U.S. Fish & Wildlife Service

Great Dismal Swamp National Wildlife Refuge

and Nansemond National Wildlife Refuge

Final Comprehensive Conservation Plan

July 2006

Cover: American black bear
Photo: Pat Cuffee

This goose, designed by J.N. "Ding" Darling, has become the symbol of the National Wildlife Refuge System.

The *U.S. Fish and Wildlife Service* is the principal federal agency responsible for conserving, protecting, and enhancing fish and wildlife, plants and their habitats for the continuing benefit of the American people. The Service manages the 96-million acre National Wildlife Refuge System comprised of 544 national wildlife refuges and thousands of waterfowl production areas. It also operates 65 national fish hatcheries and 78 ecological services field stations. The agency enforces federal wildlife laws, manages migratory bird populations, restores nationally significant fisheries, conserves and restores wildlife habitat such as wetlands, administers the Endangered Species Act, and helps foreign governments with their conservation efforts. It also oversees the Federal Aid Program which distributes hundreds of millions of dollars in excise taxes on fishing and hunting equipment to state wildlife agencies.

Comprehensive Conservation Plans provide long-term guidance for management decisions and set forth goals, objectives, and strategies needed to accomplish refuge purposes and identify the Service's best estimate of future needs. These plans detail program planning levels that are sometimes substantially above current budget allocations and, as such, are primarily for Service strategic planning and program prioritization purposes. The plans do not constitute a commitment for staffing increases, operational and maintenance increases, or funding for future land acquisition.

Comprehensive Conservation Plan Approval
for Great Dismal Swamp
and Nansemond National Wildlife Refuges

Submitted by:

7/10/2006

Suzanne C. Baird
Project Leader
Great Dismal Swamp National Wildlife Refuge

Date

Approved by:

8/01/06

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Date

Approved by:

05/01/2006

Anthony D. Leger
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Date

Final Approval:

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JUL 26 2006

Marvin E. Moriarty
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U.S. Fish and Wildlife Service

Date

Finding of No Significant Impact
Great Dismal Swamp and Nansemond National Wildlife Refuges
Comprehensive Conservation Plans

The Draft Comprehensive Conservation Plan and Environmental Assessment (Draft CCP/EA) of March 2006 for Great Dismal Swamp and Nansemond National Wildlife Refuges (NWR) evaluated three management alternatives, carefully considering their impacts on the environment, their potential contribution to the mission of the National Wildlife Refuge System (NWRS), and each refuge's purposes and goals. A brief summary of the three alternatives follows.

Alternative A: "Current Management (No Action)." This was the No Action Alternative in the Draft CCP/EA required by the Council of Environmental Quality's regulations on implementing the National Environmental Policy Act. Under this alternative, there would be no change from our current resource management programs on refuge lands. Great Dismal Swamp NWR would continue interpretive and environmental education programs already in place. Land acquisition would occur only within approved areas and extensions thereto as allowed by policy.

Alternative B: "Service's Preferred Alternative." This alternative was the U.S. Fish and Wildlife Service's (Service) Proposed Action in the Draft CCP/EA. Land acquisition occurs only within the current approved acquisition areas and extensions thereto as allowed by policy. Resource management operations and visitor services will be expanded if funds become available to add facilities, including a new visitor center and administrative building, and staff to support these operations. Phases of expansion would be anticipated as funds are allocated to enhance specific refuge operation. A new hunting opportunity would be implemented for black bear.

Alternative C: "Limited Habitat Management." This alternative retains most of the expansion of visitor services described within the Service's Preferred Alternative, but limits habitat manipulation to those activities that qualify under existing fire management programs. Thus, habitat manipulation will be limited primarily to fuels reduction, utilizing select timber cutting and prescribed burning.

The Draft CCP/EA was distributed for a 30-day public review and extended for an additional 10 days. The comment period was from March 13 to April 24, 2006. After consideration of all public comments, I determined that this EA was sufficient to support my findings.

After careful review of the proposed management actions, and based on the analysis provided in the EA and the comments received during the review period, I have selected Alternative B (the Service's Proposed Action in the Draft CCP/EA) for implementation, with the following modifications:

Land Protection: A number of comments expressed support for protection of the Great Dismal Swamp ecosystem, including surrounding lands. Additionally, a comment voiced concern that the wording of Goal 3 did not adequately reflect the refuge purpose as stated in the Dismal Swamp Act. The refuge addressed these comments with the following actions:

(1) Addition of the following strategy to Goal 3. "Develop sound working relationships with adjoining landowners, nearby neighboring landowners, and other key landowners within the ecosystem to protect the integrity of the refuge boundary and further the protection of the ecosystem." The refuge will take advantage of partnership opportunities around the refuge.

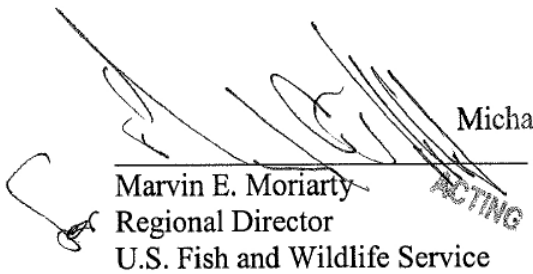
(2) Goal 3 was broadened to better reflect the intent of the enabling legislation and reworded as: "Provide protection and restoration of those areas within Great Dismal Swamp ecosystem that are remnants of the Great Dismal Swamp and/or are restorable to Great Dismal Swamp habitat while providing support to the protection and restoration of all its components and adjacent habitats that directly affect the vitality and viability of the ecosystem."

Wildlife Observation: A suggestion was made to develop a through-swamp canoe/kayak trail. This suggestion was adopted. A through-swamp canoe/kayak trail will be developed in Washington Ditch from the existing parking area to Lake Drummond and then via the Feeder Ditch to the Dismal Swamp Canal, and a partnership will be sought to oversee maintenance of the trail.

Road Improvements: A number of comments about the amount of road paving that was proposed were received. The refuge decided to reduce the amount of paving. The proposed auto tour route and the access to Lake Drummond will remain as gravel roads. Paving will only occur on highest use access roads at Washington Ditch and Jericho Ditch.

I have selected Alternative B, with the modifications noted above, because it helps fulfill the mission of the NWRS, best achieves each refuge's purpose, vision, and goals; maintains and, where appropriate, restores the ecological integrity of both refuges, addresses the significant issues identified during the planning process; and is consistent with principles of sound fish and wildlife management.

I find that the implementation of modified Alternative B will not have a significant impact on the quality of the human environment in accordance with Section 102 (2) (c) of the National Environmental Policy Act. It adheres to all legal mandates and Service policies. As such, I have concluded that an Environmental Impact Statement is not required, and this Finding of No Significant Impact is appropriate and warranted.



Michael G. Thabault

Marvin E. Moriarty ACTING
Regional Director
U.S. Fish and Wildlife Service
Hadley, Massachusetts

JUL 26 2006

Date

Guiding Principles of the National Wildlife Refuge System

We are land stewards, guided by Aldo Leopold's teachings that land is a community of life and that love and respect for the land is an extension of ethics. We seek to reflect that land ethic in our stewardship and to instill it in others.

Wildlands and the perpetuation of diverse and abundant wildlife are essential to the quality of the American life.

We are public servants. We owe our employers, the American people, hard work, integrity, fairness, and a voice in the protection of their trust resources.

Management strategies from preservation to active manipulation of habitats and populations is necessary to achieve the missions of the National Wildlife Refuge System and the U.S. Fish and Wildlife Service.

Wildlife-dependent uses involving hunting, fishing, wildlife observation, wildlife photography, and environmental education and interpretation, when compatible, are legitimate and appropriate uses of the National Wildlife Refuge System.

Partnerships with those who want to help us meet our mission are welcome and indeed essential.

Employees are our most valuable resource. They are to be respected. They deserve empowering and mentoring, and support through a caring work environment.

We respect the rights, beliefs, and opinions of our neighbors.

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1. Purpose of and Need for Action

Introduction

The National Wildlife System Administration Act of 1966, as amended by the National Wildlife Refuge System Improvement Act of 1997, requires the Service to develop a Comprehensive Conservation Plan (CCP) for each refuge. The purpose of developing a CCP is to provide refuge managers with a 15-year strategy for achieving refuge purposes and contributing toward the mission of the National Wildlife Refuge System, consistent with sound principles of fish and wildlife science, conservation, legal mandates, and Service policies. In addition to outlining broad management direction on conserving wildlife and habitats, a CCP identifies wildlife-dependent recreational opportunities available to the public, including opportunities for hunting, fishing, wildlife observation and photography, and environmental education and interpretation. The CCP will be reviewed and updated at least every 15 years in accordance with the National Wildlife Refuge System Administration Act of 1969, as amended by the National Wildlife Refuge System Improvement Act of 1997, and the National Environmental Policy Act of 1969.

Washington Ditch Trail.
Four mile hiking trail to Lake Drummond paralleling historic Washington Ditch. USFWS.

When fully implemented, this plan will strive to achieve the management vision. Overriding considerations reflected in the plan are 1) fish and wildlife conservation is first priority in refuge management, and 2) wildlife-dependent recreation is allowed and encouraged as long as it is compatible with, or does not detract from the refuge's mission or purpose.

The Planning Area

The Great Dismal Swamp National Wildlife Refuge

The Great Dismal Swamp National Wildlife Refuge (NWR) is the largest intact remnant of a vast habitat that once covered more than one million acres of southeastern Virginia and northeastern North Carolina. Formal protection of this resource began in 1973, when the Union Camp Corporation (a local forest products company) donated 49,097 acres to The Nature Conservancy. The Nature Conservancy conveyed the donated land to the federal government, which, combined with additionally purchased land, was used to establish the Great Dismal Swamp NWR in 1974. Today, the refuge encompasses 111,203 acres of this environmentally and biologically important area (Figure 1-1).

Located at the southern boundary of the northeastern administrative region (Region 5) of the U.S. Fish and Wildlife Service, the refuge is its largest and protects nearly 25% of all service owned land found in the region.

Nansemond National Wildlife Refuge

The Nansemond National Wildlife Refuge is a non-staffed, satellite refuge of the Great Dismal Swamp NWR (GDSNWR). It is not open to the public. Located on the Nansemond River in Suffolk, Virginia, the refuge lies approximately five miles to the northwest of the GDSNWR. The 423 acre refuge was established on December 12, 1973, when three tracts of tidal marsh were transferred from the Department of Defense to the U.S. Fish and Wildlife Service. An additional tract of upland was added to the refuge in 1996 after the closing of the Driver Naval Facility, also as excess lands from the Department of Defense.

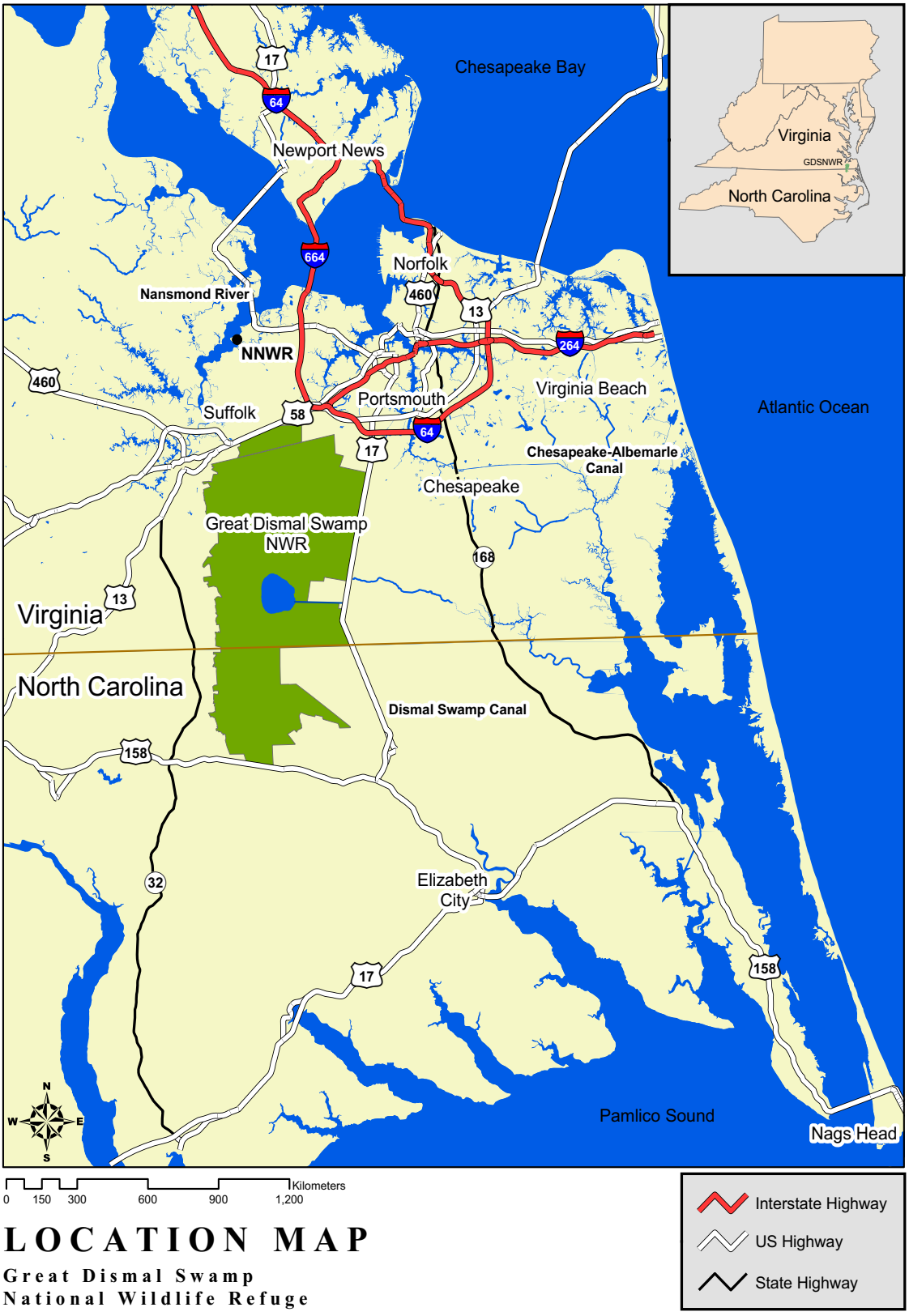
Purpose of and Need for Action

The purpose of the plan is to identify the role the refuge will play in support of the mission of the National Wildlife Refuge System and to provide guidance in refuge management activities.

The plan is needed to:

- Provide a clear statement of direction for the future management of the refuge.

Figure 1-1.



LOCATION MAP

Great Dismal Swamp National Wildlife Refuge

- Provide refuge neighbors, visitors, and government officials with an understanding of Service management actions on and around the refuge.
- Ensure that Service management actions, including land protection and recreation and education programs, are consistent with the mandates of the National Wildlife Refuge System.
- Provide long term continuity and direction in management.
- Provide a basis for the development of budget request for operations, maintenance, and capital improvement needs.

Overview of the Department of the Interior

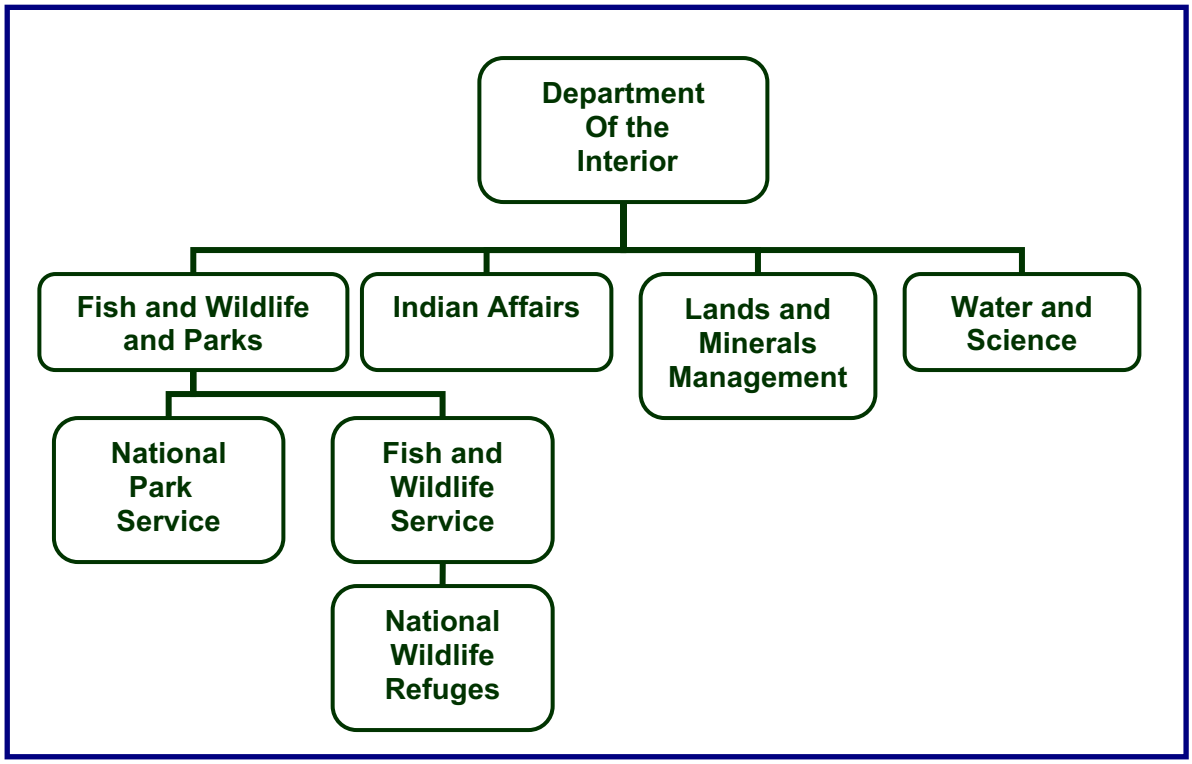
The Department of the Interior is the principal landowner of most of our nationally owned public lands and cultural resources. Management responsibilities include fostering wise use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, managing the National Wildlife Refuge System, and providing for the enjoyment of life through outdoor recreation (Figure 1-2).

U.S. Fish and Wildlife Service

The U.S. Fish and Wildlife Service is the principal organization through which the Department of the Interior carries out its responsibilities of working with others to conserve, protect, and enhance the nation's fish and wildlife and their habitats for the continuing benefit of people.

The Service manages the National Wildlife Refuge System, the world's largest collection of lands set aside specifically for the protection of fish and wildlife populations and habitats. More than 540 national wildlife refuges covering more than 95 million acres provide important habitat for native plants and many species of insects, amphibians, reptiles, fish, birds, and mammals. These refuges also play a vital role in preserving threatened and endangered species, as well as offering a wide variety of recreational opportunities. Many refuges have visitor centers, wildlife trails, and environmental education programs. The Service also manages all national fish hatcheries.

Figure 1-2. *Organizational Chart of the Fish and Wildlife Service within the U.S. Department of the Interior.*



National Wildlife Refuge System

Mission

The mission of the National Wildlife 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."

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; that growth of refuges must be strategic; and that the refuge system serves as a model for habitat management with broad participation from others.

Roanoke-Tar-Neuse-Cape Fear Ecosystem

The Ecosystem Approach to Fish and Wildlife Conservation

Throughout the past decade, the Service has placed more emphasis on focusing habitat and wildlife protection on entire ecosystems. To this end, the Service has pursued new partnerships with private landowners, state and federal agencies, corporations, conservation groups and volunteers. In implementing an ecosystem approach to management, 52 ecosystem teams were formed across the country, typically using large river watersheds to define ecosystems. Individual ecosystem teams are comprised of Service professionals and partners who work together to develop goals and priorities for research and management.

The Great Dismal Swamp National Wildlife Refuge is contained within two ecosystems: the Roanoke-Tar-Neuse-Cape Fear (RTNCF) watershed and the Chesapeake Bay-Susquehanna River watershed. The Nansemond National Wildlife Refuge is contained entirely within the Chesapeake Bay-Susquehanna River watershed (Figure 1-3).

Most ecosystem activities for the Great Dismal Swamp NWR have been associated with the RTNCF eco-team, for less than 20% of the refuge is contained within the Chesapeake Bay watershed. Moreover, the habitat within the Great Dismal Swamp NWR is more similar to that within the RTNCF watershed; thus increasing the probability of synergistic approaches to habitat protection and restoration with other Service field stations and partners (Figure 1-4).

One of the prominent characteristics of the RTNCF ecosystem is that it contains nearly a half million acres of refuge land. Three refuges (Great Dismal Swamp, Alligator River, and Pocosin Lakes) exceed 100,000 acres in size --- making these refuges relative behemoths compared to most other refuges within the eastern United States. Thus, the RTNCF ecosystem likely contains more refuge land than any other watershed east of the Mississippi River.

The large refuge component of the RTNCF watershed creates considerable potential to launch habitat protection and restoration partnerships using these refuges to anchor meaningful habitat protection and restoration programs. To begin tapping this potential, the RTNCF eco-team developed a *Resource Conservation Initiative* (RCI) -- a template for applying an ecosystem approach

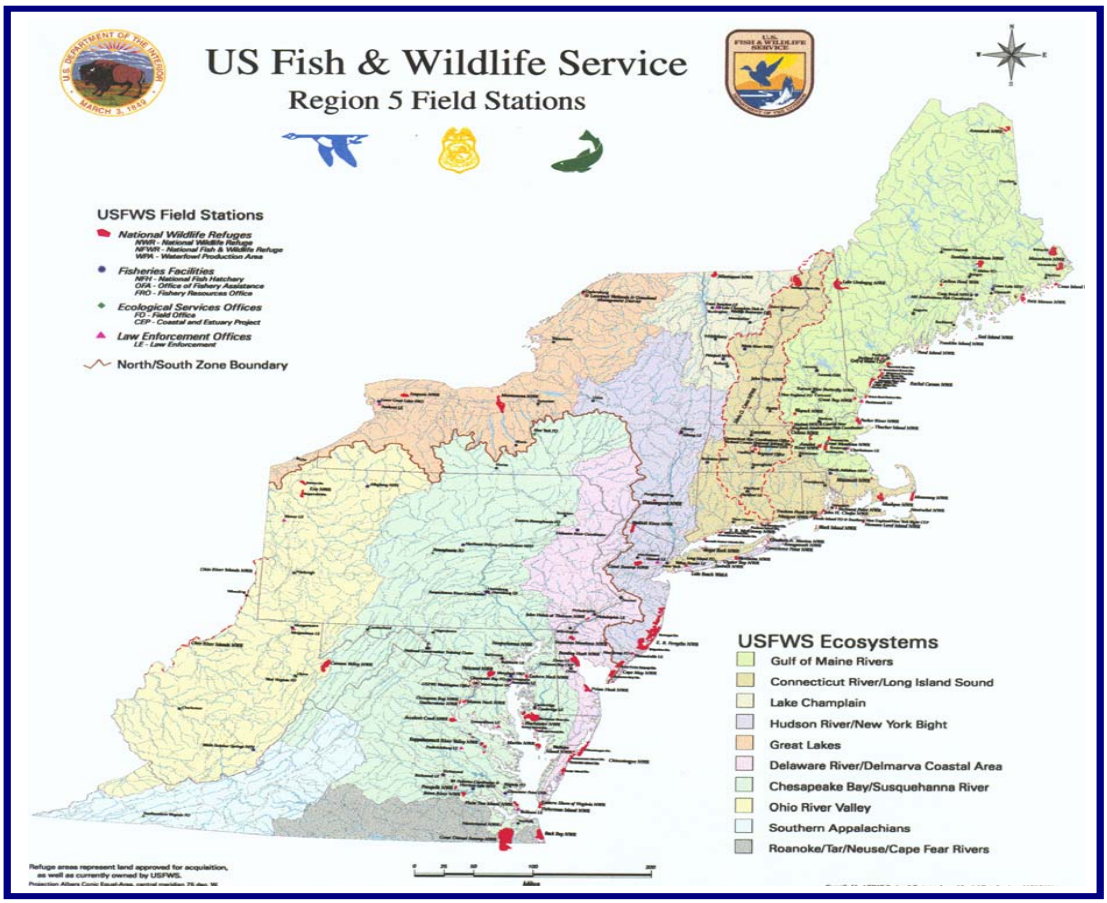


Figure 1-3. *FWS Region 5 Ecosystems map.* *Region 5 USFWS.*

to Fish and Wildlife conservation needs of trust resources within the ecosystem at the landscape level. The RCI shares the talents and fiscal resources of the Service installations within the watershed, and it is dependent upon active partnerships.

The RCI is a land protection strategy that emphasizes migration pathways and corridor linkages between established refuges. The basic tenets of the RCI are that a strategically oriented land base is critical to the well being of trust resources, maintenance of biodiversity, and overall ecosystem health; it is neither feasible nor desirable that ownership and management of the land base be limited to the Service; and that the socioeconomic effects of land protection be given full consideration.

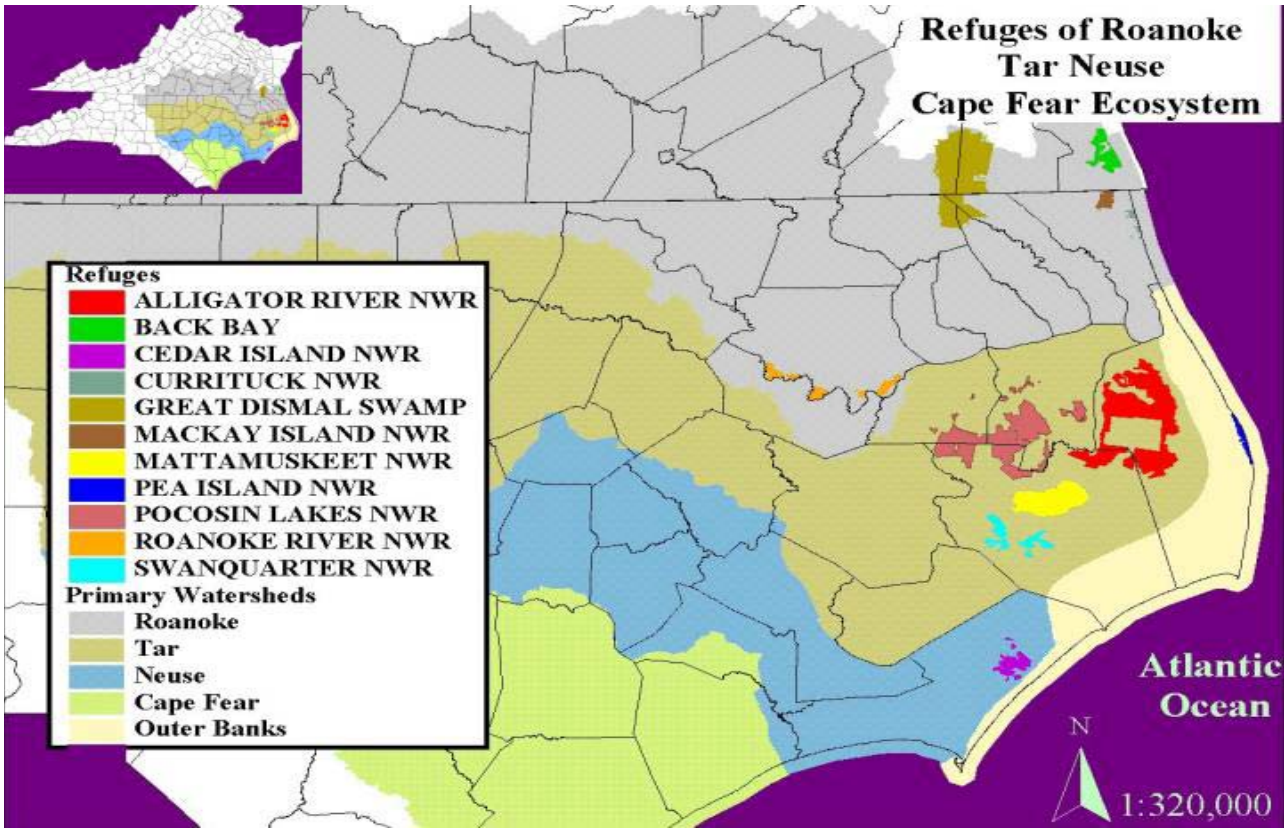


Figure 1-4. *Roanoke/Tar/Neuse/Cape Fear Ecosystem map.* *USFWS Region 4.*

Relationship to Federal, State, and Local Agencies

Another 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 government agencies and state fish and wildlife agencies during the course of acquiring and managing refuges. The Great Dismal Swamp NWR must collaborate with several federal, state, and local agencies, since the refuge incorporates large tracts of land in two states, affects the operation of the Atlantic Intracoastal Waterway, and is a prominent feature within the jurisdictions of five cities and counties.

Virginia Agencies

The refuge is, by far, the largest National Wildlife Refuge within the Commonwealth of Virginia by including over 85,000 acres within the Cities of Suffolk and Chesapeake. The refuge watershed supports

approximately 25-30% of the state's wintering population of tundra swans, and the refuge and surrounding area provides habitat for most of the black bears in eastern Virginia. The refuge collaborated with the Virginia Department of Game and Inland Fisheries (VDGIF) in identifying the refuge and surrounding watershed as key links within the Virginia Birding and Wildlife Trail in Suffolk and Chesapeake. The refuge participated on the Stakeholder Advisory Committee during the preparation of the statewide Black Bear Management Plan. VDGIF and the refuge have worked together to respond to the care of nuisance bears within the Hampton Roads area, and they are in support of establishment of a controlled bear hunting on the refuge.

The refuge has collaborated with the Cities of Suffolk and Chesapeake in the development of nature-based tourism strategies in the interest of developing activities that would complement Service interpretive and educational programs. The refuge also provides feedback to the cities on development issues for land that abuts the refuge or is located within the refuge watershed to help with the assessment of the impacts on the refuge.

North Carolina Agencies

The refuge includes over 26,000 acres within Camden, Pasquotank, and Gates Counties in North Carolina. The Service manages several large refuges within the coastal plain of the state, so the land within the Great Dismal Swamp NWR represents a relatively small amount of refuge acreage. Nevertheless, the refuge has collaborated with the North Carolina Wildlife Resources Commission on several issues including the establishment of special deer hunting seasons for the refuge, the management of black bear populations (especially those issues regarding crop depredation), and law enforcement.

The refuge's North Carolina neighbors view the refuge as a significant influence on nature-based tourism in the area. The Dismal Swamp Canal Welcome Center, operated by the North Carolina Department of Transportation in Camden County, has literally become the refuge's de facto visitor center, as the center's staff has estimated that at least 30% of their 600,000 visitors annually request information or directions to the refuge.

Elizabeth City (Pasquotank County) has waterfront businesses that cater to the yacht traffic along the Dismal Swamp Canal, so the refuge's influence on canal operations can impact their downtown economy. The refuge also works with the county to address flooding issues created by the hydrologic disruptions along US Highway 158.

Most of the refuge's North Carolina acreage is within Gates County, and many of their residents view the refuge as a critical component of maintaining their natural resources in the face of mounting development pressures from the greater Hampton Roads vicinity. The county's local newspaper, "The Gates County Index", has labeled the county as "Heaven's Gateway to the Great Dismal Swamp" since the early 1990's. More recently, the county has proposed that the refuge move part of its operations to Sunbury to strengthen the bonds between the county and refuge.

The 13,344 acre Dismal Swamp State Natural Area, located along the refuge's southeastern boundary in Camden County, is managed by the North Carolina Department of Environment and Natural Resources, Division of Parks and Recreation. For the most part, the Natural Area has been managed as a non-staffed, undeveloped satellite of Merchants Millpond State Park in Gates County since the Natural Area was established in 1974. The refuge has provided some habitat restoration and road maintenance on the Natural Area under the terms of a cooperative agreement since 1992. The state appointed the first park superintendent for the Natural Area in 2003, and plans to significantly improve visitor facilities along the west bank of the Dismal Swamp Canal in the near future. The refuge is represented on the advisory committee for the Dismal Swamp State Natural Area.

Lake Drummond Reservation. *Primitive camping is available adjacent to the spillway and boat tram on the Feeder Ditch. USFWS.*

Army Corps of Engineers

The Army Corps of Engineers (COE) maintains and operates the Dismal Swamp Canal along the eastern boundary of the refuge. The canal is a link within the Atlantic Intracoastal Waterway system, and Lake Drummond serves as the primary source of water for providing navigable depths within the canal. The refuge's establishing legislation directed that the operation of the canal could not adversely affect the refuge. Therefore, the COE ceases releasing water from Lake Drummond during severe droughts under the terms of an informal arrangement that was developed in 1977. During these periods, the canal is closed to yacht traffic, since the canal's locks at Deep Creek (Virginia) and South Mills (North Carolina) cannot operate without the replenishing water from Lake Drummond.

The Corps of Engineers also manages and maintains the Feeder Ditch/Lake Drummond Reservation access to the refuge. The Feeder Ditch connects Lake Drummond to the Dismal Swamp Canal and US Highway 17. The Lake Drummond Reservation is a modest campground surrounding the Lake Drummond water control structure operated by the COE. Since 1996, the refuge has operated under a

COE permit to manage public access and interpretive programs at the Reservation.

The Nature Conservancy

The relationship between The Nature Conservancy (TNC) and the refuge began when Union Camp Corporation donated the first 49,097 acres of land through TNC to establish the refuge. TNC retained some oversight rights when the land was conveyed to the Service. Therefore, the refuge collaborates with TNC on major facility development and resource management issues within the area they donated. More recently, the refuge has provided technical assistance, equipment, and personnel for fire management operations on TNC lands near the refuge. TNC fire specialists have worked with refuge personnel on prescribed burning operations on refuges in Virginia and Maryland.

Legal Policy Context

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 the refuge 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. Management guidance is provided by the refuge's establishing legislation, the Dismal Swamp Study Act of 1972 (Public Law 92-478) and the Dismal Swamp Act of 1974 (Public Law 93-402); the National Wildlife Refuge System Improvement Act of 1997; and the laws and policies for the operation of the National Wildlife Refuge System that are listed in Appendix A.

Lands within the National Wildlife Refuge System are closed to public uses unless specifically and legally opened. All programs and uses must be evaluated based on mandates set forth in the National Wildlife Refuge System Improvement Act (Appendix A).

Chapter 1
Purpose of and Need for Action

Chapter 2

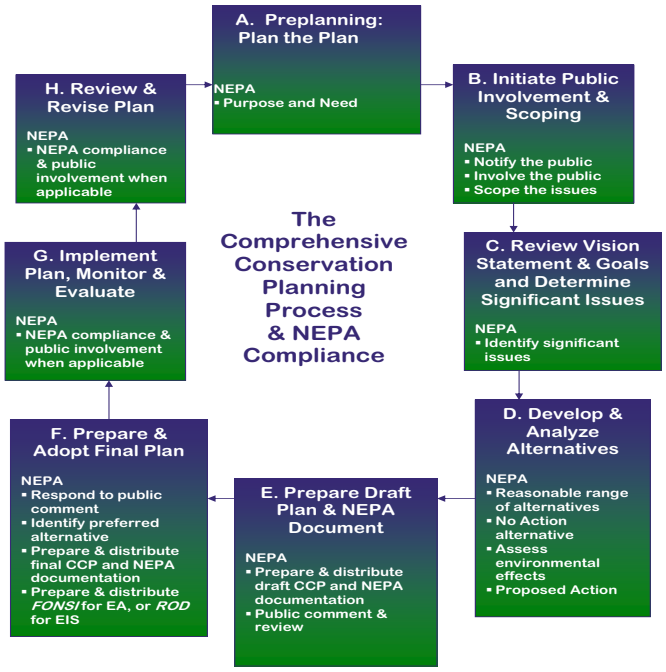
The Comprehensive Conservation Planning Process

- Wilderness Assessment
- Issues and Concerns

2. The Comprehensive Conservation Planning Process

Given the mandate in the Refuge Improvement Act to develop a CCP for each national wildlife refuge, the planning process for the Great Dismal Swamp and the Nansemond National Wildlife Refuges began in August, 2001. It was then the core planning team, consisting of field staff and staff from the Service's Northeast Regional Office, began the process of identifying needs and direction for development of the comprehensive plan.

A mailing list was compiled of nearly 600 contacts of individuals and groups including adjacent landowners, federal, state and local governing representatives, North Carolina and Virginia resource agencies, environmental organizations, sportsmen's groups, local businesses and other interested and affected people. In December, 2001, a newsletter was sent to everyone on the mailing list explaining the CCP process and identifying current issues on the refuges. The newsletter was also made available at the refuge headquarters, open house and scoping meetings, and distributed at all refuge outreach events during that winter and spring.



Contained in the newsletter was a workbook which included questions to aid in the collection of the public's ideas, concerns, and suggestions on important issues associated with managing the Great Dismal Swamp and the Nansemond National Wildlife Refuges. More than 100 workbooks were returned with written responses by summer, 2002, with additional written responses received before the close of the year.

Four scoping and open house information meetings were held on

January 8, 10, 22, and 24, 2002, in Elizabeth City and Gatesville, North Carolina, and in Suffolk and Chesapeake, Virginia, respectively. Meetings were advertised locally through news releases, paid advertisements, and through our mailing list. Approximately 290 people attended the meetings. Each began with an opportunity for guests to visit a gallery of prepared refuge exhibits and speak with attending staff. This period was followed by a staff presentation on the refuges, the Refuge System, and the planning process. Registered speakers were then allowed to make comments or ask the staff questions before the group. Each meeting concluded with questions and comments from the floor. Participants were encouraged to actively express their opinions and suggestions. Public comments and questions included those on forest management, water management, wildlife concerns, and public use. However, public use issues and improvement of visitor services dominated discussion during all four meetings.

The complete planning team, which consisted of the core team with the addition of representatives from FWS Virginia Field Office, the Army Corps of Engineers, North Carolina Wildlife Resources Commission, and Virginia Department of Game and Inland Fisheries, met in February, 2002, to review the public comments and explore management options.

An *Update* newsletter was distributed in March, 2002, summarizing public comments from the workbook, other written comments, and comments from the scoping meetings. Another meeting of the planning team was held in June, 2002, to review considerations for management objectives and strategies, and to discuss a Wilderness Study Area proposal. The core planning team then began working to formulate specific alternatives, objectives, and strategies that addressed each of the envisioned goals.

Additional meetings and workshops were held with Congressional representatives, refuge partners and other interested parties to discuss issues of habitat management and public use, among other topics. This phase of the process lasted into the spring of 2003 when a range of management alternatives was finalized. By June, 2003, the team was ready to consider environmental consequences for each alternative. Revisions and internal reviews continued until the spring of 2006 when the draft became ready for public review.

The Service solicited comments on the draft CCP/EA for Great Dismal Swamp and Nansemond National Wildlife Refuges from March 13 to April 24, 2006. The original comment period was for 30 days as outlined in the Notice of Availability, advertised in the Federal Register on March 13, 2006. This period met the requirement for public involvement under the National Environmental Policy Act (NEPA). The news release published by the Refuge provided a public comment period of 33 days,

March 13, 2006 through April 14, 2006. Due to delays in providing compact disks and hard copies, the comment period was extended an additional 10 days to provide adequate time for the state agencies to comment.

Lake Drummond. *Sunrise at the Lake. Waverley Traylor.*

During the comment period three open house meetings were held to make staff available to the surrounding communities for questions, clarifications, distribution of draft CCP copies and Highlights, and to take written comments. A meeting was held in Suffolk, VA, on March 21; in Gates County, NC, on March 23; and in Chesapeake, VA, on March 30, 2006. In addition, refuge staff participated in a symposium at Elizabeth City State University on March 24 and had the opportunity to answer questions and distribute draft copies and Highlights to interested parties. A total of 43 attendees registered at the three open house meetings. By the close of the comment period, 46 written comments had been received. Editorial suggestions, along with general notes of concurrence with or opposition to certain proposals that did not contain factual arguments were recorded in the planning record and included in the decision making process, but do not receive formal responses. We have included our responses to substantive comments in Appendix C. We have made changes to the CCP where appropriate.

Implementation of the CCP can occur once the Finding of (No) Significant Impact (FONSI) is signed. We will evaluate our accomplishments under the CCP each year. Monitoring or new information may indicate the need to change our strategies. We will modify the CCP documents and associated management activities as needed; following the procedures outlined in Service policy and NEPA requirements. The CCP will be fully revised every 15 years or sooner if necessary.

Wilderness Review

As part of the CCP process, the planning team conducted a Wilderness Review, as required by Refuge Planning Policy, to determine if any

lands and waters in fee title ownership were suitable to be proposed for designation as a Wilderness Area. A decision not to advance a Wilderness proposal was make in part as a reconfirmation of the 1974 Secretary of the Interior's report to Congress that the "pristine character of the swamp no longer exists as a result of physical alterations." This same report stated that the "ability to restore the Great Dismal Swamp as aggressively as it was altered must be maintained". At some time in the future, habitat restoration and scientific knowledge about the Great Dismal Swamp ecosystem may reach a level where designation of some portions of the refuge as wilderness would be desirable. However, continued restoration, management, and research will be needed before a credible recommendation can be developed. The full Wilderness Review is found in Appendix D.

Nansemond NWR was not of sufficient size (423 acres) to fulfill the eligibility requirements for a Wilderness Study Area as defined by the Wilderness Act.

Key Issues, Concerns, and Opportunities

Issues, concerns, and opportunities were brought to the attention of the refuge planning team through early planning discussions with local governments, State and Federal representatives, and through the public scoping process. We received comments from the public both verbally at open houses and in writing, through Issues Workbooks and individual letters. Some issues were identified by the Service and others were raised during the public review of the Draft CCP/EA. Many issues that are very important to the public often fall outside the scope of the desicion to be made within this planning process. In some instances, the Service cannot resolve issues some people have communicated to us. We have considered all issues throughout our planning process, and have developed plans that attempt to balance the competing opinions regarding important issues.

Great Dismal Swamp National Wildlife Refuge

Biodiversity Conservation

Due to its geographic location and climate, the Great Dismal Swamp is known for its unique blending of northern and southern species. Even though it is a highly disturbed ecosystem, it has retained at

least remnants of most of the historic vegetative components and habitats. Its mosaic of vegetative communities supports an astounding variety of vertebrates and invertebrates and its very size permits the maintenance of a viable bear population. Our stewardship includes not only the game species such as deer and bear, but the tiny hairstreak butterfly and orb weaving spider as well.

The Great Dismal Swamp is the largest, most complex ecosystem in public ownership in the Northeast Region of the U.S. Fish and Wildlife Service. Inventories of the mammals, birds and reptiles have been completed and the amphibians, fish and plants have been surveyed. Little is known about the majority of the invertebrates. Untold decades will be needed to unravel the relationships of the vegetative communities to their inhabitants in this swamp environment.

With its proximity to urban populations, the Great Dismal Swamp has the potential to be a preeminent environmental laboratory for research and education. Working with the academic community and governmental partners we must develop research priorities that will aid in understanding and managing this complex ecosystem.

The refuge management must maintain the gene pools of the remnant communities and their associated fauna while research is prioritized, conducted and answers found. Ongoing management efforts must focus on maintaining the habitat diversity. The following management priorities have been identified.

- **Wilderness management-** Several areas on the refuge meet the "roadless" requirement for wilderness study areas. Concerns about restrictions to future habitat and public use management must be considered.

- **Forest (Habitat) management-** Many communities within the GDS are pioneer or early successional species, which will be replaced by longer-lived climax species if not disturbed. These communities include the Atlantic white cedar, shrub pocosin, marsh and sphagnum bog. Each of these vegetative communities was historically a result of wildfire and/or maintained by fire. Wildfires have been aggressively suppressed since the 1940's resulting in reduced size and vitality of dominant species. With the changes in water regime throughout the swamp and the surrounding urbanization, permitting drought-driven wildfires to burn today is not an option.

Management of these communities must create the disturbance required for regeneration or maintenance. Strategies include the use of herbicides, and /or timber sales to reduce competition, surface

preparation completed by scarifying with heavy equipment, and/or carefully conducted site preparation prescribed burns. Pre-treatment and post-treatment field studies must be conducted to establish success of each management effort and quantify ancillary impacts to soil, water, faunal components, and adjacent vegetative communities.

- **Hydrologic management-**The historic water regime within the Great Dismal Swamp has been altered; some elements beyond restoration. The upland watershed has been timbered and the fields tilled to quickly remove excess water from the crops. Water enters the swamp in a matter of hours instead of days after a rain event and must be discharged or wasted when it exceeds the swamp's storage capacity.

Lake Drummond Spillway.
Water control spillway releasing into the Feeder Ditch. USFWS.

The majority of the ditches were dug to provide material for logging roads. The roads are now dams to the historic sheet flow of surface water. In addition, the ditches were dug deep enough to remove the confining clay layer over the sustaining aquifer sands and now the ditches shunt vital ground water through the swamp.

The refuge cannot manage the adjacent cropland to slow incoming surface water, nor can it abandon or remove the roads within the swamp because compaction has already altered the substrate and road access must be maintained to fight wildfires. The refuge cannot abandon the ditches because the clay-confining layer cannot be replaced over the aquifer.

The refuge can operate and maintain a number of water control structures that slow discharge of both surface and ground water from the swamp and serve to mitigate many of the impacts of these developments. Currently, 30 structures are maintained for this purpose with considerable success.

Concerns include excess storage resulting in spring flooding through nesting season for warblers and other neotropical migratory birds, including the Swainson's warbler. The flooding reduces food supplies for the adult birds and subjects the fledglings to death from exposure when they fall in the water upon first leaving the nest. Excess spring storage can also reduce needed discharge from adjacent upstream agricultural fields reducing the productivity of these privately owned lands.

Water conservation within the swamp is only one part of habitat maintenance and restoration. The ground water-surface water relationship must be understood; water table requirements for the various vegetative communities in both development and other phases must be established; methods to move water throughout the ditch network in order to sustain existing communities should be considered.

An additional concern has arisen regarding the beaver's return to the swamp after a hiatus of nearly 60 years. They have their own management objectives that include excess flooding. They attain their ends by damming culverts and water control structures within the swamp and the upstream watershed. Their success once more alters the productivity of adjacent cropland and interferes with refuge management objectives.

- **Fire management-** Prescribed fire is considered an essential tool for habitat restoration and maintenance as well as for fuel reduction. In addition, lightning-caused wildfires are a high probability during dry years. The use of prescribed fire, as well as fire suppression, for resource management in the GDSNWR is highly complex due to the burning on organic soils and the refuge's location within a heavily populated area. The use of refuge facilities and staff support for the Region 5 fire operations program should also be taken into consideration for facility needs.

- **Endangered Species and Wildlife Management/Research-** Limited information on habitat requirements is available for the majority of the swamp's faunal components. It is important to review the needs of the high-profile species and state and federal listed species.

Several colonies of red-cockaded woodpeckers exist within the RTNCF watershed. The refuge has large acreages of maturing loblolly and pond pine which could serve as primary habitat for this highly selective bird. The Great Dismal Swamp NWR has been identified as a potential site for relocation under the Safe Harbor agreement. Management of mature pine stands is within the mandate of refuge programs, unlike the need to cut mature stands before loss of timber value when in private or corporate ownership.

Through ongoing Swainson's warbler research on Jericho Ditch, nearly 50 years of data regarding this species as well as all neotropical species using this habitat have been collected. Staff from the Smithsonian Institution are continuing the mist-netting and banding of birds started by the well known naturalist and ornithologist Brook Meanley in the 1950's. This type of research needs to be expanded to other habitats within the refuge.

The black bear is a species of great interest to the general public. First, it fascinates the urban dwellers that they really live in reasonable proximity to hundreds of bears living wild. On the other hand, some farmers periodically have major concerns regarding varying levels of bear damage to agricultural crops. Area homeowners can become distressed when bears damage personal property or simply wander

through their neighborhood. Bears crossing highways are struck and killed by motorist. Management of the bear population must incorporate elements of the swamp's carrying capacity, the seasonal variability in mast and the number of undesirable contacts with the public. A recreational bear hunt is being proposed and is supported by the Virginia Department of Game and Inland Fisheries.

Other birds of interest include the bald eagles that have returned to nest after nearly 50 years, and the tundra swans and snow geese that use Lake Drummond as a resting area and adjacent farmlands as feeding areas.

- **Zero management-** Some see the refuge as a *de facto* wilderness and propose a "hands off" approach to management. Some propose to go as far as removing the existing developments including the roads and ditch plugs.

- **Academic Partnerships-**The stewardship of a refuge established to restore and protect a unique ecosystem requires a multi-disciplinary approach to resource management. Resource management and direction must be evaluated and guided by studies and surveys conducted by biologist, ecologist, foresters, hydrologists, ornithologists, ichthyologists, entomologists, soil scientists, mammalogists, herpetologists, mycologists, geologists, archeologists, botanists, taxonomists, botanists, plant physiologists, and morphologists, geneticists, historians, limnologists, remote sensing specialists, wildlife epidemiologists, and GIS specialist --- to name a few of the disciplines. The need exists for refuge management to collaborate with academic institutions to develop and support research on the wide range of natural and cultural issues that affect refuge resource management.

Urban interface. *North refuge development/flooding issues. USFWS.*

- **Hurricane Isabel:** Hurricane Isabel inflicted considerable changes to the refuge landscape on September 18, 2003. Several thousand acres of Atlantic white cedar forests were destroyed, and countless trees were blown down throughout the refuge, creating a potentially volatile fire situation. Without restoration, significant Atlantic white cedar acreage will be lost. The potential for catastrophic fires due to the added fuels created by the hurricane will continue to pose a risk.

Land Protection

- **Urban interface-** Urban sprawl places commercial and residential development near the refuge boundary and threatens wildlife corridors. It increases habitat management complexity related to water and fire management, and increases nuisance wildlife concerns. Wildlife

corridors connect the refuge to other natural areas within the Great Dismal Swamp (GDS) watershed. They are important for maintaining a healthy gene pool for bears and other wildlife. There is a need for highway designs that incorporate bear crossings and therein improve highway safety by reducing the probability of vehicle collisions with bears. Refuge water conservation strategies and beavers often are blamed for downstream flooding of private lands. The refuge staff believes most flooding problems are related to disruption of surface water flow by highways, railroads, and general development within the historic GDS floodplains.

- **Land acquisition-** All refuge land has been acquired from willing sellers. About 3,000 acres were added to the refuge since 1998 through Migratory Bird funds after years of failing to pick up sufficient Land and Water Conservation Funds. Some propose extending the refuge acquisition boundary to pick up existing or restorable swamp habitat south of US Highway 158 and east of US Highway 17. Some call for the protection of inflows from the west of the refuge and to establish a buffer from development along the western boundary to White Marsh and Desert Road. Even so, pockets of opposition to public land ownership remain. Easements are a potential tool to protect habitat short of fee title acquisition.

- **Boundary issues-** Considerable portions of the refuge boundary have not been posted due to inadequate staffing and some ambiguous boundary descriptions. Several known disputes are the result of neighboring owners failing to heed easements and boundaries. Some disputes are a result of contradictory and vague legal filings.

Public Use

- **The public-** There is growing interest world-wide in nature based tourism. The refuge's establishing legislation and refuge size would deem the "big six" wildlife dependent uses (hunting, fishing, wildlife observation, wildlife photography, environmental education, and interpretation) on the refuge to be compatible. Lack of staffing and facilities is the primary limiting factor.

- **Hunting-** Only deer (archery and shotgun, without dogs) hunting is allowed at the present. The refuge will be considering a bear hunt in the Railroad Ditch and Jericho Ditch areas. Some contend the use of dogs for both should be allowed. Other groups vigorously oppose hunting with dogs, particularly for bear hunts. Permits for motorized access are issued during the hunting season for retrieval of hunt dogs that stray

onto refuge land from adjacent private lands. There was some interest in waterfowl hunting for snow geese on Lake Drummond expressed during scoping.

- **Fishing/boating-** The refuge fishing season is from April 1- June 15, allowing by permit motorized vehicle/boat access to Lake Drummond via the Railroad Ditch entrance. Fishing is primarily for black crappie, although the lake is not considered to be a sport fishery since most of the more popular game fish do not reproduce well in the naturally acidic waters. Improved access for fishing and boating was requested at the public scoping. Although the refuge has never had a concessionaire agreement, one could be considered to provide rental equipment for boating and fishing. Some outfitters have provided various types of guided tours. Some have operated under a refuge permit, but most have not since they do not contact the refuge office for special services. Commercial operations are supposed to be covered by a refuge permit.

- **Environmental education-** This is one of the priority uses associated with the establishing legislation. Currently, facilities and staffing are limited. Sites have been identified as potential outdoor classroom areas, but have not been developed.

- **Interpretation-** Refuge interpretive programs need to be expanded to include not only natural history, but cultural history themes.

- **Wildlife observation/photography-** Public access is limited due to lack of facilities and inadequate roads for general vehicle access.

- **Horseback riding-** The North Carolina Horse Council is coordinating efforts to open more public lands to horseback riding. The GDSNWR is one of their focus areas.

- **Visitor/Administrative facilities-** Visitor services support facilities are woefully inadequate. Refuge administration operations have outgrown the current headquarters. The refuge is currently modestly developed, primarily for self-guided visitation, even though the refuge is located within an area populated by 1.5 million people. Public expectations for further development range from little or no development to heavy development. The 1979 Public Use Plan called for visitor facilities in Suffolk and Chesapeake, Virginia. Gates County, North Carolina, desires to establish an operations office and visitor facility in a reconditioned school building. Some Virginia interests are opposed to this location.

Partnerships

▪ **Army Corps of Engineers-** Operation and maintenance of both the Dismal Swamp Canal and the Lake Drummond Reservation is by the COE. Lake Drummond is the primary source of water for the canal. Establishing legislation directed the canal operation not to adversely affect the refuge. An informal agreement between the FWS and the COE may prompt the closing of the canal to Intracoastal waterway traffic during dry periods. The COE has agreed to cease to release water from Lake Drummond when the lake level falls to a specified point so as to comply with the mandate found within the refuge's establishing legislation. The COE allows no-fee, no permit camping at the Lake Drummond Reservation. The refuge operates under a COE permit to manage public use activities at the site. Supported guided tour services have occurred intermittently, but none are in place now. The lack of sufficient refuge staff prohibits the appropriate management to occur.

▪ **Dismal Swamp State Natural Area-** Adjacent to the refuge, this area has been an unstaffed satellite of the Merchants Millpond State Park since establishment in the early 1970's. Staffing and site plan development began in early 2004.

▪ **Nansemond Indians-** Historically, the Great Dismal Swamp lands were a primary hunting ground for this state recognized tribe.

Other Key Issues/Concerns

▪ **Law enforcement/public safety-** Considerable staff time is needed for investigation of criminal activities. Illegal vehicle access, car clouting, marijuana cultivation, bear and deer poaching, lewd and lascivious activities, trash dumping, vandalism, violation of refuge-specific hunt regulations, and homicide investigations, along with search and rescue, are among the chief law enforcement (LE) issues occurring on the 111,200 acre refuge. There is a lack of sufficient LE and public use personnel to assure a reasonably safe visit to the refuge at all times and locations.

▪ **Mosquitoes-** Eastern Equine Encephalitis and West Nile Virus have been found in the area. Aerial mosquito control occurred in October, 1999, during flood emergencies.

▪ **Support-** Generally, there is positive public support throughout the refuge area, although some communities seem to have competing interests.

▪ **Mercury contamination-** The Virginia Department of

Environmental Quality issued a fish consumption advisory for mercury contamination for fish taken from the Feeder Ditch and Dismal Swamp Canal in October 2003. These waterways are not within the refuge, but they do drain from the refuge --- suggesting the possibility of contaminants issue extending into Lake Drummond and other ditches that drain into the lake.

Nansemond National Wildlife Refuge

Nansemond National Wildlife Refuge has been managed as a closed, non-staffed satellite refuge of the Great Dismal Swamp National Wildlife Refuge since the 1973 establishment. Even so, management issues and concerns were presented by both refuge staff and public comment during the planning process. These include:

Habitat

- **Management considered-** Salt marsh dominates the Nansemond NWR acreage. Grasslands management had been once considered as a management strategy during the base closure process. Recent information suggests that acreage available for grasslands or for forest management would be too small to have significant impact on the area. No-active-management was also suggested. There has been no prescribed burning on the refuge.

- **Species inventory-** Bald eagles have reportedly nested in nearby marshes along the Nansemond River. The refuge has tidal bottoms that may be suitable for establishing oyster beds to improve water quality. Phragmites has invaded the river's marshes.

Land Protection

- **Acquisition-** The entire refuge was established from lands declared excess by the Department of Defense. No further acquisition has been considered to date. There has been no condemnation in the past and none is anticipated. Today, the surrounding area is under tremendous development pressure.

- **Boundary disputes-** The refuge boundary has not been marked adequately. Encroachment by agricultural operations has occurred in the past.

Nansemond National Wildlife Refuge. Tidal marsh on Nansemond River. *USFWS.*

Public Use

- **The Public-** The Nansemond NWR is virtually unknown since it has not been opened to the public.

- **Hunting-** No refuge hunting is allowed. Waterfowl hunting does occur on the Nansemond River.

- **Fishing/boating-** Boating occurs on the Nansemond River. The City of Suffolk, Virginia, has obtained a route on adjacent land to provide boat access to the Nansemond River.

- **Environmental education/wildlife observation/general access-** Nansemond NWR is not opened for public use.

- **Facilities-** There are no public use or administrative facilities on the site.

Partnerships

- **City of Suffolk, Virginia-** The City of Suffolk is looking at the Nansemond River basin as part of an ecotourism opportunity. In addition to the improvements for the adjacent public boat ramp, the City has also considered plans to build a recreation area (ball park) on their portion of the site nearest to Sleepy Hole Road.

- **Old Dominion University-** ODU had been considered to be a potential habitat management/research partner on an adjacent 150 acres. However, they have recently indicated that they were not going to obtain the site.

Other Key Issues/Concerns

- **Law enforcement/public safety-** LE staff and/or other staff is non-existent.

- **Contaminants-** Much of the refuge was contaminated by PCB's in the past. However, considerable remediation did occur before the base was closed. Nonetheless, the former presence of contaminants on the refuge will constrain future management options.

Chapter 2
The CCP Planning Process

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Chapter 3

Refuge and Resource Descriptions

- Introduction
- Physical Environment
  - Location and Size
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  - Geology
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  - Contaminants/Hazardous Materials
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3. Refuge and Resource Descriptions

Introduction

The Great Dismal Swamp National Wildlife Refuge (NWR) is the largest intact remnant of a vast ecosystem that once covered more than one million acres of southeastern Virginia and northeastern North Carolina.

Formal protection of this resource began in 1973, when Union Camp Corporation (a local forest products company) donated 49,097 acres to The Nature Conservancy. The Nature Conservancy conveyed the donated land to the federal government, which, combined with additional purchased land, was used to establish the Great Dismal Swamp NWR in 1974.

Great Dismal Swamp Watershed. *The Great Dismal Swamp National Wildlife Refuge (NWR) is the largest intact remnant of a vast ecosystem that once covered more than one million acres of southeastern Virginia and northeastern North Carolina. Satalite image. USFWS.*

The Dismal Swamp Act of 1974 directs the U.S. Fish and Wildlife Service to:

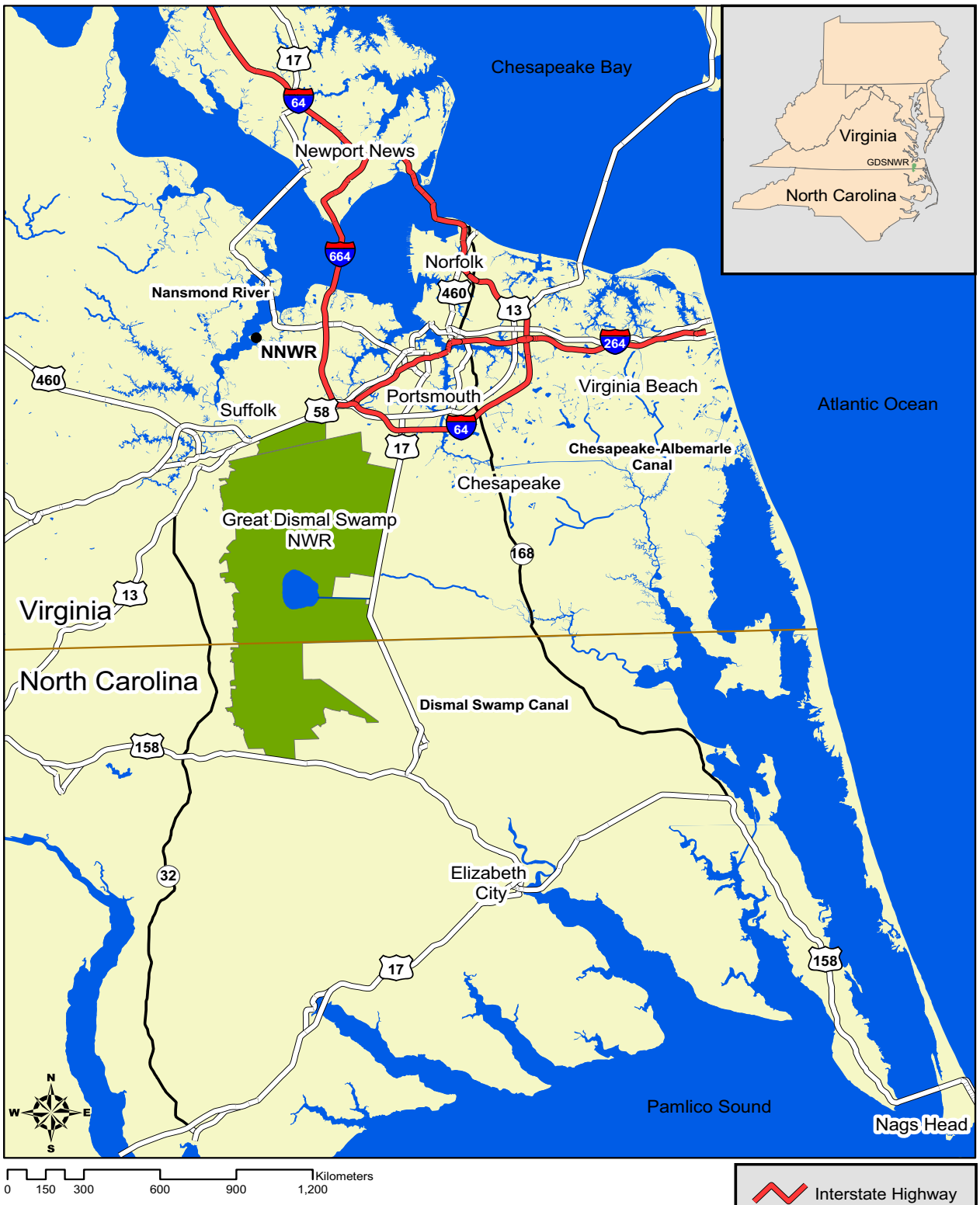
"Manage the area for the primary purpose of protecting and preserving a unique and outstanding ecosystem, as well as protecting and perpetuating the diversity of animal and plant life therein. Management of the refuge will be directed to stabilize conditions in as wild a character as possible, consistent with achieving the refuge's stated objectives."

With a secondary purpose to:

"Promote a public use program when not in conflict with the primary objectives of the refuge."

This document also addresses management of the Nansemond NWR, a 423-acre parcel located on the southeastern side of the Nansemond River approximately five miles north of the Great Dismal Swamp NWR. The Nansemond NWR was created in 1973 when 207 acres were transferred from the U.S. Navy to the U.S. Fish and Wildlife Service, pursuant to the Federal Property and Administrative Services Act of 1949, as amended, 63 Stat. 377 (40 U.S.C. 471). In 1999, an additional 216 acre parcel of upland grassland and forested stream corridor was added as a result of the Base Realignment and Closure

Figure 3-1



LOCATION MAP

Great Dismal Swamp National Wildlife Refuge

(BRAC) process. The Nansemond NWR is an unstaffed, satellite refuge administered through the Great Dismal Swamp NWR. It is not open to the public.

Physical Environment

Location and Size

The name "Dismal Swamp" originated in colonial days, referring to the poorly drained area that lies between the James River in southeastern Virginia and the Albemarle Sound in North Carolina (Oaks and Whitehead, 1979). The Great Dismal Swamp originally extended over more than one million acres in southeastern Virginia and northeastern North Carolina (Public Law 93-402). Clearing and draining for agricultural uses and residential development have greatly reduced the size of the original ecosystem and significantly altered the water cycle and fire regime of the remaining area.

The Great Dismal Swamp NWR is but one component of an extensive conservation network providing protection to the remaining resources. Within the GDS watershed other lands are protected by the City of Chesapeake, Virginia Department of Game and Inland Fisheries (VDGIF), Virginia Department of Conservation and Recreation (VDCR), North Carolina State Parks, North Carolina Wildlife Resources Commission, The Nature Conservancy, the U.S. Navy, the U.S. Army Corps of Engineers, and conservation easements on private lands. The total area protected by this network of organizations is approximately 185,000 acres (B. van Eerden, pers.com., 2001).

The Great Dismal Swamp NWR currently occupies 111,203 acres. Additional planned acquisitions are anticipated to increase the refuge size to approximately 115,000 acres. The refuge is located approximately 30 miles from the Atlantic Ocean. It is delineated on the north by U.S. Highway 58, on the east by the Dismal Swamp Canal, on the south by U.S. Highway 158, and on the west by the Suffolk Scarp (Figure 3-1). The Refuge occupies portions of two cities in Virginia, Suffolk and Chesapeake, and three counties in North Carolina, Gates, Camden, and Pasquotank.

The Great Dismal Swamp NWR is one of seventy-one wildlife refuges in the northeastern administrative region of the U.S. Fish and Wildlife Service. The refuge is the largest in Region 5, representing nearly 25 percent of all service owned land found in the northeast region. The refuge straddles the region's southern boundary with approximately 33 percent of the refuge overlapping into the Service's southeastern region, Region 4.

Physiography and Topography

Great Dismal Swamp NWR lies in the Embayed Section of the Atlantic Coastal Plain, which consists of three wide, gently sloping terraces separated by longitudinal, eastward-facing escarpments. The middle terrace, known as Dismal Swamp Terrace, is bisected by the Deep Creek swale, also running north-south. The refuge is located on the western portion of this terrace, between the Suffolk Escarpment (Scarp) and the Deep Creek Swale. Churchland Flat bounds the refuge on the north.

The refuge can be divided into three physiographic zones: Lake Drummond, the forested wetland, and a transition zone. Lake Drummond, a 3,108 acre shallow lake, is located near the center of the refuge. The forested wetland portion, the predominant feature of the refuge, is sharply disrupted on three sides by the Dismal Swamp Canal and U.S. Highways 58 and 158. Along its western edge, the transition zone from swamp to uplands is more gradual, creating an area of mixed characteristics.

Along the Suffolk Scarp, on the western side of the Great Dismal Swamp NWR, elevations rise and relief is variable. Traveling eastward across the refuge from the Suffolk Scarp, elevation drops at a rate of one foot per mile to the Deep Creek Swale (east of the Dismal Swamp Canal). In the Virginia portion of the refuge, elevations range from 15 to 25 feet; in Pasquotank County, North Carolina, elevations range from 10 to 20 feet; Camden County varies from 21 feet or lower. The topography exhibits a gentle west to east slope imposed on an even gentler north to south slope. The normal surface elevation of Lake Drummond is 18.65 feet.

Nansemond NWR also lies within the outer part of the Atlantic Coastal Plain physiographic province. The generalized physiography of the area is known for a "stair-step" appearance, consisting of wide, gently eastward sloping planes separated by linear, steeper, eastward-facing scarps. The planes slope eastward at less than two feet per mile, whereas the scarps have slopes of as much as 50-450 feet per mile through short distances.

The Nansemond NWR is situated on the east bank of the Nansemond River, east of the Suffolk Scarp. Elevation varies from sea level to 21 feet above sea level. Much of the Nansemond NWR is a well-drained knoll, with drainages emptying into the river and marshes.

Geology

Great Dismal Swamp NWR and Nansemond NWR are underlain by several geologic formations: the four most significant are the Yorktown, the Norfolk, the London Bridge, and the Sandbridge formations (USDOI, 1979).

The Yorktown Formation is the oldest and deepest unit of the four, consisting chiefly of impermeable clay. The top of the Yorktown Formation is within 15 feet of the surface throughout much of the western part of the refuge and within 25 feet of the surface in the eastern part.

The Norfolk Formation overlays the Yorktown Formation beneath most of the refuge and is closely associated with the Great Dismal Swamp NWR's water budget. The Norfolk Formation is composed of two layers. Its lower level consists primarily of coarse sand and is very permeable. The upper layer consists of eight strata, three of which play an important role in the hydrology of the refuge. The coarse-sand stratum under the Suffolk Scarp and the extreme western part of refuge serves as a shallow aquifer. The Norfolk Formation is exposed at elevations between 25 to 70 feet in a belt less than a mile wide that runs north-south along the Suffolk Scarp. This is the groundwater recharge area for the aquifer. The formation then grades eastward under the refuge into the medium-sand stratum. This stratum underlies most of the Great Dismal Swamp NWR and in turn grades into fine sand beneath the area east of refuge. Groundwater input from the Norfolk Formation accounts for the majority of water that upwells in the swamp.

The London Bridge Formation, clay silt that overlays the Norfolk Formation, occurs throughout the eastern and most of the western portions of the refuge. The Sandbridge Formation generally overlies the London Bridge Formation, where the London Bridge is present, or directly overlies the Norfolk Formation. It is composed of two sheet-like deposits: a lower layer of sand and an upper layer of silty clay. The London Bridge and Sandbridge Formations confine the Norfolk aquifer. More recent deposits over these formations consist of a layer of inorganic soils and an overlying organic layer of peat.

Soils

Organic Soils

The soils of Great Dismal Swamp NWR play a critical role in supporting its wetland communities. Organic soils predominate, with mineral soils confined to the toe of the Suffolk Scarp and to historic outflows of tributaries to the Elizabeth, Northwest, and Pasquotank Rivers. The organic soils are divided into two taxonomic classes: Typic Medisaprists and Terric Medisaprists. The mineral soils are divided into several classes with widely varying characteristics.

Typic Medisaprists are organic soils more than 51 inches thick, underlain by mineral subsoil. There are two types of Typic Medisaprists within the Great Dismal Swamp NWR: those composed of finely divided and those composed of coarsely divided soil material. Terric Medisaprists are organic soils more than 16 inches and less than 51 inches thick, underlain by loamy or sandy mineral subsoil.

In general, the organic soils of the refuge are black, fine-grained, highly decomposed mucky peat. Partially decomposed logs and stumps are buried in the decomposed organic material at depths ranging from a few inches to five feet. These soils are characterized by poor or very poor drainage, high acidity, and mean annual soil temperatures between 59° and 72° Fahrenheit. Permeability varies with the composition of the subsoil.

During much of this century, the suitability of the swamp's organic soils for cultivation resulted in conversion of extensive tracts of swamp woodlands to agricultural lands. Although the organic soils are often saturated and extremely acid, they are quite fertile, and high yields of corn, soybeans, and grain are reported from drained organic soils on the periphery of the refuge. However, remaining areas of organic soils within the refuge have low potential for agriculture due to their thickness, buried debris, and inaccessibility.

Remaining organic soils on the refuge are subject to a number of other forces. The organic soils are highly susceptible to fire. When burned, the average combustible component of the soil is 93%, leaving a 7% ash content (Otte, 1985). Historically, uncontrolled fires directly removed organic soils from the swamp. In more recent times fire suppression has countered this trend, allowing organic soils to accumulate.

Uncontrolled drainage has also contributed to organic soil loss on the ditch side of the road-ditch corridors within the refuge. In their

natural saturated state, the swamp's organic soils are 85-95% water. In areas that have undergone excessive drying due to drainage, these soils aggregate into a granular form that will not re-wet even under inundated conditions. The dehydrated soils oxidize at a rapid rate and their granular nature reduces saturation in the vegetation root zone, possibly facilitating the intrusion of vegetation typical of drier sites.

Where water is impounded in the refuge by elevated roads and functioning water control structures, saturated organic soils accumulate. The interplay between organic soil loss and accumulation caused by the opposing forces of burning, fire suppression, drainage, and impounding, as well as inherent soil instability, have resulted in very complex soil dynamics in the swamp. As peat accumulates, the distance between surface soils and the water table increases, renewing the oxidation/ subsidence process in the unsaturated layer with subsequent soil loss, until the cycle begins again. The key to maintaining saturated soils for wetland vegetation is, therefore, to keep the optimum distance between surface elevations and the water table.

In any case, due to their saturation and high organic matter content the organic soils are generally unsuitable for sanitary facilities, building site development, recreational development, and trails. They are highly corrosive to both steel and concrete construction.

Mineral Soils

Mineral soils are defined as those having an organic layer of less than 16 inches. Those present within the refuge include several taxonomic classes: Histic Humaquepts, Typic Ochraquults, Typic Hydroquents, Typic Umbraquults, and Typic Humaquepts.

Histic Humaquepts are soils with organic layers 8 to 16 inches thick over mineral subsoil of varying composition (sand, loam, and clay). Permeability depends upon the texture of the subsoil. They are usually poorly drained and moderately subject to fire and compaction.

Typic Ochraquults include loam and fine sandy loam soils and are mildly to strongly acidic. Drainage and permeability vary with the texture of the subsoils. Seasonal ponds form in some areas.

The Typic Hydroquent class is heavy gray clay that occurs frequently. It is a deep, very poorly drained soil. Ponds commonly form during wet seasons.

Other mineral soils occur to a limited extent along the Suffolk Scarp.

They are generally better drained and less subject to flooding than the soils described above. Although some mineral soils have high water tables and are subject to brief flooding, they are more suited for sanitary facilities, construction, and recreational development than the organic soils because their load-bearing strength is generally much higher.

Nansemond NWR Soils

Several soil series exist on the Nansemond NWR, including the Nansemond, Kenansville, and Bohicket series. The Nansemond series consists of a loamy fine sand surface layer with a sandy loam or sandy clay loam subsoil about 47 inches thick (USDA, SCS, 1981). The permeability of the Nansemond series is moderately rapid, and the soil has a seasonally high water table at depths of two to three feet.

The Kenansville series has a dark, grayish-brown loamy sand surface layer about three inches thick. The subsurface layer is an olive-yellow loamy sand about 20 inches thick. The subsoil is usually 20 inches deep and composed of brown fine sandy clay loam. The permeability of the Kenansville series is moderately rapid and it has a seasonally high water table of four to six feet.

The Bohicket series is a dark, grayish brown, silty clay loam, typically 13 inches thick. It is underlain by approximately 60 inches of clay. The permeability of the Bohicket series is very low. This series is typical of salt water marshes.

Climate

The Great Dismal Swamp NWR and Nansemond NWR are located in the humid-subtropical zone, characterized by long, humid summers and mild winters. The climate is moderated by the proximity of water bodies, including the Atlantic Ocean, Albemarle Sound, and Chesapeake Bay. The average annual temperature is approximately 60°F (15.6°C), ranging from monthly averages of 45°F(7.2 °C) in January to 79°F(26.1°C) in July. Extremes have been recorded as high as 105°F (40.6°C) and as low as 2°F (-16.7°C).

Rainfall is well distributed throughout the year and long periods of drought seldom occur. Average annual precipitation at Norfolk, Virginia, is 45.74 inches (116.2 cm), with the normal annual snowfall at 8.8 inches (22.4cm) (National Weather Service, Wakefield, Virginia). The annual potential evapotranspiration is 32 inches (81.3 cm).

Southwesterly winds dominate during the warmer months, while northwesterly winds dominate the cooler months. Northeast winds are less common and are usually associated with storm events and the passage of cold fronts. The mean wind speed is 10.5 miles per hour.

Water Resources

The Great Dismal Swamp is less than 9,000 years old; it was formed on a hillside instead of a basin and without the benefit of rivers flowing into or beside it. These facts set it apart from all other southern swamps. Regionally unique geologic formations and the presence of a shallow artesian aquifer changed the prehistoric, climax oak hickory forest into the cypress gum wetland complex of recent history. It is these same hydrologic factors that are maintaining the swamp today.

Hydrology

Many people perceive swamps as having standing water year round. This is not the case in the Great Dismal Swamp; in fact, most of the swamp's vegetation could not survive permanent inundation. The Great Dismal Swamp has an annual hydrologic cycle that results in changing water levels throughout the year. Historically, the swamp's natural hydrologic cycle has followed the seasons. Otte (1985) provides a description of this cycle:

> "In autumn the swamp was at its driest, with little or no standing water (except for Lake Drummond and some of the larger channels) and a low water table. There was little downstream movement of water; most water moved upward and out of the soil by evapotranspiration.
>
> In the winter -- as rains increased, temperatures declined, and evapotranspiration rates slowed, stream flow swelled and the water table rose until it reached the surface. At this point streams overflowed into the swamp and surface sheetflow toward the east and south predominated.
>
> By spring the swamp was flooded to its maximum extent with little lateral water movement. As temperatures rose and plants began to grow in the late spring, evapotranspiration removed large quantities of water from the swamp and the water table began to drop below the ground surface. This allowed soils to aerate and vegetation to obtain oxygen needed

for growth. While there were fluctuations in the annual cycle of surface water within the swamp, subsurface water losses were moderated by the large water holding capacity of the peat soils."

Water Dynamics:

Great Dismal Swamp NWR's water budget is influenced by several natural input-output events. Direct precipitation is a major source of water, contributing about 28.5 billion gallons to the refuge annually and accounting in part for the fact that more water flows out of the refuge than enters it as surface inflow. Precipitation is highest during the summer months.

Washington Ditch . *By late winter, streams have swelled and overflowed into the swamp. Sheetflow. USFWS.*

Surface water inflow occurs in the form of stream and sheet flow from the west along the Suffolk Scarp. About 82 square miles of upland area drain into the refuge, primarily via Cypress and Taylor Swamps, supplying approximately 22 billion gallons of surface water each year. Eighty-nine percent of this inflow occurs from November through April. Evapotranspiration in areas upstream from the swamp severely limits inflow during summer despite higher rainfall rates.

Evapotranspiration accounts for the biggest portion of water removal from the swamp ecosystem. It exceeds rainfall during the growing season and causes a lowering of water levels in the refuge throughout the summer. Estimated annual evaporation loss from the refuge is about 39 inches (data from Dismal Swamp Canal hydrology substation). The rate of transpiration is not known.

Surface water runoff through the swamp is also a major means of outflow. Historically, the principal drainages have been the Northwest, Pasquotank, and Elizabeth Rivers, and Shingle Creek. Much of the winter discharge within the swamp was in the form of sheet flow. During low flow periods, the water would follow the random channels cut during high flow. Over the last two centuries natural outflow patterns have been altered; most surface water now drains through the refuge in the network of canals and ditches with minimal sheet flow.

Ground water discharge is a secondary output event. Wherever the upper layer confining the shallow aquifer is absent, ground water wells up into the overlying peat and is discharged from the peat by evapotranspiration. Ground water is also discharged by seeping directly into Lake Drummond. Where the aquifer is breached, ground water is discharged from the refuge as surface flow through outlet channels that are left uncontrolled.

Current hydrologic setting:
The hydrology of the Great Dismal Swamp has been modified through years of human activities. The ramifications of these changes are not fully understood but a few generalizations can be made. The amount and rate of annual surface inflows into the refuge have increased due to upland land use practices such as field tiling, road building, and housing along the Suffolk Scarp. Water that used to recharge the shallow aquifers and enter the swamp as much delayed ground water, is now intercepted and diverted into the refuge as surface water. This increase in the volume of surface water contributes to higher surface water levels during winter and storm events and may be in part responsible for reduced volumes of water to recharge the swamp during dry summer periods.

Ditches

Within the refuge, the construction of 158 miles of canals and ditches with their attendant spoil bank roads have combined to form the single most significant alteration to the swamp's water regime. The elevated spoil bank roads serve as dams blocking overland water flow. Conversely, those ditches without controls can quickly shunt water through to the swamp. In those areas where the confining layer was removed from the underlying artesian aquifer, ground water can also be shunted through during periods of low water. The loss of the artesian waters may reduce an important buffer needed for spring and summer evapotranspiration drawdown.

Many of the refuge's ditches form a network that channels much of the current surface flow into Lake Drummond, which in turn drains into the Feeder Ditch through a gated spillway and then into the Dismal Swamp Canal. Other ditches, including Corapeake, Big Entry, and several smaller ditches, drain directly into the Dismal Swamp Canal. Several ditches in the southern portion of the swamp drain into Cross Canal and ultimately into the Pasquotank River basin. Jericho Ditch drains northwest to Shingle Creek and also south to Lake Drummond. Due to flat terrain, the flow in several ditches is reversible, depending on rainfall, obstructions, and other factors.

The Dismal Swamp Canal has had a powerful effect on the hydrology of the swamp. The canal intercepts a majority of the surface water flowing out of the swamp and has breached the artesian aquifer. Lake Drummond is the primary source of water to operate the canal. Water flow through the canal is managed by locks at either end of the canal and by the spillway on Feeder Ditch at Lake Drummond.

Of all available incoming water (precipitation, surface inflow, and ground water), Lake Drummond receives approximately 25 billion gallons; the lake has a capacity for 4.62 billion gallons. Lock operations indicate 3.5% of outflow from the lake is used for the two locks on the Dismal Swamp Canal. The remaining 96.5% of available water is discharged as it exceeds the holding capacity of the swamp.

The effects of the roads on ground water are not clearly understood, but it is assumed that associated soil disturbance, compaction, and addition of outside materials to swamp soils have significantly altered historical patterns of ground water movement through the swamp. Questions remain as to the permanence and irreversibility of these subsurface dams.

Prior to federal acquisition of the Great Dismal Swamp, the private owners recognized the need for water conservation and control to reduce water losses. Previous owners installed 115 water control devices and culverts over the years. Many of the structures deteriorated over time, but the Service has repaired or replaced most of the critical water control structures since the refuge's establishment. These control structures have reduced water losses in the swamp .

Surface water levels and the ground water table are highest from December through April and lowest from May through November.

Feeder Ditch . *Water from Lake Drummond spills into the Feeder Ditch and then into the Dismal Swamp Canal.*
Photo:Waverley Traylor.

Lake Drummond

Lake Drummond, located near the center of the refuge, is one of only two naturally occurring lakes in Virginia. This 3,108-acre lake is shallow and nearly circular in shape (2.7 miles north-to-south and 2.4 miles east-to-west). At its deepest point, Lake Drummond is only 6 to 7 feet deep. It is perhaps the most widely recognized feature of the Great Dismal Swamp NWR.

The water level in Lake Drummond is intensively managed. A 1977 informal agreement between the U.S. Fish and Wildlife Service and the U.S. Army Corps of Engineers defines a minimum lake level of 15.75 feet above mean sea level to retain sufficient water in the swamp ecosystem. When the water level is below this, water cannot be released from the lake for Dismal Swamp Canal operations.

Surface water quality is generally good. The dark tannic color and 3.5-6.7 pH level impart a distinct taste and heighten the water's ability to remain fresh.

Water Quality

Fertilizers and pesticides used on corn, soybeans, cotton and peanuts, and runoff from hog operations are potential surface water pollution sources. In addition, sediment flowing into the refuge from upstream agricultural and timber lands may eventually affect the free flow of water through the swamp and diminish water quality.

Water from the Norfolk aquifer is commonly soft with a generally low mineral content, although some areas have excessive iron and free carbon dioxide that may cause corrosion problems. The shallow aquifer is potentially susceptible to contamination from agricultural, industrial, or domestic runoff.

Nansemond NWR Water Quality

According to the Virginia Department of Environmental Quality (DEQ), some water quality problems exist in the Nansemond River. A fish eating advisory for Kepone exists for the James River and all its tributaries from the fall line at Richmond to the Hampton Roads Bridge Tunnel. It became effective on July 1, 1988, but there are no restrictions on fish consumption.

For all tributaries and mainstems of the Nansemond River, the watershed is classified as "nutrient enriched" under Virginia Water Quality Standards. This is likely due to non-point source contributions from agricultural, urban/suburban and forestry activities. DEQ has given the Nansemond River an overall water quality ranking of medium. The U.S. Environmental Protection Agency regulations require the states to give a priority ranking to identify those waters scheduled for Total Maximum Daily Load (TMDL). A ranking of medium identifies those waters scheduled for TMDL development by the year 2006.

Air Quality

The U.S. Environment Protection Agency (EPA) promulgated national ambient air quality standards in 1997 for PM2.5 (particulate matter equal to or less than 2.5 microns in diameter), however monitoring devices were not fully installed and operational until January, 1999. PM2.5 is one of six "criteria" pollutants for which standards have been established by the EPA Office of Air Quality Planning and Standards. The EPA determined that these standards are necessary to protect human health and the environment (Virginia Department of

Environmental Quality website, February, 2003). Primary standards set limits to protect public health, including the health of "sensitive" populations such as asthmatics, children, and the elderly. Secondary standards set limits to protect public welfare, including protection against decreased visibility, damage to animals, crops, vegetation, and buildings (www.epa.gov/airs/criteria.html). For PM2.5, the threshold for the annual arithmetic mean is 15 ug/m3 for primary and secondary standards, while the threshold for the 24-hour average is 65 ug/m3 for primary and secondary standards (See Figure 3-2).

VIRGINIA 2002

PM2.5 PARTICULATE MATTER SUMMARY BY REGION

METHOD CODE 118 - GRAVIMETRIC, R & P MODEL 2025 SEQUENTIAL

Micrograms Per Cubic Meter (ug/m3)

LOCATION	NO. OF OBSERVATIONS BY QUARTER				HIGHEST VALUE PER QUARTER				QUARTERLY ARITHMETIC MEAN			
	I	II	III	IV	I	II	III	IV	I	II	III	IV
TIDEWATER REGION												
CHESAPEAKE Oscar Smith Stadium	79	89	82	82	23.3	25.3	49.4	30.1	10.4	12.1	13.7	11.2
HAMPTON Va. School for the Deaf & Blind	28	30	26	30	19.7	17.5	32.9	22.5	10.4	11.0	13.6	11.6
NEWPORT NEWS Pump Station #103	28	30	28	28	17.7	18.8	33.7	33.5	9.8	11.8	14.6	11.4
NORFOLK NOAA Facility	29	27	31	31	19.9	22.1	50.8	21.2	10.7	11.9	16.6	11.4
VIRGINIA BEACH Tidewater Regional Office	28	26	28	31	21.9	22.5	50.2	26.8	10.8	11.2	15.8	12.1

Figure 3-2. *Particulate matter is the primary pollutant released during wildfires and during prescribed fire operations. Prescribed fire is used at Great Dismal Swamp NWR to improve wildlife habitat, maintain fire-dependent plant communities, and to reduce hazardous fuel accumulations near buildings and development. The data presented above represents sampling stations that may detect significant PM2.5 emissions from prescribed fire activities on the Refuge (the Chesapeake location is closest). As this data demonstrates for 2002, the threshold value for PM2.5 was never exceeded for the 24-hour average or the annual average.VDEQ.*

Contaminants/Hazardous

Great Dismal Swamp NWR Environmental Concerns

Resources of the Great Dismal Swamp NWR may have been (or continue to be) exposed to environmental contaminants from a variety of sources. To investigate the level of contaminants, the U.S. Fish and Wildlife Service sampled for three groups of pollutants: heavy metals, organochlorine pesticides, and alkanes (a constituent of petroleum products). Samples were collected from sediments, surface waters, and from the tissues of fish and small mammals during 1987, 1989, and 1992 (Kane, 1997). None of the sites demonstrated high levels of contaminants, though several areas on the refuge demonstrated higher levels than other sites. The areas exhibiting elevated levels of contaminants include the East Ditch area, where potential sources of contamination are the heavily used US Highway 58 and an automobile junkyard; the Cypress Swamp area demonstrated elevated levels of metals, but a potential source was not identified; and Lake Drummond fish showed elevated levels of mercury, chromium, nickel, and iron. Kane (1997) noted that it is well-documented that wetlands and swamps may act as sinks for metal contaminants, particularly mercury. Mercury is known to bioaccumulate and it is significant that top predators in Lake Drummond demonstrated the highest mercury levels, despite the fact that mercury was not detected in Lake Drummond water samples.

It should be reiterated that no high levels of contaminants were detected, only elevated levels in select areas. Kane (1997) suggests that this data be used as a baseline and that periodic monitoring of sediments and biota be conducted.

Nansemond NWR Environmental Concerns

A site survey was performed on April 15, 1997, by the Virginia Field Office (VAFO), U.S. Fish and Wildlife Service, Division of Ecological Services. During the survey, staff from the VAFO and the Great Dismal Swamp NWR walked the entire perimeter and most of the inner area of the 208 acres transferred to the Service in 1999. The purpose of the survey was to ascertain the likelihood of the presence and/or extent of hazardous substances or other environmental problems associated with the property. As environmental investigations and remediation have been ongoing at this site under the Installation Restoration Program (IRP), the property has been divided into several sites. The following descriptions and restrictions

correspond to designations defined through Defense Base Closure and Realignment Commission (BRAC) activities.

The first area surveyed comprises all of BRAC Sites 5 and 11 and most of the areas adjacent to these sites. Site 5 is the polychlorinated biphenyls (PCB) spill area near Star Creek. Soils in this area were contaminated by leaking transformers that were previously stored there, and historical reports indicate that oil in the transformers was drained into 55 gallon drums before being discarded into the marshy area. Results from soil sampling showed levels of PCB's up to 15,000 parts per million (ppm) in soil and 1 ppm in sediment, levels that are consistent with PCB clean-up goals at Superfund sites in the Environmental Protection Agency's Region 3. Clean fill was layered over site soils to minimize potential exposure of ecological receptors to remaining levels of PCB's in soils.

Restrictions for Site 1 prohibits the extraction of shallow groundwater and any disturbance of the surface and/or subsurface area without prior written approval of the Department of the Navy. Disturbance shall mean any intrusive activity that involves the penetration of the surface soil; such as excavation, trenching, tilling of the soil, and/or any mechanical or manual drilling. These prohibitions are intended to control the risk of direct contact with or consumption of water from the shallow aquifer and to control the risk of direct contact with or consumption of subsurface soils in contact with the groundwater in the shallow aquifer where contamination (124-trichlorobenzine) has been found to exceed the maximum contaminant level for drinking water.

The Site 7 restrictions prohibit disturbance of any surface or subsurface soils as above. The contaminant present in this case is low levels of Polynuclear Aromatic Hydrocarbons (PAH's).

Site 11 is adjacent to Site 5 and is designated as "The Disposal Pits." Construction debris was found at this site during PCB remediation activities at Site 5. The debris included shingles, wood and metal fascia.

During the April 15, 1997, site visit, a large dirt pile with a grass cover was observed. It is likely that this dirt pile is leftover clean fill that was brought in for remedial activities at Site 5. Other debris observed in the vicinity included a telephone pole, a wooden pole, a metal structure with wire conduits on the backside, and a metal container in Star Creek.

Aesthetics

The assessment of the Great Dismal Swamp NWR's aesthetic quality assumes that: (1) Unaltered natural areas possess greater natural scenic potential than modified areas, although some scenic value can be ascribed to the altered landscape if it is in character with the wildlife mission of the refuge; (2) scenic areas that are separated or buffered from intensive development, eyesores, or other unattractive environments are more valuable than those that are not; and (3) while visual resources are important, the policy of habitat protection on the refuge precludes the most visually obtrusive activities.

Visual resources were qualitatively assessed for each of six general zones in the refuge, as follows:

Aerial Views

Great Dismal Swamp NWR is dramatic from the air, as the vast expanse of forest offers a startling contrast to the surrounding mosaic of farms and urban areas. At the center of the refuge, Lake Drummond forms a prominent focal point. Bald cypress snags jut above the general forest canopy. The ecological continuity within the swamp is broken only by the road and ditch network, and even this is seasonally obscured by the canopy. The scarcity of such landscapes on the east coast adds greatly to the refuge's value as an aesthetic resource.

Lake Drummond . *The most significant visual feature in the refuge.* USFWS.

Lake Drummond

The lake is the most significant visual feature in the refuge. Its expanse of water has a shoreline punctuated by cypress snags. The lake possesses qualities of vividness, near/far contrast, and pictorial composition that are unmatched in the rest of the refuge. Colors and light change constantly, and overall wildlife viewing opportunities, especially of resting and wintering waterfowl, are better than elsewhere on the refuge.

Feeder Ditch/Dismal Swamp Canal

These waterways offer some visual interest for visitors entering the refuge by boat from the east. Overhanging branches and views of wildlife balance the visual deficit of artificial ditch banks. Development along these water routes is generally in keeping with their function.

Road/Ditch Corridors

The corridors lacing the swamp are long, narrow, and straight. In many cases, the value of the roads as viewsheds is lessened because care must be taken in negotiating around potholes, eroded edges, obstructions, etc. Views through the trees are possible when the leaves are gone; during the growing season a solid wall of vegetation forms along the roads, creating a tunnel effect. Seasonal color adds to the visual quality of the swamp forests. Wildlife viewing opportunities vary: open areas along the road and open water in the ditches offer the best chance for sighting wildlife. Because of off-road access constraints, refuge public use and resource management activities often coincide along these corridors, making visual management an important factor in retaining the aesthetic values of the refuge.

Wooded Interior

Inaccessible to viewing by most refuge visitors, the forests in the swamp interior add to the mystery of the swamp. They harbor wildlife activity and buffer activity and noise between different swamp areas.

Swamp Periphery

The edge of the swamp offers only a hint of the vast forested area lying beyond. Along most of its periphery, the swamp acts as a backdrop for various landscapes including highways, farms, and residences. Because of the sudden disruption of forest lands by development or clearing, the swamp's essential character as a potential ecological isolate, or "island", is emphasized.

Biological Resources

Refuge Habitats and Regional Context

Birds. *Two hundred and nine avian species have been reported in the Great Dismal Swamp NWR. Woodduck. Waverly Traylor.*

The Great Dismal Swamp NWR is a matrix of unique habitat types, many of which are rare. Within the refuge are found typical pocosins of the southeast (here they exist at the northern extent of their range), some of the largest remaining Atlantic white cedar woodlands to be found anywhere, and potential restorable habitat for the federally-endangered red-cockaded woodpecker.

Fauna

Birds

Two hundred and nine avian species have been reported in the Great Dismal Swamp NWR. Within this group, 92 species nest in the swamp, 49 of which are year-round residents; the remainder are migratory breeders. Most of the breeding birds of Great Dismal Swamp NWR can also be found in smaller wetlands outside the refuge, but not in such abundance and high density. One hundred and eleven migrant bird species use the refuge during fall and spring migrations. See Appendix B.

Insects

Refuge invertebrates include many individual species. Matta (1979) listed 182 species of aquatic and semi-aquatic insects, but little information was provided regarding terrestrial insects. Much of this data gap has been filled by recent surveys of butterflies and skippers (Roble et al., 1999) and damselflies and dragonflies (Roble and Cuyler, 1999). These recent reports include 52 butterflies, 41 skippers, 22 damselflies, and 43 dragonflies from within the current boundaries of the Great Dismal Swamp NWR. Six of these species are dependent upon switchcane as their only larval food plant.

Fish

Twenty-seven species of fish occur in Lake Drummond and the ditches. Seventy-five percent of the total fish population consists of the yellow bullhead. The abundance of yellow bullhead and low recruitment of black crappies, a species preferred by fishermen, may be attributed in part to yellow bullhead eating the eggs of the crappie.

Reptiles and Amphibians

Sixty-two species of heptofauna (reptiles and amphibians) have been found at Great Dismal Swamp NWR, and six additional species may be present (Mitchell et al., 1999). These include 19 toad and frog, nine salamander, ten turtle, eight lizard and 22 snake species. Three venomous snake species are present: the copperhead is the most abundant, while the canebrake rattlesnake and eastern cottonmouth are much less abundant than formerly thought.

Mammals

At least forty-seven species of mammals are found in the Great Dismal Swamp NWR. The first scientific collection of mammals inhabiting the Dismal Swamp was initiated by the U.S. Department of Agriculture in the late 1890's (Handley, 1999). Modern occurrences are described in Bulmer et al. (1999), Handley (1979), Paschal et al. (1979), Rose (1999b), Rose et al. (1999), and Webster (1999).

Mammals. *At least forty-seven species of mammals are found in the Great Dismal Swamp NWR. Red fox. Photo: Waverley Traylor.*

The most recent studies, occurring in the 1990's, have sought to fill the gaps within the mammal record, particularly small mammals and bats. At least eight studies of small mammals in the Dismal Swamp are reported during the 1980's and 1990's (Rose 1999b), and four studies of bats (Rose et al. , 1999). It should be noted that while study areas often included the Great Dismal Swamp NWR, many studies sampled the historical Great Dismal Swamp and were not limited to the refuge.

Recent studies have recorded 16 species of small mammals in the Great Dismal Swamp (Bulmer et al., 1999, Rose, 1999b). Findings include four species of shrew, six species of mice, one species of rat, two species of mole, two species of vole, and the southern bog lemming (*Synaptomys cooperi helaletes*).

Ten species of bats have been documented in the Great Dismal Swamp

NWR, with one additional species occurring just beyond the margin of the swamp (Rose et al., 1999). Beyond inventory data, little additional information is known about bats in the Great Dismal Swamp. The exception may be the red bat (*Lasiurus borealis*), which was the most numerous species presented in the summary by Rose et al. (1999). The habits of the red bat in the Great Dismal Swamp are better understood thanks to records of bat activity (Rose et al., 1999) and analysis of stomach contents (Whitaker et al. , 1997).

Larger mammalian residents of the swamp include nutria (*Myocastor coypus*), river otter (*Lutra canadensis*), beaver (*Castor canadensis*), ground hog (*Marmota monax*), raccoon (*Procyon lotor*), opossum (*Didelphis virginiana*), mink (*Mustela vison*), grey fox (*Urocyon cinereoargenteus*), red fox (*Vulpes fulva*), grey squirrel (*Sciurus carolinensis*), southern flying squirrel (*Glaucomys volans*), white-tailed deer (*Odocoileus virginianus*), black bear (*Ursus americanus*), and bobcat (*Felis rufus*).

The Great Dismal Swamp contains a significant coastal breeding population of black bears in eastern Virginia and extreme northeastern North Carolina. Hellgren (1988) and Tredick (2005) estimated the population to contain 250 - 350 bears. The refuge's mission of habitat restoration and managing public access into the swamp enables the refuge to sustain a healthy bear population. In addition, the refuge serves as a reservoir to supply bears to colonize privately-owned lands near the refuge.

Harvest data for the cities that contain the refuge has remained relatively unchanged, with an average harvest of 19 bears for the past 11 years. For the cities of Suffolk and Chesapeake, 1998 (33) and 2003 (26) were the two highest harvests and 2001(6) and 2004(11) showing the lowest harvest (VDGIF, 2004). Though harvest rates over the past 11 years do not indicate an increasing bear population, additional data, including nuisance bears, observational data, and age structure indices provide evidence of an increasing black bear population (VDGIF, 2002).

One goal identified in the Virginia Black Bear Management Plan is to stabilize the black bear population at current levels in the cities of Suffolk and Chesapeake. In looking at the two studies (Hellgren, 1988 and Tredick, 2005) that were completed over 15 years apart, both indicating a refuge population of 250 - 350 bears, and coupled with rates for high human population growth and development in southeastern Virginia, the Great Dismal Swamp NWR has begun to examine management alternatives to proactively address potential conflicts.

The refuge's carrying capacity for white-tailed deer increased during

the first half of the century when logging created additional deer habitat. Because there has been little timbering on the Great Dismal Swamp NWR since 1976, the openings that deer depend on for food are reforesting, reducing their value as deer habitat. However, these impacts have been mitigated by the development of experimental forest management plots, prescribed burning, wild fires, and road maintenance (clearing and mowing).

To maintain an appropriate relation between the deer herd and its swamp habitat, white-tailed deer are annually hunted on the refuge. The health of the deer population continues to be evaluated through off-refuge deer hunt check station data (weight, age class distribution, antler development, physical deformities). These data have indicated a gradual but steady improvement in deer health since refuge deer hunts began in 1979.

Flora

The refuge contains several plant communities comprising various associations made up from a total of 340 vascular plant species. Botanically, the swamp is the interface between northern and southeastern coastal plain swamp vegetation types. Current vegetation patterns in the refuge reflect past human activities and associated changes in the water regime. Timbering, ditching, road building, and fire suppression have influenced recent vegetation diversity. In many cases, a vegetation community includes both species typical of historical water regimes and species indicative of the recent hydrologic alteration. However, some areas within the swamp are typical historical communities whose existence predates the extensive development of the 1940's and 1950's (See Figure 3-3).

Classification of the natural communities in the Great Dismal Swamp NWR follows The Natural Communities of Virginia (Fleming et al., 2001). These classifications closely follow those used in the North Carolina classification (Schafale and Weakely, 1990). Natural communities present at the Great Dismal Swamp NWR include:

Mesic Mixed Hardwood Forests
Natural Lake Draw-Down Shores
Non-Riverine Pine-Hardwood Forests
Non-Riverine Swamp Forests
Pond Pine Woodlands and Pocosins
Peatland Atlantic White Cedar Forests

Mesic Mixed Hardwood Forests

Mesic (medium-moist site) hardwoods are stands of mixed deciduous tree species occurring at the higher elevations and better-drained mineral soils of the refuge. These forests are situated in the extreme northern end of the refuge near North Ditch and Jericho Ditch, on the Suffolk escarpment along the western boundary, and on a series of sand ridges (mesic "islands" in the midst of the swamp wetlands) near Weyerhaeuser Road.

Tree species in this community include sweetgum (*Liquidambar styraciflua*), yellow poplar (*Liriodendron tulipifera*), beech (*Fagus grandifolia*), willow oak (*Quercus phellos*), water oak (*Q. nigra*), laurel oak (*Q. laurifolia*), white oak (*Q. alba*), swamp chestnut oak (*Q. michauxii*), cherrybark oak *(Q. pagoda)*, southern red oak *(Q. falcata)* on drier sites, blackgum (*Nyssa sylvatica*), ash (*Fraxinus spp.*), elm (*Ulmus spp.*), and red maple *(Acer rubrum)*.

Virginia least trillium. *High concentrations of this globally rare species are found in the refuge. Photo: Waverley Traylor.*

Evergreen species occasionally found in this type include American holly (*Ilex opaca*), southern magnolia (*Magnolia grandifolia*), sweetbay *(Magnolia virginiana)*, and loblolly pine *(Pinus taeda)*.

The highest concentrations of Virginia least trillium *(Trilium pusillum var. virginianus)* [globally rare] occur in areas of this forest type near Jericho Ditch and Jericho Lane.

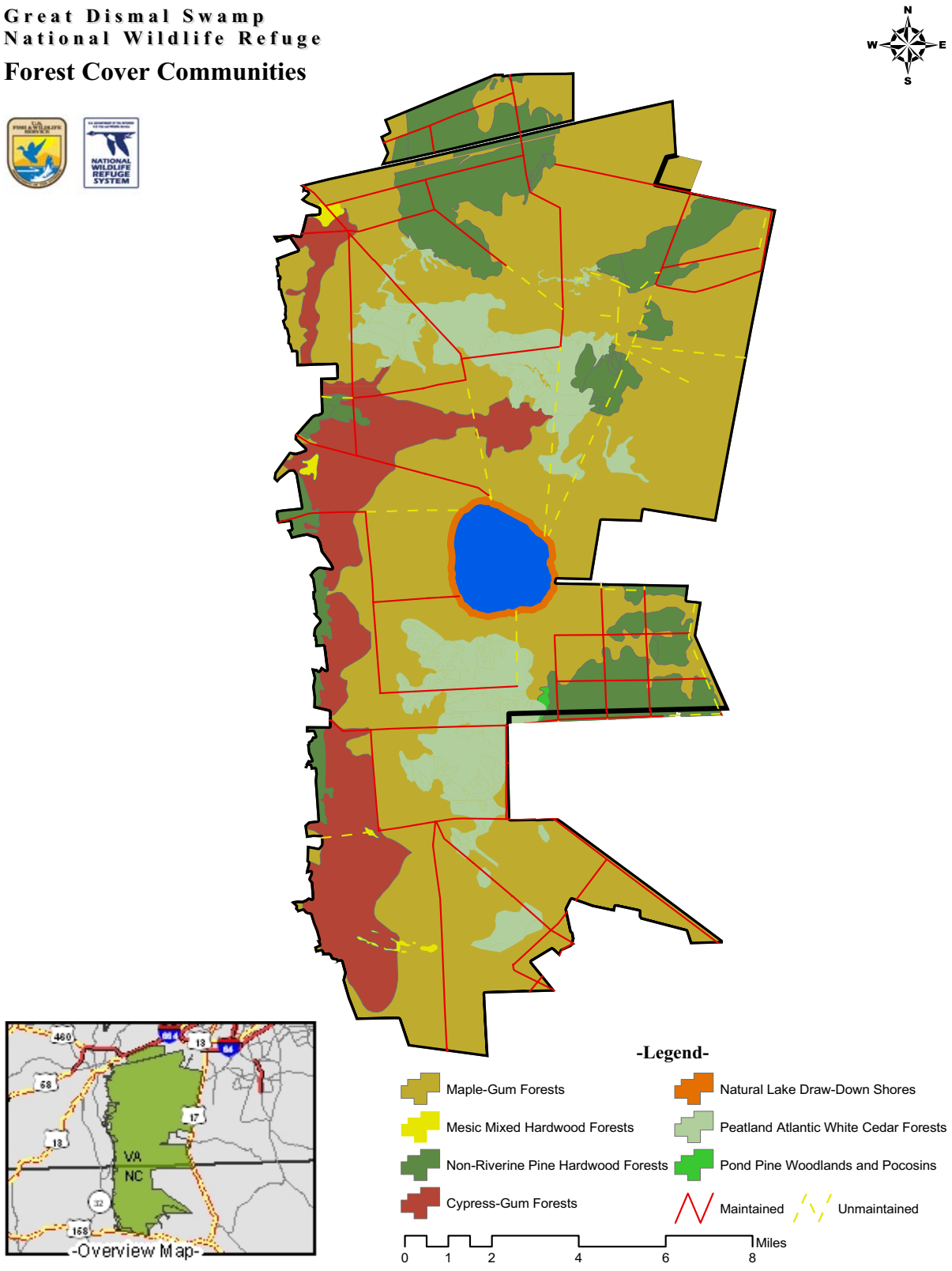
The mesic mixed hardwood community occupies 600-900 acres, or less than 1% of the refuge. It is not known if these species historically occupied any greater area within the refuge, but it is known that most peripheral swamp lands with this habitat type have been converted for agricultural use.

Recently, approximately 50-acres of this forest type has been reestablished, and another 65-acres preserved as part of a wetland restoration effort on private lands along the Suffolk escarpment, immediately south of Jericho Lane.

Natural Lake Draw-Down Shores

The only representation of this community type in Virginia lies along the margins of Lake Drummond in the Great Dismal Swamp NWR.

Figure 3-3.


Great Dismal Swamp
National Wildlife Refuge
Forest Cover Communities
N
W
E
S
-Legend-
Maple-Gum Forests
Mesic Mixed Hardwood Forests
Non-Riverine Pine Hardwood Forests
Cypress-Gum Forests
Natural Lake Draw-Down Shores
Peatland Atlantic White Cedar Forests
Pond Pine Woodlands and Pocosins
Maintained
Unmaintained
0 1 2 4 6 8
Miles
VA
NC
-Overview Map-

Non-Riverine Pine-Hardwood Forests

These appear to be successional stands that have replaced the once widespread "canebrakes" because of fire suppression. This community type presents opportunities for restoration of canebrakes. Rare species associated with the Non-Riverine Pine-Hardwood Forests include Virginia least trillium and Swainson's warbler (*Limnothlypis swainsonii*). Additionally, Roble et al. (1999) identified six species of Lepidoptera that are dependent upon switchcane as their only larval food plant.

Non-Riverine Swamp Forests

This community type is globally uncommon to rare. For the purposes of this document the Non-Riverine Swamp Forests are divided into two cover types: cypress-gum and maple-gum.

Vegetation trends.
Cypress-gum is considered to be relatively stable community in the Dismal Swamp.
USFWS.

Cypress-gum forests are typical southern swamp communities adapted to surface inundation (hydric conditions) for at least part of the growing season. The association covers 12% of the refuge, occurring in western areas of the swamp where standing water is abundant. Principal species include cypress (*Taxodium distichum*), tupelo gum (*Nyssa aquatica*), and swamp blackgum (*Nyssa biflora*). Both mineral and organic soils support the community, with the organic layers ranging in depth from a few inches to several feet.

Cypress-gum was formerly the most extensive association in the swamp. Cypress trees now occur in fairly low density, and tupelo gum is present only in scattered areas. Although cypress and tupelo gum are climax species for undisturbed wet sites, blackgum and red maple have replaced them over much of their range due to selective cutting of cypress, drainage, and fire.

Maple-gum forests cover sixty percent of the Great Dismal Swamp NWR and consist primarily of red maple and blackgum (often in association with redbay, sweetbay, sweetgum, and yellow poplar). The range of the maple-gum association has increased in the swamp over the past 30 to 40 years, and it is the only refuge habitat type that is continuing to expand.

Red maple is sensitive to wounding, fungus rot, insect attack, and fire injury (although fire-killed trees sprout vigorously and may flourish as second-growth stands). The species is also susceptible to animal damage. Red maple reproduction may be almost completely

suppressed where deer populations are excessive.

Pond Pine Woodlands and Pocosins

These are globally rare community types. Most of the pine woodlands occurring within the Great Dismal Swamp NWR consist of pond pine (*Pinus serotina*). Pond pine occurs on soils of high organic matter content in the swamp interior. Historically, this community type was maintained by fire, limiting hardwood composition. Pond pine woodland still dominates many acres in the southern portion of the refuge, however fire suppression has allowed an increase in the hardwood component.

Pocosin vegetation is commonly found in the understory of pond pine woodlands. A pocosin is a specific successional stage of many coastal palustrine wetlands, dominated by broadleaved evergreen shrub vegetation less than 20 feet tall. Pocosins occur in areas of poorly developed internal drainage on organic soils.

Fleming et al. (2001) does not distinguish between pond pine and pocosin communities because they generally occur together in southeastern Virginia (the northern extent for both communities). North Carolina does distinguish these communities and further separates pocosin into low pocosin and high pocosin (Schafale and Weakely, 1990). This background information is provided because approximately 800 acres of broad-leaved evergreen pocosin is located south of Feeder Ditch and north of Corapeake Ditch. This pocosin habitat covers less than 1% of the refuge, but represents one of the few occurrences of this community type in Virginia.

The community boundaries are indistinct, grading into the pine type. Species commonly found in this type include bitter gallberry (*Ilex coriacea*) or inkberry (*Ilex glabra*), fetterbush (*Lyonia lucida*), downy leucothoe (*Leucothoe axillaris*), titi (*Cyrilla racemiflora*), myrtle (*Myrica cerifera*), redbay (*Persea borbonia*), and scattered pond pine. Much of this community is being overtopped by maple and pine.

Peatland Atlantic White Cedar Forests

Atlantic white cedar forests are a globally rare community type. Atlantic white cedar (*Chamaecyparis thyoides*) occurs in both pure, even-aged stands and in stands mixed with swamp hardwoods such as red maple, blackgum, sweetbay, and redbay (*Persea borbonia*). Pond pine is also often associated with cedar.

Atlantic white cedar stands are found on deep organic soils where the surface has become elevated above the water table. The species requires a 70-80% moisture level at the root mat, which is maintained by capillary movement of water from the water table through the fine-grained soils. However, the vitality of cedar is severely reduced if it is subjected to surface flooding during the growing season.

Atlantic white cedar is a subclimax but relatively long-lived type, developing after disturbances such as fire, flooding, windthrow, and clear cutting. In general, height growth virtually ceases and diameter growth slows greatly when Atlantic white cedar reaches 100 years old. Individual trees estimated to be nearly 1,000 years old have been recorded, but instances of cedar dominated forest communities reaching 200 years before breaking up and converting to a climax community are rare (Little and Garrett, 1990). Appropriate conditions for regeneration of pure stands of Atlantic white cedar are created either by crown fires in dense stands with little competing understory vegetation, or by surface fires that eliminate competing hardwoods and shrubs and that provide seedbeds above standing water. The lightning fires that burned large areas of the swamp in the past encouraged the regeneration of many more acres of Atlantic white cedar than currently exist.

Atlantic white cedar has been harvested in the swamp since the 18th century when the Dismal Swamp Land Company began operations. Loggers usually cut the Atlantic white cedar but left hardwoods to take over the site, or left so much slash on the ground that Atlantic white cedar seedlings were unable to develop in such shaded conditions. Other important factors in the gradual succession of Atlantic white cedar stands to hardwoods include suppression of wildfire and changes in the swamp's water regime.

In the Great Dismal Swamp NWR, prior to Hurricane Isabel Atlantic white cedar was present in pure stands covering approximately 3,600 acres, primarily in the south central portion of the swamp with a few stands north of Lake Drummond. Hurricane Isabel felled an estimate 3,000 acres of the purest cedar stands in a single 24-hour period on September 18, 2003. Atlantic white cedar is also represented in approximately 8,200 acres of mixed cedar-hardwood community.

Unclassified Community Types

Four other wetland areas occur at the Great Dismal Swamp NWR that have a less clear fit following the Virginia natural community classification. Each likely represents Non-Riverine Swamp Forest altered by disturbance. These areas have previously been described as

persistent emergent wetlands and occupy a total of less than ½ percent of the refuge. Despite this limited acreage, the emergent wetlands, along with the pocosin areas, are the only non-forested vegetation communities on the refuge and thus contribute to habitat diversity.

North Ditch Bog (50 acres): An escaped fire, during low water table conditions, consumed several feet of peat from much of this unit. Most over story trees, mostly pine/maple, were killed. Beavers have now impounded this area and it remains flooded year round providing valuable waterfowl and bald eagle habitat.

Remnant Marsh (35 acres): Originally over 300 acres, this open marsh area has become overgrown by red maple. In 1986 the remaining 10 acres were burned to control woody encroachment. Twenty-five additional acres were cleared in 1994. The entire unit has been burned several times and is now maintained as a seasonally flooded open marsh.

Fringe Marsh (75 acres): The natural southward waterflow from the refuge is impounded by U.S. Highway 158 creating this narrow open marsh. A portion of the unit was cleared using heavy equipment in 1987. Additional acreage was converted from maple forest to marsh as the result of an escaped fire.

Railroad and West Marsh (5 acres): This area of maple/gum forest was cleared in 1985 using heavy equipment and has now been burned four times to maintain an open marsh habitat. Since 1996 beavers have impounded the area and are currently doing an excellent job of woody plant control.

Vegetation Development and Trends

Evidence indicates that the Dismal Swamp first began to develop along streams 11,000 to 12,000 years ago. A previous ice advance had left the area with characteristic boreal vegetation of jack pines and spruces. Over a period of 3,000 to 4,000 years the boreal vegetation was replaced by northern hardwood species that, in turn, was replaced by oaks, hickories, and other endemic southeastern species. The swamp gradually expanded westward along watercourses and peat began to accumulate. By 3,500 years ago, peat had blanketed the present-day Dismal Swamp, the water regime was saturated, and the oak-hickory forest was replaced by a cypress-gum swamp. Over time the composition of the swamp forest varied, as is evident today.

Future vegetation succession in the swamp cannot confidently be

predicted. Many factors determine which species will gain dominance of a site, including intensity of fire, depth of peat burn, ground water level, seed sources and methods of cutting, and the time of year. The continuing effects of human activities in the swamp now override natural influences on succession.

In general the pioneer types -- Atlantic white cedar, pine, inkberry, cane, and red maple -- result either from fire or clearcutting. Red maple may also be a climax species. The cypress-gum, mesic hardwood, and mixed hardwood types are considered to be relatively stable communities in Dismal Swamp.

Rare Species

Federally-Listed Species

Red-cockaded woodpecker

The red-cockaded woodpecker (*Picoides borealis*) is a cooperative breeding species, meaning that the rearing of young usually involves the efforts of more than just the breeding pair. A 'group' is commonly composed of three or four individuals, but may include as many as nine. Helpers in the group are usually unmated males remaining from the previous breeding season.

The federally endangered red-cockaded woodpecker was observed on the refuge until 1974, though it was last observed nesting in the southeastern portion of the swamp in 1961.

Bald eagle

The bald eagle (*Haliaeetus leucocephalus)* is a federally-listed threatened species. Currently, there is one active bald eagle nest on the refuge. This nest was identified in 1997 and, though not active every year, has produced several young. In addition, over-wintering bald eagles are seen on the refuge almost every year. Guidelines for bald eagle protection have been developed jointly by the Virginia Department of Game and Inland Fisheries and the U.S. Fish and Wildlife Service, Virginia Field Office (VDGIF-USFWS, 2000). Because of the remote location of the bald eagle nest at the refuge, disturbance is highly unlikely. To insure minimal impacts, activities proposed within 1,320 feet (1/4 mile) of the nest will be reviewed by VDGIF and USFWS.

Red wolf

Rare Species. *Virginia least trillium. USFWS.*

The Great Dismal Swamp NWR is located within the historic range by the federally endangered red wolf (*Canis rufus*), though no red wolves are currently known to inhabit the refuge. One red wolf was seen at the refuge in 1996. It was later trapped and returned to Alligator River NWR in North Carolina. If recovery efforts in North Carolina are successful, it is conceivable that red wolves could colonize the Great Dismal Swamp NWR.

State-Listed Species

Canebrake rattlesnake

The canebrake rattlesnake (*Croatalus horridus atricaudatus*) is a Virginia state listed-endangered species. The canebrake rattlesnake is found in two distinct populations in Virginia, the largest of which includes parts of Suffolk, Chesapeake, Isle of Wight, and Virginia Beach. The Great Dismal Swamp NWR is centered within this distribution.

Dismal Swamp southeastern shrew

Dismal Swamp southeastern shrew (*Sorex longirostris fisheri*) was removed from Endangered Species Act protection on February 28, 2000, however it retains its status as a Virginia state-threatened species. The shrew had held the status of 'threatened' since 1986.

Species of Concern

Four sensitive plant species are found in the Great Dismal Swamp NWR: Virginia least trillium (*Trillium pusillum var. virginianum*), which is a federal Species of Concern, and silky camellia (*Stewartia malacodendron*), sheep laurel (*Kalmia augustifolia*), and purple bladderwort (*utricularia purpurea*), on the Virginia Species of Concern and Watch lists.

The Virginia least trillium is restricted to the northwest corner of the refuge, although observations have been reported near the refuge boundary at the head of the Pasquotank River. The silky camellia is found in two locations: the mesic islands and in the northwest corner of the refuge. Great Dismal Swamp NWR is probably the northern limit of this plant's natural range.

The state of North Carolina list the canebrake rattlesnake and the star nosed mole (*Condylura cristata*) as species of specail concern. Both are found within the Great Dismal Swamp NWR.

Virginia Department of Conservation, Natural Heritage Program investigators sampling in the refuge during 1995 identified the following additional species warranting special concern from land managers:

Plecotis rafinesquii (eastern big-eared bat)
Megacephala carolina (tiger beetle)
Ilex coriacea (big gallberry)
Ludwigia pilosa (hairy seedbox)
Paspalum dissectum (water paspalum)
Solidago latissimifolia (coastal swamp goldenrod)
Tillandsia usneoides (spanish moss)
Xyris fimbriata (fringed yellow-eyed grass)

Noxious/Invasive Species

No comprehensive survey has been conducted to identify and locate invasive species at the Great Dismal Swamp NWR. The Virginia Natural Heritage Program and the Virginia Native Plant Society have prepared a list of invasive alien plant species of Virginia (http://www.dcr.state.va.us/dnh/invlist.pdf). While several occur on the refuge, phragmites (*Phragmites communis*) and privet bush (*Ligustrum spp.*) are of the greatest concern.

Invasive animals on the refuge include coyote (*Canis latrans*) and nutria (*Myocastor coypus*). Coyote, native to the western U.S., have expanded their range to include the entire east coast of the U.S. They are known to occur regularly within the Great Dismal Swamp NWR and in counties adjacent to the refuge.

Nutria were intentionally introduced to the U.S. in 1899 for fur production. After initial introduction where they were pen-raised for their pelts, nutria were transported to various locations to control unwanted vegetation and enhance trapping opportunities. Ironically, the first nutria were brought to the Chesapeake Bay region in 1943 as part of an experimental fur station at Blackwater NWR on the eastern shore of Maryland. At Great Dismal Swamp NWR, nutria are only known to occur at three locations, in the Railroad and West Marsh, in Cross Canal Ditch, and in Corapeake Ditch.

The Role of Fire

Fire has influenced forest communities of the Great Dismal Swamp dating back to pre-colonial and possibly prehistoric times. Native Americans may have used fire as a vegetation management tool as well as a means of driving game during hunting. Most swamp fires result in the loss of highly combustible organic soils to depths of a few inches to six feet. Lake Drummond is believed to have formed from a large, deep burning peat fire.

Prior to 1900, fires within the Great Dismal Swamp were uncontrolled and usually occurred during droughts. Lightning ignited most of the fires, but Native American hunting parties and loggers may have ignited some fires.

From 1900 to about 1945, railroad and timbering activities brought new sources of ignition and increased the frequency of fires that burned for extended periods. Not only did timbering activity increase sources of ignition, those activities were concentrated during periods of increased flammability. Timbering in the swamp was most easily accomplished during dry periods when men and equipment could maneuver more easily on the peaty soils. This is also when the soils are more susceptible to ignition. Simpson (1990) reported on "The Great Conflagration", a logging slash fire that burned for years during 1923-1926, eventually burning an area of about 150 square miles (nearly 100,000 acres). Yellow peat smoke filled the air around Hampton, Newport News, and Norfolk during this period.

Since the mid-1940's, fire prevention and suppression techniques have reduced both the number and magnitude of fires within the refuge and adjacent areas. However, several notable fires during this period are summarized as follows:

1955 Easter Sunday Fire: started along the railroad within the northern part of the current refuge and burned nearly 150 square miles, reaching the Portsmouth city line.

1967 South of Feeder Ditch: Someone burning debris ignited this fire that burned 1,350 acres.

1988 April Fools Fire: escaped prescribed fire burned 640 acres along the state boundary south of Lake Drummond.

1993 Clay Hill Road Fire: lightning caused fire that burned 150 acres of pine stands near the refuge's western boundary in Suffolk.

1993 Portsmouth Ditch Fire: fire of unknown origin burned 75 acres adjacent the refuge in Chesapeake.

2004 Corapeake Road Fire: lightning caused fire started on NC State Natural Area land and spilled over onto the refuge buring 286 acres.

2006 West Drummond Fire: lightning strike caused fire that burned 535 acres of maple/gum stand north of Interior Ditch.

Today, lightning is the cause of most wildfires at Great Dismal Swamp NWR. A typical summer afternoon thunderstorm can often result in hundreds of lighting strikes on the refuge. Most of the time, the strikes do not create a wildfire, but surface and ground fires occur on average 2.6 times each year. Analysis of 30 years of fire history at the refuge has identified the wildfire season as March through October, with the peak fire season occurring from July 10 through August 18 (USFWS, 1998b).

Threats to human health and safety justify the extinguishment of wildfires, though many of the habitats at the refuge require periodic fire. Fires in the Great Dismal Swamp NWR can greatly affect air quality in surrounding urban centers (Chesapeake, Suffolk, Norfolk, Virginia Beach, and others). The products of fire result in decreased visibility and elevated levels of ozone and particulate matter, which creates poor driving conditions and elevates health risks especially for asthmatics, children and the elderly.

Most fires in the refuge interior cause only minimal damage because they are not threatening to refuge neighbors, are slow to spread, and do relatively little irreparable damage to resources (depending on extent, sensitive plant species, water quality, etc.) Burned areas within maple-gum forests regenerate, in most cases, to the same species or to early successional types.

Intense fires in Atlantic white cedar and pine forests, which generally contain more volatile fuel per acre, result in more damage. Surface fires in AWC are not as damaging, in fact, they are necessary for healthy stands. Ground fires are more threatening to AWC. Although the thick bark of pines offers protection from fire, Atlantic white cedar fairs more poorly. Ground fires often burn under the roots, causing trees to topple. Damage from deep ground fires prevents regeneration of dominant species, although moderately deep fires may provide conditions for wetland species regeneration. The Great

Dismal Swamp NWR developed a Fire Management Plan in 1998. The Fire Management Plan identifies the following three priorities in descending order of importance: protection of human life and property losses, protection of fire sensitive refuge resources from wildlands fire damage, and use of prescribed fire to perpetuate those communities needing periodic fires.

Current refuge fire management plans direct that all wildfires will be suppressed as quickly and as economically as safety permits. Wildfires usually occur when refuge water levels are low, creating conditions where long-burning ground fires could emit smoke into populated areas for extended periods. Moreover, the refuge is virtually surrounded by commercial and residential development, major highways, and airports. Therefore, containing the fire and smoke within an area that does not affect the human population adjacent to the refuge is difficult to assure. However, total suppression of wildfires contradicts the natural role of fire in the swamp ecosystem. In the past, periodic surface fires were important in perpetuating a number of early successional communities including Atlantic white cedar, loblolly and pond pine, and evergreen shrub. This critical role of fire as a natural process is increasingly accepted. The current Federal Wildlands Fire Policy states that "wildlands fire, as a critical natural process, must be reintroduced into the ecosystem" (USDA-USDI, 1996).

Prescribed fire. *At the Great Dismal Swamp NWR, prescribed fire is used to maintain unique fire-dependent habitats and restore habitats that have suffered from the absence of fire.* USFWS.

Prescribed Fire

Prescribed fire was first used successfully at the Great Dismal Swamp NWR in 1982 when 50 acres of loblolly pine on mineral soils were burned for hazard reduction and wildlife habitat improvement. Since then, the use of prescribed fire as a management tool has increased at the refuge. When properly applied, prescribed fire presents few of the health and safety threats associated with wildfire. Prescribed fire is applied under conditions that promote clean burning and the rapid ventilation of smoke and particulates from the lower atmosphere. Furthermore, prescribed fires are of limited size so that operations can be limited to only optimal burning conditions.

Natural resource professionals use prescribed fire for habitat restoration, fuels management, wildlife management, and vegetation management. At the Great Dismal Swamp NWR, prescribed fire is used to maintain unique fire-dependent habitats and restore habitats that have suffered from the absence of fire. These include Atlantic white cedar stands that require fire for regeneration and to prevent succession to maple-gum habitat, controlling invasion of woody

plants in the remnant marsh, and creation of habitat for the federally endangered red-cockaded woodpecker. Fire may also be used as a management tool to limit expansion of maple and gum habitat type. These dominant species are not very fire tolerant and the extent of the habitat type in GDSNWR was historically limited by naturally occurring fire.

Prescribed fire is also used to reduce hazardous accumulations of fuels. The use of prescribed fire to reduce fuel accumulations at strategic locations minimizes the threat of wildfire to valuable resources. Fuels reduction fires are most commonly applied to land adjacent to development. This limits the fire intensity and minimizes damage if an accidental fire should occur.

Trial burns are being implemented under current management on organic soil types, emergent wetlands, and deep peat soils to test methods and effectiveness of burning as a habitat management tool.

Cultural Resources

Archaeological studies of Great Dismal Swamp National Wildlife Refuge have been mostly limited to project-specific surveys in compliance with the National Historic Preservation Act. Few archeological sites were identified at locations of refuge facilities through those studies, and no comprehensive archaeological survey of the refuge has yet been done. However, a three year study nearing completion by a PhD candidate at the College of William and Mary (Daniel O. Sayers, unpublished), strove to locate historic period work camps and escaped slave "maroon" settlements in the swamp. In addition to successfully identifying several such places, Sayers also found a considerable number of prehistoric sites.

Prehistoric and Historic Native Americans

Prehistoric sites have long been reported on uplands at the swamp edge, but it was assumed that fewer sites existed in the lowland portions. However, Sayers' work in that area (cited above) revealed a considerable number of Native American sites that appear to have been repeatedly used over a wide time span.

Despite there being few studies in the refuge proper, a broad outline of human occupation in the swamp can be described. Initial settlement dates back some 13,000 years, 4,000 years before formation of the swamp began. Mammal and waterfowl hunting and gathering of wild plants were the primary means of obtaining food for most of prehistory. While sources of clothing, housing, and a variety of other necessities were generally plentiful in the area, stone for tool manufacture was limited to river cobbles, so trading for higher quality materials from the Piedmont probably began quite early. Other materials, such as soapstone, later became noteworthy trade items in the region.

The introduction of agriculture approximately 2000 years ago provided a more reliable food supply, and population increased. Growing political complexity culminated in the establishment of the Powhatan Confederation around the turn of the 17th century. Crops were probably most heavily grown on drier uplands at the edge of the swamp, such as the Suffolk scarp, though the discovery of prehistoric maize pollen in peat near Lake Drummond (Whitehead 1965a) indicates that corn may have been planted further in the swamp.

As Euro-American settlement advanced in the 17th and 18th century, the tribes in the area were decimated by disease and largely lost control of their lands. While many departed the immediate area to avoid domination, some remained as farmers or workers in various industries that exploited the swamp's timber resources. The swamp also continued to provide them with the same plants and animals that had been of economic and cultural significance before European arrival. The state-recognized Nansemond Indians, one such group of survivors, settled along the Suffolk Scarp. The present community of Chuckatuck is the site of one of their main historic period towns.

Historic Period Euro-Americans and Afro-Americans

Beginning in the 18th century, Euro-Americans established farms on the swamp edge and began to exploit the swamp's cypress and white cedar through logging and production of shingles and barrel staves. Canals also began to be dug deep into the swamp to drain land for farming (which proved generally unsuccessful), but also for barges to ship out forest products. Enslaved African Americans were the primary labor force for all this work, and local Native Americans were probably also employed. The labor camps for construction of the canals appear in

contemporary documents and art. George Washington was an investor in one of the canal construction efforts, and the approximate site of a labor camp named "Dismal Town," is marked today near the west boundary of the refuge.

Underground Railroad. *The refuge is a designated site on the National Parks Service's Underground Railroad Network to Freedom. "Osman." Harpers Magazine, September, 1856. By permission, Cornell University Library's Making of America Digital Collection.*

Not surprisingly, the Great Dismal Swamp also served as a hiding place for African-Americans escaping slavery in the 18th and 19th centuries. These people established "maroon" communities deep in the swamp that possibly spanned several generations. As a part of the early 19th century "Underground Railroad," individuals also used the swamp as a temporary hiding place until passage could be secured to northern states or Canada. The presence of substantial maroon populations in the swamp is well demonstrated. In 1847, the North Carolina State Assembly went so far as to pass the *Act to Provide for the Apprehension of Runaway Slaves in the Great Dismal Swamp and for other purposes*. In 1842, Henry Wadsworth Longfellow's poem "The Slave of the Dismal Swamp" and, in 1856, Harriet Beecher Stowe's novel *Dred*, highlighted the swamp's reputation for hiding escaped slaves.

Recent work by Daniel O. Sayers (cited earlier) has identified sites of several canal work camps that appear in historic documents as well as some probable maroon settlements in the swamp. As a result of the recent archaeological and historical work on the maroon presence, the refuge has been designated a site on the National Parks Service's "Underground Railroad Network to Freedom" (http://www.cr.nps.gov/ugrr/program.htm).

In the late 19th and early 20th century, logging and shingle industries in the swamp continued to be economically important. A system of logging railroads branched out from the canal system, laying and pulling up track again as different areas were cut. The canal towpaths were used and improved for the railroads, and some newer roads and ditches also date from this period. Temporary logging camps, as well as sites of more permanent hunting and fishing cabins and other activities are assumed to be scattered in the swamp, but remain poorly documented. The canal and dike system constitute the only non-archaeological historic structures in the refuge.

Socio-Economics

Population

Census estimates for 2002 place the population surrounding the Great Dismal Swamp NWR (Hampton Roads, Virginia, and adjacent North Carolina counties) at more than 1.5 million people. Furthermore, the region is continuing to develop rapidly. The cities of Chesapeake and Suffolk, where most of the refuge is located, have the highest growth rates in the region (See Figure 3-4). The City of Suffolk, once a rural tidewater county, is now one of the fastest growing areas in the U.S. Population for the City of Suffolk during the period July 2001-July 2002 grew at an astounding 4.8 percent,ranking it as the 33rd fastest growing city/county in the U.S. (U.S. Census, 2002).

The North Carolina section of the refuge falls within the counties of Gates, Camden, and Pasquotank. Total population in these counties was 52,298 in 2000.

	Population (7/02 Projected)	Population (2000)	Growth Rate (%) 1990-2000	Avg Income	% Below Poverty	Unemploy-ment
Virginia	7,293,542	7,078,515	14.4	40,209	11.6	
City of Chesapeake	206,665	199,184	31.1	45,427	10.1	4.2%
City of Suffolk	69,966	63,677	22.1	34,560	16.4	7.1%
North Carolina	8,320,146	8,049,313	21.4	35,320	12.6	
Camden County	7,465	6,885	16.6	35,423	12.2	6.7%
Gates County	10,635	10,516	13.0	30,087	15.4	5.5%
Pasquotank County	35,445	34,897	11.5	29,305	19.0	6.1%
Elizabeth City						
Surrounding Areas						
Franklin, City of	8,170	8,346	-0.5	31,687	19.8%	7.0%
Hampton, City of	145,921	146,437	9.5	36,297	14.6	5.9%
Isle of Wight County	31,085	29,728	18.7	39,331	11.6	5.3%
Newport News, City of	180,272	180,150	5.1	34,306	16.7	5.9%
Norfolk, City of	239,036	234,403	-10.3	28,350	24.4	6.1%
Portsmouth, City of	99,790	100,565	-3.2	29,815	20.5	7.3%
Virginia Beach	433,934	425,257	8.2	44,714	9.0	3.9%
York County	59,720	56,297	32.7	51,898	6.1	3.8%

Figure 3-4. *Population and Employment for GDSNWR region. US Census.*

Surrounding areas with the heaviest population concentrations (Chesapeake, Norfolk, Portsmouth, and Virginia Beach, Virginia) are located northeast of the refuge. Suffolk, Virginia is located northwest of the refuge, and Elizabeth City, North Carolina is south of the refuge. With these exceptions, the area immediately surrounding the swamp has a low density rural population. The refuge has no permanent residents.

Employment

The base economy within the refuge's service area is generally dominated by: (1) military bases and defense-related activities in the south-side Hampton Roads area and (2) extensive manufacturing, particularly shipbuilding activities, on the Peninsula. Historically, farming has been a large part of the local economy, and still continues to play an important role west and southeast of the refuge. Other important sectors are food processing, trade, retail sales, and services industries. The tourist industry is important in Virginia Beach, Virginia, and in the Outer Banks of North Carolina.

Agriculture and forestry are primary industries in the outlying rural areas. The major agricultural products are cotton, soybeans, corn, livestock, and poultry. The number of farms has declined, as is the case nationwide.

Public Use

While the primary goal of the Great Dismal Swamp NWR is to 'protect and preserve this unique and outstanding ecosystem,' a secondary goal is to educate the public about the ecosystem functions that the swamp performs. This goal is accomplished through a variety of public use activities:

Education

The Great Dismal Swamp NWR is a huge outdoor laboratory. It has been used since before the creation of the refuge to educate students of all ages. Bulmer (2000) states that vertebrate zoology students from Northern Virginia Community College have visited the Great Dismal Swamp annually since 1971. Researchers from Old Dominion University and Virginia Polytechnical Institute also frequently conduct studies in the refuge.

Area primary and secondary school systems are offered teacher activity/lesson guides and a refuge video for classroom use. Groups are invited to use refuge trails for the outdoor classroom activities. Staff and volunteers visit local schools and libraries to participate in additional educational programs.

Aside from formal educational programs, the Great Dismal Swamp NWR provides informative booklets and brochures to allow visitors to explore and learn at their own pace. The Great Dismal Swamp Coalition (the refuge's Friends group) also routinely schedules nature activities at the refuge.

Wildlife Dependent Recreation

The network of land ownership in the Great Dismal Swamp provides many wildlife and outdoor-related recreation opportunities. Trails for hiking/biking, wildlife observation, wildlife photography, interpretation, and limited hunting opportunities are available at the Great Dismal Swamp NWR. Boating and fishing opportunities are present on Lake Drummond. Adjacent and nearby lands that provide similar opportunities include the Virginia Department of Game and Inland Fisheries (VDGIF) Dismal Swamp Wildlife Management Area (WMA) and Caviler WMA, Virginia Natural Area Preserves, Nature Conservancy preserves, Chesapeake's Dismal Swamp Canal Trail and Northwest River Park, North Carolina State Natural Areas and State Parks. The Albemarle Region Canoe Trail System includes the Pasquotank River and Dismal Swamp Canal. Camping opportunities exist at Chesapeake's Northwest River Park and at the Lake Drummond Reservation (COE land).

Wildlife Dependant Recreation. *Trails for hiking/biking, wildlife observation and photography, and limited hunting opportunities are available at the Great Dismal Swamp NWR. Hiking visitors on Railroad Ditch Road. USFWS.*

Tourism

There is considerable potential for increased tourism to the Great Dismal Swamp NWR. Approximately 55 percent of the U.S. population resides within 500 miles of Virginia (Virginia Tourism Corporation, 2003a). The Hampton Roads area is already the most heavily visited part of the state. The

Williamsburg area attractions accounted for three of the top five tourist attractions in Virginia in 1997-1998 and Williamsburg and Virginia Beach were in the top three cities visited in the state (Virginia Tourism Corporation, 2000). Total traveler spending in the Tidewater and Hampton Roads region of Virginia was nearly $2.5 billion in 2000 (Virginia Tourism Corporation, 2003a).

Within the Great Dismal Swamp ecosystem, numerous nature-based recreational opportunities exist. These opportunities include wildlife observation, boating, camping, education, fishing, and hunting on lands of various ownership including natural area preserves, wildlife management areas, and parks, all of which rely heavily on the much larger Great Dismal Swamp NWR and Dismal Swamp State Natural Area (North Carolina) as the core resource areas. In addition, the North Carolina Dismal Swamp Canal Welcome Center is located three miles south of the North Carolina/Virginia state line, on the refuge's eastern boundary.

During the 2002 fiscal year, the Great Dismal Swamp NWR estimated 75,382 visitor-days (GDSNWR RMIS data). Interpretation and nature observation accounts for the vast majority of visits (96.3 percent), while environmental education (0.6 percent), recreation (3.4 percent), and off-site education and outreach (2.6 percent) accounted for the remainder of visitor activities [Since visitors may participate in multiple activities, the visitation by type exceeds 100 percent].

Political Setting

The Great Dismal Swamp NWR occupies portions of two cities in Virginia, Suffolk and Chesapeake, and three counties in North Carolina, Gates, Camden, and Pasquotank. In that, the refuge lies in the 4th Congressional District in Virginia, and the 1st and 3rd Congressional Districts of North Carolina. State representation finds the refuge in the 76th and 77th District for the Virginia House of Delegates, and the 14th and 18th Districts for the Virginia State Senate. In North Carolina, state representation finds the refuge in the 1st District for both the House and the State Senate.

Chapter 3
Refuge and Resource Descriptions

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Chapter 4

Management Direction

Great Dismal Swamp National Wildlife Refuge

- Refuge Vision
- Refuge Goals, Programs, Objectives, and Strategies
- General Refuge Management

Nansemond National Wildlife Refuge

- General Refuge Management

4. Management Direction

Refuge Goals, Programs, Objectives, and Strategies

Lake Drummond.
Thousands of wintering tundra swans and snow geese are attracted to the lake each year. Waverley Traylor.

The vision and goals of Great Dismal Swamp NWR translate the Refuge System Mission and Refuge Purposes into management direction. To the extent practicable, each goal is supported by program descriptions and objectives with strategies needed to accomplish them. Objectives are intended to be accomplished within 15 years, although actual implementation may vary as a result of available funding and staff. Great Dismal Swamp NWR is the largest intact remnant of a vast habitat that once covered more than one million acres in southeastern Virginia and northeastern North Carolina. The proximity of such a large and unique ecosystem based refuge to a major urban population provides the Service with a great opportunity to achieve the following vision and goals.

Great Dismal Swamp National Wildlife Refuge Vision Statement

The following vision statement was developed to define the desired future status of the Great Dismal Swamp National Wildlife Refuge:

Great Dismal Swamp National Wildlife Refuge was established in 1974 for the primary purpose of protecting a unique ecosystem. Thus, the refuge pioneered the concept of natural resources stewardship on a landscape scale. Incorporating over 111,200 acres in Virginia and North Carolina, the refuge has become one of the largest National Wildlife Refuges on the east coast of the United States. Yet, this large remnant of seasonally flooded wetlands is located near the heart of metropolitan Hampton Roads, Virginia.

The refuge will endeavor to restore the biological diversity of the Great Dismal Swamp ecosystem through hydrologic restoration and fire management. The refuge will support the diverse flora and fauna that have historically existed within a healthy swamp ecosystem, including one of the largest populations of black bears on the east coast. Seasonally flooded forests will be maintained as habitat for neotropical migratory birds and waterfowl. The rare Atlantic white cedar forests will be restored through forest management practices that promote natural regeneration. Remnant bogs, marshes, and pocosin habitats will be restored and maintained to enhance habitat diversity as well as provide potential habitat for the endangered red-cockaded woodpecker. Wildlife and wildlands-related research, environmental education, natural and cultural interpretation, and wildlife-dependent recreation will be developed and managed in a manner that does not conflict with the primary objectives of the refuge and promotes awareness and understanding of the entire Great Dismal Swamp ecosystem. Refuge land acquisition will focus on those areas where public ownership is required for hydrologic protection and restoration, for restoring and maintaining fire-dependent habitats, and for habitat development for wintering waterfowl. Through partnerships, wildlife corridors that link the refuge to natural areas within the Albemarle-Pamlico watershed will be protected.

Forest Management.
Atlantic white cedar restoration site. USFWS.

Refuge Goals

The following goals were developed for the Great Dismal Swamp National Wildlife Refuge to highlight specific elements of our vision statement which will be emphasized in future management. The goals are not in order of priority.

1. Manage the area for the primary purpose of protecting and preserving a unique and outstanding ecosystem, as well as protecting and perpetuating the diversity of animal and plant life therein.

2. Protect and enhance Service trust resources and other significant species.

3. Provide protection and restoration of those areas within Great Dismal Swamp ecosystem that are remnants of the Great Dismal Swamp and/or are restorable to Great Dismal Swamp habitat while providing support to the protection and restoration of all its components and adjacent habitats that directly affect the vitality and viability of the ecosystem.

4. Establish a public use program that will encourage awareness, understanding, appreciation and stewardship of the Great Dismal Swamp ecosystem while complementing the refuge resource management objectives.

Goal 1: (Habitat) **Manage the area for the primary purpose of protecting and preserving a unique and outstanding ecosystem, as well as protecting and perpetuating the diversity of animal and plant life therein.**

Program: Great Dismal Swamp National Wildlife Refuge Natural Areas

Rationale for Program: The Great Dismal Swamp NWR has long been recognized for its stewardship of unique habitats. The pond pine woodlands/pocosin and the Atlantic white cedar forests have been viewed by resource management professionals as globally-rare community types. The refuge was established for the primary purpose of restoring and protecting a unique ecosystem, so the refuge incorporates bogs, marshes, and forests that used to be part of a vast seasonally-flooded ecosystem that once covered at least 500,000 acres in Virginia and North Carolina.

Forest Management.
Atlantic white cedar stand, a rare forest habitat. USFWS.

The refuge has been assigned several special designations in recognition of the unique natural features incorporated into the refuge as well as to recognize the significant contributions of the refuge to the stewardship of wildlife resources. The refuge has been designated as a National Natural Landmark, requiring periodic status reports to the National Park Service on the overall condition of the refuge habitats. The North Carolina Natural Heritage Program has designated the North Carolina portion of the refuge as a Natural Heritage Area because the refuge incorporates habitats and plants that are rare in that state. Most recently, the Virginia Audubon Council identified the refuge as an Important Bird Area, recognizing the refuge as part of a global network of areas that contribute to the conservation of bird populations.

Research Natural Areas (RNA) on National Wildlife Refuges are part of a national network of reserved areas under various ownerships. This network is the result of a designation system recognized by other federal land management agencies and the Federal Committee on Ecological Reserves. RNA's are intended to represent the full array of North American ecosystems; biological communities, habitats, and phenomena; and geological and hydrologic formation and conditions. They are areas where natural processes are allowed to predominate

without human intervention. However, under certain circumstances, deliberate manipulation is used to maintain unique features that the RNA was established to protect.

Public Use Natural Areas (PUNA) are relatively undisturbed ecosystems or sub-ecosystems that are available for use by the public with certain restrictions for protecting the area. Such an area must possess exceptional value or quality in illustrating or interpreting an element of the natural heritage of the Nation. This designation is fostered only by the National Wildlife Refuge System, and it is separate and distinct from the RNA designation system.

Objective: Establish Research Natural Areas to include remnant Atlantic white cedar forests and mesic islands within the areas identified as Unit 1 (Northeast) and Unit 2 (Gates County) of the Wilderness Review (see Appendix D) by 2010.

Rationale for Objective: The refuge was established to restore and protect a unique ecosystem. Atlantic white cedar forests and mesic islands are key components that have characterized the historic Great Dismal Swamp ecosystem. While the wilderness review concluded that these areas were not suitable for wilderness designation, these key components should be recognized as being critical to representing remnants of the natural biological diversity of the Great Dismal Swamp.

Strategies:

- Identify and designate a maximum of 1,000 acres of Atlantic white cedar forests within Unit 1 (Northeast) of the Wilderness Review as Research Natural Areas.
- Identify and designate a maximum of 500 acres of mesic islands as Research Natural Areas within Unit 2 (Gates County) of the Wilderness Review.

Objective: Establish Public Use Natural Areas within Unit 4 (Washington Ditch) and Unit 5 (Lake Drummond) of the Wilderness Review by 2010.

Rationale for Objective: The Lake Drummond scenery has remained largely unchanged over the centuries despite the fact that logging, ditching, and road construction have surrounded the lake. The Washington Ditch was originally constructed by George Washington's slaves in the 1760's, and the entire area along the Washington Ditch has been logged prior to the establishment of the refuge. Nevertheless, the history of the area, the fact that the Washington Ditch area was part of the original 49,000 acres that were donated to establish the refuge, and the fact that refuge visitors associate this primary visitor entrance

as part of the "natural" Great Dismal Swamp argue for minimal development of this part of the refuge.

Strategies:

- Establish the 3,000 acre Lake Drummond as a Public Use Natural Area.
- Establish the Washington Ditch corridor as a Public use Natural Area.

Program: Forest Management

Rationale for Program: "A timber management program to include the continuing harvest of select timber species under controlled conditions" is one of the primary objectives of the refuge (Public Law 93-402). Forest management programs are directed towards restoring and enhancing the natural habitat diversity of the refuge by restoring or mimicking natural forces that once maintained habitat and wildlife diversity of the refuge.

Objective: Restore 2,000 acres of Atlantic white cedar (AWC) forests by 2006 using helicopters and/or other specilized equipement to remove trees that were destroyed or severely damaged by Hurricane Isabel.

Rational for Objective: Hurricane Isabel inflicted considerable changes to the refuge landscape on September 18, 2003. Several thousand acres of Atlantic white cedar forests were destroyed. Without restoration, significant Atlantic white cedar acreage will be lost.

Much of the refuge is inaccessible to conventional logging equipment, making it logistically difficult or impossible to salvage forest resource and promote cedar restoration. Helicopters and/or other specialized equipment will make more Atlantic white cedar stands accessible to salvage and restoration and will be less environmentally disruptive than conventional logging equipment.

Strategies:

- Issue permits to contractors who can use helicopters and/or other specialized equipment to salvage Atlantic white cedar trees that were blown down by Hurricane Isabel.
- Permit conditions will outline "in kind" services that will require the contractors to repairs refuge roads and provide other administrative support needed to support salvage and restoration operations.

Objective: Restoration of 8,000 acres of Atlantic white cedar forest by 2019.

Rationale for Objective: Approximately 8,000 acres of Atlantic white cedar, a rare forest habitat, are 100+ years old and are expected to be lost to natural mortality within the next 20-30 years. If AWC is not regenerated in these areas, red maple and other less desirable species will replace Atlantic white cedar in these stands.

Strategies:

- Utilize commercial harvests of mature Atlantic white cedar to clear areas sufficiently for natural regeneration on 2,000 acres that are reasonably accessible by existing refuge roads.
- Utilize approved herbicides on 6,000 acres to reduce competition from competing vegetation in mature Atlantic white cedar stands that are not easily accessible to harvesting equipment.
- Promote partnerships with state forest management agencies, research institutions, and non-government resource management organizations to develop and evaluate forest management techniques.

Objective: Improve 10,000 acres of pine/pocosin habitat.

Rationale for Objective: The pine/pocosin forest, a fire dependent habitat, is being encroached on by adjacent pine and hardwood communities. The enhancement of the pine/pocosin habitat addresses the refuge's implementation legislation to maintain and restore habitats. The pine/pocosin habitat is prime foraging for the black bears and some of the highest densities of female bear ranges include this habitat type. The red-cockaded woodpecker is listed as "endangered" under the Federal Endangered Species Act and once inhabited the area now incorporated into the refuge. Biologists involved with recovery of this endangered species have indicated that the pine/pocosin forests within the refuge are potentially valuable habitat for the re-introduction of the Red-cockaded Woodpecker. Approximately 2000 acres, of the 10,000 acres, pine/pocosin will be managed for the establishment of a viable Red-cockaded Woodpecker breeding population of 10 active clusters. These activities will support the refuge mission of "protecting and preserving a unique and outstanding ecosystem" as well as support agency recovery efforts for endangered species.

Strategies:

- Implement hardwood removal and aggressive prescribed burning on 10,000 acres.

- Maintain these areas with prescribed fires occurring every 3 to 5 years.

Objective: Maintain approximately 250 acres of the Remnant Marsh.

Rationale for Objective: The Remnant Marsh once covered over 250 acres and provided brood and feeding habitat for waterfowl and wading birds. The marsh has evolved into a maple-gum forest over the decades due to the exclusion of fire and mechanical clearing, so that the area is barely recognizable as a marsh. Wildlife species associated with this habitat, particularly several species of waterfowl and wading birds, would likely cease to inhabit the refuge with the loss of marsh habitat.

Strategies:

- Maintain approximately 30 acres of the marsh that have already been restored by subjecting the area to prescribed fires every 3 to 5 years.
- Monitor vegetation and ground/surface water conditions to evaluate habitat maintenance techniques.
- Restore remaining acreage of the marsh utilizing mechanical clearing and prescribed burning to expand the total Remnant Marsh to 250 acres.

Program: Hydrologic Management

Rationale for Program: The 150 miles of ditches constructed since 1760 have created a drier forested wetlands system, resulting in significant ecological changes. Reversing this drying trend by slowing the rate of drainage supports the refuge mission of "protecting and perpetuating" the ecosystem. These efforts support refuge operations to implement prescribed burning, reduce the probability of ground fires and catastrophic wildfires, and improve brood habitat for wood ducks. Moreover, Congress recognized the importance of conserving water for the proper stewardship of the Great Dismal Swamp by directing in the refuge's establishing legislation that the operation of the Dismal Swamp Canal could not adversely affect the refuge.

Objective: Maintain and/or restore hydrologic conditions to sustain or improve viability of wetland communities and their associated wildlife species.

Rationale for Objective: Water conservation and manipulation is required to support the ecosystem restoration mission. Restoring

seasonal flooding of forests supports nesting and brood habitat for migratory waterfowl (e.g. wood ducks). Monitoring surface flooding conditions to assure that conditions are favorable to ground foraging neotropical migratory birds supports refuge and agency objectives. Maintaining higher ground water levels within Atlantic white cedar forest supports restoration and maintenance of this rare habitat.

Strategies:

- Conserve water to restore natural hydrologic conditions within areas where cypress, maple, and gum are the dominant habitats.
- Monitor surface flooding conditions to assure that surface flooding does not interfere with ground-foraging neotropical migratory birds.
- Maintain ground-water levels within one foot of the surface within Atlantic white cedar stands.

Water Management. *Refuge staff makes adjustments to water control structures as needed to inhibit flood damage to refuge roads. USFWS.*

Objective: Maintain and operate water control structures to support flood control and fire management operations.

Rationale for Objective: Water handling and conservation capabilities support prescribed fires and fire suppression operations.

Strategies:

- Adjust water control structures as needed to inhibit flood damage to refuge roads.
- Promote research and survey partnerships with research institutions, Corps of Engineers, and other government organizations to improve basic knowledge and interpretation of the refuge watershed.
- Cooperate with adjacent landowners along the Pasquotank River to allow proper operation and maintenance of the Newland flood-control dike.
- Assure that refuge water conservation measures do not result in flooding of adjacent neighboring private property.
- Continue current cooperative arrangement with the Corps of Engineers in which water release from Lake Drummond ceases at 15.75 MSL.
- Maintain water levels in ditches to support fire suppression and prescribed fire needs.
- Maintain water levels in ditches to support fire management needs in pine forests and red-cockaded woodpecker recovery areas.
- Support efforts to restore natural surface flow in those areas where off-refuge developments (e.g. US Highway 158, Norfolk-Southern Railroad) create abnormally wet conditions.
- Add water control structures to the Portsmouth/East Ditch

watersheds if needed to implement prescribed burning operations within pine forests north of Lake Drummond that will restore and maintain fire-dependent habitats.

- Remove beavers and nutria, using lethal means, when habitat damage or interference with water management strategies (e.g. flooding private property) is detected.
- Control invasive plant species if major infestations are detected in waterways and marshes.
- Develop GIS surface flooding models to provide continuous assessment of water management strategies on wildlife populations and habitat conditions.

Program: Fire Management

Rationale for Program: Fire is known to have been an important natural force in maintaining natural habitat diversity within the refuge ecosystem. Fires that were ignited by humans and lightning created clearings that allowed different species of plants to flourish and maintained forest stands of varying ages. Fires also created depressions in the organic soils that evolved into marshes, bogs, and lakes. Prescribed burning activities reintroduces fire to the refuge ecosystem, creating habitat diversity that supports the basic mission of the refuge to "protect and perpetuate" the ecosystem; agency objectives to provide habitat for migratory waterfowl and neotropical migratory birds; and the agency objectives for endangered species recovery. Fire detection/suppression and hazard-reduction burning operations reduce the probability of long lasting catastrophic wildfires that would threaten human health and property surrounding the refuge.

Fire Management. *Fire is known to have been an important natural force in maintaining natural habitat diversity within the refuge ecosystem. Prescribed burn. USFWS.*

Objective: Maintain current capabilities to detect and suppress wildfires.

Rationale for Objective: Fire detection/suppression operations reduce the probability of long-lasting catastrophic wildfires that would threaten human health and property surrounding the refuge. Major highways, three airports, and considerable residential and commercial properties would be threatened if fires escaped from the refuge. Lightning from summer thunderstorms ignite most refuge wildfires, so most wildfires occur when surface and ground water conditions are

favorable for ground fires of long duration. Long-lasting peat fires have been known to emit smoke for months and reduce air quality for lengthy periods of time. Early detection/suppression of fires reduces the chances of large fires developing; thus, reducing suppression time and expenses.

Strategies:

- Maintain 80-100 miles of roads to support fire suppression access for the refuge and Dismal Swamp State Natural Area.
- Utilize lightning detection services and aerial surveys to detect wildfires during periods of high fire probability.
- Establish and maintain cooperative agreements with state and local fire suppression agencies to support fire detection and suppression.
- Acquire additional access easements near the North Ditch and Corapeake Ditch to improve emergency access to isolated portions of the refuge.

Objective: Implement hazard reduction prescribed burning within areas that are designated by national fire management parameters.

Rational for Objective: Hazard reduction prescribed burning reduces the amounts of fuels in the forest. This would reduce the probability of major fires of long duration, which are difficult and expensive to suppress, as well as pose a greater threat to human health and private property.

Strategies:

- Implement hazard reduction burns within designated areas.
- Participate in wildlands urban interface programs that support reduction of fuel accumulations and development of fire breaks where off-refuge development and smoke-sensitive locations are threatened by refuge wildfires.

Goal 2: (Trust Resources/ Wildlife Species) **Protect and enhance Service trust resources and other significant species.**

Program: Red-cockaded Woodpecker Reintroduction

Rationale for Program: The red-cockaded woodpecker (RCW) is listed as "endangered" on the Federal endangered species list. This species is known to have once existed within mature pine forests within the refuge, and small colonies have been discovered in southeastern Virginia and northeastern North Carolina. Woodpecker biologists have determined that the refuge's pine forests hold considerable potential for red-cockaded woodpecker foraging and nesting habitat and the refuge has been identified as a possible RCW recovery site. Habitat management required for the recovery effort will support the basic refuge mission of ecosystem restoration and enhancement. The woodpecker favors mature pine forest with relatively open understory maintained by frequent fires.

Approximately 2,000 acres of pine/pocosin habitat within the refuge along the Virginia/North Carolina border have been identified as potential woodpecker habitat. A combination of mechanical clearing and prescribed burning will be required to restore and maintain this habitat. This portion of the refuge has an adequate road and ditch system to support equipment access and water transport capabilities to support the habitat restoration operations. Additional potential habitat exists within pine forests on the Dismal Swamp State Natural Area and on the refuge north of Lake Drummond, but these areas are problematic for inclusion into an aggressive prescribed fire program. The state natural area contains significant fuel accumulations due to the exclusion of fires for decades, and some of the area's access roads may require extensive repairs before they can support access for fire equipment. The pine forests north of Lake Drummond may also require road rehabilitation to provide adequate access for fire equipment. In addition, urban interface issues (Norfolk/Southern Railroad, Hampton Roads Regional Airport, US Highway 58/460, commercial/residential development) along the refuge's northern boundary increase the complexity of prescribed burning in these forests.

Objective: Re-introduce a viable population of red-cockaded woodpeckers into appropriate refuge habitat.

Strategies:

- Implement mechanical clearing and prescribed burning to restore habitat in the designated area of approximately 2,000 acres appropriate for red-cockaded woodpeckers.
- Translocate red-cockaded woodpeckers from suitable donor population into designated area of the refuge.
- Promote the Safe Harbor program to engage private landowners in recovery efforts.
- Install artificial nesting cavities to support woodpecker nesting.

Program: Neotropical Migratory Birds

Rationale for Program: The large blocks of contiguous forests attract nearly 100 species of neotropical migratory birds to seasonally inhabit the refuge, and nearly 70 species to nest within the refuge. Atlantic coast populations of neotropical migrants are generally declining due to the loss of habitat. The refuge, however, is one of the few areas where populations are stable. The large populations and number of species of neotropical migratory birds make the refuge an ideal location to support long-term monitoring and studies of these species. Neotropical banding has been ongoing for decades within the refuge, and the Smithsonian Institution has been tracking nesting activities for neotropical migrants, particularly the Swainson's warbler, since 1990.

Objective: Provide basic monitoring and survey support for neotropical migratory bird populations to regularly assess status of refuge populations.

Rationale for Objective: Surveys provide some indications on the status of neotropical migrants within the refuge as well as the mid-Atlantic region of the United States. In addition, these surveys provide feedback that can be useful in adjusting refuge habitat management operations to support neotropical migratory birds.

Strategies:

- Develop and support partnerships with the Smithsonian Institution, state wildlife agencies, Natural Heritage programs, and other research institutions to monitor neotropical migrant populations and habitat preferences.
- Support banding partnerships for neotropical migrants.
- Adjust water management and other refuge habitat management

operations to enhance habitat for neotropical migrants, particularly Swainson's warbler.
- Develop surface flooding and successional models using GIS technology to evaluate habitat conditions that affect neotropical migratory birds.

Objective: Establish a neotropical migratory bird "focus area" by 2019, in which to focus habitat management and modeling, population surveys, and education and interpretation related to neotropical migratory bird populations.

Rationale for Objective: Annual surveys for the Swainson's warbler have been accomplished since the 1960's in the northwestern quadrant of the refuge. Therefore, these surveys actually predate the establishment of the refuge and provide a solid base of data with which to measure population trends and population response to habitat changes. By focusing on a portion of the refuge where considerable data exist, habitat management and monitoring techniques can be refined and be used to identify other areas of the refuge where maximizing neotropical migratory bird population density is feasible.

Strategies:
- Establish a neotropical migratory bird focus area near Jericho Lane.
- Develop clearings of 5-10 acres using tree-girdling or small clear-cuts to establish foraging areas for neotropical migratory birds.
- Develop a trail to one of the habitat management areas to enhance interpretive and educational opportunities for neotropical migratory birds.
- Work with Partners in Flight to promote research, education, and management of migratory birds on the refuge.

Waterfowl Management. *The seasonally flooded forest provides brood habitat for wood ducks. Wood duck. Waverley Traylor.*

Program: Waterfowl Management

Rationale for Program: The large blocks of seasonally flooded forest provide natural cavities for wood duck nesting. Remnant marshes and bogs as well as the man-made ditches provide brood habitat for wood ducks. Lake Drummond provides resting habitat for estimated peak populations of 10,000-15,000 wintering tundra swans and snow geese that feed on agricultural fields within the refuge watershed.

Objective: Insure conditions for breeding and wintering waterfowl currently using the refuge are maintained.

Rationale for Objective: Waterfowl surveys have proven that the refuge provides significant nesting habitat for wood ducks and can support significant winter populations of swans and geese.

Strategies:

- Monitor and maintain existing marsh and bog restoration sites to support brood habitat for wood ducks.
- Monitor and manage public access to Lake Drummond to allow the area to be used by wintering tundra swans and snow geese.

Objective: Promote the protection and restoration of 7,000 acres of prior-converted farmland to maintain feeding habitat for wintering waterfowl.

Black Bear Management. *Off-site development may eventually create a genetically islocated black bear population. American Black Bear. Waverley Traylor..*

Rationale for Objective: Development pressures threaten to convert much of the farmland along the refuge's eastern boundary to other uses; thus eliminating these feeding areas for wintering swans and geese.

Strategies:

- Support efforts by The Nature Conservancy, Virginia Department of Game and Inland Fisheries, and other organizations to protect farmlands that are used by waterfowl from development.
- Evaluate the need to expand the refuge acquisition boundary to acquire those farmlands where public ownership would enhance their protection and restoration for waterfowl habitat.

Program: Black Bear Management

Rationale for Program: The refuge contains one of the largest concentrations of black bears on the east coast of the United States. This large bear population, however, exists within an area that is surrounded by considerable commercial and residential development as well as major highways. The continued development of off-refuge lands has decreased the amount of bear habitat surrounding the refuge. Increased traffic along existing highways and highway improvements along the refuge perimeter may eliminate natural corridors through which bears now traverse to other areas of habitat within the refuge watershed. These developments create potential for increased nuisance bear issues, as bears visit residential areas, disrupt traffic, and increase crop depredation. Moreover, the off-refuge development may eventually result in a genetically isolated black bear population.

The continued loss of habitat and corridors outside the refuge increases

the value of the refuge as stable bear habitat over time. There is a need to maintain the local bear population at a healthy level in relation to the rapidly changing landscape. Due to this concern, collaboration with biologists from the Virginia Department of Game and Inland Fisheries and the North Carolina Wildlife Resources Commission began in 1997 to assess the status of bear populations within the refuge watershed and determine the desirability to controlling the refuge bear population. These collaborations led to planning a two-day recreational hunt in late November or early December that would be conducted to assure no significant reduction of the bear population. This hunt would provide a wildlife-oriented recreational opportunity as well as provide the refuge with information on the physical parameters of the bear population. Thus, the refuge completed compatibility determinations and added "black bears" to the current big game hunting program on the refuge in 1998.

The black bear is symbolic, in the view of the public, of the wildlife associated with the Great Dismal Swamp NWR ecosystem. The habitat and large size of the refuge means that the refuge will likely always contain a large black bear population. Therefore, an expectation exists for the refuge to have significant stewardship responsibilities for this highly visible bear population.

Objective: Maintain a black bear population that is viable and within the carrying capacity of the refuge.

Strategies:

- Continue to monitor black bear populations in cooperation with the state wildlife agencies and research/educational institutions to provide adequate demographic data to guide habitat and bear population management decisions on the refuge.
- Provide sites for emergency relocations of black bears in partnership with state wildlife management agencies.
- Work with states to acquire data on bears harvested under crop depredation permits, bear hunting and road kills.
- In partnership with the states and non-governmental organizations, seek funding to conduct studies to compliment previous refuge bear research that focuses on the demography of black bears, their genetics, population size, growth and dispersal patterns.
- Cooperate with state wildlife management agencies in developing and implementing emergency response to nuisance bears and enhancing educational outreach related to bears within the refuge watershed.
- Initiate limited recreational bear hunting on the refuge (See Goal 4 / Public Use/ Hunting Opportunities).

Goal 3: (Land Protection) **Provide protection and restoration of those areas within the Great Dismal Swamp ecosystem that are remnants of the Great Dismal Swamp and/or are restorable to Great Dismal Swamp habitat while providing support to the protection and restoration of all its components and adjacent habitats that directly affect the vitality and viability of the ecosystem.**

Program: Habitat Protection and Restoration

Rationale for Program: In 1972, the Dismal Swamp Study Act (P.L. 92-478) directed the Secretary of the Interior to study the desirability and feasibility of protecting and preserving the Great Dismal Swamp and Dismal Swamp Canal. Initially, a 210,000-acre study area was delineated to be considered for protection and restoration, and the Secretary ultimately recommended that approximately 123,000 acres be acquired by state and federal agencies for protection and stewardship. Over the past three decades, much of the land that was excluded from recommended public ownership has been developed and converted to other uses. This loss of habitat poses serious adverse ramifications for the refuge and surrounding communities. First, the loss of wildlife corridors threaten to make the refuge an ecological isolate, thus threatening the health of wildlife populations and decreasing "societal carrying capacities" for some wildlife populations such as black bear. Second, the refuge has arguably become the largest urban wildlife refuge in the United States, as nearby development now supports a neighboring human population of 1.6 million people. This adjacent human population and development complicates the habitat restoration mission of the refuge, since ecosystem perpetuation will involve hydrologic restoration and aggressive fire management that could potentially affect refuge neighbors. Finally, the continued development of historic "Great Dismal Swamp" habitat threatens the quality of life for humans within the watershed through the development of flood-prone areas where hydrologic disruption is significant, by a reduction of air and water quality, and by the loss of open space.

The protection and restoration of the remaining restorable habitats would mitigate trends of creating an ecologically isolated refuge and creating societal carry capacities for refuge wildlife populations,

thus maintaining a higher quality of life for citizens in neighboring communities.

Objective: Pursue the protection and restoration of historic Great Dismal Swamp habitat within the refuge ecosystem, focusing on the area identified within the original 210,000 acre study area.

Strategies:

- Acquire the remaining properties within the current acquisition boundary when they are offered by willing sellers (approximately 4,000 acres).
- Cooperate and support efforts by neighboring cities and counties to restore and protect key remnants of restorable Great Dismal Swamp habitat outside the refuge acquisition boundary.
- Collaborate with and provide technical assistance to cities and counties when they are reviewing development proposals adjacent to the refuge and within the historic range of the Great Dismal Swamp.
- Promote the maintenance of key wildlife corridors by recommending appropriate wildlife passages be incorporated into highway designs.
- Partner with The Nature Conservancy, state wildlife agencies, and other non-government organizations to protect and restore seasonally flooded areas within the refuge watershed.
- Promote hydrologic restoration when opportunities develop (e.g. US Highway 158, Norfolk and Southern Railroad, Dismal Swamp Canal).
- Resolve boundary disputes, post the refuge boundary, and patrol/inspect the boundary to detect encroachment on the refuge and criminal activities.
- Cooperate and support protection of 7,000 acres of prior-converted farmland east of the refuge for the purpose of restoring early successional habitat for waterfowl and other wildlife management needs within the watershed.
- Cooperate and support protection of 15,000 acres of seasonally flooded forests south of US Highway 158 to expand habitat for neotropical migratory birds, red-cockaded woodpeckers, and black bears, as well as restore surface hydrology.
- Develop sound working relationships with adjoining, nearby neighboring and other key landowners within the ecosystem to protect the integrity of the refuge boundary and further the protection of the ecosystem.

Habitat Protection. *Promote the maintenance of key wildlife corridors by recommending appropriate wildlife passages be incorporated into highway designs. US Hwy 17. USFWS.*

Goal 4: (Public Use) **Establish a public use program that will encourage awareness, understanding, appreciation and stewardship of the Great Dismal Swamp NWR ecosystem while complementing the refuge resource management objectives.**

In 2002, an estimated three-million people visited the Virginia Beach/ Hampton Roads area. Nearby Colonial Williamsburg, in Williamsburg, Virginia, sold over 929,000 admission tickets to visitors. Several million more visited the Outer Banks of North Carolina, located just to the southeast of the refuge. These areas represent just a few of the locations refuge visitors stay or report visiting when they visit the Great Dismal Swamp NWR.

Public use staff will grow to accommodate the increase in facilities and services. Some facilities will be open seven days a week. This expansion of services will increase the refuge's visibility as one of the area's premier tourist destinations. With the additional staff and facilities, the refuge and the Service's message will reach a wider, more diverse audience. At the same time, wildlife resources within the refuge will be protected through a focus of visitor experiences in specific locations.

Program: Hunting Opportunities

Rationale for Program: Hunting is one of the six priority wildlife-dependent recreational uses of the National Wildlife Refuge System, as stipulated in the Refuge Improvement Act of 1997. By providing wildlife-dependent recreational opportunities, like hunting, helps foster an appreciation for wildlife and an understanding of the importance of stewardship for the environment and our renewable natural resources.

There are limited public hunting opportunities in southeastern Virginia and northeastern North Carolina. By continuing to allow hunting on the refuge, additional hunting opportunities are provided to the surrounding community.

The refuge has been deer hunting on the refuge since 1979. In 1998 a Compatibility Determination was completed and black bear hunting was added to the big game hunting program. This bear hunt has not yet been implemented. Our proposal is to implement this bear hunt as a component of this Plan.

Figure 4-1

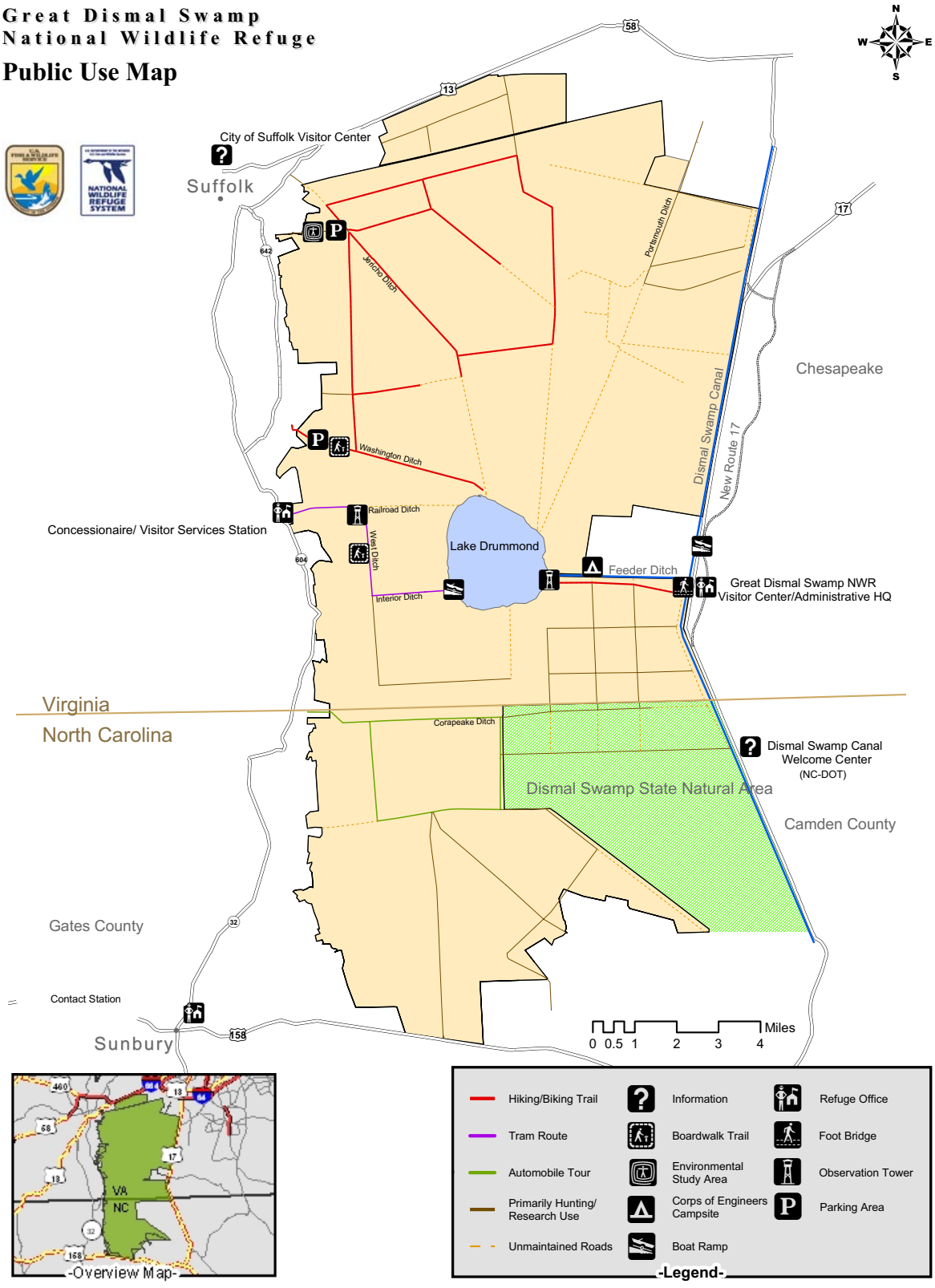

Great Dismal Swamp
National Wildlife Refuge
Public Use Map
N
W
E
S
City of Suffolk Visitor Center
Suffolk
58
13
17
642
Jericho Ditch
Portsmouth Ditch
Chesapeake
Dismal Swamp Canal
New Route 17
Washington Ditch
Railroad Ditch
Concessionaire/ Visitor Services Station
Wes Ditch
604
Lake Drummond
Feeder Ditch
Interior Ditch
Great Dismal Swamp NWR
Visitor Center/Administrative HQ
Virginia
North Carolina
Corapeake Ditch
Dismal Swamp Canal
Welcome Center
(NC-DOT)
Dismal Swamp State Natural Area
Camden County
Gates County
32
Contact Station
158
Sunbury
0 0.5 1 2 3 4
Miles
-Overview Map-
460
64
13
68
17
VA
NC
-Legend-
Hiking/Biking Trail
Tram Route
Automobile Tour
Primarily Hunting/
Research Use
Unmaintained Roads
Information
Boardwalk Trail
Environmental
Study Area
Corps of Engineers
Campsite
Boat Ramp
Refuge Office
Foot Bridge
Observation Tower
Parking Area

Figure 4-2

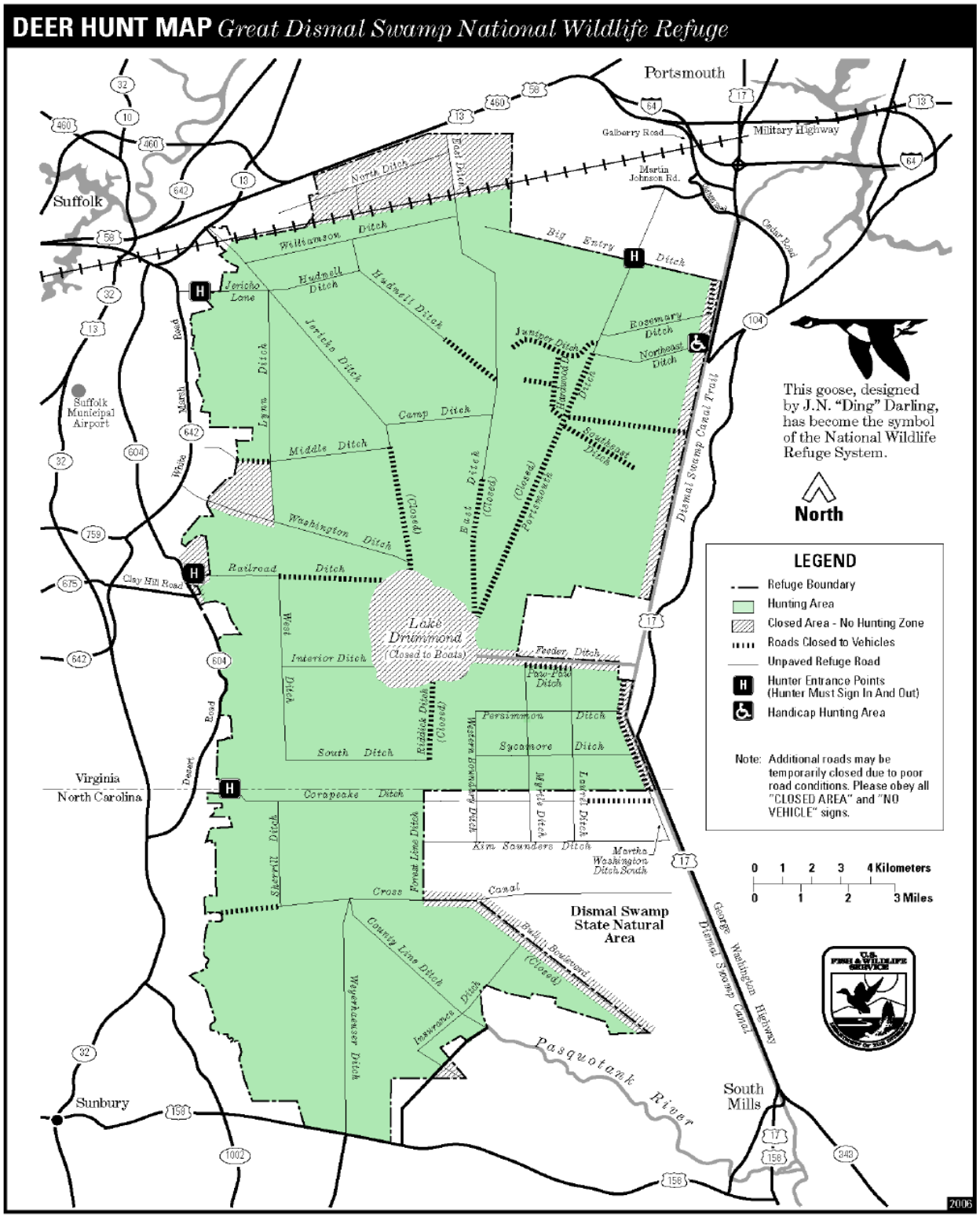
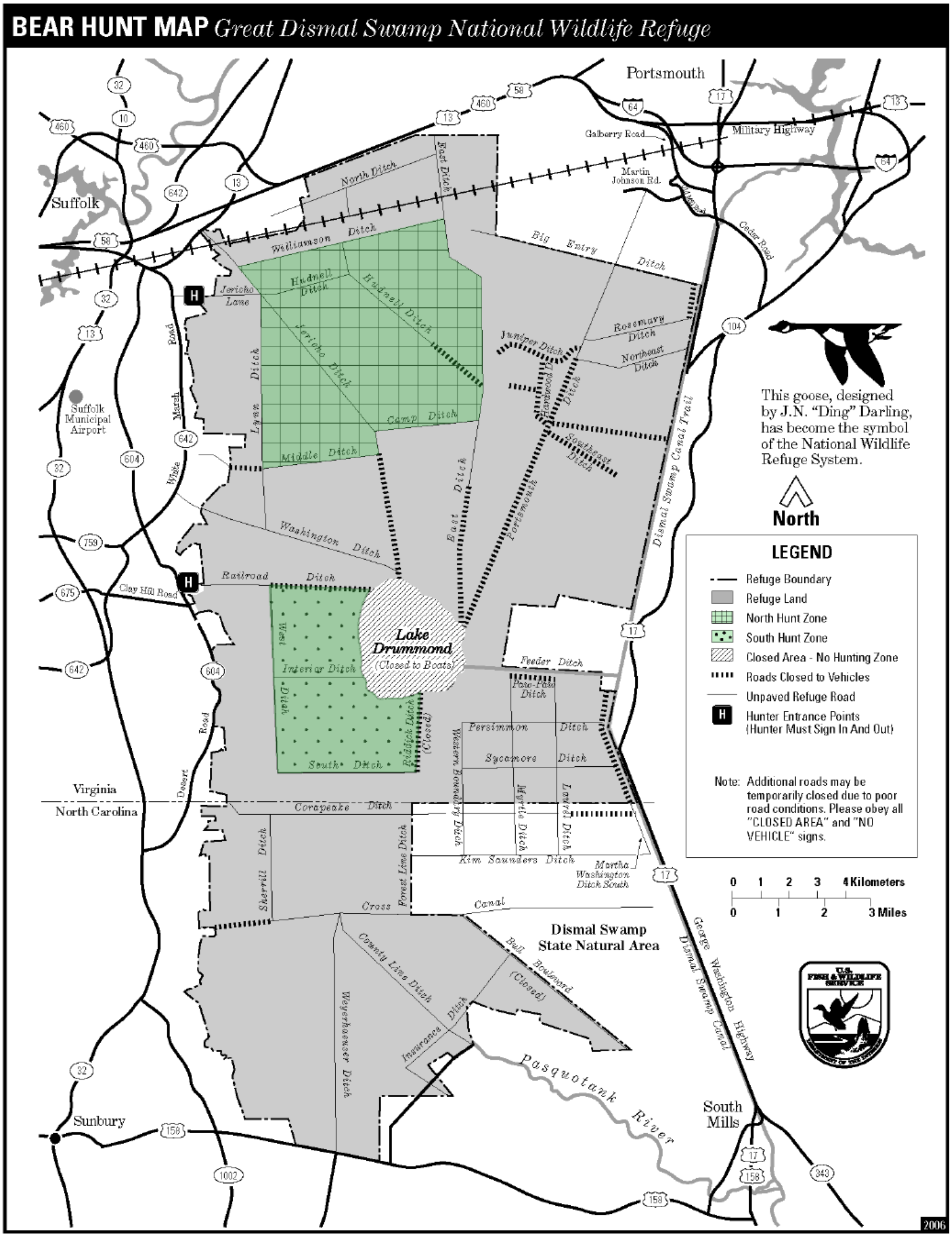

DEER HUNT MAP Great Dismal Swamp National Wildlife Refuge
Portsmouth
Suffolk
Galberry Road
Military Highway
Martin Johnson Rd.
Cedar Road
Big Entry Ditch
Williamson Ditch
Hudnell Ditch
Jericho Lane
Jericho Ditch
Lynn Ditch
Camp Ditch
Middle Ditch
Washington Ditch
Railroad Ditch
Clay Hill Road
Suffolk Municipal Airport
Juniper Ditch
Rosemary Ditch
Northeast Ditch
Dismal Swamp Canal Trail
This goose, designed by J.N. "Ding" Darling, has become the symbol of the National Wildlife Refuge System.
North
LEGEND
Refuge Boundary
Hunting Area
Closed Area - No Hunting Zone
Roads Closed to Vehicles
Unpaved Refuge Road
Hunter Entrance Points (Hunter Must Sign In And Out)
Handicap Hunting Area
Note: Additional roads may be temporarily closed due to poor road conditions. Please obey all "CLOSED AREA" and "NO VEHICLE" signs.
Lake Drummond (Closed to Boats)
Interior Ditch
South Ditch
Feeder Ditch
Persimmon Ditch
Sycamore Ditch
Corapeake Ditch
Forest Line Ditch
Sherrill Ditch
Cross Canal
Dismal Swamp State Natural Area
Bells Boulevard (Closed)
County Line Ditch
Weyerhaeuser Ditch
Pasquotank River
South Mills
Sunbury
Virginia
North Carolina
Dismal Swamp Canal
George Washington Highway
0 1 2 3 4 Kilometers
0 1 2 3 Miles
2006

Figure 4-3


BEAR HUNT MAP Great Dismal Swamp National Wildlife Refuge
Portsmouth
Suffolk
Suffolk Municipal Airport
Galberry Road
Military Highway
Martin Johnson Rd.
Cedar Road
North Ditch
East Ditch
Williamson Ditch
Big Entry Ditch
Jericho Lane
Hudnell Ditch
Jericho Ditch
Lynn Ditch
Camp Ditch
Middle Ditch
Rosemary Ditch
Northeast Ditch
Juniper Ditch
Southeast Ditch
Portsmouth Ditch
Washington Ditch
Railroad Ditch
Clay Hill Road
White Marsh Road
Dismal Swamp Canal Trail
Lake Drummond
(Closed to Boats)
West Ditch
Interior Ditch
South Ditch
Riddick Ditch (Closed)
Feeder Ditch
Paw-Paw Ditch
Persimmon Ditch
Sycamore Ditch
Western Boundary Ditch
Myrtle Ditch
Laurel Ditch
Desert Road
Virginia
North Carolina
Corapeake Ditch
Sherrill Ditch
Forest Line Ditch
Kim Saunders Ditch
Martha Washington Ditch South
Cross Canal
Dismal Swamp State Natural Area
County Line Ditch
Bull Boulevard (Closed)
Insurance Ditch
Weyerhaeuser Ditch
Pasquotank River
George Washington Highway
Dismal Swamp Canal
South Mills
Sunbury
This goose, designed by J.N. "Ding" Darling, has become the symbol of the National Wildlife Refuge System.
North
LEGEND
Refuge Boundary
Refuge Land
North Hunt Zone
South Hunt Zone
Closed Area - No Hunting Zone
Roads Closed to Vehicles
Unpaved Refuge Road
Hunter Entrance Points (Hunter Must Sign In And Out)
Note: Additional roads may be temporarily closed due to poor road conditions. Please obey all "CLOSED AREA" and "NO VEHICLE" signs.
0 1 2 3 4 Kilometers
0 1 2 3 Miles
2006

Objective: Provide a safe, quality big game hunt program and promote special hunting opportunities on the Great Dismal Swamp NWR.

Strategies:

- Provide an annual deer hunt program for archery and shotgun in designated areas of the Great Dismal Swamp NWR on designated days in October and November (see figure 4-2).
- Provide an annual black bear hunt program in designated areas of the Virginia portion of the Great Dismal Swamp NWR on designated days in November and December (see figure 4-3).
    - Bear hunting parameters may be adjusted annually based on changing conditions and data. The initial hunt will be administered within the following guidelines:
        1. Up to two entrances will be designated for the hunt, which will make up less than 25% of the potential hunting area of the refuge. A maximum of 100 permits will be issued.
        2. The hunt will be a maximum of two days.
        3. The harvest limit will be approximately 20 bears. If 10 or more bears are killed the first day, various parameters will be evaluated and the second hunt day may be cancelled.
        4. As with the deer hunt, no dogs will be used to hunt bears.
- Coordinate with special needs organizations to identify ways to provide better hunting access for people with disabilities.
- Host an annual hunter safety program at the refuge.
- Provide for youth hunting opportunities.

Boating and Fishing Access. *Many groups travel to Lake Drummond via the Dismal Swamp Canal/Feeder Ditch route. Chesapeake Public boat ramp on US Hwy 17. USFWS.*

Program: Boating and Fishing Access

Rationale for Program: Fishing is one of the six priority wildlife-dependent recreational uses of the National Wildlife Refuge System, as stipulated in the Refuge Improvement Act of 1997.

Fishing on Lake Drummond is allowed year-round during daylight hours when accessed via the Feeder Ditch on the east side of the refuge (1000 lb. limit). Utilizing a boat rental concessionaire, the Railroad Ditch entrance on the west side of the refuge would provide year-round access for boating and fishing on both sides of the refuge. In addition to concessionaire rentals, a fishing permit will be available April 1 through June 15 to allow access for private fishing boats (25 horsepower limit) to enter Lake Drummond by the Interior boat ramp.

Objective: Provide access to Lake Drummond for fishing and boating year round.

Strategies:

- Lake Drummond is open for boating and fishing during daylight hours, access via Feeder Ditch, year round.
- Continue to provide a fishing season permit, for April 1 to June 15, to Lake Drummond, access via Interior Ditch Road, during daylight hours.
- Promote fishing in southeastern Virginia and northeastern North Carolina by partnering with local municipalities and other organizations for off-site fishing events.
- Recruit and contract a private company to maintain a fleet of canoes/kayaks for rent.
- Provide guided canoe/kayak interpretive tours through the concessionaire.
- Develop in partnership with private or non-profit group a through swamp canoe/kayak trail along Washington Ditch-Lake Drummond-Feeder Ditch-Dismal Swamp Canal.

Environmental Education. *Educators will be encouraged to use the refuge for wildlife oriented outdoor classrooms. Filming of refuge educational video. USFWS.*

Program: Environmental Education

Rationale for Program: Environmental education is one of the six priority wildlife-dependent recreational uses of the National Wildlife Refuge System, as stipulated in the Refuge Improvement Act of 1997.

As our population increases, understanding its impact on the natural world is becoming increasingly more important for both our quality of life and our economy. More and more people are removed from the natural world in their daily lives and understand it less. In addition to those audiences served under current management, in this plan, the focus will be expanded to include the southeastern Virginia and northeastern North Carolina region, reaching both rural, agricultural-based, and urban communities.

Whether it was early efforts to drain the swamp, the establishment of the Dismal Swamp Canal and canal life, or runaway slaves hiding in the swamp, the Great Dismal Swamp is deeply embedded in Virginia and North Carolina history. The swamp's ecosystem contributed greatly to the history of the region. Details of this cultural contribution will be a part of the refuge's educational programs along with the biological aspects of the ecosystem.

Objective: Provide a quality comprehensive environmental education program to the Hampton Roads and northeastern North Carolina region

that incorporates the U.S. Fish & Wildlife Service message, the cultural and natural history of the Great Dismal Swamp , the impact of man on the environment, and the resource management practices used by the refuge staff to protect and preserve the Great Dismal Swamp NWR.

Strategies:

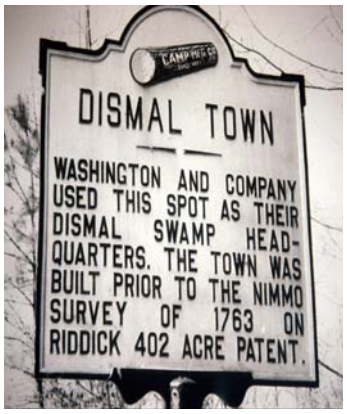
- Continue to offer teacher activity guides and refuge videos for the classroom.
- Outreach to teachers to encourage utilization of the refuge as an outdoor classroom.
- Provide field study equipment and field guides for loan to visiting school trips.
- Continue to participate in environmental education programs in schools.
- Partner with local universities and community colleges to develop and provide training on the Great Dismal Swamp NWR ecosystem utilizing refuge-specific teacher training for those school districts interested in providing professional development credits to their teachers.
- Purchase land and develop the Jericho Lane Education Pavilion.
- Develop other site-specific biological and historical educational media, utilizing the latest technology and in compliance with Virginia and North Carolina state academic standards.
- Present at local, regional, and national education conferences to encourage teachers to discover the Great Dismal Swamp NWR with their students.
- Establish partnerships with local elder-hostel programs.
- Develop and implement a Junior Naturalist program in the region.
- Establish a cooperating agreement with the region's school systems to provide specific environmental education programs which incorporate refuge-specific service learning activities.
- Establish a library and resource center for teachers and students.
- Utilize the latest technology to share the refuge environmental education program with those unable to visit.

Program: Interpretation

Rationale for Program: Interpretation is one of the six priority wildlife-dependent recreational uses of the National Wildlife Refuge System, as stipulated in the Refuge Improvement Act of 1997.

The Great Dismal Swamp is an integral part of the natural and cultural heritage of the region. The swamp's role in the timber industry from the 18th to the 20th century and its role in the Underground Railroad

are well documented, not to mention the establishment of the Dismal Swamp Canal and canal life. The Hampton Roads/Virginia Beach/Outer Banks region swells with tourists every year. In 2002, Virginia Beach estimated over 3 million visitors to the area. Colonial Williamsburg, approximately one-hour north of the refuge, identified over 929,000 ticketed visitors and countless numbers of people who did not purchase a ticket.



Interpretation. *Cultural history interpretation to include programs focused on human impact on the swamp.*
Dismal Town marker, Washington Ditch Trail. USFWS.

The Outer Banks, in North Carolina, also receives millions of visitors every year. Many of these people either travel past the refuge on their way to Virginia Beach, Colonial Williamsburg or the Outer Banks, or seek out the refuge. According to the North Carolina Department of Transportation, over 16,000 vehicles each day pass through the intersection of US Highway 158 and Rt. 32 in Sunbury, North Carolina. The Dismal Swamp Canal Welcome Center located on US Highway 17 in North Carolina estimates their visitation from 400,000 – 600,000 each year since their opening in 1989. The Center is located on a four lane portion of the highway, but a dangerous two lane section just to the north in Virginia is currently being re-aligned and improved to four lanes. At the completion of the road project, a significant increase in vehicle volume is anticipated.

The refuge will establish a visitor facility on the newly re-aligned US Highway 17, a major access way to Virginia Beach, Hampton Roads and the Outer Banks, and will be incorporated into the Dismal Swamp Canal Recreational Trail being developed by the City of Chesapeake, Virginia. The environmentally-friendly designed facility will include interactive exhibits about the Great Dismal Swamp NWR and the ecology of the region. The facility will inspire visitors to get out onto the refuge. Through coordination with the Army Corps of Engineers to provide access across the Dismal Swamp Canal, the refuge will establish a 3-mile hiking trail along the Feeder Ditch to Lake Drummond. This will make ground access to the refuge from the eastern boundary possible, a new access route about which many people inquire.

Additional staff will provide more opportunities for both on-site and off-site personal interpretation. Interpretive experiences, including guided walks, special events and festivals, display panels, exhibits and other programs will assist refuge visitors to become oriented to the trails of the refuge, and assist members of the community to understand the natural and cultural role of the swamp and man's impact on the environment.

Interpretive programming will be offered every weekend and include collaborative efforts with other museums and organizations. Gateway facilities (such as contact stations or kiosks), established along major transportation routes and near the "corners" of the refuge, such

as Sunbury and Camden, North Carolina, and the cities of Suffolk and Chesapeake, Virginia, will provide further orientation to visitors traveling around the refuge and looking for the entrances to such a vast area. Program and refuge marketing will extend beyond the immediate boundaries and into Norfolk, Virginia Beach, and the Colonial Williamsburg/Jamestown areas in Virginia, and to Elizabeth City and the Outer Banks in North Carolina.

Objective: Provide quality interpretive experiences to the southeastern Virginia/northeastern North Carolina region, designed to increase awareness, understanding and support for the swamp's unique ecosystem and its role in the cultural landscape of the region and country, and the refuge's resource management practices.

Strategies:

- Produce and provide refuge publications on general refuge information and current issues.
- Provide year-round interpretive programs at several key locations around the refuge, in both North Carolina and Virginia.
- Expand natural history interpretation to include programs focused on resource management issues such as fire, Atlantic white cedar, red cockaded woodpeckers, bears and other urban conflicts of importance to the swamp ecosystem.
- Expand cultural history interpretation to include programs focused on the human impact on the swamp, timber and economic resources of the swamp, the Underground Railroad, and the Dismal Swamp Canal.
- Host annual events highlighting conservation celebrations such as International Migratory Bird Day, National Wildlife Refuge Week, National Public Lands Day and the Great Dismal Swamp NWR anniversaries.
- Update and maintain interpretive panels, boardwalks, and kiosks at Washington Ditch and Jericho Lane.
- Update and maintain interpretive panels and kiosks on Railroad/ West/Interior Trail and Feeder Ditch Trail.
- Develop and maintain kiosk at Dismal Swamp Canal Welcome Center.
- Develop auto tour route along Corapeake, Sherrill, Cross and Forest Line Ditches to highlight the Atlantic white cedar and other forest-related issues.
- Contract a concessionaire to provide interpretive boat tours on Lake Drummond.
- Partner with the City of Suffolk to develop Great Dismal Swamp NWR exhibits for their visitor center.
- Develop interpretive exhibits and programs for the US Highway

17 complex to serve both the refuge's North Carolina and Virginia communities and the visiting public.
- Develop interpretive exhibits for the Jericho Lane Pavilion.
- Develop and produce interpretive materials for handouts.
- Develop interpretive exhibits and programs for a contact station at Sunbury, North Carolina, to orient visitors traveling east toward Virginia Beach and the Outer Banks.

Program: Wildlife Observation and Wildlife Photography

Wildlife Observation. *Refuge trails provide opportunities for visitors to view, photograph, and appreciate wildlife in the habitat.* USFWS.

Rationale for Program: Wildlife observation and wildlife photography are two of the six priority wildlife-dependent recreational uses of the National Wildlife Refuge System, as stipulated in the Refuge Improvement Act of 1997.

The Great Dismal Swamp NWR is a wonderful place to observe and photograph wildlife; however, it is also very large which can provide an obstacle in getting to some of the more picturesque locations. The refuge will contract a concessionaire to provide interpretive boat and tram tours, and bicycle and boat rentals to refuge visitors allowing them easier access to the refuge. This access will be focused on specific trails to ensure limited wildlife and habitat impact.

An additional hiking trail will be developed along the Feeder Ditch leading to Lake Drummond. An interpretive auto tour route will be established along Corapeake/Sherrill/Cross/Forest Line Ditches to highlight the Atlantic white cedar and other forest-related refuge issues.

Objective: Provide opportunities for refuge visitors to view, photograph, and appreciate wildlife in the habitat as an effort to promote understanding of the impact of man's footprint on the fragile ecosystem of the Great Dismal Swamp NWR.

Strategies:
- Maintain Washington Ditch Trail and the Lake Drummond observation pier at Washington Ditch.
- Maintain approximately 50 miles of trails for foot or bike touring.
- Continue to provide access permits to nature-based tourism groups and outfitters, such as canoeing and kayaking, as well as local municipalities, to promote wildlife observation.
- Contract a concessionaire to provide canoe/kayak and bicycle rentals and interpretive boat and tram tours, based at the Desert

Road facility (with a satellite at the US Highway 17 visitor facility) using the Railroad/West/Interior Ditch access.
- Develop observation/photography platform at West/Railroad intersection.
- Develop observation deck and trail at old cypress area on West Ditch Road.
- Coordinate with the Army Corps of Engineers to provide year-round water access of Lake Drummond via Feeder Ditch, to develop a foot-bridge system across the Dismal Swamp Canal to access the Feeder Ditch hiking trail, and to accommodate boat tours to Lake Drummond.
- Develop trail along Feeder Ditch to Lake Drummond.
- Develop observation tower on Feeder Ditch Trail overlooking Lake Drummond.
- Using environmentally friendly materials, pave public use access route from White Marsh Road to parking area on Washington Ditch Trail.
- Using environmentally friendly materials, pave public use access route from White Marsh Road to parking area on Jericho Lane.
- As additional visitor facilities are developed, general access for some trails will be restricted to research and hunting only.

Program: Volunteers

Rationale for Program: In all programs volunteers are a valuable asset, bringing a unique element of local history and knowledge and, at times, providing technical assistance to refuge wildlife management activities.

Volunteers. *Volunteers staff Service exhibits at local festivals.* USFWS.

Objective: Provide opportunities for people to donate their time and talents to the refuge, building community support and providing a financial savings to the Service.

Strategies:
- Identify volunteer opportunities and establish "job descriptions" for those opportunities.
- Distribute volunteer internship opportunities to colleges and universities nationally.
- Conduct two volunteer training workshops per year.
- Hold an annual volunteer recognition and appreciation event.
- Expand volunteer recruitment efforts to include local/regional/national levels.
- Develop and implement a Junior Naturalist program to recruit new volunteers.
- Establish RV campsite pads with electric, water and sewer for 2-3 month term volunteers at Sunbury Visitor Contact Station.

Program: Outreach

Rationale for Program: The Williamsburg/Hampton Roads/Outer Banks region is rapidly becoming a densely populated urban area. Its residential population is experiencing some of the most dramatic rates of growth in Virginia. In addition to the services offered at the current level, it is critical that the refuge reach beyond its immediate borders to educate the region on the Great Dismal Swamp NWR ecosystem and on how the activities around the refuge affect the health of the swamp and, in effect, the health of the surrounding communities.

Objective: Coordinate with Virginia and North Carolina state and local partners to participate in community events and provide input on local environmental issues.

Strategies:

- Continue to serve as advisors in regional government conservation planning.
- Continue to work with conservation groups, such as The Nature Conservancy and the Izaak Walton League of America to partner in finding solutions to area environmental issues.
- Continue to share refuge facilities (e.g. conference room at the refuge headquarters) with state and local agencies.
- Offer off-site outreach programs, by request and as staff schedules permit, to local civic and environmental organizations with special emphasis on providing various audiences information about refuge management issues, including forest management, fire management, bear management, and protection of trust resources.

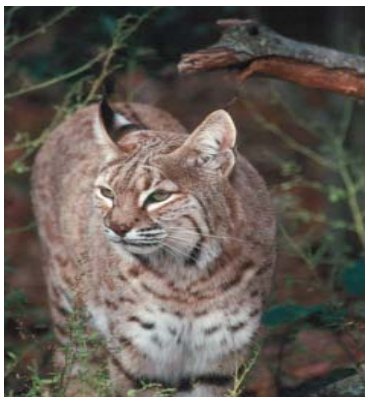
Facilities for Visitor Services

Rationale for Program: Public demand for improved visitor services was unquestionably the dominant issue presented at the public scoping meetings in January, 2002. Moreover, the establishing legislation for the refuge supported the concept of developing a visitor friendly refuge for wildlife-oriented educational and recreational activities. This concept was further corroborated and supported by the "Public Use Development Plan - Great Dismal Swamp National Wildlife Refuge" that was published by the U.S. Fish and Wildlife Service in 1979. Therefore, the vision that calls for developing major facilities for visitor services addresses a public demand, fulfills the legislated direction for the refuge, supports a long-standing agency position, and would

enhance visibility and support for the Great Dismal Swamp National Wildlife Refuge and the National Wildlife Refuge System.

Considering the large size of the refuge and the traveling time required just to traverse the perimeter of the boundary, three locations would be needed for developing adequate visitor service centers. In Suffolk, the present site of the refuge headquarters provides an ideal location to establish a Visitor Service Station to support a variety of concessionaire operated activities, refuge outreach, and distribution of trail and refuge information.

The vision for a concession operation is a business operated by a private enterprise that provides recreational, educational, and/or interpretive enjoyment of our lands and waters for the visiting public. A concession generally provides a public service and generally requires some capital investment by the concessionaire for buildings, boat docks, boats, etc. The establishment of concession operations will help to better facilitate many of the six priority public uses on a large national wildlife refuge.



Wildlife Observation. *Refuge trails provide opportunities for visitors to view, photograph, and appreciate wildlife in the habitat. Bobcat. :Waverley Traylor.*

The building, now too small to meet all staffing needs, is of adequate size to allow appropriate alterations to accommodate considerable increases in visitation. In addition, the headquarters is adjacent to the Railroad Ditch Entrance, making it possible to connect this visitor service complex directly to Railroad Ditch Road, providing a safe route for public transportation to Lake Drummond. This direct road linkage would considerably improve the safety of public access to this area, as the present Railroad Ditch Entrance is located in a blind curve on Desert Road. The conversion of the present administrative headquarters facility would create the need to move staff functions to make room for the visitor services. All other staff functions would be distributed appropriately between the administrative headquarters/Visitor Center Complex on US Highway 17 in Chesapeake, the Field Operations Center at 3216 Desert Road in Suffolk, and the Refuge Visitor Contact Station in Sunbury.

In Chesapeake, the realignment and expansion of US Highway 17 has created an ideal location for a Refuge Visitor Center Complex. Again, this site was previously identified for the same use in the Refuge's 1979 Public Use Plan. The new highway alignment provides an area of approximately 250 acres between the highway and the Dismal Swamp Canal where interpretive and educational facilities would be constructed. Adjacent to this major highway, this location can easily support the attraction of 500,000+ visitors annually. Moreover, considerable public interest exists in providing broader educational opportunities to develop partnerships with the City of Chesapeake, Virginia Department of Game and Inland Fisheries, The Nature Conservancy, Tidewater

Community College, Old Dominion University, and other educational and conservation interest.

The majority of the visitor services staff will be assigned to the Visitor Center and Headquarters facility along with some refuge management and administrative staff. The majority of the field management staff will be stationed at the Field Operations Center (FOC) in existing facilities in Suffolk. The FOC is located at 3216 Desert Road and consists of the current maintenance and fire facilities. The maintenance, biological and fire staff will maintain in offices at the FOC compound.

Facilities. *Headquarters on Desert Road to become Visitor Services Station. USFWS.*

The Sunbury Visitor Contact Station would house one law enforcement officer, deputy refuge manager, a two visitor services positions will be stationed in either the Sunbury Contact Station or the Visitor Services Station and provide an opportunity to establish a point of contact to serve refuge interest in North Carolina. The physical presence of staff in this area would improve communications, distribution of public information, and foster support for the refuge mission in this area where resource management issues will intensify over the next twenty years. In addition, the proposed site has a substantial and a relatively new sewage treatment system that should be able to accommodate the addition of RV hookups for volunteer housing.

To conclude, this overall development concept places visitor services, logistical operations, and administrative services at locations that would best serve the needs of the refuge. Also important is that this approach reduces the impact of development on the existing refuge land. Most of the development would occur on land already developed for refuge operations (Suffolk), lands procured primarily for administrative/visitor operations (Chesapeake), or moved to existing developments (Sunbury).

Objective: Develop administrative, operational, and visitor facilities to serve as hubs for visitor access to the refuge and administrative/ operational support.

Strategies:

- Develop the administrative headquarters/Visitor Center Complex on US Highway 17 in Chesapeake, Virginia.
- Convert the existing refuge headquarters in Suffolk, Virginia, to a Visitor Service Station to support concessionaire operations and serve as a visitor services station.
- Establish a Visitor Contact Station in Sunbury, North Carolina.

General Refuge Management

Accessibility

The refuge will operate its programs or activities so that when viewed in its entirety, it is accessible and usable by disabled persons. The Rehabilitation Act of 1973, as amended, requires that programs and facilities be, to the highest degree feasible, readily accessible to and usable by, all persons who have a disability.

Non-Wildlife Dependent Public Uses

Biking on Trails. *Approximately 50 miles of trails are maintained for hiking and biking. Washington Ditch Trail.USFWS.*

The refuge will remain closed to non-wildlife dependent activities such as horseback riding, racing, swimming and use of ATV's. No picnicking facilities will be available. Bicycling, canoeing/kayaking, boating and hiking are considered means to facilitate wildlife-dependent public uses and will continue to be allowed.

Special Use Permits

Special Use Permits may be issued to user groups or individuals for annual or single events. These organizations or individuals are those who want to use the refuge for a special purpose or to gain access to an area otherwise closed to the public (e.g. research, resource monitoring, environmental education, guided tours, commercial photography or filming). Guided tours, by outside groups, are permitted on the refuge if the activity is determined to be appropriate and compatible with the refuge's purpose. These groups will be given specific requirements and educational guidelines on materials to present to the public. The specific charge and specific requirements will be determined on a case-by-case basis.

Annual Fishing Access permits are issued for individuals requesting vehicle access to Lake Drummond via the Railroad Ditch Entrance. These permits are valid from April 1 – June 15 each year. Other vehicle access permits for this entrance are currently issued Monday through Friday to drive to Lake Drummond year round as management activities permit. The special access permits for the Railroad Ditch Entrance are currently under review. If feasible the permit requirement may be eliminated in the future.

Contractor or Concessionaire Operations

Certain visitor services operations will be operated by a private contractor or concessionaire. A concession is a business operated by a private enterprise that provides recreational, educational, and/or interpretive enjoyment of our lands and waters for the visiting public. A concession provides a public service and generally requires some capital investment by the concessionaire for buildings, boat docks, boats, etc. More than one firm can fill concession opportunities. The Visitor Services Station, once established, will be operated in this manner. It is proposed that this contractor or concessionaire will provide a variety of services to include but not necessarily be limited to: guided boat, bicycle and/or vehicle tours, bicycle and boat rentals, operate a bookstore as well as providing visitor information to the visiting public. Additionally, it is proposed that at or near the new Visitor Center location off of US Highway 17 a second contractor or concession operation be established to provide boat tours and rentals. These two operations could be operated by the same contract. The establishment of concession operations will help to better facilitate many of the six priority public uses on a large national wildlife refuge.

Bear Population Study. *Virginia Tech. research project. USFWS.*

Research

The Service encourages and supports research on refuge lands that improve and strengthen natural resource management decisions. The Refuge Manager encourages and seeks research relative to approved refuge objectives that clearly improves land management, promotes adaptive management, addresses important management issues or demonstrates techniques for management of species and /or habitats. Priority research addresses information that will better manage the Nation's biological resources and is generally considered important to: Agencies of the Department of Interior; the Service; the Refuge System; and State Fish and Games Agencies, or important management issues for the refuge.

We will consider research for other purposes, which may not directly relate to refuge specific objectives, but may contribute to the broader enhancement, protection, use, preservation and management of native populations of fish, wildlife and plants, and their natural diversity within the region or flyway. These proposals must still pass the Service's compatibility policy.

The Great Dismal Swamp has an extensive cultural history which is tied to the natural history of the area. The refuge has been designated as a site on the National Park Service's Underground Railroad Network to Freedom. At this time little is known about the location and existence of the maroon communities associated with the Underground Railroad as well as other historical or prehistoric activities on the refuge. Research regarding this aspect of the refuge is encouraged by refuge staff to help support interpretation and environmental education programs. All research proposals will be reviewed to ensure they are appropriate and meet refuge and compatibility standards.

All researchers will be required to submit a special use permit request which includes a detailed research proposal and project title. All requests must be submitted at least two months prior to the requested date of the project. A findings report is required within 45 days of permit expiration.

Management Direction

Nansemond National Wildlife Refuge

Nansemond NWR is an unmanned satellite of the Great Dismal Swamp NWR. Any management activity that takes place on Nansemond refuge is currently conducted by Great Dismal Swamp NWR staff. The management focus for Nansemond NWR is limited by its size, location and overall role in conservation. The refuge serves a unique role in preserving a remnant piece of habitat along the Nansemond River. Due to the small size and limited ability to contribute to management priorities for the Service only one Program/Goal was developed to facilitate future management over the next 15 years.

Program/Goal: Aggressively pursue partnerships to support the management and stewardship of Nansemond NWR

Rationale: Nansemond NWR was established in 1973 when the Department of Defense transferred 206 acres of land, primarily tidal marsh, to the Department of the Interior. In 1999, the refuge expanded

Nansemond National Wildlife Refuge. *Opportunities limited to management and preservation of open space. USFWS.*

to 423 acres when land was added from the adjacent Driver Naval Transmitter Facility. The addition to the refuge consisted primarily of upland areas that were frequently mown to maintain cleared space for the tall radio transmission towers that used to exist on these areas.

The refuge is too small to make a significant contribution to wildlife management priorities of the Service, and expansion of the refuge is not desirable or feasible due to the considerable development that has occurred within the Nansemond River watershed. Therefore, expanding Service operations on this unit is not desirable or feasible. In addition, no formal Wilderness Review has been completed at this time. The refuge's small size and the developed nature of the surrounding landscape make it unsuitable for wilderness designation.

The upland area within the refuge has a history of spot contamination, including PCB contamination, from transformers that used to serve the naval transmitter towers. Therefore, development opportunities would be limited and would likely be confined to management and preservation of open space.

Objective: Pursue partnerships for the management and stewardship of Nansemond National Wildlife Refuge.

Rationale for Objective: Partnerships would expand the range of management options for the refuge beyond the custodial level provided by the Service.

Strategy:

- Periodically inspect and maintain posted boundaries.
- Respond to any encroachment and violation of refuge regulations on the property.
- Pursue partnership discussions with city, state, and Native American representatives who have resource management, interpretive, or educational programs that require relatively undeveloped open space.

Chapter 5

Refuge Administration

- Refuge Staffing
- Refuge Funding
- Refuge Buildings and Facilities
- Step-Down Management Plans
- Maintaining Existing Facilities
- Compatibility Determinations
- Monitoring and Evaluation
- Adaptive Management
- Additional NEPA Analysis
- Plan Amendment and Revision

Literature Cited
Glossary
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Road Maintenance. *Culvert installation under road bed to prevent flood damage. USFWS.*

5.Refuge Administration

The Great Dismal Swamp and Nansemond NWRs are located in southeastern Virginia and Northeastern North Carolina. Nansemond NWR is operated as a satellite of Great Dismal Swamp NWR. Great Dismal Swamp NWR has land ownership in five county/cities (Suffolk, VA, Chesapeake, VA, Gates County, NC, Pasquotank County, NC and Camden County, NC). Currently, the headquarters facility for both refuges is in Suffolk, Virginia.

Refuge administration will be expanded to better serve the refuge constituents represented in the large landscape. Visitor Center/Contact Stations will be located at three key locations surrounding Great Dismal Swamp NWR. The Visitor Center/Headquarters Complex will be located on the east side of the refuge off US Highway 17, a major transportation corridor. A Visitor Service Station will be established in the current headquarters facility in Suffolk, VA and a small Contact Station will be located in Sunbury, North Carolina.

Refuge Staffing

Both Great Dismal Swamp and Nansemond NWRs are managed by staff outlined in the Staffing Chart (Appendix E). No additional staff is planned for the management of Nansemond NWR. The plan for Nansemond NWR calls for pursuing a partnership agreement with an organization that has the resources to manage this refuge.

We will recruit interns each year to assist with education, interpretation, biological and/or maintenance programs as funding is available. The interns will typically work between 8 – 12 weeks each summer. Interns will be offered free housing in the bunkhouse and other temporary quarters.

Additional staff is needed at Great Dismal Swamp NWR to properly manage refuge lands and to implement the expanded visitor services program. By 2021, 24 full-time permanent and three permanent seasonal employees will work at Great Dismal Swamp NWR. The additional positions are outlined in the table below.

Table 5-1: Proposed staffing increases

Position	Description
Biologist	Collects data, works with researchers and develops habitat and wildlife management plans.
Biological Technician	Collects data and assists biologist
Forestry Technician	Collects data and assists forester
Law Enforcement Officer	Protects refuge resources, visitors, staff and new facilities
Seasonal Forestry Technicians (Fire)(2)	Implement prescribed fire and wildfire program at Great Dismal Swamp NWR and VA/WV Fire Management zone
Maintenance Worker	Restores habitat and maintains new and old facilities and equipment
Tractor Operator	Works to repair and maintain roads and ditches and implements habitat projects
Visitor Services Specialist (2)	Develop and conduct interpretive programs at new visitor center
Visitor Services Technician	Support programs at new visitor center
Environmental Education Specialist	Develop multifaceted Environmental Education Program and oversee Visitor Services Station
Volunteer Coordinator	Expand and support volunteer program
Visitor Services Manager	Oversight of complex visitor services program

Additionally, the plan calls for the modification of a few positions. The forester will be upgraded from the GS-9 to a GS-11 and be funded out of refuge base funding rather than fire funding. The Facility Manager will be converted to a Supervisory Assistant Refuge Manager. One office assistant position will be eliminated, and an Administrative Officer added.

The CCP examines the need for staff specific to support the goals and objectives. Appendix E identifies current staffing as well as recommended new positions in a proposed staffing chart for full implementation. The new positions identified will increase biological expertise, facility and habitat maintenance capability, and visitor services.

Refuge Funding

Successful implementation of the CCP relies on our ability to secure funding, personnel, infrastructure, and other resources to accomplish the actions identified. Full implementation of the actions and strategies in this CCP would incur one-time costs of $17.1 million. These costs include staffing, major construction projects, and individual resource program expansions. Appendix F includes a table that lists the one-time costs and recurring costs for the implementation of this plan. The Appendix also presents a table for the refuge's existing Refuge Operating and Needs (RONS) database and the Service Asset Maintenance Management (SAMMS) database, both of which are no longer up to date, and will have to be adjusted to comply with the approved CCP.

Refuge Buildings and Facilities

The existing Refuge Headquarters, Maintenance shop complex, Fire Complex buildings located in Suffolk, Virginia will be maintained. Currently the Regional Fire Management Office is located across the parking lot from the Refuge Headquarters in a trailer. It is primarily maintained by the Regional Fire Staff with some assistance from refuge staff. There has been some discussion regarding moving the Regional Fire Office to another location. It is unknown when and if this will happen and whether the trailer will be moved to a new location. Additionally, there is a restroom facility at the Washington Ditch that will be maintained. It is open year round.

In 2005 a re-evaluation of the top 20 Visitor Centers listing was conducted and Regions were provided an opportunity to add five new facilities to the list. Great Dismal Swamp NWR was not on the original top 20 list but Region 5 did add the refuge to the list in 2005 as one of the five new stations. The proposed location for the Great Dismal Swamp NWR Visitor Center and Headquarters Complex is off US Highway 17 in Chesapeake, Virginia. The site is east of the current refuge boundary between the Dismal Swamp Canal and the re-routed section of Highway 17. The new US Highway 17 corridor isolated approximately 250 acres of prior converted wetlands (now farm fields) providing an ideal location to develop this new facility. The refuge currently owns 10 forested acres within this area. The 250 acres identified for the Visitor Center is within the refuge acquisition boundary and will need to be purchased prior to planning and construction of the facility. Refuge staff will work with State, local and non-governmental partners to secure this property and develop this facility.

Once this facility is completed the existing headquarters facility in Suffolk will be remodeled to serve as Visitor Services Station that will be operated by a cooperator, concessionaire, or partnership to provide more visitor services opportunities. As part of the remodeling project a short connector road will be constructed between the existing Headquarters parking lot and Railroad Ditch entrance. This is being proposed to address a traffic safety issue. Currently access to Railroad Ditch off of Desert road is in a dangerous curve. By providing a short connector road from the existing parking lot to Railroad Ditch access safety problems will be reduced. This new road will be built on mineral soils and wetlands are not likely to be impacted.

One new facility may be constructed in partnership with Gates County. The Sunbury Contact Station was originally planned to be in a renovated school building near the intersection of US Highway 158 and NC Highway 32. This structure may no longer be feasible. Refuge Staff will work closely with Gates County to develop an alternative plan for this facility.

The majority of the Visitor Services staff will be assigned to the Visitor Center along with refuge management and administrative staff. The majority of the field management staff will remain in the Suffolk facilities. The maintenance staff will be stationed at the Maintenance Complex. The biological and fire staff will maintain offices in the Fire Complex with one law enforcement Officer, Deputy Refuge Manager, and two Visitor Services positions being stationed in either Sunbury or the Visitor Services Station.

Additionally, an Environmental Education Pavilion will be built near the Jericho Lane Entrance. This facility was to be funded in FY2006 but the funding was redirected to Hurricane Katrina needs. We hope the funding will be received in FY2007 or 2008 to complete this project. This Pavilion will provide a location close to the population portion of southeastern Virginia where school classes can visit the refuge to learn about the natural and cultural history aspect of the Great Dismal Swamp.

The plan also calls for the establishment of an auto-tour route in North Carolina. The proposed route is Corapeake Ditch to Forest Line Ditch to Cross Canal to Sherrill Ditch. Prior to implementing this project the refuge must obtain legal access to Corapeake Ditch. This will require either fee title or easement purchase to secure this access. Additionally, Forest Line Ditch is owned by the Dismal Swamp State Natural Area. A management agreement will be drafted between the Refuge and the State Natural Area to include this ditch road as part of the auto-tour route.

Step-down Management Plans

The Refuge Manual (Part 4, Chapter 3) lists a number of stepdown management plans generally required on most refuges. These plans describe specific management actions refuges will follow to achieve objectives or implement management strategies. Some require annual revisions, such as hunt plans, while others are revised on a 5-to-10 year schedule. Some of these plans require NEPA analysis before they can be implemented. A status list of Step-Down Management Plans follows (Figure 5-2):

Step-Down Management Plans

Current:	***Current Plan***
Fire Management	1998
Pollution Prevention (Spill Prevention, Control and Countermeasures)	2001
Requires Updates :	***Current Plan/Update***
Water Management*	1990/2009
Forestland Habitat Management*	1987/2009
Fisheries Resource Management	1986/2009
Hunting**	1986/2010
Fishing**	1973/2010
Law Enforcement	1986/2009
Public Use Management**	1990/2010
Wildlife Population Management (Inventory and Monitoring)	1984/2009
Safety Operations	1997/2015
New Plans	***Complete Dates***
Cultural Resources Management	2012
Habitat Management Plan	2009
Visitor Services Plan	2010
*To be included in Habitat Management Plan **To be included in Visitor Services Plan	

Figure 5-2. *Status list of Step-Down Management Plans for the GDSNWR.*

Maintaining Existing Facilities

Periodic maintenance of existing facilities is critical to ensure safety and accessibility for refuge staff and visitors. Existing facilities include the refuge headquarters, maintenance compound, Fire Cache building, Bunkhouse, numerous parking areas and gates, two boardwalks, two piers, a boat ramp, fire tower, numerous kiosks and over 100 miles of trails/roads. Maintaining sign posts and kiosks is a never ending challenge due to impacts from bear damage. Staff is investigating means of limiting damage to these items by choosing alternate designs and materials. Some of these facilities are not currently Americans with Disabilities Act (ADA) compliant; upgrading is needed. Appendix F displays the fiscal year (FY) 2006 MMS database list of backlogged maintenance entries for the refuge.

Compatibility Determinations

Federal law and policy provide the direction and planning framework to protect the Refuge System from incompatible or harmful human activities and to ensure that Americans can enjoy Refuge System lands and waters. The Administration Act, as amended by the Refuge Improvement Act, is the key legislation on managing public uses and compatibility. Before activities or uses are allowed on a national wildlife refuge, we must determine that each is a "compatible use." A compatible use is a use that, based on 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." "Wildlife-dependent recreational uses may be authorized on a refuge when they are compatible and not inconsistent with public safety (Refuge Improvement Act). Compatibility Determinations (CDs) were distributed (in the draft CCP/EA) for a 40 day public review in March - April 2006. These CDs have since been approved, and will allow the continuation of the following public use programs: wildlife observation, wildlife photography, environmental education, interpretation, fishing, and hunting. All comments were considered and utilized in the revision. These new CDs are now final and included in Appendix G.

Additional CDs will be developed when appropriate new uses are proposed. CDs will be re-evaluated by the Refuge Manager when conditions under which the use is permitted change significantly; when there is significant new information on effects of the use; or at least every 10 years for non-priority public uses. Priority public use CDs will be re-evaluated under the conditions noted above, or at least every 15 years with revision of the CCP. Additional detail on the CD process is in Parts 25, 26, and 29 of Title 50 of the Code of Federal Regulations, effective November 17, 2000.

Monitoring and Evaluation

This Final CCP covers a 15-year period. Periodic review of the CCP is required to ensure that established goals and objectives are being met, and that the plan is being implemented as scheduled. To assist this review process, a monitoring and evaluation program will be implemented, focusing on issues involving public use activities, and wildlife habitat and population management.

Monitoring of public use programs will involve the continued collection and compilation of visitation figures and activity levels. In addition, research and monitoring programs will be established to assess the impacts of public use activities on wildlife and wildlife habitat, assess conflicts between types of refuge uses, and to identify compatible levels of public use activities. We will reduce these public use activities if we determine that incompatible levels are occurring.

We will monitor refuge habitat management programs for positive and negative impacts on wildlife habitat and populations and the ecological integrity of the ecosystem. The monitoring will be of assistance in determining if these management activities are helping to meet refuge goals. Information resulting from monitoring would allow staff to set more specific and better management objectives, more rigorously evaluate management objectives, and ultimately, make better management decisions. This process of evaluation, implementation and reevaluation is known simply as "adaptive resource management".

Monitoring and Evaluation for this CCP will occur at two levels. The first level, which we refer to as implementation monitoring, responds to the question, "Did we do what we said we would do, when we said we would do it?" The second level of monitoring, which we refer to as effectiveness monitoring, responds to the question, "Are the actions we proposed effective in achieving the results we had hoped for?" Or, in other words, "Are the actions leading us toward our vision, goals, and objectives?" Effectiveness monitoring evaluates an individual action, a suite of actions, or an entire resource program. This approach is more analytical in evaluating management effects on species, populations, habitats, refuge visitors, ecosystem integrity, or the socioeconomic environment. More often, the criteria to monitor and evaluate these management effects will be established in step-down, individual project, or cooperator plans, or through the research program. The Habitat and Wildlife Inventory and Monitoring Plan, to be completed, will be based on the needs and priorities identified in the HMP.

Adaptive Management

This CCP is a dynamic document. A strategy of adaptive management will keep it relevant and current. Through scientific research, inventories and monitoring, and our management experiences, we will gain new information which may alter our course of action. We acknowledge that our information on species, habitats, and ecosystems is incomplete, provisional, and subject to change as our knowledge base improves.

Objectives and strategies must be adaptable in responding to new information, as well as changes in time and location. We will continually evaluate management actions, through monitoring or research, and to reconsider whether their original assumptions and predictions are still valid. In this way, management becomes an active process of learning "what really works". It is important that the public understand and appreciate the adaptive nature of natural resource management.

The Refuge Manager is responsible for changing management actions or objectives if they do not produce the desired conditions. Significant changes may warrant additional NEPA analysis; minor changes will not, but will be documented in annual monitoring, project evaluation reports, or the annual refuge narratives.

Additional NEPA Analysis

NEPA requires a site specific analysis of impacts for all federal actions. These impacts are to be disclosed in either an EA or EIS. Most of the actions and associated impacts in this plan were described in enough detail in the draft CCP/EA to comply with NEPA, and will not require additional environmental analysis. Although this is not an all inclusive list, the following programs are examples that fall into this category: protecting and restoring wildlife habitat, implementing priority wildlife dependent public use programs, acquiring land, and controlling invasive plants.

Two actions described in the draft CCP/EA have been addressed under separate EA's. The Atlantic white cedar restoration and the re-introduction of red-cockaded woodpeckers are projects that have moved forward under these project-specific EA's.

A few actions may not be described in enough detail to comply with the site specific analysis requirements of NEPA. Examples of actions that may require a separate EA include: future habitat restoration projects not fully developed or delineated in this document or any identified projects that may changed significantly from what is described in the

draft CCP/EA. Monitoring, evaluation, and research can generally be increased without additional NEPA analysis.

Plan Amendment and Revision

Periodic review of the CCP will be required to ensure that objectives are being met and management actions are being implemented. Ongoing monitoring and evaluation will be an important part of this process. Monitoring results or new information may indicate the need to change our strategies.

The Service's planning policy (FWS Manual, Part 602, Chapters 1, 3, and 4) states that CCPs should be reviewed at least annually to decide if they require any revisions (Chapter 3, part 3.4 (8)). Revisions will be necessary if significant new information becomes available, ecological conditions change, major refuge expansions occur, or when we identify the need to do so during a program review. At a minimum, CCPs will be fully revised every 15 years. We will modify the CCP documents and associated management activities as needed, following the procedures outlined in Service policy and NEPA requirements. Minor revisions that meet the criteria for categorical exclusions (550 FW 3.3C) will only require an Environmental Action Statement.

REFERENCES AND SELECTED READING

Amoroso, J.L., and J.T. Finnegan. 2002. Natural Heritage Program List of the Rare Plant Species of North Carolina. North Carolina Natural Heritage Program.

Bulmer, W., R. Eckerlin, and H. Wiggins. 2000. Synopsis of 25 Years of Vertebrate Zoology Class Field Trips to the Great Dismal Swamp, pp. 255-259, In The Natural History of the Great Dismal Swamp, R.K. Rose, ed, Old Dominion University Publications, Norfolk, Virginia. 300 pp.

Christensen, N.L. 1988. Vegetation of the Southeastern Coastal Plain, pp. 317-363, In M.G. Barbour and W.D. Billings (eds.)North American Terrestrial Vegetation. Cambridge University Press.

Dabel, C.V, and F.P. Day, Jr. 1977. Structural comparisons of four plant communities in the Great Dismal Swamp, Virginia. Bulletin of the Torrey Botanical Club 104: 352-360.

Day, Jr., F.P. 1985. Tree growth rates in the periodically flooded Great Dismal Swamp. Castanea 50: 89-95.

Dean, G.W. 1969. Forests and forestry in the Dismal Swamp. Virginia Journal of Science: 20: 166-173.

Erdle, S. Y. and J. F. Pagels. 1995. Observations on Sorex longirostris (Mammalia:Soricidae) and associates in eastern portions of the historical Great Dismal Swamp. Banisteria 6:17-23.

Felker, S. 1998. The Great Dismal Swamp. Virginia Museum of Natural History. Website: http://www.vmnh.org/swmpsusn.htm. 03 May 2003.

Fernald, R.T. 1999. Canebrake rattlesnake: Croatalus horridus atricaudatus. Virginia's wildlife species profile No. 030013.1 (Fernald, R.T., Series editor). Richmond: Department of Game and Inland Fisheries.

Fleming, G.P., P.P. Coulling, D.P. Walton, K.M. McCoy, and M.R. Parrish. 2001. The natural communities of Virginia: classification of ecological community groups. First approximation. Natural Heritage Technical Report 01-1. Virginia Department of Conservation and Recreation, Division of Natural Heritage, Richmond, VA. Unpublished report. January 2001. 76 pp.

Fleming, G.P., and W.H. Moorhead III. 1998. Comparative wetlands ecology study of the Great Dismal Swamp, Northwest River, and North Landing River in Virginia. Natural Heritage Technical Report 98-9, Virginia Dept. Conservation and Recreation, Division of Natural Heritage, Richmond. Unpublished report submitted to the U.S. Environmental Protection Agency. 181 pp. plus appendices.

Frost, C.C. 1995. Presettlement fire regimes in southeastern marshes, peatlands, and swamps. Pages 39-60 in S.I. Cerulean and R.T. Engstrom, eds. Proceedings of the Tall Timbers Fire Ecology Conference, No. 19 Tall Timbers Research Station, Tallahassee, FL.

Frost, C.C. 1998. Presettlement fire frequency regimes of the United States: a first approximation. In: Pruden, T.L.; Brennan, L.A., eds. Fire in ecosystem management: shifting the paradigm

from suppression to prescription. Proceedings of the 20th Tall Timbers fire ecology conference. Tallahassee, FL: Tall Timbers Research Station: 70–81.

Gardner, R.H., W.H. Romme, and M.G. Turner. 1999. Predicting forest fire effects at landscape scales. In: D.J. Mladenoff and W.L. Baker (eds.). Spatial modelling of forest ecosystems. Springer Verlag, New York.

Handley, C.O., Jr. 1999. Mammals of the USDA Biological Survey of the Dismal Swamp, 1985-1989, pp. 11-19, In The Natural History of the Great Dismal Swamp, R.K. Rose, ed, Old Dominion University Publications, Norfolk, Virginia. 300 pp.

Handley, C.O., Jr. 1979. Mammals of the Dismal Swamp: A Historical Account, pp. 297-357, In P. Kirk (ed.), The Great Dismal Swamp: Proceedings from a Symposium Sponsored by Old Dominion University and United Virginia Bank-Seaboard National. University of Virginia Press.

Hellgren, E.C. 1988. Ecology and physiology of a black bear (Ursus americanus) population in Great Dismal Swamp and reproductive physiology in the captive female black bear. Ph.D. dessert., Virginia Tech University, Blacksburg, 231pp.

Kane, C.M. 1997. A Summary of Recent Contaminants Studies Conducted in the Great Dismal Swamp National Wildlife Refuge, Virginia. pp. 241-253, In The Natural History of the Great Dismal Swamp, R.K. Rose, ed, Old Dominion University Publications, Norfolk, Virginia. 300 pp.

Kirk, Paul W., Jr. (ed). 1979. The Great Dismal Swamp: Proceedings from a Symposium Sponsored by Old Dominion University and United Virginia Bank-Seaboard National. University of Virginia Press.

LeGrand, H.E, S.P. Hall, and J.T. Finnegan. 2001. Natural Heritage Program List of the Rare Animal Species of North Carolina. North Carolina Natural Heritage Program.

Little, S. and P.W. Garrett, 1990. Pimus rigida Mill., Pitch Pine, pp. 456-462. In R.M. Burns and B.H. Honkala (eds.) Silvics of North America, Vol. 1, Conifers, U.S.D.A. For. Serv. Agric. Handbk. 654, Washington, D.C.

Matta. 1979. Aquatic insects of the Dismal Swamp, pp. 200-221, In Kirk, P.W., Jr. (ed). The Great Dismal Swamp: Proceedings from a Symposium Sponsored by Old Dominion University and United Virginia Bank-Seaboard National. University of Virginia Press.

McCary, B. C. 1963. The archaelogy of the western area of the Dismal Swamp in Virginia. Quart. Bull. Archeol. Soc. Va. 17:40-48.

Meanley, B. 1973. The Great Dismal Swamp. Audubon Nat. Soc. Cent. Atlantic States. Washington, DC. 48 pp.

Mitchell, J.C., C.A. Pague, and D.J. Schwab. 1999. Herpetofauna of the Great Dismal Swamp, pp. 155-174, In The Natural History of the Great Dismal Swamp, R.K. Rose, ed, Old Dominion University Publications, Norfolk, Virginia. 300 pp.

Nature Conservancy, The, Virginia Chapter. 2001. The Green Sea Wetlands Site Conservation Plan. The Nature Conservancy, Virginia Chapter. Charlottesville, VA. Unpublished report.

Oaks, R.Q., Jr., and D.R. Whitehead. 1979. Geologic Setting and Origin of the Dismal Swamp, Southeastern Virginia and Northeastern North Carolina, pp. 1-24, In Kirk, P.W., Jr. (ed). The Great Dismal Swamp: Proceedings from a Symposium Sponsored by Old Dominion University and United Virginia Bank-Seaboard National. University of Virginia Press.

Otte, L.J. 1985. Patterns of Sediment Change Across the Suffolk San Ridge-Dismal Swamp Transition Zone, Viriginia and North Carolina. Contract Report for the U.S. Geological Survey. East Carolina State Univerisity. Greenville, NC.

Paschal, J.E., Jr., D.E. Sonenshine, and J.H. Richardson. 1979. A Simulation Model of a Peromyscus leucopus population in an area of the Dismal Swamp, pp. 277-296, In Kirk, P.W., Jr. (ed). The Great Dismal Swamp: Proceedings from a Symposium Sponsored by Old Dominion University and United Virginia Bank-Seaboard National. University of Virginia Press.

Richardson, C. J. 1983. Pocosins: Vanishing Wasteland or Valuable Wetlands? BioScience 33(10):626-633

Roble, S.M. 2003. Natural Heritage Resources of Virginia: Rare Animal Species. Natural Heritage Technical Report 03-04. Virginia Department of Conservation and Recreation, Division of Natural Heritage, Richmond, Virginia. 39 pp.

Roble, S.M., and R.D. Cuyler. 1999. The damselflies and dragonflies (Odonata) of the Great Dismal Swamp and vicinity, pp. 115-131, In The Natural History of the Great Dismal Swamp, R.K. Rose, ed, Old Dominion University Publications, Norfolk, Virginia. 300 pp.

Roble, S.M., W.D. Hartgroves, and P.A. Opler. 1999. The butterflies and skippers (Lepidoptera) of the Great Dismal Swamp and vicinity, pp. 93-113, In The Natural History of the Great Dismal Swamp, R.K. Rose, ed, Old Dominion University Publications, Norfolk, Virginia. 300 pp.

Rose, R.K. (ed). 1999a. The Natural History of the Great Dismal Swamp. Old Dominion University Publications, Norfolk, Virginia. 300 pp.

Rose, R.K. 1999b. The small mammals of the Dismal Swamp: an update, pp. 193-207, In The Natural History of the Great Dismal Swamp, R.K. Rose, ed, Old Dominion University Publications, Norfolk, Virginia. 300 pp.

Rose, R.K., C.S. Hobson, T.M. Padgett, and D.A. Schwab. 1999. Dismal Swamp Bats, pp. 235-239, In The Natural History of the Great Dismal Swamp, R.K. Rose, ed, Old Dominion University Publications, Norfolk, Virginia. 300 pp.

Sayers, Daniel O. 2006. *The Great Dismal Swamp Landscape Study.* Doctoral Dissertation, Anthropology Department, College of William and Mary, Williamsburg, Virginia.

Schafale, M.P., and A.S. Weakley. 1990. Classification of the Natural Communities of North Carolina: Third Approximation. North Carolina Natural Heritage Program.

Sharitz, R. R., and J. W. Gibbons. 1982. The ecology of southeastern shrub bogs (pocosins) and Carolina bays: a community profile. U.S. Fish and Wildlife Service, Division of Biological Services, Washington, DC. FWS/OBS-82-04. 93 pp.

Simpson, B. 1990. The Great Dismal: A Carolinian's Swamp Memoir. University of North Carolina Press, Chapel Hill. 185 pp.

Spies, T.P., and M.G. Turner. 1999. Dynamic forest mosaics. Pages 95-160 In: M. Hunter (ed.). Maintaining biodiversity in forest ecosystems. Cambridge University Press, New York.

Stevens, A. and W.A. Patterson III. 1998. Millenium-long fire and vegetation histories of pocosins of southeastern Virginia. Natural Heritage Technical Report 98-17. Virginia Dept. Conservation and Recreation, Division of Natural Heritage, Richmond. Unpublished report. 35 pp.

Tredick, Catherine Anne, 2005. Population Abundance and Genetic Structure of Black bears in Coastal North Carolina and Virginia Using Noninvasive Genetic Techniques. Master of Science Thesis. Virginia Polytechnic Institute and State University. Blacksburg, VA 231 pp.

Terwilliger, K. (ed). 1991. Virginia's Endangered Species: Proceedings of a symposium. McDonald and Woodward Publishing Company, Blacksburg, VA. 672 pp.

Townsend, J.F. 2002. Natural Heritage Resources of Virginia: Rare Plants. Natural Heritage Technical Report 02-13. Virginia Department of Conservation and Recreation, Division of Natural Heritage, Richmond, Virginia. Unpublished report. May 2002. 48 pp. plus appendices.

Turner, M.G., W.L. Baker, C. Peterson, and R.K. Peet. 1998. Factors influencing succession: lessons from large, infrequent disturbances. Ecosystems 1: 511-523.

Turner, M.G., and V.H. Dale. 1998. Comparing large, frequent disturbances: what have we learned? Ecosystems 1: 493-496.

U.S. Census Bureau. Population estimates for 2002. Website: http://eire.census.gov/popest/estimates.php.

U.S. Department of Agriculture and U.S. Department of Interior. 1996. Federal Wildland Fire Policy. Website: http://www.fs.fed.us/land/wdfire.htm. 14 July 2003.

U.S. Department of Agriculture, Soil Conservation Service. 1981. Soil Survey reference of City of Suffolk, VA.

U.S. Department of the Interior, Fish and Wildlife Service. 1979. Public Use Development Plan, Great Dismal Swamp National Wildlife Refuge. Tech. Report prepared by Presnell-Kidd Associates, Norfolk, VA.

U.S. Fish and Wildlife Service. 1998 a. Draft Environmental Assessment, Bear Hunting, Great Dismal Swamp National Wildlife Refuge, Virginia and North Carolina.

U.S. Fish and Wildlife Service. 1998b. Fire Management Plan, Great Dismal Swamp National Wildlife Refuge.

U. S. Fish and Wildlife Service, Region 5 Refuges and Wildlife. "Construction and Rehabilitation Cost Estimating Guide." February, 1999. Internal document.

U.S. Fish and Wildlife Service. 2003. Recovery plan for the red-cockaded woodpecker (Picoides borealis), second revision. U.S. Fish and Wildlife Service, Atlanta, GA. 296 pp.

U. S. Fish and Wildlife Service. 2004. Environmental Assessment for the Red-cockaded Woodpecker Habitat Enhancement and Reintroduction at the Great Dismal Swamp National Wildlife Refuge.

U. S. Fish and Wildlife Service. 2004. Environmental Assessment for the Atlantic White Cedar Salvage and Restoration at the Great Dismal Swamp National Wildlife Refuge.

U.S. House of Representatives. 1997. House Report 105-106, The National Wildlife Refuge System Improvement Act of 1997.

van Eerden, Brian. 2001, Pers. com. w/B. van Eerden, The Nature Conservancy.

Vaughan, M.R., and M.R. Pelton. No date. Black bears in North America. National Biological Service. Website: http://biology.usgs.gov/s+t/frame/c286.htm. 27 July 2003.

Virginia Department of Game and Inland Fisheries. 1999. Virginia Deer Management Plan. Wildlife Information Publication 99-1. Website: http://www.dgif.state.va.us/hunting/va game wildlife/ management plans/deer/deer management pla.pdf. 05 August 2003.

Virginia Department of Game and Inland Fisheries. 2002. Virginia Black Bear Management Plan (2001-2010). Website: http://www.dgif.state.va.us/huntung/va game wildlife/managment plans/bear/ Final%20Bear%20Plan%20 compiled .pdf. 23 July 2003.

Virginia Department of Game and Inland Fisheries. 2004. Virginia Black Bear Hunter Harvest (1994-2004) Website: http://www.dgif.state.va.us/hunting/va game wildlife/black bear harvest 1994 2004.pdf. 22 December 2005.

Virginia Department of Game and Inland Fisheries and U.S. Fish and Wildlife Service. 2000. Bald Eagle Protection Guidelines for Virginia. Website: http://www.dgif.state.va.us/wildlife/ publications/EagleGuidelines.pdf. 16 July 2003.

Virginia Tourism Corporation, 2003a. 2002-2003 Tourism in Virginia: An Economic Analysis. VA Tourism Corp., Richmond, VA. http://www.vatc.org/administration/VTCFF0203.pdf

Webster, W.D. 1999. Coastal freshwater swamps as mammal refugia: the role of the Great Dismal Swamp, pp. 227-234, In The Natural History of the Great Dismal Swamp, R.K. Rose, ed, Old

Dominion University Publications, Norfolk, Virginia. 300 pp.

Whitaker, J.O., Jr., R.K. Rose, and T.M. Padgett. 1997. Food of the red bat Lasiurus borealis in winter in the Great Dismal Swamp, North Carolina and Virginia. American Midland Naturalist 137: 408-411.

Whitehead, D.R. 1965a. Prehistoric maize in southeastern Virginia. Science 150:881-883.

Whitehead, D.R. 1972b. Developmental and environmental history of the Dismal Swamp. Ecol. Monographs 42:301-315.

Whitehead, D.R. 1981c. Late-Pleistocene Vegetational Changes in Northeastern North Carolina, Ecological Monographs, 51(4):451-471.

GLOSSARY

alternative – a reasonable way to fix the identified problem or satisfy the stated need [see also management alternative].

appropriate use - a proposed or existing use of a national wildlife refuge that (1) supports the Refuge System Mission, the major purposes, goals or objectives of the refuge; (2) is necessary for the safe and effective conduct of a priority general public use on the refuge; (3) is other wise determined under Service Manual Chapter 605 FW1 (draft), by the Refuge Manager and Refuge Supervisor to be appropriate.

biological or natural diversity – the abundance, variety, and genetic constitution of animals and plants in nature; also referred to as "biodiversity."

breeding habitat – habitat used by migratory birds or other animals during the breeding season.

buffer zones – protective land borders around critical habitats or water bodies that reduce runoff and nonpoint source pollution loading; areas created or sustained to lessen the negative effects of land development on animals and plants and their habitats.

candidate species – those species for which the Service has on file sufficient information on biological vulnerability and threats to propose them for listing.

carrying capacity – the size of the population that can be sustained by a given environment.

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.

community – the area or locality in which a group of people resides and shares the same government.

community type – a particular assemblage of plants and animals named for the characteristic plants.

compatible use – an allowed use that will not materially interfere with, or detract from, the purposes for which the unit was established (Service Manual 602 FW 1.4).

compatibility determination – a compatibility determination is required for a wildlife-dependant recreational use or any other public use of a refuge. A compatible use is one which, in the sound professional judgment of the Refuge Manager, will not materially interfere with or detract from fulfillment of the Refuge System Mission or refuge purpose(s).

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, help fulfill the mission of the System, maintain and where appropriate, restore the biological integrity, diversity, and environmental health of each refuge and the System, and meet other mandates.

concern – see *issue*.

conservation – the management of natural resources to prevent loss or waste. Management actions may include preservation, restoration, and enhancement.

conservation agreements – written agreements reached among two or more parties for the purpose of ensuring the survival and welfare of unlisted species of fish and wildlife and/or their habitats, or to achieve other specified conservation goals. Participants voluntarily commit to implementing specific actions that will remove or reduce the threats to these species.

conservation easement – a legal agreement between a landowner and a land trust (a private, nonprofit conservation organization) or government agency that permanently limits a property's uses in order to protect its conservation values.

cooperative agreement – the legal instrument used when the principle purpose of the transaction is the transfer of money, property, services or anything of value to a recipient in order to accomplish a public purpose authorized by Federal statute and substantial involvement between the Service and the recipient is anticipated.

cultural resources – evidence of historic or prehistoric human activity, such as buildings, artifacts, archaeological sites, documents, or oral or written history.
Public Law 100-588 (1988) lowered the threshold value of artifacts triggering the felony provision of the Act from $5,000 to $500, made attempting to commit an action prohibited by the Act a violation, and required the land managing agencies to establish public awareness programs regarding the value of archaeological resources to the Nation.

database – a collection of data arranged for ease and speed of analysis and retrieval, usually

computerized.

designated wilderness area – an area designated by the United States Congress to be managed as part of the National Wilderness Preservation System (Draft Service Manual 610 FW 1.5).

digitizing – the process of converting information from paper maps into geographically referenced electronic files for a geographic information system (GIS).

early successional stage – a vegetated area that is in the primary stages of ecological succession.

easement – an agreement by which a landowner gives up or sells one of the rights on his/her property. For example, a landowner may donate a right of way across his/her property to allow community members access.

ecological succession – the orderly progression of an area through time from one vegetative community to another in the absence of disturbance. For example, an area may proceed from a grass-forb, through a shrub-scrub, to a mixed hardwood forest.

ecosystem – a biological community together with its environment, functioning as a unit. For administrative purposes, the Service has designated 53 ecosystems covering the United States and its possessions. These ecosystems generally correspond with watershed boundaries and vary in their sizes and ecological complexity.

ecotourism – a type of tourism that maintains and preserves natural resources as a basis for promoting economic growth and development resulting from visitation to an area.

ecosystem approach – a way of looking at socio-economic and environmental information based on ecosystem boundaries, rather that town, city, or county boundaries.

emergent wetland – wetlands dominated by erect, rooted, herbaceous plants.

endangered species – a federally protected species which is in danger of extinction throughout all or a significant portion of its range.

environmental education – education aimed at producing a citizenry that is knowledgeable concerning the biophysical environment and its associated problems, aware of how to help solve these problems and motivated to work toward their solution.

environmental health – a biotic composition, structure, and functioning of the environment consistent with natural conditions, including the natural a biotic processes that shape environment.

evaportranspiration – the combined effects of evaporation and transpiration resulting from high temperatures and seasonal vegetation growth.

exotic species – species that are not native to a particular ecosystem.

extirpated – no longer occurring in a given geographic area.

federal land – public land owned by the Federal government, including lands such as National Forests, National Parks, and National Wildlife Refuges.

federally listed species – a species listed under the federal Endangered Species Act of 1973, as amended, either as endangered, threatened or species at risk (formerly candidate species).

forested land – land dominated by trees.

forested wetlands – wetlands dominated by trees.

Geographic Information System (GIS) – a computerized system used to compile, store, analyze and display geographically referenced information. Can be used to overlay information layers containing the distributions of a variety of biological and physical features.

goal – descriptive, open-ended, and often broad statement of desired future conditions that conveys a purpose but does not define measurable units.

habitat fragmentation – breaking up of a specific habitat into smaller unconnected areas. A habitat area that is too small may not provide enough space to maintain a breeding population of the species in question.

habitat conservation – the protection of an animal or plant's habitat to ensure that the use of that habitat by the animal or plant is not altered or reduced.

habitat – the place where a particular type of plant or animal lives. An organism's habitat must provide all of the basic requirements for life and should be free of harmful contaminants.

hummock – a slightly elevated mounding of soil and/or organic material occurring in the forest floor naturally or by mechanical disturbance.

interpretive facilities – structures that provides information about an event, place or thing by a variety of means including printed materials, audiovisuals or multimedia materials. Examples of these would be kiosks which offer printed materials and audiovisuals, signs and trailheads.

interpretive materials – any tool used to provide or clarify information, explain events or things, or serve to increase awareness and understanding of the events or things. Examples of these would be; (1) printed materials such as brochures, maps or curriculum materials; (2) audio/visual materials such as videotapes, films, slides, or audio tapes; and (3) interactive multimedia materials, such as cd-rom and other computer technology.

invasive species - species which have been introduced into an ecosystem which reproduce aggressively, spread over a large landscape, have few, if any, natural controls to keep them in check and displace native species.

issue – any unsettled matter that requires a management decision; e.g. a Service initiative, an opportunity, a management problem, a threat to the resources of the unit, a conflict in uses, a public

concern, or the presence of an undesirable resource condition. Issues should be documented, described, and analyzed in the CCP even if resolution cannot be accomplished during the planning process.

key issue – an issue meeting the following three criteria: (1) falls within the jurisdiction of the Service; (2) can be addressed by a reasonable range of alternatives; (3) influences the outcome of the project.

land trust – organizations dedicated to conserving land by purchasing land, receiving donations of lands, or accepting conservation easements from landowners.

limiting factor – an environmental limitation that prevents further population growth.

local agencies – generally referring to municipal governments, regional planning commissions or conservation groups.

long term protection – mechanisms such as fee title acquisition, conservation easements or binding agreements with landowners that ensure land use and land management practices will remain compatible with maintenance of the species population at the site.

Maintenance Management System Projects (MMS) - the Maintenance Management System is a national database which contains the unfunded maintenance needs of each refuge.

[management] alternative – a set of objectives and the strategies needed to accomplish each objective.

[management] concern – see *issue*.

management plan – a plan that guides future land management practices on a tract of land.

[management] strategy – a general approach to meet unit objectives. A strategy may be broad, or it may be detailed enough to guide implementation through specific actions, tasks, and projects.

migratory game birds – birds regulated under the Migratory Bird Treaty Act and state laws, that are legally hunted, includes ducks, geese, woodcock, rails.

migratory nongame birds of management concern- those species of nongame birds that (a) are believed to have undergone significant population declines; (b) have small or restricted populations; or (c) are dependent upon restricted or vulnerable habitats.

mission statement – succinct statement of the unit's purpose and reason for being.

mitigation – actions taken to compensate for the negative effects of a particular project. Wetland mitigation usually takes the form of restoration or enhancement of a previously damaged wetland or creation of a new wetland.

National Environmental Policy Act of 1969 (NEPA) – requires all agencies, including the Service,

to examine the environmental impacts of their 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.

National Wildlife Refuge (Refuge) – A "designated area of land, water, or an interest in land or water within the System but does not include Coordination Areas." Find a complete listing of all units of the System in the current *Annual Report of Lands Under Control of the U.S. Fish and Wildlife Service.*

National Wildlife Refuge System (Refuge System)– all lands and waters and interests therein administered by the Service as wildlife refuges, wildlife ranges, wildlife management areas, waterfowl production areas, and other areas for the protection and conservation of fish and wildlife, including those that are threatened with extinction.

native plant – a plant that has grown in the region since the last glaciation and occurred before European settlement.

natural conditions – conditions thought to exists from the end of the Medieval Warm Period to the advent of the industrial era (approximately 950 AD to 1800 AD), based upon scientific study and sound professional judgment.

non-attainment – air quality measures that have pollutions level above the National Ambient Air Standards.

non-comsumptive, wildlife-oriented recreation- photographing or observing plants, fish and other wildlife.

non-point source pollution – nutrients or toxic substances that enter water from dispersed and uncontrolled sites.

nonforested wetlands – wetlands dominated by shrubs or emergent vegetation.

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.

partnership – a contract or agreement entered into by two or more individuals, groups of individuals, organizations or agencies in which each agrees to furnish a part of the capital or some in-kind service, i.e., labor, for a mutually beneficial enterprise.

population monitoring – assessments of the characteristics of populations to ascertain their status and establish trends related to their abundance, condition, distribution, or other characteristics.

prescribed fire – controlled application of fire to wildland fuels in either their natural or modified state, under specified environmental conditions which allows the fire to be confined to

a predetermined area, and produce the fire behavior and fire characteristics required to attain planned fire treatment and resource management objectives.

priority public uses – see *wildlife-dependant recreational uses.*

private land – land that is owned by a private individual, group of individuals, or non-governmental organization.

private landowner – any individual, group of individuals or non-governmental organization that owns land.

private organization – any non-governmental organization.

Proposed Action (or Alternative) – activities for which an Environmental Impact Statement is being written; the alternative containing the actions and strategies recommended by the planning team. The proposed action is, for all practical purposes, the draft CCP for the refuge.

protection – mechanisms such as fee title acquisition, conservation easements or binding agreements with landowners that ensure land use and land management practices will remain compatible with maintenance of the species population at the site.

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 the Service issues and those who do or do not realize that Service decisions may affect them.

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 involvement plan – broad long term guidance for involving the public in the comprehensive planning process.

public land – land that is owned by the local, state, or Federal government.

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 mitigate.

refuge goals – descriptive, open-ended and often broad statements of desired future conditions that convey a purpose but do not define measurable units.

refuge purposes - the purpose 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, a refuge unit, or refuge subunit, and any subsequent modification of the original establishing authority for additional conservation purposes.

refuge lands – those lands in which the Service holds full interest in fee title, or partial interest such as easements.

Refuge Operating Needs System (RONS) – the Refuge Operating Needs System is a national database which contains the unfunded operational needs of each refuge. We include projects required to implement approved plans and meet goals, objectives, and legal mandates.

restoration – the artificial manipulation of a habitat to restore it to something close to its natural state. Restoration usually involves the planting of native grasses and forbs, and may include shrub removal and prescribed burning.

runoff – water from rain, melted now, or agricultural or landscape irrigation that flows over the land surface into a water body.

Safe Harbor Agreements/Program-Voluntary arrangements between the U.S. Fish and Wildlife Service and cooperating non-Federal landowners. The Agreements benefit endangered and threatened species while giving the landowners assurances from additional restrictions. Following development of an agreement, the Service will issue an "enhancement of survival" permit to authorize any necessary future incidental take to provide participating landowners with assurances that no additional restrictions will be imposed as a result of their conservation actions.

service presence – Species present in the watershed for whom the refuge has a special management interest.

state agencies – generally referring to natural resource arms of the state governments of Virginia or North Carolina.

state land- public land owned by a state such as state parks or state wildlife management areas.

step-down management plans – step-down management plans describe management strategies and implementation schedules. Step-down management plans are a series of plans dealing with specific management subjects (wilderness, fire, public use).

strategy – a specific action, tool, technique, or combination of actions, tools, and techniques used to meet unit objectives.

succession – an orderly sequence of changes in plant species and community structure over time, leading to a hypothesized stable climax community.

threatened species – a federally protected species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.

trust resource – one that through law or administrative act is held in trust for the people by the

government. A federal trust resource is one for which trust responsibility is given in part to the federal government through federal legislation or administrative act. Generally, federal trust resources are those considered to be of national or international importance no matter where they occur, such as endangered species and species such as migratory birds and fish that regularly move across state lines. In addition to species trust resources include cultural resources protected through federal historic preservation laws, nationally important and threatened habitats, notably wetlands, navigable waters, and public lands such as state parks and National Wildlife Refuges.

upland-dry ground; other than wetlands**.**

vision statement – concise statement of what the unit could be in the next 10 to 15 years.

visitor center – a permanently staffed building offering exhibits and interpretive information to the visiting public. Some visitor centers are co-located with refuge offices, others include additional facilities such as classrooms or wildlife viewing areas.

visitor contact station- compared to a visitor center, a contact station is a smaller facility which may not be permanently staffed.

visitor facility – a visitor center, visitor contact station, or concessionaire station, permanently or partially staffed by service employees and/or volunteers.

watershed – the geographic area within which water drains into a particular river, stream or body of water. A watershed includes both the land and the body of water into which the land drains.

wetlands – The U.S. Fish and Wildlife Service's definition of wetlands states that "Wetlands are lands transitional between terrestrial and aquatic systems where the water table is usually at or

near the surface or the land is covered by shallow water."

wildlife-dependent recreational use – "A use of a refuge involving hunting, fishing, wildlife observation and photography, or environmental education and interpretation." These are the six priority public uses of the System as established in the National Wildlife Refuge System Administration Act, as amended. Wildlife-dependent recreational uses, other than the six priority public uses, are those that depend on the presence of wildlife. We also will consider these other uses in the preparation of refuge CCPs, however, the six priority public uses always will take precedence.

wildlife management – the practice of manipulating wildlife populations, either directly through regulating the numbers, ages, and sex ratios harvested, or indirectly by providing favorable habitat conditions and alleviating limiting factors.

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Coordinated field and regional office communications; Team leader December, 2005 to present.

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Chapter 5
Refuge Administration-

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