

This facility currently operates as a convenience store & gas station. It is located in the northwest quadrant of Caratoke Hwy and Shortcut Road intersection. The tank bed is located approximately 50 feet from the edge of pavement. According to the UST Section registry there are two (2) tanks currently in use. Three (3) tanks were removed in 1999. There are several monitoring wells on site and appears to be under remediation. GWI # 20049 has been assigned to this facility. **This site is anticipated to present low geoenvironmental impacts to the project.**

2) **Property Name**
Poyner Auto Service
4178 Caratoke Hwy
Barco, NC 27917

Property Owner:
Mary B. Poyner
4174 Caratoke Hwy
Barco, NC 27917

Facility ID #: 0-001907

UST Owner:
Poyner Auto Service
4178 Caratoke Hwy
Barco, NC 27917

This facility (formerly Barco Esso) currently operates as Poyner Auto Service. It is located on the West side of Caratoke Hwy, approximately 375 feet south of Sam Wilkens Road. According to UST Section registry four (4) tanks were removed in 1988, and one (1) tank removed in 1993. According to the current owner, the tank bed was located just off the northeast corner of the building. No monitoring wells were noted at this facility. **This site is anticipated to present low geoenvironmental impacts to the project**.

3) **Property Name**
Currituck Sports
4306 Caratoke Hwy
Barco, NC 27917

Property Owner:
Ralph H. Lane
P.O. Box 767
Maple, NC 27956

Facility ID #: 0-011515

UST Owner: Eastern Fuels Inc.

Incident #: 13593

This facility (formerly Dixie Trading) currently operates as Currituck Sports. It is located on the West side of Caratoke Hwy, approximately 2900 feet north of Simmons Road. The former tank bed is located on the southeast end of the parking lot. According to the UST Section registry five (5) tanks were closed in 1994. Several monitoring wells were noted at this site and it appears to be under remediation. GWI # 13593 has been assigned to this facility. **This site is anticipated to present low geoenvironmental impacts to the project**.

4) **Property Name**
Exxon Coinjock
4412 Caratoke Hwy
Barco, NC 27917

Property Owner:
Maira Enterprises
4412 Caratoke Hwy
Barco, NC 27917

Facility ID #: 0-011575
Incident #: 08479

UST Owner:
Maira Enterprises
4412 Caratoke Hwy
Barco, NC 27917

This facility currently operates as convenience store & gas station. It is located on the West side of Caratoke Hwy approximately 540 feet north of Simmons Road. According to the UST Section registry there are three (3) tanks currently in use, and they are located approximately 65 feet from the edge of pavement. Seven (7) USTs where removed in 1992. GWI # 8479 has been assigned to this facility. There are several abandoned monitoring wells on site. It does not appear to be under remediation at this time. **This site is anticipated to present low geoenvironmental impacts to the project**.

5) **Property Name**
Nancy's BP
4473 Caratoke Hwy
Barco, NC 27917

Property Owner:
Midcounty Properties, LLC
125 Deerfield Lane
Aydlett, NC 27916

Facility ID #:0-011903
Incident #: 31533

UST Owner: Paul and Nancy Arvanitis

This facility currently operates as a convenience store & gas station. It is located in the northeast quadrant of Caratoke Hwy and Coinjock Village Drive intersection. According to the UST Section registry there are three (3) tanks currently in use and they are located approximately 69 feet from the edge pavement. GWI # 31533 has been assigned to this facility. There are approximately 15 monitoring wells on site. The wells are currently being sampled by Terraquest. **This site is anticipated to present low geoenvironmental impacts to the project**.

6) **Property Name**
J. I. Hayman Hardware
4510 Caratoke Hwy
Barco, NC 27917

Property Owner:
Jo Anne S. Hayman
PO Box 109
Coinjock, NC 27923

Facility ID #:N/A

UST Owner:
Jo Anne S. Hayman
PO Box 109
Coinjock, NC 27923

This facility currently operates as a Hardware Store & Lumber Yard. It is located on the West side of Caratoke Hwy approximately 450 feet north of Coinjock Acres Road. There is one (1) underground heating oil tank located on the North side of the building approximately 135 feet from the edge of pavement. **This site is anticipated to present negligible to low geoenvironmental impacts to the project**.

7) **Property Name**
Citgo (Coinjock Amoco)
4511 Caratoke Hwy
Barco, NC 27917

Property Owner:
C. Kevin and Cynthia Spain
PO Box 158
Poplar Branch, NC 27965

Facility ID #:0-034349

UST Owner: Eastern Fuels

This facility currently operates as a convenience store & gas station. It is located on the East side of Caratoke Hwy approximately 400 feet north of Coinjock Acres Road intersection. According to the UST Section registry there are five (5) tanks in use, and are located behind the building, approximately 130 feet from the edge of pavement. No monitoring wells were noted at this facility. **This site is anticipated to present negligible low geoenvironmental impacts to the project**.

8) **Property Name**
Coinjock Gas House
4529 Caratoke Hwy
Barco, NC 27917

Property Owner:
Quality Oil Company
PO Box 2736
Winston-Salem, NC 27102

Facility ID #:0-036321

UST Owner:
Quality Oil Company
PO Box 2736
Winston-Salem, NC 27102

This facility operates as a gas station. It is located in the southeast quadrant of Caratoke Hwy and Coinjock Acres Drive intersection. According to the UST Section registry there are two (2) tanks in use, and are located approximately 140 feet from the edge of pavement. No monitoring wells were noted at this facility. **This site is anticipated to present negligible to low geoenvironmental impacts to the project**.

9) **Property Name**
Coinjock Automotive
4901 Caratoke Hwy
Coinjock, NC 27923

Property Owner:
Earl and Loretta Mason
48 Carpenter Ave
Mansfield, MA 02048

Facility ID #:N/A

UST Owner:
Earl and Loretta Mason
48 Carpenter Ave
Mansfield, MA 02048

This facility operates as an auto service garage and small junk yard. It is located on the East side of Caratoke Hwy approximately 730 feet south of Young Road. There is no evidence of any UST system. The fenced area around the service area is approximately 200 feet from the edge of pavement. **This site is anticipated to present low to medium geoenvironmental impacts to the project**.

10) **Property Name**
Henry's
4952 Caratoke Hwy
Coinjock, NC 27923

Property Owner:
Barco and Cage Inc
4952 Caratoke Hwy
Coinjock, NC 27923

Facility ID #:0-024772

UST Owner:
Barco and Cage Inc
4952 Caratoke Hwy
Coinjock, NC 27923

This facility operates as a convenience store & gas station. The station is located on the West side of Caratoke Hwy approximately 160 feet north of Markert Road. According to the UST Section registry there are four (4) tanks in use, and are located approximately 75 feet from the edge of pavement. No monitoring wells were noted at this facility. This facility was not open at the time of our field investigation. **This site is anticipated to present low geoenvironmental impacts to the project**.

11) **Property Name**
Precision Auto Center
4987 Caratoke Hwy
The Stuff Store
4995Caratoke Hwy
Coinjock, NC 27923

Property Owner:
David A. Baldwin
4987 Caratoke Hwy
Coinjock, NC 27923

Facility ID #:N/A

UST Owner:
David A. Baldwin
4987 Caratoke Hwy
Coinjock, NC 27923

Two businesses operate on this location; an auto service garage and a junk yard. The parcel is located on the East side of Caratoke Hwy, approximately 600 feet south of Markert Road. There is no evidence of any UST system. Stained soil from the junk automobiles was noted through out the property. **This site is anticipated to present medium geoenvironmental impacts to the project**.

12) **Property Name**
OB Gas
814 Ocean Trail
Corolla, NC 27927

Property Owner:
OB Gas LLC
PO Box 120
Kitty Hawk, NC 27949

Facility ID #:0-036374

UST Owner:
OB Gas LLC
PO Box 120
Kitty Hawk, NC 27949

This facility operates as a convenience store & gas station. It is located on the West side of Ocean Trail approximately 330 feet North of Malia Drive. According to the UST Section registry there are three (3) tanks in use, and are located approximately 50 feet from the edge of pavement. No monitoring wells were noted at this facility. **This site is anticipated to present low geoenvironmental impacts to the project**.

13)	**Property Name** Brew Thru 790 N. Ocean Trail Corolla, NC 27927 **Facility ID #:0-033608**	**Property Owner:** T B Shops LLC 1100-C Suite 102 S. Stratford Road Winston-Salem, NC 27103 **UST Owner:** MDC Assoc. Inc.

This facility operates as a convenience store & gas station. It is located in the southwest quadrant of the Ocean Trail and Sunset Blvd intersection. According to the UST Section registry there are two (2) tanks in use, and are located approximately 160 feet from the edge of pavement on Ocean Trail. No monitoring wells were noted at this facility. **This site is anticipated to present low geoenvironmental impacts to the project**.

Appendix A
USTs, Landfills & Other Potentially Contaminated Sites

Site #	Type	Location	UST Facility ID #	Property Owner	UST Owner	Anticipated Impacts	Anticipated Severity	Comments
1	UST	3948 Caratoke Hwy	0-011789	7-11 Inc	7-11 Inc.	Petroleum contaminated soils	Low	(US 158 to NC 168 Widening) Current gas station GWI # 20049
2	UST	4178 Caratoke Hwy	0-001907	Mary B. Poyner	Poyner Auto Service	Petroleum contaminated soils	Low	(US 158 to NC 168 Widening) Former Barco Esso
3	UST	4306 Caratoke Hwy	0-011515	Ralph H. Lane	Eastern Fuels Inc	Petroleum contaminated soils	Low	(US 158 to NC 168 Widening) Current gas station Former Dixie Trading GWI # 13593
4	UST	4412 Caratoke Hwy	0-011571	Maira Enterprises	Maira Enterprises	Petroleum contaminated soils	Low	(US 158 to NC 168 Widening) Current gas station Formerly Duck-N # 1 GWI # 8479
5	UST	4473 Caratoke Hwy	0-011903	Midcounty Properties, LLC	Paul & Nancy Arvanitis	Petroleum contaminated soils	Low	(US 158 to NC 168 Widening) Current gas station GWI # 31533
6	UST	4510 Caratoke Hwy	N/A	Jo Anne S. Hayman	Jo Anne S. Hayman	Petroleum contaminated soils	Low	(US 158 to NC 168 Widening) Underground Heating Oil Tank
7	UST	4511 Caratoke Hwy	0-034349	C. Kevin and Cynthia Spain	Eastern Fuels Inc	Petroleum contaminated soils	Low	(US 158 to NC 168 Widening) Current gas station

8	UST	4529 Caratoke Hwy	0-036321	Quality Oil Company	Quality Oil Company	Petroleum contaminated soils	Low	(US 158 to NC 168 Widening) Current gas station
9	Auto Repair and Junk yard	4901 Caratoke Hwy	N/A	Earl and Loretta Mason	Earl and Loretta Mason	Petroleum contaminated soils, batteries, tires, solvents	Low To Medium	(US 158 Intersection) Junk Yard
10	UST	4952 Caratoke Hwy	0-024772	Barco and Cage Inc	Barco and Cage Inc	Petroleum contaminated soils	Low	(US 158 Intersection) Current gas station Facility may be closed
11	Auto Repair and Junk Yard	4987/4995 Caratoke Hwy	N/A	David A. Baldwin	David A. Baldwin	Petroleum contaminated soils, batteries, tires, solvents	Medium	(US 158 Intersection) Junk yard
12	UST	814 Ocean Trail Corolla	0-036347	OB Gas LLC	OB Gas LLC	Petroleum contaminated soils	Low	(Bridge corridor on NC 12) Current gas station
13	UST	790 Ocean Trail	0-033608	T B Shops LLC	MDC Assoc. Inc	Petroleum contaminated soils	Low	(Bridge corridor on NC 12) Current gas station

Appendix B

Site Photographs
December 10, 2007

Site 1: 7-Eleven

Site 2: Poyner Auto Service

Site 3: Currituck Sports.

Site 4: Coinjock Exxon

Site 5: Nancy's Mini Mart

Site 6: J. I. Hayman Hardware

Site 7: Citgo (Coinjock Amoco)

Site 8: Coinjock Gas House

Site 9: Coinjock Automotive

Site 9: Coinjock Automotive

Site 9: Coinjock Automotive

Site 10: Henry's

Site 11: Precision Auto Center

Site 11: Precision Auto Center

Site 11: Precision Auto Center

Site 11: Precision Auto Center

	
Site 12: OB Gas	**Site 13:** Brew Thru

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION

MICHAEL F. EASLEY
GOVERNOR

LYNDO TIPPETT
SECRETARY

December 2, 2008

MEMORANDUM TO: Steve DeWitt, PE
Chief Engineer
Turnpike Authority

FROM: Terry W. Fox, LG
GeoEnvironmental Project Manager
GeoEnvironmental Section
Geotechnical Engineering Unit

TIP NO: R-2576
WBS: 34470.1.TA1
COUNTY: Currituck
DESCRIPTION: Mid-Currituck Bridge Additional Project Study Area

SUBJECT: **Hazardous Materials Report**

The GeoEnvironmental Section of the Geotechnical Engineering Unit has investigated the above referenced project to identify hazardous material sites for inclusion in the environmental document.

HAZARDOUS MATERIALS EVALUATION

Purpose

This section presents the results of a hazardous material evaluation conducted along the above referenced project. The main purpose of this investigation is to identify properties within the project study area that are or may be contaminated and therefore result in increased project costs and future liability if acquired by the Department. Hazardous material impacts may include, but are not limited to, active and abandoned underground storage tank (UST) sites, hazardous waste sites, regulated landfills and unregulated dumpsites.

MAILING ADDRESS:
NC DEPARTMENT OF TRANSPORTATION
GEOTECHNICAL ENGINEERING UNIT
GEOENVIRONMENTAL SECTION
1589 MAIL SERVICE CENTER
RALEIGH NC 27699-1589

TELEPHONE: 919-250-4088
FAX: 919-250-4237

WEBSITE: WWW.DOH.DOT.STATE.NC.US

LOCATION:
CENTURY CENTER COMPLEX
BUILDING B
1020 BIRCH RIDGE DRIVE
RALEIGH NC 27610

Techniques/Methodologies

The Geographical Information System (GIS) was consulted to identify known sites of concern in relation to the project corridor. Geotechnical Engineering Unit personnel conducted a field reconnaissance along the three additional study areas on January 8 and October 14, 2008. Study Area One(NC 12 from Currituck Drive to US 158, Study Area Two(6-8 lane superstreet on US 158 from Wright Memorial Bridge to NC 12) and Study Area Three (Symmetrical widening for a 12' outbound lane on US 158 from the Wright Memorial Bridge to Aydlette Rd). A search of appropriate environmental agencies' databases was performed to assist in evaluating sites identified during this study.

Findings

UST Facilities

Based on our study, one (1) site may contain petroleum USTs within Study Area One.
Two (2) sites are within Study Area Two and ten (10) sites within Study Area Three, but are well outside of the existing right of way.

Hazardous Waste Sites

No Hazardous Waste Sites were identified within the three study areas.

Landfills

No apparent landfills were identified within the three study areas.

Other GeoEnvironmental Concerns

Three (3) other geoenvironmental concerns (all junk yards) were identified within Study Area Three.

Anticipated Impacts

One (1) possible UST facility was identified within Study Area One. We anticipate low monetary and scheduling impacts resulting from this site. The fifteen (15) other sites are within the other two study areas but are believed to be well outside the existing right-of-way and will not impact this project. (See the following table and appendices for details)

The Geotechnical Engineering Unit can provide soil assessments on each of the above properties before right of way acquisition. Please note that discovery of additional sites not recorded by regulatory agencies and not reasonably discernable during the project reconnaissance may occur. The Geotechnical Engineering Unit should be notified immediately after discovery of such sites so their potential impact(s) may be assessed.

If there are questions regarding the geoenvironmental issues, please contact me, at 919-250-4088.

Known and Potential Hazardous Material Sites

1) **Property Name**
Han-Dee Hugos 23
5361 Virginia Dare Trail
Kitty Hawk, NC 27949

Facility ID #: 0-023323

Property Owner:
Cape Oil Corp.
109 43rd Street
Virginia Beach, VA 23451

UST Owner:
Cape Oil Corp.
109 43rd Street
Virginia Beach, VA 23451

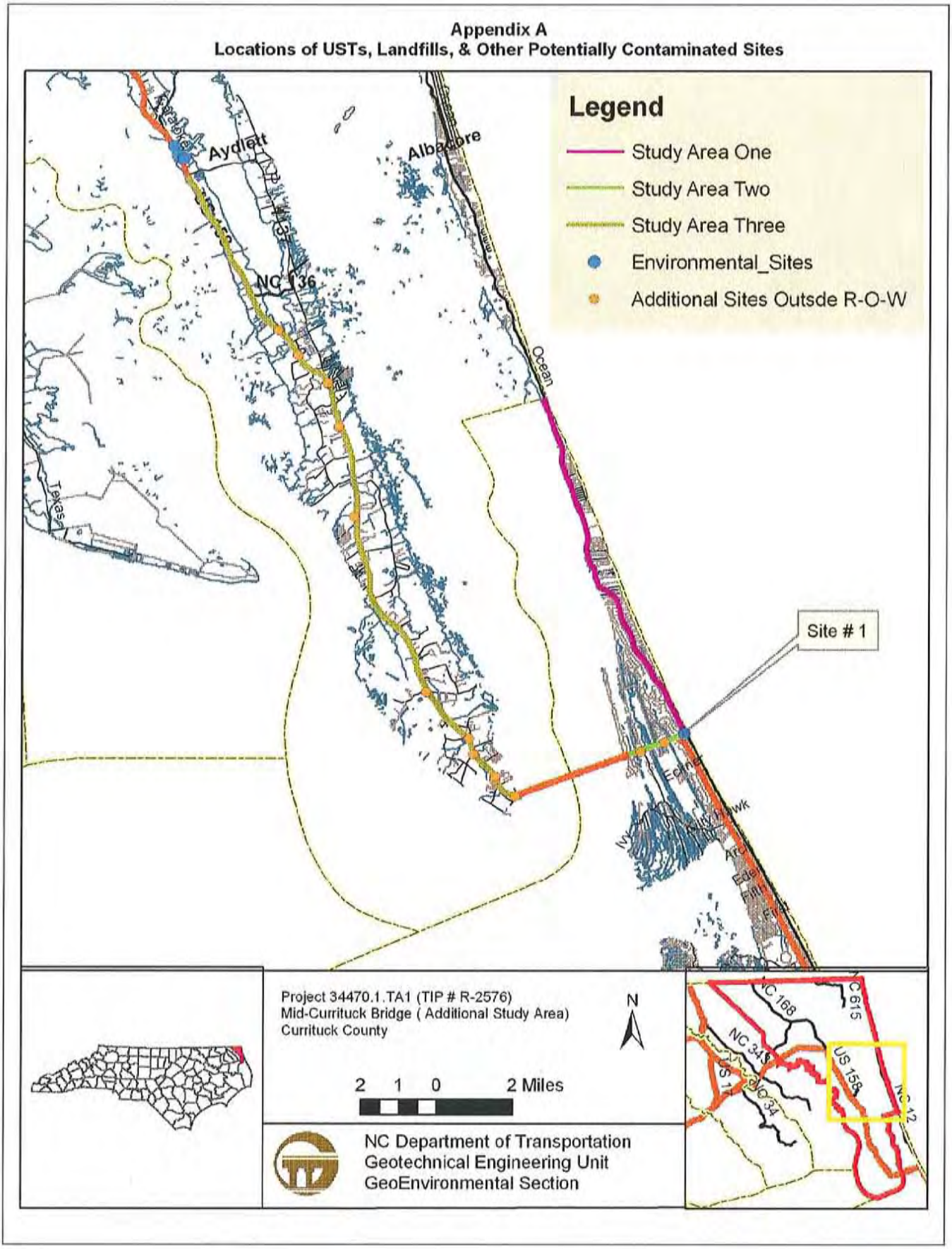
This facility currently operates as a convenience store & gas station. It is located in the northeast quadrant of Croatan Hwy and NC 12 intersection. The tank bed is located approximately 90 feet from the edge of pavement. According to the UST Section registry there are three (3) tanks currently in use. **This site is anticipated to present low geoenvironmental impacts to the project.**

Additional Sites Within Study Area's Two and Three

Address	Property Owner	Facility Type	Risk
5424 N.Croatan Hwy	Eckard Land Holding Co	UST	Low
6100 N. Croatan Hwy	Billy G.Roughton	UST	Low
9142-D Caratoke Hwy	Florez Designers Inc	UST	Low
9026 Caratoke Hwy	Jody E. Midgette	Junk yard	Low
8981 Caratoke Hwy	Sunny's Partnership	UST	Low
8808 Caratoke Hwy	W. Norman Newbern Jr.	UST	Low
8717 Caratoke Hwy	Sarah Elizabeth Forbes	UST	Low
8364 Caratoke Hwy	Jonathan D. St Leger	UST	Low
7278 Caratoke Hwy	Randy Spruill	Junk Yard	Low
6758 Caratoke Hwy	Old Brothers LLC	UST	Low
6520 Caratoke Hwy	Douglas & Michelle Haubold	UST	Low
6511 Caratoke Hwy	Key Properties LLC	UST	Low
110 Forbes Loop Rd	Sampson Bladen Oil Co	UST	Low
6265 Caratoke Hwy	Quintin & Rebecca Adams	UST	Low
6093 Caratoke Hwy	Rufus Jones	Junk Yard	Low

cc:
Dewayne Sykes, PE, Roadway Design
Mike Kinlaw, Division 1 Right of Way
K.J. Kim, PE, Eastern Regional Geotechnical Office
File

Appendix A
Locations of USTs, Landfills, & Other Potentially Contaminated Sites



Appendix B
Site Photograph

Site 1: Han-Dee Hugos 23. View to the northwest.