APPENDIX A: PREPARERS AND CONSULTANTS

David Libman, Planning Team Leader, NPS, Southeast Region
Ben West, Chief, Planning and Compliance Division, NPS, Southeast Region
Richard Sussman, Chief (retired), Planning and Compliance Division, NPS, Southeast Region
Amy Wirsching, Planner, NPS, Southeast Region
Mark Kinzer, Environmental Protection Specialist, Southeast Region
Jami Hammond, Regional Environmental Coordinator, Southeast Region
Cynthia Walton, Historian, Southeast Region
Zackary Ray, former Graduate Student Intern, NPS, Southeast Region
Gordon Wilson, Superintendent, Fort Matanzas NM
Andrew Rich, Site Manager, Fort Matanzas NM
Linda Chandler, Park Ranger (retired), Interpretation, Fort Matanzas NM
Jehu Walker, Facility Manager (retired), Fort Matanzas NM

Consultants:
Timothy Pinion, NPS, Southeast Region, Wildlife Biologist
Brian Coffey, NPS, Southeast Region, Historian
John Milio, U.S. Fish and Wildlife Service, North Florida Ecological Services Office
Michael Stevens, U.S. Department of the Interior, Office of the Regional Solicitor, Attorney
Kelly Donahue, NPS, Denver Service Center, Planning
Susan McPartland, NPS, Denver Service Center, Planning
Joanne Cody, NPS, Denver Service Center, Design and Construction

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APPENDIX B: SERVICEWIDE MANDATES AND POLICIES

Laws and executive orders that apply to the management of Fort Matanzas National Monument are provided below.

FORT MATANZAS NATIONAL MONUMENT SPECIFIC LEGISLATION AND EXECUTIVE ORDERS

Presidential Proclamation No. 1713 (43 Stat. 1968), October 15, 1924 – Established Fort Matanzas National Monument under the authority of the Antiquities Act of 1906 (16 USC 431–433).

Executive Order No. 6166 of June 10, 1933 and Executive Order No. 6228 of July 28, 1933 (5 U.S.C Secs. 124-132) transferred Fort Matanzas National Monument from the War Department to the National Park Service.

Presidential Proclamation No. 2114 (49 Stat. 3433), January 9, 1935 – Expanded the boundaries of the Fort Matanzas NM on Anastasia Island.

Presidential Proclamation No. 2773 (62 Stat. 1491), March 24, 1948 – Expanded the boundary of Fort Matanzas NM on Rattlesnake Island.

Public Law 106-524 (114 Stat. 2493), November 22, 2000 – Expanded the boundary of Fort Matanzas NM by 70 acres to include land previously donated during the 1960s.

Executive Order No. 11644 of February 8, 1972 established limits and prohibitions on the use of off-road vehicles on public (Federal) lands.

Executive Order No. 11989 of May 24, 1977 amended Executive Order No. 11644.

Executive Order No. 13186 of January 10, 2001 established responsibilities of Federal Agencies to protect migratory birds.

NATIONAL PARK SERVICE ENABLING LEGISLATION

Act of August 25, 1916 (National Park Service Organic Act); Public Law 64-235; 16 United States Code Section 1 et seq. as amended

Reorganization Act of March 3, 1933; 47 Stat. 1517

General Authorities Act, October 7, 1976; Public Law 94-458; 90 Stat. 1939; 16 United States Code 1a-1 et seq.

Act amending the Act of October 2, 1968 (commonly called Redwoods Act), March 27, 1978; Public Law 95-250; 92 Stat. 163; 16 United States Code Subsection(s) 1a-1, 79a-q

National Parks and Recreation Act, November 10, 1978; Public Law 95-625; 92 Stat. 3467; 16 United States Code 1 et seq.

OTHER LAWS AFFECTING NPS OPERATIONS

Accessibility

Architectural Barriers Act of 1968; Public Law 90-480; 82 Stat. 718; 42 United States Code 4151 et seq.

Rehabilitation Act of 1973; Public Law 93-112; 87 Stat. 357; 29 United States Code 701 et seq. as amended by the Rehabilitation Act Amendments of 1974; 88 Stat. 1617

Cultural Resources

American Indian Religious Freedom Act; Public Law 95-341; 92 Stat. 469; 42 United States Code 1996

Antiquities Act of 1906; Public Law 59-209; 34 Stat. 225; 16 United States Code 432; 43 CFR 3

Archeological and Historic Preservation Act of 1974; Public Law 93-291; 88 Stat. 174; 16 United States Code 469

Archeological Resources Protection Act of 1979; Public Law 96-95; 93 Stat. 712; 16 United States Code 470aa et seq.; 43 CFR 7, subparts A and B; 36 CFR 79

Indian Sacred Sites. Executive Order 13007. 3 CFR 196 (1997).

National Historic Preservation Act as amended; Public Law 89-665; 80 Stat. 915; 16 United States Code 470 et seq.; 36 CFR 18, 60, 61, 63, 65, 79, 800

Protection of Historic and Cultural Properties, Executive Order 11593; 36 CFR 60, 61, 63, 800; 44 Federal Register 6068

Public Buildings Cooperative Use Act of 1976; Public Law 94-541; 90 Stat. 2505; 42 United States Code 4151-4156

Natural Resources

Analysis of Impacts on Prime or Unique Agricultural Lands in Implementing the National Environmental Policy Act; E.S. 80-3, 08/11/80, 45 Federal Register 59109

Clean Air Act as amended; Public Law Chapter 360; 69 Stat. 322; 42 United States Code 7401 et seq.

Coastal Zone Management Act of 1972 as amended; Public Law 92-583; 86 Stat. 1280; 16 United States Code 1451 et seq.

Endangered Species Act of 1973, as amended; Public Law 93-205; 87 Stat. 884; 16 United States Code 1531 et seq.

Executive Order 11988: Floodplain Management; 42 Federal Register 26951; 3 CFR 121 (Supp 177)

Executive Order 11990: Protection of Wetlands; 42 Federal Register 26961; 3 CFR 121 (Supp 177)

Executive Order 11991: Protection and Enhancement of Environmental Quality

Executive Order 12898: Environmental Justice

Federal Caves Resource Protection Act of 1988

Federal Insecticide, Fungicide, and Rodenticide Act; Public Law 92-516; 86 Stat. 973; 7 United States Code 136 et seq.

Federal Water Pollution Control Act (commonly referred to as Clean Water Act); Public Law 92-500; 33 United States Code 1251 et seq. as amended by the Clean Water Act; Public Law 95-217

Fish and Wildlife Coordination Act of 1958 as amended; Public Law 85-624; 72 Stat. 563; 16 United States Code 661 et seq.

Migratory Bird Conservation Act; Public Law Chapter 257; 45 Stat. 1222; 16 United States Code 715 et seq.

Migratory Bird Treaty Act of 1918; Public Law 186; 40 Stat. 755

Magnuson-Stevens Fishery Conservation and Management Act

National Environmental Policy Act of 1969; Public Law 91-190; 83 Stat. 852; 42 United States Code 4321 et seq.

National Park System Final Procedures for Implementing Executive Order. 11988 and 11990 (45 Federal Register 35916 as revised by 47 Federal Register 36718)

Protection and Enhancement of Environmental Quality; Executive Order 11514 as amended, 1970; Executive Order 11991; 35 Federal Register 4247; 1977; 42 Federal Register 26967)

Resource Conservation and Recovery Act; Public Law 94-580; 30 Stat. 1148; 42 United States Code 6901 et seq.

Rivers and Harbors Act of 1899; 33 United States Code Chapter 425, as amended by Public Law 97-332, October 15, 1982 and Public Law 97-449; 33 United States Code 401-403

Water Resources Planning Act of 1965 (Public Law 89-80; 42 United States Code 1962 et seq.) and Water Resource Council's Principles and Standards; 44 Federal Register 723977

Watershed Protection and Flood Prevention Act; Public Law 92-419; 68 Stat. 666; 16 United States Code 100186

Other

Administrative Procedures Act; 5 United States Code 551-559, 701-706

Concessions Policy Act of 1965; Public Law 89-249; 79 Stat. 969; 16 United States Code 20 et seq.

Department of Transportation Act of 1966; Public Law 89-670; 80 Stat. 931; 49 United States Code 303

Energy Supply and Environmental Coordination Act of 1974

Executive Order 12003: Energy Policy and Conservation; 3 CFR 134 (Supp 1977); 42 United States Code 2601

Executive Order 12088: Federal Compliance with Pollution Control Standards

Executive Order 12372: Intergovernmental Review of Federal Programs; 47 Federal Register 30959

Executive Order 13514 (2009) Federal Leadership in Environmental, Energy, and Economic

Performance and Executive Order 13653 (2013), Preparing the United States for the Impacts of Climate Change 9also, relevant Secretarial Orders 3285 (2009) 3289(2010))

Farmland Protection Policy Act PL-97-98

Forest and Rangeland Renewable Resources Planning Act; Public Law 95-307; 92 Stat. 353; 16 United States Code 1600 et seq.

Freedom of Information Act; Public Law 93-502; 5 United States Code 552 et seq.

Intergovernmental Cooperation Act of 1968; Public Law 90-577; 40 United States Code 531-535 and 31 United States Code 6501-6508

Intergovernmental Coordination Act of 1969; 42 United States Code 4101, 4231, 4233

Noise Control Act of 1972 as amended; Public Law 92-574; 42 United States Code 4901 et seq.

Outdoor Recreation Coordination Act of 1963; Public Law 88-29; 77 Stat. 49

Payment in Lieu of Taxes Act; Public Law 94-565; 90 Stat. 2662; 31 United States Code 6901 et seq.

Surface Transportation Assistance Act of 1982; 96 Stat. 2097; 23 United States Code 101; and many others

Wildfire Disaster Recovery Act; Public Law 101-286

Management Polices 2006

This is an update to the *2001 Management Policies*. The policies are derived from the laws that have been enacted to establish and govern the NPS and the National Park System. This document serves as the basic, Servicewide policy manual used by park superintendents and other NPS managers to guide their decision-making. The manual prescribes policies which enable the NPS to preserve park resources and values unimpaired for the enjoyment of future generations, as required by law. The policies have been updated to keep pace with new laws that have been enacted, changes in technology and American demographics, and new understandings of the kinds of actions that are required to best protect the natural and cultural resources of the parks. The policies stress the importance of: using the parks for educational purposes; demonstrating environmental leadership in the parks; managing park facilities and resources in ways that will sustain them for future generations of Americans to enjoy; and working with partners to help accomplish the NPS mission. The new Management Policies is available on the NPS website at http://www.nps.gov/policy/MP2006.pdf .

Director's Order #12

Director's Order #12 describes the policy and procedures by which the NPS will comply with NEPA. The Council on Environmental Quality, part of the Executive Office of the President, is the "caretaker" of National Environmental Policy Act. The National Park Service is required to abide by all National Environmental Policy Act regulations (40 CFR 1500-1508) and any other procedures and requirements imposed by other higher authorities, such as the Department of the Interior.

Director's Order #24

Director's Order #24: Museum Collections Management Director's Order 24 lays the foundation by which the NPS meets its responsibilities toward museum collections. This Director's Order provides policy guidance, standards, and requirements for preserving, protecting, documenting, and providing access to, and use of, NPS museum collections.

Director's Order #28 (NPS 1998e)

Director's Order #28, issued pursuant to 16 United States Code (1 through 4), addresses cultural resource management. The National Park Service will protect and manage cultural resources in its custody through effective research, planning, and stewardship and in accordance with the policies and principles contained in the NPS Management Policies 2006.

Director's Order #28A

Director's Order #28A: Archeology provides a management framework for planning, reviewing, and undertaking archeological activities and other activities that may affect archeological resources within the National Park System.

Director's Order # 47

Director's Order #47, Soundscape Preservation and Noise Management, articulates NPS operational policies that will require, to the fullest extent practicable, the protection, maintenance, or

restoration of the natural soundscape resource in a condition unimpaired by inappropriate or excessive noise sources.

Director's Order #75A

Director's Order #75A, Civic Engagement and Public Involvement, clarifies and strengthens the commitment of the NPS to legally require public involvement and participation as it relates to accomplishing its mission and management responsibilities under the NPS Organic Act of 1916.

Directors Order #77-1

Directors Order #77-1, Wetland Protection, establishes NPS policies, requirements, and standards for implementing Executive Order (E.O.) 11990: "Protection of Wetlands" (42 Fed. Reg. 26961). E.O. 11990 was issued by President Carter in 1977 in order "…to avoid to the extent possible the long and short-term adverse impacts associated with the destruction or modification of wetlands and to avoid direct or indirect support of new construction in wetlands wherever there is a practicable alternative...."

Directors Order #77-2

Directors Order #77-2, Floodplain Management, applies to all NPS proposed actions, including the direct and indirect support of floodplain development, that could adversely affect the natural resources and functions of floodplains, including coastal floodplains, or increase flood risks. This Director's Order also applies to existing actions when they are the subjects of regularly occurring updates of NPS planning documents.

This Director's Order does not apply to historic or archeological structures, sites, or artifacts whose location is integral to their significance or to certain actions as specifically identified in Procedural Manual 77-2.

APPENDIX C: STATEMENT OF FLOODPLAIN FINDINGS

Statement of Findings for
Executive Order 11988, "Floodplain Management"
Fort Matanzas National Monument
General Management Plan

Recommended:

Gordon J Wilson — 03/13/2013

Superintendent, Fort Matanzas National Monument — Date

Concurred:

J. Edwin Adams — 3/21/13

Chief, Water Resources Division — Date

Approved:

[signature] — 4/4/13

Director, Southeast Region — Date

INTRODUCTION

In accordance with Executive Order 11988, "Floodplain Management" and National Park Service Director's Order Number 77-2 (NPS DO 77-2), the National Park Service has reviewed the flood hazards in Fort Matanzas National Monument (Monument) and has prepared this "Statement of Findings" (SOF).

In examining the Monument, the structures at the following sites were identified as being within a regulatory 100-year floodplain:

- The coquina watchtower structure on Rattlesnake Island;
- The visitor center complex on Anastasia Island;
- the Johnson House on Anastasia Island;
- road segments;
- two parking areas;
- archeological sites; and
- docks.

It is important to note that NPS DO 77-2 does not apply to historic or archeological structures, sites, or artifacts whose location is integral to their significance.

There are no other occupied structures within a regulatory floodplain at these sites that warrant inclusion in this flood hazard assessment.

This "Statement of Findings" focuses on evaluating the flood hazards for the aforementioned structures in the 100-year floodplain. As a part of the effort to develop a general management plan (GMP) for the Monument, the "Statement of Findings" describes the flood hazard, alternatives, and possible mitigation measures for the continued use of this area. Additional detail regarding the Monument lands and resources, future actions to be taken in the area, and environmental impacts may be found in the *Final General Management / Environmental Impact Statement* (GMP/EIS).

DESCRIPTION OF THE SITES AND USES

The following inventory of structures in the floodplain at Fort Matanzas National Monument is taken in large part from the monument's List of Classified Structures (LCS). The LCS is an evaluated inventory of all historic and prehistoric structures within the National Monument boundary that have historical, architectural, and/or engineering significance. The structures on the LCS include Fort Matanzas on Rattlesnake Island. Other structures are in the regulatory 100-year floodplain under NPS ownership, but are not included in the LCS.

List of Classified Structures. Fort Matanzas: LCS ID Number 000350

Fort Matanzas is a coquina masonry structure with a square plan, 120' on a side. Scarp walls 12' high rise to a terreplein, with sentry box at southwest, which covers 2/3 of the base. On the western third is a 30' tower with a rooftop observation platform.

Fort Matanzas is nationally significant as an example of an eighteenth-century Spanish fortification and for its associations with the period of rivalry between Spain, France, and England for control of North America.

Archeological Sites.

Archeological sites and descriptions are listed in the table below.

TABLE 19 – ARCHEOLOGICAL SITES

Site #	Site Name	Location	Description
8SJ28	North Midden	Rattlesnake Island, north of the fort	Shell midden containing artifacts related to the Spanish and British occupations of Fort Matanzas

Site #	Site Name	Location	Description
8SJ44B	Fort Matanzas	Rattlesnake Island	The site number refers to the archeological materials that are related to, but distinct from, the fort
8SJ90	Pompano Farm Midden	Anastasia Island, northern park boundary	Prehistoric shell midden
8SJ3231	West Midden	Rattlesnake Island, west of the fort	Shell midden with artifacts related to the Spanish and British periods of occupation
8SJ3233	Johnson House	Anastasia Island	Prehistoric and historic artifact scatter
8SJ3225	Visitor Center Site	Anastasia Island, parking lot vicinity	Prehistoric and historic midden; camp site
N/A	Marker Midden	Anastasia Island, at massacre marker	Prehistoric artifact scatter

Other Structures

Headquarters and Visitor Center. The Headquarters and Visitor Center (HQ/VC) is located on Anastasia Island, on the west side of Highway A1A. The HQ/VC consists of two buildings: a multi-use building that serves as both the primary visitor contact point and park housing, and a secondary utility building that now serves as a ranger office. The main building is two stories, intersected by an arched breezeway on the ground level. The exterior walls on the first floor are constructed of coquina block masonry. The second floor is of wood frame construction faced with wood siding. The secondary utility building is located 50 feet to the north of the main building.

Johnson House. In the 1960s, the scope of the park was greatly expanded with the donation by the Johnson family of most of the southern end of Anastasia Island, including the ocean side beaches, dunes, and maritime forests bisected by Highway A1A. Included in this donation was the Johnson family residence, which is located a few hundred feet south of the visitor center. The two-story house is currently used as park housing and is in good condition.

The Johnson House is somewhat rambling and features a large number of double-hung sash windows. The house is constructed of wood and brick with a roof composed of asphalt shingled gables. The west side of the house features an elongated covered porch that faces out to a lawn and the Matanzas River beyond. It is believed that there are portions of the house that date back more than 50 years. Additional research is necessary to determine the history and age of the structure.

GENERAL CHARACTERIZATION OF THE NATURE OF FLOODING AND FLOODPLAIN PROCESSES IN THE AREA

Structures located in Fort Matanzas National Monument are dispersed across two islands, separated by the Matanzas River, and bordered by the Intracoastal Waterway and the Atlantic Ocean. A variety of flood hazard zones including, 100-year flood hazard zones, are dispersed throughout the National Monument. A levee protects Florida State Road A1A, which bisects Anastasia Island. The levee removes SR AIA, flood hazard zone X, from the 100-year floodplain. Immediately west of A1A is an elevated strip of land, flood hazard zone X, also removed from the 100-year floodplain on which the visitor center and maintenance facility is located. East of SR A1A is flood hazard zoned VE vulnerable to coastal flooding and wave velocity hazard. The remainder of Anastasia Island has a measured base flood elevation in the 100-year flood hazard zone AE. NPS structures include the Johnson House, road segments, docks, three parking areas,

and archeological sites. (Source: *St. Johns County Flood Zone Map dated 9/10/2008,* St. Johns County Graphic Information Systems Division – Data Source – Federal Emergency Management Agency [FEMA] 9-2-2004)

Rattlesnake Island is completely located within the 100-year flood hazard zone with the exception of a small higher elevation area well away from NPS structures. Fort Matanzas and documented archeological sites on Rattlesnake Island are located in the 100-year flood hazard zone AE. Both shorelines of the Matanzas River are constantly affected by tidal flows, which change four times daily with maximum tidal currents in excess of 5 knots and a tidal amplitude of 3 to 3.5 feet. High tides in the spring and fall flood portions of Rattlesnake Island several times annually.

The National Oceanic and Atmospheric Administration (NOAA) collects oceanographic and meteorological data (historical and real-time) from stations on major water bodies throughout the country. NOAA has specifically collected historical (limited) high/low water level data at two stations in the vicinity of Fort Matanzas: one station (8720651) is located approximately 5 miles north of the fort on the Matanzas River in Crescent Beach, FL along the Route 206 bridge and the second station (8720692) is located at the Matanzas inlet (0.7 miles from the fort) along the Route A1A bridge. A data review of the minimum and maximum station elevations for both gauges from 2003 through 2005 provides a comparison for water elevations occurring at both locations (Table 1). The majority of the minimum values occurred between January and July of 2004 and the majority of the maximum values occurred from August through December of 2004. The maximum elevation value (ft) at the Crescent Beach station was 4.32 in September of 2004 and the minimum elevation value (ft) was -4.53 in April of 2004; this represents a maximum total elevation change in elevation of 8.85 ft in the Matanzas River at the Crescent Beach station in the year 2004. (Source: *Draft Environmental Assessment, Proposed Shoreline Stabilization Features and Boat Dock Replacement, Fort Matanzas National Monument*, National Park Service, June 2006).

JUSTIFICATION FOR USE OF THE FLOODPLAIN

Description of Preferred Alternative and Why Facilities Would Be Retained in the Floodplain

Under the preferred alternative in the general management plan, all of the structures currently maintained by the NPS, the Visitor Center, Johnson House, Fort Matanzas, archeological sites, and associated structures are located within the 100-year flooplain. The justification for retaining these structures in their existing locations in the 100-year floodplain is as follows:

- The National Park Service is required by law and policy to maintain all historic structures in their present locations. Existing administrative structures (e.g., park offices, maintenance facility, and visitor center) must remain on the island in order to manage resources effectively and serve visitors. The nearest non-floodplain site is miles away.
- Relocating the facilities and services at both sites may be infeasible and very costly, from both a financial cost perspective and from a level/quality of service perspective.
- All sites are located on disturbed ground. Moving the facilities would likely result in adverse impacts and the loss of other natural resource values in the area.

DESCRIPTION OF SITE-SPECIFIC FLOOD RISK

The potential for storm surge associated with hurricanes and tropical storms is the primary flood risk for the structures on Anastasia Island and Rattlesnake Island. Anastasia and Rattlesnake Islands lie between the Atlantic Ocean and the Intracoastal Waterway with the Matanzas Inlet separating the two islands. Therefore, if the banks of the Intracoastal Waterway, Matanzas Inlet, or Atlantic Ocean are overtopped by storm surge, the structures at the site might be flooded from several directions.

The timing and duration of potential flooding at Anastasia and Rattlesnake Islands would vary

depending on the intensity of the storm causing water levels to rise. Typically, tropical storms would arise with sufficient advance warning to give persons working on the island hours or days to evacuate.

Because of the site's location on the Matanzas Inlet, there are notable issues related to surface erosion and sediment deposition that could result from flooding. There could be some sediment and debris deposition at this site as a result of storm surge, and storm surge would likely have the energy to produce detectable erosion or channelization. Hydrologic changes resulting from geomorphic and erosion processes could occur, particularly in the form of channel changes to the Matanzas Inlet or Intracoastal Waterway.

FLOOD MITIGATION MEASURES

The highest level of flood mitigation for Anastasia and Rattlesnake Islands would be to relocate the facilities and/or services out of the floodplain, i.e., off of the islands. This option is not currently feasible and has several costs associated with it. Thus, this option has not been chosen by the NPS. If or when non-historic structures reach their usable lifespan, or if a future flood results in severe damage, then the NPS should assess possibilities for relocating the facilities.

The continued use of Anastasia and Rattlesnake Island, would necessitate the development (and future implementation) of an evacuation plan for the site. Given the nature of the flood risks associated with use of the island, the primary flood mitigation measure available to the NPS is the early, prompt, and safe evacuation of people working on the site. An evacuation plan would include strategies that ensure proper storm monitoring, emergency communication methods, effective evacuation routes, and timely emergency evacuation notification for staff and visitors.

Because the island is connected by bridge to Florida State Road A1A, a convenient evacuation routes is available to staff or visitors on the island. Evacuees could seek higher ground by driving north or south along Florida State Road A1A to westerly roads running inland.

The plan would be developed in concert with the protocol and strategy of the existing St. Johns County emergency management system and the National Weather Service. This St. Johns County emergency management system is already well developed and has proven to be very successful at providing people in the area with advanced warning of potential floods. During past floods, this emergency management system has given warning well in advance of storm activity, leaving ample time for evacuation.

Once the plan is developed, all staff of the monument would be informed of the plan's details and their respective implementation responsibilities. Staff at all facilities would also be informed on how to appropriately disseminate evacuation information to visitors who may be at any of the facilities when a flood occurs.

SUMMARY

The National Park Service has determined that there is no practicable alternative to maintaining the historic and administrative structures currently in use at Fort Matanzas National Monument. This determination is primarily based on the necessity of these facilities remaining in place to fulfill their essential functions, and the notable costs and impacts that would be incurred by moving and/or constructing these facilities in new locations outside the floodplain.

The primary flood mitigation measure for Fort Matanzas National Monument is to develop an evacuation plan for all facilities at monument sites and keep all NPS staff informed of the plan. Although the sites are within areas subject to flooding, there would be ample time to warn staff and visitors using the facilities to evacuate the area. If a flood occurs, visitors and staff could evacuate to higher ground via Florida State Road A1A.

APPENDIX D: DESCRIPTIONS OF FEDERAL AND STATE PROTECTED SPECIES

FEDERALLY PROTECTED SPECIES

TABLE 20 - FEDERALLY PROTECTED THREATENED AND ENDANGERED SPECIES AT FORT MATANZAS

Scientific Name	Common Name	Federal Status	Federal Agency with Jurisdiction
Birds			
Charadrius melodius	Piping plover	Threatened	USFWS
Mycteria americana	Wood stork	Endangered	USFWS
Mammals			
Peromyscus polionotus phasma	Anastasia Island Beach Mouse	Endangered	USFWS
Trichechus manatus latirostris	West Indian (Florida) Manatee	Endangered/Critical Habitat Designated	USFWS
Reptiles			
Caretta caretta	Loggerhead sea turtle	Threatened	USFWS/NMFS
Drymarchon corais couperi	Eastern Indigo snake	Threatened	USFWS
Chelonia mydas	Green sea turtle	Endangered	USFWS/NMFS
Dermocheyls coriacea	Leatherback sea turtle	Endangered	USFWS/NMFS
Lepidochelys kempii turtle	Kemp's Ridley sea turtle	Endangered	USFWS/NMFS

Source: U.S. Fish & Wildlife Service, North Florida Ecological Services Office, Federally Listed Species Website: http://www.fws.gov/northflorida/CountyList/Johns.htm , (Accessed 12-15-2010).

Birds

Bald Eagle: The bald eagle is the second largest North American bird of prey, with an average 7-foot wingspan. Bald eagles are opportunistic foragers with a diet varying across a wide range based on prey species available. They prefer fish, but will eat a great variety of mammals, amphibians, crustaceans, and birds, including many species of waterfowl. Bald eagles are monogamous and thought to mate for life unless one mate dies. Bald eagles build large stick nests lined with soft materials that are used for several years by the same pair of eagles. In Florida, breeding behaviors commence in September, and young begin to fly at 11 or 12 weeks. The U.S. Fish and Wildlife Service has announced a final rule on two new permit regulations that would allow for the take of eagles and eagle nests under the Bald and Golden Eagle Protection Act (Eagle Act). The final rule should was published in the Federal Register on September 11, 2009.

Bald Eagles were removed from the endangered species list in June 2007 because their populations recovered sufficiently. However, the protections under the Eagle Act continue to apply. When the Bald Eagle was delisted, the Service proposed regulations to create a permit program to authorize limited take of Bald Eagles and Golden Eagles where take is associated with otherwise lawful activities.

The permits will authorize limited, non-purposeful take of Bald Eagles and Golden Eagles; authorizing individuals, companies, government agencies (including tribal governments), and other organizations to disturb or otherwise take eagles in the course of conducting lawful activities such as operating utilities and airports. Most permits issued under the new regulations would authorize *disturbance*. In limited cases, a permit may authorize the physical take of eagles, but only if every precaution is taken to avoid physical take. Removal of eagle nests would usually be allowed only when it is necessary to protect human safety or the eagles. (Source: U.S. Fish and Wildlife Service North Florida Field Office Website: http://www.fws.gov/migratorybirds/baldeagle.htm ; Accessed 12-13-2010)

Piping Plover: The piping plover is a small, stocky, sand-colored bird that resembles a sandpiper. Adults have yellow-orange legs, a black band across their foreheads from eye to eye, and a black ring around the base of their necks. The bird is named for its call notes, which are

often heard before the bird is actually seen. Piping plovers breed on coastal beaches in Canada. However, they winter primarily on the Atlantic coast from North Carolina to Florida, although some migrate to the Bahamas and West Indies. The 2009 Species Status Review of the piping plover from the U.S. Fish and Wildlife Service summarizes their situation as follows:

"Habitat loss and degradation on winter and migration grounds from shoreline and inlet stabilization efforts, both within and outside of designated critical habitat, remain a serious threat to all piping plover populations."

"The threats of habitat loss and degradation, when combined with the threat of sea-level rise associated with climate change (WM 2.2.2.5*), raise serious concerns regarding the ability of private beaches to support piping plovers over the long-term."
*This alphanumeric term refers to a section in the 2009 Species Status Review cited above.

"While public lands may not be at risk of habitat loss from private development, significant threats to piping plover habitat remain on many municipal, state, and federally owned properties. These public lands may be managed with competing missions that include conservation of imperiled species, but this goal frequently ranks below providing recreational enjoyment to the public, readiness training for the military, or energy development projects." (Source: "Piping Plover *(Charadrius melodus)* 5-Year Review: Summary and Evaluation", U.S. Fish and Wildlife Service, September 2009)

Wood Stork *(Mycteria Americana)*: The wood stork is a large, long-legged wading bird with white plumage except for iridescent black primary and secondary wing feathers and a short black tail. On adults, the rough, scaly skin of the head and neck is unfeathered and blackish in color, the legs are dark, and the feet are dull pink. The bill color is also blackish. It is the only stork to regularly occur and breed in the United States. Storks can be found feeding in shallow water in both freshwater and coastal wetlands, including tidal creeks and flats, marshes, cypress swamps, ponds, ditches, and flooded fields. The wood stork eats fish, small reptiles, amphibians, and mammals, as well as other aquatic organisms. It is more numerous in summer at Fort Matanzas, indicating a fall migration to South Florida. Spring migration occurs during March and April. Following breeding, adults and young disperse widely and are often noted well outside their normal breeding range.

The wood stork is listed as endangered on both the federal and state level. However, The U.S. Fish and Wildlife Service, on September 21, 2010, announced in the Federal Register a 90-day finding on a petition to reclassify the United States breeding population of the wood stork from endangered to threatened under the Endangered Species Act of 1973, as amended. Based on that review the Service found that the petition presented substantial scientific or commercial information indicating that reclassifying the U.S. breeding population of the wood stork to threatened may be warranted. Therefore, Fish and Wildlife Service biologists conducted a 12-month comprehensive review of the species status during 2012 and in January 2013 the Service proposed upgrading the wood stork's status from endangered to threatened. The Service solicited public comments with a closing date of February 2013 and as of August 2, 2013 a final determination on the final status has not been made (based on personal communication with Bill Brooks, U.S. Fish and Wildlife Service, Jacksonville, Florida).

Mammals

Anastasia Island Beach Mouse: The Anastasia Island beach mouse is listed as federally endangered. This mouse occurs primarily at the northern (Anastasia State Park and southern (Fort Matanzas) ends of its range, and at isolated sites in-between. This species inhabits sand dunes, which are vegetated by sea oats and dune panic grass. Sometimes the mice use the former burrows of ghost crabs, but they usually dig their own. Burrow entrances are typically found on the sloping side of a dune at the base of a clump of grass. The burrows are used for nesting and food storage as well as a refuge. Breeding activities start in November and end in early January. The beach mice are primarily threatened by beach and residential development, which has eliminated suitable habitat. (Source: *Anastasia Island Beach Mouse, 5-Year Review: Summary and Evaluation*, U.S. Fish and Wildlife Service, Jacksonville

Ecological Services Field Office, Southeast Region, September 6, 2007)

Marine Mammals

Blue Whale: Blue whales are the largest animals to have ever lived on the earth. They eat tiny organisms like plankton and krill and live in pods, or small groups. They have two blowholes and a 2-14 inch thick layer of blubber. These whales grow to around 80 feet long and can weigh up to 120 tons. Females are larger than males. Blue whale's flippers are 8 feet long and they are very fast swimmers. These whales inhabit all oceans worldwide, excluding the polar seas. They do not usually live near coasts. These whales are listed as endangered in both Florida and the rest of the United States. Packs of killer whales have been known to attack and kill young blue whales and man also over hunted blue whales until 1966 (NPCA 2005).

Finback Whale: Finback Whales are light grey with white bellies and occasional splashes of orange or yellow across the back. They do not lift their tails when diving and their blow is easily visible. They can grow to a maximum length of 24 m. and their diet consists of schooling fish and krill. They are the second largest baleen whale and are fast, difficult to follow when traveling and not particularly active at the surface. These whales are endangered on the state and Federal level (NPCA 2005).

Humpback Whale: Humpback whales grow to be around 40-60 feet and are dark with white underbellies and flippers. Their flippers can reach a length of 15 feet and they lift their tails when they dive. Their dive durations range from four to ten minutes or longer.
Humpback whales are very active at the surface and employ various means to fish such as bubble nets, bubble spirals, and their own flippers. These whales are endangered in both Florida and federally (NOAA 2005).

Right Whale: Northern right whales are now considered one of the most endangered large mammals in the world due to over hunting which ended in 1935. They are endangered both in Florida and federally. Today there are only around 300 right whales left, making them close to extinction. These whales grow to around 55 feet long and are black with a broad, flat back and no dorsal fin. Right whales have two blowholes and spout in a V-shaped blow. The right whale can grow up to 50 tons on a diet of zooplankton. These whales travel to the north Florida coast just off the shore at Fort Matanzas to give birth each year during the winter months. The waters of the southern U.S. are the only know calving ground for this species. This area is a small strip of water extending only 5-15 miles offshore from the Altamaha River in Georgia south to the Sebastian Inlet in Florida. Unfortunately, these waters contain shipping lanes and ports and today, collision with a ship causes 30 to 50 percent of whale deaths. (National Park Service, Fort Matanzas. Northern Right Whale Pamphlet).

Sei Whale: Sei whales can grow to a length of 15 m and are slate gray with occasional round scars. They do not lift their tails when diving and eat copepods and krill. These whales eat by skimming small plankton and are fast swimmers with a dive time of about 10 minutes. When they are on the surface, a "footprint" can be seen, which allows them to be tracked. These whales are endangered on both the state and federal level (NPCA 2005).

Sperm Whale: Sperm whales are tooth whales and live in pods. They have a single s- shaped blowhole that measures twenty inches long on the left side of their heads. The sperm whale has a four to 12 inch layer of blubber and they can grow to be 50 to 60 feet long and 40 to 50 tons, which makes them the largest of the toothed whales. Their four-chambered heart is an average of 277 pounds. Sperm whales survive on mostly a diet of large squid and can eat a ton of food a day. They are found in many open oceans, both tropical and cool waters. They live at the surface of the ocean, but dive deeply to feed. These whales are endangered on both a state and federal level (NOAA 2005).

West Indian Manatee: The manatee is a large, herbivorous, aquatic mammal that inhabits coastal waters and rivers. The West Indian manatee's range is from the southern United States throughout the Caribbean Islands, Central America, and to northern South America. In the United States the manatee ranges up the eastern coastline into Georgia, the Carolinas, and beyond during warm months. In the Gulf they are occasionally sighted as far west as Texas. During

cold months manatees in the southern United States migrate to the warm waters of south Florida, or find a source of warm water such as artesian springs or industrial discharges.

Adults are typically 9-10 feet long and weigh around 1000 pounds. However, they may grow to over 13 feet and weigh more than 3500 pounds. Adults are gray in color, with very sparse fine hairs distributed over much of the body. Stiff whiskers grow around the face and lips. Algae growing on the dermis may make them appear green or brown. They have two fore limbs, usually with 3 or 4 nails, that they use for slow movements and to grasp vegetation while eating. They have a rounded flattened tail for swimming. The nostrils, located on the upper surface of the snout, tightly close with valves when underwater. While they can hold their breath for up to 20 minutes they typically surface to breathe approximately every 3-5 minutes. Source: Florida Fish and Wildlife Commission website: http://myfwc.com/wildlifehabitats/profiles/mammals/aquatic-mammals/manatee/, Accessed 3-25-2011.

The West Indian (Florida) manatee is both federally and state endangered. However, the 5-Year Status Review of the West Indian Manatee, signed by the Regional Director of the U.S. Fish and Wildlife Service on April 6, 2007, recommended downlisting the species from endangered to threatened. As of January 26, 2011 no downlisting has occurred and the West Indian Manatee is still federally endangered.

The manatees are found in the Matanzas River in the spring and summer months. Observations of mating herds indicate that females mate with a number of males during their 2- to 4-week estrus period, and then they go through a pregnancy estimated to last 12 to 14 months (O'Shea 1992). Births occur during all months of the year with a slight drop during winter months. Manatees inhabit both salt and fresh water of sufficient depth (1.5 meters to usually less than 6 meters) throughout their range (FWCC 2005g). The aquatic habitats associated with the Matanzas River and the Matanzas Inlet are generally considered a part of the migratory corridor for this species rather than a long-term residence. This is because of the scarcity of sufficient forage and fresh water resources to support their extended habitation within the vicinity of Fort Matanzas National Monument.

Reptiles

Green Turtles: Green turtles live in estuarine and marine coastal and oceanic waters. These turtles come ashore at Fort Matanzas beaches from June to July to nest. Nesting occurs at night on the upper beach and sand dunes like the loggerhead. Hatchlings emerge and head toward sea approximately 60 days later from August through November. Large juveniles and adults feed on seagrasses and algae. Juveniles can be found in coastal bays, inlets, lagoons, and offshore warm reefs. The green turtle is listed as federally and state endangered. The 2007 Green Sea Turtle Endangered Species Act Five-Year Review recommended no change in the status of this species.

Kemp's Ridley Sea Turtle: The Kemp's Ridley sea turtle is both federally and state endangered. The 2007 Kemp's Ridley Sea Turtle Endangered Species Act Five-Year Review recommended no change in the status of this species. Female turtles lay their eggs on beaches along the east coast of Mexico. Occasionally this turtle has been found on the beaches of Fort Matanzas after being injured by shrimp trapping nets (King and Krysko 1999c).

Leatherback Sea Turtle: Leatherback sea turtles are the largest of the three sea turtles occurring on the beaches at Fort Matanzas. They live in oceanic waters and come ashore at Fort Matanzas to nest on the beaches during the summer months. Hatchlings emerge and head toward sea midsummer to early fall. They feed primarily on jellyfish. This turtle is listed as endangered at both the federal and state level (King and Krysko 1999b). The 2007 Leatherback Sea Turtle Endangered Species Act Five-Year Review recommended no change in the status of this species.

Loggerhead Sea Turtle: The National Marine Fisheries Service (U.S. Department of Commerce, National Oceanic and Atmospheric Administration) and the U.S. Fish and Wildlife Service (U.S. Department of the Interior) jointly determined that the loggerhead sea turtle (*Caretta caretta*) is composed of nine distinct population

segments (DPSs) that constitute ‘‘species’’ that may be listed as threatened or endangered under the Endangered Species Act (ESA). On September 22, 2011 the two agencies issued a final rule listing four DSPs as threatened and five DSPs as endangered under the ESA. Loggerheads that nest on Fort Matanzas National Monument belong to the Northwest Atlantic Ocean DPS and are listed as threatened. Loggerheads live in marine coastal and oceanic waters. These turtles come ashore at night to nest on the beach at Fort Matanzas during May through August. The females nest on the upper beach or in the dunes. Hatchlings emerge at night approximately 50-60 days later and find their way to the sea (July through November). Juveniles frequent coastal bays, inlets, and lagoons. Fort Matanzas is part of the largest loggerhead sea turtle rookery in the western Atlantic Ocean (FWCC 2005d).

Eastern Indigo Snake: The Eastern indigo snake is listed as threatened at both the state and Federal levels. The 2008 Eastern indigo snake Endangered Species Act Five-Year Review recommended no change in the status of this species. Average adult size is 60-74 inches (152-188 cm); record is 103.5 inches (262.8 cm). Adults are large and thick bodied. The body is glossy black and in sunlight has iridescent blue highlights. The chin and throat is reddish or white, and the color may extend down the body. The belly is cloudy orange and blue-gray. The scales on its back are smooth, but some individuals may possess some scales that are partially keeled. There are 17 dorsal scale rows at mid-body. The pupil is round. Juveniles are black-bodied with narrow whitish blue bands. Eastern indigo snakes can be found in almost any habitat in Florida. They are non-venomous. (Source: http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=C026 , Accessed 01/03/2011).

Fish

Shortnose Sturgeon: The shortnose sturgeon is one of the smallest varieties of sturgeons in the United States. This fish is listed as endangered in both the state of Florida and federally. This sturgeon only grows to a maximum of 3.5 feet in length and rarely reaches more than 14 pounds in weight. Unlike most fish that spawn every year, the shortnose male sturgeons spawn every other year, and females spawn every third year. These fish are bottom feeders, and consume sludge worms, aquatic insect larvae, plants, snails, shrimp, and crayfish. The shortnose sturgeon is restricted to the Atlantic seaboard in North America, and can be found from the Saint John’s River in New Brunswick to the Saint John River in Florida. A combination of factors has lead to the shortnose sturgeon’s endangered status, in the 1800 and early 1900s, many larger tidal rivers served as dumping grounds for pollutants that led to major oxygen depletions and high fish D-1 losses. Also, the great demand for sturgeon eggs (or caviar) and the fish’s smoked flesh have led to overexploitation of the sturgeon population (USFWS 2005).

Smalltooth Sawfish: The smalltooth sawfish is technically a ray; however this fish resembles a shark. It’s long, flat, snout or rostrum is embedded with sharp, tooth-like scales along both edges. Besides being found in the southeastern United States, they can be found in the Caribbean, Central America (along South America to mid Brazil), possibly in the Mediterranean Sea, along the African coast, and in the western Indo-Pacific. These fish can attain lengths of around 20 feet and weigh up to a ton. They are endangered both federally and in the state of Florida due to their tendency to become entangled in commercial fishing nets. At the same time, smalltooth sawfish can cause extensive damage with their teeth, so anglers have long regarded them as nuisances and there is a high tendency to kill them before these fish can cause any trouble (NOAA 2005).

Seagrasses

Johnson’s Seagrass: This seagrass thrives in coastal lagoons in the intertidal zone. They need sandy bottoms to grow and are often found in deeper waters with other varieties of seagrass. Johnson’s seagrass is only found in southeastern Florida (FWCC 2005a). It has short, elliptical leaves that grow in pairs. The leaves reach around 2.5 cm long and are up to 4 mm wide. These plants grow best in areas at high risk to damage from boat propellers and where there is water quality degradation. Johnson’s seagrass serves as a food resource for other threatened and endangered species such as the green sea turtle and the West Indian manatee. These plants do not

reproduce sexually; instead they spread their rhizomes. Due to limited range, high damage risk, and slow reproduction, these plants are considered threatened in Florida and on the federal level (NOAA 2005).

On November 8, 2010 new threatened species rules approved by the Florida Fish and Wildlife Commission went into effect. All federally listed species that occur in Florida are now included on Florida's list as federally-designated endangered or federally-designated threatened species. In addition, the state has a listing process to identify species that are not federally listed but at risk of extinction. These species will be called State-designated Threatened. All state-designated species were grandfathered on the list and are currently undergoing status reviews. FWC will continue to maintain a separate Species of Special Concern category until all the species have been reviewed and those species either designated as threatened or endangered are removed from the list.

SPECIES OF SPECIAL CONCERN

Fish

Atlantic sturgeon (*Acipenser oxyrinchus*)
Blackmouth shiner (*Notropis melanostomus*)
Bluenose shiner (*Pteronotropis welaka*)
Crystal darter (*Crystallaria asprella*)
Key silverside (*Menidia conchorum*)
Harlequin darter (*Etheostoma histrio*)
Lake Eustis pupfish (*Cyprinodon hubbsi*)
Rivulus (*Rivulus marmoratus*)
Saltmarsh topminnow (*Fundulus jenkinsi*)
Southern tessellated darter (*Etheostoma olmstedi maculaticeps*)

Amphibians

Florida bog frog (*Lithobates okaloosae*)
Georgia blind salamander (*Haideotriton wallacei*)
Gopher frog (*Lithobates capito*)
Pine Barrens treefrog (*Hyla andersonii*)

Reptiles

Alligator snapping turtle (*Macrochelys temminckii*)
Barbour's map turtle (*Graptemys barbouri*)
Florida brown snake (*Storeria victa*)-lower Keys population only
Florida Keys mole skink (*Eumeces egregius egregius*)
Florida pine snake (*Pituophis melanoleucus mugitus*)
Key ringneck snake (*Diadophis punctatus acricus*)
Peninsula ribbon snake (*Thamnophis sauritus sackenii*)-lower Keys population only
Red rat snake (*Elaphe guttata*)-lower Keys population only
Rim rock crowned snake (*Tantilla oolitica*)
Short-tailed snake (*Stilosoma extenuatum*)
Striped mud turtle (*Kinosternon baurii*)-lower Keys population only
Suwannee cooter (*Pseudemys suwanniensis*)

Birds

American oystercatcher (*Haematopus palliatus*)
Black skimmer (*Rynchops niger*)
Brown pelican (*Pelecanus occidentalis*)
Burrowing owl (*Athene cunicularia*)
Florida sandhill crane (*Grus canadensis pratensis*)
Least tern (*Sternula antillarum*)
Limpkin (*Aramus guarauna*)
Little blue heron (*Egretta caerulea*)
Marian's marsh wren (*Cistothorus palustris marianae*)
Osprey (*Pandion haliaetus*)-Monroe County population only
Reddish egret (*Egretta rufescens*)
Roseate spoonbill (*Platalea ajaja*)
Scott's seaside sparrow (*Ammodramus maritimus peninsulae*)
Snowy egret (*Egretta thula*)
Snowy plover (*Charadrius nivosus*)
Southeastern American kestrel (*Falco sparverius paulus*)
Tricolored heron (*Egretta tricolor*)
Wakulla seaside sparrow (*Ammodramus maritimus juncicola*)
White-crowned pigeon (*Patagioenas leucocephala*)
White ibis (*Eudocimus albus*)
Worthington's marsh wren (*Cistothorus palustris griseus*)

Mammals

Big Cypress fox squirrel (*Sciurus niger avicennia*)
Eastern chipmunk (*Tamias striatus*)

Everglades mink (*Neovison vison evergladensis*)
Florida black bear (*Ursus americanus floridanus*)
Florida mastiff bat (*Eumops glaucinus floridanus*)
Florida mouse (*Podomys floridanus*)
Homosassa shrew (*Sorex longirostris eonis*)
Sanibel Island rice rat (*Oryzomys palustris sanibeli*)
Sherman's fox squirrel (*Sciurus niger shermani*)
Sherman's short-tailed shrew (*Blarina carolinensis shermani*)

Corals

Pillar coral (*Dendrogyra cylindricus*)

Mollusks

Florida treesnail (*Liguus fasciatus*)

Crustaceans

Black Creek crayfish, also known as Spotted royal crayfish (*Procambarus pictus*)
Santa Fe Cave crayfish (*Procambarus erythrops*)
(Source: Florida Fish and Wildlife Commission Website: http://myfwc.com/WILDLIFEHABITATS/imperiledSpp_index.htm ; Florida's Threatened and Endangered Species, Florida Fish and Wildlife Commission, November 2010)

STATE PROTECTED SPECIES

Black Skimmer: The black skimmer is listed as a species of concern by the FWCC. Black skimmers and least, royal, and sandwich terns nest in colonies in the open sand on beaches, sandbars, and dredged material islands. Their nests are built on the ground and often consist of simple scrapes in the sand. Habitat loss from coastal development has reduced the number of suitable nesting spots for black skimmers. This permanent resident nests May through August in Florida. Individuals from northern states swell the Florida population in the fall (August through October), and south Florida birds move north in the state to breed (FBBA 2005d).

Brown Pelican: USFWS lists the brown pelican as federally endangered, except in particular states such as Florida and Alabama. Here, the FWCC lists the brown pelican as a state species of concern. The brown pelican is one of Florida's largest shorebirds living exclusively in coastal environments. It is the only pelican that skydives for food, mainly menhaden and other herring species. Brown pelicans breed in colonies, mostly on small islands along the Intracoastal Waterway. Egg-laying in brown pelicans generally happens between December and February. Pelicans pair up for one year, and both the male and female help brood and rear the young, which fledge in about 76 days. Brown pelicans are often seen from the dock of both Rattlesnake and Anastasia Islands (FWCC 2005b, USFWS 1995).

Least Tern: The least tern is listed as state threatened by the FWCC. This bird is commonly found on the beach areas of Anastasia and Rattlesnake Island during the spring and summer. This bird prefers to nest in colonies on open, shelly, or coarse sand beaches, which are flat with sparse vegetation from April through August. The nests consist merely of a shallow depression scratched in the sand. Populations of least terns were depleted after the turn of the century, when they were hunted to harvest their features to decorate women's hats. They have lost nesting habitat due to beach development and an increase in human activity on the beaches (FWCC 2005c).

Snowy Egret: The snowy egret, a state species of concern, is commonly found throughout the year on the coast of Rattlesnake and Anastasia Islands. The snowy egret breeds from January through August, nesting in colonies with other species of waders in swamps and mangroves on islands or in emergent vegetation over water. This bird forages in both freshwater and saltwater habitats, where it often pursues its prey, small fish, shrimp, and small vertebrates (FBBA 2005a).

White Ibis: The white ibis, a state species of concern, is commonly found on Rattlesnake and Anastasia Islands. White ibises feed primarily on aquatic prey, including crayfish, crabs, snakes, anurans, and fish. They breed from March through September in mixed colonies located over standing water, within freshwater marshes or ponds, or on coastal islands. Incubation requires 21 to 22 days, and the young leave their parents when they are 40 to 50 days old (FBBA 2005b).

Gopher Tortoise: The gopher tortoise is listed as threatened in Florida by the Florida Fish and

Wildlife Conservation Commission (FWCC). The U.S. Fish and Wildlife Service has added Gopher tortoises east of Mobile Bay to the list of candidate species eligible for Endangered Species Act (ESA) protection. In making this determination, the Service completed a comprehensive review – known as a 12-month finding – and found sufficient scientific and commercial data to propose listing the species as threatened or endangered throughout its range. However, the Service is precluded from beginning work immediately on a listing proposal because its limited resources must be devoted to other, higher priority actions. While candidate species receive no statutory protection under the ESA, inclusion on the candidate list promotes cooperative conservation efforts for these species. (Source: http://www.fws.gov/northflorida/Releases-11/20110726_nr_Gopher_Tortoise-12-month_Warranted_but_Precluded_Finding_Eastern_Portion_of_range.html) The gopher tortoise is one of the most abundant reptiles in Fort Matanzas. Gopher tortoises can be found in all open dry habitats, dunes, dunes meadows, and areas between patches of forest. Tortoises excavate deep burrows for refuge from predators, oldfields, and road shoulders for refuge from predators, weather, and fire; other species of animals, such as eastern diamondback rattlesnakes, indigo snakes, coachwhips, six-lined racerunners, and mice have been recorded sharing these burrows. Gopher tortoises feed on grasses, herbs, green brier, and cactus pads. Gopher tortoises are not aquatic species, but they occasionally are found floating in the Matanzas River and Intracoastal Waterways. During colder months, above-ground activity is greatly reduced; however burrows are relatively conspicuous year-round (FWCC 2005f).

APPENDIX E: HISTORY AND LEGISLATIVE BACKGROUND REGARDING DRIVING ON THE BEACH AT FORT MATANZAS NATIONAL MONUMENT

Establishment of the National Monument: Fort Matanzas National Monument was established by Proclamation of President Calvin Coolidge on October 15, 1924 under the authority of the American Antiquities Act of 1906. The site consisted of one acre, within which stood a structure built by the Spanish in 1740 to protect the Matanzas Inlet. The fort is located on Rattlesnake Island in the Matanzas River about 14 miles south of the historic district of St. Augustine, Florida. The War Department administered the site until it was transferred to the Department of the Interior, National Park Service, by Executive Orders of President Franklin D. Roosevelt. Presidential Proclamations in 1935 and 1948 authorized the acquisition of additional acreage.

In 1962 and 1963, two tracts of land, including nearly one mile of beachfront property on Anastasia Island, were donated to the NPS. Today, the park encompasses approximately 300 acres--200 acres on Rattlesnake Island and 100 acres on Anastasia Island. The eastern boundary of the Anastasia Island portion of the National Monument is the mean high water line of the Atlantic Ocean. The State of Florida owns the beach seaward of this line.

Background and Laws Relating to Beach Driving: Public beach driving was allowed throughout St. Johns County before the establishment of Fort Matanzas National Monument. In 1941, the Florida legislature made the Atlantic Ocean beach within St. Johns County a public highway under county jurisdiction. However, during the 1980s, a series of state laws beginning in 1985, prohibited beach driving throughout Florida except for cleanup, repair, or public safety, although it left local governments with the power to authorize traffic on beaches within their jurisdiction. In 1997 St. Johns County adopted an ordinance opening specified areas of its beaches to motor vehicles (Ordinance 97-34, June 24, 1997). However, the beach seaward of the Fort Matanzas boundary was not one of the areas where driving was authorized.

President Richard Nixon's Executive Order number 11644, issued February 8, 1972, directly governs the use of off-road vehicles (ORVs), which would include vehicles driven on the beach, in units of the National Park System. This Executive Order and the regulations established under it, prohibit the operation of motor vehicles in units of the National Park System except on park roads, in designated parking areas, and on routes and areas designated for ORV use. Finally, ORV routes and areas may only be established in national recreation areas, national seashores, national lakeshores, and national preserves. Fort Matanzas was established as a National Monument on a 1-acre site on Rattlesnake Island, which sits in the Matanzas River between Anastasia Island (the barrier island that faces the Atlantic Ocean to the east) and the Intracoastal Waterway to the west. Therefore, beginning in 1985 both state law and Federal law, including presidential executive orders prohibited driving on the Atlantic Ocean beach south of the Matanzas ramp.

Current Status: Visitation at Fort Matanzas was 673,700 in 2010. Beach use constitutes approximately 80% of that total. The National Park Service has prepared this General Management Plan and Environmental Impact Statement for Fort Matanzas National Monument. Public meetings, held in March, 2008, provided opportunities for people to express their opinions and ideas regarding the management of the National Monument. In May of 2009 the park received a Freedom of Information Act request from a Florida resident with regard to beach driving. In September of 2009 the National Parks and Conservation Association and the Florida Audubon Society expressed concern that NPS failure to enforce the regulations restricting off-road driving on the beach could adversely impact resources. After consultation with the Southeast Regional office, and on the advice of legal counsel, the decision was made to close the beach to vehicles as of January 1, 2010.

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APPENDIX G: IMPACTS AND MANAGEMENT OF OFF-ROAD VEHICLES

The following section has been reproduced in its entirety from Appendix A of the Final Off-Road Vehicle Plan and Environmental Impact Statement for Cape Hatteras National Seashore (NPS, November 2010). Although the literature review appeared in an off-road vehicle plan for Cape Hatteras National Seashore, the studies and data regarding impacts come from barrier island parks all along the Atlantic Coast from New York to Florida and the Gulf Coast (Gulf Islands National Seashore). Therefore, NPS believes that this material is equally applicable to the conditions at Fort Matanzas National Monument.

LITERATURE REVIEW

While access to public lands improves the experience of ORV users, motorized access to sensitive environments, such as coastal ecosystems, can pose a threat to sensitive species that rely on the beach habitat. Other impacts from motorized access to public lands include adverse effects on water quality, adverse effects on vegetation, impacts to cultural resources, detraction from other visitors' enjoyment of public lands, and creation of law enforcement issues. ORVs can churn up and damage delicate soils (Proescholdt 2007; Ouren et al. 2007; Webb 1982). Air quality can be negatively affected by exhaust fumes, oil, and dust resulting from ORV use (Taylor n.d.; Proescholdt 2007; Ouren et al. 2007). Loud engines in quiet environments can disturb wildlife and affect visitor enjoyment for those who use parks as places of peace and solace (Proescholdt 2007). Park rangers surveyed during a 1999 study reported incidents where ORV use has destroyed or disturbed cultural resources that parks are bound by law to protect (Bluewater Network 1999). While it is unknown how many coastal park units were included in the study, it can be assumed that such issues also occur in coastal units were ORV traffic is allowed.

This literature review has been prepared to support the development of an ORV management plan at the [*Cape Hatteras National Seashore*] Seashore. The following sections summarize available information related to the potential effects of ORV use on natural resources, such as wildlife habitat, aesthetics/sound, and vegetation, found in national park units with coastal sand dune ecosystems. Relevant water quality findings are also reported here. In addition, information on the effects of ORV use on socioeconomics and management issues are examined. Because the majority of the area administered as Cape Hatteras National Seashore is best described as a coastal beach environment, with the major issues for resource protection being the protection of threatened and endangered species and the maintenance of coastal wildlife habitat, this literature review focuses on impacts from ORV use in similar coastal environments.

Wildlife and Wildlife Habitat

Numerous studies have detailed the impacts to wildlife of ORV use on public lands. Impacts generally described in these studies include direct mortality, harassment, noise effects, and habitat destruction. Specific risks to wildlife include injury during escape responses and, in severe cases, habitat avoidance and abandonment of young. Radle (2007) found that wildlife generally experience an increase in heart rate, as well as altered metabolism and hormone balance, when introduced to human-made noise. Noise from ORVs can affect the senses of animals that depend on hearing and vibration detection to survive (resulting in inability of wildlife to hear sounds important for mating, avoiding predators, and finding prey) (Berry 1980; Bury 1980; Bluewater Network 1999). ORVs also impact wildlife by destroying or fragmenting habitat. Much of the existing research has dealt specifically with the effects of vegetation damage by visitors and the associated impacts to wildlife habitat values (Monz et al. 2003). This has led some to conclude that the most effective strategies for avoiding habitat disturbance are outright road removal and the avoidance of new road construction in roadless or sparsely roaded areas (Trombulak and Frissell 2001; Walder n.d.).

Park managers generally agree that intensive ORV use harms wildlife, including endangered species. From July to November of 1999, Bluewater Network conducted a survey of 108 national park units regarding the use of all-terrain vehicles and other ORVs. While the number of surveys conducted at seashore units is not reported, among the issues cited by respondents was the use of ORVs resulting in collisions with and crushing of animals, destruction of habitat, and animals being frightened away from shelter or important habitat (Bluewater Network 1999).

Various studies have examined the effects of ORVs on intertidal invertebrates. Work done on high-energy beaches has suggested that life in the intertidal and supratidal areas may be far more abundant and varied than previously thought (Zaremba et al. 1973), and this life could be affected by ORV use. One study conducted at the Seashore (Landry 2004) documented recovery rates of ghost crab (Ocypode quadrata) populations following ORV impacts and high-energy weather events. Beach closures were initiated to study short-term effects and recovery rates. Sediment analysis and beach soil compaction differences in the ghost crab habitat were measured in both untraveled and travelled zones. The study found differences in crab burrow densities between closed and open beaches. Alternative time spans for beach closings varied in their effectiveness for promoting recovery at various beach areas.

Findings from a 1984 study conducted at nearby Cape Lookout (Wolcott and Wolcott 1984) examined impacts of ORV use on mole crabs (Emerita talpoida), coquina clams (Donax variabilis) and ghost crabs. Results indicated that ghost crabs were completely protected if borrows were at least 5 centimeters (2 inches) deep. The ghost crab creates burrows for shelter from heat and desiccation stress during summer daytime periods. Juveniles produce shallow J-shaped burrows with a mean depth of 160 millimeters (6.3 inches), while adults dig Y-shaped and spiral burrows with mean depths of 361 millimeters (14.2 inches) (Chan et al. 2006). The Wolcott study also found no damage to mole crabs or coquinas; however, crushing of ghost crabs by ORVs occurred during their nighttime feeding on the foreshore1. The study recommended establishing a ban on ORV traffic on the foreshore between dusk and dawn to protect this species (Wolcott and Wolcott 1984).

Moss and McPhee (2006) compared ghost crab burrow counts on exposed sandy beaches off the coast of southeast Queensland in areas designated as “open” and “closed” to recreational ORV use and found that beaches where recreational ORV activity was present had significantly lower ghost crab abundance than beaches where ORV use was absent. Similarly, a study on North Stradbroke Island in Australia found crab densities to be significantly lower in areas subject to heavy beach traffic. While crab mortality declined with depth of burrows, burrowing only partially protected crabs. Crabs in shallow burrows of 5 centimeters (1.9 inches) were killed by 10 vehicle passes. While deep-living crabs (which burrowed to depths of least 30 centimeters [11.8 inches]) were not killed by ORVs, this subpopulation represented only half of the total population surveyed (Schlacher et al. 2007).

Schlacher and others (2008) used surf clams (Donax deltoides) to investigate damages caused by vehicles to sandy shore invertebrates, and found that in situations where cars traversed soft sand and turned across the beach face, clams had some tolerance against vehicles at low traffic volumes (5 vehicle passes), but more than half of them were killed at higher traffic volumes (75 passes). Van Der Merwe (1991) studied the effects of ORVs on four intertidal invertebrate species in South Africa: the gastropod Bullia rhodostoma, the bivalves Donax serra and Donax sordidus, the benthic mysid Gastrosaccus psammodytes, and the supralittoral isopod, Tylos capensis. All the above-named species except for the benthic mysid showed a high tolerance for vehicular disturbances. The supralittoral isopod demonstrated increasing damage as with more vehicle passes in the less compact sand above the drift line.

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1 Also known as the intertidal zone, the foreshore is defined as that part of the beach between the spring low water mark and the spring high water mark. The upper limits of the intertidal zone are defined by the uppermost wrack line. A wrack line is a line of stranded debris along a beach face marking the point of maximum run-up during a previous high tide, and there may be several on a beach.

In a study of four beaches at Cape Cod and Fire Island National Seashores, Kluft and Ginsberg (2004), used analysis of variance as a statistical metric and found that invertebrates such as the talitrid amphipod (Talorchestia longicornis) and the lycosid spider (Arcotosa littoralis) were significantly more abundant in the wrackline in vehicle-free areas than in high-traffic zones. On sandy beaches, invertebrates such as gastropods and bivalves could be safe if buried beneath compact sand (which is common when the tide is out). Stephenson (1999), while not specifying particular invertebrate species, cited research that indicated a reduction in both the abundance and number of species of surface and subsurface invertebrates as a result of vehicles on coastal dunes. Crushing by vehicle wheels, destruction of the surface litter layer (where present), and the changes in soil properties and microclimate that accompany track creation, or the overall reduction in plant cover, all contribute to the negative response of these elements of the fauna. Invertebrates associated with the above-ground portions of plants also exhibited reductions in abundance and number of species as a consequence of vehicle impacts to the vegetation and microclimate of dunes (Stephenson 1999).

Bird species are also affected by ORV use on shoreline ecosystems. Historically, many beach-nesting waterbirds have shown population declines along the beaches of the Seashore in response to increased human disturbance, retreating to small soundside islands created from dredge material excavated from navigational channels. By the late 1970s, erosional forces and changes to dredging techniques had whittled away much of these refuges, leaving no choice for the birds but to return to ocean beaches. One such species of special concern is the piping plover (Charadrius melodus), which lays speckled eggs that are perfectly camouflaged in the beach sand. A two-year study of piping plovers along the New Jersey shore (Burger 1994) found that plovers forage along the tidal oceanfront, in the dunes, and in backbays, and their relative use of these habitats partially depends upon human presence. While on beaches with few people, plovers can spend 90 percent of time foraging, whereas on beaches with many people they may spend less than 50 percent of their foraging time in direct feeding behaviors (Burger 1994). Results of a logistic regression analysis of the spatial distribution and productivity of piping plover nests in relation to proxy indicators of human disturbance on the barrier islands of Long Island, New York, indicated that for each additional kilometer of road within a 500-meter (1640-foot) radius, the likelihood of the presence of a plover nest decreased by up to 53%. Higher productivity appeared to be only slightly correlated with increasing distance from parking lots, roads, and residential areas. Moreover, no difference in mean productivity was observed among the levels of ORV access (Thomsen 2006).

Among bird species, adverse reactions to human recreational activities have included nest desertion, temporary nest abandonment, and changes in foraging habits (Douglass et al. 1999). Comparing two beach plots open and closed to human traffic along North Carolina's Outer Banks, Collazo and others (1995) found that resting time of shorebirds was reduced by nearly 50 % in areas open to human activity. Although some research indicates predators are the main cause of nest failure of shore-nesting birds, Stephenson (1999) identifies vehicle use as a major cause for reductions in reproductive potential of birds on both coastal dunes and shorelines. Similarly, Melvin and others (1994) described 14 incidents of direct piping plover mortality caused by ORVs in Massachusetts and New York from 1989 through 1993. They estimated the number of one-way vehicle passes per day during the period when mortality occurred, demonstrating that ORV use, even at levels of less than 10 vehicle passes per day, is a threat to unfledged piping plover chicks and adults during brood-rearing periods.

An in-depth study of colonial waterbird reproductive success and population trends along the Atlantic coast, which involved field research at Cape Lookout National Seashore, revealed that American oystercatchers are also at risk in rapidly changing coastal ecosystems. The nest survival rate was calculated to be 0.928 per nest day (213 nests lost during 2,961 nest-days of incubation), with the probability of a clutch surviving to hatching of 0.133 (Davis et al. 2001). A comparison of reproductive success of the American oystercatcher on three river islands in the lower Cape Fear of North Carolina with that of birds nesting on barrier island beach habitat of

Cape Lookout National Seashore (McGowan river island habitat than on the barrier beach habitat. ORV use was directly investigated in this study. The primary cause of nest failure on river islands was flooding, while the primary cause on barrier islands was mammalian predation. In their study of reproductive success of American oystercatchers along the Atlantic coast from Cape Fear to Cape Hatteras National Seashore, Simons and McGowan (2003) also identified predation as the major factor accounting for population decline. Patterson and others (1991) studied piping plovers on Assateague Island, Maryland, in 1986–87 to estimate population size and to identify factors affecting productivity. The study found that predators accounted for most of the known causes of nest losses (91%), with only one nest lost due to direct human destruction and no evidence that suggested recreational disturbance was a factor affecting productivity.

Detailed results of an analysis of eight seasons of reproductive success data at the Seashore found that mammalian predation accounted for 29 % of nest failures (McGowan 2004). The study also found that human disturbance, 24 % of which attributable to ORVs, increased the frequency of trips from the nest during incubation and could contribute to reduced oystercatcher hatching success (McGowan 2004). A recent study by Sabine (2005) involved video monitoring of 32 American oystercatcher nests to document causes of nest failure at Cumberland Island National Seashore, Georgia. Predation was determined to be the primary cause of nest failure. Vehicle disturbances were also simulated by driving immediately below the high water line at approximately 50 meters (164 feet) seaward of nests in order to observe oystercatcher behavioral responses. Although the study found that vehicular activity reduced foraging behavior during brood rearing, results from the disturbance experiment indicated that oystercatchers were more sensitive to pedestrian disturbance than vehicle disturbance during incubation. McGowan and Simons (2006) also suggest that changes in incubation behavior might be one mechanism by which human recreation affects the reproductive success of American oystercatchers. While ATV traffic was positively associated with the rate of trips to and away from the nest, and negatively correlated with percent of time spent incubating, truck and pedestrian traffic had little measured effect on incubation. Stolen (2003) studied the effects of passing vehicles on the foraging behavior of wading birds at the Merritt Island National Wildlife Refuge near Titusville, Florida, and found that foraging wading birds were more likely to be disturbed when vehicles slowed or stopped adjacent to them than when vehicles continued driving by. Experimental disturbance by a vehicle caused a significant depression in the foraging rates of the snowy egret (Egretta thula) and the great egret (Ardea alba) and non-significant reductions in foraging rates in the tricolored heron (E. tricolor). Nineteen percent of the birds flushed after being disturbed. Species reacted differently to disturbance as vehicles approached closer to nests. Tri-colored heron were the most sensitive to flushing; the great egret was intermediately sensitive; and the snowy egret was the least sensitive.

In a study of shorebirds at South Core Banks, South Carolina, Tarr (2008) determined that vehicle disturbance influences shorebird use of ocean beach habitat for roosting during the nonbreeding season. This conclusion was based on the finding that shorebirds were abundant in areas where vehicle abundance was also relatively high, but their distribution among microhabitats was opposite that of vehicles. Vehicles were primarily located on dry sand, while shorebirds were typically found in the swash zone and wet sand microhabitats. When disturbance was introduced, microhabitat use shifted towards the swash zone. This study concluded that vehicle disturbance influences shorebird use of ocean beach habitat for roosting during the nonbreeding season. A study of the results of a ban on beach driving in 2001 on the South African coastline (Williams et al. 2004) found that in the first breeding season after the ban, there was an increase in breeding pairs for all five species in the study (two waders, two terns and a cormorant). Available data indicated that a 50-meter buffer distance around nests is adequate to prevent harassment of the majority of incubating piping plovers, as stated in the Piping Plover Revised Recovery Plan (USFWS 1996). However, fencing around nests should be expanded in cases where the standard 50-meter (164- foot) radius is inadequate to protect incubating adults or unfledged chicks from harm or disturbance. Impacts may result from species' inability to adapt to the pace of human

development. Loggerhead sea turtles, for instance, face many anthropogenic nesting threats, including beach armoring, beach nourishment, artificial lighting, commercial fishing, beach vehicular driving, and pollution (Nester 2006).

Vehicles on the beach could negatively impact sea turtles by running over nests or nesting females, hatchlings, or stranded turtles that have washed ashore. In addition, ruts left by vehicles in the sand may prevent or impede hatchlings from reaching the ocean after they emerge from the nest. Hatchlings impeded by vehicle ruts are at greater risk of death from predation, fatigue, desiccation, and being crushed by vehicles. Sand compaction due to vehicles on the beach may hinder nest construction and hatchling emergence from nests. Driving directly over incubating egg clutches can cause sand compaction, which may decrease hatching success and directly kill pre-emergent hatchlings. Additionally, vehicle traffic on nesting beaches may contribute to erosion, especially during high tides or on narrow beaches where driving is concentrated on the high beach and foredune (USFWS 2008).

Witherington (2003) cites challenges to loggerhead sea turtle (Caretta caretta) conservation: uncertainty over the historical abundance of loggerheads so that assessment of status can be made, and the incremental deterioration of suitable loggerhead nesting beaches through development (including coastal armoring and sources of beach lighting) and sea level rise. A 1996 report by the Florida Department of Environmental Protection explains that artificial lighting from a variety of sources on beaches tends to deter sea turtles from emerging from the sea to nest (Witherington and Martin 1996). If sea turtles do nest on lighted beaches, hatchlings can be jeopardized as artificial lighting disrupts a critical nocturnal behavior of hatchlings, which will move toward artificial light sources instead of crawling from their nest to the sea. Artificial lighting has also been found to deter sea turtles from emerging from the water to nest. The increase of false crawls on ORV beaches may cause nesting turtles to expend additional energy. This energy could be put into egg production or growth. To evaluate the effect of driving ORVs on nesting activity, Nester (2006) compared driven and non-driven beaches, data on beach slope, sand compaction, beach width, sand color, sand grain size, moisture content, incubation temperature, and pedestrian activity collected during the 2005 nesting season at Cape Lookout National Seashore, Cape Hatteras National Seashore, and Pea Island Wildlife Refuge, North Carolina. The study found that light intensities presented a significant factor in determining nesting or false crawls. False crawls were more likely on ORV beaches where light intensities from vehicles were found to be greater than those on non-ORV beaches. A resulting decline of 20% in production of female loggerhead turtles was estimated at these locations. Recommendations for mitigating the impacts of artificial lighting on sea turtles included installing timers and monitoring devises to minimize unnecessary lighting (Witherington and Martin 1996).

ORV tracks interfere with the ability of hatchling loggerhead turtles to reach the ocean. By observing newly-hatched loggerhead turtles which were released to the intertidal beaches at Fort Fisher Beach in southeastern North Carolina and Cape Lookout Beach in coastal North Carolina, Hosier and others (1981) determined the effect of ORV tracks on the behavior and rate of sea-approach of these turtles. The extended period of travel required to negotiate suitable paths to the surf, together with the tendency to invert, may increase the susceptibility of loggerhead turtles to stress and predation during transit to the ocean when hatching on ORV-impacted beaches. Tracks in the sand may change the micro-topography as much as 10–15 centimeters (3.9–5.9 inches), which may serve as a significant impediment to the movement of hatchling turtles to the sea. Moreover, vehicle tracks generally run parallel to the beach, and can result in distances of 10–20 meters (33–66 feet) where hatchlings cannot successfully negotiate such barriers, especially in coarse sands. At Cape San Blas, Florida, near Eglin Air Force Base, Cox and others (1994) examined hatchling tracks and observed four instances of sea turtle hatchlings being disorientated. Vehicle tracks were thought to be a contributing factor at two sites, causing some hatchlings to make a perpendicular diversion of more than 91 meters (300 feet) en route to the sea. Some hatchling tracks ended within vehicle tracks, which suggests that vehicle tracks may lengthen the time of critical exposure to beach predators, particularly ghost crabs.

Soils/Dune Ecosystems

Several studies of ORV impacts to coastal soils have focused on comparisons of soil characteristics between high-traffic areas versus non-traffic areas. One such study (Hosier and Eaton 1980) compared two barrier beaches in southeastern North Carolina. Less vegetation cover and fewer species were present on both dunes and grassland areas with vehicular traffic. To illustrate this, when quadrants containing vehicle tracks were removed from the analysis, the average vegetative cover of the dunes on the impacted beaches increased to that of the non-impacted beaches. The soil was also more compact where vehicular traffic had been most intense and where, it was suggested, this compaction may have been contributing to increasing salt flats in the area. Similarly, results of experimental testing of ORV impacts to coastal ecosystems of Cape Cod National Seashore between 1974 and 1977 (Leatherman and Godfrey 1979) showed that the ecosystem most resistant to long-term vehicle impact was the intertidal ocean beach, while the most easily damaged were areas protected from the direct ocean waves by barrier dunes or other upland features (such as salt marshes and sand flats). ORV effects are longest lasting farthest from the source of new sand; the areas farthest away from new sand promote optimal growth of grasses. More specifically, the effects of vehicles on dunes depended on the portion of the dune that was impacted. At dune edges, fewer than 100 vehicle passes stopped seaward growth of grass. In the foredune region, a relatively low number of passes (50–200) reduced plant biomass to very low levels. Recovery of the grasses on the dunes varied with the exact location of the vehicle tracks. On the foredunes, where grass growth is lush and rapid due to fresh sand input, the impacted sites were almost completely recovered after three growing seasons. Findings demonstrated that environments that undergo the greatest physical changes, such as the intertidal ocean beach, appear to have the greatest tolerance to vehicle traffic.

Studies on barrier islands have shown that although infrequent travel over dune vegetation had noticeable immediate impacts, permanent damage was ultimately caused by repeated travel over the same tracks (Judd et al. 1989). Impacts of historic ORV use at Gulf Islands National Seashore included denudation of coastal dunes and resulting blowouts and interior flooding, which have flattened the interior island topography; and the creation of trails that contribute to erosion, further narrowing the island (Shabica 1979). In a similar study at Fire Island National Seashore in New York, Anders and Leatherman (1987) found that vehicular passage over the open beach displaces sand seaward and that ORV use levels could be contributing to the overall erosion rate by delivering large quantities of sand to the swash zone and affecting dune topography. Vehicle traffic resulted in a maximum of 0.75 meters (2.5 feet) of deposition in the zone of actual impact and a slight reduction in the elevation of the foredune. The results of 89 field experiments to examine the effects of ORVs on the beach showed that slope, sand compaction, and the number of vehicle passes in the same track were the principal factors controlling the measured net seaward displacement of sand.

Investigations made between 1973 and 1974 found beach and foredune areas of North Padre Island along the mid-Texas coast to be greatly modified by vehicular traffic (McAtee and Drawe 1981). The primary effects were reduced ground cover and reduced species diversity of vegetation in the foredune areas. As the intensity of human activity increased, dune elevation decreased. Increasing human activity also correlated to higher observed evaporation, soil pH, soil temperature, average wind velocity, atmospheric and soil salinity, and wind-carried sand particles near the ground surface.

Liddle and Grieg-Smith (1975) demonstrated that below 18-centimeter (7-inch) depths, soils became less compacted as a result of vehicle use. But a study of vehicle impacts to sandy beaches on the east coast of Australia (Schlacher and Thompson 2006) found that ORVs corrugated sand as deep as 28 centimeters (11 inches), with the deepest rutting occurring between the foredunes and the drift line. Off-road vehicles in this study were capable of disrupting from 5.8% to 9.4% of the available faunal habitat matrix (the top 30 centimeters [11.8 inches] of the sand which contain the necessary conditions to support the study fauna) in a single day and routinely disturbed the drift line and the base of the foredunes. Belnap (1995) cited several causes of

desertification from off-road vehicle use, including soil compaction resulting in decreased water availability to vascular plants through decreased water infiltration. Soil loss can be further accelerated by wind and water erosion and decreased diversity and abundance of soil biota.

Vegetation and Invasive Species

Numerous studies describe the impacts of ORVs on vegetative communities, including both direct and indirect damage to vegetation by vehicle use. Research conducted in the late 1970s at Cape Cod National Seashore on the ecologic and geomorphic effects of ORVs on coastal ecosystems concluded that there is no "carrying capacity" for vehicular impact on coastal ecosystems, and even low-level impacts can result in severe environmental degradation. The most naturally unstable areas, such as the intertidal ocean beach, tend to be the least susceptible to damage due to the rapid pace of natural environmental change and recovery in these areas. Dunes can be quickly devegetated by vehicular passage, resulting in blowouts and sand migration. Of all the ecosystems evaluated, salt marshes and intertidal sand flats are the least tolerant of ORV impacts and should be closed to all vehicle traffic (Leatherman and Godfrey 1979). Similarly results were demonstrated in an experimental testing of ORV traffic on coastal ecosystems of Cape Cod National Seashore between 1974 and 1977 (Godfrey et al. 1978). As detailed in the Soils/Dune Ecosystems section, this study found that even a relatively low number of vehicle passes can reduce plant biomass to very low levels in the foredune area.

At Cape Hatteras National Seashore, potential habitat for the seabeach amaranth includes coastal overwash flats at the accreting ends of the islands and lower foredunes and on ocean beaches above mean high tide (occasionally on sound-side beaches). In its known range, it often grows in the same areas selected for nesting by shorebirds such as plovers, terns, and skimmers. Intensive recreational use, both vehicular and pedestrian, is one factor that threatens the plant's survival. Its stems are easily broken or crushed by foot traffic and tires, thus, even minor traffic can be detrimental during the growing season (USSWS 1996).

Hosier (1980) cites several cases at the Seashore where vehicle impacts to vegetation have occurred, such as at Oregon and Ocracoke inlets where vehicle traffic has compacted sediments along the unvegetated portions of the beach and near Ocracoke Inlet. In these areas, sand flat vegetation has been altered by ORV tracks and chronic operation of ORVs has kept natural stabilizing vegetation from invading the flats.

A study of vehicle impacts to coastal dunes at Fire Island National Seashore, in which vegetation was monitored in both an experimental field test and a control before and after experimental vehicle impacts, revealed that low-level ORV use (one pass per week) is severely damaging to natural dune vegetation, and that a steepening of the dune profile occurred in the impacted zones due to higher rates of ORVrelated erosion (Anders and Leatherman 1987). Another study of the response of grassy vegetation and soils of coastal sand dunes to varying degrees of vehicle use in Australia found that some species of grassy vegetation demonstrated decline, while others increased under moderate use (Liddle and Grieg-Smith 1975). The researchers also noted that while damage to plant shoots by vehicles was detrimental to plants, soil compaction alone could be beneficial in the sand dune habitat due to roots gaining greater access to higher moisture retaining soils beneath trampled areas. Similarly, results of a study at Cape Cod National Seashore, in which unstabilized and moderately stabilized dune sites were driven at varying levels of intensity, suggested that a single summer season of driving (300–700 passes) on a confined track through grass vegetation can completely destroy the above-ground portions but leave adequate underground roots and rhizomes for a small amount of vegetative regrowth after driving season ends in the late summer and fall (Brodhead and Godfrey 1977).

Three studies reviewed involved direct examination of vehicles to determine if they were potential distributors of exotic plant seeds. Osborn and others (2002) discuss a study that investigated the potential for seed transport into Kakadu National Park in Australia by means of tourist vehicles. The study concluded that vehicles were partially responsible for weed seed dispersal, but the low density of seeds found on the vehicles did not warrant the park taking preventative action.

Another study (Rooney 2005) compared soil samples taken from the undercarriage of ORVs to field surveys for seven invasive species in forested areas of Wisconsin. No evidence of actual invasive plant dispersal was noted; however, because invasive plants have seed traits that predispose them to dispersal, the study found that ORVs may occasionally contribute to long-distance dispersal events. This is further supported by a study conducted by the Montana Weed Control Association (Trunkle and Fay 1991), which involved driving a vehicle 40 feet into a vegetated plot and then to various distances from the plot. Afterwards, plant material (including spotted knapweed (Centaurea stoebe) seeds) was collected from the undercarriage. At Cape Lookout National Seashore, Hosier (1980) found that deep ORV tracks trapped seeds of sea oats as they were blown across the beach. The captured seeds were then buried and began germination, but the vehicles subsequently churned up the sand and exposed the roots, thus destroying the plants.

Lathrop (1983) found that in arid regions direct vehicle impacts constituted the primary means of vegetative destruction. The study showed that areas beyond the vehicle track width were also affected, although the degree of impact varied with conditions and intensity of vehicle use. The study demonstrated that concentrated current or recent use in localized areas (such as heavy weekend use) created the greatest reduction in vegetative cover. Also in a study of desert environments, Wilshire (1983) found that even a single pass of an ORV could destroy many types of annual and some perennial plants, although hundreds of passes may be required to destroy tough, deep-rooted shrubs.

Aesthetics/Sound

ORV use influences the character of the wild landscape and can result in conflicts between ORV users and other recreational users. With regard to ORV noise-related impacts to park resources, attempts have been made to qualify how visitor experiences in national parks are affected by the addition of mechanical versus natural sound that may come from ORV or other motorized vehicle use such as personal watercraft (PWC). A limited amount of study has been undertaken regarding ORV use and its impacts to soundscapes in NPS units. Studies related to air tours and PWC are available but not directly relevant to ORV use at Cape Hatteras National Seashore.

Gramann (1999) used many approaches to garner information from visitors about sound in NPS units to formulate a more precise picture of human reactions to sound. Overall, results showed that park users identify natural sounds as more enjoyable than mechanical sounds, but mechanical sounds do not always interfere with the user's experience. Visitor experience and sensitivity to mechanical sound are dependent on visitor expectations, group size, front or backcountry experience, and activity type. For example, a visitor in a group of three or more visiting a park for the first time in the front country and taking pictures may not be as sensitive to mechanical sounds as a lone hiker in the backcountry. People are generally tolerant of certain noise disturbances if they perceive them as necessary (e.g., helicopters conducting fire suppression activities). In this sense, the Gramann study indicated that it is important for sounds to be consistent with the visual setting within which they are heard. Variable noise disturbances may be more readily tolerated depending on the observer's perception of the setting. As a result, from a management perspective, some scenic overlooks and short front country trails may not require as much protection as backcountry locales where preserving the experience of natural sound is paramount to overall visitor experience (Gramann 1999).

Archeological Resources

Whether it is intentional or inadvertent, ORV use has the potential to affect archeological resources on public lands (BLM 2000; Lyneis et al. 1980; Schiffman 2005; Sowl and Poetter 2004; SUWA 2002). Direct impacts result from the damage or destruction that occurs when ORVs drive over and/or near archeological sites. Site integrity, a necessary element for listing a cultural resource on the National Register of Historic Places, is also affected by the visible changes caused by vehicle tracks and erosion (Sowl and Poetter 2004). Studies conducted in the California desert note that ORVs provide access to previously inaccessible, remote areas as ORV users explore new terrain (Lyneis et al. 1980). According to the

BLM, this leads to increased visitation to lands previously used only by small numbers of hikers, and increases the intentional and inadvertent damage of archeological resources through surface disturbances (BLM 2000). ORVs have also enabled collectors and pothunters to reach these remote areas, which facilitates greater archeological resource damage from intentional collection and vandalism (BLM 2000; Schiffman 2005; Lyneis et al. 1980; SUWA 2002).

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