DRAFT COMPREHENSIVE CONSERVATION PLAN AND ENVIRONMENTAL ASSESSMENT

CHASSAHOWITZKA NATIONAL WILDLIFE REFUGE

Citrus and Hernando Counties, Florida

U.S. Department of the Interior
Fish and Wildlife Service

Southeast Region
Atlanta, Georgia

May 2012

TABLE OF CONTENTS

SECTION A. DRAFT COMPREHENSIVE CONSERVATION PLAN

I. Background 1

Introduction 1
Purpose and Need for the Plan 1
U.S. Fish and Wildlife Service 5
National Wildlife Refuge System 5
Legal and Policy Context 6
Legal Mandates, Administrative and Policy Guidelines, and Other Special Considerations 6
Biological Integrity, Diversity, and Environmental Health Policy 7
National and International Conservation Plans and Initiatives 7
Florida Manatee Recovery Plan 7
Western Hemisphere Migratory Species Initiative 8
North American Bird Conservation Initiative 8
National Fish Habitat Action Plan 10
National Oceanic and Atmospheric Administration (NOAA) Marine Debris Removal Program 10
Climate Science Centers 11
Relationship to State Wildlife and Habitat Protection Agencies 11

II. Refuge Overview 13

Introduction 13
Refuge Description, History of Establishment, and Purposes 13
Special Designations 14
Outstanding Florida Waters Designation 14
Marine Protected Areas 14
Important Bird Area 14
Federal Wilderness Designation and Stewardship 14
Ecosystem Context 17
Landscape context 17
Strategic Habitat Conservation 20
National Network of Landscape Conservation Cooperatives 20
Peninsular Florida Landscape Conservation Cooperative 21
Regional Conservation Plans and Initiatives 22
Recovery Plans 22
Southeastern Coastal Plain Colonial Waterbird Conservation Plan 22
Southeastern Coastal Plain and Caribbean Region Shorebird Conservation Plan 22
State and Local Conservation Plans and Initiatives 23
Florida Comprehensive Wildlife Conservation Strategy 23
Florida Natural Areas Inventory 23
Florida Forever Program 23
Critical Lands and Waters Identification Project and the Cooperative Conservation Blueprint 24
St. Martins Marsh Aquatic Preserve Management Plan 24
Crystal River Preserve State Park Unit Management Plan 24

Chassahowitzka Wildlife Management Area Plan 25
Chassahowitzka River and Coastal Swamps 25
Withlacoochee State Forest 26
Great Florida Birding and Wildlife Trail 26
Ecological Threats and Problems 26
Potential Impacts Associated with Climate Change 26
Exotic, Invasive and Nuisance Species 28
Physical Resources 28
Climate 28
Geology and Topography 28
Soils 29
Hydrology 32
Air Quality 32
Water Quality and Quantity 37
Biological Resources 39
Habitat 39
Wildlife 43
Cultural Resources 52
Historical Period 54
Socioeconomic Environment 55
Demographic Data 56
Economy, Recreation and Tourism 58
Refuge Administration and Management 58
Land Protection and Conservation 58
Visitor Services 62
Personnel, Operations, and Maintenance 65

III. Plan Development 67

public Involvement and the Planning Process 67
Priority Resource Issues 68
Fish and Wildlife Population Management 68
Habitat Management 69
Resource Protection 70
Visitor Services 70
Refuge Administration 70
Wilderness Review 71

IV. Management Direction 73

Introduction 73
Vision 73
Goals, Objectives, and Strategies 73
Refuge Goals 73
Summary 74
Fish and Wildlife Population Management 75
Habitat Management 86
Resource Protection 92
Visitor Services 97
Refuge Administration 105

V. Plan Implementation 109

Introduction 109
Proposed Projects 109
Fish And Wildlife Population Management 109
Habitat Management 110
Resource Protection 111
Visitor Services 111
Refuge Administration 112
Funding and Personnel 112
Partnership and Volunteer Opportunities 114
Step-down Management Plans 116
Monitoring and Adaptive Management 118
Plan Review and Revision 118

SECTION B. ENVIRONMENTAL ASSESSMENT

I. Background 121

Introduction 121
Purpose and Need for Action 121
Decision Framework 121
Planning Study Area 122
Authority, Legal Compliance, and Compatibility 122
Compatibility 122
Public Involvement and the Planning Process 123

II. Affected Environment 125

III. Description of Alternatives 127

Formulation of Alternatives 127
Features Common to all Alternatives 127
Description of Alternatives 127
Alternative A: Current Management (No Action) 128
Alternative B: Increased Research and Management via Partnerships 131
Alternative C: Adaptive Management (Proposed Action) 134
Comparison of Alternatives 137

IV. Environmental Consequences 155

Overview 155
Direct and Indirect Effects 155
Effects on the Physical Environment 156
Soils 156
Hydrology 156
Water Quality 156
Air Quality 156
Noise Pollution 157
Aesthetics 157

Effects on the Socioeconomic Environment 158
Visitor Services – Public Use, Access, and Recreation 158
Refuge Revenue-Sharing 159
Facilities 159
Public Health and Safety 159
Effects Common to All Alternatives 159
Environmental Justice 159
Cultural Resources 159
Climate Change 160
Land Acquisition 161
Summary of Environmental Effects 161
Unavoidable Impacts and Minimization Measures 178
Effects on Water Quality from Soil Disturbance and Herbicide Use 178
Wildlife Disturbance 178
Vegetation Disturbance 179
User Group Conflicts 179
Effects on Adjacent Landowners 179
Land Ownership and Site Development 179
Cumulative Impacts 180
Anticipated Impacts on Wildlife Species 182
Anticipated Impacts on Refuge Programs, Facilities, Cultural Resources, Environmental Justice, Environmental Resources, and Surrounding Communities 185
Direct and Indirect Effects of Impacts 186
Short-term Uses versus Long-term Productivity 187
Summary Statement 187

V. Consultation and Coordination 189

Overview 189
CCP Planning Team 189
Wildlife and Habitat Management Review Team 189
Visitor Services Review Team 190
Wilderness Review Team 191
Interagency Partners Coordination Team 191

APPENDICES

Appendix A. Acronyms, Abbreviations and Glossary 193

Acronyms and Abbreviations 193
Glossary 196

Appendix B. References and Literature Citations 205

Appendix C. Relevant Legal Mandates and Executive Orders 215

Appendix D. Public Involvement 229

Appendix E. Appropriate Use Determinations 231

Appendix F. Compatibility Determinations 245

Appendix G. Intra-Service Section 7 Biological Evaluation 265

Appendix H. Wilderness Review 273

Appendix I. Refuge Biota 277

Appendix J. Refuge Budget 315

Appendix K. Partnerships 317

Appendix L. List of Preparers 319

Appendix M. Inventory and Monitoring Efforts by Refuge Staff and Partners 321

LIST OF FIGURES

Figure 1. Crystal River National Wildlife Refuge Complex. 2

Figure 2. Location of Chassahowitzka National Wildlife Refuge. 3

Figure 3. National wildlife refuges in Florida. 4

Figure 4. Wilderness areas, Chassahowitzka NWR. 16

Figure 5. Regional conservation lands. 18

Figure 6. Landscape conservation cooperatives. 19

Figure 7. Watersheds of Chassahowitzka NWR. 33

Figure 8. Springs of Chassahowitzka NWR. 34

Figure 9. Land cover, Chassahowitzka NWR. 40

Figure 10. Submerged habitats, Chassahowitzka NWR. 41

Figure 11. Land use. 59

Figure 12. Existing public use facilities, Chassahowitzka NWR. 64

Figure 13. Proposed public use facility improvements. 99

Figure 14. Proposed organizational chart, Crystal River NWR Complex. 115

LIST OF TABLES

Table 1. Federal- and state-listed species of Chassahowitzka NWR (2012). 49

Table 2. Demographic data comparison for Citrus and Hernando counties, the State of Florida, and the U.S. (2010). 56

Table 3. Employment by industry. 57

Table 4. Summary of projects. 113

Table 5. Approximate annual costs of proposed new staff positions for Chassahowitzka NWR (2012 costs). 114

Table 6. Chassahowitzka NWR step-down management plans. 118

Table 7. Comparison of alternatives by management issues for Chassahowitzka NWR. 138

Table 8. Summary of environmental effects by alternative for Chassahowitzka NWR. 163

SECTION A. DRAFT COMPREHENSIVE CONSERVATION PLAN

I. Background

INTRODUCTION

Chassahowitzka National Wildlife Refuge (NWR) is managed by the U.S. Fish and Wildlife Service as part of the Crystal River National Wildlife Refuge Complex, which includes five refuges: Chassahowitzka and Crystal River NWRs and three other refuges in the Tampa Bay area, the Egmont Key, Pinellas, and Passage Key NWRs (Figure 1). Chassahowitzka NWR is located in Citrus and Hernando counties along Florida's north-central west coast (Figure 2) and is managed with the Crystal River NWR in Crystal River, Florida. Chassahowitzka NWR was established on December 29, 1941, with the acquisition of 2,742 acres in Hernando County. Presently, the refuge covers 30,842 acres of primarily black needlerush (*Juncus maritima*) saltmarsh habitat within a 36,865-acre acquisition boundary. Chassahowitzka NWR is one of 29 national wildlife refuges in the State of Florida (Figure 3).

The U.S. Fish and Wildlife Service (Service) has prepared this Draft Comprehensive Conservation Plan for Chassahowitzka NWR to guide the refuge's management actions and direction over the next 15 years. Fish and wildlife conservation will receive first priority in refuge management; wildlife-dependent recreation will be allowed and encouraged as long as it is compatible with, and does not detract from, the mission of the refuge or the purposes for which it was established.

A planning team developed a range of alternatives that best met the goals and objectives of the refuge and that could be implemented within the 15-year planning period. This draft comprehensive conservation plan and the accompanying environmental assessment (Section B) describe the Service's proposed plan, as well as two other alternatives that were considered and their potential effects on the environment. Both the draft plan and environmental assessment are being made available to state and federal government agencies, conservation partners, and the general public for review and comment. All comments will be considered in the development of the final plan.

PURPOSE AND NEED FOR THE PLAN

The purpose of the plan is to develop a proposed action that best achieves the purposes of the refuge; attains the vision and goals developed for the refuge; contributes to the mission of the National Wildlife Refuge System; addresses key problems, issues and relevant mandates; and is consistent with sound principles of fish and wildlife management.

Specifically, the plan is needed to:

- provide a clear statement of the refuge's management direction;
- provide refuge neighbors, visitors, and government officials with an understanding of the Service's management actions on and around the refuge;
- ensure that the Service's management actions, including land protection and recreation/education programs, are consistent with the mandates of the National Wildlife Refuge System; and
- provide a basis for development of the refuge's budget requests for operations, maintenance, and capital improvement needs.

Figure 1. Crystal River National Wildlife Refuge Complex.

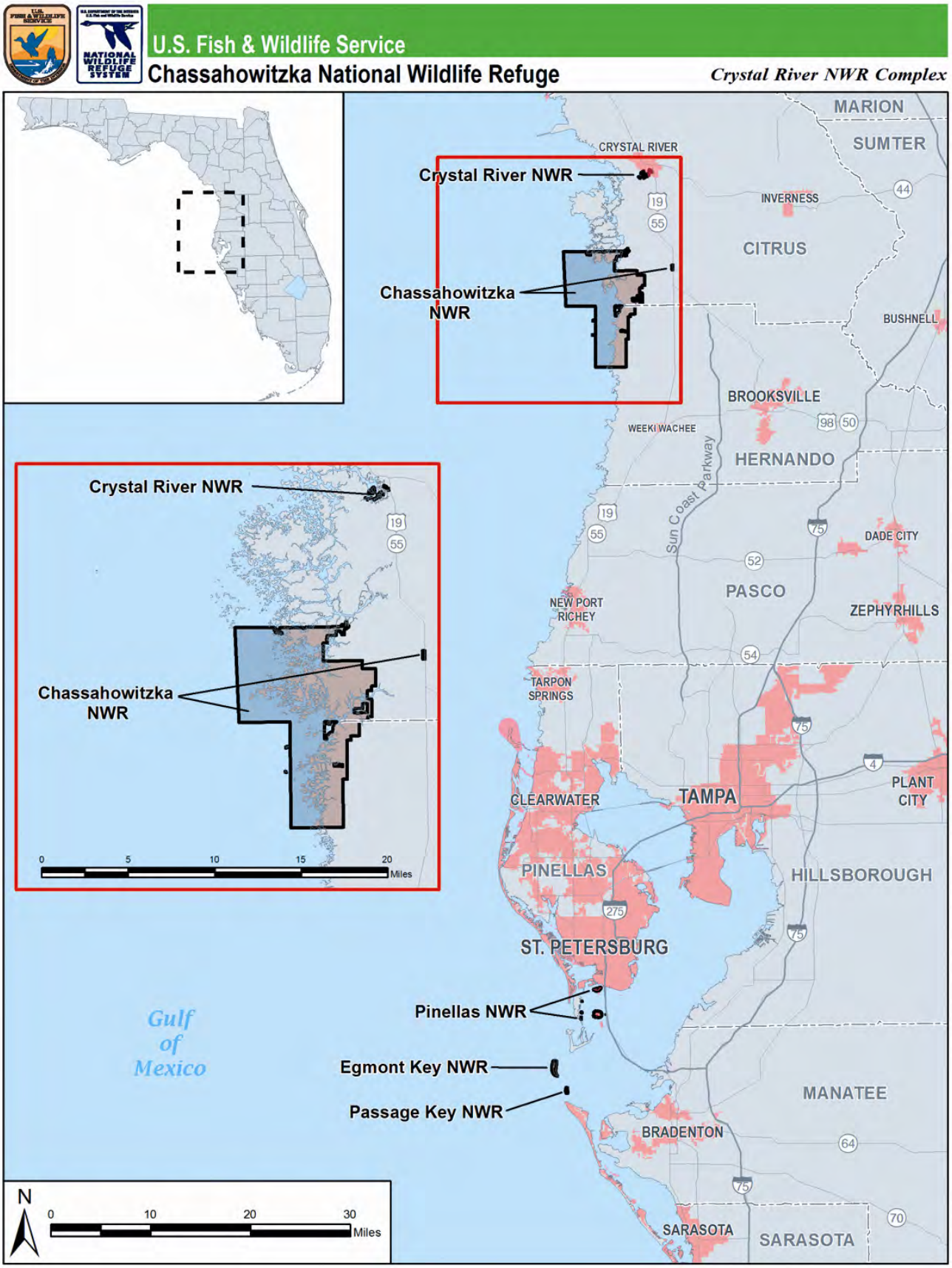


Figure 2. Location of Chassahowitzka National Wildlife Refuge.

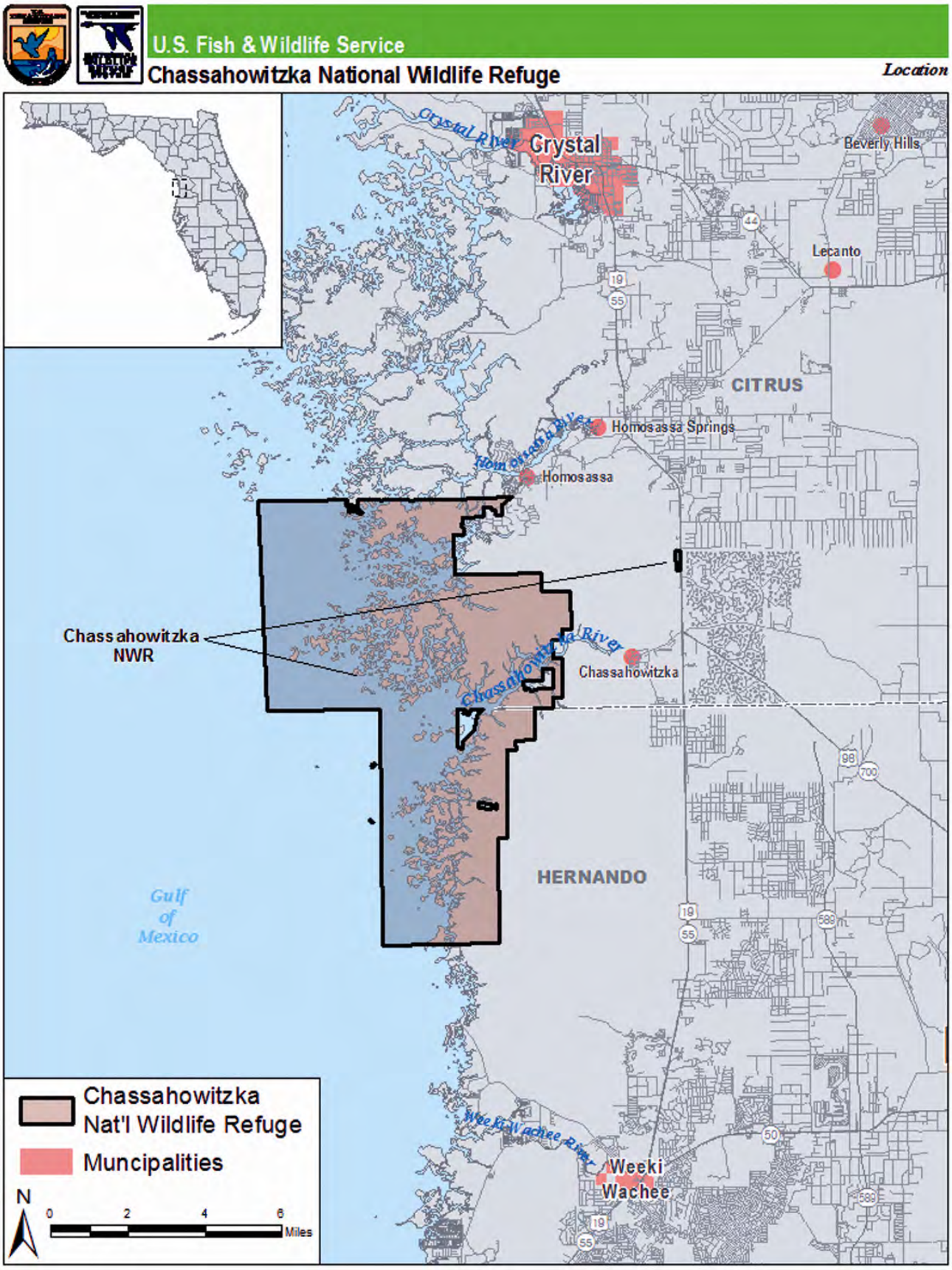


Figure 3. National wildlife refuges in Florida.

U.S. FISH AND WILDLIFE SERVICE

As part of its mission, the U.S. Fish and Wildlife Service manages 150 million acres of lands that comprise the National Wildlife Refuge System. The system encompasses 556 national wildlife refuges, thousands of small wetlands, and other special management areas. The Service also operates 70 national fish hatcheries, 63 fish and wildlife management offices, and 81 ecological services field stations. The Service enforces federal wildlife laws; administers the Endangered Species Act; manages migratory bird populations; restores nationally significant fisheries; conserves and restores wildlife habitat, such as wetlands; and helps foreign governments with their conservation efforts. It also oversees the Federal Assistance program, which distributes hundreds of millions of dollars in excise taxes on fishing and hunting equipment to state fish and wildlife agencies.

NATIONAL WILDLIFE REFUGE SYSTEM

The wildlife refuges nationwide provide habitat to over 700 species of birds, 220 species of mammals, 250 reptile and amphibian species, and more than 200 species of fish. Fifty-nine refuges were established for the primary purpose of conserving threatened or endangered species. Of the 1,200 federally listed species (i.e., those with threatened or endangered status), 280 occur on units of the Refuge System.

The mission of the National Wildlife Refuge System, as defined by the National Wildlife Refuge System Improvement Act of 1997 (Improvement Act), is:

> *... to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife and plant resources and their habitats within the United States for the benefit of present and future generations of Americans.*

The Improvement Act established a clear legislative mission of wildlife conservation for the National Wildlife Refuge System and initiated the development of comprehensive conservation plans for all refuges. These plans, which are completed with public involvement, help guide the future management of refuges by establishing natural resources and recreation/education programs. Consistent with this Act, approved plans will serve as the guidelines for refuge management for the next 15 years. The Act states that each refuge shall be managed to:

- fulfill the mission of the National Wildlife Refuge System;
- fulfill the individual purposes of each refuge;
- consider the needs of wildlife first;
- fulfill the requirement of preparing a comprehensive conservation plan for each unit of the Refuge System;
- maintain the biological integrity, diversity, and environmental health of the Refuge System;
- recognize that wildlife-dependent recreation activities including hunting, fishing, wildlife observation, wildlife photography, and environmental education and interpretation are legitimate and priority public uses; and
- retain the authority of refuge managers to determine compatible public uses.

National wildlife refuges connect visitors to their natural resource heritage and provide them with an understanding and appreciation of fish and wildlife ecology to help them understand their role in the environment. Wildlife-dependent recreation on refuges also generates economic benefits to local communities. According to the report, *Banking on Nature 2006: The Economic Benefits to Local*

Communities of National Wildlife Refuge Visitation (Carver and Caudill 2007), approximately 34.8 million people visited national wildlife refuges in fiscal year 2006, generating almost $1.7 billion in total economic activity and creating almost 27,000 private sector jobs producing about $542.8 million in employment income. Additionally, recreational spending on refuges generated nearly $185.3 million in tax revenues at the local, county, state, and federal levels (Carver and Caudill 2007). In 2006, nearly 87 million people 16 years and older fished (30 million), hunted (12.5 million), or observed wildlife (71 million), generating $120 billion nationwide (U.S. Department of Interior, Fish and Wildlife Service, and U.S. Department of Commerce, U.S. Census Bureau 2007).

Volunteers and "friends of the refuge" (Friends groups) continue to be a major contributor to the success of the Refuge System. In 2008, volunteers contributed more than 1.5 million hours on refuges nationwide, a service valued at more than $30 million and representing a total of over 745 full-time employees. Within the Service's Southeast Region, the number of station-specific Friends organizations has steadily increased and reached over 200 (U.S. Fish and Wildlife Service 2009). The volunteer program continues to grow. In the last decade, 70,501 volunteers have contributed over 3.3 million hours valued at over $62 million, equaling the work of 161 full-time employees per year.

The wildlife and habitat vision for national wildlife refuges stresses that wildlife comes first; that ecosystems, biodiversity, and wilderness are vital concepts in refuge management; that refuges must be healthy and growth must be strategic; and that the Refuge System serves as a model for habitat management with broad participation from others.

The Improvement Act stipulates that comprehensive conservation plans be prepared in consultation with adjoining federal, state, and private landowners, and that the Service develop and implement a process to ensure an opportunity for active public involvement in the preparation and revision of the plans every 15 years.

All lands of the Refuge System will be managed in accordance with an approved comprehensive conservation plan that will guide management decisions and set forth strategies for achieving refuge unit purposes. The plan will be consistent with sound resource management principles, practices, and legal mandates, including Service compatibility standards and other Service policies, guidelines, and planning documents (602 FW 1.1).

LEGAL AND POLICY CONTEXT

LEGAL MANDATES, ADMINISTRATIVE AND POLICY GUIDELINES, AND OTHER SPECIAL CONSIDERATIONS

Administration of national wildlife refuges is guided by the mission and goals of the National Wildlife Refuge System, congressional legislation, presidential executive orders, and international treaties. Policies for management options of refuges are further refined by administrative guidelines established by the Secretary of the Interior and by policy guidelines established by the Director of the Fish and Wildlife Service. Many of the treaties and laws relevant to the administration of the National Wildlife Refuge System and the management of Chassahowitzka NWR are summarized in Appendix C.

These treaties, laws, administrative guidelines, and policy guidelines assist the refuge manager in making decisions pertaining to soil, water, air, flora, fauna, and other natural resources; historical and cultural resources; research and recreation on refuge lands; and provide a framework for cooperation between Chassahowitzka NWR and its other partners, such as the Florida Department of Environmental Protection and the Florida Fish and Wildlife Conservation Commission.

Lands within the National Wildlife Refuge System are closed to public use unless specifically and legally opened. No refuge use may be allowed unless it is determined to be compatible. A compatible use is a use that, in the sound professional judgment of the refuge manager, will not materially interfere with or detract from the fulfillment of the mission of the Refuge System or the purposes of the refuge. All programs and uses must be evaluated based on mandates set forth in the National Wildlife Refuge System Improvement Act. Those mandates are to:

- contribute to ecosystem goals, as well as the refuge's purposes and goals;
- conserve, manage, and restore fish, wildlife, and plant resources and their habitats;
- monitor the trends of fish, wildlife, and plants;
- manage and ensure appropriate visitor uses, as those uses benefit the conservation of fish and wildlife resources and contribute to the enjoyment of the public; and
- ensure that visitor activities are compatible with refuge purposes.

The Improvement Act further identifies six priority wildlife-dependent recreational uses. These uses are hunting, fishing, wildlife observation, wildlife photography, and environmental education and interpretation. As priority public uses of the Refuge System, they receive priority consideration over other public uses in planning and management.

BIOLOGICAL INTEGRITY, DIVERSITY, AND ENVIRONMENTAL HEALTH POLICY

The Improvement Act directs the Service to ensure that the biological integrity, diversity, and environmental health of the Refuge System are maintained for the benefit of present and future generations of Americans. The policy is an additional directive for refuge managers to follow while achieving the purpose(s) of the refuge and the mission of the Refuge System. It provides for the consideration and protection of the broad spectrum of fish, wildlife, and habitat resources found on refuges and associated ecosystems. When evaluating the appropriate management direction for refuges, refuge managers will use sound professional judgment to determine their refuge's contribution to biological integrity, diversity, and environmental health at multiple landscape scales. Sound professional judgment incorporates field experience, knowledge of refuge resources and the refuge's role within an ecosystem, applicable laws, and best available science, including consultation with others both inside and outside the Service.

NATIONAL AND INTERNATIONAL CONSERVATION PLANS AND INITIATIVES

Multiple partnerships have been developed among government and private entities to address the environmental problems affecting regions. A large amount of conservation and protection information defines the role of the refuge at the local, national, international, and ecosystem levels. Conservation initiatives include broad-scale planning and cooperation between affected parties to address declining trends of natural, physical, social, and economic environments. The conservation guidance described below, along with issues, problems, and trends, was reviewed and integrated where appropriate into this Draft CCP/EA. This Draft CCP/EA supports, among others, the plans described below.

FLORIDA MANATEE RECOVERY PLAN

The Service, the advisory recovery team, and many other partners developed a Florida Manatee Recovery Plan (Third Revision) in 2001. The goal of this plan is to ensure the long-term viability of the Florida manatee (*Trichechus manatus latirostris*) in the wild. The plan sets forth criteria that, when met, will ensure a healthy, self-sustaining population of manatees in Florida by reducing or

removing threats to its existence. To implement those parts of the plan that the State of Florida agreed to accomplish, the Florida Fish and Wildlife Conservation Commission adopted a companion Florida Manatee Management Plan in 2007. These two documents provide the framework for major recovery initiatives within the state.

WESTERN HEMISPHERE MIGRATORY SPECIES INITIATIVE

The Western Hemisphere Migratory Species Initiative (WHMSI) seeks to contribute significantly to the conservation of the migratory species of the Western Hemisphere by strengthening communication and cooperation among nations, international conventions, and civil society, and by expanding constituencies and political support. The initiative includes all migratory species, covering taxa as diverse as birds, marine turtles, marine and terrestrial mammals, fishes, and invertebrates. The program's objectives, among others, are to:

- maintain a compilation of pertinent conservation resources;
- promote the adoption of best management practices;
- mitigate primary threats;
- restore populations of threatened species;
- articulate ongoing and planned conservation efforts;
- communicate and raise awareness of the ecological, economic, and cultural importance of migratory species; and
- increase constituency that supports the conservation of migratory species, including the promotion of local initiatives (WHMSI 2011).

Chassahowitzka NWR would help contribute toward meeting the objectives outlined in the WHMSI, especially with regard to the conservation of whooping cranes (*Grus americana)* and the West Indian manatee (*Trichechus manatus)*.

NORTH AMERICAN BIRD CONSERVATION INITIATIVE

Started in 1999, the North American Bird Conservation Initiative (NABCI) is a continent-wide coalition of government agencies, private organizations, academic institutions, and industry leaders in the United States, Canada, and Mexico, working to ensure the long-term health of North America's native bird populations by fostering partnerships to facilitate an integrated approach to bird conservation for the benefit of all birds in all habitats. The NABCI-U.S. also works to increase financial resources for bird conservation. A complementary effort is the Important Bird Area program described in Chapter II. For more information, please consult the internet website http://www.nabci-us.org/.

Chassahowitzka NWR supports five major bird conservation planning efforts: the North American Waterfowl Management Plan, the Partners in Flight Initiative, the U.S. Shorebird Conservation Plan, the North American Waterbird Conservation Plan, and the Northern Bobwhite Conservation Initiative. These are described below.

North American Waterfowl Management Plan

The North American Waterfowl Management Plan (NAWMP) is an international action plan to conserve migratory birds throughout the continent. The plan's goal is to return waterfowl populations to their 1970s levels by conserving wetland and upland habitat. Canada and the United States signed the plan in 1986 in reaction to critically low numbers of waterfowl. Mexico joined in 1994, making it a truly continental effort. The plan is a partnership of federal, provincial,

state, and municipal governments; nongovernmental organizations; private companies; and many individuals, all working towards achieving better wetland habitats for the benefit of migratory birds, other wetland-associated species, and people. The plan's projects are international in scope, but implemented at regional levels. These projects contribute to the protection of habitat and wildlife species across the North American landscape.

The NAWMP identified important waterfowl habitat areas and established habitat and population goals. It developed interstate and international partnerships called joint ventures to implement the plan's goals. In 1997, the Atlantic Coast Joint Venture added Florida as its seventeenth state partner. For more information, please visit the website http://northamerican.fws.gov/NAWMP/hawmphp.htm.

Partners in Flight Bird Conservation Plan

The Partners in Flight initiative was launched in 1990 in response to growing concerns about continental declines in the populations of many land bird species. A central premise of Partners in Flight is that the resources of public and private organizations in the Americas must be combined, coordinated, and increased in order to achieve success in conserving bird populations in this hemisphere. The Service is a member of the cooperative effort to promote research, land protection, and education about migratory birds. Other participants include federal, state, and local government agencies, philanthropic foundations, professional organizations, conservation groups, industry, the academic community, and private individuals. While its top priority is to help species at risk, the goal of the initiative is also to keep common birds common. Chassahowitzka NWR lies in Bird Conservation Region (BCR) 31, which includes much of the Florida peninsula. For more information, please consult http://www.partnersinflight.org.

U.S. Shorebird Conservation Plan

The U.S. Shorebird Conservation Plan is a partnership effort throughout the United States to ensure that stable and self-sustaining populations of shorebird species are restored and protected. The plan was developed by a wide range of agencies, organizations, and shorebird experts for separate regions of the country, and identifies conservation goals, critical habitat conservation needs, key research needs, and proposed education and outreach programs to increase public awareness of shorebirds and the threats they face.

Northern American Waterbird Conservation Plan

The North American Waterbird Conservation Plan (NAWCP) was initiated in 1998. It was established to help maintain healthy populations, distributions, and habitats of waterbirds in North America throughout their breeding, migratory, and wintering ranges. For more information on the NAWCP, please visit the website http://www.waterbirdconservation.org.

Northern Bobwhite Conservation Initiative

The Northern Bobwhite Conservation Initiative (NBCI) is the first landscape-scale habitat restoration and population recovery plan for northern bobwhites (*Colinus virginianus*) in the U.S. The NBCI was developed in recognition of (1) the continuing serious decline of bobwhite populations across most of the bird's range, and (2) the necessity for large-scale coordinated, collaborative action at the regional level. The plan focuses on the population and habitat objectives needed to achieve the overall goal of recovering bobwhite densities to their 1980 levels on remaining improvable portions of the landscape. Chassahowitzka NWR provides habitat for bobwhite in the Salt Marsh Trail area.

The plan's building blocks are the bird conservation regions (BCRs) developed for and used by the NABCI. The plan consists of separate chapters for each of 15 BCRs, with population and habitat objectives for each. Another important foundation of the NBCI is the land-use data collected and analyzed every five years by the National Resources Inventory (NRI), a database of the U.S. Department of Agriculture's Natural Resources Conservation Service. The intent of the BCR-based structure of the NBCI is to facilitate seamless integration of bobwhite habitat restoration efforts with those for migratory songbirds, along with other wildlife that share the bobwhite's habitats. For more information on the program, please visit http://www.gu.org/seqsg/nbci/nbci.cfm.

NATIONAL FISH HABITAT ACTION PLAN

In 2001, the Sport Fishing and Boating Partnership Council explored the notion of developing a partnership effort for fish on the scale of what was done for waterfowl in the 1980s through the North American Waterfowl Management Plan. The waterfowl plan has worked wonders during the past two decades to boost waterfowl populations by forming strong local and regional partnerships to protect key habitats. The mission of the National Fish Habitat Action Plan is to protect, restore and enhance the nation's fish and aquatic communities through partnerships that foster fish habitat conservation and improve the quality of life for the American people. This mission will be achieved by:

- supporting existing fish habitat partnerships and fostering new efforts;
- mobilizing and focusing national and local support for achieving fish habitat conservation goals;
- setting national and regional fish habitat conservation goals;
- measuring and communicating the status and needs of fish habitats; and
- providing national leadership and coordination to conserve fish habitats.

For more information on the plan, please visit http://www.fishhabitat.org.

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION (NOAA) MARINE DEBRIS REMOVAL PROGRAM

The NOAA's Marine Debris Program was launched in 2005 after the NOAA National Ocean Service's Office of Response and Restoration received a budget line entitled "Marine Debris" for $5 million. On December 22, 2006, President George W. Bush signed into law the Marine Debris Research, Prevention, and Reduction Act, which legally established the NOAA's Marine Debris Program. To date, the program has (1) reviewed and inventoried existing debris projects in the NOAA; (2) conducted two workshops with internal and external partners focused on the activities and needs of the NOAA and the marine debris community; (3) developed a two-year implementation plan; (4) established biweekly marine debris meetings with representatives from over ten offices across five NOAA line offices; (5) identified regional coordinators to promote the program's objectives; (6) established an outreach program; and (7) created three competitive grant programs for distributing funds.

Chassahowitzka NWR contributes towards the program's outreach and education goals, which aim to reduce injury and mortality to a wide range of marine species. Further, the refuge's staff and volunteers participate in coastal cleanup activities, specifically blue crab trap cleanups. For more information, please consult http://marinedebris.noaa.gov/welcome.html.

CLIMATE SCIENCE CENTERS

Created by the Department of the Interior in early 2010 to expand the scope and geographic reach of climate science efforts, eight regional climate science centers (CSCs) were developed for the U.S. to provide scientific information, tools, and techniques that land, water, wildlife, and cultural resource managers and other interested parties can apply to anticipate, monitor, and adapt to climate and ecologically-driven responses at regional to local scales. The CSCs will deliver basic climate change impact science to landscape conservation cooperatives (LCCs) within their respective regions, including physical and biological research, ecological forecasting, and multi-scale modeling. The CSCs will prioritize their delivery of fundamental science, data, and decision-support activities to meet the needs of the LCCs. This includes working with the LCCs to provide climate change impact information on natural and cultural resources and to develop adaptive management and other decision support tools for managers. The Southeast CSC would help serve the Peninsular Florida LCC, helping to support the refuge's understanding and responses to the impacts of climate change.

RELATIONSHIP TO STATE WILDLIFE AND HABITAT PROTECTION AGENCIES

A provision of the National Wildlife Refuge System Improvement Act of 1997, and subsequent agency policy, is that the Service shall ensure timely and effective cooperation and collaboration with other state fish and game agencies and tribal governments during the course of acquiring and managing refuges. State wildlife management areas and national wildlife refuges provide the foundation for the protection of species, and contribute to the overall health and sustainment of fish and wildlife in the State of Florida.

Chassahowitzka NWR's state agency partners include the Florida Fish and Wildlife Conservation Commission (FWC), Florida Department of Environmental Protection (FDEP), Florida Forest Service (FFS), and the Southwest Florida Water Management District (SWFWMD). Each of these agencies maintains and manages land areas for natural resource and wildlife protection.

The State of Florida's land holdings are substantial. The FWC manages 4.3 million acres of public lands and 220,000 acres of private lands for recreation and conservation purposes. The FDEP manages 150 state parks covering 600,000 acres and 57 coastal and aquatic managed areas, totaling over 5 million acres of submerged water bottoms and coastal uplands. The FFS manages over one million acres of state forests for multiple public uses including timber, recreation, and wildlife habitat. The SWFWMD manages 431,000 acres for the purposes of protecting, supplying, and conserving the region's water resources. Water quality and quantity jurisdiction is shared between the SWFWMD and FDEP.

Operating from 15 field units throughout the state, the FFS maintains a mission to protect and manage the forest resources of Florida, ensuring that they are available for future generations. Wildfire prevention and suppression are key components in the FFS's efforts.

Management of Florida's fish and wildlife resources is administered by the FWC and FDEP for the long-term well-being and benefit of people. The FWC is the lead state wildlife agency in Florida. Its mission is to manage fish and wildlife resources for their long-term well-being and the benefit of people. FWC officials, including 700 federal wildlife officers, work to protect and manage more than 575 species of wildlife, 200 species of freshwater fish, and 500 species of saltwater fish (FWC 2011). The FWC works to balance the needs of these fish and wildlife species and the habitats that support them with the needs of more than 18 million residents (U.S. Census Bureau 2007) and over 85 million annual visitors (FDOT 2008) who share the land and water with Florida's wildlife. For more information about the FWC and its programs, please visit www.myfwc.com.

The FWC's responsibilities include:

- Law Enforcement – to protect fish and wildlife, keep waterways safe for millions of boaters, and cooperate with other law enforcement agencies providing homeland security.
- Research – to provide information for the FWC and others to make management decisions based on the best science available involving fish and wildlife populations, habitat issues, and the human-dimension aspects of conservation.
- Management – to manage the state's fish and wildlife resources based on the latest scientific data to conserve some of the most complex and delicate ecosystems in the world, along with a wide diversity of species.
- Outreach – to communicate with a variety of audiences in order to encourage participation, responsible citizenship, and stewardship of the state's natural resources.

The FWC developed a Wildlife Legacy Initiative in 2004 to partner for wildlife conservation and administration of the federally funded State Wildlife Grants Program.

The SWFWMD is one of Florida's five water management agencies and is responsible for managing ground and surface water supplies in all or part of 16 counties in southwest and west central Florida, covering about 10,000 square miles. The mission of the SWFWMD is to manage water and related natural resources to ensure their continued availability, while maximizing environmental, economic, and recreational benefits. Central to the mission is maintaining the balance between the water needs of current and future users, while protecting and maintaining water and related natural resources which provide the district with its existing and future water supply.

The SWFWMD owns or manages over 400,000 acres of land, acquired for the purposes of water management, water supply, and the conservation and protection of water resources (SWFWMD 2005). These lands largely consist of wetlands or historically wet areas. Of less acreage, but not of less importance, are upland areas. These areas preserve wetlands, waters, and wildlife and provide critical buffers between rapidly encroaching development and important wetland areas. Within Citrus County, the SWFWMD manages the Chassahowitzka River and Coastal Swamps properties.

Various agencies within the state government have participated in a mix of refuge projects, including the planning process to develop this 15-year management plan for the refuge. The State of Florida's participation and contribution throughout this comprehensive conservation planning process has provided communication and opportunities to improve the ecological sustainability of fish and wildlife in Florida. An integral part of the planning process is the integration of common mission objectives, where appropriate, to protect wildlife and habitat. The planning team that developed this Draft CCP/EA includes state representatives from the FWC and FDEP.

II. Refuge Overview

INTRODUCTION

This chapter provides a general summary of Chassahowitzka NWR, including its history and purposes; its physical, natural and socioeconomic environments; and its management.

REFUGE DESCRIPTION, HISTORY OF ESTABLISHMENT, AND PURPOSES

Located about 60 miles north of St. Petersburg, Florida, Chassahowitzka NWR is comprised of 30,842 acres of saltwater bays, estuaries, and brackish marshes with a fringe of hardwood swamps along the eastern boundary. Public access to the refuge is mainly by boat. The northern boundary runs parallel to and includes some of the Homosassa River. The refuge extends southward across the scenic Chassahowitzka River for 12 miles to its southern boundary at Raccoon Point.

The refuge was established in 1943 under the Migratory Bird Act primarily to benefit waterfowl in an area long famous as a wintering site for ducks and coots. Although waterfowl numbers in central Florida have declined, the refuge supports a variety of habitats and wildlife. It provides habitat for over 200 species of birds, 50 species of mammals, and at least 30 species of reptiles.

Chassahowitzka NWR's estuarine habitats provide important breeding and feeding grounds for marine life. Shallow bays support an abundant growth of muskgrass (*Chara* spp.), which provides food for various birds and the endangered manatee. Inland from the bays are the brackish creeks and ponds where widgeon grass (*Ruppia maritima*), Eurasian watermilfoil (*Myriophyllum spicatum*), and other foods grow in abundance. The eastern boundary includes a few thousand acres of swamp habitats with cabbage palms (*Sabal palmetto*), oaks (*Quercus* spp.), cypress (*Taxodium* spp.) and southern red cedar (*Juniperus silicicola*). The outer islands mostly consist of red and black mangrove (*Rhizophora mangle* and *Avicennia nitida germinans,* respectively), which provides habitat for colonial birds. More than three-quarters of the refuge is designated by Congress as a wilderness area and is part of the National Wilderness Preservation System (NWPS).

The purposes of a refuge come from the executive orders and subsequent laws Congress passed as it established each refuge. This refuge was established under the Migratory Bird Conservation Act. Congress has also designated other specific purposes for managing the Refuge System as a whole. This plan is designed with consideration of the distinct purposes of the refuge, which are as follows:

- ... for use as an inviolate sanctuary, or for any other management purpose, for migratory birds. 16 U.S.C. 715d (Migratory Bird Conservation Act of 1929);
- ... wilderness areas...shall be administered for the use and enjoyment of the American people in such manner as will leave them unimpaired for future use and enjoyment as wilderness, and so as to provide for the protection of these areas, the preservation of their wilderness character, and for the gathering and dissemination of information regarding their use and enjoyment as wilderness...16 U.S.C. 1131 (Wilderness Act of 1964); and
- ... for the development, advancement, management, conservation, and protection of fish and wildlife resources ...16 U.S.C. 742f (a)(4)...for the benefit of the United States Fish and Wildlife Service, in performing its activities and services. Such acceptance may be subject to the terms of any restrictive or affirmative covenant, or condition of servitude ...16 U.S.C. 742f (b)(1) (Fish and Wildlife Act of 1956).

SPECIAL DESIGNATIONS

OUTSTANDING FLORIDA WATERS DESIGNATION

Refuge waters, including the Chassahowitzka and Homosassa rivers, are designated Outstanding Florida Waters. Section 403.061(27), Florida Statutes, grants the FDEP the power to "Establish rules which provide for a special category of water bodies within the state, to be referred as 'Outstanding Florida Waters,' which shall be worthy of special protection because of their natural attributes." Among other public conservation lands within state and federal ownership, all waters in national wildlife refuges are designated as Outstanding Florida Waters (OFWs). The regulatory significance of the OFWs statute is to prevent the FDEP from issuing permits for direct or indirect pollutant discharges into OFWs, which would lower or degrade their existing water quality. Permits for new dredge and fill activities must clearly be in the public interest. For more information on the Outstanding Florida Waters program, please refer to http://www.dep.state.fl.us/water/wqssp/ofw.htm.

MARINE PROTECTED AREAS

Executive Order 13158 on Marine Protected Areas (MPAs), issued on May 26, 2000, directs federal agencies to work with government and nongovernmental partners to increase protection and sustainable use of ocean resources by strengthening and expanding a national system of MPAs. The definition of MPAs provided in the President's Executive Order is "any area of the marine environment that has been reserved by federal, state, territorial, tribal, or local laws or regulations to provide lasting protection for part or all of the natural and cultural resources therein." Chassahowitzka NWR is classified as an MPA by virtue of being in the National Wildlife Refuge System. All actions concerning the management of MPAs are left to the discretion of the local, state, or federal authorities that currently have those powers. For more information on MPAs, please consult http://mpa.gov/.

IMPORTANT BIRD AREA

The refuge and surrounding coastal marsh area is designated as an Important Bird Area (IBA). The Chassahowitzka-Weeki Wachee IBA is contiguous to the Crystal River Marshes IBA to the north and the Coastal Pasco IBA to the south. An IBA is broadly defined as a place that provides essential habitat for one or more species of bird whether in breeding season, winter, or during migration. Worldwide, there are 3,500 sites. Originated by BirdLife International in Europe, the IBA programs are implemented at the local, regional and national levels. In the United States, the American Bird Conservancy (ABC) and the Audubon Society administer IBA programs. The ABC identified the top 500 sites within the United States. For a site to be designated, it must, for at least part of a year, contain habitat that supports one of the following criteria: (1) a major population of a threatened and/or endangered species; (2) a notable population of a watch list species; (3) a population of a species with a limited range; or (4) large aggregations of breeding, migrating, or wintering birds, including waterfowl, seabirds, wading birds, raptors, or landbirds. The goal of the IBA program is to create public awareness of these sites and to obtain resources to protect them. For more information on the IBA program, please visit http://www.audubon.org/bird/IBA/.

FEDERAL WILDERNESS DESIGNATION AND STEWARDSHIP

Congress designated wilderness areas in the Chassahowitzka NWR on October 19, 1976 (Public Law 94-557) to be managed under the Wilderness Act of 1964 (78 Stat. 890.892: 16 U.S.C. 1132). The refuge's wilderness areas cover 23,579 acres (Figure 4).

Under the Wilderness Act, wilderness areas "…shall be administered for the use and enjoyment of the American people in such a manner as will leave them unimpaired for future use and enjoyment as wilderness, and so as to provide for the protection of these areas, the preservation of their wilderness character, and for the gathering and dissemination of information regarding their use and enjoyment as wilderness."

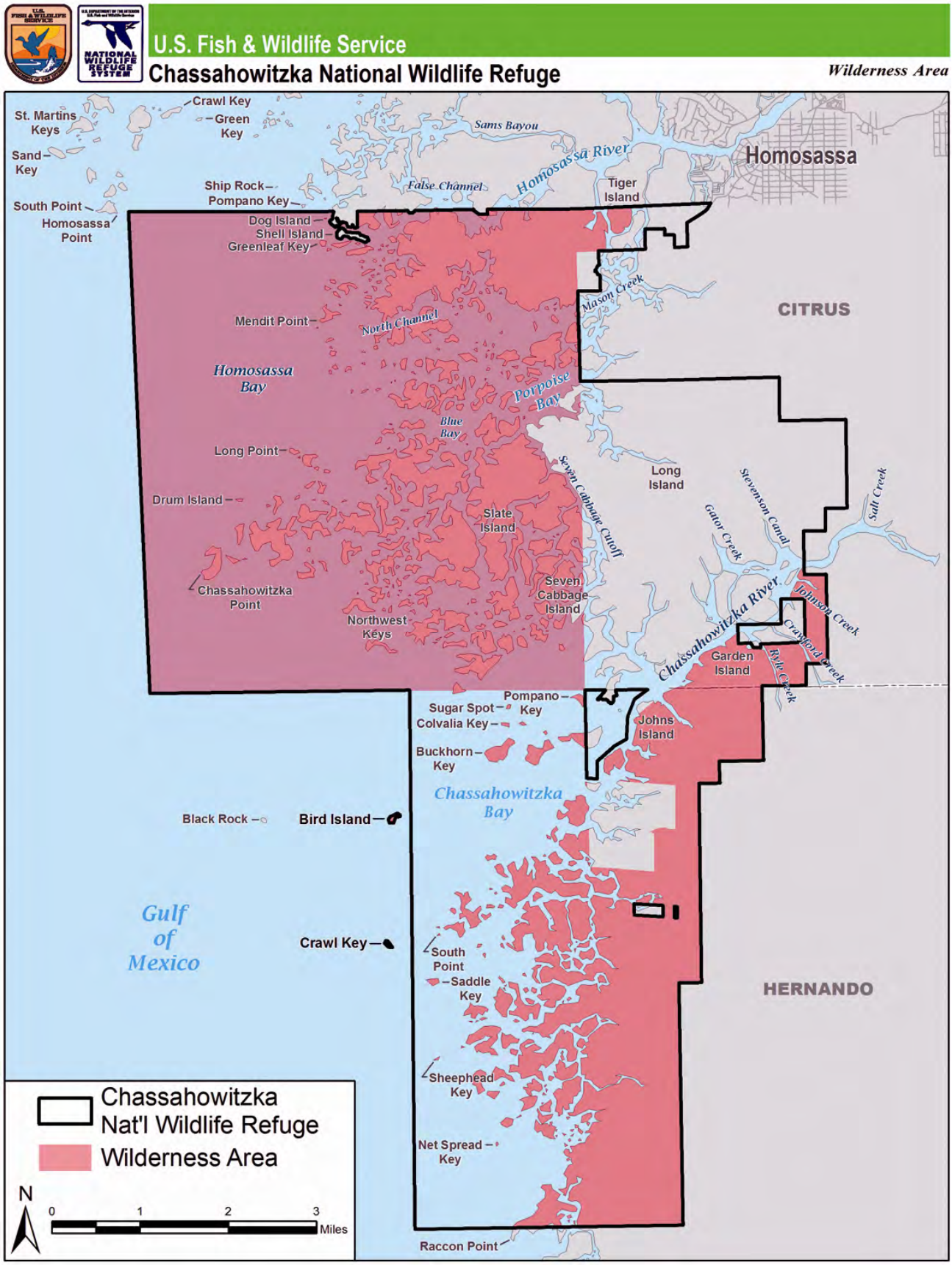
Sixteen principles of wilderness stewardship are derived from the Wilderness Act of 1964, as follows:

- Manage wilderness as a distinct resource with inseparable parts;
- Manage the use of other resources and activities within wilderness in a manner compatible with the wilderness resource;
- Allow natural processes to operate freely within wilderness;
- Attain the highest level of primeval wilderness character within legal constraints;
- Preserve wilderness air and water quality;
- Produce human values and benefits while preserving wilderness;
- Preserve outstanding opportunities for solitude or a primitive and unconfined recreation experience in each wilderness;
- Control and reduce the adverse physical and social impacts of human use in wilderness through education or minimum regulation;
- Favor wilderness-dependent activities when managing wilderness use;
- Exclude the sight, sound, and other tangible evidence of motorized or mechanical transport wherever possible within wilderness;
- Remove existing structures and terminate uses and activities not essential to wilderness management or not provided for by law;
- Accomplish necessary wilderness management work with the minimum tool;
- Establish specific management direction with public involvement in a management plan for each wilderness;
- Harmonize wilderness and adjacent land management activities;
- Manage wilderness with interdisciplinary scientific skills; and
- Manage special provisions provided for by wilderness legislation with minimum impact on the wilderness resource.

The refuge's wilderness areas are comprised of remote islands, mangroves, marshes, bays, and estuarine areas. The 16,893 acres of wilderness in the Citrus County portion of the refuge include the water bottoms acquired in fee title by the federal government. The wilderness designation of 6,736 acres in Hernando County pertains to lands above mean high tide. It does not include the navigable water, which is state-owned.

Today, commercial activities such as crabbing, other fishing, and guiding remain on the refuge. As the refuge is accessible primarily by boat, motorboats are allowed. Because the refuge does not own the waterways, it has not regulated commercial fishing and guiding in wilderness. Commercial crabbing is permitted even though crab traps sit on the refuge-owned water bottoms. Airboat use within Citrus County is prohibited with the exception of designated airboat routes. Public visitors must obtain an airboat permit in order to operate in the Hernando County portion of the refuge and along the two designated routes in Citrus County.

Figure 4. Wilderness areas, Chassahowitzka NWR.



ECOSYSTEM CONTEXT

Chassahowitzka NWR lies within a matrix of other publicly owned conservation lands and waters in Citrus and Hernando counties that provide protection of wildlife and their habitats (Figure 5). The refuge shares its northern boundary with the St. Martins Marsh Aquatic Preserve and the Crystal River Preserve State Park. The refuge also shares its eastern boundary with the Homosassa Tract of the Withlacoochee State Forest and the Chassahowitzka Wildlife Management Area. These adjacent lands are owned and managed by the State of Florida. The Service works in partnership with the state to facilitate and enhance resource management and protection. The area also includes the 5,677-acre Chassahowitzka River and Coastal Swamp.

The State of Florida has established a system of aquatic preserves throughout the state, including St. Martins Marsh in Citrus and Levy counties in 1961. The management intent, as defined in the Florida Aquatic Preserve Act of 1975, is "for such preserves possessing...exceptional biological, aesthetic and scientific value...to be set aside forever as aquatic preserves or sanctuaries for the benefits of future generations" (Section 258.36, Florida Statutes). St. Martins Marsh encompasses 23,000 acres of sovereign state lands located north of the refuge, which include seagrass meadows and hardbottom communities. For more information on Florida's aquatic preserves, please consult http://www.dep.state.fl.us/coastal/sites/stmartins.

The Chassahowitzka Wildlife Management Area (WMA) contains 27,183 acres of hardwood swamp, cypress ponds, flatwoods, saltmarsh, sandhills, scrub and wet prairies. The WMA's diverse vegetative communities provide the resources needed to sustain large wildlife assemblages. It is managed for several imperiled species, such as the Florida black bear (*Ursus americanus*); Eastern indigo snake (*Drymarchon corais couperi*); Florida gopher frog (*Rana capito*); gopher tortoise (*Gopherus polyphemus*); American alligator (*Alligator mississippiensis*); and Florida pine snake (*Pituophis melanoleucus mugitus*). The Chassahowitzka swamp supplies a source of freshwater and provides a buffer to the estuary adjacent to and around refuge lands. For more information, please visit http://www.myfwc.com/RECREATION/WMASites_Chassahowitzka_index.htm.

LANDSCAPE CONTEXT

Ecosystem management is an integrated, flexible approach to the management of biological and physical environments. Using the tools of planning, land acquisition, environmental education, regulation, and pollution prevention, it is designed to maintain, protect, and improve the ecosystem's natural, managed, and human communities.

Strategic habitat conservation (SHC) is a science-based framework for making management decisions about where and how to employ conservation measures efficiently to achieve specific biological outcomes. This framework helps resource managers to analyze, plan, implement, and then evaluate conservation methods. A series of landscape conservation cooperatives (LCCs) (Figure 6) or conservation partnerships among the U.S. Fish and Wildlife Service, the U.S. Geological Survey (USGS), other federal agencies, states, tribes, nongovernmental organizations (NGOs), universities, and stakeholders will provide the geographic framework to deliver SHC. These cooperatives will provide information to enhance decision-making and address nationwide symptoms of environmental stress, such as habitat fragmentation, genetic isolation, the proliferation of invasive species, and water scarcity. All of these threats to the nation's natural resources are accelerated or exacerbated by the global threat of climate change.

Figure 3. Regional conservation lands.

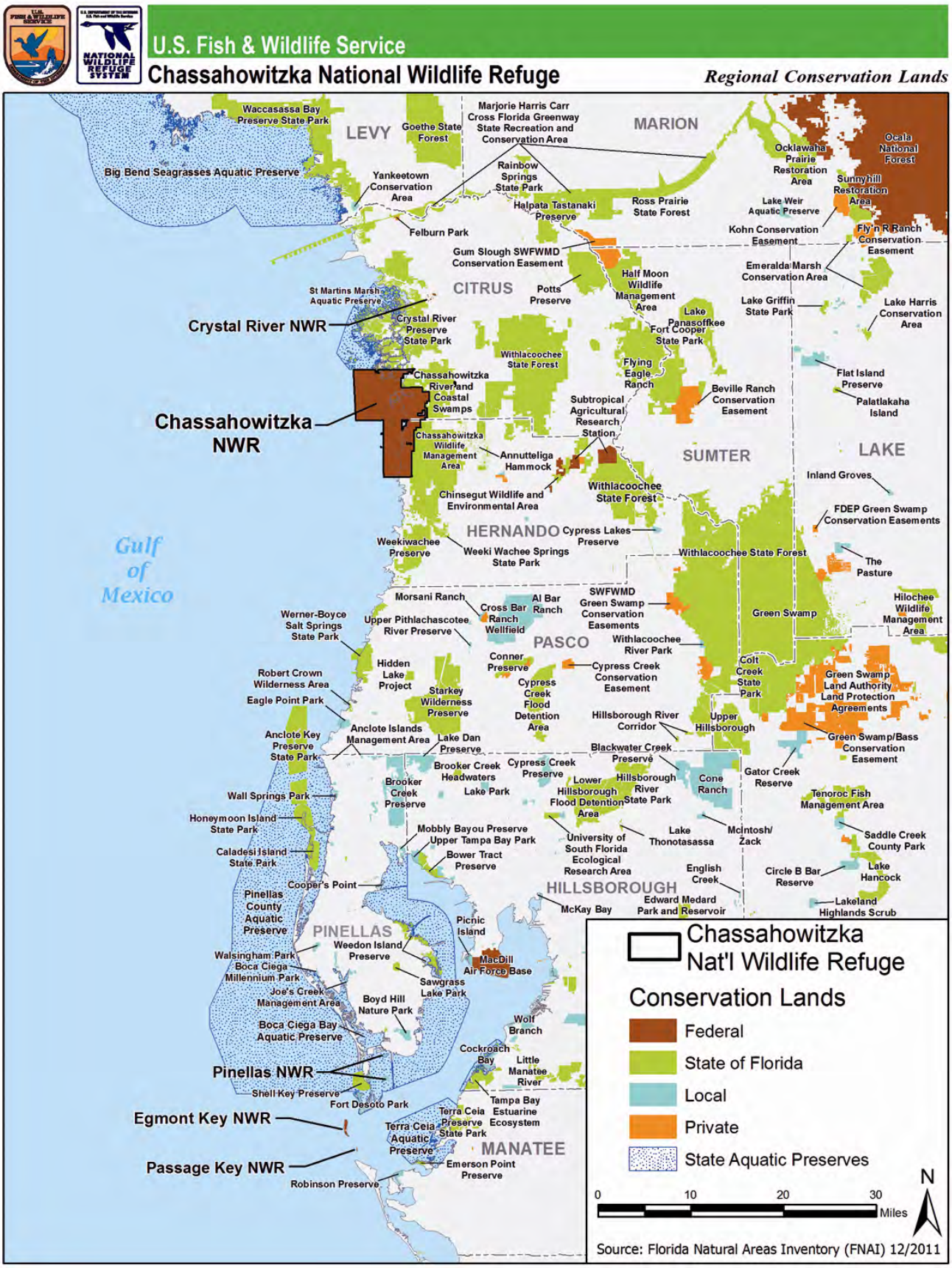
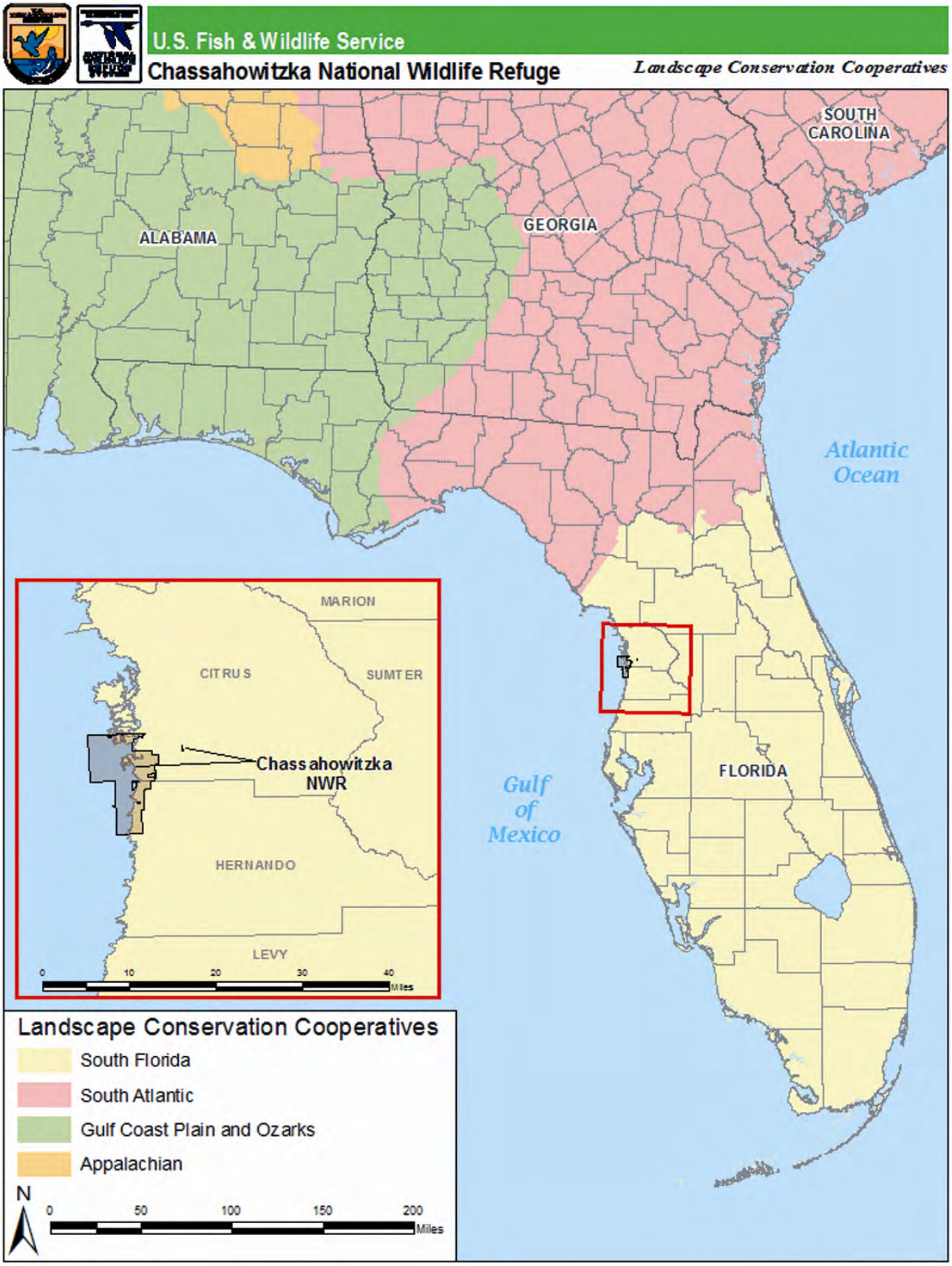


Figure 6. Landscape conservation cooperatives.



STRATEGIC HABITAT CONSERVATION

In the face of escalating challenges, such as land-use conversion, invasive species, water scarcity, and a range of other complex issues—the effects of which may be amplified by accelerated climate change—the U.S. Fish and Wildlife Service embarked several years ago to develop a broader vision for conservation.

Through a cooperative effort culminating in the 2006 National Ecological Assessment Team Report, the Service and the U.S. Geological Survey (USGS) outlined a unifying adaptive resource management approach for conservation at “landscape” scales—the entire range of a priority species or suite of species. Known as “strategic habitat conservation” (SHC), it is a business philosophy that requires a set of biological goals for priority species populations, allows strategic decision-making, and encourages constant reassessment and improvement , all of which are critical steps in dealing with large-scale conservation challenges and the uncertainty of accelerated climate change.

SHC is a national geographic framework for implementing landscape conservation envisioned to provide an effective spatial frame of reference to build capacity and partnerships for conservation. This geographic framework provides a continental platform upon which the Service can work with partners to connect project- and site-specific efforts to larger biological goals and outcomes.

The Service uses the framework as a base geography to locate the first LCCs. As noted above, LCCs are conservation-science partnerships between the Service, other federal agencies, states, tribes, nongovernmental organizations (NGOs), universities, and other entities. They are fundamental units of planning and science capacity to help carry out the functional elements of SHC: biological planning, conservation design, conservation delivery, monitoring, and research. In addition, they help to organize and direct the strategic response to accelerated climate change (see the following discussion under Landscape Conservation Cooperatives).

The Service's landscape conservation efforts are designed to meet the conservation challenges of the 21st century. These efforts parallel the changes that are occurring across the conservation and science communities as states, tribes, nongovernmental organizations, and other stakeholders recognize similar challenges and work together to preserve our nation’s fish and wildlife heritage.

NATIONAL NETWORK OF LANDSCAPE CONSERVATION COOPERATIVES

Landscape conservation cooperatives (LCCs) provide scientific and technical support for conservation at “landscape” scales —the entire range of an identified priority species or groups of species. They support biological planning, conservation design, prioritizing and coordinating research, and designing species inventory and monitoring programs. LCCs also have a role in helping partners identify common goals and priorities to target the right science in the right places for efficient and effective conservation. By functioning as a network of interdependent units rather than independent entities, LCC partnerships can accomplish a conservation mission that cannot be accomplished by a single agency or organization alone.

Collectively, LCCs will compose a seamless national network supporting landscapes capable of sustaining abundant, diverse and healthy populations of fish, wildlife and plants. They will provide a strong link between science and conservation delivery without duplicating existing partnerships or creating burdensome and unnecessary bureaucracy. Rather than create a new conservation infrastructure from the ground up, LCCs build upon explicit biological management priorities and objectives, and science available from existing partnerships, such as fish habitat

partnerships, migratory bird joint ventures and flyway councils, as well as species- and geographic-based partnerships.

LCCs support adaptive resource management by evaluating the implementation of conservation strategies, maintaining and sharing information and data, and improving products as new information becomes available. Shared data platforms serve multiple purposes, including the collaborative development of population/habitat models under alternative climate scenarios to provide spatially explicit decision support for all partners. Decision-support systems and products developed by LCCs not only help determine the most effective conservation actions to support shared priorities, but also provide tools to compare and contrast the implications of management alternatives.

In the face of accelerated climate change and other 21st-century conservation challenges, LCCs will regularly evaluate the effectiveness of scientific information and conservation actions and support necessary adjustments as new information becomes available. This iterative process of information-sharing will help scientists and resource managers deal with uncertainties on the landscape and provide tools to compare and contrast the implications of management alternatives.

PENINSULAR FLORIDA LANDSCAPE CONSERVATION COOPERATIVE

Chassahowitzka NWR lies within the Peninsular Florida LCC (PFLCC), formerly called the North Florida or Peninsular Florida Ecosystem (see Figure 6). Comprising one of the 16 delineated LCCs in the continental U.S., the Service's Peninsular Florida LCC includes several important areas with protective designations, including Ocala National Forest, Everglades National Park, Welaka National Fish Hatchery, and numerous national wildlife refuges. Various other local, state, and federal conservation areas are also located within the Peninsular Florida LCC. The Peninsular Florida LCC spans temperate and subtropical climates, numerous physiographic districts, and a wide variety of habitats. Barrier islands, xeric scrub, pine flatwoods, freshwater marshes, lakes, streams, springs, mixed hardwood/pine forests, cypress swamps and domes, dry prairies, maritime forests, hardwood hammocks, estuarine marshes, pine rocklands, sandhill woodlands, coastal strands, sawgrass prairies, sloughs, and tree islands of the Peninsular Florida LCC serve a variety of native wildlife, including over 100 federally listed species, as well as interjurisdictional fishes, neotropical migratory birds, nongame waterbirds, and waterfowl.

The biggest challenge regarding the Peninsular Florida LCC is the loss of habitat through direct destruction and fragmentation, as well as through impacts from human activities. The predominant stresses for the Peninsular Florida LCC are human population growth, tourism, agriculture, silviculture, mining, water channelization, urbanization, aquifer depletion, fire suppression, invasive species, nonpoint- source pollution, and point-source pollution. The actions of the Peninsular Florida LCC are guided by two categories: trust resources and management issues. The trust resources include migratory birds, anadromous fish, endangered species, and marine mammals. The management issues focus on habitat protection and management, habitat restoration, contaminants, regulatory compliance, law enforcement, and biodiversity.

Chassahowitzka NWR plays an important role in the Peninsular Florida LCC, especially with regard to the conservation of migratory birds and coastal gulf wetlands. The refuge has long been established as an important area for and has been managed primarily for the restoration and maintenance of habitat to serve migratory birds that use the refuge as a stopover site during their fall and spring migrations. Local, state, and federal land management agencies have acquired thousands of acres of natural areas in the region to protect fish, wildlife, and the habitats that support them.

REGIONAL CONSERVATION PLANS AND INITIATIVES

A variety of regional conservation plans and initiatives were reviewed in the preparation of this comprehensive conservation plan (CCP), including recovery plans for federally listed species as well as state and local plans. Other applicable plans, initiatives, and programs include the Florida State Wildlife Action Plan, the Southwest Florida Water Management District's Surface Water Improvement and Management Plan, Florida Natural Areas Inventory, Preservation 2000, Florida Forever Program, and Citrus and Hernando Counties Comprehensive Plans. Several of these plans address the management of conservation lands. Figure 5 shows conservation lands in the vicinity of the refuge.

RECOVERY PLANS

Under the Endangered Species Act, the Service and/or the National Marine Fisheries Service (NMFS) develops a recovery plan for each federally listed threatened or endangered species. The Service has prepared recovery plans for seven federally listed species that are known to occur at Chassahowitzka NWR: the wood stork (*Mycteria americana*), whooping crane (*Grus americana*), American alligator (*Alligator mississippiensis*), eastern indigo snake (*Drymachron corais couperi*), Atlantic green turtle (*Chelonia mydas*), Atlantic Ridley turtle (*Lepidochelys kempii*), Atlantic loggerhead turtle (*Caretta caretta*), and West Indian manatee (*Trichechus manatus*). The gopher tortoise (*Gopherus polyphemus)* is federally listing throughout its range, which includes the Florida panhandle, Georgia, and Alabama.

Each recovery plan delineates, justifies, and schedules the research and management actions necessary to support recovery of a species. If successfully undertaken, recovery actions are likely to permit reclassification or delisting of the species. As strategy documents, recovery plans do not commit manpower or funds for recovery actions, nor do they have the legal force of laws and regulations. Instead, they are used in setting regional and national federal conservation priorities for funding and implementation. The recovery plans provided a wealth of information that was used in developing this CCP.

SOUTHEASTERN COASTAL PLAIN COLONIAL WATERBIRD CONSERVATION PLAN

The Southeastern Coastal Plain Colonial Waterbird Conservation Plan is a regional effort of the NAWCP. It follows the same format as the other bird conservation plans with a focus on seabirds, colonial wading birds (e.g., herons and egrets), noncolonial wading birds (e.g., grebes, bitterns, and rails), and coastal waterbirds (e.g., gulls, terns and pelicans) and their habitats. Through public use area closures and habitat protection, the Service provides important wintering habitat for 22 priority conservation species included in the plan. The refuge has regionally important habitats, such as intertidal seagrass. For more information on this waterbird conservation plan, please consult http://www.waterbirdconservation.org/southeast_us.html.

SOUTHEASTERN COASTAL PLAIN AND CARIBBEAN REGION SHOREBIRD CONSERVATION PLAN

This is the title of the regional United States Shorebird Conservation Plan. The Southeastern Coastal Plain and Caribbean Region Shorebird Conservation Plan correlates roughly to the Partners in Flight initiative. It identifies priority species, outlines potential and present threats to shorebirds and their habitats, reports gaps in knowledge relevant to shorebird conservation, and makes recommendations for addressing identified problems. The general habitat goals for the region are to (1) provide optimal breeding habitat for priority species; (2) provide high-quality managed habitat that supports the requirements of species migrating through or spending the winter in the region; and (3) maintain

human disturbances at tolerable levels for shorebirds throughout the year. For more information, please visit http://www.fws.gov/shorebirdplan/regionalshorebird/downloads/SECPCRRev02.pdf.

STATE AND LOCAL CONSERVATION PLANS AND INITIATIVES

FLORIDA COMPREHENSIVE WILDLIFE CONSERVATION STRATEGY

In 2001, Congress established the Wildlife Grants Program with a goal of managing species before they become imperiled. To participate in this program, the FWC created a Wildlife Legacy Initiative in 2004 and a Comprehensive Wildlife Strategy in 2005 to partner for wildlife conservation and to administer the federally funded State Wildlife Grants Program. The goal of the Initiative is to develop a strategic vision for conserving all of Florida's wildlife, and its motto is "to keep common species common." A variety of species found on the refuge are listed in the Initiative as Species of Greatest Conservation Need, including the gopher tortoise; green, Kemp's Ridley, and loggerhead sea turtles; wood stork; eastern indigo snake; and West Indian manatee (FWC 2005).

The Comprehensive Wildlife Conservation Strategy (Strategy) is an action plan for conserving all of the state's wildlife and vital natural areas for future generations (FWC 2005). It identifies which native wildlife and habitats are in need of conservation and proposes management strategies to address these needs. A variety of species and habitats found on the refuge are listed in the FCWCS as needing special management protection, including the 28 federal- or state-listed species expected to occur on the refuge (including three mammals, 16 or 17 birds, eight to nine reptiles, and one fish), as well as another 48 priority migratory bird species (FWC 2005). Salt marsh, the predominant habitat type on the refuge, is one of nine marine habitat categories identified as having the highest threat status (FWC 2005). In 2011, the agency issued a draft revised Strategy. Both programs promote the wide use of partnerships and voluntary, incentive-based actions for conservation, protection, and management. For more information, please visit http://myfwc.com/wildlifelegacy/strategy.html.

FLORIDA NATURAL AREAS INVENTORY

The Florida Natural Areas Inventory (FNAI) is a nonprofit organization dedicated to gathering, interpreting, and disseminating information critical to the conservation of Florida's biological diversity. The FNAI was founded in 1981 as a member of The Nature Conservancy's international network of natural heritage programs. The databases and expertise of the FNAI facilitate environmentally sound planning and natural resource management to protect the plants, animals, and communities that represent Florida's natural heritage. The FNAI is the primary source of information on Florida's conservation lands. The inventory's databases include boundaries and statistics for more than 1,600 federal, state, local, and privately managed areas, all provided directly by the managing agencies. The FNAI's databases and project evaluations provided the basis for establishing priorities and boundaries for the Florida Conservation and Recreation Lands (CARL) Program (Preservation 2000).

FLORIDA FOREVER PROGRAM

The Florida Forever Program, created by the State Legislature in 1999, follows in the footsteps of earlier successful land acquisition programs in the State of Florida by continuing to focus land acquisition efforts in several resource categories: Natural Communities; Forest Resources; Plants; Fish and Wildlife; Fresh Water Supplies; Coastal Resources; Geologic Features; Historical Resources; and Outdoor Recreational Resources. Two Florida Forever project boundaries abut the refuge: the 9,900-acre Homosassa Reserve/Walker Property to the east and the 2,610-acre St. Martins River project to the north. Both projects are part of the Florida Springs Coastal Greenway

Project designed to conserve the natural landscape of the Citrus County Coast and to protect the water quality of the spring runs and estuaries where manatees congregate (FNAI 2011).

CRITICAL LANDS AND WATERS IDENTIFICATION PROJECT AND THE COOPERATIVE CONSERVATION BLUEPRINT

The Critical Lands and Waters Identification Project (CLIP) is the Florida Century Commission's flagship project led by Dr. Thomas Hoctor of the GeoPlan Center at the University of Florida and Jonathan Oetting of the FNAI at Florida State University. CLIP involves the use of science and the best available, statewide, spatial data to depict Florida's critical environmental resources in a database that can be used as a decision-support tool for collaborative statewide and regional conservation and land use planning. The purpose of this data tool is to envision and ensure the sustainability of Florida's green infrastructure and vital ecosystem services (Florida Century Commission 2010).

Recommendations will be vetted with rural landowners, state agencies, regional planning councils, and other stakeholders through the Cooperative Conservation Blueprint (CCB) led by the FWC in partnership with the Century Commission and the CCB steering committee. The CCB is a major multipartner strategic planning step that Florida's Wildlife Legacy Initiative is undertaking. The CCB process creates an alternate vision of what stakeholders want the state to look like by incorporating wildlife habitat needs as well as social and economic priorities. The goal is to develop a strategic plan for land and water conservation in Florida, using a new and broader range of conservation incentives with a shared view of the priorities (FWC 2010d).

CLIP priorities depict areas of opportunity for protecting biodiversity, landscapes, and water resources across the state. The project identifies refuge lands as Priority 1 (P1) resources and refuge waters as P1 Submerged, the latter of which are given the highest level of conservation significance attributed to a landscape (Hoctor et.al. 2008).

ST. MARTINS MARSH AQUATIC PRESERVE MANAGEMENT PLAN

The management intent of Florida's system of aquatic preserves, as defined in the Florida Aquatic Preserve Act of 1975, is "for such preserves possessing...exceptional biological, aesthetic and scientific value...to be set aside forever as aquatic preserves or sanctuaries for the benefits of future generations" (§258.36 Florida Statutes). St. Martins Marsh Aquatic Preserve was established on October 21, 1969, by the State of Florida (§258.39 Florida Statutes and Chapter 18-20, Florida Administrative Code). The St. Martins Marsh Aquatic Preserve Management Plan was developed in 1987. The preserve encompasses roughly 23,000 acres and covers open water areas from the Crystal River to the Homosassa River within coastal Citrus County. It is composed of open water, several inlet bays, tidal rivers and creeks, saltmarsh, and adjoins upland hammock islands. Nutrient exchange between the marshes and the Gulf of Mexico makes the saltmarsh an important area of primary production and a nursery ground for many species of commercial and recreational fish. The marshes and coastal hammocks are a southern terminus for migratory waterfowl, providing wintering and stopover areas for these and other migratory bird species. The preserve's management activities include water quality monitoring, seagrass monitoring, and habitat enhancement and restoration (FDEP 2009a; FDNR 1987).

CRYSTAL RIVER PRESERVE STATE PARK UNIT MANAGEMENT PLAN

The State of Florida acquired the Crystal River Preserve State Park in 1984 and developed a 10-year Unit Management Plan in 2004 to conserve the natural landscape; protect the water quality of the spring runs and estuaries; preserve natural lands that link with conservation lands to the south; and provide scenic areas in which the public can enjoy nature. The park covers 27,295 acres, with

approximately 5,426 upland acres and 21,869 wetland acres with parcels along 20 miles of the northern Gulf Coast from Yankeetown to Homosassa Springs. Providing habitat for a variety of resident and migratory species, the park is mostly a mosaic of saltmarsh and hammock. The range of habitat types include scrub, mesic flatwoods, scrubby flatwoods, upland mixed forest, hydric hammock, sandhill, xeric hammock, shell mound, bottomland forest, freshwater tidal swamp, basin marsh, basin swamp, depression marsh, blackwater stream, spring-run stream, prairie hammock, marine/estuarine tidal marsh and marine/estuarine tidal swamp. Management activities include water quality, plant, bird, herpetofauna, and small mammal monitoring; prescribed fire; exotic plant monitoring and removal; and feral hog removal. Numerous pre-Columbian archaeological sites are known to be protected at the park (FDEP 2009b; FDEP 2004).

CHASSAHOWITZKA WILDLIFE MANAGEMENT AREA PLAN

The Chassahowitzka Wildlife Management Area (WMA) is part of a complex of conservation lands that stretch along the Gulf coast from Pasco County to Apalachicola. The WMA was established in 1986 and consists of 27,183 acres. The Hernando County portion of Chassahowitzka NWR, an additional 6,736 acres, is managed as part of the Chassahowitzka WMA. The WMA contains a diverse assemblage of natural communities including saltwater marsh, hardwood swamp, springs, sandhill, scrub, and pine flatwoods. The majority of the area is a hardwood swamp known as the Chassahowitzka Swamp, the largest south of the Suwannee River. It plays an important role in the health and productivity of the extensive estuaries along the Gulf of Mexico by holding, filtering, and gradually releasing fresh water. The upland portions of the area serve as recharge zones for the two aquifers in the region.

The lands that comprise the WMA were purchased as three Conservation and Recreation Lands (CARL) projects: the Chassahowitzka Swamp, the Chassahowitzka Sandhill tract of the Longleaf Pine Ecosystem Projects, and the Weeki Wachee Springs tract under the Florida's First Magnitude Springs Project. Management is shared between the FWC and FFS. The WMA operates under a multiple-use management strategy where visitors can enjoy many types of recreational opportunities, including hunting, fishing, wildlife observation, hiking, biking, horseback riding, primitive camping, and environmental education. The WMA's land management objectives include preserving threatened and endangered species, protecting native plant communities and associated wildlife, and maintain the natural hydrology of the area. Specific management techniques include controlling exotic vegetation, thinning pine plantations, removing sand pine from scrub communities, and prescribed burning (FWC 2002). For more information on the Chassahowitzka Wildlife Management Area, please consult http://myfwc.com/viewing/recreation/wmas/lead/chassahowitzka/.

CHASSAHOWITZKA RIVER AND COASTAL SWAMPS

Purchased in the early 1990s, the 5,678-acre Chassahowitzka River and Coastal Swamp (CCS) is part of a large greenway of public lands that protects the Chassahowitzka Swamp ecosystem and its wildlife resources. The CCS is managed by the SWFWMD and includes nearly two miles along the Chassahowitzka River, three tributary creeks, and Chassahowitzka Springs, the latter of which forms the river's headwaters. The CCS lies along the northeastern border of the refuge and contains one of the largest remaining coastal hardwood swamps of the Gulf of Mexico (SWFWMD 2011). For more information, please visit http://www.swfwmd.state.fl.us/recreation/areas/chassahowitzka.html.

WITHLACOOCHEE STATE FOREST

Withlacoochee State Forest (WSF) is currently the third largest state forest in Florida and is divided into several distinct tracts of land. The Homosassa Tract abuts the refuge's northeastern boundary. The WSF was acquired by the federal government from private landowners between 1936 and 1939 under the provisions of the U.S. Land Resettlement Administration. The U.S. Forest Service managed the property until a lease-purchase agreement transferred the property to the Florida Board of Forestry in 1958. The WSF is presently managed by the Florida Forest Service based on a multi-use approach of forest resource management, timber management, wildlife management, ecological restoration, and outdoor recreation. For more information on the Withlacoochee State Forest, please consult http://www.fl-dof.com/state_forests/withlacoochee.html.

GREAT FLORIDA BIRDING AND WILDLIFE TRAIL

The Great Florida Birding and Wildlife Trail (GFBWT) is a 2,000-mile, self-guided highway trail that connects nearly 500 birding sites throughout Florida. The trail is a program of the FWC supported in part by the FDOT and the Wildlife Foundation of Florida, among others. It was organized as a result of a growing constituency of wildlife viewers, specifically birders looking for an organized way to find places to enjoy observing wildlife. The GFBWT is divided into four sections: East Florida, West Florida, Panhandle Florida, and South Florida. Each has two gateway sites with exceptional birding locations and clusters of sites highlighting communities and special ecosystems. Some West Florida Section trails lead to the refuge, including the Mason Creek and the Chassahowitzka River Trails (GFBWT 2011). Please visit the website www.floridabirdingtrail.com for more information.

ECOLOGICAL THREATS AND PROBLEMS

POTENTIAL IMPACTS ASSOCIATED WITH CLIMATE CHANGE

Department of the Interior (DOI) Secretarial Order 3226 states that there is a consensus in the international scientific community that global climate change is occurring and that it should be addressed in governmental planning and decision-making. S.O. 3226 was amended on January 16, 2009; however, S.O. 3285, issued on March 11, 2009, replaced Amendment Number 1 and reinstated some of the provisions of the 2001 Order. S.O. 3285 established a Climate Change Response Council within the Office of the Secretary, DOI. Its purpose is to facilitate a Department-wide approach for applying scientific tools to increase the agency staff's understanding of climate change and to coordinate an effective response to the impacts of climate change upon tribes and on the land, water, ocean, fish and wildlife, and cultural heritage resources that the Department manages. It also made production and transmission of renewable energy on public lands a priority for the Department. The Order calls for the incorporation of climate change considerations in long-term planning documents such as the CCP.

Climate change and its interrelationship to existing problems of conserving fish and wildlife is the transformational conservation challenge of the 21st century. The Intergovernmental Panel on Climate Change (IPCC) reported that the warming of the world's climate is unequivocal based on documented increases in global average air and ocean temperatures, unprecedented melting of snow and ice, and rising average sea level (IPCC 2007). While the distribution and abundance of fish and wildlife are naturally dynamic relative to a variety of environmental factors, climate change may drastically alter and accelerate the natural cycles that we are familiar with today. Some effects may include changes in precipitation, increased frequency and intensity of extreme weather events, rising sea levels and tidal fluctuations, and invasions of new exotic species. Consequently, climate change is a challenge not only because of its direct effects, but also because of its potential to amplify the

other stressors that have and will continue to be major conservation priorities, such as habitat fragmentation, urbanization, and invasive species.

Low-lying coastal areas and barrier islands will face the most direct and dramatic impacts of climate change, particularly from a rising sea level and from the increasing frequency and intensity of coastal storms (Emanuel 1987; Emanuel 2005; Webster et al. 2005; Mann and Emanuel 2006). These effects have been observed on Chassahowitzka NWR as palm trees have been dying on coastal islands within the refuge due to sea level rise. The loss of habitat will result in the loss of species using that habitat, including migrating and nesting birds. Storm events also cause considerable physical damage to native vegetation along vulnerable shorelines, impacting nesting habitat for sea life and shorebirds. Rising sea levels may decrease the availability and abundance of prey for wading birds that forage in shallow waters on the expansive tidal flats of the Gulf Coast. Climate change is expected to amplify and hasten these effects, potentially at rates that exceed the normal resiliency of plant communities to recover, shift or adapt accordingly (Stanton and Ackerman 2007; Clough 2008). Salt water intrusion into the subsurface freshwater lens from sea level rise and saltwater inundation of surface freshwaters from storm surges can alter coastal ecosystems and freshwater marshes, resulting in more salt-tolerant aquatic plant communities. The most immediate action that the Service can take is to gather the best scientific data possible for understanding natural processes in their current state, modeling possible impacts and subsequent changes from sea level rise, and developing adaptive management strategies for future conservation needs.

The effects of climate change are expected to become more frequent and severe within the 15-year time period covered by this CCP. The current level of uncertainty is high regarding the actual impacts and their extent both in time and space, but new research and modeling efforts will lead to enhanced capabilities to model and predict future scenarios. The Service is actively working with the scientific community and its partners to evaluate the effects of projected sea level rise on wildlife and their habitats. It will begin to develop strategies to enhance the resiliency of natural communities to adapt to climate change, as well as formulate criteria for when direct intervention may be necessary to save a species, such as assisted migration or removal to captivity (Hoegh-Guldberg et al. 2008; Ross et al. 2009).

A report by the Florida Oceans and Coastal Council summarized climate change drivers, effects, and potential results in relation to Florida's ocean and coastal resources. Increasing greenhouse gases are expected to result in increased ocean acidification, which in turn may result in the potential for shifts in marine ecosystem structure and dynamics and declines in or disappearance of important fisheries habitats, such as coral reefs. Increasing air temperature and water vapor is expected to result in altered rainfall and runoff patterns and altered frequency and intensity of tropical storms and hurricanes. Altered rainfall and runoff patterns may include the potential for increased frequency of extreme rainfall events, exacerbating already altered and stressed conditions in estuaries and the potential for decreasing rainfall in highly urbanized landscapes.

As sea surface temperatures continue to increase, already stressed coastal and marine environments will experience more adverse impacts and ocean currents may shift. Increasing ocean temperature is expected to result in increases in coral bleaching and disease; increases in fish diseases, sponge die-offs, and loss of marine life; changes in the distribution of native and exotic species; changes in nutrient supply, recycling, and food webs; harmful algal blooms; and hypoxia. Loss of marine life may result in the potential for more frequent die-offs of marine fauna that cannot move to cooler water, which will be exacerbated by increased nutrients, pollution, and algal blooms. Changes in nutrient supply, recycling, and food webs may result in less efficient food webs, resulting in decreased productivity, including those for economically important fish and other species. More frequent and intense harmful algal blooms may disrupt marine and estuarine systems; result in more frequent fish kills; and adversely impact people. Increased hypoxia due to increased nutrients running off into coastal systems may lead

to longer and/or recurring hypoxic events and negative impacts to bottom-dwelling and feeding organisms. Increasing sea level is expected to result in changes in estuaries, tidal wetlands, and tidal rivers; changes in beaches, barrier islands, and inlets; and reduced coastal fresh water supplies.

Changes in estuaries, tidal wetlands, and tidal rivers may result in the loss of some tidal wetlands and some lowland coastal forests; loss of over half of salt marshes, shoals, and mud flats, negatively impacting fishes and birds; replacement of high diversity wetlands with low diversity wetlands; increases in open waters; increased risk to shallow water-dependent fish species; and the loss of many coastal systems that currently buffer storm impacts. Changes in beaches, barrier islands, and inlets may include increased erosion; migration landward of barrier islands; and loss of some barrier islands, altering or eliminating marshes and estuaries. Reduced coastal water supplies may mean increased competition for water, potential for increased saltwater intrusion, and increased threats to surficial aquifers (Florida Oceans and Coastal Council 2009).

EXOTIC, INVASIVE AND NUISANCE SPECIES

Like most refuges, Chassahowitzka NWR must contend with both aquatic and upland invasive plants. Two species of invasive aquatic plants—hydrilla (*Hydrilla)* and Eurasian watermilfoil (*Myriophyllum*)—may outcompete and displace native plants but do provide food for the endangered Florida manatee. Brazilian pepper (*Schinus terebinthifolius*) has invaded upland refuge sites, including tree islands and disturbed areas. Brazilian pepper is treated sporadically by the refuge staff and under a contract to keep the spread of the plant in check. The extent of the pepper's distribution on the refuge is unknown. The presence and distribution of other exotic species is also unknown. Cogon grass (*Imperata cylindrica*) has been treated by the FWC on the levee (Main Grade) separating Chassahowitzka NWR from the Chassahowitzka Wildlife Management Area.

The main invasive animal at Chassahowitzka NWR is the feral hog (*Sus scrofa*). This species affects various refuge habitats by uprooting vegetation, increasing erosion, promoting the spread of invasive vegetation, reducing the success of ground-nesting birds, competing with native wildlife for food resources including soft and hard mast, and carrying diseases and parasites.

PHYSICAL RESOURCES

CLIMATE

The refuge's climate is considered warm temperate. Air temperatures generally range from highs of 97 degrees Fahrenheit (^{o} F) in the summer to lows of 27° F in the winter. The first killing frost usually occurs in November. Weather conditions are characterized by generally mild winter temperatures and hot, humid summers with frequent afternoon thunderstorms. The Gulf of Mexico and Atlantic Ocean provide a constant source of moist air, which is carried inland by sea breezes where it heats up to form thunderheads. Annual rainfall in the area averages from 55 to 60 inches.

GEOLOGY AND TOPOGRAPHY

Four major physiographic features are present within Citrus and Hernando counties: Coastal Swamps, Gulf Coastal Lowlands, Brooksville Ridge, and Tsala Apopka Plain. The refuge is found in the first two. The Coastal Swamp area parallels the coast and extends inland about 2 to 5 miles. It contains tidal marshes and coastal swamps and elevations range from sea level in the tidal marshes to about 10 feet in some of the swamp areas. Poorly drained organic soils directly overlay limestone of the Floridan aquifer system in much of the coastal swamp area. The Coastal Lowlands lie between the Coastal Swamp and the Brooksville Ridge and in Citrus County ranges from about 2 to 8

miles in width. Elevations vary from 10 to 100 feet above mean sea level. Sandy soils in the area contain little organic material. The topography consists of relatively flat plains to rolling hills mixed with dunes and karst features. Karst areas are characterized by numerous sinkholes, lack of surface drainage, and rolling topography. Rainfall within the Coastal Lowlands and Brooksville Ridge rapidly moves underground through these sinkholes and begins moving seaward through an extensive system of underground caverns.

Geologic formations present in Citrus County include, in ascending order, the Avon Park Formation, Ocala Limestone, Suwannee Limestone, and the Hawthorn Group sediments. The Avon Park Formation underlies Citrus County and is exposed in a small area in northwestern Citrus County. The Ocala Limestone also covers the entire area, and is the dominant formation exposed at the surface in Citrus County. Both the Ocala Limestone and Avon Park Formation comprise the Floridan aquifer. Both units have been fractured and modified by karst processes. The porous nature of the limestone is responsible for the abundance of springs along the coastal margin.

In Hernando County, the Coastal Swamp area parallels the Gulf Coast and extends inland 4 to 6 miles. This area includes both the tidal marshes and Chassahowitzka and Withlacoochee Swamps. Elevations range from sea level in the tidal marsh to about 10 feet in the swamp areas. The soils of the tidal marshes and in the swamps are very poorly drained organic and mineral soils, and the marshes are subject to daily flooding by normal tides. The natural vegetation is predominantly mixed hardwoods. A large portion of the Coastal Swamp area is underlain by limestone. Little development has taken place in this area, but a few places along the coast have been developed for urban uses.

The Gulf Coastal Lowlands are not continuous throughout the length of the Hernando County ranging from less than a mile to about 2 miles in width. Elevations are mostly between about 10 and 50 feet above sea level. The area consists mostly of pine and palmetto flatwoods with numerous small ponds. The sandy subsoil contains some organic matter.

Three main geologic formations are present in Hernando County: Ocala Limestone, Hawthorn Group, and Suwannee Limestone. Ocala Limestone is at or near the surface in the west-central portion of Florida. In this area, the Ocala Limestone exhibits karst features with numerous springs and streams found within these areas. The Hawthorn Group occurs at or near the surface near the southern end of the Ocala Platform from Gilchrist County southward to Pasco County. Karst features perforate the Hawthorn Group. Suwannee Limestone is found northwest, northeast, and southwest of the Ocala Platform.

SOILS

Some scientists believe that Florida first appeared in the early Cretaceous Period (approximately 130 million years ago) and was extensively flooded during the Eocene (55 million years ago) and the Oligocene (38 million years ago). During these periods, limestone layers were deposited, providing the base for Florida's soils. Florida slowly began to emerge in the Miocene (25 million years ago) as deposits of marine sediments and sands collected on the limerock base. During the Pliocene (10 million years ago), Florida connected to the continent and again flooded extensively during the Pleistocene (1 million years ago). This pattern of emergence and flooding results in a great variety of soil types occurring sporadically throughout the state.

Soils on the refuge are primarily of three types: (1) peat/muck soils associated with most salt marshes; (2) limestone outcrops associated with tree islands, which are scattered throughout the salt marshes; and (3) hardwood swamps and sandy-loam soils associated with the upland pine/palmetto maintenance site located along U.S. Highway 19.

The first soil types in the Citrus County portion of the refuge are classified as Homosassa-Weekiwachee-Durbin. These are nearly level, very poorly drained, sandy and mucky soils found in tidal marshes (Pilney1988).

The Weekiwachee-Durbin muck soil complex consists of very poorly drained, well decomposed organic soils that contain sulfur. These soils are along the coast at about sea level. They are in broad, flat, tidal marshes. The soil area is a transition zone between fresh water and salt water. Weekiwachee soil is found adjacent to mineral soils or rock outcrop. Typically, Weekiwachee soil has a surface layer of black muck that extends to a depth of 34 inches. The underlying material is gray fine sand to a depth of 38 inches. The next layer, to a depth of 41 inches, is white, soft limestone bedrock that is easily broken with hand tools (Pilney 1988). The soft limestone bedrock is underlain by hard limestone bedrock.

Durbin soil mainly is exposed to open water and along tidal flood channels and streams. It has a surface layer that is very dark gray muck about 7 inches thick. Below the surface layer, black muck extends to a depth of 80 inches (Pilney 1988). The Weekiwachee-Durbin soils are flooded daily at normal high tide. All these soils are flooded during storm tides. The organic soils remain nearly saturated between high tides. The available water capacity is very high. Typically, Weekiwachee and Durbin soils are in the salt marsh range site. This site can be identified by level, tidal marsh areas that have the potential to produce vast amounts of smooth cordgrass, haymarsh cordgrass, seashore saltgrass, and many other forage grasses and forbs. Tidal action causes salt water saturation of the soils and inundates the soils to a few inches above the surface layer. These types of salt marshes are generally dominated by rushes and sawgrass.

The Weekiwachee-Durbin soils support a wide variety of wildlife. They provide suitable habitat for many invertebrate species that serve as a food source for many marine species. Fresh water fish and salt water fish often share areas where the salinity of the water is diluted by incoming fresh water. These areas also provide habitat for migratory and wading birds.

A second soil type found in the Citrus County portion of the refuge is the Rock outcrop-Homosassa-Lacoochee complex (Pilney 1988). This complex consists of limestone rock outcrop and Homosassa and Lacoochee soils that are in tidal salt water marshes and on some offshore islands along the Gulf Coast. The soils in this complex are flooded daily by high tides. Rock outcrop in some areas have exposed large, flat surfaces pitted with holes. Typically, Homosassa soil has a surface layer that is black mucky fine sandy loam about 8 inches thick. Below that, dark grayish brown fine sand extends to a depth of 21 inches and is underlain by hard limestone bedrock (Pilney 1988). Lacoochee soil usually has a surface layer that is light gray fine sandy loam about 5 inches thick. The subsurface layer, to a depth of 8 inches, is grayish brown loamy fine sand. The subsoil, to a depth of 13 inches, is yellowish brown loamy fine sand. Further below, white soft limestone bedrock extends to depth of 21 inches and is underlain by hard, white, limestone bedrock (Pilney 1988). These soils are flooded daily by high tides. Some of the soils on the elevated areas are periodically flooded by exceptional high tides and storm tides. The available water capacity of Homosassa and Lacoochee soils is very high in the surface layer and moderate in the deeper layers.

The Homosassa and Lacoochee soils are usually in the salt marsh range site. This site can be identified by level, tidal marsh areas that have the potential to produce large amounts of smooth cordgrass, marshhay cordgrass, seashore saltgrass, and many other forage grasses and forbs.

A third soil type found in the Citrus County portion of the refuge is the Hallandale-Rock outcrop complex (Pilney 1988). This complex consists of a nearly level, poorly drained, mineral soil and rock outcrop. Hallandale soil is along the coast adjacent to fresh water and salt water marshes and also

on some offshore islands. It has a surface layer that is fine black sand about 2 inches thick. The subsurface layer, to a depth of 6 inches, is grayish brown fine sand (Pilney 1988). The subsoil, to a depth of 10 inches, is yellowish brown fine sand. Typically less than 20 inches below the subsoil is limestone bedrock. In most years, these soils have a high water table within 10 inches of the surface for up to 6 months. In some areas, the surface may be covered by shallow water for up to a month after very heavy rains. In drained areas, the water level fluctuates as the water level in the drainage ditches and holes in the limestone bedrock fluctuates. These soils are rarely flooded by severe coastal storms. This site is identified by thick stands of cabbage palms and a few scattered oaks.

The maintenance area of the Crystal River National Wildlife Refuge Complex has two main soil types: Okeelanta-Lauderhill-Terra Ceia and Arredondo-Kendrick-Sparr (Pilney 1988). The Okeelanta series consists of deep, nearly level, very poorly drained, organic soils that formed in a mixture of well decomposed hydrophytic nonwoody plant material and small amounts of mineral materials. These soils are in small depressions and large fresh water marshes. Okeelanta soils are also associated with Lauderhill and Terra Ceia soils. Lauderhill soils have 20 to 40 inches of organic material underlain by hard bedrock. Terra Ceia soils have an organic layer that is more than 51 inches thick (Pilney 1988).

The Arrendondo series consists of deep, nearly level to moderately-sloping, well-drained, moderately permeable soils that formed in sandy and loamy marine deposits. These soils are on upland ridges. Arrendondo soils are associated with several soils including Kendrick and Sparr. Sparr soils are similar to Arrendondo soils and are somewhat poorly drained.

Four major soil types may be found in the Hernando County portion of the refuge: Weeki Wachee muck; Homosassa mucky fine sandy loam; Aripeka fine sand; and Lacoochee fine sandy loam (Hyde 1977). Most of the soils in the salt marsh are Weeki Wachee muck. The Weekiwachee series consists of nearly level, very poorly drained, organic soils that formed in moderately thick deposits of hydrophytic plant remains and sandy marine sediments in broad areas of tidal marsh. These soils are flooded during normal high tides and can be up to 45 inches deep (Hyde 1977).

The second most abundant soil type found in the salt marsh west of the Weeki Wachee muck is Homosassa mucky fine sandy loam (Hyde 1977). The Homosassa series consist of nearly level, very poorly drained soils that formed in sandy marine sediments. These soils are in tidal marshes along the west coast of the county. The water table fluctuates during normal tides, but normally this soil is flooded daily throughout the year. These soils are up to 33 inches deep (Hyde 1977).

The soils found under the tree islands are Aripeka fine sand (Hyde 1977). The Aripeka series consists of nearly level, somewhat poorly drained, sandy soils that formed in marine, sandy, and loamy sediments over soft and hard limestone. These soils are on low ridges adjacent to saltwater marshes. In most years, under natural conditions, the water table is at a depth of 18 to 30 inches for 2 to 6 months and at a depth of 30 to 60 inches for 6 months or more. Under natural conditions, these soils may be very briefly flooded with saltwater during storm tides, but not during normal high tides. These soils are up to 29 inches deep (Hyde 1977).

The fourth type of soil found in the westernmost portion of the refuge is Lacoochee fine sandy loam (Hyde 1977). The Lacoochee series consists of nearly level, poorly drained soils that formed in marine sandy and loamy sediments over limestone. These soils are in low, broad areas of tidal marshes. The water table fluctuates with the tide, and the soil is frequently flooded during normal high tides. These soils are up to 26 inches deep (Hyde 1977).

HYDROLOGY

The refuge's water resources originate from both surface and ground water sources. Spring water, when it is in the aquifer, is considered to be groundwater. However, once spring water exits from the spring vent onto the earth's surface, it is considered to be surface water. Figure 7 portrays the hydrology (watersheds) of the refuge.

Surface waters that exist among refuge lands include two rivers, several first-order creeks, and the Gulf of Mexico. Much of the refuge waters are estuarine, meaning that their wide-mouthed, freshwater rivers mix with the tidal seas of the Gulf of Mexico. The Homosassa River receives much of its flow volume from Homosassa Springs and meanders into and near the northern boundary of the refuge. The Chassahowitzka River roughly bisects the refuge and is fed mainly by the spring of the same name. Both springs are considered first order of magnitude, that is, they have historic flow rates or discharges of greater than 100 cubic-feet per second (cfs) (Knochenmus 2001). Low-order magnitude streams on the refuge include Mason, Battle, Johnson, Crawford, Twin, Camp, Fish, and Wall Creeks. Most of these creeks have springs as their major water source. These rivers and creeks are tidally influenced and also are affected by lunar cycles and winds. Diurnal tidal range is approximately two feet for the Chassahowitzka and Homosassa Rivers at their respective mouths. Generally, salinity varies from freshwater levels of zero parts-per-thousand (ppt) sea strength to brackish (15 ppt) to saltwater (35 ppt, i.e. full sea strength) when moving from springs to the Gulf, although some springs are highly affected by tidal fluctuations and discharge salt water.

Most groundwater movement in the vicinity of the refuge is associated with the Upper Floridan aquifer. This aquifer is the major source of domestic water supply and spring flow in the area. The top of the aquifer is near the surface in and around the refuge. Groundwater, to a great extent, determines freshwater surface flows in this system.

The coastal hydrology of the Chassahowitzka NWR is dominated by the discharge of several spring groups (Homosassa, Hidden River, Halls River, and Chassahowitzka) (Figure 8), together with runoff from the coastal basin area (Knochenmus 2001). Depending on their depths, the individual spring vents discharge fresh or salt water or mixtures of both. The quality and quantity of discharge can vary tidally. Other rivers nearby include the Crystal River, a spring-fed system 15.6 miles (25 km) to the north; the Withlacoochee River, a surface-drainage river 21 miles (33.6 km) to the north; and the Weeki Wachee River, a spring-fed system 11 miles (17.6 km) to the south.

AIR QUALITY

Air pollution causes damage to the environment and property and affects human health. Monitoring data show that air pollutant emissions can be transported long distances, affecting air quality-sensitive resources in refuges located hundreds of kilometers downwind of their sources.

The U.S. Environmental Protection Agency (EPA) has the lead responsibility for the quality of air and through the 1977 Clean Air Act (as amended) (CAA), sets limits on the amount of pollutants that can be aerially discharged. Common air pollutants of ecological importance include sulfur and nitrogen oxides, ammonia, ozone, particulate matter, volatile organic compounds and heavy metals (Porter 2000). These pollutants are either emitted directly from sources, including power plants, incinerators, industries, automobiles and fires, or, as is the case with ozone, are formed downwind of sources as emissions react and are transformed in the presence of sunlight (Porter 2000). Other downwind reactions produce fine aerosols and particles, including sulfates and nitrates, which may eventually be deposited into ecosystems (Porter 2000). There are also natural sources of air pollution resulting from fires, dust storms, volcanic activity, and other natural processes. From a national perspective,

Figure 7. Watersheds of Chassahowitzka NWR.

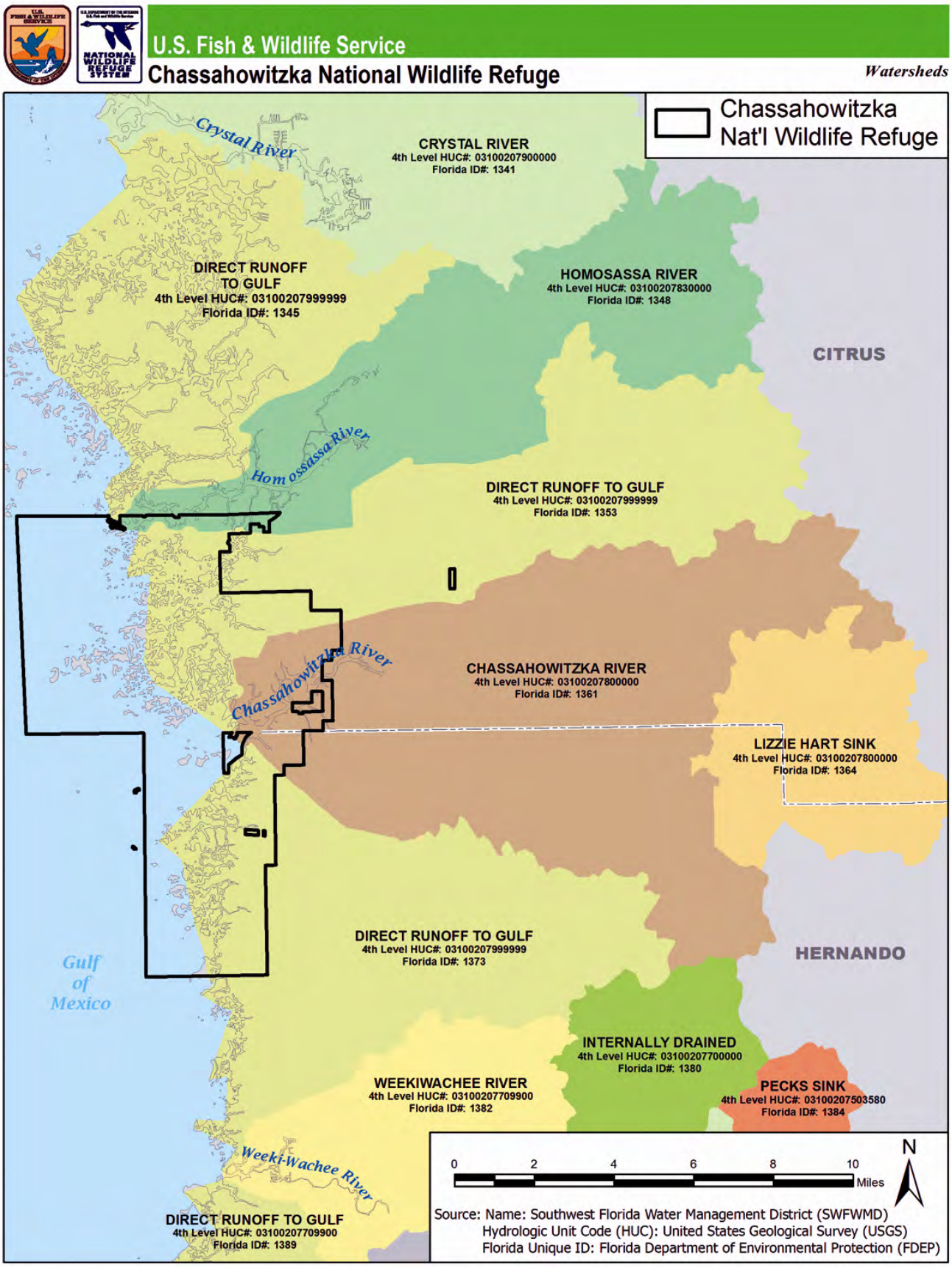
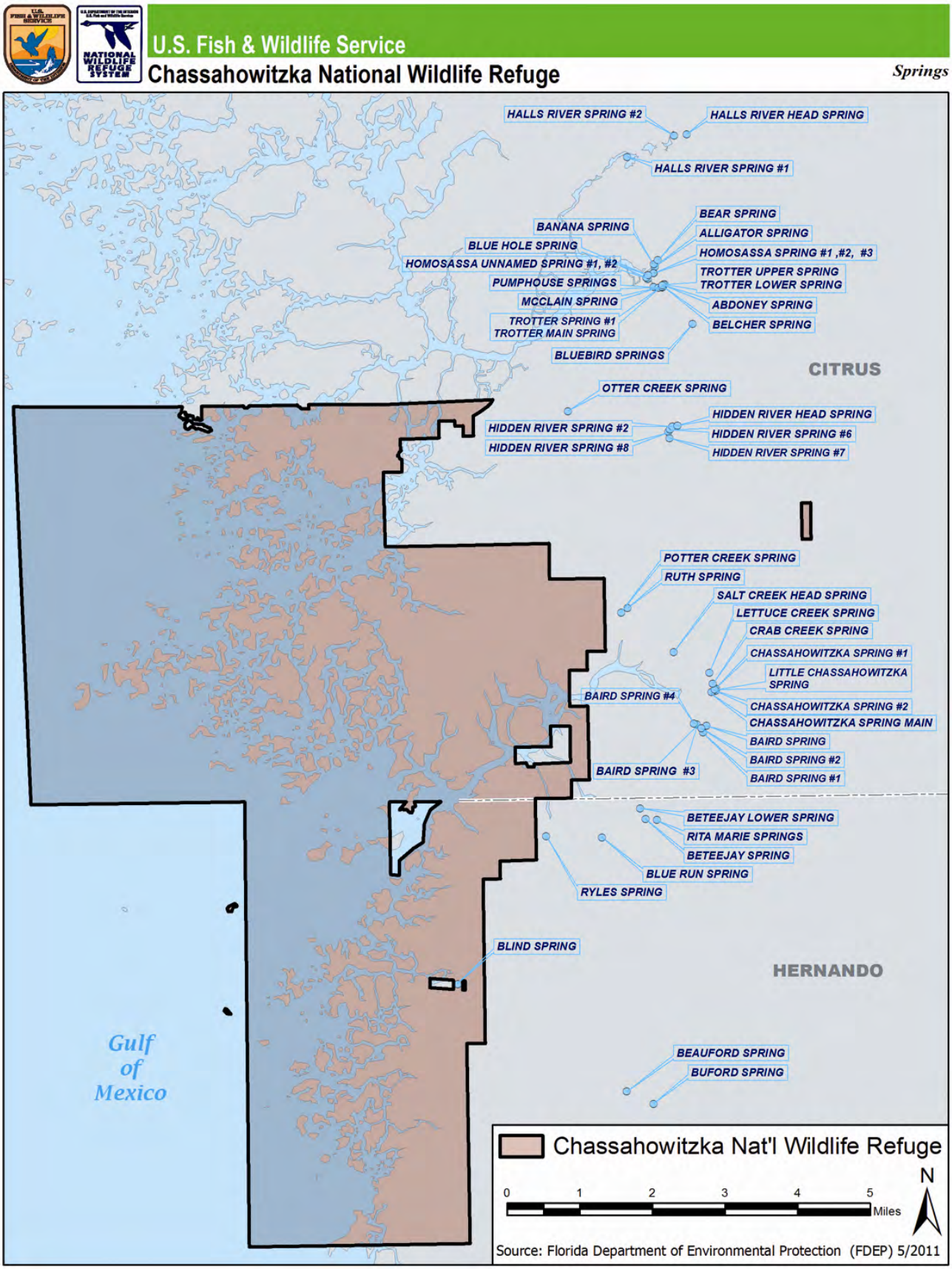


Figure 8. Springs of Chassahowitzka NWR.



air pollution impacts upon wilderness areas include: acidification of lakes, streams and soils; eutrophication of estuaries and nearshore coastal waters; direct toxicity to sensitive species; changes in species composition; changes in nutrient cycling; bioaccumulation of toxins in food chains; and visibility impairment (Porter 2000).

Federal and state governments track air quality and visibility impairment through a network of 5,200 monitors at 3,000 locations across the United States, with over 200 ambient air monitors located throughout Florida. Chassahowitzka NWR is among 21 national wildlife refuges designated as a Class I air quality area and, as such, receives special protection under the CAA. Only a very small additional amount of air pollution (from 1977 levels) can be permitted in Class I areas (Porter 2000). The CAA requirements are designed to minimize air quality deterioration where emissions from major new or modified facilities may affect Class I areas, including Chassahowitzka NWR. Among other things, the CAA requires that the refuge maintain an "affirmative responsibility to protect all those air quality related values (including visibility) of such lands…" (Senate Report 95-127, 95th Congress, 1st Session, 1977 *in* Porter 2000). The Service must also consider whether a proposed major emitting facility located within 300 kilometers of the refuge will have an adverse impact upon refuge resources. In these cases, the State of Florida notifies the Service of any permit application from a major source of emission that may affect the refuge.

Consistent with Chassahowitzka NWR's status as a Class I air quality area, air quality monitoring is conducted on the refuge at the maintenance facility in partnership with several national programs, including the National Atmospheric Deposition Program (NADP), the Mercury Deposition Network Program (MDN), and the Interagency Monitoring of Protected Visual Environments Program (IMPROVE). Volunteers record rainfall, take readings, and change modules, glassware, and buckets weekly during monitoring.

National Atmospheric Deposition Program

The National Atmospheric Deposition Program (NADP) is a cooperative monitoring program comprised of federal and state agencies, academic institutions, Native American tribal governments, and private organizations. It provides long-term spatial and temporal trend information on the concentration and deposition of major natural- and human-caused cations and anions in precipitation at over 200 sites nationwide (Porter 2000). The Service supports a NADP sampler at Chassahowitzka NWR that has continuously collected air quality data since 1997. Rain is collected on a weekly basis and analyzed at a central laboratory for concentrations of sulfate, nitrate, ammonium, calcium, magnesium, potassium, sodium, chloride, phosphate, hydrogen ions, and conductivity. Rainfall is also measured at sampling sites, allowing deposition rates to be estimated. Data from the NADP indicate that the monitored FWS areas are experiencing elevated levels of air pollutants in deposition, as are many wilderness areas in the contiguous United States (Porter 2000). The refuge's NADP information and data are available at the NADP website http://nadp.sws.uiuc.edu.

Mercury Deposition Network (MDN) Program

The Mercury Deposition Network (MDN) is the mercury wet-deposition monitoring arm of the NADP. The MDN began measuring total mercury precipitation (wet-deposition) in 1996 and now has more than 100 sites (Illinois State Water Survey 2008). The MDN is the only network providing a long-term record of total mercury (Hg) concentration and deposition in precipitation in the United States and Canada. An MDN monitoring station is located on Chassahowitzka NWR, and elevated levels of mercury have been recorded in rainfall (Porter 2000). Annual mercury deposition has ranged between 0.21ug/m^2 in 2000 to 0.40ug/m^2 in 2005 and 2007 (NAPR/MDN Program 2011). In addition, fish sampled from Chassahowitzka NWR also contain elevated

mercury levels (Facemire et al. 1995; Brim et al. 1994). The MDN information and data are available to the public at the NADP website http://nadp.sws.uiuc.edu/mdn/.

Interagency Monitoring of Protected Visual Environments (IMPROVE) Program

Our national parks and wilderness areas possess many stunning vistas and scenery. Unfortunately, these scenes are diminished by a uniform haze that causes discoloration and loss of texture and visual range. Layered hazes and plume blights also detract from the scene. Recognizing the importance of visual air quality, Congress included legislation in the 1977 CAA to prevent future and remedy existing visibility impairment in Class I areas—presently 156 national parks and wilderness areas located throughout the nation. The objectives of IMPROVE are:

- to establish current visibility and aerosol conditions in mandatory Class I areas;
- to identify chemical species and emission sources responsible for existing manmade visibility impairment;
- to document long-term trends for assessing progress towards the national visibility goal; and
- to provide regional haze monitoring representing all visibility-protected federal Class I areas where practical.

IMPROVE has also been a key participant in visibility-related research, including the advancement of monitoring instrumentation, analysis techniques, visibility monitoring, policy formulation, and source attribution field studies (Colorado State University 2011).

Since 1993, Chassahowitzka NWR has been the site of an IMPROVE monitoring station, one of over 140 stations that collectively monitor visual conditions (air particulates) across the nation. Data from all sites are being used to measure reasonable progress towards the federal goal of “natural conditions” as measured by natural visual range in mandatory Class I areas by 2064 (60 years). In the eastern U.S., visual range (a measure of visibility) is, on the average, only one-fifth of the natural visual range (that is, without manmade air pollution) (National Research Council 1993, *in* Porter 2000). At Chassahowitzka NWR, the annual average natural visual range (without manmade impairment) is 171 km. The annual visual range conditions at Chassahowitzka from 2000 to 2004 were 53 km, or less than one-third of national projections. Data indicate that visibility at this site is impaired much of the time (Porter 2000). Sulfate particles (primarily from coal-burning power plants) cause most of the light extinction, which is typical of eastern IMPROVE sites (National Acid Precipitation Assessment Program 2005d; Colorado State University 1996, *in* Porter 2000).

While regional sulfate is likely responsible for most of the haze in the Chassahowitzka Wilderness Area, organics from combustion sources in southern Georgia, western Alabama, and northern Florida are also significant contributors to haze in the region, especially during the winter (DRI 2011). Major emission sources for sulfur dioxide and nitrogen oxides in the region are most responsible for the visibility-impairing haze that is experienced at Chassahowitzka (U.S. EPA 2011b). Existing trends in visibility on the refuge appear to be stable. Results from the report entitled, *November 2006 Spatial and Seasonal Patterns and Temporal Variability of Haze and its Constituents in the U.S.* (Debell et al. 2006) indicate stable visibility (insignificantly improving or decreasing visibility) at Chassahowitzka NWR from 1995-2004, as measured through mass concentrations of major aerosol species including ammonium sulfate.

WATER QUALITY AND QUANTITY

The waters within Chassahowitzka NWR are classified as "Outstanding Florida Waters" (OFW) by Section 403.061(27) of the Florida Statutes. They are worthy of special protection because of their natural attributes, in this case, within a national wildlife refuge. These waters are listed as Class II, where shellfish propagation or harvesting is permitted. The FDEP cannot issue permits for direct pollutant discharges to OFWs, which would compromise the existing water quality, or for indirect discharges which would significantly degrade the OFW. Permits for new dredging and filling must be in the public interest and take several factors into consideration. Also, the waters within the Chassahowitzka and Homosassa river systems were designated as OFWs by Rule 62-302.700(9) in the Florida Administrative Code.

The Chassahowitzka River is one of the last, relatively undeveloped, spring-fed tidal rivers on the Gulf Coast. It is an integral part of one of the largest remaining coastal hardwood swamps on the Gulf of Mexico. The upper Chassahowitzka River, in conjunction with publicly held land and water in the Chassahowitzka Swamp, the Chassahowitzka NWR, and the St. Martin's Aquatic Preserve, comprise a major reservoir and nursery for Florida's marine fish populations and wetland-dependent listed wildlife.

From its spring-fed beginning, the Chassahowitzka River meanders through dense hardwood forests and hammocks, receiving additional flow from tributary creeks ending in the tidal marshes and grass beds of the Chassahowitzka NWR estuary. It supports an extensive wildlife and plant community, including many state- and federally-listed species, in addition to an important sport and commercial fishery. The OFW designation of this waterway is important for maintaining the long-term resource benefits of this system.

Unfortunately, the water quality and integrity of the Chassahowitzka River ecosystem is threatened by developmental pressures. The increasing flow of stormwater runoff, septic tank and domestic wastewater plant leachates, and low-quality canal waters are adversely affecting the fragile balance of this system.

Rainfall is the source for water discharging from the Florida's springs. Much of the rainfall reaching the land surface flows overland to surface water bodies, evaporates, or is transpired by plants. A portion of the rainfall travels through the sediments where it recharges the aquifers. During water's movement downward from the land surface (infiltration and percolation) to the water table, and during its residence within Florida's aquifer systems, many factors affect its chemistry. These factors include the residence time, flowpath, and the porosity of the rock. If the water is in contact with a particular portion of an aquifer for a long time, chemical reactions between the water and the rock may occur and the water chemistry would reflect the composition of the aquifer rock. Residence times range from several days to thousands of years. Short flow paths of water limit the chemical reactions between the water and the rock. Long flow-paths lead to reactions between the water and the rock and increase the total dissolved solid (TDS) content of the water. Florida's karst features contain both large and small openings in the rock. Since many of these openings are small, they act as filters for microbes, small organic substances, and clay minerals. This results in very clean groundwater that is extremely desirable for both drinking water and recreational uses. Not all contaminants originating from land activities are removed and thereby contaminate groundwater.

Three factors affecting spring water quality are nitrates, salinity, and bacteria. Florida's springs have shown a steady increase of nitrates over the past several decades (Jones et al. 1998). Nitrates have increased in the Chassahowitzka Main Spring between the 1970s and the early 2000s. Increasing nitrate concentrations may adversely affect the aquatic ecosystem in springs and spring runs, but the increased concentrations of nitrate in surface water is not fully understood.

The use of lawn and turf fertilizers in residential areas and golf courses, septic tank effluents, and effluent disposals from sewage treatment are contributing the majority of nitrogen that is present in ground water. Lawn and turf fertilization (e.g., from residences and golf courses) was determined to be the primary source of increased nitrate levels in the Homosassa, Chassahowitzka, and Weeki Wachee Springs just south of Kings Bay and Crystal River. Where concentrations are elevated in ground water, the four sources of nitrogen are associated with residential and commercial development. The nitrogen contributed by these sources is reduced by vegetative and soil-removal mechanisms, but enough reaches the groundwater to elevate concentrations.

Nitrogen from fertilizer may be entering the groundwater from stormwater runoff in the karst areas. This nitrogen loading in the springs to the coastal estuaries may not be able to be reduced, because it has been in the groundwater for many years. Results from present-day attempts to reduce nitrate levels in the springs may not be seen for decades. Water emerging from the springs can be from recent rainfall, from up to 5 decades ago, or both.

The FDEP is aware of the nitrate issues and has worked with other governmental agencies to develop a series of steps to reduce nitrate concentrations in the groundwater and springs. The FDEP encourages the development of best management practices (BMPs). BMPs are land strategies designed to reduce pollution to the environment. The FDEP is working with government and private organizations to develop and implement BMPs that will result in a reduction of nitrate concentrations in spring water in the region.

The FDEP's Bureau of Watershed Management is active in coordinating the development of spring protection measures. In September 2003, Governor Jeb Bush and the Florida Cabinet voted unanimously to strengthen protection for Florida's freshwater springs. Improvements to the Florida Springs Rule, proposed by FDEP, are designed to increase protection for water quality, flow, and habitats.

More recent studies have looked into whether phosphorus, and not nitrogen, may be the limiting factor in the growth of algae. In the Chassahowitzka River and estuary, Frazer et al. (2002) found that growth of algae varied during the year and was limited by phosphorus and/or nitrogen throughout the year. The limiting factor of phosphorus or nitrogen also varied between sites and years. For example, in the winter of 2000, algae at one station within the marsh complex was phosphorus limited. At all other stations, algal growth was co-limited by phosphorus and nitrogen. In the winter of 2001, phosphorus was the limiting factor at all stations, except the uppermost river station.

Another water quality concern affecting springs is the influence of saline water. The ultimate source of the saline indicators is from naturally occurring saline water within the Floridan Aquifer System (Floridan). Saline water may cause water-quality changes in spring water as the result of natural circumstances, such as drought and upwelling within the Floridan. The changes may also be attributed to groundwater withdrawal. Anecdotal evidence of dead trees on small, upland islands within the marsh suggest that salt water intrusion may be a cause or the cause of tree mortality.

Bacteria, such as *enterococci* and fecal coliform, are also a concern regarding spring water quality. Research is needed before definitive conclusions can be made regarding the source of the fecal bacteria. Scientists long held that these bacteria originate in fecal matter from warm-blooded animals. But now it is known that these bacteria can complete their normal life cycle outside of warm-blooded animals, especially in a warm environment as in parts of Florida. Therefore, the concentrations of fecal coliform may not necessarily represent a direct link to warm-blooded animal pathogens.

The Florida Springs Initiative addresses the nitrate and microbiological issues by providing funds for the monitoring of nitrate in springs and by sponsoring research on the microbiology of caves and spring water. The FDEP also works very closely with the water management districts to monitor

saltwater intrusion and in the establishment of minimum flows for streams and minimum levels for aquifers. Florida law (Chapter 373, Florida Statutes) requires Florida's water management districts to establish minimum flows and levels (MFLs) for water courses, water bodies, and aquifers. Minimum flows and levels are designed to assure adequate quantities of water for the streams and springs. This statute also provides authority to reserve water from permit allocation to protect fish and wildlife (Chapter 373.223(4), Florida Statutes). Manatee use of the springs is considered when determining MFLs. This law will aid in protecting historical spring flows.

The Chassahowitzka Springs form the headwaters of the Chassahowitzka River, which flows westerly to the Gulf of Mexico approximately 6 miles (9.7 km) through low coastal hardwood hammock and marsh. As many as five springs flow into the upper part of the river, and many more springs are known to exist in the lower portion. The entire river is tidally influenced. The average annual discharge from the Chassahowitzka River Springs group from 1930-1972 was 138.5 cubic feet per second (cfs). On October 15, 2001, the discharge was 53 cfs (Scott et al. 2004).

The Homosassa Springs group is located within the Ellie Schiller Homosassa Springs Wildlife State Park and forms the headwaters of the Homosassa River. This river flows approximately 6 miles (9.7 km) to the Gulf of Mexico. The entire river system is tidally influenced. The average annual discharge from the Homosassa Springs Group was 106 cfs from 1931 to 1974. On October 16, 2001, the discharge was 87 cfs (Scott et al. 2004).

BIOLOGICAL RESOURCES

HABITAT

The refuge's diverse ecosystems, including prime estuarine habitat, is home for an incredible variety and abundance of flora and fauna. The marshlands, swamplands, shallow bays, and tidal streams provide both the quantity and quality of aquatic plant and animal life required to support thousands of wintering waterfowl, marsh and waterbirds, shorebirds, fishes, and a variety of other animal species that depend on a marine environment. Figures 9 and 10 show the land cover types and submerged habitats, respectively, described in this section.

The 17,063 acres of refuge marshlands is composed primarily of dense areas of black needlerush (*Juncus roemerianus*) ranging from about 2 to 4 feet in height. Thick stands of sawgrass (*Cladium jamaicense*), intermittent patches of saltgrass (*Distichlis spicata*), and to a lesser degree saltmarsh cordgrass (*Spartina alterniflora*), border on much of the needlerush marsh. The marsh is inhabited by rails (*Rallidae*), gallinules (*Porphyrio* sp.), songbirds, smaller mammals, reptiles, amphibians, and arthropods (mostly crabs). Slightly elevated tree islands, covered with cabbage palm (*Sabal palmetto*) and eastern red cedar (*Juniperus virginiana*), are scattered throughout the salt marsh. These tree islands provide perching and resting areas for various species of birds that feed in the associated salt marsh and tidal habitats.

Dispersed throughout the salt marsh are 10,000 acres of estuarine habitat, primarily shallow bays and tidal streams. The largest streams are the Chassahowitzka and Homosassa rivers. Due to the three transitional salinity stages (ranging from fresh spring water, to brackish, and then to the saline waters of the Gulf of Mexico), a wide range of aquatic plant and animal life flourishes within all parts of this system.

Figure 9. Land cover, Chassahowitzka NWR.

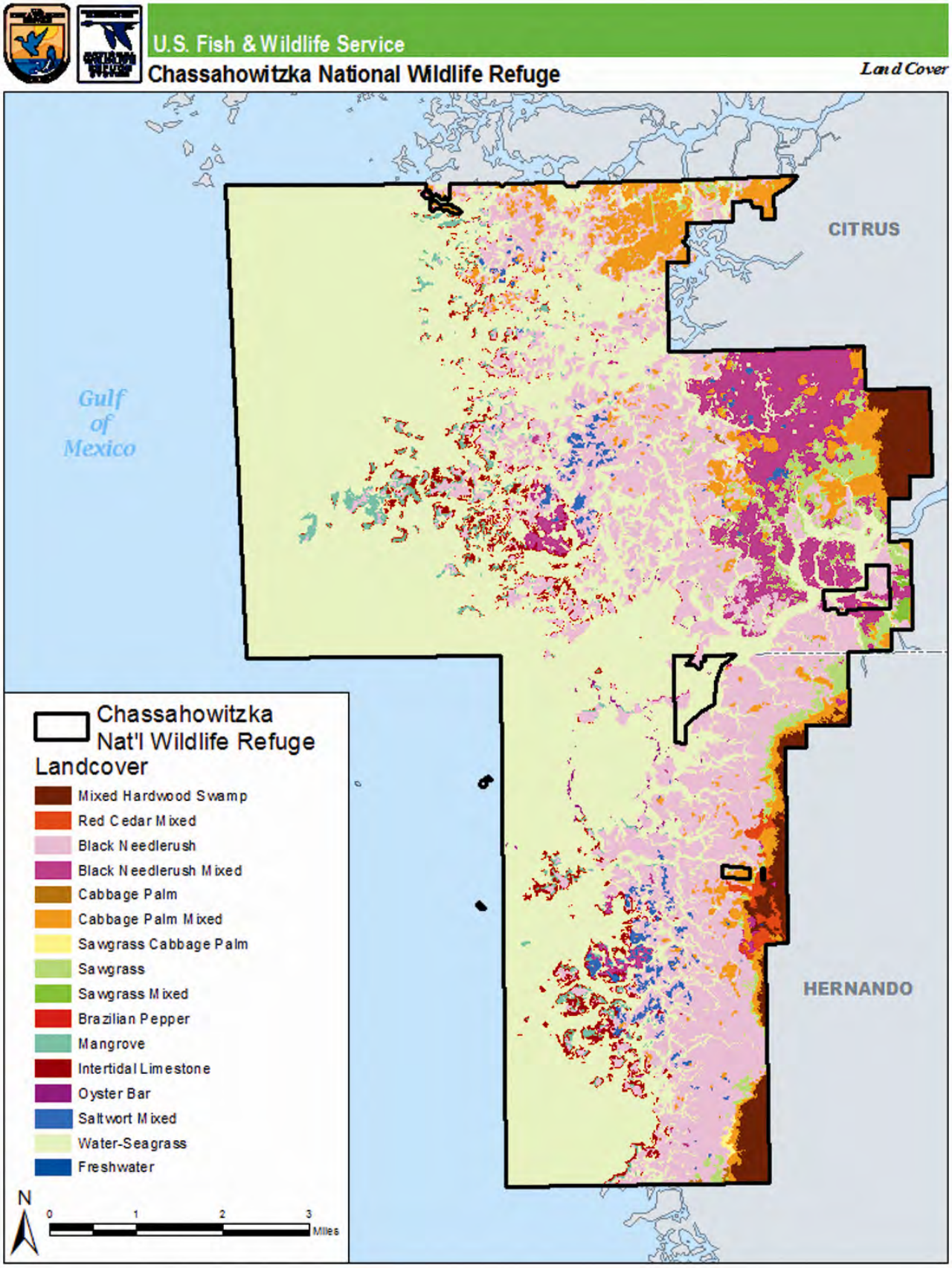
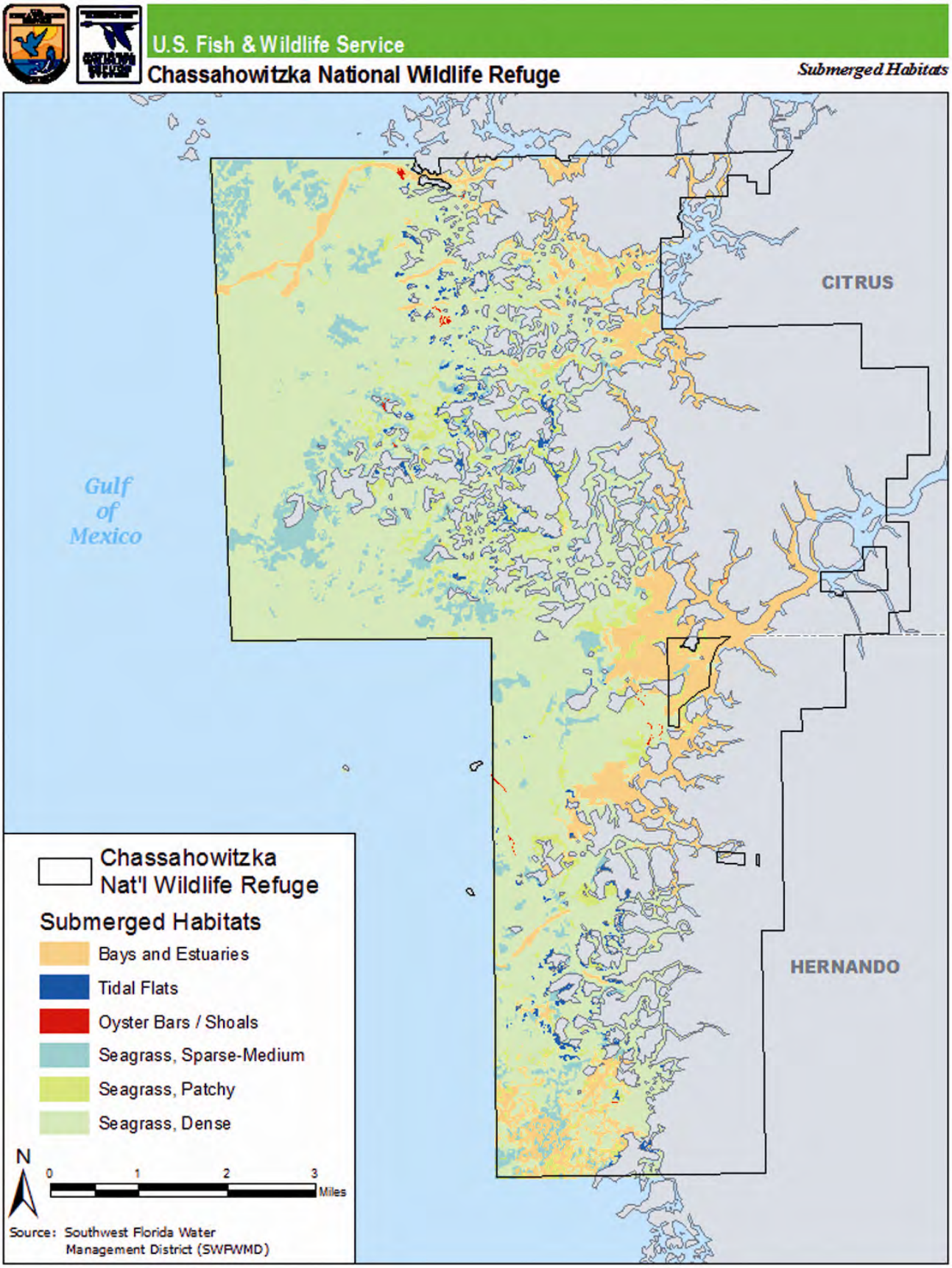


Figure 10. Submerged habitats, Chassahowitzka NWR.



Beginning with the least saline headwater streams of the refuge, indigenous aquatic plants include species such as the sago pondweed (*Potamogeton pectinatus*), southern naiad (*Najas guadalupensis*), and coontail (*Ceratophyllum demersum*). In recent years, substantial invasions of exotic (nonnative) plants have occurred in these areas, such as Eurasian watermilfoil (*Myriophyllum spicatum*), and to a lesser degree, *Hydrilla*. Manatees take advantage of these invasive plants for food in addition to the native aquatics. Inhabitants in the headwater streams include three threatened or endangered species: the West Indian manatee (*Trichechus manatus*), wood stork (*Mycteria americana*), and American alligator (*Alligator mississippiensis*). Use by other species includes wigeon (*Anas penelope*), blue-winged teal (*A. discors*), green-winged teal (*A. carolinensis*), common moorhen (*Gallinula chloropus*), coot (*Fulica americana*), wood duck (*Aix sponsa*), colonial waterbirds, and freshwater fish.

The brackish tidal areas and shallow bays provide additional variety in terms of aquatic plant and animal foods. Large areas of the tidal bays are carpeted with a most highly preferred waterfowl food in the form of green algae (*Chara* sp.) or muskgrass. Along with shoal grass, wigeon grass, and various arthropods, muskgrass comprises more than 75 percent of the diet of ducks that use this brackish zone. The dominant waterfowl species include gadwall, American wigeon, pintail, scaup, red-breasted merganser, and hooded merganser. Other wildlife species found here include the bald eagle, brown pelican, white pelican, coot, cormorant, egret, heron, ibis, anhinga, tern, gull, kestrel, hawks, and osprey. Important local sport and commercial fishery species, such as mullet, blue crab, spotted seatrout, and sheepshead, also occur in the tidal areas.

Waters of the refuge support many waterfowl species including mallard (*Anas platyrhynchos*), canvasback (*Aythya valisineria*), redhead (*Aythya americana*), ring-necked duck (*Aythya collaris*), lesser scaup (*Aythya affinis*), red-breasted merganser (*Mergus serrator*), northern pintail (*Anas acuta*), common goldeneye (*Bucephala clangula*), hooded merganser (*Lophodytes cucullatus*), ruddy duck (*Oxyura jamaicensis*), gadwall (*Anas strepera*), bufflehead (*Bucephala albeola*), and American coot (*Fulica americana*).

The most saline refuge waters, located at the edge of the Gulf, contain many of the same submerged aquatic plant species as the brackish zone, but here they are more sparsely distributed in deeper water and are much less subject to tidal fluctuations. The dominant waterfowl species occurring here include redhead, canvasback, scaup, and mergansers. Several threatened or endangered species associated with this habitat include the peregrine falcon, loggerhead sea turtle, Kemp's Ridley sea turtle, green sea turtle, Gulf sturgeon, and smalltooth sawfish. Most of the wildlife species listed previously in the brackish tidal zone also use the Gulf coast at one time or another during their annual cycle.

Mangroves are scattered throughout this estuarine environment. The mangroves provide protective barriers for the fragile estuarine habitat, serve as colonial bird rookery sites, and provide escape cover. Because Citrus and Hernando counties are considered the northern extent of the mangrove's range, the mangrove will probably continue to thrive here, but may never reach maturity.

Lastly, 2,560 acres of hardwood swamplands and 250 acres of upland forest form the refuge's eastern boundary. The dominant swampland flora includes red maple, red bay, sweet bay, and cabbage palm. The apparent lack of cypress and water tupelo may be due to logging activities prior to the establishment of the refuge. The small amount of upland forest is composed of live oak, scrub oak, longleaf pine, slash pine, wax myrtle, and saw palmetto. Wildlife indigenous to these areas include the gopher tortoise, white-tailed deer, Eastern wild turkey, black bear, small mammals, neotropical migratory birds, raptors, reptiles, and amphibians.

WILDLIFE

Chassahowitzka NWR supports a wide variety of wildlife including mammals, birds, reptiles, amphibians, invertebrates, and fish. Appendix I lists the species known to occur on the refuge.

Mammals

Nearly 50 species of mammals have been documented on the refuge, including two marine mammals: the West Indian manatee and dolphins. Manatees are discussed in detail in the Rare, Endangered, and Threatened Species section. Another notable species is the Florida black bear. Predatory species include bobcat, coyote, grey and red fox, raccoon, skunk, and river otter. The eastern cottontail rabbit, marsh rabbit, and grey squirrel are examples of herbivores found on the refuge. Several small bat species occupy various habitats across the refuge, as do several species of small rodents including shrews, mice, voles, and rats.

Birds

A primary purpose of the refuge is to protect habitat for migrating birds. The refuge provides habitat for over 200 species of breeding and nonbreeding birds.

Migratory Birds. Many of the migratory birds occurring on the refuge are transients that are present only briefly during their spring or fall migrations. For some migratory species, like shorebirds, availability of appropriate foraging habitats should coincide with peak periods of migration. Because foraging resources are most critical during migration and breeding (which are two high-energy activities), most management considerations pertain to breeding and wintering populations of migratory birds.

Important refuge habitats and resources for birds include estuarine emergent marsh (secretive marshbirds and "marsh" sparrows); forested wetlands (priority neotropical migrant landbirds); mangrove islands (breeding colonial waterbirds); and beds of submerged aquatic vegetation (wintering waterfowl). Principal conservation and management considerations focus on providing sufficient foraging resources for wintering waterfowl; preventing disturbance to waterbird breeding colonies; optimizing habitat suitability for secretive marshbirds; and addressing priority information gaps through research, inventory and monitoring. There are also special considerations for listed species, such as whooping cranes and wood storks, discussed later in this plan.

Bird conservation planning has incorporated multiple habitat scales, including both a local (refuge) and a landscape context. From an ecoregion perspective, Chassahowitzka NWR lies within Bird Conservation Region 31 (BCR 31), Peninsular Florida. BCRs represent a common spatial planning framework that facilitates integrative approaches to planning, implementation, and evaluation among the bird initiatives. For instance, habitat delivery programs can be designed in ways that best contribute to ecoregional conservation objectives for all bird groups—waterfowl, landbirds, shorebirds, and waterbirds. For Peninsular Florida, the Atlantic Coast Joint Venture is the conservation partnership that provides the proper forum for stakeholders to engage in such "all-bird" planning, implementation, and evaluation.

Due to the high diversity of birds supported within an ecoregion, conservation efforts typically focus on priority species or guilds. A list of priority species for Peninsular Florida occurring on the refuge is included in Appendix I.

Waterfowl. Roughly 25,000 ducks and 30,000 coots wintered at the refuge in 1970. In brackish tidal areas, the principal species included gadwall, American wigeon, northern pintail, scaup, and red-breasted and hooded mergansers. Canvasback, redhead, scaup and mergansers occurred in deeper, estuarine waters. Blue-winged and green-winged teal used the less saline headwaters. Since 1970, the number and diversity of wintering waterfowl using the refuge has dropped off dramatically. Four decades later, in 2010, the refuge staff estimated 1,500 wintering ducks using the refuge, primarily red-breasted mergansers.

Historically, Chassahowitzka NWR provided wintering waterfowl with ample foraging resources and quiet areas. Available foods included muskgrass (*Chara* spp.), wigeon grass (*Ruppia* spp.), shoalgrass (*Halodule* spp.), sago pondweed (*Potamogeton pectinatus*), and other aquatic plants that were known to comprise a major part of waterfowl winter diets. Shellfish beds provided important food resources used by diving species, such as scaup. All foods were available naturally, with none of the active management or manipulation of food resources typical of other refuges.

The causes of the decline in wintering waterfowl use are unknown. Water quality degradation due to altered flows and increased nutrient loads may be affecting the supply of foods. At this time, invasive plant issues do not appear to be a major threat to waterfowl through competition with or exclusion of other important food resources. The declining trend could represent regional shifts in distribution and habitat use of wintering ducks, as well as overall population level declines in certain species, for example lesser scaup (*Aythya affinis*) and northern pintail (*Anas acuta*). Some species, such as gadwall (*Anas strepera*), have experienced range-wide increases, but they may have shifted use patterns as an increase was not noted on the refuge. As a result of decreasing use by waterfowl, recreational opportunities associated with waterfowl hunting or observations of waterfowl on the refuge have diminished accordingly.

Excessive human disturbance can be a potential problem in the management of wintering waterfowl on many refuges. Relative to other bird groups, waterfowl are skittish, exhibit large flush distances, and tend to remain airborne for longer periods. They are also more cautious in returning to areas from which they are repeatedly disturbed. Thus, hunting, fishing, boating, wildlife observation, and other recreational activities can all pose disturbance threats to waterfowl if not properly managed. In addition to causing waterfowl to abandon otherwise suitable habitat, disturbance can negatively impact survival and productivity through the complex interrelationships of elevated energy demands, increased susceptibility to hunting or predation, poorer foraging efficiency, diminished physiological condition, prolonged molt, and interruption of courtship activities and rest periods.

Regulating disturbance to a minimum requires the ability to designate and enforce appropriate spatial/temporal closed areas that restrict or limit public access where and/or when it is most prudent to do so. Previous attempts, in the mid-1980s to late 1990s, to limit potential disturbance to waterfowl at the refuge were made by closing a small portion of the refuge to public use during the winter months (October 15 to February 15). This action was not effective in increasing waterfowl use. The closed zone may not have properly included appropriate food resources or prevented other human disturbance, such as from airboats. To reduce disturbance effects, a portion of the refuge's Citrus County unit (roughly 40 percent of the acreage) was closed during this same time and remains a no-hunting zone.

Marshbirds. Among wetland-inhabiting birds, those categorized as marshbirds—rails, bitterns, cranes, coots, and moorhens—have been the subject of much recent research, monitoring and management attention across the southeast. Concern for several of these species stems from both the extent of loss and the degradation of interior (fresh) and coastal (brackish to estuarine) marsh habitats, especially high marsh. Information is lacking regarding the status and trends of these

species; the secretive habits of these birds require specialized surveys to track their populations. Several of these species are hunted throughout their range, presenting the additional concern of setting responsible harvest limits in the face of limited population information.

In Bird Conservation Region 31 – Peninsular Florida, black, yellow, and king rails are among the highest of marshbird priorities (Appendix I). King rails tend to favor fresh water marsh. The refuge is listed as marginally suitable for rails, as they occur where spring waters meet estuarine waters (e.g., sawgrass fringes). American and least bitterns and limpkin are also of concern. Like king rails, these species prefer fresher water. They may tend to be limited to specific areas of the refuge where freshwater mixes (bitterns). Limpkins may be rare.

Marsh-inhabiting passerine birds of conservation priority within Peninsular Florida include the seaside sparrow and Nelson's sharp-tailed sparrow. Though truly "landbirds," these species are best treated and addressed within this section, as management activities directed at rails, bitterns, etc. typically support conservation of marsh sparrows. Sharp-tailed sparrows (both Nelson's and saltmarsh) occur in coastal areas of Florida during winter, but are secretive and obscure. Saltmarsh sharp-tailed sparrows are typically regarded as wintering on the east coast of Florida, with Nelson's sharp-tailed sparrows wintering along the Gulf coasts; smaller numbers of saltmarsh sharp-tailed sparrows also occur along Gulf coastal marshes. Presently, neither of these species is listed as occurring on the refuge, but it will likely take a directed effort to document their presence.

The extensive *Juncus/Spartina* marshes within the refuge clearly provide suitable habitat (both breeding and nonbreeding) for key species of marshbirds, but little is known about the relative abundance or population size of these species on the refuge, or whether some even occur with sufficient frequency to be of management concern. This represents an obvious need to implement survey protocols to begin understanding distribution and habitat use on the refuge and to also establish a baseline for indexing abundance. Clapper rails occur in high densities in *Juncus* marsh and are possibly quite abundant on the refuge. Other marshbird species (black rail, king rail) would be expected, but are less common.

It is realistic to expect species such as the clapper and Virginia rails, sora, and possibly black rail and least bittern, to be abundant enough to benefit from management activities that promote favored microhabitats. Other than maintaining marsh habitats through prescribed fire or other disturbance, there are few habitat management options for the extensive tracts of unimpounded coastal marsh for these species. Promoting structural heterogeneity and plant species diversity within large acreages of otherwise homogeneous marsh would be beneficial. In particular, creating or maintaining dense patches of high marsh may promote conditions favored by black rails and other marshbird species (i.e., 3 to 5 years post-treatment).

Although not likely to be very common, small numbers of black rails presumably breed and occur year-round on the refuge, so any management benefiting this high priority species should be encouraged. Additionally, opening areas of marsh through these treatments will benefit foraging wading birds that will use these openings until the marsh begins to recover and becomes too dense. Variety in topography, successional stage of marsh plants, degree and frequency of tidal inundation, etc. will all contribute to ensuring a diversity of microsites for foraging, nesting and concealment.

Landbirds and Raptors. The primary habitats of importance to landbirds on Chassahowitzka NWR are riverine hardwood swamps, coastal hammocks, and mangrove islands. There is a very limited amount of upland habitat along the eastern boundary of the refuge. These uplands are a

mix of slash/longleaf pine and hardwoods (e.g., red maple, red bay), which abruptly give way to scrubby successional stringers and marsh habitats. Together, these habitats comprise approximately 3,000 acres on the refuge.

Priority breeding and wintering landbirds for BCR 31 that occur (or are likely to occur) on the refuge (Appendix I) include the Florida prairie warbler, prothonotary warbler, yellow-billed cuckoo, bald eagle, short-tailed hawk, and swallow-tailed kite. While swallow-tailed kites are not known to breed on the refuge, they breed in forests in the vicinity of the refuge and may use the refuge for foraging during the nesting season. Kites prefer an open canopy and heavy midstory for their nest sites, particularly in areas near the edge of rivers and wetlands. Kites favor nesting in the highest trees in the forest canopy (sometimes referred to as "super-emergents"), and protection of trees that could develop into such stature could possibly promote nesting on the refuge. Short-tailed hawks have a very limited breeding range in Florida, and primarily occur in southern and eastern Florida. Since it is reported on the refuge, the biological review team concluded it should be monitored.

The refuge provides important habitat for bald eagles in the peninsular Florida region, as well as locally. Seven bald eagle nests occur within one kilometer (0.62 mile) and six others within one mile of the refuge boundary. Nine of the 13 were active in 2011. The last active nest on the refuge was recorded in 2008. The refuge-area population is part of the Western Gulf Coast eagle nest cluster, one of 16 identified clusters in the state (FWC unpublished data). Such clusters were described in the first regional Southeastern United States Bald Eagle Recovery Plan (USFWS 1989) as “nuclear populations.” This plan stated that the “loss of or substantial alteration to these population centers would seriously jeopardize the long-term survival chances for the species in Florida.” While no longer a federally listed species, it is a trust species. The refuge provides important habitat for bald eagles to feed.

The Florida prairie warbler is a coastal resident that breeds locally in portions of central and south Florida. It breeds in mangrove islands and hammocks, reaching its northernmost distribution along the Gulf coast in the Chassahowitzka and Crystal River areas. The prothonotary warbler breeds in bottoms and riverine swamps, but reaches its southernmost breeding limits in central Florida. All of these species warrant concern or management attention because of limited distributions, small populations, declining trends, or threats to breeding or nonbreeding habitats. In other areas of BCR 31, active management is being recommended to benefit the conservation of these species. The refuge is at the periphery of the range of many of these species and its capacity to contribute to their conservation is primarily limited to protection of existing habitats (as opposed to habitat restoration or enhancement).

Shorebirds and Waterbirds. Waterbirds refer to the gulls, terns, skimmers, loons and other groups of aquatic birds not addressed above under Waterfowl or Wading Birds. There is ample open water and marsh habitat for use by foraging gulls, terns, loons, cormorants, pelicans and grebes. The refuge provides a foraging area for priority species such as red-throated loons (nonbreeding), brown pelicans, black skimmers, least terns, sandwich terns, black terns (transient), and gull-billed terns. The biological review team concluded that the main management issue for these species is to ensure that watercraft and other uses of the refuge do not constitute a disturbance threat. Water quality and contaminants that impact upon the forage- fish base can have cascading effects on waterbird foraging on the refuge. Spent fishing gear can pose an entanglement threat. Educational signage and literature should promote the responsible disposal and retrieval of lost fishing gear by anglers.

Shorebirds forage on tidal mudflats, oyster rakes, and other areas of the refuge that are exposed during low tides. The Southeast Coastal Plain/Caribbean regional shorebird conservation plan identifies the refuge as having potential shorebird use, but not as being important for shorebirds primarily since foraging grounds (tidal flats, oyster rakes) comprise only a small part of the refuge area. Still, the refuge provides regular foraging opportunities to the small numbers of priority

shorebirds that occur here at different times of the year. These include American oystercatchers (resident, but not breeding on refuge), upland sandpipers (transient), red knots (nonbreeding), whimbrels (nonbreeding), semipalmated and western sandpipers (nonbreeding), and short-billed dowitchers (nonbreeding). Mechanical or pyric (i.e., fire) disturbance in areas of marsh exposed during low tide can help promote the open foraging conditions required by shorebirds.

The greatest management concern regarding shorebirds on the refuge is disturbance to foraging and roosting birds, especially during fall and spring migration. Studies have shown that repeated disturbance by passing watercraft and even relatively "low impact" activities like fishing, walking, and birdwatching can negatively affects the birds' abilities to accumulate and store fat reserves essential for timely migration and successful breeding. Thus, areas that are regularly used by shorebirds should be protected from excessive disturbance, particularly during spring and fall, when even a two-week period of uninterrupted foraging can benefit the life cycle of some of these species.

Reptiles

Reptile diversity is suspected to be high with 44 species likely to occur, but only 31 have been confirmed on the refuge. These include turtles, lizards, snakes, and one crocodilian, the American alligator. Please refer to Appendix I for a listing of the reptiles that are known or suspected to occur on the refuge. Notable species include ornate diamondback terrapins (*Malaclemys terrapin macrospilota*), gopher tortoises (*Gopherus polyphemus*), Atlantic green turtles (*Chelonia mydas mydas*), Atlantic Ridley turtles (*Lepidochelys kempi*), American alligators (*Alligator mississippiensis*), Eastern indigo snakes (*Drymarchon corais couperi*), and Eastern diamondback rattlesnakes (*Crotalus adamanteus*). Gopher tortoises, found in the maintenance area, are on the Service's Southeast Region list of management concern and are a keystone species that benefits a host of other rare species, including the federally listed indigo snake. Over 300 commensal species are identified with tortoise burrows.

Amphibians

Amphibians are a class of vertebrate animals, such as frogs, toads, salamanders, mudpuppies and newts, most of which have both freshwater (metamorphic) and terrestrial life phases. Of the 34 species likely to occur on the refuge, 11 have been confirmed including green tree frogs (*Hyla cinerea*), bullfrogs (*Rana catesbeiana*), and southern leopard frogs (*Rana utricularia*). Appendix I lists the amphibian species that may occur on the refuge.

Fish

A variety of fishes are found on or near the refuge. Because the refuge has much estuarine habitat, which most species of fish use as nursery grounds, it is important for commercially harvestable and recreational fish species. Appendix I lists the species of fish found in the refuge.

Invertebrates

Invertebrates comprise 97 percent of the animal kingdom. This class of animals is distinguished by the lack of a backbone. While many invertebrates are soft-bodied, some have exoskeletons or shells. Invertebrates include both terrestrial and aquatic species. Marine and estuarine invertebrate species (e.g., crabs, sponges, mollusks) that inhabit tidal areas and deeper waters surrounding the refuge would be expected to number in the thousands; however, these have not been cataloged or documented on the refuge. While many terrestrial invertebrate species of insects and arachnids (e.g., spiders) would be expected, these also have not been surveyed. Invertebrates are important sources of food for people and wildlife. Many insects (e.g., bees and butterflies) are essential plant pollinators.

Exotic, Invasive and Nuisance Species

Invasive animals are present in various refuge habitats. Unlike indigenous species, these species typically do not have any natural predators to limit their populations and can outcompete native animals for food and other resources. Feral hogs are the main mammalian invasive species on the refuge and are found in all upland and marsh habitats. Hogs cause extensive habitat damage, and it is suspected that they also negatively impact wildlife through direct mortality (predation) and competition for food. No current estimates exist for the hog population on the refuge, although observations of hogs in the marsh are not uncommon. Feral hog hunting is one tool being used to keep the population in check in adjacent state lands. In order to control feral hog populations and provide a visitor service opportunity, the State of Florida permits feral hog hunting on lands adjacent to Chassahowitzka NWR, including the Homosassa Tract of Withlacoochee State Forest and Chassahowitzka Wildlife Management Area.

Coyotes naturally expanded their range into Florida in the 1970s and were also introduced from western states. They are found in small numbers along the upland portions of the refuge. They do not currently appear to be having a major negative effect on native wildlife.

Introduced, nonnative species of birds occurring within the refuge include the Muscovy duck (*Cairina moschata*), monk parakeet (*Myiopsitta monachus*), rock dove (*Columba livia*), Eurasian collared dove (*Streptopelia decaocto*), European starling (*Sturnus vulgaris*), and house sparrow (*Passer domesticus*). Nonnative amphibians established on the refuge include the Cuban brown anole (*Anolis sagrei*) and Cuban tree frog (*Osteopilus septentrionalis*). Nonnative fire ants (*Solenopsois* spp.) may also be found on the refuge.

Rare, Threatened, and Endangered Species

Table 1 shows the refuge's federal- and state-listed species and their status. While the whooping crane is an endangered species, the captive-bred, human-raised population is classed as a threatened experimental population: T(E/P). Although bald eagles have been removed from the endangered species list, they are still federally protected under the Bald and Golden Eagle Protection Act.

West Indian Manatee. Manatees found in the refuge's salt marshes and associated waters are from the Northwest Florida subpopulation of manatees. This subpopulation is characterized by the animals' winter use of springs in the Crystal and Homosassa rivers region, located north of the refuge. A high count of 651 manatees in the region was documented by the refuge biologist on January 13, 2010. Biologists from U.S. Geological Survey studying this group of animals have distinguished them as part of a locally growing subpopulation, with a population growth rate of between six and eight percent per year and an annual adult survival rate of 96 percent.

Manatees use Chassahowitzka NWR primarily during the warm spring-through-fall period to feed, travel, rest, cavort, mate, and calve. A typical aerial survey conducted during the summer months has a range of 10 to 20 manatees using the refuge, primarily within the Chassahowitzka River. A record high count had 48 observed in May 1996. Slow boating speed zones are in effect from April 1 through August 31 annually along a portion of the Chassahowitzka River from the refuge's eastern boundary to the mouth of the river (John's Island). During intermittent, warm periods in the winter months, up to 12 manatees access the springs at the headwaters of the Chassahowitzka River. Winter use of these sites (and perhaps the Homosassa River) is likely accompanied by foraging bouts on the refuge.

Table 1. Federal- and state-listed species of Chassahowitzka NWR (2012).

Common Name	Scientific Name	USFWS	State of Florida
Alligator snapping turtle	*Macrochelys temminckii*		SSC
American alligator	*Alligator mississippiensis*	T(S/A)	SSC
Atlantic green turtle	*Chelonia mydas*	E	E
Atlantic Ridley turtle	*Lepidochelys kempi*	E	E
Atlantic loggerhead turtle	*Caretta caretta*	T	T
Brown pelican	*Pelecanus occidentalis*		SSC
Eastern indigo snake	*Drymachron corais couperi*[1]	T	T
Florida black bear	*Ursus americanus floridanus*		T*
Gopher tortoise	*Gopherus polyphemus*		T
Gulf sturgeon	*Acipenser oxyrinchus desotoi*	T	SSC
Least tern	*Sternula antillarum*		T
Little blue heron	*Egretta caerulea*		SSC
Reddish egret	*Egretta rufescens*		SSC
Roseate spoonbill	*Platalea ajaja*		SSC
Smalltooth sawfish	*Pristis pectinata*	E(DPS)	
Snowy egret	*Egretta thula*		SSC
Tricolored heron	*Egretta tricolor*		SSC
West Indian manatee	*Trichechus manatus*	E	E
White ibis	*Eudocimus albus*		SSC
Wood stork	*Mycteria americana*	E	E
Whooping crane	*Grus americana*	T(E/P)	
Florida sandhill crane	*Grus canadensis pratensis*		T

E: Endangered
E (DPS): Endangered – Distinct Population Segment
T (S/A): Threatened by Similarity of Appearance
T: Threatened
T(E/P): Threatened Experimental Population
SSC: State listed Species of Special Concern
** Not applicable in Baker and Columbia counties and Apalachicola National Forest*
[1] Also known as Drymarchon couperi (Orianne Society 2010)

Wood Stork. Small numbers of wood storks are usually seen feeding in the refuge during the fall and winter months. Occasionally, several hundred may be seen feeding during low tides. Wood stork nesting has not been recorded on the refuge.

Whooping Crane. Since 2001, Chassahowitzka NWR has been the winter home to an experimentally introduced population of captive-bred whooping cranes. A second site was established at St. Marks NWR in 2009 to alleviate any risks (storms, floods, disease) to the Chassahowitzka population. According to the Whooping Crane Recovery Plan, two experimental populations of whooping cranes were established in Florida with the goal of having 25 breeding pairs in each. The FWC maintains a nonmigratory flock of whooping cranes in south-central Florida (Kissimmee Prairie Basin). This flock reached a high of 103 in 2001-02, but is now down to 27 birds. No more birds will be supplied to this population due low productivity (Nesbitt and Hatchitt 2008).

For the migratory flock, captive-bred whooping cranes from the International Crane Foundation in Wisconsin and the Patuxent Wildlife Research Center in Maryland provide the chicks for this reintroduction, which are released at the Necedah National Wildlife Refuge in Wisconsin. Yearling cranes are taught to fly behind ultralight aircraft with costumed pilots and caretakers. They are flown the 1,200 miles from Wisconsin to the refuge. The first migration began during the 2001-02 season. Whooping cranes have been reintroduced into Chassahowitzka NWR for ten winter seasons as of 2011. Of the 181 reintroduced whooping cranes, 97 (or 53 percent) currently survive, including 50 males and 47 females. The reintroduction of the whooping cranes is the endeavor of many agencies, organizations, and individuals who comprise the Whooping Crane Eastern Partnership (WCEP).

The refuge was selected as a reintroduction site in an attempt to resemble habitat of Aransas NWR on the Gulf Coast of Texas. There, the diet of the natural whooping crane population depends largely on an abundance of blue crabs, which are also abundant on Chassahowitzka NWR. The refuge provides a high-quality winter release location, but due to tidal and other habitat conditions, it has not been used as winter territories by returning birds. Many of the birds visit the Chassahowitzka salt marsh upon return to Florida from autumn migration, but then move inland for the winter. Returning migratory whooping cranes and nonmigratory whooping cranes have been fairly consistent in their habitat selection in Florida. The birds are selecting inland areas containing freshwater marshes with many of the sites containing large, highland marshes, such as the Paynes and Hawthorn prairies and Clermont Marsh. They are frequently using smaller highland or flatwoods marshes adjacent to dry prairies where cattle graze. Many of the birds forage in these upland cattle or horse pastures during the day, particularly where a nearby water source, such as a ditch or pond, is present. The existence of shallow water suitable for roosting appears to be the most important factor to alleviate predation.

Important crane habitat in central Florida has been lost to development in recent years and continues to be targeted for future development. Three of the four release sites the FWC has used for their reintroduction project are now in various stages of development, as are other large ranches known to be used by both populations of whooping cranes. Crane habitat appears to be in decline in Florida.

Gulf Sturgeon. The Service and the National Marine Fisheries Service listed the Gulf or Atlantic sturgeon (*Acipenser oxyrhynchus*) as threatened in 1991 under the Endangered Species Act. The Gulf Sturgeon Recovery Management Plan was published four years later (USFWS et al. 1995). The Gulf sturgeon's historic range extended well south of the refuge to Charlotte Harbor, near Fort Myers, Florida. Critical habitat was designated as far south as the Suwannee River. Very little work has been done to determine where the Gulf sturgeon goes after breeding in the Suwannee River. Sturgeons have been found at Cedar Key, south of their designated critical habitat in Suwannee Bay, but no studies to determine current distribution and habitat use have been conducted further south. Adults have been seen in bays and estuaries with water depths as shallow as three feet.

Based on the September 2009 five-year review of the recovery plan, the threatened Gulf sturgeon population is stable (USFWS 2009). Out of the seven riverine reproducing populations, the Suwannee River population appears to be slowly increasing and is being considered for delisting in the future. Recruitment in the Suwannee River was positively correlated with high flows in September and December, and it was suggested that higher survival of young-of-year sturgeon may be related to the increased availability of lower-salinity estuarine feeding habitats in wet years.

The lower Suwannee River is important habitat for young-of-year sturgeon. The river's water quality is threatened by nutrient enrichment (i.e., nitrates in spring discharges). The influx of nitrates from these spring discharges results in seasonal algal blooms, especially in slow velocity areas. Such blooms may potentially affect young-of-year juvenile sturgeon. These algal blooms appear to be prevalent upstream of the tide (upstream of the salt water influence). Monitoring these areas for juvenile sturgeon and nutrient levels may be a consideration (J. Ziewitz, USFWS, personal communication).

Smalltooth Sawfish. Two species of sawfish inhabit Gulf of Mexico waters, one being the largetooth sawfish *(Pristis pristis)*, which is currently a species of concern. The other, the smalltooth sawfish *(Pristis pectinata)*, was listed as endangered under the Endangered Species Act (ESA) as a Distinct Population Segment (DPS) by the National Marine Fisheries Service on April 1, 2003. A DPS is one which is either (1) markedly separated from other populations of the same taxon as a consequence of physical, physiological, ecological, or behavioral factors, or (2) delineated by international governmental boundaries within which differences in control of exploitation, management of habitat, conservation status, or regulatory mechanisms exist. The species was the first marine fish to be listed as endangered by the United States.

Sawfish are classified as elasmobranchs, along with the sharks, skates and rays. A major feature of elasmobranchs is a cartilaginous skeleton. Sawfish are most closely related to the rays, but have a shark-like body with ventral gill slits and are named for their elongated flat snouts that are laterally lined with pairs of teeth used to locate, stun, and kill prey. Sawfish feed primarily on fish and crustaceans.

The smalltooth sawfish has a circumtropical distribution, but in U.S. waters occurs only in the Atlantic Ocean and Gulf of Mexico. Smalltooth sawfish commonly grow to 18 feet (5.5 m) long and may reach 25 feet (7 m). Life history is largely unknown, but they may live as long as 25-30 years, maturing after about 10 years. The species is ovoviviparous, the eggs being held inside the body until about 15 to 20 "pups" are ready to be born. Sawfish are found in shallow coastal waters and estuaries, normally close to shore over mud and sand bottoms. They often inhabit sheltered bays, shallow banks, and river mouths.

The smalltooth sawfish was likely common throughout the Gulf of Mexico from Texas to Florida, and along the Atlantic coast from Florida to Cape Hatteras. The species currently appears to be restricted to peninsular Florida, being relatively common only in waters south of Charlotte Harbor. Smalltooth sawfish were apparently never as common on the west coast of Florida as on the Atlantic side. The species was probably always restricted to south Florida waters during the cooler months. One of the earliest published U.S. records for the species was from Cedar Key in 1883. Other specimens were documented in Tampa Bay in the 1800s, with one report noting that "hundreds" occurred on the west coast of Florida. Recent records have been limited, with only five documented from the area north of Charlotte Harbor since 1966. Two of those were from offshore Crystal River (1972 and 1983), and another in Tampa Bay (1999). There are no accurate abundance trend estimates. Available records, mostly anecdotal, indicate that the species has declined dramatically in U.S. waters during the last century, with the species' distribution having been reduced by about 90 percent and population numbers reduced perhaps by 95 percent or more.

It is believed that smalltooth sawfish have declined in abundance primarily because of bycatch in various fisheries, especially those using gill nets, to which the species is particularly susceptible due to their toothed snouts being easily entangled. Smalltooth sawfish have likely been seen as damaging to fishing gear or even dangerous, so incidentally captured sawfish were often killed by fishers even if they were not kept. Recent collections of sawfish with their “saws” removed are evidence that the incidental take of sawfish in the fisheries is still a problem. There has never been a known directed fishery for the species. Other limiting factors have probably included restricted habitat requirements and a low recruitment rate. Juveniles tend to use shallow vegetated habitats, such as mangrove wetlands, as important nursery areas. Much of these habitats have been modified or lost due to development in Florida and other southeastern states. Such habitat loss also likely contributed to the decline of the species. Other habitat factors that may have contributed to population declines include eutrophication, point and nonpoint sources of pollution, increased sedimentation and turbidity, and hydrologic modifications.

The Smalltooth Sawfish Recovery Team issued a Recovery Plan in 2009 (NMFS et al. 2009), which provides specific steps to recover the DPS, focusing on reducing fishing impacts, protecting important habitats, and educating the public. The NOAA Fisheries Service and the Smalltooth Sawfish Recovery Team have developed guidelines for fishermen on how to safely handle and release sawfish they may catch. In addition to ESA protection, the State of Florida has prohibited the "take" of sawfish. The Florida ban on the use of entanglement nets in state waters should prove to be an important conservation tool for protecting the species as well. Habitat protection and additional protection from take afforded by coastal conservation areas, such as refuges, should also be viewed as important factors in the species’ recovery.

American Alligator. About 100 alligators occur throughout the refuge. Nests are found on refuge islands during the summer months.

Eastern Indigo Snake. This large, stout-bodied, shiny black snake can be up to eight feet long. It is docile and nonpoisonous, and occurs throughout Florida. It inhabits scrub and sandhills and often winters in gopher tortoise burrows in sandy uplands while foraging in hydric habitats. It requires very large tracts of land to survive. Eastern indigo snakes are found in the upland habitats of the refuge (Complex maintenance area). Small numbers of these snakes probably use the refuge.

Sea Turtles. Three species of sea turtles may occur in the refuge: Atlantic green, Kemp’s Ridley, and Atlantic loggerhead. All three species have been found in refuge waters and in nearby waters of Crystal River, St. Martins River, and/or the intake at the Crystal River Power Plant. There is no nesting habitat for sea turtles on the refuge. The sea turtles most likely use the refuge for feeding.

State-listed Species. State-listed endangered species include the wood stork, West Indian manatee, green sea turtle, and Kemp’s Ridley sea turtle. State-listed threatened species include the Florida black bear, Eastern indigo snake, gopher tortoise, and loggerhead sea turtle. State-listed species of special concern (SSC) include the brown pelican, little blue heron, snowy egret, tricolored heron, white ibis, whooping crane, Gulf sturgeon, American alligator, and alligator snapping turtle. All of these species have been documented within Chassahowitzka NWR.

CULTURAL RESOURCES

Federal agencies are legally mandated to inventory, assess, and protect cultural resources located on those lands that the agency owns, manages, or controls. The Service’s cultural resource policy is delineated in the Service Manual sections 614 FW 1-5 and 126 FW 1-3. In the Service’s Southeast Region, the cultural resource review and compliance process is initiated by contacting the Regional

Historic Preservation Officer/Regional Archaeologist. The Regional Archaeologist will determine whether the proposed undertaking has the potential to impact upon cultural resources, identify the "area of potential effect," determine the appropriate level of scientific investigation necessary to ensure legal compliance, and initiate consultation with the pertinent State Historic Preservation Office (SHPO) and federally recognized native American tribes.

The following was written by Richard W. Estabrook, Ph.D., RPA, Public Archaeologist and Regional Director, of the Florida Public Archaeology Network, Central Regional Center, University of South Florida. Dr. Estabrook is an interagency advisor on cultural resources. The following description was adapted from Milanich (1994).

Chassahowitzka NWR is situated in coastal west-central Florida at the boundary between the Central and North Peninsula Gulf Coast cultural areas (Milanich 1994: xix). Cultural areas assist archaeologists to discuss ancient peoples that shared a similar way of making stone tools like arrowheads, dart points, and spears, clay pottery, and other objects they left behind. As the names they call themselves are lost to the ages, archaeologists refer to these groups by the names used to describe their material culture, especially the kinds of pottery or spear points they made.

Archaeological evidence shows that Florida's native peoples have been dependent on the variety of aquatic, coastal and adjacent upland resources for more than 12,000 years. Changes in sea level, with corresponding changes in water salinity and resource availability, have been one of the major factors in the use of this region by prehistoric groups. As evidenced by the Page-Ladson site located along the Aucilla River in what is now Jefferson County, Paleoindian groups hunted now-extinct Pleistocene megafauna, trapped smaller game and collected edible plants. This hunter/gatherer/fisher subsistence adaptation supported countless generations of American Indians until the arrival of the Spanish in 1513. With sea levels as much as 100 m (330 feet) lower than present, many early sites, containing the unique Paleoindian lanceolate stone spear points and other stones, now lay submerged offshore.

Succeeding human habitation including the Archaic Period (7,500 B.C-500 B.C), Woodland Period (500 B.C-A.D. 900), and the Mississippian (Safety Harbor) period (A.D. 900- European Contact) added different style stone, shell, and bone tools and eventually the use of fired clay ceramics to lives of Florida's prehistoric inhabitants, but along the coastal strand, their basic hunter/gatherer/fisher-folk lifestyle changed little over the millennia. Once sea levels stabilized near current levels around 5,000 years ago, shell middens, or the leftover remains of extensive shellfish gathering, began to accumulate in appreciable amounts along the shoreline. Archaeological evidence suggests that a variety of coastal, estuarine, and nearshore freshwater swamp habitats were being used, with specific groups focusing on the collection of certain seasonally-available resources. In addition to the larger coastal middens, small- to medium-sized habitation sites, probably the homes of individual extended families or groups of closely-related families, occur along rivers and creeks and the coastal marsh edges.

The beginnings of the Archaic Period (7,500 to 500 B.C.) saw a shift towards a more diverse environment in Florida and an increase in the kinds of habitats that were used by prehistoric groups. Exploitation of a narrow range of plants and animals was abandoned, and native peoples began to specialize, focusing their efforts on extracting resources found in specific environments. Some stayed in coastal areas while others extracted resources from the growing number and size of interior wetland, riverine, and freshwater lake systems. Still, without the use of fired-clay pottery, people during the Archaic Period used stone, wood, bone, and fiber to make the tools, clothes, and shelter they needed. Because Florida's sandy soils inhibit preservation, only the stone tools and the debris from their manufacture and use are now found in the archaeological sites dating from most of the Archaic Period.

The use of fired-clay pottery is considered the hallmark of the Woodland Period (500 B.C. to A.D. 900). Although pottery is known from sites in the Southeast as early as 2,500 B.C., well-made, sand-tempered pottery and the associated shift in cooking and food storage that it provided is better documented at sites that date after 500 B.C. With this shift also came the use of burial mounds for interring the dead, certain cultivated plants (but not yet agriculture), and the use of the bow and arrow. These innovations added to the traditional nets, weirs, snares, and traps used acquire food. Wild plants were now being supplemented with some domesticated species, especially gourds and medicinal plants; however, there was no widespread use of cultivated plants like corn, beans, or squash.

The Safety Harbor Period (A.D. 900-European Contact) is marked by a shift in settlement focused around ceremonial centers, often containing one or more flat-topped platform (temple) mounds, burial mounds, plazas, and middens. Quartz crystal, copper, steatite, mica, and other nonnative resources found at these sites suggest extensive trade networks existed throughout the eastern and central United States. The capture of large marine turtles, sharks, and various fishes available only offshore indicate the use of large, sea-going canoes. The Safety Harbor people were among the first of Florida's native peoples to have contact with the early Spanish explorers in the 16th century.

HISTORICAL PERIOD

During the age of European colonialism in 1528, the Panfilo de Narvarez expedition of 300 men travelled north to Apalachee (present day Tallahassee) from Tampa Bay several miles inland from the coast, perhaps along the sand ridge bordering the eastern edge of the Chassahowitzka swamp. Hoping to find precious metals, they encountered many hardships. Only four members survived and returned to Spanish Mexico eight years later. Much of the expedition account was recorded in 1536 or 1537 by Cabeza de Vaca, an expedition member who made it to back to Spain.

In search of gold and silver, Hernando de Soto began a four-year trek in 1539 through Florida and the present-day southeastern United States. He retraced the same route as Narvarez with 600 men.

In the 200 years after these initial explorations, (1550-1750 A.D., also known as the Leon-Fort Jefferson Period), as many as 140 Spanish mission churches were established across Florida. Begun in St. Augustine, they appeared in sequence westward. The first missions built in the Apalachee territory were established in 1633 and this continued for a 70-year period. These developed into rancheros and centers for trade, culture, and education.

Unfortunately, the Spanish introduced many diseases to the native population, which reduced their numbers dramatically. As reported by Milanich in *Florida Indians and the Invasion from Europe* (Hann 1995), John Hann estimated the Apalachee population at 50,000 in the early 1500s. By 1608, it decreased to between 30,000 and 36,000 persons. A census taken in 1638 totaled 16,000 Apalachee Indians. By 1675, only 10,000 remained.

In the early 18th century, Colonel James Moore led English colonists from the Carolinas and their northern Indian allies on slave raids into Florida, causing the abandonment of missions. Native people were enslaved and sold in the Carolinas or exported to the West Indies to work on plantations. According to Milanich (1995), 1,300 persons were taken and resettled as a buffer between the English Carolina settlements and Spanish Florida settlements. One group of Apalachee Indians fled west to Louisiana. These were the only descendants of the original Floridians to survive past the 1760s. Forty-five individuals remained in 1825.

Florida was ceded to the United States in 1821 and Andrew Jackson established a new territorial government. The Second Seminole War occurred between 1835 and 1842. During his tenure as president, Jackson displaced and killed many of the Seminoles. The Seminoles and Miccosukees were forced into a few small areas of Florida; many escaped into the Everglades. There are several known Seminole Indian sites just east of the refuge in the Cove of Withlacoochee, but no evidence of their culture on the refuge.

Evidence of several Native American campsites has been found within Chassahowitzka WMA on the same high and dry ground used as camps by 20th century hunters. To the east is Indian Bend, a Weeden Island (A.D. 300- A.D. 1300) burial mound excavated at the turn of the century by C.B. Moore. Indian Bend yielded primary and secondary burials as well as check-stamped pottery.

Although no encampments or other sites have been found, the Seminole Indians were known to have been in the area during the Second Seminole War (1835-1842). They are thought to have given the region the name Chassahowitzka, meaning "pumpkin hanging place." The pumpkin referred to was a small climbing variety that is now rare and perhaps even extinct. Originally called Benton County before the Civil War, the County of Hernando was established on February 27, 1843, named in honor of Hernando Desoto. Bayport was a primary settlement, the original county seat and an entry point to the county in the early 1850s. In the 1880s, a bill was passed to divide Hernando County into three counties, thus creating the counties of Citrus to the north and Pasco to the south.

In the early 1900s, virgin bald cypress was harvested in the swamp. Southern red cedar was logged to make pencils and cigar boxes after the marketable cypress was removed. A vast tram system was constructed for mules to haul timber from the swamp to a railroad in Homosassa. Many of the tram embankments still remain and today are used by hunters, bikers, hikers, birders, and nature photographers. In the following decades the lumber industry flourished, the citrus boom hit central Florida, the phosphate industry stabilized and limestone mining was established. The Depression of the 1930s and World War II had a severe effect on the availability of resources and further development. As the county has slowly recovered, it became a slower-paced community for those wanting to escape the more hectic life in the metropolitan Tampa Bay area. Hernando County's isolation kept its population low until the completion of Interstate 75, when it became possible to live in Hernando County and work in Tampa.

SOCIOECONOMIC ENVIRONMENT

Chassahowitzka NWR is located in Citrus and Hernando counties, Florida. The area was largely unaffected by human activities until the early 1800s. Major land uses in the area in the 1800s included agriculture, horse and cattle ranching, and timber harvesting (SWFWMD 2005). During the 1800s, citrus became the big industry in the eastern part of Citrus County. The industry prospered when the Florida Orange Canal and Transit Company built a canal from the groves at the Lake Panasoffkee railhead in Sumter County, which allowed fruit to be barged through the canal and along the Withlacoochee River. In the following decades the lumber industry flourished, the citrus boom hit central Florida, and phosphate and limestone mining was established. The big freeze in 1894-95 ended the citrus industry in the county just at the time that phosphate was discovered in the area. The worker population swelled until World War I terminated the flow of phosphate to European markets. The mines closed and the population plummeted (homosassahistory.com 2011). The Depression era of the 1930s and World War II had a severe effect on the availability of resources. Further development and the area’s population remained low until the completion of Interstate 75 coupled with massive business growth in the Tampa Bay area (Webcoast.com 2011). The area then maintained itself as an agricultural community until the mid-1960s when the retiree migration began.

DEMOGRAPHIC DATA

By 2010, Florida's population reached 18.3 million, an increase of over 2.3 million from 2000, or 14.3 percent over the 10-year period (U.S. Census Bureau 2010). Seventy-seven percent of Florida's residents live in one of Florida's 35 coastal counties (U.S. Census Bureau 2010) and Florida's population is expected to continue to grow over the next 50 years, anticipated to reach 21 million by 2015 (Zwick and Carr 2006), over 28 million by 2030 (US Census Bureau 2005-2007), and over 35 million by 2060 (Zwick and Carr 2006). With over 141,000 in Citrus County and 172,000 people in Hernando County, these counties represent the 31st and 27th largest counties in Florida, respectively and have grown from 118,000 and 130,000 from 2000, respectively (U.S. Census Bureau 2010).

Citrus County has two incorporated cities: Inverness, the county seat, and the City of Crystal River. Over 90 percent of the county's population resides outside of these incorporated areas (Bureau of Economic and Business Research 2009, *in* Withlacoochee Regional Planning Council 2009). As of April 1, 2009, the City of Crystal River's population was estimated to be 3,652 (Bureau of Economic and Business Research 2009, *in* Withlacoochee Regional Planning Council 2009). While Citrus County's population has increased over time, the city has seen fluctuating population (dropping as much as 14 percent in 10 years) from a high of 4,050 in 1990, down to 3,485 in 2000, up to 3,710 in 2005, and down to 3,652 in 2009 (Bureau of Economic and Business Research 2009 and 2005 and U.S. Department of Commerce, U.S. Census Bureau 2001, *in* Withlacoochee Regional Planning Council 2009).

Hernando County also has two incorporated cities: Brooksville and Weeki Wachee. Over 95 percent of Hernando County's population resides outside of the incorporated cities (Bureau of Economic and Business Research 2009, *in* Withlacoochee Regional Planning Council 2009). As of April 1, 2009, Brooksville's population was estimated at 7,633 (Bureau of Economic and Business Research 2009, *in* Withlacoochee Regional Planning Council 2009). Since 1970, Hernando County's population has increased eight-fold from around 19,000 to 172,778 residents (U.S. Census Bureau 2010).

Demographic data for Hernando and Citrus counties, the State of Florida, and the U.S. is shown in Table 2. Employment by industry is shown in Table 3. Land use data are shown in Figure 11.

Table 2. Demographic data comparison for Citrus and Hernando counties, the State of Florida, and the U.S. (2010).

Characteristic	Citrus County	Hernando County	State of Florida	United States
Population	141,236	172,778	18,801,310	308,745,538
Median household income	$36,979	$42,457	$47,450	$51,425
Per capita income	$18,585	$22,872	$26,503	$27,041
Percent of families below poverty level	12.1	7.6	13.2	9.9
Median age	49.5	47	39.7	36.5

Characteristic	Citrus County	Hernando County	State of Florida	United States
Percent of popula-tion over age 65	30	26.1	16.9	12.6
Unemployment rates*	13.2	13.6	10.8	9.0

Sources:
U.S. Department of Commerce, U.S. Census Bureau 2010 American Community Survey
**Bureau of Labor Statistics 2011a (U.S.), 2011b (Florida), 2011c (Citrus and Hernando Counties)*

Table 3. Employment by industry.

Average Annual Employment - 2010	Citrus County* (percent)	Hernando County** (percent)	Florida (percent)
Natural Resource and Mining	0.6	0.6	1.2
Information	1.4	0.4	1.9
Manufacturing	1.4	3.4	4.3
Other Services	2.9	3.5	3.2
Financial Activities	3.3	3.1	6.6
Professional and Business Services	10.4	7.7	14.7
Leisure and Hospitality	10.6	14.3	12.9
Construction	7.2	4.9	4.9
Government	15.4	17.7	15.0
Education and Health Services	23.9	20.5	14.8
Trade, Transportation, and Utilities	22.9	23.8	20.5

**http://edr.state.fl.us/Content/area-profiles/county/citrus.pdf*
***http://edr.state.fl.us/Content/area-profiles/county/hernando.pdf*

ECONOMY, RECREATION AND TOURISM

Not only does Florida have a high number of residents and high growth rates, it also experiences high levels of tourism. Nearly 84 million people visited Florida in 2006 (Florida Department of Transportation and University of South Florida 2008). Florida is the top travel destination in the world (Visit Florida 2008). An estimated 84.5 million people visited Florida in 2007, up from 72.8 million in 2000 (Visit Florida 2008). Tourism spending increased over the same period to $65.5 billion from $50.9 billion, providing state sales tax revenue of over $3.9 billion and employing over 990,000 people in 2007. Florida's economy relies heavily on tourism; shipping is also important. Nearly 40 percent of all U.S. exports to Latin America and South America move through Florida.

The Florida State Park System uses the Money Generation Model (MGM) (Stynes 2011) to assess the economic impact of state parks on Florida's economy. Homosassa Springs Wildlife State Park, one of the highest profit makers in the Florida State Park System, is near the refuge. The park is the most popular attraction of Citrus County with an annual visitation of 329,535. The total direct economic impact in the local area from visitors equals $17.3 million per year, which generates 346 jobs. The refuge complex has a partnership with the park, which allows refuge exhibits and displays to be housed there and made accessible to park visitors.

While no economic valuation studies of tourism-related activities have been done for either county, a Tourism Development Council (TDC) Visitor Satisfaction Survey and a Valuation Destination Survey were conducted in Citrus County in 2008 and 2009, respectively. The results of the 2008 Citrus County Visitor Satisfaction Survey show that among all the recreation outdoor activities, water-related activities (boating, canoeing, kayaking) were enjoyed the most by 50 percent of the responders (224 out of 435 total responses). This fact is important considering that access to Chassahowitzka NWR is by boat only, and that refuge waters comprise 10 percent of the total coastal waters of Citrus County. The Vacation Destination Survey executive summary states that 31 percent of the 690 people surveyed chose boating and canoeing/kayaking as a preferred activity in Citrus County. Following fishing, these are the top recreational activities the refuge offers.

REFUGE ADMINISTRATION AND MANAGEMENT

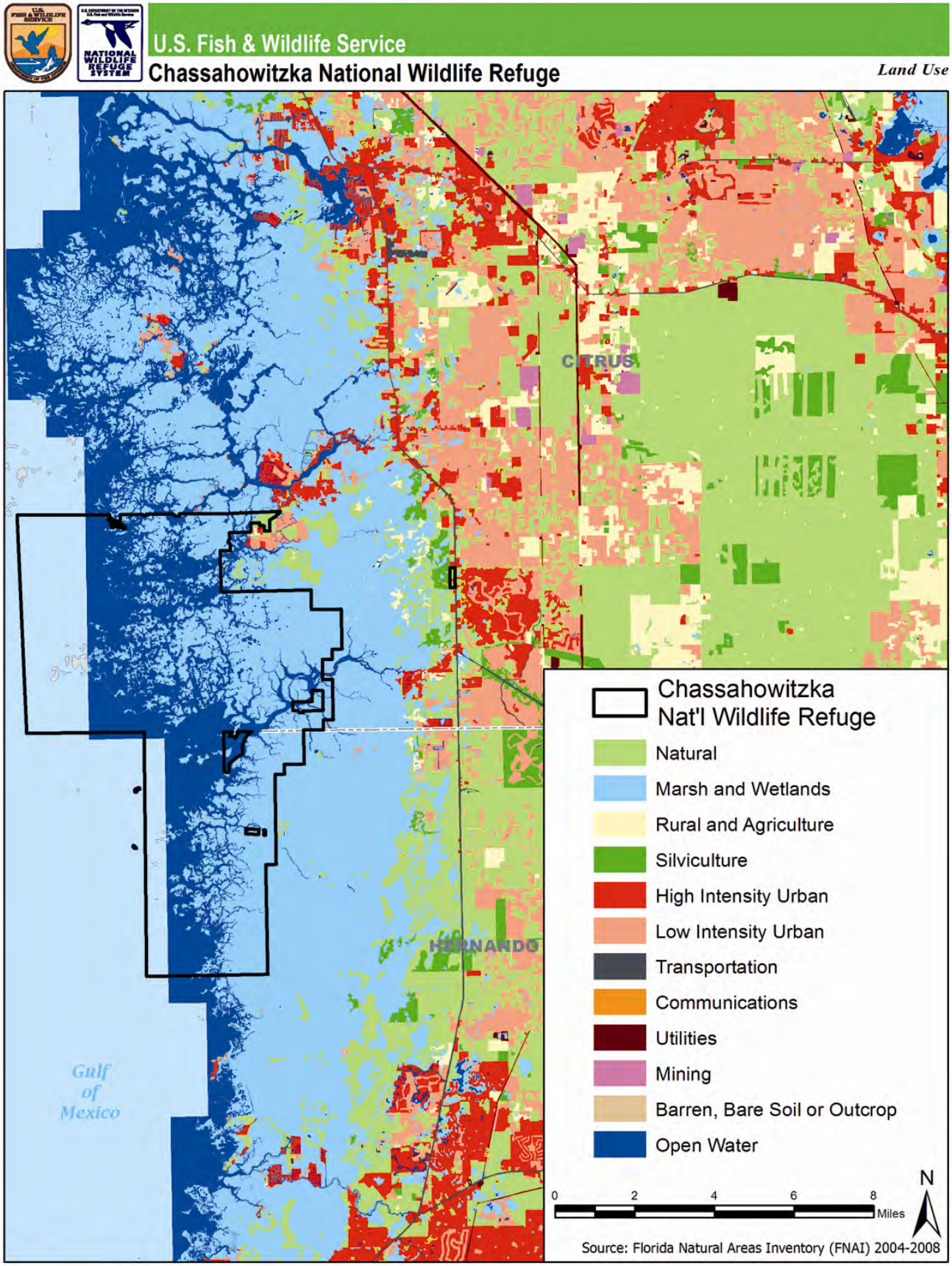
LAND PROTECTION AND CONSERVATION

Management policies of the refuge complex are designed to conserve, restore and enhance in their natural ecosystems all imperiled animals and to manage for endemic habitats and species. Creating and maintaining habitat for the whooping crane is a high priority and high visibility activity. The primary tools for habitat management include salt marsh manipulation, prescribed fire management, and invasive plant control. Land acquisition is another tool used to set aside habitat for wildlife in perpetuity, through the purchase of land in fee title from willing sellers.

Salt Marsh Manipulation

Since the refuge was established for wintering waterfowl and other migratory birds, management activities were directed at increasing the waterfowl populations. Various forms of marsh management, including burning, spraying, mowing, mechanical crushing, pothole blasting, plant transplanting, and impoundment development were employed at the refuge between 1955 and 1976. In spite of these actions, and with the exception of a peak of 18,700 in 1977, the waterfowl population decreased from 25,250 ducks in 1970 to 3,482 ducks in 1984. A peak coot population of 35,000 occurred in 1969, while none were recorded for several years (1959, 1960, 1984, 1985, 1989-1992,

Figure 11. Land use.



and 1997). There has been a steady decline in coots since 1976 when 18,000 were recorded. Approximately 250 coots were recorded in 1986, with the next 20 years having less than 100 birds each year. Current waterfowl numbers may peak at 1,500 during the winter. According to records, mowing of salt marsh vegetation was tried only in 1955 when 125 acres were mowed. The results are unknown.

Herbicide spraying for salt marsh improvement was conducted in 1956 (119 acres), 1957 (163 acres), 1958 (20 acres), and 1961 (19 acres) by both ground and aerial applications. The objective was to convert needlerush to desirable marsh vegetation through herbicide application for increased waterfowl use. In 1968, in cooperation with the Department of Agriculture, 30 acres of test plots in stands of Eurasian water milfoil were aerially sprayed in conjunction with efforts to eradicate this new invader, which was competing with other desired waterfowl food plants.

In 1964, 10 potholes were blasted in the refuge's salt marshes, and sago pondweed, wigeon grass, and *Chara* were transplanted in them through 1965. This project was accomplished with the objective of increasing available waterfowl habitat in vast stands of salt marsh that was not preferred by the waterfowl.

Between 1965 and 1968, three refuge impoundments were developed between Long Island, Seven Cabbage Cutoff, Pumpkin Creek, and Gator Creek. The objective was to improve waterfowl and wading bird habitat in the endless acres of unfavorable salt marsh. About 6,000 feet of dikes were constructed to develop the three impoundments totaling 120 acres. The impoundments were to be flooded by tidal action from a freshwater creek, but this method became undependable. In 1968, a pump was installed to effectively flood the impoundments, but Hurricane Gladys damaged the impoundment dikes that same year. Waterfowl use was good, but sporadic, between 1968 and 1970. However, by 1970, problems with leaking and deteriorating dikes and undependable water supplies were evident. In 1973, the maintenance of these dikes and impoundments was discontinued due to economics. Dike development for the impoundments may have blocked the natural movement of water over a sizable portion of the refuge's estuary and that may have adversely impacted vegetation, shellfish, and waterfowl use.

Management within these impoundments included discing, mechanical crushing, burning, and transplanting desired plants. Discing was accomplished on 36 acres of brackish marsh in 1967 for the purpose of eradicating needlerush and encouraging production of salt marsh bulrush. Favorable results were received. In 1968, eight acres in Pool A dominated by needlerush was crushed by a wide pad crawler tractor with 90 percent kill received. Nine hundred salt marsh bulrush plants were collected from refuge marsh lands and transplanted into Pool A to supplement natural succession and to hasten the production of these preferred waterfowl foods, with fair survival received. Also, burning was conducted with good results in 1969 and 1970, on 75 and 30 acres, respectively.

Winter cattle grazing was permitted on a maximum of 2,680 acres of refuge marshlands and woodlands from the time the refuge was established until 1982, when all grazing ceased. Although grazing and associated burning generally supported the maintenance of marshlands for increased waterfowl and wading bird use, the grazing of the marshlands was terminated because it could not be separated from the intermingled woodlands where adverse effects were occurring.

Fire Management

Starting in 1955 and ending in 1976, prescribed burning was used as a management tool to encourage the replacement of needlerush and sawgrass with preferred waterfowl foods (salt marsh bulrush, spikerush, etc.) During that period, 6 to 300 acres of salt marshes were burned each year, except during 1971, 1974, and 1976, with the added objective of improving grazing conditions. Attempts were made to burn on a two-year cycle, but the lack of optimum burning conditions prevented meeting this schedule.

From 1976-1988, all types of marsh management were discontinued. Prescribed burning was reinstituted in 1989 after an evaluation of past practices concluded that prescribed burning of refuge salt marsh offered benefits to wildlife other than waterfowl. Although past marsh management experiments had revealed limited benefits to waterfowl, there is evidence of more extensive seasonal use of salt marshes by wading birds following burns.

Currently, prescribed burning is to provide seasonal openings for migratory birds in salt marshes, which otherwise would remain dense and monotypic as to prevent use by the wildlife resource, to encourage growth of preferred emergent plant species diversity and vitality, and to increase the availability of plant and animal foods for migratory birds within the salt marsh. Prescribed burning of the 35-acre maintenance area is conducted every few years to reduce hazardous fuel loading in a highly developed area and to enhance habitat for wildlife diversity, particularly for the gopher tortoise and Eastern indigo snake. The last burn conducted on the refuge was in 2010.

Standard suppression actions are used on all refuge fires. Some marsh fires may be allowed to burn to natural barriers, which would limit suppression activities. Lightning strikes and ignitions by man cause one or two wildfires annually. These wildfires are generally less than 100 acres in size and burn themselves out in a relatively short period of time. A wildfire in 1989 burned 1,760 acres along Mason Creek and was thought to have been intentionally set.

Since 2000, prescribed fire activities on Chassahowitzka NWR have been conducted mainly for the whooping crane reintroduction project. Prior to the arrival of the whooping cranes in the fall, the refuge attempts to burn several hundred acres or uses the marsh master to mechanically reduce the height of the vegetation. Whooping cranes prefer to graze in vegetation shorter than the height of their belly. These activities have been conducted by the refuge staff, with assistance from the staff of other national wildlife refuges.

Invasive Plant Control

The refuge has both aquatic and upland invasive plants. Invasive aquatic plant species, including hydrilla (*Hydrilla)* and Eurasian water milfoil (*Myriophyllum*), outcompete native plants, but do provide some forage for endangered manatees.

Upland invasive species include Brazilian pepper (*Shinus terebinthifolius*) and cogon grass (*Imperata cylindrica*). Brazilian pepper is invading the refuge's tree islands, turning these islands into solid stands of pepper. Over the past 10 years, less than five acres of pepper have been treated by refuge staff on these islands under a contract through grants from the FDEP. Not all refuge islands have been checked for pepper. It is estimated that there are approximately 100 acres of pepper on the refuge. The refuge biologist has worked with landowners that have pepper on inholdings within the refuge to have them remove their seed source for pepper coming onto the refuge. These landowners have applied for grants through the counties to control their invasive plants.

Cogon grass was found on a small patch on a refuge levee that separates the refuge from the state-managed Chassahowitzka WMA which was treated by the FWC. More cogon grass has been found on the Chassahowitzka maintenance facility and treated by Service staff. These areas need to be monitored for reinfestation. Skunk vine (*Paederia foetita*) is also found in the upland portions of the refuge. These areas need to be mapped and treated.

Land Acquisition

Funding for land acquisition within the approved acquisition boundary of Chassahowitzka NWR would come from the Land and Water Conservation Fund; the Migratory Bird Conservation Fund; U.S. Army Corps of Engineers' mitigation programs; or donations from conservation and private organizations. Conservation easements and leases can be used to obtain the minimum interests necessary to satisfy refuge objectives if the refuge staff can adequately manage uses of the areas for the benefit of wildlife. The Service can negotiate management agreements with local, state and federal agencies, and accept conservation easements. Some tracts within the refuge acquisition boundary may be owned by other public or private conservation organizations. The Service would work with interested organizations to identify additional areas needing protection and provide technical assistance if needed. It is the Service's policy that acquisition of private lands is entirely contingent on the landowners and their willingness to participate.

VISITOR SERVICES

The National Survey of Fishing, Hunting, and Wildlife-associated Recreation has been conducted about every five years since 1955. It provides information on the number of participants in fishing, hunting, and wildlife watching (observing, photographing, and feeding wildlife), and the amount of time and money spent on these activities.

The 2006 survey found that over 87.5 million U.S. residents 16 or older fished, hunted, or watched wildlife that year—a one percent increase from 2001. Nearly 34 million people fished, 13 million hunted, and 66 million participated in at least one type of wildlife-watching activity. Wildlife recreation totaled $108 billion in 2001 and amounted to 1.1 percent of the gross domestic product. Wildlife watchers spent $38 billion on trips, equipment, and other items in 2001.

Public Access

The refuge's visitor contact station is located at the Crystal River National Wildlife Refuges Complex Headquarters in Crystal River, Florida (see http://www.fws.gov/chassahowitzka/). The refuge is accessible primarily by water from different entry points, such as public and private boat ramps, and from private docks, none of which are owned or maintained by the Service. There are two primary upland areas accessible by land. The first is the Salt Marsh Trail, which is part of Crystal River NWR but administered under the complex of refuges because it is nearer to Chassahowitzka NWR. The maintenance area of Chassahowitzka NWR located on U.S. Highway 19 also has trails. The refuge areas that are open to public access are free of charge and open seven days a week. Hours are from sunrise to sunset. Figure 12 shows the locations of the refuge's existing public use facilities.

Due to the uncontrolled points of water access to the refuge, it is difficult to get accurate counts of use by visitors. About 30,000 to 35,000 persons are estimated to visit the refuge annually. The refuge staff believes that annual visitation has vastly increased in the past 10 years. Gross estimates of visitor use during quarterly bird surveys conducted by the refuge staff corroborate that visitor numbers are currently higher than 35,000. A public use survey is needed to obtain more accurate estimates.

"Big Six" Priority Public Uses

The National Wildlife Refuge System Improvement Act of 1997 established six priority wildlife-dependent public uses on national wildlife refuges if they are compatible with the purposes of each refuge. Known commonly within the Service as the "Big Six," these priority uses are hunting, fishing,

photography, wildlife observation, environmental education, and interpretation. The refuge provides opportunities for all six wildlife-dependent activities. A description of these uses follows.

Hunting. Historically, waterfowl hunting was a popular recreational use in the refuge and it is allowed in both the Citrus and Hernando county portions of the refuge. But with the decline in waterfowl, few hunters use the refuge. In 2009, only one hunter made contact with the refuge headquarters prior to hunting in the refuge. Small- and big-game hunting is also allowed in the Hernando County portion of the refuge in accordance with state regulations for the Chassahowitzka Wildlife Management Area; however, the majority of the area consists of salt marsh and not many game animals are found there.

Fishing. Ninety percent of visitors using the refuge come to fish. While the refuge offers a variety of waters for fishing opportunities including the Gulf of Mexico, rivers, creeks, and backwater streams, saltwater fishing is the most popular activity. Saltwater fishing is pursued in areas that are mainly accessed by boaters. Fishing is also available from the dock at Dog Island and its floating ramp.

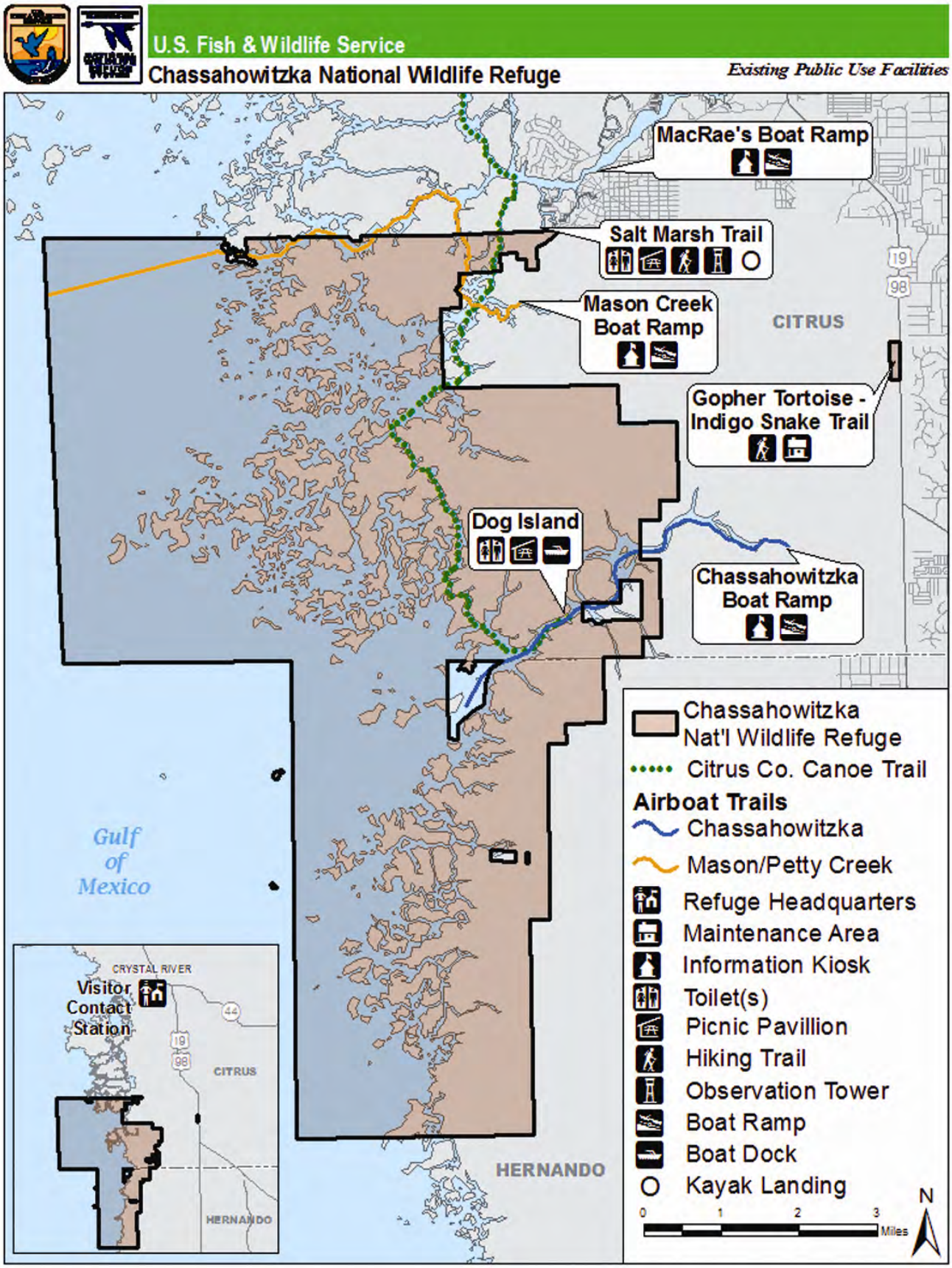
Wildlife Observation and Photography. The refuge currently has a facility at Dog Island that provides opportunities for wildlife observation and photography. It includes a large dock, a sheltered picnic area with picnic tables, and a compost toilet.

Environmental Education. The Service initiated curriculum-based environmental education (EE) programs tied to national or state education standards in 2012 at the Salt Marsh Trail site. This site is a Crystal River NWR property developed by the Friends of Crystal River NWR Complex, Inc. (Friends group) under the funding of the Lastinger Foundation. This site is adjacent to Chassahowitzka NWR. Facilities include trails, an observation tower, a pavilion, and kiosks. The facilities are located at the edge of the hardwoods and salt marsh that face Chassahowitzka NWR, providing an enticing opportunity to offer EE programs in this fundamental ecosystem within the refuge complex.

Homosassa Elementary School is located within two and a half miles of the Salt Marsh Trail site. The Friends group sought a grant from the Nature of Learning organization. With the refuge staff, they developed and coordinated four curriculum-based EE lessons for 4th and 5th graders. There are 12 instructors working on this project, including retired teachers, Student Conservation Association (SCA) interns, and staff. A few annual summer camp and school programs occur offsite.

Interpretive Programs. A substantial amount of the Service's interpretive materials are available to the public both onsite and offsite. Interpretive kiosks, interactive exhibits, and wildlife displays have been established at the visitor contact station (Crystal River Complex headquarters), the local Ellie Schiller Homosassa Springs Wildlife State Park's Manatee Education Center, and two boat ramps that provide access to the refuge. Refuge brochures and tear sheets are made available on www.fws.gov/chassahowitzka, and are also available at the headquarters, the Crystal River library, the Nature Coast Chamber of Commerce, hotels, dive shops, and other local businesses. Volunteers provide year-round person-to-person interpretation at the visitor contact station and at annual festivals around the region. A new visitor services contact station is planned to be constructed at Three Sisters Springs; it will become the primary contact station for the complex.

Figure 12. Existing public use facilities, Chassahowitzka NWR.



PERSONNEL, OPERATIONS, AND MAINTENANCE

Five refuges are administered by the Crystal River National Wildlife Refuge Complex: Crystal River NWR, Chassahowitzka NWR, and three refuges known collectively as the Tampa Bay Refuges, the Egmont Key, Pinellas, and Passage Key NWRs. The complex currently has 10 staff positions, most of which are based at the complex headquarters in Crystal River. The permanent personnel include a project leader, a deputy project leader, two federal wildlife officers, an assistant manager (for the Tampa Bay Refuges based in St. Petersburg), an office administrator/assistant, a wildlife biologist, a park ranger (Visitor Services), a maintenance mechanic, and a small craft operator. The refuge complex also relies extensively on staff specialists from other Florida refuges and the Service's Southeast Regional Office for program accomplishments, including endangered species recovery; fire management; land acquisition; information technology; and contracting. Temporary, term, and student/intern positions are also used.

In fiscal year 2010, the refuge complex (including Crystal River, Chassahowitzka, and the three Tampa Bay refuges) was allocated a budget of $1,302,015 for payroll, utilities, operational and maintenance needs, and special funding to address the maintenance project backlogs and research partnerships.

The refuge complex headquarters contains a visitor contact station, personnel offices, a dock, a floating dock, and two boathouses. A 35-acre maintenance area serves as the center for vehicle and equipment maintenance and storage; it contains pads and facilities for recreational vehicle (RV) camper volunteers and a mobile home for temporary researchers or field crews.

III. Plan Development

PUBLIC INVOLVEMENT AND THE PLANNING PROCESS

This Draft Comprehensive Conservation Plan and Environmental Assessment (Draft CCP/EA) for Chassahowitzka NWR was prepared in compliance with the requirements of the National Environmental Policy Act of 1969 (NEPA). This law requires the Service to include public involvement in its comprehensive planning efforts. Letters were sent to the Florida Fish and Wildlife Conservation Commission (FWC), the Florida Department of Environmental Protection (FDEP), and five Native American Indian tribes on January 15, 2009, inviting them to participate in the refuge's comprehensive planning process. The FWC appointed Chad Allison as a liaison to the Service for this effort. Mr. Allison is currently a District Biologist with the FWS, and was formerly the area manager for the Chassahowitzka Wildlife Management Area, a state conservation property that adjoins the eastern boundary of the refuge. Melissa Charbonneau, Manager of the Big Bend and St. Martin's Marsh Aquatic Preserves, also participated in the planning process as a representative from the FDEP's Coastal Aquatic Managed Areas program. St. Martin's Marsh Aquatic Preserve is adjacent to the refuge's northern boundary.

To obtain expert opinions, the Service used several review teams to assess the refuge's programs. One team conducted a review of the refuge's wildlife and habitat management programs in 2005. A second team reviewed the refuge's visitor services program and the third conducted a wilderness review, both in 2009. In addition, an Interagency Partners Coordination Team met on July 14, 2009, to identify the issues to be addressed in the CCP. Seven government agencies were represented on this team. Many of these same partners met on October 15, 2009, to discuss the refuge's wilderness resources. A list of experts from the Service and partnering agencies that participated in these reviews and meetings is provided in Chapter V, Consultation and Coordination, in the accompanying Environmental Assessment (Section B). The information garnered from these reviews helped the Service's planning team identify the key issues and concerns that needed to be addressed in the refuge's long-term comprehensive conservation plan (CCP).

In preparation for the CCP, public scoping was conducted. A public notice announcing the Service's intent to prepare a CCP for the refuge was published in the *Federal Register* on March 18, 2009. An advertised public comment period for public scoping was held from October 1 through 31, 2009. Notices informing the public of the CCP scoping process and inviting them to attend a scheduled public scoping meeting were published in local newspapers. Flyers announcing the same were also displayed at several locations within the refuge, including all boat ramps.

The public scoping meeting was conducted on October 1, 2009, at the Homosassa Civic Club in Homosassa, Florida. The meeting introduced the comprehensive planning process to the public and allowed attendees to voice their perspectives and comments on the issues, concerns, and opportunities they felt should be addressed in the CCP for Chassahowitzka NWR. Of the 13 citizens who signed in as attendees, five made verbal comments. The following organizations were represented: Friends of the Crystal River National Wildlife Refuge Complex, Citrus County Airboat Alliance, the United Waterfowlers of Florida, Inc., Homosassa River Alliance, and the Defenders of Wildlife. In addition to the verbal comments, three comment sheets and one letter were received during the public scoping period. The comments from this public scoping are summarized in Appendix D.

In 2009, a CCP planning team of Service staff and FWC and FDEP representatives started meeting regularly to develop the CCP for the refuge. The team considered all public and interagency comments. The team prioritized the issues that most needed to be addressed by the refuge over the

15-year life of the CCP, based on the comments and recommendations of the advisory teams and the comments obtained through public scoping. The planning process, however, was suspended for a year between July 2010 and August 2011 due to the Deepwater Horizon oil spill, which diverted staff to that undertaking. The deadline for completion of the CCP was therefore extended to 2012.

PRIORITY RESOURCE ISSUES

The CCP planning team identified a total of 12 priority resource issues related to fish and wildlife population management, habitat management, resource protection, visitor services, and refuge administration. All public and advisory team comments were considered; however, some issues that may be important to the public are beyond the scope of the Service's authority and cannot be addressed within this planning process. The team did consider all issues that were raised throughout the planning process, and has developed a plan that attempts to balance competing opinions regarding important issues. The team identified those issues that, in its best professional judgment, are most significant to the refuge. The 12 priority issues are summarized below.

FISH AND WILDLIFE POPULATION MANAGEMENT

1. Whooping Crane Recovery Project

The whooping crane recovery project is an important, high profile Service program. The refuge's pen facility for whooping cranes is a relatively successful site for the overwintering of first-year whooping cranes; 53 percent of the reintroduced birds have survived through 2011. In 2005, the biological advisory team recommended moving the facility off the refuge because second-year whooping cranes were not using the refuge habitat. However, that fact has changed with older whooping cranes now returning to the refuge to feed. Prescribed burning for whooping cranes also helps open the dense needlerush for wading birds and other secretive marsh birds to feed. The Service needs funding to support this refuge project.

2. Manatees

Data on manatee use of Chassahowitzka NWR is scant. A summer population of manatees is estimated to be around 20 animals, with high numbers approaching 50. With an increasing human/boater population, there is a need to fund the collection of boater use and manatee abundance and distribution data to determine whether (when and/or where) boating speed zones should be in place on the refuge to protect manatees. These types of data would also help the Service's state partners, the FDEP and the SWFWMD, protect this important trust resource. The FDEP sets boating speed zones, and the SWFWMD sets minimum flows and levels (MFLs) for the Chassahowitzka Spring and River.

3. Migratory Birds

The principal conservation and management considerations for migratory birds include providing sufficient sanctuary and foraging resources for wintering waterfowl; preventing disturbance to waterbird breeding colonies; optimizing habitat suitability for secretive marshbirds; and addressing priority information gaps through research, inventory, and monitoring. In recent years, wading bird nesting has declined and islands that were active for years are no longer supporting rookeries. Colonies appear to have shifted from historic locations to other islands, but overall numbers still appear to have declined. There is a need to determine which factors (disturbance, habitat quality, predators, prey fluctuations) have caused this trend. Disturbance of nesting

wading birds can result in reduced productivity due to increased predation, stress-related chick mortality, or nest abandonment. Ensuring that watercraft and other uses of the refuge do not constitute a disturbance threat is the primary management issue for shorebirds and waterbirds.

HABITAT MANAGEMENT

4. Water Resources – Water Quality and Quantity

Maintenance of fresh water quality and quantity serves a critical role in the ecological integrity of refuge resources. The SWFWMD is currently working on the MFLs for the Chassahowitzka and Homosassa rivers. If the results of the MFL process are inadequate, close coordination with the SWFWMD and the counties should continue to ensure that consumptive use permits do not threaten refuge resources. The refuge staff should be involved in the process to ensure that an accurate quantification of freshwater flows and levels has been completed for the refuge, and that ecological impacts due to decreased or altered flows are understood.

Nitrogen levels in the Chassahowitzka River have increased from background levels of 0.1-1 milligrams/liter (mg/l) to over 500 mg/l. Because of the residence time of waters in the Floridan aquifer, even if nutrients are on the decline, the refuge should expect to see a continuing upward trend of nutrient levels. An order-of-magnitude increase in chlorophyll levels has also been documented, which relates to decreased water clarity and is correlated with a loss of seagrass. The increase in chlorophyll is more closely correlated with phosphorus levels, which, though they remain an order of magnitude lower than nitrogen levels, nonetheless, have increased markedly in the last several decades (T. Frazer, unpublished data).

5. Invasive Plant Control

Chassahowitzka NWR contains both aquatic and upland invasive plants. Invasive aquatic plant species, including hydrilla (*Hydrilla)* and Eurasian watermilfoil (*Myriophyllum spicatum*), outcompete native plants. They do provide food for endangered Florida manatees. Brazilian pepper (*Schinus terebinthifolius*) has invaded upland refuge sites, including tree islands and disturbed areas such as the levee surrounding the Pumpkin Creek impoundment. Brazilian pepper has been treated by refuge staff and contractors, but not on a regular basis to keep the spread of the plant in check. The extent of the pepper, as well as additional exotic species, is unknown. Cogon grass (*Imperata cylindrica*) has been treated by the FWC on the levee (Main Grade) separating Chassahowitzka NWR from the FWC's Chassahowitzka Wildlife Management Area.

6. Invasive Animals and Integrated Pest Management Control

Feral hogs are the major mammalian invasive species on the refuge and are found in all upland and marsh habitats. The hogs cause extensive habitat damage. They cause direct mortality via predation and provide competition for food. No current estimates exist for the hog population on the refuge, although observations of hogs in the marsh are not uncommon. Feral hog hunting is one tool being used to keep the population in check in adjacent state lands. The State of Florida permits feral hog hunting on lands adjacent to Chassahowitzka NWR, including the Homosassa Tract of Withlacoochee State Forest and Chassahowitzka Wildlife Management Area. Hunting and alternative means of control on the refuge need to be evaluated.

RESOURCE PROTECTION

7. Climate Change

Meteorological and climatological events, such as hurricanes and sea level rise, also pose challenges for refuge management. Low-lying islands and freshwater estuaries will face substantial impacts from global climate change, particularly rising sea level and coastal storms. Such effects have already been experienced in the past; however, these events may become more frequent and severe within the 15-year time period covered by this CCP, based on recent projections by the Intergovernmental Panel on Climate Change.

Salt water intrusion into the subsurface freshwater lens from sea level rise and saltwater inundation of surface freshwaters from storm surges can alter the uplands and freshwater marshes, resulting in more salt-tolerant plant communities and the loss of freshwater-tolerant plant species. Storm events can cause considerable physical damage to native vegetation in the vulnerable coastal habitats.

8. Resource Protection

In addition to its biological assets, among the refuge's most valuable resources are its wilderness designation and its historic, archaeological, and cultural sites. Over three-quarters of the refuge is designated as a wilderness area. To protect cultural resources, the unique characteristics of wilderness, and the opportunities that wilderness areas afford for solitude and nature-dependent recreation, adequate education of the visiting public and a law enforcement presence are needed.

VISITOR SERVICES

9. Commercial Operations

The commercial uses of the refuge (i.e., crabbing, other fishing, commercial tours, and guiding) should be evaluated to determine how much use occurs and if there are conflicts with the wilderness values. Those operations may need to be under special use permits in wilderness areas.

10. Accessibility

Access to the majority of the refuge is by water from boat launches not owned or controlled by the Service. The primary public uses are fishing and recreational boating. The visitor services review team recommended that public use not be expanded, but that information for the uses of the refuge by the public could be improved.

REFUGE ADMINISTRATION

11. Administrative Resources

Adequate staffing, funding, and facilities are needed to fulfill the refuge's mission and purposes, and to implement the vision for the next 15 years as detailed through the goals, objectives, and strategies within this plan. Law enforcement staffing and funding is crucial to prevent and investigate illegal activities and to promote compliance of existing laws, including boating regulations. In addition, law enforcement presence is needed to ensure visitor and employee safety and to protect the refuge's wildlife, cultural, and wilderness resources.

12. Partnerships

Refuge management is increasingly dependent on partnerships and the use of volunteers to carry out essential refuge functions. Establishing partnerships with the community, universities, other government agencies, and nongovernmental organizations is critical for assessing and monitoring resources and for evaluating habitat and wildlife management techniques over time. Maintaining and training a steady, active volunteer corps is also important. Partnerships are vital for addressing the long-range external threats to the refuge, as well as carrying out daily refuge operations--conducting visitor/interpretive services, wildlife surveys, and assisting with law enforcement.

WILDERNESS REVIEW

The Service's planning policy requires a wilderness review as part of the comprehensive conservation planning process for all refuges. The purpose of the wilderness review is to identify and recommend for congressional designation any Refuge System lands and waters that merit inclusion in the National Wilderness Preservation System. The Service inventoried the current nonwilderness portions of Chassahowitzka NWR and found that none meet the eligibility criteria for a wilderness study area, as defined by the Wilderness Act. Therefore, the suitability of additional refuge lands for wilderness designation is not further analyzed in the CCP. The results of the wilderness review are provided in Appendix H.

IV. Management Direction

INTRODUCTION

The Service manages fish and wildlife habitats considering the needs of all resources in decision-making. But first and foremost, fish and wildlife conservation assumes priority in refuge management. A requirement of the National Wildlife Refuge System Improvement Act of 1997 is for the Service to maintain the ecological health, diversity, and integrity of refuges. Public uses are allowed if they are appropriate and compatible with wildlife and habitat conservation and the purposes for which the refuge was established. The Service has identified six priority wildlife-dependent public uses. These uses are hunting, fishing, wildlife observation, wildlife photography, and environmental education and interpretation.

Described below is the proposed comprehensive conservation plan for managing the refuge over the next 15 years. This proposed management direction contains the goals, objectives, and strategies that will be used to achieve the refuge vision.

VISION

Chassahowitzka NWR is predominantly unspoiled, estuarine habitat adjoining an expanse of public conservation lands along Florida's west coast that serve as important breeding and feeding grounds for aquatic life. A variety of aquatic habitats including marshlands, swamplands, tidal streams, and shallow bays filled with submerged aquatic vegetation provide a rich and diverse marine environment, which supports an abundance of wildlife. Refuge coastal and upland habitats provide a haven for rare, threatened and endangered species. Accessible mostly by boat, much of the refuge is designated as wilderness, affording unique opportunities for research, primitive and wildlife-oriented recreation, and solitude. Considering these unique refuge attributes, the refuge's vision statement is as follows:

With our conservation partners, we will protect, restore, and enhance habitats within the refuge and we will protect the character of the wilderness for present and future generations.

GOALS, OBJECTIVES, AND STRATEGIES

REFUGE GOALS

Goal 1. Fish and Wildlife Population Management

Protect, restore, and enhance a natural diversity and abundance of native fish and wildlife populations.

Goal 2. Habitat Management

Protect, restore, and enhance a natural diversity and abundance of habitats for native plants and animals.

Goal 3. Resource Protection

Protect archaeological, cultural and historic resources for future generations as examples of human interaction with the natural environment. Protect and preserve the wilderness character of those refuge lands designated by Congress as part of the National Wilderness Preservation System.

Goal 4. Visitor Services

Promote an awareness, understanding, and appreciation of natural resources and the refuge through enhanced education and interpretive programs.

Goal 5. Refuge Administration

Obtain and provide sufficient resources, staffing, partnerships, and administrative support needed to meet the refuge's goals and objectives for managing and protecting wildlife and other resources.

SUMMARY

This proposed management plan assumes a moderate growth of refuge resources over the 15-year implementation period of the CCP. It provides for a proactive, adaptive, ecosystem-management approach for the protection of wildlife populations by preserving a natural diversity and abundance of habitats for native plants and animals. Research and long-term monitoring would be initiated to expand the collection of baseline data and to measure variables of ecosystem health. Cooperative studies to monitor and model the immediate and/or long-term effects of catastrophic events (e.g., hurricanes, wildfire, oil spills) and global climate change, particularly sea level rise, would be established.

Current ongoing and proposed efforts focus on threatened, endangered, and state-listed species of plants and animals. The need for comprehensive inventorying and long-term monitoring is addressed in this plan, particularly for priority imperiled species and their habitats within the refuge. Research would be initiated to identify causal reasons for the marked, long-term decline in the wintering waterfowl population, species for which the refuge was established, and to evaluate the potential impacts of sea level rise on the ecology of wading birds.

Habitat enhancement for critically imperiled species, such as the whooping crane, would aid in ensuring the long-term sustainability of the experimental population. Because a primary purpose of the refuge is to provide sanctuary for nesting and migratory birds, greater protection from human disturbance would be provided, particularly at colonial nesting bird rookeries. Additional limitations to public use may be implemented in sensitive areas important for shorebirds. Funds are requested to purchase inholdings within the refuge's approved acquisition area from willing sellers to permanently set aside lands for wildlife management. These would be considered as wilderness study areas within two years of acquisition.

Invasive plant control would continue as an ongoing operation within the refuge to maintain native habitats and prevent new infestations. Existing partnerships would be reinforced to increase coordinated mapping and monitoring of treated areas with known infestations and ongoing control needs. Management of nonnative predators would be implemented for the benefit of threatened and endangered species. An early detection and rapid-response program would be implemented in cooperation with county, state, and federal authorities to address the increasing invasion by and potential establishment of exotic snakes, lizards and other nonnative animals, such as hogs.

A primary focus of the visitor services program, as proposed, is to enhance environmental education and outreach efforts substantially to reach larger numbers of residents, students, educators, and visitors. This plan also focuses on increasing public awareness, understanding, and support for refuge conservation and wilderness stewardship. It places priority on wildlife-dependent uses, such as fishing and wildlife observation. The details of these allowable uses are specified in appropriate use and compatibility determinations (Appendices E and F). Nonwildlife-dependent forms of

recreation would be limited or restricted in sensitive areas. Awareness efforts would be enhanced to inform visitors about protecting wilderness areas. A Visitor Services step-down plan will specify program details consistent with the Service's Southeast Regional visitor service program standards.

The basic administrative and operational needs of the refuge have been addressed. Essential new staffing is proposed through the addition and funding of eight permanent, full-time employees to be added to the refuge complex. This would help correct the long-term understaffing of the refuge complex and to address the anticipated workload and responsibilities expected for the complex. Daily operation of the refuge would be guided by the CCP and the development and implementation of 14 projects and 8 step-down management plans. Cultural resource protection objectives and strategies would be incorporated within the appropriate step-down management plans. The modest growth in administrative resources would be used for wildlife monitoring and habitat enhancement to better serve the refuge's purposes and vision. The existing number of facilities would be maintained and a new headquarters office would be built. Energy efficiency standards will be applied wherever feasible during facility maintenance, repair or renovation projects. Existing vehicles will be replaced with alternative fuel vehicles to increase fuel efficiency and reduce carbon emissions.

The goals, objectives, and strategies presented are the Service's responses to the issues, concerns, and needs expressed by the planning team, the refuge staff and partners, and the public and are presented in hierarchical format. Chapter V, Plan Implementation, identifies the projects associated with the various strategies.

These goals, objectives, and strategies reflect the Service's commitment to achieve the mandates of the National Wildlife Refuge System Improvement Act of 1997, the mission of the National Wildlife Refuge System, and the purposes and vision of Chassahowitzka NWR. Assuming adequate resources are provided through Congressional budget and grant funding, the Service aims to accomplish these goals, objectives, and strategies within the next 15 years.

FISH AND WILDLIFE POPULATION MANAGEMENT

Goal 1. Protect, restore, and enhance a natural diversity and abundance of native fish and wildlife populations.

Discussion: Management would prioritize the protection and enhancement of state and federally listed species and the ecosystems upon which they depend. For a discussion of these species, see Chapter 2, Refuge Environments, biological resources. By protecting and preserving diverse communities and minimizing human impacts to the extent possible, the outlook for many of these species can improve. Some species may require direct intervention to increase their populations and improve their long-term viability. Refuge staff work in partnership with the Service's Ecological Services Field Office, FWC and a wide array of collaborators to implement ongoing and evolving land management and recovery actions found in various Recovery plans and other related documents. Section 7(a) (1) of the ESA charges federal agencies including refuges to aid in the conservation of listed species. Section 7(a)(2) requires federal agencies to consult with the Service to ensure that actions they fund, authorize, permit or otherwise carry-out, will not jeopardize the continued existence of any listed species or adversely modify designated critical habitats. The Service and this plan strive to promote the State's conservation goal to keep common species common.

Objective 1.1. Imperiled Species – Implement measures to ensure the viability of all imperiled species and their habitats.

Discussion: Protecting rare, threatened and endangered species and the habitat they need to survive and flourish is an important aim of the National Wildlife Refuge System generally. The establishing purposes of Chassahowitzka NWR include management of migratory birds, a number of which are listed species, and protection of the refuge's wilderness character, which includes preserving the original assemblage of those species native to the area, as well as protecting biodiversity and plant and animal communities and populations. During the scoping for this CCP, the Whooping Crane Recovery Project, manatees, and migratory birds were all cited as issues.

Strategies:

- By 2019, develop a step-down Wildlife Inventorying and Monitoring Plan to standardize data collection and to address inventory, long-term monitoring, and research needs for priority species.
- To control predator species, for example bobcats on whooping cranes, that are adversely affecting threatened and endangered species, incorporate and implement integrated pest management strategies within the step-down Habitat Management Plan.
- Maintain sufficient law enforcement presence in collaboration with the Service's Office of Law Enforcement to prevent illegal take and disturbance of federally listed and trust species.
- Work with partners to conduct a vulnerability assessment to model the potential effects of climate change, especially sea level rise and storm events, on imperiled species and their habitats.
- Develop management strategies to enhance species adaptability and habitat resiliency to climate change, as feasible. Be a host site for research.

Objective 1.2. Florida Manatee – Assist in the protection and recovery of the Florida manatee by implementing provisions of the Florida Manatee Recovery Plan. These provisions include minimizing the causes of manatee disturbance, harassment, injury and mortality.

Discussion: The West Indian manatee is listed by the Service and the State of Florida as an endangered species (FWC 2009a). The greatest threats to manatee survival are collisions with boats and loss of warmwater habitat. Other threats to manatees include declines in water quality, habitat loss or decline in habitat quality, loss of natural springs and spring flows due to human development and demand for water, flood gates and canal locks, monofilament fishing line and other discarded trash, red tide blooms, and harassment. From January 12-15, 2010, 5,077 manatees were counted in Florida, representing an all-time high count (2,297 were counted on the west coast) (FWC 2010). Although population numbers for the Southwest subpopulation are currently higher than previous surveys, over the long term the trend is anticipated to slowly decline. On January 24, 2011, a total of 4,840 manatees were counted with 2,402 observed along the west coast.

Other than the Southwest subpopulation, which seems to be declining, manatees are currently increasing or stable throughout Florida. Citrus County is part of the Northwest subpopulation (but is located very close to the Southwest subpopulation, the northern boundary of which is about 36 miles south of the City of Crystal River). The Northwest subpopulation represents about 11 percent of the state's manatee population (the Southwest subpopulation is 41 percent). As reported by Runge et al. (*in* USFWS 2007b), the population growth rate for the Northwest subpopulation is four percent. The leading cause of manatee mortality in the Northwest subpopulation is watercraft collision. In 2008, eight of the 22 manatee deaths in Citrus County were attributed to watercraft, which was the leading cause of death for manatees in Citrus County (FWC 2009b). In 2009, manatee deaths in Citrus County were down to six, two of which were attributed to watercraft (FWC 2010d and 2009c). In 2010, two of the 14 deaths were attributed to watercraft. In 2011, by mid-October, two of the nine

deaths were attributed to watercraft. Key habitat related concerns for the Northwest subpopulation include: spring flow rates, water quality and submerged aquatic vegetation, storm related impacts on habitat and adult survival, aquatic plant control activities, papilloma virus, and human disturbance at warm water springs. (Adapted from the West Indian manatee five-year review [USFWS 2007b].)

Strategies:

- Coordinate or assist partners (e.g., FWC) as needed on all marine mammal stranding events within the refuge/complex. Continue participation in area manatee rescue team.
- Maintain and enforce the slow speed manatee protection zone on the Chassahowitzka River.
- Report problems with signs to the FWC's Office of Waterways and Boating Safety.
- Continue manatee abundance and distribution aerial surveys and add summer surveys.
- Maintain a database of manatee locations and provide current and historical data to resource managers and researchers.
- Conduct a boating activity study.
- Coordinate with the USGS Sirenia Project and FWC to initiate a tracking survey to ascertain the summer habitat of manatees. Use data from the study to ascertain when and/or where boating speed zones may need to be added, making recommendations to FWC as needed.
- Within three years of CCP approval, if data warrant, make a recommendation to FWC on the efficacy of manatee protection speed zones.
- Continue to work with partners in support of research activities.
- Use volunteers to install and maintain collection containers at main entry points to refuge (boat ramps, marinas, rental concessions, etc.) to promote the recycling of monofilament and to reduce the incidence of entanglement in line and fishing gear.

Objective 1.3. Saltmarsh Vole – Coordinate with partners to survey for the presence of this species on the refuge.

Discussion: The Florida saltmarsh vole (*Microtus pennsylvanicus dukecampbelli*) is a federally endangered subspecies of vole that as of the early 2000s was found at only a single site in a transitional high saltmarsh zone. It appears to be restricted to areas near stands of black needlerush, in patches of seashore saltgrass, and appears to avoid areas dominated by smooth cordgrass. Like most species in the genus *Microtus* (the voles), it probably feeds primarily on green plant materials, especially grasses. As of 2001, the saltmarsh vole was documented at just one site at Waccasassa Bay in Levy County, Florida, to the north of Citrus County where Chassahowitzka NWR is located. Here it appeared to exist in low numbers and has a very restricted range. The Service had concluded that any natural or human-caused adverse impact to this species could result in its extinction (USFWS 1997; USFWS 2001a). Subsequently, the saltmarsh vole was discovered at a second site north of Cedar Key in the Lower Suwannee National Wildlife Refuge, five miles from the original location (USFWS 2008).

The saltmarsh vole is thought to represent a relict population of the meadow vole (*Microtus pennsylvanicus*), which was more common and widespread in Florida during the Pleistocene Epoch. The range of this subspecies in Florida is believed to have been greatly reduced as climatic change resulted in vegetational changes from grassland to forest in Florida. The current highly restricted population is threatened by storm surges from hurricanes and tropical storms, the loss of coastal marshes due to flooding from rising sea level, and potentially by any human-caused alterations that might be proposed for these salt marshes (USFWS 2001a). The Five-Year Review and Evaluation in 2008 recommended mapping potential saltmarsh vole habitat at Chassahowitzka NWR and other public lands in the area, and then conducting presence/absence surveys on the potential habitat identified.

Strategies:

- Coordinate and collaborate with the University of Florida and the Service's Jacksonville Ecological Services Office to map potential saltmarsh vole habitat at Chassahowitzka NWR using existing aerial imagery or geographic information system (GIS) habitat maps.
- Due to the observed habitat preference of the vole where it has already been documented, the search for suitable habitat should concentrate first on those intermittent patches of saltgrass (*Distichlis spicata*) in the vicinity of extensive black needlerush stands. Areas of cordgrass should be avoided.
- Conduct live-trapping surveys using approved and proven techniques and protocols.
- If saltmarsh voles are discovered during the surveys, consider conducting life history studies to improve upon the limited knowledge on this subspecies. As noted in its recovery plan, information on population dynamics, habitat use, reproduction, and diseases is necessary to help determine recovery criteria. Conducting a radio telemetry study would be useful to management and recovery.
- If saltmarsh voles are not found during the surveys, consider using appropriate sites on the refuge for reintroduction of this species.

Objective 1.4. Black Bear (*Ursus americanus floridanus*) – Continue to have a volunteer staff the black bear sighting hotline and provide information to FWC and SWFWMD. This will aid in monitoring the isolated Chassahowitzka black bear population. Under a special use permit (SUP), facilitate any partnerships for research, survey or monitoring for bears.

Discussion: The Florida black bear is the largest native land mammal in the state. Shy and secretive, it hides in dense vegetation and is rarely seen in the wild. It has shiny, long, black fur and a light brown nose and snout and some have white patterns on their chests. Omnivorous like all bears, it consumes both plants and animals, include acorns, insects, berries, saw palmetto and sabal palm fruits, armadillos and honey. Mature female black bears may weigh 150-300 pounds and male bears 250-450 pounds. Most Florida black bears are between 5 to 6 feet long and are about 3 feet high at the shoulder (SWFWMD no date).

Biologists suspect that at one time there were as many as 12,000 black bears living throughout Florida. Today only an estimated 2,000-3,000 remain (FWC 2009), confined to a much smaller area overall; black bears now roam freely in just eight locations in Florida (FWC 2010). The Chassahowitzka area is thought to hold about 25 bears. Biologists attribute the decline in Florida's black bear population primarily to the destruction and development of bear habitats, combined with historic hunting pressure. In addition, many black bears are struck and killed by cars and trucks. Indeed, automobiles are now the leading cause of Florida's black bear mortality (SWFWMD no date). The black bear is considered an umbrella species with broad ecological requirements. Protecting a variety of habitats in areas large enough to sustain bear populations helps to benefit many other species of wildlife as well.

Strategies:

- Collaborate with stakeholders and partners, such as the Friends group and FWC, to increase support for maintaining the bear hotline, research, surveys, and monitoring.
- Consistent with the FWC's Bear Management Plan, work with FWC to form and support a Black Bear Assistance Group for the Chassahowitzka area, which will provide local input to the FWC to help set objectives and resolve conflicts.

- Aim to conserve adequate amount of functional bear habitat to support the Chassahowitzka bear population and promote connectivity between this isolated population and those to the north and east.
- Facilitate and educate for "Bear Smart Communities," where residents, local government, businesses and schools all take part in reducing the number of bear conflicts.
- Contribute to outreach efforts to inform the public about bears and what they can do to avoid bear conflicts.
- Employ other appropriate strategies and actions from the FWC's draft black bear management plan: http://share2.myfwc.com/BearMP/Shared%20Documents/Separated%20chapters%20of%20Management%20Plan/Chapt%205%20-Actions-%20Bear%20Management%20Plan%20Draft%205.1.pdf

Objective 1.5. White-tailed Deer – Continue to partner with the FWC on its collection of deer data (from hunts) and herd health checks on the adjacent Chassahowitzka WMA.

Discussion: A very small population of white-tailed deer inhabits the 2,560 acres of hardwood swamplands and 250 acres of upland forest in a fringe along the refuge's eastern boundary. Dominant plant species in the hardwood swamps are red maple, red bay, sweet bay, and cabbage palm. Upland forest composition is live oak, scrub oak, longleaf pine, slash pine, wax myrtle, and saw palmetto. Very little is known about the refuge's deer herd due to its relative inaccessibility. The area occupied by the herd can be reached only by boat or by one public road that crosses private property and then crosses two areas of state lands before entering refuge property.

Strategies:

- Collaborate closely with FWC by offering to provide staffing resources where possible in operating check stations on the refuge and adjacent WMA.
- As appropriate, review siting and timing of check stations with FWC to ensure complete coverage during hunting season.
- Obtain results of the FWC's ongoing health checks on deer (such as brain stems for chronic wasting disease) in a timely manner.
- Seek partners in FWC and universities to conduct a general baseline, abundance and distribution survey of white-tailed deer on the refuge.

Objective 1.6. Whooping Crane – Continue to support the Whooping Crane Eastern Partnership's (WCEP) reintroduction project efforts to maximize overwinter survival of first-year birds for the experimental population.

Discussion: The whooping crane is the tallest bird in North America and was once at the brink of extinction, its population reduced to a mere 16 individuals in 1941 (CWS and USFWS 2007). It is now making a slow but steady recovery, thanks to intensive management efforts undertaken both in Canada and the United States (Cornell Lab of Ornithology 2011). At present, some 400-500 whooping cranes exist in the wild and in captivity.

As noted in Chapter II, Chassahowitzka NWR was selected for the whooping crane's reintroduction in Florida due to the similarity of habitat and food resources (such as the blue crab) with Aransas NWR on the Texas Gulf Coast, where wild cranes have always wintered. Whooping cranes have been reintroduced into Chassahowitzka NWR for a decade. Many of these cranes now visit the Chassahowitzka salt marsh upon their return to Florida after the fall migration, but then they migrate

inland for the winter to areas containing freshwater marshes. Here they frequent smaller highland or flatwoods marshes adjacent to dry prairies and pastures grazed by cattle. The cranes forage in these upland cattle or horse pastures during the day, especially where ditches or ponds are nearby.

Strategies:

- Continue partnership with WCEP by providing and maintaining winter release pen site and facilities.
- Manipulate wet prairie, shallow water wetlands, and impoundment habitats (e.g., using prescribed fire and mechanical disturbance via marsh master) to provide winter foraging habitat for whooping cranes.
- Use nuisance predator control as needed.
- Seek partnerships to increase research for determining the use of wintering habitats on the refuge.
- Develop a step-down habitat management plan to identify and improve crane habitat on managed lands to assist in the recovery of whooping cranes. This plan should include guidelines to minimize human disturbance.

Objective 1.7. Migratory Birds – Minimize disturbance of sensitive nesting areas, particularly colonial bird rookeries, nesting colonies, and wintering areas for waterfowl, wading, marsh and shorebirds.

Discussion: Chassahowitzka NWR refuge was established on behalf of migratory birds and this remains a key purpose today. The refuge provides a variety of habitats that serve hundreds of migratory bird species, including estuarine emergent marsh (for secretive marshbirds and "marsh" sparrows), forested wetlands (for priority neotropical migrant landbirds), mangrove islands (for breeding colonial waterbirds), and submerged and emergent aquatic vegetation (for wintering waterfowl). The refuge aims to provide sufficient foraging resources for wintering waterfowl, prevent disturbance to waterbird breeding colonies, optimize habitat suitability for secretive marshbirds, and address priority information gaps through research, inventory and monitoring.

Until the relationships between waterfowl numbers, water quality, and food resource availability can be better explained, appropriate management responses will be difficult to develop and will remain speculative. The advisory biological review team concluded that gross waterfowl use of the refuge should continue to be monitored. Data regarding habitats and areas on the refuge of importance to waterfowl, and annual and diurnal patterns of use of these habitats, should be collected. Ideally, data should also be sought or collected that enables exploration of the relationships mentioned above between hydrologic factors, food availability, and waterfowl numbers.

Given the vast expanses of homogeneous *Juncus* and *Spartina* marsh, the biological review team felt it would not be harmful to attempt small burns to see if habitat could be enhanced by promoting vegetative diversity for marshbird use. The results of these management attempts should be closely assessed. Prescribed fire and mechanical methods (e.g., mowing, roller chopping, and marsh master) can be used to set back succession and encourage structural heterogeneity, but fire is the preferred method whenever possible. *Spartina* marsh is more susceptible to burning, while *Juncus* marsh has a narrow window of conditions within which to conduct burn operations. Thus, mechanical means may be more appropriate (or more practical) for opening dense patches of black needlerush, particularly where treatment areas are relatively small (less than 20 hectares). Otherwise, conducting a few, small (100-acre) prescribed burns each year should be used to enhance desired structure (and possibly composition) of the plant community. To best promote marshbird response to such

management, these burns would be best if conducted in "transition" areas along marsh-upland edges or where fresh and saline habitats intermingle.

As with wading birds, the Southeastern U.S. Waterbird Conservation Plan outlines recommendations for priority marshbirds and sets regional population objectives for these species. Additionally, a national marshbird conservation plan is currently under development and may provide some guidance useful at the refuge level in the near future.

The extensive *Juncus/Spartina* marshes within the refuge clearly provide suitable habitat (both breeding and nonbreeding) for key species of marshbirds, but little is known about the relative abundance or population size of these species on the refuge, or whether some even occur with sufficient frequency to be of management concern. This represents an obvious need to implement survey protocols to begin understanding distribution and habitat use on the refuge and to also establish a baseline for indexing abundance. Clapper rails occur in high densities in *Juncus* marsh and are possibly quite abundant on the refuge. Other marshbird species (black rail, king rail) would be expected, but are less common.

The biological review team concluded that the refuge can meaningfully contribute to the conservation objectives for whooping cranes, black rail, yellow rail and others, but at this time it would be difficult to quantify refuge-level population objectives. They suggest implementing management actions which have high likelihood for advancing marshbird conservation, while also initiating surveys and other data collection efforts to provide a stronger basis for future management decisions.

The biological review team concluded that the main management issue for shorebird and waterbird species is to ensure that watercraft and other uses of the refuge do not constitute a disturbance threat. Water quality and contaminants that impact upon the forage- fish base can have cascading effects on waterbird foraging on the refuge. Spent fishing gear (such as discarded fishing line) can pose an entanglement threat to loons, grebes, gulls, terns and other species that may be attracted or otherwise come into contact with this material.

Mechanical or pyric (i.e., fire) disturbance in areas of marsh exposed during low tide can help promote the open foraging conditions required by shorebirds. The biological review team recommended providing three to five 40-acre areas where open mudflat foraging conditions are promoted during March-early May and again from late July-September, and collecting data on shorebird responses (numbers, species, periods of use, etc) to evaluate this potential tool as a means to promote shorebird conservation.

The greatest management concern regarding shorebirds on the refuge is disturbance to foraging and roosting birds, especially during fall and spring migration. Studies have shown that repeated disturbance by passing watercraft and even relatively "low impact" activities like fishing, walking, and birdwatching can negatively affects the birds' abilities to accumulate and store fat reserves essential for timely migration and successful breeding. Thus, areas that are regularly used by shorebirds should be protected from excessive disturbance, particularly during spring and fall, when even a two-week period of uninterrupted foraging can benefit the life cycle of some of these species.

Strategies:

- Continue to conduct monthly bird surveys.
- Prior to colonial waterbird nesting season, inspect islands for nuisance predators and implement measures to remove any that become established.

- Contribute colonial waterbird survey data to regional database in order to monitor trends in numbers of nesting pairs.
- As part of an annual bird survey (overflight), count wading bird colonies and/or coordinate with FWC's annual surveys.
- Participate in a regional alliance for colonial waterbirds.
- Through a nationwide literature search, investigate causes for the decline in wintering waterfowl on the refuge (e.g., cause-and-effect relationships between water quality, food resources, disturbance, etc. and waterfowl use).
- Maintain the 3-day per week waterfowl hunting restriction for lands in Citrus and Hernando counties.
- Continue to coordinate (through a memorandum of understanding [MOU]) with the FWC on the establishment of hunting and other public use regulations that can affect waterfowl.
- Develop appropriate policies on airboat use.
- Manage migratory birds for any direct threats from disturbance. For example, maintain and enhance signage to ensure adequate public notification, increase voluntary compliance of refuge regulations, identify areas to be closed, and increase law enforcement patrols.
- Use public service announcements in available media outlets and/or establish a dispatch line to notify refuge law enforcement to encourage prompt public reporting of instances of human trespass or disturbance.
- Enhance structural heterogeneity within extensive marsh habitats through periodic disturbance. Continue yearly prescribed burning of marsh on 3 to 5 year intervals to open dense needlerush for the benefit of shorebirds, wading birds and marshbirds.
- Initiate black rail research to determine presence, population, and species needs.
- As islands deteriorate from storms and/or sea level rise, determine impacts to colonial nesting and roosting birds, imperiled bird species, and determine the protective measures needed.
- Participate in interagency working teams to help promote recovery of state-listed species.
- Use all media and staff contact opportunities to educate anglers and commercial fisherman of the threats of spent fishing and shellfishing gear. Include this information in any commercial use permit.
- Provide three to five 40-acre areas where open mudflat foraging conditions are promoted during March-early May and again from late July-September, and collect data on shorebird responses (numbers, species, periods of use, etc) to evaluate this potential tool as a means to promote shorebird conservation.

Objective 1.8. Bald Eagle – Monitor the nesting population and limit disturbances.

Discussion: Although it was delisted in 2007, the bald eagle is still protected under the Bald and Golden Eagle Protection Act, has threatened status on the state's listing, and therefore receives special attention. Chassahowitzka NWR supports a small nesting population of bald eagles and provides important habitat for this species in the peninsular Florida region, as well as locally. Some 12 nests are found within one mile of the refuge boundary. This refuge area population is part of the Western Gulf Coast eagle nest cluster, one of 16 identified clusters in the state. The biological review team stated that opportunistic observation can help track bald eagles and swallow-tailed kites' use of the refuge, so that if nesting occurs, appropriate protections (e.g., disturbance-free zones) might be considered.

Strategies:

- Continue to conduct monthly bird surveys.
- Conduct raptor survey annually.
- Continue to monitor bald eagle productivity annually throughout the refuge complex.

- Examine islands for bald eagle nesting activity according to the refuge's bald eagle inventory protocol.
- Prevent trespass on islands or areas where nests may be found (none currently).

Objective 1.9. Other Priority Land Birds – Implement a monitoring program for other priority land birds.

Discussion: Riverine hardwood swamps, coastal hammocks, and mangrove islands are the most important habitats for landbirds on the refuge. Upland habitat (a mix of slash and longleaf pine and hardwoods like red maple and red bay) occurs in small amounts along the eastern boundary of the refuge. Altogether, habitats suitable for land birds total about 3000 acres on the refuge.

Other priority breeding and wintering landbirds for BCR 31 likely to occur at Chassahowitzka NWR include the Florida prairie warbler, prothonotary warbler, yellow-billed cuckoo, short-tailed hawk, and swallow-tailed kite. The refuge is located at the periphery of the range of many of these species and its capacity to contribute to their conservation is primarily limited to protection of existing habitats (as opposed to habitat restoration or enhancement).

Many other priority landbirds are likely found as transients in the Chassahowitzka area because they use the refuge as they make their way to and from northern breeding grounds and more southerly wintering areas, mostly in the Caribbean. Examples include the Cape May warbler and black-throated blue warbler. Because they use the refuge opportunistically and in unknown numbers, it is difficult to devise management options for their needs. However, retention or promotion of soft mast-producing trees and shrubs, such as wax myrtle, gums, and cherries, is typically recommended. These species are adaptable and make use of a variety of substrates and food resources in addition to soft mast.

The biological review team concluded that only a few alternatives exist for modestly enhancing habitats for landbirds (e.g., nest site protection and managing possible disturbance). The team proposed that the Service continue to maintain the extent and integrity of refuge uplands, coastal hammocks, riverine hardbottoms and mangrove habitats. Another recommendation was to either conduct standardized point counts or area searches in appropriate habitats in order to document the presence/absence or relative frequency of occurrence of priority landbirds, such as the Florida prairie warbler and short-tailed hawks. By conducting counts or searches in mangrove habitats, refuge staff could identify whether black-whiskered vireos occur with any regularity.

Strategies:

- Continue to conduct monthly bird surveys.
- Work with partners to initiate mist netting research through Monitoring Avian Productivity and Survivorship (MAPS) stations.
- Continue to work with partners to inventory and monitor land birds in representative cover types to determine the composition, productivity, and trends in populations throughout the refuge.
- Within three years of plan adoption, work with the Peninsular Florida Landscape Conservation Cooperative, Atlantic Coast Joint Venture, FWC, and Southeast Regional Migratory Bird Program to develop population and/or habitat objectives that more explicitly link the refuge's contributions to landscape scale objectives for land birds.
- Establish point counts or other appropriate survey methods for breeding land birds and migratory birds on the refuge complex where feasible. Use point-count data to highlight areas of special concern for birds.

- Implement a volunteer program to report bird observations on refuge lands and develop a geographic information system to document bird sightings.
- Continue to support regional efforts to inventory and monitor mangrove birds in Florida.

Objective 1.10. Sea Turtles – Maintain a viable population of green and loggerhead sea turtles in support of the recovery plan efforts for these species.

Discussion: The Atlantic green and Atlantic loggerhead sea turtles have both been found in refuge waters and in Crystal River, St. Martins River, and/or the intake at the Crystal River Power Plant. Sea turtles most likely use the refuge to forage on seagrasses and submerged aquatic vegetation. The refuge does not contain any nesting habitat (sandy beaches) for sea turtles.

The federally endangered and threatened (depending on the population) green sea turtle (*Chelonia mydas*) grows to a maximum length of about four feet and a weight of 440 pounds. Adults feed almost exclusively on seagrasses and marine algae (USFWS 2011a). Green turtles usually frequent fairly shallow waters (except when migrating) inside reefs, bays, and inlets. They are attracted to lagoons and shoals with abundant marine grasses and algae. The Florida green turtle nesting aggregation is recognized as a regionally significant colony and is listed as endangered (USFWS 2011b).

The loggerhead sea turtle (*Caretta caretta*) was listed as threatened in 1978. It can reach seven feet in length and approximately 300 lbs. when fully grown. Nine distinct population segments (DPSs) have been identified globally; loggerhead turtles occurring on the refuge are part of the Northwest Atlantic Ocean DPS. Most the nesting of this DPS is concentrated along the coasts of the United States from southern Virginia through Alabama. Loggerhead turtles are very wide-ranging. As post-hatchlings, they migrate offshore and become associated with *Sargassum* habitats, driftlines, and other convergence zones. Oceanic juveniles use the North Atlantic gyre and enter Northeast Atlantic waters, ranging as far away as the Mediterranean Sea. Along the Atlantic and Gulf of Mexico shoreline, essentially all continental shelf waters are inhabited by loggerheads. The loggerhead sea turtle is omnivorous, feeding mainly on bottom-dwelling invertebrates (Conant et al. 2009).

Strategies:

- Cooperate on an as-needed basis with the FWC on any sea turtle stranding events and releases within the refuge.
- Ensure good water quality and protect seagrasses to provide adequate food sources for sea turtles.

Objective 1.11. Other Reptiles and Amphibians – Protect endemic species.

Discussion: A suite of reptiles and amphibians use the refuge, but baseline surveys to determine the population status of endemic reptiles and amphibians on the refuge is needed. The state-listed gopher tortoise uses the pinelands adjacent to the maintenance shop where the refuge has historically implemented prescribed burns to maintain gopher tortoise habitat. The federally listed indigo snake also uses habitats similar to those found on the refuge, but there are no sightings at present. Populations of reptiles and amphibians are threatened by predation from feral animals and this interaction may pose immediate and long-term negative consequences to species; however, documented incidents of feral animal predation on the refuge is lacking. The refuge would work with partners to initiate baseline surveys, conduct prescribed fires, and determine if predation by feral species is impacting reptile and amphibian populations, among other management strategies, on the refuge.

Strategies:

- Seek partnership to initiate baseline survey to determine the local population status of endemic reptiles and amphibians.
- Develop appropriate management strategies to ensure their viability. For example, maintain healthy grassy/herbaceous cover in pine sandhills for gopher tortoises.
- Conduct prescribed fires on upland portions of refuge maintenance area to reduce fuel loads and to benefit gopher tortoise and the over 300 commensal species using tortoise burrows, most notably, indigo snakes.
- Conduct post-burn gopher tortoise burrow counts and comprehensive surveys of commensal species on upland portions of the maintenance area.
- Protect gopher tortoise burrows during logging, nonemergency fire line plowing, or other heavy equipment use.
- Determine if human activity and domestic or feral animal predation is impacting reptile and amphibian populations including gopher tortoise, and take actions as needed.
- Determine population size and distribution of eastern indigo snakes by examining gopher tortoise burrows, area searches, or other techniques.
- Implement mitigation measures to protect reptiles from direct impacts from prescribed burning and other habitat management strategies.
- Cooperate on an as-needed basis with the FWC on any nuisance alligator issues within the refuge.
- Prevent alligator poaching on the refuge through increased public education and law enforcement.
- Work with partners to complete research on diamondback terrapins, box turtles, and pigmy rattlesnakes within the wetland habitats.
- Work with partners to complete research on gopher tortoise population trend at the maintenance facility.

Objective 1.12. Invertebrates – Protect and manage for native species.

Discussion: Invertebrates—animals without backbones—encompass an enormously diverse range of taxa, including 97 percent of all described animal species on earth. They inhabit both marine and terrestrial habitats at Chassahowitzka NWR and elsewhere. Invertebrates are comprised of several large phyla, including Porifera (sponges), Cnidaria (sea anemones, corals, jellyfish), Echinodermata (starfishes, sea urchins, sea cucumbers), Nematoda (roundworms), Platyhelminthes (flatworms), Arthropoda (insects, arachnids, centipedes, millipedes, crustaceans), Mollusca (bivalves, univalves, cephalopods), and Annelida (segmented worms).

The invertebrates represent a crucial food source for many marine and terrestrial vertebrates. Some, such as insects in particular, also perform important ecological services, such as pollination and decomposition, as well as being vectors of disease and sources of physical discomfort for humans and wildlife.

Strategies:

- A proposed mosquito management compatibility determination was developed to balance the conservation of native insect species, particularly Lepidopteron (butterflies), on refuge lands with public nuisance and health concerns from mosquito populations (see Appendix F).
- Perform refuge-wide baseline surveys of insects, particularly pollinators, to determine their distribution, abundance, and demographics within the refuge.

- Seek partnerships with the FWC and the Fish and Wildlife Research Institute's (FWRI) Cedar Key Laboratory to determine the status, trends and impacts of commercial fishing on blue crabs within the refuge.

Objective 1.13. Fish – Conserve fresh and saltwater fish assemblages in the refuge.

Discussion: A wide variety of marine, brackish, and freshwater fish species inhabit the refuge. They have been poorly documented and studied to date. Because the refuge has substantial amounts of estuarine habitat, which most species of marine fish use as nursery and rearing grounds, it is important for commercially harvestable and recreational fish species. Several listed species may occur on the refuge: the Gulf sturgeon, largetooth sawfish, and smalltooth sawfish.

Strategies:

- Support research by other agencies or universities on the distribution and abundance of planktonic invertebrates, crustaceans, macroinvertebrates, and fish within the refuge.
- Evaluate the potential threats posed by nonnative fish species on native fish populations and develop an appropriate management response.
- Educate the public about the negative effects of releasing aquarium fish in natural areas.
- If studies are initiated by partners (e.g., FWS-ES, NMFS) that reveal the presence of the Gulf sturgeon within or near refuge boundaries, work with partners to develop population objectives for Gulf sturgeon on the refuge.
- Work in partnership with the Regional NOAA Fisheries Office (St. Petersburg, Florida) and FWC to document the presence of smalltooth sawfish on the refuge and to educate the public to report observations and to release them if they are inadvertently caught, according to the guidelines of the Smalltooth Sawfish Recovery Plan.

HABITAT MANAGEMENT

Goal 2. Protect, restore, and enhance a natural diversity and abundance of habitats for native plants and animals.

Discussion: Because the refuge has limited resources and remote areas without easy access, the major focus is to preserve existing resources with minimal management. This plan is designed to protect and encourage natural foods and foraging habitat in accordance with refuge population and habitat objectives for native species. Habitat manipulation will be undertaken on a scale necessary to meet management goals, but will not likely be as extensive as those on some other refuges. For example, prescribed fire will make food resources and ideal habitat available for a whole suite of species throughout the refuge, many of which are imperiled (e.g., whooping cranes). Some restoration may be done by planting native plants where invasive plants are treated and removed. A new initiative for Florida wildlife refuges will be to actively participate in the Peninsular Florida Landscape Conservation Cooperative efforts.

Objective 2.1. Biological Diversity and Ecosystem Resiliency – Implement habitat management actions that foster biological diversity and ecosystem resiliency while perpetuating viable populations of endangered, threatened and candidate plant and animal species.

Discussion: Chassahowitzka NWR's diverse ecosystems, including estuarine habitat, are home for an incredible variety and abundance of both flora and fauna. The marshlands, swamplands, shallow bays and tidal streams provide both the quantity and quality of aquatic plant and animal life required

to support thousands of migrating waterbirds, marshbirds, shorebirds, fishes, and a variety of other animal species that depend on a marine environment.

Strategies:

- Develop and implement a step-down Habitat Management Plan that will guide habitat management on the refuge, using a structured decision-making process to ensure the integration of strategic landscape conservation and adaptive management principles.
- Update and implement the step-down Fire Management Plan to incorporate new scientific information, altered habitat conditions and climate change, and to address wilderness and cultural resource protection measures.
- Apply the Service's Strategic Habitat Conservation approach—i.e., set objectives, design and implement management actions, conduct monitoring and adaptive management, and support research.
- Integrate inventory, monitoring, and research activities to guide management actions.
- Monitor and maintain an annual database of invasive plants and treatment sites on the refuge.
- Target early detection invasive species for eradication. Remove incipient populations of invasive plants (e.g. cogon grass).
- Eradicate or control infestations of nonindigenous, invasive plants as categorized by the Florida Exotic Pest Plant Council on all refuge-owned and managed lands.
- Develop a step-down Integrated Pest Management strategy in partnership with the South Florida Invasive Species Strike Team and include integrated pest management within the Habitat Management Plan.
- Continue participation in the Withlacoochee Invasive Plants Working Group to share treatment strategies and to leverage funding for invasive plant removal and native plant restoration.
- Continue to participate in the Nature Coast Cooperative Invasive Species Management Area (NCCISMA).
- Continue to work with adjacent landowners and partners (FWC) to eradicate invasive plants on adjacent private lands and to prevent their spread to public lands.
- Replant native species when practical after removing invasive plants in order to restore native plant communities.
- Remove feral hogs opportunistically. Study the effect of hogs on refuge lands and evaluate the effectiveness of the State's hunting programs to reduce hog numbers.
- Maintain current relationships and encourage new partnerships with nationally recognized organizations, universities and colleges, and other agencies to provide valuable scientific data that will enhance the protection and restoration of native species and habitats.
- Work with partners in developing models to predict the effects of sea level rise and coastal storms on refuge habitats and species, including changes to submerged aquatic plants

Objective 2.2. Water Quality and Quantity – Work with partners to protect water quality and ensure adequate water quantity for estuarine resources.

Discussion: The Chassahowitzka River is one of the last, relatively undeveloped, spring-fed tidal rivers on the Gulf Coast. Refuge waters are classified as "Outstanding Florida Waters" (OFW). The FDEP cannot issue permits for direct pollutant discharges to OFWs which would compromise the existing water quality or for indirect discharges which would significantly degrade the OFW.

The refuge's water quality is threatened by upstream developmental pressures outside the refuge boundaries. The increased flow of stormwater runoff, septic tank and domestic wastewater plant leachates, and nutrients found in the springs are all causing problems. Elevated concentrations of

nitrates, salinity, and bacteria are all degrading spring water quality. The FDEP is aware of the nitrate issues and has worked with other governmental agencies to develop measures to reduce nitrate concentrations in the groundwater and springs. The Florida Springs Initiative further addresses the nitrate and microbiological (bacterial) issues by providing funds for the monitoring of nitrate in springs and by sponsoring research on the microbiology of caves and spring water. The FDEP also works very closely with the water management districts to monitor saltwater intrusion and in the establishment of minimum flows for streams and minimum levels for aquifers.

Strategies:

- Participate in Minimum Flow Level (MFL) designations and water withdrawal permitting discussions to assist manatees which are dependent on warmwater spring flow for their survival and to benefit estuaries. Monitor withdrawals and flows to ensure they are meeting MFL designation limits.
- Work with the University of Florida and other partners, such as the Mote Marine Laboratory, to continue water quality monitoring in the Chassahowitzka and Homosassa rivers in order to ensure the ecological integrity of refuge resources.
- Work with the USGS and other partners to assess long-term trends in water quality, quantity, timing and distribution.
- Identify water quality threats (fertilizer runoff, septic tank leachates, nutrient loading, increased salinity, access dredging, reduced clarity) to benefit nursery species and manatees dependent on submerged aquatic vegetation and seagrasses for food.
- Initiate long-term monitoring of freshwater resources, including salinity and other water chemistry parameters, to detect changes in water quality and quantity.

Objective 2.3. Land Protection – Continue strategic land acquisition efforts by working with willing sellers to ensure the conservation of sustainable plant communities and quality wildlife habitats in perpetuity. Work with partners to cooperatively manage areas of mutual interest.

Discussion: In order to protect lands with valuable wildlife habitats, the Service will emphasize both acquisition and collaboration. Acquisition from private landowners will focus on continuing to acquire inholdings from willing sellers. Inholdings are privately-owned parcels within the refuge's approved acquisition boundary. This boundary denotes priority lands to acquire if available. The Service will also collaborate with partners, such as the FWC, Southwest Florida Water Management District, and other public agencies and private land conservancies, to cooperatively manage and protect other wildlands within the region to promote habitat and wildlife conservation on this part of Florida's Gulf Coast.

Strategy:

- Update and implement the step-down land acquisition plan (known as a Land Protection Plan) by continuing to seek willing sellers and acquire fee title to lands within the approved refuge acquisition boundaries whenever acquisition funds are available.

Objective 2.4. Salt Marsh Transition/Tree Island Communities – Manage salt marsh transition/tree island communities to benefit native wildlife.

Discussion: Needlerush comprises about 17,000 acres of refuge marshlands. Thick stands of sawgrass, intermittent patches of salt grass, and, to a smaller extent, salt marsh cordgrass, border much of the needlerush marsh. Marshes provide habitat for rails, gallinules, songbirds, small mammals, reptiles, amphibians, and arthropods.

Tree islands are interspersed throughout the salt marsh, wherever elevations are slightly higher. Live oak, red maple, red bay, sweet bay, cabbage palm, and red cedar are the dominant species. Characteristic wildlife includes river otters, raccoons, box turtles, woodpeckers, and neotropical migratory birds.

Strategies:

- Evaluate the impacts of landscape alterations (e.g., levees, impoundments, abandoned roads and canals) on salt marsh transition communities. Conduct restoration where feasible.
- Use prescribed fire on a rotational basis every three to five years in mosaic patterns to provide heterogeneous ages and densities of vegetation conducive for use by a full suite of marsh wildlife. Augment with mechanical means as warranted.
- Update and implement the step-down Fire Management Plan accordingly to incorporate scientific information, altered habitat conditions, and climate change considerations in regard to maintaining selected salt marsh communities.
- Evaluate the effects of sea level rise and flooding from storms on salt marsh transition communities, and adapt management strategies accordingly.
- On the tree islands, control the loss of driftwood and the cutting of live cedars through law enforcement.
- Delineate areas where prescribed burning would be an appropriate tool for maintaining and enhancing salt marsh vegetation and diversifying seral stages in different salt marsh communities.

Objective 2.5. Swamps-Hardwoods – Within five years of plan approval, conduct baseline surveys to document existing conditions of forested wetlands, including species composition, abundance and structure in this habitat.

Discussion: Approximately 2,560 acres of hardwood swamplands are found along the eastern edge of the refuge. Dominant trees and shrubs are red maple, red bay, sweet bay, and cabbage palm. The refuge's hardwood swamps are accessible only by boat or by one public road. Baseline data are lacking.

Strategies:

- Work with the University of Florida and other partners to record diameter, height and features of the cover of all trees above a specified diameter, so as to obtain a precise picture of forest structure.
- Obtain estimates as to forest composition by species.
- Obtain estimates as to canopy closure coverage and basal area (in square feet per acre).
- Take notes on the soils, including the nature and depth of moisture horizons.
- Make observations on hydrological conditions encountered (presence, absence, depth of water).
- Record dominant ground cover and shrub vegetation, with special reference to all unusual species.
- Record the occurrence and extent of regeneration (seedlings/saplings of trees that have not yet reached a specified diameter).
- Record the nature and quantity of all fallen or standing dead wood and/or decomposing wood within the forest stand.

- Consider using the Continuous Forest Inventory (CFI) methodology, in which a series of uniformly spaced permanent sample plots are measured periodically to quantify forest conditions and changes. About every 10 years, the 0.2-acre plots are measured to determine what tree species are present, how much young forest has been established (regeneration) and how much existing tree growth and mortality has occurred since the last inventory.
- Use GPS and GIS; develop and maintain a GIS-based database for use in long-term management and planning.

Objective 2.6. Forested Wetland Community – Within the 15-year planning horizon of the CCP, consider whether to begin restoration of the forested wetland community (as recommended in the 2006 Wildlife and Habitat Management Review) to reach (in a century or more) the desired future condition of 50-90 percent canopy cover, basal area of 130-390 meters squared per hectare (m2/ha), stem density of 20 to100 per acre, and the following ranges for species composition, diversity and abundance represented as percentages of individuals in the overstory an understory:

- Bald Cypress (*Taxodium distichum*): 20 to 60.
- Black Gum (*Nyssa sylvatica*): 5 to 20.
- Water Tupelo (*N. aquatica*): 5 to 20.
- Red Maple (*Acer rubrum*): 5 to 40.
- Overcup Oak (*Quercus lyrata*): 5 to 20.
- Swamp Laurel Oak (*Q. laurifolia*): 5 to 20.
- Willow (*Salix spp*.): 5 to 40 of individuals in understory only.

Objective2.7. Mangroves – Maintain mangrove forest communities for the benefit of nesting and wintering migratory birds and forage fish.

Discussion: Mangroves occur throughout the refuge's estuaries. They are protective barriers for the fragile estuarine habitat, serve as colonial bird rookery sites, and furnish escape cover. Because the refuge is near the northern extent of mangroves' range, they will probably continue to flourish here but may never reach the stature observed to the south.

The refuge is known to be home to a number of species of colonial wading birds, including the state-listed little blue heron, reddish egret, and roseate spoonbill that use the remote offshore mangrove gulf islands as rookeries. Colonial nesting birds may shift nesting island preference over time due to habitat conditions on the island, including suitable cover, available prey resources, and increased capacity to protect from predation (Lusk pers. com. 2011). Shifts of existing and/or establishment of new nesting sites are evident at Chassahowitzka NWR over the past 20 years.

The refuge's Buckhorn Key had a long history of use by colonial nesting birds as a nest site until several years ago, when colonial nesting activity decreased on Buckhorn Key and shifted to Crawl and Bird Keys. In addition, nesting at Saddle Key and South Point has recently occurred, thought to be a product of shoreline mangrove habitat recovery from recent freezes (Kleen pers. com. 2011). Colonial nesting birds may flush from active nests when disturbed, exacerbating nest failure. The refuge would consider establishing and maintaining a disturbance-free buffer of 100 meters around active colonial bird nesting sites during the breeding season (Feb. to July). Location, establishment, and maintenance of buffers would be evaluated seasonally and depend on nesting use by colonial nesting birds.

Strategies:

- Within 5 years of plan completion, consider establishing and maintaining a disturbance-free zone of at least 100 meters around mangrove islands supporting colonial nesting birds during the breeding season to improve reproductive success and prevent abandonment of colonies.
- Continue to monitor and document the trend of loss and subsequent regrowth of mangroves during and after severe freezes.
- Expand cooperative efforts with the Friends group, government partners, and community volunteer groups to remove and reduce marine debris (e.g., traps, lines, monofilament, plastic products, and abandoned boats) from mangrove habitats.

Objective 2.8. Marine Habitats – In Citrus County, manage refuge-owned water bottoms, in addition to the uplands. In Hernando County, cooperatively manage marine habitats (shallow bays, tidal streams, hardbottoms, and submerged aquatic vegetation (SAV) in coordination with the State of Florida for the purpose of protecting marine wildlife resources.

Discussion: Along the western side of the refuge, at the edge of the Gulf of Mexico, are the most saline waters in the refuge. Much of the same SAV as the brackish zone also occurs here, but in this deeper water they are more sparsely distributed and are much less subject to tidal fluctuations. Dominant waterfowl species of the marine habitats are the redhead, canvasback, scaup, and mergansers. Several threatened or endangered species are also associated with this habitat, including the peregrine falcon, loggerhead sea turtle, Kemp's Ridley turtle, green turtle, and possibly Gulf sturgeon and smalltooth sawfish.

Chassahowitzka's brackish tidal areas and shallow bays provide additional variety in terms of aquatic plant and animal foods. *Chara* (muskgrass) covers large areas of the tidal bays; this multicellular green algae is a favorite food for many species of ducks. In addition, submerged portions of *Chara* and other aquatic plants provide microhabitats and food for numerous invertebrates. These invertebrates in turn are eaten by fish and other wildlife species. After aquatic plants die, bacteria and fungi facilitate their decomposition, providing food called "detritus," for many aquatic invertebrates (Texas Agricultural and Mechanical University 2011).

Along with shoal grass, wigeon grass, and various arthropods, muskgrass comprises more than 75 percent of the diet of ducks that use this brackish zone. The dominant waterfowl species include gadwall, American wigeon, pintail, scaup, red-breasted merganser, and hooded merganser. Other wildlife species found in the shallow bays on the refuge are the bald eagle, brown pelican, white pelican, coot, cormorant, egret, heron, ibis, anhinga, tern, gull, kestrel, hawks, and osprey. Important local sport and commercial fishery species, such as mullet, blue crab, spotted seatrout, sheepshead, and redfish also occur in tidal areas.

Strategies:

- Work with partners (USGS, Mote Marine Laboratory) to implement a sampling or survey protocol that would verify or otherwise determine species composition of SAV beds as delineated by remotely-sensed data.
- Analyze transect data to determine historic abundance, distribution and composition. If historical data are available, assess condition of SAV on refuge.
- Document changes to SAV over time and determine if increased salinity (sea level rise) may be a cause.

- Work with partners (possibly USGS or state) to develop geographic information system (GIS) data, including a shape file of propeller-scarred areas.
- Seek partnership to evaluate seagrass bed and SAV health and consider area closures (especially in wilderness) for areas with documented propeller scarring as warranted.
- Work collaboratively with the State of Florida, Citrus County, and marine conservation organizations on shared interests in studying and protecting marine habitats within the boundaries of the refuge.
- Continue coordination with the FWC, U.S. Coast Guard, U.S. Customs and Border Patrol Department of Homeland Security, and the Citrus County Sheriff's Office on law enforcement patrols and investigations in marine waters within the refuge's administrative boundary.
- Continue partnership with FDEP to remove abandoned crab traps on the refuge.

Objective 2.9. Upland Forest/Forest Management – As part of the step-down Habitat Management Plan, determine desired future condition.

Discussion: Approximately 250 acres of upland forest are located along the eastern edge of the refuge. Live oak, scrub oak, longleaf pine, slash pine, wax myrtle, and saw palmetto are dominant species. Wildlife indigenous to this area include a small nesting population of bald eagles (near the refuge); populations of threatened eastern indigo snakes and gopher tortoises (not confirmed on the refuge); small populations of white-tailed deer, eastern wild turkey, and Florida black bears; bobcats, raccoons, and other small mammals; neotropical migratory birds; raptors; reptiles; and amphibians. The main nonnative species found in upland forests is the feral hog.

Strategies:

- With partners, conduct baseline assessment and develop forest management options.
- Continue to seek priority land acquisition by acquiring inholdings from willing sellers.

RESOURCE PROTECTION

Goal 3. Protect archaeological, cultural and historic resources for future generations as examples of human interaction with the natural environment. Protect and preserve the wilderness character of those refuge lands designated by Congress as part of the National Wilderness Preservation System.

Cultural and Historic Resources

Discussion: With the enactment of the Antiquities Act of 1906 and passage of the National Historic Preservation Act of 1966 and Archaeological Resources Protection Act of 1979, Congress emphasized the importance of cultural resources and sought to protect archaeological sites and historic structures on lands owned, managed, or controlled by the United States. Associated regulations call for (1) each agency to systematically inventory the historic properties on its holdings and to scientifically assess each property's eligibility for the National Register of Historic Places; (2) federal agencies are to consider the effects of management actions on cultural resources and seek to avoid or mitigate adverse effects; (3) cultural resources are to be protected from looting and vandalism via informed management, law enforcement efforts, and public education; and (4) groups such as Native American tribes should be consulted to address how a project or management activity may impact specific cultural sites and landscapes deemed important to those groups. The objectives and strategies below outline the Service's plan to achieve its mandated historic preservation responsibilities.

Objective 3.1. Cultural Resources Preservation – Integrate cultural resource preservation concepts and practices into refuge programs, and modify operations and management plans to protect cultural resources in perpetuity.

Discussion: The aforementioned cultural and historic laws and Department of the Interior and Service policy require federal land managers to integrate cultural resources protection and management into refuge programs and operations. Although substantial historic properties have not been identified on the refuge to date, numerous prehistoric sites have been documented on the refuge and in the local area.

Strategies:

- Coordinate with the Regional Archaeologist to complete a cultural resources overview for the refuge.
- Include a section addressing cultural resource management and historic preservation in all applicable refuge step-down management plans.
- Update the GIS database containing location and background information about historic properties recorded on and near the refuge.
- Complete the Request for Cultural Review Compliance form and forward it to the Regional Archaeologist for review and subsequent action, including consultation with tribes, pursuant to Section 106 of the National Historic Preservation Act prior to any nonemergency, ground-disturbing activity.
- Consult with the Native American tribes for information on and input into the management of important cultural and sacred sites that may be discovered or located within the refuge.
- Consider developing a site-predictive study to identify the likely location of previously unrecorded archaeological sites through partnerships.

Objective 3.2. Cultural Resources Protection – Protect the refuge's cultural resources and diminish site destruction due to looting and vandalism.

Discussion: The refuge has a number of recorded historic properties, though many have not been subjected to archaeological testing sufficient for determining their eligibility for inclusion on the National Register of Historic Places. Moreover, the inaccessibility of the refuge, and the fact that much of it is underwater or swampy, serve to discourage looting and vandalism by all but the most determined or professional looters and vandals. Nevertheless, looters and vandals have still damaged, destroyed, and stolen archaeological resources known to authorities at the present time, and this must be prevented. These vandals may also damage or destroy sites that have yet to be documented.

Strategies:

- Submit Listing of Outlaw Treachery (LOOT) forms to the Service's Regional Archaeologist routinely. Past archaeological violations, including unpermitted collecting cited in 50 CFR, will be entered into the LOOT system.
- Establish and implement a regular system of patrolling and monitoring known cultural sites.
- Participate in cultural resource protection training for federal wildlife officers at annual law enforcement refresher courses.

Objective 3.3. Museum Property – Maintain museum property.

Discussion: As cultural resources investigations continue on the refuge, all materials and documents that are found or developed will have to be properly stored and curated.

Strategies:

- Scan historic photographs, maps, and documents and archive the originals at the Service's National Conservation Training Center and/or National Archives, as appropriate.
- Arrange for the permanent curation by the Regional Archaeologist of historic and/or archaeological collections and associated documentation derived from cultural resources investigations on the refuge.
- Identify potential partnerships on archaeological and historic investigations and museum property curation to promote interdisciplinary research.

Objective 3.4. Understanding of Refuge Ecology and Human Impacts – Enhance the public's understanding and appreciation of the refuge's ecology in relation to the historic human influence on the region's ecosystems.

Discussion: The human presence in the area of the refuge goes back thousands of years to prehistoric times. The many generations of human beings who have resided in this area have all used and depended upon its natural resources; in turn, smaller and now larger human populations, using a wide range of technologies, have had varying types and levels of impacts on these resources. Learning the story of evolving human impacts upon natural resources and the environment is important to developing the basis for a sustainable society.

Strategies:

- Incorporate information that conveys the refuge's cultural history in the development of public environmental education and interpretive programs.
- Distribute a visitor brochure that defines the Archaeological Resources Protection Act.

Wilderness Resources

Discussion: The Service's refuge planning policy requires a wilderness review during the comprehensive conservation planning process. The Service has inventoried the other refuge lands within the planning area, and found that no additional areas meet the eligibility criteria for a wilderness study area as defined by the Wilderness Act. Therefore, the suitability of additional refuge lands for designation as wilderness areas is not further analyzed in this plan. The results of the refuge's wilderness review are provided in Appendix H.

Objective 3.5. Wilderness Resources and Biological Integrity – Manage the refuge's wilderness resources to preserve and protect the biological integrity of wilderness lands.

Discussion: The 94th U.S. Congress designated 23,578 acres of Chassahowitzka NWR as a wilderness area in 1976 under the protection of the Wilderness Act of 1964, declaring that, as a unit within the National Wilderness Preservation System, the Chassahowitzka Wilderness should remain undeveloped and "unimpaired" for future generations. In 1977, Congress further acknowledged the uniqueness of the Chassahowitzka Wilderness by designating it a Class I air quality area, affording it special protection under the Clean Air Act. Maintaining the integrity of the biological elements that

comprise the ecosystem within a wilderness area is crucial to maintaining its wilderness character. Wilderness is more than scenery or solitude; it consists of intact ecosystems as well.

Strategies:

- Within two years of receiving a Solicitor's opinion on jurisdictional issues, but no later than 2017, update the 1981 step-down Wilderness Management Plan. As they are revised, or no later than 2017, incorporate wilderness protection measures in all applicable Service operations and step-down management plans. (e.g., invasive plant control or removal, fire management, visitor services, etc.).
- Enforce existing wilderness regulations via consistent law enforcement presence to minimize impacts upon natural resources.
- Determine extent of invasive plants and remove them as feasible.
- Conduct a "minimum tool" analysis for current and planned administrative activities, including the use of motor vehicles and equipment.
- Facilitate and accommodate through partnerships scientific study for the purpose of management and protection of wilderness resources.
- Monitor seagrass beds for watercraft propeller damage, especially in the Citrus County portion of the wilderness area, as part of an overall refuge assessment.

Objective 3.6. Air Quality Monitoring – Maintain and improve, if feasible and through partnerships, the air quality monitoring (e.g., ozone, haze) station on the refuge.

Discussion: Any wilderness area that is 5,000 acres or larger and designated prior to 1977 is considered a Class 1 airshed. Under the Prevention of Significant Deterioration provisions of the Clean Air Act, the federal land manager has "…an affirmative responsibility to protect the air quality related values (including visibility) of any Class 1 area and to consider, in consultation with the Environmental Protection Agency (EPA), whether a proposed major emitting facility will have an adverse impact on such values." The Interagency Monitoring of Protected Visual Environments Program (IMPROVE) establishes visibility levels, identifies sources of existing impairment, and documents long-term trends to track progress toward meeting the national visibility goal stated in the Clean Air Act (CAA).

Strategies:

- Continue to monitor air quality under the guidance of the Service's Air Quality 6 Division.
- Seek partnerships (Mote Marine Laboratory, Panama City Fisheries, etc.) for monitoring efforts or studies, which could include such tasks as updating a vegetation inventory, evaluating inshore estuary nutrient status, assessing historical seagrass data or mapping seagrasses, and/or conducting wet and dry deposition monitoring of pollutants.
- Comment on any EPA permits for expansions of neighboring power plant facilities (e.g., Crystal River Nuclear Plant).
- Foster field and regional awareness of the CAA requirements for the refuge by the staff and public.
- Address refuge-specific smoke management in the Wilderness and Fire Management step-down plans.
- Initiate through partnerships a vegetation damage ozone assessment at the refuge.
- Compile through partnerships ozone monitoring information from monitoring sites near the refuge to establish an estimate of ozone levels on the refuge.

- Compile through partnerships a list of air quality-sensitive resources (Air Quality Related Values) specific to the refuge.
- Establish dialog with the State of Florida's air quality staff to communicate the refuge's needs and concerns.

Objective 3.7. Wilderness Area Public Use – Provide opportunities for public use in the refuge's wilderness area that are dependent upon a wilderness setting, protects resources, and minimizes disturbance to wildlife and vegetation.

Discussion: The Chassahowitzka Wilderness is to be managed to retain its wilderness character. Thus, the imprint of human uses and activities should not be noticeable. Topography and vegetation on all of the islands create a primeval environment. The effects of recreation and commercial activities on the natural resources of the wilderness area have not been determined.

Wildlife and fisheries impacts from backcountry boating, mostly for recreational and commercial fishing, may cause unintentional disturbance of nesting and roosting birds, alligators, and manatees.

Section 4 of the House Report in the bill that established the Chassahowitzka Wilderness states that in Citrus County, the water bottoms within the refuge are under federal jurisdiction. The navigable waters over these bottoms are under the State of Florida's jurisdiction. Refuge ownership in Hernando County extends only to mean high tide. Motorboat traffic and any other public or commercial uses in navigable waters within the wilderness boundary must be compatible with refuge and wilderness objectives and purposes. Although the Service has no jurisdiction over air space, it could be more proactive and work with the Federal Aviation Administration (FAA) to support and assist on monitoring and prosecuting low-flying aircraft that may be threatening trust resources.

Strategies:

- Obtain a Solicitor's opinion on the extent and jurisdiction of the Service for the Chassahowitzka NWR Wilderness, especially in the Citrus County portion.
- Enforce existing regulations regarding allowable public uses on refuge wilderness areas by providing a consistent law enforcement presence to minimize disturbance to resources and to maintain the wilderness character of these areas.
- Determine the status of commercial activities in wilderness. Issue special use permits (SUPs) for those commercial activities that are compatible with wilderness.
- Conduct wilderness unit training on a periodic basis for new personnel and all commercial users conducting activities in wilderness.
- Prohibit certain public uses from the wilderness as required by law or policy.
- Airboat use, a primary means of refuge access, is under a SUP and is limited to operation in Hernando County where the refuge does not own the water bottoms. In Citrus County, airboat operation is limited to designated routes to reach Hernando County. Please refer to the Compatibility Determinations (Appendix F) for specific restrictions and prohibitions.
- Post the wilderness area boundary.
- Seek listing of the refuge and wilderness boundaries on the FAA's aeronautical charts to enhance voluntary compliance of altitude restrictions over the refuge.

Objective 3.8. Wilderness Appreciation – Convey an understanding and appreciation of the value and character of the refuge's designated wilderness areas.

Discussion: Developing a broad appreciation among Americans of the fundamentals of what constitutes wilderness is crucial to the preservation of wilderness areas now and in the future. The lands protected as wilderness are areas of our public lands, and hence belong to all Americans. Within designated wilderness areas, the Service strives to constrain and minimize human influences so that the ecosystems on those lands can change and evolve (i.e., pass through the various stages of natural succession) over time in their own way, free, as much as possible, from human manipulation and influence.

In designated wilderness areas, the Wilderness Act states, "…the earth and its community of life are untrammeled by man." The word "untrammeled" means that the forces of nature predominate and operate unrestrained and unaltered. Wilderness areas may serve multiple uses. The law limits uses to those consistent with the Wilderness Act and mandates that each wilderness area should be administered to preserve the "wilderness character of the area."

Strategies:

- Develop an interpretive display, related visitor brochures, web pages, and educational materials to distribute at public events and contact stations that convey the wilderness area locations and allowable public uses for visitors.
- Work to blend the "Leave No Trace" program with the refuge's educational materials.
- Manage ecotourism for the refuge with partners, businesses and civic organizations by promoting area attractions and participating in or providing literature to kayak clinics, birding festivals, etc.

VISITOR SERVICES

Goal 4. Promote an awareness, understanding, and appreciation of natural resources and the refuge through enhanced education and interpretive programs.

Discussion: The public will be provided with opportunities for quality wildlife-dependent recreational activities that are compatible with the primary purpose of wildlife conservation, as staffing levels allow. As identified in the National Wildlife Refuge System Improvement Act of 1997, there are six priority wildlife-dependent public use activities: hunting, fishing, wildlife observation, wildlife photography, and environmental education (EE) and interpretation. The Service will promote outreach opportunities that lead to a greater understanding of and stewardship for the refuge's fish and wildlife and their habitats, cultural resources, and wilderness values.

Refuges are closed to the public unless uses are specifically allowed. This plan makes provisions for the allowance of all six priority public uses, as well as several other uses. For details on the public uses that are proposed to be allowed in the refuge, please refer to the compatibility determinations in Appendix F. To ensure a quality, compatible wildlife-dependent recreational experience, various management tools and restrictions will be applied. For example, some uses may be prohibited in certain areas of the refuge to minimize impacts to environmentally sensitive habitats or wildlife. Other restrictions might be used to prevent conflicts among users. Certain uses may be limited on a seasonal, year-round or permanent basis, or have other stipulations as described in Appendix F.

Objective 4.1. Wildlife-dependent Public Uses – Continue to provide opportunities for appropriate and compatible wildlife-dependent recreational uses of the refuge.

Discussion: An estimated 30,000 visitors come to Chassahowitzka NWR annually. Sport fishing is the most popular public use on the refuge. All of the "Big Six" public uses are provided for on the refuge or within refuge complex lands in close proximity (e.g., Salt Marsh Trail).

Strategies:

- Complete a step-down Visitor Services Management Plan by 2014, which would include a signage plan.
- During the 15-year timeframe of the CCP, revise and update the refuge's appropriate use and compatibility determinations as needed, particularly as soon as practical after a Solicitor's opinion on jurisdiction and wilderness issues is provided.
- Require all commercial tour and guiding activities in Citrus County (i.e., fishing for finfish or shellfish such as crabs or scallops) to operate under a special use permit.
- Ascertain the current level of visitor use and the types of visitor use on the refuge.

Objective 4.2. Interpretation - Provide interpretive programs and materials to help visitors comply with refuge regulations and appreciate the refuge's resources.

Discussion: The refuge's current visitor contact station has one whooping crane exhibit. The future visitor center at Crystal River NWR will include displays and exhibits related to Chassahowitzka NWR.

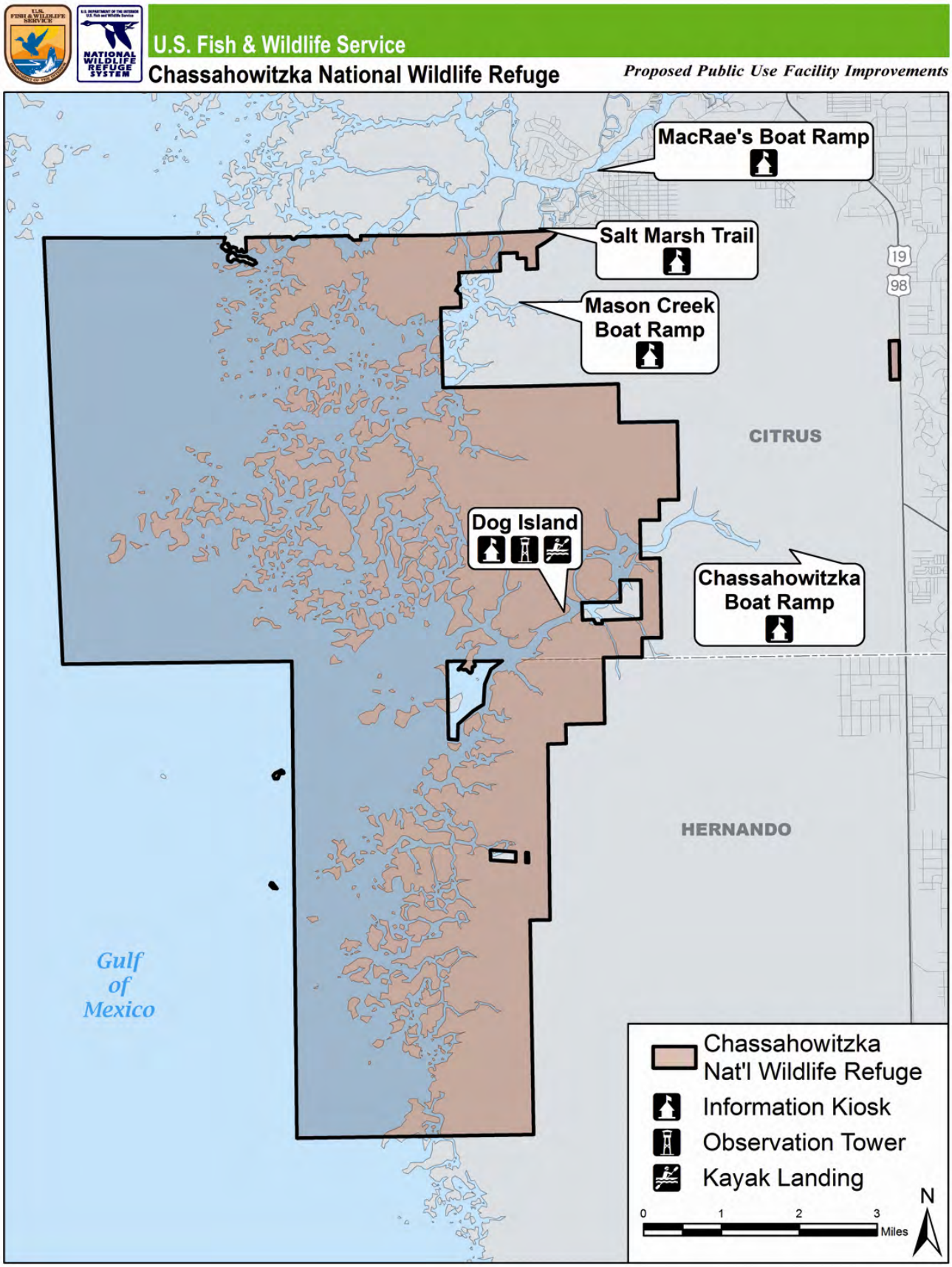
Dog Island is currently the only public use facility that provides interpretation onsite. Interpretive display panels related to whooping cranes have been installed at Dog Island. The Service plans to install additional panels related to the refuge in the upcoming years. Three separate one-panel kiosks that list the refuge regulations and provide interpretation are currently located at the three county and state boat ramps. Some of these existing panels are outdated and need to be replaced. A 13-mile canoe trail route—part of the Florida saltwater coastal trail system—has been designated and coordinated between Citrus County and the refuge. The canoe trail will be posted with new markers in conjunction with the Florida Greenways and Trails program. Figure 13 shows the locations of the proposed new or improved public use facilities.

Current refuge outreach activities that are provided by staff, volunteers and Friends group members include participation in special events and festivals. The Service organizes a yearly public event, the Whooping Crane Flyover, which hosts about 1,000 people specific to this refuge. The Service also hosts or participates in complex-wide events for all five refuges, such as Refuge Days and Earth Day.

Strategies:

- Maintain and replace, as needed, all refuge boundary and regulation signs.
- Add an educational program for commercial operators under a SUP to enhance resource protection, including information such as the Leave-No-Trace materials.
- Develop and distribute information to the public regarding proper etiquette for marine wildlife viewing and wilderness recreation.
- Develop ranger- or volunteer-led hikes providing interpretive talks along the Salt Marsh Trail.
- Participate in outreach programs that educate local residents, students, user groups and others about the threats to manatees and ways to reduce disturbance, harassment, injury and mortality.

Figure 13. Proposed public use facility improvements.



- Support SWFWMD efforts to provide information to the general public regarding how they can reduce water use and improve water quality. This can be done by making the agency's literature available at the refuge visitor contact station.
- Develop additional interpretive information as needed at the refuge's visitor contact station and continually update and improve the information presented on refuge brochures.
- Replace the existing kiosks at the boat ramps with new three-panel, covered kiosks.
- Participate in the following outreach events annually: Whooping Crane Flyover (December-January); Manatee Festival (January); Marine Quest (April); Save Our Waters Week (September); National Wildlife Refuge Week (October); Homosassa Seafood Festival (November); and the Three Sisters Springs Open House (November-February).
- Provide multimedia programs about the refuge at community venues and events to audiences including homeowners associations, civic groups, and environmental organizations.
- Weave key conservation messages into facility development, visitor center renovations, interpretive signage replacement efforts, and environmental education programs.
- Attend off-refuge events with appropriate themes that are related to refuge issues and provide a refuge booth and interpretive information.
- Create an interpretive program focusing on the appreciation and protection of cultural and historic resources.
- Create an interpretive program focusing on the appreciation and protection of wilderness resources, promoting awareness of wilderness area boundaries, and delineating areas closed to visitors or certain public uses.
- Partner with the Nature Coast Chamber of Commerce to educate the chamber's customers and businesses about appropriate and compatible wildlife-dependent recreational uses, promote proper wildlife viewing etiquette, and ensure public awareness of closed areas and prohibited uses, thereby enhancing stewardship of the refuge's natural resources.
- Include protection of imperiled species and their habitats in environmental education, interpretive programs, and literature offered by the refuge.
- Facilitate manatee recovery through public awareness and education.
- Use the refuge office, website, kiosks and other venues as distribution points for education and outreach materials.
- Continue to be involved in the Florida Springs Task Force and other such outreach efforts.
- Coordinate with Citrus County (lead agency) to post 29 route markers along the Citrus County Canoe Trail.
- Evaluate special event opportunities and determine which ones are the most appropriate for participation by refuge staff.
- Continue good relationships with media and congressional contacts.
- Develop a portable exhibit to be used as a backdrop for booths and special events.
- Increase the number of volunteers available to help with outreach events (talks to community groups, special events, etc).
- Law enforcement will work to promote voluntary compliance with refuge rules and regulations, by coordinating with Visitor Service and volunteers to provide the public with interpretive programs.

Objective 4.3. Environmental Education - Enhance environmental education programs to increase student, teacher, and parent awareness and understanding of the refuge's ecology, native flora and fauna, wildlife and habitat management, and environmental history.

Discussion: Partnering with the Friends group, a curriculum-based EE program for fourth and fifth graders began in 2012. Homosassa Elementary school students are brought to the interpretive trails of the Salt Marsh Trail site, which is adjacent to and contains habitat indicative of the refuge.

Strategies:

- Continue to provide hands-on and field-based EE programs for 4th and 5th graders at the Salt Marsh Interpretive Trail site.
- Use volunteers and develop partnerships in order to enhance and expand current environmental education programs.
- Conduct background checks on all volunteers that work with children.

Objective 4.4. Hunting – Provide quality, safe, and cost-effective hunting opportunities compatible with sustaining refuge resources and state regulations.

Discussion: The refuge is open to hunting in partnership with the FWC's hunting program. The refuge has two separate hunt programs that are divided by county. In Citrus County, only ducks and coots may be hunted and only on Wednesdays, Saturdays and Sundays during the hunting season. Public hunting in the Hernando County portion of the refuge is allowed in accordance with state regulations for the Chassahowitzka WMA adjacent to the refuge. Open seasons for small game, big game, and migratory birds is concurrent with the seasons established by the FWC. WMA regulations apply for all huntable species, bag and possession limits, and archery, muzzle-loading gun, and general gun hunt days. Hunting is permitted in all areas of the Hernando County portion of the refuge. Waterfowl hunting in Hernando County is permitted on Wednesdays, Saturdays and Sundays only during the hunting season.

A map of the areas open to hunting is found in the refuge's Hunting and Fishing Regulations brochure. All hunters must possess a valid Florida State Hunting License and a valid (signed) refuge hunting permit. Waterfowl hunters must possess a Florida Waterfowl Permit in addition to a valid Federal Migratory Bird Hunting and Conservation Stamp. For hunters in Hernando County, an FWC management area permit is required in addition to other state hunting stamps and licenses for upland hunting and big game. Currently, the refuge has no permanent hunting blinds or any other hunting facilities.

Strategies:

- Continue to partner with the FWC on hunt programs in Hernando County and formalize this partnership through a Memorandum of Agreement (in draft).
- Increase law enforcement presence on the refuge during the hunting season.
- Evaluate opening upland portions within Citrus County to feral hog hunting. Work with partners (e.g., FFS) to obtain access.

Objective 4.5. Fishing – Promote resource protection and stewardship of fisheries resources

Discussion: Sport fishing is the principal public use at Chassahowitzka NWR. Most recreational fishing occurs in the Citrus County portion of the refuge, primarily on weekends. Because of the multiple access points into the refuge, accurate angler numbers and activities have not been documented. Both recreational and commercial fishing, crabbing and scalloping occur and are allowed in refuge waters. The Service's Dog Island facility is located in the middle of the refuge and includes a shelter, pier, and restroom. It is used by anglers and boaters.

A compatibility determination for commercial and recreational fishing was completed in 1994 and has been updated as part of this CCP (see Appendix F). Fishing tournaments (e.g., redfish) take place on the refuge, but are not allowed in the refuge's wilderness area (Citrus County). Fishing is subject to state and refuge regulations. A joint hunting and fishing brochure along with state regulations is available at the complex headquarters office, and the refuge staff or volunteers periodically distribute

these materials at the boat ramps near the refuge. The Friends group also distributes maps and information about fishing opportunities at the bookstore (in headquarters).

The refuge has regulatory authority over the coastal water bottoms in Citrus County, but not in Hernando County. Service wildlife officers perform random checks of fishing activities and these direct interactions serve as the main tool for educating visitors about the refuge and its fishing regulations.

In recent years, flats fishing has increased in popularity at the refuge. The increasing use may be impacting seagrass beds, while the different styles of fishing could result in conflicts between user groups. Commercial guides and fishing tournaments are two relatively new uses at the refuge.

Strategies:

- Continue partnership with FWC on implementing sustainable fishing practices.
- Provide information on proper saltwater fishing and boating safety etiquette.
- Continue to enforce the State of Florida's saltwater fishing regulations in marine waters.
- Continue to promote public reporting of smalltooth sawfish sightings by adding information to the Dog Island and boat ramp access sites.
- Consider the establishment of no motor zones (pole-in only) for seagrass and bird colony protection.
- Increase law enforcement presence during active fishing (including shellfish) seasons (e.g., summer scallop season).
- Continue to work with FDEP to remove abandoned crab traps and to educate crabbers about wilderness issues.
- Add information about monofilament line recycling in the refuge fishing permit and establish collection sites at Dog Island and the boat ramp access points.
- Encourage anglers and commercial fishers (in brochures and through staff contacts and signage) to make all efforts to recover lost fishing gear and not cast used/spent fishing line into refuge waters. Include in a SUP for commercial fishers and airboat permits educational materials about the danger of spent fishing gear to birds, manatees, and other wildlife.

Objective 4.6. Wildlife and Habitat Observation and Photography – Continue to provide quality opportunities and facilities for wildlife observation and photography in different habitats of the refuge.

Discussion: Most refuge visitors come to observe and/or photograph wildlife as their primary activity, whether they roam the refuge by kayak or canoe or join commercial guided tours. Photographers and observers enjoy encountering manatees, dolphins, bald eagles, alligators, and the many wading and shorebirds of the refuge. Dog Island offers a resting facility for visitors exploring the refuge's isolated islands and enchanting estuaries. While most refuge access is by water, there are also upland trails at the maintenance complex on U.S. Highway 19 and at the Salt Marsh Trial site, a complex property adjacent to the refuge.

Strategies:

- Assess the need and opportunity for enhancing or expanding the existing improved trails, especially the Gopher Tortoise/Indigo Snake Trail at the complex maintenance area.
- Install a live webcam at the whooping crane pen site.
- Work with Citrus County to reestablish signs for the Citrus County Canoe Trail.

- Ask the Friends group to initiate a photography contest in conjunction with other outreach events, such as Refuge or Earth Days.
- Provide curriculum-based EE programs approved by the State of Florida for 4th and 5th graders at the Salt Marsh Trail. The initial programs are anticipated to apply to Homosassa Elementary School. The refuge staff expects to spread the EE programs to additional schools in Citrus and Hernando counties in the upcoming years.
- Commercial photography and commercial tours and guiding in Citrus County would be allowed with stipulations under a commercial special use permit.

Objective 4.7. Other Public Uses and Recreation – Allow nonpriority, nonwildlife-dependent uses such as picnicking, hiking, jogging, walking, camping, and nonmotorized and motorized boating in specified areas where they are compatible with the refuge's purposes (see Appendix F for a description of these proposed uses).

Discussion: Current nonpriority, nonwildlife-dependent public uses on the refuge include motor boating (including air boats); sea kayaking/canoe paddling; hiking, walking, and jogging; picnicking; snorkeling; commercial fishing; commercial photography; and commercial tours and guiding. Due to the inaccessibility of much of the refuge, the refuge's multiple entry points, and the logistical difficulties of patrolling it and establishing a Service presence, the refuge does not have reliable figures on the levels of use, nor any data on the effects of this use. In addition, the refuge currently has no onsite facilities that are universally accessible for visitors with disabilities, but some universally accessible facilities would be added to the adjacent Salt Marsh Trail site. The proposed new refuge headquarters and the Three Sisters visitor center, both in Crystal River, would also be constructed with universal accessibility in mind.

Strategies:

- Conduct an in-depth assessment of current visitor use to document impacts on refuge resources, to predict future uses and impacts, and to determine the feasibility of implementing group size, space/location, or time (e.g., seasonal) limits.
- Monitor nonpriority, nonwildlife-dependent public uses to ensure that the stipulations specified within the compatibility determinations are being met.
- Allowing camping along the canoe/kayak trail and in limited sites with stipulations.
- Commercial fishing and commercial tours and guiding would be allowed in Citrus County only under a commercial SUP with stipulations (see Appendix F).

Objective 4.8. Volunteers – Continue to expand and foster the participation of volunteers to achieve the refuge's visitor service program objectives.

Discussion: The refuge does not have a full-time volunteer coordinator. The volunteer program consists of about 20 volunteers dedicated to maintenance duties, front desk and office/ administrative assistance, outreach, and special projects. The refuge staff has a copy of the handbook entitled, "A Guide for Working with Volunteers," and uses it on a regular basis. Volunteers are recruited through the Nature Coast Volunteer Center, local newspapers, volunteer sign-up sheets at outreach events, and by word-of-mouth. All volunteers receive a site orientation and on-the-job training. They are shadowed at least once to ensure that their message is in line with the philosophy of the Service and the Refuge System, and that their behavior is appropriate when they work with children. The refuge has an established resident volunteer program with recreational vehicle (RV) camper pads and laundry facilities. Volunteers and Friends group members recognize volunteers through an annual Volunteer Appreciation Event and through regional and national awards.

Strategies:

- Hire a Park Ranger to assist in coordinating the Service's volunteer program. This would be a shared position for the Crystal River and Chassahowitzka NWRs.
- Develop a table-top display on volunteer opportunities for use at outreach events to recruit potential volunteers.
- Increase the number of volunteers available to help with outreach events (e.g., talks to community groups and special events).
- Continue to recruit, train, and motivate volunteers to staff the visitor contact station (office), outreach booths at special events, and environmental education efforts.
- Improve recruitment and orientation procedures for volunteers. Require background checks for all volunteers. Use position descriptions, a volunteer agreement, and provide training related to their duties.
- Provide training to volunteers regularly so that they can convey current information relating to refuge rules, resources and key interpretive themes.

Objective 4.9. Partnerships – Foster partnerships with appropriate organizations that promote the key interpretive conservation messages of the refuge.

Discussion: For over a decade, the Friends group has supported the refuge by providing financial assistance, outreach and educational support needs, and by serving as volunteers. The Friends group has been very successful in fund raising. They obtained a $152,000 grant to develop the Salt Marsh Trail site by building facilities, such as an observation tower, kayak/canoe launch, trails and an environmental education shelter. A Memorandum of Agreement is in place and should be reviewed periodically and updated as needed. The Friends group runs a sales outlet out of the complex's headquarters that sells books, t-shirts, and educational materials that support refuge-specific messages.

Strategies:

- Continue supporting and encouraging the Friends group, a nonprofit group that provides financial and in-kind support for refuge programs.
- Continue to provide refuge staff support to various education and outreach initiatives and encourage staff to participate in the "I Gave Eight" program.

Objective 4.10. Airboat Trails – Continue to maintain and allow use under a SUP.

Discussion: Public requests were made to initiate new airboat trails. However, due to jurisdictional and wilderness issues, the Service cannot accommodate that request. Presently, two airboat routes are open under a SUP that allow for transit through the refuge. They provide access to the Gulf of Mexico and Hernando County waters.

Strategies:

- At regular intervals, maintain or clear woody or thick vegetation to create a clear route along the airboat trails.
- Mark trails with signage as necessary to assist users from getting lost.
- Determine the effects of motorboat use on seagrass beds, especially in waters above the wilderness area (Citrus County).
- Keep refuge brochures and websites current with airboat trail and wilderness area maps to enhance voluntary compliance with refuge regulations.

REFUGE ADMINISTRATION

Goal 5. Obtain and provide sufficient resources, staffing, partnerships, and administrative support needed to meet refuge goals and objectives for managing and protecting wildlife and other resources.

Discussion: The administrative functions associated with the refuge include a wide array of activities that are critical to the mission of the National Wildlife Refuge System and the purposes of the refuge. These functions include staffing, training, budgeting, planning, and partnering, as well as biological monitoring, prescribed fire management, law enforcement, community relations, facilities construction, and maintenance. Protecting the refuge's natural resources and ensuring the safety of visitors are fundamental responsibilities of the Service.

Objective 5.1. Adequate Administrative Capacity – Secure resources and take administrative actions necessary to complete projects and tasks as outlined in the Refuge Annual Performance Plan in support of the Service's Strategic Plan and this CCP.

Discussion: The proposed staffing chart for the Crystal River Complex of refuges (2012) (please see Figure 14 in Chapter V, Plan Implementation) also includes the 10 current positions, most of which are based at the complex headquarters in Crystal River. The permanent personnel include a project leader, a deputy project leader, two federal wildlife officers, an Assistant Manager (for the Tampa Bay refuges based in St. Petersburg), an office assistant, a wildlife biologist, a park ranger, a maintenance mechanic and a small craft operator. The complex also relies extensively on staff specialists from other Florida refuges and the Service's Southeast Regional Office for program accomplishments, including endangered species recovery, fire management, land acquisition, information technology, and contracting. In fiscal year 2011, the refuge complex (including Crystal River and the three Tampa Bay refuges) was allocated a budget of $1,330,412 for payroll, utilities, operational and maintenance needs, and special funding to address the maintenance project backlogs, research partnerships, and challenge cost-share projects.

Strategies:

- Identify and secure funding through grants and other cost-sharing sources to supplement annual operating funds in support of ecological research and monitoring projects that enhance the conservation of ecosystem functions of native species and their habitats.
- Enhance and maintain an active, dynamic volunteer and student intern program to assist in all refuge operations, including public outreach, environmental education, wildlife interpretation, biological monitoring, habitat restoration, and facilities maintenance.
- Construct, rehabilitate, and/or maintain an appropriate suite of refuge complex facilities to support its programs and to ensure safe and efficient operations. Facilities include the administrative headquarters (office, visitors center and boat dock/houses); a maintenance shop; six RV trailer pads; the Dog Island landing/shelter; and the whooping crane wintering pen site, as well as signs, gates, kiosks, trails, and boardwalks.
- Procure and maintain equipment and vehicles needed to perform refuge operations and to ensure adequate maintenance of refuge native habitats, landscaped grounds, buildings, facilities, heavy equipment, motorboats and vehicles.
- Fund all approved positions and increase permanent staff by a total of eight new positions to fulfill the workload need identified in this CCP. The plan calls for upgrading six existing positions in the complex due to adding supervisory responsibilities and for using temporary employees as operating funds allow (see Chapter 5, Table 5).
- Administratively manage Crystal River NWR parcels that are near or adjacent to the refuge.

Objective 5.2. Professional and Safe Setting – Maintain a safe, efficient and professional working atmosphere for staff and visitors.

Discussion: Maintaining a professional and safe setting is crucial not only for staff, but for the visiting public. Unless the refuge maintains a professional and safe setting, it will not attract and keep qualified, high caliber personnel. Similarly, unless visitors feel safe at Chassahowitzka NWR and are treated by the refuge and Service staff in a professional manner, they will visit less or stop coming altogether and visitation will decrease.

Strategies:

- Review and revise the safety, hurricane, and emergency contingency plans as necessary.
- Ensure that Service personnel meet all annual, mandatory training requirements.
- Provide continuing education, training, and professional development opportunities to all staff to ensure a highly competent and motivated team (for example, through staff retreats, team building workshops, onsite and offsite activities, and detailed assignments.
- Encourage training in state-of-the-art processes, such as adaptive management, structured decision-making, geographic information systems (GIS), modeling, and integrated database management, to apply advances in wildlife and habitat management strategies.
- Procure and maintain safe and efficient equipment and vehicles to perform operations and maintenance.
- To ensure equipment accountability, maintain equipment maintenance logs and assign responsibility to staff for assigned or used equipment.
- Incorporate sustainable “green” building technology into all future construction and renovation projects for government facilities, consistent with the Leadership in Energy and Environmental Design (LEED) Green Building Rating System, developed by the U.S. Green Building Council.
- Purchase new motor vehicles and equipment that incorporate the highest energy efficiency standards available to reduce the refuge’s carbon footprint from operations and maintenance functions.
- Implement an active risk assessment system to report hazards to protect employees and visitors (i.e., designate formal time slot during staff meetings for reporting and discussing safety issues).
- Provide periodic social and team-building events for staff and partners.
- Designate an employee to be the refuge’s safety officer for the coordination of safety strategies, on a rotating collateral duty basis among those employees with applicable knowledge and skills.

Objective 5.3. Law Enforcement – Maintain a law enforcement program that will ensure the safety, security, and protection of employees, visitors, real property, equipment, and the natural and cultural resources of the refuge.

Discussion: Chassahowitzka NWR shares two federal wildlife officers with four other refuges in the Crystal River National Wildlife Refuge Complex. Sufficient law enforcement staffing and funding is crucial to the prevention and deterrence of illegal activities, and bringing perpetrators to justice when crimes are committed. A visible law enforcement presence is needed to ensure visitor and employee safety and to protect Chassahowitzka NWR’s wildlife, cultural and wilderness resources.

Strategies:

- Update the step-down Law Enforcement Management Plan as needed and revise it in 2015.
- Review and update the step-down Hurricane Preparedness Plan annually.
- Enhance law enforcement capabilities through ongoing collaboration, partnerships, detailed assignments of officers, and cooperative agreements with local, state, and federal enforcement agencies, including, but not limited to, the FWC and the Citrus County Sheriff's Office.
- Provide support to the U.S. Customs and Border Patrol, Department of Homeland Security, and the U.S. Coast Guard in matters of homeland security, illegal immigrants, and resource protection.
- Provide ongoing emergency response for natural disasters (e.g., hurricane details) or other response and recovery activities (e.g., oil spills) and search and rescue efforts.
- Work cooperatively with the Service's Office of Law Enforcement to protect against illegal trade, unlawful commercial exploitation, habitat destruction, and environmental hazards.
- Actively seek out and attend various law enforcement training sessions to increase expertise and expose the staff to newly evolved law enforcement techniques.
- Participate in community law enforcement events to increase communications and cooperation with other agencies.
- Coordinate with the Visitor Services Division at the Service's Southeast Regional Office to provide the public with interpretive programs that explain the refuge's rules and regulations.
- Participate in community law enforcement events (e.g., Friends group or other events, booths at local fairs, and trainings) to increase communication and cooperation with other agencies.
- Implement a crime reporting system for the pubic to encourage community policing (e.g., through the use of a paging system, rewards for convictions, etc.), possibly modeled on the FWC's program or conducted in partnership with the FWC. To promote voluntary compliance with refuge rules and regulations, coordinate with the aforementioned Visitor Services Division and volunteers to provide the public with interpretive programs.
- Provide periodic social and team-building events for the refuge staff, Friends group, and other partners (e.g., luncheons, refuge functions).
- Designate an employee to be the safety officer for the coordination of safety strategies, on a rotating collateral duty basis among employees with appropriate skill and knowledge.

Objective 5.4. Refuge Administration Partnerships – Continue developing internal Service and external partnerships to share equipment, manpower, and expertise in all aspects of refuge administration.

Discussion: The refuge works with partners who provide expertise in specialized fields or disciplines, such as manatee and whooping crane management, energy conservation, scientific research, etc.

Strategies:

- Maintain current relationships and encourage new partnerships with conservation organizations, academic institutions, and other agencies to provide scientific data that will enhance the management, protection, and restoration of native species and habitats.
- Integrate the Service's strategic habitat conservation principles into refuge programs in collaboration with partners in the newly formed Peninsular Florida Landscape Conservation Cooperative.

- Use cooperative agreements, interagency agreements, special use permits (SUPs), and memoranda of understanding to facilitate collaborative research and management activities to meet refuge objectives.
- Develop partnerships with energy efficiency specialists and organizations to incorporate sustainable “green” practices into all refuge operations and maintenance functions.

V. Plan Implementation

INTRODUCTION

Refuge lands are managed as defined under the National Wildlife Refuge System Improvement Act of 1997. Congress has established a clear legislative mission of wildlife conservation for all national wildlife refuges. National wildlife refuges, unlike other public lands, are dedicated to the conservation of the Nation's fish and wildlife resources and wildlife-dependent recreational uses. Priority projects on refuges emphasize the protection and enhancement of fish and wildlife species first and foremost, but considerable emphasis is placed on balancing the needs and demands for wildlife-dependent recreation and environmental education.

To accomplish the purpose, vision, goals, and objectives contained in this plan for Chassahowitzka NWR, this chapter identifies 14 projects; proposes increased staffing, equipment, and funding needs; lists partnership opportunities; describes the step-down management plans that are needed; and discusses plan updates and reviews.

PROPOSED PROJECTS

Listed below are the proposed project summaries and their associated costs for fish and wildlife population management, habitat management, resource protection, visitor services, and refuge administration over the next 15 years. This proposed project list reflects the priority needs identified by the public, planning team, and refuge staff based upon available information. These projects were generated for the purpose of achieving the refuge's objectives and strategies. The primary linkages of these projects to those planning elements are identified in each summary.

FISH AND WILDLIFE POPULATION MANAGEMENT

1. Science-based Inventorying and Monitoring of Animal Populations

Science-based inventorying and monitoring is critical to ensuring the biological integrity of the refuge. The information collected through a systematic and standardized inventorying and monitoring program forms the basis for developing, implementing, revising, and evaluating management actions; enables informed decisions; and guides refuge management activities. To date, comprehensive inventories have not been completed for all taxonomic groups in the refuge and only a few species are adequately monitored. This project will address this shortfall by expanding the inventorying and monitoring of top priority species (manatees, migratory birds, colonial nesting birds, saltmarsh voles) via funding of several important surveys. This project includes a basic, presence/absence study of saltmarsh voles, baseline surveys of invertebrate and small mammal species, and expanded manatee and bird surveys (e.g., neotropical migrants). There would also be a regular inventory and monitoring effort for invasive animals (e.g., hogs). As a result, the refuge will improve management and provide valuable long-term contributions to national and regional objectives for ecosystem management. The project consists of funding a biological science technician position. This position will also have other duties within the complex. Contractual studies and grant agreements with partners and subject matter experts will be used to supplement refuge efforts at a first-year cost of $250,000 with an annual recurring cost of $50,000. The total project cost over the 15-year period of the CCP is $950,000. (Linkages: Goal 1, Objectives 1, 2, 3, 7, and 9; Goal 2, Objective 1.)

2. Whooping Crane Reintroduction Project

The Whooping Crane Eastern Partnership (WCEP) relies on the Service to maintain the refuge's pen and observation facilities used for wintering habitat of the experimental population of whooping cranes. Maintenance involves construction and repair of the pen, blinds, boardwalk, electric fence, etc.; the use of the Marsh Master to control vegetation around the pen; and prescribed burning of the salt marsh. The annual recurring cost of this project is $20,000. The total project cost over the 15-year period of the CCP is $300,000. (Linkages: Goal 1, Objective 6; Goal 2, Objective 1.)

3. Blue Crab Population Study

The Service would contract with partnering agencies to evaluate the blue crab fishery on the crab population and seagrass resources to ascertain the sustainability of these resources. The one-time cost of this project is $100,000. The total project cost over the 15-year period of the CCP is $100,000. (Linkage: Goal 1, Objective12.)

4. Migratory Bird Study

Refuge-wide surveys over time have documented a decline in waterfowl populations for which the refuge was initially established. A study is proposed to evaluate the reason(s) for the disappearance of waterfowl on the refuge and recommend potential management solutions to restore waterfowl abundance. The one-time project cost is $150,000. The total project cost over the 15-year period of the CCP is $150,000. (Linkages: Goal 1, Objective 7; Goal 2, Objective 6.)

HABITAT MANAGEMENT

5. Climate Change Monitoring

Through partnerships with other agencies and universities, conduct long-term monitoring of the hammocks located throughout the marshes to determine the impact of sea level rise on native vegetation. In addition to evaluating satellite imagery from the past and into the future, there would be ground-truthing (photo-point) baseline surveys of the three primary vegetation types—shallow bays/submerged aquatic vegetation (SAV), emergent plants, and forested uplands—to document changes over time. The health of the seagrass beds and SAV would be evaluated, and the impacts of boating (e.g., propeller scarring) would be documented. The project includes salinity studies across habitats and over time. This project will have a first-year cost of $100,000 and a recurring annual cost of $20,000. The total project cost over the 15-year period of the CCP is $380,000. (Linkages: Goal 1, Objective 1; Goal 2, Objectives 1, 4, 6, and 7.)

6. Inventory and Control of Invasive Plants and Animals

In order to eradicate or control populations of invasive plants, continued emphasis must be placed on detecting and monitoring the presence, spread, and damage caused by these plants, particularly upon listed native plant and wildlife species and their habitats. Outreach and education must also be expanded to inform the public about the negative impacts of introducing invasive exotic species for landscaping adjacent to natural areas, and to solicit public support for controlling invasive species on private lands as well. This project consists of inventory and mapping of invasive plant species and contracting invasive plant control and native plant restoration where necessary and feasible. The project would also address predatory animals,

such as feral hogs and bobcat predation on whooping cranes. The first-year cost of this project is $350,000, with an annual recurring cost $120,000. The total project cost over the 15-year period of the CCP is $2,030,000. (Linkage: Goal 2, Objective 1).

7. Hydrologic Monitoring and Restoration

Levees were constructed in the 1960s as waterfowl habitat impoundments, but they failed and were not used for this purpose. This project will evaluate the impacts of this alteration. The results from hydrologic studies will be used to design and implement projects to restore hydrologic conditions to maintain wetlands, improve water flows and tidal connections. The first-year costs include $50,000 to conduct a hydrologic survey to determine the current status and extent of the underground freshwater lenses, with subsequent annual recurring costs of $10,000 to monitor water quality and quantity. The total project cost over the 15-year period of the CCP is $190,000. (Linkages: Goal 2, Objectives 2 and 4.)

8. Land Acquisition

Some land inholdings of vacant parcels with high quality wildlife habitat remain within the acquisition boundaries for Chassahowitzka NWR. This refuge ranks as a priority in the Service's Land Acquisition Priority System and qualifies for funding from the Land and Water Conservation Fund. The Service would like to acquire from willing sellers all available inholdings of vacant native habitat to enhance its ability to manage large tracts of habitat, expand connectivity across the landscape to facilitate native plant and animal dispersal and movement, and reduce habitat fragmentation for the recovery of threatened and endangered species. The total project cost over the 15-year period of the CCP is $15 million. (Linkage: Goal 2, Objective 3.)

RESOURCE PROTECTION

9. Posting of Wilderness Boundary

A contract for signage and the posting of the wilderness area boundaries is needed. The first-year cost of this project will be $150,000, and an estimated annual recurring cost of $10,000 will be needed to post the boundaries. The total project cost over the 15-year period of the CCP is $290,000. (Linkage: Goal 3, Objective 5.)

VISITOR SERVICES

10. Visitor Use Survey

An in-depth assessment of current visitor use and its impacts is desired, particularly for remote waterways that may require additional public use restrictions to protect the wildlife and wilderness values. This study would document the current impacts of recreational and public uses on refuge resources and predict future use impacts in order to determine carrying capacities for various sites on the refuge. This study will guide enhancements and improvements to the visitor services program and facilities. The estimated cost is $50,000 for an initial survey and 10-year follow-up survey. The total project cost over the 15-year period of the CCP is $50,000. (Linkages: Goal 4, Objectives 1 and 7.)

11. Outdoor Visitor Facility Improvements

Outdoor visitor facility improvements have been proposed for the refuge over the 15-year life of the CCP, including an elevated wildlife-observation platform with interpretive signs at Dog Island; interpretive signs at the Salt Marsh Trail tower; a kayak landing at Dog Island; new kiosks at each of the three boat ramps (off-refuge); and improvements to the upland trail at the maintenance facility. This project also includes replacement costs for new visitor use or refuge regulation signage. If any new trails are opened, this project would cover the marking and maintenance of those trails. The initial project cost associated with these projects is $125,000, with an annual recurring cost for maintenance of $5,000. The total project cost over the 15-year period of the CCP is $195,000. (Linkages: Goal 4, Objectives 2, 3, 5 and 6.)

REFUGE ADMINISTRATION

12. New Complex Headquarters

The existing renovated house that serves as the refuge complex headquarters and visitor contact station would be replaced with a new office. The one-time cost to design and construct this new facility is $2,500,000, with an annual recurring cost of $50,000 for maintenance. The total project cost over the 15-year period of the CCP is $3,200,000. (Linkage: Goal 5, Objective 1.)

13. Equipment Replacement

This project includes vehicle and boat replacement for the refuge. All 15 vehicles and 9 boats will be replaced during the 15 years following adoption of the CCP. Regular maintenance of this fleet is also required annually. The annual recurring cost of $30,000 is needed to repair and replace equipment. The total project cost over the 15-year period of the CCP is $450,000. (Linkages: Goal 5, Objectives 1 and 2.)

14. Construction and Maintenance Projects

This project includes the following construction and maintenance projects: constructing a five-bay pole barn at the maintenance shop area; upgrading the maintenance shop; improved electric and sewerage systems; and better parking and road access at the Salt Marsh Trail site. The first-year cost for all of these projects is $150,000, with an annual recurring cost of $5,000. The total project cost over the 15-year period of the CCP is $175,000. (Linkage: Goal 5, Objective 1.)

Table 4 summarizes the 14 projects and their first-year and annual recurring costs.

FUNDING AND PERSONNEL

The approved staffing chart for the Crystal River Complex of refuges currently (2012) includes 10 positions, three of which are located at Chassahowitzka NWR; six are based at the refuge complex headquarters in Crystal River; and one is based in St. Petersburg. A total of 18 new positions are proposed to be added for the complex. Eight of these would have some responsibilities for Chassahowitzka NWR. Four positions are proposed in the Tampa Bay Refuges CCP, and four are proposed in the Draft Crystal River CCP. This plan also proposes to upgrade six of the existing 10 complex positions given additional and supervisory responsibilities.

The duties and costs of the proposed new staff positions for Chassahowitzka NWR are shown in Table 5. Figure 14 shows an organizational chart of the current Crystal River NWR Complex staff, the proposed new positions involving Chassahowitzka NWR, and the proposed upgraded positions.

Table 4. Summary of projects.

PROJECT NUMBER	PROJECT TITLE	FIRST YEAR COST (U.S. $)	RECURRING ANNUAL COST ($)
1	Science-based Inventorying and Monitoring of Animal Populations	250,000	50,000
2	Whooping Crane Reintroduction Project		20,000
3	Blue Crab Population Study	100,000	
4	Migratory Bird Study	150,000	
5	Climate Change Monitoring	100,000	20,000
6	Inventory and Control of Invasive Plants and Animals	350,000	120,000
7	Hydrologic Monitoring and Restoration	50,000	10,000
8	Land Acquisition	15,000	
9	Posting of Wilderness Boundary	150,000	10,000
10	Visitor Use Survey	50,000	
11	Outdoor Visitor Facility Improvements	125,000	5,000
12	New Complex Headquarters	2,500,000	50,000
13	Equipment Replacement		30,000
14	Construction and Maintenance Projects	150,000	5,000

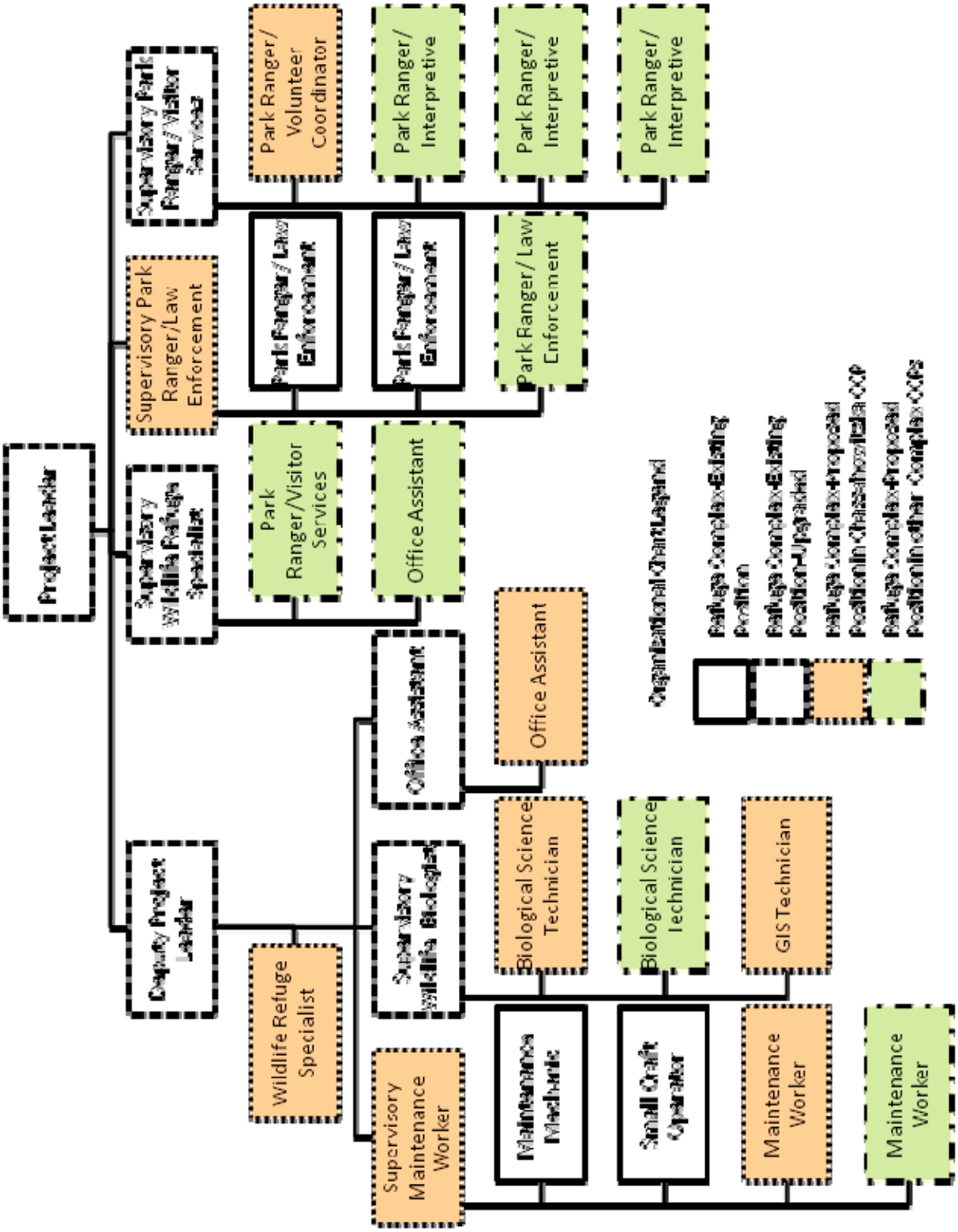
Table 5. Approximate annual costs of proposed new staff positions for Chassahowitzka NWR (2012 costs).

Title	Responsibility	Grade	Annual Cost ($)
Biological Science Technician	Inventory and monitoring, crane project assistance, contract for biological studies or habitat management work.	GS-5/7/9	39,000
Park Ranger	Volunteer coordination	GS-7/9	39,000
Maintenance Worker	General maintenance	WG-7/8	45,000
Wildlife Refuge Specialist	Refuge operations	GS- 9/11	57,000
Supervisory Park Ranger	Oversees law enforcement program for complex	GL-9/11	59,000
Supervisory Maintenance Worker	Oversees maintenance operations for complex	WS-5716-10	60,000
Office Assistant	Administrative, personnel and data management for complex	GS-7/9	39,000
GIS Technician	Mapping and data management	GS-7/9	39,000

PARTNERSHIP AND VOLUNTEER OPPORTUNITIES

A key element of this comprehensive conservation plan is to establish partnerships with local volunteers, landowners, private organizations, and state and federal natural resource agencies. In the immediate vicinity of the refuge, opportunities exist to establish partnerships (Appendix K). Refuge personnel need to develop memoranda of understanding or agreements with various partners (e.g., the FDEP, FWC, and Citrus and Hernando counties) to enhance coordination and cooperation on resource management issues.

Figure 14. Proposed organizational chart, Crystal River NWR Complex.



STEP-DOWN MANAGEMENT PLANS

A comprehensive conservation plan is a strategic plan that guides the direction of the refuge. A step-down management plan provides specific guidance on activities, such as habitat, fire, and visitor services. These step-down management plans are also developed in accordance with the National Environmental Policy Act, which requires the identification and evaluation of alternatives and public review and involvement prior to their implementation.

The Service proposes to initiate, update, revise, and/or implement eight step-down management plans for Chassahowitzka NWR within the 15-year timeframe of the comprehensive conservation plan. A list of these plans and their associated completion dates is presented in Table 6. The following sections describe each of the proposed step-down plans.

Wildlife Inventory and Monitoring Plan

A priority issue and critical need is for data collection in order to guide wildlife habitat management on the refuge. Wildlife populations need to be adequately monitored to properly determine their population trends, identify their management needs, and evaluate the impacts of management actions. This plan will identify target species, and describe inventorying and monitoring techniques for surveys of priority species or species groups. Priorities will include ecosystem resiliency and diversity at the species, community and landscape levels, as well as listed species. The plan will designate the key species and species assemblages and associated habitats that will be inventoried and monitored. A timetable for inventory and monitoring will be developed.

Fire Management Plan

The purpose of this plan is to implement the policies, objectives, and standards for fire management presented in the Fire Management Handbook (621 FW 1-5), Department Manual (620 DM), and Service Manuals (095 FW 3, 232 FW6, 241 FW 3, and 241 FW 7). It will provide guidance for achieving the resource management objectives defined in the refuge's resource management plans and comprehensive conservation plan. The primary purpose of burning on Chassahowitzka NWR is to open needlerush for habitat enhancement of whooping cranes. Guidance will be provided to staff for carrying out fire management operations, such as prescribed burning for habitat improvement and fuel reduction, and wildfire suppression activities. A Fuels and Fire Effects Monitoring Plan will be included as an appendix to this plan.

Habitat Management Plan

This plan will guide all habitat management activities on the refuge. It will be developed within a structured decision-making framework to ensure the integration of adaptive management principles. The plan will delineate the current and desired future condition of major land cover types, and identify the habitat needs of associated wildlife. It will outline the appropriate application of various management tools, such as prescribed fire, herbicide treatments, and mechanical or hand removal of vegetation. It will include parameters for using adaptive management principles to fine-tune management and to improve results for targeted priority wildlife species, species assemblages, and habitats. This plan will also address integrated pest management. Native and nonnative plant and animal species (e.g., hogs) on the refuge may require direct management strategies and intervention to control their abundance, distribution, and impacts upon refuge resources, particularly predation of endangered species at risk of extinction. The plan will outline management strategies to monitor and control pest and invasive plant and animal species.

Law Enforcement Plan

This plan provides a ready reference to Service, regional and local law enforcement resources regarding refuge policies, procedures, and programs for refuge law enforcement. It describes the objectives of the law enforcement function on the refuge. It addresses the type of jurisdiction, active memoranda of understanding, and authorities of refuge officers both on and off the refuge. It describes current assets that are available (e.g., vehicles, boats). The plan addresses crimes on refuge lands, and includes patrols and traffic control; plain clothes operations; surveillance; and investigations. It outlines procedures for custodial arrests, execution of warrants, intrusion alarm responses, searches and rescues, medical emergencies, and crowd control. The plan also describes procedures for the physical security of the refuge's personnel and assets.

Visitor Services Management Plan

This plan will guide the refuge's visitor services program. It will include strategies to avoid or minimize visitor impacts to wildlife and their habitats, and address trail maintenance needs, the six wildlife-dependent recreation priorities, recreation in the wilderness area, and interpretation of the refuge's valuable cultural resources. It will provide quality visitor opportunities for present and future generations. Specific emphasis will be placed on assessing and enhancing the environmental education and other interpretive programs, and potentially developing a new visitor contact station if the headquarters building is replaced. As a part of an appendix to this plan, a signage plan will be written to improve communication of information and regulations to visitors.

Hurricane Preparedness Plan

This plan is updated annually to prepare for the protection of facilities, employees, and natural resources during extreme weather events, particularly tropical storms and hurricanes.

Spill Prevention, Control and Countermeasure Plan

This plan outlines the procedures, methods, and equipment used at the refuge to comply with the EPA's oil spill prevention, control, and countermeasure standards, and the associated inspection, reporting, training, and record-keeping requirements found in 40 CFR 112.

Wilderness Management Plan

This plan will guide refuge operations and land management in designated wilderness areas in accordance with the mandates of the Wilderness Act. It will address the public activities that are permitted and how they will be managed; public use facilities, activities, and improvements; public health and safety; research; and resource protection. It will also include strategies for assessing new acquisitions for wilderness designation; evaluations of the threat of invasive species; and the monitoring of air quality in the Class 1 airshed.

Table 6. Chassahowitzka NWR step-down management plans.

Step-down Plan	Completion Date
Hurricane Preparedness Plan (2010)	Annually
Visitor Services Management Plan (new)	2014
Habitat Management Plan (new)	2015
Law Enforcement Plan (2010)	2015
Wilderness Management Plan (1981)	2017 *
Fire Management Plan (2010)	2015
Spill Prevention, Control and Countermeasure Plan (2011)	2018
Biological Inventory and Monitoring Plan (1992) to be renamed Wildlife Inventory and Monitoring Plan	2019
Land Protection Plan (new)	2020

** The Wilderness Management Plan will be revised within two years of the issuance of a Solicitor's opinion on jurisdiction issues, or no later than 2017.*

MONITORING AND ADAPTIVE MANAGEMENT

Adaptive management is a flexible approach to long-term management of biotic resources that is directed over time by the results of ongoing monitoring activities and other information. More specifically, adaptive management is a process by which projects are implemented within a framework of scientifically driven experiments to test the predictions and assumptions outlined within a plan.

To apply adaptive management, specific survey, inventory, and monitoring protocols will be adopted for the refuge. The habitat management strategies will be systematically evaluated to determine management effects on wildlife populations. This information will be used to refine approaches and determine how effectively the objectives are being accomplished. Evaluations will include ecosystem team and other appropriate partner participation. If monitoring and evaluation indicate undesirable effects for target and nontarget species and/or communities, then alterations to the management projects will be made. Subsequently, the comprehensive conservation plan will be revised. Specific monitoring and evaluation activities will be described in the step-down management plans.

PLAN REVIEW AND REVISION

This comprehensive conservation plan will be reviewed annually as the refuge's annual work plans and budgets are developed. It will also be reviewed to determine the need for revision. A revision will occur if and when conditions change or significant information becomes available, such as a change in ecological conditions or a major refuge expansion. The final plan will be augmented by

detailed step-down management plans to address the completion of specific strategies in support of the refuge's goals and objectives. Revisions to the comprehensive conservation plan and the step-down management plans will be subject to public review and NEPA compliance.

SECTION B. ENVIRONMENTAL ASSESSMENT

I. Background

INTRODUCTION

The U.S. Fish and Wildlife Service (Service) has prepared this Environmental Assessment for Chassahowitzka National Wildlife Refuge (NWR) in compliance with the National Environmental Policy Act of 1969 and the National Wildlife Refuge System Improvement Act of 1997. Following a public review and comment period on the Draft Comprehensive Conservation Plan and Environmental Assessment (Draft CCP/EA), a final decision will be made by the Service that will guide the management actions of Chassahowitzka NWR over the next 15 years.

The Draft CCP (Section A) proposes a management direction, which is described in detail through a set of goals, objectives, and strategies. It addresses current management issues and provides long-term management direction and guidance for the refuge.

This Environmental Assessment (EA) determines and evaluates a range of reasonable management alternatives. The intent is to support informed decision-making regarding future management of the refuge. Each alternative presented in this EA was generated with the potential to be fully developed into a final CCP. The predicted biological, physical, social, and economic impacts of implementing each alternative are analyzed in this EA. This analysis assists the Service in determining if the alternatives represent no significant impacts, thus requiring the preparation of a Finding of No Significant Impact; or if the alternatives represent significant impacts, thus requiring more detailed analysis through an Environmental Impact Statement and a Record of Decision. Following public review and comment, the Service will select an alternative to be fully developed for this refuge.

PURPOSE AND NEED FOR ACTION

The purpose of the proposed action is to establish and implement a management direction for Chassahowitzka NWR for the next 15 years. The action is needed because an adequate, long-term comprehensive plan for managing the refuge does not exist. Management of the refuge is currently guided by general policies, federal mandates, and a limited number of specific step-down action plans, the latter of which are in need of revision.

The Service has identified a number of issues, concerns, and needs through discussions with the public, agency managers, and partnering agencies. For a description of the refuge's priority resource issues, please refer to Chapter III, Plan Development, in the Draft CCP. To address these issues and concerns, the Service's planning team devised three alternatives; evaluated the environmental consequences of implementing each alternative; and recommended Alternative C as the proposed management action. In the opinion of the Service and the planning team, Alternative C, Adaptive Management, is the best approach to guide the refuge's future management direction.

DECISION FRAMEWORK

Based on the assessment described in this document and public comments concerning the significance of the described effects, the Service must decide whether the proposed action would significantly impact the environment. If so, then an Environmental Impact Statement would be prepared. If the proposed action is not found to be significant, then a Finding of No Significant Impact

(FONSI) would be prepared. The FONSI is a statement that describes why the selected alternative will not have a significant effect on the quality of the human environment. This determination is based on an evaluation of the mission of the Service and the Refuge System, the purpose(s) for which the refuge was established, and other legal mandates. Assuming that no significant impact is found, a final Comprehensive Conservation Plan for Chassahowitzka NWR would be prepared and adopted. The plan will then be monitored annually and revised when necessary.

PLANNING STUDY AREA

Chassahowitzka NWR is located on the west coast of peninsular Florida. It is roughly 60 miles north of St. Petersburg and situated on the Gulf of Mexico coast in Citrus and Hernando counties. The northern boundary runs parallel to and includes some of the Homosassa River. The 31,000-acre refuge extends southward across the Chassahowitzka River for 12 miles to its southern boundary at Raccoon Point.

AUTHORITY, LEGAL COMPLIANCE, AND COMPATIBILITY

The Service has developed this plan in compliance with the National Wildlife Refuge System Improvement Act of 1997 and Part 602 (National Wildlife Refuge System Planning) of the Fish and Wildlife Service Manual. The actions described within this plan also meet the requirements of the National Environmental Policy Act of 1969. The refuge staff has achieved compliance with this Act through the involvement of the public and the incorporation of an environmental assessment in this document, with a description of the alternatives considered and an analysis of the environmental consequences of the alternatives (Chapters III and IV in this EA). When fully implemented, the plan will strive to achieve the vision and purposes of Chassahowitzka National Wildlife Refuge.

The plan's overriding consideration is to carry out the purposes for which the refuge was established. The laws that established the refuge and provided the funds for acquisition state the purposes (please refer to Chapter II, Refuge Overview, in the Draft CCP for the refuge's purposes). Fish and wildlife management is the first priority in refuge management, and the Service allows and encourages public use (wildlife-dependent recreation) as long as it is compatible with, or does not detract from, the refuge's mission and purposes.

COMPATIBILITY

The National Wildlife Refuge System Administration Act of 1966, as amended by the National Wildlife Refuge System Improvement Act of 1997, states that national wildlife refuges must be protected from incompatible or harmful human activities to ensure that Americans can enjoy Refuge System lands and waters. Refuges are closed to public use unless specifically allowed through appropriate use determinations (Appendix E) and compatibility determinations (Appendix F). Before public activities or uses are allowed on a national wildlife refuge, they must be found to be compatible. A compatible use is defined as one that "... will not materially interfere with or detract from the fulfillment of the mission of the Refuge System or the purposes of the refuge." In addition, "wildlife-dependent recreational uses may be authorized on a refuge when they are compatible and not inconsistent with public safety."

A list of the 13 public uses proposed for Chassahowitzka NWR and their compatibility determinations are provided in Appendix F.

PUBLIC INVOLVEMENT AND THE PLANNING PROCESS

In accordance with Service guidelines and the requirements of the National Environmental Policy Act, public involvement has been a crucial factor throughout the planning process in developing the Draft Comprehensive Conservation Plan and Environmental Assessment for Chassahowitzka National Wildlife Refuge. This plan has been written with input and assistance from interested citizens, conservation organizations, and representatives of local, state, and federal agencies. The participation of these stakeholders and their ideas has been of great value in setting the management direction for Chassahowitzka NWR.

For a description of the Service's public involvement efforts and the planning process that was used to develop the plan, please refer to Chapter III, Plan Development, in the Draft CCP (Section A).

II. Affected Environment

For a description of the affected environment, please refer to Chapter II, Refuge Overview, in the Draft Comprehensive Conservation Plan (Section A).

III. Description of Alternatives

FORMULATION OF ALTERNATIVES

The planning team identified three alternatives or different management actions and activities designed to achieve the refuge's purposes, vision, and goals; the mission of the National Wildlife Refuge System; and the mission of the Service. The alternatives are described below. They represent different approaches for managing and operating the refuge over a 15-year timeframe to provide protection, restoration and management of the refuge's fish, wildlife, plants, habitats, and other resources, as well as to provide appropriate and compatible wildlife-dependent uses. Each alternative was evaluated based on how it would address the 12 priority resource issues that were identified by the Service, its partnering agency advisors, and the public during public scoping, as detailed in Chapter III of the Draft CCP (Section A). Table 7, which follows the summaries, presents a comparison of how each alternative addresses the management issues. The table is grouped by each of the five goals outlined in Chapter IV of the Draft CCP.

FEATURES COMMON TO ALL ALTERNATIVES

Several elements of refuge management are common to all three alternatives. All management activities that could impact natural, wilderness, and cultural resources would be managed to comply with all applicable laws, regulations, and policies. As the plan is implemented and projects are developed, they will be subject to applicable future permit requirements. Individual projects may require additional consultation with the Service's Regional Archaeologist and the State of Florida's Historic Preservation Office. Consultation with the Service's Ecological Services Office and state and federal permits are likely to be required when the specifics of project development are known.

Each of the alternatives described below aims to protect, restore, and enhance the refuge's natural diversity and abundance of native fish and wildlife populations, as well as the habitats that support them. They attempt to promote public awareness, understanding, and appreciation of the refuge's natural resources through enhanced education and interpretive programs. They would protect the refuge's archaeological, cultural and historic resources, as well as protect and preserve the wilderness character of those refuge lands designated as wilderness areas. Finally, the alternatives would seek sufficient funding for adequate staffing and administrative support necessary to meet the refuge's goals and objectives in managing and protecting its wildlife resources.

DESCRIPTION OF ALTERNATIVES

Alternative A describes the refuge's current management (i.e., managing without an approved CCP) and is the baseline for the other two alternatives. All ongoing activities described in Alternative A would be continued in Alternatives B and C. Assuming the addition of new resources, both Alternatives B and C include other actions, mostly dealing with increased resource protection and enhanced research capability (inventory and monitoring). Alternative B is the option that proposes increased capability primarily through outside funding. It relies on the use of partnerships and a modest staff increase. Research would be enhanced beyond priority, high profile imperiled species. While Alternative C would also heavily rely on partnerships and the use of a volunteer corps for every program area, it assumes Service funding well above current levels and proposes additional staffing to provide optimal resource protection and management capability. Research under Alternative C would include a broader suite of species, as well as habitat studies for the adaptive management of the refuge's wildlife populations.

ALTERNATIVE A: CURRENT MANAGEMENT (NO ACTION)

Alternative A assumes no further commitment of resources and continues the refuge's management activities and programs at levels similar to the current and past few years of management. Although various refuge managers have believed the Crystal River NWR Complex (complex) to be historically understaffed, this alternative also takes into account a possible reduction of refuge funding or staffing.

Wildlife and Habitat Management

Under Alternative A, the management goal for all the major habitat types on the refuge is to generally maintain them and where appropriate, actively manage and enhance them for wildlife. Chassahowitzka NWR has a high diversity of community types and endemic species, with many imperiled species. The refuge's primary mission is to provide habitat for wildlife. Currently, the complex has a small staff and funding source for the inventory and monitoring of natural resources. Much effort has been put into some imperiled species, such as whooping cranes and manatees, as a result of cooperative partnerships with academic and other research organizations. Certain species, such as birds, have been monitored over time by the refuge's biological staff and academic partners. Under this alternative, these studies would continue. The Service would continue to acquire inholdings (only from willing sellers) under the refuge's current approved acquisition boundary.

Top priority and high profile imperiled species such as the whooping crane and manatee would remain the focus of wildlife and habitat management and species research under Alternative A. Habitat manipulation of marsh is done to accommodate the wintering experimental (captive-bred and raised) whooping crane population. The refuge would continue its partnership with the Whooping Crane Eastern Partnership (WCEP) by providing and maintaining the pen site for first-year cranes. Predator control to minimize predation of whooping cranes would be used as needed. Prescribed burning would also be conducted in the maintenance shop area to reduce fuel loads, which would also benefit other species such as gopher tortoises and indigo snakes.

Priority mammal species efforts would continue and the Service would remain a partner in the Florida Manatee Recovery Plan effort. Law enforcement officers would continue to enforce the seasonal boating speed limit for manatee protection, and the refuge staff would assist the Florida Fish and Wildlife Conservation Commission (FWC) in stranding and recovery events. Officers would continue to investigate illegal harvest of American alligators and to protect other imperiled species from illegal take and, where feasible, disturbance.

To fulfill the refuge's purpose as a sanctuary for migratory birds, the Service would attempt to minimize human disturbance threats to water birds from boating and other activities on the refuge and to seasonally protect sensitive nest sites and active rookeries. There are no seasonal closures around the nests of raptors at present.

Under an ongoing partnership, the FWC collects deer data through hunter check stations during managed hunts on the refuge and the neighboring Chassahowitzka Wildlife Management Area (WMA). The FWC would also conduct health checks on deer, such as testing brain stems for chronic wasting disease. Currently, ongoing biological surveys are conducted according to protocols developed in the 1992 Inventory and Monitoring Plan for wintering waterfowl and coots; bald eagles; shore, marsh and wading birds; colonial breeding birds; manatees; and black bear. This plan would be updated by 2020. Incidental sightings of eastern indigo snakes, sea turtles (Atlantic green, Atlantic Ridley, and Atlantic loggerhead), Gulf sturgeon, and dolphins would continue to be recorded. Wood stork numbers would be recorded during monthly water bird surveys. The refuge staff would coordinate with partners to perform research studies on the black bear. The Service would also

continue to issue special use permits (SUPs) for the conduct of field research studies by partners (please refer to Appendix M for a listing of current and past projects).

A new Habitat Management Plan (HMP) would be developed by 2015. The Service would continue to work with partners and/or support research on water quality and quantity studies (e.g., Project Coast, Mote Marine Laboratory studies). Water quality and quantity management would be modified according to the findings from these studies. The refuge would continue to participate in the Southwest Florida Water Management District's (SWFWMD's) efforts in designating minimum flows and levels (MFLs) for springs within the refuge's watersheds.

As detailed in the current (2010) Fire Management Plan (FMP) and annual prescriptions, prescribed fire would be used periodically to open dense stands of needlerush in the marsh for the benefit of whooping cranes. No active management of other swamp hardwoods, mangroves, shallow bays, tidal streams, and submerged aquatic vegetation would occur. Upland forests would be subjected to prescribed fire as necessary to control fuel loads, but not for habitat management (e.g., maintenance area).

The treatment and control of invasive and nuisance plants and nuisance pest animals would remain as described in Chapter II of the Draft CCP, with ongoing control of Brazilian pepper on the refuge and opportunistic monitoring of treated sites and treatment as needed. The refuge staff would continue regional partnerships and grant-funded work with partners such as the FWC. Feral hogs would be removed opportunistically by refuge staff and through a limited harvest by hunters during the existing WMA and Homosassa Tract hunts. The refuge staff would also opportunistically document evidence of new or increased populations of invasive animals. An integrated pest management plan would be included in the 2015 HMP.

Baseline data has yet to be established for some protected species, species suites, habitats, and cultural resources. The effects climate change is not known. Elements of climate change that could potentially affect the refuge include saltwater intrusion from sea level rise and more frequent and/or more potent storm events. Under Alternative A, no active research or management regarding climate change would be conducted, other than opportunistic observations.

Visitor Services

A primary recommendation of the visitor services program review team was to improve facility and resource protection information for visitors. This is because most access is by boat and there are no refuge-owned boat launch areas. Under Alternative A, the Service would maintain the public contact station at the headquarters until a new visitor center is developed at Three Sisters Springs in Crystal River, and continue to provide visitors with updated informational brochures about the refuge. Directional, entrance, boundary, and regulatory signage would be maintained and replaced as needed. Current visitor information on the refuge's website regarding programs and facilities would be enhanced and maintained. Public use information signs would be installed at the three off-refuge boat launch sites and the primitive kayak/canoe launch at the Salt Marsh Trail site. There would be a yearly evaluation and maintenance of existing kiosks and panels at the Mason Creek, Chassahowitzka River and MacRae's boat ramps, Dog Island, the refuge maintenance area, and the Salt Marsh Trail site.

Under the existing Public Use Plan, the six priority public uses and several others would be allowed. Commercial uses would continue to be allowed, including commercial fishing and shellfishing (crabbing) and guided eco-tours for sightseeing, fishing and scalloping. Hunting on the refuge would continue as described in Chapter II of the Draft CCP, in partnership with the FWC.

Under Alternative A, the Salt Marsh Trail site would continue to provide hands-on activities and environmental education (EE) programs for students from Homosassa Elementary School. Interpretive opportunities would be maintained, primarily via the panels and kiosks at this site. The key interpretive messages would be wildlife identification, habitats and features (e.g., cranes, salt marshes, fish, alligators, swamps, prescribed fire).

Visitor opportunities for wildlife observation and photography under Alternative A include the Dog Island viewing area and the Citrus County Canoe Trail. The Salt Marsh Trail site has an observation tower and trail on the river. A nature trail is also available at the maintenance shop adjacent to U.S. Highway 19/98. Both nonmotorized and motorized boating would continue to be allowed on the refuge. Airboats would be confined to two designated trails in Citrus County, while being permitted in Hernando County waters. At the Salt Marsh Trail site, the Service would maintain a primitive kayak and canoe launch, picnic pavilion, and observation tower.

The refuge's outreach efforts would continue to strengthen public relations with local, state, and federal elected officials, and to coordinate and publicize events on and offsite through the use of news media. The refuge would join the local Chamber of Commerce and Tourist Development Council organizations. Working with partners, the refuge would continue to annually support or host at least five local outreach activities or events to promote the refuge and its purpose and mission.

The refuge would continue to support and depend upon local and seasonal volunteers; provide recreational vehicle (RV) trailer campsites for their overnight lodging; and conduct annual volunteer training and recognition programs. All current activities with the Friends of Crystal River National Wildlife Refuges Complex, Inc. (Friends group) would be continued and supported.

Resource Protection

Under Alternative A, efforts to promote visitor safety, protect resources, and ensure public compliance with refuge regulations would continue as a primary duty of the complex's two officers. Visitor service personnel also provide safety and refuge regulation information.

The refuge's wilderness area would be managed in accordance with the 1981 Wilderness Management Plan. Within two years of acquisition, new lands would be evaluated as potential wilderness study areas.

In keeping with its responsibilities under cultural and historic preservation laws, cultural resource protection is addressed in refuge operations. The Service aims to protect all known archaeological sites on the refuge from illegal take or damage. Archaeological surveys would be conducted as opportunities arise. The Service would continue to develop partnerships to aid in the management of the refuge's cultural resources and actively consult with the regional archaeologist.

Refuge Administration

Alternative A would aim to provide sufficient funding for the adequate staffing and administrative support necessary to meet the refuge's goals and objectives for managing and protecting wildlife resources.

Staffing for the complex under Alternative A includes 10 permanent positions:

- 1 Project Leader
- 1 Deputy Project Leader
- 1 Wildlife Refuge Specialist

- 1 Office Assistant (Administrative)
- 1 Wildlife Biologist
- 1 Maintenance Mechanic
- 1 Small Craft Operator
- 1 Visitor Services Specialist
- 2 Park Rangers/Wildlife Officers (Law Enforcement)

In addition, temporary student/intern and term-limit employees are used to support the refuge staff.

The refuge would maintain existing assets, infrastructure, facilities and equipment and replace equipment as needed. Extensive databases would be maintained for all refuge resources.

The Service currently works with a large number of volunteers and partnerships for research, public use, maintenance and operations. All partnerships would be maintained and encouraged. To facilitate crane research, the refuge would provide and maintain trailers and parking pads for WCEP volunteers at the maintenance shop, manage the marsh, and maintain the crane pen.

ALTERNATIVE B: INCREASED RESEARCH AND MANAGEMENT VIA PARTNERSHIPS

Under this alternative, the management efforts and activities of Alternative A would continue as described, but the refuge would take on some additional responsibilities, primarily by seeking more outside funding, partnerships, and a modest increase of staffing/funding. The net benefit of this alternative is that a more comprehensive inventory and long-term monitoring program would be conducted, not just for high priority imperiled species but for a broader suite of species. In addition, the environmental effects of climate change and the effects of fire on refuge habitats would be studied for future habitat management.

Wildlife and Habitat Management

Under Alternative B, protection of imperiled species would be improved through enhanced inventory and monitoring. These studies are proposed via the use of refuge staff, partnerships and volunteers. In addition to the monthly bird counts, the following studies and efforts would be initiated:

- Add point counts for black rail.
- Determine the use of wintering habitats on the refuge by whooping cranes.
- Participate in a regional alliance to monitor abundance and distribution of migratory birds.
- Determine what constitutes disturbance to migratory birds on the refuge.
- Determine the origin of wood storks wintering on the refuge.
- Initiate seasonal (spring/fall) point counts for neotropical migrants.
- Initiate a breeding bird survey.
- Initiate an annual aerial survey for all raptor species as part of a larger annual avian survey.
- Investigate the reasons for the decline in waterfowl use of the refuge.
- Add more aerial manatee surveys.
- Determine the seasonal use of the refuge by sea turtles.
- Determine the seasonal use of the refuge by the Gulf sturgeon.
- Conduct research projects to help determine a better season to conduct prescribed burns, which may benefit eastern indigo snakes.
- Survey and monitor to detect changes in key species as they relate to climate change.

- Conduct submerged aquatic vegetation (SAV) surveys to determine their health and the extent of damage from propeller scarring.
- Survey and monitor to detect changes in key species of invertebrates as they relate to climate change.
- Conduct a literature study of blue crabs.

Several habitat protection studies are also proposed under Alternative B:

- Determine if documented salinity increases and observed habitat changes (e.g., die-off of cabbage palms) are related to climate change from rising sea level or reduced spring flow.
- Increase information and research to enable adaptive management to cope with long-term climate change impacts.
- Determine desired future conditions by conducting a baseline assessment and developing forest management options.
- Monitor the response of wildlife to prescribed burns and wildfire effects.

Alternative B would expand ongoing efforts to control invasive and nuisance plants and animals by developing an Integrated Pest Management Plan for the refuge within the HMP; aggressively controlling feral hogs for the next decade; targeting early detection of species for eradication; and removing incipient populations of invasive plants (e.g., cogon grass). The Service would also cooperate with the South Florida Invasive Species Strike Team to use their assistance on the refuge.

New habitat management is proposed. In marsh, mechanical means would be used to open dense stands of needlerush, provided the minimum tool analysis allows for this in the wilderness area. The Service would protect submerged habitats from propeller scarring through partnerships with other agencies sharing responsibility for seagrass beds and SAV. As science, technology, and climate policy evolve, the refuge would educate partners and the public about the Service's policies, programs and efforts to study, document and address climate change.

Visitor Services

Alternative B would expand upon the provisions of Alternative A by developing a visitor services step-down management plan and by adopting compatibility determinations for the "Big Six" uses and other nonwildlife-dependent uses. Commercial operators (tour and guiding, fishing, photography) in Citrus County would be brought under special use permits. Under Alternative B, law enforcement efforts would be heightened during the active fishing seasons, such as the scallop season.

Key interpretive messages would focus on natural and primitive processes, including new messages on global climate change, the Strategic Habitat Conservation (SHC) initiative, and Landscape Conservation Cooperatives (LCCs). The Service would complete interpretation opportunities on the refuge website by 2013 and maintain a weekly update of these opportunities. Within the next 10 years, the refuge would create a station-specific video and virtual tours of the refuge as needed. A crane pen webcam would be developed for visitors, and the trail at the maintenance shop would be maintained to interpret wildlife use. New kiosks or updated interpretive panels are proposed at five sites.

Under Alternative B, enhanced opportunities for photography and wildlife observation would include:

- By 2014, establish key photo spots with Global Positioning System (GPS) points and accompanying maps, and post them on the refuge website.
- In 2015, host a photography class with partners (Friends group).
- Add an observation tower to the Dog Island facility.

Additional feral hog hunts would be evaluated on the Citrus County portion of the refuge. The impacts of visitors upon refuge resources would be assessed by contracting a study to determine the current level of visitor use on the refuge and to establish future visitor use thresholds if needed. The complex's use of volunteers would be greatly improved with a new staff person dedicated as a volunteer coordinator. Monthly volunteer meetings would be initiated and cooperation with the Friends group would be enhanced. As new Friends group presidents are elected, the refuge's visitor services staff would schedule a retreat to establish sound target goals for the group for the next 15 years. The staff would also work with the Friends group to increase their knowledge and understanding of Service policy and guidance while supporting the refuge mission.

Resource Protection

Alternative B would seek a supervisory law enforcement (LE) position and partnerships with other agencies to support local area law enforcement, enhancing visitor safety and natural, cultural, and wilderness protection.

In addition to all provisions of Alternative A, under Alternative B, the refuge's wilderness plan would be updated and wilderness provisions incorporated into all other refuge operations. To promote cultural resource protection, funding would be sought to support a refuge-wide cultural resource literature search and overview. The visitor services program would promote educational awareness to the public by providing an understanding and appreciation of the refuge's ecology and the human influence on the region's ecosystems (i.e., a visitor service theme).

Refuge Administration

Alternative B would include the current 10 permanent staff positions for the Crystal River NWR Complex listed in Alternative A, and add three more positions for a total of 13 full-time equivalent employees (FTEs). The complex's three additional staff positions would be:

- 1 Wildlife Refuge Specialist
- 1 Park Ranger (Volunteer Coordinator)
- 1 Office Assistant (Administrative)

A Wildlife Refuge Specialist would be hired for the complex to deal with administrative work, including the Service Asset and Maintenance Management System (SAMMS), special use permits (SUPs), pesticide use proposals (PUPs), annual narratives, monthly activity reports, and to serve as an outreach coordinator, etc. A dedicated Volunteer Coordinator and Administrative Assistant would be added to the complex. In addition to maintaining the refuge's vehicles and assets and replacing them as needed, this alternative seeks to provide composting toilets at the adjacent Salt Marsh Trail site, a pole barn at the maintenance area, and maintenance improvements at both upland trails.

This alternative proposes a cooperative action approach to maintaining and enhancing the use of volunteers and current partnerships and to developing new partnerships with the local communities, other government agencies, and nongovernmental organizations to further refuge goals of common benefit and interest and to conduct research.

ALTERNATIVE C: ADAPTIVE MANAGEMENT (PROPOSED ACTION)

The distinguishing aspects of Alternative C are that it provides for enhanced management capability, particularly in the areas of habitat management and natural resource protection, and for enhanced visitor service opportunities. With increased capability for baseline inventory beyond imperiled species, better decisions can be made to address species needs and habitat management. Under this alternative, studies would be conducted to determine the effects of management actions taken on the refuge and then apply that information to decision-making for future actions and refuge operations. Significant improvements also would be made to the refuge's infrastructure and visitor use facilities under this alternative.

Wildlife and Habitat Management

While Alternative B concentrates on obtaining baseline data for priority imperiled species, Alternative C would provide baseline data for a suite of animal species refuge-wide, some of which have not been inventoried nor their presence documented. The addition of a Geographic Information Systems (GIS) Specialist position would allow biologists and managers to input, map and access refuge-specific mapped data. Imperiled species management would be applied from the data generated for more active management of populations and to provide suitable habitat or to meet other species survival needs. Under Alternative C, the following research projects would be implemented for wildlife and habitat management, some with their applied management proposed:

- Manipulate habitat to increase the amount of wintering habitat available to the whooping cranes by conducting annual burns in a mosaic pattern near the pen area in order to enhance crane-foraging habitat.
- Consider the efficacy of removing portions or sections of the existing impoundment and restoring the natural hydrology. Based on data and study findings, consider closure of certain areas for waterfowl habitat needs.
- Initiate research projects on wood storks to determine issues/needs on nesting areas and protection needs for their wintering grounds.
- Participate in a regional alliance for colonial waterfowl, contributing survey data to a regional data base.
- Manage for any direct threats from disturbance to waterfowl.
- Seek partnerships for mist-netting research through Monitoring Avian Productivity and Survivorship stations (MAPS).
- Initiate black rail research.
- To determine the level of threat for manatee injury and mortality from boating, conduct a boating activity study.
- In coordination the USGS Sirenia Project and the FWC, initiate a tracking survey to monitor the summer habitat of manatees. Data from these studies would be used to make recommendations to the FWC on when and/or where boating speed zones may be needed.
- Conduct a salt marsh vole population study through a partnership.
- Work with partners to complete research on diamondback terrapins, box turtles, and pigmy rattlesnakes within the wetland habitats, and research on gopher tortoise population trends at the maintenance area facility.

- Conduct a general baseline, abundance and distribution survey of nonlisted species (e.g., deer, small and large mammals).
- Conduct and update a baseline abundance and distribution study of reptiles and amphibians on the refuge.
- Conduct a baseline evaluation of invertebrates with emphasis on pollinators and other key insects.
- Conduct a literature study of blue crabs or use graduate students to do the same.
- If needed, the refuge would initiate a study to evaluate the effects of crabbing on blue crab population and the effects of trapping on the submerged aquatic vegetation of the refuge.
- Map the occurrence of invasive species and work with the South Florida Invasive Species Strike Team to develop an Integrated Pest Management Plan, which would be included in the HMP.
- Initiate a Cooperative Invasive Species Management Area (regional focus).
- Conduct public outreach and educational programs to educate refuge visitors, employees, neighboring landowners, etc. about invasive species control and eradication.
- Study the effects of feral hogs on refuge lands and evaluate the effectiveness of other state land hunting programs.
- Conduct public outreach and educational programs to develop public understanding of the damage to refuge resources and need for invasive animal control.
- Evaluate the feasibility of hog hunting and control on the refuge and overall, aggressively eradicate incipient populations of invasive species.
- Prioritize research to ascertain the impacts of climate change on the refuge's vegetation (habitats) and imperiled species.
- Participate in the Peninsular Florida LCC and establish benchmarks to measure sea level rise; as new information becomes available, reevaluate the future status of refuge lands.
- Use prescribed fire as well as mechanical means within the refuge's wilderness area, consistent with the minimum tools analysis.
- Through law enforcement, control the loss/takings of driftwood and cutting of live cedar trees.
- Provide greater emphasis on protection of hardwood swamps for migratory birds; within five years of plan approval, the refuge would conduct baseline surveys to document the existing condition of forested wetlands.
- Expand management of mangroves by establishing seasonal disturbance-free zones for colonial nesting birds as needed.
- Seek partnerships to evaluate seagrass beds and SAV health and consider area closures for areas with documented propeller scarring as warranted.

Visitor Services

The following provisions and facilities are proposed under Alternative C to promote volunteerism and resource protection and to evaluate visitor and commercial use impacts upon refuge resources. Building on the studies and provisions of Alternative B, Alternative C would:

- expand the volunteer programs of the complex;
- add an education program to enhance resource protection under the SUP for commercial operators;
- ascertain the number and use patterns of visitors on the refuge and document any negative resource effects;
- modify visitor and commercial use on the refuge if negative effects are documented;
- use the proposed wildlife officer and biological technicians to enhance hunts/patrols;

- initiate Podcast downloads for refuge visitors for themed messages and/or a self-guided tour;
- provide expanded interpretation for the complex at the Salt Marsh Trail site;
- add an observation tower to the Dog Island facility with new interpretive panel(s);
- add new kiosks to three boat ramps and interpretive panels to the Salt Marsh Trail observation tower, proposed Dog Island viewing platform, and along the maintenance area trail;
- recommend that the Friends group initiate a photography contest (e.g., tied to refuge or Earth Day events); and
- provide weekly updates of current visitor information, programs and facilities on the refuge's website.

Resource Protection

Alternative C would seek a supervisory federal wildlife officer position for the complex and seek partnerships with other agencies to support local area law enforcement. With the addition of another wildlife officer, community policing outreach would be initiated. There would be an increased law enforcement presence in the wilderness and to protect cultural resource sites. The Service would provide outreach to neighboring communities to create awareness of wilderness resources and wilderness-specific regulations. Alternative C would expand upon the other alternatives by initiating a cultural resources inventory.

Refuge Administration

Alternative C includes adding the three staff proposed in Alternative B (*) plus five more positions for a total of eight FTEs. Additionally, under this proposal, several supervisory positions would be created and six existing positions upgraded due to the added responsibilities. The eight new proposed staff positions listed here would be added to the complex, but would have some duties on this refuge:

- 1 Wildlife Refuge Specialist*
- 1 Park Ranger (Volunteer Coordinator)*
- 1 Office Assistant (Administrative)*
- 1 Supervisory Federal Wildlife Officer
- 1 Supervisory Maintenance Worker
- 1 Maintenance Worker
- 1 GIS Technician
- 1 Biological Technician - shared position with Crystal River NWR

For a list of the costs and duties of these proposed new staff positions, please refer to Table 5 in Chapter V of the Draft CCP. Figure 14 shows the proposed organization chart for the complex.

In addition, under Alternative C, the Service would explore opportunities to use prison or trustee crews for maintenance work and evaluate using Friends group volunteers to help with various proposed wildlife and habitat management surveys.

As equipment is replaced, efforts would be made to do so with energy-efficient, low carbon emission equipment and materials, and to use renewable resources.

The refuge's facilities would be greatly improved though the implementation of the following construction and maintenance projects: replace the existing renovated house with a flood-proof office building at the headquarters site: upgrade the maintenance shop and add a five-bay pole barn;

improve onsite electric and sewerage systems; improve access, parking, and provide composting toilets at the Salt Marsh trail site; and construct an observation tower at the Dog Island facility. Efforts would be made to design and construct “green” facilities.

COMPARISON OF ALTERNATIVES

Each of the three alternatives would pursue the goals outlined in the CCP; acquire, protect, and enhance a diverse assemblage of habitats; and pursue the recovery plans for those threatened and endangered species occurring on the refuge. All are consistent with the purposes of the refuge and with the mission and goals of the National Wildlife Refuge System, but they differ in the types and levels of land management and protection to achieve the refuge’s long-term wildlife and habitat goals.

Table 7 compares the three alternatives relative to how they address the management issues identified for Chassahowitzka NWR.

Table 7. Comparison of alternatives by management issues for Chassahowitzka NWR.

Issues	Alternative A (No Action Alternative)	Alternative B (Increased Research and Management via Partnerships)	Alternative C (Adaptive Management-Proposed Alternative)
FISH & WILDLIFE POPULATION MANAGEMENT			
Goal 1: Wildlife Population Management **Protect, restore, and enhance a natural diversity and abundance of native fish and wildlife populations.**			
Update the 1992 Inventory and Monitoring Plan	This plan contains survey protocols for some species as discussed earlier.	Update the Inventory and Monitoring Step-down Plan by 2019.	Same as Alternative B, but also evaluate using Friends Group volunteers for help with surveys
Whooping Crane Eastern Partnership (WCEP)	Continue partnership with WCEP by providing and maintaining pen site for first-year cranes. Use predator control as needed.	Expand Alternative A. Seek partners to determine crane use of wintering habitats on the refuge.	Expand Alternative B. Manipulate habitat to increase the wintering forage habitat available to the cranes.
Manatees	Limited data available using aerial surveys. Partner in Florida Manatee Recovery Plan efforts for boating speed limit recommendations and enforcement. Research, stranding and recovery efforts continue to be done by staff.	Expand Alternative A. Increase the number of manatee surveys and conduct submerged aquatic vegetation (SAV) surveys to determine health and extent of prop scarring. Publish the Refuge manatee data in peer-reviewed publications.	Expand Alternative B. Conduct a boating activity study & coordinate with partners to initiate a tracking survey to ascertain the summer habitat of manatees. Use the data from these studies to ascertain when and/or where boating speed zones may need needed and suggest to FWC.
Sea turtles (Atlantic green, Atlantic Ridley, and Atlantic loggerhead)	Incidental sightings would continue.	Expand Alternative A. By working with partners, research may determine the seasonal use of the refuge by sea turtles.	Expand Alternative B. Increased knowledge from research may help the refuge better manage hunting and fishing programs and habitat protection.

Issues	Alternative A (No Action Alternative)	Alternative B (Increased Research and Management via Partnerships)	Alternative C (Adaptive Management-Proposed Alternative)
Gulf sturgeon	Incidental sightings of Gulf sturgeon using the refuge would be documented.	Expand Alternative A. By working with partners, research may determine the seasonal use of the refuge by Gulf sturgeon.	Expand Alternative B. Use data to better manage hunting and fishing programs and habitat management.
American alligator	Law enforcement would continue to investigate illegal harvest.	Working cooperatively with other law enforcement agencies may help reduce illegal harvest.	Same as Alternative B.
Wood stork	Numbers would be recorded during monthly water bird surveys.	Research projects on wood storks may help determine the origin of wood storks wintering on the refuge.	Expand Alternative B. Research projects on wood storks may determine issues/needs on nesting areas and protection needs for their wintering grounds.
Eastern Indigo snake	Incidental sightings at the maintenance shop would continue.	Research for presence/absence.	Use data from presence/absence study to evaluate the best period to conduct prescribed burns.
Migratory birds	Continue to conduct monthly bird surveys for colonial waterbirds and waterfowl.	Survey and monitor to detect changes in key species as they relate to climate change. Participate in a regional alliance to monitor abundance & distribution. Determine what constitutes disturbance to migratory birds on refuge.	Expand Alternative B. Participate in regional alliance for colonial waterfowl. Contribute survey data to regional data base. Manage for any direct threats from disturbance.

Issues	Alternative A (No Action Alternative)	Alternative B (Increased Research and Management via Partnerships)	Alternative C (Adaptive Management-Proposed Alternative)
Land Birds (5 percent of population)	Specific surveys for land birds are not being conducted.	Expand Alternative A. Seek partnerships and use volunteers to initiate seasonal (spring/fall) point counts for neotropical migrants and a breeding bird survey.	Expand Alternative B. Seek partnership for mist-netting research (MAPS).
Raptors	No seasonal closures. Continue to conduct monthly bird surveys. Continue supplying bald eagle data to FWC for its statewide data base.	Expand Alternative A. Initiate annual survey for all raptor species as part of larger avian annual survey.	Same as Alternative B.
Shorebirds, Wading Birds & Marshbirds	Continue to conduct monthly bird surveys. Conduct prescribed burns to open dense needlerush. Protect sensitive nest sites (seasonally) & active rookeries from human disturbance. Through SUPs partner to perform research studies.	Expand Alternative A. Continue yearly prescribed burning with 3-5 year intervals. Target predators in wading bird rookeries. Take measures as needed to ensure that watercraft and other uses of the refuge does not disturb birds. Initiate black rail point counts.	Expand Alternative B. Initiate black rail research.

Issues	Alternative A (No Action Alternative)	Alternative B (Increased Research and Management via Partnerships)	Alternative C (Adaptive Management-Proposed Alternative)
Waterfowl	Continue to conduct monthly bird surveys.	Expand Alternative A. Gather data to investigate reasons for decline in use of refuge. Take measures as needed to ensure that watercraft and other uses of refuges do not disturb waterfowl.	Expand Alternative B. Consider the efficacy of removing portions or sections of the existing impoundment and restoring the natural hydrology. Based on data and study findings, consider closure areas for waterfowl habitat needs.
Native Mammals	Continue state FWC partnerships to collect deer data, perform black bear research, and assist in manatee recovery plan work, particularly strandings.	Expand Alternative A. Seek partners to conduct a general baseline, abundance and distribution survey of non-listed species (e.g. deer, small and large mammals).	Expand Alternative B by initiating a salt marsh vole population study. See also Manatees above.
Fish	Continue to support current SUPs for research.	Expand Alternative A. Ask partnering agencies to conduct Gulf sturgeon research study.	Same as Alternative B.
Reptiles & Amphibians	Continue prescribed burning of maintenance shop area, which will maintain the flatwoods and sandhill ecosystems and reduce hazardous fuels.	Expand Alternative A. Seek partners to conduct and update a baseline abundance and distribution study of reptiles & amphibians.	Expand Alternative B by working with partners to complete research on diamondback terrapins, box turtles, and pigmy rattlesnakes within the wetland habitats on gopher tortoise population trends at the maintenance facility area.

Issues	Alternative A (No Action Alternative)	Alternative B (Increased Research and Management via Partnerships)	Alternative C (Adaptive Management-Proposed Alternative)
Invertebrates	Prescribed burning	Expand Alternative A. Survey and monitor to detect changes in key species as they relate to climate change. Conduct a literature review of blue crab life history, distribution and abundance.	Expand Alternative B by seeking partners to conduct a baseline evaluation of invertebrates with emphasis on pollinators and other key insects. Initiate a study if needed to evaluate the effects of crabbing on blue crab population and the effects of trapping on the refuge.
Goal 2. Wildlife Habitat Management **Protect, restore, and enhance a natural diversity and abundance of habitats for native plants and animals.**			
Habitat Management Plan	Develop and implement a habitat management plan within 3 years of CCP completion.	Same as Alternative A.	Same as Alternative A.
Water resources – water quality & quantity	Continue to work with partners and/or support research on water quality and quantity studies (e.g., Project Coast, Mote Marine Lab study). Manage according to findings. Continue to participate in SWFWMD Minimum Flow Level (MFL) designation for springs. Participate in Florida Springs Task Force.	Expand Alternative A. Designate a staff member to serves as a liaison between SWFWMD and the Refuge concerning MFL regulations and local permitting. Through partners, monitor flows to ensure meeting MFL designation limits. Monitor the effects of MFLs on the biological resources of the Refuge.	Same as Alternative B.

Issues	Alternative A (No Action Alternative)	Alternative B (Increased Research and Management via Partnerships)	Alternative C (Adaptive Management-Proposed Alternative)
Invasive Plant Control (Control of invasive and nuisance aquatic & terrestrial plants)	Brazilian pepper has been treated on refuge. FWC treated cogon grass on the main grade road between the refuge & WMA. Opportunistically monitor old invasive sites for reoccurrence of species and treat as necessary. Continue to work with partners on invasive plant control.	Expand Alternative A by developing a Pest Management Plan as part of the HMP. Annually monitor and maintain database of invasive plants on the refuge. Target early detection species for eradication. Remove incipient populations of invasive plants. (e.g., cogon grass). Work with South Florida Invasive Species Strike Team. Continue to participate in the Nature Coast Cooperative Invasive Species Management Area (regional focus).	Expand Alternative B. Map occurrence of invasive species and work with South Florida Invasive Species Strike Team to develop an Integrated Pest Management Plan. Conduct public outreach and educational programs to educate refuge visitors, employees, neighboring landowners, etc. about invasive species control and eradication.

Issues	Alternative A (No Action Alternative)	Alternative B (Increased Research and Management via Partnerships)	Alternative C (Adaptive Management-Proposed Alternative)
Invasive Animals - Integrated Predator Control **Feral Hog Control** **Control of other invasive and nuisance animals**	Limited management efforts at present on refuge lands. Feral hogs are removed opportunistically by refuge staff and limited harvest during existing WMA/ Homosassa Tract hunts. Opportunistically document signs of new or increased populations of invasive animals.	Expand Alternative A. Aggressively control hogs over the next 10 years. Partner to conduct population surveys. Be a host site for baseline study.	Expand Alternative B. Study the effects of hogs on refuge lands and evaluate effectiveness of other state land hunting programs. Conduct public outreach and educational programs to develop an understanding of the damage to refuge resources and need for invasive animal control. Evaluate the feasibility of hog hunting and control on the refuge. Aggressively eradicate incipient populations of invasive species.
Climate change (saline intrusion, storm events)	A SLAMM study has been done for the refuge which shows habitats that would be impacted. Coordinate with agency's Landscape Conservation Cooperatives (LCC). Staff continues to gain understanding and share knowledge of the key issues related to climate change.	Expand Alternative A by determining if documented increases in salinity and observed habitat changes are related to climate change from rising sea-level or reduced spring flow. Increase information and research to enable adaptive management to cope with long-term climate change impacts. As science, technology, and policy evolve, educate partners and the public about the FWS direction on climate change.	Expand Alternative B by setting priorities for climate change research to ascertain impacts to rare, threatened, and endangered species. Coordinate with partners and LCC team to establish benchmarks to measure sea level rise. As new information is available reevaluate the future status of refuge lands. Actively participate in Peninsular Florida LCC.

Issues	Alternative A (No Action Alternative)	Alternative B (Increased Research and Management via Partnerships)	Alternative C (Adaptive Management-Proposed Alternative)
Marsh/Tree islands (Salt & freshwater)	Continue use of prescribed fire to open up dense stands of needlerush. Maintain habitat, and where appropriate, manage and enhance for wildlife.	Expand Alternative A. Use mechanical means to open dense stands of needlerush (assuming minimum tool analysis allows in Wilderness).	Expand Alternative B. Use both prescribed fire and mechanical means to best open stands of needlerush (assuming minimum tool analysis allows in Wilderness). Through law enforcement, control the loss/takings of driftwood and cutting of live cedar trees.
Swamps-hardwoods	Maintain habitat, and where appropriate, manage and enhance for wildlife.	Increase invasives control.	Expand Alternative B by conducting baseline surveys to document existing condition of forested wetlands.
Mangroves	Maintain habitat, and where appropriate, manage and enhance for wildlife.	Work with partners, begin to educate public about value of mangroves and need to avoid disturbance during nesting by colonial birds.	Expand Alternative B by establish disturbance free zones for colonial nesting birds as needed.
Shallow bays, tidal streams, and submerged aquatic vegetation (SAV)	Maintain historic SAV data for the refuge. Maintain habitat, and where appropriate, manage and enhance for wildlife.	Expand Alternative A. Seek partnership to evaluate seagrass bed and SAV health.	Expand Alternative B. Consider closures for areas with documented propeller scarring as warranted.

Issues	Alternative A (No Action Alternative)	Alternative B (Increased Research and Management via Partnerships)	Alternative C (Adaptive Management-Proposed Alternative)
Upland Forest	Continue prescribed burns for fuel reduction. Acquire inholdings from willing sellers. Maintain habitat, and where appropriate, manage and enhance for wildlife.	Expand Alternative A. Determine desired future condition by conducting baseline assessment and developing forest management options.	Same as Alternative B.
Fire Management	Using the Fire Management Plan, write and implement prescriptions, such as burning on a 3-5 year rotation, using prescribed fire at the maintenance area to reduce fuel loads, & burning hundreds acres of marsh are burned every 3 years for crane habitat. Allow wildfires to burn with minimal suppression on islands and in Wilderness areas. Monitor fires and take action only to prevent loss of human life or property.	Expand Alternative A. Monitor wildlife response to prescribed burns and wildfire effects. Increase the number of marsh acres burned annually to increase the available habitat for whooping cranes	Expand Alternative B. Conduct annual prescribed burns in a mosaic pattern near the Whooping Crane pen area to enhance crane foraging habitat.
Goal 3. Promote an awareness, understanding, and appreciation of natural resources and the refuge through enhanced education and interpretive programs.			
Visitor Services Plan	Implement existing Public Use plan (written before 1997 Improvement Act).	Develop a Visitor Services step-down management plan to meet RO and refuge-specific needs.	Same as Alternative B.

Issues	Alternative A (No Action Alternative)	Alternative B (Increased Research and Management via Partnerships)	Alternative C (Adaptive Management-Proposed Alternative)
Accessibility	Refuge use is limited by existing water access points with no refuge-owned boat launch areas. On the Salt Marsh Trail site property, a primitive kayak and canoe launch is maintained. There is also access to a trail at the maintenance area.	Expand Alternative A. Evaluate and comment on proposals to develop more boat launches in the area. Expanded hunt area/access would be evaluated.	Same as Alternative B.
Welcome and Orient	Maintain the public contact station in Crystal River. Annually review and provide information through website, brochures, kiosks, etc. Maintain and replace directional, entrance, boundary and regulatory signage as needed.	Expand Alternative A. Public use information signs will be installed at four boat launch sites.	Expand Alternative B. Provide weekly updates of current visitor information, programs and facilities on the refuge's web site.
Hunting	Operate with current State hunt regulations and provide opportunities in partnership with FWC/Chassahowitzka WMA.	Expand Alternative A. Increase law enforcement patrols during the hunt season and supplement hunt checks with proposed biological technician position.	Expand Alternative B by adopting a Cooperative Agreement with FWC concerning hunting, exotic plant control, etc. Evaluate whether to open feral hog hunting on the Citrus County portion of refuge.
Fishing	Commercial and recreational fishing are currently allowed under 1994 CDs.	Expand Alternative A by having a more visible law enforcement presence during active fishing seasons (e.g., scallop season).	Expand Alternative B by redesign hunt/fishing brochure to include the location of Wilderness Areas.

Issues	Alternative A (No Action Alternative)	Alternative B (Increased Research and Management via Partnerships)	Alternative C (Adaptive Management-Proposed Alternative)
Environmental Education (EE)	Provide EE programs for students from Homosassa Elementary School at Salt Marsh Trail site.	During 15 years of CCP, set target goals to increase the number or students or classes offered at trail site.	Same as Alternative B.
Interpretation	Key messages are: wildlife identification, habitats and features (e.g. cranes, salt marshes, fish, alligators, swamps, prescribed fire) & primarily conveyed through kiosk and information panels. The development of the Three Sisters site in Crystal River will provide options.	Key messages to focus on natural and primitive processes including global climate change, SHC & LCCs with on- and off-site programs and at two trails. Enhance website interpretation and maintain weekly updates. Create a station-specific video and virtual tour of the refuge, with a webcam at the crane pen.	Expand Alternative B. Initiate Podcast downloads for refuge visitors for themed messages and/or self-tour.
Wildlife Observation and Photography	Visitor opportunities include the: Dog Island viewing area, Citrus County Canoe Trail, Salt Marsh Trail site tower and riverside trail, and nature trail at the refuge's maintenance area.	Establish key photo spots with GPS points with accompanying maps and post on website. With partners host one photo class per year beginning 2015.	Expand Alternative B. Recommend Friends group initiate a photography contest (e.g. tied to Refuge or Earth Day events). Build an observation tower on Dog Island.

Issues	Alternative A (No Action Alternative)	Alternative B (Increased Research and Management via Partnerships)	Alternative C (Adaptive Management-Proposed Alternative)
Outreach	Continue to strengthen public relations with local, state and federal elected officials and promote refuge events through the media. Work with partners to annually support at least five local outreach activities/events promoting the refuge purpose and mission.	Expand on Alternative A by updating key messages as noted in interpretation above. Actively maintain current visitor information on refuge web site regarding programs and facilities. Join local Chamber of Commerce and Tourist Development Council.	Same as Alternative B. There will be new opportunities for outreach with the addition of a new visitors' center at Three Sisters Spring (CRNWR) for the complex.
Volunteers	Continue to support local and seasonal volunteers.	Hire a dedicated Volunteer Coordinator for complex; initiate monthly volunteer meetings.	Create a more active volunteer program and develop a volunteer plan.
Friends group	Support the Friends group by attending monthly meetings, providing refuge updates, and coordinating outreach events.	Expand Alternative A by starting planning retreats and trainings on key service policies, target goals, etc.	Expand Alternative B by using Friends group to conduct environmental education programs and new outreach events (e.g. photography contest).
Appropriate Use and Compatibility Determinations	Allow existing uses under 1994 compatibility determinations.	Update and adopting compatibility determinations for existing and some new public uses.	Same as Alternative B.
Commercial operations	Currently these uses are allowed: commercial fishing and shellfishing (crabbing), and guided eco-tours for sightseeing, fishing and scalloping.	Initiate a special use permit (SUP) for all commercial operators in Citrus County (tour and fishing guides, commercial fishers, and commercial photographers).	Add an education program to the commercial SUP to enhance resource protection. Conduct surveys to determine extent and impacts of commercial use upon refuge resources.

Issues	Alternative A (No Action Alternative)	Alternative B (Increased Research and Management via Partnerships)	Alternative C (Adaptive Management-Proposed Alternative)
Research and Monitoring	Research projects that are compatible with refuge goals are approved as SUPs. Staff conducts surveys according to the Wildlife Inventory Plan.	Projects would be encouraged that support the refuge mission and revised Inventory and Monitoring Plan.	Same as Alternative B.
Mosquito Management	Citrus County was issued an SUP to conduct mosquito surveillance operations (dip counts) within its portion of the refuge. Aerial spraying would only be permitted for imminent human health concerns (rare event).	Same as Alternative A.	Same as Alternative A.
Non-Big Six Uses: **Boating (motorized and nonmotorized)**	Boating is allowed on refuge. Airboats are permitted to run in Hernando Co. and 2 routes in Citrus County. Work with Citrus County to re-establish signs for the Citrus County Canoe Trail.	Contract a study to determine the current level of visitor use on the refuge and to establish future visitor use thresholds as needed. Coordinate with partners to determine the effects on seagrass beds, especially in waters above Wilderness.	Determine the effects on seagrass beds, especially in waters above Wilderness.
Other Non-Big Six Uses:	Picnicking is permitted at the Dog Island Recreation and Salt Marsh Trail (SMT). Nature trails exist at SMT and the maintenance shop for hiking, walking, etc.	Primitive camping would be permitted along canoe/kayak trail and Salt Marsh Trail site with stipulations.	Same as Alternative B.

Issues	Alternative A (No Action Alternative)	Alternative B (Increased Research and Management via Partnerships)	Alternative C (Adaptive Management-Proposed Alternative)
Goal 4: Resource Protection **Protect archaeological, cultural and historic resources for future generations as examples of human interaction with the natural environment. Protect and preserve the wilderness character of those refuge lands designated by Congress as part of the National Wilderness Preservation System.**			
Provide visitor safety, protect resources and ensure compliance with refuge regulations	Two federal wildlife officers for the refuge complex provide periodic law enforcement, prevent, and prosecute illegal activities and enforce area closures.	Expand Alternative A by seeking a supervisory federal wildlife officer position. Seek partnerships with other agencies to support local area law enforcement.	Expand Alternative B by considering the use of a volunteer community workforce (e.g. boat captains, pilots) to observe and monitor refuge areas.
Wilderness Resources	Wilderness is managed according to the 1981 Wilderness Management Plan and Service policies.	Revise 1981 Wilderness Management Plan and incorporate wilderness provisions into other refuge step-down plans as they are updated or developed.	Expand Alternative B by adding a supervisory Wildlife Officer to add patrols and to initiate community policing and increased law enforcement presence in the Wilderness and provide outreach to neighboring communities to create awareness of Wilderness resources and wilderness-specific regulations.

Issues	Alternative A (No Action Alternative)	Alternative B (Increased Research and Management via Partnerships)	Alternative C (Adaptive Management-Proposed Alternative)
Cultural Resources – **Archaeological and Historical site protection**	Protection is addressed in refuge operations and site area closures as needed. Conduct archaeological surveys as opportunity arises. Develop partnerships to aid in the management of the refuge cultural resources. Actively consult with regional archaeologist. Protect all known archaeological sites on the refuge from illegal take or damage.	Expand Alternative A. As step-down plans for refuge operations are developed, address cultural and historic site protection. Seek funding to support a refuge-wide cultural resource literature search and overview. Promote educational awareness to the public by providing an understanding and appreciation of the refuge's ecology and the human influence on the region's ecosystems. (Visitor Service theme).	Expand Alternative B. Support a cultural resources inventory. If cultural sites are identified on the refuge, consider closure of these areas to public use and increase law enforcement patrol. The addition of a supervisory law enforcement position will add personnel to increase patrols and reduce the opportunity for vandalism or other crimes.
Goal 5: Refuge Administration **Provide sufficient funding for adequate staffing and administrative support necessary to meet refuge goals and objectives for managing and protecting wildlife resources.**			
Administrative Resources: Personnel Management	Staff of 10 permanent positions at complex: 1 Project Leader 1 Deputy Project Leader 1 Wildlife Refuge Specialist 1 Office Assistant 1 Wildlife Biologist 1 Maintenance Mechanic 1 Small Craft Operator 1 Visitor Services staff 2 Wildlife Officers (Law Enforce.)	Add three new positions for a total in the complex of 13 FTEs: 1 Wildlife Refuge Specialist 1 Park Ranger (Volunteer Coordinator) 1 Administrative Assistant	Same as Alternative B, plus add five new positions (8 total): 1 Supervisory Federal Wildlife Officer 1 Supervisory Maintenance Worker 1 GIS technician 1 Maintenance Worker 1 Biological Technician

Issues	Alternative A (No Action Alternative)	Alternative B (Increased Research and Management via Partnerships)	Alternative C (Adaptive Management-Proposed Alternative)
Administrative Resources: Facilities	Maintain existing assets, facilities and equipment on the refuge. Replace equipment as needed with "green" technologies. Secure funding to maintain crane pen and trailers for crane volunteers	Work with Friends to provide composting toilets at Salt Marsh Trail site.	Create a tower at Dog Island. A mid-sized farm tractor is needed for maintenance projects. Buy a 10-person airboat for tours.
Administrative Data Base Management and Resource Management	Maintain databases for all refuge resources—RONS, SAMMS, Real Property Inventory, LAPS, etc. .	Hire an office assistant and Wildlife Refuge Specialist (WRS) to address increasing workloads and reporting. The WRS would also have outreach duties.	Same as Alternative B.
Partnerships	Crane research - Provide and maintain trailers and parking pads for WCEP volunteers at maintenance shop, manage marsh and maintain the crane pen. See Appendices for full list of existing partnerships.	Using a cooperative action approach, the refuge will maintain and enhance current partnerships and will develop new partnerships with the local communities, other government agencies, and nongovernmental organizations to further refuge goals of common benefit and interest.	Same as Alternative B. Additionally, consider use of prison and trustee crews for refuge maintenance work.

IV. Environmental Consequences

OVERVIEW

This chapter analyzes and discusses the potential environmental effects or consequences that can be reasonably expected by the implementation of each of the three alternatives described in Chapter III. Conclusions are based on the best available scientific information, internal consultation, peer review, and the professional judgment of the CCP planning team. Appendix B provides an extensive list of references that were reviewed in preparation of this Draft CCP/EA.

The CCP is a programmatic document intended to analyze proposed actions over a 15 year-timeframe on a conceptual level to guide management direction and priorities. It should be noted that these are anticipated effects. Due to the conceptual nature of the projects proposed in this plan, actual effects will be detailed later in any step-down management plan or project proposal, which would involve federal, state, regional and/or local consultation and NEPA compliance. For example, environmental assessments (EAs) may be developed for the revised Habitat Management or Wilderness plans.

The refuge is also required to consult with the Service's Ecological Services Office prior to the implementation of any plans or actions identified in the CCP, due to the potential to affect federally listed and candidate species. Specifically, section 7(a)(2) of the Endangered Species Act (ESA) requires all federal agencies to consult with the Service to ensure that the actions they fund, authorize, permit, or otherwise carry out will not jeopardize the continued existence of any listed species or adversely modify designated critical habitats. Section 7(a)(1) of the ESA charges federal agencies to aid in the conservation of listed species. Refuge construction projects must also comply with provisions of government permits. The Service will consult with county, state, and federal agencies that have shared management interest and/or jurisdictional authority over affected resources. All applicable federal laws, regulations, and policies will be adhered to and reiterated further under specific step-down management plans.

DIRECT AND INDIRECT EFFECTS

Direct effects are caused by an action and occur at the same time as the action. Indirect effects are caused by an action but are manifested later in time or further removed in distance, but are still reasonably foreseeable. The actions proposed for implementation under the proposed alternative include the development of a new headquarters office; wildlife and population management; habitat management; resource protection; public use; and the operation of the refuge (administrative programs). These actions could likely lead to both direct and indirect effects. Facility development, for example, could lead to increased public use in certain areas, which might have potential indirect effects such as increased traffic, noise or littering.

Other indirect effects that may result from implementing the proposed action include minor impacts from siltation and ground disturbance during construction of the visitor center, elevated observation tower, and photography blind. A discussion of the effects of all three alternatives on the refuge's physical, biological, and socioeconomic environments follows. None of the direct or indirect impacts are anticipated to be significant.

EFFECTS ON THE PHYSICAL ENVIRONMENT

To assist in this analysis, the impacts on the physical environment were divided into the categories of soils, hydrology, water quality, air quality, noise, aesthetics, and facilities.

SOILS

Under Alternative A, no proposed actions would significantly degrade the soils in the refuge. Prescribed fires conducted under carefully selected environmental conditions would be managed to move quickly through the forest to reduce fine fuels and minimize pine mortality.

Burning in salt marsh and tree islands is advocated to enhance whooping crane habitat. The historic and ecological role of fire in this habitat is currently being studied. Temporary changes in soil characteristics may occur after a fire, but would be negligible and more than offset by the potential benefits conferred on crane habitat. The development of a new office building is not expected to affect any soils because it will be constructed on an already scarified existing site. A more detailed environmental assessment will be completed based on specific site plans developed for the proposed office building platform prior to construction.

Under Alternative C, mechanical and hand clearing is proposed as the primary tool to achieve the improvements at the Salt Marsh Trail (parking and access). Mechanical equipment displaces and compacts soils. Foot traffic may cause minor rutting and compaction of soils. With the possible construction of a pole barn and modifications to the maintenance shop, construction could affect soils. Upgrading the existing cleared areas may be feasible.

HYDROLOGY

Alternative B proposes a hydrological study and associated work to restore altered levee areas to a more natural hydrology. The possible implementation of this study under Alternative C would facilitate restorative efforts that would benefit natural wetland processes and enhance waterfowl habitat.

WATER QUALITY

Under all alternatives, the effects of long-term herbicide use for exotic plant control could result in a slight decrease in water quality in localized areas. With proper application under EPA-approved label instructions, no leaching of chemicals into water bodies would be expected. Under all alternatives, since exotic plant infestation areas would be discovered and treated while still relatively small, a reduced amount of herbicide would be needed for treatment, lessening the impact of herbicides and mechanical treatment that may affect local water quality.

Alternative C would monitor the consequences of gradual climatological changes, such as sea level rise, on refuge. It would confer the additional advantage of working with partners to develop predictive models to guide management strategies in light of existing and predicted changes in baseline data, and promote partnerships to maintain ambient water quality.

AIR QUALITY

Under all alternatives, impacts to air quality and visibility may be caused from smoke emissions associated with prescribed fires. All fire management activities must comply with the national air ambient air quality standards established under the Clean Air Act to protect public health and the

environment, and require authorization by the Florida Forest Service. Air quality impacts will be temporary and minimal due to careful planning of prescribed burning operations when environmental conditions (e.g., wind speed and direction, humidity, fuel moistures) are most optimal to minimize smoke production and movement. Wildfires tend to consume considerably more biomass per acre and occur under weather conditions outside the planning window of fire managers; therefore, air quality impacts are expected to be greater, though only temporary as all wildfires will be suppressed under all alternatives.

Effects on air quality from vehicular use with associated carbon emissions is likely to continue under all three alternatives due to a growing local and regional population and refuge visitation. However, this might be offset by reduced vehicle or residential emissions that could result from protecting existing or purchasing new lands that might otherwise have been developed. Compared to other land uses, all of the alternatives for the refuge would provide greater protection against degradation of daily ambient air quality over the long term. Under all alternatives, the Service will transition its vehicle fleet to alternative fuel models, and incorporate energy conservation measures into renovated and new facilities to reduce emissions and conserve resources, with an expected beneficial impact on local air quality.

NOISE POLLUTION

Under all alternatives, temporary noise and minor traffic increases would result from wildfire suppression and prescribed burning activities, in which mechanized machinery or fire trucks (in the uplands) are used. Exotic plant species control on the uplands may involve the use of hand chainsaws or a mechanized chipper to cut and mulch vegetation, which would generate temporary increases in noise for all alternatives.

Visitors to the refuge can access some areas only by airboat, an approved nonwildlife-dependent recreational activity. Two airboat routes are designated in Citrus County to access the Gulf of Mexico and Hernando Country refuge waters (nonwilderness). Under Alternative C, studies done for other purposes (boat traffic for manatee protection, commercial and visitor use studies) may lead to information to better manage these existing uses if found to be a problem.

AESTHETICS

Under all alternatives, aesthetics are expected to be positively impacted through the acquisition of inholding lands from any willing sellers. Prescribed fire may have a temporary, negative aesthetic impact to trail users and people who dislike seeing burned vegetation until new green growth appears. But there would be benefits of reducing fuel loads and enhancing and maintaining habitat for species such as whooping cranes, eastern indigo snakes and gopher tortoises (and the hundreds of commensal species that share their burrows). Also, when upland areas are brought into an uneven-aged condition through rotational or mosaic prescribed fire application, it results in greater plant diversity in the understory and a more visually appealing forest.

Exotic plant control would have temporary negative aesthetic impacts with easily observable dead and dying vegetation along roadsides in high use areas in particular. However, under all alternatives, these actions would result in a net benefit to aesthetics by preventing the establishment of exotic plant monocultures and restoring native plant diversity.

Under Alternative C, construction of a headquarters office center would have a temporary negative effect on aesthetics during the construction stages. However, the facility would be built

on the existing developed site. The completed facility would complement rather than degrade, the aesthetics. The office would be built to Service standards, conform to local building codes, and be compatible with architectural and landscaping standards desired by the local community.

EFFECTS ON THE SOCIOECONOMIC ENVIRONMENT

Each of the alternatives is anticipated to positively affect the socioeconomic factors of the community.

VISITOR SERVICES – PUBLIC USE, ACCESS, AND RECREATION

Fishing

Under all alternatives, the Service would promote resource protection by providing information on proper boating safety and fishing etiquette, and through promotion and enforcement of the state's saltwater fishing regulations. Fishing in freshwater habitats is not allowed under any of the alternatives. Special use permits would be required for commercial fishers and fishing guides under Alternatives B and C. Commercial guides and guide associations would be provided with environmental education under the proposed Alternative C.

Wildlife Observation and Photography

Under Alternative A, the refuge's current visitor facilities would be maintained. Under Alternative C, a new observation platform or tower would be constructed at Dog Island.

Environmental Education and Interpretation

Under Alternative A, current environmental education and interpretation efforts would be maintained at the Salt Marsh Trails area. Under Alternatives B and C, goals would be set to serve a greater number of students or provide a greater number of programs. Additional interpretive signs would be installed at existing boat ramp, trail and observation sites in order to increase the public's understanding of refuge resources and public use provisions. These, along with brochures and maps, will emphasize the sensitivity of wildlife to human disturbance and encourage proper wildlife viewing etiquette, resulting in long-term beneficial impacts to refuge resources. Expanded partnerships will be sought to educate businesses and their customers about appropriate and compatible wildlife-dependent recreational uses, and also promote public awareness of closed areas and prohibited uses. Such partnerships would enhance stewardship of the refuge's natural resources. Under Alternative C, the hiring of a volunteer coordinator position would allow for more training of volunteers and a larger volunteer corps to provide these services to refuge users and students.

Other Permitted Activities

Several nonwildlife-dependent public uses will be allowed to continue at existing or reduced levels on the refuge. All alternatives allow for the continued uses of boating, walking, day hiking, picnicking, commercial fishing, photography, and tours and guiding. Commercial users will be under special use permits in Alternative B, but have the added responsibility of receiving and providing resource training in an effort to educate their clients about the refuge's resources and regulations. Public access will be maintained and enhanced at upland facilities in Alternatives B and C.

REFUGE REVENUE-SHARING

Although the refuge does occupy lands that might provide income to the local tax base, those lost tax revenues are offset by enhanced property values on adjacent lands and by improved aesthetics related to conservation lands and open space. Conservation lands require less expenditure of local taxes to fund infrastructure and other services than those required by developed lands. The Service provides Citrus and Hernando counties with annual Refuge Revenue-Sharing Act payments in lieu of local property taxes.

FACILITIES

Under Alternatives A and B, there would be little or no change to the current facilities. Under Alternative C, there would be facility construction for better administration (e.g., new office building, pole barn) and new or enhanced public use facilities (trail improvements, kiosks and interpretive panels, improved parking and access to the Salt Marsh Trail site, and a canoe/kayak landing and observation tower at Dog Island). These facilities would enhance visitor use opportunities.

PUBLIC HEALTH AND SAFETY

Based on the nature of each alternative, the location of the refuge, and current land use, the three alternatives are not anticipated to have any significant or negative impacts on the quality of the human environment, including public health and safety.

EFFECTS COMMON TO ALL ALTERNATIVES

A few potential effects would be similar under each of the alternatives.

ENVIRONMENTAL JUSTICE

Executive Order 12898, “Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations,” was signed by President Bill Clinton on February 11, 1994, to focus federal attention on the environmental and human health conditions of minority and low-income populations, with the goal of achieving environmental protection for all communities. The order directed federal agencies to develop environmental justice strategies to aid in identifying and addressing disproportionately high and adverse human health or environmental effects of their programs, policies, and activities on minority and low-income populations. The order is also intended to promote nondiscrimination in federal programs substantially affecting human health and the environment, and to provide minority and low-income communities with access to public information and opportunities for participation in matters relating to human health or the environment.

None of the management alternatives described in this environmental assessment will disproportionately place any adverse environmental, economic, social, or health impacts on minority and low-income populations. Implementation of any action alternative that includes public use and environmental education is anticipated to provide a benefit to the residents residing in the surrounding communities.

CULTURAL RESOURCES

The Service is responsible for managing archaeological and historical sites found on refuge lands. Because cultural resource surveys on the refuge have been limited, additional surveys would be conducted prior to any new construction or excavation on refuge lands in order to fully satisfy the

provisions of the NEPA and all applicable cultural resource laws and policies. Potentially negative impacts from the construction of trails or facilities would require review by the Service's Regional Archaeologist and consultation with the Florida State Historic Preservation Office. Determining whether a particular management action has the potential to affect cultural resources is an ongoing process that would occur during the detailed planning stages of every project.

Service acquisition of land with known or potential archaeological or historical sites provides three major types of protection for these resources: protection from private development (e.g., into single-family homes); protection from damage by federal activities; and protection from vandalism or theft. The Service's policy is to preserve these resources in the public trust, avoiding impacts whenever possible. Minimal or no negative impacts are anticipated for any particular cultural resources of the refuge under any of the alternatives. As a whole, positive impacts are expected to the cultural resources due to management and protection of these resources under all of the alternatives. However, the level of positive impacts to cultural resources varies by alternative.

CLIMATE CHANGE

U.S. Department of the Interior Secretarial Order 3226 states that "there is a consensus in the international community that global climate change is occurring and that it should be addressed in governmental decision making…This Order ensures that climate change impacts are taken into account in connection with Departmental planning and decision making." Additionally, it calls for the incorporation of climate change considerations into long-term planning documents such as the CCP. Global atmospheric concentrations of carbon dioxide, methane, and nitrous oxide have increased markedly as a result of human activities since 1750 and now far exceed pre-industrial values determined from ice cores spanning many thousands of years. The global increases in carbon dioxide concentration are due primarily to fossil fuel use and land use changes, while those of methane and nitrous oxide are primarily due to agricultural operations (Bindoff et al. 2007). The increase of carbon dioxide within the earth's atmosphere—from about 280 parts per million (ppm) in the pre-industrial era to about 390 ppm and rising in 2011—has been linked to the gradual rise in surface temperatures commonly referred to as global warning.

In relation to comprehensive planning for national wildlife refuges, carbon sequestration is one of the primary climate-related impacts to be considered in planning. The U.S. Department of Energy's *Carbon Sequestration Research and Development* (U.S. Department of Energy 1999) defines carbon sequestration as "...the capture and secure storage of carbon that would otherwise be emitted to or remain in the atmosphere." The land is a tremendous force in carbon sequestration. Terrestrial biomes of all sorts—grasslands, forests, wetlands, tundra, perpetual ice, and desert—are effective both in preventing carbon emissions and in acting as a biological "scrubber" of atmospheric carbon monoxide. The conclusions of the Department of Energy's report noted that ecosystem protection is important to carbon sequestration and may reduce or prevent the loss of carbon currently stored in the terrestrial biosphere.

The Wildlife Society (TWS) published an informative technical review report in 2004 entitled, *Global Climate Change and Wildlife in North America* (Inkley et al. 2004). It interprets results and details from such publications as the Intergovernmental Panel on Climate Change reports (1996-2002) and describes the potential impacts and implications on wildlife and habitats. It mentions that projecting the impacts of climate change is hugely complex because not only is it important to predict changing precipitation and temperature patterns, but more importantly, to predict their rate of change, as well as the exacerbated effects of other stressors on the ecosystems. Those stressors include loss of wildlife habitat to urban sprawl and other developed land uses; pollution; ozone depletion; exotic species; disease; and other factors.

Projections over the next 100 years indicate such major impacts as extensive warming in most areas, changing patterns of precipitation, and significant acceleration of sea level rise. According to the TWS report, "…other likely components of ongoing climate change include changes in season lengths, decreasing range of nighttime versus daytime temperatures, declining snowpack, and increasing frequency and intensity of severe weather events" (Inkley et al. 2004). The TWS report details known, and possible influences on, habitat and wildlife including changes in primary productivity, changes in plant chemical and nutrient composition, changes in seasonality, sea level rise, snow, permafrost, and sea ice decline, increased invasive species, pests and pathogens, and impacts on major vertebrate groups. The effects of climate change on populations and range distributions of wildlife are expected to be species-specific and highly variable, with some effects considered negative and others considered positive.

Generally, the prediction in North America is that the ranges of habitats and wildlife will generally move upwards in elevation and northward as temperatures rise. Species with small and/or isolated populations and low genetic variability will be least likely to withstand the impacts of climate change. Species with broader habitat ranges, wider niches, and greater genetic diversity should fare better or may even benefit. This will vary depending on specific local conditions, changing precipitation patterns, and the particular response of individual species to the different components of climate change (Inkley et al. 2004). The TWS report emphasizes that developing precise predictions for local areas is not possible due to the scale and accuracy of current climate models, which is further confounded by the lack of information concerning species-level responses and to ecosystem changes, their interactions with other species, and the impacts from other stressors in the environment. In other words, only imprecise generalizations can be made about the implications to refuge management from regional climate change.

Conserving natural habitat for wildlife is the heart of any long-range plan for national wildlife refuges. All alternatives presented for Chassahowitzka NWR include protection and management of natural habitats, which help to sequester carbon and minimize climate change impacts. This, in turn, contributes positively to efforts to mitigate human-induced global climate changes. Further, while the Alternative A currently pursues information to better understand climate change and its impacts on the resources of the refuge, the other two action alternatives (Alternatives B and C) propose additional management and coordination to increase this understanding and to adapt management as necessary to better respond to these impacts.

LAND ACQUISITION

Funding for land acquisition within the approved acquisition boundary of Chassahowitzka NWR would come from the Land and Water Conservation Fund; the Migratory Bird Conservation Fund; or donations from conservation and private organizations. Some inholding tracts are located within the refuge's acquisition boundary. Under all alternatives, the Service would seek to acquire these identified lands from any willing sellers as funding becomes available.

SUMMARY OF ENVIRONMENTAL EFFECTS

Table 8 summarizes the environmental effects of each of the three alternatives. It follows the same format that was used in Table 7 in Chapter III. Table 8 is also presented in the same order as the five goals identified in Chapter IV of the Draft CCP. Under each goal, each of the corresponding priority issues described in Chapter III of the Draft CCP is addressed.

The purpose of an environmental assessment is to determine if there are any significant adverse effects to a proposed action, which would require the initiation of an Environmental Impact Statement and actions to mitigate those effects. Table 8 provides a summary statement of each anticipated environmental effect. The legend for this table is as follows:

Neutral means that there is no observable effect, positive or negative, from implementing a planned action.

Positive means that there would be benefits to the refuge's physical, biological or socioeconomic environments by implementing an action as described in the plan.

Negative means that there would be some adverse impact to implementing a proposed action. Those that are minor, temporary, or mitigated in some way to provide a net benefit or improvement would not be considered a significant, adverse action.

Most mean that of the three alternatives, this alternative has the most positive or negative effects.

This plan was designed to have net positive benefits under all three alternatives.

Table 8. Summary of environmental effects by alternative for Chassahowitzka NWR.

Priority Issues	Alternative A Current Management (No Action)	Alternative B (Increased Management through Partnerships)	Alternative C (Increased Management- Proposed Action)
FISH & WILDLIFE POPULATION MANAGEMENT			
Goal 1: Wildlife Population Management **Protect, restore, and enhance a natural diversity and abundance of native fish and wildlife populations.**			
Inventory and Monitoring Plan	Neutral to positive. Protocols would be updated but no new ones added.	Positive. The plan would be revised and updated by 2019 and new species protocols added.	Most Positive. The addition of a biological technician would improve capability to survey and contract studies. The addition of a GIS specialist would aid data entry, mapping and reporting. Possible use of volunteers from Friends group may increase capacity for monitoring.
Whooping Cranes	Neutral to positive. Current efforts on behalf of cranes would continue, providing some benefits.	Positive. Possible involvement of partners may increase knowledge of crane use of refuge habitats.	Most Positive. Manipulating wintering crane habitat to increase forage availability would be beneficial.
Manatee	Neutral to positive. The manatee sub-population would likely be maintained.	Positive. Boating, manatee survey and seagrass studies would add knowledge to improve species management.	Most Positive. Greater protective measures may reduce accidental mortality and increase numbers.

Priority Issues	Alternative A Current Management (No Action)	Alternative B (Increased Management through Partnerships)	Alternative C (Increased Management- Proposed Action)
Sea turtles (Atlantic green, Atlantic Ridley, and Atlantic loggerhead)	Neutral to positive. Coastal waters, SAV, and aquatic organisms would be protected.	Positive. By working with partners, research may determine the seasonal use of the refuge by sea turtles.	Most Positive. Increased knowledge from research may help the refuge better protect habitat and manage hunting and fishing programs.
Gulf sturgeon	Neutral to positive. Coastal waters would continue to be protected.	Positive. By working with partners, research may determine the seasonal use of the refuge by Gulf sturgeon.	Most Positive. Increased knowledge from research may aid in resource protection and management.
American alligator	Neutral to positive. Coastal waters would continue to be protected.	Positive. Research projects on alligators may help determine their population dynamics.	Positive. Same as Alternative B.
Wood stork	Neutral to positive. Coastal habitat would continue to be protected.	Positive. Research projects on wood storks may help determine the origin of wood storks wintering on the refuge.	Most Positive. Research projects on wood storks may determine issues/needs on nesting areas and protection needs for their wintering grounds.

Priority Issues	Alternative A Current Management (No Action)	Alternative B (Increased Management through Partnerships)	Alternative C (Increased Management- Proposed Action)
Eastern indigo snake	Neutral to positive. Upland habitat would continue to be protected and prescribe burned every 3-5 years to reduce fuel loads.	Positive. Research projects may help determine a better time period to conduct prescribed burns.	Positive. Same as Alternative B.
Migratory Birds	Neutral to positive. Continued surveys and protective measures would maintain current abundance and distribution.	Positive. Combination of increased surveys, monitoring, and collaboration with partners would improve prospects of migratory birds on refuge.	Most Positive. Combination of increased surveys, monitoring, collaboration with partners, and reduction in disturbance would improve prospects.
Land Birds	Neutral to positive. Continued surveys and maintenance of habitats would likely maintain current abundance and distribution.	Positive. Increased surveys and maintenance of habitats would likely maintain current abundance and distribution and improve knowledge to inform management.	Most Positive. In addition to Alternative B provisions, some habitat management is proposed.
Raptors	Neutral. No active management or research.	Positive. Increased surveys and maintenance of habitats would improve knowledge to inform management.	Positive. Same as Alternative B.

Priority Issues	Alternative A Current Management (No Action)	Alternative B (Increased Management through Partnerships)	Alternative C (Increased Management- Proposed Action)
Shorebirds, Wading Birds & Marshbirds	Positive. Prescribed burning of needlerush and nest site protection, and research studies would benefit these species.	Positive. Greater number of partnerships and studies.	Most Positive. More resources (research funding and bio-tech) to conduct research and adaptively manage for populations. Hydrology studies may lead to habitat manipulation.
Waterfowl	Neutral to positive. Monthly bird surveys and continuing habitat protection would benefit waterfowl populations, although perhaps insufficient to offset historic population declines.	Positive. Additional data-gathering may determine new causes for the decline in waterfowl numbers.	Most Positive. Potentially more beneficial than Alternative B depending on results of studies and closure decisions.
Native Mammals	Neutral to positive. FWC partner efforts benefit deer and black bear. Refuge maintenance of habitats benefits all mammals	Positive. Partner-assisted surveys of non-game mammals would increase knowledge base and enhance management.	Positive. Saltmarsh vole population study would benefit that species if detected.
Fish	Neutral to positive. Fish populations, sport and commercial fishing would all continue on refuge.	Positive. Gulf sturgeon research study would improve knowledge and potential for managing this federally listed species.	Positive. Same as Alternative B.

Priority Issues	Alternative A Current Management (No Action)	Alternative B (Increased Management through Partnerships)	Alternative C (Increased Management- Proposed Action)
Reptiles & Amphibians	Neutral to positive. Prescribed burning would provide localized benefits for gopher tortoise and indigo snake.	Positive. Baseline abundance and distribution study of reptiles and amphibians would increase knowledge and improve management capability. Expanding prescribed fire to upland portions of refuge would increase habitat for species such as gopher tortoises and indigo snakes.	Positive. Same as Alternative B.
Invertebrates	Neutral. Climate change may begin to affect diversity, distribution, and abundance of species.	Positive. Proposed surveys and monitoring related to climate change would be essential to adaptive management.	Positive. Study results may prompt refuge habitat or species management actions.

Priority Issues	Alternative A Current Management (No Action)	Alternative B (Increased Management through Partnerships)	Alternative C (Increased Management- Proposed Action)
FISH AND WILDLIFE POPULATION MANAGEMENT			
Goal 2: Wildlife and Habitat Management **Protect, restore, and enhance a natural diversity and abundance of habitats for native plants and animals.**			
Water Resources - Water Quality & Quantity	Neutral. Water quality and quantity, affected by mainly external factors outside the refuge boundaries, such as development upstream, unlikely to change substantially.	Positive. If research partnerships are available, studies would be undertaken to determine hydrology changes from impoundments, climate change impacts and salinity changes.	Most Positive. Biological and GIS staffing capability would be enhanced to conduct, contract and report/map data, which would be used in management decisions, such as whether hydrologic restoration is needed. Staff would participate in MFL reviews.
Invasive Plant Control	Neutral. Opportunistic and spot treatment of invasive plants.	Positive. Integrated Pest Management Plan, early detection and eradication, and other efforts would likely increase control and related benefits.	Most Positive. Additional proposed efforts should help eradicate and control more invasives over a broader area of the refuge.
Invasive Animals and Integrated Predator Control	Neutral. Opportunistic removal of feral hogs somewhat reduces their impacts on native flora and fauna.	Positive. An integrated pest management plan would be included within the HMP by 2015. Increased control efforts would further reduce impacts on native flora and fauna.	Most Positive. In addition to Alternative B, there would be increased public outreach and an evaluation of the feral hog hunting program.

Priority Issues	Alternative A Current Management (No Action)	Alternative B (Increased Management through Partnerships)	Alternative C (Increased Management- Proposed Action)
Climate Change	Neutral to negative. A large external threat, saline intrusion from sea level rise, warming trends, and storm events likely to damage existing habitats and adversely affect key species of wildlife dependent on these habitats.	Neutral to negative. Saline intrusion and storm events likely to damage existing habitats and adversely affect key species of wildlife dependent on these habitats. Greater information may assist with adaptive management to mitigate adverse effects.	Neutral to negative. Same as Alternative B. This global phenomenon is hard to mitigate at the local level, but studies to document climate change effects are proposed and may lead to solutions.
Marsh/tree island (marine and freshwater)	Neutral to positive. Limited use of prescribed fire to open dense stands of needlerush improves habitat somewhat for waterfowl and other marsh birds.	Positive. Use of prescribed fire to open dense stands of needlerush will result in enhance crane habitat.	Positive. Expanded use of both prescribed fire and mechanical treatments would benefit habitat. Tree islands protected through more law enforcement against take.
Hardwood swamps	Neutral. No major changes in habitat quantity or quality expected. Potential adverse impacts from sea level rise and saline intrusion likely to continue.	Neutral to positive. Potential partnership with FWC would benefit refuge habitat by removing exotics.	Positive. Baseline surveys and certain protective measures may enhance swamps for migratory birds.

Priority Issues	Alternative A Current Management (No Action)	Alternative B (Increased Management through Partnerships)	Alternative C (Increased Management- Proposed Action)
Mangroves	Neutral. No major changes in habitat quantity or quality expected. Potential effects from sea level rise and saline intrusion likely to continue.	Neutral to positive. Greater educational efforts may increase appreciation and protection by public.	Neutral to positive. Establishment of disturbance free zones for colonial nesting birds may increase value of mangroves for these species.
Shallow bays, tidal streams, and submerged aquatic vegetation (SAV)	Neutral. Climate change and sea level rise may change distribution and abundance.	Neutral to positive. Partnerships may result in protection of SAV from propeller damage.	Neutral to positive. SAV health evaluations and area closures may increase quality and habitat restoration.
Upland Forest	Neutral to positive. No active management of upland forests on refuge but continuing acquisition of any inholdings by willing sellers would protect more area.	Neutral to positive. Beginning baseline inventory and determining desired future conditions are first steps in active habitat management in upland forests, and may eventually yield benefits.	Neutral to positive. Adaptively manage prescribed fire to benefit habitat.
Fire Management	Neutral to positive. Implementation of Fire Management Plan maintains and improves habitat.	Positive. More beneficial since it includes monitoring of wildlife response to both prescribed and wildfire.	Most Positive. Annual prescribed burns for whooping cranes would provide additional habitat available for forage.

Priority Issues	Alternative A Current Management (No Action)	Alternative B (Increased Management through Partnerships)	Alternative C (Increased Management- Proposed Action)
VISITOR SERVICES			
Goal 3: Visitor Services **Promote an awareness, understanding, and appreciation of natural resources and the refuge through enhanced education and interpretive programs.**			
Accessibility	Neutral. Current limited number of access points would not change.	Neutral to positive. Limited access does conserve refuge's wildness.	Neutral to positive. Promotion of upland sites and uses and the Dog Island facility would occur through improvements of trails and new viewing areas.
Hunting	Neutral to positive. Continuing to provide limited hunting opportunities for waterfowl, small game, large game and migratory birds would represent a public benefit.	Positive. Expanding law enforcement patrols would reduce poaching and protect the public.	Positive. Expanding law enforcement patrols would reduce poaching and protect the public. Opening additional area to hunting would benefit this public use.
Fishing (Recreational)	Neutral to positive. Continuing to provide sport and limited commercial fishing opportunities and facilities would represent a public benefit.	Positive. Expanding law enforcement presence during active fishing season would reduce poaching and protect the public.	Positive. Same as Alternative B.
Environmental Education	Neutral to positive. EE would continue offsite.	Neutral to positive. Same as Alternative A.	Neutral to positive. Same as Alternative A.

Priority Issues	Alternative A Current Management (No Action)	Alternative B (Increased Management through Partnerships)	Alternative C (Increased Management- Proposed Action)
Interpretation	Neutral to positive. Limited interpretive features and opportunities on the refuge would continue.	Positive. Proposed expansion of interpretation would enhance public knowledge and appreciation of refuge resources.	Positive. Hiring a volunteer coordinator would add a volunteer corps for this purpose and in developing program materials.
Wildlife Observation and Photography	Neutral to positive. The Dog Island facility provides one of many scenic vistas. Trails for airboats and on uplands make the refuge accessible to view wildlife.	Positive. An annual photography class is proposed along with a self tour of scenic vistas.	Most Positive. In addition to Alternative B, a photography contest is proposed. The construction of an observation platform on Dog Island would add opportunities.
Outreach	Positive. Continue existing levels and types of outreach which promote the refuge to the public, stakeholders, and community leaders.	Positive. A Wildlife Refuge Specialist would be hired for the complex to handle outreach issues. Information promoted on website.	Most Positive. In addition to the provisions of Alternative B, the hiring of a Volunteer Coordinator would generate a volunteer corps for this purpose.
Volunteers	Positive. Existing opportunities for volunteers would continue, benefiting both the refuge and the public.	Positive. Capacity of volunteer program would be expanded.	Most Positive. Creation of a volunteer coordinator position on refugee staff would increase potential size, complexity and capacity of volunteer program.

Priority Issues	Alternative A Current Management (No Action)	Alternative B (Increased Management through Partnerships)	Alternative C (Increased Management- Proposed Action)
Friends group	Positive. Staff support of Friends Group would continue.	Positive. Collaboration with Friends Group would increase.	Most Positive. Collaboration with Friends group would intensify and contributions increase by conducting EE and outreach events.
Commercial operations	Negative. All current commercial operations would be allowed to continue at approximately current levels.	Neutral to positive. Initiating SUP would allow for improved refuge control of commercial operations. Partners may help determine the number of commercial crabbers, fishing and scalloping tours that occur on refuge.	Neutral to positive. Adding an education program may enhance resource protection. Management actions may be initiated depending on the results of seagrass and commercial use studies and the Solicitor opinion on Wilderness Area issues and authority.
Research and Monitoring	Neutral. All research that is compatible with the refuge goals is approved under an SUP. Refuge staff conducts monitoring according to the Wildlife Inventory Plan.	Neutral to positive. Research may increase through partnerships. Partnerships may aid in conducting refuge monitoring.	Neutral to positive. Additional research projects may be approved with additional staff. Additional staff may assist with conducting additional refuge monitoring projects.

Priority Issues	Alternative A Current Management (No Action)	Alternative B (Increased Management through Partnerships)	Alternative C (Increased Management- Proposed Action)
Mosquito Management	Positive. Citrus County is permitted to conduct dip counts on the refuge. Spraying is not permitted and would only be allowed in rare imminent human health emergencies under refuge approval.	Positive. Same as Alternative A.	Positive. Same as Alternative A.
Non-Big Six Use: Boating (motorized and nonmotorized)	Neutral to positive. Nonmotorized and motorized boating would continue to be allowed on refuge.	Neutral to positive. Proposed study on visitor use levels would facilitate more informed decision-making on whether and how to limit non Big Six public uses. Effects on seagrass beds would be determined.	Neutral to positive. Level of airboat use to be permitted still undetermined. Effects on seagrass beds would be determined and the Service would adaptively manage accordingly through area closures and possible restoration.
Other Non-Big Six Uses:	Negative to neutral. Picnicking would continue at the Dog Island Recreation and Salt Marsh Trail areas. The trail around the maintenance shop would be maintained. Camping is currently not allowed.	Neutral to positive. Same as Alternative A, plus interpretive signs would be placed along existing trails.	Neutral to positive. New, primitive camp sites would be accommodated along the Citrus County Canoe Trail. Additional camping may be allowed for groups providing an environmental service for the refuge in the maintenance area. Camps associated with hunting may be evaluated in the future.

Priority Issues	Alternative A Current Management (No Action)	Alternative B (Increased Management through Partnerships)	Alternative C (Increased Management- Proposed Action)
RESOURCE PROTECTION			
Goal 4: Resource Protection **Protect archaeological, cultural and historic resources for future generations as examples of human interaction with the natural environment. Protect and preserve the wilderness character of those refuge lands designated by Congress as part of the National Wilderness Preservation System.**			
Resource Protection	Neutral to negative. Two Federal Wildlife Officers for the complex insufficient to establish presence on refuge and serve as a deterrent to illegal activities.	Neutral to positive. Partnerships and new supervisory Federal Wildlife Officer position, if obtained, would enhance law enforcement presence and deterrence effect.	Most Positive. Partnerships and new supervisory Federal Wildlife Officer position, if obtained, would enhance law enforcement presence and deterrence effect. Use of a volunteer community workforce could increase observational capacity of law enforcement.
Wilderness Resources	Neutral to negative. Increasing public uses, especially boating, continue to compromise wilderness values like solitude from noise and other evidence of human and mechanical intrusion.	Neutral. Updating the 1981 Wilderness Management Plan would enable the refuge to address issues affecting designated Wilderness.	Most Positive. Although human pressures and intrusions would continue in Wilderness Area, their adverse impact could be ameliorated somewhat by increased law enforcement, community policing, and public awareness of wilderness values.

Priority Issues	Alternative A Current Management (No Action)	Alternative B (Increased Management through Partnerships)	Alternative C (Increased Management- Proposed Action)
Cultural Resources – Archaeological and Historical site protection	Neutral. Known cultural resources and sites may continue to be looted due to lack of law enforcement.	Positive. Refuge-wide cultural resource literature search and overview and increased public awareness would enhance protection and appreciation of cultural resources.	Most Positive. If funding could be obtained for cultural resources survey, additional sites, properties, and cultural resources would be discovered and probability of protection increased.
REFUGE ADMINISTRATION			
Goal 5: Refuge Administration **Provide sufficient funding for adequate staffing and administrative support necessary to meet refuge goals and objectives for managing and protecting wildlife resources.**			
Staff	Neutral to positive. Managing the complex of 5 refuges is challenging for the present staff of ten FTEs.	Positive. Adding three FTEs would expand the refuge's ability to fulfill its purposes, goals, and objectives.	Most Positive. Adding eight FTEs would be optimal for refuge management and responsibilities.

Priority Issues	Alternative A Current Management (No Action)	Alternative B (Increased Management through Partnerships)	Alternative C (Increased Management- Proposed Action)
Administrative, Utilities, Equipment, and signage	Neutral. Facilities, equipment, signage and infrastructure unchanged.	Positive. Installing composting toilets at adjacent Salt Marsh Trail site would benefit visitors.	Most Positive. Augment facilities and assets by adding an observation tower at Dog Island, heavy equipment for maintenance, airboat for tours, etc. A new pole barn, improvements to Salt Marsh trail access, and a new office building would benefit visitors and have minimal effects due to being on existing disturbed sites. Traffic is expected to decrease at the headquarters when the visitor center is relocated to another site.
Administrative Data Base Management and Resource Management	Neutral to positive. All databases for refuge resources maintained.	Same as Alternative A. Adding an office assistant would reduce administrative burden of current staff.	Positive. Increased staffing (wildlife refuge specialist) would expand database and reporting capacity.
Partnerships	Neutral to positive. All current partnerships with other agencies, universities, and other institutions would be maintained.	Positive. Mutually beneficial partnerships would be expanded.	Positive. Same as Alternative B.

UNAVOIDABLE IMPACTS AND MINIMIZATION MEASURES

Under Alternative A, the no action alternative, there are a number of unavoidable impacts, including a less than ideal level of law enforcement presence necessary to protect existing and increasing visitor use, especially unauthorized and illegal uses, because the vast majority of the refuge is remote, inaccessible, and designated as wilderness; disturbance of wildlife and solitude associated with wilderness; continued degradation of native plant and wildlife habitat due to the invasion of exotic and nuisance species of plants and animals; water contamination; storms, salt water intrusion, and sea level rise associated with climate change; and a continued loss of habitats outside the refuge due to development and habitat fragmentation. If these issues are not addressed, they will continue to negatively impact refuge resources.

Alternatives A and C, the action alternatives, also have some of the same unavoidable impacts, but they are expected to be less severe due to adaption and mitigation measures undertaken by the refuge. The following sections describe measures the refuge will employ to minimize potential impacts resulting from implementation of the proposed action.

EFFECTS ON WATER QUALITY FROM SOIL DISTURBANCE AND HERBICIDE USE

Any soil disturbance and siltation due to water management activities, road maintenance, and construction of trails, observation platforms, or boardwalks are expected to be minor and of short duration. To further reduce potential impacts, the refuge will use best management practices such as erecting silt fences or broadcasting native grass seed over denuded areas to minimize erosion of soils into water bodies.

Long-term herbicide use to control invasive plant species outbreaks and infestations could result in a slight, localized degradation of water quality. Through proper application of selected herbicides and adjuvants appropriate to site-specific conditions, herbicidal control of invasive plants seeks to benefit the environmental health and integrity of the refuge. Appropriately used herbicides and adjuvants may have a minimal short-term impact on water quality in the immediate vicinity of the application, where significant and unexpected rain events or high winds may move recently applied and highly mobile herbicides. The use of site-appropriate herbicides is a proven standard methodology to control and manage exotic plant infestations presently degrading native plant and wildlife habitats throughout Florida, and their proper application following label requirements greatly reduces the risks to water quality. Every effort will be employed to ensure proper and appropriate application of herbicides to control noxious weeds throughout the refuge.

WILDLIFE DISTURBANCE

Disturbance to wildlife is an unavoidable consequence of any public use program, regardless of the activity involved. While some activities may be less disturbing than others, all public use activities proposed will be planned to avoid unacceptable levels of impacts. At Chassahowitzka NWR, the main form of wildlife disturbance is from human-operated motorized watercraft—boats, personal watercraft (i.e., jet skis), and airboats. Boating in and of itself is not a wildlife-dependent activity, although anglers must use boats to access fishing grounds and engage in fishing, which is a wildlife-dependent public use.

Levels of disturbance from the proposed action are not considered to be high and are not significantly adverse. The refuge will determine whether to allow more airboat use or limit further all motorboat use. Where appropriate, providing access for fishing opportunities allows the use of a renewable natural resource without adversely impacting other resources. General wildlife observation may

result in minimal disturbance to wildlife. If the refuge determines that impacts from the expected additional visitor uses are above acceptable levels, those uses will be modified, discontinued, restricted, or rerouted to other less sensitive areas and/or properties to minimize impacts.

VEGETATION DISTURBANCE

Negative impacts could result from the maintenance or construction of trails that require clearing of nonsensitive vegetation along their lengths. This is expected to be a minor, short-term, and discrete impact.

USER GROUP CONFLICTS

As public use increases, unanticipated conflicts between different user groups could occur. If this should happen, the refuge will adjust its programs, as needed, to eliminate or minimize any public use issues. The refuge will use methods that have proven to be effective in reducing or eliminating public use conflicts. These methods include establishing separate use areas, different use periods, and limits on the numbers of users in order to provide safe, quality, appropriate, and compatible wildlife-dependent recreational opportunities.

EFFECTS ON ADJACENT LANDOWNERS

Implementation of the proposed action is not expected to negatively affect owners of private lands adjacent to the refuge. Positive impacts that would be expected include higher property values, less intrusion of invasive exotic plants, increased aesthetics, and increased opportunities for viewing more diverse wildlife.

However, some negative impacts may occur. To help minimize these potential impacts on adjacent landowners, the refuge will work with partners to provide informational signs that clearly mark refuge and partnering agency boundaries; maintain the partners' existing parking facilities and appropriate access points; use law enforcement; and provide increased educational efforts at the visitor contact stations. Prescribed burning could negatively impact adjacent landowners, but the refuge would minimize effects by informing the public well in advance of any burns. Furthermore, prescribed burns would be relatively infrequent (on a less than annual basis) and of short duration (lasting hours). Prescribed burning on refuge lands will also benefit adjacent landowners by decreasing fuel loads and minimizing the risk of catastrophic fires.

LAND OWNERSHIP AND SITE DEVELOPMENT

Land acquisition efforts by the Service could lead to changes in land use. If additional lands are acquired, they would be restored and maintained in a natural state and managed for native wildlife populations in accordance with goals, objectives, and strategies developed in the CCP. Additional lands acquired for the refuge would be evaluated for appropriate and compatible wildlife-dependent public uses.

Potential development of any refuge structures or other improvements could lead to minor short-term discrete negative impacts on plants, soils, and some wildlife species. When building structures, efforts would be made to use recycled products and environmentally sensitive treated lumber. All construction activities would comply with all applicable laws, policies, and treaties, including the requirements of Section 404 of the Clean Water Act, the National Historic Preservation Act, and Executive Order 11988, Floodplain Management.

CUMULATIVE IMPACTS

A cumulative impact is defined as an impact on the natural or human environment that results from the incremental impact of the proposed action when added to other past, present, and reasonably foreseeable future actions, regardless of which agency (federal or nonfederal) or person undertakes such other actions (40 CFR §1508.7). Cumulative impacts are the overall net effects on a resource that arise from multiple actions. Impacts can "accumulate" spatially, when different actions affect different areas of the same resource. They can also accumulate over the course of time, from actions in the past, the present, and the future. Occasionally, different actions counterbalance one another, partially canceling out each other's effect on a resource. But more typically, multiple effects add up, with each additional action contributing an incremental impact on the resource. In addition, sometimes the overall effect is greater than merely the sum of the individual effects, such as when one more reduction in a population crosses a threshold of reproductive sustainability and threatens to extinguish the population.

A thorough analysis of impacts always considers their cumulative aspects, because actions do not take place in a vacuum. There are virtually always some other actions that have affected that resource in some way in the past, or are affecting it in the present, or will affect it in the reasonably foreseeable future. So any assessment of a specific action's effects must in fact be made with consideration of what else has happened to that resource, what else is happening, or what else will likely happen to it.

The Service is not aware of any past, present, or future planned actions that would result in a significant negative cumulative impact when added to the refuge's proposed management activities, as outlined in the proposed action.

None of the alternatives are expected to have significant cumulative adverse impacts on hydrology, water quality, or floodplains. All alternatives include measures to increase coordination with partners to address concerns related to water quality, quantity, and timing, especially in relation to the watershed.

The management activities in the proposed action are intended to maintain or improve the area's biological resources, protecting the biological integrity of the refuge. Benefits are anticipated for rare, threatened, and endangered species; migratory birds; and native wildlife and habitat diversity, including the minimization of negative impacts associated with exotic, invasive, and nuisance species.

The management activities in the proposed action are not anticipated to have significant adverse impacts on climate change. The effects of climate change on populations and range distributions of wildlife are expected to be species-specific and highly variable, with some effects considered negative and others considered positive. Generally, the prediction in North America is that the ranges of habitats and wildlife will generally move upwards in elevation and northward as temperatures rise. Species with small and/or isolated populations and low genetic variability will be least likely to withstand the impacts of climate change. Species with broader habitat ranges, wider niches, and greater genetic diversity should fare better or may even benefit. This will vary depending on specific local conditions, changing precipitation patterns, and the particular response of individual species to the different components of climate change (Inkley et al. 2004). One measure that the Service is undertaking nationwide is the effort to reduce the carbon footprint of the agency. The Refuge Complex will strive to reduce its carbon footprint through a variety of conservation measures that could include alternative energy, energy-saving appliances, energy-efficient vehicles (e.g., hybrid and electric), and recycled and recyclable materials. The proposed management action includes working with partners to understand and ameliorate the impacts of climate change on the natural resources of the refuge and the area.

Further, the management activities in the proposed action are not expected to have significant adverse impacts to the cultural resources of the area; instead, they will provide enhanced protection of these resources on the refuge.

Nor are significant adverse impacts expected from the proposed action regarding the local economy; instead, the proposed management activities are anticipated to support area property values and aesthetics.

A few activities in the proposed action are anticipated to have negligible to minor cumulative impacts, including the following:

Fishing is not anticipated to cause any significant adverse cumulative effects. State catch limits would ensure that fish stocks in the area and on the refuge would not be depleted. Sportfish populations are expected to be maintained on the refuge.

The negative cumulative impacts of increased visitation, especially various forms of boating, are anticipated to be manageable. As noted at various points in this document, boating has increased substantially in recent decades. The CCP gives refuge management the prerogative to control this boating in such a way as to prevent excessive problems and conflicts with other refuge users, refuge resources, and wilderness values.

Negative cumulative effects of prescribed fire in the marshes are anticipated to be minimal. The use of relatively small in scale, prescribed burns conducted in accordance with agency policies and under an approved Fire Management Plan would help maintain local air pollution at acceptable levels. These managed burns reduce fuel loads and help prevent catastrophic wildfires that have the potential to cause serious reductions in short-term air quality.

Cumulative impacts from integrated pest control should be largely beneficial over time if the proposed program is successful. By implementing the CCP proposals, invasive plant infestations should be less problematic than at present. The proposed control of feral hogs would reduce habitat destruction, thereby cumulatively improving habitats over time and reducing competition with native fauna.

The proposed invasive plant control activities are not expected to have significant adverse cumulative effects. These activities involve mechanical removal, application of approved herbicides, release of biological control agents, and prescribed burning or a combination of these activities. The herbicides used for exotic plant control are intended only to target specific exotic plants or infestations, are approved for use in natural areas to control exotic plants, and generally do not have long-lasting residual effects to the environment, as their chemical nature provides for a relatively quick breakdown of the product upon application. Further, the use of herbicides is inherently limited based on label rates and approved application practices on refuge lands and natural areas in the State of Florida, further minimizing any negative impact. All exotic plant chemical applications would be conducted in accordance with Service policy and under an approved refuge-specific Integrated Pest Management Plan (IPMP).

Because of concerns expressed at certain other refuges about the cumulative effects of hunting, the following section analyzes and discusses in some detail the cumulative impacts of the hunting program of each alternative on a variety of resources at Chassahowitzka NWR.

ANTICIPATED IMPACTS ON WILDLIFE SPECIES

Migratory Birds

The U.S. Fish and Wildlife Service annually prescribes frameworks, or outer limits, for dates and times when hunting may occur and the number of birds that may be taken and possessed. These frameworks are necessary to allow state selections of season and limits for recreation and sustenance; aid federal, state, and tribal governments in the management of migratory game birds; and permit harvests at levels compatible with population status and habitat conditions. Because the Migratory Bird Treaty Act stipulates that all hunting seasons for migratory game birds are closed unless specifically opened by the Secretary of the Interior, the Service annually promulgates regulations (50 CFR Part 20) establishing the frameworks from which states may select season dates, bag limits, shooting hours, and other options for each migratory bird hunting season. The frameworks are essentially permissive in that hunting of migratory birds would not be permitted without them. Thus, in effect, federal annual regulations both allow and limit the hunting of migratory birds.

Migratory game birds are those bird species so designated in conventions between the United States and several foreign nations for the protection and management of these birds. Under the Migratory Bird Treaty Act (16 U.S.C. 703-712), the Secretary of the Interior is authorized to determine when "hunting, taking, capture, killing, possession, sale, purchase, shipment, transportation, carriage, or export of any ... bird, or any part, nest, or egg" of migratory game birds can take place, and to adopt regulations for this purpose. These regulations are written after giving due regard to "the zones of temperature and to the distribution, abundance, economic value, breeding habits, and times and lines of migratory flight of such birds," and are updated annually (16 U.S.C. 704(a)). This responsibility has been delegated to the U.S. Fish and Wildlife Service as the lead federal agency for managing and conserving migratory birds in the United States. Acknowledging regional differences in hunting conditions, the Service has administratively divided the nation into four flyways for the primary purpose of managing migratory game birds. Each flyway (Atlantic, Mississippi, Central, and Pacific) has a flyway council, a formal organization generally composed of one member from each state and province in that flyway. Chassahowitzka NWR lies within the Atlantic Flyway.

The process for adopting migratory game bird hunting regulations, located in 50 CFR Part 20, is constrained by three primary factors. Legal and administrative considerations dictate how long the rule-making process will last. Most importantly, however, the biological cycle of migratory game birds controls the timing of data-gathering activities and thus the dates on which these results are available for consideration and deliberation. The process of adopting migratory game bird hunting regulations includes two separate regulations—development schedules based on "early" and "late" hunting season regulations. Early hunting seasons pertain to all migratory game bird species in Alaska, Hawaii, Puerto Rico, and the U.S. Virgin Islands; migratory game birds other than waterfowl (e.g., dove, woodcock, etc.); and special early waterfowl seasons, such as those for teal or resident Canada geese. Early hunting seasons generally begin prior to October 1. Late hunting seasons generally start on or after October 1 and include most waterfowl seasons not already established. There are basically no differences in the processes for establishing either early or late hunting seasons. For each cycle, Service biologists and others gather, analyze, and interpret biological survey data and provide this information to all those involved in the process, through a series of published status reports and presentations to flyway councils and other interested parties (USFWS 2006).

Because the Service is required to take abundance of migratory birds and other factors into consideration, the Service undertakes a number of surveys throughout the year in conjunction with the Canadian Wildlife Service, state and provincial wildlife management agencies, and others. To determine the appropriate frameworks for each species, the Service considers factors such as

population size and trend, geographical distribution, annual breeding effort, the condition of breeding and wintering habitat, the number of hunters, and the anticipated harvest. After frameworks are established for season lengths, bag limits, and areas for migratory game bird hunting, migratory game bird management becomes a cooperative effort of state and federal governments. After Service establishment of final frameworks for hunting seasons, the states may select season dates, bag limits, and other regulatory options for the hunting seasons. States may always be more conservative (restrictive) in their selections than the federal frameworks, but never more liberal (less restrictive). Season dates and bag limits for national wildlife refuges open to hunting are never longer or larger than the state regulations. In fact, based upon the findings of an environmental assessment developed when a national wildlife refuge opens a new hunting activity, season dates and bag limits may be more restrictive than the state allows.

NEPA considerations by the Service for hunted migratory game bird species are addressed by the programmatic document, ‘‘Final Supplemental Environmental Impact Statement: Issuance of Annual Regulations Permitting the Sport Hunting of Migratory Birds” (FSES 88– 14), filed with the Environmental Protection Agency on June 9, 1988. The Service published a Notice of Availability in the *Federal Register* on June 16, 1988 (53 FR 22582), and a Record of Decision on August 18, 1988 (53 FR 31341). Annual NEPA considerations for waterfowl hunting frameworks are covered under separate, tiered environmental assessments. More information may be obtained from: Chief, Division of Migratory Bird Management, U.S. Fish and Wildlife Service, Department of the Interior, MS MBSP-4107-ARLSQ, 1849 C Street, Washington, D.C. 20240.

Hunting of waterfowl on the refuge is in a designated area in Citrus County and in accordance with state regulations for the Chassahowitzka WMA in Hernando County. Waterfowl hunting is permitted on Wednesdays, Saturdays, and Sundays only through the waterfowl season.

Resident Big Game

White-tailed Deer. White-tailed deer inhabit 2,560 acres of hardwood swamplands and 250 acres of upland forest in a fringe along the refuge’s eastern boundary. Little is known about the refuge’s deer herd due to its relative inaccessibility. The area occupied by the herd can be reached only by boat or by one public road, which crosses private property and then crosses two areas of state lands before entering refuge property. The FWC manages a deer hunt on the refuge in conjunction with hunting on the adjacent Chassahowitzka WMA. The FWC also conducts ongoing health checks of the deer herd at check stations during the hunting season. Despite the hunting pressure to which they are subjected, deer continue to occur on appropriate habitats within the refuge. Continuation of deer hunting on refuge lands should not have adverse cumulative impacts on the area’s and state’s deer herd, and may indeed be beneficial both for habitats and the health of individual animals in the herd itself.

Resident Small Game

Public hunting on the Hernando County portion of the refuge is conducted in accordance with state regulations for the Chassahowitzka WMA directly adjacent to the refuge. The open season for resident small game is concurrent with seasons established by the FWC. WMA regulations apply for all huntable species, bag and possession limits, and archery, muzzeloading gun, and general gun hunt days. There is no evidence that allowing these hunts is causing negative cumulative impacts on small game populations on the refuge or adjacent properties.

Nongame Wildlife

Nongame or nonhunted wildlife would include nonhunted migratory birds such as songbirds, wading birds, raptors, and woodpeckers; small mammals such as voles, moles, mice, shrews, and bats; reptiles and amphibians such as snakes, skinks, turtles, lizards, salamanders, frogs and toads; and invertebrates such as butterflies, moths, other insects and spiders. Except for migratory birds and some species of migratory bats, butterflies and moths, these species have very limited home ranges and hunting could not affect their populations regionally; thus, only local effects will be discussed.

Disturbance to nonhunted migratory birds could have regional, local, and flyway effects. Regional and flyway effects would not be applicable to species that do not migrate, such as most woodpeckers and some songbirds including cardinals, titmice, wrens, chickadees, etc. The cumulative effects of disturbance to nonhunted migratory birds under the proposed action are expected to be negligible for the following reasons. Except for the spring turkey season, hunting seasons would not coincide with the nesting season. Long-term future impacts that could occur if reproduction was reduced by hunting are not relevant for this reason. Disturbance to the daily wintering activities of birds, such as feeding and resting, might occur. Disturbance to birds by hunters would probably be commensurate with that caused by nonconsumptive users. The cumulative effects of disturbance to nonhunted migratory birds under the proposed action are expected to be small for the above reasons.

With regard to other wildlife, disturbance would be unlikely for the following reasons. Small mammals, including bats, are inactive during winter when hunting season occurs (with the exception of the spring turkey season). These species are also nocturnal. Both of these qualities make hunter interactions with small mammals very rare. Hibernation or torpor by cold-blood reptiles and amphibians also limits their activity during the hunting season when temperatures are low. Hunters would rarely encounter reptiles and amphibians during most of the hunting season. Encounters with reptiles and amphibians in the early fall are few and should not have cumulative negative effects on reptile and amphibian populations. Invertebrates are also not active during cold weather and would have few interactions with hunters during the hunting season. Refuge regulations further mitigate possible disturbance by hunters to nonhunted wildlife. Vehicles are restricted to roads and the harassment or taking of any wildlife other than the game species legal for the season is not permitted.

Over time, the ingestion of lead shot (used by hunters for upland game) by nonhunted wildlife could possibly emerge as a cumulative impact. (In the West, it is believed to be affecting scavengers such as the reintroduced and endangered California condor, for example.) Over the life of the CCP and beyond, the Service and refuge management will remain alert for any signs of lead poisoning in nongame and game wildlife. In general, waterfowl and birds of prey face a greater risk of lead exposure than other birds and mammals because of their feeding habits (ingesting lead shot as grit for use in their gizzard or consuming lead shot from the tissues of prey). Therefore, lead shot pellets scattered over woodland and field are less likely to result in cumulative problems for wildlife, but the refuge will be vigilant in the face of this possibility.

Threatened and Endangered Species

Federally listed species occurring or known to have historically occurred on Chassahowitzka NWR include three species of sea turtles, the eastern indigo snake, Gulf sturgeon, smalltooth sawfish, American alligator, wood stork, manatee, and whooping crane. None of these closely resembles game species, and thus hunters are unlikely to pursue them.

An Intra-Service Section 7 evaluation under the Endangered Species Act is included in Appendix G. It concludes that the proposed action would have no effect on the above-listed species. The cumulative adverse impact on listed species would be negligible, comparable to that caused by anglers, boaters and nonconsumptive users.

ANTICIPATED IMPACTS ON REFUGE PROGRAMS, FACILITIES, CULTURAL RESOURCES, ENVIRONMENTAL JUSTICE, ENVIRONMENTAL RESOURCES, AND SURROUNDING COMMUNITIES

Wildlife-dependent Recreation

If public use levels continue to increase over time, unanticipated conflicts between user groups may occur at Chassahowitzka NWR. The refuge's visitor use programs would be adjusted as needed to eliminate or minimize each problem and provide quality wildlife-dependent recreational opportunities. Experience on many national wildlife refuges has proven that time and space zoning (e.g., establishment of separate use areas, use periods, and restrictions on the number of users) is an effective tool in eliminating conflicts between user groups. Overall, the cumulative impact of hunting on other wildlife-dependent recreation at Chassahowitzka NWR would be negligible to minor.

Refuge Facilities

The Service defines facilities as "Real property that serves a particular function(s) such as buildings, roads, utilities, water control structures, raceways, etc." Chassahowitzka NWR has very few such facilities. Overall, the cumulative impact of hunting on the refuge's facilities would be negligible.

Cultural Resources

Hunting, regardless of method or species targeted, is a consumptive activity that does not pose any threat to historic properties on or near the refuge. In fact, hunting meets only one of the two criteria used to identify an "undertaking" that triggers a federal agency's need to comply with Section 106 of the National Historic Preservation Act. These criteria, which are delineated in 36 CFR Part 800, state:

> "An undertaking is any project, activity, or program that can alter the character or use of an archaeological or historic site located within the 'area of potential effect;' and the project, activity, or program must also be either funded, sponsored, performed, licensed, or have received assistance from the agency."

Consultation with the pertinent State Historic Preservation Office and federally recognized Native American Indian tribes are, therefore, not required.

Environmental Justice

Executive Order 12898, "Federal Actions to address Environmental Justice in Minority Populations and Low-income Populations," was signed by President Bill Clinton on February 11, 1994, to focus federal attention on the environmental and human health conditions of minority and low-income populations to achieve environmental protection of all communities. In part, the order is intended to promote nondiscrimination in federal programs substantially affecting human health and the environment and to provide minority and low-income communities access to public information and participation in matters relating to human health or the environment.

There are low-income and minority populations in the area, but there is no evidence of adverse disproportionate environmental justice issues associated with the refuge's existing hunting program or proposed expansion. Any affected populations would generally be affected in the same ways as the regional population as a whole.

Environmental Resources

The refuge expects no appreciable adverse impacts of the proposed action on the Chassahowitzka NWR environment, which consists of soils, vegetation, air quality, water quality and solitude. Some disturbance to surface soils and vegetation would occur in areas selected for hunting; however, impacts would be minor and localized. Litter left behind by hunters would also be expected, although unlike the litter associated with fishing, which often concentrates near or at certain heavily fished locations, litter from hunters is likely to be more widely dispersed and therefore less conspicuous. Hunting would be expected to benefit vegetation, since it is used to maintain many resident wildlife populations, particularly deer, in balance with the habitat's carrying capacity. When and where necessary, the refuge would also control access or close areas to minimize habitat degradation.

The refuge expects impacts to air and water quality to be minimal and only due to refuge visitors' automobile and outboard motor emissions. The effect of these refuge-related activities, as well as other management activities, on overall air and water quality in the region are anticipated to be negligible, compared to the contributions of industrial centers, power plants, and nonrefuge vehicle traffic in this portion of the Gulf Coast of Florida. Existing state water quality criteria and use classifications are adequate to achieve desired on-refuge conditions; thus, implementation of the proposed action and alternatives would not impact adjacent landowners or users beyond the constraints already implemented under existing state standards and laws.

Overall, impacts on solitude from hunting are expected to be minor, given time and space zone management techniques, such as seasonal access and area closures, used to avoid conflicts among user groups. However, at those times when the refuge is being heavily hunted, those users seeking solitude rather than game may be disappointed and want to avoid the refuge.

Surrounding Communities

The refuge would cooperate with state, local, and private partners to minimize adverse impacts on adjacent lands and landowners. Hunting is generally popular in rural Florida, but there is always a potential for conflicts with adjacent landowners due to negligence or ignorance. The nature of the potential impacts on surrounding communities is less cumulative than it is long-running and persistent.

DIRECT AND INDIRECT EFFECTS OF IMPACTS

Direct effects are caused by an action and occur at the same time as the action. Indirect or secondary effects are also caused by an action, but by means of an additional cause which itself is an effect of the original cause. Indirect effects are usually manifested later in time or further removed in distance, yet they are still reasonably foreseeable. The actions proposed for implementation under the proposed action include wildlife and habitat management and resource protection. These actions would result in both direct and indirect effects. None of the direct or indirect effects are anticipated to be significantly adverse. There will, however, be beneficial effects from the Service's actions.

None of the proposed management activities would lead, directly or indirectly, to a violation of federal, state, or local laws imposed for the protection of the environment; and none of the direct or indirect impacts are anticipated to be significant. Adaptive management is a key component of each

alternative. As such, the actions outlined would not establish a precedent for future actions with significant negative impacts, nor do they represent a decision in principle about future considerations. Refuge management activities would constantly be adapted as new research, data, and information become available to protect resources and minimize impacts.

SHORT-TERM USES VERSUS LONG-TERM PRODUCTIVITY

All of the alternatives strive to maintain or enhance the long-term productivity and sustainability of natural resources on the refuge. The alternatives strive to conserve federal trust species and the habitats upon which they depend. The habitat protection and management actions outlined under the proposed action are dedicated to maintaining the long-term productivity of the refuge's habitats. The benefits of this plan for long-term productivity far outweigh any impacts from short-term actions such as prescribed burns. While invasive exotic plant removal could produce unsightly results for a time, they would also provide long-term wildlife and habitat benefits to the refuge.

The proposed outreach and environmental education programs are also part of each alternative. They strive to increase ethical outdoor behavior, minimize impacts from human disturbances, and encourage visitors and participants in refuge programs to be better stewards of the environment. The short-term negative impacts associated with adjacent public use activities will help produce long-term benefits for the refuge's entire ecosystem and provide an improved visitor experience and understanding of ecological processes.

The key to protecting and ensuring the refuge's long-term productivity is to find the threshold where public uses do not degrade or interfere with the refuge's natural resources through careful monitoring and adaptive management. The activities outlined under the proposed action have been carefully conceived to ensure that the threshold is not passed. Implementing the proposed action would lead to long-term benefits for wildlife protection and land conservation that far outweighs any short-term impacts. In summary, all alternatives would contribute positively to maintaining or enhancing the long-term productivity of the refuge's environment.

SUMMARY STATEMENT

The management activities in the proposed action are anticipated to maintain or improve the refuge's biological resources and protect its biological integrity. Benefits are expected for endangered, threatened, candidate and imperiled species, native wildlife, and habitat diversity. Benefits are also expected for cultural and wilderness resources, as well as for the local economy. Beneficial, but no significantly adverse effects, are expected for the refuge's resources with the implementation of the proposed alternative.

V. Consultation and Coordination

OVERVIEW

The comprehensive planning process for Chassahowitzka NWR CCP involved a wide variety of participants, including federal, state, and local governments; universities and other researchers; private nonprofit groups; and the Friends group, as well as a wide variety of local residents, local businesses, concerned citizens, and state and national organizations. The list of participants, beyond those individuals and organizations providing comments during the public scoping process, includes the CCP Planning Team, the Wildlife and Habitat Management Review Team, the Visitor Services Review Team, the Wilderness Review Team, and the Interagency Partners Coordination Team.

CCP PLANNING TEAM

The CCP Planning Team met several times between 2005 and 2011. It included representatives from the Service and the State of Florida. The team met as a whole to determine the priority issues, identify potential solutions or approaches (alternatives), and to develop, draft, review and refine the plan.

U.S. Fish and Wildlife Service (USFWS)

- Mary Morris, Natural Resource Planner, Tallahassee, Florida, Planning Team Leader
- Joyce Kleen, Wildlife Biologist, Crystal River NWR Complex
- Michael Lusk, Project Leader, Crystal River NWR Complex
- Ivan Vicente, Visitor Services Specialist, Crystal River NWR Complex
- Craig Cavanna, Federal Wildlife Officer, Crystal River NWR Complex
- Ryan Maier, Federal Wildlife Officer, Crystal River NWR Complex
- Chad Allison, Chassahowitzka Wildlife Management Area, Florida Fish and Wildlife Conservation Commission (FWC), Brooksville, Florida

Former Team Members

- Melissa Charbonneau, former Florida Department of Environmental Protection (FDEP), Aquatic Preserve Manager, St. Martins Marsh Aquatic Preserve, Coastal and Aquatic Managed Areas, Crystal River, Florida (2009-March 2012)
- Laura Housh, USFWS Regional Planner
- Bill Miller, USFWS, former Planner (2011)
- Keith Ramos, USFWS, former Deputy Refuge Manager (Acting Refuge Manager), Crystal River NWR Complex
- Richard Meyers, USFWS, former Assistant Refuge Manager, Tampa Bay Refuges

WILDLIFE AND HABITAT MANAGEMENT REVIEW TEAM

The Wildlife and Habitat Management Review Team consisted of Service staff with invited state and county agency researchers and natural resource managers. The refuge's wildlife and habitat management review was conducted during October 17 to 20, 2005. The review summary was completed by Stephen Earsom in September, 2006. The Service personnel are based either at Crystal River, Florida (refuge headquarters) or the Southeast Regional Office in Atlanta, Georgia, unless otherwise noted.

U.S. Fish and Wildlife Service

- Deborah Jerome, Regional Wilderness Coordinator, Southeast Regional Office
- John Kasbohm, former Deputy Project Leader, Crystal River NWR Complex
- Joyce Kleen, Wildlife Biologist, Crystal River NWR Complex
- Jim Kraus, former Project Leader, Crystal River NWR Complex
- Mike Legare, Deputy Project Leader, Lower Suwannee NWR, Chiefland, Florida
- Stefani Melvin, Regional Nongame Bird Biologist, Migratory Birds, Southeast Regional Office
- Billy Brooks, Fish and Wildlife Biologist, North Florida Field Office, Ecological Services, USFWS, Jacksonville, Florida
- Jim Valade, Fish and Wildlife Biologist, North Florida Field Office, Ecological Services, Jacksonville, Florida
- Dean Demarest, Deputy Division Chief, Migratory Birds, Southeast Regional Office
- Stephen D. Earsom, former Regional Refuge Ecologist, Southeast Regional Office
- Van Fischer, former Natural Resources Planner, Florida Keys NWR complex, Big Pine Key, Florida

State of Florida Representatives

- Chad Bedee, former manager, St. Martins Marsh Aquatic Preserve, FDEP, Crystal River
- Dr. Tom Frazer, Professor, University of Florida, Gainesville, Florida
- Paul Hansen, former FWC Fish and Wildlife Biologist III, Chassahowitzka Wildlife Management Area, Brooksville, Florida
- Steve Nesbitt, retired Biological Administrator II, FWC, Gainesville, Florida
- Wilbur Priest, Forestry Supervisor II, Florida Forest Service, Homosassa, Florida

VISITOR SERVICES REVIEW TEAM

The Visitor Services Review Team consisted of Service staff from the Southeast Regional Office in Atlanta, Georgia, other refuges and staff from the Crystal River NWR Complex. The visitor services review for the refuge was conducted at the complex headquarters during March 23 to 26, 2009. The Visitor Services Review Report for the refuge was completed by Garry Tucker on July 1, 2009.

U.S. Fish and Wildlife Service

- Garry Tucker, Visitor Services and Outreach, Southeast Regional Office
- Deborah Jerome, Visitor Services and Outreach, Southeast Regional Office
- Stacy Armitage, Visitor Services and Outreach, Southeast Regional Office
- Keith Ramos, former acting Project Leader, Crystal River NWR Complex
- Ivan Vicente, Visitor Services Specialist, Crystal River NWR Complex
- Mary Morris, Natural Resource Planner, Tallahassee, Florida
- Joyce Kleen, Wildlife Biologist, Crystal River NWR Complex

State Agency CCP Team Representatives

- Chad Allison, FWC, Brooksville, Florida
- Melissa Charbonneau, formerly of FDEP, Crystal River, Florida

WILDERNESS REVIEW TEAM

The Service reviewed the refuge's potential for additional wilderness areas at a CCP team meeting on February 3, 2009, and found that no other areas on the refuge met the criteria or intent of the Wilderness Act. The Wilderness Review draft summary was completed on September 7, 2009, by Mary Morris.

U.S. Fish and Wildlife Service

- Mary Morris, Natural Resource Planner, Tallahassee, Florida
- Joyce Kleen, Wildlife Biologist, Crystal River NWR Complex
- Ryan Maier, Federal Wildlife Officer, Crystal River NWR Complex
- Keith Ramos, former Acting Refuge Manager, Crystal River NWR Complex
- Ivan Vicente, Visitor Services Specialist, Crystal River NWR Complex

State Agency CCP Team Representatives

- Chad Allison, FWC, Brooksville, Florida
- Melissa Charbonneau, formerly of FDEP, Crystal River, Florida

INTERAGENCY PARTNERS COORDINATION TEAM

An intergovernmental group of partners met in Crystal River on July 14, 2009, at the FDEP office to discuss priority issues of concern that the CCP team should address in developing the CCP. This meeting included local, state, regional, and federal government natural resource representatives.

U.S. Fish and Wildlife Service

- Mary Morris, Natural Resource Planner, Tallahassee, Florida
- Keith Ramos, former Acting Refuge Manager, Crystal River NWR Complex
- Joyce Kleen, Wildlife Biologist, Crystal River NWR Complex
- Ivan Vicente, Visitor Services Specialist, Crystal River NWR Complex

U.S. Geological Survey

- Ellen Rabbe, St. Petersburg, Florida

Florida Fish and Wildlife Conservation Commission

- Captain John Burton, Area Commander, Law Enforcement, Crystal River, Florida
- Holly Edwards, Biologist, Florida and Wildlife Research Institute, St. Petersburg, Florida
- Ron Mezich, Biological Scientist IV, Aquatic Habitat Restoration and Conservation Section, Marine Habitat Management, Tallahassee, Florida
- Robbie Lovestrand, Regional Biologist, Floral City, Florida

Florida Department of Environmental Protection

- Melissa Charbonneau, former Aquatic Preserve Manager, St. Martins Marsh Aquatic Preserve, Coastal and Aquatic Managed Areas, Crystal River, Florida
- Keith Morin, Environmental Specialist I, Florida Division of Recreation and Parks, Crystal River
- Timothy Jones, Environmental Specialist II, Office of Coastal Aquatic and Managed Areas

Florida Department of Agriculture and Consumer Services

- Wilbur Priest, Forestry Supervisor II, Florida Forest Service, Homosassa, Florida

Florida Public Archaeology Network

- Richard W. Estabrook, M.A., RPA, Public Archaeologist / Regional Director, Central Regional Center, University of South Florida, Crystal River, Florida

Citrus County (all from Lecanto, Florida)

- Frank Aumack, Director of Operations, Aquatic Services (now with Mosquito Control)
- Mark Edwards, Department of Public Works, Aquatic Services
- Sue Farnsworth, Environmental Planner, Community Development Division
- Gary Maidhof, Director, Development Services

Hernando County

- Patricia L. McNeese, AICP, Planner II, Hernando County Planning Department, Brooksville, Florida

Appendix A. Acronyms, Abbreviations and Glossary

ACRONYMS AND ABBREVIATIONS

§	Section
AGWQMP	Ambient Ground-Water Quality Monitoring Program
BCR	Bird Conservation Region
BTI	*Bacillus thuringiensis israelensis*
^{o}C	Degrees Celsius
CAA	Clean Air Act
CARL	Conservation and Recreational Lands
CAMA	Coastal and Managed Areas
cfs	cubic feet per second
CBRA	Coastal Barrier Resources Act
CBRS	Coastal Barrier Resources System
CCP	Comprehensive Conservation Plan
CCS	Chassahowitzka River and Coastal Swamps
CFI	Continuous Forest Inventory
CFR	Code of Federal Regulations
CSC	Climate Science Center
E	Endangered
EA	Environmental Assessment
EE	Environmental Education
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
EO	Executive Order
^{o}F	Degrees Fahrenheit
FAC	Florida Administrative Code
FBCI	Florida Bird Conservation Initiative
FCT	Florida Communities Trust
FCWCS	Florida Comprehensive Wildlife Conservation Strategy
FDACS	Florida Department of Agriculture and Consumer Services
FDEP	Florida Department of Environmental Protection
FDOT	Florida Department of Transportation
FFS	Florida Forest Service
FLEPPC	Florida Exotic Pest Plant Council
FNAI	Florida Natural Areas Inventory
FONSI	Finding of No Significant Impact
FS	Florida Statutes
FTE	Full-time Equivalent
FWC	Florida Fish and Wildlife Conservation Commission
FWRI	Fish and Wildlife Research Institute
FWS	U.S. Fish and Wildlife Service
FY	Fiscal Year
GFBWT	Great Florida Birding and Wildlife Trail
GIS	Geographic Information System

GPS	Global Positioning System
ha	hectares
HMP	Habitat Management Plan
IBA	Important Bird Area
IMPROVE	Interagency Monitoring of Protected Visual Environments Program
IPCC	Intergovernmental Panel on Climate Change
LCC	Landscape Conservation Cooperative
LOOT	Listing of Outlaw Treachery Clearinghouse
LPP	Land Protection Plan
m	meters
MAPS	Monitoring Avian Productivity and Survivorship
MDN	Mercury Deposition Network
MEP	Minor Expansion Proposal
m2/ha	meters squared per hectare
mg/l	milligrams per liter
MGM	money generation model
MMEP	Marine Mammal Enhancement Permit
MMPA	Marine Mammal Protection Act
MPA	Marine Protected Area
NABCI	North American Bird Conservation Initiative
NADP	National Atmospheric Deposition Program
NAWCP	North American Waterbird Conservation Plan
NAWMP	North American Waterfowl Management Plan
NBCI	Northern Bobwhite Conservation Initiative
NCCISMA	Nature Coast Cooperative Invasive Species Management Area
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NOA	Notice of Availability
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent
NPS	National Park Service
NRI	National Resources Inventory
NWR	National Wildlife Refuge
NWRIA	National Wildlife Refuge System Improvement Act
NWRS	National Wildlife Refuge System
NVCS	National Vegetation Classification System
OFW	Outstanding Florida Waters
OPA	Otherwise Protected Area
ppt	parts per thousand
PWC	personal watercraft
RA	Refuge Administration
RO	Regional Office
ROD	Record of Decision
RONS	Refuge Operating Needs System
RP	Resource Protection
RV	recreational vehicle
SAMMS	Service Asset and Maintenance Management System
SAV	Submerged Aquatic Vegetation
SC	Species of Concern
SCA	Student Conservation Association
Service	U.S. Fish and Wildlife Service

SGCN	Species of Greatest Conservation Need
SHPO	State Historic Preservation Officer
SSC	Species of Special Concern
SWFWMD	Southwest Florida Water Management District
SWIM	Surface Water Improvement and Management
T	Threatened
T (S/A)	Threatened by similarity of appearance
TDC	Tourism Development Council
THPO	Tribal Historic Preservation Officer
TWS	The Wildlife Society
UF	University of Florida
U.S.	United States
USACE	U.S. Army Corps of Engineers
U.S.C.	United States Code
USDA	U.S. Department of Agriculture
USGS	U.S. Geological Survey
USFWS	U.S. Fish and Wildlife Service
VS	Visitor Services
WCEP	Whooping Crane Eastern Partnership
WMA	Wildlife Management Area
WHM	Wildlife and Habitat Management
WHMSI	Western Hemisphere Migratory Species Initiative
WSF	Withlacoochee State Forest

Glossary

Accidentals:	Bird species that are observed on single or very few occasions very far from their normal range.
Adaptive Management:	Refers to a process in which policy decisions are implemented within a framework of scientifically driven experiments to test predictions and assumptions inherent in management plan. Analysis of results help managers determine whether current management should continue as is or whether it should be modified to achieve desired conditions.
Alternative:	A reasonable way to fix the identified problem or satisfy the stated need (40 CFR 1500.2). Also, alternatives are different sets of objectives and strategies or means of achieving refuge purposes and goals, helping fulfill the Refuge System mission, and resolving issues (Service Manual 602 FW 1.6B).
Biological Diversity:	The variety of life and its processes, including the variety of living organisms, the genetic differences among them, and the communities and ecosystems in which they occur (USFWS Manual 052 FW 1. 12B). The System's focus is on indigenous species, biotic communities, and ecological processes. Also referred to as Biodiversity.
Carrying Capacity:	The maximum population of a species able to be supported by a habitat or area.
Categorical Exclusion (CE,CX, CATEX, CATX):	A category of actions that do not individually or cumulatively have a significant effect on the human environment and have been found to have no such effect in procedures adopted by a federal agency pursuant to the National Environmental Policy Act (40 CFR 1508.4).
CFR:	Code of Federal Regulations.
Class I Area (Federal lands):	As defined by the Clean Air Act Amendments of 1977 (P.L. 95-95; 91 Stat. 685), include all national wilderness areas exceeding 500 acres, national parks greater than 6,000 acres, and national memorial parks greater than 5,000 acres. Federal land managers are charged with direct responsibility to protect the air quality and related values (including visibility) of class I lands and to consider, in consultation with the EPA, whether proposed industrial facilities will have an adverse impact on these values. Federal land managers are also required to determine whether existing industrial sources of air pollution must be retrofitted to reduce impacts on Class I areas to acceptable levels.

Clean Air Act:	Refers to the Clean Air Amendments of 1977 (P.L. 95-95; 91 Stat. 685). The primary objective of the Clean Air Act is to establish Federal standards for various pollutants from both stationary and mobile sources and to provide for the regulation of polluting emissions via state implementation plans. In addition, the amendments are designed to prevent significant deterioration in certain areas where air quality exceeds national standards, and to provide for improved air quality in areas which do not meet Federal standards ("nonattainment" areas).
Commensalism:	A relationship between two species, from which one benefits and the other is neither harmed nor helped; the gopher tortoise's burrow benefits many other species, from which it receives nothing in return.
Compatible Use:	A proposed or existing wildlife-dependent recreational use or any other use of a national wildlife refuge that, based on sound professional judgment, will not materially interfere with or detract from the fulfillment of the National Wildlife Refuge System mission or the purpose(s) of the national wildlife refuge (50 CFR 25.12 (a)). A compatibility determination supports the selection of compatible uses and identifies stipulations or limits necessary to ensure compatibility.
Comprehensive Conservation Plan (CCP):	A document that describes the desired future conditions of a refuge or planning unit and provides long-range guidance and management direction to achieve the purposes of the refuge; helps fulfill the mission of the Refuge System; maintains and, where appropriate, restores the ecological integrity of each refuge and the Refuge System; helps achieve the goals of the National Wilderness Preservation System; and meets other mandates (Service Manual 602 FW 1.6 E).
Cultural Resource Inventory:	A professionally conducted study designed to locate and evaluate evidence of cultural resources present within a defined geographic area. Inventories may involve various levels, including background literature search, comprehensive field examination to identify all exposed physical manifestations of cultural resources, or sample inventory to project site distribution and density over a larger area. Evaluation of identified cultural resources to determine eligibility for the National Register follows the criteria found in 36 CFR 60.4 (Service Manual 614 FW 1.7).

Cultural Resource Overview:	A comprehensive document prepared for a field office that discusses, among other things, its prehistory and cultural history, the nature and extent of known cultural resources, previous research, management objectives, resource management conflicts or issues, and a general statement on how program objectives should be met and conflicts resolved. An overview should reference or incorporate information from a field offices background or literature search described in Section VIII of the Cultural Resource Management Handbook (Service Manual 614 FW 1.7).
Cultural Resources:	The remains of sites, structures, or objects used by people in the past.
Disturbance:	Significant alteration of habitat structure or composition or wildlife behavior. May be natural (e.g., fire) or human-caused events (e.g., aircraft overflight).
Ecosystem:	A dynamic and interrelating complex of plant and animal communities and their associated non-living environment.
Ecosystem Management:	Management of natural resources using system-wide concepts to ensure that all plants and animals in ecosystems are maintained at viable levels in native habitats and basic ecosystem processes are perpetuated indefinitely.
Endangered Species (Federal):	A plant or animal species listed under the Endangered Species Act that is in danger of extinction throughout all or a significant portion of its range.
Endangered Species (State):	A plant or animal species in danger of becoming extinct or extirpated in the state within the near future if factors contributing to its decline continue. Populations of these species are at critically low levels or their habitats have been degraded or depleted to a significant degree.
Environmental Assessment (EA):	A concise public document, prepared in compliance with the National Environmental Policy Act, that briefly discusses the purpose and need for an action, alternatives to such action, and provides sufficient evidence and analysis of impacts to determine whether to prepare an environmental impact statement or finding of no significant impact (40 CFR 1508.9).
Environmental Impact Statement (EIS):	A detailed written statement required by section 102(2)(C) of the National Environmental Policy Act, analyzing the environmental impacts of a proposed action, adverse effects of the project that cannot be avoided, alternative courses of action, short-term uses of the environment versus the maintenance and enhancement of long-term productivity, and any irreversible and irretrievable commitment of resources (40 CFR 1508.11).
Estuary:	The wide lower course of a river into which the tides flow. This is a transition area between fresh, brackish and saltwater.

Extirpation:	When a species can no longer survive in regions that were once part of its range.
Finding of No Significant Impact (FONSI):	A document prepared in compliance with the National Environmental Policy Act, supported by an environmental assessment, that briefly presents why a federal action will have no significant effect on the human environment and for which an environmental impact statement, therefore, will not be prepared (40 CFR 1508.13).
Goal:	Descriptive, open-ended, and often broad statement of desired future conditions that conveys a purpose. (Service Manual 620 FW 1.6J).
Habitat:	Suite of existing environmental conditions required by an organism for survival and reproduction.
Habitat Restoration:	Management emphasis designed to move ecosystems to desired conditions and processes, and/or to healthy ecosystems.
Hypoxia:	Hypoxia, or low oxygen, occurs when the levels of oxygen dissolved in water fall below levels necessary to support ocean and coastal life, and can lead to what is called a dead zone. Hypoxic waters have dissolved oxygen concentrations of less than two to three parts per million.
Improvement Act:	The National Wildlife Refuge System Improvement Act of 1997.
Issue:	Any unsettled matter that requires a management decision, e.g., an initiative, opportunity, resource management problem, threat to the resources of the unit, conflict in uses, public concern, or other presence of an undesirable resource condition (Service Manual 602 FW 1.6K).
Manatee Refuge:	An area in which the Director has determined that certain waterborne activity would result in the taking of one or more manatees, or that certain waterborne activity must be restricted to prevent the taking of one or more manatees, including but not limited to a taking by harassment (50 CFR Subpart J §17.102).
Manatee Sanctuary:	An area in which the Director has determined that any waterborne activity would result in a taking of one or more manatees, including but not limited to a taking by harassment (50 CFR Subpart J §17.102). Manatee sanctuaries are more restrictive than manatee refuges.
Migration:	The seasonal movement from one area to another and back.
Mission Statement:	Succinct statement of the unit's purpose and reason for being.
Monitoring:	The process of collecting information to track changes of selected parameters over time.

National Environmental Policy Act of 1969 (NEPA):	Requires all agencies, including the Service, to examine the environmental effects of its actions, incorporate environmental information, and use public participation in the planning and implementation of all actions. Federal agencies must integrate NEPA with other planning requirements, and prepare appropriate NEPA documents to facilitate better environmental decision making (40 CFR 1500).
National Wildlife Refuge System Improvement Act of 1997 (Public Law 105-57):	Under the Refuge Improvement Act, the U.S. Fish and Wildlife Service is required to develop 15-year Comprehensive Conservation Plans for all National Wildlife Refuges outside Alaska. The Act also describes the six public uses given priority status within the NWRS (i.e., hunting, fishing, wildlife observation, photography, environmental education, and interpretation).
National Wildlife Refuge System Mission:	The mission is to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans.
National Wildlife Refuge System:	Various categories of areas administered by the Secretary of the Interior for the conservation of fish and wildlife, including species threatened with extinction; all lands, waters, and interests therein administered by the Secretary as wildlife refuges; areas for the protection and conservation of fish and wildlife that are threatened with extinction; wildlife ranges; games ranges; wildlife management areas; or waterfowl production areas.
National Wildlife Refuge:	A designated area of land, water, or an interest in land or water within the System.
Native Species:	Species that normally live and thrive in a particular ecosystem.
Notice of Availability (NOA):	A notice that an environmental document is available. Published in the Federal Register.
Notice of Intent (NOI):	A notice that an environmental document will be prepared and considered (40 CFR 1508.22). Published in the Federal Register.
Noxious Weed:	A plant species designated by federal or state law as generally possessing one or more of the following characteristics: aggressive or difficult to manage; parasitic; a carrier or host of serious insect or disease; or nonnative, new, or not common to the United States, according to the Federal Noxious Weed Act (PL 93-639), a noxious weed is one that causes disease or had adverse effects on man or his environment and therefore is detrimental to the agriculture and commerce of the Untied States and to the public health.

Objective:	A concise statement of what we want to achieve, how much we want to achieve, when and where we want to achieve it, and who is responsible for the work. Objectives derive from goals and provide the basis for determining strategies, monitoring refuge accomplishments, and evaluating the success of strategies. (Service Manual 602 FW 1.6N).
Passerines:	A category of birds that includes medium to small, perching landbirds. Most are territorial singers and migratory. Also called songbirds.
Plant Association:	A classification of plant communities based on the similarity in dominants of all layers of vascular species in a climax community.
Plant Community:	An assemblage of plant species unique in its composition; occurs in particular locations under particular influences; a reflection or integration of the environmental influences on the site such as soils, temperature, elevation, solar radiation, slope, aspect, and rainfall; denotes a general kind of climax plant community.
Preferred Alternative:	This is the alternative determined [by the decision maker] to best achieve the Refuge purpose, vision, and goals; contributes to the Refuge System mission, addresses the significant issues; and is consistent with principles of sound fish and wildlife management.
Prescribed Fire:	The application of fire to wildland fuels to achieve identified land use objectives (Service Manual 621 FW 1.7).
Priority Species:	Fish and wildlife species that the Washington Department of Fish and Wildlife believe require protective measures and/or management guidelines to ensure their perpetuation. Priority species include the following: (1) state-listed and candidate species; (2) species or groups of animals susceptible to significant population declines within a specific area or statewide by virtue of their inclination to aggregate (e.g., seabird colonies); and (3) species of recreation, commercial, and/or tribal importance.
Public Involvement:	A process that offers impacted and interested individuals and organizations an opportunity to become informed about, and to express their opinions on Service actions and policies. In the process, these views are studied thoroughly and thoughtful consideration of public views is given in shaping decisions for refuge management.
Public:	Individuals, organizations, and groups; officials of federal, state, and local government agencies; Indian tribes; and foreign nations. It may include anyone outside the core planning team. It includes those who may or may not have indicated an interest in Service issues and those who do or do not realize that Service decisions may affect them.
Purposes of the Refuge:	The purposes are specified in or derived from the law, proclamation, executive order, agreement, public land order, donation document, or administrative memorandum establishing, authorizing, or expanding a refuge. For refuges that contain Wilderness, the purposes of the Wilderness Act are additional purposes of the refuge (602 FWS 106).

Record of Decision (ROD):	A concise public record of decision prepared by the federal agency, pursuant to NEPA, that contains a statement of the decision, identification of all alternatives considered, identification of the environmentally preferable alternative, a statement as to whether all practical means to avoid or minimize environmental harm from the alternative selected have been adopted (and if not, why they were not), and a summary of monitoring and enforcement where applicable for any mitigation (40 CFR 1505.2).
Step-down Management Plan:	A plan that provides specific guidance on management subjects (e.g., habitat, public use, fire, safety) or groups of related subjects. It describes strategies and implementation schedules for meeting CCP goals and objectives (Service Manual 602 FW 1.6 U).
Strategy:	A specific action, tool, technique, or combination of actions, tools, and techniques used to meet unit objectives (Service Manual 602 FW 1.6 U).
Study Area:	The area reviewed in detail for wildlife, habitat, and public use potential. For purposes of this CCP/EIS the study area includes the lands within the currently approved Refuge boundary and potential Refuge expansion areas.
Threatened Species (Federal):	Species listed under the Endangered Species Act that are likely to become endangered within the foreseeable future throughout all or a significant portion of their range.
Threatened Species (State):	A plant or animal species likely to become endangered in the state within the near future if factors contributing to population decline or habitat degradation or loss continue.
Tiering:	The coverage of general matters in broader environmental impact statements with subsequent narrower statements of environmental analysis, incorporating by reference, the general discussions and concentrating on specific issues (40 CFR 1508.28).
U.S. Fish and Wildlife Service Mission:	The mission of the U.S. Fish and Wildlife Service is working with others to conserve, protect, and enhance fish and wildlife and their habitats for the continuing benefit of the American people.
Vagrants:	Bird species found close to, but outside of their normal range and can be expected to be observed on rare occasions.
Vegetation, Habitat, or Forest Cover Type:	A land classification system based upon the concept of distinct plant associations.

Vision Statement:	A concise statement of what the planning unit should be, or what we hope to do, based primarily upon the Refuge System Mission and specific refuge purposes, and other mandates. We will tie the vision statement for the refuge to the mission of the Refuge System; the purpose(s) of the refuge; the maintenance or restoration of the ecological integrity of each refuge and the Refuge System; and other mandates (Service Manual 602 FW 1.6 Z).
Wilderness Study Areas:	Lands and waters identified through inventory as meeting the definition of Wilderness Area and undergoing evaluation for recommendation for inclusion in the Wilderness System.
Wilderness Area:	An area designated by the U.S Congress to be managed as part of the National Wilderness Preservation System (Draft Service Manual 610 FW 1.5).
Wildfire:	A free-burning fire; all fire other than prescribed fire that occurs on wildlands (Service Manual 621 FW 1.7).

Appendix B. References and Literature Citations

Bindoff, N.L., et al. 2007. Observations: Oceanic Climate Change and Sea Level. Solomon, S. et al. (eds.). Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the IPCC. Cambridge University Press.

Borremans, N. and G.T. Milanich.1990. The Paleoindian Historical Context. Available online at: http://www.flheritage.com/facts/reports/contexts/paleo.cfm (Accessed April 29, 2011).

Brim, M., D. Bateman and R. Jarvis. 1994. Mercury Concentrations in Fishes of the Chassahowitzka National Wildlife Refuge. U.S. Fish and Wildlife Service Publication No. PCFO-EC 94-01. Panama City, Florida.

Bureau of Economic and Business Research. 2009. Florida Estimates of Population. January 2009. University of Florida. Gainesville, Florida.

Bureau of Economic and Business Research. 2005. Florida Estimates of Population. University of Florida. Gainesville, Florida.

Bureau of Labor Statistics. 2011a. Local Area Unemployment Statistics, April 2011. Washington, D.C. Available online at: http://www.bls.gov/cps/ (Accessed May 23, 2011).

Bureau of Labor Statistics. 2011b. Labor Force Data by County, Not Seasonally Adjusted, February 2010 – March 2011. Washington, D.C. Available online at: http://www.bls.gov/lau/ (Accessed May 23, 2011).

Bureau of Labor Statistics. 2011c. Labor Force Data by County, Not Seasonally Adjusted, February 2010 – March 2011. Washington, D.C. Available online at: http://www.bls.gov/lau/laucntycur14.txt (Accessed May 23, 2011).

Canadian Wildlife Service and U.S. Fish and Wildlife Service. 2007. International Recovery Plan for the Whooping Crane. Ottawa: Recovery of Nationally Endangered Wildlife (RENEW), and U.S. Fish and Wildlife Service, Albuquerque, New Mexico, USA.

Carver, E. and J. Caudill. 2007. Banking on Nature 2006: The Economic Benefits to Local Communities of National Wildlife Refuge Visitation. Washington, D.C.: U.S. Fish and Wildlife Service, Division of Economics. September 2007. 382 pp.

Caudill, J., and E. Henderson. 2005. Banking on Nature 2004: The Economic Benefits to Local Communities of National Wildlife Refuge Visitation. September 2005. U.S. Fish and Wildlife Service, Division of Economics. Washington D.C.

Century Commission – Research and Project Overviews. 2010. Critical Lands and Waters Identification Project (CLIP) and the Cooperative Conservation Blueprint initiative. Available online at: http://www.collinscenter.org/?ReschProjectsOvrview#CLIP (Accessed April 4, 2011).

Clough, J.S. 2008. Application of the Sea-Level Affecting Marshes Model (SLAMM 5.0) to Crystal River NWR. Warren Pinnacle Consulting, Inc. for U.S. Fish and Wildlife Service. 46 pp.

Colorado State University. 2011. IMPROVE Monitoring Program Overview. Available online at: http://vista.cira.colostate.edu/improve/Overview/IMPROVEProgram_files/frame.htm (Accessed May 06, 2011).

Colorado State University. Cooperative Institute for Research in the Atmosphere. 1996. IMPROVE, Interagency Monitoring of Protected Visual Environments. Spatial and Seasonal Patterns and Long Term Variability of the Composition of the Haze in the United States: An Analysis of Data from the IMPORVE Network.

Conant, T.A., et al. 2009. Loggerhead Sea Turtle (*Caretta caretta*) 2009 Status Review Under the U.S. Endangered Species Act. Report of the Loggerhead Biological Review Team to the National Marine Fisheries Service, August 2009. 222 pp.

Cornell Lab of Ornithology. 2011. All About Birds: Whooping Crane (*Grus americana*). Available online at: http://www.allaboutbirds.org/guide/Whooping_Crane/id (Accessed August 8, 2011).

Debell, L.J., K. Gebhart, W.C., Malm, M.L. Pitchford, B.A. Schichtel, W.H. White. Spatial and Seasonal Patterns and Temporal Variability of Haze and its Constituents in the United States: Report IV. November 2006. Available online at: http://vista.cira.colostate.edu/improve/Publications/Reports/2006/2006.htm (Accessed May 09, 2011).

Emanuel, K.A. 1987. The Dependence of Hurricane Intensity on Climate. Nature 326: 483-485.

Emanuel, K.A. 2005. Increasing Destructiveness of Tropical Cyclones Over the Past 30 Years. Nature 436: 686–688.

Facemire, C., et al. 1995. Impacts of Mercury Contamination in the Southeastern United States. Water, Air, and Soil Pollution 80: 923-926.

Florida Department of Environmental Protection. 2009a. St. Martins Marsh Aquatic Preserve. Tallahassee, Florida. Available online at: http://www.dep.state.fl.us/COASTAL/sites/stmartins/ (Accessed December 13, 2011).

Florida Department of Environmental Protection. 2009b. Crystal River Preserve State Park. Florida State Parks. Florida Park Service. Tallahassee, Florida. Available online at: http://www.floridastateparks.org/crystalriverpreserve/default.cfm (Accessed December 13, 2011).

Florida Department of Environmental Protection. 2004. Crystal River Preserve State Park Unit Management Plan. October 15, 2004. Division of Recreation and Parks. Tallahasse, Florida. 95 pp. Available online at: http://www.dep.state.fl.us/parks/planning/parkplans/CrystalRiverPreserveStatePark.pdf (Accessed December 13, 2011)

Florida Department of Natural Resources. 1987. St. Martins Marsh Aquatic Preserve Management Plan. Bureau of Aquatic Preserves, Division of State Lands. Tallahassee, Florida. 121 pp. Available online at: http://www.dep.state.fl.us/COASTAL/downloads/management_plans/aquatic/StMartinsMarsh.pdf (Accessed December 13, 2011)

Florida Department of Transportation and University of South Florida. 2008. Trends and Conditions Report – 2008; Travel Demand: Visitors and Tourists. Office of Policy Planning of the Florida Department of Transportation and the Center for Urban Transportation Research at the University of South Florida. November 2008. 15 pp. Available online at: http://www.dot.state.fl.us/planning/trends/tc-report/Tourism112008.pdf (Accessed December 13, 2011).

Florida Fish and Wildlife Conservation Commission (FWC). Unpublished Data. 2010-2011 Annual Monitoring Report. Available online at: http://myfwc.com/wildlifehabitats/managed/bald-eagle/monitoring/

Florida Fish and Wildlife Conservation Commission (FWC). 2011. Overview – Fast Facts. Available online at: http://myfwc.com/about/overview (Accessed March 30, 2011).

Florida Fish and Wildlife Conservation Commission (FWC). 2011b. Draft Black Bear Management Plan. Florida Fish and Wildlife Conservation Commission, Tallahassee, FL. Available online at: http://share2.myfwc.com/BearMP/Shared%20Documents/Draft%206.1%20Bear%20Management%20Plan.pdf (Accessed December 13, 2011).

Florida Fish and Wildlife Conservation Commission (FWC). 2010a. Manatee Synoptic Surveys. Available online at: http://myfwc.com/research/manatee/projects/population-monitoring/synoptic-surveys/ (Accessed January 28, 2010).

Florida Fish and Wildlife Conservation Commission (FWC). 2010b. Gopher Tortoise Natural History. Available online at: http://www.myfwc.com/WILDLIFEHABITATS/GopherTortoise_NaturalHistory.htm (Accessed February 2, 2010).

Florida Fish and Wildlife Conservation Commission (FWC). 2010c. Preliminary Manatee Mortality Report: 11/01/2009 to 12/31/2009. Marine Mammal Pathobiology Laboratory, Fish and Wildlife Research Institute. St. Petersburg, Florida. Available online at: http://research.myfwc.com/manatees/ (Accessed January 28, 2010).

Florida Fish and Wildlife Conservation Commission (FWC). 2010d. Cooperative Conservation Blueprint. Available online at: http://myfwc.com/conservation/special-initiatives/fwli/archive/taking-action/blueprint/ (Accessed April 4, 2011).

Florida Fish and Wildlife Conservation Commission (FWC). 2009a. Florida's Endangered Species, Threatened Species, and Species of Special Concern. Species Conservation Planning Section, Division of Habitat and Species Conservation, Florida Fish and Wildlife Conservation Commission. Tallahassee, Florida. 6 pp.

Florida Fish and Wildlife Conservation Commission (FWC). 2009b. 2008 Manatee Mortality: 01/01/2008 to 12/31/2008. Marine Mammal Pathobiology Laboratory, Fish and Wildlife Research Institute. St. Petersburg, Florida. Available online at: http://research.myfwc.com/manatees/ (Accessed January 28, 2010).

Florida Fish and Wildlife Conservation Commission (FWC). 2009c. 2009 Manatee Mortality: 01/01/2009 to 10/31/2009. Marine Mammal Pathobiology Laboratory, Fish and Wildlife Research Institute. St. Petersburg, Florida. Available online at: http://research.myfwc.com/manatees/ (Accessed January 28, 2010).

Florida Fish and Wildlife Conservation Commission (FWC). 2009d. Save the Manatee Trust Fund 2008-2009 Annual Report. Population Monitoring and Assessment. Fish and Wildlife Research Institute. St. Petersburg, Florida. 16 pp.

Florida Fish and Wildlife Conservation Commission (FWC). 2009e. Wildlife Legacy Initiative: Taking Action. Tallahassee, Florida. Available online at: http://myfwc.com/WILDLIFEHABITATS/Legacy_takingaction.htm (Accessed January 28, 2010).

Florida Fish and Wildlife Conservation Commission (FWC). 2005. Florida's Wildlife Legacy Initiative: Florida's Comprehensive Wildlife Conservation Strategy. Planning for the Future of Florida's Wildlife. Tallahassee, Florida. 472 pp. Available online at: http://myfwc.com/docs/WildlifeHabitats/Legacy_Strategy.pdf (Accessed January 28, 2010).

Florida Fish and Wildlife Conservation Commission (FWC). 2002. Nature-Based Recreation Master Plan for Chassahowitzka Wildlife Management Area. 35 pp.

Florida Natural Areas Inventory (FNAI). 2011. Florida Forever Board of Trustees Projects. Available online at: http://data.labins.org/imf2/FREAC/FNAI2.jsp (Accessed April 14, 2011).

Florida Oceans and Coastal Council. 2009. The Effects of Climate Change on Florida's Ocean and Coastal Resources. A Special Report to the Florida Energy and Climate Commission and the People of Florida. Tallahassee, FL. 34 pp.

Franz, R., et al. 1998. Avon Park Air Force Range Project: Distribution and Abundance of Sensitive Wildlife Species at Avon Park Air Force Range. Final Report RWO-169.

Frazer, T. K. , C. A. Jacoby, and D. D. Saindon. 2009. Water Quality Characteristics of the Nearshore Gulf Coast Waters Adjacent to Citrus, Hernando and Levy Counties. SWFWMD Contract Number 06C00000079 Final Report. 16pp.

Frazer, T. K., et al. 2002. Nutrient Limiting Status of Phytoplankton in Five Gulf Coast Rivers and Their Associated Estuaries. SWFWMD Contract Number 00CON000038 Final Report. 21 pp.

Great Florida Birding and Wildlife Trail (GFBWT). 2011. Available online at: http://floridabirdingtrail.com/ (Accessed April 05, 2011).

Hoctor, T.,J. Oetting, and S. Beyeler. 2008. CLIP (final Draft) Critical Lands and Waters Identification Project Report on Completion of the CLIP Database Version 1.0 to the Century Commission for a Sustainable Florida and Florida Fish and Wildlife Conservation Commission. 86 pp.

History of Citrus County Florida. Available online at: www.homosassahistory.com/CitrCountyHist.pdf (Accessed May 20, 2011).

Hoegh-Guldberg, O., et al. 2008. Assisted Colonization and Rapid Climate Change. Science 231: 45-346.

Hyde, A. G., et al. 1977. Soil Survey of Hernando County, Florida. U.S. Department of Agriculture, Soil Conservation Service, Brooksville, Florida 152 pp.

Illinois State Water Survey. 2008. Monitoring Mercury Deposition: A Key Tool to Understanding the Link Between Emissions and Effects. National Atmospheric Deposition Program. Illinois State Water Survey. IEM 2005-03 and NADP Brochure 2005-01 revised 02-08.

Inkley, D.B., et al. 2004. Global Climate Change and Wildlife in North America, Wildlife Society Technical Review 04-2. The Wildlife Society, Bethesda, Maryland.

Intergovernmental Panel on Climate Change (IPCC). 2007. Climate Change 2007: Synthesis Report. Contribution of Working Groups I, II and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, Pachauri, R. K. and Reisinger, A. (eds.)]. IPCC, Geneva, Switzerland.

Jones, G.W. and B. Upchurch. 1998. Origin of Nutrients in Ground Water Discharging from the King's Bay Springs. Southwest Florida Water Management District, Brooksville, Florida.

Knochenmus, L. A. and D.K. Yobbi. 2001. Hydrology of the Coastal Springs Ground-Water Basin and Adjacent Parts of Pasco, Hernando, and Citrus Counties, Florida. USGS Water-Resources Investigations Report. 01-4230. 88 pp.

Marcus, S. et al. 1982-83. Species Lists for Chassahowitzka National Wildlife Refuge including plants, birds, mammals, reptiles and amphibians.

Mann, M.E. and K.A. Emanuel. 2006. Atlantic Hurricane Trends Linked to Climate Change. Eos Trans. AGU 87: 233-244.

Milanich, J. T. 1995. Florida Indians and the Invasion from Europe. University of Florida Press. Gainesville, FL.

National Acid Precipitation Assessment Program. 2005. National Acid Precipitation Assessment Program 2004 Integrated Assessment Report. Washington, D.C.

National Acid Precipitation Assessment Program. 1990. Acidic Deposition: State of Science and Technology, Report 24, Visibility: Existing and Historical Conditions – Causes and Effects. Washington, D.C.

National Atmospheric Deposition Program (NADP) Mercury Detection Network (MDN) Monitoring Program. 2011. National Atmospheric Deposition Program (NADP) Mercury Detection Network (MDN) Monitoring Location FL05 Sample Data for Chassahowitzka National Wildlife Refuge. Available online at: http://nadp.sws.uiuc.edu/sites/siteinfo.asp?net=MDN&id=FL05 (Accessed May 05, 2011).

National Ecological Assessment Team. 2006. Strategic Habitat Conservation. A Report from the National Ecological Assessment Team. U.S. Fish and Wildlife Service and U.S. Geological Survey. Available online at: http://www.fws.gov/southwest/About%20Us/SHC%20NEAT_Final_Rpt.pdf (Accessed December 13, 2011).

National Marine Fisheries Service (NMFS). 2009. Recovery Plan for Smalltooth Sawfish (*Pristis pectinata*). Prepared by the Smalltooth Sawfish Recovery Team for the National Marine Fisheries Service, Silver Spring, Maryland.

National Oceanic and Atmospheric Administration (NOAA) Marine Debris Removal Program website. 2011. Available online at: http://marinedebris.noaa.gov/welcome.html (Accessed March 30, 2011).

National Research Council. 1993. Protecting Visibility in National Parks and Wilderness Areas. Washington, D.C.: National Academy Press. 466 pp.

Nesbitt, S.A. and J.L.Hatchitt. 2008. Trends in Habitat and Population of Florida Sandhill Cranes. Proceedings of the North American Crane Workshop 10: 40-42.

Nevada System of Higher Education, Desert Research Institute (DRI). 2011. Conceptual Model – Causes of Haze in Chassahowitzka Wilderness Area (CHAS 1). Through the Causes of Haze Assessment (COHO) Analysis. Available online at: http://www.coha.dri.edu/web/state_analysis/Florida/ChassahowitzkaWA.html (Accessed May 09, 2011).

North American Bird Conservation Initiative – United States website. 2011 Available online at: http://www.nabci-us.org/main2.html (Accessed March 30, 2011).

North American Waterbird Conservation Plan website. 2011. Available online at: http://www.waterbirdconservation.org/ (Accessed March 30, 2011).

North American Waterfowl Management Plan website. 2011. Available online at: http://www.fws.gov/birdhabitat/NAWMP/index.shtm (Accessed March 30, 2011).

Northern Bobwhite Quail Initiative website. 2011. Available online at: http://www.qu.org/seqsg/nbci/nbci.cfm (Accessed March 30, 2011).

National Fish Habitat Action Plan. 2006. Available online at: www.fishhabitat.org (Accessed March 30, 2011).

Nyman, J.A. and R.H. Chabreck. 1995. Fire in Coastal Marshes: History and Recent Concerns. *In* R.T. Engstrom (ed.) pp. 135-141 *In* S.I. Cerulean and R.T. Engstrom (eds.). Proceedings 19th Tall Timbers Fire Ecology Conference – Fire in Wetlands: a Management Perspective. Tall Timbers Research, Inc. Tallahassee, Florida.

Orianne Society 2010. www.oriannesociety.org/eastern-indigo-snake.

Partners in Flight website. 2011. Available online at: http://www.partnersinflight.org/ (Accessed March 30, 2011).

Pilney, P. E., et al. 1988. Soil Survey of Citrus County, Florida. U.S. Department of Agriculture, Soil Conservation Service. Brooksville, Florida. 192 pp.

Porter E. M. 2000. Air Quality Management in U.S. Fish and Wildlife Service Wilderness Areas. USFWS Air Quality Branch, NPS-AIR, PO Box 25287, Denver, CO 80225. *In* USDA Forest Service Proceedings RMRS-P-15-VOL-5. 2000. pp. 336-340.

Rochow, T.F. 1985. Hydrologic and Vegetational Changes Resulting from Underground Pumping at the Cypress Gardens Wellfield, Pasco County, FL. Florida Science 48: 65-80.

Ross, M.S. et al. 2009. Disturbance and the Rising Tide: The Challenge of Biodiversity Management on Low-Island Ecosystems. Frontiers in Ecology and the Environment 7: 471-478.

Scott, T.M., et al. 2004. Springs of Florida. Florida Geological Survey. 377 pp.

Southwest Florida Water Management District (SWFWMD). 2011. Chassahowitzka River and Coastal Swamps fact sheet. Available online at: http://www.swfwmd.state.fl.us/recreation/areas/chassahowitzka.html (Accessed April 05, 2011).

Southwest Florida Water Management District. 2009. An Inventory of Spring Vents in Kings Bay, Crystal River, Florida. 15 pp.

Southwest Florida Water Management District. 2005. District Water Management Plan. Planning Department. Brooksville, Florida. 98 pp.

Southwest Florida Water Management District. 2004. Crystal River/Kings Bay Technical Summary: 1966-2004. Surface Water Improvement and Management Program, Resource Management Department. 34 pp. Available online at: http://www.citruscountyfl.org/devservices/commdev/community/cr_kingsbay_summary.pdf (Accessed December 13, 2011).

Stanton, E.A. and F. Ackerman. 2007. Florida and Climate Change: The Costs of Inaction. Tufts University Global Development and Environment Institute and Stockholm Environment Institute–US Center, Tufts University, Medford, MA.

Stynes, D. J. 2011. Economic Benefits to Local Communities from National Park Visitation and Payroll, 2009. Natural Resource Report NPS/NRPC/SSD/NRR—2011/281. National Park Service, Fort Collins, Colorado.

Texas Agricultural and Mechanical University. 2011. Aquaplant: A Pond Manager Diagnostics Tool – Muskgrass, Chara. Department of Wildlife and Fisheries Sciences, Texas AgriLife Extension Service. Available online at: http://aquaplant.tamu.edu/plant-identification/alphabetical-index/muskgrass/ (Accessed August 12, 2011).

U.S. Department of Commerce. U.S. Census Bureau 2011. Population Estimates Program. Available online at: http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml (Accessed May 20, 2011).

U.S. Department of Commerce, U.S. Census Bureau. 2010 American Community Survey. Available online at: http://factfinder.census.gov.

U.S. Department of Commerce, U.S. Census Bureau. 2010. Florida Population Estimate Program. Available online at: http://2010.census.gov/2010census/data/ (Accessed October 13, 2011).

U.S. Department of Commerce. U.S. Census Bureau 2005-2009. American Community Survey. Available online at: http://factfinder.census.gov/home/saff/main.html?_lang=en (Accessed May 23, 2011).

U.S. Department of Commerce. U.S. Census Bureau, 2005-2007. U.S. Census Bureau, 2005-2007 American Community Survey. Available online at: http://factfinder.census.gov/servlet (Accessed June 17, 2009).

U.S. Department of Energy. 1999. Carbon Sequestration Research and Development. December 1999. Washington, D.C. Available online at: http://www.ornl.gov/carbon_sequestration/

U.S. Department of Interior, Fish and Wildlife Service and U.S. Department of Commerce, U.S. Census Bureau. 2007. 2006 National Survey of Fishing, Hunting, and Wildlife–Associated Recreation. October 2007. Washington D.C. 164 pp. Available online at: http://library.fws.gov/pubs/nat_survey2006_final.pdf (Accessed December 13, 2011)

U.S. Environmental Protection Agency (EPA). 2011a. PM 2.5 – Visibility (IMPROVE) website. Available online at: http://www.epa.gov/ttnamti1/visdata.html (Accessed May 05, 2011).

U.S. Environmental Protection Agency (EPA). 2011b. National Emission Inventory (NEI) Database for Criteria and Hazardous Pollutants. Available online at: http://www.epa.gov/oar/data/neidb.html (Accessed May 06, 2011).

U.S. Fish and Wildlife Service. 2011a. Species Profile: Green Sea Turtle (*Chelonia mytas*). Available online at: http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=C00S (Accessed August 9, 2011).

U.S. Fish and Wildlife Service. 2011b. Factsheet for Green Sea Turtle. Available online at: http://www.fws.gov/northflorida/SeaTurtles/Turtle%20Factsheets/green-sea-turtle.htm (Accessed August 9, 2011).

U.S. Fish and Wildlife Service. 2009. Gulf Sturgeon (*Acipenser oxyrinchus desotoi*), 5-Year Review: Summary and Evaluation. Available online at: http://ecos.fws.gov/docs/five_year_review/doc2620.pdf (Accessed August 9, 2011).

U.S. Fish and Wildlife Service. 2008. Florida Salt Marsh Vole (*Microtus pennsylvanicus dukecampbelli*), Five-Year Review: Summary and Evaluation. Available online at: http://ecos.fws.gov/docs/five_year_review/doc1915.pdf (Accessed August 1, 2011).

U.S. Fish and Wildlife Service. 2007a. National Bald Eagle Management Guidelines. U.S. Fish and Wildlife Service. Washington, D.C. 23 pp. Available online at: http://www.fws.gov/migratorybirds/CurrentBirdIssues/Management/BaldEagle/NationalBaldEagleManagementGuidelines.pdf (Accessed August 9, 2011).

U.S. Fish and Wildlife Service. 2007b. West Indian Manatee (*Trichechus manatus*); 5-Year Review: Summary and Evaluation. Jacksonville Ecological Services Field Office and Caribbean Ecological Services Field Office, Southeast Region, U.S. Fish and Wildlife Service. Jacksonville, Florida and Boqueron, Puerto Rico. 79 pp.

U.S. Fish and Wildlife Service. 2001a. Florida Salt Marsh Vole (*Microtus pennsylvanicus dukecampbelli*). Available online at: http://www.fws.gov/northflorida/Species-Accounts/PDFVersions/Saltmarsh-Vole-2005.pdf (Accessed December 13, 2011)

U.S. Fish and Wildlife Service. 2001b. Florida Manatee Recovery Plan, (*Trichechus manatus latirostris*), Third Revision. U.S. Fish and Wildlife Service. Atlanta, Georgia. 144 pp.

U.S. Fish and Wildlife Service. 1999. South Florida Multi-Species Recovery Plan. Atlanta, GA. 2172 pp.

U.S. Fish and Wildlife Service. 1997. Recovery Plan for the Florida Salt Marsh Vole. U.S. Fish and Wildlife Service, Atlanta, Georgia. 9 pp. Available online at: http://ecos.fws.gov/docs/recovery_plan/970930d.pdf (Accessed August 1, 2011).

U.S. Fish and Wildlife Service and Gulf States Marine Fisheries Commission. 1995. Gulf Sturgeon Recovery Plan. Atlanta, Georgia. 170 pp.

U.S. Fish and Wildlife Service. 1989. Southeastern States Bald Eagle Recovery Plan, U.S. Fish and Wildlife Service. Atlanta, Georgia.

U.S. Shorebird Conservation Plan website. 2011. Available online at: http://www.fws.gov/shorebirdplan/ (Accessed March 30, 2011).

Visit Florida. 2012. http://www.visitflorida.com (Accessed May 20, 2011).
Webcoast.com. 2011. Hernando County History. Available online at: http://www.webcoast.com/hernando.htm (Accessed May 20, 2011).

Webster, P. J., et al. 2005. Changes in Tropical Cyclone Number, Duration, and Intensity, in a Warming Environment. Science 309: 1844–1846.

Western Hemisphere Migratory Species Initiative 2011. Western Hemisphere Migratory Species Initiative website. Available online at: http://www.fws.gov/international/dic/WHMSI/whmsi_about.html (Accessed March 30, 2011).

Withlacoochee Regional Planning Council. 2009. Demograpic Data. Ocala, Florida. Available online at: http://www.wrpc.cc/demographicdata.asp (Accessed March 18, 2010).

Zwick, P.D. and M.H. Carr. 2006. Florida 2060: A Population Distribution Scenario of the State of Florida. A Research Project Prepared for 1000 Friends of Florida by the GeoPlan Center at the University of Florida, Gainesville. Available online at: http://www.1000friendsofflorida.org/planning/2060.asp (Accessed December 13, 2011).

Appendix C. Relevant Legal Mandates and Executive Orders

NATIONAL WILDLIFE REFUGE SYSTEM AUTHORITIES

The mission of the Fish and Wildlife Service is to conserve, protect, and enhance the nation's fish and wildlife and their habitats for the continuing benefit of the American people. The Service is the primary Federal agency responsible for migratory birds, endangered plants and animals, certain marine mammals, and anadromous fish. This responsibility to conserve our nation's fish and wildlife resources is shared with other Federal agencies and State and Tribal governments.

As part of this responsibility, the Service manages the National Wildlife Refuge System. The mission of the National Wildlife Refuge System is to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans.

The Chassahowitzka National Wildlife Refuge is managed as part of this system in accordance with the Refuge Recreation Act of 1962, the National Wildlife Refuge System Administration Act of 1966 as amended by the National Wildlife Refuge System Improvement Act of 1997, Executive Order 12996 (Management and General Public Use of the National Wildlife Refuge System), and other relevant legislation, executive orders, regulations, and policies.

FEDERAL LAWS AND MANDATES

The following list includes federal laws (statutes), Presidential Executive Orders (EO), and Secretarial Orders (SO) issued by the Secretary of the Department of Interior (DOI) that are relevant to the acquisition, administration, and management of national wildlife refuges. The descriptions highlight some aspects of these laws and policies that are relevant to comprehensive conservation planning; however, they are not legal interpretations. The entire act or Executive or Secretarial Orders should be referenced for additional detail. Further information can be obtained from the following websites: http://laws.fws.gov/lawsdigest and http://elips.doi.gov/app_SO/so.cfm.

STATUTE	DESCRIPTION
Administrative Procedures Act (1946)	Outlines administrative procedures to be followed by federal agencies with respect to identification of information to be made public; publication of material in the *Federal Register*; maintenance of records; attendance and notification requirements for specific meetings and hearings; issuance of licenses; and review of agency actions.
American Antiquities Act of 1906	Provides penalties for unauthorized collection, excavation, or destruction of historic or prehistoric ruins, monuments or objects of antiquity on lands owned or controlled by the United States. The Act authorizes the President to designate as national monuments objects or areas of historic or scientific interest on lands owned or controlled by the Unites States.

STATUTE	DESCRIPTION
American Indian Religious Freedom Act of 1978	Protects the inherent right of Native Americans to believe, express, and exercise their traditional religions, including access to important sites, use and possession of sacred objects, and the freedom to worship through ceremonial and traditional rites.
Americans With Disabilities Act of 1990	Intended to prevent discrimination of and make American Society more accessible to people with disabilities. The Act requires reasonable accommodations to be made in employment, public services, public accommodations, and telecommunications for persons with disabilities.
Animal Welfare Act	Provides regulatory standards for the maintenance, care, and transportation of captive animals (7 U.S.C. 2131 et seq).
Archaeological Resources Protection Act of 1979, as amended.	This act strengthens and expands the protective provisions of the Antiquities Act of 1906 regarding archaeological resources. It also revised the permitting process for archaeological research.
Architectural Barriers Act of 1968	Requires that buildings and facilities designed, constructed, or altered with federal funds, or leased by a federal agency, must comply with standards for physical accessibility.
Bald and Golden Eagle Protection Act of 1940, as amended	Prohibits the possession, sale or transport of any bald or golden eagle, alive or dead, or part, nest, or egg except as permitted by the Secretary of the Interior for scientific or exhibition purposes, or for the religious purposes of Indians.
Clean Air Act of 1970	Regulates air emissions from area, stationary, and mobile sources. This Act and its amendments charge federal land managers with direct responsibility to protect the “sir quality and related values” of land under their control. These values include fish, wildlife, and their habitats.
Clean Water Act of 1974, as amended	This Act and its amendments have as its objective the restoration and maintenance of the chemical, physical, and biological integrity of the Nation’s waters. Section 401 of the Act requires that federally permitted activities comply with the Clean Water Act standards, state water quality laws, and any other appropriate state laws. Section 404 charges the U.S. Army Corps of Engineers with regulating discharge of dredge or fill materials into waters of the United States, including wetlands (33 U.S.C. 1251 et seq.).
Coastal Barrier Resources Act of 1982 (CBRA)	Identifies undeveloped coastal barriers along the Atlantic and Gulf coasts and included them in the John H. Chafee Coastal Barrier Resources System (CBRS). The objectives of the act are to minimize loss of human life, reduce wasteful federal expenditures, and minimize the damage to natural resources by restricting most federal expenditures that encourage development within the CBRS.

STATUTE	DESCRIPTION
Coastal Barrier Improvement Act of 1990	Reauthorized the CBRA, expanded the CBRS to include undeveloped coastal barriers along the Great Lakes and in the Caribbean, and established "Otherwise Protected Areas (OPAs)." The Service is responsible for maintaining official maps, consulting with federal agencies that propose spending federal funds within the CBRS and OPAs, and making recommendations to Congress about proposed boundary revisions.
Coastal Wetlands Planning, Protection, and Restoration (1990)	Authorizes the Director of the Fish and Wildlife Service to participate in the development of a Louisiana coastal wetlands restoration program, participate in the development and oversight of a coastal wetlands conservation program, and lead in the implementation and administration of a National coastal wetlands grant program.
Coastal Zone Management Act of 1972, as amended	Established a voluntary national program within the Department of Commerce to encourage coastal states to develop and implement coastal zone management plans and requires that "any Federal activity within or outside of the coastal zone that affects any land or water use or natural resource of the coastal zone" shall be "consistent to the maximum extent practicable with the enforceable policies" of a state's Coastal Zone Management Plan. The law includes an Enhancement Grants Program for protecting, restoring or enhancing existing coastal wetlands or creating new coastal wetlands. It also established the National Estuarine Reserve Research System, guidelines for estuarine research, and financial assistance for land acquisition (16 U.S.C. 1451 et seq.).
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Florida – CITES - Secures international cooperation to regulate trade that might threaten the survival of wild plant and animal species (27 U.S.T. 1087 T.I.A.S. No. 8249).
Emergency Wetlands Resources Act of 1986	This Act authorized the purchase of wetlands from Land and Water Conservation Fund moneys, removing a prior prohibition on such acquisitions. The Act requires the Secretary to establish a National Wetlands Priority Conservation Plan, requires the states to include wetlands in their Comprehensive Outdoor Recreation Plans, and transfers to the Migratory Bird Conservation Fund amounts equal to import duties on arms and ammunition. It also established entrance fees at National Wildlife Refuges.
Endangered Species Act of 1973, as amended	Provides for the conservation of threatened and endangered species of fish, wildlife, and plants by federal action and by encouraging the establishment of state programs. It provides for the determination and listing of endangered and threatened species and the designation of critical habitats. Section 7 requires refuge managers to perform internal consultation before initiating projects that affect or may affect endangered species (16U.S.C.1531 et seq.).

STATUTE	DESCRIPTION
Environmental Education Act of 1990	This act established the Office of Environmental Education within the Environmental Protection Agency to develop and administer a federal environmental education program in consultation with other federal natural resource management agencies, including the Fish and Wildlife Service.
Estuary Protection Act of 1968	Authorized the Secretary of the Interior, in cooperation with other federal agencies and the states, to study and inventory estuaries of the United States, including land and water of the Great Lakes, and to determine whether such areas should be acquired for protection. The Secretary is also required to encourage state and local governments to consider the importance of estuaries in their planning activities relates to federal natural resource grants. In approving any state grants for acquisition of estuaries, the Secretary was required to establish conditions to ensure the permanent protection of estuaries.
Estuaries and Clean Waters Act of 2000	This law creates a federal interagency council that includes the Director of the Fish and Wildlife Service, the Secretary of the Army for Civil Works, the Secretary of Agriculture, the Administrator of the Environmental Protection Agency and the Administrator for the National Oceanic and Atmospheric Administration. The Council is charged with developing a national estuary habitat restoration strategy and providing grants to entities to restore and protect estuary habitat to promote the strategy.
Federal Advisory Committee Act (1972), as amended	Governs the establishment of and procedures for committees that provide advice to the federal government. Advisory committees may be established only if they will serve a necessary, nonduplicative function. Committees must be strictly advisory unless otherwise specified and meetings must be open to the public.
Federal-Aid Highways Act of 1968	Established requirements for approval of federal highways through wildlife refuges and other designated areas to preserve the natural beauty of such areas. The Secretary of Transportation is directed to consult with the Secretary of the Interior and other federal agencies before approving any program or project requiring the use of land under their jurisdiction.
Federal Noxious Weed Act of 1990, as amended	The Secretary of Agriculture was given the authority to designate plants as noxious weeds and to cooperate with other federal, state, and local agencies; farmers associations; and private individuals in measures to control, eradicate, prevent, or retard the spread of such weeds. The Act requires each federal land-managing agency including the Fish and Wildlife Service to designate an office or person to coordinate a program to control such plants on the agency's land and implement cooperative agreements with the states including integrated management systems to control undesirable plants.

STATUTE	DESCRIPTION
Fish and Wildlife Act of 1956	Establishes a comprehensive national fish, shellfish, and wildlife resources policy with emphasis on the commercial fishing industry but also includes the inherent right of every citizen and resident to fish for pleasure, enjoyment, and betterment and to maintain and increase public opportunities for recreational use of fish and wildlife resources. Among other things, it authorizes the Secretary of the Interior to take such steps as may be required for the development, advancement, management, conservation and protection of fish and wildlife resources including, but not limited to, research, development of existing facilities, and acquisition by purchase or exchange of land and water or interests therein.
Fish and Wildlife Conservation Act of 1980, as amended	Requires the Service to monitor nongame bird species, identify species of management concern, and implement conservation measures to preclude the need for listing under the Endangered Species Act.
Fish and Wildlife Coordination Act of 1958	Promotes equal consideration and coordination of wildlife conservation with other water resource development programs by requiring consultation with the Fish and Wildlife Service and the state fish and wildlife agencies where the “waters of a stream or other body of water are proposed or authorized, permitted or licensed to be impounded, diverted…or otherwise controlled or modified” by any agency under federal permit or license.
Fish and Wildlife Improvement Act of 1978	This act was passed to improve the administration of fish and wildlife programs and amends several earlier laws, including the Refuge Recreation Act, the National Wildlife Refuge Administration Act, and the Fish and Wildlife Act of 1956. It authorizes the Secretary to accept gifts and bequests of real and personal property on behalf of the United States. It also authorizes the use of volunteers on Service projects and appropriations to carry out volunteer programs.
Fish and Wildlife Programs Improvement and National Wildlife Refuge System Centennial Act of 2000	Recognizes the vital importance of the Refuge System and the fact that the System will celebrate its centennial anniversary in the year 2003. Established the National Wildlife Refuge System Centennial Commission to prepare a plan to commemorate the 100th anniversary of the System, coordinate activities to celebrate that event, and host a conference on the National Wildlife Refuge System. The commission is also responsible for developing a long-term plan to meet the priority operations; maintenance and construction needs for the System, and improve public use programs and facilities.
Fishery (Magnuson) Conservation and Management Act of 1976	Established Regional Fishery Management Councils comprised of federal and state officials including the Fish and Wildlife Service. It provides for regulation of foreign fishing and vessel fishing permits.

STATUTE	DESCRIPTION
Freedom of Information Act, 1966	Requires all federal agencies to make available to the public for inspection and copying administrative staff manuals and staff instructions, official, published and unpublished policy statements, final orders deciding case adjudication, and other documents. Special exemptions have been reserved for nine categories of privileged material. The Act requires the party seeking the information to pay reasonable search and duplication costs.
Lacey Act of 1900, as amended	Originally designed to help states protect their native game animals and to safeguard U.S. crop production from harmful foreign species. This Act prohibits interstate and international transport and commerce of fish, wildlife or plant taken in violation of domestic or foreign laws. It regulates the introduction to America of foreign species into new locations.
Land and Water Conservation Fund Act of 1948	This act provides funding through receipts from the sale of surplus federal land, appropriations from oil and gas receipts from the outer continental shelf, and other sources for land acquisition under several authorities. Appropriations from the fund may be used for matching grants to states for outdoor recreation projects and for land acquisition by various federal agencies including the Fish and Wildlife Service.
Marine Mammal Protection Act of 1972, as amended	The 1972 Marine Mammal Protection Act established a federal responsibility to conserve marine mammals with management vested in the Department of Interior for sea otter, walrus, polar bear, dugong, and manatee. The Department of Commerce is responsible for cetaceans and pinnipeds, other than the walrus. With certain specified exceptions, the Act establishes a moratorium on the taking and importation of marine mammals as well as products taken from them.
Migratory Bird Conservation Act of 1929	Established a Migratory Bird Conservation Commission to approve areas recommended by the Secretary of the Interior for acquisition with Migratory Bird Conservation Funds. The role of the Commission was expanded by the North American Wetland Conservation Act to include approving wetlands acquisition, restoration, and enhancement proposals recommended by the North American Wetlands Conservation Council.
Migratory Bird Hunting and Conservation Stamp Act of 1934	Also commonly referred to as the Duck Stamp Act”, requires waterfowl hunters 16 years of age or older to possess a valid federal hunting stamp. Receipts from the sale of the stamp are deposited into the Migratory Bird Conservation Fund for the acquisition of migratory bird refuges.
Migratory Bird Treaty Act of 1918, as amended	This Act implements various treaties and conventions between the U.S. and Canada, Japan, Mexico and the former Soviet Union for the protection of migratory birds. Except as allowed by special regulations, this Act makes it unlawful to pursue, hunt, kill, capture, possess, buy, sell, purchase, barter, export or import any migratory bird, part, nest, egg or product.

STATUTE	DESCRIPTION
National and Community Service Act of 1990	Authorizes several programs to engage citizens of the U.S. in full-and/or part-time projects designed to combat illiteracy and poverty, provide job skills, enhance educational skills, and fulfill environmental needs. Among other things, this law establishes the American Conservation and Youth Service Corps to engage young adults in approved human and natural resource projects, which will benefit the public or are carried out on federal or Indian lands.
National Environmental Policy Act of 1969	Requires analysis, public comment, and reporting for environmental impacts of federal actions. It stipulates the factors to be considered in environmental impact statements, and requires that federal agencies employ an interdisciplinary approach in related decision-making and develop means to ensure that unqualified environmental values are given appropriate consideration, along with economic and technical considerations.
National Historic Preservation Act of 1966, as amended	It establishes a National Register of Historic Places and a program of matching grants for preservation of significant historical features. Federal agencies are directed to take into account the effects of their actions on items or sites listed or eligible for listing in the National Register.
National Trails System Act (1968), as amended	Established the National Trails System to protect the recreational, scenic and historic values of some important trails. National Recreation Trails may be established by the Secretaries of Interior or Agriculture on land wholly or partly within their jurisdiction, with the consent of the involved state(s), and other land managing agencies, if any. National Scenic and National Historic Trails may only be designated by an Act of Congress. Several National Trails cross units of the National Wildlife Refuge System.
National Wildlife Refuge System Administration Act of 1966	Prior to 1966, there was no single federal law that governed the administration of the various wildlife refuges that had been established. This Act defines the National Wildlife Refuge System and authorizes the Secretary of the Interior to permit any use of an area provided such use is compatible with the major purposes(s) for which the area was established.
National Wildlife Refuge System Improvement Act of 1997	This Act amends the National Wildlife Refuge System Administration Act of 1966. It defines the mission of the National Wildlife Refuge System, establishes the legitimacy and appropriateness of six priority ‘wildlife-dependent’ public uses, establishes a formal process for determining ‘compatible uses’ of System lands, identifies the Secretary of the Interior as responsible for managing and protecting the System, and requires the development of a comprehensive conservation plan for all refuges outside of Alaska.
Native American Graves Protection and Repatriation Act of 1990	Requires federal agencies and museums to inventory, determine ownership of, and repatriate certain cultural items and human remains under their control or possession. The Act also addresses the repatriation of cultural items inadvertently discovered by construction activities on lands managed by the agency.

STATUTE	DESCRIPTION
Neotropical Migratory Bird Conservation Act of 2000	Establishes a matching grants program to fund projects that promote the conservation of Neotropical migratory birds in the United States, Latin America, and the Caribbean.
North American Wetlands Conservation Act of 1989	Provides funding and administrative direction for implementation of the North American Waterfowl Management Plan and the Tripartite Agreement on wetlands between Canada, U.S. and Mexico. North American Wetlands Conservation Council is created to recommend projects to be funded under the Act to the Migratory Bird Conservation Commission. Available funds may be expended for up to 50 percent of the United States share cost of wetlands conservation projects in Canada, Mexico, or the United States (or 100 percent of the cost of projects on federal lands).
Refuge Recreation Act of 1962, as amended	This Act authorizes the Secretary of the Interior to administer refuges, hatcheries, and other conservation areas for recreational use, when such uses do not interfere with the area's primary purposes. It authorizes construction and maintenance of recreational facilities and the acquisition of land for incidental fish and wildlife oriented recreational development or protection of natural resources. It also authorizes the charging fees for public uses.
Partnerships for Wildlife Act of 1992	Establishes a Wildlife Conservation and Appreciation Fund, to receive appropriated funds and donations from the National Fish and Wildlife Foundation and other private sources to assist the state fish and game agencies in carrying out their responsibilities for conservation of nongame species. The funding formula is no more that 1/3 federal funds, at least 1/3 Foundation funds, and at least 1/3 state funds.
Refuge Revenue Sharing Act of 1935, as amended	Provided for payments to counties in lieu of taxes from areas administered by the Fish and Wildlife Service. Counties are required to pass payments along to other units of local government within the county, which suffer losses in tax revenues due to the establishment of Service areas.
Rehabilitation Act of 1973	Requires nondiscrimination in the employment practices of federal agencies of the executive branch and contractors. It also requires all federally assisted programs, services, and activities to be available to people with disabilities.
Rivers and Harbors Appropriations Act of 1899, as amended	Requires the authorization by the U.S. Army Corps of Engineers prior to any work in, on, over, or under a navigable water of the United States. The Fish and Wildlife Coordination Act provides authority for the Service to review and comment on the effects on fish and wildlife activities proposed to be undertaken or permitted by the Corps of Engineers. Service concerns include contaminated sediments associated with dredge or fill projects in navigable waters.

STATUTE	DESCRIPTION
Sikes Act (1960), as amended	Provides for the cooperation by the Department of the Interior and Defense with state agencies in planning, development, and maintenance of fish and wildlife resources and outdoor recreation facilities on military reservations throughout the U.S. It requires the Secretary of each military department to use trained professionals to manage the wildlife and fishery resource under his jurisdiction, and requires federal and state fish and wildlife agencies be given priority in management of fish and wildlife activities on military reservations.
Transfer of Certain Real Property for Wildlife Conservation Purposes Act of 1948	This Act provides that upon determination by the Administrator of the General Services Administration, real property no longer needed by a federal agency can be transferred, without reimbursement, to the Secretary of the Interior if the land has particular value for migratory birds, or to a state agency for other wildlife conservation purposes.
Transportation Equity Act for the 21st Century (1998)	Established the Refuge Roads Program, requires transportation planning that includes public involvement, and provides funding for approved public use roads and trails and associated parking lots, comfort stations and bicycle/pedestrian facilities.
Uniform Relocation & Assistance & Real Property Acquisition Policies Act 1970	Provides for uniform and equitable treatment of persons who sell their homes, businesses, or farms to the Service. The Act requires that any purchase offer be no less than the fair market value of the property.
Water Resources Planning Act of 1965	Established Water Resources Council to be composed of Cabinet representatives including the Secretary of the Interior. The Council reviews river basin plans with respect to agricultural, urban, energy, industrial, recreational and fish and wildlife needs. The act also established a grant program to assist states in participating in the development of related comprehensive water and land use plans.
Wilderness Act of 1964, as amended	The Wilderness Act of 1964 directs the Secretary of the Interior to review every roadless area of 5,000 acres (2,023 ha) or more and every roadless island regardless of size within the National Wildlife Refuge System and to recommend suitability of each such area. The Act permits certain activities within designated Wilderness Areas that do not alter natural processes. Wilderness values are preserved through a “minimum tool” management approach, which requires refuge managers to use the least intrusive methods, equipment and facilities necessary for administering the areas.
Youth Conservation Corps Act of 1970	Established a Youth Conservation Corps (YCC) programs within the Department of Interior and Agriculture. Within the Service, YCC participants perform many tasks on refuges, fish hatcheries, and research stations.

EXECUTIVE ORDERS	DESCRIPTIONS
EO 11593, Protection and Enhancement of the Cultural Environment (1971)	States that if the Service proposes any development activities that may affect the archaeological or historic sites, the Service will consult with Federal and State Historic Preservation Officers to comply with Section 106 of the National Historic Preservation Act of 1966, as amended.
EO 11644, Use of Off-road Vehicles on Public Land (1972)	Established policies and procedures to ensure that the use of off-road vehicles on public lands will be controlled and directed so as to protect the resources of those lands, to promote the safety of all users of those lands, and to minimize conflicts among the various uses of those lands.
EO 11988, Floodplain Management (1977)	The purpose of this Executive Order is to prevent federal agencies from contributing to the "adverse impacts associated with occupancy and modification of floodplains" and the "direct or indirect support of floodplain development." In the course of fulfilling their respective authorities, federal agencies "shall take action to reduce the risk of flood loss, to minimize the impact of floods on human safety, health and welfare, and to restore and preserve the natural and beneficial values served by floodplains."
EO 11989 (1977), Amends Section 2 of EO 11644	Directs agencies to close areas negatively impacted by off-road vehicles.
EO 11990, Protection of Wetlands (1977)	Federal agencies are directed to provide leadership and take action to minimize the destruction, loss of degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands.
EO 12372, Intergovernmental Review of Federal Programs (1982)	Seeks to foster intergovernmental partnerships by requiring federal agencies to use the state process to determine and address concerns of state and local elected officials with proposed federal assistance and development programs.
EO 12898, Environmental Justice (1994)	Requires federal agencies to identify and address disproportionately high and adverse effects of its programs, policies, and activities on minority and low-income populations.
EO 12906, Coordinating Geographical Data Acquisition and Access (1994), Amended by EO 13286 (2003). Amendment of EOs and other actions in connection with transfer of certain functions to Secretary of DHS.	Recommended that the executive branch develop, in cooperation with state, local, and tribal governments, and the private sector, a coordinated National Spatial Data Infrastructure to support public and private sector applications of geospatial data. Of particular importance to comprehensive conservation planning is the National Vegetation Classification System (NVCS), which is the adopted standard for vegetation mapping. Using NVCS facilitates the compilation of regional and national summaries, which in turn, can provide an ecosystem context for individual refuges.

EXECUTIVE ORDERS	DESCRIPTIONS
EO 12962, Recreational Fisheries (1995)	Federal agencies are directed to improve the quantity, function, sustainable productivity, and distribution of U.S. aquatic resources for increased recreational fishing opportunities in cooperation with states and tribes.
EO 13007, Native American Religious Practices (1996)	Provides for access to, and ceremonial use of, Indian sacred sites on federal lands used by Indian religious practitioners and direction to avoid adversely affecting the physical integrity of such sites.
EO 13061, Federal Support of Community Efforts Along American Heritage Rivers (1997)	Established the American Heritage Rivers initiative for the purpose of natural resource and environmental protection, economic revitalization, and historic and cultural preservation. The Act directs Federal agencies to preserve, protect, and restore rivers and their associated resources important to our history, culture, and natural heritage.
EO 13084, Consultation and Coordination With Indian Tribal Governments (2000)	Provides a mechanism for establishing regular and meaningful consultation and collaboration with tribal officials in the development of federal policies that have tribal implications.
EO 13112, Invasive Species (1999)	Federal agencies are directed to prevent the introduction of invasive species, detect and respond rapidly to and control populations of such species in a cost effective and environmentally sound manner, accurately monitor invasive species, provide for restoration of native species and habitat conditions, conduct research to prevent introductions and to control invasive species, and promote public education on invasive species and the means to address them. This EO replaces and rescinds EO 11987, Exotic Organisms (1977).
EO 13186, Responsibilities of Federal Agencies to Protect Migratory Birds. (2001)	Instructs federal agencies to conserve migratory birds by several means, including the incorporation of strategies and recommendations found in Partners in Flight Bird Conservation plans, the North American Waterfowl Plan, the North American Waterbird Conservation Plan, and the United States Shorebird Conservation Plan, into agency management plans and guidance documents.
EO 13443, Facilitation of Hunting Heritage and Wildlife Conservation (2007)	Directs federal agencies to facilitate the expansion and enhancement of hunting opportunities and the management of game species and their habitats.

SECRETARIAL ORDERS	DESCRIPTIONS
3289A1- Addressing the Impacts of Climate Change on America's Water, Land, and Other Natural and Cultural Resources February 22, 2010	This Order provides guidance to bureaus and offices within the Department of the Interior (DOI) on how to provide leadership by developing timely responses to emerging climate change issues. This Order replaces Secretarial Order No. 3226, signed on January 19, 2001, entitled "Evaluating Climate Change Impacts in Management Planning." It is intended to reaffirm efforts within DOI that are ongoing with respect to this important issue. Specific provisions include: Each DOI bureau and office must consider and analyze potential climate change impacts when undertaking long-range planning exercises, setting priorities for scientific research and investigations, developing multi-year management plans (CCPs), and making major decisions regarding potential use of resources under the Department's purview. DOI will develop landscape-level strategies for understanding and responding to climate change impacts. Interior bureaus and agencies, guided by the Energy and Climate Change Council, will work to stimulate the development of a network of collaborative "Landscape Conservation Cooperatives." These cooperatives will work interactively with the relevant DOI Climate Science Center(s) and help coordinate adaptation efforts in the regions.
3305 – Ensuring Scientific Integrity Within the Department of Interior (DOI) September 29, 2010	This directs the establishment of Department-wide policy to guide and ensure the integrity of science and scientific products developed and used by DOI in decision making and in the creation of policy related to the conservation and responsible development of our Nation's natural resources, protecting our heritage, and honoring native cultures and tribal communities. This policy has been incorporated in 305 DM 3.
3270 – Adaptive Management March 9, 2007	This Order provides policy guidance and procedures for implementing adaptive management. It was superseded by the 522 Department Manual (DM) 1 on February 1, 2008.

MANATEE REGULATIONS

Manatees are protected directly and indirectly through a number of federal, state, and local laws. The primary statutes at the federal level are the Endangered Species Act (ESA) of 1973, as amended, and the Marine Mammal Protection Act of 1972 (MMPA). The manatee is a federally listed species. At the state level, the Florida manatee was reclassified as threatened under Rule 68A-27.003, FAC. State listing criteria and definitions of endangered and threatened are different from federal laws.

One important state regulatory mechanism specific to manatees is the Florida Manatee Sanctuary Act of 1978. This act established Florida as a refuge and sanctuary for manatees. The act protects manatees from injury, disturbance, harassment, or harm in the waters of Florida and allows for enforcement of boat speeds and operations in areas where manatees are concentrated. Since 2001, there have been numerous additions and improvements to federal, state and local manatee protection zones throughout peninsular Florida, as well as studies to assess the effectiveness of these protection zones. The primary state agency for manatee protection is the Florida Fish and Wildlife Conservation Commission (FWC).

State laws also provide a regulatory basis to protect spring flows. Specific regulations to ensure sufficient flows to many springs that provide important habitat for manatees are being adopted.

To reduce unauthorized “take” associated with boat facility construction and the boats that use them, the Service, state, and permitting authorities have developed permitting guidance to minimize the effects of these activities on manatees. In addition, the State of Florida drafted a management plan in 2007. As part of a state initiative beginning in 1991, numerous coastal counties have adopted manatee protection plans and other manatee protection measures.

Feeding manatees is against both federal and state law; it is considered a form of “harassment” under the federal ESA and MMPA and the Florida Administrative Code (68C-22.002, FAC). In addition to law enforcement activities, extensive outreach initiatives exist to address these activities. In the case of “swim with” interactions, people generally swim with manatees during the winter when animals are locally abundant near aggregation sites. Citrus County, Florida, is the principal area where this activity occurs. People swimming with manatees do so independently or through the services of commercial dive shops. There has been much public interest associated with these activities. The Service and the FWC continue to implement efforts to minimize harassment.

PRIMARY STATE WILDLIFE REGULATIONS

The State of Florida’s primary wildlife regulations are found in Chapter 327.072, Florida Statutes and Chapter 68A-27, Florida Administrative Code (FAC). The Florida Fish and Wildlife Conservation Commission maintains the state list of animals designated as threatened, endangered, or species of special concern, in accordance with Rules 68A-27.003 to .005, FAC. For additional information, please visit https://www.flrules.org/. This list is also found on the Commission’s website: http://myfwc.com. The state list of plants, which are designated as threatened, endangered, and commercially exploited, are administered and maintained by the Florida Department of Agriculture and Consumer Services via Chapter 5B-40, FAC. This list of plants can be obtained at the Department’s website: http://www.doacs.state.fl.us/~pi/index.html.

Appendix D. Public Involvement

In accordance with Service and NEPA guidelines, public involvement has been a crucial factor throughout the development of the Draft Comprehensive Conservation Plan (CCP, the plan) and Environmental Assessment for Chassahowitzka NWR. In 2009, a core CCP planning team of Service staff and state natural resource and wildlife agency representatives started meeting regularly to develop the CCP for the refuge. A public notice announcing the Service's intent to develop a CCP for the refuge was published in the *Federal Register* on March 18, 2009. The plan was written with input from interested citizens, conservation organizations, and representatives of local, regional, state, and federal agencies. The participation of these stakeholders and their ideas has been of great value in setting the management direction for Chassahowitzka NWR.

An interagency meeting of government partners convened on July 14, 2009, to identify the important issues that needed to be addressed in the CCP. Seven agencies were represented. Many of these same partners met on October 15, 2009, to discuss the refuge's wilderness resources.

In preparation for the CCP and in accordance with the requirements of the NEPA, public scoping was conducted. An advertised public comment period for the public scoping process was held from October 1 through October 31, 2009. Notices informing the public of the CCP scoping process and inviting them to attend a scheduled public scoping meeting were published in several local newspapers. Flyers announcing the same were also displayed at several locations within the refuge, including all boat ramps.

The public scoping meeting was conducted on October 1, 2009, at the Homosassa Civic Club in Homosassa, Florida. Of the 13 citizens who signed in as attendees, five made verbal comments. The following organizations were represented: the Friends group, the Citrus County Airboat Alliance, the United Waterfowlers of Florida, Inc., the Homosassa River Alliance, and the Defenders of Wildlife.

Three comment sheets and one letter were received during the public scoping period. Most of the public comments (verbal and in writing) asked for stronger protections for wildlife resources. The comments are summarized below.

1. Protect the water quality of the estuaries and rivers adjacent to or owned by the refuge.
2. Protect the springs, spring flow (first-order magnitude) and Homosassa River.
3. The plan should address the observed decline in use of waterfowl and decline in habitat and to take measures to restore a population and re-establish viable hunting in the area. A representative of the United Waterfowlers of Florida, Inc. suggested using impoundments or other means to restore use to original purpose of refuge under Migratory Bird Act using Merritt Island NWR as an example.
4. The president of the Homosassa River Alliance suggested having the refuge designated as a National Estuarine Research Reserve. Another member suggested National Estuary Program status.
5. Need to work with counties to guide development and limit withdrawals from groundwater and springs.
6. Citizens were concerned about the possibility of offshore drilling off the coast and felt it should not be allowed.
7. Defenders of Wildlife recognized the small population of black bears in the Chassahowitzka area; are interested in the whooping crane project; and would like for the refuge to focus on

examining the effects of climate change on the refuge. In a 10-page letter from the Defenders of Wildlife's national office, the following recommendations were made:

- The CCP should incorporate information on how western Florida coastal habitats are impacted by climate change (sea level rise and increased storm frequency);
- incorporate information on how wildlife using the refuge are affected by climate change;
- address non-climatic issues affecting manatees and other species using the refuge;
- outline a plan to research and monitor the ongoing and emerging ecosystem changes induced by climate change;
- discuss and consider the impacts of climate change on the Chassahowitzka ecosystem and explore opportunities for the inclusion of such information in the refuge's environmental education programs;
- take steps to increase plant and wildlife resiliency by working to reduce non-climatic stressors;
- plan to inventory existing conditions to acquire the necessary baseline information on all wildlife species and species guilds, vegetation, spring flows, visitor use, land acquisition efforts, funding and future funding needs, and law enforcement and management capacity;
- ensure that the refuge is managed as an integral part within the larger geographic complex; and
- strive for flexibility in allowing adaptive management.

Other comments included the following suggestions on public use of the refuge:

1. The Citrus County Airboat Alliance suggested providing an airboat route through the Citrus County portion of the refuge to eliminate travel times and distance for local waterway users. This airboat route could promote boater safety by avoiding the need to travel out to the open waters of the Gulf of Mexico.
2. Do not allow airboats;
3. Restrict use to boats that do not pollute via emissions or noise, such as, for example, kayaks, canoes, and electric-motor boats.

The CCP planning team considered all public and interagency comments. As summarized in Chapter III, Plan Development, of the Draft CCP, the team identified the most crucial issues for management of the refuge over the 15-year life of the CCP. The team also considered three alternatives for managing the refuge and their potential environmental effects in the Environmental Assessment (Section B). Alternative C, Adaptive Management, is the Service's proposed alternative for best addressing the critical issues that were identified, and is described in Chapters IV and V of the Draft CCP.

Appendix E. Appropriate Use Determinations

Refuges are closed to public use unless opened for specific uses. An appropriate use determination is the initial decision process a refuge manager undertakes when considering whether or not to allow a proposed use on a refuge. If an existing use is not appropriate, the refuge manager will eliminate or modify the use as expeditiously as practicable. If a new use is not appropriate, the refuge manager will deny the use without determining compatibility. Uses that have been administratively determined to be appropriate are:

- The six wildlife-dependent recreational uses - Under the NWRS Improvement Act of 1997 hunting, fishing, wildlife observation, environmental education, wildlife photography and environmental interpretation are determined to be appropriate.
- Take of fish and wildlife under state regulations - States have regulations concerning take of wildlife that includes hunting, fishing, and trapping. The Service considers take of wildlife under such regulations appropriate.

The refuge manager will also consider if the use contributes to fulfilling the refuge purpose(s), the Refuge System mission, or goals or objectives described in a refuge management plan approved after October 9, 1997, the date the Improvement Act was signed into law. Once a use is determined to be appropriate, then the refuge manager must conduct a second evaluation to determine if the each use is compatible before allowing it on a refuge. The propose Compatibility Determinations for the refuge are provided in Appendix F.

Appropriate use findings are listed below for the following uses:

1. Research and Monitoring
2. Boating (motorized and nonmotorized)
3. Picnicking
4. Walking, Hiking and Jogging
5. Commercial Photography
6. Commercial Tours and Guiding
7. Mosquito Management
8. Camping.

Uses found not to be appropriate include:

1. Geocaching
2. Dirt Bike Riding
3. Commercial Drift Wood Collecting.

Statutory Authorities for this policy include: (for a description, see Appendix C: Legal Mandates)

National Wildlife Refuge System Administration Act of 1966, as amended by the National Wildlife Refuge System Improvement Act of 1997, 16 U.S.C. §668dd-668ee;

Refuge Recreation Act of 1962, 16 U.S.C. 460k; and

Executive Orders 11644 and 11989.

FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: Chassahowitzka NWR

Use: Fishing (commercial)

This form is not required for wildlife-dependent recreational uses, take regulated by the State, or uses already described in a refuge CCP or step-down management plan approved after October 9, 1997.

Decision Criteria:	YES	NO
(a) Do we have jurisdiction over the use?	X	
(b) Does the use comply with applicable laws and regulations (Federal, State, tribal, and local)?	X	
(c) Is the use consistent with applicable executive orders and Department and Service policies?	X	
(d) Is the use consistent with public safety?	X	
(e) Is the use consistent with goals and objectives in an approved management plan or other document?	X	
(f) Has an earlier documented analysis not denied the use or is this the first time the use has been proposed?	X	
(g) Is the use manageable within available budget and staff?	X	
(h) Will this be manageable in the future within existing resources?	X	
(i) Does the use contribute to the public's understanding and appreciation of the refuge's natural or cultural resources, or is the use beneficial to the refuge's natural or cultural resources?	X	
(j) Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see section 1.6D, 603 FW 1, for description), compatible, wildlife-dependent recreation into the future?	X	

Where we do not have jurisdiction over the use ["no" to (a)], there is no need to evaluate it further as we cannot control the use. Uses that are illegal, inconsistent with existing policy, or unsafe ["no" to (b), (c), or (d)] may not be found appropriate. If the answer is "no" to any of the other questions above, we will **generally** not allow the use.

If indicated, the refuge manager has consulted with State fish and wildlife agencies. **Yes _X_ No ___**

When the refuge manager finds the use appropriate based on sound professional judgment, the refuge manager must justify the use in writing on an attached sheet and obtain the refuge supervisor's concurrence.

Based on an overall assessment of these factors, my summary conclusion is that the proposed use is:

Not Appropriate_____ **Appropriate__X__**

Refuge Manager:_____ Date:_____

If found to be **Not Appropriate**, the refuge supervisor does not need to sign concurrence if the use is a new use.
If an existing use is found **Not Appropriate** outside the CCP process, the refuge supervisor must sign concurrence.
If found to be **Appropriate**, the refuge supervisor must sign concurrence.

Refuge Supervisor:_____ Date:_____

A compatibility determination is required before the use may be allowed.

FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: Chassahowitzka NWR

Use: Research and Monitoring

This form is not required for wildlife-dependent recreational uses, take regulated by the State, or uses already described in a refuge CCP or step-down management plan approved after October 9, 1997.

Decision Criteria:	YES	NO
(a) Do we have jurisdiction over the use?	X	
(b) Does the use comply with applicable laws and regulations (Federal, State, tribal, and local)?	X	
(c) Is the use consistent with applicable executive orders and Department and Service policies?	X	
(d) Is the use consistent with public safety?	X	
(e) Is the use consistent with goals and objectives in an approved management plan or other document?	X	
(f) Has an earlier documented analysis not denied the use or is this the first time the use has been proposed?	X	
(g) Is the use manageable within available budget and staff?	X	
(h) Will this be manageable in the future within existing resources?	X	
(i) Does the use contribute to the public's understanding and appreciation of the refuge's natural or cultural resources, or is the use beneficial to the refuge's natural or cultural resources?	X	
(j) Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see section 1.6D, 603 FW 1, for description), compatible, wildlife-dependent recreation into the future?	X	

Where we do not have jurisdiction over the use ["no" to (a)], there is no need to evaluate it further as we cannot control the use. Uses that are illegal, inconsistent with existing policy, or unsafe ["no" to (b), (c), or (d)] may not be found appropriate. If the answer is "no" to any of the other questions above, we will **generally** not allow the use.

If indicated, the refuge manager has consulted with State fish and wildlife agencies. **Yes** X **No** ___

When the refuge manager finds the use appropriate based on sound professional judgment, the refuge manager must justify the use in writing on an attached sheet and obtain the refuge supervisor's concurrence.

Based on an overall assessment of these factors, my summary conclusion is that the proposed use is:

Not Appropriate_____ **Appropriate**__X__

Refuge Manager:_____ Date:_____

If found to be **Not Appropriate**, the refuge supervisor does not need to sign concurrence if the use is a new use.
If an existing use is found **Not Appropriate** outside the CCP process, the refuge supervisor must sign concurrence.
If found to be **Appropriate**, the refuge supervisor must sign concurrence.

Refuge Supervisor:_____ Date:_____

A compatibility determination is required before the use may be allowed.

FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: Chassahowitzka NWR

Use: Boating (motorized and nonmotorized)

This form is not required for wildlife-dependent recreational uses, take regulated by the State, or uses already described in a refuge CCP or step-down management plan approved after October 9, 1997.

Decision Criteria:	YES	NO
(a) Do we have jurisdiction over the use?	X	
(b) Does the use comply with applicable laws and regulations (Federal, State, tribal, and local)?	X	
(c) Is the use consistent with applicable executive orders and Department and Service policies?	X	
(d) Is the use consistent with public safety?	X	
(e) Is the use consistent with goals and objectives in an approved management plan or other document?	X	
(f) Has an earlier documented analysis not denied the use or is this the first time the use has been proposed?	X	
(g) Is the use manageable within available budget and staff?	X	
(h) Will this be manageable in the future within existing resources?	X	
(i) Does the use contribute to the public's understanding and appreciation of the refuge's natural or cultural resources, or is the use beneficial to the refuge's natural or cultural resources?	X	
(j) Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see section 1.6D, 603 FW 1, for description), compatible, wildlife-dependent recreation into the future?	X	

Where we do not have jurisdiction over the use ["no" to (a)], there is no need to evaluate it further as we cannot control the use. Uses that are illegal, inconsistent with existing policy, or unsafe ["no" to (b), (c), or (d)] may not be found appropriate. If the answer is "no" to any of the other questions above, we will **generally** not allow the use.

If indicated, the refuge manager has consulted with State fish and wildlife agencies. **Yes** _X_ **No** ___

When the refuge manager finds the use appropriate based on sound professional judgment, the refuge manager must justify the use in writing on an attached sheet and obtain the refuge supervisor's concurrence.

Based on an overall assessment of these factors, my summary conclusion is that the proposed use is:

Not Appropriate_____ **Appropriate**__X__

Refuge Manager:_____ Date:_____

If found to be **Not Appropriate**, the refuge supervisor does not need to sign concurrence if the use is a new use.
If an existing use is found **Not Appropriate** outside the CCP process, the refuge supervisor must sign concurrence.
If found to be **Appropriate**, the refuge supervisor must sign concurrence.

Refuge Supervisor:_____ Date:_____

A compatibility determination is required before the use may be allowed.

FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: Chassahowitzka NWR

Use: Picnicking

This form is not required for wildlife-dependent recreational uses, take regulated by the State, or uses already described in a refuge CCP or step-down management plan approved after October 9, 1997.

Decision Criteria:	YES	NO
(a) Do we have jurisdiction over the use?	X	
(b) Does the use comply with applicable laws and regulations (Federal, State, tribal, and local)?	X	
(c) Is the use consistent with applicable executive orders and Department and Service policies?	X	
(d) Is the use consistent with public safety?	X	
(e) Is the use consistent with goals and objectives in an approved management plan or other document?	X	
(f) Has an earlier documented analysis not denied the use or is this the first time the use has been proposed?	X	
(g) Is the use manageable within available budget and staff?	X	
(h) Will this be manageable in the future within existing resources?	X	
(i) Does the use contribute to the public's understanding and appreciation of the refuge's natural or cultural resources, or is the use beneficial to the refuge's natural or cultural resources?	X	
(j) Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see section 1.6D, 603 FW 1, for description), compatible, wildlife-dependent recreation into the future?	X	

Where we do not have jurisdiction over the use ["no" to (a)], there is no need to evaluate it further as we cannot control the use. Uses that are illegal, inconsistent with existing policy, or unsafe ["no" to (b), (c), or (d)] may not be found appropriate. If the answer is "no" to any of the other questions above, we will **generally** not allow the use.

If indicated, the refuge manager has consulted with State fish and wildlife agencies. **Yes** _X_ **No** ___

When the refuge manager finds the use appropriate based on sound professional judgment, the refuge manager must justify the use in writing on an attached sheet and obtain the refuge supervisor's concurrence.

Based on an overall assessment of these factors, my summary conclusion is that the proposed use is:

Not Appropriate_____ **Appropriate** _X_

Refuge Manager:_____ Date:_____

If found to be **Not Appropriate**, the refuge supervisor does not need to sign concurrence if the use is a new use.
If an existing use is found **Not Appropriate** outside the CCP process, the refuge supervisor must sign concurrence.
If found to be **Appropriate**, the refuge supervisor must sign concurrence.

Refuge Supervisor:_____ Date:_____

A compatibility determination is required before the use may be allowed.

FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: Chassahowitzka NWR

Use: Commercial Tours and Guiding

This form is not required for wildlife-dependent recreational uses, take regulated by the State, or uses already described in a refuge CCP or step-down management plan approved after October 9, 1997.

Decision Criteria:	YES	NO
(a) Do we have jurisdiction over the use?	X	
(b) Does the use comply with applicable laws and regulations (Federal, State, tribal, and local)?	X	
(c) Is the use consistent with applicable executive orders and Department and Service policies?	X	
(d) Is the use consistent with public safety?	X	
(e) Is the use consistent with goals and objectives in an approved management plan or other document?	X	
(f) Has an earlier documented analysis not denied the use or is this the first time the use has been proposed?	X	
(g) Is the use manageable within available budget and staff?	X	
(h) Will this be manageable in the future within existing resources?	X	
(i) Does the use contribute to the public's understanding and appreciation of the refuge's natural or cultural resources, or is the use beneficial to the refuge's natural or cultural resources?	X	
(j) Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see section 1.6D, 603 FW 1, for description), compatible, wildlife-dependent recreation into the future?	X	

Where we do not have jurisdiction over the use ["no" to (a)], there is no need to evaluate it further as we cannot control the use. Uses that are illegal, inconsistent with existing policy, or unsafe ["no" to (b), (c), or (d)] may not be found appropriate. If the answer is "no" to any of the other questions above, we will **generally** not allow the use.

If indicated, the refuge manager has consulted with State fish and wildlife agencies. **Yes _X_ No ___**

When the refuge manager finds the use appropriate based on sound professional judgment, the refuge manager must justify the use in writing on an attached sheet and obtain the refuge supervisor's concurrence.

Based on an overall assessment of these factors, my summary conclusion is that the proposed use is:

Not Appropriate_____ **Appropriate__X__**

Refuge Manager:_____ Date:_____

If found to be **Not Appropriate**, the refuge supervisor does not need to sign concurrence if the use is a new use.
If an existing use is found **Not Appropriate** outside the CCP process, the refuge supervisor must sign concurrence.
If found to be **Appropriate**, the refuge supervisor must sign concurrence.

Refuge Supervisor:_____ Date:_____

A compatibility determination is required before the use may be allowed.

FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: Chassahowitzka NWR

Use: Mosquito Management

This form is not required for wildlife-dependent recreational uses, take regulated by the State, or uses already described in a refuge CCP or step-down management plan approved after October 9, 1997.

Decision Criteria:	YES	NO
(a) Do we have jurisdiction over the use?	X	
(b) Does the use comply with applicable laws and regulations (Federal, State, tribal, and local)?	X	
(c) Is the use consistent with applicable executive orders and Department and Service policies?	X	
(d) Is the use consistent with public safety?	X	
(e) Is the use consistent with goals and objectives in an approved management plan or other document?	X	
(f) Has an earlier documented analysis not denied the use or is this the first time the use has been proposed?	X	
(g) Is the use manageable within available budget and staff?	X	
(h) Will this be manageable in the future within existing resources?	X	
(i) Does the use contribute to the public's understanding and appreciation of the refuge's natural or cultural resources, or is the use beneficial to the refuge's natural or cultural resources?	X	
(j) Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see section 1.6D, 603 FW 1, for description), compatible, wildlife-dependent recreation into the future?	X	

Where we do not have jurisdiction over the use ["no" to (a)], there is no need to evaluate it further as we cannot control the use. Uses that are illegal, inconsistent with existing policy, or unsafe ["no" to (b), (c), or (d)] may not be found appropriate. If the answer is "no" to any of the other questions above, we will **generally** not allow the use.

If indicated, the refuge manager has consulted with State fish and wildlife agencies. **Yes _X_ No ___**

When the refuge manager finds the use appropriate based on sound professional judgment, the refuge manager must justify the use in writing on an attached sheet and obtain the refuge supervisor's concurrence.

Based on an overall assessment of these factors, my summary conclusion is that the proposed use is:

Not Appropriate_____ **Appropriate__X__**

Refuge Manager:_____ Date:_____

If found to be **Not Appropriate**, the refuge supervisor does not need to sign concurrence if the use is a new use.
If an existing use is found **Not Appropriate** outside the CCP process, the refuge supervisor must sign concurrence.
If found to be **Appropriate**, the refuge supervisor must sign concurrence.

Refuge Supervisor:_____ Date:_____

A compatibility determination is required before the use may be allowed.

FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: Chassahowitzka NWR

Use: Commercial Photography

This form is not required for wildlife-dependent recreational uses, take regulated by the State, or uses already described in a refuge CCP or step-down management plan approved after October 9, 1997.

Decision Criteria:	YES	NO
(a) Do we have jurisdiction over the use?	X	
(b) Does the use comply with applicable laws and regulations (Federal, State, tribal, and local)?	X	
(c) Is the use consistent with applicable executive orders and Department and Service policies?	X	
(d) Is the use consistent with public safety?	X	
(e) Is the use consistent with goals and objectives in an approved management plan or other document?	X	
(f) Has an earlier documented analysis not denied the use or is this the first time the use has been proposed?	X	
(g) Is the use manageable within available budget and staff?	X	
(h) Will this be manageable in the future within existing resources?	X	
(i) Does the use contribute to the public's understanding and appreciation of the refuge's natural or cultural resources, or is the use beneficial to the refuge's natural or cultural resources?	X	
(j) Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see section 1.6D, 603 FW 1, for description), compatible, wildlife-dependent recreation into the future?	X	

Where we do not have jurisdiction over the use ["no" to (a)], there is no need to evaluate it further as we cannot control the use. Uses that are illegal, inconsistent with existing policy, or unsafe ["no" to (b), (c), or (d)] may not be found appropriate. If the answer is "no" to any of the other questions above, we will **generally** not allow the use.

If indicated, the refuge manager has consulted with State fish and wildlife agencies. **Yes _X_ No ___**

When the refuge manager finds the use appropriate based on sound professional judgment, the refuge manager must justify the use in writing on an attached sheet and obtain the refuge supervisor's concurrence.

Based on an overall assessment of these factors, my summary conclusion is that the proposed use is:

Not Appropriate_____ **Appropriate__**X**__**

Refuge Manager:_____ Date:_____

If found to be **Not Appropriate**, the refuge supervisor does not need to sign concurrence if the use is a new use.
If an existing use is found **Not Appropriate** outside the CCP process, the refuge supervisor must sign concurrence.
If found to be **Appropriate**, the refuge supervisor must sign concurrence.

Refuge Supervisor:_____ Date:_____

A compatibility determination is required before the use may be allowed.

FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: Chassahowitzka NWR

Use: Walking, Hiking, and Jogging

This form is not required for wildlife-dependent recreational uses, take regulated by the State, or uses already described in a refuge CCP or step-down management plan approved after October 9, 1997.

Decision Criteria:	YES	NO
(a) Do we have jurisdiction over the use?	X	
(b) Does the use comply with applicable laws and regulations (Federal, State, tribal, and local)?	X	
(c) Is the use consistent with applicable executive orders and Department and Service policies?	X	
(d) Is the use consistent with public safety?	X	
(e) Is the use consistent with goals and objectives in an approved management plan or other document?	X	
(f) Has an earlier documented analysis not denied the use or is this the first time the use has been proposed?	X	
(g) Is the use manageable within available budget and staff?	X	
(h) Will this be manageable in the future within existing resources?	X	
(i) Does the use contribute to the public's understanding and appreciation of the refuge's natural or cultural resources, or is the use beneficial to the refuge's natural or cultural resources?	X	
(j) Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see section 1.6D, 603 FW 1, for description), compatible, wildlife-dependent recreation into the future?	X	

Where we do not have jurisdiction over the use ["no" to (a)], there is no need to evaluate it further as we cannot control the use. Uses that are illegal, inconsistent with existing policy, or unsafe ["no" to (b), (c), or (d)] may not be found appropriate. If the answer is "no" to any of the other questions above, we will **generally** not allow the use.

If indicated, the refuge manager has consulted with State fish and wildlife agencies. **Yes _X_ No ___**

When the refuge manager finds the use appropriate based on sound professional judgment, the refuge manager must justify the use in writing on an attached sheet and obtain the refuge supervisor's concurrence.

Based on an overall assessment of these factors, my summary conclusion is that the proposed use is:

Not Appropriate_____ **Appropriate__X__**

Refuge Manager:_____ Date:_____

If found to be **Not Appropriate**, the refuge supervisor does not need to sign concurrence if the use is a new use.
If an existing use is found **Not Appropriate** outside the CCP process, the refuge supervisor must sign concurrence.
If found to be **Appropriate**, the refuge supervisor must sign concurrence.

Refuge Supervisor:_____ Date:_____

A compatibility determination is required before the use may be allowed.

FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: Chassahowitzka NWR

Use: Camping

This form is not required for wildlife-dependent recreational uses, take regulated by the State, or uses already described in a refuge CCP or step-down management plan approved after October 9, 1997.

Decision Criteria:	YES	NO
(a) Do we have jurisdiction over the use?	X	
(b) Does the use comply with applicable laws and regulations (Federal, State, tribal, and local)?	X	
(c) Is the use consistent with applicable executive orders and Department and Service policies?	X	
(d) Is the use consistent with public safety?	X	
(e) Is the use consistent with goals and objectives in an approved management plan or other document?	X	
(f) Has an earlier documented analysis not denied the use or is this the first time the use has been proposed?	X	
(g) Is the use manageable within available budget and staff?	X	
(h) Will this be manageable in the future within existing resources?	X	
(i) Does the use contribute to the public's understanding and appreciation of the refuge's natural or cultural resources, or is the use beneficial to the refuge's natural or cultural resources?	X	
(j) Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see section 1.6D, 603 FW 1, for description), compatible, wildlife-dependent recreation into the future?	X	

Where we do not have jurisdiction over the use ["no" to (a)], there is no need to evaluate it further as we cannot control the use. Uses that are illegal, inconsistent with existing policy, or unsafe ["no" to (b), (c), or (d)] may not be found appropriate. If the answer is "no" to any of the other questions above, we will **generally** not allow the use.

If indicated, the refuge manager has consulted with State fish and wildlife agencies. **Yes _X_ No ___**

When the refuge manager finds the use appropriate based on sound professional judgment, the refuge manager must justify the use in writing on an attached sheet and obtain the refuge supervisor's concurrence.

Based on an overall assessment of these factors, my summary conclusion is that the proposed use is:

Not Appropriate_____ **Appropriate__**X**__**

Refuge Manager:_____ Date:_____

If found to be **Not Appropriate**, the refuge supervisor does not need to sign concurrence if the use is a new use.
If an existing use is found **Not Appropriate** outside the CCP process, the refuge supervisor must sign concurrence.
If found to be **Appropriate**, the refuge supervisor must sign concurrence.

Refuge Supervisor:_____ Date:_____

A compatibility determination is required before the use may be allowed.

FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: Chassahowitzka NWR

Use: Geocaching

This form is not required for wildlife-dependent recreational uses, take regulated by the State, or uses already described in a refuge CCP or step-down management plan approved after October 9, 1997.

Decision Criteria:	YES	NO
(a) Do we have jurisdiction over the use?	X	
(b) Does the use comply with applicable laws and regulations (Federal, State, tribal, and local)?		X
(c) Is the use consistent with applicable executive orders and Department and Service policies?		X
(d) Is the use consistent with public safety?	X	
(e) Is the use consistent with goals and objectives in an approved management plan or other document?		X
(f) Has an earlier documented analysis not denied the use or is this the first time the use has been proposed?	X	
(g) Is the use manageable within available budget and staff?	X	
(h) Will this be manageable in the future within existing resources?	X	
(i) Does the use contribute to the public's understanding and appreciation of the refuge's natural or cultural resources, or is the use beneficial to the refuge's natural or cultural resources?		X
(j) Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see section 1.6D, 603 FW 1, for description), compatible, wildlife-dependent recreation into the future?		X

Where we do not have jurisdiction over the use ["no" to (a)], there is no need to evaluate it further as we cannot control the use. Uses that are illegal, inconsistent with existing policy, or unsafe ["no" to (b), (c), or (d)] may not be found appropriate. If the answer is "no" to any of the other questions above, we will **generally** not allow the use.

If indicated, the refuge manager has consulted with State fish and wildlife agencies. **Yes** X **No** ___

When the refuge manager finds the use appropriate based on sound professional judgment, the refuge manager must justify the use in writing on an attached sheet and obtain the refuge supervisor's concurrence.

Based on an overall assessment of these factors, my summary conclusion is that the proposed use is:

Not Appropriate _X_ **Appropriate**____

Refuge Manager:_____ Date:_____

If found to be **Not Appropriate**, the refuge supervisor does not need to sign concurrence if the use is a new use.
If an existing use is found **Not Appropriate** outside the CCP process, the refuge supervisor must sign concurrence.
If found to be **Appropriate**, the refuge supervisor must sign concurrence.

Refuge Supervisor:_____ Date:_____

A compatibility determination is required before the use may be allowed.

FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: Chassahowitzka NWR

Use: Dirt Bike Riding

This form is not required for wildlife-dependent recreational uses, take regulated by the State, or uses already described in a refuge CCP or step-down management plan approved after October 9, 1997.

Decision Criteria:	YES	NO
(a) Do we have jurisdiction over the use?	X	
(b) Does the use comply with applicable laws and regulations (Federal, State, tribal, and local)?	X	
(c) Is the use consistent with applicable executive orders and Department and Service policies?		X
(d) Is the use consistent with public safety?		X
(e) Is the use consistent with goals and objectives in an approved management plan or other document?		X
(f) Has an earlier documented analysis not denied the use or is this the first time the use has been proposed?	X	
(g) Is the use manageable within available budget and staff?		X
(h) Will this be manageable in the future within existing resources?		X
(i) Does the use contribute to the public's understanding and appreciation of the refuge's natural or cultural resources, or is the use beneficial to the refuge's natural or cultural resources?		X
(j) Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see section 1.6D, 603 FW 1, for description), compatible, wildlife-dependent recreation into the future?		X

Where we do not have jurisdiction over the use ["no" to (a)], there is no need to evaluate it further as we cannot control the use. Uses that are illegal, inconsistent with existing policy, or unsafe ["no" to (b), (c), or (d)] may not be found appropriate. If the answer is "no" to any of the other questions above, we will **generally** not allow the use.

If indicated, the refuge manager has consulted with State fish and wildlife agencies. **Yes _X_ No ___**

When the refuge manager finds the use appropriate based on sound professional judgment, the refuge manager must justify the use in writing on an attached sheet and obtain the refuge supervisor's concurrence.

Based on an overall assessment of these factors, my summary conclusion is that the proposed use is:

Not Appropriate__X__ **Appropriate____**

Refuge Manager:_____ Date:_____

If found to be **Not Appropriate**, the refuge supervisor does not need to sign concurrence if the use is a new use.
If an existing use is found **Not Appropriate** outside the CCP process, the refuge supervisor must sign concurrence.
If found to be **Appropriate**, the refuge supervisor must sign concurrence.

Refuge Supervisor:_____ Date:_____

A compatibility determination is required before the use may be allowed.

FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: Chassahowitzka NWR

Use: Commercial Drift Wood Collecting

This form is not required for wildlife-dependent recreational uses, take regulated by the State, or uses already described in a refuge CCP or step-down management plan approved after October 9, 1997.

Decision Criteria:	YES	NO
(a) Do we have jurisdiction over the use?	X	
(b) Does the use comply with applicable laws and regulations (Federal, State, tribal, and local)?	X	
(c) Is the use consistent with applicable executive orders and Department and Service policies?		X
(d) Is the use consistent with public safety?	X	
(e) Is the use consistent with goals and objectives in an approved management plan or other document?	X	
(f) Has an earlier documented analysis not denied the use or is this the first time the use has been proposed?	X	
(g) Is the use manageable within available budget and staff?	X	
(h) Will this be manageable in the future within existing resources?	X	
(i) Does the use contribute to the public's understanding and appreciation of the refuge's natural or cultural resources, or is the use beneficial to the refuge's natural or cultural resources?		X
(j) Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see section 1.6D, 603 FW 1, for description), compatible, wildlife-dependent recreation into the future?	X	

Where we do not have jurisdiction over the use ["no" to (a)], there is no need to evaluate it further as we cannot control the use. Uses that are illegal, inconsistent with existing policy, or unsafe ["no" to (b), (c), or (d)] may not be found appropriate. If the answer is "no" to any of the other questions above, we will **generally** not allow the use.

If indicated, the refuge manager has consulted with State fish and wildlife agencies. **Yes** _X_ **No** ___

When the refuge manager finds the use appropriate based on sound professional judgment, the refuge manager must justify the use in writing on an attached sheet and obtain the refuge supervisor's concurrence.

Based on an overall assessment of these factors, my summary conclusion is that the proposed use is:

Not Appropriate__X__ **Appropriate**____

Refuge Manager:_____ Date:_____

If found to be **Not Appropriate**, the refuge supervisor does not need to sign concurrence if the use is a new use.
If an existing use is found **Not Appropriate** outside the CCP process, the refuge supervisor must sign concurrence.
If found to be **Appropriate**, the refuge supervisor must sign concurrence.

Refuge Supervisor:_____ Date:_____

A compatibility determination is required before the use may be allowed.

Appendix F. Compatibility Determinations

CHASSAHOWITZKA NATIONAL WILDLIFE REFUGE COMPATIBILITY DETERMINATIONS

Uses: The following uses were evaluated to determine their compatibility with the mission of the Refuge System and the purposes of the refuge.

1. Environmental Education and Interpretation
2. Wildlife Observation and Photography
3. Recreational Fishing
4. Commercial Fishing
5. Hunting (Migratory Bird, Small Game, Resident Game, and Big Game Hunting)
6. Research and Monitoring
7. Boating (motorized and nonmotorized)
8. Picnicking
9. Walking, Hiking and Jogging
10. Commercial Photography
11. Commercial Tours and Guiding
12. Mosquito Management
13. Camping

Refuge Name: Chassahowitzka National Wildlife Refuge

Date Established: June 15, 1943

Establishing and Acquisition Authority(ies): The refuge was established by authority of the Migratory Bird Conservation Act as “an inviolate sanctuary” for wintering waterfowl and other migratory birds. In 1976, 16,893 acres in Citrus County and 6,736 acres in Hernando County were designated as Wilderness Areas.

Refuge Purpose(s): ... for use as an inviolate sanctuary, or for any other management purpose, for migratory birds. 16 U.S.C. 715d (Migratory Bird Conservation Act)

... wilderness areas ... shall be administered for the use and enjoyment of the American people in such manner as will leave them unimpaired for future use and enjoyment as wilderness, and so as to provide for the protection of these areas, the preservation of their wilderness character, and for the gathering and dissemination of information regarding their use and enjoyment as wilderness ...16 U.S.C. 1131 (Wilderness Act)

... for the development, advancement, management, conservation, and protection of fish and wildlife resources ... 16 U.S.C. 742f(a)(4) ... for the benefit of the United States Fish and Wildlife Service, in performing its activities and services. Such acceptance may be subject to the terms of any restrictive or affirmative covenant, or condition of servitude... 16 U.S.C. 742f(b)(1) (Fish and Wildlife Act of 1956)

National Wildlife Refuge System Mission:

The mission of the Refuge System, as defined by the National Wildlife Refuge System Improvement Act of 1997, is:

> *... to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife and plant resources and their habitats within the United States for the benefit of present and future generations of Americans.*

Other Applicable Laws, Regulations, and Policies:

Animal Welfare Act of 1966, Public Law 89-544. (7 U.S.C. 2131 et. seq.)
50 Code of Federal Regulations (CFR) 17.100 Subpart J, Manatee Protection Areas
Institutional Animal Care and Use Committee (IACUC) policies
Marine Mammal Protection Act of 1972)16 U.S.C. 1361-1421)
Endangered Species Act of 1973 (16 U.S.C. 1531 et seq; 87 Stat. 884)
Antiquities Act of 1906 (34 Stat. 225)
Migratory Bird Treaty Act of 1918 (15 U.S.C. 703-711; 40 Stat. 755)
Migratory Bird Conservation Act of 1929 (16 U.S.C. 715r; 45 Stat. 1222)
Migratory Bird Hunting Stamp Act of 1934 (16 U.S.C. 718-178h; 48 Stat. 451)
Criminal Code Provisions of 1940 (18 U.S.C. 41)
Bald and Golden Eagle Protection Act (16 U.S.C. 668-668d; 54 Stat. 250)
Refuge Trespass Act of June 25, 1948 (18 U.S.C. 41; 62 Stat. 686)
Fish and Wildlife Act of 1956 (16 U.S.C. 742a-742j; 70 Stat.1119)
Refuge Recreation Act of 1962 (16 U.S.C. 460k-460k-4; 76 Stat. 653)
Wilderness Act (16 U.S.C. 1131; 78 Stat. 890)
Land and Water Conservation Fund Act of 1965
National Historic Preservation Act of 1966, as amended (16 U.S.C. 470, et seq.; 80 Stat. 915)
National Wildlife Refuge System Administration Act of 1966 (16 U.S.C. 668dd, 668ee; 80 Stat. 927)
National Environmental Policy Act of 1969, NEPA (42 U.S.C. 4321, et seq; 83 Stat. 852)
Refuge Revenue Sharing Act of 1935, as amended in 1978 (16 U.S.C. 715s; 92 Stat. 1319)
National Wildlife Refuge Regulations for the Most Recent Fiscal Year
(50 CFR Subchapter 1; 43 CFR 32.28)
Emergency Wetlands Resources Act of 1986 (S.B. 740)
North American Wetlands Conservation Act of 1990
Food Security Act (Farm Bill) of 1990 as amended (HR 2100)
The Property Clause of the U.S. Constitution Article IV 3, Clause 2
The Commerce Clause of the U.S. Constitution Article 1, Section 8
The National Wildlife Refuge System Improvement Act of 1997 (Public Law 105-57, USC668dd)
Executive Order 12996, Management and General Public Use of the National Wildlife Refuge System. March 25, 1996
Title 50, Code of Federal Regulations, Parts 25-33
Archaeological Resources Protection Act of 1979
Native American Graves Protection and Repatriation Act of 1990

The compatibility determinations for each use are described separately. Although for brevity, the preceding “Uses” through “Other Applicable Laws, Regulations and Policies” sections and the succeeding “Public Review and Comment” and “Approval of Compatibility Determinations” sections are only written once within the plan, they are part of each descriptive use and become part of that compatibility determination if considered outside of the comprehensive conservation plan.

Description of Use: *Environmental Education and Interpretation*

Environmental education and interpretation include a variety of activities, mediums, and facilities designed to increase the public's knowledge and understanding of wildlife and to promote wildlife conservation practices. These are tools used to inform the public of resource values and issues. Examples of environmental education activities include staff-led or teacher-led events, student and teacher workshops, nature studies, etc. Interpretive programs and facilities include special events, visitor center displays, onsite and offsite visitor contact stations, displays, brochures, and signs. Most of the activities, programs and facilities are located at the Crystal River NWR Complex headquarters in Crystal River, Florida.

Availability of Resources: The Friends of the Crystal River National Wildlife Refuges Complex, Inc. have developed and administer an environmental educational program for the Salt Marsh Trail site.

Anticipated Impacts of the Use: The use of the refuge for onsite, hands-on, action-oriented activities to accomplish environmental education objectives may impose short-term impacts on the sites used for the activities. Impacts may include temporary disturbance to wildlife species in the immediate use area. Group activities would not be allowed where impacts would be permanent or long-lasting. The interpretive activities that occur at the visitor center, or off the refuge at festival locations in the local community, pose no threat to habitat or wildlife.

Determination (check one below):

_____ Use is Not Compatible
__X__ Use is Compatible with Following Stipulations

Stipulations Necessary to Ensure Compatibility: Activities should be held where minimal impacts will occur. Periodic evaluation of the sites and program activities should be done to assess if program objectives are being met, resources are being degraded, or wildlife is being disturbed. If adverse impacts become evident, the environmental education and interpretation activities may need to be rotated, moved, reduced, eliminated, or adapted to minimize impacts. Group size may be restricted. Certain areas of the refuge may be restricted seasonally to avoid disturbance of wildlife or to protect sensitive habitat.

Justification: Environmental education and interpretation are priority public uses under the National Wildlife Refuge System Improvement Act of 1997. The refuge uses environmental education and interpretation to motivate citizens of all ages to support and practice wildlife and wild lands stewardship. Environmental education and interpretation can have positive outcomes, such as instilling preservation ethics in visitors, developing support for the refuge, and lessening disturbance of species, particularly manatees and birds.

NEPA Compliance for Refuge Use Description: *Place an X in appropriate space.*

_____ Categorical Exclusion without Environmental Action Statement
_____ Categorical Exclusion and Environmental Action Statement
___X___ Environmental Assessment and Finding of No Significant Impact
_____ Environmental Impact Statement and Record of Decision

Mandatory 15-year Re-evaluation Date: _____

Description of Use: *Wildlife Observation and Photography*

Wildlife observation is the viewing of wildlife and plants or their habitats by refuge visitors. Nonconsumptive wildlife observation uses include birdwatching, manatee observation, and nature photography. Photography is defined as recreational photography, videography, filming, or other recording of sight or sound, the subject matter of which is not for commercial or educational purposes. It assumes refuge visitation for the purpose of photographing the refuge's natural or cultural resources and/or associated public uses for personal use.

Availability of Resources: Dog Island, accessible by water, contains a pavilion with a picnic table, composting toilet, and a dock. The Salt Marsh Trail site, accessible by land and water, contains an observation tower and a pavilion with picnic table.

Anticipated Impacts of the Use: Some violations of refuge regulations are anticipated, such as littering or wildlife disturbance. Law enforcement is necessary to enforce laws and to curtail potential violations.

Determination (check one below):

_____ Use is Not Compatible
__X__ Use is Compatible with Following Stipulations

Stipulations Necessary to Ensure Compatibility: Access to the refuge is primarily by boat. State-established boating safety and manatee protection speed zones require boaters to travel at idle or slow speeds in high manatee use areas, and these zones are jointly enforced by federal, state, and county law enforcement officers. A special use permit is required for commercial, news, or educational photography purposes.

Law enforcement patrol of public use areas should continue to minimize violations of refuge regulations. Some areas may be closed to the public seasonally to protect wildlife from disturbance or to protect habitat. Public use is prohibited in all areas that are posted as closed areas. This use is allowed beginning a half-hour before sunrise and ending a half-hour after sunset.

Justification: These are priority public uses under the National Wildlife Refuge System Improvement Act of 1997.

NEPA Compliance for Refuge Use Description: *Place an X in appropriate space.*

_____ Categorical Exclusion without Environmental Action Statement
_____ Categorical Exclusion and Environmental Action Statement
__**X**__ Environmental Assessment and Finding of No Significant Impact
_____ Environmental Impact Statement and Record of Decision

Mandatory 15-year Re-evaluation Date: _____

Description of Use: *Recreational Fishing*

Recreational fishing refers to the traditional recreational fishing with a hook and line or cane pole, casting a net for bait, and the harvest of shellfish (scalloping). It also refers to fishing as allowable under the State of Florida's fishing regulations for sport (catch and release) or personal consumption. Fishing occurs in state-owned and managed waters in Hernando County and on the refuge-owned water bottoms in Citrus County.

Availability of Resources: Staff resources are adequate to allow this use. This is an established part of the refuge federal wildlife officer's duties addressed in partnership with Florida Fish and Wildlife Conservation Commission officers.

Anticipated Impacts of the Use: Fishing-related impacts include the disturbance of wildlife and the taking of nontarget fish or wildlife species, littering, and water pollution from boat motors. Discarded fishing line can entangle or snare manatees and other wildlife. Discarded monofilament line, hooks, and other fishing gear can cause wildlife injury or death by entanglement or ingestion. Boating to fishing sites can result in propeller scarring and blunt or propeller trauma to manatees or other wildlife.

Determination (check one below):

___ Use is Not Compatible
_X_ Use is Compatible with Following Stipulations

Stipulations Necessary to Ensure Compatibility: In Citrus County, no bowfishing or spearfishing is allowed at any time on refuge-owned lands and waters. State law requires a clearance of boaters from swimmers and divers of at least 100 feet. All fishing activity must adhere to state fishing laws and regulations. Boaters traveling to fishing sites must comply with the stipulations listed under boating (motorized and nonmotorized). All or parts of the refuge may be closed to fishing at any time if necessary for public safety, to provide wildlife sanctuary, or for administrative reasons. Airboats used for recreational fishing in Hernando County and on designated trails in Citrus County are required to obtain an airboat permit from the refuge office.

Justification: Fishing is a priority public use under the National Wildlife Refuge System Improvement Act of 1997.

NEPA Compliance for Refuge Use Decision: *Place an X in appropriate space*.

___ Categorical Exclusion without Environmental Action Statement
___ Categorical Exclusion and Environmental Action Statement
_X_ Environmental Assessment and Finding of No Significant Impact
___ Environmental Impact Statement and Record of Decision

Mandatory 15-year Re-evaluation Date: _____

Description of Use: *Commercial Fishing*

Commercial fishing refers to the commercial harvest of fish and shellfish (e.g., crabbing and scalloping), which includes the collection and sale of bait fish. Commercial fishing occurs on the refuge in Hernando and Citrus counties.

Availability of Resources: Staff resources are adequate to allow this use. This is an established part of the refuge federal wildlife officer's duties addressed in partnership with Florida Fish and Wildlife Conservation Commission officers.

Anticipated Impacts of the Use: Commercial fishing-related impacts include the disturbance and taking of nontarget fish or wildlife species, littering, and water pollution from boat motors. Discarded fishing line can entangle or snare manatees and other wildlife. Discarded monofilament line, hooks, and other fishing gear can cause wildlife injury or death by entanglement or ingestion. Boating to fishing sites can result in propeller scarring and blunt or propeller trauma to manatees or other wildlife. Abandoned crab traps or other gear can defile habitat or harm nontarget species, such as diamondback terrapins.

Determination (check one below):

___ Use is Not Compatible
_**X**_ Use is Compatible with Following Stipulations

Stipulations Necessary to Ensure Compatibility: The following stipulations apply in Citrus County: all commercial fishers must obtain and operate under a special use permit; no bowfishing or spearfishing is allowed at any time on refuge-owned lands and waters; state law requires a clearance of boaters from swimmers and divers of at least 100 feet; all fishing activity must adhere to state fishing laws and regulations; and no fishing tournaments are allowed in the refuge-owned water bottoms of Citrus County (the Wilderness portion of the refuge). All boaters traveling to fishing sites must comply with the stipulations listed under boating (motorized and nonmotorized). Other Wilderness provisions and refuge regulations may apply.

Justification: With the current regulations in place for commercial fishing and the above mentioned considerations, commercial fishing on the refuge is compatible with refuge purposes. The Wilderness designation legislative record showed that lawmakers intended to allow commercial fishing on the wilderness portion of the refuge, but this provision was not included in the law leaving an issue for the Service solicitors to resolve. The use has been historically continued by the refuge in line with the legislative intent.

NEPA Compliance for Refuge Use Decision: *Place an X in appropriate space*.

___ Categorical Exclusion without Environmental Action Statement
___ Categorical Exclusion and Environmental Action Statement
_**X**_ Environmental Assessment and Finding of No Significant Impact
___ Environmental Impact Statement and Record of Decision

Mandatory 10-year Re-evaluation Date: _____

Description of Use: *Hunting (Migratory Bird, Small Game, Resident Game, and Big Game Hunting)*

Migratory bird hunting refers to the hunting of ducks and coots on the refuge's approved area in Citrus County, which is accessible by water only and conducted under a refuge hunting permit. Hunting in the Hernando County portion of the refuge for migratory birds (ducks, coots, rails, etc.), small game (gray squirrels, rabbits, raccoon, etc.), resident game (turkeys), and big game (deer, feral hogs, etc.) is in accordance with state regulations for the Chassahowitzka Wildlife Management Area (WMA). Feral hog hunting in the Citrus County portion of the refuge may be added in the future.

Availability of Resources: Sufficient staff resources exist to enforce hunting laws and regulations, ensure public safety, monitor resource impacts, and administer permits. At the current level of use, there are enough funds in the refuge's operating budget and for staff salaries to administer this program.

Anticipated Impacts of the Use: Sport hunting provides recreational opportunities and can be used to assist in the management of certain game species. For example, carefully managed deer hunting maintains populations at a level commensurate with available habitat. Spring turkey hunting can disrupt nesting. The harvest of feral hogs is beneficial to native wildlife because the hogs compete for mast, destroy native plant populations, and prey upon nests, small vertebrates and invertebrates. There may be some limited disturbance to nontarget species of wildlife and some trampling of vegetation; however, this should be short-lived, relatively minor, and is not expected to adversely affect refuge habitats. Problems associated with littering and violations of game laws and limits will be controlled through law enforcement. All hunts are designed to provide quality user opportunities based on estimated population levels and biolgical parameters. Because hunting in Citrus County is accessible by boat only, the impacts discussed in the boating CD also pertain here. There could be some incidental take of nontarget waterowl during the hunts. There would also be some disturbance, such as trampling of vegetation to tidal and upland habitats. Disturbance would likely be minimal due to the limited time available to hunt and small number of participants. Lead shot used in hunting upland game may cause lead poisoning as a long-term cumulative impact. Waterfowl hunters are restricted to the use of steel shot only.

Determination (check one below):

_____ Use is Not Compatible
__X__ Use is Compatible with Following Stipulations

Stipulations Necessary to Ensure Compatibility: Public hunting of migratory bird, small game, resident game, and big game species in the Hernando County portion of the refuge will be in accordance with state regulations for Chassahowitzka WMA. These regulations with an area map of the WMA (which includes the Hernando County portion of the refuge) are detailed in the annual hunting brochure. See http://myfwc.com/hunting/wma-brochures and click on "southwest" and "Chassahowitzka." Federal regulations are detailed in the Service's Chassahowitzka National Wildlife Refuge Hunting and Fishing Regulations brochure, which is also made available on the refuge website http://southeast.fws.gov/chassahowitzka; click on "Hunt Regulations."

Waterfowl hunting (ducks and coots only) in Citrus County will be in accordance with the special hunting regulations governing hunting on wildlife refuges, as set forth in Title 50 of the Code of Federal Regulations and applicable state regulations. A refuge hunt permit, state waterfowl permit, and federal duck stamp is required for the hunting of waterfowl on the refuge. Waterfowl hunting is permitted on Wednesdays, Saturdays, and Sundays only. The use of steel shot for hunting waterfowl is required on the refuge. Retrievers are permitted for hunting waterfowl on the refuge.

The number of hunters, hunting days, areas, and bag limits will be adjusted as needed to minimize the possible effects of overharvest, resource damage, or conflicts with other priority public uses. The projected level of hunting is considered compatible with the purposes of the refuge.

Justification: Hunting is a priority public use within the National Wildlife Refuge System and it is compatible with the purposes for which the refuge was established. Migratory bird, small game, and big game hunting, as described, was determined to be compatible in view of potential impacts because: (1) hunter densities and use levels are fairly low; (2) restrictions have been established to ensure that an adequate amount of habitat is available for deer and other species; and (3) sufficient opportunities are available for other wildlife-dependent recreation during the hunt seasons.

NEPA Compliance for Refuge Use Description: *Place an X in appropriate space.*

_____ Categorical Exclusion without Environmental Action Statement
_____ Categorical Exclusion and Environmental Action Statement
___X__ Environmental Assessment and Finding of No Significant Impact
_____ Environmental Impact Statement and Record of Decision

Mandatory 15-year Re-evaluation Date: _____

Description of Use: *Research and Monitoring*

Research and survey activities include scientific research, baseline inventories, long-term monitoring, and scientific collecting conducted by nonrefuge personnel on refuge lands. Research at Chassahowitzka NWR is wide-ranging in nature and includes activities such as: radio-tracking, capture for health assessments, disease monitoring of animals, other biological studies (including water quality and quantity monitoring), and vegetation surveys, etc. Research and monitoring are used to increase the refuge manager's knowledge, understanding, and ability to manage animals, plants, habitats, and ecosystem processes found on the refuge. These activities support short- and long-term research projects by resource agencies, universities, nonprofit organizations, and other research entities. Conclusions derived from research and monitoring allow refuge managers to evaluate management activities and adapt those activities to be more effective.

Availability of Resources: Some refuge resources above general operational costs may be required for this use. The cost of most field studies is borne by the researchers with the exception of staff time to review proposals, issue special use permits (SUPs), provide logistical support, and monitor projects. These are considered regular (routine) duties of biologists and managers. Researchers typically provide all the materials needed and, depending on the project, the refuge may provide support with office space, housing, boats, and/or vehicles.

Anticipated Impacts of the Use: Generally, research and monitoring impacts are minimal. There may be slight or temporary disturbances to wildlife or habitats. These impacts are generally not significant or permanent. A small number of individual plants or animals might be collected for further scientific study, but these collections are anticipated to have minimal impact on the populations from which they came. Research project impacts are minimized by applying stipulations on research activities under the SUP by refuge personnel.

Determination (check one below):

_____ Use is Not Compatible
__X__ Use is Compatible with Following Stipulations

Stipulations Necessary to Ensure Compatibility: All researchers are required to obtain special use permits (SUPs) from the refuge and comply with all federal wildlife permitting processes and standards. The SUP specifies the purpose and duration of the project, location of field work, and any special conditions that the permittee is required to follow. SUPs include study-specific restrictions applicable to methods, study site(s), and other project elements. These are done on a case-by-case basis. All research proposals are reviewed by refuge staff before approval is given. Refuge personnel regularly monitor the progress of all field work and permittees are required to submit interim reports, an annual report of the work accomplished, and/or a final report of the study. In applying for SUPs, researchers are required to show proof that they have fulfilled all other applicable permitting requirements, such as state collecting permits and endangered species permits.

Justification: Research and monitoring can provide important benefits to the refuge and the natural resources supported by the refuge. Research conducted on the refuge can lead to new discoveries, new facts, verified information, and better management decisions. Research and monitoring is vital for furthering knowledge and understanding of refuge resources. Research is also important because it provides the Service with scientific information that can be used to manage natural resources. Species identification, resource inventories, and monitoring provide valuable data for refuge operations. Access to current and state-of-the art research can aid management decisions and be used in adaptive management strategies to manage resources.

NEPA Compliance for Refuge Use Description: *Place an X in appropriate space.*

_____ Categorical Exclusion without Environmental Action Statement
_____ Categorical Exclusion and Environmental Action Statement
__X___ Environmental Assessment and Finding of No Significant Impact
_____ Environmental Impact Statement and Record of Decision

Mandatory 10-year Re-evaluation Date: _____

Description of Use: *Boating (motorized and nonmotorized)*

Boating uses include motorboat operations, pontoon or jon boat use, kayaking, canoeing, and the use of personal watercraft. At Chassahowitzka NWR, this use is primarily connected with other public waterborne activities, such as fishing. Airboating is permitted in Hernando County and in two designated trails in Citrus County. See: http://www.fws.gov/chassahowitzka/airboat_map.html.

Availability of Resources: State-established manatee protection speed zones require boaters to travel at idle or slow speeds in high manatee use areas. These zones and other boating safety regulations are enforced by federal, state and local law enforcement officers.

Anticipated Impacts of the Use: Some violations to refuge regulations and state manatee protection zones are anticipated and require enforcement to minimize the number of infractions. Enforcement responsibilities are generally shared by Florida Fish and Wildlife Conservation

Commission and Service officers. Some temporary disturbance to manatees and other wildlife, such as birds (flushing), can occur through engine or vessel occupant noise, setting of anchors, swimming by boaters, and disturbance by vessels when they enter shallow waters where manatees or other wildlife are present. Boating may cause propeller scarring to seagrass beds. Blunt force and/or propeller traumas may kill or injure manatees or other wildlife.

Determination (check one below):

_____ Use is Not Compatible
__X__ Use is Compatible with Following Stipulations

Stipulations Necessary to Ensure Compatibility: Access to the refuge is primarily by boat. State-established manatee protection zones require boaters to travel at slow speeds in high manatee use areas and these zones are jointly enforced by federal, state and county law enforcement officers. Airboat operators must obtain a permit and confine use to Hernando County and on designated airboat routes in Citrus County. Enforcement patrols in public use areas should continue in order to minimize the number of refuge regulation violations. Some areas are closed to the public to protect wildlife from disturbance and/or to protect habitat. Public use is prohibited in all areas that are posted as closed areas. Overnight boat mooring is prohibited in Citrus County.

Justification: Access to the refuge is primarily by boat from launches that are not on refuge lands. Without boating, most public uses would not be accessible.

NEPA Compliance for Refuge Use Description: *Place an X in appropriate space.*

_____ Categorical Exclusion without Environmental Action Statement
_____ Categorical Exclusion and Environmental Action Statement
__X__ Environmental Assessment and Finding of No Significant Impact
_____ Environmental Impact Statement and Record of Decision

Mandatory 10-year Re-evaluation Date: _____

Description of Use: *Picnicking*

Availability of Resources: The designated picnic pavilions at Dog Island and the Salt Marsh Trail site are maintained by refuge staff, contractors, and volunteers.

Anticipated Impacts of the Use: No significant impacts are anticipated because picnicking is restricted to one small area of the refuge. Some littering, vandalism, plant removal, and feeding/disturbance of wildlife have been noted in the past. Violations are infrequent and usually confined to the immediate vicinity of the area. Litter is controlled by refuge staff, contracted staff, and volunteers. Informal picnicking at other nondesignated sites should not result in significant impacts.

Determination (check one below):

___ Use is Not Compatible
_X_ Use is Compatible with Following Stipulations

Stipulations Necessary to Ensure Compatibility: Law enforcement patrol of the picnic area should minimize any violations of refuge regulations.

Justification: The shelter at Dog Island and the observation tower at the Salt Marsh Trail site give refuge visitors a place to rest and observe wildlife with minimal disturbance to wildlife.

NEPA Compliance for Refuge Use Decision: *Place an X in appropriate space*.

___ Categorical Exclusion without Environmental Action Statement
___ Categorical Exclusion and Environmental Action Statement
_X_ Environmental Assessment and Finding of No Significant Impact
___ Environmental Impact Statement and Record of Decision

Mandatory 10-year Re-evaluation Date:_____

Description of Use: *Walking, Hiking, and Jogging*

Walking, hiking, and jogging are all activities currently open to the public on the refuge. These activities are not necessarily wildlife-dependent recreation, but can be used in support of wildlife observation, photography, and environmental education. Walking and jogging activities would mainly occur on established foot trails. However, walking and jogging would be allowed anywhere on the refuge that is not marked as closed.

Availability of Resources: Funding for these programs is borne by annual operation and maintenance funds. The refuge has adequate resources to cover the cost of the proposed use. No special equipment, facilities, or improvements are needed to support the use. Maintenance of existing facilities would include mowing roadsides and maintaining signs, kiosks, and designated hiking trails. These facilities are maintained for refuge management and other public use activities on the refuge. No monitoring costs are anticipated.

Anticipated Impacts of the Use: Walking, hiking, and jogging, as proposed, would not impact the refuge's mission or management activities. The activities could cause temporary disturbance to wildlife from noise, but no problems have been observed. Trampling of vegetation would be limited in scope to designated trails. As proposed, these activities would have minimum impact on refuge resources. An active refuge law enforcement program will ensure regulation compliance and will protect refuge resources and the public.

Determination (check one below):

_____ Use is Not Compatible
__X__ Use is Compatible with Following Stipulations

Stipulations Necessary to Ensure Compatibility: Apart from any posted refuge regulations, such as refuge open hours, no special provisions apply.

Justification: The primary purpose for allowing walking, hiking, and jogging is to provide the public with an additional recreational opportunity to observe wildlife and to enjoy nonurban environments. The use is biologically sound. Walking, hiking, and jogging at the levels found on Chassahowitzka NWR do not cause more than minor negative impacts to refuge wildlife and help develop appreciation for the refuge and its resources.

NEPA Compliance for Refuge Use Description: *Place an X in appropriate space.*

_____ Categorical Exclusion without Environmental Action Statement
_____ Categorical Exclusion and Environmental Action Statement
__X__ Environmental Assessment and Finding of No Significant Impact
_____ Environmental Impact Statement and Record of Decision

Mandatory 10-year Re-evaluation Date: _____

Description of Use: *Commercial Photography*

Commercial photography includes still photography and filming and is often difficult to distinguish from recreational photography. While recreational photography is a priority public use under the Improvement Act, commercial photography is not. Commercial photography is the taking of photographs or films by an individual or company for commercial gain or profit. Photography classes, television news crews, and photographic production shoots are examples of commercial photography. These activities are varied in their scopes and impacts, ranging from a single individual in a single vehicle to numerous people and associated support vehicles (e.g., trucks with aerials).

Availability of Resources: Operation and maintenance funds to support commercial photography would be taken from the refuge's annual operating budget. Staff time to review, process, and monitor special use permits issued for these activities, including monitoring specific activities to ensure that impacts are minimized and to ensure adherence to conditions of the permits, would be considered as normal duties. The Dog Island facility and the observation tower at the Salt Marsh Trail site offer scenic vistas.

Anticipated Impacts of the Use: Potential impacts include minor trampling of vegetation and disturbance of nesting, foraging, and resting waterbirds.

Determination (check one below):

_____ Use is Not Compatible
__X__ Use is Compatible with the Listed Stipulations

Stipulations Necessary to Ensure Compatibility: Commercial photography approved on the refuge must have a primary focus on education and information related to the refuge's primary purposes, the resources protected by the refuge, and/or the National Wildlife Refuge System mission. Where the refuge manager can identify commercial photography activities, they can be regulated and monitored through special use permits (SUPs). These permits will contain conditions under which the activities are allowed to operate. Special use permits for commercial photography will be issued on a per event basis, often limited to a single day's or a week's activities. Further, the refuge will develop mandatory orientation materials for commercial photographers as part of the conditions of the special use permit to help limit wildlife and habitat impacts, to help limit conflicts with other visitors, and to help increase the ethical behavior of commercial photographers on the refuge. Certain parts of the refuge may be excluded from use, such as the Citrus County Wilderness Area.

Conditions under which commercial photography could occur are as follows:

- Requests are considered if they demonstrate a means to enhance education, appreciation, and/or understanding of the National Wildlife Refuge System;
- Commercial photographers would be managed under special use permits stipulating dates, times, and general locations that can be photographed. In many cases, the photographer is limited to the same areas in which the general public is allowed to go, but this can be evaluated on a case-by-case basis; and
- Commercial photographers should ensure proper credit is given to the refuge and the Service.

The refuge will modify or eliminate any use that results in unacceptable impacts.

Justification: Under certain circumstances, commercial photography can support priority public uses of the refuge, including environmental education and interpretation, as well as vicarious wildlife observation. Commercial photography can help the refuge and the National Wildlife Refuge System increase awareness, understanding, and support for the refuge and its management, natural resources, the National Wildlife Refuge System, and the Service. Conditions imposed in required special use permits will help ensure that these activities minimize impacts.

NEPA Compliance for Refuge Use Description:

_____ Categorical Exclusion without Environmental Action Statement
_____ Categorical Exclusion and Environmental Action Statement
__X__ Environmental Assessment and Finding of No Significant Impact
_____ Environmental Impact Statement and Record of Decision

Mandatory 10-year Re-evaluation Date: _____

Description of Use: *Commercial Tours and Guiding*

Commercial tours and guiding (for fishing, scalloping, airboating, and boating) will be permitted within the refuge boundary through a special use permit (SUP). Commercial is defined as any activity that provides facilities, goods, or services for the purposes of generating profit. This includes commercial guiding, touring, or outfitting of refuge visitors to view fish, wildlife, plants, or their habitats within the refuge. It also includes commercial guiding and outfitting of sport anglers or shellfishers (scalloping, crabbing) and access to fishing areas or shellfish beds. Tours by airboat are conducted off the refuge for the most part, but a section of the tour along the Homosassa River crosses through refuge property. This use does not pertain to individuals who perform these services for no fee, not-for-profit groups, schools, colleges, or other governmental agencies.

Availability of Resources: Costs to refuge operations to administer commercial tour and guiding services include, but are not limited to: administration of annual permits, maintenance of facilities, and enforcement and monitoring of permit holders. There is a picnic shelter and compost toilet at Dog Island for boaters. The Salt Marsh Trail site has an observation tower, trails, and picnic pavilion, which may be accessed by commercial kayak outfitters. Staff resources are adequate to allow this use. Patrol and enforcement of refuge regulations are regular duties of the refuge's law enforcement officers. Compliance with boating and fishing regulations is done in partnership with the FWC and U.S. Coast Guard (USCG) officers.

Anticipated Impacts of the Use: Impacts from guided groups include flushing or disturbing wildlife, noise and trampling. Guided tour activities have the potential to disturb wildlife and habitat, more so than an individual user, due to the increase in the number of people involved in the activity and the frequency or duration of trips. Littering and vandalism may be less likely under the supervision of a guide. There can be potential user conflicts because commercial tours may use the same areas as other refuge visitors. Unregulated commercial operations could adversely affect the safety of other visitors and the quality of their experience, and they could contribute to wildlife disturbance. The SUP will contain conditions to address these concerns.

The main difference between recreational fishing and fishing with guides is the level of fishing activity, number of fishers, and number of trips. Individual users generally make shorter and less frequent trips (e.g., weekend) versus commercial guides who may make daily or more trips. Fishing-related impacts from guided fishing include the disturbance and taking of nontarget fish and wildlife species, littering, and water pollution from boat motors. Discarded fishing line can entangle or snare manatees and other wildlife. Discarded monofilament line, hooks, and other fishing gear can cause wildlife injury or death by entanglement or ingestion. Boating to fishing sites can result in propeller scarring to submerged aquatic vegetation or seagrasses and blunt or propeller trauma to manatees or other wildlife. Abandoned crab traps or other gear can defile habitat or harm nontarget species, such as diamondback terrapins.

Determination (check one below):

___ Use is Not Compatible
_X_ Use is Compatible with Following Stipulations

Stipulations Necessary to Ensure Compatibility: Title 50 CFR, 27.97 Private Operations, prohibits unauthorized commercial enterprise on any refuge. Therefore, commercial tour or guide providers are required to apply for a SUP. By establishing a SUP system, the refuge is able to set sustainable limits on the number of permits issued; regulate visitor number, use, time and area; and monitor effects on wildlife and natural resources.

Commercial operators shall be permitted only in the areas open to the public. Seasonal or permanent closures in certain areas may be imposed on commercial operators if the level of use becomes excessive, if conflicts occur with other users engaged in priority wildlife-dependent recreation, or if wildlife impacts occur. In the future, interpretive training and other stipulations may be required of commercial operators to help the refuge achieve its outreach and educational objectives. Further, permits for guides will contain stipulations addressing ethical behavior and messages (e.g., stewardship) that will be delivered to clients.

Commercial service providers must follow all refuge regulations along with additional special conditions stipulated in their permits. All conditions of the special use permits must be met. A special use permit may be revoked for failure to comply with the conditions or for repeat violations of applicable regulations. The refuge will modify or eliminate any use that results in unacceptable impacts. Permit fees will apply.

Additional stipulations for guided fishing in Citrus County: no bowfishing or spearfishing is allowed at any time on refuge-owned lands and waters. State law requires a clearance of boaters from swimmers, divers, and posted dive flags of at least 100 feet. All fishing activity must adhere to state fishing laws and regulations. Boaters traveling to fishing sites must comply with the stipulations listed under boating (motorized and nonmotorized). Fishing tournaments are not allowed in the refuge-owned water bottoms of Citrus County (the Wilderness portion of the refuge). Other wilderness provisions and regulations may apply.

Justification: Commercial tours and guiding on the refuge would support the priority wildlife-dependent public uses of wildlife observation, photography, and environmental education and interpretation. They would promote recreational fishing opportunities. These activities provide recreational and educational opportunities for the public who desire a quality wildlife-dependent experience, but who may lack the necessary equipment, skills, knowledge, ability, or resources to obtain it themselves. It would allow access to the refuge for a broader and geographically more diverse group of users than local residents and boaters. Visitors participating in commercial tours are educated about the refuge and its natural resources. The experience gained on outdoor excursions can lead to environmental appreciation and instill stewardship. The use would also allow some economic benefit to local communities due to refuge visitation.

NEPA Compliance for Refuge Use Decision: *Place an X in appropriate space*.

___ Categorical Exclusion without Environmental Action Statement
___ Categorical Exclusion and Environmental Action Statement
_X_ Environmental Assessment and Finding of No Significant Impact
___ Environmental Impact Statement and Record of Decision

Mandatory 10-year Re-evaluation Date: _____

Description of Use: *Mosquito Management*

Both Hernando and Citrus counties conduct mosquito control activities in communities within and adjacent to the refuge. Ordinarily no activities are conducted on the refuge. However, each county has proposed an arthropod management plan that would permit mosquito control on refuge lands under special circumstances. Eastern equine encephalitis, St. Louis encephalitis, and recently, West Nile virus are established and recurring diseases in the region of the refuge. Although these diseases most often occur in horses, they may cause serious, life-threatening illness in humans. The counties' plans propose treatments on the refuge only if surveillance, including landing rate counts and larval dips, indicate that disease-carrying species of refuge-based mosquito population numbers exceed the state standard for requiring treatment. The only control material proposed is *Bacillus thuringiensis israelensis* (BTI), a larvicide. Chemical spraying would be a rare event that would only occur during an emergency crisis where there is an imminent human health threat.

Availability of Resources: All aspects of any mosquito control actions will be financed and administered by Hernando and Citrus counties. No additional refuge resources will be needed for mosquito control.

Anticipated Impacts of Use: BTI is a microbial larvicide that is applied to aquatic habitats where mosquito larvae occur. This bacterium produces a crystal-containing spore that causes fragment toxicity when ingested by the mosquito larvae. It is species-specific and affects the larvae of mosquitoes, black flies, and midges. It poses a minimal threat to nontarget vertebrate and invertebrate species. Experimental testing has shown no demonstrated effect against other aquatic insects, including dragonflies, damselflies, mayflies, stoneflies, caddis flies, and water beetles. Other invertebrates, such as Daphnia, cyclops, rotifers and crustaceans, are also not susceptible to BTI. There are no known mammalian health effects resulting from BTI. It is not a phytotoxic and has shown no effect on seed germination or plant vigor.

Determination (check one below):

___ Use is Not Compatible
_X_ Use is Compatible with Following Stipulations

Stipulations Necessary to Ensure Compatibility: Prior to the initiation of any mosquito control efforts, surveillance must be used according to the Florida Department of Environmental Protection standards that establish a need for control of disease-carrying mosquitoes. The Service's Interim Mosquito Guidance (2005) or subsequent amended guidance will be followed. An approved pesticide use proposal (PUP) is required prior to application of a pesticide to Refuge System lands. BTI is the only control agent to be used on refuge property. Any aerial spraying off refuge lands must be planned and executed considering wind and flight pattern to avoid drift onto refuge lands. Prior to initiation of any control action on refuge lands, a Section 7 Endangered Species Act consultation must be completed.

Justification: Mosquito control is generally not practiced on the refuge. If mosquito populations are elevated due to storm events or disease outbreaks, mosquito control may be required in the future. Because several small towns or communities are adjacent to the refuge, it would be difficult to have effective spraying in the county if the refuge lands are not included. Control actions outside refuge boundaries are likely to be conducted by use of adulticide chemicals that do have harmful effects on nontarget species. Chemical spraying of private lands interspersed near refuge lands may affect refuge lands due to drift. It may, in some cases, be preferable to do larvicidal control on the refuge

instead of spraying adulticides adjacent to the refuge. In the rare occurrence of an imminent human health threat, chemical spraying may be considered for use if no other practical option exists.

NEPA Compliance for Refuge Use Decision: *Place an X in appropriate space*.

___ Categorical Exclusion without Environmental Action Statement
___ Categorical Exclusion and Environmental Action Statement
___ Environmental Assessment and Finding of No Significant Impact
___ Environmental Impact Statement and Record of Decision

Mandatory 10- year Re-evaluation Date: _____

Description of Use: *Camping*

Camping is a secondary public use on many national wildlife refuges, and it is allowed when it supports the Refuge System's six priority public uses. Currently the refuge not does have public camping; however, in the 15-year timeframe of the CCP, the Service may designate certain areas for camping and for specific uses. Three areas are being considered. The first is the use of the maintenance headquarters area, which currently houses work campers and could be used to house work crews such as environmental groups that fulfill a Service project. Secondly, the Salt Marsh Trail site may be considered for a group camp site that may include environmental groups or youth groups, such as Boy Scouts or Girl Scouts. Such a site would be limited to conservation or outdoor recreation groups that would further the refuge's stewardship ethics, promote the refuge's mission, and/or provide a service. Thirdly, there is local government support to designate a primitive camping site, possibly improved with a platform or hut along the Citrus County Canoe Trail that runs through refuge property. There are currently no facilities for camping, but if the use is allowed, the following may be obtained or constructed at the land sites: fire pits/rings, grills, tent platforms, and composting or portable toilet(s). A tent platform(s) or hut may be considered along the Citrus County Canoe Trail. Camping would be by advanced reservation and/or by special use permit.

Availability of Resources: Operation and maintenance costs would come from the refuge's annual operating budget. Refuge staff would obtain advanced reservations and/or issue permits, patrol the refuge, and ensure a conservation project is accomplished if a requirement of the allowed use. Construction of any improvements by the refuge would be based on availability of funds. Existing staff can administer permits or reservations, monitor use, and maintain sites or facilities as a part of routine management duties. Law enforcement patrols would help reduce these risks.

Anticipated Impacts of the Use: Some impacts such as littering, soil compaction, vegetation trampling, and wildlife disturbance can be expected, but are anticipated to be minor. Sites would not be designated where gopher tortoises or their burrows occur or are expected, wildlife disturbance is likely, or sensitive habitat exists. There is a threat of accidental wildfire or arson and the potential for vandalism.

Determination (check one below):

_____ Use is Not Compatible
__X__ Use is Compatible with Following Stipulations

Stipulations Necessary to Ensure Compatibility: All group camping would be by advance reservation and/or permit system, so that the refuge would be able to approve each group. Group applicants must have a conservation basis supporting the mission of the Service, Refuge System, the purposes and goals of the refuge, and the priority public uses of the System. Refuge staff may recommend or require that a conservation project be undertaken by the group to further the mission or goals of the refuge. Conditions of the visit/use would be agreed upon in advance of the outing. Zoning of visitor activities by time and space, clustering public use facilities, proper monitoring, educating visitors, and enforcement will ensure compatibility with the purpose of the refuge and mission of the Refuge System. Through periodic evaluation, the refuge will assess resource impacts and take measures to reduce or eliminate any impacts.

For the potential land-based group camp use, the following stipulations apply:

- Rest room facilities (e.g., composting toilet) will be available onsite.
- No open fires would be allowed. Fires would be permitted only if contained onsite and in designated areas, such as grills and fire rings/pits, and if weather, wind and local forestry advisories are favorable.
- Firewood can only be obtained from downed tree limbs and branches and other dead vegetative material.
- No cutting of live wood or branches is permitted.
- Campers would be expected to “Leave No Trace,” meaning that they would carry in all equipment and food and carry out all equipment and refuse. No visible signs of their use would remain.
- Some group camping may be permitted according to the recommendation or requirement of a Service project, such as clearing or maintaining trails, removing debris/litter, building or installing small structures (hiking trail signs or markers, benches, kiosks, wood duck or bat boxes), or planting native vegetation or removing exotic plants.
- The refuge may chose to restrict the number of camp events, the number of campers allowed per group, or the area(s) of use, depending on impacts to refuge resources or other refuge activities, such as closures for bird seasons or for prescribed fire.
- Access to the Salt Marsh Trail site or maintenance area campsites would be by land only.
- No overnight camping/mooring at the Dog Island picnic shelter is permitted.

For the potential canoe/kayak primitive site(s), the following stipulations apply:

- Access to the primitive site(s) along the Citrus County Canoe Trail would be by boat only.
- Camping is in accordance with refuge regulations.
- No open fires are permitted. Fires would be permitted only if contained onsite and in designated areas, such as grills and fire rings/pits, and if weather, wind and local forestry advisories are favorable.
- Firewood can only be obtained from downed tree limbs and branches and other dead vegetative material.
- Leave no trace; pack in and carry out all debris and equipment.

Justification: Camping provides opportunities for wildlife-oriented recreational activities and natural resource appreciation. Ocassional primitive camping is a low-impact and low-cost activity. Providing this opportunity to youth groups fosters a land ethic and exposes young people to the outdoors, refuges, wildlife, and natural resources. This activitiy is an opportunity for visitors to connect with nature and perform or provide a valuable service to the refuge. Providing this activity is compatible with the refuge's purposes and goals and with the Service's mission and regulations.

NEPA Compliance for Refuge Use Description: *Place an X in appropriate space.*

_____ Categorical Exclusion without Environmental Action Statement
_____ Categorical Exclusion and Environmental Action Statement
___X___ Environmental Assessment and Finding of No Significant Impact
_____ Environmental Impact Statement and Record of Decision

Mandatory 10-year Re-evaluation Date: _____

PUBLIC REVIEW AND COMMENT

These draft compatibility determinations will be made available for public review and comment during the public review period established for the Draft Comprehensive Conservation Plan and Environmental Assessment for Chassahowitzka NWR. All comments will be addressed in the final determinations.

APPROVAL OF COMPATIBILITY DETERMINATIONS

The signature of approval is for all compatibility determinations considered within the Comprehensive Conservation Plan for Chassahowitzka National Wildlife Refuge. If one of the descriptive uses is considered for compatibility outside of the comprehensive conservation plan, the approval signature becomes part of that determination.

Refuge Manager: _____
(Signature/Date)

Regional Compatibility Coordinator: _____
(Signature/Date)

Refuge Supervisor: _____
(Signature/Date)

Regional Chief, National Wildlife Refuge System, Southeast Region: _____
(Signature/Date)

Appendix G. Intra-Service Section 7 Biological Evaluation

REGION 4
INTRA-SERVICE SECTION 7 BIOLOGICAL EVALUATION FORM

Originating Person: Joyce M. Kleen
Telephone Number: 352/563-2088 x211 **E-Mail:** joyce_kleen@fws.gov
Date: October 11, 2011

PROJECT NAME (Grant Title/Number): Chassahowitzka National Wildlife Refuge Comprehensive Conservation Plan

I. Service Program:

___ **Ecological Services**
___ **Federal Aid**
- ___ **Clean Vessel Act**
- ___ **Coastal Wetlands**
- ___ **Endangered Species Section 6**
- ___ **Partners for Fish and Wildlife**
- ___ **Sport Fish Restoration**
- ___ **Wildlife Restoration**

___ **Fisheries**
_X_ **Refuges/Wildlife**

II. State/Agency: Florida/U.S. Fish and Wildlife Service

III. Station Name: Chassahowitzka National Wildlife Refuge

IV. Description of Proposed Action (attach additional pages as needed):

The proposed action would result in the implementation of the Comprehensive Conservation Plan (CCPs) for Chassahowitzka National Wildlife Refuge (NWR), totaling almost 31,000 acres in Citrus and Hernando Counties, Florida. It is part of the Crystal River NWR Complex, which includes five refuges. Approval and subsequent implementation of the CCP will direct management actions on the complex for the next 15 years. CCP Attached.

V. Pertinent Species and Habitat:

A. Include species/habitat occurrence map:

Maps for each species are not available. CCP attached.

B. Complete the following table:

SPECIES/CRITICAL HABITAT	STATUS[1]
Whooping crane	E(Exp.)
Wood stork	E
West Indian manatee	E
American alligator	T(S/A)
Atlantic loggerhead turtle	T
Atlantic green turtle	E
Atlantic Ridley turtle	E
Eastern indigo snake	T
Gulf sturgeon	T
Smalltooth sawfish	T

[1]STATUS: E=endangered, T=threatened, PE=proposed endangered, PT=proposed threatened, CH=critical habitat, PCH=proposed critical habitat, C=candidate species, Exp=Experimental Population, S/A=Similarity of Appearance

VI. Location (attach map):

A. Ecoregion Number and Name: Ecoregion 32, North Florida Ecosystem

B. County and State: Citrus and Hernando Counties, Florida

C. Section, township, and range (or latitude and longitude):

N 82^0 40', W 28^0 45'

D. Distance (miles) and direction to nearest town:

Three miles east to Chassahowitzka, Florida

E. Species/habitat occurrence:

An experimental population of whooping cranes winters on the refuge.
Wood stork feed in the shallow waters of the refuge usually at low tide.
West Indian manatees primarily use open water grass beds during the summer.
American alligators occur in the fresh and brackish water areas of the refuge year-round. Atlantic loggerhead turtles, Atlantic green turtles, and Atlantic Ridley turtles are occasionally sighted in the Gulf of Mexico waters. Eastern indigo snakes use

the 35-acre upland area surrounding the maintenance shop where there are gopher tortoise burrows. There are no documented sightings of Gulf sturgeon in refuge waters and there have only been two sightings of the smalltooth sawfish near Crystal River since 1966. However, the refuge has habitat which could support these species. The historic range of the Gulf sturgeon extended south of the refuge to Charlotte Harbor, near Ft. Meyers. Critical habitat includes the Suwannee River, approximately 50 miles north. The smalltooth sawfish range is typically south of Charlotte Harbor. Juveniles occupy shallow vegetative habitats, such as mangroves.

VII. Determination of Effects:

A. Explanation of effects of the action on species and critical habitats in item V. B. (attach additional pages as needed):

The proposed action is expected to be beneficial to listed species.

SPECIES/ CRITICAL HABITAT	IMPACTS TO SPECIES/CRITICAL HABITAT
Whooping crane	The project is not likely to adversely affect the species.
Wood stork	The project is not likely to adversely affect the species.
West Indian manatee	The project is not likely to adversely affect the species.
American alligator	The project is not likely to adversely affect the species.
Atlantic loggerhead turtle	The project is not likely to adversely affect the species.
Atlantic green turtle	The project is not likely to adversely affect the species.
Atlantic Ridley turtle	The project is not likely to adversely affect the species.
Eastern indigo snake	The project is not likely to adversely affect the species.
Gulf sturgeon	The project is not likely to adversely affect the species.
Smalltooth sawfish	The project is not likely to adversely affect the species.

Effects of the proposed action are expected to be neutral to positive for the above listed species. The refuge would seek partners to increase research and to determine crane use of wintering habitats. This research may yield better management decisions for the benefit of the whooping crane population. Manipulating wintering crane habitat mechanically and with prescribed fire would be beneficial to whooping cranes. Whooping cranes like to forage where there is an open vista in order to see predators.

The proposed action would increase manatee research by adding manatee surveys and conducting submerged aquatic vegetation (SAV) surveys to determine health and extent of scarring by boat propellers. Greater protective measures as a result of further studies and surveys may reduce accidental mortality and increase numbers of manatees. A larger or more stable manatee population may be the eventual result of these additional efforts.

The proposed Gulf sturgeon research study would improve knowledge and potential for managing this species.

Preparation and implementation of an Integrated Pest Management Plan, early detection and eradication, and other efforts would likely increase control of invasive plants and ecological benefits related to this. The plan proposes continuation of measures to control invasive plant species through herbicide application. The long-term beneficial use of herbicides outweighs the short-term negative impacts of non-target pesticide damage. This is done under Section 7 consultation and under approved pesticide use proposals approved by USFWS-Jacksonville Ecological Services.

The proposed action would generate additional information about invasive animals and means of controlling them. Aggressively removing hogs, partnering to conduct population surveys, and serving as a host site for a baseline study would serve to reduce the impact of invasive animals on refuge resources. Adoption of the plan would initiate several new studies, surveys and cooperative efforts with partners that would step-up control of both invasive plants and animals.

Effects of the proposed action on reptiles and amphibians would be generally though modestly positive, including the Eastern indigo snake. While there would be no active management for most species, prescribed fire would provide local benefits for both the gopher tortoise and indigo snake in the vicinity of the maintenance shop. It would improve the understory conditions of pine flatwoods and perpetuate habitat in the long-term. Overall though, no substantial increase is anticipated in the abundance or diversity of reptiles and amphibians on the refuge as a result of implementing the plan. The proposed baseline abundance and distribution study of reptiles and amphibians would increase knowledge and improve long-term management capability. Prescribed fire is done in relatively small-scale applications and conducted in accordance with agency policies and under and approved Fire Management Plan. Managed burns, such as that at the maintenance area grounds can reduce fuel loads and help prevent catastrophic wildfires.

B. Explanation of actions to be implemented to reduce adverse effects:

SPECIES/ CRITICAL HABITAT	ACTIONS TO MITIGATE/MINIMIZE IMPACTS
Whooping crane	Actions to mitigate/minimize impacts to the species are discussed below.
Wood stork	No actions to mitigate/minimize impacts to the species are needed or planned.
West Indian manatee	No actions to mitigate/minimize impacts to the species are needed or planned.
American alligator	No actions to mitigate/minimize impacts to the species are needed or planned.
Atlantic loggerhead turtle	No actions to mitigate/minimize impacts to the species are needed or planned.
Atlantic green turtle	No actions to mitigate/minimize impacts to the species are needed or planned.
Atlantic Ridley turtle	No actions to mitigate/minimize impacts to the species are needed or planned.
Eastern indigo snake	Actions to mitigate/minimize impacts to the species are discussed below.
Gulf sturgeon	No actions to mitigate/minimize impacts to the species are needed or planned.
Smalltooth sawfish	No actions to mitigate/minimize impacts to the species are needed or planned.

No mitigation is required for most species at this stage of the CCP since authorization of the CCP will not adversely affect and may positively affect threatened and endangered species. Prior to implementing CCP actions, Endangered Species Act consultation will occur.

Whooping crane: Habitat manipulation using a marsh master and prescribed burning are conducted prior to whooping cranes arriving for the winter. This provides the cranes with an open vista to forage.

Eastern indigo snake: Prescribed burning is conducted during the winter months when snakes are not as active**.**

VIII. Effect Determination and Response Requested:

SPECIES/ CRITICAL HABITAT	DETERMINATION[1]			RESPONSE[1] REQUESTED
	NE	NA	AA	
Whooping crane		X		Concurrence
Wood stork		X		Concurrence
West Indian manatee		X		Concurrence
American alligator		X		Concurrence
Atlantic loggerhead turtle		X		Concurrence
Atlantic green turtle		X		Concurrence
Atlantic Ridley turtle		X		Concurrence
Eastern indigo snake		X		Concurrence
Gulf sturgeon		X		Concurrence
Smalltooth sawfish		X		Concurrence

[1]*DETERMINATION/RESPONSE REQUESTED:*

NE = no effect. This determination is appropriate when the proposed action will not directly, indirectly, or cumulatively impact, either positively or negatively, any listed, proposed, candidate species or designated/proposed critical habitat. Response Requested is optional but a "Concurrence" is recommended for a complete Administrative Record.

NA = not likely to adversely affect. This determination is appropriate when the proposed action is not likely to adversely impact any listed, proposed, candidate species or designated/proposed critical habitat or there may be beneficial effects to these resources. Response Requested is a "Concurrence".

AA = likely to adversely affect. This determination is appropriate when the proposed action is likely to adversely impact any listed, proposed, candidate species or designated/proposed critical habitat. Response Requested for listed species is "Formal Consultation". Response Requested for proposed or candidate species is "Conference".

IX. Reviewing Ecological Services Office Evaluation:

A. Concurrence _____ Nonconcurrence _____

B. Formal consultation required _____

C. Conference required _____

D. Informal conference required _____

E. Remarks (attach additional pages as needed):

_____ _____

_____ _____
Signature (originating station) **date**

_____
Title

_____ _____
Signature **date**

_____ _____
Title **office**

Appendix H. Wilderness Review

Introduction and Overview

Congress designated approximately 23,360 acres of Chassahowitzka NWR as a Wilderness Area on October 19, 1976, with the passage of Public Law 94-557. With the addition of refuge property, the current wilderness areas are listed as 23,579 acres, according to the Service's Annual Report of Lands under Control of the U.S. Fish and Wildlife Service (2010). The areas designated as wilderness are described in Chapter II of the Draft CCP (Section A) and are portrayed in Figure 4. They encompass about three-quarters of the refuge's land holdings.

A wilderness review is a required component of the CCP. The Wilderness Act defines a wilderness area as an area of federal land retaining its primeval character and influence, without permanent improvements or human habitation, which is managed so as to preserve its natural conditions and (1) generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable; (2) has outstanding opportunities for solitude or primitive and unconfined type of recreation; (3) has at least 5,000 contiguous roadless acres or is of sufficient size to make practicable its preservation and use in an unimpaired condition; (4) does not substantially exhibit the effects of logging, farming, grazing, or other extensive development or alteration of the landscape, or its wilderness character could be restored through appropriate management, at the time of review; (5) is a roadless island; and (6) may contain ecological, geological, or other features of scientific, education, scenic, or historic value.

The Acting Project Leader and CCP team met at the Chassahowitzka NWR headquarters in Crystal River on February 3, 2009, to gather information and conduct the wilderness review. The meeting's purpose was to inventory about a quarter of the refuge land, i.e., those refuge lands that are currently not designated as wilderness, and to make a recommendation on whether any of these remaining refuge lands might qualify as wilderness study areas (WSAs), i.e., those that meet the Wilderness Area definition.

The wilderness review team included:

- Keith Ramos, Acting Project Leader;
- Mary Morris, CCP Planning Team Leader;
- Joyce Kleen, Wildlife Biologist;
- Ivan Vicente, Visitor Services;
- Richard Meyers, former Assistant Manager, Tampa Bay Refuges;
- Melissa Charbonneau, formerly of the Florida Department of Environmental Protection; and
- Chad Allison, Florida Fish and Wildlife Conservation Commission.

During the inventory phase of the wilderness review, the emphasis is on an assessment of wilderness character within the inventory unit. Special values (i.e., ecological, geological, scenic, and historical) should be identified. The determination to recommend (or not recommend) a wilderness study area to Congress for wilderness designation is made through the CCP decision-making process. The team reached consensus on a preliminary decision that no refuge lands would qualify as WSAs.

Several other meetings took place regarding wilderness issues when Michael Lusk became the Project Leader in August 2009, including CCP team meetings in August and October 2009. The Service hosted a Wilderness Unit Training session for government agency partners in Crystal River

on October 15-16, 2009, and invited Karen Lindsey of the Arthur Carhart National Wilderness Training Center, Missoula, Montana; Nancy Roeper of the Service's Washington Office; and Deborah Jerome, Wilderness Coordinator of the Service's Southeast Regional Office. The team considered a host of issues for wilderness management and whether any of the remaining portions of the refuge (i.e., those not currently designated as wilderness) would qualify as WSAs.

Wilderness Management

The wilderness management policy and regulations allow motorized access and use of mechanized equipment for administrative purposes only if such uses are the minimum necessary to accomplish wilderness objectives. For the purpose of analysis in this CCP, managers should assume that authorization of such uses would be temporary and rare in a wilderness area. If such restrictions would significantly limit the Service's ability to accomplish other resource management objectives, these impacts should be fully described in the EA, Chapter IV, and would obviously be a factor for consideration in selecting a preferred alternative. The Chassahowitzka Wilderness is unique in that Congress intended for commercial uses, such as fishing and shellfishing, to be continued on the refuge. They have been allowed and are proposed to be continued, but brought under a special use permit in the revised compatibility determinations (Appendix F) for the refuge in Citrus County.

Resource Management Issues

Fire Management

Prescribed burning is not conducted in the wilderness areas of Chassahowitzka NWR. Unintentional wildfires are suppressed only if they affect inholding properties to minimize risk to human safety and property.

Endangered Species

There are 10 federally listed species associated with this refuge. Please refer to Table 1 in Chapter II of the Draft CCP (Section A) for a listing and description of these species.

Exotic Plant Species Control

Some exotic plant species control has been conducted under contract in areas accessed by airboat. This is likely to be an activity that will require occasional use of airboats within the wilderness.

Public Use

All access to the refuge is via boat from three public boat ramps. Traditional uses involving boats include fishing (recreational, commercial and guided) and hunting where allowed. Airboats are allowed in two designated waterway trails under special use permit.

Mineral Rights

The 1981 Wilderness Plan states that some private mineral rights existed prior to wilderness designation. Traditional mining in the area is for phosphate rock. No mining activity occurs at present on the refuge.

Navigable Waters

While the refuge owns the water bottoms within its boundary in Citrus County, it does not own the water column, which is regulated by the State of Florida. The refuge and regional office managers have requested a legal opinion from the Service's Solicitor's Office due to the complex ownership and jurisdictional issues. Once the legal opinion is issued, the refuge's compatibility determinations and Wilderness Management Plan will be revised accordingly.

Wilderness Review Findings

The lands within Chassahowitzka NWR that are currently not designated as wilderness were reviewed for their suitability in meeting the criteria for wilderness, as defined by the Wilderness Act of 1964. None of these areas were deemed to be suitable for further consideration as wilderness study areas. Potential areas to be included in wilderness were evaluated for naturalness, opportunities for solitude, and special and supplemental values. Many of the inholdings on the refuge contain cabins or other structures and are no longer natural. Boating, both motorized and nonmotorized, is permitted on the refuge, and although opportunities for solitude exist in the current wilderness, motorized boats are used to access the inholdings. There may be supplemental values associated with the inholdings, such as the presence of cultural and/or natural resources; however, these values may have been lost under private ownership.

For these reasons, no new lands are proposed as wilderness study areas. Future additions to the refuge will be evaluated for inclusion within two years of acquisition. The Service will revisit the issue of proposing any new WSAs before updating the refuge's Wilderness Management Plan.

Appendix I. Refuge Biota

BIRDS

Common Name	Scientific Name
LOONS	
Common Loon	*Gavia immer*
GREBES	
Pied-billed Grebe	*Podilymbus podiceps*
Horned Grebe	*Podiceps auritus*
Eared Grebe	*Podiceps nigricollis*
PELICANS	
American White Pelican	*Pelecanus erythrorhynchos*
Brown Pelican	*Pelecanus occidentalis*
CORMORANTS	
Double-crested Cormorant	*Phalacrocorax auritus*
DARTERS	
Anhinga	*Anhinga anhinga*
FRIGATEBIRDS	
Magnificent Frigatebird	*Fregata magnificens*
HERONS & BITTERNS	
American Bittern	*Botaurus lentiginosus*
Least Bittern	*Ixobrychus exilis*
Great Blue Heron	*Ardea Herodias*
Great Egret	*Ardea alba*
Snowy Egret	*Egretta thula*
Little Blue Heron	*Egretta caerulea*
Tricolored Heron	*Egretta tricolor*
Reddish Egret	*Egretta rufescens*
Cattle Egret	*Bubulcus ibis*
Green Heron	*Butorides virescens*

Common Name	Scientific Name
Black-crowned Night Heron	*Nyctanassa nycticorax*
Yellow-crowned Night Heron	*Nyctanassa violacea*
STORKS	
Wood Stork	*Mycteria americana*
IBISES & SPOONBILLS	
White Ibis	*Eudocimus albus*
Glossy Ibis	*Plegadis falcinellus*
Roseate Spoonbill	*Platalea ajaja*
SWANS, GEESE & DUCKS	
Snow Goose	*Chen caerulescens*
Wood Duck	*Aix sponsa*
Green-winged Teal	*Anas crecca*
American Black Duck	*Anas rubripes*
Mottled Duck	*Anas fulvigula*
Mallard	*Anas platyrhynchos*
Northern Pintail	*Anas acuta*
Blue-winged Teal	*Anas discors*
Northern Shoveler	*Anas clypeata*
Gadwall	*Anas stepera*
American Wigeon	*Anas Americana*
Canvasback	*Aythya valisineria*
Redhead	*Aythya americana*
Ring-necked Duck	*Aythya collaris*
Greater Scaup	*Aythya marila*
Lesser Scaup	*Aythya affinis*
Bufflehead	*Bucephala albeola*
Hooded Merganser	*Lophodytes cucullatus*
Red-breasted Merganser	*Mergus serrator*
Ruddy Duck	*Oxyura jamaicensis*
Tundra Swan	*Cygnus columbianus*

Common Name	Scientific Name
Great White-fronted Goose	*Anser albifrons*
Common Goldeneye	*Bucephala clangula*
Common Merganser	*Mergus merganser*
VULTURES	
Black Vulture	*Coragyps atratus*
Turkey Vulture	*Cathartes aura*
HAWKS & KITES	
Osprey	*Pandion haliaetus*
Swallow-tailed Kite	*Elanoides forficatus*
Bald Eagle	*Haliaeetus leucocephalus*
Sharp-shinned Hawk	*Accipiter striatus*
Cooper's Hawk	*Accipiter cooperii*
Red-shouldered Hawk	*Buteo lineatus*
Broad-winged Hawk	*Buteo platypterus*
Short-tailed Hawk	*Buteo brachyurus*
Red-tailed Hawk	*Buteo jamaicensis*
Northern Harrier	*Circus cyaneus*
FALCONS	
American Kestrel	*Falco sparverius*
Peregrine Falcon	*Falco peregrinus*
Merlin	*Falco columbarius*
TURKEYS & QUAIL	
Wild Turkey	*Carduelis tristis*
Northern Bobwhite	*Colinus virginianus*
CRANES & LIMPKINS	
Sandhill Crane	*Grus canadensis*
Whooping Crane (reintroduced 2002)	*Grus americana*
Limpkin	*Aramus guarauna*

Common Name	Scientific Name
RAILS, GALLINULES, COOTS	
Yellow Rail	*Coturnicops noveboracensis*
Black Rail	*Laterallus jamaicensis*
Clapper Rail	*Rallus longirostris*
King Rail	*Rallus elegans*
Virginia Rail	*Rallus limicola*
Sora	*Porzanacarolina*
Common Moorhen	*Gallinula galeata*
American Coot	*Fulica americana*
OYSTERCATCHERS	
American Oystercatcher	*Haematopus palliatus*
STILTS & AVOCETS	
Black-necked Stilt	*Himantopus mexicanus*
American Avocet	*Recurvirostra americana*
PLOVERS	
Black-bellied Plover	*Pluvialis squatarola*
Snowy Plover	*Charadrius alexandrinus*
Wilson's Plover	*Charadrius wilsonia*
Semipalmated Plover	*Charadrius semipalmatus*
Killdeer	*Charadrius vociferus*
SANDPIPERS	
Greater Yellowlegs	*Tringa melanoleuca*
Lesser Yellowlegs	*Tringa flavipes*
Solitary Sandpiper	*Tringa solitaria*
Willet	*Tringa semipalmata*
Spotted Sandpiper	*Actitis macularia*
Whimbrel	*Numenius phaeopus*
Long-billed Curlew	*Numenius americanus*
Marbled Godwit	*Limosa fedoa*
Ruddy Turnstone	*Arenaria interpres*

Common Name	Scientific Name
Red Knot	*Calidris canutus*
Sanderling	*Calidris alba*
Semipalmated Sandpiper	*Calidris pusilla*
Western Sandpiper	*Calidris mauri*
Least Sandpiper	*Calidris minutilla*
Pectoral Sandpiper	*Calidris melanotos*
Dunlin	*Calidris alpina*
Stilt Sandpiper	*Calidris himantopus*
Long-billed Dowitcher	*Limnodromus scolopaceus*
Short-billed Dowitcher	*Limnodromus griseus*
Wilson's Snipe	*Gallinago delicata*
Common Snipe	*Gallinago gallinago*
American Woodcock	*Scolopax minor*
GULLS, TERNS & SKIMMERS	
Laughing Gull	*Leucophaeus atricilla*
Bonaparte's Gull	*Chroicoephalus philadelphia*
Ring-billed Gull	*Larus delawarensis*
Herring Gull	*Larus argentatus*
Caspian Tern	*Sterna caspia*
Royal Tern	*Thalasseus maximus*
Sandwich Tern	*Thalasseus sandvicensis*
Common Tern	*Sterna hirundo*
Forster’s Tern	*Sterna forsteri*
Least Tern	*Sternula antillarum*
Black Tern	*Chlidonias niger*
Black Skimmer	*Rynchops niger*
PIGEONS & DOVES	
White-winged Dove	*Zenaida asiatica*
Mourning Dove	*Zenaida macroura*
Common Ground-dove	*Columbina passerina*

Common Name	Scientific Name
CUCKOOS	
Black-billed Cuckoo	*Coccyzus erythropthalmus*
Yellow-bellied Cuckoo	*Coccyzus americanius*
OWLS	
Barn Owl	*Tyto alba*
Eastern Screech Owl	*Otus asio*
Great Horned Owl	*Bubo virginianus*
Barred Owl	*Strix varia*
Short-eared Owl	*Asio flammeus*
GOATSUCKERS	
Common Nighthawk	*Chordeiles minor*
Chuck-will's-widow	*Caprimulgus carolinensis*
Eastern Whip-poor-will	*Caprimulgus vociferus*
SWIFTS	
Chimney Swift	*Chaetura pelagica*
HUMMINGBIRDS	
Ruby-throated Hummingbird	*Archilochus colubris*
KINGFISHERS	
Belted Kingfisher	*Megaceryle alcyon*
WOODPECKERS	
Red-headed Woodpecker	*Melanerpes erythrocephalus*
Red-bellied Woodpecker	*Melanerpes carolinus*
Downy Woodpecker	*Picoides pubescens*
Hairy Woodpecker	*Picoides villosus*
Northern Flicker	*Colaptes auratus*
Pileated Woodpecker	*Dryocopus pileatus*
Yellow-bellied Sapsucker	*Sphyrapicus varius*
FLYCATCHERS	
Eastern Phoebe	*Eastern Phoebe*
Great-crested Flycatcher	*Myiarchus crinitus*

Common Name	Scientific Name
Eastern Kingbird	*Tyrannus tyrannus*
Gray Kingbird	*Tyrannus dominicensis*
Acadian Flycatcher	*Empidonax virescens*
Eastern Wood-pewee	*Contopus virens*
SWALLOWS	
Purple Martin	*Progne subis*
Tree Swallow	*Tachycineta bicolor*
Northern Rough-winged Swallow	*Stelgidopteryx serripennis*
Bank Swallow	*Riparia riparia*
Barn Swallow	*Hirundo rustica*
JAYS & CROWS	
Blue Jay	*Cyanocitta cristata*
American Crow	*Corvus brachyrhynchos*
Fish Crow	*Corvus ossifragus*
CHICKADEES & TITMICE	
Carolina Chickadee	*Poecile carolinensis*
Tufted Titmouse	*Baeolophus bicolor*
NUTHATCHES & CREEPERS	
White-breasted Nuthatch	*Sitta carolinensis*
Brown-headed Nuthatch	*Sitta pusilla*
Brown Creeper	*Certhia americana*
WRENS	
Carolina Wren	*Thryothorus ludovicianus*
House Wren	*Troglodytes aedon*
Marsh Wren	*Cistothorus palustris*
Winter Wren	*Troglodytes hiemalis*
Sedge Wren	*Cistothorus platensis*
MOCKINGBIRDS & THRASHERS	
Gray Catbird	*Dumetella carolinensis*
Northern Mockingbird	*Mimus polyglottos*

Common Name	Scientific Name
Brown Thrasher	*Toxostoma rufum*
THRUSHES	
Eastern Bluebird	*Sialia sialis*
Veery	*Catharus fuscescens*
Gray-cheeked Thrush	*Catharus minimus*
Swainson's Thrush	*Catharus ustulatus*
Hermit Thrush	*Catharus guttatus*
Wood Thrush	*Hylocichla mustelina*
American Robin	*Turdus migratorius*
Louisiana Waterthrush	*Parkesia motacilla*
Northern Waterthrush	*Parkesia noveboracensis*
KINGLETS & GNATCATCHERS	
Golden-crowned Kinglet	*Regulus satrapa*
Ruby-crowned Kinglet	*Regulus calendula*
Blue-gray Gnatcatcher	*Polioptila caerulea*
PIPITS	
American Pipit	*Anthus rubescens*
WAXWINGS	
Cedar Waxwing	*Bombycilla cedrorum*
SHRIKES	
Loggerhead Shrike	*Lanius ludovicianus*
VIREOS	
White-eyed Vireo	*Vireo griseus*
Blue-headed Vireo	*Vireo solitarius*
Yellow-throated Vireo	*Vireo flavifrons*
Red-eyed Vireo	*Vireo olivaceus*
WARBLERS	
Blue-winged Warbler	*Vermivora pinus*
Northern Parula	*Parula Americana*
Yellow Warbler	*Setophaga petechia*

Common Name	Scientific Name
Black-throated Blue Warbler	*Setophaga caerulescens*
Yellow-rumped Warbler	*Setophaga coronata*
Yellow-throated Warbler	*Setophaga dominica*
Pine Warbler	*Setophaga pinus*
Prairie Warbler	*Setophaga discolor*
Palm Warbler	*Setophaga palmarum*
Black-and-White Warbler	*Mniotilta varia*
American Redstart	*Setophaga ruticilla*
Prothonotary Warbler	*Protonotaria citrea*
Ovenbird	*Seiurus aurocapillus*
Common Yellowthroat	*Geothlypis trichas*
Black-throated Green Warbler	*Setophaga virens*
Blackpoll Warbler	*Setophaga striata*
Cape May Warbler	*Setophaga Tigrina*
Hooded Warbler	*Setophaga citrina*
Magnolina Warbler	*Setophaga Magnolia*
Worm-eating Warbler	*Helmitheros Vermivorus*
Connecticut Warbler	*Oporornis agilis*
Orange-crowned Warbler	*Oreothlypis celata*
Yellow-breasted Chat	*Icteria virens*
TANAGERS, GROSBEAKS & BUNTINGS	
Summer Tanager	*Piranga rubra*
Scarlet Tanager	*Piranga olivacea*
Northern Cardinal	*Cardinalis cardinalis*
Blue Grosbeak	*Guiraca caerulea*
Indigo Bunting	*Passerina cyanea*
Rose-breasted Grosbeak	*Pheucticus ludovicianus*
Painted Bunting	*Passerina ciris*
SPARROWS & FINCHES	
Chipping Sparrow	*Spizella passerina*

Common Name	Scientific Name
Seaside Sparrow	*Ammodramus maritimus*
Song Sparrow	*Melospiza melodia*
Swamp Sparrow	*Melospiza georgiana*
White-throated Sparrow	*Zonotrichia albicollis*
Dark-eyed Junco	*Junco hyemalis*
Bachman's Sparrow	*Peucaea aestivalis*
Vesper Sparrow	*Pooecetes gramineus*
Sharp-tailed Sparrow	*Ammodramus caudactus*
Savannah Sparrow	*Passerculus sandwichensis*
Le Conte's Sparrow	*Ammodramus leconteii*
Henslow's Sparrow	*Ammodramus henslowii*
Grasshopper Sparrow	*Ammondaramus savannarum*
Field Sparrow	*Spizella pusilla*
Eastern Towhee	*Pipilo erythrophthalmus*
American Goldfinch	*Spinus virginianus*
BLACKBIRDS & ALLIES	
Bobolink	*Dolichonyx oryzivorus*
Red-winged Blackbird	*Agelaius phoeniceus*
Eastern Meadowlark	*Sturnella magna*
Boat-tailed Grackle	*Quiscalus major*
Common Grackle	*Quiscalus quiscula*
Brown-headed Cowbird	*Molothrus ater*
Baltimore Oriole	*Icterus galbula*
Rusty Blackbird	*Euphagus carolinus*
INTRODUCED NONNATIVE SPECIES	
Muscovy Duck	*Cairina moschata*
Monk Parakeet	*Myiopsitta monachus*
Rock Dove	*Columba livia*
Eurasian Collared-dove	*Streptopeleia decaocto*
European Starling	*Sturnus vulgaris linnaeus*

Common Name	Scientific Name
House Sparrow	*Passer domesticus*
Budgerigar	*Melopsittacus undulatus*

COMMON NAME	SCIENTIFIC NAME
MAMMALS	
Big brown bat	*Eptesicus fuscus*
Bobcat	*Lynx rufus*
Bottlenose dolphin	*Tursiops truncatus*
Brazilian Free-Tailed bat	*Tadarida brasiliensis*
Common opossum	*Didelphis marsupialis*
Cotton deermouse	*Peromyscus gossypinus*
Coyote	*Canis latrans*
Eastern cottontail	*Sylvilagus floridanus*
Eastern gray squirrel	*Sciurus carolinensis*
Eastern harvest mouse	*Reithrodontomys humulis*
Eastern mole	*Scalopus aquaticus*
Eastern pipistrel	*Pipistrellus subflavus*
Eastern red bat	*Lasiurus borealis*
Eastern spotted skunk	*Spilogale putorius*
Eastern woodrat	*Neotoma floridana*
Evening bat	*Nycticeius humeralis*
Everglades short-tailed shrew	*Blarina peninsulae*
Florida black bear	*Ursus americanus floridanus*

COMMON NAME	SCIENTIFIC NAME
Florida mink	*Neovison vison lutensis*
Florida mouse	*Podomys floridanus*
Florida panther	*Puma concolor couguar*
Fox squirrel	*Sciurus niger*
Golden mouse	*Ochrotomys nuttalli*
Gray fox	*Urocyon cinereoargenteus*
Hispid cotton rat	*Sigmodon hispidus*
Hoary bat	*Lasiurus cinereus*
Homosassa shrew	*Sorex longirostris eionis*
House mouse	*Mus musculus*
Long-tailed weasel	*Mustela frenata*
Marsh rabbit	*Sylvilagus (tapeti) palustris*
Nine-banded armadillo	*Dasypus novemcinctus*
Northern yellow bat	*Lasiurus intermedius*
Northern American least shrew	*Cryptotis parva*
North American river otter	*Lontra canadensis*
Pine vole	*Microtuspinetorum*
Raccoon	*Procyon lotor*
Rafinesque's big-eared bat	*Corynorhinus rafinesquil*
Red fox	*Vulpes vulpes*
Rice rat	*Oryzomys palustris*
Seminole bat	*Lasiurus seminolus*
Southern myotis	*Myotis austroriparius*
Southeastern pocket gopher	*Geomys pinetis*

COMMON NAME	SCIENTIFIC NAME
Southeastern shrew	*Sorex longirostris*
Southern flying squirrel	*Glaucomys volans*
Striped skunk	*Mephitis mephitis*
West Indian manatee	*Trichechus manatus*
White-tailed deer	*Odocoileus virginianus*
REPTILES	
TURTLES	
Alligator snapping turtle	*Macrochelys temmincki*
Green sea turtle	*Chelonia mydas*
Atlantic hawksbill sea turtle	*Eretmochelys imbricata imbricata*
Atlantic loggerhead sea turtle	*Caretta caretta*
Snapping turtle	*Chelydra serpentina*
Eastern chicken turtle	*Dierochelys reticularia*
Eastern musk turtle	*Sternotherus oddratus*
Florida box turtle	*Terrapene carolina bauri*
Florida mud turtle	*Kinosternon subrubrum steindachneri*
Florida red-bellied turtle	*Pseudemys nelsoni*
Florida softshell	*Apalone ferox*
Gopher tortoise	*Gopherus polyphemus*
Gulf coast box turtle	*Terrapene carolina major*
Kemp's Ridley Sea Turtle	*Lepidochelys kempii*
Ornate diamondback terrapin	*Malaclemys terrapin macrospilota*
Peninsula cooter	*Pseudemyspeninsularis*
Stinkpot	*Sternotherus odoratus*

COMMON NAME	SCIENTIFIC NAME
Striped mud turtle	*Kinosternon baurii*
Suwannee cooter	*Chrysemys concinna suwanniensis*
CROCODILIANS	
American alligator	*Alligator mississippiensis*
SNAKES	
Blue-striped ribbon snake	*Thamnophis sauritus nitae*
Central Florida crowned snake	*Tantilla relicta neilli*
Corn snake	*Elaphe guttata guttata*
Dusky pigmy rattlesnake	*Sistrurus miliarius barbouri*
Eastern coral snake	*(Or Harlequin)Micrurus fulvius*
Eastern diamondback rattlesnake	*Crotalus adamanteus*
Eastern garter snake	*Thamnophis sirtalis similis*
Eastern indigo snake	*Drymarchon corais couperi*
Florida cottonmouth	*Agkistrodon piscivorus conanti*
Florida kingsnake	*Lampropeltis getula floridana*
Southern black racer	*Coluber constrictor priapus*
Southern ring-neck snake	*Diadophis punctatus punctatus*
LIZARDS	
Broad-headed skink	*Eumeces laticeps*
Common five-lined skink	*Eumeces fasciatus*
Eastern glass lizard	*Ophisaurus ventralis*
Eastern slender glass lizard	*Ophisaurus attenuatus longicaudus*
Ground skink (or Little Brown Skink)	*Sincella lateralis*
Island glass lizard	*Ophisaurus compressus*

COMMON NAME	SCIENTIFIC NAME
Northern green anole	*Anolis carolinensis carolinensis*
Peninsula mole skink	*Eumeces egregius onocrepis*
Six-lined racerunner	*Cnemidophorus sexlineatus*
Southeastern five-lined skink	*Eumeces inexpectatus*
Southern fence lizard	*Sceloporus undulatus*
AMPHIBIANS	
FROGS	
Barking treefrog	*Hyla gratiosa*
Bronze frog	*Rana clamitans clamitans*
Bullfrog	*Rana catesbeiana*
Eastern narrow-mouth toad	*Gastrophryne carolinensis*
Eastern spadefoot	*Scaphiopus holbrookii*
Florida chorus frog	*Pseudacris nigrita verrucosus*
Florida cricket frog	*Acris gryllus dorsalis*
Florida gopher frog	*Rana capito aesopus*
Green treefrog	*Hyla cinerea*
Greenhouse frog	*Eleutherodactylus planirostris*
Little grass frog	*Limnaoedus ocularis*
Oak toad	*Bufo quercicus*
Ornate chorus frog	*Pseudacris ornata*
Pig frog	*Rana grylio*
Pine woods treefrog	*Hyla femoralis*
River frog	*Rana heckscheri*
Striped chorus frog	*Pseudacris nigrita nigrita*

COMMON NAME	SCIENTIFIC NAME
Southern leopard frog	*Rana sphenocephala utriculara*
Southern spring peeper	*Pseudacris crucifer bartramiana*
Southern toad	*Bufo terrestris*
Squirrel treefrog	*Hyla squirella*
SALAMANDERS	
Dwarf salamander	*Eurycea quadridigitata*
Eastern lesser siren	*Siren intermedia intermedia*
Eastern tiger salamander	*Ambystoma tigrinum tigrinum*
Greater siren	*Siren lacertian*
Gulf hammock dwarf siren	*Pseudobranchus striatus lustricolus*
Mole salamander	*Ambystoma talpoideum*
Northern Slimy salamander	*Plethodon glutinosus*
One-toed amphiuma	*Amphiuma pholeter*
Peninsula newt	*Notophthalmus viridescens piaropicola*
Rusty mud salamander	*Pseudotriton montanus floridanus*
Southern dusky salamander	*Desmognathus auriculatus*
Striped newt	*Notophthalmus perstriatus*
Two-toed amphiuma	*Amphiuma means*
FISH	
American eel[7]	*Anguilla rostrata*
Atlantic croaker[2]	*Micropogonias undulatus*
Black drum[1]	*Pogonias cromis*
Blue crab[1]	*Callinectes sapidus*
Bluefish[1] (primarily as juveniles in estuary)	*Pomatomus saltatrix*

COMMON NAME	SCIENTIFIC NAME
Bluegill[2]	*Lepomis macrochirus*
Bowfin[2]	*Amia calva*
Brown shrimp[1]	*Penaeus aztecus*
Channel catfish[2]	*Ictalurus punctatus*
Dog snapper[1] (mainly juveniles in estuary)	*Lutjanus jocu*
Eastern oyster[1]	*Crassostrea virginica*
Florida gar	*Lepisosteus platyrhyncus*
Florida pompano[2]	*Trachinotus carolinus*
Gag grouper[1] (mainly juveniles in estuary)	*Epinephilus morio*
Gizzard shad[2]	*Dorosama cepedianum*
Goliath grouper[3] (mailnly juveniles in estuary)	*Epinephelus itajara*
Gulf flounder[1]	*Paralichthys albigutta*
Gulf menhaden[1]	*Brevoortia patronus*
Gulf sturgeon[5]	*Acipenser oxyrinchus desotoi*
Jack crevalle[2]	*Caranx hippos*
Lane snapper[1] (primarily as juveniles in estuary)	*Lutjanus synagris*
Largemouth bass[2]	*Micropterus salmoides*
Mahogany snapper[1] (juveniles in estuary)	*Lutjanus mahogoni*
Mangrove/Gray snapper[2] (juveniles in estuary)	*Lutjanus griseus*
Needlefish	*Strongylura sp.*
Pink shrimp[1]	*Penaeus duorarum*
Red drum[1]	*Sciaenops ocellata*
Redear sunfish[2]	*Lepomis microlophus*

COMMON NAME	SCIENTIFIC NAME
Sand tiger shark[4]	*Carcharias taurus*
Sheepshead[2]	*Archosargus probatocephalus*
Smalltooth sawfish[6]	*Pristis pectinata*
Southern flounder[1]	*Paralichthys lethostigma*
Spanish mackerel[1] (juveniles in estuary)	*Scomberomorus maculates*
Spot[2]	*Leiostomus xanthurus*
Spotted seatrout[1]	*Cynoscion nebulosus*
Stone crab[1]	*Menippe mercenaria*
Striped mullet[1]	*Mugil cephalus*
Tarpon[2]	*Megalops atlanticus*
Threadfin shad[2]	*Dorosoma petenense*
Warmouth[2]	*Lepomis gulosus*
Warsaw grouper[3]	*Epinephelus nigritus*
Yellowmouth grouper[1] (juveniles in estuary)	*Mycteroperca interstitialis*
Yellowtail Snapper[2] (juveniles in estuary)	*Ocyurus chrysurus*

[1]Species under interjurisdictional Fisheries Management
[2]Species in Recreational/Commercial Fisheries, not under Interjurisdictional Fisheries Management
[3]NOAA Fisheries candidate species
[4]NOAA Fisheries Species of Concern
[5]Threatened
[6]Endangered
[7]Petitioned for listing; status review pending

The above list of fish was compiled by Doug Frugé of the Service's Gulf Coast Fisheries Coordination Office. It lists species occurring in estuarine or coastal waters of the Gulf of Mexico. They are considered potential conservation targets for the refuge because 1) they are most commonly sought either recreationally or commercially; 2) they are under some framework of interjurisdictional management and may occur on the refuge at some life stage; or 3) they are either listed under the Endangered Species Act or are of special conservation concern.

COMMON NAME	SCIENTIFIC NAME
PLANTS	
FERNS AND FERN ALLIES	
Inland giant leather fern	*Acrostichum danaeifolium*
Toothed midsorus fern	*Blechnum serrulatum*
Royal fern	*Osmunda regalis*
Golden polypody	*Phlebodium aureum*
Resurrection fern	*Pleopeltis polypodioides*
Bracken fern	*Pteridium aquilinum*
Chinese brake fern	*Pteris vittata*
Wood fern	*Thelypteriskunthil*
Shoestring fern	*Vittaria lineata*
HERBS AND VINES	
Sweet acacia	*Acacia farnesiana*
Sticky jointvetch	*Aeschynomene viscidula*
Beach false foxglove	*Agalinis fasciculata*
Saltmarsh false foxglove	*Agalinis maritimae*
Purple false foxglove	*Agalinis purpurea*
Giant southern amaranth	*Amaranthus australis*
Short ragweed	*Ambrosia artemisiifolia*
Pepper vine	*Ampelopsis arborea*
Broomsedge	*Andropogon virginicus*
Bottlebrush three-awn	*Aristida spiciformis*
Wire grass	*Aristida stricta*
Butterfly weed	*Asclepias tuberosa*
Climbing aster	*Aster carolinianus Ampelaster carolinianus*
Eastern annual saltmarsh aster	*Aster subulatus Symphyotricum subulatum*
Pine barren, White-topped aster	*Aster tortifolius Oclemena reticulata*

COMMON NAME	SCIENTIFIC NAME
Milk-vetch, Florida vetch-milk	*Astragalus obcordatus*
Combleaf yellow false foxglove	*Aureolaria pectinata*
Coastal water-hyssop	*Bacopa monnieri*
Rattan vine, Alabama supple jack	*Berchemia scandens*
Florida green-eyes	*Berlandiera subacaulis*
Cross vine	*Bignonia capreolata*
Sea oxeye daisy	*Borrichia frutescens*
Florida blueheart's	*Buchnera floridana*
Trumpet vine creeper	*Campsis radicans*
Sedge	*Carex leptalea*
Coastal plain chaffhead	*Carphephorus corymbosus*
Vanillaleaf (aka Deer's tongue)	*CarphephorusTrilisa odoratissimusa*
Partridge pea	*Cassia Chamaecrista fasciculata*
Coast sandspur	*Cenchrus incertus*
Butterfly-pea	*Centrosema virginianum*
Coontail	*Ceratophyllum demersum*
Hyssop spurge	*Chamaesyce hyssopifolia*
Muskgrass	*Chara spp.*
Maryland golden aster	*Chrysopsis mariana*
Horrible yellow thistle	*Cirsium horridulum*
Jamaica swamp, Marinevine, Sorrelvine	*Cissus trifoliata*
Sawgrass	*Cladium jamaicense*
Swamp leather flower	*Clematis reticulata*
Butterfly-pea	*Clitoria mariana*
Tread-softly, Fingerrot, 7-minute-itch	*Cnidoscolus stimulosus*
Whitemouth dayflower	*Commelina erecta*
Dwarf canadian horseweed	*Conyza canadensis var. Pusilla*

COMMON NAME	SCIENTIFIC NAME
Leavenworth's tickseed	*Coreopsis leavenworthii*
Swamp lily seven sisters	*Crinum americanum*
Scratch daisy, Slender scratchdaisy	*Croptilon divaricatum* (*Haplopappus divaricatus)*
Smooth crotalaria, Smooth rattlebox	*Crotalaria mucronata*
Pursh's rattlebox	*Crotalaria purshii*
Rabbitbells	*Crotalaria rotundifolia*
Silverleaf croton, Healing croton	*Croton argyranthemus*
Narrowleaf rushfoil, Michaux's croton	*Crotonopsis linearis croton michauxii*
American scurf-pea	*Cullen americanum* (*Psoralea lupinellus)*
Gulf coast swallow-wort	*Cyanchum angustifolium* (*Lyonia palustris)*
Manatee grass	*Cymodocea filiformis*
Fragrant flatsedge	*Cyperus odoratusodorata*
Manyspike flatsedge, Texas sedge	*Cyperus polystachyos*
Pinebarren flatsedge	*Cyperus retrorsus*
Whitetassels	*Dalea carnea*
Climbing hydrangea (aka Wild hydrangea, Cowitch vine)	*Decumaria barbara*
Pinnate tansy mustard	*Descurainia pinnata*
Hairy small-leaf ticktrefoil	*Desmodium ciliare*
Beggar-weed, Florida ticktrefoil	*Desmodium floridanum*
Tick clover, Zarazabacoa comun	*Desmodium incanum var. incum*
White-edge panicum, Cypress panicgrass	*Dichanthelium dichotomum var. Panicum tenue*
Variable panicum, Variable panicgrass	*Dichanthelium (Panicum) commutatum*
Carolina ponysfoot	*Dichondra carolinensis*
White-top sedge	*Dichromena colorata*
Buttonweed	*Diodia species*
Salt grass	*Distichlis spicata*
Dwarf sundew	*Drosera leucantha*

COMMON NAME	SCIENTIFIC NAME
Oblongleaf snakeherb (aka Twinflower)	*Dyschoriste oblongifolia*
White spikerush	*Eleocharis albida*
Gulf coast spikerush	*Eleocharis cellulosa*
Dwarf spikerush	*Eleocharis parvula*
Hairy elephant's foot, Devil’s Canadian waterweed	*Elephantopus tomentosus*
American elodea	*Elodea canadensis*
Carolina scalystem	*Elytraria caroliniensis*
Green fly orchid	*Epidendrum conopseum*
Horsetail, Scouringrush	*Equisetum hyemale*
Fireweed, American burnweed	*Erechtites hieracifolia*
Horseweed	*Erigeron canadensis*
Southern fleabane, Oakleaf fleabane	*Erigeron quercifolius*
Wild buckwheat	*Eriogonum tomentosum*
Fragrant eryngium	*Eryngium aromaticum*
Baldwin’s eryngo	*Eryngium baldwinii*
Cherokee bean, Red cardinal	*Erythrina herbacea*
Dogfennel	*Eupatorium capillifolium*
Late flowering thoroughwort	*Eupatorium serotinum*
Spurge	*Euphorbia species*
Catchfly-gentian	*Eustoma exaltatum*
Marsh fimbry	*Fimbristylis castanea*
Sand sedge, Hairy fimbry (aka sandsedge)	*Fimbristylis puberula*
Narrowleaf yellowtop	*Flaveria linearisa*
Cottonweed	*Froelichia floridana*
Southern umbrella-sedge	*Fuirena scirpoidea*
Downy milk pea	*Galactia volubilis*
Stiff Marsh bedstraw	*Galium tinctorum*

COMMON NAME	SCIENTIFIC NAME
Southern beeblossomgaura	*Gaura angustifolia*
Yellow jessamine, Carolina jessamine	*Gelsemium sempervirens*
Water locust	*Gleditsia aquatica*
Cudweed	*Gnaphalium pensylvanicum*
Purple cudweed	*Gnaphalium purpureum*
Rough hedgehyssop	*Gratiola hispida*
Hoalweed, Shoalgrass	*Halodule wrightii*
Engelmann's seagrass	*Halophila engelmannii*
Flat-top millegraines	*Hedyotis corymbosa* *Aka Oldenlandia corybosa*
Bitterweed	*Helenium amarum*
Pine barren frostweed	*Helianthemum corymbosum*
Crimsoneyed rose mallow	*Hibiscus moscheutos*
Coastal plain hawkweed	*Hieracium megacephalon*
Fairy footprints, Innocence	*Houstonia Hedyotis procumbens*
Many Flower marsh pennywort	*Hydrocotyle umbellate*
Perfumed spider lily	*Hymenocallis latifolia*
Pineweed, Orangegrass	*Hypericum gentianoides*
Sharp-pod morning glory, Tievine	*Ipomoea cordatotriloba var. cordatotriloba trichocarpa*
Saltmarsh morning glory	*Ipomoea sagittata*
Virginia iris, Great blue flag (aka blue iris)	*Iris virginica*
Black needlerush, Needlegrass rush	*Juncus roemerianus*
Needlepod rush	*Juncus scirpoides*
Virginia saltmarsh mallow	*Kosteletzkya virginica*
Trailing krameria (aka Sandspur)	*Krameria lanceolata*
Virginia dwarf dandelion	*Krigia virginica*
Carolina redroot	*Lachnanthes caroliniana*
Grassleaf lettuce	*Lactuca graminifolia*

COMMON NAME	SCIENTIFIC NAME
Virginia pepper weed	*Lepidium virginicum*
Bearded sprangletop	*Leptochloa fuscafascicularis*
Hairy bush-clover	*Lespedeza hirta*
Blazing star	*Liatris pauciflora*
Sea lavender	*Limonium species*
Florida yellow-flax	*Linum floridanum*
White lobelia	*Lobelia paludosa*
Coral honeysuckle, Trumpet honeysuckle	*Lonicera sempervirens*
Seaside primrose-willow	*Ludwigia maritima*
Wand loosestrife, Saltmarsh loosestrife	*Lythrum lineare*
Axilflower	*Mecardonia acuminata*
Snow squarestem	*Melanthera nivea*
Climbing hemp vine	*Mikania scandens*
Sensitive briaer	*Mimosa (Schrankia) microphylla*
Partridge berry	*Mitchella repens*
Stalked miterwort, Lax hornpod	*Mitreola petiolata*
Southern waternymph	*Najas guadalupensis*
Tropical puff	*Neptunia pubescens*
Apalachicola Florida toad-flax	*Nuttallanthus floridanus* (*Linaria floridana)*
Cutleaf evening-primrose	*Oenothera laciniata*
Yellow wood sorrel	*Oxalis stricta*
Hemlock water dropwort, Water cowbane	*Oxypolis filiformis*
Butterweed	*Packera (Senecio) glabellaus*
Coastal plain palafox	*Palafoxia integrifolia*
Maidencane	*Panicum hemitomon*
Switchgrass	*Panicum virgatum*
Florida paspalum	*Paspalum (Parthenocissus) floridanum*

COMMON NAME	SCIENTIFIC NAME
Bahia grass	*Paspalum (Parthenocissus) notatum*
Trailing phlox	*Phlox nivalis*
Match-heads, Turkey tangle fogfruit	*Phyla (Lippia) nodiflora*
Ground cherry	*Physalis species*
Pokeweed	*Phytolacca americana*
Pitted stripeseed	*Piriqueta cistoides ssp. caroliniana*
Narrowleaf silk-grass, Golden aster	*Pityopsis graminifolia*
Marsh fleabane	*Pluchea odorataa*
Rosy camphorweed	*Pluchea rosea*
Candyweed, Orange milkweed	*Polygala lutea*
Bachelor's button, Candyroot	*Polygala nana*
Tall Jointweed (aka Wireweed)	*Polygonella gracilis*
Swamp smartweed	*Polygonum hydropiperdoides*
Juniper-leaf (aka Rust weed)	*Polypremum procumbens*
Pickerel weed	*Pontederia cordata*
Slender pondweed, Baby pondweed	*Potamogeton pusillus*
Black root, Dense-spiked blackroot	*Pterocaulon pycnostachyum*
Carolina false-dandelion	*Pyrrhopappus carolinianus*
Pale Meadow- beauty, Maryland meadowbeauty	*Rhexia mariana*
Clustered beakrush, Fascicled beaksedge	*Rhynchospora fascicularis*
Beakrush, Plumed beaksedge	*Rhynchospora plumosaa*
Black-eyed susan	*Rudbeckia hirta*
Carolina wild petunia	*Ruellia caroliniensis*
Heartwing sorrel	*Rumex hastatulus*
Widgeon grass	*Ruppia maritimae*
Shortleaf rose gentian	*Sabatia brevifolia*
Rose-of-plymouth	*Sabatia stellaris*

COMMON NAME	SCIENTIFIC NAME
American cupscale	*Sacciolepis striata*
Bulltongue arrowhead (aka Arrowroot)	*Saggittaria lancifolia*
Dwarf saltwort (aka Annual glasswort)	*Salicornia bigelovii*
Water-pimpernel, Seaside brookweed	*Samolus valerandi ssp. parviflorus*
Perennial glasswort, Chicken claws	*Sarcocornia (Salicornia) perennis*
Lizard's tail	*Saururus cernuus*
Olney three-square bulrush, American bulrush	*Schoenoplectus americanus (Scirpus olneyi)*
Soft-stem bulrush	*Schoenoplectus tabernaemontaniscirpus validus*
California bulrush (aka Southern bulrush)	*Schoenoplectus (Scirpus) californicus*
Sturdy bulrush (aka Saltmarsh bulrush)	*Schoenoplectus (Scirpus) robustus*
Florida scrub skullcap	*Scutellaria arenicola*
Rough skullcap, Helmet-flower	*Scutellaria integrifolia*
Foxtail, Marsh bristle grass	*Setaria parvifloragenicula*ta
Starry rosin-weed	*Silphium asteriscusa*
Bear's foot, Hairy leafcup	*Smallanthus (Polymnia) uvedalia*
Earleaf greenbriar (aka Laurel-leaved Greenbriaer)	*Smilax auriculata*
Catbriaer, Saw greenbriar	*Smilax bona-nox*
Cat greenbriar (aka Glaucous greenbriaer)	*Smilax glauca*
Laurel greenbriaer	*Smilax laurifolia*
Dwarf greenbriar, (aka Hairy greenbriaer)	*Smilax pumila*
Lanceleaf greenbriaer	*Smilax smalliilanceolata*
Coral greenbriar (aka Red-berry greenbriaer)	*Smilax walteri*
Common nightshade, American black nightshage	*Solanum americanum*
Carolina horsenettle (aka Nightshade)	*Solanum carolinense*
Black nightshade (aka Nightshade)	*Solanum nigrum*
Seaside goldenrod	*Solidago sempervirens*
Twistleaf goldenrod	*Solidago tortifoliaa*

COMMON NAME	SCIENTIFIC NAME
Lopsided indiangrass	*Sorghastrum secundum*
Smooth cordgrass	*Spartina alterniflora*
Saltmeadow cordgrass	*Spartina patens*
Roughfruit scaleweed scaleseed	*Spermolepis divaricata*
Ladies'-tresses	*Spiranthes species*
Sago pondweed	*Stuckenia pectinata (Potamegeton pectinatus)*
Coastal plain dawnflower	*Stylisma patens ssp. Angustifolia*
Annual seepweed (aka Sea blite)	*Suaeda linearis*
Yellow hatpins (aka Bantam-button)	*Syngonanthus flavidulus*
Scurf hoary-pea	*Tephrosia chrysophylla*
Turtle- grass	*Thalassia testudinum*
Bent alligator-flag	*Thalia geniculata*
Spanish moss	*Tillandsia usneoides*
Poison ivy	*Toxicodendron radicans*
Venus's looking-glass	*Triodanis perfoliata*
Cattail	*Typha spp.*
Zigzag bladderwort	*Utricularia subulata*
Tapegrass, Amercian eelgrass	*Vallisneria americana*
Frost-weed, iceweed, Virginia crownbeard	*Verbesina virginica*
Tall ironweed (aka Narrow-leafed ironweed)	*Vernonia angustifolia*
Summer grape (aka Bird grape)	*Vitis aestivalis*
Munson's grape (aka Muscadine grape)	*Vitis rotundifloria var. munsoniana*
Scuppernong, Grape muscadine	*Vitus rotundifolia*
Southern rockbell	*Wahlenbergia marginata*
Carolina yellow-eyed-grass	*Xyris caroliniana*
Elliott's yellow-eyed-grass	*Xyris elliottii*
Savannah yellow-eyed-grass	*Xyris flabeliformis*

COMMON NAME	SCIENTIFIC NAME
Horned pondweed	*Zannichellia palustris*
TREES AND SHRUBS	
Red maple	*Acer rubrum*
Red buckeye	*Aesculus pavia*
Alder	*Alnus serrulata*
Clusterspike false indigo (aka Lead plant)	*Amorpha herbacea*
Devil's walking stick	*Aralia spinosa*
Red chokeberry	*Aronia arbutifolia*
Slimleaf pawpaw (aka Slender-leaf pawpaw)	*Asimina augustifolialongiflora*
Woolly pawpaw (aka Hairy pawpaw)	*Asimina incanaspeciosa*
Small flower pawpaw (aka Small-fruited pawpaw)	*Asimina parviflora*
Black mangrove	*Avicennia nitida (germinans)*
Saltwater False willow	*Baccharis angustifolia*
Saltbush, Eastern halimfolia	*Baccharis halimifolia*
Tarflower	*Befaria racemosa*
Bushy sea ox-eye	*Borrichia frutescens*
American beauty berry	*Callicarpa americana*
Blue beech, American hornbean	*Carpinus caroliniana*
Pignut hickory	*Carya glabra*
Chinkapin	*Castanea pumila var. pumilaalnifolia*
New Jersey tea	*Ceanothus americanus*
Hackberry	*Celtis species*
Buttonbush	*Cephalanthus occidentalis*
Sandhill rosemary, Sand heath	*Ceratiola ericoides*
Redbud	*Cercis canadensis*
Fringe-tree	*Chionanthus virginicus*
Stiff dogwood (aka Swamp dogwood)	*Cornus foemina*

COMMON NAME	SCIENTIFIC NAME
Parsley hawthorn	*Crataegus marshallii*
One-flowered hawthorn	*Crataegus uniflora*
Swamp titi (aka White titi)	*Cyrilla racemiflora*
Water willow, Swamp loosestrife	*Decondon verticullatus*
Persimmon, Eastern persimmon	*Diospyros virginiana*
Hearts-a-bursting, Strawberry bush	*Euonymus americanus*
Carolina ash	*Fraxinus caroliniana*
Dwarf huckleberry	*Gaylussacia dumosa*
Dangleberry, Blue huckleberry	*Gaylussacia frondosa*
Loblolly bay	*Gordonia lasianthus*
Witch-hazel	*Hamamelis virginiana*
St. Peter's wort	*Hypericum crux-andreaestans*
St. Andrew's cross	*Hypericum hypericoides*
Fourpetal St. John's wort	*Hypericum tetrapetalum*
Carolina holly	*Ilex ambigua*
Dahoon (aka Dahoon holly)	*Ilex cassine*
Large galberry	*Ilex coriacea*
Galberry, inkberry	*Ilex glabra*
Yaupon holly, Yaupon	*Ilex vomitoria*
Virginia sweetspire (aka Virginia willow)	*Itea virginica*
Marsh elder, Jesuit’s bark	*Iva frutescens*
Southern red cedar	*Juniperus virginiana var. silicicola*
Hairy laurel	*Kalmia hirsuta*
White mangrove	*Languncularia racemosa*
Largeleaf lantana	*Lantana camara*
Swamp doghobble (aka Fetter-bush)	*Leucothoe racemosa*
Gopher apple	*Licana michauxii* (*Chrysobalanus oblongifolius)*

COMMON NAME	SCIENTIFIC NAME
Sweetgum	*Liquidambar styraciflua*
Christmas berry, Carolina wolf berry	*Lycium carolinianum*
Rusty staggerbush, tree (aka Rusty lionia)	*Lyonia ferruginea*
Coastalplain staggerbush	*Lyonia fruticosa*
Maleberry	*Lyonia lingustrina*
Fetterbush, Fetterbush lyonia	*Lyonia lucida*
Southern magnolia	*Magnolia grandiflora*
Sweetbay (aka Sweetberry)	*Magnolia virginiana*
Red mulberry	*Morus rubra*
Wax myrtle, Dwarf wax myrtle	*Myrica cerifera*
Blackgum, Swamp tupelo	*Nyssa biflora*
Cockspur prickly pear cactus	*Opuntia pusilladrummondii*
Wild olive, Devilwood	*Osmanthus americanus*
Hophornbeam	*Ostrya virginiana*
Redbay	*Persea borbonia*
Pennyroyal	*Piloblephis rigida*
Slash pine	*Pinus elliottii*
Longleaf pine	*Pinus palustris*
Loblolly pine	*Pinus taeda*
Black cherry	*Prunus serotina*
Wild coffee, Seminole balsamo	*Psychotria nervosa*
Chapman oak	*Quercus chapmanii*
Sand-live oak	*Quercus geminatae*
Bluejack oak	*Quercus incana*
Turkey oak	*Quercus laevis*
Laurel oak	*Quercus laurifolia*
Swamp chestnut oak	*Quercus michauxii*

COMMON NAME	SCIENTIFIC NAME
Dwarf live oak	*Quercus minima*
Myrtle oak	*Quercus myrtifolia*
Running oak	*Quercus pumila*
Shumard oak	*Quercus shumardii*
Live oak	*Quercus virginiana*
Carolina buckthorn	*Rhamnus caroliniana*
Needle palm	*Rhaphidophyllum hystrix*
Red mangrove	*Rhizophora mangle*
Swamp azalea	*Rhododendron viscosumsurrelatum*
Winged sumac, Flameleaf sumac	*Rhus copallinuma*
Swamp rose	*Rosa palustris*
Sand blackberry	*Rubus cuneifolius*
Southern dewberry	*Rubus trivialis*
Dwarf palmetto (aka Blue palmetto)	*Sabal minor*
Cabbage palm	*Sabal palmetto*
Coastal plain willow	*Salix caroliniana*
Common elderberry	*Sambucus nigra ssp. canadensis* (*S. simpsonii)*
Gulf Sebastian bush	*Sebastiania fruticosa* *aka Ditrysinia fructicosa*
Saw palmetto	*Serenoa repens*
Bigleaf snowbell	*Styrax grandifolia*
Sweet leaf, Common sweetleaf	*Symplocus tinctoria*
Pond cypress	*Taxodium ascendens*
Bald cypress	*Taxodium distichum*
Carolina basswood (aka Florida basswood)	*Tilia americana var. caroliniana* (*T. floridana)*
Winged elm	*Ulmus alata*
American elm	*Ulmus americana*
Tree sparkleberry	*Vaccinium arboretum*

COMMON NAME	SCIENTIFIC NAME
Shiny blueberry (aka Evergreen blueberry)	*Vaccinium myrsinites*
Deerberry	*Vaccinium stamineumcaesium*
Possum-haw viburnum	*Viburnum nudum*
Walter's viburnum, Small-leaf arrowhead	*Viburnum obovatum*
Rusty black-haw	*Viburnum rufidulum*
Southern arrowwood	*Viburnum scabrellum* *aka Viburnum dentatum var. dentatum*
Tallow wood	*Ximenia americana*
Aloe yucca, Spanish dagger (aka Spanish bayonet)	*Yucca aloifolia*
Adam's needle (aka Bear grass)	*Yucca filamentosa*
Coontie, Florida arrowroot	*Zamia pumila ssp pumilaintegrifolia*
Toothache tree	*Zanthoxylum americanum*
ALGAE AND LICHENS	
LICHENS AS DESCRIBED BY GRIFFIN (1994)	
Mermaid's wine glass (aka Venus wine glass)	*Acetabularia crenulata*
	AmandineaBuellia punctata (hoffm.) Massal.
	Anadyomene stellata
	Arthonia mesoleuca nyl.
Dot lichen	*Arthonia sp.*
	Arthothelium interveniens (nyl.) Zahlbr.
Chenille algae	*Batophora oerstedi*
Brigantiaea lichen	*Brigantiaea leucoxantha (sprengel) r. Sant.& hafellner*
Disc lichen	*Buellia sp.*
	Calicium cf. Leucochlorum tuch.
Carolina canoparmelia lichen	*Canoparmelia caroliniana (nyl.) Elix. & hale*
Canoparmelia lichen	*Canoparmelia cryptochlorophaea (hale) elix & hale*
	Caulerpa paspaloides

COMMON NAME	SCIENTIFIC NAME
	Caulerpa prolifera
Musk grass	*Chara hornemannii*
	Chiodecton sanguineum (swartz) vain.
	Chondria sp.
Cup lichen	*Cladonia sp.*
Dixie reindeer lichen (aka Deer moss)	*Cladonia subtenuis*
	Crocynia pxxinoides nyl.
	Cryptothecia striata chiodecton montagnaei tuck.
	Digenia Digenea simplex
	Dirinaria aegialita (ach.) Moore
Dirinaria lichen	*Dirinaria picta (swartz) clements & shear*
	Dirinaria sp.
	GlyphisGlyphis cicatricosa ach.
Afzel's script lichen	*Graphis afzelii ach.*
Gyrostomum lichen	*Gyrostomum scyphuliferum (ach.) E. Fries*
	Haematomma puniceum (sm.ex ach.) Massal.
	Halimeda gracilis
Shield lichen	*Heteroderma albicans (pers.) Swinscow & krog.*
Caesarett's shield lichen	*Heterodermia caesarettiana (massal.) Trev.*
Shield lichen	*Heterodermia galatactophylla (tuck.) Culb.*
Shield lichen	*Heterodermia sp.*
	Laurencia sp.
Rim lichen	*Lecanora sp.*
Austroameridcan lichen	*Leptogium austroamericanum (malme) dodge*
Blue skin lichen	*Leptogium azureum (swartz.) Mont.*
Skin lichen	*Leptogium cyanescens (rabenh.) Koerber*
Skin lichen	*Leptogium marginellum (swartz.) S. gray*

COMMON NAME	SCIENTIFIC NAME
Letrouitia lichen	*Letrouitia vulpina (tuck.) Hafellner & bellem*
Lung lichen	*Lobaria tenuis vain*
Wart lichen	*Melanotheca anomala (ach.) Malme*
Myriotrema lichen	*Myriotrema reclusum (krempelh.) Hale*
American ocellularia lichen	*Ocellularia americana hale*
Parmotrema lichen	*Parmotrema crinitum (ach.) Hale*
Parmotrema lichen	*Parmotrema cristiferum (tayl.) Hale*
Parmotrema lichen	*Parmotrema dilatatum (vain.) Hale*
Parmotrema lichen	*Parmotrema eudosulophureum (hillman) Hale*
Michaux's parmotrema lichen	*Parmotrema michauxianum (zahlbr.) Hale*
Perforated parmotrema lichen	*Parmotrema perforatum (jacq.) Massal.*
Parmotrema lichen	*Parmotrema praesorediosum (nyl.) Hale*
Parmotrema lichen	*Parmotrema rampodde (nyl.) Hale*
Netted rimelia lichen	*Parmotrema reticulatum (tayl.) Choisy*
Parmotrema lichen	*Parmotrema tinctorum (nyl.) Hale*
Parotrema lichen	*Parmotrema ultralucens (krog.) Hale*
	Penicillus sp.
Pore lichen	*Pertusaria sp.*
	Physcia atrostriata (moberg)
	Polysiphonia ferulacea
Wart lichen	*Pyrenula cruenta (mont.) Vain.*
Wart lichen	*Pyrenula leucostoma*
	Pyrenula mamillanamarginata (hook.) In kurth
Pyrrhospora lichen	*Pyrrhospora varians (ach.) R.c. harris*
	Pyxine caesiopruinosa (nyl.) Imsh.
Pyxine lichen	*Pyxine cocoes (swartz.) Nul*
Eschweileri pyxine lichen	*Pyxine eschweileri (tuck.) Vain.*

COMMON NAME	SCIENTIFIC NAME
American cartilage lichen	*Ramalina americana hale*
Cartilage lichen	*Ramalina sp.*
Netted rimelia lichen	*Rimelia reticulata (tayl.) Hale & fletcher*
Rimeliia lichen	*Rimelia subisidiosa (muell. Arg.) Hale (nyl.) R.c. & Fletcher*
Sarcographa lichen	*Sarcographa tricosa (ach.) Mull. Arg.*
	Sargassum sp.sargassum
	Trypethelium aenum (eschw.) Zahlbr.
	Trypethelium mastordeum (ach.) Ach.
	Trypethelium nitidiusculum harris
	Trypethelium ochroleucum (eschw.) Nyl.
	Trypethelium sp.
	Trypethelium tropicum (ach.) Muell. Arg.
	Udotea conglutinata
	Udotea flabellum
Beard lichen	*Usnea mutabilis stirton*
Old man’s beard, beard lichen	*Usnea sp.*
Old-man's beard	*Usnea strigosa*
Florida beard lichen	*Usnea strigosaflorida*

NONNATIVE, INVASIVE, AND/OR EXOTIC SPECIES OCCURRING OR THOUGHT TO OCCUR ON THE REFUGE

COMMON NAME	SCIENTIFIC NAME
BIRDS	
Eurasian collared dove	*Streptopelia decaocto*
European starling	*Sturnus vulgaris*
House sparrow	*Passer domesticus*
Monk parakeet	*Myiopsitta monachus*
Muscovy duck	*Cairina moschata*
Rock pigeon, Rock dove	*Columba livia*
MAMMALS	
Feral hog, Feral pig, Wild boar	*Sus scrofa*
REPTILES AND AMPHIBIANS	
Brown anole	*Anolis sagrei*
Cuban tree frog	*Osteopilus septentrionalis*
PLANTS	
Mexican tea	*Chenopodium ambrosioides*
Bermuda grass	*Cynodon dactylon*
Sagotia beggar-weed, Threeflower ticktrefoil	*Desmodium triflorum*
Common water hyacinth	*Eichhornia crassipes*
Hydrilla, Water thyme	*Hydrilla verticillata*
Cogon grass	*Imperata cylindrica*
Rough hairy indigo	*Indigofera hirsuta*
Japanesa honeysuckle	*Lonicera japonica*
Black medic	*Medicago lupulina*
Eurasian watermilfoil	*Myriophyllum spicatum*
Skunk vine	*Paederia fortita*
Water lettuce	*Pistia stratiotes*

COMMON NAME	SCIENTIFIC NAME
Paraguayan purslane	*Portulaca amilis*
Wild radish	*Raphanus raphanistrum*
Brazilian pusley, Tropical Mexican clover	*Richardia brasiliensis*
Sow thistle	*Sonchus oleraceus*
Johnson grass	*Sorghum halepense*
Wheat, Common wheat	*Triticum aestivum*
Brazilian pepper tree	*Schinus terebinthifolius*

Appendix J. Refuge Budget

The refuge's budget requests are contained in the Service's Refuge Operating Needs System (RONS) and Service Asset and Maintenance Management System (SAMMS) databases that include a wide variety of new and maintenance refuge projects.

The RONS and SAMMS lists are constantly updated and include priority projects. Please contact the refuge for the most current RONS and SAMMS lists. Please refer to Chapter V, Plan Implementation, in the Draft CCP for the key budget requests associated with the proposed projects and staffing.

Appendix K. Partnerships

EXISTING PARTNERSHIPS

Federal Agencies:

National Oceanic and Atmospheric Administration (NOAA)
- National Estuary Program
- National Marine Fisheries Service

United States Department of Agriculture
- Animal and Plant Health Inspection Service, Wildlife Services
- Forest Service

United States Department of Defense
- Army Corps of Engineers

United States Department of Homeland Security
- Immigration and Customs Enforcement
- United States Coast Guard, Yankeetown
- United States Coast Guard Auxiliary
- United States Customs and Border Protection

United States Department of Interior
- National Park Service
  - Archaeological Center
- United States Fish and Wildlife Service
  - South Florida Invasive Species Strike Team
- United States Geological Survey
  - Florida Integrated Science Center
  - National Wildlife Health Center

United States Department of Justice
- United States Marshals Service

State Agencies:

Florida Department of Agriculture and Consumer Services
- Florida Forest Service

Florida Department of Environmental Protection (FDEP)
- Division of State Lands
  - Division of Parks and Recreation - Florida Park Service
    - Crystal River Preserve State Park
    - Ellie Schiller Homosassa Springs Wildlife State Park
    - Office of Greenways and Trails
- Office of Coastal and Aquatic Managed Areas (CAMA)
  - St. Martins Marsh Aquatic Preserve

Florida Department of Highway Safety and Motor Vehicles

Florida Highway Patrol

Florida Department of Transportation

Florida Fish and Wildlife Conservation Commission (FWC)
- Division of Habitat and Species Conservation
  - Terrestrial Habitat Conservation and Restoration (THCR) Section

Division of Law Enforcement
Fish and Wildlife Research Institute
Wildlife and Environmental Areas, Chassahowitzka Wildlife Management Area
Southwest Florida Water Management District (Regional Office)

Local Government Agencies:

Citrus County
Board of County Commissioners
Department of Development Services, Community Development Division
Department of Public Works, Aquatic Services
Sheriff's Office

Regional Agencies, Events or Programs:

Florida Exotic Pest Plant Council
Withlacoocheee Invasive Plants Working Group

Other Organizations and Academia:

Amy H. Remley Foundation
Avian Research and Conservation Institute
Center for Marine Conservation, The Ocean Conservancy
Citrus County Audubon Society
Nature Coast Chamber of Commerce
Defenders of Wildlife
Florida Native Plant Society
Friends of the Crystal River National Wildlife Refuge Complex, Inc. (Friends group)
Friends of Crystal River Preserve State Park
Friends of the Homosassa Springs Wildlife State Park, Inc.
Homosassa River Alliance
National and Aquatic Conservation Program Wildlife Trust
National Audubon Society-Audubon of Florida, Florida Coastal Islands Sanctuaries
National Wildlife Refuge Association
Nature World Wildlife Sanctuary
Sea to Shore Alliance
Save the Manatee Club
The Nature Conservancy
University of Georgia, Southeast Cooperative Wildlife Disease Study (SCWDS)
University of Florida (Tom Frazer)
University of South Florida – Florida Public Archaeology Network

POTENTIAL PARTNERSHIPS

Ducks Unlimited
Florida Guides Association
National Association for Interpretation
North American Association of Environmental Educators (NAAEE)
United Waterfowlers of Florida, Inc. (UWF)
USA National Phenology Network

Appendix L. List of Preparers

Writers/Contributers:

- Mary Morris, Natural Resource Planner, U.S. Fish and Wildlife Service (USFWS), Southeast Regional Office
- Joyce Kleen, Wildlife Biologist, USFWS, Crystal River NWR Complex
- Ivan Vicente, Public Use Specialist, USFWS, Crystal River NWR Complex
- Melissa Charbonneau, former Aquatic Preserve Manager, St. Martins Marsh and Big Bend Seagrasses Aquatic Preserves, Florida Department of Environmental Protection (FDEP), Coastal Aquatic and Managed Areas
- Michael Lusk, Project Leader, USFWS, Crystal River NWR Complex
- Craig Cavanna, Refuge Officer/Law Enforcement, USFWS, Crystal River NWR Complex
- Ryan Maier, Refuge Officer/Law Enforcement, USFWS, Crystal River NWR Complex
- Chad Allison, Florida Fish and Wildlife Conservation Commission (FWC), Chassahowitzka Wildlife Management Area
- Boyd Blihovde, Deputy Project Leader, USFWS, Crystal River NWR Complex
- Laura Housh, Regional Planner, USFWS, Southeast Regional Office
- William G. Miller, USFWS, former Natural Resource Planner
- Leon Kolankiewicz, Wildlife Biologist/Environmental Planner, Mangi Environmental Group
- Internal review draft commentors - USFWS, FDEP, FWC

Map Preparers:

- Melissa Charbonneau, formerly FDEP
- Barry Wood, GIS Specialist, USFWS, South Florida Ecological Services Office, Vero Beach
- Jane Cooke, GIS Intern, USFWS, South Florida Ecological Services Office, Vero Beach

Document Preparation and Distribution:

- Evelyn Nelson, Editor, USFWS, Southeast Regional Office
- Jim Wood, Writer/Editor, USFWS (Ret.)
- Randy Musgraves, Visual Information Specialist, USFWS, Southeast Regional Office
- Rose Hopp, Senior Planner, USFWS, Southeast Regional Office

Appendix M. Inventory and Monitoring Efforts by Refuge Staff and Partners

Wildlife and Habitat Surveys:

Aerial Manatee Survey- bimonthly (April to August)
Colonial Waterbird Survey (includes nesting)- monthly
Waterfowl Survey- monthly
Gopher Tortoise Burrow Count- once every 3 years, following prescribed burn
IMPROVE Air Quality and Mercury Deposition Monitoring- weekly by volunteers

Selected research projects conducted under special use permit from 2001-2011:

Audubon of Florida- Hodgson – 41510-06058: Conduct surveys of colonial nesting birds, shorebirds, and other bird species within Chassahowitzka NWR. (2001-2006)

Bureau of Archaeological Research- Moates – 41510-06053: Record and re-survey the remains of a potentially important shipwreck sunk near the mouth of the Homosassa River. (2006)

Citrus County Dept of Public Works- Thomas – 41510-07053: Survey corner markers in sections of Chassahowitzka NWR to update a GIS base map. (2007)

Citrus County Mosquito Control-Jacobson – 41510-11085: Establish and monitor surveillance traps for mosquitoes and to dip for larvae. (2011)

Florida Fish and Wildlife Conservation Commission (FWC)- Onorato – 41510-08040: Collect fish eggs, larvae, planktonic invertebrate larvae and adults, bottom-associated crustaceans, a diversity of juvenile fishes, adult stages of smaller resident fishes, and selected larger macroinvertebrates in order to develop ecological metrics and minimum flows for Chassahowitzka. (2008-2010)

Florida Fish and Wildlife Conservation Commission (FWC)- McCown – 41510-09008, 10013: Define the primary (presence of females) and secondary (presence of bears) ranges of bears in the Chassahowitzka area. (2009-2010).

Florida Fish and Wildlife Conservation Commission (FWC)- Roger – 41510-10020: Survey of marsh bird species within Chassahowitzka NWR. (2010-2011)

International Crane Foundation- Hook/Szyszkoski/Wellington/Zimorski/Beilfuss/Fasoli/ Kerley/Love/Wisinski – 41510-07041, 08034, 09001, 10003, 11049: Monitor an experimental migratory flock of whooping cranes that have been reintroduced into the Chassahowitzka NWR. (2006-2011)

Jacksonville Zoo- Bear- Hull/Buck/Smith – 41510-11067: Monitor an experimental flock of whooping cranes that have been reintroduced into the Chassahowitzka NWR. (2011)

Operation Migration, Inc.- Duff/Paulan/Pennypacker/Van Heuvelen – 41510-07040, 08044, 09003, 10005, 11050: Reintroduce an experimental migratory flock of whooping cranes into the Chassahowitzka NWR using ultralight aircraft and monitor the population. (2001-2011)

Resource Designs, Inc. -Hodgson – 41510-11084: Map the occurrence and distribution of submerged aquatic vegetation (SAV) species and to identify the abundance of avian species in association with SAV species. (2011-2013)

Resource Designs, Inc./USF Institute for Environmental Studies -Hodgson – 41510-11077: Conduct avian surveys with emphasis on colonial nesting birds and shorebirds. (2011-2012)

Southwest Florida Water Management District -Craw – 41510-06061, 08052, 11086: Collect and analyze water quality and clarity data within the Coastal River Basin as part of a diagnostic monitoring for the Springs Coast Watershed. (2005-2014)

United States Geological Survey (USGS)- Kane/Morasco – 41510-07055: Establish and monitor of minimum flow stations that monitor the quantity and quality of surface-water flows within selected river basins. (2007-2012)

USFWS- Urbanek – 41510-06033, 07042, 08035, 09002, 10004: Monitor an experimental migratory flock of whooping cranes that have been reintroduced into the Chassahowitzka NWR. (2005-2010)

U.S. Geological Survey (USGS)- Kane – 41510-06055: Establish and monitor minimum flow stations that monitor the quantity and quality of surface-water flows within selected river basins. (2005-2007)

U.S. Geological Survey (USGS) Patuxent Wildlife Research Center- Coontz – 41510-11051: Monitor an experimental flock of whooping cranes that have been reintroduced into the Chassahowitzka NWR. (2011)

University of South Florida, Department of Geology -Hunt – 41510-10021: Collect sediment samples to investigate geologic processes in region of Florida's Gulf Coast. (2010-2011)

University of South Florida -Wang – 41510-06056: Conduct shoreline mapping and bathymetric survey for the Chassahowitzka River. (2006)