DRAFT COMPREHENSIVE CONSERVATION PLAN
AND ENVIRONMENTAL ASSESSMENT

TENNESSEE NATIONAL WILDLIFE REFUGE

Henry, Benton, Decatur, and Humphreys Counties, Tennessee

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

Southeast Region
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SECTION A. DRAFT COMPREHENSIVE CONSERVATION PLAN

I. Background

INTRODUCTION

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

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

PURPOSE AND NEED FOR THE PLAN

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

Specifically, the plan is needed to:

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

U.S. FISH AND WILDLIFE SERVICE

The U.S. Fish and Wildlife Service traces its roots to 1871 through the establishment of the Commission of Fisheries involved with research and fish culture. The once-independent commission was renamed the Bureau of Fisheries and placed under the Department of Commerce and Labor in 1903.

The Service also traces its roots to 1886 with the establishment of a Division of Economic Ornithology and Mammalogy in the Department of Agriculture. Research on the relationship of birds and animals to agriculture shifted to delineation of the range of plants and animals, so the name was changed to the Division of the Biological Survey in 1896.

The Department of Commerce's Bureau of Fisheries was combined with the Department of Agriculture's Bureau of Biological Survey on June 30, 1940, and transferred to the Department of the Interior as the Fish and Wildlife Service. The name was changed to the Bureau of Sport Fisheries and Wildlife in 1956 and finally to the Fish and Wildlife Service in 1974.

The Service, working with others, is responsible for conserving, protecting, and enhancing fish and wildlife and their habitats for the continuing benefit of the American people through federal programs relating to migratory birds, endangered species, interjurisdictional fish and marine mammals, and inland sport fisheries (142 DM 1.1).

As part of its mission, the Service manages more than 540 national wildlife refuges covering over 95 million acres. These areas comprise the National Wildlife Refuge System, the world's largest collection of lands set aside specifically for fish and wildlife. The majority of these lands, 77 million acres, are in Alaska. The remaining acres are spread across the other 49 states and several United States territories. In addition to refuges, the Service manages thousands of small wetlands, national fish hatcheries, 64 fishery resource offices, and 78 ecological services field stations. The Service enforces federal wildlife laws, administers the Endangered Species Act, manages migratory bird populations, restores nationally significant fisheries, conserves and restores wildlife habitat, and helps foreign governments with their conservation efforts. It also oversees the Federal Aid program that distributes hundreds of millions of dollars in excise taxes on fishing and hunting equipment to state fish and wildlife agencies.

NATIONAL WILDLIFE REFUGE SYSTEM

The 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 National Wildlife Refuge System Improvement Act of 1997 established, for the first time, a clear legislative mission of wildlife conservation for the National Wildlife Refuge System. Actions were initiated in 1997 to comply with the direction of this new legislation, including an effort to complete comprehensive conservation plans for all refuges. These plans, which are completed with full public involvement, help guide the future management of refuges by establishing natural resources and recreation/education programs. Consistent with this Act, approved plans will serve as the guidelines for refuge management for the next 15 years. The Act states that each refuge shall be managed to:

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

The following are just a few examples of the Service's national network of conservation lands. Pelican Island National Wildlife Refuge, the first refuge, was established in 1903 for the protection of colonial nesting birds in Florida, such as the snowy egret and the brown pelican. Western refuges were established for American bison (1906), elk (1912), prong-horned antelope (1931), and desert bighorn sheep (1936) after overhunting, competition with cattle, and natural disasters decimated the once-abundant herds. The drought conditions of the Dust Bowl during the 1930s severely depleted breeding populations of ducks and geese. Refuges established during the Great Depression focused on protecting waterfowl production areas, such as the prairie wetlands in America's heartland. The emphasis on waterfowl continues today but also includes protection of wintering habitat in response to a dramatic loss of bottomland hardwoods. By 1973, the Service had begun to focus on establishing refuges for endangered species.

National wildlife refuges connect visitors to their natural resource heritage and provide them with an understanding and appreciation of fish and wildlife ecology to help them understand their role in the environment. Wildlife-dependent recreation on refuges also generates economic benefits to local communities. According to the report, *Banking on Nature 2006: The Economic Benefits to Local Communities of National Wildlife Refuge Visitation*, approximately 34.8 million people visited national wildlife refuges in fiscal year 2006, generating almost $1.7 billion in total economic activity and creating almost 27,000 private sector jobs, producing about $542.8 million in employment income (Carver and Caudill 2007).

Additionally, recreational spending on national wildlife refuges generated nearly $185.3 million in tax revenues at the local, county, state, and federal levels (Carver and Caudill 2007). As the number of visitors grows, significant economic benefits are realized by local communities. In 2006, nearly 71 million people, 16 years and older, fished, hunted, or observed wildlife, spending $45.7 billion and generating $122.6 billion (Leonard 2008).

Volunteers continue to be a major contributor to the success of the Refuge System. In 2005, approximately 38,000 volunteers donated more than 1.4 million hours on the refuges nationwide, a service valued at more than $25 million.

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

The National Wildlife Refuge System Improvement Act of 1997 stipulates that comprehensive conservation plans be prepared in consultation with adjoining federal, state, and private landowners and that the Service develop and implement a process to ensure an opportunity for active public involvement in the preparation and revision (every 15 years) of the plans.

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

LEGAL AND POLICY CONTEXT

Legal Mandates, Administrative and Policy Guidelines, and Other Special Considerations

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

Treaties, laws, administrative guidelines, and policy guidelines assist the refuge manager in making decisions pertaining to the refuge's soils, water, air, flora, fauna, and other natural resources; historical and cultural resources; research and recreation on refuge lands; and provide a framework for cooperation between the refuge and other partners, such as the Tennessee Wildlife Resources Agency (TWRA), Tennessee Valley Authority (TVA), and private landowners.

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

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

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

Biological Integrity, Diversity, and Environmental Health Policy

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

NATIONAL AND INTERNATIONAL CONSERVATION PLANS AND INITIATIVES

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

This draft plan supports, among others, the Partners in Flight Plan, the North American Waterfowl Management Plan, the Western Hemisphere Shorebird Reserve Network, and the National Wetlands Priority Conservation Plan.

North American Bird Conservation Initiative. Started in 1999, the North American Bird Conservation Initiative is a coalition of government agencies, private organizations, academic institutions, and private industry leaders in the United States, Canada, and Mexico working to ensure the long-term health of North America's native bird populations by fostering an integrated approach to bird conservation to benefit all birds in all habitats. The four international and national bird initiatives include the North American Waterfowl Management Plan, Partners in Flight, Waterbird Conservation for the Americas, and the U.S. Shorebird Conservation Plan.

North American Waterfowl Management Plan. The North American Waterfowl Management Plan is an international action plan to conserve migratory birds throughout the continent. The plan's goal is to return waterfowl populations to their 1970s levels by conserving wetland and upland habitat. Canada and the United States signed the plan in 1986 in reaction to critically low numbers of waterfowl. Mexico joined in 1994, making it a truly continental effort. The plan is a partnership of federal, provincial, state, and municipal governments, nongovernmental organizations, private companies, and many individuals, all working towards achieving better wetland habitat for the benefit of migratory birds, other wetland-associated species and people. The plan’s projects are international in scope, but implemented at regional levels. These projects contribute to the protection of habitat and wildlife species across the North American landscape.

Partners in Flight Bird Conservation Plan. Managed as part of the Partners in Flight Plan, the Interior Low Plateaus physiographic area represents a scientifically-based landbird conservation planning effort that ensures long-term maintenance of healthy populations of native landbirds, primarily nongame landbirds. Nongame landbirds have been vastly underrepresented in conservation efforts, and many are exhibiting significant declines. This plan is voluntary and nonregulatory, and focuses on relatively common species in areas where conservation actions can be most effective, rather than the frequent local emphasis on rare and peripheral populations.

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

Northern American Waterbird Conservation Plan. This plan provides a framework for the conservation and management of 210 species of waterbirds in 29 nations. Threats to waterbird populations include destruction of inland and coastal wetlands, introduced predators and invasive

species, pollutants, mortality from fisheries and industries, disturbance, and conflicts arising from abundant species. Particularly important habitats of the southeast region include pelagic areas, marshes, forested wetlands, and barrier and sea island complexes. Fifteen species of waterbirds are federally listed, including breeding populations of wood storks, Mississippi sandhill cranes, whooping cranes, interior least terns, and Gulf Coast populations of brown pelicans. A key objective of this plan is the standardization of data collection efforts to better recommend effective conservation measures.

RELATIONSHIP TO STATE WILDLIFE AGENCY

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

In Tennessee, the Service partners with the Tennessee Wildlife Resources Agency (TWRA, http://www.state.tn.us/twra/). The TWRA is the state agency charged with game enforcement responsibilities and management of state natural resources in Tennessee. The TWRA manages approximately 1.35 million acres of state wildlife management areas (WMAs) and state wildlife refuges, coordinates the state's wildlife conservation program, and provides public recreation opportunities, including an extensive hunting and fishing program on state wildlife management areas.

The TWRA's participation and contribution throughout this comprehensive planning process will provide for ongoing opportunities and open dialogue to improve the ecological sustainment of fish and wildlife in the State of Tennessee. An essential part of comprehensive conservation planning is the integration of common mission objectives where appropriate.

II. Refuge Overview

INTRODUCTION

On December 28, 1945, President Harry S. Truman signed Executive Order No. 9670 establishing the Tennessee National Wildlife Refuge (NWR or refuge). The following day, the Department of the Interior and the Tennessee Valley Authority (TVA) entered into an agreement that the lands would henceforth be reserved for use as a wildlife refuge.

Tennessee National Wildlife Refuge runs along 65 miles of the Tennessee River (Figure 1). The refuge is comprised of three units: the Duck River Unit (26,738 acres), Big Sandy Unit (21,348 acres), and Busseltown Unit (3,272 acres), for a total acreage of 51,358 acres.

The Big Sandy Unit is the northernmost unit (Figure 2), located at the junction of the Big Sandy and Tennessee rivers, about 12 miles north of the town of Big Sandy. Most of the lands on this unit are upland and forested with little wetland management capabilities. Waterfowl management activities primarily consist of providing sanctuary on the waters and mudflats of Kentucky Lake and agricultural crops for foraging habitats.

The Duck River Unit is located at the junction of the Duck and Tennessee rivers in Humphreys and Benton counties (Figure 3). This unit has the best wetland management potential of all units. A wide variety of habitats are available for waterfowl and other waterbirds, including agriculture, moist soil, mudflats, forested wetlands and scrub-shrub.

The Busseltown Unit is located along the western bank of the Tennessee River in Decatur County, roughly five miles northeast of Parsons, Tennessee (Figure 4). It is primarily managed for waterfowl by providing agricultural crops for foraging habitats. Some moist soil and scrub-shrub habitats are also available.

All three units were used extensively for agriculture in the 1800s and early 1900s. The two northern units were named for the rivers that run through them, while the much smaller Busseltown Unit was named after Johnse Bussel, an earlier settler to the area who established a store and home in the area that later became known as Busseltown. The mixture of open water, wetlands, woodlands, croplands, and grasslands creates a mosaic of wildlife-rich habitats (USFWS no date-b). Table 1 shows figures for current estimated habitat acreage by type at Tennessee NWR (USFWS no date-c). The refuge provides valuable wintering habitat for migrating waterfowl. It also provides habitat and protection for endangered and threatened species such as the gray bat, Indiana bat, least tern, pink mucket pearlymussel, ring pink mussel, orangefoot pimpleback pearlymussel, rough pigtoe, and pigmy madtom.

Table 1. Habitat acreage at Tennessee NWR.

Habitat Type	Acres
Farmland	3,100
Native Wetland Plants	1,400
Forested	19,700
Open Water	26,400
Total	**51,000**

Figure 1. Vicinity map of Tennessee National Wildlife Refuge.

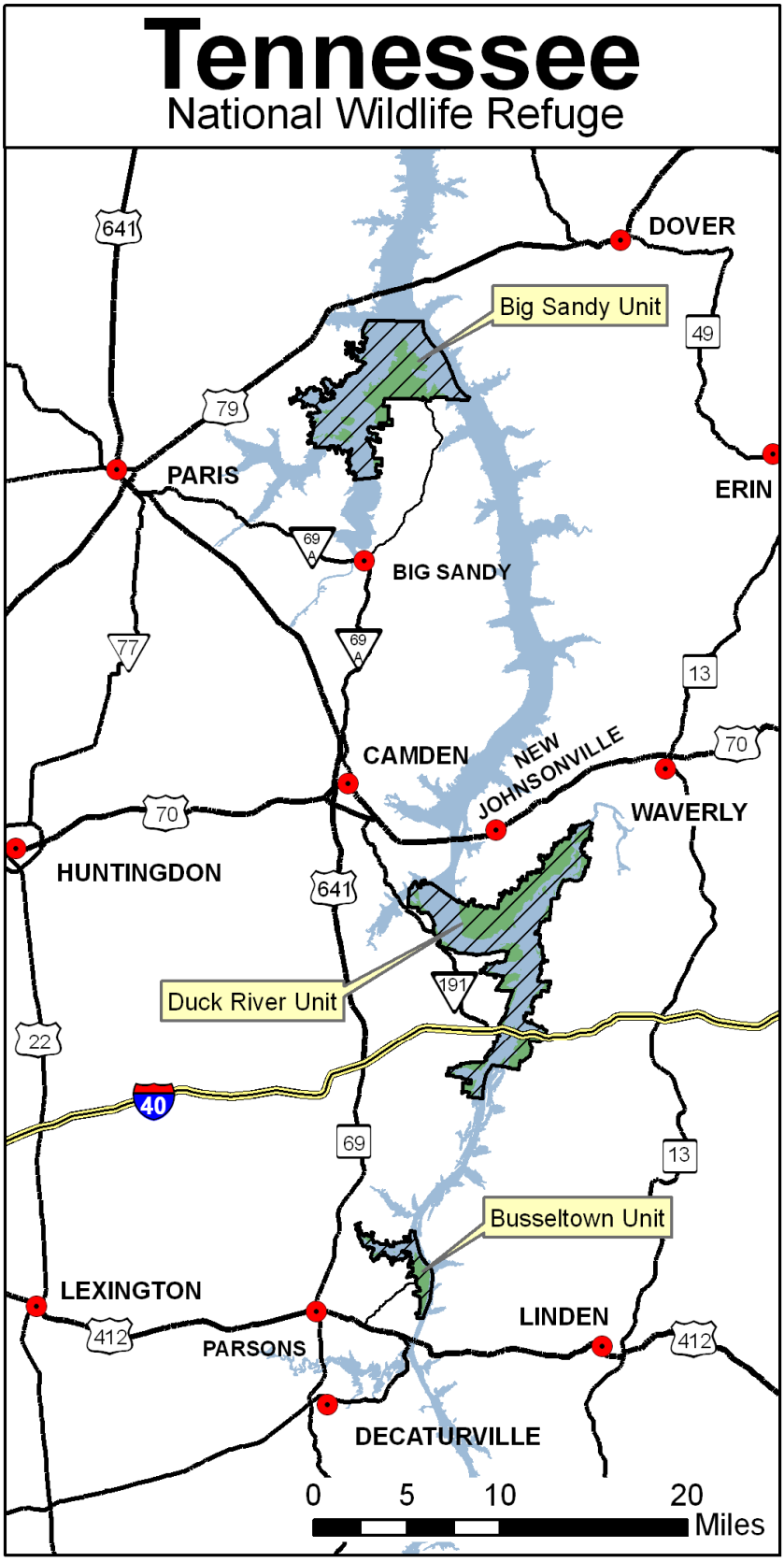


Figure 2. Big Sandy Unit.

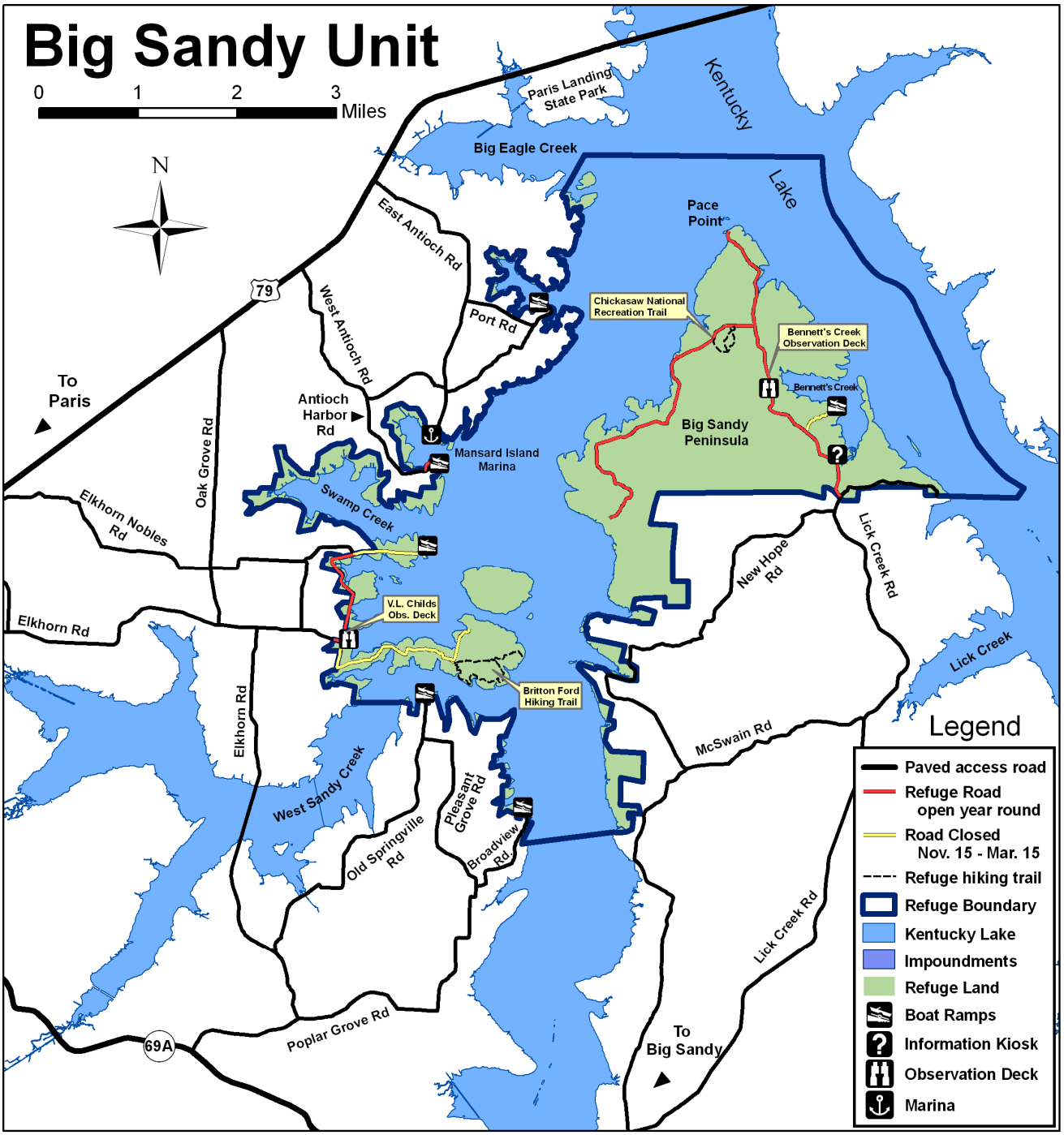


Figure 3. Duck River Unit.

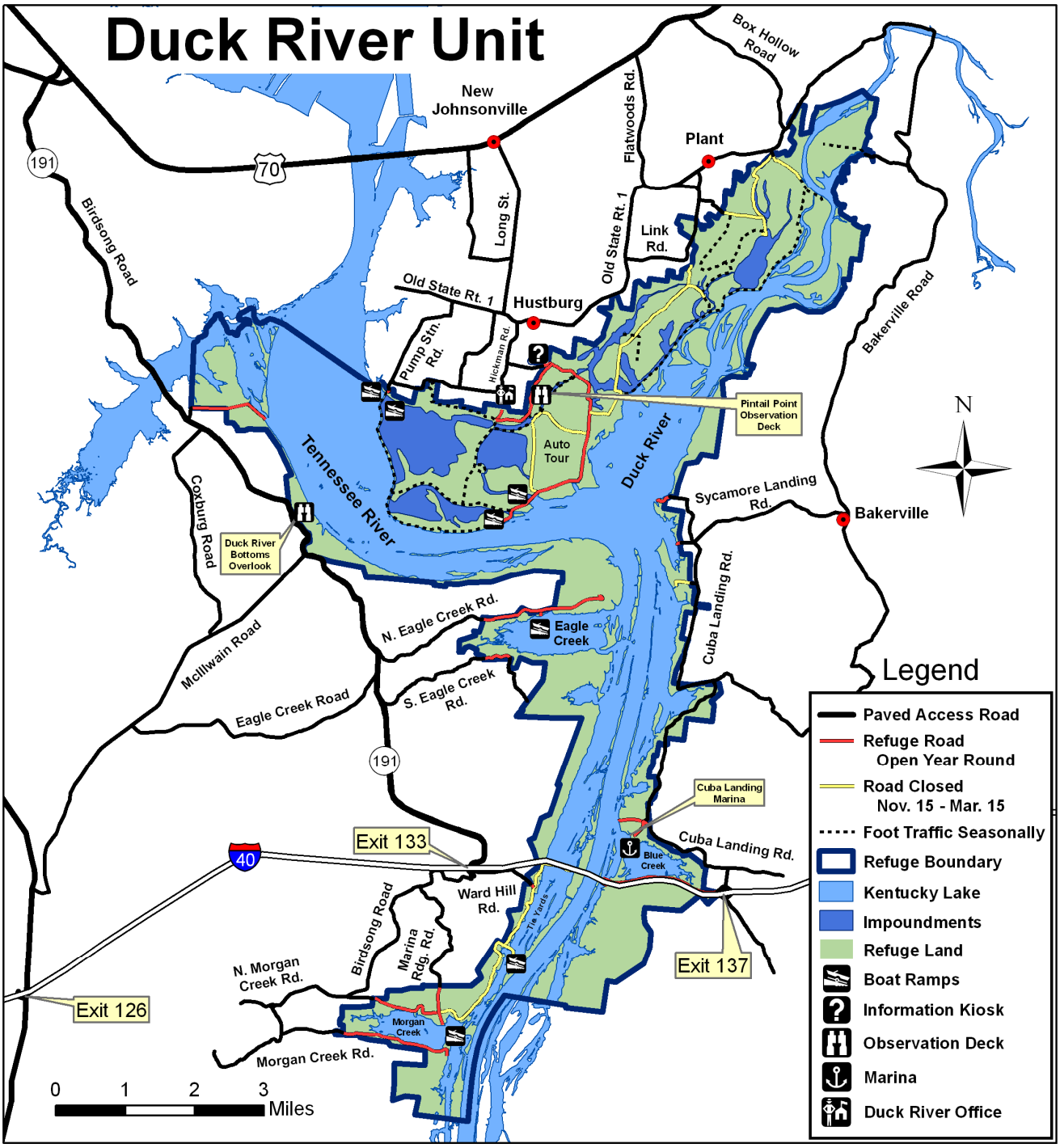
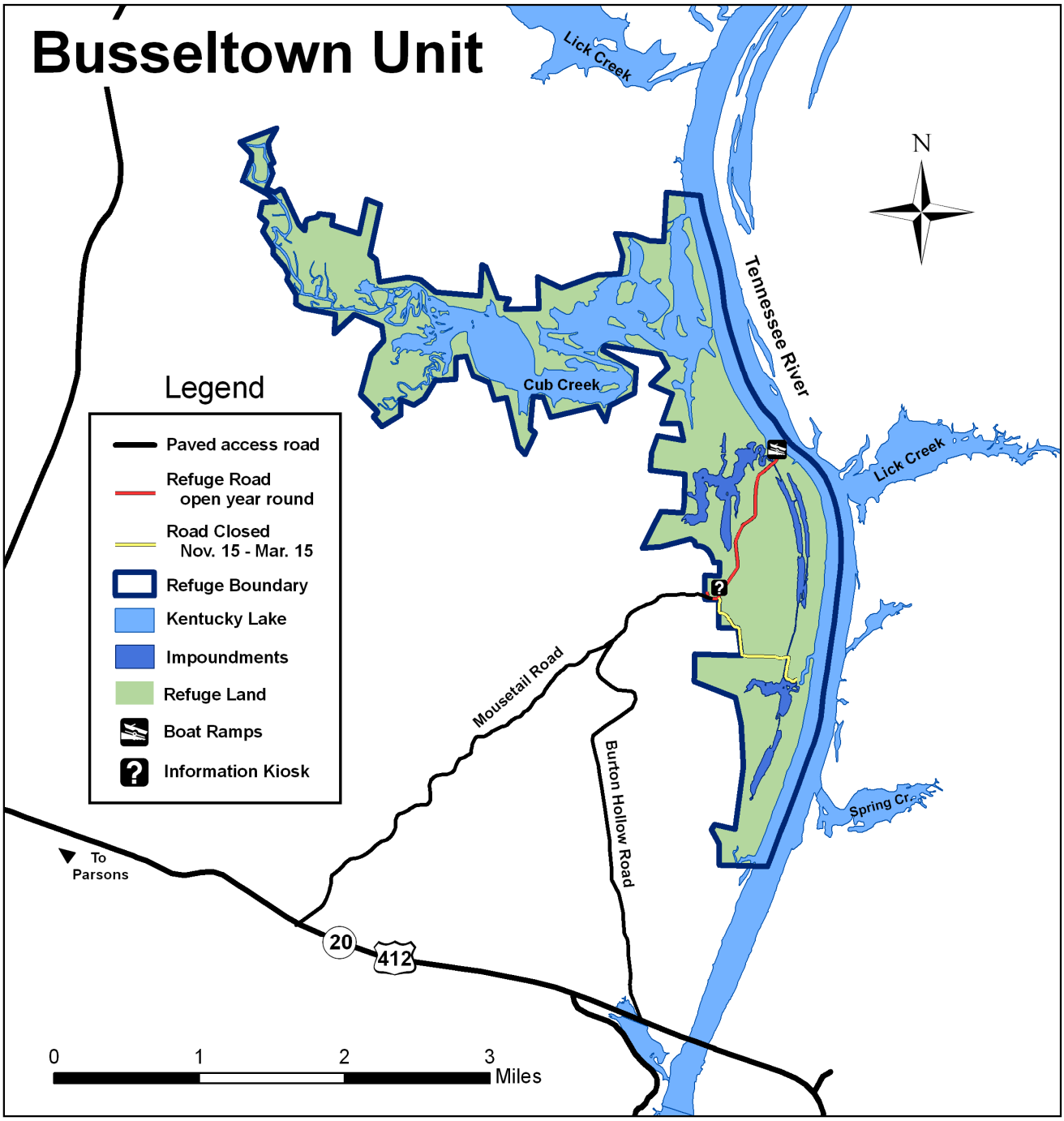


Figure 4. Busseltown Unit.



Tennessee NWR lies in the central portion of the Mississippi Flyway. Peak wintering populations of ducks have reached over 320,000 in particularly cold winters, and average approximately 200,000 in a typical winter. Peak wintering populations of Canada geese have reached almost 20,000 once since 2000. However, recent wintering Canada goose populations averaged 7,500 from 2004-2009 (USFWS unpub. data).

Bald eagles have made a comeback nationwide and this is evidenced by their recent removal from the Endangered Species List. The success of the bald eagle recovery can also be seen on the Tennessee NWR, where there are bald eagles year-round, with at least 10 nesting pairs and dozens of others using the refuge during the winter (USFWS unpub. data).

The refuge also supports an abundance of wildlife, including over 650 species of plants, 303 species of birds, and 280 species of mammals, fish, reptiles, and amphibians (USFWS 2007a; USFWS 2007b).

REFUGE HISTORY AND PURPOSE

The National Wildlife Refuge System Improvement Act states that each refuge is to be managed to fulfill the purpose for which it was established but also the mission of the National Wildlife Refuge System. If there is a conflict between the two, the purposes for which the refuge was established takes precedence.

The establishing and acquisition authorities for Tennessee NWR include the Migratory Bird Conservation Act (16 U.S.C. 715-715r) and Fish and Wildlife Coordination Act (16 U.S.C. 661-667). These documents state that the refuge:

- "… [be] for use as an inviolate sanctuary, or for any other management purpose, for migratory birds."
- "…shall be administered by him [Secretary of the Interior] directly or in accordance with cooperative agreements … and in accordance with such rules and regulations for the conservation, maintenance, and management of wildlife, resources thereof, and its habitat thereon …"

In addition, Public Land Order 4560 identified the purposes of the refuge to be "… to build, operate and maintain sub-impoundment structures; produce food crops or cover for wildlife; to regulate and restrict hunting, trapping and fishing and to otherwise manage said lands and impoundment areas for the protection and production of wildlife and fish populations …" (Public Land Order, 1962).

Specifically, the objectives for Tennessee NWR are:

- To provide habitat for migratory birds, especially waterfowl.
- To provide habitat and protection for threatened and endangered species such as the pink mucket pearlymussel, ring pink mussel, orangefoot pimpleback pearlymussel, rough pigtoe, pigmy madtom, piping plover, least tern, gray bat, Indiana bat.
- To provide recreation and environmental education opportunities for the public (USFWS no date-d).

Tennessee NWR was established to provide feeding and resting habitat for migratory birds in the central portion of the Mississippi Flyway, with an emphasis placed on providing habitat for wintering waterfowl. Objectives are achieved through a water management program for waterfowl, wading bird

rookeries, and neotropical migratory landbirds. Other methods are cultivation of about 3,150 acres of agricultural land and management of about 1,400 acres of moist soil habitat. Management of the moist soils and impoundments uses a network of levees and water control structures to adjust water levels to provide food and habitat, as well as manage water levels for agriculture. The cooperative and staff farming programs leave a portion of the crops grown to provide food and shelter for waterfowl and other wildlife (USFWS 2005).

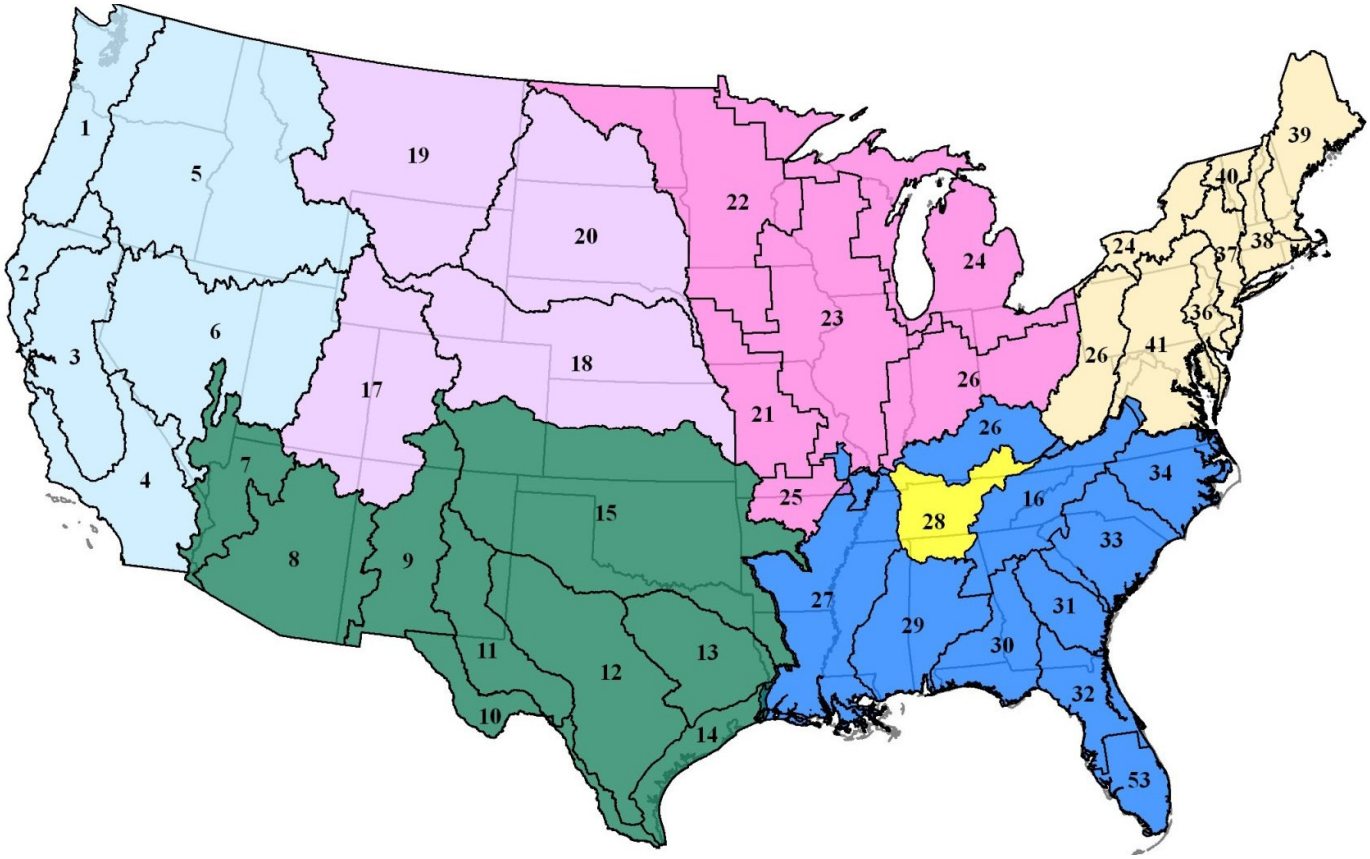
SPECIAL DESIGNATIONS

Tennessee National Wildlife Refuge does not include any lands under special designation. That is, it does not contain congressionally-designated Wilderness Areas, federally-designated Wild and Scenic Rivers, demonstration areas, or research natural areas. In addition, oil and gas activities do not occur on the refuge.

ECOSYSTEM CONTEXT

In approaching its mission to conserve wildlife and their habitats throughout the country, the U.S. Fish and Wildlife Service has found it useful to divide the entire contiguous United States into 53 distinct ecosystems, drawn primarily along watershed boundaries (Figure 5). Tennessee National Wildlife Refuge lies within the Lower Tennessee-Cumberland Ecosystem, which spans portions of Tennessee, Alabama, and Kentucky. This ecosystem is further divided into two subunits, the Lower Tennessee River watershed and the Cumberland River watershed. The refuge is in the Tennessee River watershed (LTCE no date-a).

Figure 5. USFWS-designated ecosystems in the conterminous U.S., with the Lower Tennessee-Cumberland Ecosystem (#28) highlighted.



The Lower Tennessee-Cumberland Ecosystem team (LTCE) has developed a strategic planning approach to outline goals, objectives, and strategies to protect and restore the Service's trust resources and ecological integrity within the LTCE (LTCE 1995). The LTCE team formed three subgroups – Aquatics, Migratory Birds, and Land Acquisition – to help achieve these plans. The first two subgroups identify priority watersheds, determine research needs, and develop projects for the restoration and protection of marine life and migratory birds respectively (LTCE no date-b; LTCE no date-c). The last subgroup focuses on providing recommendations for land purchases for the USFWS (LTCE no date-d). The LTCE team collaborates with other agencies and concerned groups to help accomplish team objectives. Tennessee NWR has contributed to meeting the biological goals and objectives of the LTCE.

Tennessee NWR has a special role to play in the conservation of migratory birds. The refuge serves as an important wintering ground for thousands of migratory waterfowl using the Mississippi Flyway and provides a significant contribution to the North American Waterfowl Management Plan (NAWMP). Suitable wintering or nesting habitat occurs on the refuge for species including American black duck, mallard, gadwall, American wigeon, blue-winged teal, American green-winged teal, northern pintail, wood duck, ring-necked duck, canvasback, lesser scaup, bufflehead, common goldeneye, and ruddy duck, Canada geese, great blue heron, bald eagle, and others.

At least 10 pairs of bald eagles nest on the refuge. The refuge also provides stopover habitat for at least 30 shorebird species. The abundance and diversity of managed wetlands at Tennessee NWR supports over 40 species of herons, egrets, rails, gulls, terns, and other waterbirds (USFWS, 2005).

REGIONAL CONSERVATION PLANS AND INITIATIVES

Tennessee Comprehensive Wildlife Conservation Strategy. Tennessee's State Wildlife Grants (SWG) program began in fiscal year 2002. Under this new program, Congress provided an historic opportunity for state fish and wildlife agencies and their partners to design and implement a more comprehensive approach to the conservation of America's wildlife. A requirement of SWG was that each state complete a Comprehensive Wildlife Conservation Strategy (CWCS) by October 1, 2005. Development of the CWCS was intended to identify and focus management on "species in greatest need of conservation." Congress expects SWG funds to be used to manage and conserve declining species and avoid their potential listing under the Endangered Species Act.

Tennessee's CWCS effort began in 2003. In late 2003, the TWRA contracted with The Nature Conservancy (TNC) for the services of its state conservation planning manager to establish and lead a core planning team. The result of this team's work, as well as the collaboration of Tennessee's conservation partners, resulted in the production of the first edition of the Tennessee CWCS. The U.S. Fish and Wildlife Service approved the Tennessee CWCS in 2005. The CWCS uses a consolidated geographic information system (GIS) as a component for identifying wildlife species in the greatest need of conservation. The plan also describes the actions necessary for these species' restoration (TWRA 2005).

The state's participation and contribution throughout this comprehensive conservation planning process provides for ongoing opportunities and open dialogue to improve the ecological health and diversity of fish and wildlife. A vital part of the comprehensive planning process is integrating common mission objectives where appropriate.

Landscape Conservation Cooperatives. To ensure that the U.S. Fish and Wildlife Service is "putting science in the right places," the Directorate determined in April 2009 that the agency needed a national geographic framework for implementing landscape conservation. Just as migratory bird

flyways have provided an effective spatial frame of reference to build capacity and partnerships for international, national, state and local waterfowl conservation, this geographic framework will provide a continental platform upon which the U.S. Fish and Wildlife Service can work with partners to connect site-specific efforts to larger biological goals and outcomes. In its meeting on August 4-6, 2009, the Directorate approved a map of the geographic framework developed by a team of USFWS and U.S. Geological Survey (USGS) experts from across the country. The map defines *Geographic Areas* that provide a spatial frame of reference for building and targeting science capacity that will support the Service and partners in planning and designing conservation strategies at landscape scales. It also allows us to more precisely explain to partners, Congress, and the American public why, where, and how the Service targets conservation resources and how the Service's science-based efforts connect to a greater whole. Currently, Tennessee NWR falls within the Appalachians Landscape Conservation Cooperative.

ECOLOGICAL THREATS AND PROBLEMS

LOWER TENNESSEE-CUMBERLAND ECOSYSTEM

Much of the region's economic activity – agriculture, lumbering, mining, and recreation – is based on using the watershed's natural resources. Sustaining most of these activities requires maintenance of a healthy ecosystem. Stress from human activities has adversely affected the ecological integrity of the LTCE, and there are indications that this stress is increasing. The exceptionally diverse but damaged mussel fauna illustrates the extent of these adverse impacts. This unique faunal group evolved and flourished in response to a free-flowing riverine ecosystem that was spared the periodic ravages of glaciation. However, since Euro-American settlement, and especially during the 20th century, this vast riverine ecosystem was profoundly altered by impoundments (over 2,000 miles of its rivers are impounded), channelization, siltation, and water pollution. Historically, about 100 distinct mussel taxa existed in the LTCE. This once diverse and abundant fauna has been so decimated that nearly half (46 percent) of the species are either extinct (8 percent), classified as endangered (24 percent), or under review for federal protection (14 percent). During the twentieth century, no other wide-ranging faunal group within the continental United States experienced this degree of loss (LTCE 1995).

Other taxonomic groups are also in jeopardy. There are 74 species in the LTCE that are federally listed as threatened or endangered or are proposed for listing: 28 species of mussels, 19 species of plants, 10 species of fish, eight species of mammals, two species of birds, four species of snails, and one arachnid. Additionally, based on data from the Breeding Bird Survey, 74 percent of the neotropical migratory bird species breeding in Tennessee suffered declining populations between 1980 and 1989 (LTCE 1995).

Environmental alteration and degradation are continuing challenges to the maintenance of a productive and healthy LTCE. Indigenous biological resources of the area are threatened by land conversion, poor land use practices, direct and indirect physical alteration of the area's rivers and streams, and both point- and nonpoint-source discharges of pollutants. Herbicides, insecticides, nutrients, and sediment are significant components of the agricultural runoff that adversely affects aquatic systems throughout the area. Acid precipitation and other airborne pollutants are having dramatic impacts on aquatic and terrestrial communities, particularly at high elevations. An expanding human population and its increasing demand for renewable and nonrenewable resources further threaten natural resources. Contamination of both aquatic and terrestrial systems through the accidental release of toxic chemicals is a continuing threat. The expansion of urban and suburban areas within the ecosystem and the concurrent loss of forest, agricultural, and other types of open space associated with this expansion have reduced the quantity and quality of natural habitats available to fish and wildlife (LTCE 1995).

Given the abundance of ecosystem-altering influences past and present, a coordinated landscape-scale effort is necessary to reverse and prevent further declines in biological resources. A healthy ecosystem will provide much more than diverse flora and fauna. It will provide clean air and water, healthy soil, sustainable harvests from forests and fields, and abundant outdoor recreational opportunities for this and future generations (LTCE 1995).

TENNESSEE NATIONAL WILDLIFE REFUGE

Current challenges and ecological threats facing the refuge include: increased development of adjacent forested lands (sale of Mead/Westvaco forest lands); increase in residential development next to or near the refuge; incompatible use of shoreline on the Big Sandy Unit (interest by refuge neighbors to clear vegetation due to perceived disease threat from mosquitoes and ticks and to improve access and view lake); limitation of waterfowl management capability from an increase in the number of waterfowl hunt clubs along the refuge boundary; growing interest by county governments for increased public use activities on the refuge to boost eco-tourism in a depressed economy; commercial development (e.g., Benton/Decatur County Sewer project); commercial sand and gravel dredging in the Tennessee River adjacent to the refuge; shoreline erosion; battling invasive species; and working with the TVA and the U.S. Army Corps of Engineers (USACE) on addressing possible wildlife impacts to potential changes in Kentucky Lake levels during late summer and early fall.

The Kentucky Lake area of west Tennessee has experienced an increase in development as more people retire in the area. Large blocks of forestlands once owned and managed by Mead/Westvaco are now being sold to private individuals. Loss of forestlands adjacent to the refuge will negatively impact forest bird species. The refuge staff is actively collaborating with the Central Hardwoods Joint Venture to develop management plans to protect this valuable habitat type.

The refuge's role as a sanctuary enhances waterfowl hunting on nearby public and private lands, as well as providing opportunities for wildlife observation. Tennessee NWR is the only sanctuary locally, while six state wildlife management areas (WMAs) within a 10-mile radius are open to waterfowl hunting. Providing waterfowl sanctuaries is a critical part of annual waterfowl conservation and management. Sanctuaries provide areas where birds can rest, gain fat, and develop pair bonds that improve the likelihood of successful nesting in the spring and summer.

Nearby private waterfowl hunt areas are becoming larger and more developed with increased emphasis placed on maintaining flooded food sources that support several thousand waterfowl. The popularity in waterfowl hunting is resulting in an increase in the number of hunt clubs adjoining the refuge. Farms are being bought by waterfowl hunters that are developing impoundments and hunt blinds for personal and commercial hunting opportunities. Due to legal concerns, the increase of hunt clubs adjacent to refuge agriculture fields is hampering the refuge's ability to manipulate crops in these fields. This is resulting in the refuge having to take shares in less desirable fields.

The construction of dams on the Tennessee River has resulted in the disruption of the natural fluvial processes that replenish sand and gravel bars. The refuge has historically permitted sand and gravel dredging. The USACE continues to issue permits for commercial dredging within the refuge boundary, however the refuge has not issued permits to dredge within the last several years. The refuge staff has conducted a compatibility review and determined that commercial dredging is not compatible with the ecosystem plan for protecting these endangered mussels.

Dam construction and operation, wastewater outfalls, navigation-related dredging, contaminants, and commercial sand and gravel dredging are likely contributors to the degradation of water quality and substrate habitat in and around the refuge. Habitat fragmentation, habitat degradation, contamination

and human disturbance cause declines of wildlife populations, especially shorebirds, waterbirds, and mollusks. With increasing human population and development in the area, these pressures will only intensify (USFWS 2005).

The refuge encompasses portions of a navigable waterway in which the refuge does not have jurisdiction to manage activities, and there are many uses of the river that are inappropriate and/or incompatible with the mission of the refuge. These uses include commercial activities such as the above-mentioned dredging and other recreational activities such as pleasure boating, use of jet skis, and water skiing.

Wave action and wakes from large boats have increased shoreline erosion. This in turn has resulted in a loss of refuge habitat, exposure of sensitive archeological sites, and a decrease in water quality. Refuge personnel have partnered with the TVA to stabilize some eroded areas. Funding and lack of personnel are the greatest challenge the refuge is facing in not protecting other areas.

The refuge has no control over the water level schedule in Kentucky Lake, which is not managed primarily for the benefit of wildlife. Historically, the operating schedule for Kentucky Lake called for the fall drawdown to be initiated on June 15, but it was delayed to July 1 in 1980 for recreational boating activities. Typically the drawdown is unofficially delayed until July 5 to maintain a higher lake level through the Fourth of July holiday. The drawdown results in the reservoir's water levels dropping five feet, exposing vast areas of mudflats. These habitats are extremely important to shorebirds, waterfowl, and other waterbirds (Wirwa 2009). The change in the operating schedule that occurred in 1980 likely had significant impacts on the mudflat habitat. Any future delays in the fall drawdown could potentially eliminate mudflat availability to most shorebird species that migrate through this region in August and September. Waterfowl heavily utilize the mudflats as a source of forage. Canada geese and American wigeon browse on the leafy vegetation of annual plants that become established on the flats and teal forage on the seeds produced by these plants. The drawdown timing is essential to the establishment and growth of these annual plants.

The refuge is battling numerous invasive species in all habitat types. Invasive species occurring at Tennessee NWR include alligatorweed, parrotfeather, *Paspalum* spp., *Sesbania* spp., kudzu, Japanese honeysuckle, mimosa, tree of heaven, multiflora rose, Chinese privet, and Japanese stilt plant. All of these invasive plants compete with native vegetation that provides food and nesting cover for wildlife. Other invasive species issues that impact the productivity of agricultural crops include Johnson grass, broadleaf signal grass, sicklepod, and cocklebur.

Aquatic invasive plants clog pipes, inhibit water flow, and out-compete beneficial plants that provide food and cover. Thus, invasive species present a significant obstacle to water management and to migratory bird utilization of wetlands. Through competition for water nutrients, and space, invasive species contribute to the less than maximum productivity of the agricultural fields for waterfowl food. One of the biggest challenges involves managing alligatorweed in moist soil units. Alligatorweed out-competes native wetland plant species.

Little of the original bottomland hardwood forest remains from the conversion to agriculture, open lake, and waterfowl impoundments. This results in less habitat for forest-dependent species such as the prothonotary warbler. This is a top species of conservation concern by the Central Hardwoods Joint Venture (CHJV) and the Partners in Flight North American Landbird Conservation Plan (PIF). Other species of concern in this habitat are wood thrush, cerulean warbler, and Swainson's warbler (USFWS 2005). The refuge does have a forest management plan but the refuge forester position has been lost, and with it, forest and fire management capability.

A network of levees and water control structures at Tennessee NWR allows water levels to be controlled for optimum habitat for many species of wildlife and especially for waterfowl. The primary objectives of flood control and hydroelectric power dictate the schedule for Kentucky Lake's water level operation, which occurs too late for moist soil management. Thus, the refuge has to use pumping to manage the water levels, which invasive species and beaver hinder (USFWS 2005). Regular maintenance and replacement of water control structures, especially on the Duck River Unit, is crucial to ensuring water management capabilities in the refuge's impoundments and pools.

CLIMATE CHANGE

The Intergovernmental Panel on Climate Change (IPCC) has concluded that "warming of the climate system is unequivocal." Global climate change poses risks not only to human health but also to terrestrial and aquatic ecosystems. The abundance and distribution of wildlife and fish will change, particularly affecting those species already "at risk." Important economic resources such as agriculture, forestry, and water resources also can be affected. Warmer temperatures, more severe droughts and floods, and sea level rise will have a wide range of impacts. All these stresses, added to existing stresses on resources caused by other influences such as population growth, land-use changes, and pollution, pose a significant challenge for fish and wildlife conservation.

According to data from the National Oceanic and Atmospheric Administration (NOAA) and the National Aeronautics and Space Administration (NASA), the Earth's average surface temperature has increased by about 1.2 to 1.4ºF since 1900. The ten warmest years in the 20th century have all occurred within the past 15 years. Some climate models, based on emissions of greenhouse gases, primarily carbon dioxide, methane, and nitrous oxide, predict that average surface temperatures could increase from 2.5 to 10.4^{o}F by the end of the 21st century. The frequency of extremely hot summer days is expected to increase, along with this general warming trend. Increases in atmospheric carbon dioxide (CO_2) are attributed largely to human activities, which have grown rapidly since the 1940s. The burning of fossil fuels adds 5.6 billion tons of carbon, and deforestation contributes another 0.4 to 2.5 billion tons of carbon to the atmosphere each year.

The effects of climate change and global warming will be changes in weather/rainfall patterns, decreases in snow and ice cover, rising sea levels, and stressed ecosystems. For the southeastern U.S. and the Tennessee region, this could mean extreme precipitation events; greater likelihood of warmer/drier summers and wetter/reduced winter cold; and alterations of ecosystems and habitats due to these changes in weather patterns. For Tennessee NWR, warmer conditions would favor increased densities of vegetation and wetter conditions would favor trees and vegetation that are better adapted to these conditions. If conditions become drier, the current range and density of forests would be reduced and replaced by grasslands and the probability of wildfires would increase.

A recent study of the effects of climate change on eastern U.S. bird species concluded that as many as 78 bird species could decrease by at least 25%, while as many as 33 species could increase in abundance by at least 25% due to climate and habitat changes (Matthews et al. 2004). In short, global warming could increase storm intensity, negatively change ecologically important plant species, alter the spread of invasive species, increase drought-induced fires, and further imperil already threatened and endangered species. Tennessee NWR will need to monitor for these changes on the refuge.

PHYSICAL RESOURCES

CLIMATE

The climate for the refuge region is described as having warm, humid summers and mild winters (NOAA 1980, 1993). However, summer temperatures in the 90s and winter lows well below freezing are not uncommon (Owenby and Ezell 1992). January is the coldest month, with an average temperature of 34.2 degrees Fahrenheit. July is normally the hottest, with an average temperature 77.8 degrees Fahrenheit. Winters are mild with most snow occurring in January and February (NOAA 2004).

The average yearly rainfall is over 53 inches, with rainfall well distributed throughout all seasons and the wettest season is spring. March is the wettest month at 5.40 inches, and October is the driest at 3.51 inches (NOAA 2004). Yearly floods in bottomlands and along the shoreline of Kentucky Lake are common during winter and spring.

GEOLOGY AND TOPOGRAPHY

The majority of the refuge lands are located on the Western Highland Rim of the Interior Low Plateau Physiographic Province (Fenneman 1938; Thornburg 1965). Smalley (1980) describes the topography of the uplands of this region as "narrow winding to moderately broad undulating ridges flanked by steep side slopes" with narrow V-shaped valleys in the upper reaches of the intermittent streams, gradually becoming U-shaped and broader as the streams approach the major river bottoms. Land elevations range from approximately 640 to 354 feet above mean sea level (MSL).

Over 5,000 acres of the refuge lie within the major river bottom floodplain of the Duck River. These lands are nearly flat to gently sloping, with well-drained to poorly-drained soils. A small portion of the Big Sandy Unit is within the East Gulf Coastal Plain Physiographic Province, where the topography is characterized as undulating and rolling with gentle to moderate slopes (Fenneman 1938).

The remainder of the refuge acreage encompasses the hillsides surrounding the Tennessee River valley, with a mixture of rolling hills and rocky high bluffs.

SOILS

Most of the lands on Tennessee National Wildlife Refuge fall within four soil associations as described by Springer and Elder (1980). The soils of the upland sites within the Western Highland Rim are classified in the Bodine-Mountview-Dickson (D11) soil association. The western edge of the Big Sandy Unit, which is in the East Gulf Coastal Plain, is included in the Ruston-Lexington-Providence (C11) soil association. The hills just north of the Duck River Bottoms are classified in the Pickwick-Paden (C31) soil association. The Duck River Bottoms are included in the Wolftever-Egam-Beason-Lindside (A41) soil association.

Springer and Elder (1980) describe the D11 soil association as consisting of “hilly and steep, excessively drained, cherty soils from limestone, and undulating, well-drained and moderately well-drained, silty soils from thin loess and limestone.” Most of the upland forests on the refuge are of this association. The soils of the hillsides are pale, deep, very cherty, droughty, strongly acidic, and low in fertility. The cherty, well-drained to excessively drained Bodine soils cover the majority of the hills, especially on the steepest sites. Well-drained Mountview soils occur on the wider ridgetops. The soils of the narrow tracts of bottom land and foot slopes commonly are deep, well-drained, and strongly acidic, with variable amounts of chert washed from the nearby hills. These areas on the refuge are dominated by the moderately well-drained Paden soils and well-drained Humphreys soils of stream terraces.

The C11 soil association is described by Springer and Elder (1980) as “undulating and rolling, brown, well-drained and moderately well-drained, silty soils from loess over coastal plain sediment; with bottoms of loamy and silty soils.” The only location on the refuge that this association occurs is on the Big Sandy Unit west of the Big Sandy River. These soils are generally well-drained, highly leached, low in natural fertility, and strongly acidic. The dominant soils that occur within the forested areas are the well-drained Dexter soils and moderately well-drained Freeland soils.

The C31 soil association is characterized as ”undulating and rolling, well-drained, silty soils from thin loess and alluvium” (Springer and Elder 1980). The soils are generally deep, well-drained to moderately well-drained, low in fertility, and strongly acidic. This association is represented on the hillsides adjacent to the Duck River Bottoms. The moderately well-drained Paden soils dominate this area on the refuge.

Springer and Elder (1980) describe the A41 soil association as “moderately well-drained and somewhat poorly drained, clayey and silty soils.” These soils are found on first bottoms and low terraces of the Tennessee River and are nearly level. They are deep, moderately well-drained to somewhat poorly drained, moderate in fertility, and moderately acidic. The moderately well-drained Wolftever soils occupy the low terraces or second bottoms. Silty, imperfectly drained, Lindside soils dominate the first bottoms. Well-drained loamy Huntington soils are near the river bank. The poorly drained Melvin soils are found in the sloughs.

HYDROLOGY

Tennessee NWR lies within the Tennessee River Valley. In 1944, the construction of Kentucky Dam across the Tennessee River near Gilbertsville, Kentucky, was completed, forming Kentucky Lake. The excess waters of Kentucky Lake are discharged into the Tennessee River, which flows into the Ohio River.

Drainage within much the bottomlands of the refuge is dependent upon the water level of Kentucky Lake. Under normal water flows, the TVA has sole control over the water management of Kentucky Lake for its primary objectives of flood control and hydroelectric power production. Lake levels are typically higher in the summer, reaching 359 MSL and lowered to a winter pool level of 354 MSL for floodwater storage. Uncontrolled flooding of the bottom lands on the refuge occurs when heavy rains fall within the Tennessee River Valley or when the Ohio and/or Mississippi rivers exceed flood stage, prompting the Corps of Engineers to order the TVA to reduce discharges from Kentucky Lake.

Site-specific drainage varies considerably throughout the refuge. Drainage within the bottom lands ranges from good to poor depending on the soil type. Upland sites have well to excessive drainage, primarily related to topographic position.

AIR QUALITY

Implementation of clean air legislation through the years has resulted in emission reductions and significant improvements in outdoor air quality for the Tennessee Valley. However, ozone and fine particle pollution will continue to be a challenge and remain a concern, even though progress has been made.

Of some concern for the refuge area is the TVA's coal-fired Johnsonville Fossil Plant, located on the east bank of the Tennessee River in New Johnsonville, Tennessee, in the vicinity of the Duck River Unit. There has been some public controversy over its emissions and the smog and acid rain to which these may contribute. Table 2 shows the plant's emissions from 1996 through 2007. The TVA provides emissions information about the Johnsonville Plant and steps they are taking to improve the situations on their website (http://tva.com/environment/air/johnson.htm).

Table 2. NOx, SO_2, and CO_2 emissions from Johnsonville Plant.

Thousands of tons per year

Year	NOx	SO_2	CO_2
2007	18.2	65.0	9,300
2006	18.1	86.8	9,000
2005	17.7	74.6	8,500
2004	20.0	95.7	8,100
2003	23.6	100.0	8,900
2002	24.4	108.8	9,400
2001	20.4	94.2	8,400
2000	22.6	118.4	9,600
1999	20.4	119.8	7,800
1998	18.0	114.6	7,600
1997	18.6	115.9	7,300
1996	20.7	126.4	8,600

Source: TVA, no date.

National Ambient Air Quality Standards (NAAQS) exist for six contaminants, referred to as criteria pollutants, and apply to the ambient air. Ambient air is the air that the general public is exposed to every day (United States Environmental Protection Agency [USEPA] 2002). These criteria pollutants include carbon monoxide, ozone, particulate matter, nitrogen oxides (NOx), sulfur dioxide (SO_2), and lead. Air quality monitoring across the country indicates which are in attainment of the NAAQS and which areas are nonattainment. The four counties in which Tennessee NWR is located are all in attainment for each of the criteria pollutants' NAAQS (USEPA 2008).

WATER QUALITY AND QUANTITY

In Tennessee, the most common causes of pollution in rivers and streams are sediment/silt, habitat alteration, pathogens, and nutrients. The main sources of these pollutants are agriculture, hydrologic modification, municipal dischargers, and construction. The leading causes of pollution in reservoirs and lakes are organic substances, like PCBs, dioxins, and chlordane, plus nutrients, sediment/silt, and low dissolved oxygen (DO). The principal source of problems in reservoirs and lakes is the

historical discharge of pollutants that have accumulated in sediment and fish flesh. Other sources include agriculture, hydrologic modifications, municipal dischargers, and construction (Tennessee Department of Environment and Conservation [TDEC] 2006).

The TVA monitored Kentucky Lake annually from 1991 through 1995 to establish baseline data on the reservoir's ecological health under a range of weather and flow conditions. It is now monitored every other year. The ecological health of Kentucky Lake was rated good in 2007 (TVA no date-a). Since 1991, the rating for the lake has been either fair or good, with only small changes among indicators. Ecological health indicators at Kentucky Lake in 2007 were all listed as fair to good with the exceptions of the DO and chlorophyll indicators of the Big Sandy embayment and the chlorophyll indicator of the forebay (at Kentucky Dam). The poor rating for the Big Sandy embayment was due to low DO levels near the bottom in mid-summer (Table 3). Chlorophyll levels were actually elevated at the forebay and Big Sandy embayment monitoring locations in 2007. The refuge does not currently conduct any water quality sampling, although the Duck River Unit impoundment pools may be an option for future sampling.

As noted in the above Hydrology section, drainage within much of the bottomlands on the refuge is dependent upon the water level of Kentucky Lake. The lake's levels are typically higher in the summer, reaching 359 feet MSL, and are lowered to a winter pool level of 354 MSL for floodwater storage.

Table 3. Ecological health indicators at Kentucky Lake, 2007.

Monitoring locations	Dissolved oxygen	Chlorophyll	Fish	Bottom life	Sediment
Forebay	Fair	Poor	Good	Good	Good
Mid-reservoir	Good	Good	Good	Good	Good
Big Sandy embayment	Poor	Poor	Fair	Fair	Good
Inflow			Fair	Good	

CONTAMINANTS

In September 1996, an Environmental Quality Assessment of Tennessee National Wildlife Refuge was begun (USFWS 2003). Fish and sediment samples were collected at the Big Sandy, Duck River, and Busseltown units of the refuge from 1996 to 1998. Wood duck eggs were collected at the Duck River Unit. In summary, based on the whole-body fish sample results, none were expected to exceed any applicable action levels established by the Food and Drug Administration (FDA). Overall, there did not appear to be any immediate need for mitigation or cleanup of environmental contamination at the three refuge units sampled in the study. There were elevated concentrations of various inorganic contaminants in sediment within the Busseltown Unit. To date there has been no follow-up monitoring.

BIOLOGICAL RESOURCES

HABITAT

There is an annual average of 3,150 acres of cropland on all three units, with approximately 750 acres on the Big Sandy Unit, 1,700 on the Duck River Unit, and 700 acres on the Busseltown Unit. Most of this land is farmed each year through cooperative farming agreements to provide supplemental food and cover for the thousands of waterfowl. In addition, approximately 1,400 acres in the Duck River Bottoms are managed for moist soil vegetation. These bottoms are compartmentalized by a series of levees and water control structures that allow water levels to be controlled for optimum waterfowl food production. The refuge contains approximately 20,000 acres of forest, with the majority being comprised of upland stands that are predominantly oak-hickory. Small isolated blocks of bottomland hardwoods occur on the Duck River and Busseltown units. Most of these stands are dominated by light seeded species such as maples, sweetgum, and green ash. The remainder of the refuge not falling into the forested, agricultural, or moist soil categories primarily consists of open water habitats (USFWS 2005).

Figures 6, 7, and 8 show the distribution of habitat types among the three refuge units discussed below.

Cropland and Farming

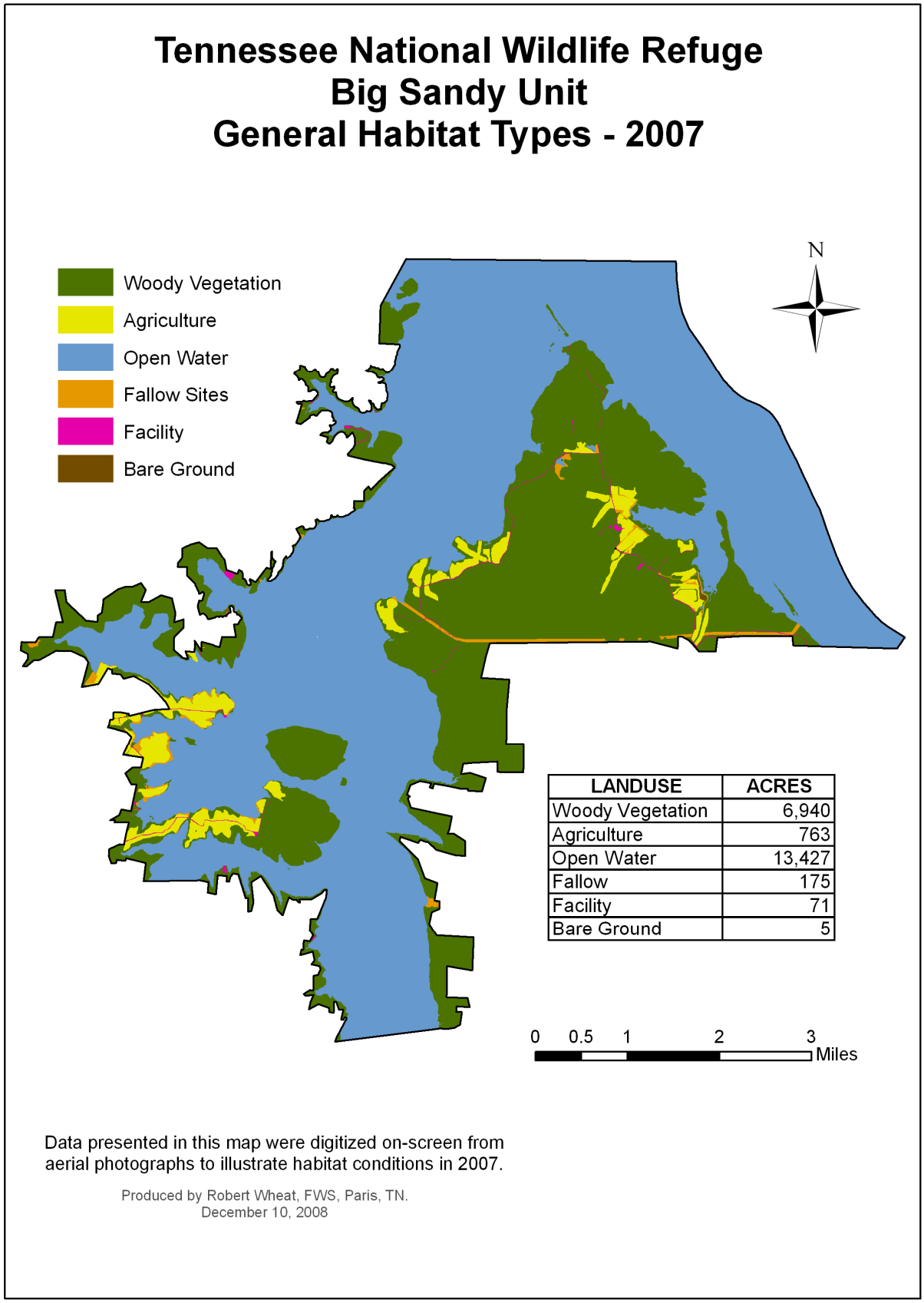
Farming has been a significant component of the waterfowl management program since the refuge was established. Initially, nearly 9,000 acres of the refuge were farmed; however, in 1979 the farmed acreage was reduced to around 5,500 acres. During the early 1990s the farmed acreage reached an all-time low of approximately 1,700 acres in row crops. This acreage has since steadily increased to the current level of about 3,100 acres.

The goal of the refuge's farming program is to provide food and cover for migratory birds and other resident wildlife. It supplements natural foods with grains such as corn, milo, and millet, and winter wheat for green browse. Like many national wildlife refuges, Tennessee NWR has a cooperative farming program, under which five farmers have contracts with the refuge to cultivate crops, typically harvesting 75 percent for themselves and leaving 25 percent behind for wildlife on the refuge. Corn is the preferred crop for the refuge shares, although millet is planted in areas that remain too wet for corn production. Between about 3,000 and 3,500 acres have been planted annually in the last five years, including some acreage by force-account farming (planted by refuge staff). Force-account farming has included planting wheat in harvested row crop fields and fallow fields for green browse, Japanese and brown-top millet in refurbished moist soil areas, and occasionally corn and milo.

The refuge requires the cooperative farmers to follow best management practices as they relate to crop rotations, conservation tillage, and pesticide use. The refuge has an approved Integrated Pest Management (IPM) Plan that addresses pesticide use requirements, as well as best management practices to reduce the amount of pesticides needed and measures to protect nontarget plants and animals.

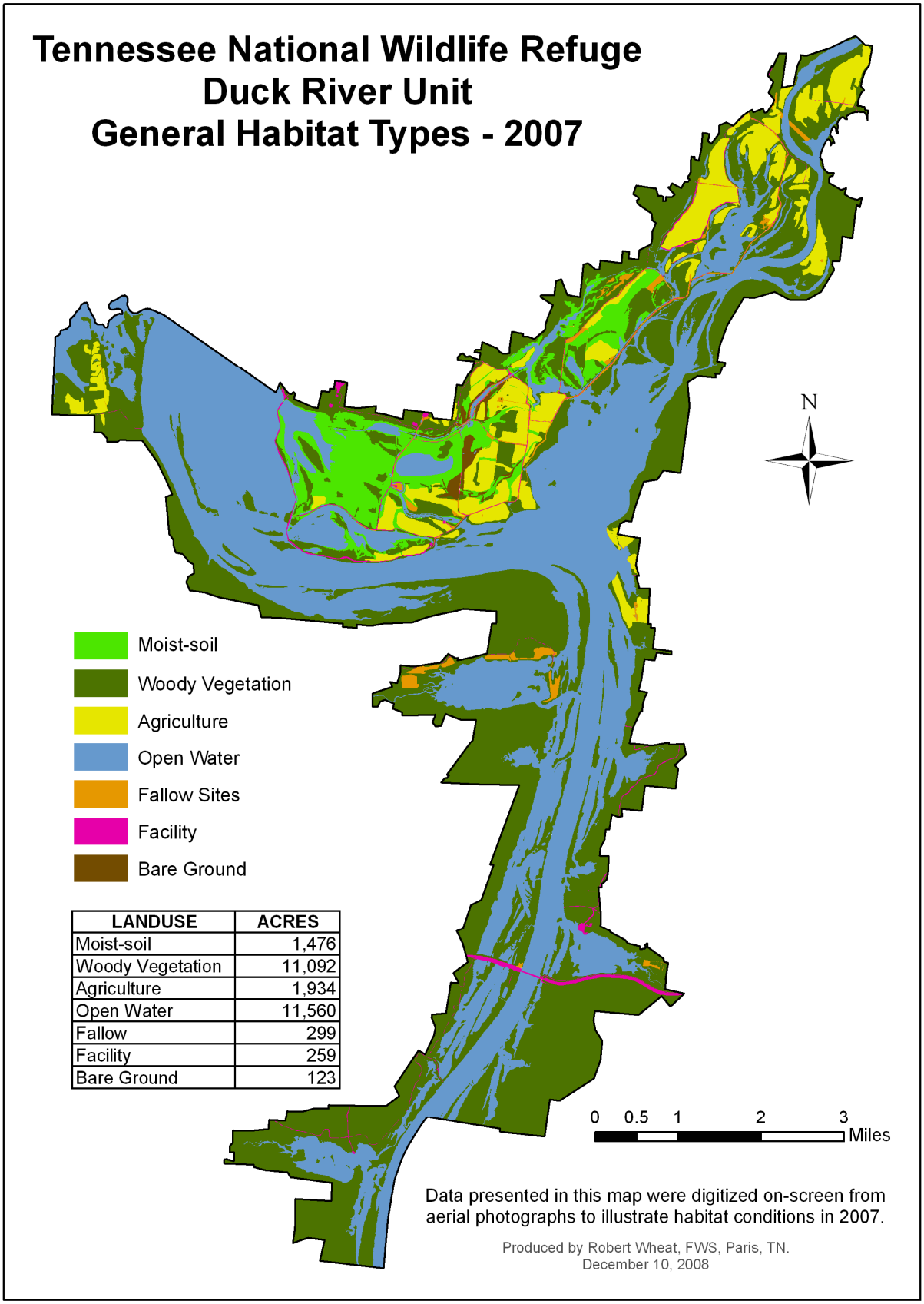
In the past, many small fields, mainly in upland areas, have been farmed on the refuge in order to increase the acreage so additional refuge shares could be taken in fields utilized by waterfowl. Due to the small numbers of Canada geese now migrating to the refuge, utilization of some of the refuge share of corn has been minimal. Cooperative farmers express some concern regarding the large amounts of waste corn sprouting in the fields presenting "weed" problems the following year. They have also expressed a possible interest in abandoning unprofitable farmlands in some areas. Minor adjustments were made in the Duck River Bottoms that included planting some corn force-account

Figure 6. General habitat types of the Big Sandy Unit.



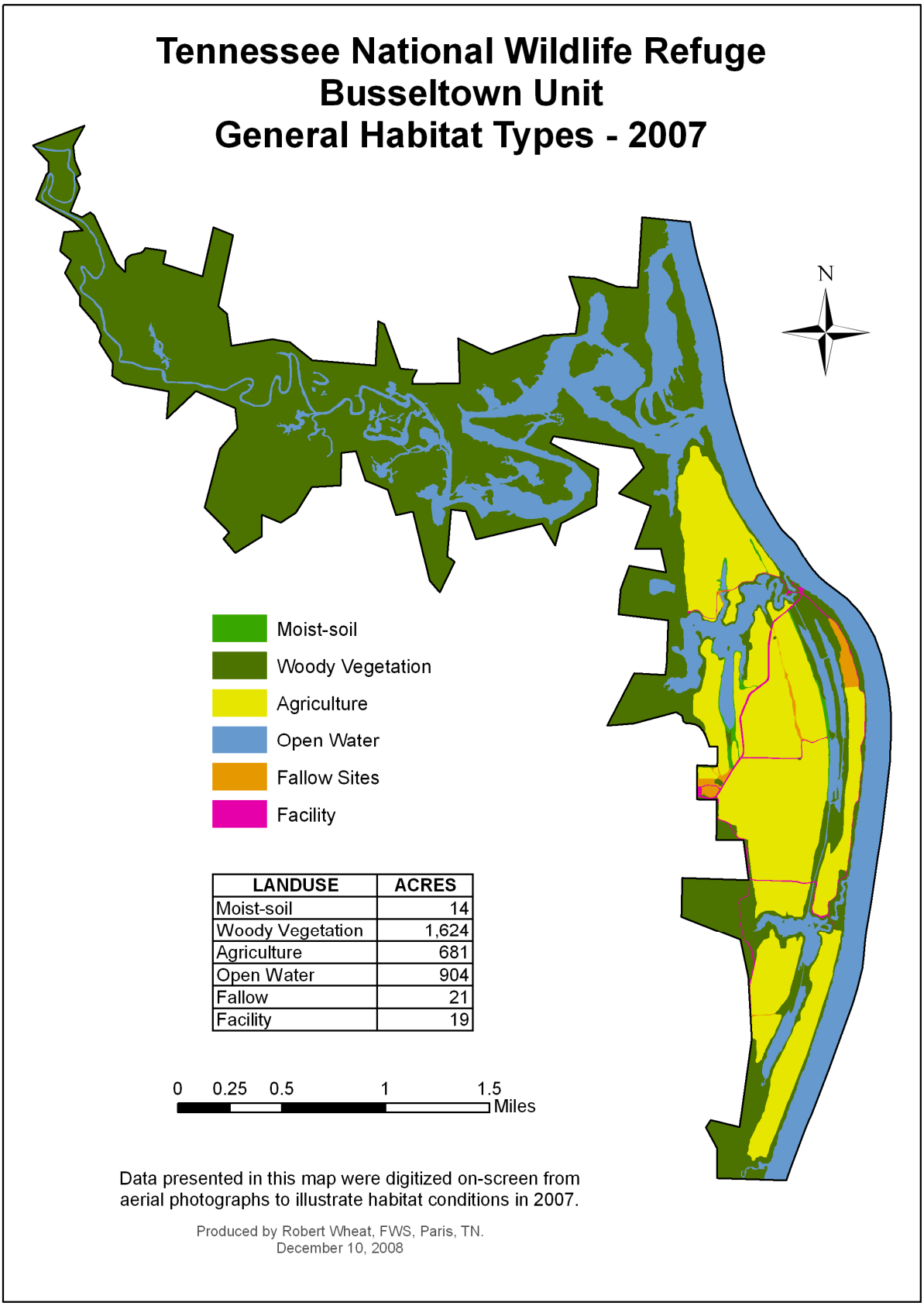
LANDUSE	ACRES
Woody Vegetation	6,940
Agriculture	763
Open Water	13,427
Fallow	175
Facility	71
Bare Ground	5

Figure 7. General habitat types of the Duck River Unit.



LANDUSE	ACRES
Moist-soil	1,476
Woody Vegetation	11,092
Agriculture	1,934
Open Water	11,560
Fallow	299
Facility	259
Bare Ground	123

Figure 8. General habitat types of the Busseltown Unit.



LANDUSE	ACRES
Moist-soil	14
Woody Vegetation	1,624
Agriculture	681
Open Water	904
Fallow	21
Facility	19

and retiring poor and highly flood-prone farmland from the cooperative farming program. Some potential adjustments can be made on the Big Sandy Peninsula with increased force-account farming, but staff and funding limitations are an issue. Most of the remaining farmland is needed to meet objectives unless force-account farming is increased significantly beyond current capabilities.

The cooperative farming program enables the refuge to better meet its objectives without much of the expense associated with a farming program. Essentially, the only cost to the Service is administering the program. However, a price has to be paid in order to produce the agricultural foods at such a low cost. There is no doubt that if funds and/or personnel were not limited, the agricultural habitats on the refuge would be managed under a different program. Contract farming (private farmers contracted to plant all crops) or force-account farming (refuge staff planting all crops) would greatly reduce the acres under cultivation. Some positive results would be (1) more land available for other habitats; (2) less fragmentation of forested habitats; (3) reduction in the amount of pesticides and other agricultural inputs used on the refuge; (4) more control on when the crops are planted; (5) greater ability to follow best management practices; and (6) greater ability to plant more wildlife-desirable crop varieties (such as dwarf corn).

A few problems exist with the croplands. First, healthy populations of turkey, resident Canada geese, and deer eat the crops leaving less for the migratory birds. In addition, the amount of crops eaten during the growing season threatens the profitability of the cooperative farming. The proliferation of private hunting clubs near the refuge boundary limit the area where crops can be left for waterfowl by the cooperative farming program because of the necessary barrier needed to provide a sanctuary and the legal aspects of the refuge manipulating crops during the waterfowl hunting season. Lastly, flooding of the crops is much more desirable. The TVA controls the water levels, which mandates the flooding of the croplands by pumps and other methods. By damaging the levees and ditches, beavers and invasive species are obstacles to maintenance of this ecosystem (USFWS 2005).

Water Management

The TVA reserves all rights on flood control, navigation, and power production for Kentucky Lake. Water management within refuge-controlled impoundments is impacted by the water levels of the reservoir. Kentucky Lake has an annual water fluctuation, which is exactly the opposite of what is needed for water management within the refuge impoundments. The lake's normal summer pool is 359 feet MSL, with a drawdown to 354 feet MSL during the winter months. The reservoir's drawdown begins July 5, gradually dropping to winter pool by December 1. The lake begins to rise again on April 1, reaching summer pool by May 1. Even though the water management schedule for Kentucky Lake presents difficulties in managing the water within the refuge impoundments, the benefits of the habitats produced on the reservoir greatly outweigh the negative impacts.

The refuge manages 26 impoundments. Most of these impoundments were constructed during the 1980s and many of the levees and water control structures (WCS) are in need of repair or replacement. The refuge's Annual Habitat Management Plan provides water management details, which are updated yearly. The primary purpose for managing the water levels within these impoundments is to enhance food production and to make it available to waterfowl during migration and wintering periods. Other migratory waterbirds such as shorebirds, herons, and rails greatly benefit from this management practice. Agriculture and moist soil are the primary habitats for which these impoundments are managed. When an impoundment or portion of an impoundment is to be planted in row crops, such as corn and soybeans, the drawdown is planned to initiate in early March to allow sufficient drying time. Moist soil drawdowns occur later during the growing season and vary from mid-April to mid-July. The drawdown timing and levels for each impoundment varies from year-

to-year, as much as possible, to reduce the impacts of undesirable and invasive plants. Water management plans have to be altered during most years due to flooding from Kentucky Lake.

Three small impoundments, totaling 39 acres, are located on the Big Sandy Peninsula (USFWS unpub. data). These impoundments represent the only managed waters on the Big Sandy Unit. The topography of this unit is too rolling to be conducive to large-scale impoundment construction. However, there are other potential areas where additional impoundments could be developed. The existing impoundments are independent of one another and are solely dependant upon rainwater during flooding. These impoundments are managed in a moist soil/agriculture rotation to provide a diversity of flooded habitats and to keep the fields in an early successional state. A project with the assistance of Ducks Unlimited (DU) refurbished these levees and replaced the WCS in 2006.

The Duck River Bottoms contain 19 impoundments totaling 4,758 surface acres of water. These impoundments range in size from less than an acre to 1,046 acres (USFWS unpub. data). Much of the bottoms that can have water management capabilities are already developed. However, a potential to construct small impoundments or subdivide some existing impoundments still exists. The existing impoundments are somewhat interconnected and water movement can and does occur between some of the impoundments. A 50,000 gallons per minute (GPM) electric pump that is located in the lowest end of the bottoms is available to pump water out of (not into) all of the impoundments. Typically, it is only used to pump water out of the lower six impoundments due to time and budget constraints.

Much of the water from the remaining impoundments in the Duck River Bottoms is drained by gravity flow into Kentucky Lake prior to April 1, when the reservoir levels begin to rise towards summer pool. Only a few impoundments are small enough to be efficiently pumped using the portable pumps. Flooding of the impoundments begins on a small scale in August in order to provide habitat for early migrating waterfowl and rails. The timing of fall flooding in some impoundments is sometimes delayed until the cooperative farmer's harvest is complete. For the most part, fall filling is dependent upon rainfall. Rarely can the refuge open WCS to move water from the reservoir into any impoundment because the reservoir water level has dropped to the winter pool. With the assistance of Ducks Unlimited, a project to install a 17,000-GPM pump in the upper bottoms was initiated in 2008. This pump will be strategically positioned along the bank of the Duck River to lift water out of Kentucky Lake in order to assist in flooding most of the impoundments throughout the Duck River Bottoms. This pump is planned to be operational in the fall of 2010.

The Busseltown Unit has four impoundments totaling 369 acres (USFWS unpub. data). The drawdown of these impoundments generally occurs in early March. This unit is primarily managed for agriculture through the cooperative farming program, with only the lowest fringe of the impoundments producing moist soil habitat. There are possibilities for increased water management capabilities. Ducks Unlimited was contracted in 2008 to survey about 300 acres within this unit and develop a design to impound as much of the area as possible. This project identified six potential impoundments, totaling 95 acres of flooded habitat. Currently, funds are not available to construct these impoundments but efforts to secure funding are underway. Fall filling of most of the unit occurs by rainfall. A few small impoundments are typically filled by the use of portable pumps.

Moist Soil Management

Tennessee NWR manages moist soil habitats to provide food and cover for a wide variety of waterfowl and other migratory birds. The refuge attempts to meet as much of the waterfowl forage objective through the moist soil management program as feasible. Additionally, several other migratory bird groups, including rails, wading birds, shorebirds and some species of landbirds, benefit

from the refuge's moist soil management practices. On occasion, management efforts within individual impoundments are focused towards species groups other than waterfowl.

The refuge's moist soil program essentially began in the mid-1980s when most of the impoundments were constructed. The management program that exists today has largely resulted from the use of moist soil management methods identified by Fredrickson and Taylor (1982). Under the current management strategy, the refuge has the capability to manage for approximately 1,600 acres of moist soil habitats (1,500 acres on the Duck River Unit and 50 acres each on the Big Sandy and Busseltown units). An average of 1,400 acres, with varying levels of quality, is produced each year. Capabilities of expanding the moist soil program do exist, but additional impoundments will be needed and/or the farming program will be impacted.

The most significant issues the refuge staff faces with managing moist soil habitats are (1) invasive exotic plants; (2) limited personnel time to properly manage all units; (3) impacts of growing season floods; and (4) deteriorating infrastructure (levees, spillways, and water control structures).

Forested Uplands

Prior to the establishment of the refuge, most of the forestlands had been used and altered by Euro-American settlement for well over a hundred years. Forests were cleared for farming, resulting in thousands of acres of agricultural lands. Some of the cleared land was marginal but farmed for years and then grazed. Much of this agricultural land was eventually abandoned, producing various stages of poorly stocked timber stands throughout the refuge. Some of the abandoned fields were planted in pine by the TVA in the 1940s and by the refuge in the 1970s, and a few were planted in oaks in the 1980s and 90s. Where the topography was not conducive to clearing for agriculture, forest stands were heavily cut for sawtimber and then burned to encourage browse growth for livestock. In the early 1900s the iron ore industry clearcut forests in the region to produce charcoal. Much of the refuge's forest stands were generally even-aged with closed canopies and a sparse midstory and understory as a result of these practices.

There have not been any large-scale forest habitat management activities since the harvest in Compartment 4 of the Big Sandy Unit in 2001. Several attempts were made at using prescribed burns on the refuge, but it proved logistically difficult to coordinate weather conditions with the fire teams' availability. Harvest of Compartment 4 was conducted in a manner that would be conducive to conduction research that would determine the impacts of the forest management activities. Until this research project was complete, all harvest activities were suspended until the results of the research project were available. The research was completed and the results demonstrated that the management activity had positive effects on several landbird species (Thatcher 2007).

Upland Habitat Management

The 1962 Forest Management Plan for the Tennessee NWR had as its primary objective "to improve the forest condition so as to develop and maintain optimum game populations, primarily for wild turkey, white-tailed deer, and waterfowl, through sound forest management practices." The secondary objective listed by this plan was "the application of good silvicultural practices aimed toward obtaining and maintaining optimum stocked timber stands of desired species, size classes and quality to best meet both wildlife requirements and commercial purposes." In spite of the plan, little forest habitat management took place in the following decades.

A forest habitat management evaluation was conducted at Tennessee NWR in 1996 (USFWS 1996). In 1998, refuge staff began preparing a new Forest Management Plan (FMP) based on the findings of

this evaluation. The evaluation recommended a refuge forest management program concentrating on the upland forested areas and their potential as habitat for a selected assemblage of migratory landbirds. The bird list of priority species was developed based on the *Partners in Flight Bird Conservation Plan for the Interior Low Plateau* (Ford et al. 2000). The refuge forest is similar to many of the forests in the region in that it is generally even-aged with near-completely closed canopies, small individual crowns and lacking midstory and understory vegetation/structure. The FMP sought to create more openings in the canopy, increased groundcover, understory and midstory presence, and larger, more developed canopy crowns. In 1999, with the aid of a new Refuge Forester, the refuge's updated FMP was completed to final draft form and approved at the Service's Southeast Regional Office in January 2000.

The refuge's first forest inventory in nearly 40 years was conducted in the summer of 2000 as directed by the approved FMP. The cruise inventoried timber volumes and forest habitat conditions on 922 acres of the Big Sandy Peninsula identified as Compartment 4. The cruise data reinforced the conclusions of the 1996 forest habitat review. In nine of the ten delineated mature upland stands, the canopy closures were estimated to be ninety-three percent or more. These nine stands comprised over eighty percent of the refuge's mature forested area (USFWS unpub. data).

A forest prescription plan was written and approved in 2001 for Compartment 4. The prescribed actions included timber harvesting and controlled burning. Prescribed fire was suggested in order to enhance the habitat by promoting grasses and forbs that attract invertebrates, which are a critical component in the diet of many migratory landbirds. The primary target species of these management actions are the cerulean warbler, wood thrush, worm-eating warbler, Kentucky warbler, and hooded warbler. In addition to migratory landbirds, game species such as wild turkey and white-tailed deer, which are valued by refuge hunters and visitors, will benefit from a more diverse forest structure. A study designed in conjunction with Dr. David Buehler of the University of Tennessee was established to test the results of a planned selective timber harvest and prescribed burn. The objectives of this research project were to evaluate the impacts of the refuge's forest management activities on (1) habitat structure and composition; (2) breeding bird use; and (3) avian breeding productivity.

Harvesting of the compartment began in 2001 and was conducted with a coordinated system of a track-mounted feller-buncher, followed by a track-mounted stroke de-limber, followed by either a traditional skidder or clam bunk. These machines allow precision directional felling and bunching which reduces the damage to the crowns and bark of remaining trees that is otherwise common in selective harvests.

A prescription for the controlled burn areas was developed and approved in 2002. Attempts were made on several occasions to conduct the burn. Due to weather conditions and problems associated with having a qualified burn crew available at the appropriate time when conditions were within prescription, the refuge was unsuccessful conducting this burn. No large-scale forest habitat management activities have been conducted since the harvest in 2001. The harvest of Compartment 4 was conducted in a manner that would be conducive to conduction research that would determine the impacts of the forest management activities. Until this research project was complete, all harvest activities were suspended until the results of the research project were available. The research was completed and the results demonstrated that the management activity had positive effects on several landbird species (Thatcher 2007).

Invasive Exotic Upland Plant Control

Various species of pest plants exist on the refuge's forested areas. Chinese privet (*Ligustrum* spp.), Japanese grass (*Microstegium vimineusm*), Japanese honeysuckle (*Lonicera japonica*), kudzu

(*Pueraria montana*), mimosa (*Albizia julibrissin*), tree of heaven (*Ailanthus altissima*), multifloral rose (*Rosa multiflora*), and musk thistle (*Cardus nutans*) are species of concern. At this time, these pest species are not greatly impacting the management objectives of the refuge. The refuge is monitoring some areas with kudzu and privet. Forest management actions on Big Sandy plots will be monitored for an increase in exotic or invasive species. The refuge is continuing to look for potential partners to help with this activity. The refuge is working with the Wild Turkey Federation and the TVA to manage power line rights-of-way to provide quality habitat for resident species and federal trust resources.

Bottomland Hardwoods

Bottomland hardwood stands on the refuge are primarily limited to small isolated blocks within the Duck River and Busseltown Dewatering Areas and low-lying areas along the shore of Kentucky Lake, primarily along the Duck River and Cub Creek. Many of these stands have resulted from the natural succession of abandoned agricultural and moist soil areas. The tree species composition consists mostly of lightly seeded species, such as black willow (*Salix nigra*), sweetgum (*Liquidambar styraciflua*), silver maple (*Acer saccharinum*), and green ash (*Fraxinus pennsylvanica*). Very few stands contain a good composition of hard mast-producing trees. Only a few areas that were abandoned have been planted to oaks. Within some more remote areas of the refuge, loss of quality bottomland hardwoods have resulted from beaver activities. Currently, the refuge has no large-scale active forest management activities planned within any bottomland hardwood stands.

Open Water

Tennessee National Wildlife Refuge has many open water areas, among them the Tennessee River, Duck River, Big Sandy River, and Kentucky Lake. Some of the water impoundments also have open water. The open waters of the refuge attract large numbers of common loons, grebes, gulls, terns, white pelicans, double-crested cormorants, and coots. As many as 700 common loons and 500 horned grebes have been observed by birders during the fall on the Big Sandy River embayment of the refuge. Gulls and terns are abundant throughout Kentucky Lake.

Natural Habitat Protection

In addition to the managed habitats addressed above, there are several naturally occurring habitats (or at least habitats not actively managed by the refuge) that are extremely important to many species of wetland wildlife. The primary role the refuge plays with these habitats is protecting them.

Most of these habitats are outside the main levees of Duck River and Busseltown Dewatering Areas and are influenced by the TVA's Kentucky Lake operation schedule. Under the current water control schedule, the drawdown of Kentucky Lake from summer pool (359 feet MSL) toward winter pool starts around July 5 and steadily drops to winter pool (354 feet MSL) by December 1. By mid- to late August, the level typically drops approximately two feet. At this level water is completely off the willow-buttonbush zone, allowing woody plants and herbaceous perennials an opportunity to "breathe" and seedlings to germinate. Annual plants such as yellow nutsedge germinate in areas where the sunlight is sufficient. Shorebirds and early migrating blue-winged teal readily utilize the newly exposed mudflats that are free of dense woody vegetation (Wirwa 2009).

The water level continues to drop throughout the fall, exposing vast areas of mudflats. Normally, during the fall the only habitat available to shorebirds on the refuge are the flats associated with Kentucky Lake. Annual grasses and sedges carpet these flats, providing browse for geese and some species of ducks. This habitat is critical for early migrating geese that start arriving in late September because it is typically the only habitat available at this time of the year, because crop harvest has not

yet been initiated. Throughout the fall and winter, tens of thousands of green-winged teal, wigeon, and gadwall forage on these flats (Wirwa 2009).

During the winter and early spring flood events, many of the mallards, black ducks, and wood ducks will vacate the managed habitats in the bottoms to utilize the newly flooded moist soil, willow-buttonbush, and bottomland hardwood habitats along the shoreline of the reservoir (Wirwa 2009). Over 55 percent of the duck use and 48 percent of the goose use on the refuge is found to occur in the reservoir as opposed to the more intensively managed impoundments (USFWS unpub. data). The water schedule reverses on April 1 and the reservoir is allowed to quickly rise to summer pool by May 1. The willow-buttonbush zone is again flooded, providing excellent wood duck brood habitat, as well as habitat for many other species of birds, reptiles, amphibians, and mammals. This habitat is also essential for spawning and fry survival for many species of fish.

Submersed and free-floating aquatic plant communities are found in scattered locations within the impoundments and on the reservoir throughout the refuge where conditions are favorable. These plant communities consist of both native and exotic species, including Eurasian watermilfoil (*Myriophyllum spicatum*), spinyleaf naiad (*Najas minor*), southern naiad (*N. guadalupensis*), coontail (*Ceratophyllum demersum*), and duckweeds (*Lemna* spp.). Waterfowl commonly utilize these habitats especially during the early fall. The refuge does not specifically manage for or against the aquatic plant species listed above.

Diving ducks and mergansers utilize the open deep water habitats that primarily occur on Kentucky Lake. The Big Sandy Unit holds a greater number and diversity of these species than the other two units combined. Diving ducks and mergansers make up approximately 20 percent of the ducks on this unit (USFWS unpub. data). The only management the refuge practices in these habitats is protection from disturbance and unintentional take with commercial fishing nets. During the early 1990's the refuge documented a problem with diving ducks getting entangled in commercial fishing gear within high use areas of the Big Sandy Unit. The refuge staff worked with the TWRA to change commercial fishing regulations for the refuge during the wintering period. Since the new regulations have been in place, no further kills have been documented on the refuge. The refuge has also closed some of the highest use areas to boats to reduce disturbance.

Bottomland hardwood stands on the refuge are primarily limited to small isolated fragments within the Duck River and Busseltown Dewatering Areas and low-lying areas along the shore of Kentucky Lake, especially along the Duck River and Cub Creek. Many of these stands have resulted from natural succession of abandoned agricultural and moist soil areas. Tree species composition consists mostly of light seeded species, such as black willow (*Salix nigra*), sweetgum (*Liquidambar styraciflua*), silver maple (*Acer saccharinum*), and green ash (*Fraxinus pennsylvanica*). There are very few stands that contain a good composition of hard mast producing trees. Only a few areas that were abandoned have been planted to oaks. Within some more remote areas of the refuge, loss of quality bottomland hardwoods have resulted from beaver activities. Currently, no active forest management activities are planned within any bottomland hardwood stands.

Disturbance Management - Closed Areas

Selected roads, lands, and waters are closed to public access from November 15 - March 15 to reduce disturbance to eagles, waterfowl and other water birds in high use areas of the refuge. Outside of the closed period most of the levees and field roads remain closed to vehicle access but foot and bicycle traffic is allowed. These roads are closed primarily for public safety and facility protection. Major roads within each unit remain open to allow the public opportunities to observe wildlife. The seasonally closed areas on the Big Sandy Unit consist of three large segments of Kentucky Lake and the adjacent lands

and access roads. Of the total duck use that occurs on this unit, over 80 percent occurs within these closed areas (USFWS, unpub. data). Most of the roads and all of the lands and waters within the impounded areas of the Duck River Bottoms and Busseltown are at least closed seasonally.

In 2005, the beginning of the closed period was moved back to November 15 in an effort to have the regulations on all the refuges within Tennessee as consistent as possible. The refuge staff does not feel this change will have significant impacts to waterfowl since populations are typically very low during early November.

Great blue herons have nested in a 10-acre cypress stand of Grassy Lake in the Duck River Bottoms since before the Service accumulated data in 1949. Because sportfishing is so prevalent within the impoundments, the immediate area, within about a 100-yard radius, has historically been restricted to boat traffic during the herons' nesting season. The closed radius around the heron rookery was extended to a 0.5-mile radius in 1984 and access was denied year-around. In the mid-1990s, the period the rookery area was closed was relaxed to allow access after August 31. The rookery area would then close on November 1 associated with the normal seasonal closures. Starting in the fall of 2005, the period of closure changed to November 15 - August 31. When the great blue herons abandoned this rookery in 2005, public assess was no longer restricted other than the normal November 15 – March 15 closure period.

Invasive Exotic Aquatic Plant Control

Some of the invasive exotic plants known to occur in the wetland habitats on the refuge include alligatorweed (*Alternanthera philoxeroides*), parrotfeather (*Myriophyllum aquaticum*), purple loosestrife (*Lythrum salicaria*), *Paspalum* spp., and *Sesbania* spp. Currently, only a few species are creating significant problems on the refuge, but the potential exists for others to become major problems. Control of these species can be extremely difficult, and in many cases, will only be temporary due to the extremely invasive nature of these pests. Even if species are controlled on the refuge, they can easily be re-introduced from adjacent river system during flood events. The refuge staff has not conducted a complete inventory of all known invasive species and their locations within the refuge boundaries. Monitoring has been limited to the intensively managed wetland habitats.

The invasive nature, adaptability to various soil moisture conditions, and resistance to mechanical and chemical control of alligatorweed have resulted in a significant impact on wetland management activities within the impoundments in Duck River Bottoms. Alligatorweed was first documented in the Duck River Bottoms in 1988 with a total of four acres found within four separate impoundments. Currently, it is impacting about 400 acres within the bottoms. Alligatorweed also occurs in small patches within Busseltown Bottoms and in one impoundment on the Big Sandy Unit. Several locations of heavy and light infestations occur on Kentucky Lake, both on and off the refuge (USFWS unpub. data).

Most of the refuge's invasive exotic plant monitoring and control efforts are focused on alligatorweed within the impoundments on the refuge. Control efforts began in 1989 and continue to this date. Experiments have been conducted to evaluate mechanical (disking), water level management (keeping it as dry as possible), and herbicide (several different chemicals) treatments. Mechanical control efforts have been ruled out because disking spreads the plant, due to its ability to sprout from cuttings. Dry conditions do stress alligatorweed and allow competition from other plants, but will not eliminate it and the resulting habitat conditions are poor waterfowl habitat. Most locations where alligatorweed thrives cannot be dried sufficiently to have long-term effects. Frequent herbicide treatments appear to be the only means to gain any control over this plant. Of the herbicides tested, aquatic-labeled imazapyr products (i.e., Habitat) produce the best results (USFWS unpub. data).

Applications of herbicide have been done using ground equipment (backpack sprayers, tractor and ATV-mounted boom sprayers) and aerially (helicopter). When possible, aerial treatments are the most feasible, due to access issues and the amount of area covered relative to the effort applied. Aerial treatments were initiated in 2002 when 320 acres of alligatorweed was sprayed with glyphosate. Aerial treatments of alligatorweed with glyphosate continued through 2005 with about 200 acres sprayed each year. Control of alligatorweed by glyphosate was limited and short-lived. In 2005 a new herbicide, Habitat, was tested on 50 acres. Treatment results were promising and the acres treated more than doubled the next year. Currently, about 150 acres of alligatorweed is aerially sprayed with Habitat herbicide and progress is being made to control this invasive plant. In addition to the aerial treatments, several acres are also sprayed using ground methods during each year. The preliminary results of this intensive effort seem to be reducing the density of alligatorweed but not eliminating the threat of reestablishment if control efforts are relaxed (USFWS unpub. data).

Parrotfeather, known to be extremely invasive in aquatic environments, was first located in 2002 on two acres within two impoundments in the Duck River Bottoms. Parrotfeather was first treated with 2,4-D in 2003, which did not prove to be effective. Renovate (an aquatic herbicide labeled Garlon) was used in 2004 and control was not achieved. In 2005, Habitat herbicide was tested at a low rate and the results showed minimal control. The application rate for Habitat was increased to the maximum level in the 2007 treatments and control was much improved. The refuge hopes to eliminate this plant before it becomes well established.

A small colony of purple loosestrife exists on the Busseltown Unit. This colony has been present there for a number of years with little indication of expansion. Herbicide treatment with glyphosate has been attempted for several years prior to 2003. This practice may have reduced the expansion of the colony but appeared to have no other long-term impacts. In 2003, a biological control agent was released in the purple loosestrife colony – approximately 2,500 Galerucella beetles were released after the flood waters had receded on June 16, which was an unusual late release date. The beetles have been released most years since the first release. This treatment appears to be containing the colony.

Paspalum spp. and *Sesbania* spp. are present in isolated patches within some of the moist soil areas in the Duck River and Busseltown bottoms. They have not currently reached unmanageable levels, but do impact moist soil production where they occur. The refuge has made some effort towards controlling these plants, but with the focus on alligatorweed this effort has been limited. Where practicable, *Paspalum* spp. can be controlled by prolonged deep flooding during the growing season. Herbicide treatment with glyphosate is also effective. *Sesbania* spp. can be controlled through mechanical means (late summer disking or mowing) or herbicide treatments with 2,4-D.

WILDLIFE

The diversity of aquatic and terrestrial habitats enables a variety of wildlife species to make the refuge their home either during the entire year, during the winter months as many waterfowl do, or during temporary stopovers as do some migratory songbirds. The refuge focuses most of its efforts on waterfowl habitat management, but a variety of these habitat management practices benefit numerous other species. More than 300 species of birds have been observed on the refuge; of this total, 28 species have been observed and are listed as “accidental” birds (USFWS 2007a). The abundance and diversity of managed and natural wetlands support over 100 species of waterfowl, shorebirds, herons, egrets, rails, gulls, terns, and other waterbirds. The large bodies of water scattered along the refuge host a diversity of waterbirds associated with lacustrine (lake-related) habitats. In addition, up to 230 species of mammals, fish, reptiles, and amphibians may use the refuge for part or all of their life cycles (USFWS 2007b).

Waterfowl

Tennessee NWR serves as an important wintering ground for thousands of migratory waterfowl using the Mississippi Flyway. The refuge winters approximately 200,000 ducks and 7,500 geese. In some cold winters, the refuge has been known to exceed a peak of 250,000 ducks. During the last ten years, geese have peaked at 19,000 and ducks have peaked at more than 320,000 (Figures 9 and 10) (USFWS unpub. data).

The refuge is a significant wintering area for American black ducks in Tennessee, accounting for 50 to 75 percent of the population observed during the Mid-winter Survey (Tennessee NWR and TWRA, unpub. data). Over 40 percent of the black ducks in the Mississippi Flyway observed during the Mid-winter Survey from the 1970s through the mid-1990s occurred in Tennessee (Sanders et al. 1995). Thus, during normal winters the refuge winters 20-30 percent of the black ducks occurring in the Mississippi Flyway; however, the refuge has exceeded 30 percent the last few years. Other duck species present in significant numbers during the fall and winter include the mallard, gadwall, wigeon, blue-winged teal, green-winged teal, pintail, ring-necked duck, canvasback, lesser scaup, bufflehead, goldeneye, and ruddy duck.

Tennessee NWR is one of the three critical terminal wintering regions for those migrant Canada geese showing fidelity for Deep South wintering sites (Orr et al. 1998). It is important that the refuge provide sufficiently for the life-history needs for South James Bay (SJB) and Mississippi Valley Goose populations (MVP), in order to ensure the southeast can retain wild migrant populations and their traditional migration patterns (Combs et al. 2001). In the 1980s, the Tennessee Refuge often wintered more than 40,000 migrant Canada geese, but recent numbers have ranged between 5,000 and 13,000 (USFWS unpub. data). Very mild winters and/or numerous management actions in more northern states and Canada could be limiting factors. However, history has shown that very harsh winters may double or even triple overwintering densities.

Tennessee NWR is part of the larger seven-county Kentucky Lake Area (KLA), one of the state's top three waterfowl sites. Numerous state WMAs and private land waterfowl impoundments are within this seven-county landscape, all with the potential to provide duck foraging and sanctuary requirements. A biological review conducted in 2004 (USFWS 2005) recommended the refuge should provide 60% of the KLA foraging needs for 202,000 ducks for 110 days (22.2 million duck-use days [DUDs]) and 75% of the 10-year average (1992-2001) refuge peak Canada goose population of 21,000 for 90 days (1.9 million goose-use days [GUDs]). This would result in refuge foraging habitat objectives of 121,000 ducks for 110 days and 16,000 geese for 90 days. The duck population objective was derived from the 1970-79 average KLA Midwinter Inventory for nine species of ducks, plus a separate wood duck objective added to create the total. Under this objective, the foraging needs of the remaining 40% of the duck population and 25% of the Canada goose population will be provided on state WMAs, TVA properties, and private lands.

An expanding population of resident Canada geese (*Branta canadensis maxima*) is adversely impacting the refuge's ability to manage for migratory waterfowl by damaging habitat during the growing season. Impacts on agricultural crops are threatening the profitability of the cooperative farming program and reducing the quantity of grain available to migrants. Damage to moist soil vegetation likely decreases the quality of this habitat in some locations. The refuge is currently attempting to control resident Canada goose numbers through refuge hunts to avoid excessive competition for forage and to reduce off-refuge depredation. The Kentucky Lake Waterfowl Management Plan calls for an interim population objective of 6,000 resident Canada geese, as

Figure 9. Peak duck populations on Tennessee NWR, 1970–2009.

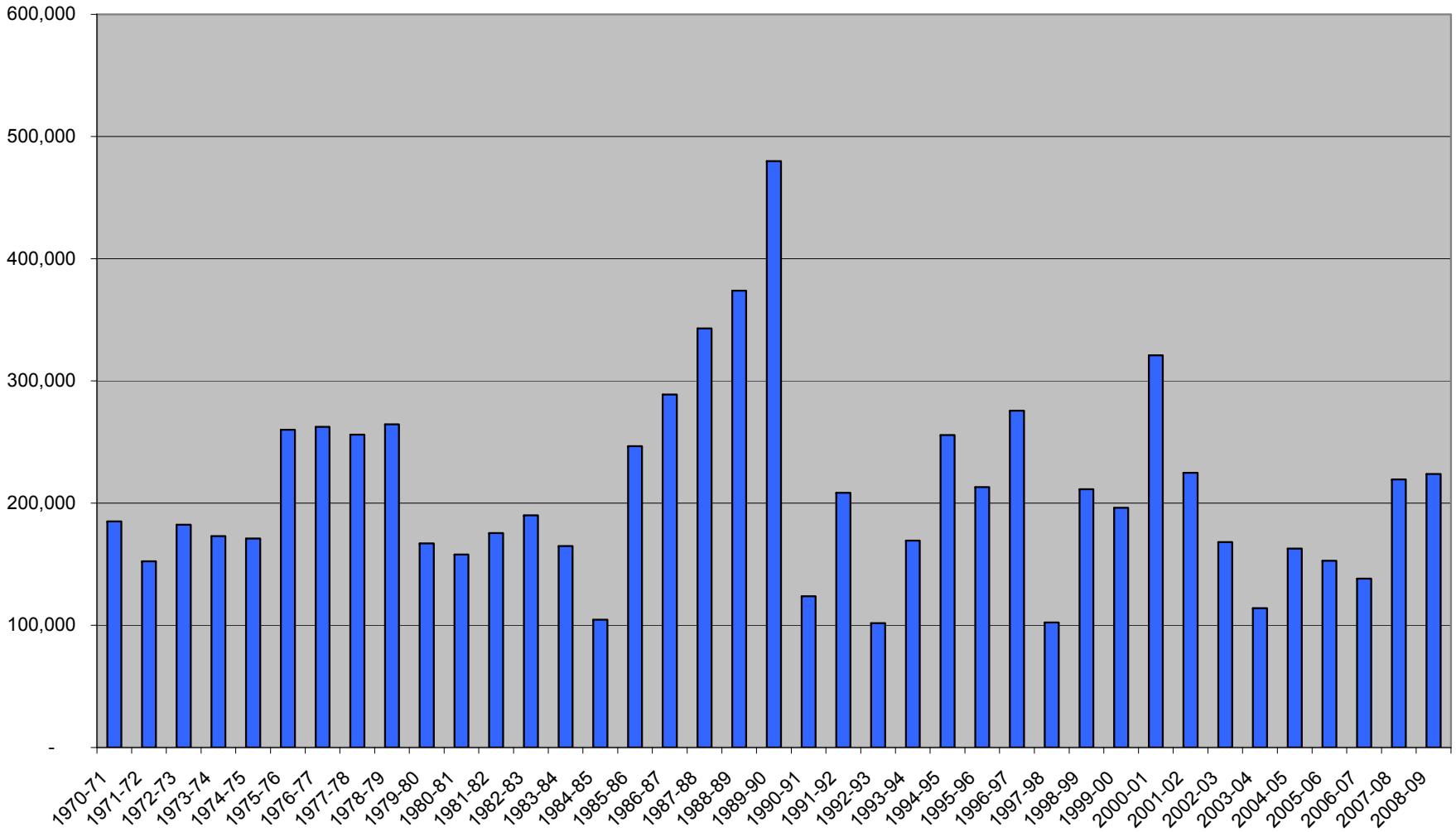
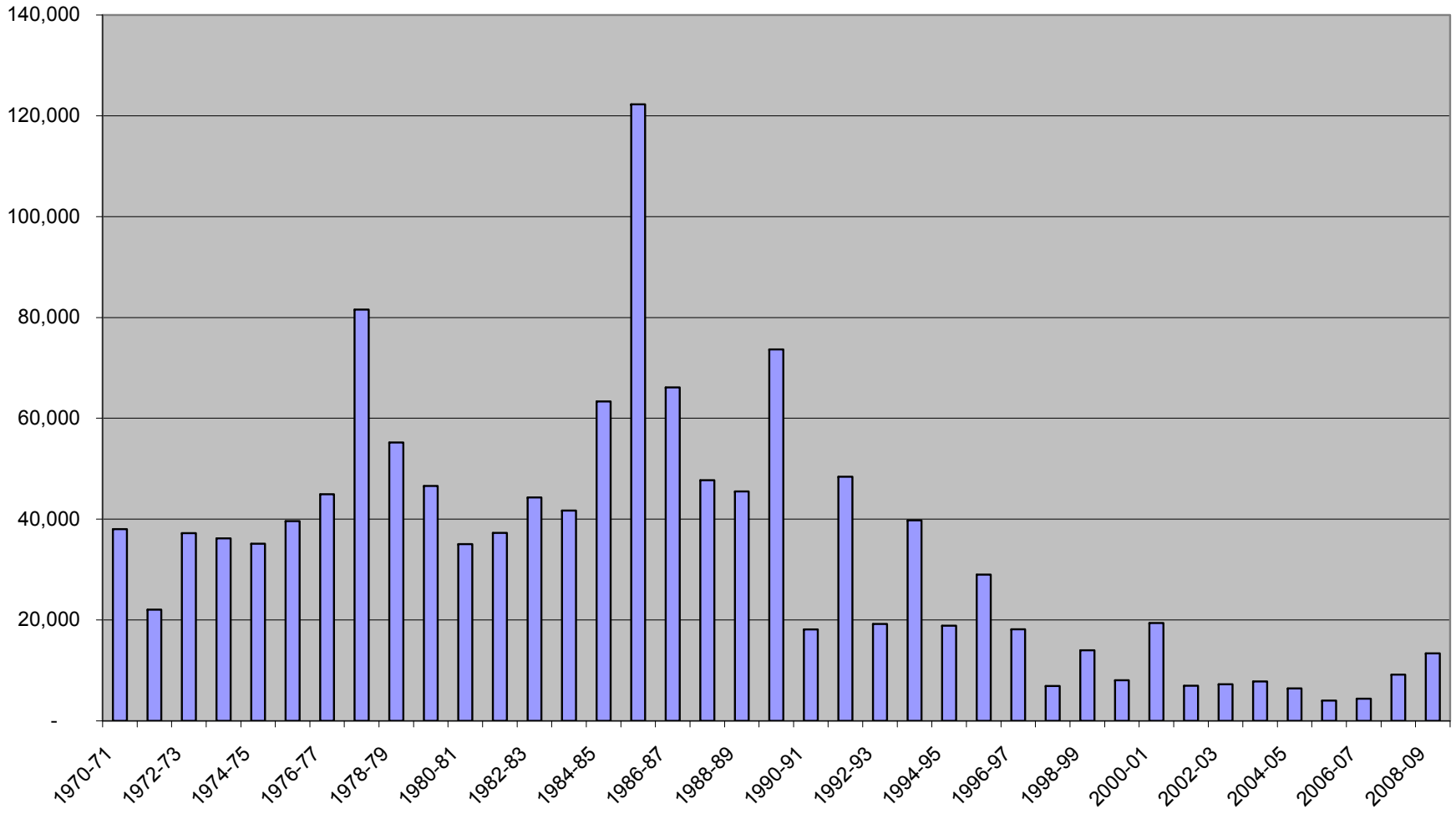


Figure 10. Peak goose populations on Tennessee NWR, 1970–2009.



measured by the TWRA's annual spring survey. The refuge currently does not have a population objective, but may consider establishing one in the future for management purposes.

The refuge's role as a sanctuary enhances waterfowl hunting on nearby public and private lands, as well as providing opportunities for wildlife observation. Waterfowl sanctuaries are a critical part of annual waterfowl conservation and management. Sanctuaries provide areas where birds can rest, gain fat, and develop pair bonds that improve the likelihood of successful nesting in the spring and summer. Waterfowl hunting, with the exception of a September goose season, is not currently allowed on the refuge. However, private waterfowl hunting areas are becoming larger and more developed with increased emphases placed on maintaining flooded food sources that support several thousand waterfowl. A wider buffer would greatly decrease disturbances along the boundaries and further enhance the refuge's ability to meet its intended purposes (USFWS 2005).

Wood Duck Nest Boxes and Banding

Tennessee NWR has a wood duck nest box program that has been active since 1988. Currently, there are around 160 boxes available each year. The vast majority of these boxes are in the Duck River Bottoms, where the quality and quantity of brood habitat is superior to that of the other units and the proximity to the Duck River Work Base maximizes staff efficiency. A few boxes are located on a couple of small farm ponds on the Big Sandy Unit with a primary purpose of environmental education. Good brood habitat on the Big Sandy Unit is limited to the willow and buttonbush plant communities that occur in the riparian zone along the shoreline of Kentucky Lake. There is a potential for additional nest boxes in locations where creeks enter the reservoir creating large areas of quality habitat. There are no boxes on the Busseltown Unit, even though good habitat is present in several locations throughout this unit. The refuge staff would like to expand the nest box program to the Busseltown Unit and the Big Sandy Unit, but personnel limitations have constrained this commitment. Maintaining the wood duck nest box program at the current level requires 13 man-days of effort. This includes box maintenance, data collection, and data entry and reporting.

All boxes are checked and maintained on at least an annual basis. A total of 50 boxes are checked monthly to provide more accurate data relative to the number of times a box was used during a season, the number of eggs laid, the number hatched, etc. Use rates and success rates have varied somewhat over the years, with the last five years averaging 60-70 percent used by wood ducks, 10-30 percent used by hooded mergansers, 65-80 percent successful wood duck nests, and 50-75 percent successful merganser nests. Even though predator guards are used on all boxes, 30 percent of the nests are predated, with woodpeckers being the most common culprits (USFWS unpub. data).

Tennessee NWR bands more wood ducks that any other refuge within the Service's Southeast Region and possibly in the entire Refuge System. Historically, the refuge bands an average of 925 wood ducks annually, but this number has declined to 567 with the start of the resident goose season on the refuge (USFWS unpub. data). Due to the potential of a baiting problem, banding operations have been significantly reduced due to the resident goose hunt. The refuge banded 1,124 wood ducks in 2009. This represents the highest number banded since the start of the resident goose hunt. Since the duck trap that is located in the Duck River Bottoms was constructed in 1987, all the wood ducks banded on the refuge are captured in this trap. The current banding quota is: 73 adult females; 45 adult males; 135 hatch-year females; and 81 hatch-year males, totaling 334 wood ducks. Most years these quotas are easily met. The banding data are entered into the Bird Banding Laboratory's (BBL) Bandit database and submitted to the BBL.

With the large numbers reliably captured at this station, the refuge has been requested on several occasions to serve a larger role than just meeting a banding quota. The refuge has hosted several banding workshops to train TWRA and Service banders within the state. Each year the refuge holds several events that serve as an educational opportunity for youth groups associated with conservation-oriented organizations, the refuge's Friends group, and university wildlife classes. Numerous individuals from the local communities also gain exposure to the refuge by assisting with the wood duck banding program as volunteers.

Marshbirds

The presence of nesting king rails on the refuge is noteworthy. Tennessee NWR is the only known king rail nesting site currently used in Tennessee, although there were two other possible sites in western Tennessee during the 1990s (Nicholson 1997). Other species of secretive marshbirds potentially nest in the area, including the least bittern. Based on the results from surveys, a management strategy featuring the needs of king rails and other secretive marshbirds should be developed on the refuge in the wetlands of the Duck River Unit (USFWS 2005).

Most waterfowl-oriented management, especially for wintering populations, is geared away from promoting tall emergent vegetation. Tall emergent vegetation, including cattail, big bulrush, and other species, can be aggressive and take over impoundments without careful control. However, the number of species that require tall emergent vegetation (and the apparent severity of the king rail's decline) suggests that some degree of middle ground is required to cover both the needs of waterfowl and priority marshbirds. The observation that at least some breeding king rails persist at the Duck River Unit attests that the management practices conducted there are in line with meeting the needs of both waterfowl and priority marshbirds.

During the last several decades, overall loss of freshwater emergent wetlands has been occurring as development pressures increase, especially away from immediate coastlines. As a result, king rails are thought to have declined dramatically from inland areas and are now considered to be a species in potentially deep conservation trouble away from coastal areas. Least bitterns are likely also suffering from freshwater wetland losses in recent decades. The purple gallinule is in decline locally, if not regionally. The potential for supporting some habitat for these breeding species is high, but must be done at locations that would not interfere with priority actions targeting waterfowl, or in ways that do not detract from waterfowl management. All of these factors considered together suggest that the Tennessee Refuge is reasonably well positioned to support healthy habitat for these and other marshbird species, mixed in with waterfowl objectives, when in the surrounding areas such habitat is now likely very scattered and in decline.

The king rail, by being the highest priority marshbird, may serve as an umbrella species for the other priority marshbirds. King rails may be the most habitat-specialized of the species nesting in tall emergent vegetation. Their nests are constructed near the soil, usually where the standing water depths are about 10 inches. Higher water levels have the potential to flood out the species, and little or no standing water potentially exposes nests to greater depredation pressure from raccoons, etc. These conditions should support nesting least bitterns as well, with nests usually placed higher in the vegetation, making this species more tolerant of deeper flooding.

Shorebirds

Although the Interior Low Plateaus may not be considered among the most important regions in eastern North America for supporting migrant shorebirds, there are still sizeable populations moving through the region and in particular the Tennessee River Valley. Habitat for migrant shorebirds is particularly

restricted in the Interior Low Plateaus unless it is actively managed. The observations of many managers are that almost all habitat is used, suggesting there are more birds moving through than habitat is available. Given the development of the U.S. Shorebird Conservation Plan and the identified need to provide migration stopover habitat in the region, it is essential that the refuge consider developing some designated units for migration stopover and to actively manage them to maximize use.

Many species of shorebirds face significant threats from habitat loss, habitat degradation, and human disturbance. There is little existing information for many species that would allow a determination of how shorebird populations have been affected by alterations to their habitat. Despite major ongoing conservation efforts, many shorebird populations are declining. Seven highly imperiled shorebird taxa and 23 taxa of high concern are identified in the U.S. Shorebird Conservation Plan (Brown et al. 2001), several of which are in need of management or monitoring in the southeastern United States (Hunter 2002). Among those known or suspected to occur on or near Tennessee NWR are highly imperiled birds such as the piping plover and buff-breasted sandpiper. Birds of high concern include the American golden plover, solitary sandpiper, upland sandpiper, western sandpiper, short-billed dowitcher, American woodcock, and Wilson's phalarope (USFWS 2005).

A shorebird survey route was initiated on the refuge in 2000 as a part of the International Shorebird Survey (ISS) operated by the Manomet Center for Conservation Sciences. This route is located within the lower Duck River Bottoms and covers portions of or all of Pools 1, 2, 3, 4, 5, 6, 10, and 11. Late winter and spring drawdowns of the impoundments managed for moist soil and agriculture provide excellent habitat for shorebirds.

Although the refuge is not a major shorebird stopover area, it does provide habitat for respectable numbers, consisting of over 25 species. The timing and duration of the moist soil and agricultural impoundments coincides with the spring migration period of most shorebird species. During the fall when most of the impoundments are in the process of being flooded, shorebird habitat is essentially limited to the TVA's annual drawdown of Kentucky Lake.

A research project conducted in 2007-2008 found the mudflats of Kentucky Lake to be extremely important to shorebirds (Wirwa 2009). Twenty-six species were documented during this study. Wirwa (2009) also found the mudflats to be rich in invertebrates, the primary food for shorebirds. Mean shorebird abundance, richness, and diversity were greatest during September, while mean shorebird density was greatest during August when mudflat acreage was lowest. This indicates that habitat availability may be a limiting factor during August. Most long-distance migrant shorebirds of high conservation concern were recorded during August and September.

Colonial Nesting Waterbirds (Long-legged Wading Birds)

The refuge's abundance and diversity of managed and natural wetlands support several species of herons, egrets, and other waterbirds. There are several great blue heron rookeries with an occasional great egret nest occurring on the Duck River Unit. The large body of water surrounding the Big Sandy Unit hosts a diversity of waterbirds associated with lacustrine habitats.

Species of conservation interest in the Interior Low Plateaus that use Tennessee NWR during the post-breeding period may include the little blue heron, black-crowned night-heron, yellow-crowned night-heron, wood stork, and white ibis.

In recent years, the one big colony of mostly great blue herons at Grassy Lake was abandoned. However, one large rookery and several other smaller colonies have become established in the vicinity. The loss of the rookery at Grassy Lake may be nothing more than simply a case of tree

die-off and movement of the birds to other more suitable colony sites. The bigger issue may be with respect to discovering why the trees involved were dying (mostly cypress), which may be due to changing water levels.

Generally speaking, nesting long-legged wading birds have ample habitat available, but the issue of how much disturbance these nesting birds can tolerate is key to protecting these species. When the refuge staff find nesting areas at remote sites (from the standpoint of public use), it may be worth the effort to occasionally monitor the site for potential disturbance problems and make entry adjustments accordingly. In other situations where colonies form and there has been a long history of public use nearby, such measures may not be necessary. The main issue is change in public use around established colony sites.

Forest Birds

The upland forests within Tennessee NWR were historically comprised of mature, deciduous forests on rolling hills. Upland forest cover currently consists of various age stands ranging from young natural regeneration (under 10 years old) to mature stands of deciduous trees (over 100+ years old). These forests provide habitat for numerous species of upland forest birds, including many listed as species of concern in the Central Hardwoods Joint Venture (CHJV) Plan (Fitzgerald 2003), the Partners in Flight (PIF) Interior Low Plateaus Plan (Ford et al. 2000), and the PIF North American Landbird Conservation Plan (Rich et al. 2004). Bird species of concern in mature upland forests at Tennessee NWR include the cerulean warbler, worm-eating warbler, wood thrush, Kentucky warbler, Louisiana waterthrush, whip-poor will, yellow-throated vireo, Acadian flycatcher, yellow-billed cuckoo, great crested flycatcher, and eastern wood-pewee (USFWS 2005).

The Partners in Flight Plan (Rich et al. 2004) has population goals for these species, which still need to be stepped down to the level of the Central Hardwoods Bird Conservation Region (BCR) and Tennessee NWR. The global population goals for many species on the list range from increasing populations 100 percent for the cerulean warbler to increasing populations 50 percent for the wood thrush, prothonotary warbler, Kentucky warbler, and maintaining current populations, which is desired for the remainder of the species listed above. Species of highest conservation concern require specific attention at the refuge and Kentucky Lake area (USFWS 2005).

Interior Forest-breeding Bird Point Counts

In 1997, five routes consisting of 62 points were created on the Big Sandy and Duck River units. The routes on the Duck River Unit were surveyed through 2004 and the routes on the Big Sandy Unit were discontinued in 2005. Starting in 2008 monitoring efforts shifted to focusing on the managed forests of Compartment 4 on the Big Sandy Unit. This compartment was thinned in 2001 to improve habitat for several nesting landbirds. A total of 24 points were established and point counts and vegetation surveys conducted in 2008. An additional 12 points are planned to be established and surveyed at this location in the near future. The data is provided to Tennessee Partners in Flight (PIF), where they are entered into a statewide database to monitor regional trends. The refuge maintains a paper copy of the data sheets. The refuge has not yet utilized these data for management purposes.

Roadside Breeding Bird Point Counts

Three driven roadside point count routes were established by volunteers on the refuge in 1995. One route is located on the Big Sandy Peninsula and the other two are in the Duck River Bottoms. These routes are monitored according to guidelines outlined in *A Land Manager's Guide to Point Counts of*

Birds in the Southeast (Hamel et al. 1996). With minor exceptions, all routes have been surveyed by the same volunteers every year from 1995-2007. The data have been provided to Tennessee PIF and have been utilized to update the refuge's bird list and provide general information. These surveys were discontinued because monitoring efforts statewide have become more focused on specific management activities (i.e., forest management).

Monitoring Avian Productivity and Survivorship Program (MAPS)

The refuge staff has operated a Monitoring Avian Productivity and Survivorship Program (MAPS) station on the Big Sandy Peninsula from 1993-2005. Operation of this MAPS station was discontinued due to a strain on the limited staff available on the refuge. MAPS is a constant-effort mist netting and banding program that is conducted during the breeding season. It is designed to provide long-term data on productivity, survivorship, and population trends for landbird species throughout the North American continent. The Institute for Bird Populations (IBP) in Point Reyes Station, California, is the organization leading this effort.

The refuge has operated the MAPS station annually during the breeding season. Each new bird captured was marked with a uniquely-numbered aluminum leg band. Band numbers were recorded for all recaptures. Species, age, sex, aging and sexing criteria, wing chord, weight, capture date, capture time, net number, and disposition were recorded for all birds captured. Data was recorded on IBP's field forms and later entered into their database and submitted to the IBP. Banding data was also exported into the Bird Banding Laboratory's (BBL) Band Manager database and submitted to the BBL. The cumulative breeding bird list is presented in Table 4.

Table 4. MAPS cumulative breeding status list, 1993–2003.

Species	Status	Species	Status	Species	Status
Tufted Titmouse	R	**Great-crested Flycatcher**	R	**Carolina Chickadee**	O
Carolina Wren	R	**Worm-eating Warbler**	R	**Hairy Woodpecker**	O
Wood Thrush	R	**Louisiana Waterthrush**	R	**Blue-gray Gnatcatcher**	O
Downy Woodpecker	R	**Kentucky Warbler**	U	**Ruby-throated Hummingbird**	O
Eastern Wood-Pewee	R	**Northern Parula**	U	**White-eyed Vireo**	O
Acadian Flycatcher	R	**White-breasted Nuthatch**	U	**Yellow-throated Vireo**	O
Pileated Woodpecker	R	**Red-bellied Woodpecker**	U	**Indigo Bunting**	O
Blue Jay	R	**Ovenbird**	U	**Red-tailed Hawk**	O

Species	Status	Species	Status	Species	Status
Summer Tanager	R	**Yellow-billed Cuckoo**	U	**Common Yellowthroat**	O
Scarlet Tanager	R	**Brown-headed Cowbird**	U	**Eastern Towhee**	O
Northern Cardinal	R	**American Crow**	U	**American Goldfinch**	O
Red-eyed Vireo	R				

R - Regular Breeder (in all years); U - Usual Breeder (> one-half, not all, years); O - Occasional Breeder (< or = one-half years)

Research

During the early stages of developing the refuge's forest management program, it was decided that scientific evaluation of the management practices was essential to the success of the program. During the summer of 2001, prior to management, a Ph.D. research project under the direction of Dr. David Buehler of the University of Tennessee at Knoxville (UTK) was initiated with funding by the National Wild Turkey Federation. The title of this project was *Evaluation of Experimental Selection Cutting to Increase Forest Songbird Population Density and Nest Survival in Hardwood Forests on Tennessee National Wildlife Refuge* (Thatcher 2007).

The results of this research, which was completed in 2005, indicate that thinning had strong effects on forest habitat attributes and the demographics of some priority bird species. In the short term (1 to 4 years post-treatment), thinning appears to provide suitable breeding habitat for priority bird species (eastern towhee, indigo bunting, Kentucky warbler, white-eyed vireo, yellow-breasted chat) that prefer dense understory vegetation or partially-opened overstories for nesting. Conversely, thinning had neutral or negative effects on some species (Acadian flycatcher and wood thrush) and functional groups that nest in midstory vegetation, indicating there may be an ecological cost, in the short term, associated with implementing this treatment. This treatment likely will have differential costs and benefits for avian populations as forest habitat conditions continue responding via successional dynamics and vegetative growth to the initial thinning operation (Thatcher 2007).

Grassland Birds

Grassland bird populations are declining throughout the region. Some of the top priority species are known to be nesting in the immediate area (e.g., Henslow's sparrows in Benton County). Grasslands provide habitat for many species of breeding birds, including many listed as species of concern by the CHJV, the PIF North American Landbird Conservation Plan, and the Northern Bobwhite Initiative (Dimmick et al. 2002). Bird species of concern that nest in grasslands at Tennessee NWR include the eastern meadowlark, field sparrow, and northern bobwhite. Grasslands provide nesting, foraging, and roosting areas for these species, but they are commonly found along hedgerows and in scrub-shrub habitat as well. Another species of high conservation concern occasionally occurring at the Tennessee Refuge during the spring, summer and fall is the grasshopper sparrow.

Other Birds of Interest

Bald eagles have been recently removed from the federal threatened and endangered species list and can be found in good numbers on Tennessee NWR, both during the nesting and migration periods. These magnificent birds are typically found along the Tennessee River and in some of the larger impoundments on the refuge because of the abundant prey near water bodies.

Many bald eagles can be spotted roosting or nesting on top of large trees throughout the refuge. Each year many of these eagles establish nests and successfully raise young. Currently there are at least 10 active nests on the Tennessee NWR (USFWS unpub. data). Bald eagles construct platform nests to which they return each spring. Eagle nests increase in size each year due to the addition of new materials. Some nests may grow to weigh several tons and span more than ten feet in width.

Most American woodcock in Tennessee are migrants, probably moving to or through Tennessee fall/wintering sites in late November/December and stopping over again during spring migration in mid- to late February. These forest, shrub, and scrub migrant shorebirds are at all-time 10-15 year recorded lows, and a North American Woodcock Plan is being rejuvenated to help improve the population's status. Although hunting season lengths and bag limits have been reduced, the primary limiting factor(s) are believed to be lack of high quality habitats, such as early successional shrub/scrub wetland sites; sapling-sized trees/stems in high densities; and relatively predator-free nocturnal sites, migrational habitats, and nesting areas (Kelley 2004; Kelley et al. 2006).

Favorable wild turkey habitat and a healthy, huntable population of turkeys exist throughout the refuge. These game birds benefit from the hundreds of acres of grain crops planted each year throughout the area. It is common to encounter in excess of 100 birds in a single flock feeding in agricultural fields during the winter. Turkeys probably consume a significant portion of the grain intended for waterfowl. With harvest regulations allowing the take of only one bearded turkey per season, the annual turkey population is more related to weather factors, primarily during the spring nesting season, rather than to impacts of hunting.

Mammals

White-tailed deer are abundant throughout the refuge, utilizing the diversity of habitats present. They heavily use agricultural fields from summer through the winter months. Based upon the most recent herd health checks, the deer population on the refuge exceeds the nutritional carrying capacity. The abomasum parasite counts (APCs) from these checks have risen significantly since these investigations were initiated. Foraging activities of high density deer populations can have a significant negative impact on forest regeneration as well as on agricultural crops (USFWS 2005).

Gray and fox squirrels are abundant, particularly where suitable mast-producing hardwoods occur. Squirrels, particularly fox squirrels, also utilize grain crops on the refuge. Due to their high potential reproductive rate, directly related to the availability of hard mast, and high natural mortality rates, it is unlikely that any long-term changes in squirrel population densities have occurred within the available habitat (USFWS 2005).

Other mammals include beaver, raccoon, muskrat, and groundhog. Small mammals on the refuge include mice, chipmunks, rabbits, and moles. Several species of bats inhabit the Tennessee NWR (USFWS 2007b).

Amphibians and Reptiles

Baseline information for these species on the refuge does not exist. Nevertheless, at a minimum 89 species of reptiles and amphibians probably occur at Tennessee NWR, based on documented sightings and the expected presence from natural distribution ranges overlapping the refuge (USFWS 2005, 2007b).

Fish and Aquatic Fauna

Tennessee's geographic and hydrographic diversity lend it perhaps the highest freshwater fauna diversity of any state, including fish, mollusks, crayfish, and several aquatic insect groups (Etnier and Starnes 1993). With the exception of Alabama, Tennessee once hosted the most diverse assemblage of freshwater mollusks (Parmalee and Bogan 1998). With the influence of the three rivers – the Tennessee, Duck, and Big Sandy – which now form Kentucky Lake and its location being within two physiographic areas, Tennessee NWR shares in this wealth of aquatic diversity. With 144 species, the refuge certainly has far more freshwater fish species than any other national wildlife refuge in the entire country (personal communication with David A. Etnier, Emeritus Professor, Department of Ecology and Evolutionary Biology, University of Tennessee at Knoxville, 2004).

Kentucky Lake provides a good sports fishery, especially for crappie and largemouth bass. The TVA and the state fisheries agencies have developed a Sportfishing Index rating for all the reservoirs in the Tennessee River System (http://www.tva.com/environment/water/sportfish.htm). These ratings are based upon fish survey data and angler surveys. For most species, Kentucky Lake rates above average and had the highest score for crappie and one of the highest for largemouth bass. The refuge does not take an active role, other than law enforcement, in managing the Kentucky Lake fishery. The TVA and TWRA conduct all fisheries management efforts on the reservoir.

The impounded waters within Duck River and Busseltown Dewatering Areas do provide for good sportfishing and the refuge controls all management activities. Because the management focus of these areas is for migratory birds and they frequently flood from rising waters of Kentucky Lake, no active fisheries management occurs in the impoundments. However, when water management plans are developed, consideration is given to the potential impacts of those decisions on sportfishing. Conflicts do occur, but the refuge has been able to resolve most of these fairly easily without losing focus on the main objectives. A Fishery Management Plan for the refuge was developed in 1994.

Commercial fishing and musseling do occur within most waters of Kentucky Lake on the refuge. On the reservoir, the TWRA is the responsible agency for regulating and managing these commercial uses. However, at the request of the refuge, a special regulation is in place on the Big Sandy Unit to protect diving ducks and other waterbirds from being captured in entanglement nets. The refuge allows limited commercial fishing within the impoundments from March 16 - November 14 under conditions outlined in the required special use permit. Of special interest is the mussel sanctuary located on the Duck River Unit. This area is closed to commercial harvest of mussels. The TWRA established this sanctuary to serve as a research area to monitor the impacts of mussel harvesting.

Threatened and Endangered Wildlife

Tennessee NWR contains a diversity of habitats that supports populations of Federal and State-listed species. Protection of these species and their habitats is the greatest priority of the refuge. The biological review team identified two groups – bats and mussels – for which more monitoring and possibly management attention are needed.

Bats

Although federally endangered Indiana bats (*Myotis sodalis*) have not been found on the refuge, the potential for this species to use the area is high. Featherfoot Cave, which housed about 20,000 federally endangered gray bats (*M. grisescens*) in 2000 and 2002, is located about one mile south of the Busseltown Unit.

Even though their presence has not been documented, it is likely that Indiana and gray bats periodically occur on the refuge. The refuge is well within the ranges of these species and has suitable foraging habitat for transients moving through the area. The refuge has no known caves, but there are caves within close proximity of the refuge. The refuge's forested areas contain suitable summer maternity habitat for Indiana bats.

Management activities on the refuge are not likely to negatively impact either species of bat. The resulting habitat following the selective harvest strategy outlined in the refuge's Forest Management Plan is an uneven-aged open canopy forest containing large-diameter trees. The plan also calls for the retention of snags, cavity trees, and trees with exfoliating bark during harvest operations. These habitat conditions are identified in the *Agency Draft Indiana Bat (Myotis sodalis) Revised Recovery Plan* as desirable for maternity colonies (USFWS 1999).

Mussels

Mussels associated with the refuge are a relatively unique resource, especially because of the presence of endangered species. At this point, the Service tends to rely on TWRA, USGS, and TVA personnel to maintain mussel distribution records for the area. The refuge's efforts to eliminate sand and gravel dredging within the refuge boundaries are helpful in protecting mussel resources. Additional efforts to establish mussel sanctuaries and to participate in monitoring efforts regarding the commercial mussel harvest may be appropriate. Documentation of species harvested and their size/age structure would be helpful in determining possible needs for limiting the harvest.

Six federally endangered mussel species have the possibility to occur within the waters of the Tennessee River on the refuge. Due to the lack of qualitative surveys, it can only be speculated as to the current existence of any of these species within the refuge. All of these mussels are big river species that were detrimentally impacted by the conversion of a riverine habitat to reservoirs by the construction of dams. Dam construction is considered to be a primary factor in the decline of many mussel species throughout the system, but many other factors such as contaminants (Parmalee and Bogan 1998) and commercial sand and gravel dredging (Hubbs et al. no date) continue to contribute to the degradation of water quality and substrate habitat.

The ring pink, orangefoot pimpleback, and pink mucket mussels are listed as endangered and have been documented in the Tennessee River on the refuge. Records of the ring pink and orangefoot pimpleback on the refuge predate the construction of Kentucky Dam and the establishment of the refuge. These two species were last documented near the refuge a few miles upstream of the Busseltown Unit in 1964 (Natural Heritage Database 2004). The pink mucket was last located on the Duck River Unit at River Mile 111.8 in 1992. The orangefoot pimpleback and pink mucket still have somewhat stable populations within Kentucky Lake near Pickwick Dam (Parmalee and Bogan 1998).

Rough pigtoe, fanshell, and white wartyback mussels probably occurred within the boundaries of the refuge prior to the construction of Kentucky Dam and the establishment of the refuge. There are no records of the rough pigtoe in Kentucky Lake since it was inundated. A remnant fanshell population

was reported below Pickwick Dam on Kentucky Lake. The last Tennessee record of the white wartyback occurred in 1987 below Pickwick Dam (Parmalee and Bogan 1998).

The refuge's wildlife management activities should have no impacts on these mussels. The refuge's role in protecting these species is to protect the potential habitat from threats, such as contaminants and gravel dredging.

Fish

The pygmy madtom, a species of fish endemic to the Tennessee River drainage, is listed as endangered (USFWS 1994). Etnier and Starnes (1993) reported the pygmy madtom as one of the rarest fishes in North America with fewer than fifty individuals collected from two widely separated locations within the Tennessee River Valley. One location is on a short reach of the Clinch River in upper east Tennessee and the other near River Mile 17.5 on the Duck River in Humphreys County. The habitat requirements are described in the recovery plan as "shallow shoals, where the current is moderate to strong and where there is pea-sized gravel of fine sand substrates, in moderately large rivers" (USFWS 1994).

The refuge extends up the Duck River to River Mile 10 and, to date; the pygmy madtom has not been located on the refuge. However, it is possible that it may occasionally occur on the refuge. Since most of the Duck River within the boundary of the refuge is strongly influenced by the slack waters of Kentucky Lake it is unlikely that suitable habitat exists on the refuge. Nonetheless, the *Pygmy Madtom Recovery Plan* stated that habitat restoration efforts might be appropriate on the refuge.

Birds

Three federally listed species of birds have been documented on the refuge – the least tern, wood stork, and piping plover – although they are infrequent visitors.

The least tern only occurs on the refuge during spring and fall migrations. It has been documented on either the Big Sandy or Duck River units seven out of the last ten years. Most observations have consisted of individuals, with the exception of nine birds found loafing on the mudflats at Pace Point on the Big Sandy Unit during the fall of 2001. Because no formal surveys have been conducted in the areas where a majority of the observations have occurred, it is suspected that most occurrences of least terns go unnoticed. Most of the least tern sightings on the refuge are associated with the mudflats on Kentucky Lake. Efforts to protect this habitat for least terns and many other species of migratory birds are a priority of the refuge.

The most notable wood stork observations occurred on the Duck River Unit during late summer of 1999 and 2000, associated with post-breeding dispersal. Two immature wood storks were observed on several occasions feeding in the wetlands within the Duck River Bottoms. This was the first sighting of wood storks on the refuge in several decades. Twelve immature wood storks were observed feeding in the shallow waters of an impoundment in the Duck River Bottoms in August 2000. The most recent sighting of the wood stork was of one individual in the Duck River Bottoms in 2008. Although the wood stork is not federally listed in the state of Tennessee, the protection of this species on the refuge is still important. The moist soil management program that is focused towards waterfowl inadvertently provides the shallow water habitats desired as foraging sites for wood storks. Summer drawdowns concentrate fish and other aquatic species in shallow pools, improving access to many species of wading birds.

The piping plover is probably a very rare fall migrant on the refuge. There are three known records, two on the Big Sandy Unit and one on the Duck River Unit. The most recent observation on the refuge was made in 1989. An individual was observed on a mudflat a few miles north of the Duck River Unit in 2008 (Wirwa, 2009). All the piping plover sightings on and in the vicinity the refuge are associated with the mudflats on Kentucky Lake. Efforts to protect this habitat for piping plovers and many other species of migratory birds are a priority of the refuge.

Animal Control Program

Tennessee NWR's current Animal Control Plan addresses the general control of beavers and muskrats in areas where they are damaging habitat or refuge facilities. The refuge has a contract with the U.S. Department of Agriculture Wildlife Services (WS) to control the population of beavers and muskrats through lethal trapping and shooting and the removal of beaver dams. Most of the work done by WS is focused on problems associated with beavers.

Surveys and Monitoring

Winter Waterfowl Survey

Waterfowl surveys have been conducted on the refuge from at least the early 1950s. Currently, the surveys are conducted twice a month, close to the first and sixteenth of each month, beginning in mid-October and ending in early March. The only exception to this rule is that the Mid-winter Waterfowl Survey has a set time period of the first full week in January. All surveys are now conducted using a fixed-wing aircraft with one observer in addition to the pilot. The twice-monthly approach allows more time to accomplish the survey, which is needed because the weather often affects when aerial surveys can be conducted. Attempts are made using the same observer to survey all the waterfowl habitats within the refuge following the same route during each survey period.

Each refuge unit is divided into individual management subunits (impoundments, farm units, bays, etc.) that may have different management strategies. The data for each subunit are collected individually so that waterfowl response to management actions or other issues can be measured. The data are recorded by waterfowl species. In addition to waterfowl, bald eagles (by age class - adult/immature), golden eagles (by age class - adult/immature), sandhill cranes, white pelicans, and common loons are recorded when observed.

Duck and goose populations typically fluctuate from year to year on the refuge (Figures 10 and 11), much of which is related to weather conditions. Changes in migration patterns have been documented over time. The refuge's duck populations arrive two weeks later now as compared to what occurred in the 1970s. The delay in the goose peak on the refuge is even greater. This delay in migration and the lower goose populations has resulted in a significant reduction of goose use on the refuge. Duck distribution between the units of the refuge has also changed.

Moist Soil Vegetation Survey

Moist soil vegetation surveys are conducted annually during the late summer and early fall to assess the quality and quantity of moist soil habitat in each managed impoundment. During these surveys the locations of invasive exotic plants like alligatorweed are also documented and mapped. These moist soil and invasive plant data form the basis for habitat management recommendations in these seasonally flooded wetlands.

Moist soil surveys have been conducted off and on since 1983. Sampling methods have varied somewhat, especially in the earliest years. Since 1993, the survey method has followed the vegetation sampling procedure described in the "Moist Soil Management Advisor" (USFWS and University of Missouri, Columbia, 1995). Data are maintained in an Excel spreadsheet to aid in calculations and for future reference. Digital data in this format are available back to 1997, while earlier surveys are in paper files stored at the refuge office.

Heron Rookery Survey

The refuge conducted an annual heron rookery survey to determine the number of active nests within some of the rookeries that occur on the Duck River Unit. All active nests were counted during one visit that usually occurs in late May. These data were used to establish long-term trends. This survey was discontinued in 2006 following the abandonment of the Grassy Lake Rookery in 2005 since the herons moved to more inaccessible locations. Data are stored in an Excel spreadsheet and go back to 1954.

The Grassy Lake Rookery was once the third largest rookery in the state. The number of nests has ranged from over 600 in the early 1990s to a low of 25 in 1976. This rookery was completely abandoned in 2005. The refuge staff believes the decline resulted in a shift in nesting locations rather than a local population decrease. Within the last several years, other great blue heron rookeries have been established on the Duck River Unit, primarily on islands in Kentucky Lake.

Shorebird Survey

A shorebird survey route was initiated in 2000 as a part of the International Shorebird Survey (ISS) operated by the Manomet Center for Conservation Sciences. This route is located within the lower Duck River Bottoms. Surveys are scheduled to be conducted three times each month from April 1 through June 10 for the spring migration. Fall migration surveys cover the period of July 11 through October 31. Total numbers for each species are recorded by pool number.

The data are currently entered by the refuge into an Excel spreadsheet and the completed data forms are sent directly to Manomet and a copy is retained in the refuge files. The refuge uses these data to improve the accuracy of the Bird List, to develop a better knowledge of the chronology of the shorebird migration through this area, and to better time the drawdowns of the impoundments to coincide with the peak migration periods. The data is also provided to the Tennessee River Valley Shorebird Working Group as part of a shorebird monitoring effort aimed at assessing the importance of the Tennessee Valley during migration.

Research

Black Duck Research, 1990-1995

During the early 1990s, four research projects studied habitat use, food habits, and survival of black ducks on Tennessee NWR (Byrd 1991; Chipley 1995; Clark 1996; and White 1994). Byrd's (1991) study compared the food habits of black ducks and mallards on the Duck River Unit during the winter of 1990-91. The diets of both species consisted predominantly of vegetative matter (94 percent for black ducks and 95 percent for mallards). Seeds from plants (other than agricultural grains) were the dominant major food group, consisting of 72 percent of the black duck and 87 percent of the mallard diets.

The research project conducted by White (1994) during the winter seasons of 1990-91 and 1991-92 looked at body condition, activity budgets, and food habitats of black ducks on the Duck River Unit. Evaluation of the activity budgets determined that black ducks spent about 48 percent of their time

feeding, which ranged from 24 percent during the early winter to 59 percent during late winter. Moist soil units and waters along levees were the preferred foraging habitats. Black ducks rested 28 percent of the time and preferred more open habitats, including mudflats and open water. Plant seeds (other than agricultural grains) were again the dominant food source for black ducks (54 percent) and mallards (50 percent). Water smartweed (*Polygonum hydropiperoides*), primrose-willow (*Ludwigia* sp.), wild millet (*Echinochloa crusgalli*), and lovegrass (*Eragrostis hypnoides*) were the dominant seeds consumed by black ducks. Mallards preferred wild millet, lovegrass, flat sedge (*Cyperus* sp.), and smartweed (*P. lapathifolium*).

During the winters of 1992-93 and 1993-94, Clark (1996) studied the habitat preference differences between black ducks and mallards on six sites in Tennessee, with the refuge being one of these sites. Clark found that black ducks selected open water habitats more frequently than mallards, which preferred more densely vegetated areas. Black ducks were found in higher densities relative to mallards in moist soil and scrub-shrub habitats that contained a substantial open water component than similar habitats without open water.

Chipley (1995) studied the habitat use and survival of female black ducks captured on the Duck River Unit and equipped them with radio transmitters during the winters of 1990-91 and 1991-92. He found that moist soil was the preferred habitat during nocturnal periods. During the early winter periods moist soil and lacustrine habitats were the predominate locations utilized by black ducks. Most late winter locations still occurred in moist soil and open water areas, but a shift towards forested wetlands, scrub/shrub wetlands, and agricultural habitats was noticed.

Black Duck Blood Lead Concentrations

Two studies have been conducted on the refuge to measure lead exposure in black ducks from ingesting lead shot. The first study occurred in 1986-88 (Samuel et al. 1992) prior to the nationwide lead shot ban and a follow-up study took place in 1997-99 (Samuel and Bowers 2000). During both studies, blood samples were taken from black ducks captured on the Tennessee and Cross Creeks NWRs. In the first study, 11.7% of the ducks had lead exposure above normal levels (0.2 ppm), as compared to 6.5% detected in the later study. This represents a 44 percent decline in elevated blood lead levels.

Botanical Study of the Duck River Unit

From May 2001-November 2002 an inventory of the vascular flora was conducted on the Duck River Unit (Gunn 2003). This inventory was conducted by a M.S. student from Austin Peay State University. The flora found during this study included 699 species in 403 genera in 95 families. Over half of the species located were county records and one Walter's millet (*Echinochloa walteri*) was a state record. Exotic species, totaling 118, made up 17% of the flora. The largest two families were Asteraceae and Poaceae. Six species are on the Tennessee elements of concern list: Walter's millet – special concern; blue mud plantain (*Heteranthera limsoa*) – endangered; fen orchid (*Liparis loeselii*) – endangered; shortbeak arrowhead (*Sagittaria brevirostra*) – threatened; river bulrush (*Scirpus fluviatilis*) – special concern; and marsh ladies'-tresses (*Spiranthes odorata*) – endangered.

Wood Duck Nest Box Study

A study to examine the differences in wood duck nesting success, dump nesting, nest predation, blood parasites, and hen stress levels at clustered (each box entrance hole visible from the other boxes) and unclustered (visibly isolated) nest box sites was initiated in 2004. This study was conducted by a M.S. student from the Biology Department of Murray State University. Boxes were placed on the Duck River Unit, Cross Creeks NWR, and Fort Campbell Military Reservation during February 2004. Box placement was as follows: five locations with four clustered boxes and ten isolated boxes, totaling thirty boxes per study area. During the summers of 2004 and 2005, the boxes were checked once weekly. Blood was drawn from the hens to determine parasite and stress levels.

Forest Management Evaluation Study

Partners in Flight (PIF) recommends using silviculture to improve breeding habitat conditions for migrant landbirds. Alternative thinning treatments may benefit priority landbird species by increasing structural complexity in second-growth forests. However, the effects of thinning on landbird populations in oak-hickory forests have not been experimentally demonstrated. This study used a randomized and replicated large-scale manipulative experiment to evaluate the effects of thinning (i.e., crown-release and gap creation) on forest habitat characteristics and avian populations at the Tennessee NWR. Data was collected during 2001 (pre-treatment) and from 2002 to 2005 (1 to 4 years post-treatment) in 20-hectare (ha) thinned (n = 8) and control (n = 4) plots. The purpose of this research was to assess the impacts of the refuge's forest management activities (Thatcher 2007)

Thinning resulted in a 29% difference in basal area between treatments (thinned = 20.3 m2 ha-1; control = 28.5 m2 ha-1). Compared to controls, the thinned plots had significantly less overstory cover and midstory cover and significantly more downed wood and herbaceous and woody vegetation in the lower forest strata. Specifically, greater densities were detected of oak (*Quercus* spp.), yellow-poplar (*Liriodendron tulipifera*), and sourwood (*Oxydenrum arboretum*) saplings, and greater cover in poison ivy (*Toxicodendron radicans)* and blackberry (*Rubus* spp.) in thinned than in control plots.

Spot-mapping was used to estimate the densities of PIF priority species. Thinning had positive effects on the densities of seven species (eastern towhee [*Pipilo erythropthalmus*], eastern-wood pewee [*Contopus virens*], indigo bunting [*Passerina cyanea*], Kentucky warbler [*Oporornis formosus*], white-eyed vireo [*Vireo griseus*], yellow-breasted chat [*Icteria virens*], and yellow-throated vireo [*Vireo flavifrons*]), inconclusive or negligible effects on the densities of two species (Louisiana waterthrush [*Seiurus motacilla*] and worm-eating warbler [*Helmitheros vermivorus*]), and negative effects on the densities of two species (Acadian flycatcher and wood thrush).

A total of 1,149 nests of 28 species were monitored. Predation accounted for 80% of all nest failures. Mayfield-adjusted nest daily survival rates of all species combined did not significantly differ between treatments. For all species combined, the rates of cowbird parasitism varied annually but did not significantly differ between thinned (20.8%, SE = 2.3) and control (18.5%, SE = 3.7) plots. The study assigned bird species to functional groups for further analyses. PIF priority mature-forest species exhibited nest daily survival rates (0.972 vs. 0.969), realized brood sizes (2.8 vs. 2.6), and parasitism rates (16.9% vs. 10.4%) that were comparable between thinned and control plots. Based on 162 nests in thinned plots, PIF shrubland species had nest daily survival rates of 0.958, realized brood sizes of 2.9, and parasitism rates of 13.6%; this functional group nested too rarely in control plots for analysis. Treatment effects were significant for the overstory and midstory nesting functional groups. Overstory nesters exhibited nest daily survival rates that were greater in thinned (0.982) than control (0.963) plots. Midstory nesters experienced greater parasitism rates in thinned (30.0%) than control (17.9%) plots.

Nest-site selection and factors affecting nest predation rates were evaluated for 132 Acadian flycatcher and 112 wood thrush nests. In thinned plots, both species selected nest sites with greater overstory and midstory cover than found at random. Little evidence was found that nest predation rates were influenced by the amount of agriculture in the local (314 ha) landscape or by distance to anthropogenic edge, perhaps because the landscape was predominantly forested (agriculture < 4%) and most nests were >350 m from an edge. In thinned plots, predation rates on wood thrush nests decreased with increasing overstory cover and increasing basal area in large trees; predation rates increased with increasing basal area in small-diameter trees. None of the habitat predictors that were measured had a strong relationship to Acadian flycatcher nest predation rates in thinned or control plots. Model-averaged nest survival estimates for wood thrushes were 27.8% and 26.8% in thinned and control plots, respectively. Acadian flycatcher model-averaged nest survival estimates were 53.5% in thinned and 56.4% in control plots.

In summary, the results indicate that thinning had strong effects on forest habitat attributes and the demographics of some priority bird species. In the short term (1 to 4 years post-treatment), thinning appears to provide suitable breeding habitat for priority bird species that prefer dense understory vegetation or partially opened overstories for nesting. Conversely, thinning had neutral or negative effects on some species and functional groups that nest in midstory vegetation, indicating there may be an ecological cost, in the short-term, associated with implementing this treatment. This treatment likely will have differential costs and benefits for avian populations as forest habitat conditions continue responding via successional dynamics and vegetative growth to the initial thinning operation.

Waterbird Use of Mudflats Study

Mudflats associated with rivers in the midcontinental United States are important for waterbirds to rest and replenish energy reserves during migration. Kentucky Lake is the largest reservoir in the Tennessee River Valley (TRV), and extensive mudflat acreage is exposed during annual fall drawdowns. It has been proposed that timing of the fall drawdown be delayed until September 1 to enhance recreational boating opportunities (TVA 2004). The refuge and other wildlife resource managers raised concern that delays in the drawdown will significantly affect waterbird use of TRV mudflats. This study quantified influences of drawdown of Kentucky Lake on waterbird use, available food resources, and mudflat characteristics (Wirwa 2009).

From August-December 2006 and 2007, waterbird surveys were conducted twice weekly at 9 mudflats in Kentucky Lake. This study quantified temporal and spatial changes at mudflat sites by sampling mudflat acreage weekly and vegetation, aquatic invertebrates, soil characteristics, and water depth twice monthly. Initial mudflat exposure occurred in early to mid-August; mean mudflat acreage was 35 hectares. A total of 26 species of shorebirds, 20 species of waterfowl, and 25 species of other waterbirds (e.g., herons, gulls) were recorded using mudflats in Kentucky Lake. Mean shorebird abundance, richness, and diversity were greatest during September, while mean shorebird density was greatest during August when mudflat acreage was lowest. Most long-distance migrant shorebirds of high conservation concern were recorded during August and September, whereas shorter-distance migratory shorebirds and waterfowl were most common October-December.

Invertebrates were the most abundant food resource available to shorebirds and waterfowl (1.5 – 3.6 g m^{-2}); Chironomidae was the most common taxa. Vegetation establishment and seed production decreased with decreasing mudflat elevation, which was related to duration of mudflat exposure. Soil moisture and compaction, water depth, and invertebrate density results revealed that optimal foraging conditions for shorebirds occurred within a 20-m band centered on the waterline. Shorebirds and waterfowl using mudflats spent the majority of their time feeding, while all other waterbirds spent most of their time resting.

These results indicate that Kentucky Lake's mudflats provide important foraging and resting habitat for a diverse assemblage of waterbirds. The researcher recommend that mudflats in Kentucky Lake be exposed by 1 August (New Johnsonville gauge height <108.81 m [357 ft] MSL) to provide habitat for rare long-distance migratory shorebirds and to facilitate vegetation establishment and seed production for waterfowl.

Agriculture Grain Availability Study

Biologists in Tennessee and elsewhere estimate annually the amount of available grain for waterfowl during migration and winter, and use these estimates to calculate duck energy-days (DEDs). Thus, reliable estimates of available grain are paramount for accurate DED calculations. Grain may be provided in unharvested food plots or remain in fields after harvested (the latter called waste grain). Therefore, this study compared grain biomass in 53 harvested and 21 unharvested corn, grain sorghum and soybean fields from fall 2006 through early January 2007 to determine DEDs provided by these grains and the rates of grain loss through time. Waste grain biomass was compared among landowner categories (federal, state and private), and quantified the fate of seed loss (Foster 2009).

Duck energy-days in harvested corn, soybean and grain sorghum fields in early January were low (194, 20 and 0 DEDs/ha, respectively), and near or below the food-density threshold (50 kg/ha) when waterfowl are believed to abandon foraging sites. Corn and soybean biomass in harvested fields decreased significantly ($P < 0.01$) between harvest and early January. Grain sorghum showed a similar trend, but was not significant ($P = 0.22$). Biomass of waste corn in harvested fields was greater ($P < 0.01$) in federal fields than in state or private fields immediately post-harvest, but no differences were detected ($P = 0.49$) among landowner categories in January. No differences were detected ($P = 0.09$) in waste soybean biomass among ownership categories immediately following harvest or during January. Decomposition, germination and granivory contributed to waste grain loss. Decomposition rates increased with time post-harvest, whereas germination rates decreased as winter approached. Waste corn granivory was greatest ($P = 0.03$) in October and January. Finally, biomass of corn, soybean, and grain sorghum in unharvested fields did not differ ($P > 0.16$) among months, and was equivalent to 101,605, 34,232, and 26,002 DEDs/ha, respectively (Foster 2009).

CULTURAL RESOURCES

In this section, the references used in researching the cultural resources and history of the refuge and Tennessee Valley region are Autry and Hinshaw 1978; TVA 1983; Wheatley 1980; and personal communication with Dr. Edward W. Chester, Department of Biology, Austin Peay State University, Clarksville, Tennessee.

Cultural resources include historic properties as defined in the National Historic Preservation Act (NHPA); cultural items as defined in the Native American Graves Protection and Repatriation Act (NAGPRA); archaeological resources as defined in the Archeological Resources Protection Act (ARPA); sacred sites as defined in Executive Order 13007, Protection and Accommodation of Access to "Indian Sacred Sites," to which access is provided under the American Indian Religious Freedom Act (AIRFA); and collections. As defined by the NHPA, a historic property or historic resource is any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion in, the National Register of Historic Places (NRHP), including any artifacts, records, and remains that are related to and located in such properties. The term also includes properties of traditional religious and cultural importance (traditional cultural properties), which are eligible for inclusion in the NRHP as a result of their association with the cultural practices or beliefs of an American Indian tribe. Archaeological resources include any material of human life or activities that is at least 100 years old, and that is of archaeological interest.

The area within and surrounding Tennessee NWR is rich in history and prehistory. Archaeological investigations indicate that the earliest known presence of human beings may have occurred about 8,000 years ago during the Paleoindian/Early Archaic period. Evidence uncovered by research archaeologists indicates that early inhabitants were hunters and gatherers along the watercourses and within the forests of the area.

Limestone, timber, and deposits of iron ore were all locally abundant. In addition, plentiful streams furnished power and the river systems provided transportation to markets. The confluence of these factors spurred the development of an iron industry, which reached its peak during the 1850s. The local area is also extremely rich in Civil War history. Fort Donelson National Battlefield, located to the northeast on the Cumberland River, preserves the battlefield at which in early 1862 a then-relatively unknown Union general – Ulysses S. Grant – claimed his first major victory in the war. Forts Henry and Hyman (now submerged under Kentucky Lake) were located along each bank of the Tennessee River just downstream of Tennessee NWR. These two forts were taken by the Union in the days before Fort Donelson fell. If Grant had not won the battle at Fort Donelson, then arguably, there would have been no Shiloh, Vicksburg, Appomattox Court House, or White House in his and the nation's future.

BRIEF HISTORY OF THE AREA

The story of man in Tennessee begins with the last retreat of the Ice Age glaciers, when a colder climate and forests of spruce and fir prevailed in the region. Late Ice Age hunters probably followed animal herds into west Tennessee some 12,000-15,000 years ago. These nomadic Paleo-Indians camped in caves and rock shelters and left behind their distinctive arrowheads and spear points. About 12,000 years ago, the region's climate began to warm and the predominant vegetation changed from conifer to our modern deciduous forest. Abundant acorns, hickory, chestnut, and beech mast attracted large numbers of deer and elk. Warmer climate, the extinction of the large Ice Age mammals, and the spread of deciduous forests worked together to transform Indian society.

During what is known as the Archaic period, descendants of the Paleo-Indians began to settle on river terraces, such as those found along the Tennessee River, where they gathered wild plant food and shellfish in addition to hunting game. Sometime between 3,000 and 900 BC, natives took the crucial step of cultivating edible plants such as squash and gourds – the first glimmerings of agriculture. Archaic Indians were thereby ensured a dependable food supply and freed themselves from seasonal shortages of wild plant foods and game. With a more secure food supply, populations expanded rapidly across what is now west Tennessee and scattered bands combined to form larger villages. Several Archaic Indian settlements have been found within or near current Tennessee NWR lands in recent years.

The next major stage of west Tennessee prehistory is known as the Woodland period, lasting almost 2,000 years. This era saw the introduction of pottery, the beginnings of settled farming communities, the construction of burial mounds, and the growing stratification of Indian society. Native Americans in Tennessee made the transition from societies of hunters and gatherers to well-organized tribal, agricultural societies dwelling in large permanent towns. The peak of prehistoric cultural development in west Tennessee occurred during the Mississippian period, from 900 AD to the early 16th century. The gradual shift at the end of the Woodland period to a substantial dependence upon cultivated crops for a food source tied societies to specific locations, emphasized territoriality and control of land, provided a supply of food that permitted population growth, encouraged specialization of labor, provided for the growth of exchange networks for raw materials and finished products, and led to the development and spread of religious ceremonies. This horticultural complex included several varieties of maize, squash, pumpkin, gourd, sunflower, and beans. The addition of these crops to the wide variety of gathered native fruits, nuts, and berries, along with wild game, provided an ample

supply of food. This more efficient horticultural economy brought an increase in population to the areas with favorable growing conditions and soils, such as those found within and near current Tennessee NWR lands. Evidence of these settlements has been found on or near refuge lands, primarily located on alluvial terraces adjacent to the most productive soils in the bottomlands.

The first European incursions into the area, in the mid-1500s, proved highly disruptive to the people then living in the region. When explorers arrived in the 16th century, they encountered Chickasaw Indians roaming and utilizing the lands of what is now middle and west Tennessee. This land was prized as great hunting grounds because of wildlife abundance along the Tennessee River. The Great Salt Lick on Big Sandy River, present day Henry County, was the most cherished hunting ground of the Chickasaw. White settlers, in their push westward for land and opportunity, tried many means to rid the land of the threat from Indians. Treaties were signed in attempts to compromise, but settlers continued to encroach on Indian lands and hostilities continued and intensified. Between 1810 and 1815, the Tennessee River was made the eastern boundary of Indian Territory in an attempt to harness the confrontations. Negotiations for the purpose of extinguishing the Chickasaw title to reservations east of the Mississippi River began in 1830. The settlement of west Tennessee was well under way by 1834. Cheap and fertile land, abounding game, and plentiful water lured settlers to the area at a steady pace. Settlers settled and began lives of farming and subsistence living in the fertile lands of the Tennessee River bottoms. Farmers grew cotton, corn, oats, and peanuts, as well as raise cattle and livestock. The Tennessee River became vital to the white settlers' existence, as it was to previous occupants.

The late 1700s and early 1800s were also the years of the iron ore industry in Middle and West Tennessee. With knowledge of this craft brought from Pennsylvania, numerous furnaces and forges were built to capitalize on the abundant iron ores of the Western Highland Rim region, present-day Stewart, Houston, Humphreys, Perry, and Wayne counties, Tennessee. One of the prime considerations in locating the furnaces was the availability of vast amounts of timber since large amounts of charcoal were required for use as fuel in these furnaces. Timber was harvested for many miles within a working iron ore furnace, removing forests from the landscape at a steady pace. The iron industry supplied blacksmiths, mill owners, and farmers with the metal they needed. Although the iron ore found in this area was not considered top grade, it was plentiful enough to be considered one of the main sources prior to the Civil War.

A treaty signed in 1818 by Chickasaw and United States representatives relinquished all lands between the Tennessee and Mississippi rivers. The Great Salt Lick on the Big Sandy River was not easily relinquished and many attempts to exploit the salt reserves took place, ultimately resulting in abandonment because no water was found of sufficient quality for commercial salt production. In 1820, the total population of west Tennessee was 2,500 and by 1830 it had climbed to over 100,000.

Big Sandy Unit

In the areas comprising the present-day Big Sandy Unit of the Tennessee NWR, agriculture was the economic mainstay along with raw material-processing industries. Farms of the region were small but prosperous with a mixture of cash and subsistence crops. Corn, tobacco, cotton, and wheat were the most important crops. Since the land proved more suitable for tobacco than for cotton, it soon came to dominate the cash crops. Tobacco growing began about 1826 and peaked about 1860. Several tobacco factories were established in the area and they produced plug tobacco and cigars. The earlier importance of cotton is illustrated by the three cotton gins that operated in Henry County by 1827. Additionally, a number of cotton manufacturing plants were also established early in the region, but most failed during the post-Civil War depression. In the earliest years, goods were transported by flatboat and keelboat, but regular steamboat traffic was established along the river by

1821-1822. Steamboats soon became the primary source of transportation, communication, and entertainment for people living along the Tennessee River. Landings for the steamboats soon sprang up everywhere along the Tennessee River banks. Several landings with historic interest still exist on the current Tennessee NWR, such as the Iron Bridge Landing on the Big Sandy Unit.

One of the earliest settlements on the present-day refuge began on the land between the Big Sandy and Tennessee rivers, known as the "Old 23rd District." Establishing settlements in the early 1820s, these people were isolated from the rest of Henry County and the only means of access was by ferry at the Mouth of Sandy. The people here developed their own community, living and working together to survive the best they could. A focal point in this community was the Mount Zion Church. Established in 1853, Mount Zion was the only church serving the area for a long time. In the early days, people came from miles around on horseback, in wagons or buggies, or on foot to attend the church services. When the TVA bought this land between the rivers in the 1940s, they allowed the Mount Zion Church to remain standing. It is now listed on the National Register of Historic Places (NRHP), and an annual reunion service is still held on the Fourth of July.

Another center of community spirit was Lashlee Springs, a stopping place for thirsty and tired travelers. A general store, a sawmill, a molasses mill, and a warehouse existed in the area up until the Great Depression. One other cultural feature in the current Big Sandy Unit was the Sulphur Well Resort. The resort was located on the west bank of the Big Sandy River near the Benton-Henry County line. The sulfur water found there was considered to be healthful and the resort was created soon after the Chickasaw had relinquished these lands. The area continued to be a popular resort with local residents and tourists alike until the site was inundated by the rising waters of Kentucky Lake.

Duck River Unit

A piece of land considered to be one of the most productive in the nation lay between the Tennessee and Duck rivers. Nicknamed "Big Bottom," it was a 33,000-acre stretch of rich bottomland. Extensive settlement took place on the land in the 1840s and it soon became the most densely populated portion of Humphreys County. The owners of this land didn't use fences but instead used rocks and/or iron rods to mark their boundaries. For the most part, the farms were small and the farmers practiced subsistence farming. Corn was the principal crop grown since it was well adapted to virgin land, quick to mature, and easy to harvest. Vegetables, small grains, and cotton were also produced for home use, and a small amount of tobacco was grown for home and market. Other important industries in these southern sections included livestock husbandry, mussel harvesting, and timbering.

One of the most famous (or infamous) residents of Big Bottom was Jesse Woodson James, the famous outlaw. After robbing a bank in Minnesota, James came south looking for a hideout. He came to Big Bottom in August 1877, and rented a farm from W. H. Link. James was locally known as J. D. Howard and lived unsuspected among the people. James left for Nashville one cold winter night, supposedly running from a debt owed to a local. He had farmed what is today refuge land and lived on the ridge overlooking his piece of Big Bottom. His house has since burned, but behind where it once stood are two markers indicating the burial places of the twin children Jesse and his wife had to bury while they lived in Humphreys County.

The area now known as Duck River Bottoms was dewatered by the TVA with pumping until 1965 for mosquito control. Farming was the primary management tool used on the unit until 1983, when the refuge staff constructed a series of 12 subimpoundments to enhance natural food production for waterfowl. In 1992, the refuge, in partnership with the TVA and the E. I. Dupont Company, restored the pumping capability of the unit. Through a balanced mix of providing agricultural and natural foods

and sanctuary, the Duck River Bottoms today continues to be one of the most important wintering areas for waterfowl and eagles in the region.

An existing landing is Sycamore Landing, located near the confluence of the Tennessee and Duck rivers. This landing served the counties of Benton and Humphreys and was one of the most important landings on the east bank of the Tennessee in the latter part of the 19th Century. Yet another landing, Cuba Landing, named after a Cuban who decided the scenery looked much like his native Cuba, did well and served the Blue Creek area of Humphreys County, part of the present-day Duck River Unit.

Busseltown Unit

"Uncle" Jimmy Harris was the first settler of the land currently located in the Busseltown Unit of the refuge. Harris floated down the Tennessee and landed at the mouth of a little stream he later named Cub Creek, after the young bears he killed there. Johnse Bussell arrived in this area as well, prior to the Civil War, where he established Bussell's Landing, consisting of a warehouse at the water's edge. The community that developed nearby was later named Busseltown, where Bussell also had a store. Johnse built a house sometime around 1857, which once stood on refuge land but currently stands on the U.S. Forest Service's Land Between the Lakes National Recreation Area as one of the few remaining pioneer structures in the region. It is a double-pen and dogtrot poplar-log house covered with board and batten and can be seen as the main log cabin at "The Homeplace." John and Jim Bussell, sons of Johnse, operated the store and warehouse into the early 20th Century, but the business ended with their deaths.

SOCIOECONOMIC ENVIRONMENT

Table 5 includes demographic data from the U.S. Census Bureau for the State of Tennessee and the four counties in which Tennessee NWR is located: Benton, Decatur, Henry and Humphreys.

Table 5. Demographic data for the counties in which Tennessee NWR is located.

Demographic feature	State of Tennessee	Benton County	Decatur County	Henry County	Humphreys County
Population[1]	6,038,803	16,378	11,426	31,837	18,394
Persons/sq. mi. (2000)	138	41.9	35.1	55.4	33.7
Pop. % change, 2000-2006	6.1%	-1.0%	-2.6%	2.4%	2.6%
White persons %	80.4%	96.3%	95.0%	89.6%	95.4%
Black persons %	16.9%	2.3%	3.8%	8.6%	3.1%
Asian persons %	1.3%	0.4%	0.2%	0.4%	0.3%
American Indian %	0.3%	0.4%	0.2%	0.2%	0.3%
Hispanic origin %[2]	3.2%	1.3%	2.9%	1.2%	1.1%
Foreign born %	2.8%	0.7%	1.7%	1.0%	0.9%

Demographic feature	State of Tennessee	Benton County	Decatur County	Henry County	Humphreys County
High school graduates, %, age 25+ (2000)	75.9%	65.8%	63.6%	70.5%	72.0%
University degree, % age 25+ (2000)	19.6%	6.3%	7.3%	12.1%	9.3%
Persons with disability, age 5+ (2000)	1,149,693	4,950	2,809	7,193	3,831
% with disability (2000)	19%	30%	25%	23%	21%
Homeownership rate (2000)	69.9%	80.5%	80.1%	77.4%	77.9%
Median household income (2004)	$38,945	$29,498	$31,409	$31,219	$37,128
Per capita money income (1999)	$19,393	$14,646	$17,285	$15,855	$17,757
Persons below poverty, % (2004)	15.0%	18.0%	17.0%	15.9%	13.1%

Source: U.S. Census Bureau (USCB), 2008
[1] 2006 estimate
[2] Hispanics may be of any race, so also are included in applicable race categories.

The four counties in which the three units of Tennessee NWR are located have average population densities well under that of Tennessee as a whole, which is not surprising, given the rural setting of this and most national wildlife refuges. While the state grew by about one percent annually in the current decade, the populations of the four counties have either declined slightly or increased less than half of the state rate. Non-Hispanic whites comprise a substantially greater share of the four counties' population than in Tennessee or the country in general. This is typical of most rural counties throughout the United States, because minorities tend to be more concentrated in larger urban centers. The percentages of blacks, Asians, American Indians, Hispanics, and the foreign-born are all lower than state and national averages in Benton, Decatur, Henry, and Humphreys counties.

Levels of educational attainment are lower in these four rural counties than in Tennessee generally; this is also a characteristic shared by most rural counties in the state and country. The percentage of the population above age five with disabilities is higher in each of the countries than in the state as a whole; this is especially true in Benton County, where 30 percent of the population is disabled compared to 19 percent for Tennessee.

The average homeownership rate in the four counties is about 80 percent, 10 percent higher than the Tennessee average of 70 percent. Once more, this is representative of the difference between these counties, comprised of rural and small town residents, and of more urban areas, where substantially greater numbers of apartment renters are to be found.

Finally, average incomes, both median household income and per capita money incomes, are somewhat lower for the four counties than for the state. This tends to be the case throughout the entire country – urban and suburban incomes on average are higher than rural incomes. However, the percentage of the four counties living below the poverty line is only slightly higher than the state average, and in one county (Humphreys, at 13 percent), it is lower than the state (15 percent).

Extrapolating from studies at other national wildlife refuges throughout the country (Carver and Caudill 2007), spending by visitors to Tennessee NWR injects millions of dollars annually into the local economies of the surrounding counties. Thus, the refuge is an important economic asset.

REFUGE ADMINISTRATION AND MANAGEMENT

LAND PROTECTION AND CONSERVATION

Currently, Tennessee NWR is part of the Kentucky/Barkley Lake Waterfowl Managers Group along with the TWRA and TVA. The mission statement of this group is: “To provide adequate habitat for the Kentucky/Barkley Lakes waterfowl populations and enhance quality hunter opportunities and satisfaction.” Waterfowl population objectives for Kentucky Lake and the allocation of habitats between federal, state, and private lands have been determined.

Attempts have been made to work with adjacent private landowners to help them protect and enhance their forested habitats. A few years ago, the refuge supported three such landowners in an attempt to enroll their forested lands in the Forest Legacy Program to be protected from future development by permanent easement. Even though the state Forest Legacy Subcommittee did not select any of these lands for protection, due to stiff competition for the available funds, the refuge was successful in demonstrating a desire to work with its neighbors to protect wildlife habitat. There is a need to develop a means to assist adjacent landowners that have the desire to protect and enhance forested habitats. As the Central Hardwoods Joint Venture develops, hopefully a focus will be placed on such an endeavor.

The refuge is involved in several other partnerships with other agencies and organizations that involve research and habitat protection and enhancement. The National Wild Turkey Federation (NWTF) and the University of Tennessee at Knoxville have provided a significant amount of funds and in-kind services for the forest habitat management research projects. Ducks Unlimited (DU) is currently assisting the refuge with a project to refurbish some existing levees and develop a design to construct new impoundments for better water and habitat management capabilities on the Big Sandy Unit. The TVA has been a long-time partner on several projects on the refuge, including maintenance of the pumping station in the Duck River Bottoms and shoreline stabilization projects.

Efforts to expand partnerships both on and off the refuge have become a greater focus of the refuge staff. Some potential future projects involving partnerships are (1) to work towards securing funding through DU’s MARSH program to develop the new impoundments designed by DU; (2) to work with the TVA and the NWTF to better manage a 4-mile segment of a transmission right-of-way that crosses the Big Sandy Unit; and (3) to initiate a hydrology restoration project that could involve several partners (TWRA, TVA, etc.) to restore bottomland hardwoods within the TVA Dewatering Areas off the refuge.

VISITOR SERVICES

Tennessee NWR has a public use program that serves an estimated 373,000 users annually (Figure 11). The most popular uses include fishing, other water-related recreation, wildlife observation, hunting, and environmental education. The two most popular areas for visitation on the refuge include Duck River Bottoms and the Big Sandy Unit. Figures 12-14 show visitor facilities on the three units.

An active volunteer program is in place with an average of 2,000 hours being donated annually by 50 official refuge volunteers. Assisting with the Jr. Duck Stamp program, facility construction and maintenance, invasive plant control, trash pickup, wood duck banding and box checks, and helping with special events accounts for the majority of the hours. In 2005, the refuge began the Friends of Tennessee NWR, drawing on supporters in the surrounding communities. The focus of the group is to help promote the refuge in the community and to spread the word about its mission. In 2009 the Friends Group attracted a membership of 240. The group hosts a booth at most local community events, publishes a quarterly newsletter, contributes school partnership grants for projects on the refuge, and hosts a monthly Refuge Discovery Series featuring environmental education events on the refuge. In recent years, it has supported refuge operations financially with habitat restoration projects, king rail surveys, and with invasive plant control. The Friends Group has also been an advocate to the refuge, urging the support of a new office/visitor center to be built on the refuge.

Figure 11. Annual visitation figures for Tennessee NWR, 1999-2008.

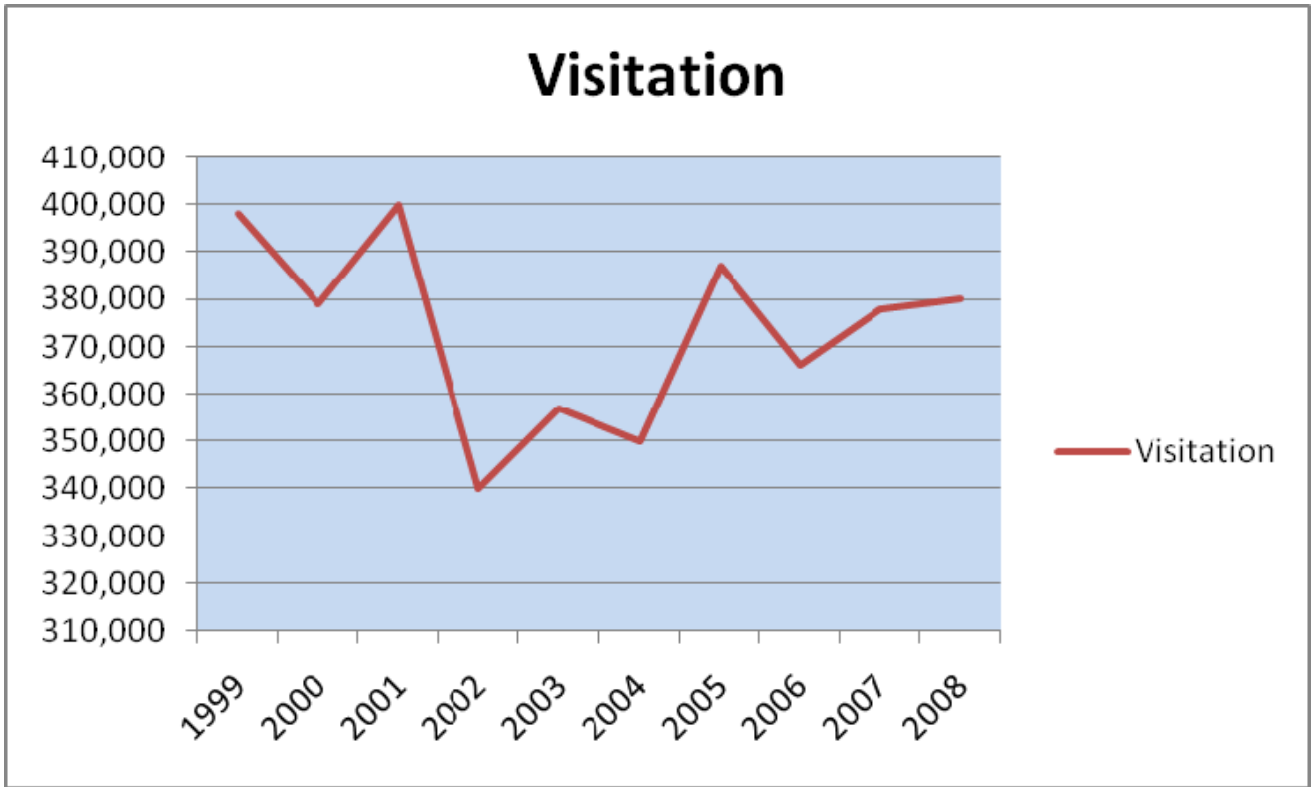


Figure 12. Visitor use facilities on the Big Sandy Unit.

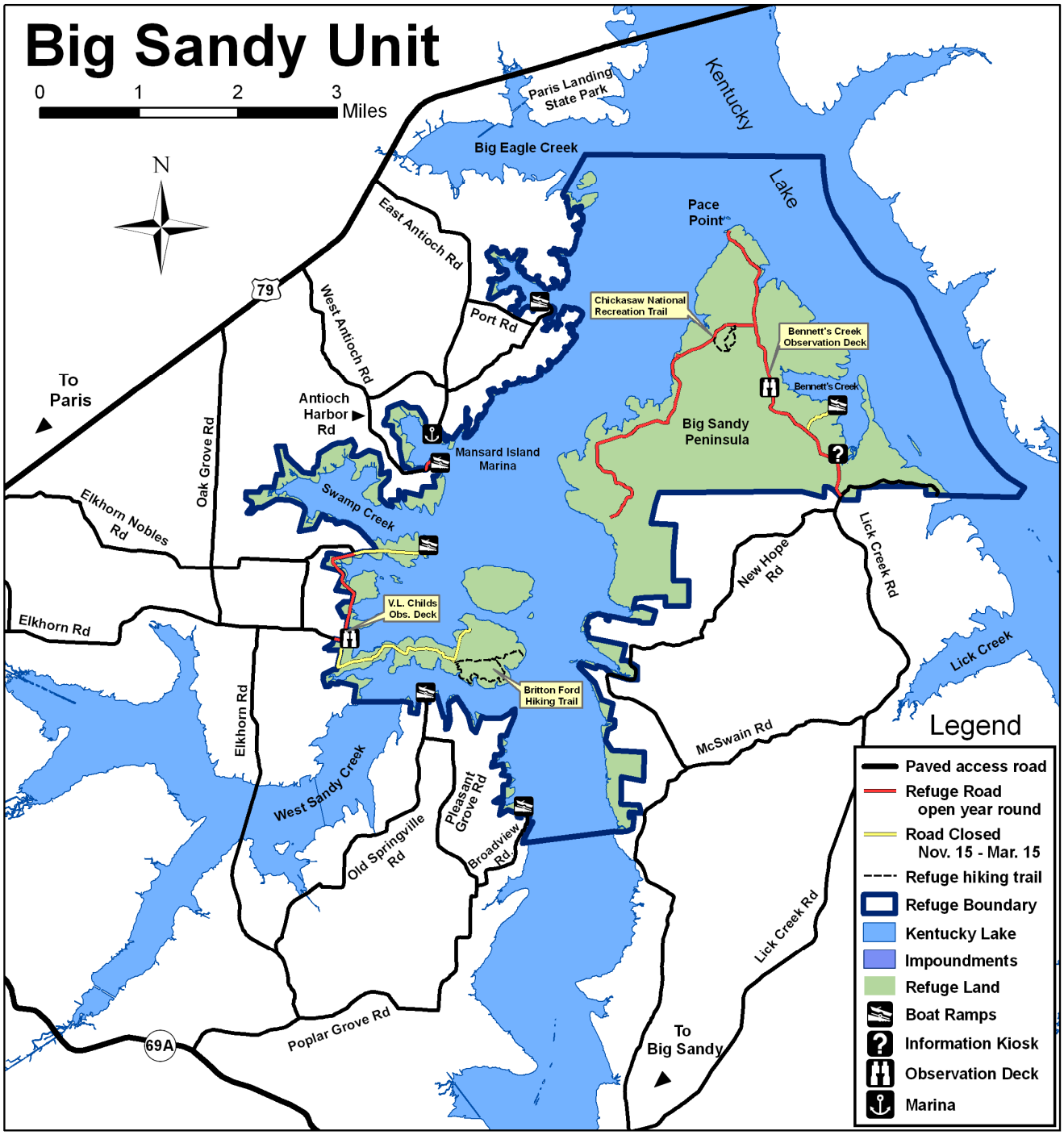


Figure 13. Visitor use facilities on the Duck River Unit.

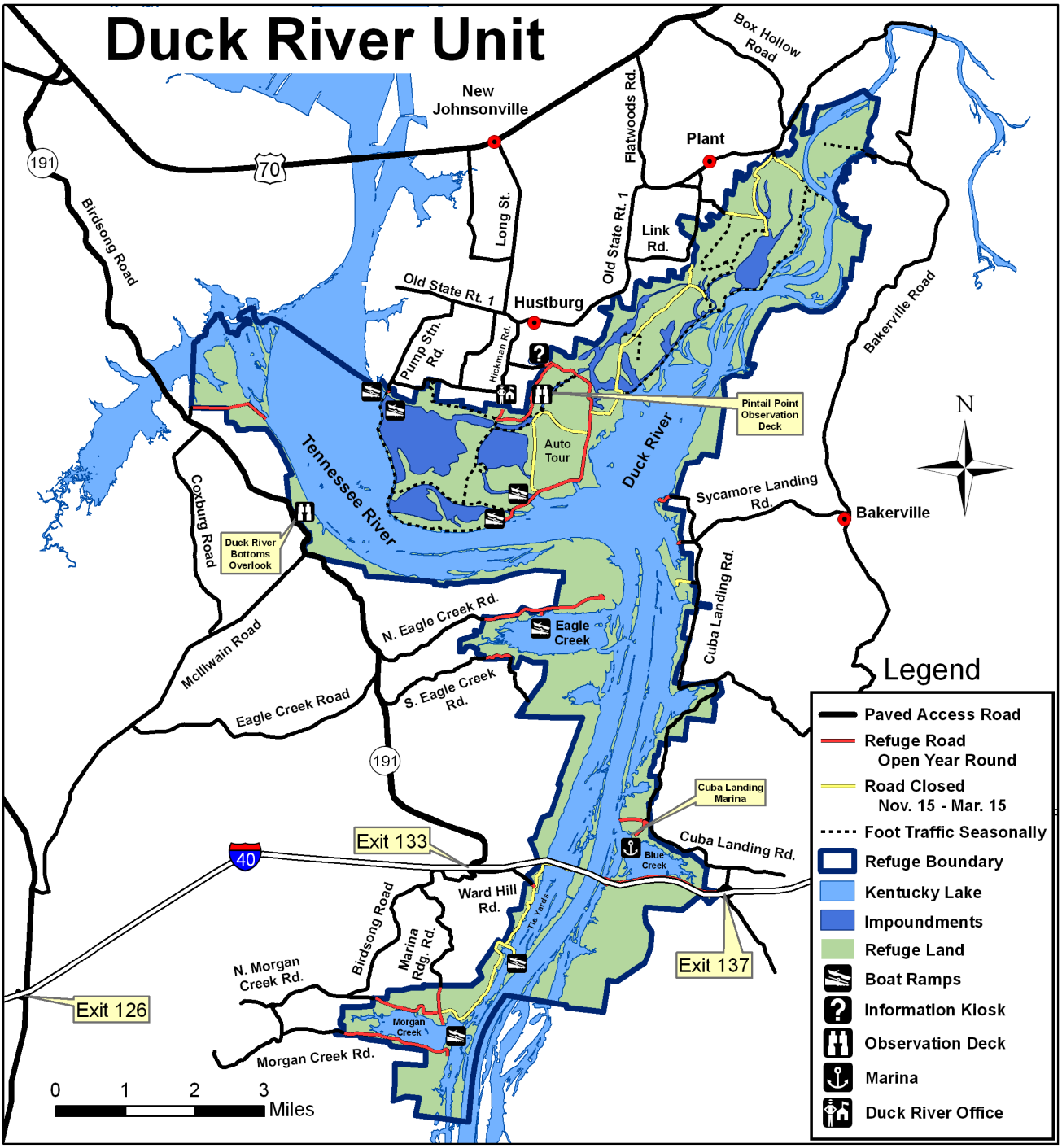
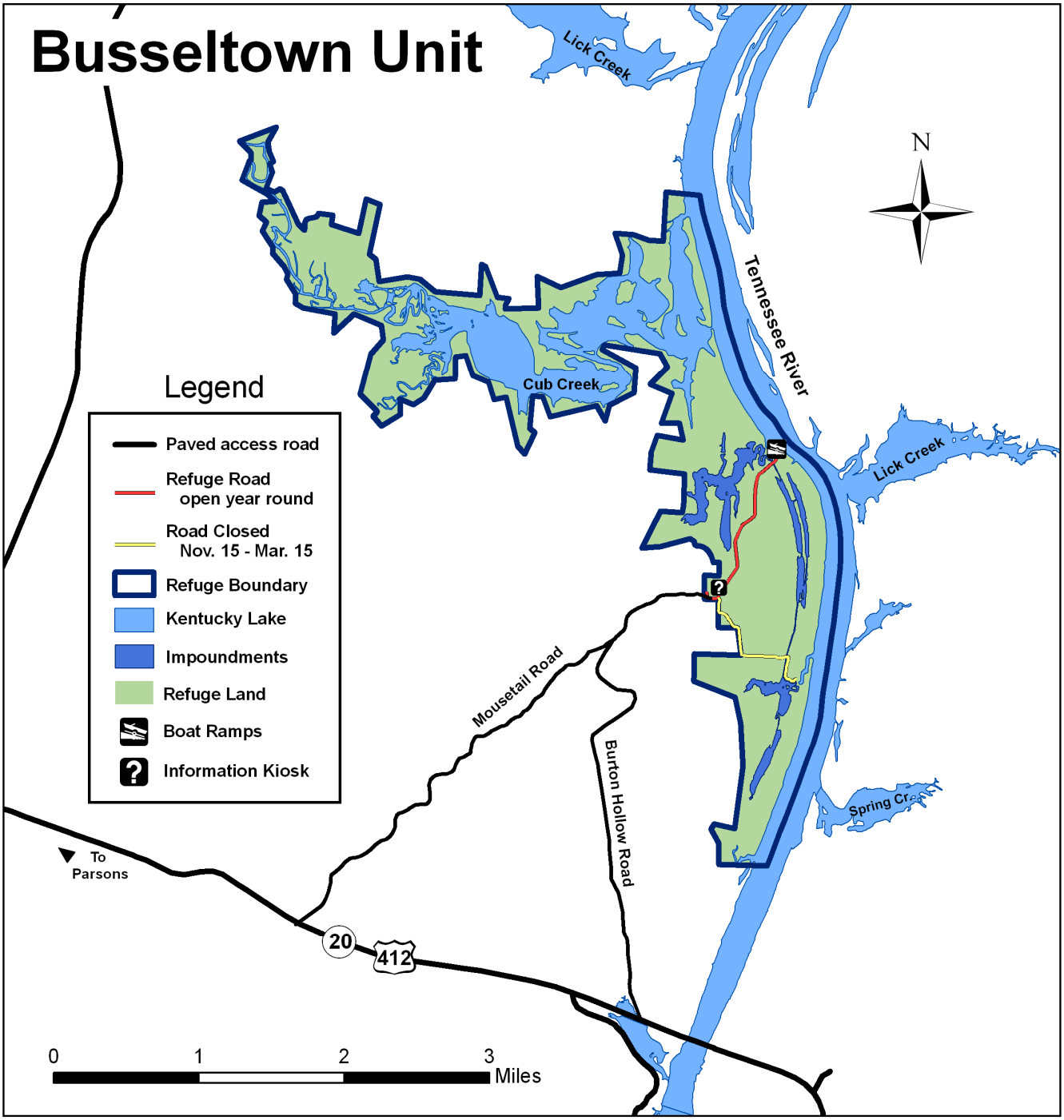


Figure 14. Visitor use facilities on the Busseltown Unit.



The Duck River Bottoms continues to be the most popular area on the refuge for visitors viewing and photographing wildlife. During the winter months over 100,000 ducks uses this area. In recent years a winter waterfowl tour has been popular, inviting visitors to briefly drive back into "closed" areas to view the waterfowl. The Britton Ford/Sulphur Wells area, however small, also gets significant public use because of its proximity to Highway 79 and the outdoor recreation tourism that occurs near Paris Landing State Park. The Big Sandy Peninsula also receives heavy public use from hunters and birding groups.

Excellent opportunities exist at Tennessee NWR to participate in each of the Service's "Big 6" wildlife-dependent priority public uses, which are summarized below.

Hunting

Tennessee NWR has a 1989 Hunt Plan that was amended in 2003 for migratory birds. The refuge is open to nonquota hunting for white-tailed deer, turkey, squirrel and raccoon. A new resident Canada goose season was added in 2003. A hunter participating in a scheduled hunt may also take beaver, coyote, and armadillo with any legal weapon.

There are two special firearms quota hunts for deer. Archery gear and muzzleloaders may also be used during firearm hunts. Hunters apply for these quota hunts on a computer-scanned application form, and a computer program does the draw. A total of 840 hunters are permitted for these quota hunts. There are also two special nonquota hunts for primitive weapons and for a youth hunt. Primitive weapons include longbow, recurve bow, and side-hammered muzzleloader.

All quota and nonquota adult hunters are required to purchase a $12.50 annual hunting permit. This allows them to hunt on both the Tennessee and Cross Creeks NWRs. Youth hunters are exempt from all fees.

Approximately 25,000 acres of Tennessee NWR are open to hunting. Potential for user conflicts exists in the Britton Ford/Sulphur Well hiking trail and Chickasaw National Recreation Trail area during periods when hunting and hiking occur at the same time. There are currently no special provisions given to hunters with disabilities; state areas adjacent to the refuge provide this type of opportunity (USFWS 2004).

Fishing

Fishing is an extremely popular activity and as noted earlier, the fish species diversity on this refuge is the highest of any inland refuge in the country. Anglers target several of the 144 species of fishes found on Tennessee NWR, with largemouth bass, crappie, catfish, and sauger being the prime targets. Bluegill, sunfish, smallmouth bass, and hybrid bass are also caught in large numbers.

A variety of sportfishing opportunities is available on the refuge year-round. Swamp Creek, the West Sandy Creek embayment, Bennett's Creek, and all interior impoundment areas are open to fishing seasonally from March 16 through November 14 during daylight hours only. The remainder of the refuge portion of Kentucky Lake is open year-round. Bank fishing is permitted year-round on the Kentucky Lake shoreline, along Refuge Lane, at the New Johnsonville Pump Station, at the Busseltown Pump Station, and at the Henry County Port. The Henry County Port is open to fishing both day and night due to a partnership agreement.

Creel limits, boating safety, and license requirements are in accordance with state regulations, subject to special refuge regulations listed in the fishing regulations brochure. Brochures are available at the office, sub-office, refuge kiosks, and community stores. The refuge staff has limited

contact with fishermen due to the expanse of the refuge, the lack of sufficient refuge law enforcement personnel, and no visitor contact area available on weekends.

There are 32 boat ramps, both improved and unimproved, which provide access for anglers. In addition to bank fishing from many parts of the refuge, there are also two universally accessible fishing piers available for public use. Two marinas have concession contracts with the refuge. They provide access and services to refuge anglers and recreation boaters.

In 2004-2005, a Fishing Derby was held in conjunction with a local business at a pond on their site. This pond had been stocked 15-20 years previous, but had never been fished. Both years around 250 children and parents attended, with the refuge providing a "pathways to fishing" education station. Some kids were catching catfish that were over two feet long. The event was considered very successful (USFWS 2004).

Wildlife Observation and Photography

Tennessee NWR provides some opportunities for wildlife observation. Visiting the four observation decks; hiking the 2.5-mile interpretive Britton Ford hiking trail or the 1.1-mile interpretive Chickasaw National Recreation Trail; driving; and walking or biking on refuge roads are the most common means of observing the refuge's wildlife. Birding is one of the most popular forms of wildlife observation on the refuge. Viewing wintering ducks and geese; looking for spring and fall migrants; seeking songbirds or unusual visitors such as white pelicans and sandhill cranes; and viewing bald eagles is common practice for local and traveling "birders." Tennessee NWR is well known to serious birders who are looking to view unusual migrants that cannot be found at many other places in the state.

Due to the popularity of the refuge's observation decks, a challenge cost-share project was used to build a universally accessible 11' x 16' observation tower at the Big Sandy Peninsula at the location where an existing building was removed. The observation deck was constructed in the winter of 2004-2005. This platform now gives visitors with disabilities a good view of the Bennett's Creek embayment, as well as two interior impoundments that receive significant wildlife use. It is also one of the best places on the refuge to view bald eagles in the winter.

In 2008, an observation deck in the Duck River Bottoms was relocated to a better location, creating the Pintail Point Observation Deck. This deck includes a 1/8-mile hiking trail ending in a boardwalk that leads to a covered observation deck. This area gives the visitor close encounters with wintering waterfowl and other wetland wildlife, as well as an excellent place to view woodpeckers. This observation deck also serves as a photography blind.

Visitors to the refuge may also enjoy the two other observation decks that include the V.L. Childs Observation Deck and the scenic Duck River Bottoms Overlook deck. Sightings of other wildlife such as hawks and owls, white-tailed deer, wild turkey, raccoon, squirrel, snakes, turtles, beavers and a variety of songbirds are common on the refuge.

In 2008, a five-mile auto tour called the "Blue Goose Boulevard" was created at the refuge's most popular viewing area, the Duck River Bottoms. This seasonal auto tour will open up some areas of the refuge that have been normally closed off to vehicles. It not only will allow visitors to see wildlife and beautiful views that only guided tours have previously been able to provide, but will also interpret the management practices used in the bottoms area. The interpretive signs and pull-offs are scheduled to be constructed in 2009.

Interpretation

The primary interpretive theme of the refuge focuses on the awareness and importance of waterfowl, migratory birds and their conservation. This refuge is a major winter resting area for thousands of waterfowl, including 29 different species of ducks and geese. The variety of habitat types within the refuge also provides for a wide diversity of birds, including songbirds, shorebirds and others. Several rare or unusual species may utilize the refuge at some time during the year.

The managers, refuge ranger, biologists, and law enforcement officers all take turns conducting programs that help to interpret the management activities on the refuge. Talks and tours are given both onsite and offsite by these individuals, depending on subject matter and expertise.

Both the 2.5-mile Britton Ford hiking trail and the 1.1-mile Chickasaw National Recreation Trail have interpretive signs throughout their lengths. Tree identification signs are also posted along the Britton Ford Trail. These signs pose a question to test the hiker's knowledge of tree species. The answer to the question is hidden beneath a wooden flap. The auto tour at Duck River Bottoms will be fully interpreted with "pull-offs" and signs that can be read from the vehicle. The kiosks at the four main entrance areas also have interpretive signs. Both the Pintail Point Observation Deck and the Duck River Bottoms Overlook have interpretive signage on the decks, and the V.L. Childs observation deck within the Big Sandy Unit has two permanent viewing scopes.

Environmental Education

The ranger conducts most of the environmental education on the refuge. Field trips to the refuge, guided tours, in-class presentations, teacher training workshops, and assistance with special classroom projects are examples of the types of environmental education offered. Local school systems also have environmental education resources available to them from the refuge office. These include curriculum guides and activity books, but the most-used resources are 12 environmental education trunks called "Critter Crates." These range from a variety of wildlife and habitat topics and are full of hands-on learning opportunities. They can be checked out free by schools, home schools, boy scouts, girl scouts, churches, or any other groups that work with children. The boxes are geared for K-8th grades, but can easily be adapted for older or younger ages.

An environmental education component has also been included in most refuge special events such as centennial events, wood duck bandings, kids fishing derbies, waterfowl and bald eagle viewing events, and offsite events such as Earth Day and Agricultural Education days.

Other Public Uses

Numerous other public uses occur on Tennessee NWR. Some are wildlife-oriented while others are not. These activities include walking, jogging, bicycling, horseback riding, canoeing, and picnicking. General boating, jet skiing, swimming, and water skiing take place on the navigable waters of Kentucky Lake. Horseback riding is allowed only on refuge roads open to motorized vehicles. Many areas of the refuge are closed to all entry during the winter months due to waterfowl disturbance.

Other illegal activities do occur on the refuge, such as riding all-terrain vehicles into closed areas. Hunting for artifacts along the shoreline and on the river bottoms has constantly been an issue for law enforcement officers.

PERSONNEL, OPERATIONS, AND MAINTENANCE

The number of permanent personnel (full-time equivalent positions or FTEs) at Tennessee NWR is down from a high of 17 during the early 1980s to the current size of 13 (Table 6). These 13 FTEs do not count the contracted law enforcement officers at Fort Campbell.

Table 6. Current Tennessee NWR staff positions.

Project Leader	GS-0485-14
Deputy Project Leader	GS-0485-13
Assistant Refuge Manager	GS-0485-11
Biologist	GS-0486-12
Refuge Ranger	GS-0025-11
Biologist	GS-0486-09
Refuge Planner	GS-0485-12
Supervisory Law Enforcement Officer	GS-0025-12
Law Enforcement Officer	GS-0025-09
Administrative Officer	GS-0341-09
Office Assistant (Temporary)	GS-0303-04
Engineering Equipment Operator	WG-5716-09
Engine Equipment Operator	WG-5716-09
Engine Equipment Operator	WG-5716-08
Tractor Operator (Temporary)	WG-5705-06

In addition to these 13 permanent FTE positions, at any given time the refuge usually has several temporary or seasonal employees, including those who participate in the Student Temporary Employment Program (STEP) and/or Student Career Employment Program (SCEP).

III. Plan Development

PUBLIC INVOLVEMENT AND THE PLANNING PROCESS

The process of developing this plan began in 2004 with a biological review and a visitor services review of the refuge. In August 2004, a diverse team of federal and state personnel undertook a holistic biological examination of the refuge's habitat and wildlife management programs. The team then considered how the refuge might fit into accomplishing a number of relevant system-wide and landscape conservation needs. The biological review team included staff from the refuge, as well as fish and wildlife biologists from the Service's Southeast Regional Office, Division of Ecological Services, and Division of Migratory Birds. In addition, wildlife biologists from the Tennessee Wildlife Resources Agency (TWRA), Tennessee Valley Authority (TVA), the University of Tennessee at Knoxville, and the Tennessee Wildlife Federation participated. The biological review team's recommendations were set forth in a report entitled, "Tennessee National Wildlife Refuge Biological Review" (USFWS 2005), and was instrumental in the planning process.

The visitor services review was conducted in February 2004 by Service public use and outreach specialists. The visitor services review team toured the refuge, identified and discussed the current status of public use programs, and provided a report with its recommendations for enhancing and improving these programs (USFWS 2004).

The comprehensive conservation plan (CCP) core planning team, which consists of the refuge manager, deputy refuge manager, two wildlife biologists, a park ranger, a natural resources planner from the Service's Southeast Regional Office, and a contractor with experience in comprehensive conservation planning, met for the first time in November 2007. The team reviewed the recommendations of the biological and visitor services review teams, and conducted a comprehensive review of the refuge's overall natural resources management and public use programs. It also conducted additional internal scoping and prepared a preliminary schedule and plans for public involvement. The team developed a mailing list of the public, landowners, state and tribal agencies, nonprofit organizations, and local governments. Letters were sent notifying these parties of the planning process being initiated, and encouraging their participation in the public scoping of issues in preparation for developing the draft plan for Tennessee NWR. A notice of intent to prepare a CCP for the refuge was published in the *Federal Register* on April 2, 2008.

The core planning team then held a series of three public scoping meetings in Paris, Parsons, and New Johnsonville, Tennessee, on May 5, 6, and 7, 2008, respectively. Appendix D, Public Involvement, summarizes the comments from these public scoping meetings, as well as additional information regarding the overall planning process.

SUMMARY OF ISSUES, CONCERNS, AND OPPORTUNITIES

The core planning team identified a number of issues, concerns, and opportunities related to fish and wildlife protection, habitat restoration, recreation, and management of threatened and endangered species. Additionally, the planning team considered federal and state mandates, as well as applicable local ordinances, regulations, and plans. The team also directed the process of obtaining public input through three public scoping meetings, open planning team meetings, comment packets, and personal contacts. All public and advisory team comments were considered; however, some issues that are important to the public are beyond the scope of the Service's authority and cannot be addressed within this planning process. The team did consider all issues that were raised throughout

the planning process, and has developed a plan that attempts to balance the competing opinions regarding important issues. The team identified those issues that, in its best professional judgment, are most significant to the refuge. The significant issues are summarized below.

FISH AND WILDLIFE POPULATION MANAGEMENT

- Research and support that will facilitate science-based management of the resources on the refuge is needed.

- Dates for closing and reopening portions of the refuge when migratory waterfowl are on the refuge in the winter to avoid human disturbance.

- Multiple closure dates on different refuges or different portions of Tennessee NWR have led to confusion.

- Experiment with closing the road at Busseltown to see if that would attract more waterfowl.

- Cowbird parasitism is affecting some songbirds.

- Creating shorebird impoundments in the Duck River Unit would impact 30 acres or so of farmland there.

- Among the threatened and endangered species and species of concern are the interior least tern and piping plover, both of which migrate through the refuge. There are endangered freshwater mussels in the lake. The king rail is a species of concern and there is a small breeding population in the Duck River Bottoms. Some neotropical migratory birds are species of concern, including the cerulean warbler.

- Complete, intensive inventory and monitoring of biological resources is needed in order to track population changes over time.

- Trapping should be given serious consideration in the CCP. Trapping will lower predator populations, which would help the ground-nesting birds such as turkey and quail. It would also help to control the beaver and coyote problems, as well as provide some economic benefits for local trappers.

- Nonnative plants and animals are the most important issues facing the refuge. Spraying, cutting, and relocating are possible means for addressing the problem posed by nonnatives.

- The refuge should diversify food sources for wildlife and not rely so much on corn and beans.

- Overall the refuge does a good job managing habitats and wildlife, but spends very little on fishing habitat compared to ducks and geese.

- The new management plan should not make accessibility for hunters an integral part of the refuge's mission. The concept of a "refuge" should be just that, as a haven for migratory birds to rest and feed, and to provide a nesting area for resident wildlife. The Service should rise above local politics and special interest input and manage the Refuge System as it was originally intended. There may be specific requirements when a limited hunt is necessary to prevent an overpopulation of a species, but the general concept of a refuge (sanctuary) should be maintained.

HABITAT MANAGEMENT

- Facilities need to be developed for migratory bird management including repair or replacement of water control structures, repair of existing levees, drainage maintenance, and replacement of farming and other types of needed equipment.

- Resources are needed for proper migratory bird management including funds for water pumping, new water control structures, increased pumping capability, wells to enhance flooding capabilities, and additional farming equipment and funds if force-account and/or contract farming efforts are expanded.

- Geographic Information System (GIS) projects are needed, such as (1) vegetation type maps through aerial photo interpretation and field reconnaissance; (2) detailed contour mapping within the impoundments to facilitate better water and habitat management; and (3) better monitoring of invasive exotic plant communities.

- The refuge has no control over the water level schedule in Kentucky Lake. The lake is usually lowered starting on July 1; mudflats are needed for shorebirds and waterfowl.

- Crop manipulation (e.g., knocking down of corn stalks) in farmed areas is an issue because of hunt clubs.

- Under the refuge's cooperative farming program, it is sometimes difficult for the 5 farmers to stick to their agreements with the refuge.

- To implement force-account farming (by refuge staff) takes staff and budget.

- Forest management planning is a public process; there has been one thinning of over 400 acres on the Big Sandy Unit. The refuge does have a forest management plan.

- In terms of invasive plant control, the refuge mostly focuses on aquatics.

- Refuge forester position has been lost; forester and fire management capability would be nice to have.

- Should moist soil acreage be increased in certain areas?

- The public will say that there are too many crops on Duck River and not enough water on the Busseltown Unit.

RESOURCE PROTECTION

- Law enforcement is spread across five counties. Crime runs the gamut from game and fish violations to meth labs, marijuana cultivation, and digging for artifacts (arrowheads, rocks, and fossils). Hunters and anglers are often the eyes and ears of law enforcement.

- The Service (FWS) and the Department of Defense (DOD) (Fort Campbell) jointly fund law enforcement officers at an 80 percent Fort Campbell to 20 percent FWS ratio. Tennessee NWR gets 20 percent of all Fort Campbell officers' time.

- Two more full-time equivalent law enforcement officers are needed for Tennessee NWR alone, one of which would be stationed at Duck River.

- Another law enforcement position would be stationed at the headquarters or at Cross Creeks NWR.

- Violations are impinging on the sanctuary for waterfowl and the problem appears to be getting worse.

- The waterfowl impoundments at Big Sandy Creek used to be a fishing area; habitat management has been extensive in this area.

- Buck bushes appear to be disappearing in coves on Kentucky Lake; sticker trees are shading out buck bushes, which may be a result of TVA water manipulations.

- Drawdown and water manipulations and levels by TVA may conflict with refuge management.

- Aquatic habitat manipulation to benefit fish stocks and sportfishing is needed. Stake beds with plastic pipes used for fish habitat.

- In order to address climate change on Tennessee NWR, a basic biota survey needs to be conducted to use as a baseline to gauge if climate induced changes are occurring.

VISITOR SERVICES

- Among the refuge's visitor facilities are 32 boat ramps. The refuge has attempted to close down some small boat ramps, but received strong opposition from the public. With so many ramps, it is difficult to maintain them all. During peak fishing use periods, visitors are limited by parking lot capacity at boat ramps. For four to five weeks these parking lots are overflowing, which causes problems.

- Waterfowl hunting on the refuge. The resident Canada goose hunt has been problematic in recent years. Tennessee NWR is the only sanctuary locally and six WMAs within a 10-mile radius are open to waterfowl hunting. Clubs would probably oppose opening the refuge to hunting waterfowl.

- Would a waterfowl hunt be manageable? Law enforcement might be spread too thin.

- Could a youth waterfowl hunt be conducted with Ducks Unlimited assistance?

- Closing areas to public use for the benefit of wildlife or wintering waterfowl is controversial.
- Equestrians want to use more of the refuge; right now they can only use refuge roads that are open to motorized vehicles.
- The refuge has 20+ boat ramps which are expensive to maintain.
- Boat ramps need designated parking areas to avoid blocking roads and gates.
- Is there a potential for partnerships in maintaining the boat ramps?
- Address the refuge's policy on fishing tournaments.
- Construction of a visitor center and headquarters on the refuge is needed to increase the potential for environmental education, volunteer participation, and more efficient management of the refuge.
- There is some demand to use all-terrain vehicles (ATVs) for hunting, but it is not allowed.
- Adequacy of the refuge's universally accessible hunting and fishing facilities for visitors with disabilities.
- The Britton Ford Boat Ramp has a problem with accessibility for visitors with disabilities.
- There is a camping property next door to refuge with limited opportunities to access refuge resources.
- We need more universally accessible areas for electric wheel chairs or golf carts.
- Set up areas strictly for universally accessible access for fishing, hunting, and wildlife viewing, for the benefit of visitors with disabilities. This issue needs to be addressed nationally.
- There is an increasing population in local areas, raising public use pressure on refuge.
- Accessibility is sometimes difficult.
- Increase waterfowl hunting opportunities.
- Introducing more people to wildlife resources via the refuge.
- The local Chamber of Commerce believes the refuge manager has done a tremendous job as a partner and has increased the understanding of wildlife refuge resources.
- There are opportunities to increase tourism related to the refuge and therefore increase the quality of life for local communities and residents.
- All public lands (state, county, and federal) represent a great opportunity to introduce families and the public to nature and increase the quality of life.

- Positive publicity among groups has brought people together and welcomed many to the refuge.

- Seventy-nine percent of refuge users are nonresidents; five states are represented in a campground next to the refuge.

- Refuge can pursue outreach to others and bring more people to the area, which may increase public use opportunities.

- Fishing on the Big Sandy Unit is nice, which attracts a lot of visitors.

- Add raccoon hunting with dogs to refuge public use program.

- Better access for visitors with disabilities is the most important issue facing the refuge. Visitors with disabilities should be able to ride golf carts to the ramp.

- While the types of public use are appropriate, the refuge is open only one-half time; life goes on at night.

- By permit, the refuge should allow scouts and other nonprofits to stay overnight; a “no fire” camping policy is O.K.

- The most important issue facing the refuge is to make it more user friendly, so more people can see the wonderful work the refuge does for habitat and wildlife.

- Refuge should build better and larger boat ramps and more parking.

- The more different types of visitors the refuge supports, the more supportive they, in turn, will be, especially when the refuge asks for more money to help with its services; i.e., asking congressmen to vote for an increase in funds.

- There should be some special privileges or accommodations made for people visiting family graves on the refuge, many of which are off the main roads. For most elderly, a half-mile hike is out of the question. Accessibility becomes a subjective issue based on individual capabilities. Accessibility to graveyards where gravel roads are available should be allowed by vehicle.

- Hunting is animal abuse. It is far too dangerous and corrosive to a nation to allow it in these sites designated as refuges. Trapping is also animal abuse, pure and simple. You trap the animal so it lives in pain for days so the trapper gets $2 for the pelt. That animal is worth a million dollars alive to me. I oppose the corruption and greed that allow this murder and abuse of wildlife and birds to continue.

REFUGE ADMINISTRATION

- Based upon the 2005 Deployment Model for the National Wildlife Refuge System, the addition of 4.4 law enforcement FTEs are needed to adequately protect the Tennessee Refuge.

- Additional biological personnel (one full-time biologist and two biological technicians) will be needed to fully implement the fish and wildlife inventory and monitoring program and to increase invasive exotic plant control efforts as outlined in this document. The seasonal positions would not be needed if invasive control efforts are contracted.

- Two forestry technicians will be needed when full-scale forest management operations to enhance forest interior migratory bird habitat are implemented.

- The refuge currently has a deficit of three maintenance positions. These positions are needed to adequately manage the habitats and maintain support facilities and equipment.

- Operating budgets are tight at Tennessee NWR, as they are on all national wildlife refuges. Funds for operating the Duck River pump station, controlling invasive species, and conducting other habitat management activities are very limited. Maintenance funds vary with the number of funded projects. The refuge has been fortunate with several projects having been funded in the past years. The refuge has an adequate vehicle fleet and heavy equipment, although it has a need to replace some aging equipment such as bulldozers, farm tractors and road graders. Facilities are adequate at Duck River but are inadequate on the other units. The refuge has Maintenance Management System (MMS) projects to upgrade storage facilities at all three units. One of the challenges the refuge faces is the distance between the far-flung refuge units and the need to transport equipment to the other units. This transportation results in loss of time and delays in competing projects. Adequate and secured storage facilities would promote the storage of equipment on these units and reduce loss of staff time on projects.

- Maintain, repair and/or replace roads and bridges and equipment necessary to access the refuge. Without access, proper management of resources will be difficult to accomplish.

- Refuge staff is effective in supporting original refuge purposes.

- Refuge is doing a good job.

- Shortage of restroom facilities throughout the refuge. They entail both capital and maintenance costs.

- Busseltown has fewer visitor use facilities because of its remoteness and the potential for vandalism.

- The Friends group is three years old and continuing to get established and find its place.

- Refuge boundaries need to be resurveyed, posted, and maintained.

- The loss of Cross Creeks NWR's public use person means Tennessee NWR's park ranger will have to divert some of her efforts to assisting that refuge.

- There is a substantial maintenance backlog that includes grading roads, mowing, and rehabbing boat ramps.

- Maintaining and dredging the main ditch in the Lower Duck River Bottoms is needed to improve water management capability.

- Spillways are needed to avoid flood damage.
- Refuge needs a pumping project to pump water into pools, so that they're not so dependent on the lake level.
- Need maintenance/grounds staff; even a seasonal position would help.
- The refuge is very spread out and lengthy round-trip travel time to distant portions is an impediment.
- Refuge does not have a heavy equipment maintenance shop.
- Refuge has a hard time getting vendors to deliver construction materials because of cost and county road weight limits on trucks.
- Primary issue facing the refuge is funding and providing adequate staff to support the refuge and its resources; budgets have been decreasing.
- Potential for cooperating with Paris Landing State Park to manage adjacent property and provide an environmental education and interpretation center.
- Cooperative and partnering opportunities can be achieved with local camping facilities.

WILDERNESS REVIEW

Refuge planning policy requires a wilderness review as part of the comprehensive conservation planning process. The results of Tennessee NWR's wilderness review are included in Appendix H.

IV. Management Direction

INTRODUCTION

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

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

Four alternatives for managing the refuge were considered: Alternative A, No Action (Current Management Direction); Alternative B, Public Use Emphasis; Alternative C, Wildlife Management Emphasis; and Alternative D, Enhanced Wildlife Management and Public Use Program. Each of these alternatives is described in Chapter III of the Environmental Assessment (Section B). The Service has chosen Alternative D as the proposed management direction.

Implementing the proposed alternative will continue to emphasize managing habitat for waterfowl, but will expand management on behalf of other native wildlife. The refuge will also furnish increased opportunities for compatible, wildlife-dependent visitation.

VISION

Tennessee National Wildlife Refuge was established in 1945 to provide an inviolate sanctuary and manage habitat for migratory birds. Over the foreseeable future, Tennessee NWR will continue its emphasis on managing habitat for waterfowl. The refuge will also expand its management activities for other migratory birds, in turn providing habitat for other wildlife. In addition, the refuge will strive to be a model for wise land stewardship, including management for indigenous species of flora and fauna and the control of invasive plants and animals.

Tennessee NWR will also continue to serve the American people by expanding opportunities for appropriate and compatible, wildlife-dependent recreation such as hunting, fishing, wildlife photography and observation, as well as environmental education and interpretation. An adequate law enforcement presence will be provided in order to protect the public and natural and cultural resources. Refuge staff will build on existing partnerships with other agencies and stakeholders in implementing this vision.

GOALS, OBJECTIVES, AND STRATEGIES

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

These goals, objectives, and strategies reflect the Service's commitment to achieve the mandates of the National Wildlife Refuge System Improvement Act of 1997; the mission of the National Wildlife Refuge System; and the purposes and vision of Tennessee National Wildlife Refuge. The Service intends to accomplish these goals, objectives, and strategies within the next 15 years.

FISH AND WILDLIFE POPULATION MANAGEMENT

Goal 1: Contribute to healthy and viable native wildlife and fish populations representative of the Lower Tennessee-Cumberland Ecosystem, with special emphasis on waterfowl and other migratory birds.

Objective 1-1: <u>Migratory ducks</u> – Provide adequate habitats to meet the foraging needs of 121,000-182,000 ducks (or a range specified by NAWMP goals) for 110 days and other habitats that are needed for loafing, roosting, molting, etc.

Discussion: Tennessee NWR typically winters about 200,000 Mississippi Flyway ducks, with the peak over the past decade reaching more than 321,000. The refuge is an especially important wintering area for American black ducks. During normal winters, 20-30 percent of the entire Mississippi Flyway black duck population winters at the refuge. Other species found in significant numbers during fall and winter include the mallard, gadwall, wigeon, blue-winged teal, green-winged teal, pintail, ring-necked duck, canvasback, lesser scaup, bufflehead, goldeneye, and ruddy duck. Since ducks commonly feed in upland grain fields, both flooded crops and unflooded upland forage crops should be available to support the objective's targets.

Strategies:

- To the extent possible, make available some moist soil habitat, flooded crops, upland crops, and green browse on each of the three refuge units.

- Manage approximately 1,600 acres of flooded habitat to annually provide at least 1,200 acres of moist soil that averages 400 lbs. of seed per acre. (Each year some of the 1,600 acres will be in agriculture, treated with herbicide, etc. to set back succession and will not provide moist soil habitat.)

- Provide some flooded habitat in at least one moist soil unit during the August- October period for early arriving waterfowl.

- Provide a minimum of 350 acres of unharvested corn as weather permits to meet the duck foraging objective (or an equivalent amount of other grains) that averages 100 bushels per acre. It is estimated that 15% of waterfowl grain crops are utilized by other wildlife. An allowance for other wildlife use will be considered when determining the amount of grain crops to be retained as refuge share.

- Further increase the amount of flooded unharvested agriculture by subdividing the existing impoundments in the Duck River Bottoms and creating new impoundments on the Busseltown Unit, so that 75% of this habitat type is floodable.

- Increase the amount of flooded unharvested agriculture by creating new impoundments on the Big Sandy Unit, so that 25% - 50% of this habitat is floodable.

- Continue efforts to improve water management capability on each of the three units. This includes improving the water supply by installing wells and pumps. Additional water control structures are also needed to increase the discharge capacity.

- Unharvested row crops that occur in locations where flooding is not likely should be evaluated and if possible be made available to waterfowl throughout the wintering period by mechanically knocking or mowing the crop to the ground (i.e., crop manipulation).

- Assure that adequate habitat presently exists in both the managed and natural habitats to continue meeting the needs of diving ducks.

- Continue to provide other habitats, such as mudflats, natural aquatic, flooded woodlands, and open water that provide food resources as well as habitats for loafing, resting, roosting, and molting.

- Document waterfowl use of the various refuge habitats.

- Continue to conduct aerial waterfowl population surveys, which are considered to be the most reliable and consistent with refuge historic survey data.

- Continue to conduct aerial waterfowl population surveys at least monthly from October through February, recording the number of birds observed by water management unit and where feasible, habitat type.

- Conduct quantitative analyses of the refuge waterfowl unit survey data, vegetative data, and environmental data to determine if waterfowl use can be correlated with these variables.

Objective 1-2: <u>Migratory geese</u> – Provide adequate habitats to meet the needs of about 16,000 migrant Canada geese for 90 days but readjust these population levels as suggested by future needs.

Discussion: Tennessee NWR is one of just three crucial terminal wintering regions for those migrant Canada geese that prefer to winter in the Deep South. In particular, the refuge needs to provide for the life-history needs of South James Bay and Mississippi Valley Goose populations to ensure that the Southeast can retain wild migrant populations and their traditional migration patterns. Back in the 1980's, the refuge often wintered more than 40,000 migrant Canada geese, but more recently numbers have ranged from 8,000 to 13,000. Very mild winters and/or numerous management actions in more northern States and Canada could be limiting factors. However, history has shown that very harsh winters may double or even triple over-wintering densities.

A growing population of resident Canada geese threatens the refuge's ability to manage for migratory waterfowl by damaging habitat during the growing season. Impacts on agricultural crops also threaten the profitability of the cooperative farming program and reduce the quantity of grain available to migrants. Damage to moist soil vegetation likely reduces the quality of this habitat to some extent. Resident Canada goose numbers will have to be controlled to avoid excessive competition for forage and to reduce off-refuge depredation. The Kentucky Lake Waterfowl Management Plan calls for an interim population objective of 6,000 resident Canada geese, as measured by the TWRA's annual spring survey. The refuge currently does not presently have a population objective for resident Canada geese, but may consider establishing one in the future for management purposes.

Strategies:

- Assume that half of the goose foraging needs will be provided by corn (or an equivalent amount of other grain) and half by green browse.

- To the extent possible, make available some moist soil habitat, flooded crops, upland crops, and green browse on each of the three refuge units and within large open areas where human disturbance is minimal.

- In traditional use areas, make available some large, open fields, such as harvested grain or planted wheat fields, for those geese arriving in late September and early October.

- Provide about 24 acres of unharvested corn that averages 100 bushels/acre (or a comparable amount another grain) in traditional goose use areas where geese are not reluctant to feed.

- Where unharvested row crops occur in locations where flooding is not likely, evaluate, and if possible, make available to waterfowl throughout the wintering period by mechanically knocking the crop to the ground (i.e., crop manipulation).

- Provide approximately 300 acres of winter wheat browse in traditional goose use areas (i.e., areas open enough to attract and hold geese).

- In traditional goose use areas, maintain habitats in an open state (large open fields and clean shorelines) so birds will not be reluctant to use these areas. Control woody vegetation along the shoreline in these areas every 3-5 years, as needed. Implement a prescribed fire program to aid in the management of these open shoreline areas.

- Every 5 years reevaluate the foraging needs of geese. If migrant Canada goose peak populations have remained below 2,000 for 10-15 consecutive years, adjustments to the foraging needs for Canada geese will be considered.

- If it is determined that all of the existing farm acreage is not necessary to meet the foraging and other upland habitat needs of geese, any unneeded acreage located in traditional goose use areas should be maintained in a condition (i.e., grassland) that will permit reclaiming it as farmland should the need arise.

- Record the date, location, and number of migrant geese arriving on the refuge every fall. (Migrant Canada geese have traditionally arrived in late September and early October.)

- Conduct research that will produce refuge-specific models to better estimate foraging carrying capacity for the managed habitats on the refuge.

- Control the resident Canada goose population on the refuge to reduce impacts to habitat managed for migrant waterfowl.

- Consider planting lure crops in an effort to reduce damage to cooperative farmer's crops or other habitats.

- Continue to allow resident Canada goose hunting during the September 1-15 season.

- Incorporate lethal control techniques for resident Canada geese into the refuge's Animal Control Plan, and utilize lethal control if the hunting program does not control the population at acceptable levels.

Objective 1-3: <u>Sanctuary</u> – Provide sanctuary for wintering waterfowl and other migratory birds.

Discussion: One of the establishing and acquisition authorities for Tennessee NWR is the Migratory Bird Conservation Act, which calls for use of the refuge as an "inviolate sanctuary," among other things. The refuge is the only sanctuary locally and six state WMAs within a 10-mile radius allow waterfowl hunting. The refuge's sanctuary status improves waterfowl hunting on nearby public and private lands, as well as providing opportunities for wildlife observation. Waterfowl sanctuary is a critical part of annual waterfowl conservation and management. Sanctuary provides areas where birds can rest, gain fat, and develop pair bonds that improve the likelihood of successful nesting in the spring and summer.

Strategies:

- Provide sanctuary for wintering waterfowl and other migratory birds from November 15 to March 15.

- Protect high use wintering waterfowl habitat from human disturbance by closing roads, lands and waters to public access.

- Continue with the current closures that exist on the refuge.

- Additional closures may be needed, especially in the vicinity of the Duck River on the reservoir side of the levee and Cub Creek, if disturbance from boats becomes an issue.

- The proposed auto-tour route in the Duck River Bottoms needs to be carefully evaluated to ensure disturbance to waterfowl is kept to a minimum. Consider limited access during key periods, such as pair bonding, molting, and roosting.

- Increase seasonally closed areas by the seasonal closure of all roads on the Busseltown Unit and consider the closure of the Honey Point Ferry Road on the Duck River Unit.

Objective 1-4: <u>Wood ducks</u> – Maintain 200-250 nesting boxes, expanding program to the Big Sandy and Busseltown Units and continue to meet the banding goals of the Mississippi Flyway Council.

Discussion: Wood ducks are an important species harvested in Tennessee and the Southeast, often ranking first or second in ducks retrieved by the hunting public. They are a species difficult to survey and estimate population status, hence the need for sustained banding programs. Also, wood duck boxes can make a positive contribution to the well-being of this species if properly constructed, located, predator proofed, and managed (yearly maintenance).

Tennessee NWR has had an excellent wood duck banding program and efforts will be continued to meet refuge quotas by age and sex during the preseason banding period. In managing wood ducks, the refuge will endeavor to follow the objectives and strategies as outlined in the updated 2003

Guidelines for Wood Duck Management and Banding (USFWS Refuge Lands – Southeast) prepared by the Service's Southeast Regional Office, Division of Migratory Birds. The overall aim of this objective is to promote management and banding activities to increase wood duck productivity on refuge lands and to improve information on Flyway population status.

Strategies:

- Meet refuge wood duck banding goals during the July 1- September 30 preseason banding period that contribute to achieving state, regional, and flyway goals.
- Achieve, and exceed whenever possible, wood duck banding quotas.
- Conduct reward banding programs as requested.
- Provide properly located and maintained nesting sites (trees/boxes), brood-rearing, and feeding areas for wood ducks and fall/wintering sites for black ducks throughout key areas of Tennessee NWR.
- Follow the 2003 Regional Wood Duck Management Guidelines for nest box programs.
- Make at least one nest box check after the breeding season to insure the box and predator guards are in good condition and to refresh nesting material.
- Expand the number of nesting boxes in suitable brood-rearing habitat, if personnel are available for maintenance.
- Continue to map location of boxes and archive species use/map locations.
- Improve forest and brood habitats via longer timber rotations for riverine hardwoods (100 yrs.) and retention of some beaver ponds (see 2003 Regional Office Wood Duck Guidelines).
- Recognize importance of natural cavities and retention of larger, older trees to improve natural cavity formation (see Regional Guidelines regarding wood duck management).
- During timber harvest and thinning activities those trees that are most likely to develop natural cavities normally should not be cut.
- Recognize that beaver ponds and greentree sites are favored areas for wood duck broods, black ducks, roosting waterfowl, etc.
- Provide approximately one thousand acres of forested and scrub-shrub wetlands that are spread throughout the refuge.

Objective 1-5: <u>Marshbirds</u> – Create and enhance existing habitat for secretive marshbirds.

Discussion: The refuge currently has the only documented nesting site for king rails in Tennessee. Other species of rails migrating through Tennessee NWR include the sora and Virginia rail. Tall emergent vegetation such as cattail and big bulrush is preferred habitat for these marshbirds. These can be aggressive and take over impoundments without careful control. However, the number of

species that require tall emergent vegetation – and the apparent severity of the king rail's decline) suggests that compromise is in order to meet the needs of both waterfowl and priority marshbirds.

The king rail, as the highest priority marshbird, may serve as an umbrella species for the other priority marshbirds. The king rail may be the most habitat-specialized of the species nesting in tall emergent vegetation. Its nests are constructed near the soil, usually where standing water depths are about 10 inches. Higher water levels have the potential to flood out the species and little or no standing water potentially exposes nests to greater predation. These conditions should support nesting least bitterns as well, with nests usually placed higher in the vegetation, making this species more tolerant of deeper flooding. Assuming that a minimum of five acres is necessary to support at least one pair, and if a minimum of 250 acres could be dedicated towards supporting this species at Tennessee NWR, then it may be possible to support a minimum of 50 nesting pairs of king rails.

Opportunities to identify potential sites for marshbird management would be in the Duck River Unit. Such focus will require maintaining micro-topography within the impoundments. Where there is good wood duck brooding habitat there should be opportunity to support more tall emergent wetlands, but this will be a long-term process.

Strategies:

- Focus specific attention to promoting tall emergent vegetation in a way that would support 15-25 nesting territories for king rail pairs and least bittern migrant populations spread across the Refuge, by 2011.

- Identify how much habitat can be managed in at least 20-acre units and use this as a baseline for integrating the needs of breeding marshbirds with wood duck brooding habitat and other (wintering) waterfowl habitat requirements.

- For habitat conditions, promote 40-70 percent in tall emergent vegetation, with the remaining 30-60 percent in open water, floating vegetation, and submergent aquatic vegetation in support of breeding pied-billed grebes and American coots, as well as brooding wood duck, wintering waterfowl, and amphibians.

- Consider retaining tall emergent vegetation, how much each year to be determined later and in concert with waterfowl objectives.

- Consider initiating the marshbird survey to establish baseline data and monitor use of managed sites targeting breeding rails, bitterns, grebes, gallinules, and coots.

- Spot-check habitat patches to determine use by priority species. Especially focus survey effort using marshbird call-back survey points and contribute to ongoing secretive marshbird survey data presently coordinated by USGS-BRD at the University of Arizona.

Objective 1-6: <u>Shorebirds</u> – Within 10 years of CCP approval, provide at least 100 acres of foraging sites in multiple impoundments for both northbound and southbound shorebirds during migration and conduct population and habitat surveys to evaluate shorebird use and invertebrate densities within managed and unmanaged habitat.

Discussion: Sizeable populations of shorebirds migrate through the Tennessee River Valley. Habitat for migrant shorebirds is particularly restricted and almost all habitat is used, suggesting there are more birds moving through than habitat is available. Given the development of the U.S. Shorebird Conservation Plan and the identified need to provide migration stopover habitat in the region, it is essential that the refuge consider developing some designated units for migration stopover and to actively manage them to maximize use. The fact that the TVA has changed the fall drawdown schedule from June 15 to July 5 in the past has greatly reduced habitat availability on the river. The public pressures the TVA to maintain summer pool levels to satisfy recreational interests through the Labor Day weekend, which restricts available shorebird habitat in Kentucky Lake.

Where opportunities exist, managing shorebird habitat should be focused during both northbound and southbound migration periods. However, it is clear that a combination of Kentucky Lake and Tennessee NWR impoundments (Duck River Unit) are critically important, particularly for southbound migrants within the Interior Low Plateaus. With emphasis on southbound migrants (when habitat is generally unavailable in most areas), the already established regime of initiating gradual drawdowns starting no later than early July and continuing through to early October is very important.

To support southbound migration of shorebirds, specific measures need to be employed. Specifically, there are generally two peaks, one for adults in July and early August and one for juveniles from August - October. An approach would be to hold water in some impoundments into July and then gradually draw down. Flooding other impoundments will be necessary for drawing down water in August and September. September habitat would overlap needs of southbound migrating blue-winged teal and northern pintail.

Strategies:

- Provide for both northbound and especially southbound shorebird foraging sites, by 2010.
- Continue to draw down water in late summer and early fall at Duck River Unit and continue to provide northbound habitat from late March to late May as well in concert with waterfowl or other management, by 2010.
- Manage one impoundment exclusively for shorebirds. This impoundment should rotate locations among years if possible.
- Management emphasis should be placed on fall shorebird habitat.
- Drawdown during July-August for adults and August-October for juvenile shorebirds.
- Create smaller, more manageable impoundments using low-level terraces.
- Sub-divide some existing impoundments in the Duck River Bottoms to create impoundments no larger than 30-50 acres.
- Supply a dependable source of water for shorebird impoundments through the use of wells or pumps.
- Conduct population and habitat surveys to evaluate the shorebird use and invertebrate densities within managed and unmanaged habitat.

- Work with TVA to monitor fall shorebird use on Kentucky Lake mudflats, also monitor invertebrate densities. Use these data to determine the need for additional fall shorebird habitat on the refuge.

- Initiate Shorebird Survey protocol and conduct more regular surveys using International Shorebird Survey protocol in coordination with the South Atlantic Migratory Bird Initiative, Manteo, NC, Migratory Bird Office, by 2010.

Objective 1-7: Long-legged wading birds – Continue to provide for both secure nesting sites and ample foraging habitat.

Discussion: Species of conservation interest that may use Tennessee NWR during the post-breeding period include the little blue heron, black-crowned night heron, yellow-crowned night heron, wood stork, and white ibis. Nesting long-legged wading birds have sufficient habitat available on the refuge, but limiting the disturbance these nesting birds are subject to is the key to protecting these species. When refuge staff finds nesting areas at sites with low public use, it may be worthwhile to occasionally monitor the site for potential disturbance problems and make entry adjustments accordingly. In other situations where colonies form and there has been a long history of public use nearby, such measures may not be necessary. The main issue is change in public use around established colony sites.

In managing for long-legged wading birds it is important to provide post-breeding foraging habitat in late summer and early fall. This management will benefit several species of wading birds, which may include dispersing wood storks from federally listed populations east of Mississippi as well as birds breeding in Mexico. Management actions that produce habitat conditions similar to that provided for shorebirds and waterfowl by drawing down water in impoundments will provide post-breeding foraging habitat for wading birds.

Strategies:

- Locate nesting sites for colonial waterbird species each year and determine if special measures are needed to reduce disturbance.

- Determine the use of managed wetlands and lakebeds during post-breeding periods by long-legged wading birds, concurrently with southbound shorebird surveys.

- Continue to monitor wood stork, little blue heron, black-crowned night heron, yellow-crowned night heron, and white ibis during post-breeding dispersal.

- Continue with daily observations of these species, their numbers, use of impoundments, and the condition and management of these impoundments.

- Provide information for guiding future management decisions compatible with what is needed for brooding wood duck and later use by migrating and wintering waterfowl.

Objective 1-8: Grassland birds – Consider providing 50-100 acres in 1-3 tracts for Henslow's sparrow and other grassland species in the Big Sandy Unit.

Discussion: Grassland bird populations are in decline throughout the region and some of the top priority species nest in the immediate area. Thus, the refuge has the opportunity to contribute to grassland bird conservation by developing an initial experimental management effort. The Biological Review team recommended that refuge staff identify at least one area where up to 100 acres of native warm season grasslands could be established in a series of adjacent fields. The most logical place to do this is in uplands that are not being extensively used for waterfowl management, such as the Big Sandy Peninsula.

Strategies:

- Locate a field or a series of adjacent fields that total between 50-100 acres and manage for warm-season grasses, implementing a disturbance cycle that would allow some rough to accumulate, which is the preferred habitat of nesting Henslow's sparrow.

- Consider converting some of the agriculture fields on the Big Sandy Peninsula that are not productive for waterfowl management to warm-season grasses.

- If fields are converted, monitoring should occur to determine grassland bird usage.

- Implement a prescribed fire program to manage the warm-season grass stands. Explore opportunities to develop cooperative burning teams with the U.S. Forest Service at Land Between the Lakes and the Department of Defense's Fort Campbell staff.

- Explore cost-share opportunities with partners such as Quail Unlimited and the National Wild Turkey Federation to minimize impact on refuge budgets.

Objective 1-9: <u>Forest interior migratory birds</u> – Increase quality of forest habitat to provide for sustainable increase in populations of priority forest interior migratory birds.

Discussion: Results from the forest management experiment on the Big Sandy Unit with the University of Tennessee suggest that forest birds overall will benefit from the forest management activities that were put in place. Some concern has been expressed, however, about brown-headed cowbird parasitism rates on the experimental units.

During the Biological Review, there was much discussion over the status of continuing cooperative cropland management on the Big Sandy Peninsula of the Big Sandy Unit. The difficulty the cooperative farmer was having with deer depredation of crops, the apparent lack of enthusiasm the cooperative farmer has had in recent years to plant the fields early enough, and the relatively low importance of having cropland habitat available for waterfowl on the Big Sandy Peninsula all suggest that it would be best to minimize cropland management here given the importance of promoting healthy forest bird populations on the refuge.

The biological review team recommended maintaining some cropland adjacent to the moist soil units, not to exceed 50 acres, which could be done through force-account or contract farming. If this is acceptable, then the remaining cropland could be converted to more wildlife friendly conditions. One suggestion is to have at least one field between 50-100 acres dedicated to warm-season grassland habitat (mentioned above). Other options, not mutually exclusive, would be to reforest many of these fields, either through old-field succession (i.e., let seed dispersal from adjacent forest lands determine tree species composition) or investigate the potential for carbon sequestration contracts to replant trees.

Strategies:

- Continue evaluation of forest habitat management for increasing habitat for priority species.
- Provide for less suitable brown-headed cowbird habitat directly adjacent to the forested areas on the Big Sandy Peninsula.
- Working with the University of Tennessee, continue long-term monitoring and evaluation of the Big Sandy Unit experimental forest treatment plot.
- Determine feasibility, given other objectives, of discontinuing cooperative farming operations on certain Big Sandy Peninsula fields, and consider alternative habitats (grassland, reforested through either natural regeneration or planting).
- Reactivate the forest management program that has become idle since the loss of the forester position.
- Implement a prescribed fire program to serve as a tool in the management of upland forests and the potential creation and perpetuation of savanna on dry forested ridges and southern-facing slopes.

Objective 1-10: <u>Bald eagles</u> – Continue to monitor and protect nesting sites and count wintering bald eagles on the refuge.

Discussion: Bald eagles occur along the Tennessee River and in some of the larger impoundments on the refuge because of the abundant prey near water bodies. Many bald eagles roost or nest atop large trees throughout the refuge; there are presently over 10 active nests. While this bird, the national symbol, is no longer listed as a federally listed threatened species under the Endangered Species Act, it is still protected by the Bald Eagle Protection Act of 1940.

Strategies:

- Continue long-term monitoring of bald eagles numbers, distribution, and trends.
- Provide for secure nesting and roosting sites for bald eagles.
- Implement revised Southeast Regional Bald Eagle Management Guidelines around known any nest or roost sites when discovered.

Objective 1-11: <u>Resident game species</u> – Continue to manage populations of resident game species such as deer, turkey, squirrel, raccoon, and resident Canada goose.

Discussion: Resident game species occurring at Tennessee NWR include white-tailed deer, wild turkey, gray and fox squirrels, raccoon, and resident Canada geese. Deer utilize virtually all habitats on the refuge, and likely do best on sites that contain adequate ground and understory food and cover, in combination with mast-producing hardwoods. They also heavily feed in the agricultural fields from mid-summer throughout the winter months. The refuge could support considerably higher deer hunter numbers.

The only resident game bird currently hunted is the wild turkey. Good turkey habitat and a healthy, huntable population of turkeys exist throughout the forested portion of the refuge. These game birds also benefit from the several thousand acres of grain crops planted each year throughout the area.

Resident Canada goose populations have increased to the point where habitat damage is occurring in agriculture fields and moist soil units. In an effort to control this damage, the refuge recently opened sport hunting of resident geese during the September Canada goose season.

Gray and fox squirrels are both abundant at Tennessee NWR, particularly where suitable mast-producing hardwoods occur. Squirrels, especially fox squirrels, also feed on grain crops on the refuge. Due to their high potential reproductive rate, directly related to the availability of hard mast, and high natural mortality rates, it is unlikely that any long-term changes in squirrel population densities have occurred within the available habitat.

Although raccoons are quite adaptable, their general habitat preference is hardwoods with an abundance of den trees. Since raccoons are omnivorous and opportunistic feeders, raccoon habitat is abundant on the refuge, as is their population. Although raccoon populations are somewhat cyclic, high raccoon densities result in excessive predation on migratory and resident bird eggs. To help prevent extreme peak raccoon populations, raccoon hunting opportunities that are compatible with other refuge activities and resources can be an effective management tool.

Strategies:

- Allow big/small game hunting with time-and-area restraints where necessary for refuge wildlife purposes and to maintain safe hunt conditions.
- Facilitate ways to increase the harvest of white-tailed deer to keep the population below the carrying capacity, as measured by abomasum parasite counts (APCs) and biological data collected at check stations.
- Strive to maximize hunter participation by increasing the number of quota gun hunt permits to approximately one permit/40 acres of huntable habitat.
- Monitor deer herd health by continuing herd health checks every 5-7 years.
- Contingent on available staff and funding and with the assistance of volunteers and/or students, operate manned refuge check stations during the quota hunts to collect data on at least 50% of the harvested deer.
- Continue with current small game hunts with limitations on nocturnal hunting (raccoons, etc.).
- Limit fall/winter small game hunt periods, so no activity occurs from November 15 to March 15 in key waterfowl areas.
- Consider and execute if necessary, a quota on any night-hunt activities.
- Do not increase night hunting of raccoons during key waterfowl use periods.

Objective 1-12: Resident nongame species – Within 10 years of CCP approval, develop and implement more baseline inventories for nongame mammals, reptiles, amphibians and invertebrates. Also, develop partnerships with other agencies, nongovernmental organizations (NGOs) and the public in efforts to inventory nongame species and participate in the implementation of appropriate management activities.

Discussion: The current status of reptile and amphibian populations on the refuge is unknown, since baseline information is lacking on species composition, distribution, and abundance. This information would be useful for biological reference and public education. Amphibians especially are considered good biological indicators of environmental disturbance because of their relatively low mobility, biphasic development (aquatic then terrestrial), and semipermeable skin. They also are important components of both aquatic and terrestrial food webs. Thus, monitoring trends in their populations can provide important insights into environmental health and degradation. The refuge contains extensive aquatic habitats for amphibians in low-lying areas and appears to contain a significant amount of these habitats at upland sites. A variety of reptiles are also found across the entire refuge.

Strategies:

- Develop a greater understanding of the impacts of refuge management on reptiles and amphibians and remain aware of their needs when planning and conducting migratory bird habitat management activities.
- Determine species composition, distribution and abundance of reptile and amphibian species occurring on the refuge by conducting refuge-wide baseline inventories.
- Accomplish baseline inventories by funding graduate research at the master's level.
- Develop an annual amphibian monitoring protocol for the refuge.
- Develop a distributional map for each species that occurs on the refuge.
- Implement the annual amphibian monitoring.
- Identify the impacts of refuge habitat management activities on populations of reptiles and amphibians through controlled studies and/or long-term monitoring of changes in species presence, abundance, and distribution.
- Identify species that benefit from current management practices, such as water and vegetation management in moist soil units and retention of logging debris.
- Address these benefits and species in planning documents.
- Consider incorporating specific management practices such as, retention of upland road ruts following logging activities and placement of breeding structure in upland ponds into management plans.

Objective 1-13: Fishes and other aquatic species – Within 15 years of CCP approval, determine species composition, distribution and relative abundance of fishes and invertebrates occurring on the refuge. Also, develop partnerships with other agencies, NGOs and the public in efforts to inventory aquatic species.

Discussion: As noted in Chapter II, due to Tennessee's geographic and hydrographic diversity, it may have the greatest freshwater fauna diversity of any state. Similarly, Tennessee National Wildlife Refuge's 144 species of freshwater fish are by far the greatest of any national wildlife refuge in the entire United States. In addition to the Tennessee River (Kentucky Lake), small streams on the refuge may contain unique fauna, including fishes and invertebrates. It is recommended that a plan for aquatic surveys be designed as the refuge information database is further developed. Involvement of big river fish species would also be appropriate in your description of aquatic resources.

Strategies:

- Develop a greater knowledge of the fishes and invertebrates occurring in the streams and rivers on the refuge.
- Determine species composition, distribution and relative abundance of fishes and invertebrates occurring on the refuge.
- Design and implement aquatic surveys in the many small streams that occur on the refuge.
- Elaborate on the occurrence of big river fish species in the description of aquatic resources within planning documents.

Objective 1-14: <u>Threatened and endangered species</u> – Determine the distribution and abundance of Indiana and gray bats and listed mussels on the refuge and protect and enhance, if possible, the habitat needed by these species.

Discussion: Tennessee NWR embraces a diversity of habitats that supports populations of federal and state-listed species. Protection of these species and their habitats is of the highest priority of the refuge. During the Biological Review, two groups were identified for more monitoring and possibly management attention: bats and mussels. Two species of endangered bats – the Indiana bat and the gray bat – may potentially occur on the refuge. While several species of listed birds and fish may also use the refuge (see Chapter II), there is less scope for management action on their behalf.

The Service has tended to rely on TWRA, USGS, and TVA personnel to maintain mussel distribution records for the area. Service personnel should maintain comprehensive species distribution records for the entire refuge area and be familiar with T/E mussel records near the refuge. The refuge's efforts to minimize sand and gravel dredging are helpful in protecting mussel populations. Additional efforts to establish mussel sanctuaries and to participate in monitoring efforts regarding the commercial mussel harvest may be appropriate. Documentation of species harvested and their size/age structure would be helpful in determining possible needs for limiting the harvest.

Strategies:

- Determine the distribution and abundance of Indiana and gray bats on the refuge and protect and enhance, if possible, the habitat needed by these species.
- Through coordination with the Service's Ecological Services Field Office in Cookeville, develop protective measures related to forest management actions for Indiana bats.
- Determine the population status and habitat use of the Indiana bat on the refuge so management and conservation recommendations can be adequately conceived.

- Conduct a research project to determine bat population status and habitat use, especially in areas where active forest management has occurred or is planned.

- In cooperation with the Ecological Services Cookeville Field Office, develop partnerships with local cave owners when possible to maximize conservation of gray and Indiana bats.

- Maintain comprehensive species distribution records for T/E mussels on and near the refuge and protect these mussels from commercial activities.

- Through coordination with the Service's Ecological Services Cookeville Field Office, TWRA, USGS, and TVA, maintain mussel distribution records for the refuge.

- Continue to protect threatened and endangered mussels from commercial dredging and harvest.

- Continue to prohibit commercial sand and gravel dredging in the Tennessee River on the refuge.

- Consider establishing additional mussel sanctuaries where appropriate.

- Participate in monitoring efforts regarding the commercial mussel harvest.

Objective 1-15: <u>Nuisance animal species control</u> – When necessary, expand nuisance animal species control using approved techniques to help achieve refuge conservation goals and objectives.

Discussion: Trapping should be a tool retained by the refuge and USDA Wildlife Services in order to address such issues as disease problems, beaver-pond management, overabundant problem species (i.e., resident Canada geese), banding quotas, animal relocations, special studies/research and other similar biological needs.

Strategies:

- Control certain wildlife species via approved permitted trapping techniques to help achieve biological and scarce species objectives.

- Maintain trapping as a management technique for meeting an array of refuge conservation goals and objectives.

- Control problem beaver sites via a combination of trapping and direct take.

- Maintain trapping as a tool to help control resident Canada geese.

- Control destructive wildlife individuals that have become imprinted on nest boxes, banding sites, etc.

HABITAT MANAGEMENT

Goal 2: Maintain, restore, and enhance diverse and resilient habitats and essential processes necessary to support sustainable populations of migratory and resident wildlife species indigenous to the Lower Tennessee-Cumberland Ecosystem.

Discussion: A variety of habitats are found at Tennessee National Wildlife Refuge. The Service manages these habitats either actively or passively to provide benefits to a tremendous diversity of wildlife species. Actively managed habitats include both moist soil and cropland, both of which require intensive and regular manipulation to maintain their productivity and function. Forested habitats, in contrast, can be allowed to develop on their own for decades between given management interventions or treatments.

Objective 2-1: <u>Moist soil</u> – Improve the moist soil management program on about 1,600 acres by expanding the invasive exotic plant control program, water management capabilities, and the use of management techniques that set back plant succession.

Discussion: Moist soil habitats furnish food and cover for a diverse array of waterfowl and other migratory birds, including rails, wading birds, shorebirds, and even some landbirds. The refuge's moist soil program essentially began in the mid-1980's, with construction of most of the impoundments. The refuge currently has the capability to manage for approximately 1,600 acres of quality moist soil habitats (1,500 acres on the Duck River Unit and 50 acres each on the Big Sandy and Busseltown units). An average of 1,350 acres, with varying levels of quality, is produced each year. The biggest problems in managing moist soil habitats are (1) invasive exotic plants, (2) limited personnel time to properly manage the units, (3) impacts of growing season floods, and (4) deteriorating infrastructure (levees, spillways, and water control structures).

Strategies:

- Increase efforts toward controlling invasive exotic plants, including alligatorweed, parrot feather, purple loosestrife, Paspalum spp., and Sesbania spp. that impact the productivity of moist soil habitats.

- Continue herbicide control efforts and annually treat as much of the areas affected by invasive exotic plants as feasible.

- In addition to glyphosate products, utilize other appropriate herbicides to reduce the possibility of glyphosate resistance developing in the target species.

- Document in writing all past and future activities undertaken to control pest plants and the results of those efforts. Maintain both hard and digital copies of all documents. This will assist future management efforts in judging the best control methods.

- Initiate a study that would evaluate different herbicides, mechanical manipulations, and biological control on alligatorweed.

- Maintain at least 50 percent of the plant composition in each moist soil unit in plant species considered to be of good to fair food value for waterfowl.

- Conduct moist soil plant composition surveys to assist in judging when moist soil units should be disked or disturbed by other methods.

- Incorporate the use of models to predict seed and aquatic invertebrate production in conjunction with the composition surveys.

- Soil disturbance activities designed to keep moist soil units in early successional stages should have a rotational management scheme so a mix of habitats is available (a mosaic of moist soil habitats for late summer/fall, winter periods, etc.).

- Shallow-disk most moist soil units every 3-5 years to increase the percentage of plants considered to be of good food value for waterfowl.

- Where feasible, utilize cooperative farming on a rotational basis with moist soil habitat to aid in maintaining early successional stages.

- Consider using prescribed fire as one of the management technique utilized to maintain the moist soil units in early successional stages.

- In areas where mechanical disturbance is impractical due to soil moisture, etc., the use of herbicides will be considered to remove undesirable vegetation. During drought conditions priority will be given to disking these areas as allowed.

- Stagger drawdowns within and among impoundments throughout the late spring and summer to create a more diverse plant composition.

- Improve water management capabilities within moist soil units by 1) subdividing the existing impoundments to create smaller impoundments; 2) improving water supply via wells, pumps and additional water control structures; and 3) renovating existing levees and water control structures.

- Monitor plant responses within first 30 days of drawdowns or water manipulations and if possible respond/change water management as needed.

- Document environmental conditions and activities for each moist soil management unit.

- Because water level manipulation can be an effective tool for managing moist soil units, install gauges and monitoring water levels in each unit.

- Record all manipulation activities by date for each unit.

- Make written records of all moist soil management activities in an effort to better understand and predict the results of each activity.

- Assess the value of moist soil habitats as compared to floodable agriculture.

- Conduct research to collect comparative data on waterfowl activities in moist soil and agricultural habitats.

Objective 2-2: <u>Forest management</u> – In cooperation with partners, reactivate forest management program on the refuge to the benefit of priority forest interior migratory birds, waterfowl, and resident game species.

Discussion: The refuge contains both upland and bottomland forests. Most of the forests in the area, including those on the refuge, had long been cut, modified, or cleared for farming by Euro-American settlers. Some of the cleared land was marginal but farmed for years and then grazed. Much of this agricultural land was eventually abandoned, producing various stages of poorly stocked timber stands throughout the refuge.

No large-scale forest habitat management activities have been undertaken since the harvest in Compartment 4 of the Big Sandy Unit in 2001. Several attempts were made at using prescribed burns on the refuge, but it proved logistically difficult to coordinate weather conditions with the fire teams' availability. Harvest of Compartment 4 was conducted in a manner that would be conducive to conduct research that would determine the impacts of the forest management activities. Until this research project was complete all harvest activities were suspended until the results of the research project were available. The research was completed and the results demonstrated that the management activity had positive effects on several landbird species (Thatcher 2007).

Bottomland hardwood stands on the refuge are primarily limited to small isolated blocks within the Duck River and Busseltown Dewatering Areas and low-lying areas along the shore of Kentucky Lake, especially along the Duck River and Cub Creek. Many of these stands have resulted from natural succession of abandoned agricultural and moist soil areas.

Strategies:

General:

- Add one forester and one forestry technician to refuge staff to provide more forest management expertise and emphasis.

- Continue evaluation of forest habitat management for increasing habitat for priority bird species.

- Assess existing forest stands on the refuge using standardized vegetation sampling techniques. Use sampling protocol to categorize stands by age, physical structure, and current and potential habitat for breeding birds. This and other information should be used to establish forest compartments for management.

- Develop standardized protocol for forest assessment. Determine needed measurements, i.e. basal area, species and number of woody species (in canopy and understory), canopy cover, mid-story cover, understory cover, ground cover, stem density, among other parameters. Determine sampling protocol, i.e. the number of points per stand/ compartment and conduct surveys.

- Establish a ranking or category system for forest stands (compartments) in terms of current and potential habitat for breeding birds. Determine which stands would provide the most benefit for upland forest breeding birds if management (timber harvest) was conducted. Assess forest stands in terms of economically harvested logging to attain desired forest conditions.

Upland Forests

- Develop document of desired forest conditions for upland forests in the Central Hardwoods Bird Conservation Region (BCR).

- Discuss conditions needed for forest birds in upland forests with regional experts, assess results of studies of silviculture techniques on bird abundance and nesting success, and develop a list of management techniques needed to ultimately create "desired forest conditions."

- Obtain and modify the Bottomland Hardwood Resources Working Group's "Desired Forest Conditions" document for upland forest birds.

- Develop a plan for improving forest quality in closed and "stagnant" stands, including potential for a research project on invasive plants, such as Microstegium, to determine impact to forest regeneration, tree stress, and understory development.

- Locate forest stands that have a high density of small diameter (generally under ten centimeters or four inches) trees at approximately the same height and little or no understory growth. These stands are likely experiencing high levels of competition among trees, resulting in reduced tree growth, poor forest structure, and lower quality wildlife habitat.

- Reduce stem density to approximately 50 percent across 80 percent of those stands with some small areas, i.e., 0.4-1.2 hectares (1-3 acres) to release competition, which will promote rapid vertical growth, understory development, and a heterogeneous forest.

- Incorporate fire into the upland forest management program to manage approximately 7,000 of acres of upland forests for landbirds and other wildlife. The potential exists manage some of the upland forests as savanna.

- Develop a funding source to secure the capacity to thin forest stands if suggested practices are not economically viable.

- Develop a document proposing partnerships and a landscape plan for managing for large forest blocks on the refuge. Include contact information for public and private landowners that maintain large tracts of forest in the region.

- Produce a map showing forest cover and identifying type of ownership on lands adjacent to the refuge.

- Assure consistency between this partnership area and CHJV focal areas and LTCE priorities.

- Conduct analysis of forest cover on public and private lands adjacent to the refuge.

- Compile list of owners and managers of large tracts of forested land, i.e., USFWS, TVA, FS, TWRA, and others, and their contact information.

- Identify which forest blocks could be combined to form one larger block for forest interior breeding birds (PIF plan). In addition, identify forest blocks that could be connected either through purchase, partners, and/or management via reforestation and made into corridors for wildlife.

- In coordination with the CHJV, organize a meeting of local partners and develop a larger plan for developing and managing forest for interior forest birds and establishing new corridors.

Bottomland Hardwood Forests

- In the next forest management plan revision, provide a detailed plan and timeframe for assessing bottomland hardwood forests.

- Assess existing forest using standardized vegetation sampling techniques across compartments. Use sampling protocol to categorize stands by age, physical structure, and current and potential habitat for breeding birds.

- Make a designation and design and purchase a sign about bottomland hardwood management for display.

- Provide a management plan with maps of areas where fields are infrequently visited by waterfowl and geese (least used sites) and/or where deer browse is excessive.

- Produce a map which identifies sites where 1) deer browse is excessive, 2) sites of low waterfowl and goose usage, 3) managing for bottomland hardwood forests would benefit early successional songbirds in the short term and ultimately mature forest species, and 4) reduce forest fragmentation while not impacting high visitation waterfowl impoundments.

- Increase acreage of hard mast producing bottomland hardwood forest tree species.

- Identify the highest priority sites and either reforest those sites with tree plantings (on sites greater than 200 yards from a natural seed source) or allow natural succession to occur (on sites less than 200 yards from a natural seed source).

- Obtain acorns or seedlings for use in planting from local sources of bottomland oaks, including water oak (*Quercus nigra*), pin oak (*Q. palustris*), and overcup oak (*Q. lyrata*), as well as swamp chestnut oak (*Q. Michauxii*), shumard oak (*Q. shumardii*), and cherry bark oak (*Q. falcata* var. *pagodaefolia*).

Objective 2-3: <u>Agriculture</u> – Over the life of the CCP, redirect management actions to increase acreage of unharvested cropland to meet foraging needs of waterfowl and habitat for other native species.

Discussion: Farming is an important part of the refuge management, providing grain and browse to meet waterfowl objectives. Currently around 3,000-3,300 acres of farmland are planted on an annual basis. Most of the farmlands are managed under a cooperative farming program, but some force-account, in which refuge staff farm, occurs each year. Cooperative farming and force-account farming methods utilized on the refuge include the planting of row crops (corn, milo, soybeans, and wheat) with both non genetically modified crop seed and genetically modified crops (GMCs) to provide food for migratory waterfowl. Five cooperative farmers plant row crops on the refuge. The refuge share of the crops planted by the cooperators has varied from 10-25 percent, depending upon the farming economy and the potential productivity of specific farmlands.

To meet the recommended duck and goose objectives advanced under Goal 1, the refuge farming program would need to produce approximately 374 acres of unharvested corn or an equivalent grain (i.e. milo or millet) that averages 100 bushels/acre. Accounting for other wildlife use of the grain (estimated at 15 percent) and potential shortfalls in yield, the refuge plans to provide around 450 acres of unharvested corn each year. As much of this corn as possible will be produced through cooperative farming. If funds are available, force-account or contract farming will be used when additional acreage is needed to meet the objective and/or to plant corn in areas where cooperative farming is not profitable.

Approximately 300 acres of winter wheat was recommended by the Biological Review Team to meet half of the goose objective. As much of the wheat will be planted by cooperative farmers as possible, but it is likely that the refuge will have to force-account plant some wheat to fully meet this objective. The cooperative farmers will be allowed to double crop with winter wheat and the browse produced by this crop will be counted toward the objective if the fields are located in traditional goose use areas. In recent years double cropping with winter wheat has not been economical and very little has occurred on the refuge.

Strategies:

- Utilize the farming program to help meet the waterfowl foraging objectives identified in Objectives 1-1 and 1-3 in the Fish and Wildlife Population Management Goal earlier in this chapter.

- Continue farming about 3,000 acres under Cooperative Farming Agreements or pending additional staff and funding supplement or substitute this acreage as needed by force-account or contract farming to meet objectives.

- Produce around 450 acres of unharvested corn to help meet the duck and goose foraging objectives.

- Provide 300 acres of winter wheat browse to meet half of the goose objective.

- Increase the probability of crops being planted and harvested in a timely manner by continuing to have 1 or 2 local cooperative farmers on each unit of the refuge.

- Work towards annually flooding approximately 75% of the unharvested corn or other row crop within the Duck River Bottoms and Busseltown Unit and 25% on the Big Sandy Unit.

- Construct additional low level levees within existing agricultural fields on all units.

- As feasible, make unharvested grain that cannot be flooded to an optimum depth available to waterfowl throughout the wintering period. Through mechanical means (logging down or mowing) put the refuge share of standing crops on the ground in acceptable areas that cannot normally be flooded.

- Put down (manipulate) the crops in a timely manner so that foods are available throughout the winter. Generally, half of the crop should be made available in early winter and the remainder during late winter.

Objective 2-4: <u>Managed internal impoundments</u> – Increase water management capabilities by subdividing existing impoundments, creating new impoundments, and increasing water supply (i.e. pumps, wells, structures, etc.) for migratory birds. Also make a concerted effort to accommodate sportfishing opportunities where and when circumstances allow.

Discussion: There are 26 managed impoundments on the refuge, most of which are located in the Duck River Bottoms. Most were built during the 1980's and many levees and water control structures need repair or replacement. The *Annual Habitat Management Plan* provides water management details, which are updated yearly. The main purpose for managing impoundment water levels is to enhance food production and to make it available to waterfowl during migration and wintering periods. Other migratory waterbirds, such as shorebirds, herons, and rails also greatly benefit from this management practice.

Agriculture and moist soil are the primary habitats for which these impoundments are managed. When an impoundment or portion of an impoundment is to be planted in row crops such as corn and soybeans the drawdown is planned to initiate in early March to allow sufficient drying time. Moist soil drawdowns occur later during the growing season and vary from mid-April to mid-July. The drawdown timing and levels for each impoundment varies from year-to-year, as much as possible, to reduce the impacts of undesirable and invasive plants. Water management plans have to be altered during most years due to flooding from Kentucky Lake.

Strategies:

- Continue to update the Annual Habitat Management Plan yearly and follow its prescriptions and procedures.
- Identify and repair/replace numerous key water control gates.
- Strive to enhance habitat management capabilities by subdividing those impoundments that best lend themselves to such compartmentalization.
- Improve pumping capabilities and pump period flexibility to remove and/or provide water.
- Increase water management capability by increasing pumping capacity and installing shallow wells.
- Continue or expand aerial spraying for control of aquatic exotics.
- Every year monitor the impacts of the water management strategies of the impoundments on sportfishing opportunities.

Objective 2-5: <u>Kentucky Lake wetland habitats</u> – Working with partners, continue to provide mudflats during August-September for shorebird and early migratory waterfowl, scrub-shrub habitat, and desirable aquatic plants. Provide additional education and interpretation of importance of early drawdowns of Kentucky Lake.

Discussion: The TVA has reserved all rights on flood control, navigation, and power production for Kentucky Lake. Water management within refuge-controlled impoundments is impacted by the water levels of the reservoir. Annual water level fluctuation on Kentucky Lake is precisely the opposite of what is needed for water management within the refuge impoundments. Normal summer pool is 359 feet above mean sea level (MSL) with a drawdown to 354 feet MSL during the winter months. The

reservoir drawdown begins July 5 gradually dropping to winter pool on December 1. The lake begins to rise again on April 1 reaching summer pool on May 1. Even though the water management schedule for Kentucky Lake presents difficulties in managing the water within the impoundments, the benefits of the habitats produced on the reservoir greatly outweigh the negative impacts.

Strategies:

- Maintain a cooperative working relationship and good communication with the USACE and TVA while proactively representing the refuge's interest in water level management.

- Ensure that the importance of early drawdowns of Kentucky Lake is emphasized in all written and oral communications with the public, media and other agencies.

Objective 2-6: <u>Invasive plants</u> – Provide additional education and interpretation of invasive species. Expand control efforts of invasive species through active methods of removal. These methods will work towards reducing infestations, and eliminating populations whenever feasible.

Discussion: Invasive exotic plants known to occur in the wetland habitats on the refuge include alligatorweed, parrotfeather, purple loosestrife, *Paspalum* spp., and *Sesbania* spp. Currently, only a few species are causing major problems, but other species may potentially do so. It can be very hard to control invasive species, once established. In many cases, control will only be temporary due to the extremely invasive and resilient nature of these pests. Even if species are controlled on the refuge proper, they can easily be reintroduced from adjacent river system during flood events.

Various species of pest plants also plague forested areas at Tennessee NWR. Chinese privet, Japanese grass, Japanese honeysuckle, kudzu, mimosa, tree of heaven, and multi floral rose are the main species of concern. At present, these pest species are not greatly affecting refuge management objectives.

Current control efforts are and will continue to be focused on aquatic species, such as alligatorweed, parrotfeather, and purple loosestrife. The Biological Review recommended that the refuge expand efforts towards controlling of invasive aquatic species. The specific tasks outlined to address these recommendations are identified above under Strategy 3.1 of the "Waterfowl" section. Additional funding will be needed to expand control efforts. The refuge has developed RONS projects in hopes to secure funding to control both wetland and upland invasive exotic plants. The refuge is continuing to look for potential partners to help with this activity. A research project related to the control of alligatorweed on the refuge was recommended by several Team members. Products of the research would be (1) baseline data on the negative influence of alligatorweed on native flora and fauna, and (2) development of a suite of management options for control of alligatorweed.

Strategies:

- Monitor the presence and abundance of exotic species.

- Conduct a refuge-wide inventory to identify problem species and areas of concentration.

- Develop documentation and mapping system using GIS and GPS technologies.

- Identify priority species, habitats, and locations to focus control efforts.

- Control exotic species using the most environmentally sound and cost effective techniques available.

- Conduct literature and field research to determine the impacts of exotic species upon native species and to identify the most effective control methods.

- Implement the best control methods.

- Document and monitor control efforts and be adaptive based upon the results.

- Continue annual spraying or biological control of invasive plants including alligatorweed, privet, sesbania, purple loosestrife, encroaching woody vegetation, spatterdock, and parrotfeather.

- Conduct mechanical control (mowing and disking) as needed of certain upland plants.

Objective 2-7: <u>Accelerated climate change</u> – Relate climate change to the Service's wildlife mission in environmental education programs. Monitor habitats and wildlife and utilize adaptive management to respond to possible climate change adverse impacts. Pursue opportunities for carbon sequestration with native trees.

Discussion: The increase of carbon dioxide and other greenhouse gases within the earth's atmosphere has been linked to the gradual rise in surface temperatures commonly referred to as global warming or climate change. In relation to comprehensive planning for national wildlife refuges, carbon sequestration constitutes the primary climate-related impact to be considered in planning. The U.S. Department of Energy's *Carbon Sequestration Research and Development* (U.S. Department of Energy 1999) defines carbon sequestration as "... the capture and secure storage of carbon that would otherwise be emitted to or remain in the atmosphere."

The U.S. Department of the Interior issued an order in January 2001 requiring federal agencies with land management responsibilities under its direction to consider the impacts of potential climate change as part of their long-range planning endeavors.

Strategies:

- As materials and exhibits on the refuge are updated and revised, ensure that climate change, its causes, impacts, and mitigations are covered in new text.

- In conducting long-term monitoring, censuses, and inventories of habitats and wildlife on the refuge, be cognizant of the possible role of climate change in driving responses and adaptations on the part of local flora and fauna.

- Pursue adaptive management when approaching possible adverse impacts on wildlife habitat and populations due to climate change.

- Pursue opportunities for carbon sequestration with native trees by mapping potential reforestation sites and maintaining communication with third parties (e.g., electrical utilities) interested in obtaining credits.

- Stay abreast of changes in regulatory regime vis-à-vis carbon emissions and possible opportunities or issues these may represent for the refuge.

Objective 2-8: <u>Fire Management</u> – Develop a fire management plan by 2010 and incorporate the use of prescribed fire as part of the forest management program, open lands management, and facilities maintenance.

Discussion: The Tennessee NWR's development of a prescribed fire program have been confounded by lack of qualified and experienced staffing, and difficulty in scheduling off-refuge details by qualified personnel from the Service and other nearby agencies to capture opportunities during satisfactory prescribed burning conditions. This has led the refuge staff to utilize other alternative methods, such as mowing, disking, other mechanical and chemicals where prescribed fire would be the ecologically significant choice.

Prescribed fire is needed to improve management on approximately 7,000 of acres of upland forests for landbirds and other wildlife. The forested upland on the Complex is dominated by oak-hickory stands that would tolerate the use of fire. Fire may be important in maintaining the long-term health and dominance of oaks in these stands. The potential exists to manage some of the upland forests as savanna. There are stands on rocky ridge tops and steep south slopes that were historically in a more savanna condition. Future forest management activities on these excessively dry sites may move towards developing savanna habitats to make these stands more productive for priority landbirds and other wildlife.

Over the last decade several levees that were repaired or improved have been planted in switchgrass. Switchgrass has been proven to be more effective stabilize earthen levees than fescue, providing a native alternative that is much more wildlife-friendly. Maintenance of these levees is currently done by mowing. Prescribed fire would better maintain this switchgrass and be more efficient than mowing.

Tennessee NWR's Biological Review called for the establishment of at least 100 acres of native warm-season grasses (NWSG) on the Big Sandy Peninsula. These habitats would be managed to provide habitat for Henslow's sparrows and other priority grassland birds. Fire is the best management tool for maintaining the long-term health of NWSG stands.

In several locations on the refuge the shoreline of Kentucky Lake is kept in an open state to enhance waterfowl use of adjacent upland agriculture fields. Currently mechanical clearing and herbicide applications are the tools used to maintain these open habitats. Prescribed fire would be a much more efficient and desirable management tool for the control of woody vegetation along shorelines.

Strategies:

- Enhance the structure and health of the upland forests by incorporating prescribed fire in the management of this habitat. In the appropriate sites manage some of the upland forests as savanna.

- Maintain the switchgrass cover on several levees using prescribed fire. Currently there are over 11 miles (50 acres) of levees on the refuge that have switchgrass as the dominant cover. If fire was available as a management tool more levees would be seeded in switchgrass, providing better habitat for wildlife and stabilization to the levees during floods. There is a potential for 200-300 acres that would be burned on a 2-3 year rotation.

- After establishment, maintain native warm-season grasses stands on the refuge using prescribed fire. There is a potential for approximately 150 acres of established grasslands that would be burned in a 2-3 year rotation, burning approximately 50-75 acres annually. There may eventually be other locations on the Complex where this type of habitat may be developed and managed.

- Maintain the shoreline habitat that is kept in an open state in desirable locations to enhance waterfowl use of adjacent upland agriculture fields. There is about 40 acres of shoreline habitat that could be managed in a grassy cover through the use of prescribed fire.

- Other potential uses would be burning dozer piles, removal of excess vegetation to enhance the planting agricultural fields (few hundred acres annually), and rehabbing moist soil habitats (few hundred acres annually).

RESOURCE PROTECTION

Goal 3: Identify and protect natural and cultural resources on the refuge.

Discussion: The area within and surrounding Tennessee NWR is rich in history and prehistory. The Service is required to abide by federal laws protecting historic, cultural, and archaeological resources, among them the American Antiquities Act of 1906, Archaeological Resources Protection Act of 1979, as amended, National Historic Preservation Act of 1966, as amended, and the Native American Graves Protection and Repatriation Act of 1990.

Objective 3-1: <u>Cultural and historic resources</u> – Continue to manage cultural resources consistent with Section 106 of the National Historic Preservation Act. Also, within 5 years of CCP approval, develop and begin to implement a Cultural Resources Management Plan (CRMP).

Discussion: The refuge possesses valuable historic resources, which the Service is committed to preserving. One of the earliest settlements on the present-day refuge began on the land between the Big Sandy and Tennessee rivers. A focal point in this community was the Mount Zion Church, which was established in 1853, and was the only church serving the area for a long time. When TVA purchased this area in the 1940s, it allowed the Mount Zion Church to remain standing. The church is now listed on the National Register of Historic Places (NRHP), and an annual reunion service is still held every Fourth of July. One of the most famous (or infamous) historic residents of Big Bottom on the Duck River Unit was the outlaw Jesse James. His house has since burned, but behind where it once stood are two markers indicating the burial places of the twin children Jesse and his wife had to bury while they lived here. On the Busseltown Unit, early settler Johnse Bussell, after whom Busseltown is named, built a house sometime around 1857, which once stood on refuge land but currently stands on the U.S. Forest Service's Land Between the Lakes National Recreation Area as one of the few remaining pioneer structures in the region.

Tennessee NWR follows standard procedures under Section 106 of the National Historic Preservation Act to protect the public's interest in preserving its cultural/historic legacy that may potentially occur on the refuge. Whenever construction work is undertaken that involves any excavation outside of existing disturbed areas like roadbeds with heavy earth-moving equipment such as tractors, graders and bulldozers, as in the development of new moist soil units or levees, or the construction of new facilities, structures, and infrastructure, the refuge contracts with a qualified archaeologist/cultural resources expert to conduct an archaeological survey of the subject property.

The results of this survey are submitted to the Service's Regional Historic Preservation Officer (RHPO) as well as the State Historic Preservation Office (SHPO), which in Tennessee is the Tennessee Historical Commission within the Department of Environment and Conservation. The SHPO reviews the surveys and determines whether cultural resources will be impacted, that is, whether any properties listed in or eligible for listing in the National Register of Historic Places (NRHP) will be affected. If cultural resources are actually encountered during construction activities, the refuge is to notify the SHPO immediately.

Strategies:

- Within 5 years of plan approval, complete Phase I archeological surveys of the nonflooded areas of the refuge, by qualified personnel, as a necessary first step in cultural resources management.

- Conduct a Phase II investigation if archeological resources are identified during the Phase I survey. In this, the eligibility of identified resources for listing on the National Register of Historic Places (NRHP) is evaluated prior to any disturbance.

- Conduct a Phase III data recovery if resources identified in Phases I and II are determined to be eligible. This will recover data and mitigate adverse effects of any undertaking.

- Within 5 years of plan approval, prepare a Cultural Resources Management Plan (CRMP) for the refuge.

- Follow procedures outlined in CRMP for consultation with RHPO, SHPO, and potentially interested American Indian tribes.

- Follow procedures detailed in CRMP for inadvertent discoveries of human remains.

- Ensure that archeological and cultural values are described, identified, and taken into consideration prior to implementing undertakings.

- Develop a step-down plan for surveying lands to identify archeological resources and for developing a preservation program.

Objective 3-2: <u>Land acquisition/minor boundary expansion</u> – Prioritize areas for possible minor boundary expansion to accommodate refuge visitors. Target minor boundary expansions to reduce adjacent threats to refuge and expand habitat management opportunities.

Discussion: There are several sites adjacent to the refuge for which a minor boundary expansion and land acquisition would help accommodate refuge visitors, reduce adjacent threats, and expand habitat management opportunities. Minor boundary expansions can be approved by the Service's Southeast Regional Office in Atlanta rather than the national office in Washington, D.C. (located at Arlington, Virginia). Any land acquired by the Service for the refuge would be from willing sellers only. Minor boundary expansions would be focused on areas that can me managed to provide additional habitat for migratory birds.

Strategies:

- Work with the Service's Division of Realty in the Southeast Regional Office and field office(s) to prepare a minor boundary expansion proposal.

- Maintain open communication and good relations with prospective sellers and surrounding communities in general, so that refuge staff becomes aware of potential opportunities in a timely fashion.

VISITOR SERVICES

Goal 4: Provide appropriate and compatible wildlife-dependent recreational opportunities, environmental education, and interpretation that foster an appreciation for wildlife and habitat conservation.

Discussion: The refuge hosts an estimated 370,000 visitors annually. The most popular uses include fishing, other water-related recreation, wildlife observation, hunting, and environmental education. The two most heavily visited areas on the refuge are Duck River Bottoms and the Big Sandy Unit. The Duck River Bottoms continues to be the most popular area for viewing and photographing wildlife. During the winter months approximately 100,000 ducks use the bottoms. In recent years a winter waterfowl tour has been popular, inviting visitors to briefly drive back into "closed" areas to view the waterfowl. In the summer several groups with large numbers of children participate in special wood duck banding opportunities. The Britton Ford/Sulphur Wells area, however small, also gets significant public use because of its proximity to Highway 79 and the outdoor recreation tourism that occurs near Paris Landing State Park. The Big Sandy Peninsula also receives heavy public use from hunters, birders and those observing wildlife.

Objective 4-1: <u>Visitor services</u> – Within five years of CCP approval, draft, approve and begin to implement a new Visitor Services Plan using the current format for such documents.

Discussion: There is an existing 1986 Public Use Review and Development Plan; a 1989 Hunt Plan (with a 2003 amendment for migratory birds); a 1997 Recreational Fishery Resource Plan; and a 1979 Sign Plan. These plans will be revised as the CCP is implemented and will result in a comprehensive step-down plan for visitor services. All visitor services activities programs and facilities will be wildlife-dependent and compatible with the purpose of the refuge. In addition, all activities and programs will relate to the six priority public uses.

Issues related to refuge management will be addressed in the plan and will be conveyed to the public through a variety of means. Current and future staffing needs to implement the recommendations within the plan will also be addressed. The Visitor Services Plan will include budgetary needs and current databases such as RONS and MMS and will explore opportunities for funding and partnerships to help the refuge accomplish the recommendations within the plan.

The plan will include a system for monitoring and evaluating the effectiveness of the visitor services program annually.

Strategies:

- The Visitor Services Plan should reflect current legislation, director's orders, initiatives, policy, and the mission of Tennessee NWR, the NWR System and the U.S. Fish and Wildlife Service.

- The plan should address the current and future visitor services and recreation needs of refuge visitors.

- The plan will include information and recommendations on the welcoming and orientation of visitors.

Objective 4-2: Hunting – Increase hunting opportunities for deer. Continue to allow managed, limited hunting for turkey, squirrel, raccoon, and resident Canada geese.

Discussion: The refuge has a 1989 Hunt Plan that was amended in 2003 for migratory birds. The refuge is open to nonquota hunting for white-tailed deer, turkey, squirrel, raccoon and beginning in 2004, resident Canada geese. The refuge staff coordinates the hunt program with state personnel and regulations.

A hunter participating in a scheduled hunt may also take beaver, coyote and armadillo with any legal weapon. There are two firearm quota hunts for deer. Firearms include guns, archery, and muzzleloader. Nearly 810 hunters are permitted for quota hunts. A special nonquota youth hunt and a primitive weapons hunt are also held on the refuge. Primitive weapons include longbow, recurve bow, and side-hammered muzzleloader.

All quota and nonquota adult hunters are required to purchase an annual hunting permit for $12.50. The permit allows hunters to participate in all quota and nonquota hunts at both Tennessee and Cross Creeks NWR. Youth hunters are exempt from all fees. Refuge regulation brochures are readily available to hunters at the office, sub-office, four kiosks located throughout the refuge, and community stores.

Approximately 25,000 acres of Tennessee NWR are open to hunting. Potential for user conflicts in terms of safety exist in the Britton Ford Hiking Trail and the Chickasaw National Recreation Trail area during periods when hunting and hiking occur at the same time.

There are currently no special provisions given to disabled hunters. However, state areas adjacent to the refuge do provide this type of opportunity.

Strategies:

- Consider one of the following options for dealing with safety concerns regarding increased public use of the Britton Ford Hiking Trail and Chickasaw National Recreation Trail areas while hunting is going on:

  Put a sign at the entrance to the area that informs the visitors "Hunt in Progress."
  Split open time between hunting-hiking (time/use zoning).
  Create a No Hunt Zone around the hiking trail.

- Develop an online hunt application program.

- As deer populations allow, increase hunting opportunities for deer by lengthening seasons or adding new quota hunts with expanded quotas.

Objective 4-3: <u>Fishing</u> – Provide opportunities for fishing on the refuge by furnishing adequate boat launching facilities, bank fishing areas, and over the life of the CCP, provide additional Americans with Disabilities Act (ADA)-compliant piers to accommodate anglers of all abilities.

Discussion: There are 144 species of fish found on the refuge due to the confluence of the Duck and Tennessee rivers. This is the highest fish species diversity of any inland refuge in the country, making fishing an extremely popular activity. Anglers seek many species including largemouth bass, crappie, catfish, sauger, bluegill, sunfish, smallmouth bass, and other hybrid bass.

Creel limits, boating safety, and license requirements are in accordance with state regulations, subject to special refuge regulations listed in the fishing regulations brochure. Brochures are available at the office, sub-office, refuge kiosks, and community stores. The refuge staff has limited contact with fishermen due to the expanse of the refuge, lack of adequate refuge law enforcement personnel, and no visitor contact area available on weekends.

A variety of sportfishing opportunities are available on the refuge year-round. Swamp Creek, Sulphur Wells Bay, Bennett's Creek, and all interior impoundment areas are open to fishing seasonally from March 16 through November 14 during daylight hours only. The remainder of the refuge portion of Kentucky Lake is open year-round. Bank fishing is permitted year-round along Refuge Lane, at the New Johnsonville Pump Station, at the Busseltown Pump Station, and at Henry County Port. Henry County Port is open to fishing both day and night due to a partnership agreement.

There are 32 boat ramps, both improved and unimproved, which provide access for anglers. In addition to bank fishing from many parts of the refuge, there are also two universally accessible fishing piers available for public use. Two marinas have concession contracts with the refuge. They provide access and services to refuge anglers and recreational boaters.

Strategies:

- Increase outreach to fishermen to increase awareness about Tennessee NWR.
- Develop an attractive color poster with basic information about fishing at the refuge to be displayed in local businesses.
- Prepare informational spots for the local cable TV channel.
- Prepare or participate in features on local radio programs.
- Make sure bank fishing areas are adequately signed and include these areas on the map in the fishing brochure.
- Develop a priorities list for improving and maintaining the boat launches and concentrate efforts on top priorities.
- Continue working with partners to maintain and improve boat launches.

- Develop refuge-specific regulations for the collection of crawfish. This activity has high potential to negatively affect king rails and other migratory birds if left uncontrolled.

Objective 4-4: <u>Wildlife observation and wildlife photography</u> – Continue to offer opportunities for wildlife observation and photography throughout the refuge. Increase wildlife observation/photography opportunities with blinds and a boardwalk. Continue to develop auto tour at Duck River Bottoms.

Discussion: Tennessee NWR provides many opportunities for wildlife observation. There are currently four observation decks, a 2.5-mile hiking trail open seasonally, a 1.1-mile interpretive hiking trail open year round and approximately 43 miles of refuge roads that may be driven, walked or bicycled either seasonally or year-round. Additionally, there is several unofficial wildlife viewing areas where the public can pull over and observe or photograph wildlife.

In 2008, an observation deck in the Duck River Bottoms was relocated to a better location creating Pintail Point Observation Deck. This deck includes a 1/8-mile hiking trail ending in a boardwalk that leads to a covered observation deck. This area gives the visitor close encounters with wintering waterfowl and other wetland wildlife as well as an excellent place to view woodpeckers. This observation deck also serves as a photography blind.

Birding is one of the most popular forms of observation on the refuge. Viewing wintering ducks and geese, looking for spring and fall migrants, seeking songbirds or unusual species such as the white pelican or sandhill crane, and viewing bald eagles are common practice for local and traveling “birders”. Tennessee NWR is well-known to serious birders that are looking for unusual migrants, not found elsewhere in the state. Visitors may also see other common forms of wildlife such as hawks and owls, white-tailed deer, wild turkey, raccoon, squirrel, snakes, turtles, beavers and a variety of songbirds.

In 2008, a five-mile auto tour was created at the refuge’s most popular view area: Duck River Bottoms. This seasonal auto tour will open up some areas of the refuge that have been normally closed off to vehicles. It not only will allow visitors to see wildlife and beautiful views that only guided tours have been able to view, but also, through signs, will interpret the management practices used in the bottoms area. These interpretive signs will call the auto tour “the Blue Goose Boulevard.

Strategies:

General

- Continue the partnership with Benton County to develop the Duck River Bottoms Overlook.
- Develop a birding brochure that lists the good birding spots on the refuge.
- Maintain a current “Sightings hotline” or bulletin board for birds on the refuge website as well as on the ground at a kiosk.
- Conduct more outreach about the birding opportunities on the refuge to bird watchers (including the “casual birder”).
- Build a photo blind at each of the three priority public use areas.
- Continue to develop the auto tour route at Duck River Bottoms.

- Develop an observation deck along the hiking trail at Britton Ford.
- Develop an observation deck at the kiosk location in the Busseltown Unit.
- Develop a plan for dealing with possible safety issue related to trail use during hunting season.

Big Sandy Peninsula

- Develop the birding opportunities in this area.
- Develop a rack card that has a map with birding sites numbered and a description of what might be seen at each site.
- Work with the county to provide visitors to the community information about the birding opportunities at Big Sandy Peninsula.
- On the rack card highlight the main public use (birding) roads and use different marking beyond that point (color, dashed lines, etc.).

Black Rock Point - Loon Viewing

- Put up a sign indicating Wildlife Viewing Area.
- Develop an information panel about loons and other birds that use the area.

Pace Point

- Put up a sign indicating Wildlife Viewing Area.
- Develop an information panel about birds in the area.

Chickasaw National Recreation Trail

- Continue to maintain and promote trail.

Duck River Bottoms

- Continue and expand the annual winter waterfowl and bald eagle tours.
- Continue to improve and develop Pintail Point Observation Deck/Photography Blind.
- Develop an observation deck at the end of Honey Point Ferry Road where wintertime viewing of waterfowl is popular.
- Continue to develop the auto tour route adding interpretive signs at each pull off.
- Develop boardwalk wildlife observation trail along Clear Lake.

- Develop an additional photo blind for this area that will be available through a reservation system.

Objective 4-5: Environmental education (EE) – Continue to provide environmental education services to the public, including limited visits to schools, EE workshops, and onsite and offsite EE programs. Work with partners to expand EE facilities and opportunities on and near the refuge.

Discussion: Working primarily with the local Henry County school system, the refuge ranger conducts most of environmental education on the refuge. There have not been as many opportunities to work with the Paris city school system.

Field trips to the refuge, guided tours, in-class presentations, teacher training workshops, and assistance with special classroom projects are examples of the types of environmental education offered. Local school systems also have environmental education resources available to them from the refuge office. These include curriculum guides and activity books, but the most used resource is 12 environmental education trunks called "Critter Crates." These provide a variety of wildlife and habitat topics and are full of hands-on learning opportunities. They can be checked out free for schools, home schools, boy scouts, girl scouts, churches, or any other groups that work with children. The boxes are geared for K-8th grades, but can be adapted for older or younger ages. Primarily teachers from Henry and Benton Counties use the crates. Use of the trunks has declined somewhat over the last year.

Approximately 15 to 20 onsite refuge field trips are conducted during the year. Most of the onsite refuge environmental education programs are conducted on the Big Sandy Unit at the Britton Ford Hiking trail. Many programs are conducted offsite; group size is usually 50-100 students. Teacher workshops (Project WET, Project WILD) have been conducted in the past to impart information to school teachers that they can carry back to the classroom.

In 2007, the Friends of Tennessee NWR initiated the Refuge Discovery Series that focuses on a different environmental education program each month, taught by members of the community but held on the refuge. Program topics include insects/spiders, wildlife photography, reptiles/amphibians, scenic canoeing, astronomy, mussels and aquatics, animal tracks, etc.

An environmental education component has also been included in most refuge special events such as centennial events, open houses, kids fishing derbies, waterfowl and bald eagle viewing events and offsite events such as the Earth Day event and the Agricultural Education Day where the use of farming on the refuge is emphasized.

Strategies:

- Develop a different system for educators getting critter crates. Options include mailing or partnership with local delivery service (UPS); alternative site for distribution; later office hours at least one day a week for pick up/return; Friend's group manages program and delivers and picks up (possible for a small fee).

- Increase volunteer group to assist with EE programs.

- Build an EE pavilion at the Britton Ford hiking trail.

- Train a group of volunteers to conduct offsite programs.

Objective 4-6: Interpretation – Expand on existing interpretive program.

Discussion: The primary interpretive theme of the refuge focuses on raising awareness of the importance of waterfowl, migratory birds and their conservation. This refuge, a "hidden jewel", is a major wintering area for thousands of waterfowl, including 29 different species of ducks and geese. The variety of habitat types within the refuge also provides for a wide diversity in birds, including songbirds, shorebirds and others. Many rare or unusual species may utilize the refuge at some time during the year. A Forest Management Plan has been written and implemented to address the need for landbird conservation through the Bird Conservation Plan initiative. Other important management techniques including moist soil management are actively conducted throughout the year.

The ranger, biologists and law enforcement officers share in conducting programs that help to interpret the management activities on the refuge. Talks and tours are given both onsite and offsite by these individuals, depending on subject matter and expertise.

A 2.5-mile hiking trail on the Britton Ford Peninsula (Big Sandy Unit) has been developed and is fully interpreted. Signs for the trail were installed in 2004. The 3.5-mile auto tour route at the Duck River Bottoms area will be fully interpreted with "pull-offs" and signs that can be read from the vehicle. The kiosks at the four main entrance areas have interpretive signs with interchangeable seasonal panels. An observation deck within the Big Sandy Unit has interpretive signage and two permanent viewing scopes.

Strategies:

- When developing new panels at specific sites such as the auto tour, Big Sandy Peninsula, and Duck River Bottoms, make sure that the information is related to the purpose and management of the refuge.

- Develop a "roving interpreter" group to provide public contact at primary public use areas. Possible interpretive themes include:

  Waterfowl
  Management activities
  Migratory birds
  Species diversity
  Forest management
  Endangered species

Objective 4-7: Visitor center and visitor contact station – Within 5 years of CCP approval, work with partners to construct a combined headquarters and visitor center, incorporating "green" technology, on the Big Sandy Unit, and within 15 years of CCP approval, build a visitor contact station at the Duck River Unit.

Discussion: At present this large, dispersed, heavily visited national wildlife refuge has no dedicated visitor center. The current refuge headquarters, located off the refuge at a rented space in the town of Paris, has a visitor contact station in front, but no formal exhibits. A visitor center would help Tennessee NWR attract, orient, and educate visitors, and thus help the refuge fulfill its role in the National Wildlife Refuge System. This objective would construct, operate, and maintain an administrative headquarters and visitor center facility on approximately 5 acres, owned by the U.S. government and managed by the Tennessee NWR, on the Britton Ford Peninsula. The Big Sandy Unit of Tennessee NWR is located in Henry County, Paris, Tennessee. The administrative headquarters area would be approximately

5,848 square feet in size and would provide staff offices, conference rooms, storage, and law enforcement storage space. The visitor services contact station would be approximately 5,603 square feet in size and would provide a visitor contact area, exhibit hall, bookstore, and multi-purpose room for the public. The Environmental Education (EE) module would be approximately 1,392 square feet with environmental education classroom suitable for class sizes of 40 students. The combined footprint of the new building would be approximately 12,479 square feet. The new building would consolidate Refuge Complex-level administrative, resource management, and visitor contact services operations. Both the visitor contact and the environmental education areas of the facility would be devoted largely to educational activities, but would provide a central location for the staff of the Tennessee National Wildlife Refuge Complex. The complex staff includes the headquarters staff, the staff at the Duck River Unit sub-headquarters, the staff at Cross Creeks NWR, and the law enforcement staff at Fort Campbell. This site is centrally located between those areas.

Strategies:

- Collaborate with the Service's Southeast Regional Office (RO) in Atlanta in developing and using appropriate criteria for site selection of combined office and visitor center.
- Work closely with the RO and architects in selecting and modifying a design for the building.
- Orient the building so as to take advantage of passive solar energy and incorporate other green design features.
- Work closely with a landscape architect to design and develop a building that is "earth-friendly" and fits into the immediate landscape, while offering wildlife viewing opportunities from both inside and outside.
- Consider developing a short to medium length (0.5 to 1.0 mile) interpretive trail around the combined headquarters and visitor center.

REFUGE ADMINISTRATION

Goal 5: Provide personnel, partners, funding, and facilities needed to ensure that the goals and objectives identified in this CCP are achieved.

Discussion: The Biological Review, Visitor Services Review, and CCP teams all specified certain additional staffing and facilities/equipment needed to implement the refuge's purposes, vision, goals, and objectives identified in this CCP. Unless adequate resources are available, filling these positions and adding this equipment will not happen, and the refuge will not to be able to fully implement the CCP.

Objective 5-1: <u>Staffing</u> – Maintain current staff and add 12 FTEs, including 1 forester, 1 forestry technician, 2 engineering equipment operators, 1 tractor operator, 2 refuge ranger, 1 law enforcement officer, 2 biological technicians, 1 assistant refuge manager, and 1 office assistant.

Discussion: The addition of twelve FTEs will enable to refuge to fully implement the various objectives and strategies described in this CCP.

Strategies:

- Law enforcement – Based upon the 2005 Deployment Model for the National Wildlife Refuge System, the addition of 4.4 law enforcement FTEs are needed to adequately enforce refuge regulations.

- Forestry personnel – One forester and one forestry technician will be needed when full-scale forest management operations to enhance forest interior migratory bird habitat are implemented. These positions need to meet fire qualifications. The forester position needs to maintain a Type II Burn Boss Qualification.

- Maintenance personnel – The refuge currently has a deficit of three maintenance positions. These positions are needed to adequately manage habitats and maintain support facilities and equipment.

- Refuge ranger – These positions will be tasked with managing the refuge's very active volunteer program, collaborating with the Friends Group, and operation of the new visitor center Headquarters Office Facility.

- Biological Technicians – These positions will increase survey and monitoring to track changes in wildlife and plant species abundance and distribution.

- Refuge Management – This position will improve refuge management capabilities.

Objective 5-2: <u>Facilities, equipment and infrastructure</u> – Maintain existing facilities, equipment and infrastructure. Add HQ/visitor center and Duck River visitor contact station and replace bunkhouse. In addition, replace Duck River office/maintenance facility and add equipment listed under strategies.

Discussion: Under this objective, the refuge will maintain existing stock of rented office space for Headquarters in Paris while the new visitor center is being constructed; will replace office with visitor contact station, bunkhouse, storage and maintenance facilities at the Duck River Unit; maintain the existing stock of heavy equipment, tractors, refuge roads, levees, water control structures, and pumps; and acquire new equipment where needed.

The Service has two computer databases where the needs of each refuge are documented. The Service Asset Management and Maintenance System (SAMMS) records requests for repair, rehabilitation, or replacement of existing facilities and equipment and requests for new facilities that require major construction. The Refuge Operation Needs System (RONS) documents requests for new employees, facilities, and equipment necessary to meet the current and expanding challenges of natural resources conservation. The needs of Tennessee NWR documented in these databases are too numerous to list in this portion of the CCP, but are included in Appendix J.

Strategies:

- Acquire one open and one enclosed equipment storage facility.

- Acquire one no-till grain drill.

- Acquire one self-propelled spray rig.

- Acquire a low ground pressure dozer.

- Acquire one aquatic excavator.

- Acquire one 24-inch centrifugal pump and engine.

- Maintain, repair, and/or replace facilities for migratory bird management, e.g., repair or replacement of water control structures, repair of existing levees, drainage maintenance, and replacement of farming and other types of needed equipment.

- Maintain, repair and/or replace roads and bridges and equipment necessary to access the refuge.

- Develop plans and associated tasks to create a visitor contact station on the Duck River Unit of the refuge. Replace the bunkhouse.

Objective 5-3: Volunteers and partnerships – Strengthen the refuge's volunteer programs, Friend's Group, and partnerships by investing an increased portion of staff time into nurturing these promising relationships.

Discussion: An active volunteer program is in place, with an average of 2,000 hours being donated annually by 50 official refuge volunteers. Assisting with the Jr. Duck Stamp program, facility construction and maintenance, wood duck banding, and special events account for the majority of the hours. The refuge has no full-time Volunteer Coordinator. This is handled by the refuge ranger as one of her duties.

In 2005, the Friends of Tennessee NWR was established. This Friends group assists the refuge and staff by implementing environmental education activities on the refuge as well as increasing the awareness and value of the refuge to the local community and politicians. The Friends group has also been instrumental in providing monetary assistance for special projects on the refuge as well as being an advocacy group for the well being of the refuge.

The refuge is involved in many different types of partnerships with the surrounding communities and counties. Many of these partnerships directly impact the visitor services program at the refuge. Examples include partnering with Henry County and other agencies to develop a Henry County boat launch and fishing area, and partnering with Benton County to develop the Duck River Bottoms Overlook.

Strategies:

- Hold an annual volunteer appreciation banquet.

- In addition to volunteers, use students who participate in the refuge's Student Temporary Employment Program (STEP), interns, etc. more to assist with public use.

- Develop a Volunteer Plan for the refuge.

- Discuss with staff the refuge's needs, decide on numbers, develop job descriptions, and fill the needs accordingly.

- Develop a plan to attract more recreational vehicle (RV) camper-volunteers, to utilize the camper pad at Duck River Bottoms.

- Consider different ways to increase recruitment efforts:

  Newspaper articles
  Cable TV channel
  Sign-up table at special events
  Booth about volunteering at Tennessee NWR – could be a focus at the Fish Fry or other local events that attract a lot of local folks.

- Advertise volunteer opportunities on websites and in publications such as Workamper News (refuge website, volunteer.gov).

- Continue to build a close working, symbiotic relationship with the new Friends group to develop projects that benefit the refuge and give stature, recognition, and a feeling of positively contributing to the Friends group and its members.

- Do not expand concessions at this point in time.

- Continue to build positive working relationships with concessionaires.

V. Plan Implementation

INTRODUCTION

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

To accomplish the purpose, vision, goals, and objectives contained in this plan for Tennessee National Wildlife Refuge, this section identifies projects, funding and personnel needs, volunteers, partnerships opportunities, step-down management plans, a monitoring and adaptive management plan, and plan review and revision.

PROPOSED PROJECTS

Listed below are the proposed project summaries and their associated costs for fish and wildlife population management, habitat management, resource protection, visitor services, and refuge administration over the next 15 years. This proposed project list (Table 7) reflects the priority needs identified by the public, planning team, and refuge staff based upon available information. These projects were generated for the purpose of achieving the refuge's objectives and strategies. The primary linkages of these projects to those planning elements are identified in each summary.

FISH AND WILDLIFE POPULATION MANAGEMENT

1. Exotic and Invasive Species Control on Tennessee NWR

Agricultural fields, forested areas, roadsides, and impoundments have become infested with populations of exotic or invasive plant and animal species. In order to eliminate or control these populations more emphasis will be placed on early detection and monitoring the presence, spread, and damage caused by these species to native plants and wildlife and their habitat. This project supports the addition of a biological technician and engineering equipment operator. Recurring cost: $200,000; Special project cost: $500,000. *(Linkages: Goal 1, Objectives 1-1 – 1-15; and Goal 2.)*

2. Expand the biological monitoring program on Tennessee NWR

This project and supported biological technician position will provide an increase in the numbers and types of surveys being conducted, thus increasing the biological information for the refuge. Additional wildlife surveys would focus on bats, secretive waterbirds, woodcock, colonial waterbirds, and amphibians. Some existing surveys will be improved and expanded such as forest bird point counts, eagle nest monitoring, deer and resident Canada goose crop depredation, and shorebird surveys. The position would also be responsible for helping the complex meet annual banding quotas for wood ducks and maintaining nest boxes on the refuge. Recurring cost: $70,000; Special project cost: $69,000. *(Linkages: Goal 1, Objectives 1-1 – 1-15; and Goals 2 and 3.)*

HABITAT MANAGEMENT

3. Implement forest management program
Refuge forestlands will be inventoried and assessed; subsequent prescriptions and management will be driven by habitat needs. Currently, over 20,000 acres of refuge forestland is unmanaged. Additional personnel are critical to long-term inventory, analysis, and field implementation of the Forest Management Plan. Forest inventory and analysis determine the necessary prescriptions ((harvest), planting, invasive exotic eradication, prescribed burning, and monitoring) as defined by needs of the priority bird species. Additional refuge forestry responsibilities include shoreline restoration partnerships with residential refuge neighbors and the prescribed fire management program. This project supports a forester position, which will also asses the need for and identifies sites suitable for carbon sequestration projects. Recurring cost: $115,000; Special project cost: $115,000. *(Linkages: Goal 2, Objectives 2-2, 2-4, 2-6, 2-7, and 2-8.)*

4. Inventory and monitor forest management program

This project will assist in the development and implementation of a silvicultural prescription to improve forest habitat conditions specifically designed for forest songbirds and other forest-dwelling wildlife. A forestry technician will provide assistance with cruising and marking timber. The technician would monitor timber harvest and document the progress. The technician would assist the forester and the complex biologist monitor the effects is silvicultural treatments on wildlife. This position is critical to the future implementation of a prescribed burning program on the Tennessee and Cross Creeks national wildlife refuges. Recurring cost: $70,000; Special project cost: $70,000. *(Linkages: Goal 2, Objectives 2-2, 2-4, 2-6, 2-7, and 2-8.)*

5. Expand waterfowl management capabilities on the Busseltown Unit

Expand the water management capabilities by constructing 6 new waterfowl impoundments on the Busseltown Unit, adding about 90 acres of flooded habitat, through a partnership with Ducks Unlimited (DU). Survey work for this project was completed by DU in 2007. The refuge historically provided foraging habitat on agricultural grains in nonflooded fields. Winter weather has been abnormally mild in recent years and ducks have become more and more reluctant to utilize fields that cannot be flooded. The additional habitat provided by these impoundments will help provide forage for the over 200,000 waterfowl that winter on Tennessee NWR. Waterfowl usage of the Busseltown Unit is limited by the availability of impounded waters. Recurring cost: $205,000; Special project cost: $205,000. *(Linkages: Goal 2, Objectives 2-1, 2-3, 2-5, 2-7, and 2-8.)*

6. Expand waterfowl management capabilities on the Big Sandy Unit

Expand the water management capabilities on 4 waterfowl impoundments on the Big Sandy Unit by 30 acres through a partnership with Ducks Unlimited (DU). Survey work for this project was completed by DU in 2006. Final project design is still needed. The refuge historically provided foraging habitat on agricultural grains in nonflooded fields. Winter weather has been abnormally mild in recent years and ducks have become more and more reluctant to utilize fields that cannot be flooded. The additional habitat provided by these impoundments will help provide forage for the over 200,000 waterfowl that winter on Tennessee NWR. Waterfowl usage of the Big Sandy Unit is limited by the availability of impounded waters. Recurring cost: $150,000; Special project cost: $150,000. *(Linkage: Goal 2.)*

7. Bottomland hardwood reforestation

Reforest 100 acres of bottomland hardwoods within the Duck River Bottoms. Several abandoned agricultural fields will be planted in mast producing seedlings. The fields that are to be planted are capable of being flooded and would provide excellent waterfowl habitat as the trees mature. The additional habitat provided by this will help provide forage for the over 200,000 waterfowl that winter on the refuge, as well as other forest interior birds and resident wildlife. Recurring cost: $20,000; Special project cost: $20,000. *(Linkages: Goal 2, Objectives 2-2, 2-4, 2-6, 2-7, 2-8.)*

8. Vegetation mapping

Develop detailed vegetative cover maps for all three units of the refuge following standards outlined by the National Vegetation Classification System. This will be accomplished by using Geographic Information Systems (GIS) to classify vegetation from satellite imagery and color infrared aerial photography. The aerial photography is currently unavailable and will need to be contracted. These photos are to be at a scale of 1:8000 to aid in developing detailed vegetation coverage data. Flight lines for the refuge have already been established by the USGS through a BRD Research Partnership Project. Detailed vegetation maps are essential to progressive habitat management planning and monitoring. These maps will also provide a baseline to monitor potential impacts on vegetation communities by climate change. Recurring cost: $120,000; Special project cost: $120,000. *(Linkages: Goal 2.)*

9. Enhance habitat management and visitor service facilities

Provide an engineering equipment operator to assist in maintaining the three units that are a part of the Tennessee National Wildlife Refuge Complex. The distance of the units from the maintenance facility located at the Duck River sub-headquarters averages a one-hour drive time to Big Sandy or Busseltown. The current maintenance staff of two employees cannot fully meet the maintenance needs on refuge habitats and facilities. The engineering equipment operator will enable the Tennessee National Wildlife Refuge Complex to offer a higher degree of safety for refuge visitors, as well as a more cost-effective maintenance program for the refuge. Currently, the station's visitor service facilities and water management infrastructure are suffering from a lack of adequate preventative and corrective maintenance. Additional staff will allow for the completion of routine maintenance of facilities and infrastructure to provide safe access for visitors and improved habitat for wildlife. Recurring cost: $78,000; Special project cost: $78,000. *(Linkages: Goals 2 and 4.)*

10. Water management operations system

Man-made hydrological alterations have all but eliminated the natural flooding regimes that once supported historical numbers of waterfowl and shorebirds. In this altered floodplain, a system of levees, water control structures, and wells are necessary to provide dependable flooded habitats that correspond with the migration chronologies of migratory birds. The timing of water management is critical to meet the needs of migratory birds, the primary purpose of the refuge, to stimulate the production of desirable moist soil plants, to control undesirable plants, and reduce farmed acreage on the refuge by utilizing force-account farming. Water management includes monitoring water flow, water levels, and pumping via a GIS database to more efficiently manage resources. This project will increase refuge water management capabilities by (1) expanding pumping capabilities by adding another 50,000-gpm pump at the pump station; (2) developing flooded habitat at Britton Ford/Sulphur Well; (3) expand force-account farming; (4) establish and maintain about 100 acres of grassland on the Big Sandy Peninsula; (5) armor levees at Duck River to protect them during floods; and (6) construct shorebird impoundments. To efficiently improve, manage and maintain the water

management system, this project includes the installation of additional 50,000-gpm pump at the pump station ($150,000), additional water control structures, one low lift pump ($40,000), and an underground irrigation pipe system ($50,000). The estimated first-year total cost of this project is $420,000, with a recurring cost of $95,000. *(Linkages: Goal 2, Objectives 2-2, 2-4, 2-6, 2-7, 2-8.)*

11. Shoreline stabilization

Partner with the Tennessee Valley Authority (TVA) on a shoreline stabilization project along Kentucky Lake on the Big Sandy Unit of the refuge. Shoreline erosion due to heavy wave activity is severe in many locations on the refuge. Large stone and geotextile fabric will be placed along approximately 1,200 feet of shoreline at eroded sites. This project will focus on stabilizing areas adjacent to agriculture fields that are managed for waterfowl foraging habitat. The refuge provides habitat for over 200,000 waterfowl that winter on the refuge. Recurring cost: $250,000; Special project cost: $250,000. *(Linkages: Goals 2 and 3.)*

RESOURCE PROTECTION

12. Cultural and historical resource interpretation overview of Tennessee NWR

Using available scientific and historic information, the selected contractor will author an interdisciplinary overview of the refuge's cultural landscape as it has changed over the past 15-20,000 years. The final technical report will include, at a minimum, sections about the area's geomorphology and hydrological regime, paleoenvironmental reconstruction, the area's cultural history, the scope and scale of past archaeological investigations on and near the refuge, a detailed list of the refuge's historic properties, and future research questions. Submission of the overview report will satisfy the cultural resource objectives listed in the CCP, as well as those listed in other Service documents. Using the information generated from the overview, as well as ongoing scientific archaeological investigations of the area, the selected contractor will inventory and then evaluate the National Register's eligibility of historic properties located on the refuge. Recurring costs include the conservation and protection of sites and the administrative needs for existing or new sites that are found. This project would also include interpretation and display of pertinent information for the visiting public. Recurring costs: $10,000 and special project cost: $75,000. *(Linkages: Goal 3, Objective 3-1.)*

VISITOR SERVICES

13. Provide for administrative assistance and improve visitor services

Improve visitor services by providing an office assistant at the Duck River Unit sub-headquarters. This will provide support with administrative reporting and provide a presence at the sub-headquarters office on a daily basis. This will improve visitor services by having someone on site to answer visitor inquiries by phone or for visitors who come into the office. The staff at the sub-headquarters are typically in the field working and not present at the office on a regular basis to greet the public and provide assistance. This will also provide help with reporting requirements and allow the maintenance and biological staff to dedicate more time to habitat related projects and to maintaining visitor services facilities. Recurring cost: $77,321; Special project cost: $77,321. *(Linkage: Goal 4.)*

14. Develop refuge interpretive video for Tennessee NWR

Develop refuge interpretive video. The refuge has some interpretive signs and brochures to help the public understand why it was created and what we are trying to manage, and how the public can help us accomplish this mission. However, a short video about the refuge could be extremely helpful in connecting people to the overall mission of the refuge. This video could be used in many different ways such as during school programs, interpretive talks or meetings with the public or with partners. This project would hire NCTC to create a short 15-minute video to introduce the refuge and the Service mission to visitors before they depart the headquarters and venture out on the refuge. Recurring cost: $3,000; Special project cost: $35,000. *(Linkages: Goal 4, Objectives 4-1, 4-5, 4-6, and 4-7.)*

15. Develop waterfowl live-feed camera "Duck Cam"

Develop a live-feed camera that highlights wild waterfowl at the refuge. An exhaustive search of live "cams" has found little evidence that anyone has a live-feed camera that focuses on wild waterfowl species. This refuge would like to establish a "Duck Cam" that would show concentrations of overwintering waterfowl feeding and loafing on the refuge. The "duck cam" would be featured on the refuge's home page and would be linked to cameras at several different impoundment locations. Recurring cost: $2,000; Special project cost: $52,000. *(Linkages: Goal 4, Objectives 4-1, 4-5, 4-6, and 4-7.)*

16. Expand visitor services program on Tennessee NWR

An exhibit area including refuge orientation will be developed at the Duck River Unit. Currently, the Duck River Unit offers limited opportunities for wildlife-dependent recreation due, primarily, to a lack of facilities and availability of staff to plan and implement a visitor services program. Site specific areas will also be developed for public information throughout the refuge. Each site will include maintained trails with boardwalks (when necessary), foot bridges (when necessary), interpretive panels, and additional observation facilities (as appropriate). Informational brochures and interpretive panels will describe the area's natural and cultural resources, refuge management programs, and the NWR System. This project will also provide a Refuge Ranger position to meet the visitor services needs of the new headquarters and visitor service facility. This position will staff the visitor's center and provide for both on and off site programs to schools groups, scouts, church organizations, university students, and refuge partners. This position will provide assistance to visitors by answering the many inquiries the refuge receives related to hunting, fishing, and wildlife observation via e-mail, phone, or in person. Recurring cost: $295,000; Special project cost: $120,000. *(Linkages: Goal 4.)*

17. Maintain public use facilities and increase habitat management

Provide a permanent tractor operator at Tennessee NWR. This project would ensure that the wildlife drive, kiosks, observation platforms, and hiking trails are kept in a neat well-manicured manner. The project would provide assistance with mowing roadsides, parking areas, and boat ramps. This will prevent invasive and other noxious plants from growing over water control structures, gates, signs, wood duck boxes, and refuge roads. This will also provide a permanent source for maintaining Chickasaw National Recreation Trail, the Britton Ford Trail and their associated infrastructure. The project will provide for additional food that will be available for wildlife by planting winter wheat, millet, corn, or other crops as needed. Recurring cost: $68,000; Special project cost: $68,000. *(Linkages: Goal 2 and 4.)*

18. Expand environmental education program on Tennessee NWR

Assist in the further development and implementation the visitor services program at Tennessee National Wildlife Refuge. Responsibilities include planning and implementation of the environmental education program, planning and conducting special events, and oversight of the interpretive program on the Duck River Unit, including update and upkeep of Refuge-related publications, and sign placement and maintenance. This project will include the addition of a refuge ranger position. Recurring cost: $95,000; Special project cost: $95,000. *(Linkages: Goal 4, Objective 4-1, 4-5, 4-6, and 4-7.)*

REFUGE ADMINISTRATION

19. Improve management capability on Tennessee NWR

Improve refuge management capabilities by providing an assistant refuge manager and additional law enforcement officer for the Tennessee NWR complex. The assistant manager would provide oversight and support to the public use program, farming program, maintenance program, and invasive species control. The position would support facilities management by keeping the appropriate property records current and up to date. The assistant manager would also maintain the appropriate databases related to facilities maintenance for the refuge. This will permit the maintenance staff to commit more time to habitat and public use related projects. The manager would be responsible for the cooperative farming program, nuisance animal control, and maintenance on the Busseltown and Big Sandy Units. These two units are at a minimum a one-hour drive from the Duck River sub-headquarters, which makes visiting the units difficult for the Duck River manager. Public use has continued to increase with hunting and fishing pressure on the refuge along with other issues requiring law enforcement such as vandalism, compliance with access and public use regulations. The refuge needs to hire one full-time park ranger (GS-0025-7/9) ($140,000). This will allow the refuge to adequately address safety and resource protection issues. Recurring cost: $210,000; Special project cost: $240,000. *(Linkages: Goal 5, Objectives 5-1 - 5-3.)*

FUNDING AND PERSONNEL

Table 7 lists the projects described above and their associated first year and annual recurring costs. The refuge currently has a staff of 13 full-time equivalent (FTE) staff positions (see Table 6). The plan proposes to maintain the current staff and add 12 FTEs, including 1 forester, 1 forestry technician, 2 engineering equipment operators, 1 tractor operator, 2 refuge ranger, 1 Law Enforcement Officer, 2 biological technicians, 1 assistant refuge manager, and 1 office assistant.

Table 7. Summary of projects.

PROJECT NUMBER	PROJECT TITLE	FIRST YEAR COST	RECURRING ANNUAL COST	STAFF (FTE'S)
1	**Exotic and Invasive Species Control on Tennessee NWR**	500,000	200,000	2
2	**Expand the biological monitoring program on Tennessee NWR**	70,000	70,000	1
3	**Implement forest management program**	115,000	115,000	1
4	**Inventory and monitor forest management program**	70,000	70,000	1
5	**Expand waterfowl management capabilities on the Busseltown Unit**	205,000	205,000	
6	**Expand waterfowl management capabilities on the Big Sandy Unit**	150,000	150,000	
7	**Bottomland hardwood reforestation**	20,000	20,000	
8	**Vegetation Mapping**	120,000		
9	**Enhance habitat management and visitor service facilities**	78,000	78,000	1
10	**Water Management Operations System**			
11	**Shoreline stabilization**	250,000	250,000	
12	**Cultural and Historical Resource Interpretation Overview of the Refuge**	75,000	10,000	
13	**Provide for administrative assistance and improve visitor services**	78,000	78,000	1
14	**Develop refuge interpretive video for Tennessee NWR**	35,000	3,000	
15	**Develop waterfowl live-feed camera "Duck Cam"**	52,000	2,000	
16	**Expand visitor services program on Tennessee NWR**	95,000	95,000	1

PROJECT NUMBER	PROJECT TITLE	FIRST YEAR COST	RECURRING ANNUAL COST	STAFF (FTE'S)
17	**Maintain public use facilities and increase habitat management**	68,000	68,000	1
18	**Expand environmental education program on Tennessee NWR**	95,000	95,000	1
19	**Improve management capability on Tennessee NWR**	95,000	95,000	2

PARTNERSHIP AND VOLUNTEER OPPORTUNITIES

A volunteer program exists on the refuge and will be continued for the life of this CCP. The refuge will continue to recruit volunteers to assist with wood duck and blue bird nest box management, grounds maintenance, interpretive material development, visitor center docents, photography, lead trail walks, make presentations, and assist with administrative functions.

In addition, the potential exists to develop a local friends group to enhance refuge activities, with the assistance of the Friends of Tennessee National Wildlife Refuge as a mentoring group. A key element of this CCP is to establish partnerships with local volunteers, landowners, private organizations, and state and federal natural resource agencies. In the immediate vicinity of the refuge, opportunities exist to establish partnerships with the organizations and agencies such as the County Mayor's Offices, Paris Chamber of Commerce, Sheriff's Offices, Henry, Benton, Decatur, and Humphries County School Systems, and the University of Tennessee-Martin.

At regional and state levels, partnerships may be established or enhanced with organizations such as Land Between the Lakes (USDA Forest Service), Fort Donelson (National Park Service), Tennessee Valley Authority, Natural Resources Conservation Service, U.S. Geological Survey, Tennessee Wildlife Resources Agency, and Tennessee Department of Conservation and Environment. Other potential partnerships may be established with Partners in Flight, Partners in Amphibian and Reptile Conservation, the National Fish and Wildlife Foundation, Southeastern Association of Fish and Wildlife Agencies, National Turkey Federation, Quail Unlimited, and Ducks Unlimited.

STEP-DOWN MANAGEMENT PLANS

A comprehensive conservation plan is a strategic plan that guides the direction of the refuge. A step-down management plan provides specific guidance on activities, such as habitat, fire, and visitor services. These step-down management plans (Table 8) are also developed in accordance with the National Environmental Policy Act, which requires the identification and evaluation of alternatives and public review and involvement prior to their implementation.

Table 8. Tennessee NWR step-down management plans related to the goals and objectives of the comprehensive conservation plan.

Step-down Plan	Completion Date
Station Safety Plan – Revise (2007) Annually	Annual
Forest Management Plan – Revise	2013
Fire Management Plan – Revise	2010
Animal Control Plan – Revise	2013
Wildlife Inventory Plan – Revise	2010
Sportfishing Plan – Revise	2013
Visitor Services Plan – Revise	2010
Crowd Control Plan – Revise with Law Enforcement Plan	2012
Habitat Management Plan -Develop	2011
Cultural Resources Management Plan	2015

MONITORING AND ADAPTIVE MANAGEMENT

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

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

PLAN REVIEW AND REVISION

This comprehensive conservation plan will be reviewed annually as the refuge's annual work plans and budgets are developed. It will also be reviewed to determine the need for revision. A revision will occur if and when conditions change or significant information becomes available, such as a change in ecological conditions or a major refuge expansion. The final plan will be augmented by detailed step-down management plans to address the completion of specific strategies in support of the refuge's goals and objectives. Revisions to the comprehensive conservation plan and the step-down management plans will be subject to public review and NEPA compliance.

SECTION B. ENVIRONMENTAL ASSESSMENT

I. Background

INTRODUCTION

The U.S. Fish and Wildlife Service (Service) has prepared this Environmental Assessment (EA) for Tennessee National Wildlife Refuge in compliance with the National Environmental Policy Act and the National Wildlife Refuge System Improvement Act of 1997. The National Wildlife Refuge System Improvement Act requires the development of comprehensive conservation plans (CCPs) for all refuges. Following a public review and comment period on the Draft CCP (Section A), a final decision will be made by the Service that will guide Tennessee National Wildlife Refuge's management actions and decisions over the next 15 years, provide greater public understanding about the refuge and its management activities, and incorporate information and suggestions from the public and refuge partners.

The Draft CCP proposes a management direction, which is described in detail through a set of goals, objectives, and strategies. The Draft CCP addresses current management issues, provides long-term management direction and guidance for the refuge, and satisfies the legislative mandates of the National Wildlife Refuge System Improvement Act of 1997. While the plan provides general management direction, subsequent step-down plans will provide more detailed management direction and actions.

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

This plan is needed to address current management issues, to provide long-term management direction for the refuge, and to satisfy the legislative mandates of the National Wildlife Refuge System Improvement Act of 1997, which requires the preparation of a comprehensive conservation plan for all national wildlife refuges.

PURPOSE AND NEED FOR ACTION

The purpose of the CCP and EA is to meet the purposes of the refuge and the goals identified in the CCP, for which the Service evaluates each alternative. The purpose is to ensure that Tennessee NWR serves as an inviolate sanctuary and provides habitat for migratory birds, especially waterfowl; conserves and manages other wildlife and associated resources and habitat; builds, operates and maintains impoundment structures; produces food crops or cover for wildlife; provides habitat and protection for threatened and endangered species; and provides recreation and environmental education opportunities for the public, especially the "Big 6" priority uses of hunting, fishing, wildlife observation, wildlife photography, and environmental education and interpretation.

This environmental assessment addresses the need to adopt a 15-year management plan for Tennessee National Wildlife Refuge that provides guidance for future refuge management and meets the requirements of the National Wildlife Refuge System Improvement Act of 1997.

DECISION FRAMEWORK

Based on the assessment described in this document, the Service will select an alternative to implement the Comprehensive Conservation Plan for Tennessee National Wildlife Refuge. The finalized plan will include a Finding of No Significant Impact (FONSI), which is a statement explaining why the selected alternative will not have a significant effect on the quality of the human environment. This determination is based on an evaluation of the mission of the Service and the Refuge System, the purposes for which the refuge was established, and other legal mandates. Assuming no significant impact is found, implementation of the plan will begin after the FONSI is signed, and the plan will be monitored annually and revised when necessary.

PLANNING STUDY AREA

Tennessee National Wildlife Refuge consists of three discontinuous units that run along 65 miles of the Tennessee River (Kentucky Lake) in four counties – Benton, Decatur, Henry and Humphreys – of northwestern Tennessee (Figures 1 and 2 in the Draft CCP). The three units are Duck River (26,738 acres), Big Sandy (21,348 acres), and Busseltown (3,272 acres), which together encompass a total of 51,358 acres.

This environmental assessment will identify management on refuge lands, as well as those lands proposed for acquisition by the Service.

AUTHORITY, LEGAL COMPLIANCE, AND COMPATIBILITY

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

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

COMPATIBILITY

The National Wildlife Refuge System Administration Act of 1966, as amended by the National Wildlife Refuge System Improvement Act of 1997, states that national wildlife refuges must be protected from incompatible or harmful human activities to ensure that Americans can enjoy Refuge System lands and waters. Before activities or uses are allowed on a national wildlife refuge, the uses must be found to be compatible. A compatible use is defined as one that "... will not materially interfere with or detract from the fulfillment of the mission of the Refuge System or the purposes of the refuge." In

addition, “wildlife-dependent recreational uses may be authorized on a refuge when they are compatible and not inconsistent with public safety.”

An interim compatibility determination is a document that assesses the compatibility of an activity during the period of time the Service first acquires a parcel of land to the time a formal, long-term management plan for that parcel is prepared and adopted. The Service has completed an interim compatibility determination for the six priority general public uses of the system, as listed in the National Wildlife Refuge System Improvement Act of 1997. These uses are hunting, fishing, wildlife observation, wildlife photography, and environmental education and interpretation.

PUBLIC INVOLVEMENT AND THE PLANNING PROCESS

In accordance with Service guidelines and National Environmental Policy Act recommendations, public involvement has been a crucial factor throughout the development of the Draft Comprehensive Conservation Plan for Tennessee National Wildlife Refuge. This plan has been written with input and assistance from interested citizens, conservation organizations, and employees of local and state agencies. The participation of these stakeholders and their ideas has been of great value in setting the management direction for Tennessee NWR. The Service, as a whole, and the refuge staff, in particular, are very grateful to each individual who has contributed time, expertise, and ideas to the planning process. The staff remains impressed by the passion and commitment of so many individuals for the lands and waters administered by the refuge.

Prior to public scoping in 2008, a biological review and a visitor services review of the refuge were conducted. In August 2004, a diverse team of federal and state personnel undertook a holistic biological examination of the refuge’s habitat and wildlife management programs. The team then considered how the refuge might fit into accomplishing a number of relevant system-wide and landscape conservation needs. The biological review team included staff from the refuge, as well as Service fish and wildlife biologists from the Regional Office as well as the Division of Ecological Services and Division of Migratory Birds. In addition, wildlife biologists from the Tennessee Wildlife Resources Agency (TWRA), Tennessee Valley Authority, University of Tennessee at Knoxville, and Tennessee Wildlife Federation participated. The team’s recommendations were set forth in its final report entitled, “Tennessee National Wildlife Refuge Biological Review” (USFWS 2005), which was instrumental in the planning process.

The visitor services review was conducted in February 2004 by Service public use and outreach specialists. The review team toured the refuge, identified and discussed the current status of public use programs, and provided a report with recommendations for enhancing and improving these programs (USFWS 2004).

The CCP core planning team, which consists of the refuge manager, deputy refuge manager, two wildlife biologists, park ranger, a natural resources planner from the Service’s Southeast Regional Office, and a contractor with experience in comprehensive conservation planning, met for the first time in November 2007, for a tour of the refuge and an overview of its habitat and wildlife resources and public use programs, facilities, and opportunities. The core planning team reviewed the recommendations of the biological and visitor services review teams, and also conducted additional internal scoping and prepared a preliminary schedule and plans for public involvement. The core team developed a mailing list of the public, landowners, state and tribal agencies, nonprofit organizations, and local governments. Letters were sent notifying these parties of the planning process being initiated, and encouraging their participation in the scoping of issues in preparation for developing the Draft CCP/EA for this refuge.

Three public scoping meetings were held in Paris, Parsons, and New Johnsonville, Tennessee, on May 5, 6, and 7, 2008, respectively. These locations correspond to the refuge's three distinct units – Big Sandy, Busseltown, and Duck River. These scoping meetings introduced the comprehensive planning process to the public and allowed the Service to receive input, perspectives, and comments as to the issues, concerns, and opportunities that the public feels should be addressed in the CCP.

A complete summary of the issues and concerns that were expressed at the public scoping meetings, as well as additional information on the overall planning process, is provided in Appendix D, Public Involvement.

II. Affected Environment

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

III. Description of Alternatives

FORMULATION OF ALTERNATIVES

Alternatives are different approaches or combinations of management objectives and strategies designed to achieve the refuge's purpose and vision, and the goals identified in the comprehensive conservation plan; the priorities and goals of the Lower Tennessee-Cumberland Ecosystem Team; the goals of the National Wildlife Refuge System; and the mission of the U.S. Fish and Wildlife Service. Alternatives are formulated to address the significant issues, concerns, and problems identified by the Service and the public during public scoping.

The four alternatives identified and evaluated represent different approaches to provide permanent protection, restoration, and management of the refuge's fish, wildlife, plants, habitats, and other resources, as well as compatible wildlife-dependent recreation. The refuge staff assessed the biological conditions and analyzed the external relationships affecting the refuge. This information contributed to the development of refuge goals and, in turn, helped to formulate the alternatives. As a result, each alternative presents different sets of objectives for reaching refuge goals. Each alternative was evaluated based on how much progress it would make and how it would address the identified issues related to fish and wildlife populations, habitat management, resource protection and conservation, visitor services, and refuge administration.

DESCRIPTION OF ALTERNATIVES

Serving as a basis for each alternative, a number of goals and sets of objectives were developed to help achieve the refuge's purpose and the mission of the Refuge System. Objectives are desired conditions or outcomes that are grouped into sets and, for this planning effort, were consolidated into four alternatives. These alternatives represent different management approaches for managing the refuge over a 15-year timeframe, while still meeting the refuge's purposes and goals. The four alternatives are summarized below. A comparison of each alternative follows the general description.

ALTERNATIVE A: CURRENT MANAGEMENT (NO ACTION)

In general, Alternative A would maintain the current management direction, that is, the refuge's habitats and wildlife populations would continue to be managed as they have in recent years. Public use patterns would remain relatively unchanged from those that exist at present. This alternative would pursue the same five broad refuge goals as each of the other alternatives.

Goal A concerns wildlife. It calls for Tennessee NWR to contribute to healthy and viable native wildlife and fish populations representative of the Lower Tennessee-Cumberland River Ecosystem, with special emphasis on waterfowl and other migratory birds. Under Alternative A, the refuge would work toward achieving a number of objectives in pursuit of the wildlife goal.

Concerning waterfowl, under Alternative A, Tennessee NWR would provide adequate habitats to meet the foraging needs of 121,000 ducks for 110 days and other habitats that are needed for loafing, roosting, molting, etc. The refuge would also maintain the seasonal closure (Nov. 15-March 15) of waters, roads, and land areas to provide sanctuary for waterfowl. In addition, the refuge would provide adequate corn and wheat browse to meet the needs of about 16,000 migrant Canada geese for 90 days. Lastly, the refuge would continue to maintain 175 wood duck nesting boxes on the Duck River Unit and meet the banding goals of the Mississippi Flyway Council.

Under Alternative A, the refuge would continue several other actions on behalf of other migratory birds. The refuge would continue to:

- Protect a minimum of 50 acres of habitat for secretive marshbirds, sufficient to support 10 nesting territories for king rails.
- Continue to provide at least 50 acres of foraging sites for both northbound and southbound shorebirds during migration and conduct population surveys.
- Continue to provide for both secure nesting sites and ample foraging habitat.

No active management would be pursued for grassland birds under Alternative A. However, the refuge would continue to provide habitat to benefit existing populations of priority forest interior migratory birds. It would also continue to monitor and protect bald eagle nesting sites and count wintering bald eagles on the refuge; continue to manage populations of resident game species such as deer, turkey, squirrel, raccoon, and resident Canada geese; continue to maintain and periodically update lists of resident nongame species; and continue to provide indirect benefits through habitat management for targeted species.

In terms of fisheries, the Tennessee Refuge would continue to maintain its fish list; otherwise, no active management or research would be undertaken with this alternative. With regard to threatened and endangered species, the refuge would continue to protect all federal listed species, in particular the Indiana and gray bats and listed mussels, under the Endangered Species Act. As necessary, the refuge would continue to control nuisance beavers on a limited basis.

Goal 2 calls for maintaining, restoring, and enhancing diverse and resilient habitats and essential processes necessary to support sustainable populations of migratory and resident wildlife species indigenous to the Lower Tennessee-Cumberland Ecosystem. Under this goal, Alternative A would maintain the refuge's existing habitat management programs, practices, and actions.

The refuge would continue its moist soil management program on about 1,600 acres. There would be no active forest management, but the refuge would continue evaluation of past forest treatments for increasing habitat for priority species on the Big Sandy Peninsula. Prescribed fire would not be used as a land management tool. The refuge would maintain the cooperative farming program and continue cultivating crops on about 3,000 acres under Cooperative Farming Agreements and with refuge staff (force-account) for the benefit of waterfowl and resident game species. Bottomland hardwood forest habitat would not be actively managed, but the refuge would continue its current water management of about 5,160 acres of impounded water management units.

Working with partners, the refuge would continue to provide mudflats during August-September for shorebird and early migratory waterfowl, scrub-shrub habitat, and desirable aquatic plants. The refuge would also continue annual spraying and biological control of invasive plants alligatorweed, privet species, sesbania, purple loosestrife, encroaching woody vegetation, spatterdock, and parrot feather. Mechanical control (mowing and disking) of certain upland plants would be conducted as needed. There would be no active monitoring, management, or education related to climate change.

Goal 3 calls for identifying and protecting natural and cultural resources on the refuge. Under Alternative A, the refuge would continue to manage cultural resources consistent with Section 106 of the National Historic Preservation Act. The refuge's size and boundaries would not change, as the refuge would not pursue acquisition or minor boundary expansion.

Goal 4 aims to provide appropriate and compatible wildlife-dependent recreational opportunities, environmental education, and interpretation that foster an appreciation for wildlife and habitat conservation. Pursuing this goal under Alternative A, Tennessee NWR would continue to provide visitor services under the existing public use review and development plan approved in 1986. The refuge would continue to allow managed, limited hunting for deer, turkey, squirrel, raccoon, and resident Canada geese, as well as to provide opportunities for fishing. The refuge would also continue to offer opportunities for wildlife observation and photography throughout the refuge, and to provide environmental education services to the public, including limited visits to schools, environmental education workshops, and onsite and offsite environmental education programs.

Under Alternative A, Tennessee NWR would continue to maintain its kiosks, brochures, website, signs, and interpretive programs at the current level.

Goal 5 calls for Tennessee NWR to provide personnel, partners, funding, and facilities needed to ensure that the goals and objectives identified in the CCP are achieved. Under Alternative A, the refuge would maintain its current staff of 13 full-time equivalent positions (FTEs), including the refuge manager, deputy refuge manager, two refuge biologists, refuge ranger, refuge planner, two law enforcement (LE) officers, three heavy equipment operators, administrative officer, and assistant refuge manager. No new staff positions would be added. The refuge would maintain an office, bunkhouse, storage and maintenance at the Duck River Unit, as well as the existing inventory of heavy equipment, tractors, refuge roads, levees, water control structures, and pumps.

The Tennessee Refuge would maintain its existing partnerships with the Tennessee Valley Authority (TVA), U.S. Army Corps of Engineers (USACE), Tennessee Wildlife Resources Agency (TWRA), U.S. Forest Service (USFS), National Park Service (NPS), Natural Resources Conservation Service (NRCS), the Friends of Tennessee NWR group, and other federal, state and local agencies, as well as private nongovernmental organizations (NGOs).

ALTERNATIVE B: PUBLIC USE EMPHASIS

In general, Alternative B would emphasize enhanced public use on Tennessee NWR. With regard to Goal A, on native wildlife and fish populations, this alternative would be quite similar to Alternative A in many respects.

Concerning waterfowl, under Alternative B, the Tennessee Refuge would provide adequate habitats to meet the foraging needs of 121,000 ducks for 110 days and other habitats that are needed for loafing, roosting, molting, etc. The refuge would also maintain the seasonal closure (Nov. 15-March 15) of waters, roads, and land areas to provide sanctuary for waterfowl. In addition, the refuge would provide adequate corn and wheat browse to meet the needs of about 16,000 migrant Canada geese for 90 days. Lastly, the refuge would continue to maintain 175 wood duck nesting boxes on the Duck River Unit and meet the banding goals of the Mississippi Flyway Council.

Under Alternative B, the refuge would continue several other actions on behalf of other migratory birds. The refuge would continue to:

- Protect a minimum of 50 acres of habitat for secretive marshbirds, sufficient to support 10 nesting territories for king rails.
- Continue to provide at least 50 acres of foraging sites for both northbound and southbound shorebirds during migration and conduct population surveys.
- Continue to provide for both secure nesting sites and ample foraging habitat.

There would be no active management for grassland birds under Alternative B. However, the refuge would continue to provide habitat to benefit existing populations of priority forest interior migratory birds. It would also continue to monitor and protect bald eagle nesting sites and count wintering bald eagles on the refuge.

Alternative B would continue to manage populations of resident game species such as deer, turkey, squirrel, raccoon, and resident Canada geese; continue to maintain and periodically update lists of resident nongame species; and continue to provide indirect benefits through habitat management for targeted species. In terms of fisheries, Tennessee NWR would continue to maintain its fish list; otherwise, no active management or research would be undertaken with this alternative. Alternative B would differ from Alternative A on these efforts by developing partnerships with NGOs and the public in efforts to inventory nongame and aquatic species and possibly in certain habitat management activities.

With regard to threatened and endangered species, as in Alternative A, under Alternative B the refuge would continue to protect all federally listed species, in particular the Indiana and gray bats and listed mussels, under the Endangered Species Act. As necessary, the refuge would continue to control nuisance beavers on a limited basis. The refuge would also control other invasive species if they begin to appear.

Goal 2 concerns management of habitats and essential ecological processes. In pursuit of this goal, Alternative B would be very similar to Alternative A in aiming to maintain existing habitat management programs, practices, and actions.

The refuge would continue moist soil management program on about 1,600 acres. There would be no active forest management, but the refuge would continue its evaluation of past forest treatments for increasing habitat for priority species on the Big Sandy Peninsula. Prescribed fire would not be used as a land management tool. The refuge would maintain the cooperative farming program and continue cultivating crops on about 3,000 acres under Cooperative Farming Agreements and with refuge staff (force-account) for the benefit of waterfowl and resident game species. Bottomland hardwood forest habitat would not be actively managed.

Under Alternative B, the refuge would increase water management efforts toward increasing sportfishing opportunities within the 5,160 acres of impoundments. Working with partners, the refuge would continue to provide mudflats during August-September for shorebird and early migratory waterfowl, scrub-shrub habitat, and desirable aquatic plants. The refuge would also offer additional education and interpretation of importance of early drawdowns of Kentucky Lake.

Alternative B, like Alternative A, would continue annual spraying and biological control of invasive plants alligatorweed, privet species, sesbania, purple loosestrife, encroaching woody vegetation, spatterdock, and parrot feather. The refuge would also conduct mechanical control (mowing and disking) as needed of certain upland plants. Moreover, the refuge would provide additional education and interpretation of invasive species for the public. With regard to climate change, under Alternative B the refuge would relate climate change to the Service's wildlife mission in environmental education programs. However, there would still be no active monitoring or management related to climate change.

Goal 3 calls for identifying and protecting natural and cultural resources on the refuge. Under Alternative B, the refuge would continue to manage cultural resources consistent with Section 106 of the National Historic Preservation Act. The refuge staff would prioritize areas for possible minor boundary expansion to accommodate and better serve refuge visitors.

Goal 4 aims to provide appropriate and compatible wildlife-dependent recreational opportunities, environmental education, and interpretation that foster an appreciation for wildlife and habitat conservation. Alternative B would emphasize Goal 4 more than any other alternative.

Under Alternative B, within five years of CCP approval, the refuge would draft, approve and begin to implement a new Visitor Services Plan using the current format for such documents. Hunting opportunities would be increased for deer and maintained for turkey, squirrel, raccoon, and resident Canada geese, and new hunts would be considered. The refuge would provide opportunities for fishing by furnishing adequate boat launching facilities, bank fishing areas, and over the life of the CCP, provide additional Americans with Disabilities Act (ADA)-compliant fishing piers to accommodate anglers of all abilities.

Tennessee NWR would continue to offer opportunities for wildlife observation and photography throughout the refuge. The refuge would also aim to increase wildlife observation and photography opportunities with blinds and a boardwalk, and within two years of CCP approval, open a seasonal wildlife drive in the Duck River Bottoms. The refuge would continue to provide environmental education (EE) services to the public, including limited visits to schools, EE workshops, and onsite and offsite EE programs, as well as work with partners to expand EE facilities and opportunities on and near the refuge. The refuge's existing interpretive program would be expanded.

Under Alternative B, within five years of CCP approval, Tennessee NWR would work with partners to construct a combined headquarters and visitor center, incorporating "green" technology, on the Big Sandy Unit. Within 15 years of CCP approval, the refuge would build a visitor contact station at the Duck River Unit.

Goal 5 calls for Tennessee NWR to provide personnel, partners, funding, and facilities needed to ensure that the goals and objectives identified in the CCP are achieved. Under Alternative B, the refuge would maintain its current staff of 13 FTEs. Four FTEs would be added, including two refuge rangers, one LE officer, and one office assistant.

Alternative B would maintain the office, bunkhouse, storage and maintenance at Duck River Unit, and the existing inventory of heavy equipment, tractors, refuge roads, levees, water control structures, and pumps. Alternative B would construct a headquarters/visitor center on the Big Sandy Unit and a visitor contact station at the Duck River Unit. The bunkhouse would also be replaced.

Under Alternative B, the refuge would strengthen its volunteer programs, Friend's Group, and partnerships by investing an increased portion of staff time into nurturing these promising relationships.

ALTERNATIVE C: WILDLIFE MANAGEMENT EMPHASIS

Alternative C aims to intensify and expand wildlife and habitat management at Tennessee NWR. This would increase benefits for wildlife species, which fulfills the refuge's purposes and goals. Public use opportunities, and refuge's efforts to provide visitor services, would remain approximately as they are now. This alternative would pursue the same five broad refuge goals as each of the other alternatives.

Goal A concerns managing wildlife and fish populations. It calls for Tennessee NWR to contribute to healthy and viable native wildlife and fish populations representative of the Lower Tennessee-Cumberland River Ecosystem, with special emphasis on waterfowl and other migratory birds. Under Alternative C, the refuge would pursue a number of objectives to advance the wildlife goal.

Concerning waterfowl, under Alternative C, the refuge would provide adequate habitats to meet the foraging needs of 182,000 ducks for 110 days and other habitats that are needed for loafing, roosting, molting, etc. This is a 50 percent increase in the number of ducks under Alternatives A and B. As in the two previous alternatives, Alternative C would also maintain seasonally closed (Nov. 15-March 15) waters, roads, and land areas to provide sanctuary for waterfowl. In addition, Alternative C would increase seasonally closed areas, including the closure of Busseltown and Honey Point Ferry roads.

Alternative C would provide adequate corn and wheat browse to meet the needs of about 16,000 migrant Canada geese for 90 days, the same as Alternatives A and B. In contrast with these two alternatives, however, Alternative C would also readjust population levels as suggested by future needs, that is, it would follow adaptive management principles.

To promote wood duck reproduction, Alternative C would maintain 200-250 nesting boxes (compared to 175 boxes in Alternatives A and B), expanding the program to the Big Sandy and Busseltown units. It would also continue to meet the banding goals of the Mississippi Flyway Council.

Under this alternative, the refuge would create and enhance existing habitat for secretive marshbirds, sufficient to support 25 nesting territories for king rail pairs. Within 10 years of CCP approval, the refuge would provide at least 200-300 acres of foraging sites in multiple impoundments for both northbound and southbound shorebirds during migration and conduct population and habitat surveys to evaluate shorebird use and invertebrate densities within managed and unmanaged habitat. To benefit long-legged wading birds, as in Alternative A, under Alternative C, the refuge would continue to provide for both secure nesting sites and ample foraging habitat.

While neither Alternative A nor B would conduct active management for grassland birds, Alternative C would consider providing 50-100 acres in 1-3 tracts for the Henslow's sparrow and other grassland bird species in the Big Sandy Unit. The refuge would strive to increase the quality of forest habitat to provide for a sustainable increase in the populations of priority forest interior migratory birds. The refuge would also continue to monitor and protect bald eagle nesting sites and count wintering bald eagles on the refuge.

Tennessee NWR would continue to manage populations of resident game species such as deer, turkey, squirrel, raccoon, and resident Canada geese in Alternative C, just like Alternatives A and B.

To learn more about all wildlife species at the refuge, within 10 years of CCP approval, the refuge would develop and implement more baseline inventories for nongame mammals, reptiles, amphibians and invertebrates. Similarly, within 15 years of CCP approval, the refuge would aim to determine species composition, distribution and relative abundance of fishes and invertebrates occurring on the refuge.

Alternative C would continue to protect all federally listed species, in particular the Indiana and gray bats and listed mussels, under the Endangered Species Act. In addition, it would endeavor to determine the distribution and abundance of Indiana and gray bats and listed mussels on the refuge and protect and enhance, if possible, the habitat needed by these species.

As necessary, the refuge would continue to control nuisance beavers on a limited basis and expand nuisance animal species control using approved techniques to help achieve refuge conservation goals and objectives.

Goal 2 calls for maintaining, restoring, and enhancing diverse and resilient habitats and essential processes necessary to support sustainable populations of migratory and resident wildlife species indigenous to the Lower Tennessee-Cumberland Ecosystem. Under this goal, Alternative C would expand or intensify the refuge's existing habitat management programs, practices, and actions.

The refuge would improve the moist soil management program on about 1,600 acres by expanding the invasive exotic plant control program, water management capabilities, and the use of management techniques that set back plant succession. In cooperation with partners, the refuge would reactivate the forest management program on the refuge for the benefit of priority forest interior migratory birds and resident game species. Prescribed fire will be used as a management tool to enhance forested and open land habitats.

Over the life of the CCP, Alternative C would eliminate cooperative farming and reduce total farmed acreage, while increasing the acreage of unharvested cropland through force-account or contract farming to meet the foraging needs of waterfowl and habitat for other native species. It would also increase acreage of hard mast-producing bottomland hardwood forest species.

The refuge would increase its water management capabilities by subdividing existing impoundments, creating new impoundments, and increasing the water supply (i.e., pumps, wells, structures, etc.) for migratory birds. Working with partners, the refuge would continue to provide mudflats during August-September for shorebird and early migratory waterfowl, scrub-shrub habitat, and desirable aquatic plants, as in Alternative A.

Tennessee NWR would expand control efforts of invasive species through active methods of removal. These methods would work towards reducing infestations, and eliminating populations whenever feasible. In response to possible adverse impacts from climate change, the refuge would monitor habitats and wildlife and utilize adaptive management.

Under Goal 3, Tennessee NWR would identify and protect natural and cultural resources. Under this goal, Alternative C would continue to manage cultural resources consistent with Section 106 of the National Historic Preservation Act. It would also target minor boundary expansions to reduce adjacent threats to the refuge and to expand habitat management opportunities.

Goal 4 aims to provide appropriate and compatible wildlife-dependent recreational opportunities, environmental education, and interpretation that foster an appreciation for wildlife and habitat conservation.

Pursuing this goal under Alternative C, Tennessee NWR would continue to provide visitor services under the existing public use review and development plan approved in 1986. For the duration of the CCP, the refuge would manage game populations to maintain quality hunting opportunities while maintaining habitat for federal trust species. The refuge would also continue to provide fishing opportunities, but find partners to help maintain boat ramps and associated facilities.

Alternative C would also continue to offer opportunities for wildlife observation and photography throughout the refuge, and to provide environmental education services to the public, including limited visits to schools, environmental education workshops, and onsite and offsite environmental education programs.

Under Alternative C, Tennessee NWR would continue to maintain its kiosks, brochures, website, signs, and interpretive programs. Within 5 years of CCP approval, the refuge would work with partners to construct a combined headquarters and visitor center, incorporating “green” technology, on the Big Sandy Unit, and within 15 years of CCP approval, build a visitor contact station at the Duck River Unit.

Goal 5 calls for Tennessee NWR to provide personnel, partners, funding, and facilities needed to ensure that the goals and objectives identified in the CCP are achieved. Under Alternative C, the refuge would maintain its current staff of 13 FTEs. The refuge would also add five FTE staff positions, including one forester, one forestry technician, two heavy equipment operators, and one tractor operator.

Alternative C would maintain the office, bunkhouse, storage and maintenance at Duck River Unit, and the existing inventory of heavy equipment, tractors, refuge roads, levees, water control structures, and pumps. Alternative C would also construct a headquarters/visitor center on the Big Sandy Unit and a visitor contact station at the Duck River Unit. The bunkhouse would also be replaced. Lastly, this alternative would add one open and one enclosed equipment storage facility, one no-till grain drill, one self-propelled spray rig, a low ground pressure dozer, one aquatic excavator, and one 24-inch centrifugal pump and engine.

Under Alternative C, Tennessee NWR would maintain its existing partnerships with the TVA, USACE, TWRA, USFS, NPS, NRCS, the Friends group, and other federal, state and local agencies, as well as private NGOs.

ALTERNATIVE D: ENHANCED WILDLIFE MANAGEMENT AND PUBLIC USE PROGRAM (PROPOSED ALTERNATIVE)

Alternative D would enhance both wildlife management and the public use program at Tennessee National Wildlife Refuge. This alternative would pursue the same five broad refuge goals as each of the other alternatives. In general, Alternative D is very similar to Alternative C on the wildlife and habitat goals and objectives, and very similar to Alternative B on the public use goals and objectives.

Goal A concerns managing wildlife and fish populations. It calls for Tennessee NWR to contribute to healthy and viable native wildlife and fish populations representative of the Lower Tennessee-Cumberland River Ecosystem, with special emphasis on waterfowl and other migratory birds. Under Alternative D, the refuge would pursue a number of objectives to advance the wildlife goal.

Concerning waterfowl, under Alternative D, the refuge would provide adequate habitats to meet the foraging needs of 121,000-182,000 ducks (or a range specified by the goals of the North American Waterfowl Management Plan) for 110 days, and other habitats that are needed for loafing, roosting, molting, etc. This objective includes a range that matches Alternatives A and B at the low end and Alternative C at the high end. As in the three previous alternatives, Alternative D would also maintain seasonally closed (Nov. 15-March 15) waters, roads, and lands to provide sanctuary for waterfowl. In addition, Alternative D would consider increasing seasonally closed areas, including possible closure of Busseltown and Honey Point Ferry roads.

Alternative D would provide adequate corn and wheat browse to meet the needs of about 16,000 migrant Canada geese for 90 days, the same as Alternatives A and B. In contrast with these two alternatives, however (but like Alternative C), Alternative D would also readjust population levels as suggested by future needs, that is, it would follow adaptive management principles.

To promote wood duck reproduction, Alternative D would maintain 200-250 nesting boxes (compared to 175 boxes in Alternatives A and B), expanding the program to the Big Sandy and Busseltown units. It would also continue to meet the banding goals of the Mississippi Flyway Council.

Under this alternative, the refuge would create and enhance its existing habitat for secretive marshbirds, sufficient to support 15-25 nesting territories for king rail pairs, which is more than Alternatives A and B, but somewhat less than Alternative C. Within 10 years of CCP approval, the refuge would provide at least 100 acres of foraging sites in multiple impoundments for both northbound and southbound shorebirds during migration and conduct population and habitat surveys to evaluate shorebird use and invertebrate densities within managed and unmanaged habitat. To benefit long-legged wading birds, as in each of the other alternatives, under Alternative D the refuge would continue to provide for both secure nesting sites and ample foraging habitat.

While neither Alternative A nor B would conduct active management for grassland birds, Alternative D, like Alternative C, would consider providing 50-100 acres in 1-3 tracts for the Henslow's sparrow and other grassland bird species in the Big Sandy Unit. The refuge would strive to increase the quality of forest habitat to provide for a sustainable increase in the populations of priority forest interior migratory birds. The refuge would also continue to monitor and protect bald eagle nesting sites and count wintering bald eagles on the refuge.

As in each of the alternatives, Tennessee NWR would continue to manage populations of resident game species such as deer, turkey, squirrel, raccoon, and resident Canada geese in Alternative D.

To learn more about all wildlife species at the refuge, within 10 years of CCP approval, the refuge would develop and implement more baseline inventories for nongame mammals, reptiles, amphibians and invertebrates. Similarly, within 15 years of CCP approval, the refuge would aim to determine the species composition, distribution and relative abundance of fishes and invertebrates occurring on the refuge. The refuge would try to develop partnerships with other agencies, NGOs, and the public in efforts to inventory nongame and aquatic species and participate in the implementation of appropriate management activities.

Alternative D would continue to protect all federally listed species, in particular the Indiana and gray bats and listed mussels, under the Endangered Species Act. In addition, it would endeavor to determine the distribution and abundance of Indiana and gray bats and listed mussels on the refuge and protect and enhance, if possible, the habitat needed by these species.

As necessary, and as in Alternative C, Alternative D would continue to control nuisance beavers on a limited basis and expand nuisance animal species control using approved techniques to help achieve refuge conservation goals and objectives.

Goal 2 calls for maintaining, restoring, and enhancing diverse and resilient habitats and essential processes necessary to support sustainable populations of migratory and resident wildlife species indigenous to the Lower Tennessee-Cumberland Ecosystem. Under this goal, Alternative D would expand or intensify existing habitat management programs, practices, and actions.

The refuge would improve the moist soil management program on about 1,600 acres by expanding the invasive exotic plant control program, water management capabilities, and the use of management techniques that set back plant succession. In cooperation with partners, the refuge would reactivate the forest management program on the refuge for the benefit of priority forest interior migratory birds and resident game species. Prescribed fire will be used as a management tool to enhance forested and open land habitats.

Over the life of the CCP, Alternative D would redirect management actions to increase the acreage of unharvested cropland to meet the foraging needs of waterfowl and habitat for other native species. It would also increase the acreage of hard mast-producing bottomland hardwood forest species.

The refuge would increase water management capabilities by subdividing existing impoundments, creating new impoundments, and increasing the water supply (i.e., pumps, wells, structures, etc.) for migratory birds. While doing this, the refuge would also make a concerted effort to accommodate sportfishing opportunities where and when circumstances allow.

Working with partners, the refuge would continue to provide mudflats during August-September for shorebird and early migratory waterfowl, scrub-shrub habitat, and desirable aquatic plants, as in Alternatives A and C. As in Alternative B, the refuge would also provide additional education and interpretation on the importance of early drawdowns of Kentucky Lake.

Tennessee NWR would expand control efforts of invasive species through active methods of removal. These methods would work towards reducing infestations, and eliminating populations whenever feasible. Additional education and interpretation of invasive species would be provided.

In response to possible adverse impacts from climate change, the refuge would monitor habitats and wildlife and utilize adaptive management. The refuge would also relate climate change to the Service's wildlife mission in environmental education programs and pursue opportunities for carbon sequestration with native trees.

Under Goal 3, Tennessee NWR would identify and protect natural and cultural resources. Under this goal, Alternative D would continue to manage cultural resources consistent with Section 106 of the National Historic Preservation Act. Alternatives A, B, and C would also do so, but only Alternative D would begin to implement a Cultural Resources Management Plan (CRMP) within 15 years of CCP approval. Alternative D would pursue and prioritize minor boundary expansions to (1) reduce adjacent threats to the refuge, (2) expand habitat management opportunities, and (3) accommodate refuge visitors.

Goal 4 aims to provide appropriate and compatible wildlife-dependent recreational opportunities, environmental education, and interpretation that foster an appreciation for wildlife and habitat conservation. With regard to this goal, Alternative D is very similar to Alternative B, the Public Use Emphasis alternative.

Under Alternative D, within five years of CCP approval, the refuge would draft, approve and begin to implement a new Visitor Services Plan using the current format for such documents. Hunting opportunities would be increased for deer and the refuge would continue to allow managed, limited hunting for turkey, squirrel, raccoon, and resident Canada geese. No youth waterfowl hunt or rabbit and quail hunting would be considered. The refuge would provide opportunities for fishing by furnishing adequate launching facilities, bank fishing areas, and over the life of the CCP, provide additional ADA-compliant fishing piers to accommodate anglers of all abilities.

Tennessee NWR would continue to offer opportunities for wildlife observation and photography throughout the refuge. The refuge would also aim to increase wildlife observation and photography opportunities with blinds and a boardwalk, and within two years of CCP approval, open a seasonal wildlife drive in the Duck River Bottoms. The refuge would continue to provide environmental education services to the public, including limited visits to schools, EE workshops, and onsite and offsite EE programs, as well as work with partners to expand EE facilities and opportunities on and near the refuge. The existing interpretive program would be expanded.

Under Alternative B, within five years of CCP approval, Tennessee NWR would work with partners to construct a combined headquarters and visitor center, incorporating “green” technology, on the Big Sandy Unit. Within 15 years of CCP approval, the refuge would build a visitor contact station at the Duck River Unit.

Goal 5 calls for Tennessee NWR to provide personnel, partners, funding, and facilities needed to ensure that the goals and objectives identified in the CCP are achieved. Under Alternative D, the refuge would expand its current staff by twelve FTEs, including one forester, one forestry technician, two heavy equipment operators, one tractor operator, two refuge rangers, one law enforcement officer, two biological technicians, one assistant manager, and one office assistant.

Alternative D would maintain the office, bunkhouse, storage and maintenance at the Duck River Unit, and the existing inventory of heavy equipment, tractors, refuge roads, levees, water control structures, and pumps. Alternative D would also construct a new headquarters/visitor center on the Big Sandy Unit and a new visitor contact station at the Duck River Unit. The bunkhouse would also be replaced. Lastly, this alternative would add one open and one enclosed equipment storage facility, one no-till grain drill, one self-propelled spray rig, a low ground pressure dozer, one aquatic excavator, and one 24-inch centrifugal pump and engine. Under Alternative D, as in Alternative B, the refuge would strengthen its volunteer programs, Friend’s group, and partnerships by investing an increased portion of staff time into nurturing these promising relationships.

ALTERNATIVES CONSIDERED BUT ELIMINATED FROM FURTHER ANALYSIS

The alternatives development process under NEPA and the Refuge Improvement Act is designed to allow consideration of the widest possible range of issues and potential management approaches. During the alternatives development process, many different solutions were considered. The following alternative components were considered but were not selected for detailed study in this Draft CCP/EA for the reason(s) described.

PRE-SETTLEMENT CONDITIONS

This alternative is often used as a baseline in the development of CCP alternatives. Pre-settlement conditions typically refer to the habitat conditions that prevailed on lands that eventually became a refuge prior to significant Euro-American settlement of North America over the last several centuries. In the case of Tennessee NWR, most upland sites would have been covered by oak-hickory hardwood forests. The American chestnut, later wiped out by the fungal pathogen *Cryphonectria parasitica* (the chestnut blight), was also present on upland sites. Bottomlands near the Tennessee River and its many tributaries would also have been characterized by hardwood forest, but with a somewhat different species composition; sycamores, yellow poplar, willows, and certain oaks predominated. There would be no cropland, grasslands, or managed wetlands. Kentucky Lake would not exist and the Tennessee River would flow unimpeded through the refuge, bordered on both sides by bottomland hardwood forests.

This alternative was considered by the planning team but rejected on the basis of its impracticability. In particular, removal of the TVA’s Kentucky Dam and Kentucky Lake is unfeasible politically because of the significant adverse effects on navigation, recreation, hydroelectric generation, and flood control that would result. In addition, the potential environmental impacts of such an action would be significant enough as to require a full Environmental Impact Statement (EIS) and supporting technical analyses.

CUSTODIAL MANAGEMENT OF UPLAND AND WETLAND HABITAT

Under this scenario, the refuge staff would cease all management of both upland and wetland habitat at Tennessee NWR. The staff would allow natural succession to proceed unhindered on upland and bottomland sites and not control invasive emergent vegetation on Kentucky Lake or any of the impoundments. No upland invasive plant species control would be carried out and no forest thinning would take place. Moist soil units would cease to be actively managed and farmland would be allowed to revert to forest. The refuge staff would focus its efforts on research and data collection related to successional trends and on management of public visitation to the refuge.

This alternative was considered and abandoned from detailed consideration because of the unsatisfactory outcomes it would lead to in all probability for both wildlife and habitat. In particular, if the refuge were to implement this alternative, it would be ignoring its purposes and goals, such as providing for the needs of wintering migratory waterfowl. Permitting the unchecked proliferation of invasive aquatic species would not only reduce the habitat value, but also the recreational value (fishing) of Kentucky Lake, adjacent impoundments, and former moist soil units. Furthermore, the refuge's partnering agencies – including the TVA and the TWRA – would not agree to what they would see as an abdication of the Service's wildlife and habitat management responsibilities.

CONTROL OF KENTUCKY LAKE WATER LEVELS

Under this alternative, Tennessee NWR would manage the water levels in Kentucky Lake for the benefit of nesting and wintering bird populations in the refuge. Current management of those water levels by the Tennessee Valley Authority is sub-optimal for wildlife and especially waterfowl.

This alternative was considered but dismissed because the TVA and USACE have the legal right and obligation to manipulate reservoir water levels to meet a variety of competing and sometimes conflicting needs, of which wildlife is but one. The TVA and USACE would not and could not relinquish this responsibility to the Service.

SUBSTANTIAL EXPANSION OF RECREATIONAL OPPORTUNITIES

Under this alternative, Tennessee NWR would undertake a large increase of recreational opportunities on the refuge, including the development of more trails, boat ramps, docks, wildlife observation decks and platforms, an expanded wildlife drive, canoe trails, increased hunting opportunities, and camping.

This alternative was considered but rejected because for several reasons, including staffing and budgetary constraints, conflicts between excessive recreational presence/visitation and sanctuary/rest for wildlife, as well as the fact that ample recreational opportunities are available in the area, including the Land Between the Lakes National Recreation Area, the nonrefuge portions of Kentucky Lake, state wildlife management areas, and Paris Landing State Park.

COMPARISON OF ALTERNATIVES

Table 9 compares each of the four alternatives according to the management issues raised during scoping.

Table 9. Comparison of alternatives by management issues for Tennessee NWR.

Issue	Alternative A: Current Management (No Action)	Alternative B: Public Use Emphasis	Alternative C: Wildlife Management Emphasis	Alternative D: Enhanced Wildlife Management and Public Use Program (Proposed Alternative)
Goal 1: Contribute to healthy and viable native wildlife and fish populations representative of the Lower Tennessee-Cumberland Ecosystem, with special emphasis on waterfowl and other migratory birds.				
Migratory ducks	Provide adequate habitats to meet the foraging needs of 121,000 ducks for 110 days and other habitats that are needed for loafing, roosting, molting, etc.	Same as Alternative A.	Provide adequate habitats to meet the foraging needs of 182,000 ducks for 110 days and other habitats that are needed for loafing, roosting, molting, etc.	Provide adequate habitats to meet the foraging needs of 121,000-182,000 ducks (or a range specified by NAWMP goals) for 110 days and other habitats that are needed for loafing, roosting, molting, etc.
Migratory geese	Provide adequate corn and wheat browse to meet the needs of about 16,000 migrant Canada geese for 90 days.	Same as Alternative A.	Same as Alternative A but readjust population levels as suggested by future needs.	Same as Alternative C.
Sanctuary	Maintain seasonally closed (Nov. 15-March 15) waters, roads, and land areas to provide sanctuary for waterfowl.	Same as Alternative A.	Increase seasonally closed areas, including closure of Busseltown and Honey Point Ferry roads.	Same as Alternative C.
Wood ducks	Continue to maintain 175 nesting boxes on the Duck River Unit and meet the banding goals	Same as Alternative A.	Maintain 200-250 nesting boxes, expanding program to the Big Sandy and Busseltown Units	Same as Alternative C.

Issue	Alternative A: Current Management (No Action)	Alternative B: Public Use Emphasis	Alternative C: Wildlife Management Emphasis	Alternative D: Enhanced Wildlife Management and Public Use Program (Proposed Alternative)
	of the Mississippi Flyway Council.		and continue to meet the banding goals of the Mississippi Flyway Council.	
Marshbirds	Continue to protect a minimum of 50 acres of habitat for secretive marshbirds, sufficient to support 10 nesting territories for king rails.	Same as Alternative A.	Create and enhance existing habitat for secretive marshbirds, sufficient to support 25 nesting territories for king rail pairs.	Create and enhance existing habitat for secretive marshbirds, sufficient to support 15-25 nesting territories for king rail pairs.
Shorebirds	Continue to provide at least 50 acres of foraging sites for both northbound and southbound shorebirds during migration and conduct population surveys. .	Same as Alternative A.	Within 10 years of CCP approval, provide at least 200-300 acres of foraging sites in multiple impoundments for both northbound and southbound shorebirds during migration and conduct population and habitat surveys to evaluate shorebird use and invertebrate densities within managed and unmanaged habitat.	Within 10 years of CCP approval, provide at least 100 acres of foraging sites in multiple impoundments for both northbound and southbound shorebirds during migration and conduct population and habitat surveys to evaluate the shorebird use and invertebrate densities within managed and unmanaged habitat.
Long-legged wading birds	Continue to provide for both secure nesting sites and ample foraging habitat.	Same as Alternative A.	Same as Alternative A.	Same as Alternative A.
Grassland birds	No active management for grasslands.	Same as Alternative A.	Consider providing 50-100 acres in 1-3 tracts for Henslow's sparrow and	Same as Alternative C.

Issue	Alternative A: Current Management (No Action)	Alternative B: Public Use Emphasis	Alternative C: Wildlife Management Emphasis	Alternative D: Enhanced Wildlife Management and Public Use Program (Proposed Alternative)
			other grassland species in the Big Sandy Unit.	
Forest interior migratory birds	Continue to provide habitat to benefit existing populations of priority forest interior migratory birds.	Same as Alternative A.	Increase quality of forest habitat to provide for sustainable increase in populations of priority forest interior migratory birds.	Same as Alternative C.
Bald eagles	Continue to monitor and protect nesting sites and count wintering bald eagles on the refuge.	Same as Alternative A.	Same as Alternative A.	Same as Alternative A.
Resident game species	Continue to manage populations of resident game species such as deer, turkey, squirrel, raccoon, and resident Canada goose.	Same as Alternative A.	Same as Alternative A.	Same as Alternative A.
Resident nongame species	Continue to maintain and periodically update lists of resident nongame species and continue to provide indirect benefits through habitat management for targeted species.	Develop partnerships with NGOs and the public in efforts to inventory nongame species and possibly in certain habitat management activities.	Within 10 years of CCP approval, develop and implement more baseline inventories for nongame mammals, reptiles, amphibians and invertebrates.	Same as Alternative C, and develop partnerships with other agencies, NGOs and the public in efforts to inventory nongame species and participate in the implementation of appropriate management activities.
Fishes and other aquatic species	Continue to maintain fish list; otherwise no active	Develop partnerships with NGOs and the	Within 15 years of CCP approval, determine	Same as Alternative C, and develop partnerships

Issue	Alternative A: Current Management (No Action)	Alternative B: Public Use Emphasis	Alternative C: Wildlife Management Emphasis	Alternative D: Enhanced Wildlife Management and Public Use Program (Proposed Alternative)
	management or research.	public in efforts to inventory aquatic species.	species composition, distribution and relative abundance of fishes and invertebrates occurring on the refuge	with other agencies, NGOs and the public in efforts to inventory aquatic species.
Threatened and endangered species	Continue to protect all federal listed species, in particular the Indiana and gray bats and listed mussels, under the Endangered Species Act.	Same as Alternative A.	Determine the distribution and abundance of Indiana and gray bats and listed mussels on the refuge and protect and enhance, if possible, the habitat needed by these species.	Same as Alternative C.
Nuisance animal species control	As necessary, continue to control nuisance beavers on a limited basis.	Same as Alternative A, and control other invasive species if they begin to appear.	When necessary, expand nuisance animal species control using approved techniques to help achieve refuge conservation goals and objectives.	Same as Alternative C.
Goal 2: Maintain, restore, and enhance diverse and resilient habitats and essential processes necessary to support sustainable populations of migratory and resident wildlife species indigenous to the Lower Tennessee-Cumberland Ecosystem.				
Moist soil	Continue moist soil management program on about 1,600 acres of the refuge.	Same as Alternative A.	Improve the moist soil management program on about 1,600 acres by expanding the invasive	Same as Alternative C.

Issue	Alternative A: Current Management (No Action)	Alternative B: Public Use Emphasis	Alternative C: Wildlife Management Emphasis	Alternative D: Enhanced Wildlife Management and Public Use Program (Proposed Alternative)
			exotic plant control program, water management capabilities, and the use of management techniques that set back plant succession.	
Forest management	No active forest management, but continue evaluation of past forest treatments for increasing habitat for priority species on the Big Sandy Peninsula.	Same as Alternative A.	In cooperation with partners, reactivate forest management program on the refuge to the benefit of priority forest interior migratory birds and resident game species. Increase acreage of hard mast producing bottomland hardwood forest species.	Same as Alternative C.
Agriculture	Continue cultivating about 3,000 acres under Cooperative Farming Agreements and with refuge staff (force-account) for the benefit of waterfowl and resident game species.	Same as Alternative A.	Over the life of the CCP, eliminate cooperative farming and reduce total farmed acreage, while increasing acreage of unharvested cropland through force-account or contract farming to meet foraging needs of waterfowl and habitat for other native species.	Over the life of the CCP, redirect management actions to increase acreage of unharvested cropland to meet foraging needs of waterfowl and habitat for other native species.

Issue	Alternative A: Current Management (No Action)	Alternative B: Public Use Emphasis	Alternative C: Wildlife Management Emphasis	Alternative D: Enhanced Wildlife Management and Public Use Program (Proposed Alternative)
Managed internal impoundments	Continue current water management of about 5,160 acres of impounded water management units.	Increase water management efforts toward sportfishing opportunities within the impoundments.	Increase water management capabilities by subdividing existing impoundments, creating new impoundments, and increasing water supply (i.e., pumps, wells, structures, etc.) for migratory birds.	Same as Alternative C, but also make a concerted effort to accommodate sportfishing opportunities where and when circumstances allow.
Kentucky Lake wetland habitats	Working with partners, continue to provide mudflats during August-September for shorebird and early migratory waterfowl, scrub-shrub habitat, and desirable aquatic plants.	Same as Alternative A, plus additional education and interpretation of importance of early drawdowns of Kentucky Lake.	Same as Alternative A.	Same as Alternative B.
Invasive plants	Continue annual spraying of invasive plants alligatorweed, privet species, sesbania, purple loosestrife, encroaching woody vegetation, spatterdock, and parrot feather. Also conduct mechanical control (mowing and disking) as needed of certain upland plants.	Same as Alternative A, plus additional education and interpretation of invasive species.	Expand control efforts of invasive species through active methods of removal. These methods will work towards reducing infestations, and eliminating populations whenever feasible.	Alternative B and C combined.

Issue	Alternative A: Current Management (No Action)	Alternative B: Public Use Emphasis	Alternative C: Wildlife Management Emphasis	Alternative D: Enhanced Wildlife Management and Public Use Program (Proposed Alternative)
Fire Management	No active fire management program or plan established on the refuge.	Establish fire management plan and implement only when a public safety concern arises.	Develop a fire management plan and incorporate the use of prescribed fire as part of the forest management program, open lands management, and facilities maintenance.	Same as Alternative C.
Accelerated climate change	No active monitoring, management, or education related to climate change.	Relate climate change to the Service's wildlife mission in environmental education programs.	Monitor habitats and wildlife and utilize adaptive management to respond to possible climate change adverse impacts.	Combination of B and C and pursuing opportunities for carbon sequestration with native trees.
Goal 3: Identify and protect natural and cultural resources on the refuge.				
Cultural and historic resources	Continue to manage cultural resources consistent with Section 106 of the National Historic Preservation Act.	Same as Alternative A.	Same as Alternative A.	Same as Alternative A. Also, within 5 years of CCP approval, develop and begin to implement a Cultural Resources Management Plan (CRMP).

Issue	Alternative A: Current Management (No Action)	Alternative B: Public Use Emphasis	Alternative C: Wildlife Management Emphasis	Alternative D: Enhanced Wildlife Management and Public Use Program (Proposed Alternative)
Land acquisition/minor boundary expansion	Refuge acreage and boundaries continue unchanged; no acquisition or minor boundary expansion pursued.	Prioritize areas for possible minor boundary expansion to accommodate refuge visitors.	Target minor boundary expansions to reduce adjacent threats to refuge and expand habitat management opportunities.	Combination of Alternatives B and C.
Goal 4: Provide appropriate and compatible wildlife-dependent recreational opportunities, environmental education, and interpretation that foster an appreciation for wildlife and habitat conservation.				
Visitor services	Continue to provide visitor services under the existing public use review and development plan approved in 1986,	Within 5 years of CCP approval, draft, approve and begin to implement a new Visitor Services Plan using the current format for such documents.	Same as Alternative A.	Same as Alternative B.
Hunting	Continue to allow managed, limited hunting for deer, turkey, squirrel, raccoon, and resident Canada goose.	Increase hunting opportunities for deer. Maintain opportunities for turkey, squirrel, raccoon, and resident Canada goose. Consider new hunts. .	For the duration of the CCP, manage game populations to maintain quality hunting opportunities while maintaining habitat for federal trust species.	Increase hunting opportunities for deer. Continue to allow managed, limited hunting for turkey, squirrel, raccoon, and resident Canada goose.
Fishing	Continue to provide opportunities for fishing on the refuge.	Provide opportunities for fishing on the refuge by furnishing adequate launching facilities, bank fishing areas, and over	Continue to provide fishing opportunities, but find partners to help maintain boat ramps and associated facilities.	Same as Alternative B.

Issue	Alternative A: Current Management (No Action)	Alternative B: Public Use Emphasis	Alternative C: Wildlife Management Emphasis	Alternative D: Enhanced Wildlife Management and Public Use Program (Proposed Alternative)
		the life of the CCP, provide additional ADA-compliant piers to accommodate anglers of all abilities.		
Wildlife observation and wildlife photography	Continue to offer opportunities for wildlife observation and photography throughout the refuge.	Same as Alternative A, and increase wildlife observation/photography opportunities with blinds and a boardwalk, and within 2 years of CCP approval, open a seasonal wildlife drive in the Duck River Bottoms.	Same as Alternative A.	Same as Alternative B.
Environmental education	Continue to provide environmental education services to the public, including limited visits to schools, EE workshops, and onsite and offsite EE programs.	Same as Alternative A, and work with partners to expand EE facilities and opportunities on and near the refuge.	Same as Alternative A.	Same as Alternative B.
Interpretation	Continue to maintain kiosks, brochures, website, signs, and interpretive programs.	Expand on existing interpretive program.	Same as Alternative A.	Same as Alternative B.
Visitor center and visitor contact station	No visitor center at rented refuge HQ.	Within 5 years of CCP approval, work with partners to construct a combined headquarters	Same as Alternative B.	Same as Alternative B.

Issue	Alternative A: Current Management (No Action)	Alternative B: Public Use Emphasis	Alternative C: Wildlife Management Emphasis	Alternative D: Enhanced Wildlife Management and Public Use Program (Proposed Alternative)
		and visitor center, incorporating "green" technology, on the Big Sandy Unit, and within 15 years of CCP approval, build a visitor contact station at the Duck River Unit.		
Goal 5: Provide personnel, partners, funding, and facilities needed to ensure that the goals and objectives identified in this CCP are achieved.				
Staffing	Maintain current staff of 13 FTEs, including refuge manager, deputy refuge manager, 2 refuge biologists, refuge ranger, refuge planner, 2 law enforcement officers, 3 heavy equipment operators, administrative officer, and assistant manager.	Maintain current staff and add 4 FTEs, including 2 refuge rangers, 1 L.E. officer, and 1 office assistant.	Maintain current staff and add 5 FTEs, including 1 forester, 1 forestry technician, 2 heavy equipment operators, and 1 tractor operator.	Maintain current staff and add 12 FTEs, including 1 forester, 1 forestry technician, 2 engineering equipment operators, 1 tractor operator, 2 refuge ranger, 1 L.E. officer, 1 assistant manager, 2 biological technicians, and 1 office assistant.
Facilities, equipment and infrastructure	Maintain existing stock of rented office space for HQ in Paris, office, bunkhouse, storage & maintenance at Duck River Unit, and existing stock of heavy	Same as Alternative A (except for rented office) but add HQ/visitor center and Duck River visitor contact station and replace bunkhouse.	Same as Alternative B, plus replace Duck River office/maintenance facility and add 1 open & 1 enclosed equipment storage facility, 1 no-till grain drill, 1 self-propelled	Same as Alternative C.

Issue	Alternative A: Current Management (No Action)	Alternative B: Public Use Emphasis	Alternative C: Wildlife Management Emphasis	Alternative D: Enhanced Wildlife Management and Public Use Program (Proposed Alternative)
	equipment, tractors, refuge roads, levees, water control structures, and pumps.		spray rig, low ground pressure dozer, 1 aquatic excavator, 1 24-inch centrifugal pump and engine.	
Volunteers and partnerships	Maintain existing partnerships with TVA, USACE, TWRA, USFS, NPS, NRCS, Friends Group, and other federal, state and local agencies, as well as private NGOs.	Strengthen the refuge's volunteer programs, Friend's Group, and partnerships by investing an increased portion of staff time into nurturing these promising relationships.	Same as Alternative A.	Same as Alternative B.

IV. Environmental Consequences

OVERVIEW

This section analyzes and discusses the potential environmental effects or consequences that can be reasonably expected by the implementation of each of the four alternatives described in Chapter III of this environmental assessment. For each alternative, the expected outcomes are portrayed through the 15-year life of the comprehensive conservation plan.

EFFECTS COMMON TO ALL ALTERNATIVES

A few potential effects will be the same under each alternative. These are summarized under seven categories: environmental justice, climate change, other management, land acquisition, cultural resources, refuge revenue-sharing, and other effects.

ENVIRONMENTAL JUSTICE

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

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

CLIMATE CHANGE

The U.S. Department of the Interior issued an order in January 2001 requiring federal agencies with land management responsibilities under its direction to consider the potential impacts of climate change as part of their long-range planning endeavors.

The increase of carbon dioxide and other greenhouse gases within the earth's atmosphere has been linked to the gradual rise in surface temperatures commonly referred to as global warming. In relation to comprehensive planning for national wildlife refuges, carbon sequestration constitutes the primary climate-related impact to be considered in planning. The U.S. Department of Energy's *Carbon Sequestration Research and Development* (U.S. Department of Energy 1999) defines carbon sequestration as "... the capture and secure storage of carbon that would otherwise be emitted to or remain in the atmosphere."

The land is a tremendous force in carbon sequestration. Terrestrial biomes of all sorts – grasslands, forests, wetlands, tundra, perpetual ice, and desert – are effective both in preventing carbon emissions and in acting as a biological "scrubber" of atmospheric carbon monoxide. The conclusions of the Department of Energy's report noted that ecosystem protection is important to carbon sequestration and may reduce or prevent the loss of carbon currently stored in the terrestrial biosphere.

Conserving natural habitat for wildlife is the heart of any long-range plan for national wildlife refuges. The actions proposed in this comprehensive conservation plan would conserve or restore land and water, and would thus enhance carbon sequestration. This, in turn, contributes positively to efforts to mitigate human-induced global climate changes.

OTHER MANAGEMENT

All management activities that could affect the refuge's natural resources, including subsurface mineral reservations, utility lines and easements, soils, water and air, and historical and archaeological resources, would be managed to comply with all laws and regulations. In particular, any existing and future oil and gas exploration, extraction, and transport operations on the refuge would be managed identically under each of the alternatives. Thus, the impacts would be the same.

LAND ACQUISITION

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

CULTURAL RESOURCES

All alternatives afford additional land protection and low levels of development, thereby producing little negative effect on the refuge's cultural and historic resources. Potentially negative effects could include logging, construction of new trails or facilities, and development of water impoundments. In most cases, these management actions would require review by the Service's Regional Archaeologist in consultation with the State of Tennessee Historic Preservation Office, as mandated by Section 106 of the National Historic Preservation Act. Therefore, the determination of whether a particular action within an alternative has the potential to affect cultural resources is an ongoing process that would occur during the planning stages of every project.

Service acquisition of land with known or potential archaeological or historical sites provides two major types of protection for these resources: protection from damage by federal activity and protection from vandalism or theft. The National Historic Preservation Act requires that any actions by a federal agency which may affect archaeological or historical resources be reviewed by the State Historic Preservation Office, and that the identified effects must be avoided or mitigated. The Service's policy is to preserve these cultural, historic, and archaeological resources in the public trust, and avoid any adverse effects wherever possible.

Land acquisition, within the current acquisition boundary, by the Service would provide some degree of protection to significant cultural and historic resources. If acquisition of private lands does not occur and these lands remain under private ownership, the landowner would be responsible for protecting and preserving cultural resources. Development of off-refuge lands has the potential to destroy archaeological artifacts and other historical resources, thereby decreasing opportunities for cultural resource interpretation and research.

REFUGE REVENUE-SHARING

Annual refuge revenue-sharing payments to Benton, Decatur, Henry, and Humphreys counties would continue at similar rates under each alternative. If lands are acquired and added to the refuge, the payments would increase accordingly.

OTHER EFFECTS

Each of the alternatives would have similar effects or minimal to negligible effects on soils, water quality and quantity, noise, transportation, human health and safety, children, hazardous materials, waste management, aesthetics and visual resources, and utilities and public services.

SUMMARY OF EFFECTS BY ALTERNATIVE

The following section describes the environmental consequences of adopting each refuge management alternative. Table 10 summarizes and addresses the likely outcomes for the specific issues, and is organized by broad issue categories.

ALTERNATIVE A: CURRENT MANAGEMENT (NO ACTION)

As described in Chapter III of the EA, in general, Alternative A would maintain the refuge's current management direction, that is, the refuge's habitats and wildlife populations would continue to be managed as they have in recent years.

Under this alternative, no overall changes are anticipated in either wintering duck or geese populations on the refuge. Maintaining the existing set of 175 nesting boxes would help maintain the breeding population of wood ducks at Tennessee NWR. Populations of secretive marshbirds, including king rails, would likely remain unchanged and no change is expected in the numbers of migrating shorebirds in spring and fall. Similarly, no change in populations of resident long-legged wading birds is predicted to occur.

Grassland birds will likely continue to occur incidentally and in relatively small numbers on the refuge. There would be no change to existing populations of priority forest interior migratory birds, except consistent with wide-scale continent-wide trends. Numbers of nesting and wintering bald eagles are likely to remain stable or increase gradually.

Concerning game species on the refuge, deer, turkey, squirrel, raccoon, and resident Canada goose populations are unlikely to change under Alternative A. Among nongame species, no changes in the relative abundance or diversity are expected. Likewise, no changes are anticipated in fish populations or aquatic species diversity.

Alternative A would continue to protect federally listed species such as the Indiana bat, gray bat, and listed mussels. Any change in numbers of listed species on the refuge (increase or decrease) would be due to external factors beyond the refuge's control.

Continuing to control problem beavers as needed would limit their impacts on facilities and infrastructure at Tennessee NWR.

In general, habitats would remain the same under Alternative A. Moist soil acreage, management, and the wildlife benefits associated with moist soil unit seed production would continue unchanged. While there would be no new active forest management in this alternative, evaluation of past forest treatments for increasing habitat for priority species on the Big Sandy Peninsula would continue. Prescribed fire would not be used as a land management tool. The acreage of cropland habitat on the refuge would remain the same, as would the amount of grain production and the quantities left for game and nongame wildlife.

The limited acreage of bottomland hardwood forest at Tennessee NWR would remain unchanged; habitat values for wildlife would also stay the same. The current acreage of managed internal impoundments and the benefits they provide to wildlife would continue. Mudflats, scrub-shrub habitat, and desirable aquatic plants continue at current levels.

The limited control of invasive plants provided by this alternative would likely maintain their status on the refuge, neither increasing nor decreasing the level of encroachment in terrestrial and aquatic habitats. Alternative A would continue to protect known cultural resources in accordance with Section 106 of the National Historic Preservation Act. The refuge's acreage and boundaries would both remain unchanged.

Under this alternative, visitor services and facilities, and related opportunities for public use would largely continue as at present level. Hunting, fishing, and wildlife observation and photography opportunities would remain unchanged. Continued environmental education services for the public would represent a beneficial impact. Kiosks, brochures, website, signs, and interpretive programs would maintain present level of beneficial impacts.

The lack of a visitor center would continue to represent a disadvantage for the refuge and the visiting public. There would be no impacts either from or on existing facilities, equipment and infrastructure maintained.

Few changes in the refuge's climate are likely to be observable over the coming 15 years. Average temperatures may rise somewhat, with hotter summers and warmer winters, especially winter nights. There could be changes to total precipitation and distribution and an increase in severe weather events. The specific ecological implications of long-term changes to the refuge's climate are not predictable at present, but broadly, ecosystems may experience some disturbance and change, and there may be relative "winners" and "losers" among various species of plants and animals.

ALTERNATIVE B: PUBLIC USE EMPHASIS

In general, Alternative B would emphasize enhanced public use on Tennessee NWR.

Under this alternative, no overall changes are anticipated in either wintering duck or geese populations on the refuge. Maintaining the existing set of 175 nesting boxes would help maintain the breeding population of wood ducks at Tennessee NWR. Populations of secretive marshbirds, including king rails, would likely remain unchanged. The greater level of effort (with partners) to inventory shorebirds and possibly undertake certain habitat management activities may lead to somewhat greater populations of migrating shorebirds in the spring and fall.

No change in populations of resident long-legged wading birds is predicted to occur. Grassland birds will likely continue to occur incidentally and in relatively small numbers on the refuge. There would be no change to existing populations of priority forest interior migratory birds, except consistent with wide-scale continent-wide trends. Numbers of nesting and wintering bald eagles are likely to remain stable or increase gradually. Among resident game species on the refuge, including deer, turkey, squirrel, raccoon, and resident Canada goose, populations are unlikely to change under Alternative B.

With regard to nongame species, including amphibians and reptiles, the proposed development of partnerships with the public to inventory nongame species and possibly carry out habitat management activities may have a beneficial effect on their populations and species diversity. No changes are anticipated in fish populations or aquatic species diversity. Federally listed species such as the Indiana bat, gray bat, and listed mussels would continue to be protected under Alternative B. Any increase or decrease in numbers on the refuge would be due to external factors beyond the refuge's control. The control of invasive animals if they begin to appear would provide greater protection for native flora and fauna than in Alternative A.

In general, habitats would remain the same under Alternative B, as with Alternative A. Moist soil acreage, management, and the wildlife benefits associated with moist soil unit seed production would continue unchanged. While there would be no new active forest management in this alternative, evaluation of past forest treatments for increasing habitat for priority species on the Big Sandy Peninsula would continue. Prescribed fire would not be used as a land management tool. The acreage of cropland habitat on the refuge would remain the same, as would the amount of grain production and the quantities left for game and nongame wildlife. The limited acreage of bottomland hardwood forest at Tennessee NWR would remain unchanged; habitat values for wildlife would also stay the same.

Sportfishing opportunities within the refuge's managed internal impoundments may increase because of the greater emphasis on expanding recreational opportunities. Kentucky Lake's wetland habitats, including mudflats, scrub-shrub habitat, and desirable aquatic plants, would all continue at current levels. The limited control of invasive plants provided by this alternative would likely maintain their status on the refuge, neither increasing nor decreasing the level of encroachment in terrestrial and aquatic habitats. Alternative B would continue to protect known cultural resources in accordance with Section 106 of the National Historic Preservation Act.

This alternative may result in possible minor boundary expansion to better accommodate visitors, which would be a beneficial impact. Similarly, preparing and implementing a new Visitor Services Plan would likely improve and/or expand visitor services and associated public use. Hunting opportunities for deer would increase somewhat, which would benefit hunters. Other hunting opportunities would stay the same as they are at present. Furnishing additional fishing facilities would represent a beneficial impact.

Alternative B would aim to increase facilities for wildlife observation and photography, including a seasonal wildlife drive in the Duck River Bottoms, which would be beneficial for the public. Expanded EE facilities and opportunities on and near the refuge, as well as an expanded interpretive program, would increase beneficial impacts on each of these "Big 6" uses.

One of the major differences between the public use-related impacts of Alternative B, versus the No Action Alternative A, would be the addition of a visitor center and new contact station. This would be a very positive benefit for the public visiting Tennessee NWR. However, adding a new headquarters/visitor center, Duck River visitor contact station, and replacing the bunkhouse would increase the facilities that require maintenance and represent an additional budgetary and staffing burden for the refuge.

With regard to climate change, possible impacts on habitats, wildlife and public use would be the same as Alternative A (see the description there), but under Alternative B, the refuge would integrate information and education on climate change into its messages and exhibits.

ALTERNATIVE C: WILDLIFE MANAGEMENT EMPHASIS

Alternative C aims to intensify and expand wildlife and habitat management at Tennessee NWR. This would increase benefits for wildlife species, which fulfills the refuge's purposes and goals. Public use opportunities and refuge's efforts to provide visitor services would remain approximately as they are now.

Under this alternative, the refuge would likely support larger wintering duck numbers than at present, but it is expected that there would be no overall change in wintering geese populations. Adding 25-75 more nesting boxes for a total of 200-250 on the refuge, and expanding into other units would likely increase the breeding population of wood ducks on the refuge. Creating more and enhancing existing habitat for secretive marshbirds would probably lead to slightly higher populations. Increasing the number and acreage of foraging sites during both spring and fall migration would likely increase transient shorebird numbers during these seasons.

In Alternative C, no changes in the populations of long-legged wading birds are expected, as with Alternative A. However, the refuge may see a greater presence and numbers of Henslow's sparrows and other grassland bird species in the Big Sandy Unit as a result of efforts made on their behalf. Also, there could be an increase in the populations of priority forest interior migratory birds in response to improved habitats that would occur in this alternative, if fully implemented.

The numbers of nesting and wintering bald eagles is likely to remain stable or increase gradually, as under current management direction. Game species, including deer, turkey, squirrel, raccoon, and resident Canada goose populations, are unlikely to change substantially. Developing and implementing baseline inventories for nongame mammals, reptiles, amphibians and invertebrates within 10 years of CCP approval would increase managers' knowledge of the resource and perhaps eventually result in greater numbers and/or species diversity. No changes are anticipated in fish populations or species diversity under Alternative C.

Federally listed species such as the Indiana bat, gray bat, and listed mussels would continue to be protected; any change in their numbers on the refuge (increase or decrease) would be due to external factors beyond the refuge's control. Determining the distribution and abundance of all federally listed species would increase managers' knowledge and possibly allow for greater protective and recovery measures. Control of invasive animals if they begin to appear (as with Alternative B) would provide greater protection for native flora and fauna.

Alternative C would emphasize habitat enhancements to benefit wildlife. Improved moist soil management would increase wildlife benefits by increasing seed production. In cooperation with partners, the refuge would reactivate its forest management program to the benefit of priority forest interior migratory birds and resident game species. Increased acreage of unharvested cropland would help to meet the foraging needs of waterfowl and habitat for other native species. Increased acreage of hard mast-producing bottomland hardwood forest species from active management would benefit wildlife over the long term. Increased water management capabilities and subdividing existing impoundments would benefit migratory birds. Kentucky Lake's wetland habitats, that is, mudflats, scrub-shrub habitat, and desirable aquatic plants, would all continue at current levels, as in Alternative A. Fire management would improve habitat conditions for a variety of native wildlife and plants.

With regard to protection of natural and cultural resources, the extent of infestation from various invasive plants would probably be reduced as a result of stepped-up control measures. Known cultural resources would continue to be protected in accordance with Section 106 of the National Historic Preservation Act, as in Alternative A. The refuge may pursue possible minor boundary expansion to address threats to refuge habitats and wildlife.

With three notable exceptions, visitor services would continue at the present level under Alternative C. Hunting opportunities for deer would increase somewhat, which would benefit hunters. Other hunting opportunities would stay the same. Fishing, wildlife observation, wildlife photography, environmental education, and interpretation opportunities would all remain generally the same as at present, providing the same levels of benefits to the visiting public. Building a new visitor center and new contact station would be very positive benefits for the public. Seasonal closure of roads at Busseltown and Honey Point Ferry Road would reduce visitor access during the winter.

The number of new facilities requiring upkeep and maintenance would increase, including those that were previously mentioned, and others related to wildlife management.

With regard to climate change, broad impacts to the refuge from large-scale, long-term climate trends would be the same as in Alternative A. However, in Alternative C, monitoring of habitat and wildlife responses to a changing climate would, through adaptive management, provide a basis for possible management actions to mitigate adverse impacts and capitalize on potentially beneficial impacts.

ALTERNATIVE D: ENHANCED WILDLIFE MANAGEMENT AND PUBLIC USE PROGRAM (PROPOSED ALTERNATIVE)

Alternative D would enhance both wildlife management and the public use program at Tennessee National Wildlife Refuge. In general, the effects from implementing Alternative D would be very similar to those of Alternative C on the wildlife and habitat goals and objectives, and very similar to Alternative B on the public use goals and objectives.

Under this alternative, the refuge would likely support larger wintering duck numbers than at present, but probably not as many ducks as in Alternative C. However, it is expected that there would be no overall change in wintering geese populations on the refuge. Adding 25-75 more nesting boxes for a total of 200-250 on the refuge, and expanding into other units would likely increase the breeding population of wood ducks on the refuge.

Creating more habitat and enhancing existing habitat for secretive marshbirds would probably lead to slightly higher populations. The refuge would likely support increased numbers of migrating shorebirds than at present, but probably not as much as Alternative C, because not as much additional mudflat habitat would be provided. No changes in the populations of long-legged wading birds are expected. The refuge may see a greater presence and numbers of Henslow's sparrows and other grassland bird species in the Big Sandy Unit. An increase is possible in the populations of priority forest interior migratory birds in response to improved habitats.

Numbers of nesting and wintering bald eagles are likely to remain stable or increase gradually in this alternative, as in each of the other alternatives. Deer, turkey, squirrel, raccoon, and resident Canada goose populations are unlikely to change. Any changes in the relative abundance or diversity of resident nongame species are likely to be positive. Also, no changes are anticipated in fish populations or aquatic species diversity.

As with Alternative A, federally listed species such as the Indiana bat, gray bat, and listed mussels would continue to be protected; any change in numbers on refuge (increase or decrease) would be due to external factors beyond refuge's control. Determining the distribution and abundance of all listed species would increase managers' knowledge and possibly allow for greater protective and recovery measures. Control of invasive animals if they begin to appear would provide greater protection for native flora and fauna.

Improved moist soil management would increase wildlife benefits. Reactivating the forest management program in cooperation with partners would the benefit of priority forest interior migratory birds and resident game species. Increased acreage of unharvested cropland would help to meet foraging needs of waterfowl and habitat for other native species. Increased acreage of hard mast-producing bottomland hardwood forest species would benefit wildlife. Increased water management capabilities and subdividing existing impoundments would benefit migratory birds. Sportfishing opportunities may also increase. Mudflats, scrub-shrub habitat, and desirable aquatic plants on the margins of Kentucky Lake would continue at current levels. The extent of infestation from various invasive plants would probably be reduced as a result of increasing control measures. Fire management would improve habitat conditions for a variety of native wildlife and plants.

As in Alternative A, under Alternative D the refuge's known cultural resources would continue to be protected in accordance with Section 106 of the National Historic Preservation Act. In addition, development and implementation of a Cultural Resources Management Plan would increase knowledge and management potential over time. Under Alternative D, there may be possible minor boundary expansions to accommodate visitors or address threats to habitats and wildlife; either or both would be beneficial.

Preparing and implementing a new Visitor Services Plan would likely improve and/or expand visitor services and associated public use. Hunting opportunities for deer would increase somewhat, which would benefit hunters. Other hunting opportunities would stay the same as at present. Furnishing additional fishing facilities would represent a beneficial impact. Alternative D would aim to increase facilities for wildlife observation and photography, including a seasonal wildlife drive in the Duck River Bottoms, which would be beneficial for the public. Expanded EE facilities and opportunities on and near the refuge, as well as an expanded interpretive program, would increase beneficial impacts on each of these "Big 6" uses. Adding a visitor center and new contact station are also positive benefits for public. The number of new facilities requiring upkeep and maintenance would increase. Seasonal closure of roads at Busseltown and Honey Point Ferry Road would reduce visitor access during the winter at these locations.

Few changes in climate are likely to be observable over the next 15 years during the life of the CCP. Average temperatures may rise somewhat, with hotter summers and warmer winters, especially winter nights. There may be changes in total precipitation and the distribution of this precipitation seasonally; there could also be more extreme weather events. At present, the ecological implications of changes to climate are not predictable with any precision.

In addressing accelerated climate change, this alternative would combine elements of Alternatives B and C, as well as the pursuit of opportunities for carbon sequestration with native trees. Monitoring of habitat and wildlife responses to a changing climate would, through adaptive management, provide a basis for possible management actions to mitigate adverse impacts and capitalize on certain potentially beneficial impacts.

Table 10. Summary of environmental effects by alternative, Tennessee National Wildlife Refuge.

Issue	Alternative A: Current Management (No Action)	Alternative B: Public Use Emphasis	Alternative C: Wildlife Management Emphasis	Alternative D: Enhanced Wildlife Management and Public Use Program (Proposed Alternative)
Migratory ducks	No overall change in wintering duck populations on the refuge.	Same as Alternative A.	Refuge would likely support larger wintering duck numbers than at present.	Refuge would likely support larger wintering duck numbers than at present, but probably not as much as Alternative C.
Migratory geese	No overall change in wintering geese populations on the refuge.	Same as Alternative A.	Same as Alternative A.	Same as Alternative A.
Wood ducks	Maintaining 175 nesting boxes would help continue breeding population of wood ducks on the refuge.	Same as Alternative A.	Adding 25-75 more nesting boxes for a total of 200-250 on the refuge, and expanding into other units would likely increase the breeding population of wood ducks on the refuge.	Same as Alternative C.
Marshbirds	Populations of secretive marshbirds, including king rails, would likely remain unchanged.	Same as Alternative A.	Creating more and enhancing existing habitat for secretive marshbirds would probably lead to slightly higher populations.	Same as Alternative C.

Issue	Alternative A: Current Management (No Action)	Alternative B: Public Use Emphasis	Alternative C: Wildlife Management Emphasis	Alternative D: Enhanced Wildlife Management and Public Use Program (Proposed Alternative)
Shorebirds	No change expected in numbers of migrating shorebirds in spring and fall.	Greater level of effort (with partners) to inventory shorebirds and possibly undertake certain habitat management activities may lead to somewhat greater populations of migrating shorebirds.	Increasing the number and acreage of foraging sites during both spring and fall migration would likely increase transient shorebird numbers during these seasons.	Refuge would likely support increased numbers of migrating shorebirds than at present, but probably not as much as Alternative C.
Long-legged wading birds	No change in populations expected.	Same as Alternative A.	Same as Alternative A.	Same as Alternative A.
Grassland birds	Grassland birds continue to occur incidentally and in relatively small numbers.	Same as Alternative A.	May see greater presence and numbers of Henslow's sparrow and other grassland species in the Big Sandy Unit.	Same as Alternative C.
Forest interior migratory birds	No change to existing populations of priority forest interior migratory birds, except consistent with continent-wide trends.	Same as Alternative A.	Possible increase in populations of priority forest interior migratory birds in response to improved habitats.	Same as Alternative C.
Bald eagles	Numbers of nesting and wintering bald eagles likely to remain stable or increase gradually.	Same as Alternative A.	Same as Alternative A.	Same as Alternative A.
Resident game species	Deer, turkey, squirrel, raccoon, and resident Canada goose populations unlikely to change.	Same as Alternative A.	Same as Alternative A.	Same as Alternative A.

Issue	Alternative A: Current Management (No Action)	Alternative B: Public Use Emphasis	Alternative C: Wildlife Management Emphasis	Alternative D: Enhanced Wildlife Management and Public Use Program (Proposed Alternative)
Resident nongame species	No changes in relative abundance or diversity expected.	Developing partnerships with the public to inventory nongame species and possibly carry out habitat management activities may have a beneficial effect.	Developing and implementing baseline inventories for nongame mammals, reptiles, amphibians and invertebrates within 10 years of CCP approval would increase managers' knowledge of the resource.	Any changes in relative abundance or diversity are likely to be positive.
Fish and other aquatic species	No changes anticipated in fish populations or species diversity.	Same as Alternative A.	Same as Alternative A.	Same as Alternative A.
Threatened and endangered species	Federally listed species such as the Indiana bat, gray bat, and listed mussels would continue to be protected; any change in numbers on refuge (increase or decrease) would be due to external factors beyond refuge's control.	Same as Alternative A.	Same as Alternative A. Determining the distribution and abundance of all listed species would increase managers' knowledge and possibly allow for greater protective and recovery measures.	Same as Alternative C.
Nuisance animal species	Controlling problem beavers as needed would limit their impacts on facilities and infrastructure.	Control of other invasive animals if they begin to appear would provide greater protection for native flora and fauna.	Same as Alternative B.	Same as Alternative B.

Issue	Alternative A: Current Management (No Action)	Alternative B: Public Use Emphasis	Alternative C: Wildlife Management Emphasis	Alternative D: Enhanced Wildlife Management and Public Use Program (Proposed Alternative)
Moist soil habitat	Moist soil acreage, management, and wildlife benefits would continue unchanged.	Same as Alternative A.	Improved moist soil management would increase wildlife benefits.	Same as Alternative C.
Upland forest habitat	No active forest management, but continue evaluation of past forest treatments for increasing habitat for priority species on the Big Sandy Peninsula.	Same as Alternative A.	In cooperation with partners, reactivate forest management program on the refuge to the benefit of priority forest interior migratory birds and resident game species.	Same as Alternative C.
Cropland	Acreage of cropland habitat would remain the same.	Same as Alternative A.	Increased acreage of unharvested cropland would help to meet foraging needs of waterfowl and habitat for other native species.	Same as Alternative C.
Bottomland hardwood forest	Limited acreage would remain unchanged; habitat values would stay the same.	Same as Alternative A.	Increased acreage of hard mast producing bottomland hardwood forest species would benefit wildlife.	Same as Alternative C.
Managed internal impoundments	Current acreage and benefits to wildlife would continue.	Sportfishing opportunities within the impoundments may increase.	Increased water management capabilities and subdividing existing impoundments would benefit migratory birds.	Same as Alternative C, but sportfishing opportunities may also increase.

Issue	Alternative A: Current Management (No Action)	Alternative B: Public Use Emphasis	Alternative C: Wildlife Management Emphasis	Alternative D: Enhanced Wildlife Management and Public Use Program (Proposed Alternative)
Kentucky Lake wetland habitats	Mudflats, scrub-shrub habitat, and desirable aquatic plants continue at current levels.	Same as Alternative A.	Same as Alternative A.	Same as Alternative A.
Fire Management	Forests would remain unmanaged and open land management would continue at current levels without the use of prescribed fire and a management tool.	Same as Alternative A.	Forest management would be enhanced by the use of prescribed fire. Savanna development would be possible. Grasslands could be established and managed. Prescribed fire could be used as another tool to manage other open lands.	Same as Alternative C.
Invasive plants	Limited control of invasive plants would likely maintain their status on the refuge, neither increasing nor decreasing level of encroachment in terrestrial and aquatic habitats.	Same as Alternative A.	Extent of infestation from various invasive plants would probably be reduced.	Same as Alternative C.
Cultural and historic resources	Known cultural resources would continue to be protected in accord with Section 106 of the National Historic Preservation Act.	Same as Alternative A.	Same as Alternative A.	Same as Alternative A. Development and implementation of a CRMP would increase knowledge and management potential over time.

Issue	Alternative A: Current Management (No Action)	Alternative B: Public Use Emphasis	Alternative C: Wildlife Management Emphasis	Alternative D: Enhanced Wildlife Management and Public Use Program (Proposed Alternative)
Refuge size and boundaries	Refuge acreage and boundaries unchanged.	Possible minor boundary expansion to accommodate visitors.	Possible minor boundary expansion to address threats to refuge habitats and wildlife.	Possible minor boundary expansion to accommodate visitors or address threats to habitats and wildlife.
Visitor services	Visitor services would continue as at present level.	Preparing and implementing a new Visitor Services Plan would likely improve and/or expand visitor services.	Same as Alternative A, except additional seasonal road closures will reduce visitor access in the winter.	Same as Alternative B, except additional seasonal road closures will reduce visitor access in the winter.
Hunting	Hunting opportunities remain unchanged.	Hunting opportunities for deer would increase somewhat, which would benefit hunters. Other opportunities would stay the same.	Same as Alternative B.	Same as Alternative B.
Fishing	Fishing opportunities would remain the same as at present.	Furnishing additional facilities would represent a beneficial impact.	Same as Alternative A.	Same as Alternative B.
Wildlife observation and wildlife photography	Existing opportunities would continue.	Increased facilities and seasonal wildlife drive in the Duck River Bottoms would represent a beneficial impact.	Same as Alternative A.	Same as Alternative B.

Issue	Alternative A: Current Management (No Action)	Alternative B: Public Use Emphasis	Alternative C: Wildlife Management Emphasis	Alternative D: Enhanced Wildlife Management and Public Use Program (Proposed Alternative)
Environmental education	Continued environmental education services for the public would represent a beneficial impact.	Expanded EE facilities and opportunities on and near the refuge would increase beneficial impacts.	Same as Alternative A.	Same as Alternative B.
Interpretation	Kiosks, brochures, website, signs, and interpretive programs would maintain present level of beneficial impacts.	Expanded interpretive program would increase beneficial impacts.	Same as Alternative A.	Same as Alternative B.
Visitor center and visitor contact station	Lack of visitor center is a disadvantage for the refuge.	Adding visitor center and new contact station are positive benefit for public.	Same as Alternative B.	Same as Alternative B.
Facilities, equipment and infrastructure	No impacts: existing facilities, equipment and infrastructure maintained.	Adding new HQ/visitor center and Duck River visitor contact station, and replacing bunkhouse would increase facilities requiring maintenance.	The number of new facilities requiring upkeep and maintenance would increase, including those in Alt. B, and others related to wildlife management.	Same as Alternative C.

Issue	Alternative A: Current Management (No Action)	Alternative B: Public Use Emphasis	Alternative C: Wildlife Management Emphasis	Alternative D: Enhanced Wildlife Management and Public Use Program (Proposed Alternative)
Accelerated climate change	Few changes in climate likely to be observable in coming 15 years; average temperatures may rise somewhat, with hotter summers and warmer winters, especially winter nights; could be changes to total precipitation and distribution; ecological implications of changes to climate not predictable at present.	Same as Alternative A but refuge would integrate information and education on climate change into messages and exhibits.	Same as Alternative A. In addition, monitoring of habitat and wildlife responses to a changing climate would, through adaptive management, provide a basis for possible management actions to mitigate adverse impacts and capitalize on potentially beneficial impacts.	Combination of Alternatives B and C, as well as pursuit of opportunities for carbon sequestration with native trees.

UNAVOIDABLE IMPACTS AND MITIGATION MEASURES

Under Alternative A – the no-action alternative – there are numerous unavoidable adverse impacts, including law enforcement that is not adequate for protecting visitor use; continued degradation of the biological functions of native plant communities and wildlife habitat due to the invasion of exotic plants and nuisance animals; unmanaged forest habitat that is sub-optimal for neotropical migrants; water levels in Kentucky Lake (over which the Service has no control) that sometimes work against the refuge's habitat and migratory bird objectives; and a continued decline in biodiversity overall. Over time, if these issues are not addressed, they will continue to adversely impact refuge resources.

Alternative B – Public Use Emphasis – suffers from virtually all of the unavoidable adverse impacts listed for Alternative A, because it does not focus on addressing these challenges.

Alternative C – Wildlife Management Emphasis – addresses the above-mentioned problems head-on, substantially reducing the intensity of adverse impacts, but would require additional budgetary and staffing resources to implement.

Alternative D, the proposed alternative, also has some unavoidable adverse impacts. The primary impacts are water levels in Kentucky Lake (over which the Service has no control) that sometimes work at cross purposes to refuge migratory waterfowl and other water bird objectives. Overall however, the impacts of Alternative D are generally expected to be minor and/or short-term in duration. However, the refuge will attempt to minimize these impacts whenever possible. The following sections describe the measures the refuge will employ to mitigate and minimize the potential impacts that would result from implementation of the proposed alternative.

WATER QUALITY FROM SOIL DISTURBANCE AND USE OF HERBICIDES

Soil disturbance and siltation due to water management activities; road and levee maintenance; and the construction of observation towers, boat ramps, and a headquarters and visitor center is expected to be minor and of short duration. To further reduce potential impacts, the refuge will use best management practices to minimize the erosion of soils into water bodies.

Foot traffic on new and extended foot trails is expected to have a negligible impact on soil erosion. To minimize the impacts from public use, the refuge will include informational signs that request trail users to remain on the trails, in order to avoid causing potential erosion problems.

Long-term herbicide use for exotic plant control could result in a slight decrease in water quality in areas prone to exotic plant infestation. Through the proper application of herbicides, however, this is expected to have a minor impact on the environment, with the benefit of reducing or eliminating exotic plant infestations.

WILDLIFE DISTURBANCE

Disturbance to wildlife is an unavoidable consequence of any public use program, regardless of the activity involved. While some activities such as wildlife observation may be less disturbing than others, all of the public use activities proposed under the proposed alternative will be planned to avoid unacceptable levels of impact.

The known and anticipated levels of disturbance from the proposed alternative are not considered to be significant. Nevertheless, the refuge will manage public use activities to reduce impacts. Providing access for fishing opportunities allows the use of a renewable natural resource without

adversely impacting other resources. Hunting will also be managed with restrictions that ensure minimal impact on other resources. General wildlife observation may result in minimal disturbance to wildlife. If the refuge determines that impacts from the expected additional visitor uses are above the levels that are anticipated, those uses will be discontinued, restricted, or rerouted to other less sensitive areas.

VEGETATION DISTURBANCE

Negative impacts could result from the creation, extension, and maintenance of trails that require the clearing of nonsensitive vegetation along their length. This is expected to be a minor impact.

Increased visitor use may increase the potential for the introduction of new exotic species into areas when visitors do not stay on trails. The refuge will minimize this impact by enforcing the regulations for access to the refuge's water bodies, and by installing informational signs that request users to stay on the trails.

USER GROUP CONFLICTS

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

EFFECTS ON ADJACENT LANDOWNERS

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

However, some negative impacts that may occur include a higher frequency of trespass onto adjacent private lands, and noise associated with increased traffic. To minimize these potential impacts, the refuge will provide informational signs that clearly mark refuge boundaries; maintain the refuge's existing parking facilities; use law enforcement; and provide increased educational efforts at the visitor center.

Prescribed fire could have impacts on adjacent landowners due to the potential for fire escape and smoke. To minimize these potential impacts, a prescription (Prescribed Fire Plan) will be written for each burn that identifies required weather conditions, personnel requirements, equipment needs, emergency plans, and other measures needed to prevent and/or quickly contain escape fire and smoke related problems. These plans will be reviewed by a Fire Management Officer to ensure all preventative measures are in place. During all phases of every burn the plans will be followed and the burning will be delayed or ceased if all conditions are not in prescription.

LAND OWNERSHIP AND SITE DEVELOPMENT

Land acquisition efforts by the Service could lead to changes in land use and recreational use patterns. However, most of the non-Service-owned lands within the refuge's approved acquisition boundary are currently undeveloped. If these lands are acquired as additions to the refuge, they

would be maintained in a natural state, managed for native wildlife populations, and opened to wildlife-compatible public uses, where feasible.

Potential development of the refuge's buildings, trails, and other improvements could lead to minor short-term negative impacts on plants, soils, and some wildlife species. When building the observation towers, efforts would be made to use recycled products and environmentally sensitive treated lumber. The visitor center will be constructed to be aesthetically pleasing to the community and to avoid any additional impacts to native plant communities. All construction activities would comply with the requirements of Section 404 of the Clean Water Act; the National Historic Preservation Act; Executive Order 11988, Floodplain Management; and other applicable regulatory requirements.

CUMULATIVE IMPACTS

A cumulative impact is defined as an impact on the natural or human environment, which results from the incremental impact of the proposed action when added to other past, present, and reasonably foreseeable future actions regardless of which agency (federal or nonfederal) or person undertakes such other actions (40 Code of Federal Regulations, 1508.7).

Cumulative impacts are the overall, net effects on a resource that arise from multiple actions. Impacts can "accumulate" spatially, when different actions affect different areas of the same resource. They can also accumulate over the course of time, from actions in the past, the present, and the future. Occasionally, different actions counterbalance one another, partially canceling out each other's effect on a resource. But more typically, multiple effects add up, with each additional action contributing an incremental impact on the resource. In addition, sometimes the overall effect is greater than merely the sum of the individual effects, such as when one more reduction in a population crosses a threshold of reproductive sustainability, and threatens to extinguish the population.

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

Nevertheless, because of concerns expressed about the cumulative effects of hunting in particular, this section analyzes and discusses in some detail the cumulative impacts of the hunting program of each alternative on a variety of resources at the Tennessee Refuge.

ANTICIPATED IMPACTS ON WILDLIFE SPECIES

Migratory Birds

The U.S. Fish and Wildlife Service annually prescribes frameworks, or outer limits, for dates and times when hunting may occur and the number of birds that may be taken and possessed. These frameworks are necessary to allow state selections of season and limits for recreation and sustenance; aid federal, state, and tribal governments in the management of migratory game birds; and permit harvests at levels compatible with population status and habitat conditions. Because the Migratory Bird Treaty Act stipulates that all hunting seasons for migratory game birds are closed unless specifically opened by the Secretary of the Interior, the Service annually promulgates regulations (50 CFR Part 20) establishing the frameworks from which states may select season dates, bag limits, shooting hours, and other options for the each migratory bird hunting season. The frameworks are essentially permissive in

that hunting of migratory birds would not be permitted without them. Thus, in effect, federal annual regulations both allow and limit the hunting of migratory birds.

Migratory game birds are those bird species so designated in conventions between the United States and several foreign nations for the protection and management of these birds. Under the Migratory Bird Treaty Act (16 U.S.C. 703-712), the Secretary of the Interior is authorized to determine when "hunting, taking, capture, killing, possession, sale, purchase, shipment, transportation, carriage, or export of any ... bird, or any part, nest, or egg" of migratory game birds can take place, and to adopt regulations for this purpose. These regulations are written after giving due regard to "the zones of temperature and to the distribution, abundance, economic value, breeding habits, and times and lines of migratory flight of such birds," and are updated annually (16 U.S.C. 704(a)). This responsibility has been delegated to the U.S. Fish and Wildlife Service as the lead federal agency for managing and conserving migratory birds in the United States. Acknowledging regional differences in hunting conditions, the Service has administratively divided the nation into four flyways for the primary purpose of managing migratory game birds. Each flyway (Atlantic, Mississippi, Central, and Pacific) has a Flyway Council, a formal organization generally composed of one member from each state and province in that Flyway. Tennessee NWR is within the Mississippi Flyway.

The process for adopting migratory game bird hunting regulations, located in 50 CFR Part 20, is constrained by three primary factors. Legal and administrative considerations dictate how long the rule-making process will last. Most importantly, however, the biological cycle of migratory game birds controls the timing of data-gathering activities and thus the dates on which these results are available for consideration and deliberation. The process of adopting migratory game bird hunting regulations includes two separate regulations: development of schedules based on "early" and "late" hunting season regulations. Early hunting seasons pertain to all migratory game bird species in Alaska, Hawaii, Puerto Rico, and the U.S. Virgin Islands; migratory game birds other than waterfowl (such as dove, woodcock, etc.); and special early waterfowl seasons, such as for teal or resident Canada geese. Early hunting seasons generally begin prior to October 1. Late hunting seasons generally start on or after October 1 and include most waterfowl seasons not already established. There are basically no differences in the processes for establishing either early or late hunting seasons. For each cycle, Service biologists and others gather, analyze, and interpret biological survey data and provide this information to all those involved in the process through a series of published status reports and presentations to Flyway Councils and other interested parties (USFWS 2006).

Under each of the four alternatives, including the proposed action, the only waterfowl hunting permitted would be of resident (i.e., nonmigratory) Canada geese; thus, there would be no cumulative impact of this action on waterfowl populations in Tennessee and the Mississippi Flyway. Peak wintering populations of ducks at Tennessee NWR have not changed much over the last quarter century. Wintering geese numbers have declined markedly. This decline is believed to be largely a function of weather patterns and where the geese choose to winter, not hunting pressure.

Because the Service is required to take abundance of migratory birds and other factors in consideration, the Service undertakes a number of surveys throughout the year in conjunction with the Canadian Wildlife Service, state and provincial wildlife management agencies, and others. To determine the appropriate frameworks for each species, the Service considers factors such as population size and trend, geographical distribution, annual breeding effort, the condition of breeding and wintering habitat, the number of hunters, and the anticipated harvest. After frameworks are established for season lengths, bag limits, and areas for migratory game bird hunting, migratory game bird management becomes a cooperative effort of state and federal governments. After the Service's establishment of final frameworks for hunting seasons, the states may select season dates, bag limits, and other regulatory options for the hunting seasons. States may always be more conservative

(restrictive) in their selections than the federal frameworks, but never more liberal (less restrictive). Season dates and bag limits for national wildlife refuges open to hunting are never longer or larger than the state regulations. In fact, based upon the findings of an environmental assessment developed when a national wildlife refuge opens a new hunting activity, season dates and bag limits may be more restrictive than the state allows. At Tennessee NWR, the only hunting of waterfowl allowed is of resident Canada geese, not migratory ducks and geese. Large populations of resident geese can overbrowse young moist soil vegetation and agricultural crops during the growing season, resulting in lower seed production. Thus, continuation of resident Canada goose hunting on the refuge should not have negative cumulative impacts on the area's and state's resident goose population and will be beneficial for habitats.

NEPA considerations by the Service for hunted migratory game bird species are addressed by the programmatic document, ''Final Supplemental Environmental Impact Statement: Issuance of Annual Regulations Permitting the Sport Hunting of Migratory Birds (FSES 88– 14),'' filed with the Environmental Protection Agency on June 9, 1988. The Service published a Notice of Availability in the *Federal Register* on June 16, 1988 (53 FR 22582), and the Service's Record of Decision on August 18, 1988 (53 FR 31341). Annual NEPA considerations for waterfowl hunting frameworks are covered under a separate, tiered Environmental Assessment, "Duck Hunting Regulations for [YEAR]," and associated Findings of No Significant Impact (FONSIs). Further, in a notice published in the September 8, 2005, *Federal Register* (70 FR 53376), the Service announced its intent to develop a new Supplemental EIS for the migratory bird hunting program. More information may be obtained from the Chief, Division of Migratory Bird Management, U.S. Fish and Wildlife Service, Department of the Interior, MS MBSP-4107-ARLSQ, 1849 C Street, NWR, Washington, DC 20240.

Resident Big Game

Deer

There are five quota hunts for deer, including a youth hunt, a primitive weapons hunt, and three firearms hunts. Primitive weapons include longbow, recurve bow, and side-hammered muzzleloader. Firearms include guns, archery, and muzzleloader. Nearly 1,200 hunters are permitted for the quota hunts.

Even under the hunting pressure to which they are subjected, deer continue to be abundant throughout the refuge, utilizing the diversity of habitats. They heavily use the agricultural fields from summer through the winter months. An abomasum parasite count (APC) in 2004 determined that the refuge's deer herd far exceeds carrying capacity. The refuge has tried to liberalize the hunt program and bring the herd to below carrying capacity. High-density deer populations can negatively impact forest regeneration from overbrowsing as well as agricultural crops. Thus, continuation of deer hunting on refuge lands should not have negative cumulative impacts on the area's and state's deer herd and may be beneficial for habitats.

Wild Turkey

Favorable turkey habitat and a healthy, huntable population of turkeys exist throughout the refuge. This game bird benefits from the hundreds of acres of grain crops planted each year throughout the area, often competing with food resources intended for migratory waterfowl. It is common to encounter in excess of 100 birds in a single flock feeding in agricultural fields during the winter. With harvest regulations allowing the take of only one bearded turkey per season, the annual turkey population is more related to weather factors, primarily during the spring nesting season, rather than to impacts of hunting. Hunting of turkeys also occurs on the refuge during statewide hunting

seasons. The fall turkey season coincides with the state archery deer season, and the spring turkey season is from late March to May.

Service biologists believe the turkey population can support the current modest, controlled hunting pressure, as judged by continuing high turkey populations. The refuge would continue to manage the turkey hunt in such a manner as to avoid cumulative adverse effects on turkey numbers.

Resident Small Game

The only small game hunted on the refuge are gray and fox squirrels and raccoon. Hunting of squirrels occurs during the statewide hunting season, from August to mid-November. None of the alternatives would increase the current hunting opportunities for squirrel. Squirrel populations appear to be stable both on the refuge and in the state. If there were indications to the contrary, the refuge would implement measures to restrict the harvest.

Raccoon habitat is abundant on the refuge, as is their population. Although raccoon populations are somewhat cyclic, high raccoon densities result in excessive predation on migratory and resident bird eggs. Hunting helps avoid extreme peak raccoon populations.

Nongame Wildlife

Nongame or nonhunted wildlife would include nonhunted migratory birds such as songbirds, wading birds, raptors, and woodpeckers; small mammals such as voles, moles, mice, shrews, and bats; reptiles and amphibians such as snakes, skinks, turtles, lizards, salamanders, frogs and toads; and invertebrates such as butterflies, moths, other insects and spiders. Except for migratory birds and some species of migratory bats, butterflies and moths, these species have very limited home ranges and hunting could not affect their populations regionally; thus, only local effects will be discussed.

Disturbance to nonhunted migratory birds could have regional, local, and flyway effects. Regional and flyway effects would not be applicable to species that do not migrate such as most woodpeckers, and some songbirds including cardinals, titmice, wrens, chickadees, etc. The cumulative effects of disturbance to nonhunted migratory birds under the proposed action are expected to be negligible for the following reasons. Except for the spring turkey season, hunting seasons would not coincide with the nesting season. Long-term future impacts that could occur if reproduction was reduced by hunting are not relevant for this reason. Disturbance to the daily wintering activities of birds, such as feeding and resting, might occur. Disturbance to birds by hunters would probably be commensurate with that caused by nonconsumptive users. The cumulative effects of disturbance to nonhunted migratory birds under the proposed action are expected to be small for the above reasons.

With regard to other wildlife, disturbance would be unlikely for the following reasons. Small mammals, including bats, are inactive during winter when hunting season occurs (with the exception of the spring turkey season). These species are also nocturnal. Both of these qualities make hunter interactions with small mammals very rare. Hibernation or torpor by cold-blood reptiles and amphibians also limits their activity during the hunting season when temperatures are low. Hunters would rarely encounter reptiles and amphibians during most of the hunting season. Encounters with reptiles and amphibians in the early fall are few and should not have cumulative negative effects on reptile and amphibian populations. Invertebrates are also not active during cold weather and would have few interactions with hunters during the hunting season. Refuge regulations further mitigate possible disturbance by hunters to nonhunted wildlife. Vehicles are restricted to roads and the harassment or taking of any wildlife other than the game species legal for the season is not permitted.

Over time, the ingestion of lead shot by nonhunted wildlife could emerge as a cumulative impact. Lead shot is permitted following state regulations for squirrel, raccoon, and turkey. Over the life of the CCP, refuge management will remain alert for any signs of lead poisoning in nongame and game wildlife. In general, waterfowl and birds of prey face a greater risk of lead exposure than other birds and mammals because of their feeding habits (ingesting lead shot as grit for use in their gizzard or consuming lead shot from the tissues of prey). Therefore, lead shot pellets scattered over woodlands and fields are less likely to result in cumulative problems for wildlife, but the refuge will be vigilant in the face of this possibility.

Some species of bats, butterflies and moths are migratory. Cumulative effects to these species at the "flyway" level should be negligible. These species are in torpor or have completely passed through northwestern Tennessee by the peak hunting season in November-January. Some hunting occurs during August through October when these species are migrating; however, hunter interactions would be commensurate with that of nonconsumptive users.

Threatened and Endangered Species

Federally listed species occurring or known to have historically occurred on Tennessee NWR are the least tern, piping plover, Indiana and gray bats, and several species of freshwater mussels, including the ring pink, orangefoot pimpleback, and pink mucket.

An Intra-Service Section 7 evaluation under the Endangered Species Act is included as Appendix G in this Draft CCP/EA. It concludes that the proposed action would have no effect on these listed species. While some of these species may occur on the refuge, hunters are unlikely to mistake them for Canada geese, turkeys, deer, raccoons, or squirrels. The cumulative adverse impact on listed species would be negligible, comparable to that caused by anglers, boaters and nonconsumptive users.

ANTICIPATED IMPACTS ON REFUGE PROGRAMS, FACILITIES, CULTURAL RESOURCES, ENVIRONMENTAL JUSTICE, ENVIRONMENTAL RESOURCES, AND SURROUNDING COMMUNITIES

Wildlife-dependent Recreation

As public use levels increase over time, unanticipated conflicts between user groups may occur at Tennessee NWR. The refuge's visitor use programs would be adjusted as needed to eliminate or minimize each problem and provide quality wildlife-dependent recreational opportunities. Experience on many national wildlife refuges has proven that time and space zoning (such as establishment of separate use areas, use periods, and restrictions on the number of users) is an effective tool in eliminating conflicts between user groups. Overall, the cumulative impact of hunting on other wildlife-dependent recreation at Tennessee NWR would be negligible to minor.

Refuge Facilities

The Service defines facilities as: "Real property that serves a particular function(s) such as buildings, roads, utilities, water control structures, raceways, etc." Those facilities most utilized by hunters are roads, parking lots, trails and boat launching ramps. Maintenance or improvement of existing facilities (i.e. parking areas, roads, trails, and boat ramps) would cause minimal short-term impacts to localized soils and waters and may cause some wildlife disturbances and damage to vegetation. The facility maintenance and improvement activities described are periodically conducted to accommodate daily refuge management operations and general public uses such as wildlife observation and photography. These activities would be conducted at times (seasonal and/or daily)

to cause the least amount of disturbance to wildlife. Siltation barriers will be used to minimize soil erosion, and all disturbed sites will be restored to as natural a condition as possible. During times when roads are impassible due to flood events or other natural causes, those roads, parking lots, trails and boat ramps impacted by the event would be closed to vehicular use.

Overall, the cumulative impact of hunting on Tennessee NWR's facilities would be negligible.

Cultural Resources

Hunting, regardless of method or species targeted, is a consumptive activity that does not pose any threat to historic properties on or near the refuge. In fact, hunting meets only one of the two criteria used to identify an "undertaking" that triggers a federal agency's need to comply with Section 106 of the National Historic Preservation Act. These criteria, which are delineated in 36 CFR Part 800, state that:

- an undertaking is any project, activity, or program that can alter the character or use of an archaeological or historic site located within the "area of potential effect;" and
- the project, activity, or program must also be either funded, sponsored, performed, licensed, or have received assistance from the agency.

Consultation with the pertinent State Historic Preservation Offices and federally recognized tribes are, therefore, not required.

Environmental Justice

Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-income Populations," was signed by President Bill Clinton on February 11, 1994, to focus federal attention on the environmental and human health conditions of minority and low-income populations to achieve environmental protection of all communities. In part, the order is intended to promote nondiscrimination in federal programs substantially affecting human health and the environment and to provide minority and low-income communities access to public information and participation in matters relating to human health or the environment.

There are low-income and minority populations in the area but there is no evidence of adverse disproportionate environmental justice issues associated with the refuge's existing hunting program or proposed expansion. Any affected populations would generally be affected in the same ways as the regional population as a whole.

Environmental Resources

The refuge expects no appreciable adverse impacts of the proposed action on the Tennessee NWR environment, which consists of soils, vegetation, air quality, water quality and solitude. Some disturbance to surface soils and vegetation would occur in areas selected for hunting; however, the impacts would be minor and localized. Litter left behind by hunters would also be expected, although unlike the litter associated with fishing, which often concentrates near or at certain heavily fished locations, litter from hunters is likely to be more widely dispersed and therefore less conspicuous. Hunting would be expected to benefit vegetation, since it is used to maintain many resident wildlife populations, particularly deer and resident Canada geese, in balance with the habitat's carrying capacity. When and where necessary, the refuge would also control access or close areas to minimize habitat degradation.

The refuge expects impacts to air and water quality to be minimal and only due to refuge visitors' automobile and outboard motor emissions and smoke from prescribed fire. The effect of these refuge-related activities, as well as other management activities, on overall air and water quality in the region are anticipated to be negligible, compared to the contributions of industrial centers, power plants, and nonrefuge vehicle traffic in this portion of northwest Tennessee. Existing State water quality criteria and use classifications are adequate to achieve desired on-refuge conditions; thus, implementation of the proposed action and alternatives would not impact adjacent landowners or users beyond the constraints already implemented under existing State standards and laws.

Overall, impacts on solitude are expected to be minor, given time and space zone management techniques, such as seasonal access and area closures, used to avoid conflicts among user groups. However, at those times when the refuge is being heavily hunted, those users seeking solitude rather than game may be disappointed and want to avoid the refuge.

Surrounding Communities

The refuge would cooperate with state, federal, and private partners to minimize adverse impacts on adjacent lands and their natural resources. The nature of impacts on surrounding communities is less cumulative than it is long-running and persistent. Hunting is generally popular in this part of rural Tennessee, but it does contribute to certain conflicts with adjacent landowners, some of whom, as noted in scoping for the CCP, expressed strong concerns about trespass, litter, and safety. On the other hand, many residents in the wider area and neighboring communities are likely to view continued hunting opportunities favorably. The refuge expects continuing visitation and tourism, some of it due to hunting, to generate revenues to local communities, but this spending would be very small in comparison with the size of the local economy. Smoke generated from prescribed fire and the potential for escape could have impacts on the surrounding communities. To minimize these impacts, a prescription (Prescribed Fire Plan) that identifies required weather conditions, personnel requirements, equipment needs, emergency plans, and other measures needed to prevent and/or quickly contain escape fire and smoke-related problems will be written, and reviewed and strictly followed for each burn. Any effects of a prescribed fire program on the refuge will not have cumulative impacts on the local communities.

The concerns of neighboring landowners can best be addressed through increased education and enforcement, which are contemplated under each of the alternatives.

DIRECT AND INDIRECT EFFECTS OR IMPACTS

Direct effects are caused by an action and occur at the same time as the action. Indirect effects are caused by an action but are manifested later in time or further removed in distance, but still reasonably foreseeable.

The actions proposed for implementation under the proposed alternative include facility development, wildlife and population management, resource protection, public use, and administrative programs. These actions would result in both direct and indirect effects. Facility development, for example, would most likely lead to increased public use, a direct effect; and it, in turn, would lead to indirect effects such as increased littering, noise, and vehicular traffic.

Other indirect effects that may result from implementing the proposed alternative include minor impacts from siltation due to the disturbance of soils and vegetation while installing water control structures, as well as expanding or creating new foot trails; construction of the observation tower and visitor center; and providing greater visitor access through improvements to the boat ramps.

SHORT-TERM USES VERSUS LONG-TERM PRODUCTIVITY

The habitat protection and management actions proposed under the proposed alternative are dedicated to maintaining the long-term productivity of refuge habitats. The benefits of this plan for long-term productivity far outweigh any impacts from short-term actions, such as the construction of observation towers and a visitor center, or creation of new trails. While these activities would cause short-term negative impacts, the educational values and associated public support gained from the improved visitor experience would produce long-term benefits for the refuge's entire ecosystem.

The key to protecting and ensuring the refuge's long-term productivity is to find the threshold where public uses do not degrade or interfere with the refuge's natural resources. The plans proposed under the proposed alternative have been carefully conceived to achieve that threshold. Therefore, implementing the proposed alternative would lead to long-term benefits for wildlife protection and land conservation that far outweigh any short-term impacts.

V. Consultation and Coordination

OVERVIEW

This chapter summarizes the consultation and coordination that has occurred to date in identifying the issues, alternatives, and proposed alternative, which are presented in this Draft Comprehensive Conservation Plan and Environmental Assessment (Draft CCP/EA). It lists the meetings that have been held with the various agencies, organizations, and individuals who were consulted in the preparation of the Draft CCP/EA.

The following meetings, contacts, and presentations were undertaken during the preparation of the Draft CCP/EA.

Prior to public scoping in 2008, a biological review and a visitor services review of the refuge were conducted. In August 2004, a diverse team of federal and state personnel undertook a holistic biological examination of the refuge's habitat and wildlife management program. The team then considered how the refuge might fit into accomplishing a number of relevant system-wide and landscape conservation needs.

The biological review team included staff from the refuge, as well as Service fish and wildlife biologists from the Southeast Regional Office, the Division of Ecological Services, and the Division of Migratory Birds. In addition, wildlife biologists from the Tennessee Wildlife Resources Agency (TWRA), Tennessee Valley Authority (TVA), the University of Tennessee at Knoxville, and Tennessee Wildlife Federation participated. The biological review team's recommendations were set forth in its final report entitled, "Tennessee National Wildlife Refuge Biological Review" (USFWS 2005), and was instrumental in the planning process.

The visitor services review was conducted in February 2004 by Service public use and outreach specialists. The visitor services review team toured the refuge, identified and discussed the current status of public use programs, and provided a report with recommendations for enhancing and improving these programs (USFWS 2004).

The comprehensive conservation plan (CCP) core planning team, which consists of the refuge manager, deputy refuge manager, two wildlife biologists, park ranger, a Service natural resources planner, and a contractor with experience in comprehensive conservation planning, met for the first time in November 2007 for a tour of the refuge and an overview of its habitat and wildlife resources and public use programs, facilities, and opportunities.

The TWRA was invited in January 2008 to participate on the planning team tasked with preparing the Draft CCP/EA. As noted above, the state was also involved in the biological review.

Three public scoping meetings were held in Paris, Parsons, and New Johnsonville, Tennessee, on May 5, 6, and 7, 2008, respectively. These locations correspond to the refuge's three distinct units – Big Sandy, Busseltown, and Duck River. The scoping meetings introduced the comprehensive planning process to the public and allowed the Service to receive input, perspectives, and comments as to the issues, concerns, and opportunities that the public feels should be addressed in the CCP. Articles appeared in local newspapers about these meetings and the development of the CCP.

SECTION C. APPENDICES

Appendix A. Glossary

Adaptive Management: Refers to a process in which policy decisions are implemented within a framework of scientifically driven experiments to test predictions and assumptions inherent in a management plan. Analysis of results helps managers determine whether current management should continue as is or whether it should be modified to achieve desired conditions.

Alluvial: Sediment transported and deposited in a delta or riverbed by flowing water.

Alternative: 1. A reasonable way to fix the identified problem or satisfy the stated need (40 CFR 1500.2). 2. Alternatives are different sets of objectives and strategies or means of achieving refuge purposes and goals, helping fulfill the Refuge System mission, and resolving issues (Service Manual 602 FW 1.6B).

Anadromous: Migratory fishes that spend most of their lives in the sea and migrate to fresh water to breed.

Biological Diversity: The variety of life and its processes, including the variety of living organisms, the genetic differences among them, and the communities and ecosystems in which they occur (Service Manual 052 FW 1. 12B). The System's focus is on indigenous species, biotic communities, and ecological processes. Also referred to as biodiversity.

Carrying Capacity: The maximum population of a species able to be supported by a habitat or area.

Categorical Exclusion: A category of actions that does 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.

Compatible Use: A proposed or existing wildlife-dependent recreational use or any other use of a national wildlife refuge that, based on sound professional judgment, will not materially interfere with or detract from the fulfillment of the National Wildlife Refuge System mission or the purpose(s) of the national wildlife refuge [50 CFR 25.12 (a)]. A compatibility determination supports the selection of compatible uses and identifies stipulations or limits necessary to ensure compatibility.

Comprehensive Conservation Plan:	A document that describes the desired future conditions of a refuge or planning unit and provides long-range guidance and management direction to achieve the purposes of the refuge; helps fulfill the mission of the Refuge System; maintains and, where appropriate, restores the ecological integrity of each refuge and the Refuge System; helps achieve the goals of the National Wilderness Preservation System; and meets other mandates (Service Manual 602 FW 1.6 E).
Concern:	See Issue
Cover Type:	The present vegetation of an area.
Cultural Resource Inventory:	A professionally conducted study designed to locate and evaluate evidence of cultural resources present within a defined geographic area. Inventories may involve various levels, including background literature search, comprehensive field examination to identify all exposed physical manifestations of cultural resources, or sample inventory to project site distribution and density over a larger area. Evaluation of identified cultural resources to determine eligibility for the National Register follows the criteria found in 36 CFR 60.4 (Service Manual 614 FW 1.7).
Cultural Resource Overview:	A comprehensive document prepared for a field office that discusses, among other things, its prehistory and cultural history, the nature and extent of known cultural resources, previous research, management objectives, resource management conflicts or issues, and a general statement on how program objectives should be met and conflicts resolved. An overview should reference or incorporate information from a field office's background or literature search described in Section VIII of the Cultural Resource Management Handbook (Service Manual 614 FW 1.7).
Cultural Resources:	The remains of sites, structures, or objects used by people in the past.
Designated Wilderness Area:	An area designated by the U.S. Congress to be managed as part of the National Wilderness Preservation System (Draft Service Manual 610 FW 1.5).
Disturbance:	Significant alteration of habitat structure or composition. May be natural (e.g., fire) or human-caused events (e.g., aircraft overflight).
Ecosystem:	A dynamic and interrelating complex of plant and animal communities and their associated nonliving environment.
Ecosystem Management:	Management of natural resources using system-wide concepts to ensure that all plants and animals in ecosystems are maintained at viable levels in native habitats and basic ecosystem processes are perpetuated indefinitely.

Endangered Species (Federal):	A plant or animal species listed under the Endangered Species Act that is in danger of extinction throughout all or a significant portion of its range.
Endangered Species (State):	A plant or animal species in danger of becoming extinct or extirpated in the state within the near future if factors contributing to its decline continue. Populations of these species are at critically low levels or their habitats have been degraded or depleted to a significant degree.
Environmental Assessment (EA):	A concise public document, prepared in compliance with the National Environmental Policy Act, that briefly discusses the purpose and need for an action, alternatives to such action, and provides sufficient evidence and analysis of impacts to determine whether to prepare an environmental impact statement or finding of no significant impact (40 CFR 1508.9).
Environmental Impact Statement (EIS):	A detailed written statement required by section 102(2)(C) of the National Environmental Policy Act, analyzing the environmental impacts of a proposed action, adverse effects of the project that cannot be avoided, alternative courses of action, short-term uses of the environment versus the maintenance and enhancement of long-term productivity, and any irreversible and irretrievable commitment of resources (40 CFR 1508.11).
Estuary:	The wide lower course of a river into which the tides flow. The area where the tide meets a river current.
Finding of No Significant Impact (FONSI):	A document prepared in compliance with the National Environmental Policy Act, supported by an environmental assessment, that briefly presents why a federal action will have no significant effect on the human environment and for which an environmental impact statement, therefore, will not be prepared (40 CFR 1508.13).
Goal:	Descriptive, open-ended, and often broad statement of desired future conditions that conveys a purpose but does not define measurable units (Service Manual 620 FW 1.6J).
Habitat:	Suite of existing environmental conditions required by an organism for survival and reproduction. The place where an organism typically lives.
Habitat Restoration:	Management emphasis designed to move ecosystems to desired conditions and processes, and/or to healthy ecosystems.
Habitat Type:	See Vegetation Type.
Improvement Act:	The National Wildlife Refuge System Improvement Act of 1997.
Informed Consent:	The grudging willingness of opponents to “go along” with a course of action that they actually oppose (Bleiker).

Issue:	Any unsettled matter that requires a management decision [e.g., an initiative, opportunity, resource management problem, threat to the resources of the unit, conflict in uses, public concern, or other presence of an undesirable resource condition (Service Manual 602 FW 1.6K)].
Management Alternative:	See Alternative
Management Concern:	See Issue
Management Opportunity:	See Issue
Migration:	The seasonal movement from one area to another and back.
Mission Statement:	Succinct statement of the unit's purpose and reason for being.
Monitoring:	The process of collecting information to track changes of selected parameters over time.
National Environmental Policy Act of 1969 (NEPA):	Requires all agencies, including the Service, to examine the environmental 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 (40 CFR 1500).
National Wildlife Refuge System Improvement Act of 1997 (Public Law 105-57):	Under the Refuge Improvement Act, the Fish and Wildlife Service is required to develop 15-year comprehensive conservation plans for all national wildlife refuges outside Alaska. The Act also describes the six public uses given priority status within the Refuge System (i.e., hunting, fishing, wildlife observation, wildlife photography, and environmental education and interpretation).
National Wildlife Refuge System Mission:	The mission is to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans.
National Wildlife Refuge System:	Various categories of areas administered by the Secretary of the Interior for the conservation of fish and wildlife, including species threatened with extinction; all lands, waters, and interests therein administered by the Secretary as wildlife refuges; areas for the protection and conservation of fish and wildlife that are threatened with extinction; wildlife ranges; game ranges; wildlife management areas; or waterfowl production areas.

National Wildlife Refuge:	A designated area of land, water, or an interest in land or water within the Refuge System.
Native Species:	Species that normally live and thrive in a particular ecosystem.
Noxious Weed:	A plant species designated by federal or state law as generally possessing one or more of the following characteristics: aggressive or difficult to manage; parasitic; a carrier or host of serious insect or disease; or nonnative, new, or not common to the United States. According to the Federal Noxious Weed Act (P.L. 93-639), a noxious weed is one that causes disease or had adverse effects on man or his environment and therefore is detrimental to the agriculture and commerce of the Untied States and to the public health.
Objective:	A concise statement of what we want to achieve, how much we want to achieve, when and where we want to achieve it, and who is responsible for the work. Objectives derive from goals and provide the basis for determining strategies, monitoring refuge accomplishments, and evaluating the success of strategies. Making objectives attainable, time-specific, and measurable (Service Manual 602 FW 1.6N).
Plant Association:	A classification of plant communities based on the similarity in dominants of all layers of vascular species in a climax community.
Plant Community:	An assemblage of plant species unique in its composition; occurs in particular locations under particular influences; a reflection or integration of the environmental influences on the site such as soils, temperature, elevation, solar radiation, slope, aspect, and rainfall; denotes a general kind of climax plant community.
Preferred Alternative:	This is the alternative determined (by the decision-maker) to best achieve the refuge purpose, vision, and goals; contributes to the Refuge System mission, addresses the significant issues; and is consistent with principles of sound fish and wildlife management.
Prescribed Fire:	The application of fire to wildland fuels to achieve identified land use objectives (Service Manual 621 FW 1.7). May occur from natural ignition or intentional ignition.
Priority Species:	Fish and wildlife species that require protective measures and/or management guidelines to ensure their perpetuation. Priority species include the following: (1) State-listed and candidate species; (2) species or groups of animals susceptible to significant population declines within a specific area or statewide by virtue of their inclination to aggregate (e.g., seabird colonies); and (3) species of recreation, commercial, and/or tribal importance.
Public Involvement Plan:	Broad long-term guidance for involving the public in the comprehensive conservation planning process.

Public Involvement: A process that offers impacted and interested individuals and organizations an opportunity to become informed about, and to express their opinions on Service actions and policies. In the process, these views are studied thoroughly and thoughtful consideration of public views is given in shaping decisions for refuge management.

Public: Individuals, organizations, and groups; officials of federal, state, and local government agencies; Indian tribes; and foreign nations. It may include anyone outside the core planning team. It includes those who may or may not have indicated an interest in service issues and those who do or do not realize that Service decisions may affect them.

Purposes of the Refuge: "The purposes 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, refuge unit, or refuge sub-unit." For refuges that encompass congressionally designated wilderness, the purposes of the Wilderness Act are additional purposes of the refuge (Service Manual 602 FW 106 S).

Recommended Wilderness: Areas studied and found suitable for wilderness designation by both the Director of the Fish and Wildlife Service and the Secretary of the Department of the Interior, and recommended for designation by the President to Congress. These areas await only legislative action by Congress in order to become part of the Wilderness System. Such areas are also referred to as "pending in Congress" (Draft Service Manual 610 FW 1.5).

Record of Decision (ROD): A concise public record of decision prepared by the federal agency, pursuant to NEPA, that contains a statement of the decision, identification of all alternatives considered, identification of the environmentally preferable alternative, a statement as to whether all practical means to avoid or minimize environmental harm from the alternative selected have been adopted (and if not, why they were not), and a summary of monitoring and enforcement where applicable for any mitigation (40 CFR 1505.2).

Refuge Goal: See Goal

Refuge Purposes: See Purposes of the Refuge

Songbirds: (Also Passerines) A category of birds that is medium to small, perching landbirds. Most are territorial singers and migratory.

Step-down Management Plan: A plan that provides specific guidance on management subjects (e.g., habitat, public use, fire, and safety) or groups of related subjects. It describes strategies and implementation schedules for meeting CCP goals and objectives (Service Manual 602 FW 1.6 U).

Strategy:	A specific action, tool, technique, or combination of actions, tools, and techniques used to meet unit objectives (Service Manual 602 FW 1.6 U).
Study Area:	The area reviewed in detail for wildlife, habitat, and public use potential. For purposes of this CCP, the study area includes the lands within the currently approved refuge boundary and potential refuge expansion areas.
Threatened Species (Federal):	Species listed under the Endangered Species Act that are likely to become endangered within the foreseeable future throughout all or a significant portion of their range.
Threatened Species (State):	A plant or animal species likely to become endangered in the state within the near future if factors contributing to population decline or habitat degradation or loss continue.
Tiering:	The coverage of general matters in broader environmental impact statements with subsequent narrower statements of environmental analysis, incorporating by reference, the general discussions and concentrating on specific issues (40 CFR 1508.28).
U.S. Fish and Wildlife Service Mission:	The mission of the U.S. Fish and Wildlife Service is working with others to conserve, protect, and enhance fish and wildlife and their habitats for the continuing benefit of the American people.
Unit Objective:	See Objective
Vegetation Type, Habitat Type, Forest Cover Type:	A land classification system based upon the concept of distinct plant associations.
Vision Statement:	A concise statement of what the planning unit should be, or what we hope to do, based primarily upon the Refuge System mission and specific refuge purposes, and other mandates. We will tie the vision statement for the refuge to the mission of the Refuge System; the purpose(s) of the refuge; the maintenance or restoration of the ecological integrity of each refuge and the Refuge System; and other mandates (Service Manual 602 FW 1.6 Z).

Wilderness Study Areas: Lands and waters identified through inventory as meeting the definition of wilderness and undergoing evaluation for recommendation for inclusion in the Wilderness System. A study area must meet the following criteria:

- Generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable;
- Has outstanding opportunities for solitude or a primitive and unconfined type of recreation; and
- Has at least 5,000 contiguous roadless acres or is sufficient in size as to make practicable its preservation and use in an unimpaired condition (Draft Service Manual 610 FW 1.5).

Wilderness: See Designated Wilderness

Wildfire: A free-burning fire requiring a suppression response; all fire other than prescribed fire that occurs on wildlands (Service Manual 621 FW 1.7).

Wildland Fire: Every wildland fire is either a wildfire or a prescribed fire (Service Manual 621 FW 1.3

ACRONYMS AND ABBREVIATIONS

BBL	Bird Banding Laboratory
BCC	Birds of Conservation Concern
BCR	Bird Conservation Region
BRT	Biological Review Team
BSU	Big Sandy Unit
CCP	Comprehensive Conservation Plan
CHJV	Central Hardwoods Joint Venture
CWCS	Comprehensive Wildlife Conservation Strategy
CFR	Code of Federal Regulations
DO	dissolved oxygen
DOI	Department of the Interior
DU	Ducks Unlimited
EA	Environmental Assessment
EE	environmental education
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
FDA	Food and Drug Administration
FMP	Forest Management Plan
FR	Federal Register
FTE	full-time equivalent
FWS	U.S. Fish and Wildlife Service (also Service)
FY	Fiscal Year
GIS	Global Information System
IBP	Institute for Bird Populations
ISS	International Shorebird Survey
LTCE	Lower Tennessee-Cumberland Ecosystem
MAPS	Monitoring Avian Productivity and Survivorship Program
MSL	Mean Sea Level
NEPA	National Environmental Policy Act
NOAA	National Oceanic and Atmospheric Administration
NPS	National Park Service
NRCS	USDA Natural Resources Conservation Service
NRHP	National Register of Historic Places
NWR	National Wildlife Refuge
NWRS	National Wildlife Refuge System
NWTF	National Wild Turkey Federation
NAWMP	North American Waterfowl Management Plan
PFT	Permanent Full Time
PIF	Partners in Flight
PUNA	Public Use Natural Area
RM	Refuge Manual
RNA	Research Natural Area
ROD	Record of Decision
RONS	Refuge Operating Needs System
RRP	Refuge Roads Program
RV	Recreational Vehicles
SAMMS	Service Asset Maintenance Management System
SJBP	Southern James Bay Population (of Canada Geese)

SWG	State Wildlife Grants
TDEC	Tennessee Department of Conservation and Environment
TFT	Temporary Full Time
TN	Tennessee
TNC	The Nature Conservancy
TVA	Tennessee Valley Authority
USACE	U.S. Army Corps of Engineers
USC	United States Code
USCB	U.S. Census Bureau
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service (also Service)

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Appendix C. Relevant Legal Mandates and Executive Orders

STATUE	DESCRIPTION
Administrative Procedures Act (1946)	Outlines administrative procedures to be followed by federal agencies with respect to identification of information to be made public; publication of material in the Federal Register; maintenance of records; attendance and notification requirements for specific meetings and hearings; issuance of licenses; and review of agency actions.
American Antiquities Act of 1906	Provides penalties for unauthorized collection, excavation, or destruction of historic or prehistoric ruins, monuments, or objects of antiquity on lands owned or controlled by the United States. The Act authorizes the President to designate as national monuments objects or areas of historic or scientific interest on lands owned or controlled by the Unites States.
American Indian Religious Freedom Act of 1978	Protects the inherent right of Native Americans to believe, express, and exercise their traditional religions, including access to important sites, use and possession of sacred objects, and the freedom to worship through ceremonial and traditional rites.
Americans With Disabilities Act of 1990	Intended to prevent discrimination of and make American society more accessible to people with disabilities. The Act requires reasonable accommodations to be made in employment, public services, public accommodations, and telecommunications for persons with disabilities.
Anadromous Fish Conservation Act of 1965, as amended	Authorizes the Secretaries of Interior and Commerce to enter into cooperative agreements with states and other nonfederal interests for conservation, development, and enhancement of anadromous fish and contribute up to 50 percent as the federal share of the cost of carrying out such agreements. Reclamation construction programs for water resource projects needed solely for such fish are also authorized.
Archaeological Resources Protection Act of 1979, as amended.	This Act strengthens and expands the protective provisions of the Antiquities Act of 1906 regarding archaeological resources. It also revised the permitting process for archaeological research.
Architectural Barriers Act of 1968	Requires that buildings and facilities designed, constructed, or altered with federal funds, or leased by a federal agency, must comply with standards for physical accessibility.

STATUE	DESCRIPTION
Bald and Golden Eagle Protection Act of 1940, as amended	Prohibits the possession, sale or transport of any bald or golden eagle, alive or dead, or part, nest, or egg except as permitted by the Secretary of the Interior for scientific or exhibition purposes, or for the religious purposes of Indians.
Bankhead-Jones Farm Tenant Act of 1937	Directs the Secretary of Agriculture to develop a program of land conservation and utilization in order to correct maladjustments in land use and thus assist in such things as control of soil erosion, reforestation, conservation of natural resources and protection of fish and wildlife. Some early refuges and hatcheries were established under authority of this Act.
Cave Resources Protection Act of 1988	Established requirements for the management and protection of caves and their resources on federal lands, including allowing the land managing agencies to withhold the location of caves from the public, and requiring permits for any removal or collecting activities in caves on federal lands.
Clean Air Act of 1970	Regulates air emissions from area, stationary, and mobile sources. This Act and its amendments charge federal land managers with direct responsibility to protect the "air quality and related values" of land under their control. These values include fish, wildlife, and their habitats.
Clean Water Act of 1974, as amended	This Act and its amendments have as its objective the restoration and maintenance of the chemical, physical, and biological integrity of the Nation's waters. Section 401 of the Act requires that federally permitted activities comply with the Clean Water Act standards, state water quality laws, and any other appropriate state laws. Section 404 charges the U.S. Army Corps of Engineers with regulating discharge of dredge or fill materials into waters of the United States, including wetlands.
Coastal Barrier Resources Act of 1982 (CBRA)	Identifies undeveloped coastal barriers along the Atlantic and Gulf Coasts and included them in the John H. Chafee Coastal Barrier Resources System (CBRS). The objectives of the act are to minimize loss of human life, reduce wasteful federal expenditures, and minimize the damage to natural resources by restricting most federal expenditures that encourage development within the CBRS.
Coastal Barrier Improvement Act of 1990	Reauthorized the Coastal Barrier Resources Act (CBRA), expanded the CBRS to include undeveloped coastal barriers along the Great Lakes and in the Caribbean, and established "Otherwise Protected Areas (OPAs)." The Service is responsible for maintaining official maps, consulting with federal agencies that propose spending federal funds within the CBRS and OPAs, and making recommendations to Congress about proposed boundary revisions.

STATUE	DESCRIPTION
Coastal Wetlands Planning, Protection, and Restoration (1990)	Authorizes the Director of the Fish and Wildlife Service to participate in the development of a Louisiana coastal wetlands restoration program, participate in the development and oversight of a coastal wetlands conservation program, and lead in the implementation and administration of a national coastal wetlands grant program.
Coastal Zone Management Act of 1972, as amended	Established a voluntary national program within the Department of Commerce to encourage coastal states to develop and implement coastal zone management plans and requires that "any federal activity within or outside of the coastal zone that affects any land or water use or natural resource of the coastal zone" shall be "consistent to the maximum extent practicable with the enforceable policies" of a state's coastal zone management plan. The law includes an Enhancement Grants Program for protecting, restoring, or enhancing existing coastal wetlands or creating new coastal wetlands. It also established the National Estuarine Research Reserve System, guidelines for estuarine research, and financial assistance for land acquisition.
Emergency Wetlands Resources Act of 1986	This Act authorized the purchase of wetlands from Land and Water Conservation Fund moneys, removing a prior prohibition on such acquisitions. The Act requires the Secretary to establish a National Wetlands Priority Conservation Plan, required the states to include wetlands in their Comprehensive Outdoor Recreation Plans, and transfers to the Migratory Bird Conservation Fund amounts equal to import duties on arms and ammunition. It also established entrance fees at national wildlife refuges.
Endangered Species Act of 1973, as amended	Provides for the conservation of threatened and endangered species of fish, wildlife, and plants by federal action and by encouraging the establishment of state programs. It provides for the determination and listing of threatened and endangered species and the designation of critical habitats. Section 7 requires refuge managers to perform internal consultation before initiating projects that affect or may affect endangered species.
Environmental Education Act of 1990	This Act established the Office of Environmental Education within the U.S. Environmental Protection Agency to develop and administer a federal environmental education program in consultation with other federal natural resource management agencies, including the Fish and Wildlife Service.

STATUE	DESCRIPTION
Estuary Protection Act of 1968	Authorized the Secretary of the Interior, in cooperation with other federal agencies and the states, to study and inventory estuaries of the United States, including land and water of the Great Lakes, and to determine whether such areas should be acquired for protection. The Secretary is also required to encourage state and local governments to consider the importance of estuaries in their planning activities relative to federal natural resource grants. In approving any state grants for acquisition of estuaries, the Secretary was required to establish conditions to ensure the permanent protection of estuaries.
Estuaries and Clean Waters Act of 2000	This law creates a federal interagency council that includes the Director of the Fish and Wildlife Service, the Secretary of the Army for Civil Works, the Secretary of Agriculture, the Administrator of the Environmental Protection Agency and the Administrator for the National Oceanic and Atmospheric Administration. The council is charged with developing a national estuary habitat restoration strategy and providing grants to entities to restore and protect estuary habitat to promote the strategy.
Food Security Act of 1985, as amended (Farm Bill)	The Act contains several provisions that contribute to wetland conservation. The Swampbuster provisions state that farmers who convert wetlands for the purpose of planting after enactment of the law are ineligible for most farmer program subsidies. It also established the Wetland Reserve Program to restore and protect wetlands through easements and restoration of the functions and values of wetlands on such easement areas.
Farmland Protection Policy Act of 1981, as amended	The purpose of this law is to minimize the extent to which federal programs contribute to the unnecessary conversion of farmland to nonagricultural uses. Federal programs include construction projects and the management of federal lands.
Federal Advisory Committee Act (1972), as amended	Governs the establishment of and procedures for committees that provide advice to the federal government. Advisory committees may be established only if they will serve a necessary, nonduplicative function. Committees must be strictly advisory unless otherwise specified and meetings must be open to the public.
Federal Coal Leasing Amendment Act of 1976	Provided that nothing in the Mining Act, the Mineral Leasing Act, or the Mineral Leasing Act for Acquired Lands authorized mining coal on refuges.

STATUE	DESCRIPTION
Federal-Aid Highways Act of 1968	Established requirements for approval of federal highways through national wildlife refuges and other designated areas to preserve the natural beauty of such areas. The Secretary of Transportation is directed to consult with the Secretary of the Interior and other federal agencies before approving any program or project requiring the use of land under their jurisdiction.
Federal Noxious Weed Act of 1990, as amended	The Secretary of Agriculture was given the authority to designate plants as noxious weeds and to cooperate with other federal, State and local agencies, farmers' associations, and private individuals in measures to control, eradicate, prevent, or retard the spread of such weeds. The Act requires each Federal land-managing agency, including the Fish and Wildlife Service, to designate an office or person to coordinate a program to control such plants on the agency's land and implement cooperative agreements with the states, including integrated management systems to control undesirable plants.
Fish and Wildlife Act of 1956	Establishes a comprehensive national fish, shellfish, and wildlife resources policy with emphasis on the commercial fishing industry but also includes the inherent right of every citizen and resident to fish for pleasure, enjoyment, and betterment and to maintain and increase public opportunities for recreational use of fish and wildlife resources. Among other things, it authorizes the Secretary of the Interior to take such steps as may be required for the development, advancement, management, conservation, and protection of fish and wildlife resources including, but not limited to, research, development of existing facilities, and acquisition by purchase or exchange of land and water or interests therein.
Fish and Wildlife Conservation Act of 1980, as amended	Requires the Service to monitor nongamebird species, identify species of management concern, and implement conservation measures to preclude the need for listing under the Endangered Species Act.
Fish and Wildlife Coordination Act of 1958	Promotes equal consideration and coordination of wildlife conservation with other water resource development programs by requiring consultation with the Fish and Wildlife Service and the state fish and wildlife agencies where the "waters of a stream or other body of water are proposed or authorized, permitted or licensed to be impounded, diverted…or otherwise controlled or modified" by any agency under federal permit or license.

STATUE	DESCRIPTION
Improvement Act of 1978	This act was passed to improve the administration of fish and wildlife programs and amends several earlier laws, including the Refuge Recreation Act, the National Wildlife Refuge System Administration Act, and the Fish and Wildlife Act of 1956. It authorizes the Secretary to accept gifts and bequests of real and personal property on behalf of the United States. It also authorizes the use of volunteers on Service projects and appropriations to carry out volunteer programs.
Fishery (Magnuson) Conservation and Management Act of 1976	Established Regional Fishery Management Councils comprised of federal and state officials, including the Fish and Wildlife Service. It provides for regulation of foreign fishing and vessel fishing permits.
Freedom of Information Act, 1966	Requires all federal agencies to make available to the public for inspection and copying administrative staff manuals and staff instructions; official, published and unpublished policy statements; final orders deciding case adjudication; and other documents. Special exemptions have been reserved for nine categories of privileged material. The Act requires the party seeking the information to pay reasonable search and duplication costs.
Geothermal Steam Act of 1970, as amended	Authorizes and governs the lease of geothermal steam and related resources on public lands. Section 15 c of the Act prohibits issuing geothermal leases on virtually all Service-administrative lands.
Lacey Act of 1900, as amended	Originally designed to help states protect their native game animals and to safeguard U.S. crop production from harmful foreign species, this Act prohibits interstate and international transport and commerce of fish, wildlife or plants taken in violation of domestic or foreign laws. It regulates the introduction to America of foreign species.
Land and Water Conservation Fund Act of 1948	This Act provides funding through receipts from the sale of surplus federal land, appropriations from oil and gas receipts from the outer continental shelf, and other sources for land acquisition under several authorities. Appropriations from the fund may be used for matching grants to states for outdoor recreation projects and for land acquisition by various federal agencies, including the Fish and Wildlife Service.
Marine Mammal Protection Act of 1972, as amended	The 1972 Marine Mammal Protection Act established a federal responsibility to conserve marine mammals with management vested in the Department of the Interior for sea otter, walrus, polar bear, dugong, and manatee. The Department of Commerce is responsible for cetaceans and pinnipeds, other than the walrus. With certain specified exceptions, the Act establishes a moratorium on the taking and importation of marine mammals, as well as products taken from them.

STATUE	DESCRIPTION
Migratory Bird Conservation Act of 1929	Established a Migratory Bird Conservation Commission to approve areas recommended by the Secretary of the Interior for acquisition with Migratory Bird Conservation Funds. The role of the commission was expanded by the North American Wetland Conservation Act to include approving wetlands acquisition, restoration, and enhancement proposals recommended by the North American Wetlands Conservation Council.
Migratory Bird Hunting and Conservation Stamp Act of 1934	Also commonly referred to as the "Duck Stamp Act," requires waterfowl hunters 16 years of age or older to possess a valid federal hunting stamp. Receipts from the sale of the stamp are deposited into the Migratory Bird Conservation Fund for the acquisition of migratory bird refuges.
Migratory Bird Treaty Act of 1918, as amended	This Act implements various treaties and conventions between the United States and Canada, Japan, Mexico, and the former Soviet Union for the protection of migratory birds. Except as allowed by special regulations, this Act makes it unlawful to pursue, hunt, kill, capture, possess, buy, sell, purchase, barter, export or import any migratory bird, part, nest, egg, or product.
Mineral Leasing Act for Acquired Lands (1947), as amended	Authorizes and governs mineral leasing on acquired public lands.
Minerals Leasing Act of 1920, as amended	Authorizes and governs leasing of public lands for development of deposits of coal, oil, gas, and other hydrocarbons; sulphur; phosphate; potassium; and sodium. Section 185 of this title contains provisions relating to granting rights-of-way over federal lands for pipelines.
Mining Act of 1872, as amended	Authorizes and governs prospecting and mining for the so-called "hardrock" minerals (i.e., gold and silver) on public lands.
National and Community Service Act of 1990	Authorizes several programs to engage citizens of the U.S. in full- and/or part-time projects designed to combat illiteracy and poverty, provide job skills, enhance educational skills, and fulfill environmental needs. Among other things, this law establishes the American Conservation and Youth Service Corps to engage young adults in approved human and natural resource projects, which will benefit the public or are carried out on federal or Indian lands.

STATUE	DESCRIPTION
National Environmental Policy Act of 1969	Requires analysis, public comment, and reporting for environmental impacts of federal actions. It stipulates the factors to be considered in environmental impact statements, and requires that federal agencies employ an interdisciplinary approach in related decision-making and develop means to ensure that unqualified environmental values are given appropriate consideration, along with economic and technical considerations.
National Historic Preservation Act of 1966, as amended	It establishes a National Register of Historic Places and a program of matching grants for preservation of significant historical features. Federal agencies are directed to take into account the effects of their actions on items or sites listed or eligible for listing in the National Register.
National Trails System Act (1968), as amended	Established the National Trails System to protect the recreational, scenic, and historic values of some important trails. National recreation trails may be established by the Secretaries of Interior or Agriculture on land wholly or partly within their jurisdiction, with the consent of the involved state(s), and other land managing agencies, if any. National scenic and national historic trails may only be designated by Congress. Several national trails cross units of the National Wildlife Refuge System.
National Wildlife Refuge System Administration Act of 1966	Prior to 1966, there was no single federal law that governed the administration of the various national wildlife refuges that had been established. This Act defines the National Wildlife Refuge System and authorizes the Secretary of the Interior to permit any use of a refuge provided such use is compatible with the major purposes(s) for which the refuge was established.
National Wildlife Refuge System Improvement Act of 1997	This Act amends the National Wildlife Refuge System Administration Act of 1966. This Act defines the mission of the National Wildlife Refuge System, establishes the legitimacy and appropriateness of six priority wildlife-dependent public uses, establishes a formal process for determining compatible uses of Refuge System lands, identifies the Secretary of the Interior as responsible for managing and protecting the Refuge System, and requires the development of a comprehensive conservation plan for all refuges outside of Alaska.
Native American Graves Protection and Repatriation Act of 1990	Requires federal agencies and museums to inventory, determine ownership of, and repatriate certain cultural items and human remains under their control or possession. The Act also addresses the repatriation of cultural items inadvertently discovered by construction activities on lands managed by the agency.
Neotropical Migratory Bird Conservation Act of 2000	Establishes a matching grant program to fund projects that promote the conservation of neotropical migratory birds in the united States, Latin America, and the Caribbean.

STATUE	DESCRIPTION
North American Wetlands Conservation Act of 1989	Provides funding and administrative direction for implementation of the North American Waterfowl Management Plan and the Tripartite Agreement on wetlands between Canada, the United States, and Mexico. The North American Wetlands Conservation Council was created to recommend projects to be funded under the Act to the Migratory Bird Conservation Commission. Available funds may be expended for up to 50 percent of the United States' share cost of wetlands conservation projects in Canada, Mexico, or the United States (or 100 percent of the cost of projects on federal lands).
Refuge Recreation Act of 1962, as amended	This Act authorizes the Secretary of the Interior to administer refuges, hatcheries, and other conservation areas for recreational use, when such uses do not interfere with the area's primary purposes. It authorizes construction and maintenance of recreational facilities and the acquisition of land for incidental fish and wildlife-oriented recreational development or protection of natural resources. It also authorizes the charging of fees for public uses.
Partnerships for Wildlife Act of 1992	Establishes a Wildlife Conservation and Appreciation Fund to receive appropriated funds and donations from the National Fish and Wildlife Foundation and other private sources to assist the state fish and game agencies in carrying out their responsibilities for conservation of nongame species. The funding formula is no more that 1/3 federal funds, at least 1/3 foundation funds, and at least 1/3 state funds.
Refuge Revenue Sharing Act of 1935, as amended	Provided for payments to counties in lieu of taxes from areas administered by the Fish and Wildlife Service. Counties are required to pass payments along to other units of local government within the county, which suffer losses in tax revenues due to the establishment of Service areas.
Rehabilitation Act of 1973	Requires nondiscrimination in the employment practices of federal agencies of the executive branch and contractors. It also requires all federally assisted programs, services, and activities to be available to people with disabilities.
Rivers and Harbors Appropriations Act of 1899, as amended	Requires the authorization by the U.S. Army Corps of Engineers prior to any work in, on, over, or under a navigable water of the United States. The Fish and Wildlife Coordination Act provides authority for the Service to review and comment on the effects on fish and wildlife activities proposed to be undertaken or permitted by the Corps of Engineers. Service concerns include contaminated sediments associated with dredge or fill projects in navigable waters.

STATUE	DESCRIPTION
Sikes Act (1960), as amended	Provides for the cooperation by the Departments of Interior and Defense with state agencies in planning, development, and maintenance of fish and wildlife resources and outdoor recreation facilities on military reservations throughout the United States. It requires the Secretary of each military department to use trained professionals to manage the wildlife and fishery resource under his jurisdiction, and requires that federal and state fish and wildlife agencies be given priority in management of fish and wildlife activities on military reservations.
Transfer of Certain Real Property for Wildlife Conservation Purposes Act of 1948	This Act provides that upon determination by the Administrator of the General Services Administration, real property no longer needed by a federal agency can be transferred, without reimbursement, to the Secretary of the Interior if the land has particular value for migratory birds, or to a state agency for other wildlife conservation purposes.
Transportation Equity Act for the 21st Century (1998)	Established the Refuge Roads Program, requires transportation planning that includes public involvement, and provides funding for approved public use roads and trails and associated parking lots, comfort stations, and bicycle/pedestrian facilities.
Uniform Relocation and Assistance and Real Property Acquisition Policies Act (1970), as amended	Provides for uniform and equitable treatment of persons who sell their homes, businesses, or farms to the Service. The Act requires that any purchase offer be no less than the fair market value of the property.
Water Resources Planning Act of 1965	Established Water Resources Council to be composed of Cabinet representatives including the Secretary of the Interior. The Council reviews river basin plans with respect to agricultural, urban, energy, industrial, recreational and fish and wildlife needs. The act also established a grant program to assist States in participating in the development of related comprehensive water and land use plans.
Wild and Scenic Rivers Act of 1968, as amended	This Act selects certain rivers of the nation possessing remarkable scenic, recreational, geologic, fish and wildlife, historic, cultural, or other similar values; preserves them in a free-flowing condition; and protects their local environments.
Wilderness Act of 1964, as amended	This Act directs the Secretary of the Interior to review every roadless area of 5,000 acres or more and every roadless island regardless of size within the National Wildlife Refuge System and to recommend suitability of each such area. The Act permits certain activities within designated wilderness areas that do not alter natural processes. Wilderness values are preserved through a “minimum tool” management approach, which requires refuge managers to use the least intrusive methods, equipment, and facilities necessary for administering the areas.

STATUE	DESCRIPTION
Youth Conservation Corps Act of 1970	Established a permanent Youth Conservation Corps (YCC) program within the Departments of Interior and Agriculture. Within the Service, YCC participants perform many tasks on refuges, fish hatcheries, and research stations.

EXECUTIVE ORDERS	DESCRIPTIONS
EO 11593, Protection and Enhancement of the Cultural Environment (1971)	States that if the Service proposes any development activities that may affect the archaeological or historic sites, the Service will consult with Federal and State Historic Preservation Officers to comply with Section 106 of the National Historic Preservation Act of 1966, as amended.
EO 11644, Use of Off-road Vehicles on Public Land (1972)	Established policies and procedures to ensure that the use of off-road vehicles on public lands will be controlled and directed so as to protect the resources of those lands, to promote the safety of all users of those lands, and to minimize conflicts among the various uses of those lands.
EO 11988, Floodplain Management (1977)	The purpose of this Executive Order is to prevent federal agencies from contributing to the “adverse impacts associated with occupancy and modification of floodplains” and the “direct or indirect support of floodplain development.” In the course of fulfilling their respective authorities, federal agencies “shall take action to reduce the risk of flood loss, to minimize the impact of floods on human safety, health and welfare, and to restore and preserve the natural and beneficial values served by floodplains.”
EO 11989 (1977), Amends Section 2 of EO 11644	Directs agencies to close areas negatively impacted by off-road vehicles.
EO 11990, Protection of Wetlands (1977)	Federal agencies are directed to provide leadership and take action to minimize the destruction, loss of degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands.

EXECUTIVE ORDERS	DESCRIPTIONS
EO 12372, Intergovernmental Review of Federal Programs (1982)	Seeks to foster intergovernmental partnerships by requiring federal agencies to use the state process to determine and address concerns of state and local elected officials with proposed federal assistance and development programs.
EO 12898, Environmental Justice (1994)	Requires federal agencies to identify and address disproportionately high and adverse effects of its programs, policies, and activities on minority and low-income populations.
EO 12906, Coordinating Geographical Data Acquisition and Access (1994), Amended by EO 13286 (2003). Amendment of EOs and other actions in connection with transfer of certain functions to Secretary of DHS.	Recommended that the executive branch develop, in cooperation with state, local, and tribal governments, and the private sector, a coordinated National Spatial Data Infrastructure to support public and private sector applications of geospatial data. Of particular importance to comprehensive conservation planning is the National Vegetation Classification System (NVCS), which is the adopted standard for vegetation mapping. Using NVCS facilitates the compilation of regional and national summaries, which in turn, can provide an ecosystem context for individual refuges.
EO 12962, Recreational Fisheries (1995)	Federal agencies are directed to improve the quantity, function, sustainable productivity, and distribution of U.S. aquatic resources for increased recreational fishing opportunities in cooperation with states and tribes.
EO 13007, Native American Religious Practices (1996)	Provides for access to, and ceremonial use of, Indian sacred sites on federal lands used by Indian religious practitioners and direction to avoid adversely affecting the physical integrity of such sites.
EO 13061, Federal Support of Community Efforts Along American Heritage Rivers (1997)	Established the American Heritage Rivers initiative for the purpose of natural resource and environmental protection, economic revitalization, and historic and cultural preservation. The Act directs Federal agencies to preserve, protect, and restore rivers and their associated resources important to our history, culture, and natural heritage.
EO 13084, Consultation and Coordination With Indian Tribal Governments (2000)	Provides a mechanism for establishing regular and meaningful consultation and collaboration with tribal officials in the development of federal policies that have tribal implications.

EXECUTIVE ORDERS	DESCRIPTIONS
EO 13112, Invasive Species (1999)	Federal agencies are directed to prevent the introduction of invasive species, detect and respond rapidly to and control populations of such species in a cost effective and environmentally sound manner, accurately monitor invasive species, provide for restoration of native species and habitat conditions, conduct research to prevent introductions and to control invasive species, and promote public education on invasive species and the means to address them. This EO replaces and rescinds EO 11987, Exotic Organisms (1977).
EO 13186, Responsibilities of Federal Agencies to Protect Migratory Birds. (2001)	Instructs federal agencies to conserve migratory birds by several means, including the incorporation of strategies and recommendations found in Partners in Flight Bird Conservation plans, the North American Waterfowl Plan, the North American Waterbird Conservation Plan, and the United States Shorebird Conservation Plan, into agency management plans and guidance documents.

Appendix D. Public Involvement

SUMMARY OF PUBLIC SCOPING COMMENTS

Public Involvement and Planning Process: Prior to public scoping in 2008, a biological review and a visitor services review of the refuge were conducted. In August 2004, a diverse team of federal and state personnel undertook a holistic examination of habitat and wildlife management programs at the refuge. The team then considered how the refuge might fit into accomplishing a number of relevant system-wide and landscape conservation needs. The biological review team included staff from the refuge, as well as Service fish and wildlife biologists from the Southeast Regional Office and the Service's Division of Ecological Services and Division of Migratory Birds. In addition, wildlife biologists from the Tennessee Wildlife Resources Agency (TWRA), Tennessee Valley Authority (TVA), University of Tennessee (Knoxville), and Tennessee Wildlife Federation participated. The team's recommendations were set forth in its final report entitled, "Tennessee National Wildlife Refuge Biological Review," and was instrumental in the planning process.

The visitor services review was conducted in February 2004 by Service public use and outreach specialists. The visitor services review team toured the refuge, identified and discussed the current status of public use programs, and provided a report with recommendations for enhancing and improving these programs.

The comprehensive conservation plan core planning team, which consists of the refuge manager, deputy refuge manager, two wildlife biologists, park ranger, a natural resources planner from the Service's Southeast Regional Office, and a contractor with experience in comprehensive conservation planning met for the first time in November 2007 for a tour of the refuge and an overview of its habitat and wildlife resources and public use programs, facilities, and opportunities. The core planning team also conducted additional internal scoping and prepared a preliminary schedule and plans for public involvement. The core team developed a mailing list of the public, landowners, state and tribal agencies, nonprofit organizations, and local governments. Letters were sent notifying these parties of the planning process being initiated, and encouraging their participation in the scoping of issues in preparation for developing the draft plan for this refuge.

State Involvement and Date of Initial Contact: The TWRA was invited in January 2008 to participate on the planning team tasked with preparing the Draft CCP/EA. The state was also involved in the biological review.

Summary of Issues Identified from Internal Scoping: The core planning team identified a number of issues relating to management of migratory birds, threatened and endangered species, wildlife protection, habitat restoration, and recreation. Also, a number of federal and state mandates plus applicable local ordinances, regulations, and plans were considered.

Wildlife and Fish Population and Habitat Management

- Dates for closing and re-opening portions of the refuge when migratory waterfowl are here in the winter to avoid human disturbance.

- Multiple closure dates on different refuges or different portions of TN Refuge have led to confusion.

- There would be confusion once more if dates were to change again.

- The refuge has no control over the water level schedule in Kentucky Lake. It is usually lowered starting July 1; mudflats are needed for shorebirds and waterfowl.

- Crop manipulation (e.g., knocking down of corn stalks) in farmed areas is an issue because of hunt clubs.

- Cooperative farming program – it is sometimes difficult for the 5 farmers to stick to their agreements with the refuge.

- To implement force-account farming (by refuge staff) takes staff and budget.

- The public will say that there are too many crops on Duck River and not enough water on the Busseltown Unit.

- Experiment with closing the road at Busseltown to see if that would attract waterfowl.

- Forest management planning is a public process; there has been one thinning over 400 acres on the Big Sandy Unit. The refuge does have a forest management plan.

- In terms of invasive plant control, the refuge mostly focuses on aquatics.

- Cowbird parasitism is affecting some songbirds.

- Refuge forester has been lost; forester and fire management capability would be nice to have.

- Should moist soil acreage be increased in certain areas?

- Creating shorebird impoundments in the Duck River Unit would impact 30 acres or so of farmland there.

- Among the threatened and endangered species and other species of concern are the interior least tern and piping plover, both of which migrate through the refuge. There are endangered freshwater mussels in the lake. The king rail is a species of concern and there is a small breeding population in the Duck River Bottoms. Some neotropical migratory birds are species of concern, including the cerulean warbler.

Public Use

- Waterfowl hunting on the refuge. The resident Canada goose hunt has been problematic in recent years. Tennessee NWR is the only sanctuary locally and six WMAs within a 10-mile radius are open to waterfowl hunting. Clubs would probably oppose opening the refuge to hunting waterfowl.

- Would a waterfowl hunt be manageable? Law enforcement might be spread too thin.

- Could a youth waterfowl hunt be conducted with Ducks Unlimited assistance?

- Closing areas to public use for the benefit of wildlife or wintering waterfowl is controversial.
- Equestrians want to use more of the refuge; right now they can only use refuge roads that are open to motorized vehicles.
- Refuge has 20+ boat ramps which are expensive to maintain.
- Boat ramps need designated parking areas to avoid blocking roads and gates.
- Is there potential for partnerships in maintaining boat ramps?
- What should the refuge's policy be on fishing tournaments?
- There is some demand to use ATVs for hunting, but it is not allowed.
- Adequacy of refuge's handicapped hunting and fishing facilities.

Resource Protection

- Law enforcement is spread across five counties. Crime runs the gamut from game & fish violations to meth labs, marijuana cultivation and digging for artifacts (arrowheads, rocks, fossils). Hunters and fishers are often the eyes and ears of LE.
- USFWS and DOD (Ft. Campbell) jointly fund LE officers at a 80% Ft. Campbell to 20% USFWS ratio. TN NWR gets 20% of all Ft. Campbell officers time.
- Two more FTE LE officers needed for TN NWR alone, 1 of which would be stationed at Duck River.
- Another LE position would be stationed at HQ or at Cross Creeks Refuge.
- Violations are impinging on the sanctuary for waterfowl and the problem appears to be getting worse.

Administration (Staffing and Facilities)

- Shortage of restroom facilities throughout the refuge. They entail both capital and maintenance costs.
- Busseltown has fewer visitor use facilities because of its remoteness and the potential for vandalism.
- The Friends Group is 3 years old and continuing to get established and find its place.
- Refuge boundaries need to be re-surveyed, posted, and maintained.
- The loss of the Cross Creeks Refuge's public use person means the Tennessee NWR park ranger will have to divert some of her efforts to assisting that refuge.

- There is a substantial maintenance backlog that includes grading roads, mowing, and rehabbing boat ramps.

- Maintaining and dredging the main ditch in the Lower Duck River Bottoms is needed to improve water management capability.

- Spillways are needed to avoid flood damage.

- Refuge needs a pumping project to pump water into pools, so that they're not so dependent on the lake level.

- Need maintenance/grounds staff; even a seasonal position would help.

- The refuge is very spread out and lengthy round-trip travel time to distant portions is an impediment.

- Refuge has a hard time getting vendors to deliver construction materials because of cost and county road weight limits on trucks.

State: In a letter dated May 16, 2008, the Executive Director of the Tennessee Wildlife Resources Agency (TWRA) requested that all or some portion of the refuge be opened to a regulated furbearer trapping season. TWRA argues that such a season would provide mutual benefits for Tennessee sportsmen and refuge management. Allowing licensed trappers on the refuge will help alleviate potential overabundance of traditional furbearer species such as beavers and coyotes, while allowing for recreational opportunities for Tennessee sportsmen.

Tribes: None

Partners: Continue close coordination with the TVA regarding management of lake water levels. Coordinate with TWRA on hunting and fishing programs and expand the state's participation in refuge planning activities.

Summary of Issues Identified from External (Public) Scoping: Three public scoping meetings were held – in Paris, Parsons, and New Johnsonville, Tennessee – on May 5, 6, and 7, 2008, respectively. These locations correspond to the refuge's three distinct units – Big Sandy, Busseltown, and Duck River. The scoping meetings introduced the CCP to the public and allowed the Service to receive input, perspectives, and comments as to the issues, concerns, and opportunities that the public feels should be addressed in the CCP. The following bullet points summarize the issues raised orally by the public at these meetings, and later, in written comments received as emails, faxes, letters, and on comment forms.

Wildlife and Fish Population and Habitat Management

- Refuge staff is effective in supporting original refuge purposes.

- Refuge is doing a good job.

- Waterfowl impoundments at Big Sandy Creek used to be a fishing area; habitat management has been extensive in this area.

- Buck bushes appear to be disappearing in coves on Kentucky Lake; sticker trees are shading out buck bushes, which may be a result of TVA water manipulations.

- Drawdown, and water manipulations and levels by TVA may conflict with refuge management.

- Aquatic habitat manipulation to benefit fish stocks and sportfishing – Stake beds with plastic pipes use for fish habitat.

- Complete, intensive inventory and monitoring of biological resources is needed in order to track population changes over time.

- I hope trapping will be given serious consideration in the CCP. Trapping will lower predator populations, which would help the ground-nesting birds such as turkey and quail. It would also help to control the beaver and coyote problems, as well as provide some economic benefits for local trappers.

- Nonnative plants and animals is the most important issue facing the refuge. Spraying, cutting, and relocating are possible means for addressing the problem posed by nonnatives.

- The refuge should diversify food sources for wildlife and not rely so much on corn and beans.

- Overall the refuge does a good job managing habitats and wildlife, but spends very little on fishing habitat compared to ducks and geese.

- I hope the new management plan does not make accessibility for hunters an integral part of the refuge's mission. The concept of a "refuge" should be just that, as a haven for migratory birds to rest and feed, and to provide a nesting area for resident wildlife. I hope the U.S. Fish and Wildlife Service can rise above local politics and special interest input and manage the refuge system as it was originally intended. I know there may be specific requirements when a limited hunt is necessary to prevent an overpopulation of a species, but the general concept of a refuge (sanctuary) should be maintained.

Public Use

- Britton Ford, Problem with handicap accessibility.

- Camping property next door to refuge and there are limited opportunities to access refuge resources.

- We need more handicap accessible areas for electric wheel chairs/golf carts.

- Set up areas strictly for handicap accessible access for fishing, hunting, wildlife viewing. This issue needs to be addressed nationally.

- There are a lot of competing interests and few places to go.

- There is an increasing population in local areas, raising public use pressure on refuge.

- Accessibility is sometimes difficult.

- Increase waterfowl hunting opportunities.
- Introduce more people to wildlife resources via the refuge.
- Chamber of Commerce believes refuge manager has done a tremendous job as a partner and increased understanding of wildlife refuge resources.
- There are opportunities to increase tourism related to the refuge and therefore increase the quality of life for local communities and residents.
- All public lands (State, County, and Federal NWR land) represent a great opportunity to introduce families and public to nature and increase quality of life.
- Positive publicity among groups has brought people together and welcomed many to the refuge.
- 79% of refuge users are nonresidents; five states are represented in a campground next to the refuge.
- Refuge can pursue outreach to others and bring more people to the area, which may increase public use opportunities.
- Fishing on the Big Sandy Unit is nice, which attracts a lot of visitors.
- Add raccoon hunting with dogs to refuge public use program.
- Better access for the handicapped is the most important issue facing the refuge. Handicapped people should be able to ride golf carts to the ramp.
- While the types of public use are appropriate, the refuge is open only one-half time; life goes on at night.
- By permit, the refuge should allow Scouts and other nonprofits to stay overnight; a “no fire” camping policy is O.K.
- Handicapped people are allowed to ride golf carts in federal parks. So why can’t the ride them to the ramp if they have a handicapped placard.
- Refuge habitats and wildlife should be managed so that they are more accessible to the handicapped.
- The types of public use and visitation permitted and encouraged by the refuge are not appropriate because a person that can’t walk very well and goes to the ramp on a golf cart gets ticketed.
- The most important issue facing the refuge is to make it more user friendly, so more people can see the wonderful work the refuge does for habitat and wildlife.
- Refuge should build better and larger boat ramps and more parking.

- You need to be friendlier to handicapped people and older people. Golf carts with handicapped stickers should be OK to drive in parks and parking lots.

- The more different types of visitors the refuge supports, the more supportive they in turn will be when the refuge asks for more money to help for its services to tell their congressmen to vote for an increase in funds.

- I think there should be some special privileges or accommodations made for people visiting family graves on the refuge, many of which are off the main roads. For most elderly, a half-mile hike is out of the question. Accessibility becomes a subjective issue based on individual capabilities. Accessibility to graveyards where gravel roads are available should be allowed by vehicle.

- Hunting is animal abuse, and encourages gun wackos to go out and shoot their friends in the face. It is far too dangerous and corrosive to a nation to allow it in these sites designated as refuges. Trapping is also animal abuse, pure and simple. You trap the animal so it lives in pain for days so the trapper gets $2.00 for the pelt. That animal is worth a million dollars alive to me. I do not understand this corruption and greed that allow this murder and abuse of wildlife and birds to continue. I oppose it.

Administration (Staffing and Facilities)

- Primary issue facing the refuge is funding and providing adequate staff to support the refuge and resources; budgets have been decreasing.

- Potential for cooperating with Paris Landing State Park to manage adjacent property and provide an environmental education and interpretation center.

- Cooperative and partnering opportunities can be achieved with local camping facilities.

Appendix E. Appropriate Use Determinations

Tennessee National Wildlife Refuge Appropriate Use Determinations

An appropriate use determination is the initial decision process a refuge manager follows when first considering whether or not to allow a proposed use on a refuge. The refuge manager must find that a use is appropriate before undertaking a compatibility review of the use. This process clarifies and expands on the compatibility determination process by describing when refuge managers should deny a proposed use without determining compatibility. If a proposed use is not appropriate, it will not be allowed and a compatibility determination will not be undertaken.

Except for the uses noted below, the refuge manager must decide if a new or existing use is an appropriate refuge use. If an existing use is not appropriate, the refuge manager will eliminate or modify the use as expeditiously as practicable. If a new use is not appropriate, the refuge manager will deny the use without determining compatibility. Uses that have been administratively determined to be appropriate are:

- Six wildlife-dependent recreational uses - As defined by the National Wildlife Refuge System Improvement Act of 1997, the six wildlife-dependent recreational uses (hunting, fishing, wildlife observation, wildlife photography, and environmental education and interpretation) are determined to be appropriate. However, the refuge manager must still determine if these uses are compatible.

- Take of fish and wildlife under state regulations - States have regulations concerning take of wildlife that includes hunting, fishing, and trapping. The Service considers take of wildlife under such regulations appropriate. However, the refuge manager must determine if the activity is compatible before allowing it on a refuge.

Statutory Authorities for this policy:

National Wildlife Refuge System Administration Act of 1966, as amended by the National Wildlife Refuge System Improvement Act of 1997, 16 U.S.C. §668dd-668ee. This law provides the authority for establishing policies and regulations governing refuge uses, including the authority to prohibit certain harmful activities. The Act does not authorize any particular use, but rather authorizes the Secretary of the Interior to allow uses only when they are compatible and "under such regulations as he may prescribe." This law specifically identifies certain public uses that, when compatible, are legitimate and appropriate uses within the Refuge System. The law states ". . . it is the policy of the United States that . . .compatible wildlife-dependent recreation is a legitimate and appropriate general public use of the System . . .compatible wildlife-dependent recreational uses are the priority general public uses of the System and shall receive priority consideration in refuge planning and management; and . . . when the Secretary determines that a proposed wildlife-dependent recreational use is a compatible use within a refuge, that activity should be facilitated . . . the Secretary shall . . . ensure that priority general public uses of the System receive enhanced consideration over other general public uses in planning and management within the System . . ." The law also states "in administering the System, the Secretary is authorized to take the following actions: . . . issue regulations to carry out this Act." This policy implements the standards set in the Act by providing enhanced consideration of priority general public uses and ensuring other public uses do not interfere with our ability to provide quality, wildlife-dependent recreational uses.

Refuge Recreation Act of 1962, 16 U.S.C. 460k. The Act authorizes the Secretary of the Interior to administer refuges, hatcheries, and other conservation areas for recreational use, when such uses do not interfere with the area's primary purposes. It authorizes construction and maintenance of recreational facilities and the acquisition of land for incidental fish and wildlife oriented recreational development or protection of natural resources. It also authorizes the charging of fees for public uses.

Other Statutes that Establish Refuges, including the Alaska National Interest Lands Conservation Act of 1980 (ANILCA) (16 U.S.C. §410hh - 410hh-5, 460 mm - 460mm-4, 539-539e, and 3101 - 3233; 43 U.S.C. 1631 et seq.).

Executive Orders. The Service must comply with Executive Order 11644 when allowing use of off-highway vehicles on refuges. This order requires the Service to designate areas as open or closed to off-highway vehicles in order to protect refuge resources, promote safety, and minimize conflict among the various refuge users; monitor the effects of these uses once they are allowed; and amend or rescind any area designation as necessary based on the information gathered. Furthermore, Executive Order 11989 requires the Service to close areas to off-highway vehicles when it is determined that the use causes or will cause considerable adverse effects on the soil, vegetation, wildlife, habitat, or cultural or historic resources. Statutes, such as ANILCA, take precedence over executive orders.

Definitions:

Appropriate Use
A proposed or existing use on a refuge that meets at least one of the following four conditions.

1) The use is a wildlife-dependent recreational use as identified in the Improvement Act.
2) The use contributes to fulfilling the refuge purpose(s), the Refuge System mission, or goals or objectives described in a refuge management plan approved after October 9, 1997, the date the Improvement Act was signed into law.
3) The use involves the take of fish and wildlife under state regulations.
4) The use has been found to be appropriate as specified in section 1.11.

Native American. American Indians in the conterminous United States and Alaska Natives (including Aleuts, Eskimos, and Indians) who are members of federally recognized tribes.

Priority General Public Use. A compatible wildlife-dependent recreational use of a refuge involving hunting, fishing, wildlife observation, wildlife photography, and environmental education and interpretation.

Quality. The criteria used to determine a quality recreational experience include:

- Promotes safety of participants, other visitors, and facilities.
- Promotes compliance with applicable laws and regulations and responsible behavior.
- Minimizes or eliminates conflicts with fish and wildlife population or habitat goals or objectives in a plan approved after 1997.
- Minimizes or eliminates conflicts with other compatible wildlife-dependent recreation.
- Minimizes conflicts with neighboring landowners.
- Promotes accessibility and availability to a broad spectrum of the American people.
- Promotes resource stewardship and conservation.
- Promotes public understanding and increases public appreciation of America's natural resources and the Service's role in managing and protecting these resources.

- Provides reliable/reasonable opportunities to experience wildlife.
- Uses facilities that are accessible and blend into the natural setting.
- Uses visitor satisfaction to help define and evaluate programs.

Wildlife-Dependent Recreational Use. As defined by the Improvement Act, a use of a refuge involving hunting, fishing, wildlife observation, wildlife photography, and environmental education and interpretation.

FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: Tennessee National Wildlife Refuge

Use: Cooperative Farming

This form is not required for wildlife-dependent recreational uses, take regulated by the State, or uses already described in a refuge CCP or step-down management plan approved after October 9, 1997.

Decision Criteria:	YES	NO
(a) Do we have jurisdiction over the use?	x	
(b) Does the use comply with applicable laws and regulations (Federal, State, Tribal, and local)?	x	
(c) Is the use consistent with applicable executive orders and Department and Service policies?	x	
(d) Is the use consistent with public safety?	x	
(e) Is the use consistent with goals and objectives in an approved management plan or other document?	x	
(f) Has an earlier documented analysis not denied the use or is this the first time the use has been proposed?	x	
(g) Is the use manageable within available budget and staff?	x	
(h) Will this be manageable in the future within existing resources?	x	
(i) Does the use contribute to the public's understanding and appreciation of the refuge's natural or cultural resources, or is the use beneficial to the refuge's natural or cultural resources?	x	
(j) Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see section 1.6D, 603 FW 1, for description), compatible, wildlife-dependent recreation into the future?	x	

Where we do not have jurisdiction over the use ["no" to (a)], there is no need to evaluate it further as we cannot control the use. Uses that are illegal, inconsistent with existing policy, or unsafe ["no" to (b), (c), or (d)] may not be found appropriate. If the answer is "no" to any of the other questions above, we will **generally** not allow the use.

If indicated, the refuge manager has consulted with State fish and wildlife agencies. **Yes** x__ **No** ___

When the refuge manager finds the use appropriate based on sound professional judgment, the refuge manager must justify the use in writing on an attached sheet and obtain the refuge supervisor's concurrence.

Based on an overall assessment of these factors, my summary conclusion is that the proposed use is:

Not Appropriate_____ **Appropriate** x___

Refuge Manager: _____Date:_____

If found to be **Not Appropriate**, the refuge supervisor does not need to sign concurrence if the use is a new use. If an existing use is found **Not Appropriate** outside the CCP process, the refuge supervisor must sign concurrence. If found to be **Appropriate**, the refuge supervisor must sign concurrence.

Refuge Supervisor:_____Date:_____

A compatibility determination is required before the use may be allowed.

FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: Tennessee National Wildlife Refuge

Use: Marine Concessions

This form is not required for wildlife-dependent recreational uses, take regulated by the State, or uses already described in a refuge CCP or step-down management plan approved after October 9, 1997.

Decision Criteria:	YES	NO
(a) Do we have jurisdiction over the use?	x	
(b) Does the use comply with applicable laws and regulations (Federal, State, Tribal, and local)?	x	
(c) Is the use consistent with applicable executive orders and Department and Service policies?	x	
(d) Is the use consistent with public safety?	x	
(e) Is the use consistent with goals and objectives in an approved management plan or other document?	x	
(f) Has an earlier documented analysis not denied the use or is this the first time the use has been proposed?	x	
(g) Is the use manageable within available budget and staff?	x	
(h) Will this be manageable in the future within existing resources?	x	
(i) Does the use contribute to the public's understanding and appreciation of the refuge's natural or cultural resources, or is the use beneficial to the refuge's natural or cultural resources?	x	
(j) Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see section 1.6D, 603 FW 1, for description), compatible, wildlife-dependent recreation into the future?	x	

Where we do not have jurisdiction over the use ["no" to (a)], there is no need to evaluate it further as we cannot control the use. Uses that are illegal, inconsistent with existing policy, or unsafe ["no" to (b), (c), or (d)] may not be found appropriate. If the answer is "no" to any of the other questions above, we will **generally** not allow the use.

If indicated, the refuge manager has consulted with State fish and wildlife agencies. **Yes** x__ **No** ___

When the refuge manager finds the use appropriate based on sound professional judgment, the refuge manager must justify the use in writing on an attached sheet and obtain the refuge supervisor's concurrence.

Based on an overall assessment of these factors, my summary conclusion is that the proposed use is:

Not Appropriate_____ **Appropriate** x___

Refuge Manager: _____Date:_____

If found to be **Not Appropriate**, the refuge supervisor does not need to sign concurrence if the use is a new use. If an existing use is found **Not Appropriate** outside the CCP process, the refuge supervisor must sign concurrence. If found to be **Appropriate**, the refuge supervisor must sign concurrence.

Refuge Supervisor:_____Date:_____

A compatibility determination is required before the use may be allowed.

FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: Tennessee National Wildlife Refuge

Use: Scientific Research

This form is not required for wildlife-dependent recreational uses, take regulated by the State, or uses already described in a refuge CCP or step-down management plan approved after October 9, 1997.

Decision Criteria:	YES	NO
(a) Do we have jurisdiction over the use?	x	
(b) Does the use comply with applicable laws and regulations (Federal, State, Tribal, and local)?	x	
(c) Is the use consistent with applicable executive orders and Department and Service policies?	x	
(d) Is the use consistent with public safety?	x	
(e) Is the use consistent with goals and objectives in an approved management plan or other document?	x	
(f) Has an earlier documented analysis not denied the use or is this the first time the use has been proposed?	x	
(g) Is the use manageable within available budget and staff?	x	
(h) Will this be manageable in the future within existing resources?	x	
(i) Does the use contribute to the public's understanding and appreciation of the refuge's natural or cultural resources, or is the use beneficial to the refuge's natural or cultural resources?	x	
(j) Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see section 1.6D, 603 FW 1, for description), compatible, wildlife-dependent recreation into the future?	x	

Where we do not have jurisdiction over the use ["no" to (a)], there is no need to evaluate it further as we cannot control the use. Uses that are illegal, inconsistent with existing policy, or unsafe ["no" to (b), (c), or (d)] may not be found appropriate. If the answer is "no" to any of the other questions above, we will **generally** not allow the use.

If indicated, the refuge manager has consulted with State fish and wildlife agencies. **Yes** x__ **No** ___

When the refuge manager finds the use appropriate based on sound professional judgment, the refuge manager must justify the use in writing on an attached sheet and obtain the refuge supervisor's concurrence.

Based on an overall assessment of these factors, my summary conclusion is that the proposed use is:

Not Appropriate_____ **Appropriate** x___

Refuge Manager: _____Date:_____

If found to be **Not Appropriate**, the refuge supervisor does not need to sign concurrence if the use is a new use. If an existing use is found **Not Appropriate** outside the CCP process, the refuge supervisor must sign concurrence. If found to be **Appropriate**, the refuge supervisor must sign concurrence.

Refuge Supervisor:_____Date:_____

A compatibility determination is required before the use may be allowed.

FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: Tennessee National Wildlife Refuge

Use: Horseback riding / horse drawn conveyance

This form is not required for wildlife-dependent recreational uses, take regulated by the State, or uses already described in a refuge CCP or step-down management plan approved after October 9, 1997.

Decision Criteria:	YES	NO
(a) Do we have jurisdiction over the use?	x	
(b) Does the use comply with applicable laws and regulations (Federal, State, Tribal, and local)?	x	
(c) Is the use consistent with applicable executive orders and Department and Service policies?	x	
(d) Is the use consistent with public safety?	x	
(e) Is the use consistent with goals and objectives in an approved management plan or other document?	x	
(f) Has an earlier documented analysis not denied the use or is this the first time the use has been proposed?	x	
(g) Is the use manageable within available budget and staff?	x	
(h) Will this be manageable in the future within existing resources?	x	
(i) Does the use contribute to the public's understanding and appreciation of the refuge's natural or cultural resources, or is the use beneficial to the refuge's natural or cultural resources?	x	
(j) Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see section 1.6D, 603 FW 1, for description), compatible, wildlife-dependent recreation into the future?	x	

Where we do not have jurisdiction over the use ["no" to (a)], there is no need to evaluate it further as we cannot control the use. Uses that are illegal, inconsistent with existing policy, or unsafe ["no" to (b), (c), or (d)] may not be found appropriate. If the answer is "no" to any of the other questions above, we will **generally** not allow the use.

If indicated, the refuge manager has consulted with State fish and wildlife agencies. **Yes** x__ **No** ___

When the refuge manager finds the use appropriate based on sound professional judgment, the refuge manager must justify the use in writing on an attached sheet and obtain the refuge supervisor's concurrence.

Based on an overall assessment of these factors, my summary conclusion is that the proposed use is:

Not Appropriate_____ **Appropriate** x___

Refuge Manager: _____Date:_____

If found to be **Not Appropriate**, the refuge supervisor does not need to sign concurrence if the use is a new use. If an existing use is found **Not Appropriate** outside the CCP process, the refuge supervisor must sign concurrence. If found to be **Appropriate**, the refuge supervisor must sign concurrence.

Refuge Supervisor:_____Date:_____

A compatibility determination is required before the use may be allowed.

FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: Tennessee National Wildlife Refuge

Use: Commercial fishing to remove rough fish from impounded waters

This form is not required for wildlife-dependent recreational uses, take regulated by the State, or uses already described in a refuge CCP or step-down management plan approved after October 9, 1997.

Decision Criteria:	YES	NO
(a) Do we have jurisdiction over the use?	x	
(b) Does the use comply with applicable laws and regulations (Federal, State, Tribal, and local)?	x	
(c) Is the use consistent with applicable executive orders and Department and Service policies?	x	
(d) Is the use consistent with public safety?	x	
(e) Is the use consistent with goals and objectives in an approved management plan or other document?	x	
(f) Has an earlier documented analysis not denied the use or is this the first time the use has been proposed?	x	
(g) Is the use manageable within available budget and staff?	x	
(h) Will this be manageable in the future within existing resources?	x	
(i) Does the use contribute to the public's understanding and appreciation of the refuge's natural or cultural resources, or is the use beneficial to the refuge's natural or cultural resources?	x	
(j) Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see section 1.6D, 603 FW 1, for description), compatible, wildlife-dependent recreation into the future?	x	

Where we do not have jurisdiction over the use ["no" to (a)], there is no need to evaluate it further as we cannot control the use. Uses that are illegal, inconsistent with existing policy, or unsafe ["no" to (b), (c), or (d)] may not be found appropriate. If the answer is "no" to any of the other questions above, we will **generally** not allow the use.

If indicated, the refuge manager has consulted with State fish and wildlife agencies. **Yes** x__ **No** ___

When the refuge manager finds the use appropriate based on sound professional judgment, the refuge manager must justify the use in writing on an attached sheet and obtain the refuge supervisor's concurrence.

Based on an overall assessment of these factors, my summary conclusion is that the proposed use is:

Not Appropriate_____ **Appropriate** x___

Refuge Manager: _____Date:_____

If found to be **Not Appropriate**, the refuge supervisor does not need to sign concurrence if the use is a new use. If an existing use is found **Not Appropriate** outside the CCP process, the refuge supervisor must sign concurrence. If found to be **Appropriate**, the refuge supervisor must sign concurrence.

Refuge Supervisor:_____Date:_____

A compatibility determination is required before the use may be allowed.

FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: Tennessee National Wildlife Refuge

Use: Bicycling

This form is not required for wildlife-dependent recreational uses, take regulated by the State, or uses already described in a refuge CCP or step-down management plan approved after October 9, 1997.

Decision Criteria:	YES	NO
(a) Do we have jurisdiction over the use?	x	
(b) Does the use comply with applicable laws and regulations (Federal, State, Tribal, and local)?	x	
(c) Is the use consistent with applicable executive orders and Department and Service policies?	x	
(d) Is the use consistent with public safety?	x	
(e) Is the use consistent with goals and objectives in an approved management plan or other document?	x	
(f) Has an earlier documented analysis not denied the use or is this the first time the use has been proposed?	x	
(g) Is the use manageable within available budget and staff?	x	
(h) Will this be manageable in the future within existing resources?	x	
(i) Does the use contribute to the public's understanding and appreciation of the refuge's natural or cultural resources, or is the use beneficial to the refuge's natural or cultural resources?	x	
(j) Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see section 1.6D, 603 FW 1, for description), compatible, wildlife-dependent recreation into the future?	x	

Where we do not have jurisdiction over the use ["no" to (a)], there is no need to evaluate it further as we cannot control the use. Uses that are illegal, inconsistent with existing policy, or unsafe ["no" to (b), (c), or (d)] may not be found appropriate. If the answer is "no" to any of the other questions above, we will **generally** not allow the use.

If indicated, the refuge manager has consulted with State fish and wildlife agencies. **Yes** x__ **No** ___

When the refuge manager finds the use appropriate based on sound professional judgment, the refuge manager must justify the use in writing on an attached sheet and obtain the refuge supervisor's concurrence.

Based on an overall assessment of these factors, my summary conclusion is that the proposed use is:

Not Appropriate_____ **Appropriate** x___

Refuge Manager: _____Date:_____

If found to be **Not Appropriate**, the refuge supervisor does not need to sign concurrence if the use is a new use. If an existing use is found **Not Appropriate** outside the CCP process, the refuge supervisor must sign concurrence. If found to be **Appropriate**, the refuge supervisor must sign concurrence.

Refuge Supervisor:_____Date:_____

A compatibility determination is required before the use may be allowed.

Appendix F. Compatibility Determinations

TENNESSEE NATIONAL WILDLIFE REFUGE COMPATIBILITY DETERMINATIONS

Introduction: The U.S. Fish and Wildlife Service has reviewed several uses for compatibility during the process of developing the Comprehensive Conservation Plan (CCP) for Tennessee National Wildlife Refuge. The descriptions and anticipated impacts of each of these uses are addressed separately. However, the "Uses" through "Public Review and Comment" sections, the "Literature Cited" section, and the "Approval of Compatibility Determinations" section apply to each use. If one of these uses is considered outside of the Comprehensive Conservation Plan for Tennessee National Wildlife Refuge, then those sections become part of that compatibility determination.

Uses: The following uses were evaluated to determine their compatibility with the mission of the Refuge System and the purposes of the refuge:

- Wildlife observation and photography;
- Environmental education and interpretation;
- Fishing;
- Hunting;
- Cooperative Farming;
- Marina Concessions;
- Scientific Research;
- Commercial fishing to remove rough fish from impounded waters;
- Horseback riding / horse-drawn conveyance; and
- Bicycling.

Refuge Name: Tennessee National Wildlife Refuge, Benton, Decatur, Henry, Humphreys, Tennesee.

Date Established: 1945.

Establishing and Acquisition Authorities: Migratory Bird Conservation Act, Refuge Recreation Act, Executive Order 9670.

Refuge Purpose: "... as a refuge and wildlife management area for migratory birds and other wildlife ..." (Executive Order 9670, dated Dec. 28, 1945)

"... for use as an inviolate sanctuary, or for any other management purpose, for migratory birds." 16 U.S.C. § 715d (Migratory Bird Conservation Act)

"... suitable for (1) incidental fish and wildlife-oriented recreational development, (2) the protection of natural resources, (3) the conservation of endangered species or threatened species ..." 16 U.S.C. § 460k-1 "... the Secretary ... may accept and use ... real ... property. Such acceptance may be accomplished under the terms and conditions of restrictive covenants imposed by donors ..." 16 U.S.C. § 460k-2 (Refuge Recreation Act (16 U.S.C. § 460k-460k-4), as amended).

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

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

Other Applicable Laws, Regulations, and Policies:

Antiquities Act of 1906 (34 Stat. 225)
Migratory Bird Treaty Act of 1918 (15 U.S.C. 703-711; 40 Stat. 755)
Migratory Bird Conservation Act of 1929 (16 U.S.C. 715r; 45 Stat. 1222)
Migratory Bird Hunting Stamp Act of 1934 (16 U.S.C. 718-178h; 48 Stat. 451)
Criminal Code Provisions of 1940 (18 U.S.C. 41)
Bald and Golden Eagle Protection Act (16 U.S.C. 668-668d; 54 Stat. 250)
Refuge Trespass Act of June 25, 1948 (18 U.S.C. 41; 62 Stat. 686)
Fish and Wildlife Act of 1956 (16 U.S.C. 742a-742j; 70 Stat.1119)
Refuge Recreation Act of 1962 (16 U.S.C. 460k-460k-4; 76 Stat. 653)
Wilderness Act (16 U.S.C. 1131; 78 Stat. 890)
Land and Water Conservation Fund Act of 1965
National Historic Preservation Act of 1966, as amended (16 U.S.C. 470, et seq.; 80 Stat. 915)
National Wildlife Refuge System Administration Act of 1966 (16 U.S.C. 668dd, 668ee; 80 Stat. 927)
National Environmental Policy Act of 1969, NEPA (42 U.S.C. 4321, et seq.; 83 Stat. 852)
Use of Off-road Vehicles on Public Lands (Executive Order 11644, as amended by Executive Order 10989)
Endangered Species Act of 1973 (16 U.S.C. 1531 et seq.; 87 Stat. 884)
Refuge Revenue Sharing Act of 1935, as amended in 1978 (16 U.S.C. 715s; 92 Stat. 1319)
National Wildlife Refuge Regulations for the Most Recent Fiscal Year (50 CFR Subchapter C; 43 CFR 3101.3-3)
Emergency Wetlands Resources Act of 1986 (S.B. 740)
North American Wetlands Conservation Act of 1990
Food Security Act (Farm Bill) of 1990 as amended (HR 2100)
The Property Clause of the U.S. Constitution Article IV 3, Clause 2
The Commerce Clause of the U.S. Constitution Article 1, Section 8
The National Wildlife Refuge System Improvement Act of 1997 (Public Law 105-57, USC668dd)
Executive Order 12996, Management and General Public Use of the National Wildlife Refuge System, March 25, 1996
Title 50, Code of Federal Regulations, Parts 25-33
Archaeological Resources Protection Act of 1979
Native American Graves Protection and Repatriation Act of 1990

Public Review and Comment: The compatibility determinations for Tennessee National Wildlife Refuge are being made available for public review and comment in conjunction with the public comment period for the refuge's Draft Comprehensive Conservation Plan and Environmental Assessment (Draft CCP/EA). Public comments on these compatibility determinations are invited and are due by the deadline stated on the cover of the Draft CCP/EA.

The methods being used to solicit public review and comment include a Notice of Availability for public review of the Draft CCP/EA published in the *Federal Register;* notices posted at the refuge headquarters; news releases sent to area newspapers; public service announcements sent to local

radio stations; and copies of the Draft CCP/EA distributed to adjacent landowners, the general public, and local, state, and federal agencies.

Description of Use: *Wildlife Observation and Photography*

Wildlife observation and photography have been identified in the National Wildlife Refuge System Improvement Act of 1997 as priority wildlife-dependent recreational uses, provided they are compatible with the purposes for which the refuge was established.

Wildlife photography, including other image-capturing activities, such as videography, has occurred on the refuge. It is in anticipated that an increase in nonconsumptive wildlife-dependent uses will occur over the next few years as facilities and access are improved and demand increases.

Open seasonally, the Blue Goose Boulevard interpretive auto tour off Refuge Lane in the Duck River Bottoms is open from March 16-Nov. 14, offering an interpretive explanation of refuge management activities. Pintail Point photography and observation deck blind is also located near the entrance to the Duck River "Bottoms" area. A variety of wildlife can be observed in this area, including waterfowl in the fall and winter, shorebirds and wading birds in spring and fall, and other wildlife throughout the year. On the Big Sandy Unit, off of Swamp Creek Road, the V.L. Childs Overlook offers an observation deck equipped with a mounted spotting scope to view a variety of wildlife. On Big Sandy Peninsula, the Bennett's Creek Observation Deck provides scenic and wildlife viewing opportunities as well as one of the best places to observe the American bald eagle on the refuge. The Duck River Bottoms Scenic Overlook off of Birdsong Road offers a panoramic view of the Duck River and Kentucky Lake.

Availability of Resources:

Resources involved in the administration and management of the use: Minor amounts of personnel time associated with administration, management, and law enforcement.

Special equipment, facilities, or improvements necessary to support the use: Observation decks, auto tour route, access roads, kiosks, and brochures.

Maintenance costs: $20,000/year.

Monitoring costs: $5,000/year.

Offsetting revenues: None.

Anticipated Impacts of the Use:

Short-term Impacts: The refuge provides habitat for resident and migratory wildlife. As a result of these activities, individual animals may be disturbed by human contact to varying degrees. Examples of potential disturbance include flushing of birds from feeding, resting, or nesting areas and trampling of plants from observers and photographers. Disturbance to trust species are expected to be minimal.

Construction of foot trails, boardwalks, observation platforms, and upgrading refuge roads will alter small portions of the natural environment. Proper planning prior to construction, sediment retention, and grade stabilization features will reduce negative impacts to wetlands and species of special

concern. Impacts Short-term impacts to facilities, such as roads and trails, can be avoided by special closures due to unsafe conditions.

Long-term Impacts: Current utilization of these uses is incidental to overall refuge programs and no long-term adverse impacts have been experienced.

Cumulative Impacts: No cumulative impacts are anticipated.

Determination (check one below):

_____ Use is Not Compatible

__X__Use is Compatible with Following Stipulations

Stipulations Necessary to Ensure Compatibility: Visitors are required to abide by all refuge regulations that limit impacts on plant and wildlife populations.

Justification: Visitors have the opportunity to view and photograph many species of wildlife with relative ease at many places on the refuge. Opportunities exist for these activities by boat, by walking, or by driving the public roads.

NEPA Compliance for Refuge Use Description: *Place an X in appropriate space.*

_____ Categorical Exclusion without Environmental Action Statement
_____ Categorical Exclusion and Environmental Action Statement
__X__ Environmental Assessment and Finding of No Significant Impact
_____ Environmental Impact Statement and Record of Decision

Mandatory 15-Year Re-evaluation Date: _____

Description of Use: *Environmental Education and Interpretation*

Environmental education and interpretation activities include traditional environmental education, such as teacher or staff-led onsite field trips, offsite programs in classrooms, and interpretation of wildlife resources on the refuge. The refuge also provides environmental education resources to the public including 12 hands-on learning trunks called “Critter Crates” that are available for checkout. These activities and resources are largely utilized to encourage understanding in citizens of all ages to develop land ethics, foster public support, increase visibility, and improve the image of the Service.

Environmental education and interpretation have been identified in the National Wildlife Refuge System Improvement Act of 1997 as priority public uses, provided they are compatible with the purpose for which the refuge was established.

Environmental education and interpretation could occur throughout the refuge year-round as requested by the public. Although the activities do not require special use permits, they are most often closely coordinated with the refuge manager and led or supervised by the park ranger.

Availability of Resources:

Resources involved in the administration and management of the use: One permanent full-time Refuge Ranger (GS-11) is committed to supporting this program, as well as other staff who fill in as a collateral duty.

Special equipment, facilities, or improvements necessary to support the use: Kiosks, observation decks, brochures, and environmental education materials.

Maintenance costs: $5,000/year.

Monitoring costs: None.

Offsetting revenues: Recreational fees collected from the sale of hunting permits are used to support these activities such as paying for publications to be printed.

Anticipated Impacts of the Use:

Short-term Impacts: The use of onsite, hands-on, action-oriented activities by groups of teachers and students to accomplish environmental education objectives may impose a low-level impact on the sites used for these activities. Impacts may include trampling of vegetation and temporary disturbance to wildlife species in the immediate vicinity during the activities. Since most activities would take place on existing roads, trails, and other facilities, impacts would be minimal.

Long-term Impacts: Current utilization of these uses is incidental to overall refuge programs and no long-term adverse impacts have been experienced. Long-term beneficial impacts include the furthering of the refuge mission through the education of the general public.

Cumulative Impacts: No cumulative impacts are anticipated.

Determination (check one below):

_____ Use is Not Compatible

__X__ Use is Compatible with Following Stipulations

Stipulations Necessary to Ensure Compatibility: Onsite activities should be held where minimal impact would occur. Evaluations of sites and programs should be conducted periodically to assess if objectives are being met and to ensure that the natural resources are not being degraded. If evidence of unacceptable adverse impacts begins to appear, it may be necessary to change the location of the outdoor activities.

Justification: Environmental education and interpretation are used to encourage citizens of all ages to act responsibly in protecting a healthy ecosystem. They are tools to use in building land ethic, developing public support, and decreasing wildlife violations. They constitute one method of increasing visibility in the community and improving the image of the Service.

NEPA Compliance for Refuge Use Description: *Place an X in appropriate space.*

_____ Categorical Exclusion without Environmental Action Statement
_____ Categorical Exclusion and Environmental Action Statement
__X__ Environmental Assessment and Finding of No Significant Impact
_____ Environmental Impact Statement and Record of Decision

Mandatory 15-Year Re-evaluation Date: _____

Description of Use: *Fishing*

Fishing was a traditional recreational use of the area that is now Tennessee NWR prior to its inclusion in the National Wildlife Refuge System and continues to be a recreational pursuit with the public. It is one of the more popular wildlife-dependent uses on the refuge. Fish populations currently support a sustainable harvest under a regulated fishing program.

Fishing, a wildlife-dependent recreation, has been identified in the National Wildlife Refuge System Improvement Act of 1997 as a priority public use, provided it is compatible with the purpose for which the refuge was established.

Fishing is permitted on each of the three units within Tennessee NWR seasonally. Fishing in interior impoundments is permitted during daylight hours only Swamp Creek, Sulphur Well Bay, Bennett's Creek and all interior impoundments are open to fishing from March 16 through November 14. The remainder of the refuge portion of Kentucky Lake will remain open year-round. Bank fishing is permitted year-round along Refuge Lane, from the New Johnsonville Pump Station, and from the Busseltown Pump Station.

Availability of Resources:

Resources involved in the administration and management of the use: Personnel time associated with administration and law enforcement.

Special equipment, facilities, or improvements necessary to support the use: Boat ramps, parking lots, courtesy docks, fishing piers, kiosks, brochures, law enforcement equipment, and access roads.

Maintenance costs: $20,000/year.

Monitoring costs: $5,000/year.

Offsetting revenues: Recreation fee funds collected from the sale of hunt permits are used to help maintain boat launch facilities that are used by hunters and fishermen.

Anticipated Impacts of the Use:

Short-term Impacts: Minor impacts, such as litter and gasoline contamination, could occur but not at a level that would cause serious concern. There is some erosion from outboard wakes.

Long-term Impacts: Fishing, as regulated, should not have any long-term negative impacts on the refuge.

Cumulative Impacts: No cumulative impacts are known to occur.

Determination (check one below):

_____ Use is Not Compatible

__X__ Use is Compatible with Following Stipulations

Stipulations Necessary to Ensure Compatibility: Interior impoundments are shallow and full of hidden obstacles. Boat travel is restricted to a "Minimum Wake" speed for safety. Litter is unsightly, illegal, and a hazard to wildlife. Please dispose of unwanted material properly.

- All-terrain vehicle (ATV) use on the refuge is prohibited.
- Camping and campfires on the refuge are prohibited.
- Vehicles must remain on refuge roads that are designated open.
- Boats cannot be left on the refuge overnight.
- Swimming is not permitted.
- Operation of a motor vessel under the influence of alcohol is prohibited.
- Searching for or removing any object of antiquity including arrowheads, pottery, or other artifacts is prohibited.
- No taking of turtles or bullfrogs on refuge.
- No jug, trot, or limb lines in impounded waters.

Justification: Fishing is probably one of the most popular forms of outdoor recreation in the state, and the refuge has the opportunity to provide quality fishing to the public, which is a priority public use. Current state and refuge regulations limit impacts to fish and wildlife populations on the refuge, while providing a safe and rewarding experience for the refuge visitor.

NEPA Compliance for Refuge Use Description: *Place an X in appropriate space.*

_____ Categorical Exclusion without Environmental Action Statement
_____ Categorical Exclusion and Environmental Action Statement
__X__ Environmental Assessment and Finding of No Significant Impact
_____ Environmental Impact Statement and Record of Decision

Mandatory 15-Year Re-evaluation Date: _____

Description of Use: *Big Game, Upland Game, and Migratory Bird Hunting*

- Migratory Bird Hunting – resident Canada geese
- Big Game Hunting – deer, feral hog, and turkey
- Upland Game Hunting – squirrel

Approximately 25,000 acres of Tennessee NWR are open to hunting. The refuge is open to nonquota hunting for white-tailed deer, turkey, squirrel and raccoon. A new resident Canada goose season was added in 2003. A hunter participating in a scheduled hunt may also take beaver, coyote, and armadillo with any legal weapon.

There are also two special quota gun hunts for deer. Other hunts for deer include a youth hunt and a primitive weapons hunt. Primitive weapons include longbow, recurve bow, and side-hammered muzzleloader. Firearms include guns, archery, and muzzleloader. Hunters apply for the gun quota hunts on a computer scanned application form and a computer program does the draw. 840 hunters are permitted for these quota hunts.

All quota and nonquota adult hunters are required to purchase a $12.50 annual hunting permit. This allows them to hunt all five species on Tennessee NWR. Youth hunters are exempt from all fees.

Hunting is being proposed as a management tool to maintain the health of animal populations that occur on the refuge and reduce depredation on refuge habitats. For example, reducing the number of deer using the refuge throughout the year will increase the food produced by the refuge's cooperative farming program for wintering waterfowl.

Availability of Resources: Enforcement of refuge regulations to protect trust resources and provide for a quality recreational opportunity will occur via regular patrols by refuge law enforcement officers. Currently, the refuge has two full-time law enforcement officers. Additionally, refuge officers based at Fort Campbell Military Installation and personnel from the Tennessee Wildlife Resources Agency will patrol the refuge and assist refuge officers when needed.

The hunt program at the refuge will cost approximately $35,000 annually, which includes costs to create and print the hunt brochure, law enforcement, and creating and maintaining parking areas and ATV trails. Participation in the hunt program is estimated to be 1,500 visitors annually.

Anticipated Impacts of the Use: Hunting is not expected to have any significant impacts on refuge lands nor on the species being hunted. In few instances hunters will park their vehicles in ways that will interfere with other traffic or in places where parking is not permitted. These parking violations will be resolved through hunter education and regulatory enforcement. Damage to habitat by vehicles and by hunters walking to and from hunting sites will be minimal and temporary. The use of temporary blinds will cause trampling of vegetation in the immediate area of their use but will not cause significant long-term damage. The use of temporary tree stands will cause some superficial damage to the trees on which they are used.

Monitoring of harvest will be accomplished through data collection from refuge staff from TWRA check station records. This monitoring will provide a way to measure the health of the impacted wildlife. If wildlife populations significantly change, that difference will be reflected in the harvest. The long-term impact of hunting will be monitored in the following way on a yearly basis.

Harvest management of big game (white-tailed deer and turkey) is the art of combining wildlife science and landowner objectives for the attainment of a specific management goal. Whenever possible, harvest management strategies should be based on objectives established as part of hunting plans developed for the area. The objective-setting process must be based on a complete analysis of biological data. Specific harvest objectives allow the setting of hunting regulations. Results of each hunting season will be thoroughly evaluated to ensure that the harvest management program remains dynamic and responsive to an evolving management environment (Bookhout 1994).

Harvest management of small game and furbearers (squirrel, raccoon, and beaver) is considerably different from that of big game. Current literature suggests that user take (<50% of total mortality) of most upland game is compensatory; that factors such as immigration from adjacent areas and density-dependent production operate in most upland game populations; and that hunting does not significantly impact populations. Hunting is substituted for natural mortality. Production of large,

annual surpluses of young allow for lengthy seasons and generous bag limits with little concern for overharvest and minimal chance of population impacts in most areas (Bookhout 1994).

We do not anticipate any direct or indirect long-term impacts from resident Canada goose hunting on other wildlife or habitat. Resident Canada goose populations continue to rise on and off the refuge and are beginning to impact agriculture crops and moist soil management for migratory waterfowl. We hope that this hunt will help to control or at least hold the population at an acceptable level so habitats are not impacted.

Based on available information, the threatened or endangered species, interior least tern or piping plover, will not be affected by this action. It is anticipated that the current levels and expected future levels of hunting or other wildlife-dependent recreation activities would not directly, indirectly, or cumulatively impact any listed, proposed, or candidate species or designated/proposed critical habitat. Data gathered from future biological surveys regarding the importance or potential importance of the refuge to threatened or endangered species or critical habitat (or proposed threatened, endangered, or critical habitat), could result in changes to public use activities across time; however, these changes would have no effect on listed species.

No assessable environmental impact to the refuge, its habitats, or wildlife species is expected by this use. The refuge has been a favorite hunting area to regional hunters for many years. Concerns primarily center on the possibility of impacting threatened and other sensitive nontarget species through excessive disturbance. With restrictions limiting access to specific locations and motorized vehicles in other areas, disturbance is minimized. Restrictions to the hunting program assure that these activities have no adverse impacts on other wildlife species and little adverse impact to other public use programs.

Cumulative Impacts: Other users of the refuge may be impacted by this use. Fishing and bird watchers may have to share the refuge with resident Canada goose hunters. However, time and space zoning is adaptively managed for differing user groups. Therefore, other refuge users should not be impacted. We do not anticipate any additional direct or indirect cumulative impacts on refuge resources.

Determination (check one below):

_____ Use is Not Compatible

__X__ Use is Compatible with Following Stipulations

Stipulations Necessary to Ensure Compatibility: The refuge is open to hunting the following species only: squirrel, raccoon, white-tailed deer, wild turkey, and Canada goose. Beaver, coyote, and armadillo may be taken on a scheduled hunt for other species with any weapon legal for that hunt. No taking of turtles or bullfrogs on refuge. Hunting is permitted on various portions of Tennessee National Wildlife Refuge with the exception of those areas marked “Closed” on the map or by “Closed Area” signs on refuge lands or waters. Applicable federal and state laws and regulations apply.

- Only legally licensed vehicles are allowed on the refuge. Vehicles must remain on refuge roads that are shown on map and designated as open. ATV and golf cart use on the refuge is prohibited.
- It is unlawful to hunt within 100 yards of a private dwelling, and to access the refuge across private land without permission from the private landowner. Shooting across any road is prohibited.

- Except for raccoon and opossum hunting, access to the refuge is allowed 2 hours before sunrise until 2 hours after sunset.
- Carrying, possessing, or discharging fireworks or explosives on a national wildlife refuge is prohibited. Firearms are permitted only during authorized hunts and must be unloaded and either dismantled or encased when transported in vehicles and boats while on the refuge or as authorized by state law. Weapons legally possessed for hunting are the same as those prescribed by the state of Tennessee.
- Use or possession of alcoholic beverages while hunting is prohibited.
- Camping and campfires on the refuge are prohibited.
- Horses and mules are prohibited on all refuge hunts.
- Dogs are allowed for small game hunting and retrieval of geese during the early goose season. All dogs must be restrained by chain or leash if not being legally used for hunting. Dog owners/handlers must have a collar on each dog with the owners name, and address/or telephone number.
- Temporary blinds or stands permitted on the day of the hunt only. All blinds and stands must be removed at the end of each day's hunt.
- It is unlawful to mark any tree or other feature with paint or similar substance. Please remove all flagging tape and other marking material upon leaving the refuge.
- All hunters born after Jan. 1, 1969, must have completed a hunter safety course as demonstrated by card or certificate.
- Hunters must wear on the upper portion of their body and head a minimum of 500 square inches of fluorescent orange during all refuge quota, youth and primitive weapon hunts.
- Field dressing deer within 50 yards of a public road or trail is prohibited.
- Boats cannot be left on the refuge overnight. Swimming is prohibited.
- It is illegal to cut corn stalks, trees or other vegetation on the refuge.
- Hunting permitted in designated areas only. A hunt map will be published and made available prior to the hunt season.

Justification: Hunting is a priority wildlife dependent public use listed under the 1997 National Wildlife Refuge System Improvement Act. Development of hunting opportunities fulfills both the refuge system mission as well the goals for Tennessee NWR.

Resident Canada goose hunting is also a priority wildlife-dependent recreational activity. This use will disperse resident flocks of Canada geese that are impacting moist soil production and agricultural crops that are being produced to provide food for migratory waterfowl. Hunting resident geese should benefit management actions for migratory waterfowl and reduce depredation claims by cooperative farmers.

NEPA Compliance for Refuge Use Description: *Place an X in appropriate space.*

_____ Categorical Exclusion without Environmental Action Statement
_____ Categorical Exclusion and Environmental Action Statement
__X__ Environmental Assessment and Finding of No Significant Impact
_____ Environmental Impact Statement and Record of Decision

Mandatory 15-Year Re-evaluation Date: _____

Description of Use: *Cooperative Farming*

Cooperative farming is the planting of row crops (corn, milo, soybeans, and wheat) to provide food for migratory waterfowl through the use of cooperative farmers. This use is a refuge economic management activity. Approximately 3,000 acres of refuge lands are farmed by cooperative farmers to provide a variety of row crops for up to 250,000 migratory waterfowl each year. Twenty to 25 percent of the crop is left in the field or planted for use by migratory waterfowl. According to the management agreement with the Tennessee Valley Authority (TVA), the Fish and Wildlife Service is to administer primary wildlife areas for the purpose of carrying out an intensive management program for the development, feeding, and management of migratory birds and other wildlife. The Department (of the Interior) further agrees that in its administration of said areas it will cooperate with soil conservation associations in licensing for agricultural use such portions of the primary wildlife area as may be suitable for such use.

The proposed use will occur on approximately 3,000 acres of traditional farm land in Benton, Decatur, Henry and Humphreys Counties. Tennessee NWR consists of approximately 51,000 acres with 1,350 acres in moist soil production; 19,984 in woody vegetation; 3,158 in agriculture; 26,447 in open water; 528 in early succession; and 239 in facilities. The cooperative farm program occurs on approximately 6 percent of the refuge lands. There are no endangered or threatened species associated with the agricultural lands. Several avian, mammalian, amphibian insect and plant species are associated with agricultural fields. The Integrated Pest Management Plan directs the use of pesticides and identifies best management practices to deal with various pests species that may impact agricultural crops. The Integrated Pest Management plan ensures that surrounding habitats and wildlife are not impacted by farming activities.

The cooperative farming program is basically a late spring through fall type of activity. Fields are planted in late spring and harvested in fall. Winter wheat is planted in September and October and harvested before spring planting. The refuge's share of crops are flooded or knocked down by refuge staff during the winter months to make them accessible to wintering waterfowl. All work is performed during daylight hours.

Cooperative farmers will provide all equipment to prepare fields, plant and harvest all crops. Cooperative farmers are required to perform soil tests to determine nutrient needs (fertilizer and lime applications) and all applications must be approved by the refuge. Cooperative farming and force-account farming methods utilized on the refuge include the planting of row crops (corn, milo, soybeans, and wheat) with both nongenetically modified crop seed and GMC seed to provide food for migratory waterfowl. Application of pesticides must follow Integrated Pest Management plan and be approved through the Pesticide Use Proposal process and proper authority. The Assistant Refuge Manager or Refuge Biologists will administer the Cooperative Farming program. The Assistant Manager or Refuge Biologists will be required to prepare farming contracts, meet with farmers, verify crop plantings, verify pest problems, and negotiate refuge shares in the fall. Total staff time required to administer this activity is approximately 100 staff days.

The U.S. Fish and Wildlife Service is proposing the use of cooperative farming to meet the food requirements for migratory waterfowl on Tennessee NWR. To meet the food requirements for 200,000 waterfowl would require funds and personnel to farm approximately 750 acres of the refuge. Cooperative farmers are currently the only feasible method to accomplish this refuge management activity. Current moist soil units are not of sufficient size to produce the amount of food necessary to support our portion (approximately 50%) of the 23.5 million waterfowl use days for the Kentucky Lake area.

Availability of Resources:

Resources involved in the administration and management of the use: The station has adequate resources to accomplish this activity. Administration of the cooperative farming program consists of approximately 100 staff days or less than five percent of refuge staff time devoted to administering this activity. No additional refuge equipment is used to administer this use. If cooperative farmers were not available or permitted to farm these lands the refuge would be required to farm 750 acres in order to provide food for 50 percent of the migratory waterfowl in the Kentucky Lake area. Force-account farming would require a large expenditure of refuge funds for equipment and personnel to accomplish our mission of providing sufficient habitat to meet the needs of migratory waterfowl.

Special equipment, facilities, or improvements necessary to support the use: None.

Maintenance costs: Maintenance costs include personnel and equipment for maintaining roads for access to farm fields and removing flood debris from fields. The costs and personnel time required to maintain these roads and fields for cooperative farmers would be the same if these fields were farmed using force-account labor and station funds. With a cooperative farm program, these maintenance functions can be written into the farming contract and thus, become the responsibility of the cooperative farmer.

Monitoring costs: Monitoring costs include one staff person spending ten staff days verifying refuge crops planted and pest monitoring if necessary. We have the personnel and the time to devote to the monitoring of the cooperative farming program.

Offsetting revenues: There are no offsetting revenues returned to the station, however, the refuge does receive 25 percent of the crops for wildlife use.

Anticipated Impacts of the Use:

Short-term Impacts: The cooperative farming program supports refuge purposes as stated in the Executive Order 9670 and the Migratory Bird Conservation Act, refuge goals of providing quality agricultural habitat for feeding waterfowl in support of objectives in the North American Waterfowl Management Plan, and the mission of the National Wildlife Refuge System. Cooperative farmers are a valuable tool in assisting refuge staff to accomplish our goals and objectives.

A farming program is necessary to meet the habitat needs of migratory waterfowl on the refuge. The refuge has submitted a Refuge Operation Needs (RONS) request to hire additional personnel and purchase required equipment to force-account farm the 750 acres of necessary to meet the food requirements for 11.75 million waterfowl use days. However, until this project is funded, the refuge will continue to rely upon cooperative farmers to meet our goals and objectives. A cooperative farming program utilizes more land than a force-account farming program to meet food needs of waterfowl; however, the refuge does not have the funds, personnel or equipment to force-account farm 750 acres. A cooperative farm program involves the use of pesticides and other chemicals in order to be profitable for the farmers. The use of these products conflict with the biological integrity policy of the 1997 National Wildlife Refuge System Improvement Act; however, the use of cooperative farmers is the only viable method available to refuge staff to meet the habitat needs of 11.75 million waterfowl use days at this time. In certain situations, genetically modified crops are planted to reduce the use of certain pesticides. Measures are taken to ensure that Integrated Pest Management Plan and best management practices are followed by the cooperative farmers.

Long-term Impacts: We do not anticipate any long-term impacts by permitting a cooperative farm program.

Cumulative Impacts: We do not anticipate any direct or indirect cumulative impacts of cooperative farming on existing or anticipated refuge uses.

Determination (check one below):

_____ Use is Not Compatible

__X__ Use is Compatible with Following Stipulations

Stipulations Necessary to Ensure Compatibility: The cooperative farming program is regulated through annual cooperative farming agreements that specify the field crops to be grown, acceptable farming practices, and approved pesticide use procedures. Special conditions contained in each cooperative farming agreement provide the following requirements: (1) Farming operations would be permitted starting March 15 through November 1. The farmer's share of crops must be removed from refuge lands by November 1 or as stated in the farming contract; (2) Cooperative farmers must abide by all conditions established in the cooperative farming agreement and all addendums; (3) Cooperative farmers will apply best management practices and integrated pest management techniques as recommended by refuge staff; and (4) All proposed chemicals must be submitted and approved by the Regional Integrated Pest Management Coordinator, Regional Office and/or Washington Office and the Refuge Manager.

Justification: One of the purposes of Tennessee NWR is to provide wintering habitat for waterfowl within the Kentucky Lake Area (KLA). Based on Midwinter Inventories from 1970-79, the KLA duck population objective is 202,000 ducks for 110 days (22.2 million duck-use days [DUDs]). The KLA goose population objective is 21,000 for 90 days (1.9 million goose-use days [GUDs]), which is the 10-year average refuge Canada goose peak population between 1992-2001. The refuge objective is to provide at least 60% of the foraging needs for the KLA duck population and 75% of the goose foraging needs. This equates to 13.3 million DUDs and 1.4 million GUDs. Tennessee NWR provides approximately 1,350 acres of moist soil habitat that supports approximately 2.5 million DUDs (1,868 DUDs/acre provided by moist soil seeds, tubers, invertebrates). The remaining waterfowl use days are met through grain crops and browse left by cooperative farmers and force-account farming. The current cooperative farming program consists of around 2,900 acres with the refuge receiving between 600 to 700 acres of standing crops. A 100 bushel/acre field of corn will support 11,817 goose-use days or 28,591 duck-use days. Therefore, after accounting for the foraging needs met by moist soils, the refuge would need approximately 378 acres of corn to meet the remaining 10.8 million DUDs. In order to provide the 1.4 million GUDs, the refuge must provide 59 acres of corn (1,400,000 GUDs x .5 / 11817 = 59 acres) where .5 is the recommended proportion of food requirements to be provided by corn and 11,817 is the number of GUDs a 100 bushel/acre corn field can support. Also, the refuge must provide 273 acres of winter wheat (1,400,000 GUDs x .5 / 2560 = 273 acres) where .5 is the recommended proportion of food requirements to be provided by green wheat and 2,560 is the number of GUDs a 1,500 pounds/acre field of winter wheat will provide for 90 days (data provided by USFWS Wildlife Biologist Don Orr) (USFWS 2005).

Tennessee NWR is identified in both the Southern James Bay Population (SJBP) and Mississippi Valley Population (MVP) Flyway Management Plans as important wintering areas that need to be properly managed for geese in order to achieve North American Waterfowl Management Plan (NAWMP) population objectives. These management plans provide direction relating to habitat management and food production.

Objective II of the "Management Plan for the Southern James Bay Population of Canada Geese" (February 2002) is to "Increase the January population in Kentucky, Tennessee, and Alabama to 130,000 total Canada geese … (based on 1985-89 pre-decline averages)." Objective III under Habitat Management states "ensure adequate food, water, and protection on nesting, migration, and wintering areas consistent with population objectives, habitat status, and landowner tolerances." The plan goes on to state that "State and federal land management areas should be oriented toward producing a substantial portion of the food requirements for wintering populations. A recent inventory of food, water, and sanctuary was initiated for key SJBP areas. This information should be evaluated to determine if these areas are adequate to sustain the SJBP or if, in southern areas, they could support the larger January populations stated in the distribution objective. Even though populations have been decreasing on southern wintering areas, it is important that state and federal management areas maintain or increase habitat and food resources to ensure that adequate resources are available in those years when large numbers are found to migrate to and winter on southern management areas in response to poor weather in northern areas, such as occurred in the winter of 2000-2001."

Tennessee NWR wintering population of Canada geese is composed of approximately 40% MVP Canada geese. Therefore, we look to the Mississippi Flyway Management Plan for refuge management directions. Both Tennessee and Cross Creeks NWRs are shown on the MVP range map as wintering refuges. The Management Plan for the Mississippi Valley Population of Canada Geese, 1997-2002, states "the habitat management objective is to manage and develop Canada goose habitat throughout the MVP range consistent with the MVP population objective … Intensive and effective management of refuge farmlands in primary wintering areas will be required to sustain population objectives, particularly in years of poor crop production, severe winter weather or when private landowners shift, due to market conditions, to crops of little benefit to geese. Cropland management plans should be developed and implemented on winter refuges that optimize seasonal availability of high quality food supplies."

There is general agreement among goose experts that agricultural crops (both corn and green browse) are very important components of wintering habitat for Canada geese (Bellrose 1976; Cook et al. 1998). Goose surveys reveal that large concentrations of Canada geese and other goose species are found on large agricultural fields or other large open areas. Maintaining adequate open habitat and food resources are key to maintaining goose populations. Determining the amount of open habitat to adequately meet refuge population objectives is a rather subjective judgment. Certainly maintaining the current amount of open habitat that is now present might be a reasonable judgment, but the amount of open habitat on our refuges has decreased since they were established. How much food is adequate to support population objectives was calculated in previous correspondence. Several authors have identified the importance of agricultural crops for providing important food resources on wintering grounds. Bellrose (1976) stated, "Agricultural crops are unquestionably the mainstay of Canada geese on their migration and wintering grounds" and Johnsgard (1975) reported, "This combination, then, of safe roosting sites and the availability of agricultural crops or other suitable foods would seem to be the prime requisites for wintering habitats."

According to goose biologists, there is little, if any published information on how much open habitat (agriculture land, pasture, hay, and water) is necessary to maintain a given population of geese. In Illinois the standards for establishing a new or expanding an existing Canada goose management unit is based on a primary goal of securing refuge management integrity on at least 1,000 acres of cropland. Of course, in that country the surrounding private lands are mostly croplands as well. It is recommended that Tennessee NWR at least maintain the current level of open habitat and food resources to provide necessary habitat to support 2.5 million goose-use days on the refuge. If over the next 10-15 years the goose populations remain below 10,000-15,000, the refuge will reevaluate the need for open habitat and food resource necessary to support 1 million goose-use days.

Cooperative farming is necessary to meet our habitat management needs for migratory waterfowl. Operation budgets are not sufficient to provide the 700 acres of agricultural crops necessary to meet our waterfowl use day objectives. Also, the refuge does not have sufficient moist soil or natural vegetation to meet our waterfowl use-day objectives. Cooperative farming is the most practical method of achieving our habitat objectives given the current strain on budgets and personnel.

NEPA Compliance for Refuge Use Description: *Place an X in appropriate space.*

_____ Categorical Exclusion without Environmental Action Statement
_____ Categorical Exclusion and Environmental Action Statement
__X__ Environmental Assessment and Finding of No Significant Impact
_____ Environmental Impact Statement and Record of Decision

Mandatory 10-Year Re-evaluation Date: _____

Description of Use: *Marina Concessions*

The proposed use is the operation of marina concessions on the refuge. Currently, two marinas (Cuba Landing and Mansard Island) operate on the refuge by providing boat slips, boat ramp and piers, boating and fishing supplies, and other boating conveniences. The Mansard Island Marina offers 80 boat slips and Cuba Landing offers 250 boat slips. The Mansard Island Marina is located in Henry County within the Big Sandy Unit, and Cuba Landing is located in Humphreys County within the Duck River Unit. Thousands of visitors use these facilities to participate in wildlife-dependent recreational activities, such as fishing, wildlife observation, wildlife photography, and general information about the refuge. These marinas also provide services and access to Kentucky Lake for boating, water skiing, and other boating-related activities on the lake. Facilities to support the concessions include boat ramps, parking lots, docks, and access roads. A portion of the fees collected go towards maintaining these facilities and covering administrative costs associated with overseeing the operations.

The Mansard Island Marina is located in Henry County between Swamp Creek and Sulfur Branch within Kentucky Lake. Most of the users of this marina are local citizens or visitors to the local area that recreate both on and off the refuge within a few river miles of the marina. The Cuba Landing Marina is located in southern Humphreys County just north of Interstate 40. Most of the users of Cuba Landing are not from the local area but from Nashville, Jackson and Memphis that have large recreational-type boats. They travel large stretches of the river. The refuge encompasses approximately 26,000 acres of open water. Users from these marinas recreate on most of the 26,000 acres.

The marinas are open year-round and visitors with slips have access to their boats 24 hours a day. Most visitors utilize the marinas during the spring and summer months and during daylight hours.

The refuge enters into a concession contract with the concession owner that outlines the refuge's expectations of the concession operation. The contract describes goods and services to be offered, hours of operation, employee conduct, and facilities to be offered and maintained, prices for services and promotion of wildlife dependent recreational opportunities on the refuge. Refuge personnel meet with concession owners on a regular basis to ensure compliance with the contract. Also, refuge personnel conduct quarterly inspections of the operations. The concession owner maintains general appearances of concession facilities. Large-scale repairs to refuge facilities will be covered by refuge

funds or from fees collected from concessions operations. Examples of such repairs include repairing boat ramps or parking lots.

Developing wildlife-dependent recreational opportunities on Tennessee NWR is one of the refuge's purposes. By the 1960s, very few facilities existed on Kentucky Lake to promote fishing opportunities. The refuge decided to allow marinas to provide boating access and services and to promote fishing opportunities on the refuge. There are other marinas off the refuge that provide similar services as the concessions. However, there is a demand for additional marina services. There are very few private docks on Kentucky Lake and most of the shoreline is still in federal ownership. In the early 1990s, the refuge determined that the mooring of boats on refuge property was not compatible and numerous refuge neighbors continue to search for marina slips to store their boats during the summer. Refuge personnel believe these concessions provide a valuable service to the local communities and the thousands of visitors to the area.

Availability of Resources:

Resources involved in the administration and management of the use: The refuge has adequate resources to manage this use. Resources needed to administer the concessions include 10 staff days to monitor and inspect concession operations and 10 staff days to conduct law enforcement patrols. Facility maintenance is funded through Maintenance Management System (MMS) funds and concession fees. Also, the staff time spent administering the concession contract is funded through concession fees paid to the refuge. The refuge can administer this use with current staff and funding levels.

Special equipment, facilities, or improvements necessary to support the use: None.

Maintenance costs: Maintenance costs associated with the concessions include maintaining boat ramps, parking lots, access roads and kiosks. The concessionaire is responsible for maintaining facilities that directly support the concession such as piers and buildings on the refuge. The cost of replacing a boat ramp is approximately $110,000 and replacing a parking lot is approximately $25,000. Maintaining access roads is covered by deferred maintenance funds and the Refuges Roads program. The concessionaire is responsible for maintaining the grounds and all facilities assigned to the concession. If MMS funds are available for maintaining or replacing boat ramps and parking areas, the refuge would have sufficient funds to maintain these facilities.

Monitoring costs: Refuge personnel will spend approximately 20 staff days monitoring concession activities to ensure compliance with the concession contract, safety inspections, and administering the concession fees returned to the refuge.

Offsetting revenues: The concessions pay a percentage of their fees collected to the Service. The refuge receives these fees to offset the cost of administering the concession and for small maintenance projects associated with the concessions.

Anticipated Impacts of the Use:

Short-term Impacts: There may be some direct short-term disturbance to birds and other wildlife during busy summer days due to large amounts of boat traffic. The Mansard Island Marina closes during the late fall due to the lack of business. The Cuba Landing Marina is open year-round, but their business drops off significantly in the late fall and winter months. Waterfowl use around these areas is minimal. Litter is a constant problem that must be addressed by the concession owners. Overall, we anticipate very little direct or indirect short-term impacts because of this use.

Long-term Impacts: We do not anticipate any long-term impacts by this activity.

Cumulative Impacts: We do not anticipate any direct or indirect cumulative impacts of these concession operations when added to existing or projected refuge uses on refuge resources.

Determination (check one below):

_____ Use is Not Compatible

__X__ Use is Compatible with Following Stipulations

Stipulations Necessary to Ensure Compatibility: The following stipulations are required to ensure compatibility. No new boat docks, facilities or slips are allowed unless addressed in the concession contract and approved by the refuge manager and a new compatibility determination is made. The concessionaire is responsible for litter control and facility maintenance to Service approval. The public is notified of all refuge regulations through signs and other means as approved by the refuge manager. No cutting of refuge vegetation is allowed, except in those areas designated in the concession contract, without prior approval of the refuge manager.

Justification: These facilities have been in operation on the refuge since 1968. Impacts of these facilities are concentrated and may lessen cumulative impacts of public uses to wildlife. The most significant impact would be from boats on navigable waters. The location of these marinas provides a controlled access point with refuge rules and regulations posted. These marinas promote several Big Six activities, including fishing, wildlife viewing, and interpretation.

The proposed use is an economic use. These marina concessions directly support "incidental fish and wildlife-oriented recreational development" as described in the Refuge Recreation Act. These marinas directly support fishing and wildlife viewing on the refuge. A portion of the revenue collected from the marinas is returned to the refuge to support its operation. Refuge neighbors and other visitors utilize these marinas for boat storage and the marinas also provide vital services to refuge visitors traveling via the Tennessee River.

NEPA Compliance for Refuge Use Description: *Place an X in appropriate space.*

_____ Categorical Exclusion without Environmental Action Statement
_____ Categorical Exclusion and Environmental Action Statement
__X__ Environmental Assessment and Finding of No Significant Impact
_____ Environmental Impact Statement and Record of Decision

Mandatory 10-Year Re-evaluation Date: _____

Description of Use: *Scientific Research*

The proposed use is scientific studies and research and monitoring on the refuge. Most studies or research projects initiated on the refuge are at our request in order to answer specific management questions. We are encouraged to work with the U.S. Geological Survey to conduct studies and research on national wildlife refuges to support wildlife and habitat management decisions. Management decisions are supported by sound scientific data. Scientific studies and research on the refuge provide the necessary information to make sound management recommendations. Studies

and research by universities and other groups directly support refuge management actions. Also, studies and research provide information to identify potential threats from proposed uses that may impact wildlife or habitat. The Forest Management Plan described a research proposal to study the response of forest bird species to our forest management treatments. Treatment blocks were identified to determine the best management treatment to benefit forest bird species.

Researchers have conducted numerous studies on the refuge. All studies directly support refuge management actions and decisions. Current and future research projects will typically involve less than 10 people on the refuge associated with research activities. Most research work occurs in the late spring and early fall and has very little impact on trust species or habitat.

There are no other associated uses, equipment or facilities necessary to carry out most studies or research on the refuge. Researchers utilize current facilities such as roads and buildings to conduct their work.

All areas of the refuge may be involved in scientific studies or research activities. Most studies or research projects are conducted on small areas (study plots) on the refuge to limit potential disturbance. Study areas or access routes maybe restricted to designated portions of the refuge due to logistical constraints, to protect sensitive areas or at critical times of the year. Access to research areas will be through existing roads or trails.

Scientific studies or research projects could occur throughout the year, day, frequency and duration depending upon the habitat or wildlife species being studied. Most study or research projects have designated field seasons. Sampling designs are set up to take into consideration critical times of the year or day and to limit potential harmful impacts of research on wildlife subjects or their habitats. Universities and other researchers have developed detailed handling protocols to ensure the safety of captured individuals.

Techniques used and required equipment depend upon the specific research project. Generally, equipment required would include nets or other capture equipment, vehicles for transportation, handling equipment for the specific wildlife species, survey instruments such as mirrors or binoculars, and other items that are normally used on a refuge to survey or manage wildlife and their habitats. The number of people involved could range from one to several dozen depending on the study. A large collective effort to roundup and tag geese could involve 30 to 40 people for two days and a forest bird study may require three to four individuals for three months during the year.

Most wildlife or habitat studies or research projects are proposed by refuge personnel. Some outside organizations or groups may propose a research project on the refuge (such as migration studies) to address larger landscape questions. Most studies and research projects conducted on refuges will support management actions or decisions on the refuge or within the System. One of the special conditions to ensure compatibility is that the proposed study or research project must address questions to improve wildlife and habitat management within the System or on the refuge.

Availability of Resources:

Resources involved in the administration and management of the use: We estimate approximately 30 staff days to coordinate the activities of the researchers. Our biologists and managers work closely with these individuals to design studies to answer specific management questions. Other staff time is spent meeting with partners and preparing research grants to arrange for funding to address our research needs on the refuge.

Special equipment, facilities, or improvements necessary to support the use: None.

Maintenance costs: None.

Monitoring costs: None.

Offsetting revenues: None.

Anticipated Impacts of the Use:

Short-term Impacts: We do not anticipate any indirect short-term impacts due to scientific studies or research. There may be some direct short-term impacts to individuals due to capture and/or handling to collect the necessary biological information. These short-term impacts should not have any long-term negative impacts on local populations. Researchers and scientists follow strict protocols to ensure the safety of the individual animals during capture and handling. Studies or research on habitat conditions usually involve nondestructive sampling and survey methods, thus, there are no short-term direct or indirect impacts on the habitat. Scientific studies and research on the refuge will directly address or assess management actions and decisions on the refuge. Scientific studies and research projects should not have any negative impacts on other public uses, especially wildlife-dependent priority public uses.

Long-term Impacts: We do not anticipate any direct or indirect long-term impacts due to conducting scientific studies or research on the refuge. These studies and/or research will be conducted by university researchers or other researchers and will involve limited participation by refuge staff. Funds to conduct these studies will come from a variety of sources, including the Service, universities, state conservation organizations, and nongovernmental conservation organizations. These studies and research projects should directly support fulfilling the System mission and/or refuge purposes. We do not anticipate an increase in the number of scientific studies or research that is conducted on the refuge in the near future. However, we feel there would be no direct or indirect long-term impacts if the number of studies and research projects were to increase on the refuge. The proposals will have stipulations to limit anticipated impacts on wildlife or their habitats.

Cumulative Impacts: We do not anticipate any direct or indirect cumulative impacts of scientific studies or research projects on other existing refuge uses. Special conditions will be put in place in the research proposal to eliminate or greatly reduce any potential conflicts with existing refuge uses.

Determination (check one below):

_____ Use is Not Compatible

__X__ Use is Compatible with Following Stipulations

Stipulations Necessary to Ensure Compatibility:

- Scientific studies or research projects should support the mission of the System and/or the purpose of the refuge.
- All research proposals must be reviewed and approved by refuge staff.
- The field staff shall contact the refuge manager or designee prior to beginning field operations.

- The researchers shall take adequate precautions to protect wildlife and their habitat from injury.
- Study areas or research times may be restricted to protect sensitive wildlife species.
- Yearly reports and updates and a copy of the final research report, thesis, dissertation or journal article will be submitted at the conclusion of the project.

Justification: Scientific studies and research projects should directly support the mission of the System and/or the purpose, goals and/or objectives of the refuge. Approved studies and research projects should directly or indirectly benefit wildlife and their habitats through a better understanding of our management actions or other outside influences such as loss of breeding/wintering areas, disease, over harvest, etc. that may impact wildlife. We do not anticipate that studies or research projects would conflict with any existing or potential wildlife-dependent priority public uses.

NEPA Compliance for Refuge Use Description: *Place an X in appropriate space.*

_____ Categorical Exclusion without Environmental Action Statement
_____ Categorical Exclusion and Environmental Action Statement
__X__ Environmental Assessment and Finding of No Significant Impact
_____ Environmental Impact Statement and Record of Decision

Mandatory 10-Year Re-evaluation Date: _____

Description of Use: *Commercial fishing to remove rough fish from impounded waters*

We are reevaluating the existing use of commercial fishing to remove rough fish from impoundments at Duck River Bottoms and the Tie Yard area of the Duck River area. Rough fish, primarily common carp and smallmouth buffalo, are harvested from the impoundments. Common carp are invasive exotic species that can impact waterfowl and native fish populations by increasing water turbidity through feeding and breeding and remove desirable submerged aquatic vegetation. They remove aquatic vegetation which results in increased turbidity; the lack of sunlight limits the growth of other submerged vegetation. Also, they increase siltation which deprives oxygen for other fish eggs to develop (Etnier and Starnes 1993). We typically issue four Special Use Permits to commercial fishermen for these areas. Each permittee pays $50.00 to commercially fish these impoundments. Commercial fishermen must be licensed by the state and must abide by all state laws and special refuge regulations. This use occurs in Pool 1, Grassy Lake, Clear Lake, the Lawrence Creek Impoundment, Gaynor Slough, and the Tie Yard impoundment.

Other associated uses include motor boat operation in the impoundments. Motor boats are permitted for recreational fishing by the public. Boat ramps and parking lots are in place at these impoundments to facilitate recreational fishing.

This use occurs in the impounded waters of Pool 1, Grassy Lake, Clear Lake, the Lawrence Creek Impoundment and Gaynor Slough in Duck River Bottoms, and the Tie Yard impoundment on the Duck River Unit south of Interstate 40. These impoundments include approximately 3,000 acres that are open to commercial fishing. All of these impoundments are important recreational fishing areas for bass, crappie and bluegill and provide habitat for wintering waterfowl and wading birds.

The proposed use would occur from March 16 through November 14. Commercial fishing is conducted after a flood event when waters start to recede. Nets are normally operated until the impoundments reach normal pool levels. Nets are to be checked each day and nets can only be checked during daylight hours.

Commercial fisherman would set nets in the impoundments following state and refuge regulations. We would issue no more than six permits on a first-come, first-served basis for commercial fishing these impoundments. Commercial fishermen may only operate their nets during daylight hours, must check their nets everyday, and must report all nontarget fish caught in the nets. Also, nets are not permitted to block any culverts or close any bay or canal. Commercial fishermen utilize existing boat ramps and parking lots that recreational anglers use for fishing.

We are proposing to continue to allow commercial fishermen to remove carp and buffalo from impoundments at Duck River Bottoms and Interstate 40 to promote game fish for refuge visitors and to reduce the impacts these fish have on aquatic vegetation that are utilized by waterfowl. Carp and buffalo populations are maintained through natural reproduction and are supplemented during flood events. Carp impact the growth of aquatic vegetation that are utilized by wintering waterfowl. By allowing this use, fishermen are assisting the refuge in accomplishing its mission.

Availability of Resources:

Resources involved in the administration and management of the use: Administration of this use includes issuing a Special Use Permit and collection of funds from the commercial fishermen. These functions are performed by the office assistants or the refuge managers. No additional resources are required to administer this activity. No more than one staff day is involved in issuing the Special Use Permits and collecting the fees.

Special equipment, facilities, or improvements necessary to support the use: None.

Maintenance costs: Maintenance costs associated with this use include maintaining boat ramps, parking lots and access roads to the impoundments. These facilities would be maintained as part of our other big six wildlife dependent uses and other management activities. Boat ramp and parking lot replacement would be funded from Maintenance dollars or other specially designated funds. Replacing a interior water boat ramp would cost approximately 50,000 dollars. These ramps normally need replacing every ten years. Parking lot maintenance would consist of adding gravel and occasional grading. This cost would be approximately $2,500 each year.

Monitoring costs: None.

Offsetting revenues: A Special Use Permit is issued to commercial fishermen. We collect a $50.00 fee for each Special Use Permit issued for commercial fishing.

Anticipated Impacts of the Use:

Short-term Impacts: Commercial fishing in the impoundments of Duck River Bottoms and the Tie Yard area will cause some short-term disturbance to wading birds in the vicinity of the commercial fishing when the nets are checked. However, the disturbance would be less than normal fishing activities in the area. All of these impoundments are open to fishing from March 16 to November 15. Boating activity can have significant adverse affects on colonial nesting waterbirds (Rodgers and Smith 1995). Disturbance from boating activity during the breeding season for waterbirds may cause

nest abandonment and stress to young. We close all waters around nesting colonies and rookeries to avoid impacts to colonial nesting birds.

Long-term Impacts: We do not anticipate any direct or indirect long-term impacts from commercial fishing activities or from boating activity. We believe that removing carp from these impoundments will promote the growth of aquatic vegetation that is beneficial for waterfowl and will promote healthy game fish populations that are popular with anglers. Motorized boats are allowed at low speed for recreational fishing in each of these impoundments. We do not anticipate any direct or indirect long-term impacts due to boating activities in association with commercial fishing. No resources will be diverted from other activities to support this use.

Cumulative Impacts: We do not anticipate any direct or indirect cumulative impacts of commercial fishing or motorized boats with other existing or projected refuge uses. Commercial fishing permits are issued on a first-come, first-served basis with a maximum of six permits issued each year. Permits are not issued every year. The infrequent use and limiting the number of permits to six should limit any potential, cumulative impacts.

Determination (check one below):

_____ Use is Not Compatible

__X__ Use is Compatible with Following Stipulations

Stipulations Necessary to Ensure Compatibility:

- Commercial fishermen must request a Special Use Permit and pay a $50.00 fee. Permit will be valid between the dates shown above. Permits are not transferable.
- A maximum of six permits will be issued per year on a first-come, first-served basis.
- Nets may not enclose any culvert from open water.
- No boats are to be left unattended. Boats are not to be docked or parked on the refuge overnight.
- Nets must be checked during daylight hours. No night use is permitted.
- Nets may not completely cut off or enclose any canal or body of water.
- All State Commercial Fishing Regulations concerning the Kentucky Lake Reservoir apply.
- All nets must be checked at least once a day, during daylight hours only.
- The permit holder must notify the refuge office if any nontarget species are caught.
- Boats must be operated at low speeds to reduce wake.
- Sensitive areas may be closed to fishing and/or boats at any time at the discretion of the refuge manager.

Justification: Commercial fishing would directly support the mission of the refuge and benefit waterfowl and other fish species by removing carp that directly impact aquatic vegetation utilized by waterfowl and turbidity that impacts game fish. Commercial fishing does not materially interfere or detract from refuge goals, objectives or other refuge management activities. Commercial fishing to remove carp from the impoundments will support recreational fishing for game fish and promote wildlife viewing in these impoundments. Traditional rod and reel fishing is not effective in removing significant numbers of carp to prevent impacts to habitat or other fish and wildlife species.

Commercial fishing is an economic use because carp are sold for food processing. Commercial fishing contributes to the purpose of the refuge by harvesting these fish that impact habitat for waterfowl and other fish species. Carp cause an increase in turbidity which impacts the growth of desired aquatic vegetation and impacts reproduction of other game fish.

NEPA Compliance for Refuge Use Description: *Place an X in appropriate space.*

_____ Categorical Exclusion without Environmental Action Statement
_____ Categorical Exclusion and Environmental Action Statement
__X__ Environmental Assessment and Finding of No Significant Impact
_____ Environmental Impact Statement and Record of Decision

Mandatory 10-Year Re-evaluation Date: _____

Description of Use: *Horseback Riding/Horse-drawn Conveyances*

The proposed use is to allow horseback riding or horse-drawn conveyances to travel refuge roads open to motor vehicles. Horses would not be allowed on any closed roads, trails or dikes. There are a few Amish communities in the area and they travel to the refuge to partake in wildlife-dependent activities. Horse use on the refuge is very low with only occasional use. This use occurs on the Duck River Unit in Humphreys and Benton counties, the Britton Ford and Big Sandy Units in Henry County, and the Busseltown Unit in Decatur County. There are no other associated uses, equipment, and/or facilities necessary for or supportive of this use. Horse use is only allowed on roads open to vehicular traffic by the public. No additional parking lots or other facilities are necessary to accommodate horse use.

Horse use would be allowed only on roads open to the public on all three units. Roads, with approximate mileage, that are open for horse use include the following:

- Big Sandy Unit: Elkhorn overlook road (2.45 miles), Big Sandy Road (6.87 miles) and Britton Ford Road (2.45 miles - seasonally closed)
- Duck River Unit: Refuge Lane (3.52 miles), Morgan Creek Road (5.38 miles), Lawrence Creek Road (2.71 miles), Haul Road (1.51 miles) and Honey Point Ferry Road (0.86 miles)
- Busseltown: Busseltown Road (1.21 miles).

We do not anticipate other areas being affected by horse use. Some illegal access (riding on closed roads) may occur, but this occurrence should be infrequent and not result in long-term impacts to the habitat or wildlife of the area. Public education and information will be available to inform horse users of the regulations and the importance of staying out of closed areas.

Horse use would be permitted anytime of year during daylight hours only on designated roads open to public use. We anticipate frequency of horse use to be occasional by small groups of riders. We estimate horse use to be less than five riders per week throughout the year. Most use would occur on the weekends and during the summer months.

There is no special equipment required or other supporting uses or associated facilities needed to conduct horse use on the refuge. Roads and parking lots are established to support other wildlife-dependent public uses. These roads and parking lots are maintained to support these other uses plus refuge management activities. No other structures or improvements are necessary to support horse use.

Horse use is being requested by a small user group and Amish community members in the area. We believe all refuge user groups should have access to the refuge for wildlife-dependent public uses. Horse use is available on other state and federal properties in the area. We believe horse use on public use roads open to vehicles will not have any impacts on refuge habitats or wildlife. Spread of invasive species should be very minimal. Most road shoulders have invasive species present that the refuge is treating.

Availability of Resources:

Resources involved in the administration and management of the use: None.

Special equipment, facilities, or improvements necessary to support the use: None.

Maintenance costs: None.

Monitoring costs: None.

Offsetting revenues: None.

Anticipated Impacts of the Use:

Short-term Impacts: There are no anticipated direct or indirect short-term impacts from horse use on the refuge. There would be no effects or impacts from horse use on accomplishing the purpose of the refuge, the mission of the System, refuge goals, refuge management activities, fish, wildlife, plants, habitats, the biological integrity of the refuge or the System, public safety or other refuge uses. Horse use would only be permitted on roads open to motor vehicles, so wildlife disturbance due to horse use would be minimal and not discernable from vehicle use. Invasive weed species may be deposited along the roads; however, the refuge has invasive weeds along most road shoulders that are controlled with herbicides and mechanical treatments.

Long-term Impacts: We do not anticipate any direct or indirect long-term impacts due to horse use on the refuge. We do not anticipate a significant increase in future horse use. We will not have to divert any refuge resources from any other activities to administer horse use on the refuge.

Cumulative Impacts: We do not anticipate any direct or indirect cumulative impacts from horse use when added to existing or projected refuge uses. However, if the auto tour route is developed in the Duck River Bottoms, horse use may be prohibited on the auto tour route due to potential disturbance of wildlife utilizing the impoundments. The auto tour route compatibility determination will address wildlife disturbance for vehicles, pedestrians, bicycles and horse users. If the auto tour route is found compatible, stipulations will address any secondary uses that may impact wildlife or habitats.

Determination (check one below):

_____ Use is Not Compatible

__X__ Use is Compatible with Following Stipulations

Stipulations Necessary to Ensure Compatibility:

- Horses are only permitted on roads open to motor vehicles.
- Horses are only permitted during daylight hours.
- Specific roads, such as designated auto tour routes, may be closed to horses due to wildlife disturbance.
- No organized trail rides by local clubs or organizations will be permitted.

Justification: Horse use does not support, materially interfere with, detract from refuge goals, objectives, or any refuge management activities. Also, horse use does not adversely impact fish, wildlife, plants and their habitats on the refuge as long as the horse riders remain on designated roads open to motor vehicles. Horse use does support wildlife viewing, hunting and fishing especially for members of the Amish community that visit the refuge.

NEPA Compliance for Refuge Use Description: *Place an X in appropriate space.*

_____ Categorical Exclusion without Environmental Action Statement
_____ Categorical Exclusion and Environmental Action Statement
__X__ Environmental Assessment and Finding of No Significant Impact
_____ Environmental Impact Statement and Record of Decision

Mandatory 10-Year Re-evaluation Date: _____

Description of Use: *Bicycling*

Bicycling is not a priority public use, but is regulated by the refuge. Bicycling is not a commercial activity and is infrequently conducted on the refuge. Less than 100 cyclists utilize the refuge annually. The refuge requires no special facilities in support of this use other than the normal road maintenance that supports all other refuge and wildlife-dependent activities.

Bicycling would be restricted to refuge-maintained gravel roads. No off-road use (trails, firebreaks, woods roads, etc.) would be allowed including all roads closed to the general public whether a scheduled seasonal or emergency closure. Should numbers increase to an unacceptable level, this activity would be reduced or terminated.

Bicycling would occur year-round, but most likely from March through October when temperatures are mild or when families would be on vacation. It would occur to a lesser extent as a means for transportation by hunters seeking to access remote portions of the refuge.

All equipment would be provided by the general public. Except on rare occasions, uses would be less than 5 on any one day. No additional facilities would be required or provided by the refuge.

The refuge is allowing this use under the assumption that users are gaining an excellent exposure to the refuge with an opportunity to observe wildlife at a level of quality equal to or greater than vehicle traffic on the auto tour route. Bicycling off the refuge is available but not in a surrounding that provides wildlife observation. It also facilitates hunter access.

Availability of Resources:

Resources involved in the administration and management of the use: No additional refuge resources are needed to support this activity.

Special equipment, facilities, or improvements necessary to support the use: None.

Maintenance costs: None.

Monitoring costs: None.

Offsetting revenues: None.

Anticipated Impacts of the Use:

Short-term Impacts: This activity does not impact refuge objectives. It is not in itself a primary "Big 6" recreational use, but it does provide for additional wildlife viewing opportunities; often the activity encourages family outings on the refuge in a manner that is not any more disturbing to wildlife than other vehicular traffic. It provides hunter access to remote portions of the refuge.

Long-term Impacts: There would be no diversion of refuge resources away from other programs. Road maintenance is currently a high priority because it supports other refuge operations and all of the "Big 6" activities.

Cumulative Impacts: Bicycling is not a "Big 6" recreational use, but it does provide for additional wildlife viewing opportunities and hunter access; often the activity encourages family outings on the refuge in a manner that is not any more disturbing to wildlife than other vehicular traffic. There would be no diversion of refuge resources away from other programs. Road maintenance is currently a high priority because it supports other refuge operations and all of the "Big 6" activities.

Determination (check one below):

_____ Use is Not Compatible

__X__ Use is Compatible with Following Stipulations

Stipulations Necessary to Ensure Compatibility: Bicycling is compatible as long as access is limited to graveled roads and the number of users does not increase dramatically.

Justification: Bicycling enhances opportunities to observe wildlife and allows deer hunters to access remote portions of the refuge without negatively impacting wildlife or other wildlife-dependent priority public uses.

NEPA Compliance for Refuge Use Description: *Place an X in appropriate space.*

_____ Categorical Exclusion without Environmental Action Statement
_____ Categorical Exclusion and Environmental Action Statement
__X__ Environmental Assessment and Finding of No Significant Impact
_____ Environmental Impact Statement and Record of Decision

Mandatory 10-Year Re-evaluation Date: _____

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Bookhout, T.A., ed. 1996. Research and Management Techniques for Wildlife and Habitats. Fifth edition, revised. The Wildlife Society, Bethesda, Maryland. 740pp.

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Johnsgard, P.A. 1975. Waterfowl of North America. Indiana University Press, Bloomington, Indiana. 624 pp.

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APPROVAL OF COMPATIBILITY DETERMINATIONS

The signature of approval is for all compatibility determinations considered within the Comprehensive Conservation Plan for Tennessee National Wildlife Refuge. If one of the descriptive uses is considered for compatibility outside of the comprehensive conservation plan, the approval signature becomes part of that determination.

Refuge Manager: _____
(Signature/Date)

Regional Compatibility Coordinator: _____
(Signature/Date)

Refuge Supervisor: _____
(Signature/Date)

Regional Chief, National Wildlife Refuge System, Southeast Region: _____
(Signature/Date)

Appendix G. Intra-Service Section 7 Biological Evaluation

INTRA-SERVICE SECTION 7 BIOLOGICAL EVALUATION FORM

Originating Person: John T Taylor
Telephone Number: 731-642-2091 ext. 306
E-Mail: John_Taylor@fws.gov
Date: October 1, 2009

PROJECT NAME (Grant Title/Number): Tennessee National Wildlife Refuge Comprehensive Conservation Plan

I. Service Program:
___ Ecological Services
___ Federal Aid
___ Clean Vessel Act
___ Coastal Wetlands
___ Endangered Species Section 6
___ Partners for Fish and Wildlife
___ Sport Fish Restoration
___ Wildlife Restoration
___ Fisheries
_X_ Refuges/Wildlife

II. State/Agency: N/A

III. Station Name: Tennessee National Wildlife Refuge

IV. Description of Proposed Action (attach additional pages as needed):
Implement the Comprehensive Conservation Plan for Tennessee NWR by adopting the proposed alternative. This plan directs the management of the refuge for the next 15 years.

V. Pertinent Species and Habitat:

A. Include species/habitat occurrence map:

B. Complete the following table:

SPECIES/CRITICAL HABITAT	STATUS[1]
Pink mucket pearly mussel	E
Orangefoot pimpleback mussel	E
Pygmy madtom	E
Rough pigtoe mussel	E
Ring pink mussel	E
Least tern	T
Piping plover	E
Indiana bat	E
Gray bat	E

[1]STATUS: E=endangered, T=threatened, PE=proposed endangered, PT=proposed threatened, CH=critical habitat, PCH=proposed critical habitat, C=candidate species

VI. Location (attach map): map attached

A. Ecoregion Number and Name: Tennessee River/Cumberland River Ecosystem

B. County and State: Henry, Benton. Humphrey, and Decatur Counties in Tennessee

C. Section, township, and range (or latitude and longitude): Henry County-Paris, TN; Benton County-Camden, TN; Humphreys County-New Johnsonville, TN; and Decatur County-Parsons, TN. Latitude 35.96487 Longitude -87.96399.

D. Distance (miles) and direction to nearest town: Henry County-Paris, TN: Britton Ford/Sulphur Well portion of Refuge is located ~4 miles east of the Paris Refuge headquarters. Benton County-Camden, TN: Eagle Creek and Birdsong are located ~7 miles southeast of Camden. Humphreys County-New Johnsonville, TN: Duck River Unit is located ~5 miles south of the Refuge sub-headquarters. Decatur County-Parsons, TN: Busseltown unit is located ~9 miles northeast of Parsons.

E. **Species/habitat occurrence:** Species occur in main stream of KY Lake which could change due to annual flooding. Ecological Services will contact the refuge if more information is needed.

VII. Determination of Effects:

A. Explanation of effects of the action on species and critical habitats in item V. B (attach additional pages as needed):

Pink mucket pearly mussel, Orangefoot pimpleback mussel, Rough pigtoe mussel, Ring pink mussel, and the Pygmy madtom fish - These mussels and fish are found in KY Lake and not in impounded waters of the refuge. These species should not be negatively impacted by implementation of the proposed alternative in the CCP.

Least tern and Piping plover – The Least tern has been documented occasionally on the Refuge in recent years. The Piping plover has not been recently documented on the Refuge. Both species migrate through the area during the spring and fall. These species are not established species to the Refuge and are a rarity. These species should not be negatively affected by any aspect of the proposed action.

Indiana bat and Gray bat – Both of these species have not been documented to occur on the Refuge; however, the appropriate habitat does occur. These species will not be negatively affected by any aspect of the proposed action.

SPECIES/ CRITICAL HABITAT	IMPACTS TO SPECIES/CRITICAL HABITAT
Orangefoot pimpleback mussel	None.
Pygmy madtom	None.
Rough pigtoe mussel	None.
Ring pink mussel	None.
Least tern	None.
Piping plover	None.
Indiana bat	None.
Gray bat	None.

B. Explanation of actions to be implemented to reduce adverse effects:

SPECIES/ CRITICAL HABITAT	ACTIONS TO MITIGATE/MINIMIZE IMPACTS
Orangefoot pimpleback mussel	None.
Pygmy madtom	None.
Rough pigtoe mussel	None.
Ring pink mussel	None.
Least tern	None.
Piping plover	None.
Indiana bat	None.
Gray bat	None.

As stated above, nothing in the preferred alternative would negatively affect these species. All habitat management, including forest treatments, would be beneficial to most wildlife including these by providing more structure, food and availability of habitat.

VIII. Effect Determination and Response Requested:

SPECIES/ CRITICAL HABITAT	DETERMINATION[1]			RESPONSE[1] REQUESTED
	NE	NA	AA	
Pink mucket pearly mussel		X		Concurrence
Orangefoot pimpleback mussel		X		Concurrence
Pygmy madtom		X		Concurrence
Rough pigtoe mussel		X		Concurrence
Ring pink mussel		X		Concurrence
Least tern		X		Concurrence
Piping plover		X		Concurrence
Indiana bat		X		Concurrence
Gray bat		X		Concurrence

[1]*DETERMINATION/RESPONSE REQUESTED:*

NE = no effect. This determination is appropriate when the proposed action will not directly, indirectly, or cumulatively impact, either positively or negatively, any listed, proposed, candidate species or designated/proposed critical habitat. Response Requested is optional but a "Concurrence" is recommended for a complete Administrative Record.

NA = not likely to adversely affect. This determination is appropriate when the proposed action is not likely to adversely impact any listed, proposed, candidate species or designated/proposed critical habitat or there may be beneficial effects to these resources. Response Requested is a "Concurrence".

AA = likely to adversely affect. This determination is appropriate when the proposed action is likely to adversely impact any listed, proposed, candidate species or designated/proposed critical habitat. Response Requested for listed species is "Formal Consultation". Response Requested for proposed or candidate species is "Conference".

_____ _____
Signature (originating station) **Date**

_____
Title

IX. Reviewing Ecological Services Office Evaluation:

A. Concurrence _____ Nonconcurrence _____

B. Formal consultation required _____

C. Conference required _____

D. Informal conference required _____

E. Remarks (attach additional pages as needed):

_____ _____
Signature **Date**

_____ _____
Title **Office**

Appendix H. Wilderness Review

The Wilderness Act of 1964 defines a wilderness area as an area of federal land that retains its primeval character and influence, without permanent improvements or human inhabitation, and is managed so as to preserve its natural conditions and which:

1. generally appears to have been influenced primarily by the forces of nature, with the imprint of man's work substantially unnoticeable;

2. has outstanding opportunities for solitude or primitive and unconfined types of recreation;

3. has at least 5,000 contiguous roadless acres or is of sufficient size to make practicable its preservation and use in an unimpeded condition; or is a roadless island, regardless of size;

4. does not substantially exhibit the effects of logging, farming, grazing, or other extensive development or alteration of the landscape, or its wilderness character could be restored through appropriate management at the time of review; and

5. may contain ecological, geological, or other features of scientific, educational, scenic, or historic value.

The lands within Tennessee National Wildlife Refuge were reviewed for their suitability in meeting the criteria for wilderness, as defined by the Wilderness Act of 1964. No lands in the refuge were found to meet these criteria, in particular criterion #3 (5,000 contiguous roadless acres). Therefore, the suitability of refuge lands for wilderness designation is not further analyzed in this plan.

Appendix I. Refuge Biota

BIRDS

Seasonal appearance
Sp - Spring - (March to May)
S - Summer - (June to August)
F - Fall - (September to November)
W - Winter - (December to February)

Seasonal abundance
a - abundant
c - common
u - uncommon
o - occasional
r - rare
* - Nests on Refuge

Loons	**SP**	**S**	**F**	**W**
Red-throated Loon (*Gavia stellata*)	o		o	o
Pacific Loon (*Gavia pacifica*)	o		o	o
Common Loon (*Gavia immer*)	u		c	c

Grebes	**SP**	**S**	**F**	**W**
Pied-billed Grebe (*Podilymbus podiceps*)	c	r	c	c
Horned Grebe (*Podiceps auritus*)	u		c	c
Red-necked Grebe (*Podiceps grisngena*)			r	r
Eared Grebe (*Podiceps nigricollis*)	r		r	r
Western Grebe *(Aechmophorus occidentalis)*	x		r	r

Pelicans	**SP**	**S**	**F**	**W**
American White Pelican (*Pelecanus erythrorhynchos*)	o	o	u	u

Cormorants	**SP**	**S**	**F**	**W**
Double-crested Cormorant* (*Phalacrocorax auritus*)	c	c	a	a

Bitterns and Herons	**SP**	**S**	**F**	**W**
American Bittern (*Botaurus lentiginosus*)	u		u	
Least Bittern (*Ixobrychus exilis*)	o	o	o	
Great Blue Heron* (*Ardea herodias*)	a	a	a	c
Great Egret* (*Ardea alba*)	c	c	c	o
Snowy Egret (*Egretta thula*)	r	o	r	
Little Blue Heron (*Egretta caerulea*)	u	u	u	
Tricolored Heron (*Egretta caerulea*)		x	x	
Cattle Egret (*Bubulcus ibis*)	o	o	o	

Green Heron* (*Butorides virescens*)	c	c	c	
Black-crowned Night Heron (*Nycticorax nycticorax*)	u	u	u	r
Yellow-crowned Night Heron (*Nyctanassa violacea*)	u	u	u	
Ibises	**SP**	**S**	**F**	**W**
White Ibis (Eudocimus albus)		r	r	
Glossy Ibis (Plegadis falcinellus)			r	
Storks	**SP**	**S**	**F**	**W**
Wood Stork (*Mycteria americana*)		x	x	
Vultures	**SP**	**S**	**F**	**W**
Black Vulture* (*Coragyps atratus*)	c	c	c	c
Turkey Vulture* (*Cathartes aura*)	c	c	c	c
Waterfowl	**SP**	**S**	**F**	**W**
Greater White-fronted Goose (*Anser albifrons*)	u		u	u
Snow Goose (*Chen caerulescens*)	o	x	u	u
Ross's Goose (*Chen rossii*)	o		o	o
Cackling Goose *(Branta hutchinsii)*	o		u	u
Canada Goose* (*Branta canadensis*)	c	c	c	c
Tundra Swan (*Cygnus columbianus*)			r	r
Wood Duck* (*Aix sponsa*)	c	c	c	u
Gadwall (*Anas strepera*)	u		a	a
American Wigeon (*Anas americana*)	u		c	c
American Black Duck (*Anas rubripes*)	c	x	c	c
Mallard* (*Anas platyrhynchos*)	c	u	a	a
Blue-winged Teal (*Anas discors*)	c	o	c	r
Northern Shoveler (*Anas clypeata*)	u		u	u
Northern Pintail (*Anas acuta*)	c	x	c	c
Green-winged Teal (*Anas crecca*)	c	x	c	c
Canvasback (*Aythya valisineria*)	u		u	c
Redhead (*Aythya americana*)	u		u	u
Ring-necked Duck (*Aythya collaris*)	u		c	c
Greater Scaup (*Aythya marila*)	o		u	u
Lesser Scaup (*Aythya affinis*)	u		u	c
Surf Scoter (*Melanitta perspicillata)*	o		o	r
White-winged Scoter (*Melanitta fusca)*	r		r	r
Black Scoter (*Melanitta nigra*)			r	r
Oldsquaw (*Clangula hyemalis*)	r		r	r
Bufflehead (*Bucephala albeola*)	u		u	c
Common Goldeneye (*Bucephala clangula*)	u		u	u
Hooded Merganser* (*Lophodytes cucullatus*)	u	u	c	c
Common Merganser (*Mergus merganser*)	r		o	o
Red-breasted Merganser (*Mergus serrator*)	o		u	u
Ruddy Duck (*Oxyura jamaicensis*)	u		c	c
Hawks and Allies	**SP**	**S**	**F**	**W**
Osprey* (*Pandion haliaetus*)	u	c	u	
Bald Eagle* (*Haliaeetus leucocephalus*)	u	u	u	c

Northern Harrier (*Circus cyaneus*)	c	x	u	c
Sharp-shinned Hawk (*Accipiter striatus*)	u	r	u	u
Cooper's Hawk* (*Accipiter cooperii*)	u	o	u	u
Red-shouldered Hawk* (*Buteo lineatus*)	u	u	u	u
Broad-winged Hawk* (*Buteo platypterus*)	u	o	u	
Red-tailed Hawk* (*Buteo jamaicensis*)	c	c	c	c
Rough-legged Hawk (*Buteo lagopus*)				r
Golden Eagle (*Aquila chrysaetos*)	r		o	u
American Kestrel* (*Falco sparverius*)	u	o	u	u
Merlin (*Falco columbarius*)	r		r	r
Peregrine Falcon (*Falco peregrinus*)	r		o	r
Turkey and Quail	**SP**	**S**	**F**	**W**
Wild Turkey* (*Meleagris gallopavo*)	u	u	u	u
Northern Bobwhite* (*Colinus virginianus*)	u	u	u	u
Rails, Gallinules and Coots	**SP**	**S**	**F**	**W**
Yellow Rail (Coturnicops noveboracensis)			r	
King Rail* (*Rallus elegans*)	o	o	o	
Virginia Rail (*Rallus limicola*)	o		o	
Sora (*Porzana carolina*)	u		c	
Common Moorhen (*Gallinula chloropus*)	r	r	r	
American Coot (*Fulica americana*)	c	r	a	c
Cranes	**SP**	**S**	**F**	**W**
Sandhill Crane (*Grus canadensis*)			u	o
Shorebirds	**SP**	**S**	**F**	**W**
Black-bellied Plover (*Pluvialis squatarola*)	r		o	
American Golden-Plover (*Pluvialis dominica*)	o		r	
Semipalmated Plover (*Charadrius semipalmatus*)	u		u	
Piping Plover (*Charadrius Melodus*)			r	
Killdeer* (*Charadrius vociferous*)	c	c	c	c
Black-necked Stilt (*Himantopus mexicanus*)	r	x	x	
American Avocet (*Recurvirostra americana*)	x	x	r	
Greater Yellowlegs (*Tringa melanoleuca*)	c	u	c	r
Lesser Yellowlegs (*Tringa flavipes*)	c	u	c	x
Solitary Sandpiper (*Tringa solitaria*)	c	o	c	
Willet (*Catoptrophorus semipalmatus*)	r		r	
Spotted Sandpiper (*Actitis macularia*)	u	r	u	
Upland Sandpiper (*Bartramia longicauda*)	r		r	
Marbled Godwit (*Limosa fedora*)	x		r	
Ruddy Turnstone (*Arenaria interpres*)	x		r	
Red Knot (*Calidris canutus*)			r	
Sanderling (*Calidris alba*)			o	x
Semipalmated Sandpiper (*Calidris pusilla*)	c		c	
Western Sandpiper (*Calidris mauri*)	o	o	u	
Least Sandpiper (*Calidris minutilla*)	c	u	c	u
White-rumped Sandpiper (*Calidris bairdii*)	o		o	
Baird's Sandpiper (*Calidris bairdii*)	r		o	

Pectoral Sandpiper (*Calidris melanotus*)	c	u	c	
Dunlin (*Calidris alpine*)	o		u	o
Stilt Sandpiper (*Calidris himantopus*)	o		u	
Buff-breasted Sandpiper (*Tryngites subrufcollis*)			o	
Short-billed Dowitcher (*Limnodromus griseus*)	u	o	u	
Long-billed Dowitcher (*Limnodromus scolopaceus*)	r	o	o	o
Common Snipe (*Gallinago gallinago*)	c		c	u
American Woodcock* (*Scolopax minor*)	u	o	o	o
Wilson's Phalarope (*Phalaropus tricolor*)	o		o	
Red-necked Phalarope (*Phalaropus lobatus*)	x		r	
Gulls and Terns	**SP**	**S**	**F**	**W**
Laughing Gull (*Larus atricilla*)	r		o	r
Franklin's Gull (*Larus pipixcan*)	r		o	r
Bonaparte's Gull (*Larus Philadelphia*)	u		u	c
Ring-billed Gull (*Larus delawarensis*)	a	r	a	a
Herring Gull (*Larus argentatus*)	u		u	c
Thayer's Gull *(Larus thayeri)*			r	r
Lesser Black-backed Gull (*Larus fuscus*)			o	o
Great Black-blacked Gull (*Larus marinus*)			r	r
Caspian Tern (*Sterna caspia*)	c	u	u	c
Common Tern (*Sterna hirundo*)	o	o	o	
Forster's Tern (*Sterna forsteri*)	o	r	u	r
Least Tern (*Sternula antillarum*)	r	r	r	
Black Tern (*Chlidonias niger*)	u	r	c	
Pigeons and Doves	**SP**	**S**	**F**	**W**
Rock Dove* (*Columba livia*)	o	o	o	o
Mourning Dove* (*Zenaida macroura*)	c	c	a	c
Cuckoos	**SP**	**S**	**F**	**W**
Black-billed Cuckoo (*Coccyzus erythropthalmus*)	r	r	r	
Yellow-billed Cuckoo* (*Coccyzus americanus*)	c	c	c	
Owls	**SP**	**S**	**F**	**W**
Barn Owl (*Tyto alba*)	r	r	r	r
Eastern Screech Owl* (*Megascops asio*)	c	c	c	c
Great Horned Owl* (*Bubo virginianus*)	u	u	u	u
Barred Owl* (*Strix varia*)	c	c	c	c
Long-eared Owl (*Asio otus*)	r		r	r
Short-eared Owl (*Asio flammeus*)	r		r	o
Nightjars	**SP**	**S**	**F**	**W**
Common Nighthawk* (*Chordeiles minor*)	u	o	u	
Chuck-will's-widow* (*Caprimulgus carolinensis*)	u	u	u	
Whip-poor-will* (*Caprimulgus vociferus*)	u	u	u	
Swifts	**SP**	**S**	**F**	**W**
Chimney Swift* (*Chaetura pelagica*)	u	u	u	

Hummingbirds	**SP**	**S**	**F**	**W**
Ruby-throated Hummingbird* (*Archilochus colubris*)	c	c	c	

Kingfishers	**SP**	**S**	**F**	**W**
Belted Kingfisher* (*Megaceryle alcyon*)	u	u	u	u

Woodpeckers	**SP**	**S**	**F**	**W**
Red-headed Woodpecker* (*Melanerpes erythrocephalus*)	u	u	u	u
Red-bellied Woodpecker* (*Melanerpes carolinus*)	c	c	c	c
Yellow-bellied Sapsucker (*Sphyrapicus varius*)	u		u	u
Downy Woodpecker* (*Picoides pubescens*)	c	c	c	c
Hairy Woodpecker* (*Picoides villosus*)	u	u	u	u
Northern Flicker* (*Colaptes auratus*)	c	c	c	c
Pileated Woodpecker* (*Dryocopus pileatus*)	u	u	u	u

Flycatchers	**SP**	**S**	**F**	**W**
Olive-sided Flycatcher (*Contopus cooperi*)	o		o	
Eastern Wood-Pewee* (*Contopus virens*)	c	c	c	
Yellow-bellied Flycatcher (*Empidonax flaviventris*)	r		r	
Acadian Flycatcher* (*Empidonax virescens*)	c	c	c	
Alder Flycatcher (*Empidonax alnorum*)	r		r	
Willow Flycatcher* (*Empidonax traillii*)	o	o	o	
Least Flycatcher (*Empidonax minimus*)	r		r	
Eastern Phoebe* (*Sayornis phoebe*)	u	u	u	o
Great Crested Flycatcher* (*Myiarchus crinitus*)	c	c	c	
Eastern Kingbird* (*Tyrannus tyrannus*)	c	c	c	

Shrike	**SP**	**S**	**F**	**W**
Loggerhead Shrike* (*Lanius ludovicianus*)	u	o	u	u

Vireos	**SP**	**S**	**F**	**W**
White-eyed Vireo* (*Vireo griseus*)	c	c	c	
Blue-headed Vireo (*Vireo solitarius*)	u	x	u	x
Yellow-throated Vireo* (*Vireo flavifrons*)	u	u	u	
Philadelphia Vireo (*Vireo philadelphicus*)	o		o	
Warbling Vireo* (*Vireo gilvus*)	u	u	u	
Red-eyed Vireo* (*Vireo olivaceus*)	c	c	c	

Jays and Crows	**SP**	**S**	**F**	**W**
Blue Jay* (*Cyanocitta cristata*)	c	c	c	c
American Crow* (*Corvus brachyrhynchos*)	c	c	c	c

Larks	**SP**	**S**	**F**	**W**
Horned Lark* (*Eremophila alpestris*)	u	u	u	u

Swallows	**SP**	**S**	**F**	**W**
Purple Martin (*Progne subis*)	c	c	u	
Tree Swallow* (*Tachycineta bicolor*)	c	c	c	x
Northern Rough-winged Swallow* (*Stelgidopteryx serripennis*)	c	c	c	
Bank Swallow (*Hirundo rustica*)	o	r	o	

Cliff Swallow* (*Hirundo pyrrhonota*)	c	c	c	
Barn Swallow* (*Hirundo rustica*)	c	c	c	
Chickadees and Titmice	**SP**	**S**	**F**	**W**
Carolina Chickadee* (*Parus carolinensis*)	c	c	c	c
Tufted Titmouse* (*Parus bicolor*)	c	c	c	c
Nuthatches	**SP**	**S**	**F**	**W**
Red-breasted Nuthatch (*Sitta canadensis*)	o		o	o
White-breasted Nuthatch* (*Sitta carolinensis*)	u	c	u	u
Creepers	**SP**	**S**	**F**	**W**
Brown Creeper (*Certhia americana*)	u		u	u
Wrens	**SP**	**S**	**F**	**W**
Carolina Wren* (*Thryothorus ludovicianus*)	c	c	c	c
Bewick's Wren (*Thryomanes bewickii*)	r	r	r	r
House Wren (*Troglodytes aedon*)	o	r	o	r
Winter Wren (*Troglodytes troglodytes*)	u		u	u
Sedge Wren (*Cistothorus platensis*)	u	r	u	r
Marsh Wren (*Cistothorus palustris*)	o		u	r
Kinglets and Gnatcatchers	**SP**	**S**	**F**	**W**
Golden-crowned Kinglet (*Regulus satrapa*)	u		u	u
Ruby-crowned Kinglet (*Regulus calendula*)	u		u	u
Blue-gray Gnatcatcher* (*Polioptila caerulea*)	c	c	c	
Thrushes	**SP**	**S**	**F**	**W**
Eastern Bluebird* (*Sialia sialis*)	c	c	c	c
Veery (*Catharus fuscescens*)	o		o	
Gray-cheeked Thrush (*Catharus minimus*)	u		u	
Swainson's Thrush (*Catharus ustulatus*)	c		c	
Hermit Thrush (*Catharus guttatus*)	o		u	u
Wood Thrush* (*Hylocichla mustelina*)	c	c	c	
American Robin* (*Turdus migratorius*)	c	c	c	c
Mimic Thrashers	**SP**	**S**	**F**	**W**
Gray Catbird* (*Dumetella carolinensis*)	u	u	u	
Northern Mockingbird* (*Mimus polyglottos*)	c	c	c	c
Brown Thrasher* (*Toxostoma rufum*)	c	c	c	u
Starlings	**SP**	**S**	**F**	**W**
European Starling* (*Sturnus vulgaris*)	c	c	c	a
Pipits	**SP**	**S**	**F**	**W**
American Pipit (*Anthus rubescens*)	u		u	u
Waxwings	**SP**	**S**	**F**	**W**
Cedar Waxwing* (*Bombycilla cedrorum*)	u	r	u	u

Warblers	**SP**	**S**	**F**	**W**
Blue-winged Warbler (*Vermivora pinus*)	o	r	o	
Golden-winged Warbler (*Vermivora chrysoptera*)	o		o	
Tennessee Warbler (*Vermivora peregrina*)	c		c	
Orange-crowned Warbler (*Vermivora celata*)	r		o	r
Nashville Warbler (*Vermivora ruficapilla*)	u		u	
Northern Parula* (*Parula americana*)	u	u	u	
Yellow Warbler* (*Dendroica petechia*)	u	o	u	
Chestnut-sided Warbler (*Dendroica pensylvanica*)	u		u	
Magnolia Warbler (*Dendroica magnolia*)	u		u	
Cape May Warbler (*Dendroica tigrina*)	u		u	
Black-throated Blue Warbler (*Dendroica caerulescens*)	r		r	
Yellow-rumped Warbler (*Dendroica coronata*)	c		c	u
Black-throated Green Warbler (*Dendroica virens*)	c		c	
Blackburnian Warbler (*Dendroica fusca*)	u		u	
Yellow-throated Warbler* (*Dendroica dominica*)	u	u	u	
Pine Warbler* (*Dendroica pinus*)	u	u	u	u
Prairie Warbler* (*Dendroica discolor*)	u	u	u	
Palm Warbler (*Dendroica palmarum*)	u		u	
Bay-breasted Warbler (*Dendroica castanea*)	u		u	
Blackpoll Warbler (*Dendroica striata*)	c		r	
Cerulean Warbler (*Dendroica cerulea*)	u	r	o	
Black-and-white Warbler* (*Mniotilta varia*)	u	o	u	
American Redstart* (*Setophaga ruticilla*)	u	o	u	
Prothonotary Warbler* (*Protonotaria citrea*)	c	c	c	
Worm-eating Warbler* (*Helmitheros vermivorus*)	u	u	u	
Swainson's Warbler (*Limnothlypis swainsonii*)	r	r	r	
Ovenbird* (*Seiurus aurocapilla*)	u	u	u	
Northern Waterthrush (*Seiurus noveboracensis*)	u		u	
Louisiana Waterthrush* (*Seiurus motacilla*)	u	u	u	
Kentucky Warbler* (*Oporornis formosus*)	u	u	u	
Common Yellowthroat* (*Geothlypos trichas*)	c	c	c	x
Hooded Warbler* (*Wilsonia citrine*)	u	o	u	
Wilson's Warbler (*Wilsonia pusilla*)	o		o	
Canada Warbler (*Wilsonia Canadensis*)	o		o	
Yellow-breasted Chat* (*Icteria virens*)	c	c	c	

Tanagers	**SP**	**S**	**F**	**W**
Summer Tanager* (*Piranga rubra*)	c	c	c	
Scarlet Tanager* (*Piranga olivacea*)	c	c	c	

Towhees, Sparrows and Longspurs	**SP**	**S**	**F**	**W**
Eastern Towhee* (*Pipilo erythrophthalmus*)	c	c	c	c
American Tree Sparrow (*Spizella arborea*)	r		r	r
Chipping Sparrow* (*Spizella passerine*)	u	u	u	r
Field Sparrow* (*Spizella pusilla*)	c	c	c	c
Vesper Sparrow (*Pooecetes gramineus*)	u		u	r
Lark Sparrow (*Chondestes grammacus*)	r	r		
Savannah Sparrow (*Passerculus sandwichensis*)	c		c	c
Grasshopper Sparrow (*Ammodramus savannarum*)	o	r	o	

Henslow's Sparrow			r	
Le Conte's Sparrow (*Ammodramus leconteii*)	o		o	u
Nelson's Sharp-tailed Sparrow (*Ammodramus nelsoni*)	r		r	
Fox Sparrow (*Passerella iliaca*)	u		u	u
Song Sparrow (*Melospiza melodia*)	c	r	c	c
Lincoln's Sparrow (*Melospiza lincolnii*)	u		u	r
Swamp Sparrow (*Melospiza georgiana*)	c		c	c
White-throated Sparrow (*Zonotrichia Ilbicollis*)	c		c	c
White-crowned Sparrow (*Zonatrichia leucophrys*)	u		u	u
Dark-eyed Junco (*Junco hyemalis*)	c		c	c
Lapland Longspur (*Calcarius lapponicus*)			r	o

Cardinals, Grosbeaks and Allies	**SP**	**S**	**F**	**W**
Northern Cardinal* (*Cardinalis cardinalis*)	c	c	c	c
Rose-breasted Grosbeak (*Pheucticus ludovicianus*)	u		u	
Blue Grosbeak* (*Passerina caerulea*)	u	u	u	
Indigo Bunting* (*Passerina cyanea*)	c	c	c	
Dickcissel* *(Spiza americana)*	u	u	u	

Blackbirds and Allies	**SP**	**S**	**F**	**W**
Bobolink (*Dolichonyx oryzivorus*)	u		o	
Red-winged Blackbird* (*Agelais phoeniceus*)	c	c	a	a
Eastern Meadowlark* (*Sturnella magna*)	u	u	u	u
Rusty Blackbird (*Euphagus carolinus*)	u		u	u
Brewer's Blackbird (*Euphagus cyanocephalus*)	r		r	r
Common Grackle* (*Quiscalus quiscula*)	c	c	c	c
Brown-headed Cowbird* (*Molothrus ater*)	c	c	c	c
Orchard Oriole* (*Icterus spurious*)	c	c	u	
Northern Oriole* (*Icterus galbula*)	u	o	o	

Old World Finches	**SP**	**S**	**F**	**W**
Purple Finch (*Carpodacus purpureus*)	u		u	u
House Finch* (*Carpodacus mexicanus*)	c	u	u	c
Pine Siskin (*Carduelis pinus*)	o		o	o
American Goldfinch* (*Carduelis tristis*)	c	c	c	c
Evening Grosbeak (*Coccothraustes vespertinus*)	r		r	r

Weaver Finches	**SP**	**S**	**F**	**W**
House Sparrow* (*Passer domesticus*)	c	c	c	c

Accidental Birds

Yellow-billed Loon *(Gavia adamsii)*
Brown Pelican *(Pelecanus occidentalis)*
Anhinga *(Anhinga anhinga)*
White-faced Ibis *(Plegadis chihi)*
Roseate Spoonbill *(Ajaia ajaia)*
Fulvous Whistling-Duck *(Dendrocygna bicolor)*
Barnacle Goose *(Branta leucopsis)*
Brant *(Branta bernicla)*

Eurasian Wigeon *(Anas penelope)*
Cinnamon Teal *(Anas cyanoptera)*
Northern Goshawk *(Accipiter gentilis)*
Swainson's Hawk *(Buteo swainsoni)*
Whooping Crane *(Grus americana)*
Curlew Sandpiper *(Calidris ferruginea)*
Red Phalarope *(Phalaropus fulicarius)*
Pomarine Jaeger *(Stercorarius pomarinus)*
Parasitic Jaeger *(Stercorarius parasiticus)*
Long-Tailed Jaeger *(Stercorarius longicaudus)*
Sabine's Gull *(Xema sabini)*
Little Gull *(Hydrocoloeus minutus)*
Black-headed Gull *(Chroicocephalus ridibundus)*
California Gull *(Larus californicus)*
Iceland Gull *(Larus glaucoides)*
Glaucous Gull *(Larus hyperboreus)*
Sooty Tern *(Onychoprion fuscatus)*
Common Ground-Dove *(Columbina passerine)*
Mourning Warbler *(Oporornis philadelphia)*
Spotted Towhee *(Pipilo maculates)*
Harris's Sparrow *(Zonotrichia querula)*
McCown's Longspur *(Calcarius mccownii)*
Yellow-headed Blackbird *(Xanthocephalus xanthocephalus)*

AMPHIBIANS

Common Name	Scientific Name
Order Anura – Frogs and Toads	
Blanchard's Cricket Frog	*Acris crepitans blanchardi*
Northern Cricket Frog	*Acris crepitans crepitans*
American Toad	*Bufo americanus americanus*
Fowler's Toad	*Bufo woodhousei fowleri*
Eastern Narrowmouth Toad	*Gastrophryne carolinensis*
Western Bird-voiced Treefrog	*Hyla avivoca avivoca*
Cope's Gray Treefrog	*Hyla chrysoscelis*
Green Treefrog	*Hyla cinerea*
Gray Treefrog	*Hyla versicolor*
Northern Spring Peeper	*Pseudacris crucifer crucifer*
Upland Chorus Frog	*Pseudacris triseriata feriarum*
Northern Crawfish Frog	*Rana areolata circulosa*
Bullfrog	*Rana catesbeiana*
Green Frog	*Rana clamitans melanota*
Pickerel Frog	*Rana palustris*
Southern Leopard Frog	*Rana utricularia*
Eastern Spadefoot	*Scaphiopus holbrookii holbrookii*
Order Caudata – Salamanders	
Spotted Salamander	*Ambystoma maculatum*
Marbled Salamander	*Ambystoma opacum*
Mole Salamander	*Ambystoma talpoideum*
Small-mouthed Salamander	*Ambystoma texanum*
Eastern Tiger Salamander	Ambystoma tigrinum tigrinum
Eastern Hellbender	*Cryptobranchus alleganiensis alleganiensis*
Spotted Dusky Salamander	*Desmognathus fuscus conanti*
Southern Two-lined Salamander	*Eurycea cirrigera*
Three-lined Salamander	*Eurycea longicauda guttolineata*
Long-tailed Salamander	*Eurycea longicauda longicauda*

Common Name	Scientific Name
Cave Salamander	*Eurycea lucifuga*
Mudpuppy	*Necturus maculosus*
Eastern Newt	*Notophthalmus viridescens*
Zig-zag Salamander	*Plethodon dorsalis*
Mississippi Slimy Salamander	*Plethodon mississippi*
Red Salamander	*Pseudotriton ruber*
Western Lesser Siren	*Siren intermedia nettingi*

REPTILES

Common Name	Scientific Name
Order Testudines - Turtles	
Common Snapping Turtle	*Chelydra serpentine serpentina*
Hieroglyphic River Cooter	*Chrysemys concinna hieroglyphica*
Southern Painted Turtle	*Chrysemys picta dorsalis*
Midland Painted Turtle	*Chrysemys picta marginata*
Red-eared Pond Slider	*Chrysemys scripta elegans*
Map Turtle	*Graptemys geographica*
Ouachita Map Turtle	*Graptemys ouachitensis ouachitensis*
Mississippi Map Turtle	*Graptemys pseudogeographica kohnii*
False Map Turtle	*Graptemys pseudogeographica pseudogeographica*
Eastern Mud Turtle	*Kinosternon subrubrum subrubrum*
Alligator Snapping Turtle	*Macroclemys temmincki*
Stinkpot	*Sternotherus odoratus*
Eastern Box Turtle	*Terrapene carolina carolina*
Midland Smooth Softshell	*Trionyx muticus muticus*
Eastern Spiny Softshell	*Trionyx spiniferus spiniferus*
Order Squamata, suborder Lacertilia – Lizards	
Six-lined Racerunner	*Cnemidophorus sexlineatus sexlineatus*
Southern Coal Skink	*Eumeces anthracinus pluvialis*

Common Name	Scientific Name
Five-lined Skink	*Eumeces fasciatus*
Southeastern Five-lined Skink	*Eumeces inexpectatus*
Broad-headed Skink	*Eumeces laticeps*
Eastern Slender Glass Lizard	*Ophisaurus attenuatus longicaudus*
Northern Fence Lizard	*Sceloporus undulates hyacinthinus*
Ground Skink	*Scinella lateralis*
Order Squamata, Suborder Serpentes – Snakes	
Northern Copperhead	*Agkistrodon contortrix mokeson*
Western Cottonmouth	*Agkistrodon piscivorus leucostoma*
Midwest Worm Snake	*Carphophis amoenus helenae*
Northern Scarlet Snake	*Cemophora coccinea copei*
Southern Black Racer	*Coluber constrictor priapus*
Timber Rattlesnake	*Crotalus horridus*
Mississippi Ringneck Snake	*Diadophis punctatus strictogenys*
Corn Snake	*Elaphe guttata*
Gray Rat Snake	*Elaphe obsoleta*
Western Mud Snake	*Farancia abacura reinwardti*
Eastern Hognose Snake	*Heterodon platyrhinos*
Prairie Kingsnake	*Lampropeltis calligaster calligaster*
Mole Snake	*Lampropeltis calligaster rhombamaculata*
Speckled Kingsnake	*Lampropeltis getulus holbrooki*
Black Kingsnake	*Lampropeltis getulus nigra*
Scarlet Kingsnake	*Lampropeltis triangulum elapsoides*
Red Milk Snake	*Lampropeltis triangulum syspila*
Green Water Snake	*Nerodia cyclopion cyclopion*
Yellow-bellied Water Snake	*Nerodia erythrogaster flavigaster*
Broad-banded Water Snake	*Nerodia fasciata confluens*
Diamondback Water Snake	*Nerodia rhombifera rhombifera*
Midland Water Snake	*Nerodia sipedon pleuralis*
Rough Green Snake	*Opheodrys aestivus*

Common Name	Scientific Name
Northern Pine Snake	*Pituophis melanoleucus melanoleucus*
Queen Snake	*Regina septemvittata*
Western Pygmy Rattlesnake	*Sistrurus miliarius streckeri*
Midland Brown Snake	*Storeria dekayi wrightorum*
Northern Red-bellied Snake	*Storeria occipitomaculata occipitomaculata*
Southeastern Crowned Snake	*Tantilla coronata*
Eastern Ribbon Snake	*Thamnophis sauritus sauritus*
Eastern Garter Snake	*Thamnophis sirtalis sirtalis*
Western Smooth Earth Snake	*Virginia valeriae elegans*

FISH

Common Name	Scientific Name
Family Petromyzontidae - Lampreys	
Chestnut Lamprey	*Ichthyomyzon castaneus*
Silver Lamprey	*Ichthymyzon unicuspis*
Least Brook Lamprey	*Lampetra aepyptera*
Family Polyodontidae - Paddlefishes	
Paddlefish	*Polyodon spathula*
Family Lepisosteidae - Gars	
Spotted Gar	*Lepisosteus oculatus*
Longnose Gar	*Lepisosteus osseus*
Shortnose Gar	*Lepisosteus platostomus*
Family Amiidae - Bowfin	
Bowfin	*Amia calva*
Family Hiodontidae - Mooneyes	
Goldeye	Hiodon alosoides
Mooneye	Hiodon tergisus
Family Anguillidae - Freshwater Eels	
American Eel	*Anguilla rostrata*

Common Name	Scientific Name
Family Clupeidae - Herrings & Shad	
Skipjack Herring	*Alosa chrysochlaris*
Gizzard Shad	*Dorosoma cepedianum*
Threadfin Shad	*Dorosoma petenense*
Family Cyprinidae - Minnows	
Central Stoneroller	*Campostoma anomalum*
Largescale Stoneroller	*Campostoma oligolepis*
Goldfish	*Carassius auratus*
Rosyside Dace	*Clinostonus funduloides*
Grass Carp	*Ctenopharyngodon idella*
Whitetail Shiner	*Cyprinella galactura*
Spotfin Shiner	*Cyprinella spiloptera*
Blacktail Shiner	*Cyprinella venusta*
Steelcolor Shiner	*Cyprinella whipplii*
Common Carp	*Cyprinus carpio*
Streamline Chub	*Erimystax dissimilis*
Blotched Chub	*Erimystax insiginis*
Cypress Minnow	*Hybognathus hayi*
Silvery Minnow	*Hybognathus nuchalis*
Bigeye Chub	*Hybopsis amblops*
Bighead Carp	*Hypophthalmichthys nobilis*
Striped Shiner	*Luxilus chrysocephalus*
Rosefin Shiner	*Lythrurus ardens*
Ribbon Shiner	*Lythrurus fumeus*
Redfin Shiner	*Lythrurus umbratilis*
Spotted Chub	*Macrhybopsis hyostoma*
Silver Chub	*Macrhybopsis storeriana*
Redtail Chub	*Nocomis effuses*
Golden Shiner	*Notemigonus crysoleucas*
Emerald Shiner	*Notropis atherinoides*

Common Name	Scientific Name
River Shiner	*Notropis blennius*
Bigeye Shiner	*Notropis boops*
Ghost Shiner	*Notropis buchanani*
Tennessee Shiner	*Notropis leuciodus*
Silver Shiner	*Notropis photogenis*
Rosyface Shiner	*Notropis rubellus*
Telescope Shiner	*Notropis telescopus*
Mimic Shiner	*Notropis volucellus*
Channel Shiner	*Notropis wickliffi*
Pugnose Minnow	*Opsopaeodus emiliae*
Suckermouth Minnow	*Phenacobius mirabilis*
Stargazing Minnow	*Phenacobius uranops*
Southern Redbelly Dace	*Phoxinus erythrogaster*
Bluntnose Minnow	*Pimephales notatus*
Fathead Minnow	*Pimephales promelas*
Bullhead Minnow	*Pimephales vigilax*
Blacknose Dace	*Rhinichthys atratulus*
Creek Chub	*Semotilus atromaculatus*
Family Catostomidae - Suckers	
River Carpsucker	*Carpiodes carpio*
Quillback	*Carpiodes cyprinus*
Highfin Carpsucker	*Carpiodes velifer*
White Sucker	*Catostomus commersonii*
Blue Sucker	*Cycleptus elongates*
Creek Chubsucker	*Erimyzon oblongus*
Northern Hogsucker	*Hypentelium nigricans*
Smallmouth Buffalo	*Ictiobus bubalus*
Bigmouth Buffalo	*Ictiobus cyprinellus*
Black Buffalo	*Ictiobus niger*
Spotted Sucker	*Minytrema melanops*

Common Name	Scientific Name
Silver Redhorse	*Moxostoma anisurum*
Smallmouth Redhorse	*Moxostoma breviceps*
River Redhorse	*Moxostoma carinatum*
Black Redhorse	*Moxostoma duquesnii*
Golden Redhorse	*Moxostoma erythrurum*
Shorthead Redhorse	*Moxostoma macrolepidotum*
Family Ictaluridae - Freshwater Catfishes	
Black Bullhead	*Ameiurus melas*
Yellow Bullhead	*Ameiurus natalis*
Blue Catfish	*Ictalurus furcatus*
Channel Catfish	*Ictalurus punctatus*
Mountain Madtom	*Noturus eleutherus*
Tadpole Madtom	*Notorus gyrinus*
Brindled Madtom	*Noturus miurus*
Freckled Madtom	*Notorus nocturnus*
Flathead Catfish	*Pylodictis olivaris*
Family Esocidae - Pikes	
Grass Pickerel	*Esox americanus*
Chain Pickerel	*Esox niger*
Family Aphredoderidae - Pirate Perches	
Pirate Perch	*Aphredoderus sayanus*
Family Fundulidae - Killifishes	
Northern Studfish	*Fundulus catenatus*
Blackstripe Topminnow	*Fundulus notatus*
Blackspotted Topminnow	*Fundulus olivaceus*
Family Poeciliidae - Livebearers	
Western Mosquitofish	*Gambusia affinis*
Family Atherinidae - Silversides	
Brook Silverside	*Labidesthes sicculus*
Mississippi Silverside	*Menidia audens*

Common Name	Scientific Name
Family Mugilidae - Mullets	
Striped Mullet	*Mugil cephalus*
Family Cottidae - Sculpins	
Banded Sculpin	*Cottus carolinae*
Family Moronidae - Temperate Basses	
White Bass	*Morone chrysops*
Yellow Bass	*Morone mississippiensis*
Striped Bass	*Morone saxatilis*
Family Centrarchidae - Sunfishes	
Rock Bass	*Ambloplites rupestris*
Green Sunfish	*Lepomis cyanellus*
Warmouth	*Lepomis gulosus*
Orangespotted Sunfish	*Lepomis humilis*
Bluegill	*Lepomis macrochirus*
Dollar Sunfish	*Lepomis marginatus*
Longear Sunfish	*Lepomis megalottis*
Redear Sunfish	*Lepomis microlophus*
Redspotted Sunfish	*Lepomis miniatus*
Smallmouth Bass	*Micropterus dolomieui*
Spotted Bass	*Micropterus punctulatus*
Largemouth Bass	*Micropterus salmoides*
White Crappie	*Pomoxis annularis*
Black Crappie	*Pomoxis nigromaculatus*
Family Percidae - Perches	
Coppercheek Darter	*Etheostoma aquali*
Mud Darter	*Etheostoma asprigene*
Buffalo Darter	*Etheostoma bison*
Greenside Darter	*Etheostoma blennioides*
Rainbow Darter	*Etheostoma caeruleum*
Bluntnose Darter	*Etheostoma chlorosoma*

Common Name	Scientific Name
Black Darter	*Etheostoma duryi*
Fantail Darter	*Etheostoma flabellare*
Saffron Darter	*Etheostoma flavum*
Slough Darter	*Etheostoma gracile*
Harlequin Darter	*Etheostoma histrio*
Stripetail Darter	*Etheostoma kennicotti*
Blackfin Darter	*Etheostoma nigripinne*
Johnny Darter	*Etheostoma nigrum*
Guardian Darter	*Etheostoma oophylax*
Goldstripe Darter	*Etheostoma parvipinne*
Redline Darter	*Etheostoma rufilineatum*
Snubnose Darter	*Etheostoma simoterum*
Slabrock Darter	*Etheostoma smithi*
Orangethroat Darter	*Etheostoma spectabile*
Speckled Darter	*Etheostoma stigmaeum*
Banded Darter	*Etheostoma zonale*
Bandfin Darter	*Etheostoma zonistium*
Yellow Perch	*Perca flavescens*
Blotchside Logperch	*Percina burtoni*
Logperch	*Percina caprodes*
Gilt Darter	*Percina evides*
Slenderhead Darter	*Percina phoxocephala*
Dusky Darter	*Percina sciera*
River Darter	*Percina shumardi*
Sauger	*Sander canadense*
Walleye	*Sander vitreus*
Family Sciaenidae - Drums	
Freshwater Drum	*Aplodinotus grunniens*

MAMMALS

Common Name	Scientific Name
Order Didelphimorpha	
Virginia Opossum	*Didelphis virginiana*
Order Insectivora	
Southern Short-tailed Shrew	*Blarina carolinensis*
Least Shrew	*Cryptotis parva*
Eastern Mole	*Scalopus aquaticus*
Pygmy Shrew	*Sorex hoyi*
Southeastern Shrew	*Sorex longirostris*
Order Chiroptera	
Rafinesque's Big-eared Bat*	*Corynorhinus rafinequii*
Big Brown Bat	*Eptesicus fuscus*
Silver-haired Bat	*Lasionycteris noctiraganus*
Eastern Red Bat	*Lasiurus borealis*
Hoary Bat	*Lasiurus cinereus*
Southeastern Bat*	*Myotis austroriparius*
Gray Myotis**	*Myotis grisescens*
Eastern Small-footed Myotis*	*Myotis leibii*
Little Brown Myotis	*Myotis lucifugus*
Northern Long-eared Myotis	*Myotis septentrionalis*
Indiana Myotis**	*Myotis sodalis*
Evening Bat	*Nycticeius humeralis*
Eastern Pipistrelle	*Pipistrellus subflavus*
Order Zenarthra	
Nine-banded Armadillo	*Dasypus novemcinctus*
Order Lagomorpha	
Swamp Rabbit	*Sylvilagus aquaticus*
Eastern Cottontail	*Sylvilagus floridanus*
Order Rodentia	
American Beaver	*Castor canadensis*

Common Name	Scientific Name
Southern Flying Squirrel	*Glaucomys volans*
Woodchuck	*Marmota monax*
Prairie Vole	*Microtus ochrogaster*
Woodland Vole	*Microtus pinetorum*
House Mouse	*Mus musculus*
Eastern Woodrat	*Neotoma floridana*
Golden Mouse	*Ochrotomys nuttalli*
Muskrat	*Ondatra zibethicus*
Marsh Rice Rat	*Oryzomys palustris*
Cotton Mouse	*Peromyscus gossypinus*
White-footed Mouse	*Peromyscus leucopus*
Deer Mouse	*Peromyscus maniculatus*
Norway Rat	*Rattus norvegicus*
Eastern Harvest Mouse	*Reithrodontomys humulis*
Eastern Gray Squirrel	*Sciurus carolinensis*
Eastern Fox Squirrel	*Sciurus niger*
Hispid Cotton Rat	*Sigmodon hispidus*
Eastern Chipmunk	*Tamias striatus*
Meadow Jumping Mouse	*Zaprus hudsonius*
Order Carnivora	
Coyote	*Canis latrans*
Bobcat	*Felis rufus*
Northern River Otter	*Lutra canadensis*
Striped Skunk	*Mephitis mephitis*
Long-tailed Weasel	*Mustela frenata*
American Mink	*Mustela vison*
Raccoon	*Procyon lotor*
Gray Fox	*Urocyon cinereoargenteus*
Red Fox	*Vulpes vulpes*

Common Name	Scientific Name
Order Artiodactyla	
White-tailed Deer	*Odocoileus virginianus*
**of special concern* ***endangered*	

Appendix J. Budget Requests

REFUGE OPERATING NEEDS SYSTEM (RONS)

42620 Tennessee NWR

FY08-3420
SR: 1
RS:
RR:

One-Time:
RecurBase: $77,650
Tot. 1st Year: $77,650

	Num	Cost
Permanent Staff:	1	$77,650
Temporary Staff:		

Title: Enhance habitat management and visitor service facilities

Description: Provide an engineering equipment operator to assist in maintaining the three Units that are a part of the Tennessee National Wildlife Refuge Complex. The distance of the Units from the maintenance facility located at the Duck River Sub-headquarters averages a one hour drive time to Big Sandy or Busseltown. The current maintenance staff of two employees can not fully meet the maintenance needs on refuge habitats and facilities. The engineering equipment operator will enable Tennessee National Wildlife Refuge Complex to offer a higher degree of safety for refuge visitors, as well as, a more cost effective maintenance program for the refuge. Currently, the stations visitor service facilities and water management infrastructure are suffering from a lack of adequate preventative and corrective maintenance. Additional staff will allow for the completion of routine maintenance of facilities and infrastructure to provide safe access for visitors and improved habitat for wildlife.

42620 Tennessee NWR

FY08-3430
SR: 2
RS:
RR:

One-Time:
RecurBase: $77,321
Tot. 1st Year: $77,321

	Num	Cost
Permanent Staff:	1	$77,321
Temporary Staff:		

Title: Provide for administrative assistance and improve visitor services

Description: Improve visitor services by providing an office assistant at the Duck River Unit sub-headquarters. This will provide support with administrative reporting and provide a presence at the sub-headquarters office on a daily basis. This will improve visitor services by having someone on site to answer visitor inquiries by phone or for visitors who come into the office. The staff at the sub-headquarters are typically on the refuge working and not present at the office on a regular basis to greet the public and provide assistance. This will also provide help with reporting requirements and allow the maintenance and biological staff to dedicate more time to habitat related projects and to maintaining visitor services facilities.

42620 Tennessee NWR

FY08-3472
SR: 3
RS:
RR:

One-Time:
RecurBase: $114,439
Tot. 1st Year: $114,439

	Num	Cost
Permanent Staff:	1	$114,439
Temporary Staff:		

Title: Implement forest management program

Description: Refuge forestlands will be inventoried and assessed; subsequent prescriptions and management will be driven by habitat needs. Currently, over 20,000 acres of refuge forest land is unmanaged. Additional personnel are critical to long-term inventory, analysis and field implementation of the Forest Management Plan. Forest inventory and analysis determine the necessary prescriptions ((harvest), planting, invasive exotic eradication, prescribed burning, and monitoring) as defined by needs of the priority bird species. Additional refuge forestry responsibilities include shoreline restoration partnerships with residential refuge neighbors. The forester will also asses the need for and identifies sites suitable for carbon sequestration projects.

42620 Tennessee NWR

FY08-3485
SR: 4
RS:
RR:

One-Time:
RecurBase: $69,584
Tot. 1st Year: $69,584

	Num	Cost
Permanent Staff:	1	$69,584
Temporary Staff:		

Title: Inventory and monitor forest management program

Description: This project will assist in the development and implementation of a silvicultural prescription to improve forest habitat conditions specifically designed for forest songbirds and other forest-dwelling wildlife. A forestry technician will provide assistance with cruising and marking timber. The technician would monitor timber harvest and document the progress. The technician would assist the forester and the complex biologist monitor the effects is silvicultural treatments on wildlife. This position is critical to the future implementation of a prescribed burning program on Tennessee and Cross Creeks National Wildlife Refuges.

42620 Tennessee NWR

FY08-3489
SR: 5
RS:
RR:

One-Time: $205,000
RecurBase:
Tot. 1st Year: $205,000

	Num	Cost
Permanent Staff:		
Temporary Staff:		

Title: Expand waterfowl management capabilities on the Busseltown Unit

Description: Expand the water management capabilities on 6 waterfowl impoundments on the Busseltown Unit by 30 acres through a partnership with Ducks Unlimited (DU). Survey work for this project was completed by DU in 2006. The refuge historically provided foraging habitat on agricultural grains in nonflooded fields. Winter weather has been abnormally mild in recent years and ducks have become more and more reluctant to utilize fields that cannot be flooded. The additional habitat provided by these impoundments will help provide forage for the over 200,000 waterfowl that winter on Tennessee NWR. Waterfowl usage of the Busseltown Unit is limited by the availability of impounded waters.

42620 Tennessee NWR

FY08-3493
SR: 6
RS:
RR:

One-Time: $150,000
RecurBase:
Tot. 1st Year: $150,000

	Num	Cost
Permanent Staff:		
Temporary Staff:		

Title: Expand waterfowl management capabilities on the Big Sandy Unit

Description: Expand the water management capabilities on 4 waterfowl impoundments on the Big Sandy Unit by 30 acres through a partnership with Ducks Unlimited (DU). Survey work for this project was completed by DU in 2006. Final project design is still needed. The refuge historically provided foraging habitat on agricultural grains in nonflooded fields. Winter weather has been abnormally mild in recent years and ducks have become more and more reluctant to utilize fields that cannot be flooded. The additional habitat provided by these impoundments will help provide forage for the over 200,000 waterfowl that winter on Tennessee NWR. Waterfowl usage of the Big Sandy Unit is limited by the availability of impounded waters.

42620 Tennessee NWR

FY08-3496
SR: 7
RS:
RR:

One-Time: $250,000
RecurBase:
Tot. 1st Year: $250,000

	Num	Cost
Permanent Staff:		
Temporary Staff:		

Title: Shoreline stabilization

Description: Partner with the Tennessee Valley Authority (TVA) on a shoreline stabilization project along Kentucky Lake on the Big Sandy Unit of the refuge. Shoreline erosion due to heavy wave activity is severe in many locations on the refuge. Large stone and geotextile fabric will be placed along approximately 1,200 feet of shoreline at eroded sites. This project will focus on stabilizing areas adjacent to agriculture fields that are managed for waterfowl foraging habitat. The refuge provides habitat for over 200,000 waterfowl that winter on the refuge.

42620 Tennessee NWR

FY08-3504
SR: 8
RS:
RR:

One-Time: $20,000
RecurBase:
Tot. 1st Year: $20,000

	Num	Cost
Permanent Staff:		
Temporary Staff:		

Title: Bottomland hardwood reforestation

Description: Reforest 100 acres of bottomland hardwoods within the Duck River Bottoms. Several abandoned agricultural fields will be planted in mast producing seedlings. The fields that are to be planted are capable of being flooded and would provide excellent waterfowl habitat as the trees mature. The additional habitat provided by this will help provide forage for the over 200,000 waterfowl that winter on the refuge, as well as other forest interior birds and resident wildlife.

42620 Tennessee NWR

FY08-3511	**One-Time:**	$35,000	**Title: Develop refuge interpretive video for Tennessee NWR**
SR: 9	**RecurBase:**		**Description:** Develop refuge interpretive video. The refuge has some interpretive signs and brochures to help the public understand why it was created and what we are trying to manage, and how the public can help us accomplish this mission. However, a short video about the refuge could be extremely helpful in connecting people to the overall mission of the refuge. This video could be used in many different ways such as during school programs, interpretive talks or meetings with the public or with partners. This project would hire NCTC to create a short 15 minute video to introduce the Refuge and the Service mission to visitors before they depart the headquarters and venture out on the Refuge.
RS:	**Tot. 1st Year:**	$35,000	
RR:			
	Num	Cost	
Permanent Staff:			
Temporary Staff:			

42620 Tennessee NWR

FY08-3515	**One-Time:**	$50,000	**Title: Develop waterfowl livefeed camera "Duck Cam"**
SR:	**RecurBase:**	$2,000	**Description:** Develop a livefeed camera that highlights wild waterfowl at the refuge. An exhaustive search of live "cams" has found little evidence that anyone has a livefeed camera that focuses on wild waterfowl species. This refuge would like to establish a "Duck Cam" that would show concentrations of overwintering waterfowl feeding and loafing on the refuge. The 'duck cam" would be featured on the refuge's home page and would be linked to cameras at several different impoundment locations.
RS:	**Tot. 1st Year:**	$52,000	
RR:			
	Num	Cost	
Permanent Staff:			
Temporary Staff:			

42620 Tennessee NWR

FY08-3516	**One-Time:**	$120,000	**Title: Vegetation Mapping**
SR:	**RecurBase:**		**Description:** Develop detailed vegetative cover maps for all three units of the refuge following standards outlined by the National Vegetation Classification System. This will be accomplished by using Geographic Information System (GIS) to classify vegetation from satellite imagery and color infrared aerial photography. The aerial photography is currently unavailable and will need to be contracted. These photos are to be at a scale of 1:8000 to aid in developing detailed vegetation coverage data. Flight lines for the refuge have already been established by USGS through a BRD Research Partnership Project. Detailed vegetation maps are essential to progressive habitat management planning and monitoring. These maps will also provide a baseline to monitor potential impacts on vegetation communities by climate change.
RS:	**Tot. 1st Year:**	$120,000	
RR:			
	Num	Cost	
Permanent Staff:			
Temporary Staff:			

42620 Tennessee NWR

FY08-3518
SR: 10
RS:
RR:

One-Time:
RecurBase: $94,588
Tot. 1st Year: $94,588

	Num	Cost
Permanent Staff:	1	$94,588
Temporary Staff:		

Title: Expand visitor services program on Tennessee NWR

Description: Provide a Refuge Ranger to meet the visitor services needs of the new headquarters and visitor service facility. This position will staff the visitor's center and provide for both on and off site programs to schools groups, scouts, church organizations, university students, and refuge partners. This position will provide assistance to visitors by answering the many inquiries the refuge receives related to hunting, fishing, and wildlife observation via e-mail, phone, or in person.

42620 Tennessee NWR

FY08-3546
SR: 11
RS:
RR:

One-Time:
RecurBase: $77,650
Tot. 1st Year: $77,650

	Num	Cost
Permanent Staff:	1	$77,650
Temporary Staff:		

Title: Enhance habitat management and visitor service facilities

Description: Provide an engineering equipment operator to assist in maintaining the three Units that are a part of the Tennessee National Wildlife Refuge Complex. The distance of the Units from the maintenance facility located at the Duck River Sub-headquarters averages a one hour drive time to Big Sandy or Busseltown. The current maintenance staff of two employees can not fully meet the maintenance needs on refuge habitats and facilities. The engineering equipment operator will enable Tennessee National Wildlife Refuge Complex to offer a higher degree of safety for refuge visitors, as well as, a more cost effective maintenance program for the refuge. Currently, the stations visitor service facilities and water management infrastructure are suffering from a lack of adequate preventative and corrective maintenance. Additional staff will allow for the completion of routine maintenance of facilities and infrastructure to provide safe access for visitors and improved habitat for wildlife.

42620 Tennessee NWR

FY08-3549
SR: 12
RS:
RR:

One-Time:
RecurBase: $67,129
Tot. 1st Year: $67,129

	Num	Cost
Permanent Staff:	1	$67,129
Temporary Staff:		

Title: Maintain public use facilities and increase habitat management

Description: Provide a permanent tractor operator at Tennessee NWR. This project would ensure that the wildlife drive, kiosks, observation platforms, and hiking trails are kept in a neat well manicured manner. The project would provide assistance with mowing roadsides, parking areas, and boat ramps. This will prevent invasive and other noxious plants from growing over water control structures, gates, signs, wood duck boxes, and refuge roads. This will also provide a permanent source for maintaining Chickasaw National Recreation Trail, the Britton Ford Trail and their associated infrastructure. The project will provide for additional food that will be available for wildlife by planting winter wheat, millet, corn, or other crops as needed.

42620 Tennessee NWR

FY08-3561
SR: 13
RS:
RR:

One-Time:
RecurBase: $69,584
Tot. 1st Year: $69,584

	Num	Cost
Permanent Staff:	1	$69,584
Temporary Staff:		

Title: Expand the biological monitoring program on Tennessee NWR

Description: Agricultural fields, forested areas, roadsides, and impoundments have become infested with populations of exotic or invasive plant and animal species. In order to eliminate or control these populations more emphasis will be placed on early detection and monitoring the presence, spread, and damage caused by these species to native plants and wildlife and their habitat. This position will also allow an expansion in the numbers and types of surveys being conducted, thus increasing the biological information for the Refuge. Additional wildlife surveys would focus on bats, secretive waterbirds, woodcock, colonial waterbirds and amphibians. Some existing surveys will be improved and expanded such as forest bird point counts, eagle nest monitoring, deer and resident Canada goose crop depredation, and shorebird surveys.

42620 Tennessee NWR

FY08-3584
SR: 14
RS:
RR:

One-Time:
RecurBase: $94,588
Tot. 1st Year: $94,588

	Num	Cost
Permanent Staff:	1	$94,588
Temporary Staff:		

Title: Improve management capability on Tennessee NWR

Description: Improve refuge management capabilities by providing an assistant refuge manager for the Tennessee NWR complex. The assistant manager would provide oversight and support to the public use program, farming program, maintenance program, and invasive species control. The position would support facilities management by keeping the appropriate property records current and up to date. The assistant manager would also maintain the appropriate databases related to facilities maintenance for the Refuge. This will permit the maintenance staff to commit more time to habitat and public use related projects. The manager would be responsible for the cooperative farming program, nuisance animal control, and maintenance on the Busseltown and Big Sandy Units. These two units are at a minimum a one hour drive from the Duck River sub-headquarters which makes visiting the units difficult for the Duck River manager.

42620 Tennessee NWR

FY08-3589
SR: 15
RS:
RR:

One-Time:
RecurBase: $94,588
Tot. 1st Year: $94,588

	Num	Cost
Permanent Staff:	1	$94,588
Temporary Staff:		

Title: Expand visitor services program on Tennessee NWR

Description: Assist in the further development and implementation the visitor services program at Tennessee National Wildlife Refuge. Responsibilities include planning and implementation of the environmental education program, planning and conducting special events, and oversight of the interpretive program on the Duck River Unit, including update and upkeep of Refuge-related publications, and sign placement and maintenance.

42620 Tennessee NWR

FY08-3601	**One-Time:**		**Title: Expand the biological monitoring program on Tennessee NWR**
SR: 16	**RecurBase:**	$69,584	**Description:** This position will provide an increase in the numbers and types of surveys being conducted, thus increasing the biological information for the Refuge. Additional wildlife surveys would focus on bats, secretive waterbirds, woodcock, colonial waterbirds and amphibians. Some existing surveys will be improved and expanded such as forest bird point counts, eagle nest monitoring, deer and resident Canada goose crop depredation, and shorebird surveys. The position would also be responsible for helping the complex meet annual banding quotas for wood ducks and maintaining nest boxes on the Refuge.
RS:	**Tot. 1st Year:**	$69,584	
RR:			

	Num	Cost
Permanent Staff:	1	$69,584
Temporary Staff:		

SERVICE ASSET MAINTENANCE MANAGEMENT SYSTEM (SAMMS)

Work Order	Description	Location/RPI #	Parent Location	Asset	Status	Work Type	Sub Work Type	Target Start	Site
2007694693	Replace Pole Barn	10016849	42620-4040		WAPPR	DM	DMRP		R4
2007733834	Replace old and rickety DRU pole shed barn at the "Bull Pen".	10016849	42620-4040		WAPPR	DM	DMFP		R4
2006537389	Bridge Repairs 10016854	10016854	42620-4076		WAPPR	DM	DMCM		R4
05137724	Replace water control structure at Robertson Pond	10016859	42620-4016		WAPPR	DM			R4
2007701754	Repair leaking Farmer Pond on the Big Sandy Unit.	10016860	42620-4016		WAPPR	DM	DMFP		R4
2006553800	Repair Water Control Structure	10016860	42620-4016		WAPPR	DM	DMRH		R4
2007701673	Replace wooden secondary entrance signs on the Duck River Unit of Tennessee National Wildlife Refuge.	10016868	42620-4080		WAPPR	DM	DMFP		R4
2006549932	Repair Wood	10016868	42620-4080		WAPPR	DM	DMCM		R4
2007733835	Rehabilitate eroded 12' X 60' boat launching ramps constructed of either natural or concrete materials and paneling on the BS	10016873	42620-4013		WAPPR	DM	DMFP		R4
2007716058	Repair eroded Big Sandy boat ramps	10016873	42620-4013		WAPPR	DM	DMCM		R4

Work Order	Description	Location/RPI #	Parent Location	Asset	Status	Work Type	Sub Work Type	Target Start	Site
2007716059	Repair eroded Duck River boat ramps	10016874	42620-4013		WAPPR	DM	DMCM		R4
2007733837	Repair eroded boat ramps on the Busseltown Unit in Decatur County, Tennessee.	10016875	42620-4013		WAPPR	DM	DMFP		R4
2007716060	Repair cracked Busseltown Unit boat ramps	10016875	42620-4013		WAPPR	DM	DMCM		R4
2007694696	Replace the old 640 square foot shop Busseltown Unit	10016876	42620-3560		WAPPR	DM	DMRP		R4
2007733838	Replace rickety and damaged BTU shop building near the entrance on the unstaffed Busseltown Unit.	10016876	42620-3560		WAPPR	DM	DMFP		R4
2006546252	Rehab Red Shop Site Converted Parking	10016877	42620-4066		WAPPR	DM	DMRH		R4
2006546251	Rehab Pole Shed Parking	10016878	42620-4066		WAPPR	DM	DMRH		R4
2006546266	Rehab Shop Parking Lot	10016879	42620-4066		WAPPR	DM	DMRH		R4
2006546267	Rehab Old Shop Parking	10016880	42620-4066		WAPPR	DM	DMRH		R4
2007692963	Rehabilitate Structure	10016890	42620-3580		WAPPR	DM	DMRH		R4
2007716214	Replace failed Pool 4-6 water control structure	10016894	42620-4016		WAPPR	DM	DMRP		R4

Work Order	Description	Location/RPI #	Parent Location	Asset	Status	Work Type	Sub Work Type	Target Start	Site
2008877307	PERM-ERFO #1/2 Cross Creek Road (Child)	10016901	42620-4016		WAPPR	DM	DMRH		R4
2008877503	PERM-ERFO #2/11 Dike Road (Child)	10016902	42620-4016		WAPPR	DM	DMRH		R4
2008877439	PERM-ERFO #7/9 Dike Road (Child)	10016904	42620-4016		WAPPR	DM	DMRH		R4
2008877495	PERM-ERFO #3/4 Dike Road (Child)	10016906	42620-4016		WAPPR	DM	DMRH		R4
2008877459	PERM-ERFO #5/11 Dike Road (Child)	10016908	42620-4016		WAPPR	DM	DMRH		R4
2008877428	PERM-ERFO Lawrence Creek (Child)	10016910	42620-4016		WAPPR	DM	DMRH		R4
2008876692	EM-ERFO Lawrence Creek (Child)	10016910	42620-4016		WAPPR	DM	DMRH		R4
2007733840	Rehabilitate levee overgrown with woody vegetation.	10016911	42620-4016		WAPPR	DM	DMFP		R4
2007716154	Repair overgrown Pool 8-9 dikes	10016911	42620-4016		WAPPR	DM	DMCM		R4
2007716215	Replace failed Pool 11-1 water control structure	10016914	42620-4016		WAPPR	DM	DMRP		R4
2005201838	Replace WCS & Culverts ENG child of 03125876	10016914	42620-4016		WAPPR	DM	DMEG		R4
2005201833	Replace WCS & Culverts DM child of 03125876	10016914	42620-4016		WAPPR	DM	DMRP		R4

Work Order	Description	Location/RPI #	Parent Location	Asset	Status	Work Type	Sub Work Type	Target Start	Site
03125876	Replace two 48" water control structures and two 6	10016914	42620-4016		WAPPR	DM	DMFP		R4
2007716216	Repair eroded Pool 2-11 water control structure	10016916	42620-4016		WAPPR	DM	DMCM		R4
2008877466	PERM-ERFO Pool #7 Overflow(Child)	10016920	42620-4016		WAPPR	DM	DMRH		R4
2007716217	Replace failed Pool 9 water control structure	10016922	42620-4016		WAPPR	DM	DMRP		R4
2007733841	Replace leaking 60 inch water control structure.	10016922	42620-4016		WAPPR	DM	DMFP		R4
2008877481	PERM-ERFO #10/1 Dike Road (Child)	10016923	42620-4016		WAPPR	DM	DMRH		R4
2007694709	Repair eroded leaking water control structure	10016934	42620-4016		COMP	DM	DMRP		R4
2007733842	Replace leaky, corroded WCS on the BTU.	10016934	42620-4016		COMP	DM	DMFP		R4
2007694710	Replace 24 x 60 number 1 water control structure	10016935	42620-4016		COMP	DM	DMRP		R4
2007733844	Replace leaky, rusted out WCS on the BTU.	10016935	42620-4016		COMP	DM	DMFP		R4
05137686	Repair the earthen levee between pools 12/wood duc	10016940	42620-4016		WAPPR	DM			R4
2007694711	Repair the 80,000 square foot waterfowl banding site	10016944	42620-4080		WAPPR	DM	DMCM		R4

Work Order	Description	Location/RPI #	Parent Location	Asset	Status	Work Type	Sub Work Type	Target Start	Site
05137690	Repair the earthen levee between pool 9 and the ag	10016945	42620-4016		WAPPR	DM			R4
2007694712	Replace 24" x 60" water control structure at pool ENG Child of 05137763	10016946	42620-4016		WAPPR	DM	DMRP		R4
2007694714	Replace 24 x 60 water control structure at pool DM Child of 05137771	10016948	42620-4016		WAPPR	DM	DMRP		R4
2007694715	Replace 24 x 60 water control structure at sub-headquarters maintenance pool DM Child of 05137779	10016950	42620-4016		WAPPR	DM	DMRP		R4
03125726	Replace the 6000 square foot Headquarters pole bar	10016951	42620-4040		WAPPR	DM	DMFP		R4
2007733845	Rehabilitate corroded/leaking uninsulated aluminum windows, repair and repaint water damaged walls on the subheadquarters sho	10016953	42620-3560		WAPPR	DM	DMFP		R4
2007716004	Repair damaged shop building	10016953	42620-3560		WAPPR	DM	DMRH		R4
2007694718	Replace 2000 feet of water line DM child of 03125729	10016957	42620-4071		WAPPR	DM	DMRP		R4
2005201419	Replace 2000 feet of water line DM child of 03125729	10016957	42620-4071		WAPPR	DM	DMRP		R4
03125729	Replace 2000 feet of water line (Property Number 1	10016957	42620-4071		WAPPR	DM	DMFP		R4

Work Order	Description	Location/RPI #	Parent Location	Asset	Status	Work Type	Sub Work Type	Target Start	Site
2007716061	Repair overgrown Moriah Road boat ramp	10016966	42620-4013		WAPPR	DM	DMCM		R4
2005206154	Rehabilitate Eagle Creek boat launching ramp. DM child of 91103328	10016971	42620-4013		COMP	DM	DMRH		R4
91103328	Rehabilitate Eagle Creek boat launching ramp. Yea	10016971	42620-4013		COMP	DM	DMFP		R4
2005225687	40190 Replace 48" WCS at Pool 1/Pool 2. ENG child of 03125877	10016982	42620-4016		INPRG	DM	DMEG		R4
2005225686	Replace 48" WCS Pool 1/Pool 2. DM child of 03125877	10016982	42620-4016		INPRG	DM	DMRP		R4
2005225684	Replace 48" water control structures and 6	10016982	42620-4016		INPRG	DM	DMFP		R4
2007694721	Repair eroded water control structure	10016983	42620-4016		WAPPR	DM	DMRP		R4
2007694722	Repair water control structure at pool 1	10016984	42620-4016		WAPPR	DM	DMRH		R4
2007692972	Repair Roof	10016985	42620-3530		WAPPR	DM	DMCM		R4
2007734445	Replace current unsafe fishing platform with smaller ADA accessible structure at Duck River Bottoms	10016991	42620-4013		WAPPR	DM	DMRP		R4
2005203341	Repair Federal Highway Administration Rte 010, Elkhorn Overlook Rd	10040231	42620-4076		WAPPR	DM	DMRP		R4

Work Order	Description	Location/RPI #	Parent Location	Asset	Status	Work Type	Sub Work Type	Target Start	Site
2005218241	Repair Rte 010 DM child of 03125521	10040232	42620-4076		WAPPR	DM	DMRH		R4
2006559960	Repair Federal Highway Administration Rte 011, Lic DM child of 03125737	10040233	42620-4076		WAPPR	DM	DMRH		R4
2005222750	Repair Federal Highway Administration Rte 011, Lic ENG child of 03125737	10040233	42620-4076		WAPPR	DM			R4
2005222749	Repair Federal Highway Administration Rte 011, Lic DM child of 03125737	10040233	42620-4076		WAPPR	DM	DMRH		R4
03125737	Repair Federal Highway Administration Rte 011, Lic	10040233	42620-4076		WAPPR	DM			R4
2005257809	R4 Tennessee Rehab Big Sandy Rd Rte 012 (Child)	10040235	42620-4076		WAPPR	DM	DMRH		R4
2005257808	R4 Tennessee PE Rehab Big Sandy Rd Rte 012 (Parent)	10040235	42620-4076		WAPPR	DM	DMFP		R4
2006545921	Rehab FHWA Rte 012, Big Sandy Road	10040250	42620-4076		WAPPR	DM	DMRH		R4
2008845594	Repair worn FHWA Route 12 Big Sandy Road	10040250	42620-4076		WAPPR	DM	DMFP		R4
2007711273	R4 Tennessee Refuge Lane Rte 013 (Child)	10040256	42620-4016		WAPPR	DM	DMRH		R4
2006500292	R4 Tennessee Refuge Lane Rte 013 (Child)	10040256	42620-4016		WAPPR	DM	DMRH		R4

Work Order	Description	Location/RPI #	Parent Location	Asset	Status	Work Type	Sub Work Type	Target Start	Site
2007740393	CM Child Rehab Refuge Lane Rte 013	10040256	42620-4016		WAPPR	DM	DMRH		R4
2005222755	Repair Federal Highway Administration Rte 013, Ref ENG child of 03125753	10040256	42620-4016		WAPPR	DM			R4
2005222757	Repair Federal Highway Administration Rt3 013, Ref DM child of 03125753	10040256	42620-4016		WAPPR	DM			R4
03125753	Repair Federal Highway Administration Rte 013, Ref	10040256	42620-4016		WAPPR	DM			R4
2007740391	PE Child Rehab Refuge Lane Rte 013	10040256	42620-4016		WAPPR	DM	DMRH		R4
92103345	Preliminary engineering. Unidentified Roads (Rte)	10040256	42620-4016		WAPPR	DM			R4
2005222770	Repair Federal Highway Administration Route 014, ENG child of 03125755	10040257	42620-4076		WAPPR	DM			R4
2005222767	Repair Federal Highway Administration Route 014, M DM child of 03125755	10040257	42620-4076		WAPPR	DM	DMRH		R4
03125755	Repair Federal Highway Administration Route 014, M	10040257	42620-4076		WAPPR	DM			R4
2005221772	Repair fed hwy admin Route 014	10040259	42620-4076		WAPPR	DM	DMRH		R4
2005221829	Repair fed hwy admin Route 015	10040260	42620-4076		WAPPR	DM	DMRH		R4

Work Order	Description	Location/RPI #	Parent Location	Asset	Status	Work Type	Sub Work Type	Target Start	Site
2006559936	Rehab FHWA Rte 016	10040270	42620-4016		WAPPR	DM	DMRH		R4
30125775	Repair Federal Highway Administration Route 016, B	10040270	42620-4016		WAPPR	DM			R4
2005221847	Repair fed hwy admin Route 100	10040273	42620-4076		WAPPR	DM	DMRH		R4
2005221873	Repair fed hwy admin Route 101 DM child of 03125782	10040287	42620-4076		WAPPR	DM	DMRH		R4
03125782	Repair Federal Highway Administration Route 101, A	10040287	42620-4076		WAPPR	DM			R4
2008876688	EM-ERFO Sulpher Well Road (Child)	10040289	42620-4076		WAPPR	DM	DMRH		R4
2005221915	Repair fed hwy admin Route 102	10040289	42620-4076		WAPPR	DM	DMRH		R4
2005221948	Repair fed hwy admin Route 104	10040296	42620-4076		WAPPR	DM	DMRH		R4
2005217329	Repair Route 105 Tennessee NWR	10040297	42620-4076		WAPPR	DM	DMRH		R4
2008876673	EM-ERFO Britton Ford Road (Child)	10040299	42620-4076		WAPPR	DM	DMRH		R4
2005201011	Repair FHA Rt 106, Britton Ford Road Section 2	10040304	42620-4076		WAPPR	DM	DMRH		R4
2005221966	Repair fed hwy admin Route 107	10040322	42620-4076		WAPPR	DM	DMRH		R4

Work Order	Description	Location/RPI #	Parent Location	Asset	Status	Work Type	Sub Work Type	Target Start	Site
2005257807	R4 Tennessee Rehab Pace Point Rd Rte 108 (Child)	10040323	42620-4076		WAPPR	DM	DMRH		R4
2005223698	Repair Iron Bridge Land. Access	10040344	42620-4076		WAPPR	DM	DMRH		R4
2005221981	Repair fed hwy admin Route 110	10040347	42620-4076		WAPPR	DM	DMRH		R4
2006444276	R4 Tennessee Haul road Rte 113 (Child)	10040358	42620-4076		WAPPR	DM	DMRH		R4
2006500293	R4 Tennessee Haul road Rte 113 (Child)	10040358	42620-4076		WAPPR	DM	DMRH		R4
2005210595	R4 Tennessee Haul road Rte 113 (Child)	10040358	42620-4076		WAPPR	DM	DMRH		R4
2005210574	R4 Tennessee Haul Road Rte. 113 (Child)	10040358	42620-4076		WAPPR	DM	DMRH		R4
2008877454	PERM-ERFO Haul Road (Child)	10040358	42620-4076		WAPPR	DM	DMRH		R4
2006500310	R4 Tennessee Haul road Rte 113 (Child)	10040358	42620-4076		WAPPR	DM	DMRH		R4
2007701787	Repair rutted Federal Highway Administration Route 114.	10040365	42620-4076		WAPPR	DM	DMFP		R4
2005222079	Repair fed hwy admin Route 114 DM child of 2007701787	10040365	42620-4076		WAPPR	DM	DMRH		R4
2005222112	Repair fed hwy admin Route 115	10040384	42620-4076		WAPPR	DM	DMRH		R4

Work Order	Description	Location/RPI #	Parent Location	Asset	Status	Work Type	Sub Work Type	Target Start	Site
2005222128	Repair fed hwy admin Route 116	10040391	42620-4076		WAPPR	DM	DMRH		R4
2005222150	Repair fed hwy admin Route 117	10040393	42620-4076		WAPPR	DM	DMRH		R4
2005222164	Repair fed hwy admin Route 118	10040396	42620-4076		WAPPR	DM	DMRH		R4
2005222185	Repair fed hwy admin Route 119	10040442	42620-4076		WAPPR	DM	DMRH		R4
2005222197	Repair fed hwy admin Route 121	10040445	42620-4076		WAPPR	DM	DMRH		R4
2005222216	Repair fed hwy admin Route 122	10040454	42620-4076		WAPPR	DM	DMRH		R4
2007701785	Repair worn and rutted Federal Highway Administration Route 123, Cooley Road, in Humphreys County, TN.	10040460	42620-4076		WAPPR	DM	DMFP		R4
2005222238	Repair fed hwy admin Route 123 DM child of 03125849	10040460	42620-4076		WAPPR	DM	DMRH		R4
2008877509	PERM-ERFO Waverly Pump Road (Child)	10040462	42620-4016		WAPPR	DM	DMRH		R4
2005222260	Repair fed hwy admin Route 124	10040462	42620-4016		WAPPR	DM	DMRH		R4
2005207288	40190 Repair Honey Point Ferry Road. ENG child of 91103347	10040464	42620-4076		COMP	DM	DMEG		R4

Work Order	Description	Location/RPI #	Parent Location	Asset	Status	Work Type	Sub Work Type	Target Start	Site
2005207286	Repair Honey Point Ferry Road. DM child of 91103347	10040464	42620-4076		COMP	DM	DMRH		R4
91103347	Repair Honey Point Ferry Road (Real Property Number	10040464	42620-4076		COMP	DM	DMRH		R4
2006546246	Rehab FHWA Rte 126, Busseltown South Spur Road	10040467	42620-4076		WAPPR	DM	DMRH		R4
2007701795	Rehabilitate worn FHWA Route 126 - Busseltown South Spur Road.	10040467	42620-4076		WAPPR	DM	DMFP		R4
2006559979	Rehab FHWA Rte 127, Busseltown Pump Road	10040470	42620-4016		WAPPR	DM	DMRH		R4
2007733847	Repair worn and eroded FHA Rte 127, Busseltown Pump Station Road;	10040470	42620-4016		WAPPR	DM	DMFP		R4
03125852	Replace Federal Highway Administration route 127 B	10040470	42620-4016		WAPPR	DM			R4
2005222293	Repair fed hwy admin Route 120	10040476	42620-4076		WAPPR	DM	DMRH		R4
2005222321	Repair fed hwy admin Route 900	10040520	42620-4066		WAPPR	DM	DMRH		R4
2005222423	Repair fed hwy admin Route 901	10040539	42620-4066		WAPPR	DM	DMRH		R4
2005222429	Repair fed hwy admin Route 902	10040587	42620-4066		WAPPR	DM	DMRH		R4
2005223832	Repair Parking Elk.-Nob. Boat Ramp	10040591	42620-4066		WAPPR	DM	DMRH		R4

Work Order	Description	Location/RPI #	Parent Location	Asset	Status	Work Type	Sub Work Type	Target Start	Site
2006546247	Rehab FHWA Rte 905, Elkhorn Point Parking	10040593	42620-4066		WAPPR	DM	DMRH		R4
2005221812	Replace Bobcat Bend Parking	10040594	42620-4066		WAPPR	DM	DMRP		R4
2005221833	Replace Britton Ford Parking	10040595	42620-4066		WAPPR	DM	DMRP		R4
2005221851	Replace Cemetery Parking	10040597	42620-4066		WAPPR	DM	DMRP		R4
2005223898	Rehab Parking at Black Rocks	10040598	42620-4066		WAPPR	DM	DMRH		R4
2005210598	R4 Tennessee Pool 5 Parking Lot Rte. 911 (Child)	10040601	42620-4066		WAPPR	DM	DMRH		R4
2005210612	R4 Tennessee Pool 5 Parking Rte 911(Child)	10040601	42620-4066		WAPPR	DM	DMRH		R4
2006500316	R4 Tennessee Pool 5 Parking Rte 911(Child)	10040601	42620-4066		WAPPR	DM	DMRH		R4
2006500320	R4 Tennessee Pool 5 Parking Rte 911(Child)	10040601	42620-4066		WAPPR	DM	DMRH		R4
03125929	Replace Federal Highway Administration Route 911,	10040601	42620-4066		WAPPR	DM			R4
2006546248	Rehab FHWA Rte 910, Duck River Bottom Parking	10040656	42620-4066		WAPPR	DM	DMRH		R4
2006546249	Rehab FHWA Rte 912, Pool 5 Handicap Parking	10040725	42620-4066		WAPPR	DM	DMRH		R4

Work Order	Description	Location/RPI #	Parent Location	Asset	Status	Work Type	Sub Work Type	Target Start	Site
2005210623	R4 Tennessee Duck River HQ Parking Re 913 (Child)	10040732	42620-4066		WAPPR	DM	DMRH		R4
2005210607	R4 Tennessee Duck River Parking Lot Rte. 913 (Child)	10040732	42620-4066		WAPPR	DM	DMRH		R4
2006500323	R4 Tennessee Duck River HQ Parking Re 913 (Child)	10040732	42620-4066		WAPPR	DM	DMRH		R4
2006500326	R4 Tennessee Duck River HQ Parking Re 913 (Child)	10040732	42620-4066		WAPPR	DM	DMRH		R4
2005221920	Replace Pump Station Boat Ramp Parking	10040734	42620-4066		WAPPR	DM	DMRP		R4
2005221953	Replace Pump Sta. East Parking	10040737	42620-4066		WAPPR	DM	DMRP		R4
2005221970	Replace N. Eagle Landing Parking	10040740	42620-4066		WAPPR	DM	DMRP		R4
2005221989	Replace Morgan Cr. Land. Parking	10040743	42620-4066		WAPPR	DM	DMRP		R4
2005222017	Replace Pond Bott. Land. Parking	10040750	42620-4066		WAPPR	DM	DMRP		R4
2005217326	Repair Rte 921	10040781	42620-4066		WAPPR	DM	DMRH		R4
2005217335	Repair Rte 922	10040785	42620-4066		WAPPR	DM	DMRH		R4
2005222084	Replace Bussel. U. Parking	10040791	42620-4066		WAPPR	DM	DMRP		R4

Work Order	Description	Location/RPI #	Parent Location	Asset	Status	Work Type	Sub Work Type	Target Start	Site
2005222107	Replace Bussel. U. Pump. Sta. Parking	10040796	42620-4066		WAPPR	DM	DMRP		R4
2005217359	Repair Rte 925	10040798	42620-4066		WAPPR	DM	DMRH		R4
2006546250	Rehab Moons Landing Parking	10041328	42620-4066		WAPPR	DM	DMRH		R4
2008870517	Repalce rusted and worn culverts	10041346	42620-4016		WAPPR	DM	DMRP		R4
2008870437	Replace rusted and worn culverts	10041346	42620-4016		WAPPR	DM	DMFP		R4
05137888	Replace 36¿ X 60¿ Southern water control structure	10041933	42620-4016		WAPPR	DM			R4
05137890	Replace 36¿ X 60¿ Northern water control structure	10041934	42620-4016		WAPPR	DM			R4
05137894	Replace water control structure at Pools 4/11 with	10042048	42620-4016		WAPPR	DM	DMFP		R4
2007733849	Replace leaking 36 inch water control structures at Pool 12/8 and Pool 12/WDP on the Duck River Unit of Tennessee NWR.	10042066	42620-4016		APPR	DM	DMFP		R4
2007731183	Replace rusted water control structures	10042066	42620-4016		WMATL	DM	DMRP		R4
05137901	Replace 24¿ X 60¿ water control structure at Pool	10042094	42620-4016		WAPPR	DM			R4

Work Order	Description	Location/RPI #	Parent Location	Asset	Status	Work Type	Sub Work Type	Target Start	Site
2007716261	Repair eroded Pools 11-1 water control structure	10042104	42620-4016		WAPPR	DM	DMCM		R4
2006546271	Rehab Eagle Creek N. Cemetery Road	10046361	42620-4076		WAPPR	DM	DMRH		R4
2007716067	Repair eroded Swayne Point boat ramp	10047514	42620-4013		WAPPR	DM	DMCM		R4
2007733851	Repair eroded portions of 12' X 45' & 12' X 60' boat launching ramp on Swayne Point that is accessed by Federal Highway Admin	10047514	42620-4013		WAPPR	DM	DMFP		R4
2006553030	Repair Leaks	10047543	42620-4016		WAPPR	DM	DMCM		R4
2009909099	Repair Damage to TVA outer levee at the Duck River Unit	10047548	42620-4016		WAPPR	DM	DMRH		R4
2006546255	Rehab Yergin Lane Boat Ramp Parking	10047675	42620-4066		WAPPR	DM	DMRH		R4
2006546253	Rehab Broadview Boat Ramp Parking	10047677	42620-4066		WAPPR	DM	DMRH		R4
2006546260	Rehab 23rd Liberty Cemetery Road	10047680	42620-4076		WAPPR	DM	DMRH		R4
2006546265	Rehab Lake Access Road at Antioch Area	10047682	42620-4076		WAPPR	DM	DMRH		R4
2006546264	Rehab Fairview Cemetery Road	10047685	42620-4076		WAPPR	DM	DMRH		R4

Work Order	Description	Location/RPI #	Parent Location	Asset	Status	Work Type	Sub Work Type	Target Start	Site
2006546274	Rehab Rochelle Road	10047803	42620-4076		WAPPR	DM	DMRH		R4
2006546269	Rehab Cooley Bottoms Road	10047839	42620-4076		WAPPR	DM	DMRH		R4
2006546273	Rehab Eagle Creek Peninsula Road	10047847	42620-4076		WAPPR	DM	DMRH		R4
2006546261	Rehab 23rd Power Line Field Road	10047849	42620-4076		WAPPR	DM	DMRH		R4
2006546268	Rehab Birdsong Ag. Road	10047855	42620-4076		WAPPR	DM	DMRH		R4
2006550632	Rehab Grain Bin Road	10047858	42620-4076		WAPPR	DM	DMRH		R4
2006546263	Rehab 23rd Ridge Road System	10047861	42620-4076		WAPPR	DM	DMRH		R4
2006546275	Rehab Waverly Pump Road East	10047868	42620-4076		WAPPR	DM	DMRH		R4
2006546258	Rehab 23rd Bennett Creek Road West	10047869	42620-4076		WAPPR	DM	DMRH		R4
2006546257	Rehab 23 Ross Creek Road East	10047873	42620-4076		WAPPR	DM	DMRH		R4
2006546262	Rehab 23rd Williams Barn Road	10047874	42620-4076		WAPPR	DM	DMRH		R4
2006546259	Rehab 23rd Fire Tower Road	10047876	42620-4076		WAPPR	DM	DMRH		R4

Work Order	Description	Location/RPI #	Parent Location	Asset	Status	Work Type	Sub Work Type	Target Start	Site
2007694726	Repair the two sluice gates DM Child of 05138079	10049640	42620-4016		WAPPR	DM	DMCM		R4
2007647548	REHAB HAUL ROAD EXTENDED	10055839	42620-4076		WAPPR	DM	DMRH		R4

Appendix K. List of Preparers

Tennessee National Wildlife Refuge (U.S. Fish and Wildlife Service)

John Taylor
Troy Littrell
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Raye Nilius
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United States Fish and Wildlife Service

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Bill Smith
Bob Ford

United States Forest Service, Land Between the Lakes National Recreation Area

Sharon Waltrip

Tennessee Valley Authority

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