U.S. Fish & Wildlife Service

Draft Comprehensive Conservation Plan and Environmental Impact Statement

Rocky Mountain Arsenal National Wildlife Refuge

The mission of the U.S. Fish and Wildlife Service is working with others to conserve, protect, and enhance fish, wildlife, plants, and their habitats for the continuing benefit of the American people.

The mission of the National Wildlife Refuge System is to administer a national network of lands and waters for the conservation, management, and, where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans.

Cover photograph of burrowing owls.
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Draft Comprehensive Conservation Plan and Environmental Impact Statement

Rocky Mountain Arsenal National Wildlife Refuge

Colorado

May 2015

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Summary

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Burrowing owls

> *On this sand farm in Wisconsin, first worn out and then abandoned by our bigger and better society, we try to rebuild, with shovel and axe, what we are losing elsewhere.*
>
> *Aldo Leopold*, A Sand County Almanac

The Rocky Mountain Arsenal National Wildlife Refuge Complex, consisting of some of the newer properties in the National Wildlife Refuge System, is a work in progress. Offering unique assets to surrounding communities, these lands promise to become some of the premier urban wildlife refuges in the country. At the heart of the refuge complex is the Rocky Mountain Arsenal National Wildlife Refuge: 16,000 acres of shortgrass and mixed-grass prairie that is home to bison, bald eagles, migratory songbirds, prairie dogs, and much more—all within the Denver Metropolitan area.

This comprehensive conservation plan will be the first in the country designed to begin implementing the Refuge System's new Urban Refuge Initiative. To accomplish this, we analyzed a wide range of options on how best to support up to one million visitors per year without compromising our principal purposes to protect and preserve fish and wildlife and their habitats.

We are fortunate to have inherited a great deal of infrastructure from the U.S. Army, but we are also constrained by the current condition and layout of these facilities. Some of this infrastructure may be acting as barriers to the public—a condition inconsistent with the purposes of the refuge. Accordingly, we have developed a goal to increase and improve suitable access to the refuge, develop sustainable transportation options, and provide more connections among the units of the refuge complex. This increased access will enable people from all walks of life to visit the refuge. The vision we have developed for the refuge complex calls for the restoration of the refuge's historical habitats, and the reconnection of people with the natural lands of the refuge and of the region at large using a network consisting of multimodal trails, a far-reaching light-rail system, and the Denver International Airport.

This refuge is well positioned to leverage and catalyze early investments to create world-class wildlife habitat and a conservation education facility in the heart of a rapidly growing urban metropolis. So positioned, the refuge represents the ideal inter-

section of nature and education to transmit the message of conservation, outdoor recreation, and stewardship to future generations. Toward this end, collaboration is essential to the refuge's future success. We will continue to foster and improve our strong public and private partnerships in the surrounding communities. These partnerships will enable us to act quickly and effectively as we invest in education and outreach efforts to fulfill our potential as a conservation catalyst in neighboring communities, the larger Intermountain West, and the world.

A New Chapter

The homesteader and wartime eras of the Rocky Mountain Arsenal represent important chapters in American history, but how these lands can benefit wildlife and people well into the future is an equally important chapter. Following the massive environmental cleanup that concluded in 2012, the next chapter in the story of the Rocky Mountain Arsenal National Wildlife Refuge will teach us lessons about healing wildlife habitats and the resiliency of our natural environment. The refuge offers a destination for millions of people to learn about and connect with their natural environment. Our hope is that these people will love nature as we do and join in the stewardship of our public lands.

In the early 1930s, Aldo Leopold purchased an 80-acre farm in Sauk County, Wisconsin. On this farm, Leopold and his family focused much of their effort on the restoration of the natural environment. Many people believe that Leopold was one of the first to consider restoration as a land management tactic. His essay "The Land Ethic"—published in 1949 and incorporated into later editions of A Sand County Almanac—proposed a new relationship between people and nature and set the stage for the modern conservation movement. In December 2013, members of our planning team participated in a Land Ethic Leadership Workshop facilitated by the Aldo Leopold Foundation. Members of the team decided that "The Land Ethic" would be a centerpiece in the development of this comprehensive conservation plan.

Like Leopold's farm, our lands were once harmed, and our efforts to transform the refuge will require a landscape approach to land management, linking conservation science, policy, and ethics in an effort to ensure the future health of land and water. This transformation will take time, and we must recognize that the refuge is only in its infancy. We will strive to restore a diverse, native prairie ecosystem made up of vegetative mosaics of varying composition, height, and density that provide important wildlife habitat. We will restore 4,500 acres to native shortgrass prairie and 8,000 acres to mixed-grass prairie. We will also maintain shrublands as nesting habitat for birds and as forage and shelter for other species. Finally, we will employ the historic cultural landscape left by the prior landowners to maintain the wetlands and reservoirs on the refuge, creating an oasis for wildlife in a highly urbanized environment.

The last master plan for the refuge was completed in 1996. This plan served us well and guided the refuge through its establishment and the Superfund cleanup process. Almost 20 years have passed since this plan was finalized; this new plan will guide management and conservation of the refuge for the next 15–20 years.

Restoration of Native Prairie

Restored prairies, along with a few remnants of prairie that escaped the plow, are mere fragments of what once existed. Fertile soils created by glacial action were kept treeless and nutrient-rich by periodic fires and the prairie plants themselves (Mlot 1990). However, when prairie grasslands—like those on the land occupied by the refuge—have been converted to agriculture and other human-centric uses, restoration is challenging, and the mechanisms are not always well understood (Camill et al. 2004). To date, more than 10,000 acres of the refuge have been treated and seeded, but the true restoration of these lands will take an unknown amount of time. Our restoration efforts are guided by a habitat restoration plan (FWS 1999a) and a long-term habitat management plan (FWS 2013a). In the short term, we will continue to battle the establishment of invasive plant species. In the long term, we seek to improve the richness of plant species found on the refuge through increased bison grazing and the use of prescribed fire.

Reintroduction of Native Wildlife Species

Over time, many of the terrestrial species originally found on the refuge and surrounding prairie were extirpated. Wild bison were reintroduced to the refuge in 2007 and have been helping us to restore the prairie. Over time we may also reintroduce greater prairie-chicken, plains sharp-tailed grouse, and pronghorn.

Cindy Souders / USFWS

Prickly poppy

Once again we refer to Aldo Leopold, who is credited with first describing the mechanism known as trophic cascade (Leopold 1944; Leopold et al. 1947; Ripple and Beschta 2005). A trophic cascade is an ecological phenomenon triggered by the addition or removal of top predators, the subsequent changes throughout the food chain, and the dramatic changes witnessed in ecosystem structure and nutrient cycling. In this plan, we propose reintroducing the endangered black-footed ferret to the refuge. This will not only assist with the species' recovery; but because the ferret is a key predator in the prairie ecosystem, its reintroduction will also assist with the ecological restoration of the refuge.

At the same time, it is important to recognize that, because of the size, isolation, and continuing restoration of the refuge, we must actively manage populations of certain wildlife species. Allowing unregulated population growth of grazing species would jeopardize the long-term sustainability of native prairie and shrublands and contribute to the worsening condition of individual animals, in turn increasing the potential incidence of wildlife diseases.

Surrogate Species

Recently, the U.S. Fish and Wildlife Service refined its strategic habitat conservation (SHC) approach to focus conservation design on creating functional landscapes capable of supporting self-sustaining populations of fish and wildlife species (FWS 2012a). This approach is based on the selection of surrogate species, which Caro (2010) defines as "species that are used to represent other species or aspects of the environment." This approach is still under development, but offers promise for a systematic method of landscape conservation design that could address the absence of key species that are necessary to preserve biodiversity and habitat function.

The use of surrogate species allows us to achieve our conservation mission more strategically by using a smaller number of species to inform our goals and future management of the refuge. For the purposes of this plan, we have chosen four species (black-tailed prairie dog, lark bunting, Cassin's sparrow, and American bison) as surrogates that are consistent with our goals to focus on threatened and endangered species, declining populations of migratory birds, and the genetic conservation of bison to represent the majority of other species that occur on the refuge. These species and their habitat (shortgrass and mixed-grass prairies with a shrubland component) act as reliable indicators of any impacts on wildlife and their habitats associated with future management. We believe that if we are successful in managing these four species, these habitat types and our other refuge habitats (lacustrine, riparian, wetlands, and woodlands) should react favorably as well.

Urban Refuge Initiative

Periodically, the Refuge System develops a vision document to assist in guiding its national network of conservation lands. In July 2010, refuge managers from across the nation met in Madison, Wisconsin, to develop our most recent vision, "Conserving the Future," which is supported by three pillars: wildlife and wildlands, a connected conservation constituency, and leading conservation into the future. The recommendations from this group are clear, stating that we should strive to engage urban audiences in order to remain relevant to the American people.

With 80 percent of Americans living in cities, we must find ways to connect urban America with our wild places, such as our national wildlife refuges. It is important that we teach each new generation to love the land and that we help children learn to find inspiration in nature even in their urban surroundings. We believe that Americans will have much of their direct contact with nature while in an urban setting, and that we, as stewards of our natural heritage, must reach beyond the boundaries of our wildlands to shape the Nation's conservation values, ethics, and priorities.

© Dawn Wilson

Sunrise on the refuge

Planning Process

Over the past year, we met with the public on several occasions to solicit their input on the content of this plan. Based on that input, a large and diverse group of stakeholders, representing Federal, State, and local governments with important relationships to the refuge, met and drafted this plan.

The primary purposes of this plan are to:

- Develop a vision to guide the future management of the Rocky Mountain Arsenal National Wildlife Refuge.
- Develop a set of alternatives and analyze their effects in order to understand the environmental, social, and cultural impacts of proposed changes to the management of the refuge.
- Identify ideas and actions for transforming a wildlife refuge in the middle of a major metropolitan area into one of the Nation's premier national wildlife refuges.
- Describe what will be necessary to balance our goals of providing high-quality experiences for an increasing number of visitors while also protecting the resources that make the refuge significant.

The planning team evaluated four alternatives in this plan, ultimately selecting alternative C, the "Urban Refuge Alternative," as the proposed alternative for this draft plan and environmental impact statement. Alternatives C and D both seek to implement the Service's Urban Refuge Initiative: alternative C represents the refuge's steps toward implementing the Urban Refuge Initiative, while Alternative D constitutes a slightly different approach focusing more effort external to the Refuge.

Colorado's Front Range Refuges

While this plan outlines a vision for all our refuge holdings along Colorado's Front Range (figure 1), its provisions are specific to the Rocky Mountain Arsenal NWR in Adams County, Colorado. A similar plan was completed for the Rocky Flats National Wildlife Refuge in 2005. Once we complete this plan, we will begin to update the 1997 plan for the Two Ponds National Wildlife Refuge. In this plan we explore administratively renaming the refuge complex so that it better reflects all the units we manage and the geographic locale where the refuges occur.

Vision for the Refuge Complex

We developed a vision for the complex at the beginning of the planning process. The vision describes the focus of refuge complex management and portrays a picture of the refuge complex in 15 years.

As the sun rises, bison thunder across the prairie, red-tailed hawks soar overhead, and the urban bustle begins. Lands once known for their agricultural and industrial uses are being restored on the Nation's premiere urban wildlife refuge, where time moves at nature's pace and wildlife have the right-of-way. Propelled by public and private partnerships, refuge stewards at Rocky Mountain Arsenal, Two Ponds, and Rocky Flats National Wildlife Refuges continue to work to repair and regenerate wildlife habitat. These prairie oases nestled within Colorado's Front Range communities welcome visitors from near and far and foster an appreciation for nature. They will connect people with the land for generations to come.

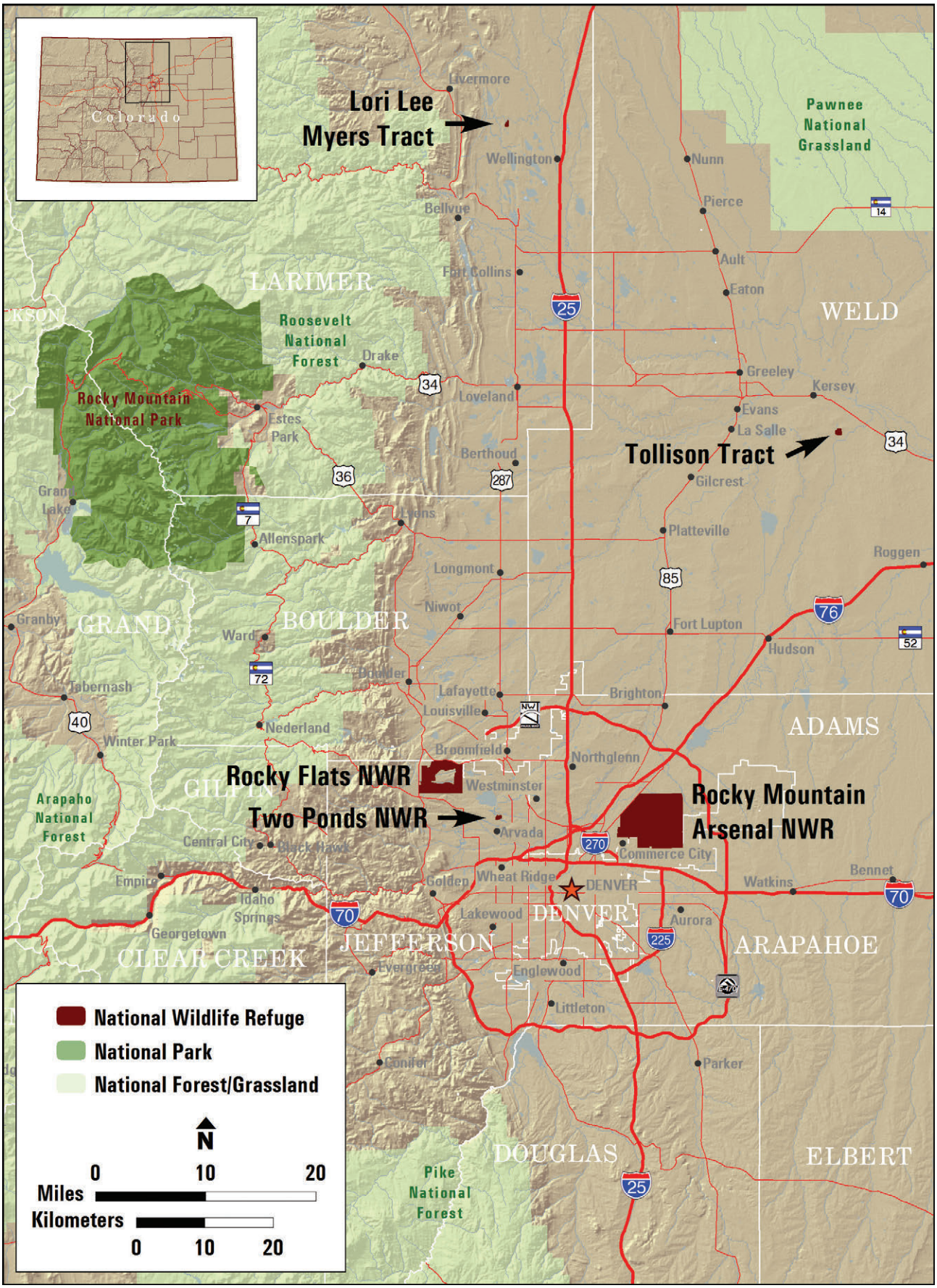

Figure 1. Rocky Mountain Arsenal National Wildlife Refuge Complex, Colorado.

Goals for the Refuge

We developed nine goals (table S-1) for the refuge based on the Improvement Act, the purposes of the refuge, and information developed during planning. The goals focus work toward achieving the vision and purposes of the refuge and outline approaches for managing refuge resources.

Implementation

In the coming months, we will again solicit the public's opinions and comments. Your comments on this draft will be considered in developing a final plan and environmental impact statement. The final plan will include the objectives and detailed strategies necessary to implement the selected alternative.

This is a 15–20 year plan, and the actions we propose must be phased in over time. Full implementation will be a slow process. At various stages, we will review this plan and make changes to it. Fish and wildlife conservation remains our primary responsibility.

If conflicts arise between actions proposed in this plan and our management of fish and wildlife resources, we reserve the ability to forgo actions proposed in this plan and make decisions to restrict access and public-use activities.

Table S-1. Goals for the Refuge.

Goal Area	*Goal*
Habitat Management	Use an adaptive management framework to conserve, restore, and enhance the ecological integrity of Front Range prairie communities, including wetlands, grasslands, native shrubs, and trees.
Wildlife Management	Balance and preserve wildlife species of concern through active management.
Visitor Services	Foster the public's appreciation of natural resources and provide inclusive, high-quality, wildlife-dependent recreation, education, and interpretation.
Communications and Outreach	Through effective communication and innovative technology, engage the public and stakeholders to help them better understand the importance of natural resources, operations, and history at the refuge complex so that they are inspired to take part in and support management and restoration efforts.
Partnerships	Seek and foster strong partnerships to support research and management, enhance wildlife-dependent recreation, and promote an appreciation of nature.
Cultural Resources	Protect artifacts and interpret the archeological, agricultural, military, and industrial histories of the refuge complex and the story of its restoration in order to connect visitors and the community to the area's past.
Research and Science	Use science and promote research to advance the understanding of natural resource functions and management within the refuge complex and beyond.
Infrastructure and Operations	Effectively use money, staff, partners, volunteers, and equipment to restore and manage refuge complex habitats, conduct programs, and improve and maintain all necessary infrastructure.
Access and Transportation	Support the improvement of suitable access to the refuges, develop sustainable transportation options, and provide more connections within the refuge complex.

Abbreviations

°F	degrees Fahrenheit
21CSC	21st Century Conservation Service Corps
Administration Act	National Wildlife Refuge System Administration Act of 1966
ALR	Anthropogenic Light Ratio
APHIS	Animal and Plant Health Inspection Service
Arsenal	Rocky Mountain Arsenal
BFF Center	National Black-Footed Ferret Conservation Center
BTPDMP	Black-tailed Prairie Dog Management Plan
CCP	comprehensive conservation plan
CDOT	Colorado Department of Transportation
CDPHE	Colorado Department of Public Health and Environment
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CLIR	Climate Leadership in Refuge
CMP	Comprehensive Management Plan
CPRA	Colorado Parks and Recreation Association
CPW	Colorado Parks and Wildlife
DIA	Denver International Airport
DOI	Department of the Interior
DRCOG	Denver Regional Council of Governments
Eagle Repository	National Eagle Repository
EIS	environmental impact statement
EPA	Environmental Protection Agency
Federal duck stamp	Migratory Bird Hunting and Conservation Stamps
FHA	Federal Highway Administration
FHWA	Federal Highway Administration
FMP	Fire Management Plan
FONSI	Finding of No Significant Impact
GIS	geographic information system
GPLCC	Great Plains LLC
HMP	habitat management plan
I-	Interstate

IFs	Isolated Finds
Improvement Act	National Wildlife Refuge System Improvement Act of 1997
IPMP	Integrated Pest Management Plan
LCC	Landscape Conservation Cooperative
NEPA	National Environmental Policy Act of 1969
NHPA	National Historic Preservation Act
NPL	National Priority List
NPS	National Park Service
NWR	National Wildlife Refuge
Partners program	Partners for Fish and Wildlife Program
proposed action	proposed actions under Alternative C
RAQC	Regional Air Quality Council
refuge	Rocky Mountain Arsenal National Wildlife Refuge
refuge complex	Rocky Mountain Arsenal National Wildlife Refuge Complex
Refuge System	National Wildlife Refuge System
Repository	National Wildlife Property Repository
ROD	Record of Decision
RRS	Refuge Revenue Sharing
RTD	Regional Transportation District
Secretary	Secretary of the Interior
Service	U.S. Fish and Wildlife Service
SHC	strategic habitat conservation
SSP	Station Safety Plan
Superfund	National Priorities List
TCHD	Tri-County Health Department
UCD	University of Colorado at Denver
UDFCD	Urban Drainage and Flood Control District
USACE	U.S. Army Corps of Engineers
U.S.C.	United States Code
USDA	U.S. Department of Agriculture
USGS	U.S. Geological Survey
WMP	Water Management Plan

Chapter 1—Introduction

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Bison

> *Conservation is a state of harmony between men and land. Despite nearly a century of propaganda, conservation still proceeds at a snail's pace; progress still consists largely of letterhead pieties and conventional oratory. On the back forty we still slip two steps backward for each forward stride.*
>
> *From* The Land Ethic, *by Aldo Leopold, 1949*

We, the Service, have developed this draft comprehensive conservation plan (CCP) and environmental impact statement (EIS) to describe alternatives for and potential consequences of the management and use of the Rocky Mountain Arsenal National Wildlife Refuge (NWR or refuge). The refuge is part of the Rocky Mountain Arsenal National Wildlife Refuge Complex (refuge complex), which also manages the Two Ponds NWR and the Rocky Flats NWR, as well as various properties in Larimer and Weld Counties. The units of the refuge complex are in Adams, Boulder, and Jefferson Counties along the Front Range region of Colorado (figure 1). Although all three refuges making up the refuge complex are managed by the same staff, Two Ponds NWR has a separate Comprehensive Management Plan (CMP) and Rocky Flats NWR has a separate CCP. Consequently, those units are not included in this CCP.The CCP is being developed in compliance with the National Wildlife Refuge Administration Act of 1966, as amended (16 United States Code [U.S.C.] §§ 668dd et seq.) and Part 602 (National Wildlife Refuge System Planning) of the Fish and Wildlife Service Manual (FWS 2000a) and other Service guidelines. The actions described in the CCP also meet the requirements of the National Environmental Policy Act of 1969 (NEPA).

Wildlife conservation, including habitat conservation, is the Service's first priority for managing national wildlife refuges. Public uses, specifically wildlife-dependent recreational uses, are allowed and encouraged as long as they are compatible with the establishment purposes of each refuge.

The draft CCP and EIS for the refuge discusses program levels that are sometimes substantially

above current budget allocations and would, therefore, be phased in over time. The final CCP will specify the objectives and strategies necessary to achieve the refuge's purposes, vision, and goals.

We have formulated three alternatives—the action alternatives—for managing the refuge, as well as the no-action alternative (the continuation of current management). The action alternatives were developed in collaboration with Federal, State, local agencies, and neighboring cities and municipalities, as well as through public scoping. The core planning team of representatives from several Service programs (see appendix A) prepared this draft CCP and EIS. In addition, the following cooperating agencies were on the planning team:

- Adams County
- City of Commerce City
- City and County of Denver
- Colorado Department of Public Health and Environment (CDPHE)
- Colorado Parks and Wildlife (CPW)
- Denver International Airport (DIA)
- Denver Water
- Environmental Protection Agency (EPA)
- National Park Service (NPS)
- Tri-County Health Department (TCHD)
- Urban Drainage and Flood Control District (UDFCD)
- U.S. Army
- U.S. Department of Agriculture, Animal and Plant Health Inspection Service (APHIS)
- U.S. Department of Transportation, Federal Highway Administration (FHWA)

Public involvement in the planning process is discussed in section 1.6 and in further detail in appendix B. Details on the no-action alternative and three action alternatives are in "Chapter 3–Alternatives," and the predicted effects of the alternatives are described in "Chapter 5–Environmental Consequences." We have identified one alternative as the proposed action.

1.1 Purpose and Need for Action

The National Wildlife Refuge System Improvement Act of 1997 (Improvement Act) requires that each unit of the National Wildlife Refuge System (Refuge System) be managed in accordance with a CCP. Furthermore, the Improvement Act establishes that each CCP will be revised at least every 15 years. Since the existing comprehensive management plan for the refuge was prepared more than 15 years ago, we are in need of developing a CCP for the refuge. Therefore, one of the purposes of this draft CCP and EIS is to comply with the Improvement Act requirement to develop a CCP for this unit of the Refuge System. A second purpose for this CCP and EIS is to describe the role of the refuge in supporting the mission of the Refuge System: 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."

The third purpose of this draft CCP and EIS is to provide long-term guidance for management of refuge programs and activities. The fourth purpose of this plan is to help us achieve the following:

- Communicate better with the public and other partners about our efforts to carry out the mission of the Refuge System and meet the purposes of the refuge.
- Provide a clear statement of direction for management of the refuge.
- Ensure that the refuge continues to conserve fish, wildlife, and ecosystems in spite of current challenges such as water shortages and the effects of climate change.
- Provide neighbors, visitors, and government officials with an understanding of our management actions on and around the refuge.
- Recruit and collaborate with regional partners to develop strategies for connecting more residents of the Denver Metropolitan area with nature.
- Ensure that our management actions are consistent with the mandates of the Improvement Act.
- Ensure that management of the refuge considers other Federal, State, and local government plans.
- Provide a basis for development of budget requests for the operation, maintenance, and capital improvement needs of the refuge.

We are committed to sustaining the Nation's fish and wildlife resources through the combined efforts of governments, businesses, and private citizens.

1.2 The U.S. Fish and Wildlife Service and the National Wildlife Refuge System

We are the principal Federal agency responsible for fish, wildlife, and plant conservation. The Refuge System is one of our major programs.

The U.S. Fish and Wildlife Service and its Mission

Our mission is working with others to conserve, protect, and enhance fish, wildlife, and plants and their habitats for the continuing benefit of the American people.

The Service was established in the Department of the Interior (DOI) in 1940 through the consolidation of bureaus then operating in several Federal departments. The primary precursor agency was the Bureau of Biological Survey in the U.S. Department of Agriculture (USDA). Today, we enforce Federal wildlife laws, manage migratory bird populations, restore nationally significant fisheries, conserve and restore vital wildlife habitat, protect and support recovery of endangered species, and help other agencies and governments with conservation efforts. In addition, we administer a Federal aid program that distributes hundreds of millions of dollars to states for fish and wildlife restoration, boating access, hunter education, and related programs.

Service Activities in Colorado

Our activities in Colorado contribute to the State's economy, ecosystems, and education programs. The following list describes some of our activities:

- We manage 10 units of the Refuge System encompassing a total area of 339,760 acres. This includes nine national wildlife refuges plus other lands managed under the Farm Services Administration and interest along the Colorado River. These ten units of the Refuge System are considered as refuges in the Service's Annual Lands Report (FWS 2013b). We also manage two fish hatcheries with a total area of 3,208 acres, two coordination areas with a total area of 1,153 acres, and one administrative site (FWS 2013b).
- We provide millions of dollars annually, recovered as excise taxes from the sale of firearms and ammunition, to CPW for sport fish and wildlife restoration and hunter education under the Pittman-Robertson Act of 1937 and the Dingell-Johnson Act of 1950 (FWS 2013c).
- We manage the National Black-Footed Ferret Conservation Center (BFF Center) near Fort Collins in Larimer County.
- For more than 20 years, our Partners for Fish and Wildlife Program (Partners program) has helped to restore more than 29,647 wetland acres, 296 linear miles of streams, and 104,910 upland acres in Colorado (FWS 2013d).
- In 2014, we paid Adams County $417,630 under the Refuge Revenue Sharing Act for use in schools, roads, and other county services (FWS 2013e).

The National Wildlife Refuge System

The mission of the National Wildlife Refuge System is to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources, and their habitats within the United States for the benefit of present and future generations.

In 1903, President Theodore Roosevelt designated the 5.5-acre Pelican Island in Florida as the Nation's first wildlife refuge to protect nesting colo-

nies of brown pelicans, egrets, and other birds. This was the first time the Federal Government had set aside land specifically for wildlife. This small but significant designation was the beginning of the Refuge System.

Since then, the Refuge System has become the largest collection of lands in the world specifically managed for wildlife, with at least one refuge in every State and in five U.S. territories and Commonwealths, as well as numerous wetland management districts across the nation. These units of the Refuge System vary widely in size, purpose, origin, climate, level of development and use, and degree of Federal ownership (Fischman 2005; FWS 2013f).

Historically, most refuge-establishing statutes that authorized acquisition of national wildlife refuge lands gave broad authority to the Service for managing lands for wildlife. However, in many cases the establishing authorities lacked specific direction or procedures for uniform management of the acquired and reserved lands. To resolve this, Congress passed two statutes in the 1960s to provide administrative guidance: the Refuge Recreation Act of 1962 and the National Wildlife Refuge System Administration Act of 1966 (Administration Act) (refer to appendix C). While the Administration Act consolidated the units under our jurisdiction, it still did not meet its goal of giving clear direction for Refuge System management. The Administration Act gave the Secretary of the Interior (Secretary) broad power to decide what secondary uses could occur on refuges and districts, but it did not provide any biological standards or other standards of review beyond the establishing purposes. Furthermore, Congress did not specify a definition for compatible uses or provide any other direction on making such a determination (Tredennick 2000).

Aaron Rinker / USFWS

Weighing a fawn

In the late 1980s, a decline in migratory bird populations prompted a General Accounting Office study of how refuge and wetland management district management activities negatively affected these populations (General Accounting Office 1989; U.S. House of Representatives 1997). The report concluded that the focus on secondary uses of refuges and wetland management districts diverted the managers' attention and resources away from wildlife management. In the early 1990s, several environmental organizations, seeking to end recreational and economic uses of the units of the Refuge System because of alleged incompatibility with wildlife conservation, challenged the Service through several lawsuits (Tredennick 2000). Eventually, the Service settled the lawsuits by changing or eliminating several existing uses of Refuge System lands. The pressure for new legislation intensified as a direct result of these lawsuits and other concerns, and the ground was laid for passage of a bill that would give us a clear mission and help resolve the problems of the past (U.S. House of Representatives 1997). Finally, on October 9, 1997, Congress passed into law the National Wildlife Refuge System Improvement Act of 1997. The Improvement Act established a clear vision for the Refuge System.

The Improvement Act (and associated regulations) states that each unit of the Refuge System must be managed to:

- "fulfill the mission of the Refuge System, as well as the specific purposes for which that unit of the Refuge System was established";
- consider "wildlife conservation… [as] the singular Refuge System mission" (Final Compatibility Regulations Pursuant to the National Wildlife Refuge System Improvement Act of 1997; FWS 2000b);
- "ensure that the biological integrity, diversity, and environmental health of the Refuge System are maintained";
- fulfill the requirements of preparing "a comprehensive conservation plan… for each unit of the Refuge System within 15 years after the date of enactment of the… Act" and of ensuring opportunities for "public involvement in the preparation and revision of [these] plans";

- recognize that "compatible wildlife-dependent recreation [fishing, hunting, wildlife observation and photography, and environmental education and interpretation] is a legitimate and appropriate general public use of the Refuge System";

- keep the authority of a refuge manager to "make… the compatibility determination" after exercising "sound professional judgment… regarding wildlife conservation and uses of the Refuge System" (Final Compatibility Regulations Pursuant to the National Wildlife Refuge System Improvement Act of 1997; FWS 2000b).

We began following the direction of the new legislation immediately after passage of the Improvement Act, most directly through initiating preparation of CCPs for all units of the Refuge System. In accordance with the mandates of the Improvement Act, we encourage public involvement in the preparation of all CCPs.

People and the Refuge System

The Nation's fish and wildlife heritage contributes to the quality of American lives and is an integral part of the country's greatness. Wildlife and wild places have always given people special opportunities to recreate, relax, and appreciate the natural world.

Wildlife-dependent recreation contributes millions of dollars to local economies through birding, fishing, hunting, photography, and other wildlife-related pursuits. Nearly 46.5 million people visited the units of the Refuge System in 2011 (Carver and Caudill 2013), mostly to observe wildlife in their natural habitats. Refuge System visitors enjoy nature trails, auto tours, interpretive programs, and hunting and fishing opportunities. Local communities that surround the refuges and districts receive significant economic benefits. Economists report that Refuge System visitors contribute more than $2.4 billion annually to local economies, 72 percent of which is generated by nonconsumptive activities (Carver and Caudill 2013).

Urban Wildlife Refuge Initiative

With 80 percent of Americans living in cities, the Service needs to find a way to connect urban America with our wild places, such as our national wildlife refuges. Such connections are vital for fostering an appreciation for nature in today's generation and for finding ways for the people of our Nation to be inspired by nature in the urban surroundings where they live. We believe that most Americans will have their most direct contact with nature while residing in an urban environment, and that that experience will help shape the Nation's conservation values, ethics, and priorities. For these reasons, our refuge and the Service overall need to reach out beyond the boundaries of the lands we manage. This is the mandate of the Urban Wildlife Refuge Initiative.

Born from the "Conserving the Future" document, the initiative focused the Refuge System on recognizing the distinct value of refuges near and within major metropolitan areas. In 2014, working with a broad range of government and nongovernmental organizations, we developed a proposal describing the approach and steps necessary for transforming the Rocky Mountain Arsenal National Wildlife Refuge into one of the Nation's premier urban national wildlife refuges. The Service's new "Standards of Excellence for Urban National Wildlife Refuges" (FWS 2014a) has informed and inspired many of the actions proposed in this plan.

Compatible Refuge Uses

Lands in the Refuge System are different from other Federal lands that have multiple-use purposes. They are closed to the public upon acquisition unless specifically and legally opened. A refuge use is not allowed unless the Service finds the use to be compatible (FWS 2000b). In the case of refuges, we cannot allow a new use, nor can we or expand, renew, or extend an existing use, unless the Secretary has decided that the use is compatible and is consistent with public safety. A compatible use is one that, in the sound professional judgment of the manager, will not materially interfere with or detract from the fulfillment of the Refuge System mission or the purposes of the unit of the specific refuge or refuge complex. Sound professional judgment is defined as a decision that is consistent with the principles of fish and wildlife management and administration, the available science and resources, and adherence to the law.

Compatibility determinations are typically completed as part of the process for a CCP or stepdown management plan. Draft compatibility determinations for existing and new uses for the proposed actions under alternative C (proposed action) are provided in appendix D. A compatibility determination is the written documentation that an existing or proposed use of a national wildlife refuge either is or

is not compatible with the purposes of the refuge. Following public review, a final determination is made about the compatibility of various uses. Subsequently, the determination is signed and dated by the manager with the concurrence of the assistant regional director for the Refuge System. Once a final compatibility determination is made, it is not subject to administrative appeal.

The Improvement Act states that six priority uses—hunting, fishing, wildlife observation, photography, interpretation, and environmental education—should receive consideration over other public uses in planning and management. All activities associated with recreational uses, or where there is an economic benefit associated with a use (such as livestock grazing or commercial recreation), require compatibility determinations. However, management activities such as prescribed fire or invasive plant control do not require compatibility determinations.

Biological Integrity, Diversity, and Environmental Health

Central to the Improvement Act is the requirement that the biological integrity, diversity, and environmental health of the Refuge System be maintained for the benefit of present and future generations of Americans. In 2001, we published a policy with guidance on this topic (FWS 2001). This policy directs refuge managers to consider the broad spectrum of fish, wildlife, and habitat resources found on the refuge or district and in associated ecosystems while fulfilling the purposes of the refuge and the Refuge System mission. The policy defines the terms biological integrity, diversity, and environmental health, and provides direction for secondary economic uses like farming, haying, livestock grazing, beekeeping, firewood collection, and other extractive activities. These are permissible habitat management practices only when prescribed in plans to meet wildlife or habitat management objectives and only when more natural methods, such as fire or grazing by native herbivores, cannot meet the purposes and goals of the Refuge System unit. As stated above, a compatibility determination is required for these uses.

Rocky Mountain Arsenal National Wildlife Refuge Act of 1992

The Rocky Mountain Arsenal National Wildlife Refuge Act of 1992 transferred management and jurisdiction of the Rocky Mountain Arsenal to DOI for management as a national wildlife refuge and established guidelines for initiating environmental cleanup. The act is reproduced in appendix E.

1.3 National and Regional Mandates

Refuge System units are managed to achieve the mission and goals of the Refuge System, along with the designated purposes of the refuges, conservation areas, and wetland management districts as described in establishing legislation, Executive Orders, or other establishing documents. Key concepts and guidance for the Refuge System are set forth in the National Wildlife Refuge System Administration Act of 1966, as amended by the Improvement Act (16 U.S.C. 668dd et seq.) and further detailed in Title 50 of the Code of Federal Regulations (CFR) and the "Fish and Wildlife Service Manual."

Brief descriptions of the laws and Executive Orders that may affect the development or implementation of this CCP are presented in "Appendix C—Key Legislation and Policies." Service policy for the planning process and management of refuges and districts is found in the "Fish and Wildlife Service Manual."

Strategic Habitat Conservation

Escalating challenges such as threatened and endangered species, land use conversion, invasive species, water scarcity, environmental contaminants, urbanization, and climate change have led us to move away from our earlier approach to conservation, which emphasized ecosystems, toward a broader vision that emphasizes landscape conservation in partnership with others.

A cooperative effort by the Service and the U.S. Geological Survey (USGS) culminated in a report on SHC by the National Ecological Assessment Team (USGS and FWS 2006). The report outlined a unifying adaptive resource management approach for landscape-scale conservation of the entire range of a priority species or suite of species. This is SHC—a way of thinking and doing business by incorporating biological goals for priority species populations, by making strategic decisions about the work needed, and by constantly reassessing and refining the approach (figure 2).

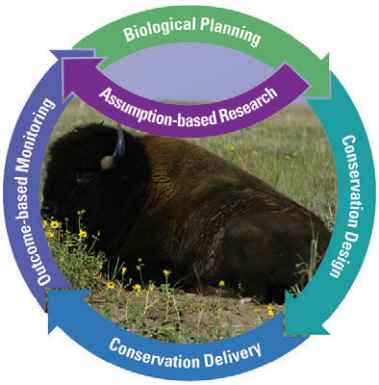

Figure 2. Strategic habitat conservation.

Since 2006, we have taken significant steps to turn this vision into a reality by defining a framework of 22 geographic areas. Experts from both the Service and USGS developed this framework through an aggregation of Bird Conservation Regions. The refuge lies within the Great Plains Geographic Area (figure 3).

We have used this framework as the basis to establish the first generation of Landscape Conservation Cooperatives (LCCs). These LCCs are conservation-science partnerships between the Service and other Federal agencies, States, tribes, nongovernmental organizations, universities, and others. Designed as fundamental units for planning and science, the LCCs have the capacity to help us carry out the elements of SHC: biological planning, conservation design and delivery, and monitoring and research. Coordinated planning and scientific information will strengthen our strategic response to possible climate change and other challenges. Because the sheer number of species that we and our partners work with makes designing and conserving landscape-scale habitats impractical on a species-by-species basis, we are now developing a process to collaboratively identify surrogate species, or species that can represent a suite of other species or aspects of the environment such as habitat or water quality. For more information about surrogate or focal species, refer to chapters 3 and 4.

Climate Change

We expect that any change in climate would affect the Nation's fish, wildlife, and plant resources in profound ways. While many species would continue to thrive, some may decline and some may go extinct. Some species would survive in the wild only through direct and continuous intervention by managers. In 2010, we completed a strategic plan to address climate change for the next 50 years. The strategic plan is built on three key strategies: adaptation, mitigation, and engagement. In addition, the plan acknowledges that no single organization or agency can address climate change without establishing partnerships across the Nation and around the world (FWS 2010a). This strategic plan is an integral part of DOI's strategy for addressing climate change as expressed in Secretarial Order 3226 and updated by Order 3289 (DOI 2009). Order 3226 states that "there is a consensus in the international community that global climate change is occurring and that it should be addressed in governmental decision making" (see chapter 4, section 4.2.2). Furthermore, we are employing the National Fish, Wildlife, and Plants Climate Adaptation Strategy (National Fish, Wildlife, and Plants Climate Adaptation Partnership 2012), which is a call to action to work with other natural resource professionals and decision makers to conserve the Nation's fish, wildlife, plants, and natural systems that could be affected by climate change.

We will use the following guiding principles from the strategic plan (FWS 2010a) in responding to climate change:

- *Priority setting*—Continually evaluate priorities and approaches, make difficult choices, take calculated risks, and adapt to possible climate change.
- *Partnership*—Commit to a new spirit of coordination, collaboration, and interdependence with others.
- *Best science*—Reflect scientific excellence, professionalism, and integrity in all of our work.
- *Landscape conservation*—Emphasize the conservation of habitats within sustainable landscapes, applying our SHC framework.
- *Technical capacity*—Assemble and use state-of-the-art technical capacity to meet the challenge of a possible change in climate.
- *Global approach*—Be a leader in national and international efforts to meet the challenge of a possible change in climate.

Conserving the Future

In 1999, we developed a vision for the Refuge System. A report titled "Fulfilling the Promise—The National Wildlife Refuge System" (FWS 1999b) was

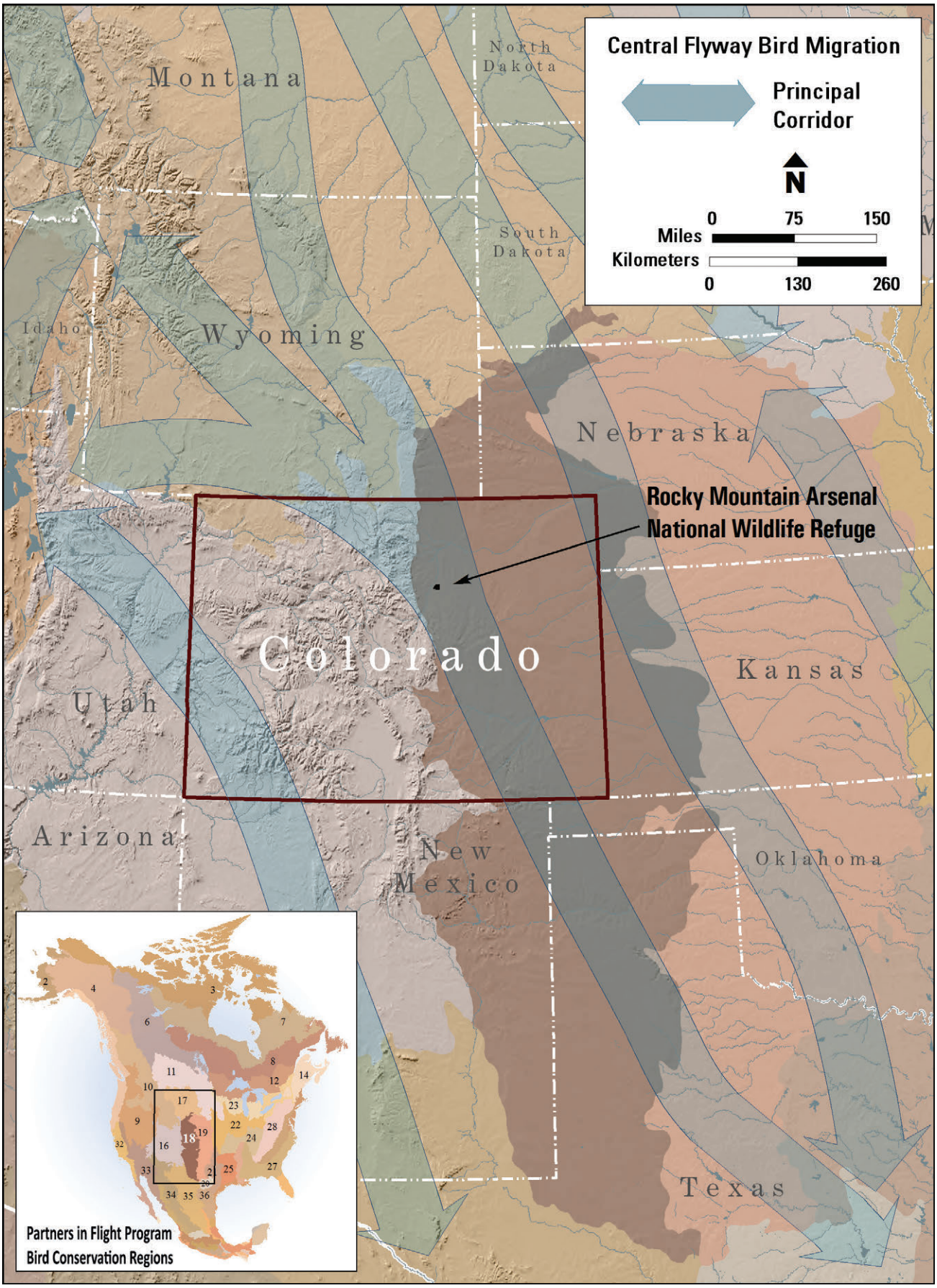

Figure 3. Principal flyway corridors and North American Bird Conservation Regions.

the culmination of a year-long process by teams of Service employees to evaluate the Refuge System nationwide. It was the focus of the first National Refuge System conference (in 1998), which was attended by the managers of Refuge System units, other Service employees, and representatives from leading conservation organizations. The report contains 42 recommendations bundled with 3 vision statements dealing with wildlife and habitat, people, and leadership. The outcome of that effort continues to influence CCP planning both nationally and locally.

In 2010, we began updating our earlier vision for the Refuge System in a report titled "Conserving the Future—Wildlife Refuges and the Next Generation" to chart a course for the Refuge System's next 10 years (FWS 2011a). The new vision recognizes many new challenges in landscape conservation efforts, including a rapidly changing landscape and a constricted Federal budget. Moreover, less undeveloped land is available, more invasive species are spreading, and it appears that we are experiencing the effects of a possible change in climate. In the face of these and other challenges, we believe we can most effectively pursue conservation objectives through continued partnering with Federal, State, and local agencies; tribes; nongovernmental organizations; friends groups; and volunteers. As we have done in the past, we will strive to be a vital part of local communities as we work to conserve wildlife and habitats (FWS 2011a).

We believe that the wildlife management and habitat recovery and conservation actions outlined in this CCP reflect our commitment to the American people to support the Refuge System's landscape conservation efforts and to respond to the climate change challenge (see "Climate Change" in chapter 3 of this CCP and EIS).

1.4 Other National Conservation Efforts

As part of our SHC mission, the refuge collaborates with the planning and conservation work of many regional and national agencies and organizations. Some of these collaborations are described below.

Recovery Plans for Threatened and Endangered Species

Where federally listed threatened or endangered species occur within the refuge, we adhere to the management goals and strategies in the recovery plans for those species. The list of threatened and endangered species at the refuge changes as species are listed or delisted or as listed species are discovered. The refuge will follow the recovery and management plans for the black-footed ferret, which is listed as endangered. (Refer to "Habitat and Wildlife Resources" in chapter 3 and "Biological Resources" in chapter 4.) Other listed species or species of concern that could occur on the refuge are detailed in chapter 4, section 4.3.

Bird and Landscape Conservation

Over the past few decades, interest in conserving birds and their habitats has been growing. This increased interest has led to the development of partnership-based bird conservation initiatives that have produced international, national, and regional conservation plans. The North American Bird Conservation Initiative Committee, started in 1999, is a coalition of government agencies, private organizations, and bird initiative groups in the United States, Canada, and Mexico working to advance and integrate bird conservation efforts. The primary conservation planning initiatives follow the Partners in Flight North American Landbird Conservation Plan, the North American Waterfowl Management Plan, the U.S. Shorebird Conservation Plan, and the North American Waterbird Conservation Plan. Furthermore, to help apply adaptive management strategies across large landscapes, the Service is partnering with new and established conservation groups in developing LCCs to address issues for plant, wildlife, and fish resources that share similar stressors and impacts, such as climate change, on a landscape-scale level. The refuge's role in connection with Partners in Flight and the Great Plains LCC is described below.

Partners in Flight

The Partners in Flight program began in 1990 in response to the declining population levels of many migratory bird species. The program's primary goal is to provide for the long-term health of birdlife in the Western Hemisphere. Partners in Flight's mission is expressed in three related concepts: (1) helping species at risk; (2) keeping common birds common; and (3) voluntary partnerships for birds, habitats, and people (Partners in Flight 2012).

For planning purposes, Partners in Flight divides North America into seven groupings of birds by ecological area, avifaunal biome, and 37 Bird Conservation Regions (figure 3). The refuge is in Bird Conservation Region 18–Shortgrass Prairie (North American Bird Conservation Initiative 2013). Region

18 is a topographically complex area that includes the Front Range region of Colorado. Wetlands and riparian corridors along the Front Range support a variety of nesting waterfowl, and the surrounding uplands provide migration habitat for various bird species of management concern.

Focal birds are a subset of the list of the Service's 2009 Birds of Management Concern (FWS 2011b) and are selected on the basis of: (1) high conservation need, (2) characteristics representative of a broader group of species sharing the same or similar conservation needs, (3) a high level of current Service effort, (4) a potential to stimulate partnerships, and (5) a high likelihood that factors affecting the species' status can realistically be addressed.

As discussed in chapter 3, section 3.2, and chapter 4, section 4.2, some focal species identified for Bird Conservation Region 18 occur on the refuge complex.

Landscape Conservation Cooperatives

The refuge is in the Great Plains LCC (GPLCC) (figure 4). The GPLCC contains grasslands, playas, saline lakes, prairie rivers, streams and riparian corridors, savannahs, shrublands, and sand dune habitats in parts of Kansas, Nebraska, western Oklahoma and Texas, eastern Colorado and New Mexico, and southeastern Wyoming. The GPLCC has identified an initial list of priority species for shortgrass and mixed-grass prairies, including lesser prairie chicken, burrowing owl, black-tailed prairie dog, American bison, American burying beetle, black-footed ferret, mountain plover, and ferruginous hawk. As discussed in chapter 3, section 3.2, and chapter 4, section 4.2, some of these species occur on the refuge.

Monarch Butterfly Conservation Initiative

The Service plans to allocate an additional $2 million in fiscal year 2015 for monarch conservation, building upon our already robust commitment to work with our partners to restore and enhance approximately 200,000 acres of habitat for monarchs while also supporting more than 750 schoolyard habitats and pollinator gardens.

Our Monarch Conservation Strategy identifies key investments in conservation planning, design, delivery, inventory, and monitoring—the primary elements of our SHC approach to our emerging monarch conservation strategy. This comprehensive approach involves habitat restoration and enhancement projects, native seed strategies, and education and outreach programs. Investments align with the strategy's goals, listed below:

- Conservation planning and design processes for key geographic areas range-wide.
- Restoring and enhancing habitat in the eastern population's central flyway for migrating monarchs from border to border, with a focus on first-generation spring breeding habitat and summer breeding areas for monarchs in the high production areas of what is known as the Corn Belt.
- Developing a range-wide, geospatial approach for conserving the western monarch population while also restoring and enhancing important habitat.
- Engaging communities, schools, and citizens through a conservation campaign across the country, focusing efforts around a vision for Interstate 35 as the centerpiece of a greater landscape partnership for monarchs and pollinators.

The refuge will seek a partnership with the Butterfly Pavilion in Westminster, Colorado, to support monarch butterfly conservation efforts.

State Comprehensive Fish and Wildlife Conservation Strategy

Over the past several decades, many declines of wildlife populations have been documented across the Nation. To help prevent species from becoming threatened or endangered, Congress created the State Wildlife Grant program in 2001. This program provides States and territories with Federal money to support wildlife conservation.

Under this program, each State develops a Comprehensive Fish and Wildlife Conservation Strategy that defines an integrated approach to the stewardship of all wildlife species, with emphasis on species of concern and habitats at risk. The goal is to shift focus from single-species management and highly specific individual efforts to a landscape-oriented, geographically based conservation effort. The Service approves each State's conservation strategy and administers the State Wildlife Grant money.

Colorado's highest priority watersheds include the South Platte Basin, where the refuge is located. Tier 1 species (highest priority) consist of all federally listed species, along with 52 species of greatest conservation need, for a total of 107 Tier 1 species. The remaining 103 species of greatest conservation need make up Tier 2. Some of the Tier 1 bird species relevant to the refuge are bald eagle, Swainson's hawk, burrowing owl, grasshopper sparrow, lark bunting, Cassin's sparrow, and loggerhead shrike (Murray Laubhan, FWS Region 6 Zone biologist; telephone conversation; September 25, 2014).

Figure 4. Landscape Conservation Cooperatives.

The planning team for the CCP used Colorado's Comprehensive Fish and Wildlife Conservation Strategy during development of the draft CCP and EIS (CDOW 2006). Implementation of the CCP will support the goals and objectives of the State conservation strategy.

1.5 Planning Process

Planning for the refuge's CCP began in spring 2013 with site visits and meetings with refuge staff and invitations to State and Native American tribal representatives, followed with the establishment of a core planning team of Service staff from the refuge and the Mountain-Prairie region in summer 2013. Appendix B lists the core planning team and cooperating agency members for this planning process.

The core team was responsible for the development of a set of management alternatives, the analysis of environmental consequences, and the writing and production of the draft CCP and EIS. With the participation of the entire refuge staff, the core team developed a preliminary vision and set goals for the refuge. The cooperating agencies (refer to section 1.6) are part of the larger planning team, who met throughout the process in a series of collaborative workshops to develop and review the alternatives and to review drafts of the CCP and EIS.

While developing the CCP, the planning team collected available information about the resources of the refuge and surrounding area. This information, summarized in chapter 4, served as the baseline for analyzing the predicted effects of the alternatives. Table 1 lists many other planning activities that occurred subsequent to creation of a habitat management plan (HMP), a stepdown plan to the CMP that we developed over the last few years and finalized in 2013.

The planning process is based on the Refuge System planning policy, which was issued in 2000 (FWS 2000a). The resulting requirements and guidance for refuge and district plans, including CCPs and stepdown management plans, ensure that planning efforts comply with the Improvement Act. The planning policy sets out the steps of the CCP and environmental analysis process (figure 5).

Table 1. Planning process summary for the CCP and EIS for Rocky Mountain Arsenal National Wildlife Refuge, Colorado.

Date	*Planning Activity*	*Outcome*
May 6, 2013	Preplanning meeting and tour of the refuge	Met with refuge staff. Identified refuge purposes and initial list of issues and qualities. Provided overview of the CCP development process.
June 13, 2013	Mailing of Regional Director's Invitation Letters to Native American Tribal leaders and Cooperating Agencies	Invited Native American Tribal governments and cooperating agencies to join in the process of developing the CCP/EIS.
June 14, 2013	Mass mailing of first CCP and EIS Planning Update	Informed members of the public, cooperating agencies, Congressional delegation, and others of our intent to prepare a CCP, our desire for their participation, how to provide comments, and public scoping meetings subsequently held near the refuge.
June 24, 2013	Onsite meeting and tour of refuge for Congressional Representatives	Met with and briefed local Congressional Delegation on the refuge's mission, its challenges and issues, and the process to develop the CCP.
June 26, 2013	Kickoff meeting and tour of the refuge	Updated the list of issues and qualities affecting the refuge complex. Identified needed biological information and maps. Developed draft vision and goals.
July 25, 2013	Public scoping meeting at the Reunion Recreation Center	Reached out to public to present an overview of the planning process, request their involvement, and solicit their input.
July 30, 2013	Public scoping meeting at the Central Park Recreation Center	Reached out to public to present an overview of the planning process, request their involvement, and solicit their input.
August 7, 2013	Publication in Federal Register of Notice of Intent to Prepare a CCP and EIS for the RMA NWR	Informed the public of our intention to prepare a CCP/EIS for the refuge, of how to provide us comments, and of the CCP public meetings.

Table 1. Planning process summary for the CCP and EIS for Rocky Mountain Arsenal National Wildlife Refuge, Colorado.

Date	*Planning Activity*	*Outcome*
August 7, 2013	Bilingual public scoping meetings at the Commerce City Recreation Center (English and Spanish)	Reached out to public to present an overview of the planning process, request their involvement, and solicit their input.
August 15, 2013	Bilingual public scoping meetings at the Montbello Recreation Center (English and Spanish)	Reached out to public to present an overview of the planning process, request their involvement, and solicit their input.
October 29–30, 2013	Visitor Services Program Assessment Workshop	Planning team reviewed existing RMA NWR visitor services program and brainstormed how it might be enhanced and expanded.
December 19, 2013	Meeting on RMA NWR CCP/EIS transportation needs	Planning team leader met with FHWA personnel to identify transportation issues, analysis, and needs, and to plan workshop.
January 8-9, 2014	Purposes, Vision, and Goals Workshop	Planning team reviewed establishment purposes of the refuge and developed a vision and a set of goals statements for the CCP/EIS.
January 28, 2014	Transportation Alternatives Workshop	Gained understanding of existing access and circulation conditions, and outlined RMA NWR transportation issues to address in CCP/EIS.
February 7, 2014	CCP/EIS alternatives briefing	Planning team leader briefed FHWA personnel on range of alternatives development process and analysis needs.
February 24–25, 2014	Range of Management Alternatives Development Workshop	Formulated a range of management alternatives; ensured that management alternatives generated by workshop participants satisfy NEPA; defined requirements for a full range of viable options.
March 11, 2014	Alternatives Mapping Workshop	Refuge and Regional Office staff met to discuss GIS and mapping needs to show the features of each alternative graphically.
April 14–16, 2014	Environmental Consequences Assessment Workshop	Identified affected resources, defined thresholds, discussed and described impacts of management alternatives
May 16, 2014	Preliminary Proposed Action Workshop	Reviewed and updated alternatives, reviewed and updated impact summary work to date, reviewed how alternatives meet goals/vision for RMA, discussed preliminary proposed action and reasoning, planned for moving CCP/EIS forward.
June 11, 2014	Black-Footed Ferret Consultation Conference	Refuge staff conferred with staff from the Ecological Services Colorado Field Office on black-footed ferret reintroduction issues and procedures.
June 19, 2014	CCP/EIS and black-footed ferret reintroduction status briefing to DIA staff	Presented draft alternatives and proposed black-footed ferret reintroduction details and maps to DIA staff, answered their questions, and received input and comments from them.
June 26–October 16, 2014	Drafting of CCP/EIS for internal review	Refuge and Regional Office staffers prepared a preliminary draft CCP/EIS to be reviewed internally by the planning team and Service personnel.
July 7, 2014	CCP/EIS status briefing to the City of Commerce City Council	Presented draft vision, goals, alternatives, and proposed action details and maps to the City of Commerce City Council members, answered their questions, and received input and comments from them.
July 16, 2014	UCD Design Studio meeting	Planning team leaders met with instructor from University of Colorado at Denver Landscape Architecture program to discuss planning needs.
July 17, 2014	CCP/EIS status briefing to RMA Committee	Presented draft vision, goals, alternatives, and proposed action details and maps to the RMA Committee members, answered their questions, and received input and comments from them.

Table 1. Planning process summary for the CCP and EIS for Rocky Mountain Arsenal National Wildlife Refuge, Colorado.

Date	*Planning Activity*	*Outcome*
August 12, 2014	Meeting on CCP/EIS long-range transportation needs	Planning team leader met with other RO employees and FHWA staff to discuss the RMA NWR CCP/EIS long-range transportation needs.
August 14, 2014	CCP/EIS status briefing to Denver Parks and Recreation	Presented draft vision, goals, alternatives, and proposed action details and maps to the members of the Denver Parks and Recreation directorate, answered their questions, and received input and comments from them.
August 22, 2014	Meeting on CCP/EIS planning and alternatives	Planning team leaders met with FHWA staff to discuss the status of the RMA NWR CCP/EIS planning effort and the details of the alternatives.
August 28, 2014	Teleconference on socioeconomic analysis needs	Refuge and RO staffers held teleconference with USGS socioeconomic branches to discuss CCP/EIS socioeconomic analysis needs.
September 30, 2014	Refuge project leader and planning team leaders briefing with Refuge Supervisor	The RMA NWR project leader and the planning team leaders briefed the refuge supervisor on the planning effort status and alternatives details.
May–June 2015	Publishing of Notice of Availability in Federal Register, press release, distribution of draft CCP/EIS for public review, public meetings	The RMA NWR staff informed the public about the release of the draft CCP/EIS for public comment and conducted public meetings to solicit public input.

Figure 5. Comprehensive conservation planning process.

1.6 Public Involvement

Public scoping began in June 2013 with the release of a planning update that described the CCP process and its anticipated schedule (FWS 2013g). We published a notice of intent to prepare a CCP and EIS in the Federal Register on August 7, 2013. Since then, we conducted four public meetings during the scoping and development of the alternatives; mailed one planning update; posted information on the Web site for the CCP; and coordinated with Federal, State, and local agencies and Native American tribes.

The purpose of the first round of public meetings during the scoping phase was to inform the public about the project and to solicit their ideas and concerns regarding the future management of the refuge. During the alternative public meetings, we described the alternatives to meeting participants, answered their questions, and collected feedback.

An important consideration in the development of this plan—including the vision and goals—is the opinions, perspectives, and values of all interested citizens, agencies, and organized groups. While there are no requirements to base management decisions on public opinion, we value and consider input from the public. As detailed in appendix B, the Service has contacted and invited Native American tribes and actively involved Federal and State agencies, local governments, organizations, and private citizens throughout the process.

Cooperating Agencies

We sent letters of notification about the planning process, including an invitation to join the planning team, to several Federal and State agencies: Environmental Protection Agency (EPA), Federal Highway Administration (FHA), U.S. Army, Colorado Parks and Wildlife (CPW), Colorado Department of Public Health and Environment, Tri-County Health Department (TCHD), Adams County, City of Commerce City, City and County of Denver, Denver International Airport (DIA), UDFCD, and Denver Water. These agencies are participating as cooperating agencies in the planning process and planning team.

Native American Tribes

We sent letters of notification about the planning process, including an invitation to join the planning team, to the following tribes: Northern Arapaho, Northern Cheyenne, Southern Ute Indian Tribe, and Ute Mountain Ute Tribe. We will reach out to and work with tribes who are interested in the planning process.

1.7 Significant Issues to Address

Habitat and Wildlife Management

We manage a wide variety of habitats on the refuge, including prairie grasslands, wetlands, reservoirs and ponds, and riparian corridors. The nearly 26 square miles of open land encompassed by the refuge provide important feeding, nesting, and wintering habitat for many bird species, including burrowing owl and bald eagle. Many species of mammals use the refuge, including American bison, deer, coyote, red fox, and black-tailed prairie dog. In total, more than 350 species of wildlife can be found on the refuge at different times of the year. Because of previous land management practices and Superfund cleanup activities, many acres of the refuge grassland habitats were severely affected, and we are still in the process of restoring these habitats. The grassland reestablishment task becomes especially challenging when the developing vegetation is subjected to strong grazing pressure, such as that from bison and prairie dogs. Accordingly, it is very important to reduce grazing pressure on recently restored grasslands until these habitats attain a degree of stability that can sustain more intense grazing. We try to accomplish this by managing the refuge's bison herd grazing areas and by maintaining a healthy prairie dog population.

Many of our wildlife and habitat management issues have already been addressed in our HMP. Consequently, we have limited our analysis of impacts to new actions, such as increased visitation and reintroduction of native species.

Water Rights

It is our policy to comply with State laws, regulations, and procedures in obtaining and protecting water rights, both for Service facilities and for trust fish and wildlife resources on lands not owned by the United States, except where application of State stat-

utes and regulations does not permit Federal purposes to be achieved. Federal reserved water rights will be quantified and asserted when necessary to accomplish the primary purpose of the reservation. Water rights appurtenant to lands proposed for protection, restoration, enhancement, development, or acquisition will be identified and evaluated early in the planning process, and proposed actions will not proceed until water rights have been acquired. We will cooperate with the State on all matters related to water use and water rights and will seek to resolve conflicts through negotiation, in coordination with the Solicitor's Office, as appropriate. However, if negotiations are unproductive, other courses of action, including litigation, will be pursued (FWS 1993).

Groundwater and water storage rights for the refuge appear to be adequate for current management. Most of our reservoirs have additional storage available. In the future we may seek a change in location of our senior water rights in Upper Derby Lake, or we may petition for additional water rights to the maximum storage available in our reservoirs.

The refuge's water rights and water management are complex subjects requiring an indepth analysis and their own management plan. Accordingly, we developed a more detailed plan (FWS 2014b) that explains how our water will be managed under a variety of circumstances. In summary, we generally obtain water in the following order: (1) use surface water, (2) purchase recycled water, and (3) pump groundwater. This order of priority is the most cost effective, involves the smallest carbon footprint, and limits the amount of groundwater removed from the aquifer. This water management approach requires minor infrastructure. However, because there would be no changes to our current management approach, no impact analysis is necessary in the EIS.

We recognize that all natural systems are dynamic. The refuge will experience years with high and low water levels, and both beneficial and adverse effects can result from these fluctuations. In most years, water rights become an issue in the South Platte basin. Accordingly, we will store what we are legally allowed and will divert any additional water directly back to the basin via our wetlands. During dry years, we may be required to purchase and pump more water to meet our needs.

The water rights pertaining to the refuge are summarized in tables 2, 3, and 4.

Table 2. Summary of surface water storage rights, Rocky Mountain Arsenal National Wildlife Refuge, Colorado.

Name	*Priority Date*	*Maximum Storage Right*	*Case Number*
Lake Ladora	March 3, 1919	203 af	No. 54658 (12 November 1924)
Lake Ladora (enlargement)	May 12, 1942	323 af	No. W-9160 (b) -77 (6 August 1996)
Upper Derby Lake	May 12, 1942	460 af	No. W-9160 (b) -77 (6 August 1996)
Lower Derby Lake	October 3, 1893	387 af	No. 807 (9 June 1924)
Lower Derby Lake (enlargement)	May 12, 1942	660 af	No. W-9160 (b) -77 (6 August 1996)
Lake Mary	November 24, 1960	57 af	No. W-9160 (b) -77 (6 August 1996)
Havana Pond	February 28, 1985	79 af	No. W-9160 (b) -77 (6 August 1996)

af = acre-feet

Table 3. Summary of groundwater rights for Sections 4 and 12 Wells, Rocky Mountain Arsenal National Wildlife Refuge, Colorado.

Name	*Priority Date*	*Maximum Water Right*	*Case Number*
Section 4 Wells (Wells # 385, 386, 387)	August 6, 1956	750 gpm 466 af	No. W-9160(a)-77 (16 December 1994) No. W-9161(a)-77 (16 December 1994) No. W-9162(a)-77 (16 December 1994)
Section 4 Wells (increase)	March 26, 1999	900 gpm 700 af	No. 2002CW238 (16 April 2013)
Section 12 Well	December 20, 2004	900 gpm 700 af	No. 2008CW286 (25 November 2014)

af = acre-feet; gpm = gallons per minute

Table 4. Summary of groundwater rights for other wells (<50 gpm), Rocky Mountain Arsenal National Wildlife Refuge, Colorado.

Name	*Priority Date*	*Maximum Water Right*	*Case Number*
Ole Rugger Well (Section 20)	May 1, 1965	25 gpm Stock	No. W-9150-77 (28 March 1989)
Section 8 Well	January 1, 1960	10 gpm 160 af	No. W-9164-77 (9 October 1981)
Section 32 Well	January 1, 1942	40 gpm Stock	No. W-9159-77 (13 March 1992)

af = acre-feet; gpm = gallons per minute

Connecting People with Nature

Many of the comments we received during the scoping meetings and by email reiterated an issue that the Service is trying to help address through expanded public opportunities on the units of the Refuge System—connecting people with nature.

Recent studies in the U.S. suggest that a lack of personal connection with nature and decreased engagement in outdoor recreational activities could have potential adverse effects on children, adults, and the health of society in general. The Service's Connecting People with Nature program seeks to reconnect our Nation's residents with the natural world, especially at the units of the Refuge System.

Our refuge needs to become an example of how our agency and the units of the Refuge System can help address this issue by reconnecting the present and future generations of Americans with the natural world, and instilling in them an appreciation for the conservation of our natural resources.

Setting Clear Expectations About the Refuge

Many individuals and members of our staff commented that it is not uncommon for visitors to the refuge and other units of the Refuge System to be unaware of the difference between our agency and the lands we manage and other agencies and their lands, such as the National Park Service, Bureau of Land Management, USDA Forest Service, and Colorado Parks and Wildlife. Similarly, many visitors are unaware of what activities are allowed in the lands we manage. We realize it is important for us to find better ways to communicate to the public about who the Service is, what our mission and lands are, and how the public can participate in that mission and in the activities offered throughout the lands we manage. To that end, we have developed a Communications and Outreach Goal (see "Summary") in this draft CCP and EIS through which we propose concrete actions to help us communicate more efficiently and clearly with our visitors and stakeholders.

Improving and Expanding Public Use Facilities and Programs

Comments that we received during the scoping period show a desire from the public that we expand and improve our visitor services programs and facilities to appeal to a wider audience and nontraditional refuge visitors. Since we expect the number of visitors to the refuge to increase steadily over coming decades, it is important to consider, plan, and implement changes and improvements to our refuge's visitor services programs and facilities to accommodate these anticipated increases and diversification of future visitors (see appendix I for projected increases in visitation). Failing to do so could create logistical complications for our staff, diminish the quality of our visitors' experiences, and cause us to miss opportunities to educate refuge visitors about our refuge, the Refuge System, and environmental conservation in general.

We also received many inquiries and comments regarding expanded fishing opportunities and opening hunting opportunities on the refuge. There is both support for and opposition to the use of hunting as a management tool and a wildlife-dependent recreational activity throughout the country, and on the refuge specifically. The alternatives reflect these requests by providing hunts and hunting education at varying levels.

Some groups wish to invest more and partner with the refuge in environmental education and interpretation to educate visitors about the importance of the refuge and the history of the refuge site.

We also received public comments recommending that we open more refuge areas to wildlife observation and photography, and build more blinds and observation facilities throughout the refuge.

There is widespread and increasing interest among the public for the allowance of other outdoor recreational opportunities and facilities to support bicycling, camping, snowshoeing, cross-country skiing, jogging, hiking, and picnicking. Many of our partners would like to think beyond the boundaries of each refuge, craft plans at the landscape scale where possible, and use a variety of mechanisms to accomplish our common goals. This philosophy is reflected in alternative D.

Maintaining a Sense of Retreat

Many comments we received reminded us that the refuge offers a precious sense of retreat in the midst of a highly urbanized area. This characteristic is not only of great value for visitors, but is also essential to the wildlife living in or migrating through the refuge. We have been asked to preserve this refuge attribute—unique in the context of the Denver Metropolitan area.

Interpretation of the Site's History

Many comments stressed the importance of preserving the refuge area's rich pre– and post–European settlement history and requested that we continue protecting and interpreting historical artifacts, structures, and sites within the refuge boundary. In general, there has been outstanding cooperation between Federal agencies, tribes, and the State Historic Preservation Office to preserve and document the refuge site's history.

Museum property representing arsenal activities during World War II and the Cold War are currently stored in one of the refuge's buildings. We have been asked to display and interpret these artifacts or to create a World War II and Cold War era museum on the refuge. Although the proper care of these artifacts is the Service's responsibility, and several are displayed in the Visitor Center as part of the interpretation of those eras, a more extensive display is not within the refuge's primary purposes. Nevertheless, our staff needs to determine the best preservation options and future use of these artifacts.

Improving Access and Transportation

Many comments pointed out the need to provide more and easier access to the refuge now that cleanup activities have concluded. Our alternatives have been developed to address these comments. Refuge neighbors have pointed out that despite their proximity to the refuge boundary, they must travel miles to enter the refuge through the only currently available public access point. Other comments pointed out that adding new refuge access points would offer neighbors and other visitors a more direct connection between refuge trails and other nearby trail systems, such as the Rocky Mountain Greenway Trail Network.

Some commenters asked us to consider allowing the use of bicycles in the refuge to participate in refuge programs and view wildlife and habitats. We have also been asked to consider how our existing and possible future trails may better accommodate pedestrians, bicyclists, and other refuge visitors.

Other comments asked us to study the possibility of expanding the existing auto tour route and opening some of the staff-only roads to visitors to provide access to areas currently closed to the general public. Presently, the 7.8-mile Wildlife Drive in the central portion of the refuge is open only to refuge, U.S. Army, or appropriate contractor's staff, and to visitors while being transported in the refuge bus and guided by refuge staff. Allowing refuge visitors to use this drive would provide them with access to refuge habitats and wildlife in the southern portion of the refuge. Many other roads, remnants of the site's diverse uses, are similarly closed to the general public; these are currently used by the refuge, U.S. Army, and appropriate contractors for maintenance and other necessary activities. We have been asked to determine if some of these roadways may be opened to the general public, thereby extending the existing Wildlife Drive.

A few comments pointed out that because some of the site's remnant roads crisscrossing the refuge may no longer be essential for management, maintenance, or general transportation, such roads should be decommissioned and the roadbeds restored to native habitat to improve habitat connectivity. Other commenters pointed out a need for expanded parking facilities where refuge visitors can safely park their vehicles without affecting refuge habitats and other visitors' mobility.

Finally, some commenters have suggested improvements to the refuge signage to help refuge visitors more easily navigate the refuge sites and facilities.

Alternatives C and D propose increased public access to the Wildlife Drive and other areas of the refuge. Alternatives B, C, and D entail improvements to refuge signs and facilities.

Reintroducing Native Species

In addition to the American bison—successfully reintroduced to the refuge a few years ago—we are considering bringing back other animal species that historically inhabited the Front Range region of Colorado. These species include the federally listed black-footed ferret, pronghorn, greater prairie-chicken, and plains sharp-tailed grouse. We will need to conduct some research and consultation with species experts to determine if the size and current habitat conditions on the refuge are adequate to sustain populations of these species.

As part of the overall recovery strategy for the black-footed ferret, we are considering reintroducing this highly endangered mammal to the refuge's grasslands habitats. This proposal has generated tremendous interest from the public and NGOs throughout the nation, as well as from neighboring communities, State and local governments, and a variety of State and Federal agencies throughout the region.

Improving Outreach to Neighboring Communities

Many people noted that, while visitation to the refuge has increased steadily and dramatically in the past 10 years, many residents in the surrounding communities and the broader Colorado Front Range region are unaware that the refuge exists, is open to the public, and offers programs and outdoor recreational opportunities. They pointed out a need to improve and expand our outreach efforts to these communities.

Ever since the establishment of the refuge, we have endeavored to reach out to partners, stakeholders, and the public using a variety of means and personnel. Based on comments during public scoping, it appears that our efforts have met with mixed results. Many people, especially members of nontraditional and minority groups, are not aware of the refuge or its mission and programs or, perhaps, do not find them appealing.

The Refuge System—the largest system of lands dedicated to wildlife in the world—is tasked with conserving wildlife and the habitats on which they depend for the enjoyment of future generations. Yet many refuge visitors and members of the general public do not know of the Refuge System's existence or of its important mission. Because it is nestled within the Denver Metropolitan area and adjacent to DIA, the refuge can be a vital ambassador for the Refuge System, accessible to local residents as well as international visitors.

We need to convey to today's young people the importance of the Refuge System and the Service's role in the conservation of wildlife and the habitats on which they depend on a local, national, and international scale. To this end, we must increase the scope and effectiveness of our outreach activities if we are to be successful stewards and leave a fitting natural legacy for future generations.

Alternatives C and D would expand and diversify our outreach programs and activities to better communicate the importance of the refuge and the Refuge system.

Increasing Partnership Opportunities

Some commenters suggested that we assess strategies for increasing our partnerships with neighbors, stakeholders, and others during the planning process. Refuge management offers many opportunities for partners and volunteers to advance the refuge's mission and programs. Both former and existing partnerships have helped us maintain and expand refuge programs, as well as carry out restoration and conservation projects.

The Service in general and our staff in particular appreciate and value the importance of partnerships in achieving the Service's and Refuge System's missions and the refuge's purposes. Accordingly, our planning team has addressed opportunities for partnerships with our neighbors, stakeholders, and others in this CCP.

Alternatives B, C, and D, to varying degrees, would maintain or expand existing partnerships and seek out new ones.

Make the Refuge More Welcoming

We received many comments about the refuge boundary fence and vehicular entrance, suggesting that we expand public access to the refuge and create a more welcoming and appropriate look and atmo-

sphere. Currently, an 8-foot chain-link fence—a remnant of the prior cleanup period—surrounds the entire refuge. Although most of the site has become a wildlife refuge, this boundary fence has remained despite the conclusion of Superfund cleanup activities. The existing fence reinforces the messages of closure and exclusion that characterized the site's previous condition, and that is in direct opposition to the message we wish to convey to neighbors, stakeholders, and visitors.

An effective barrier is necessary to promote public safety. We are attempting to keep large wildlife species (such as bison and deer) from moving out of the refuge and endangering people and themselves, causing disruptions to the vehicular and aircraft traffic patterns around the refuge, and damaging private property. The fence has also helped isolate refuge deer populations from populations outside the refuge that may carry chronic wasting disease. The refuge must find ways to continue managing its habitats and wildlife to ensure public safety, while at the same time creating a more welcoming look and environment for neighbors and visitors.

The Service's Urban Wildlife Refuge Program seeks to engage urban communities as partners in wildlife conservation (see appendix F for information on the Standards of Excellence for Urban National Wildlife Refuges). To accomplish this, units of the Refuge System near or within urban areas must reach out to and engage the residents of these urban areas. We understand that the current infrastructure of our refuge is not ideal to support the goals of the Service's Urban Wildlife Refuge Program; accordingly, in this draft CCP and EIS we have proposed steps to support this program.

1.8 Issues Not Addressed

We considered several issues that were identified by the public during scoping and alternatives development but were not selected for detailed analysis in the CCP and EIS. In accordance with the requirements of NEPA, we have identified and eliminated from detailed analysis the topics or issues that are not significant or are beyond the scope of this planning process. These issues and the rationale for not discussing them further in the CCP and EIS are briefly described below.

Development of Mineral Rights

When the refuge was created, the majority of mineral rights were acquired with the land. In addition, the United States and the State of Colorado entered into an agreement stating that all minerals owned by the State within the boundaries of the refuge are subordinated (November 5, 1942). For those remaining outstanding mineral rights, the draft CCP and EIS does not address the rights of private property owners to exercise their rights to extract any locatable minerals or oil and gas within or adjacent to the refuge. Any exploration or other activities supporting the testing, development, or production of gas, oil, and other resources will be analyzed through an additional and separate NEPA process designed to address that issue specifically. While this CCP and EIS does not analyze any future mineral development alternative, we are considering how habitat, wildlife, and visitor services should be managed if private mineral development occurs near or adjacent to the refuge.

Decisions Made in Other Planning Documents

During the past several years our staff has been working with other Service employees from the Division of Biological Resources, the Division of Water Resources, and the Division of Fire Management to prepare various plans to assist in refuge management. The plans include an HMP, an Integrated Pest Management Plan (IPMP), a Water Management Plan (WMP), a Fire Management Plan (FMP), a Black-Tailed Prairie Dog Management Plan (BTPDMP), and a Station Safety Plan (SSP). Most of these plans were drafted and released for public comment in spring and summer 2013. After analyzing the comments we received during the public comment period, we addressed all significant comments and then finalized the plans. These plans have been under implementation since they were finalized. The CCP and EIS does not readdress the decisions made on the HMP, IPMP, WMP, FMP, BTPDMP, or SSP as these plans have already undergone their own NEPA analysis and public scrutiny.

We use a variety of plans to assist with refuge management. The plans discussed below have been developed in the last 2 years and are not included in the scope of this planning process.

Habitat Management Plan

The HMP provides additional details regarding specific strategies and implementation schedules for meeting the wildlife and habitat goals for the refuge.

Integrated Pest Management Plan

The IPMP provides a broad strategy for combating invasive plant species and weed control on all three refuges, focusing on early detection and a rapid response program for species with a high potential for spread.

Water Management Plan

The WMP is a synthesis of our water sources and how water is managed on the refuge. The WMP establishes monitoring protocols to ensure compliance with State of Colorado regulations.

Fire Management Plan

The FMP provides policy direction for wildland fire suppression and prescribed fire activities on all three refuges to promote healthy native habitat for wildlife.

Black-Tailed Prairie Dog Management Plan

The BTPDMP establishes a transparent decision-making process and information on the methods that will be used to control and maintain a healthy and balanced population of prairie dogs on the refuge.

Station Safety Plan

The SSP assesses risks associated with refuge staff and visitors, outlines the procedures for safe operations, and provides information and procedures to be followed in case of an emergency. All of our safety analysis is covered under our SSP.

Superfund Cleanup

Some of the site's historical military and industrial activities resulted in contamination of portions of the lands within and around the refuge boundary. In 1987, the site was studied and declared a Superfund site, initiating a vast and comprehensive cleanup effort. EPA, the U.S. Army, and Shell Oil Company have performed numerous environmental studies and complied with appropriate NEPA regulations, including full disclosure, public outreach, and opportunities for public comment. The lands transferred by the U.S. Army and currently being managed by the Service have been cleaned up sufficiently to guarantee human and wildlife safety. From this process, several encumbrances, or land use restrictions, have been passed along to us (see section 2.1).

Because the site's Superfund designation and subsequent cleanup activities were subjected to their own NEPA analysis and process, this CCP and EIS does not further address these issues.

Refuge Revenue Sharing Payments

Since 1935, we have made revenue-sharing payments for refuge lands under our administration to counties under the Refuge Revenue Sharing (RSS) Act of 1935 (16 U.S.C. 715s), which was subsequently amended. These payments are not the same as other Federal revenue-sharing payment measures, such as payments in lieu of taxes, that apply to lands administered by other agencies, including those within DOI. When there is not enough money to cover the payments, Congress is authorized to appropriate money to make up the deficit; however, payments to a county are reduced when Congress fails to appropriate the money. Understandably, these are issues of concern for many counties in times of declining revenues, but the Service has no control over Congress in making these payments.

In section 5.10 of this document we provide information about the refuge's RRS payments and how they contribute to the local economy. Nevertheless, the issue of Congressional levels of funding for RSS payments is outside the scope of this CCP and EIS.

Management of U.S. Army–Retained Sites

The Rocky Mountain Arsenal (Arsenal) was established by the U.S. Army during World War II. With the passage of the Rocky Mountain Arsenal National Wildlife Refuge Act of 1992 (Public Law 102-402), the Secretary of the Army was directed to transfer jurisdiction of the Arsenal to the Secretary of the Interior. This act created the refuge by transferring most of the former Arsenal lands to the Service. However, the U.S. Army retained some lands (approximately 1,000 acres) for the operation and

maintenance of landfills and groundwater treatment facilities.

Except for any cumulative effects that result from our proposed actions, the CCP and EIS does not address the management of U.S. Army–retained sites on or adjacent to the refuge, as these lands are managed by a different agency and this issue is outside the scope of the analysis.

Power Transmission Lines

We have received many questions about the large overhead power lines at the refuge. In 1947, the U.S. Army granted an easement to the Public Service Company of Colorado, later becoming XCEL Energy Company, to construct and maintain an electric transmission line over and across the refuge. In 1997, the term of this easement was extended by 50 years (ending April 29, 2047). In 2003, a slight adjustment was made to facilitate the widening of 56th Avenue and allow the power lines to go behind the U.S. Army Reserve Center. Power lines constructed by the refuge will typically be below ground, but any changes to power lines owned by Public Service Company of Colorado within existing easements are outside the scope of this document.

Repository Programs

The Service's Office of Law Enforcement manages the National Wildlife Property Repository (Repository) and the National Eagle Repository (Eagle Repository), both of which are within the refuge boundaries.

These facilities support the Service's law enforcement, migratory bird permit, and educational outreach programs nationwide. Both are funded from criminal fine monies deposited in the Lacey Act Reward Account.

The Repository receives, stores, and distributes wildlife property that has been abandoned or forfeited to the government as a result of Service wildlife inspections and wildlife crime investigations. It currently houses approximately 1.5 million individual pieces of wildlife property, including many striking examples of the impact that unlawful wildlife trafficking has on imperiled species such as tigers, rhinoceros, elephants, bears, and too many more to list here. The Repository loans wildlife products to public scientific and educational institutions, State agencies, and Service offices for use in conservation education or law enforcement. In 2013, we played a major role in planning and hosting the U.S. Ivory Crush.

The Eagle Repository supplies whole eagles and eagle feathers and parts to enrolled members of federally recognized Native American tribes for religious use under a Service permit program. In 2012 and 2013 the Eagle Repository conducted formal nationwide government-to-government consultations with tribes, and started using the information from those consultations to make improvements to the Repository's distribution processes beginning June 1, 2014. Since its transfer to Colorado in 1995, the Eagle Repository has filled more than 42,000 individual orders for Tribal members. Because the Repository is not managed by the refuge, we do not further address it in this CCP and EIS.

1.9 Scope of the Document

The scope of our decisions and analysis are broken out into two areas: the decision area and the analysis area.

Decision Area

The decision area is the area within the designated boundary of the Rocky Mountain Arsenal National Wildlife Refuge (figure 6; refer to chapter 2 for a complete description of the refuge).

Analysis Area

The analysis area (table 5) encompasses the decision area as well as areas outside the decision area where most of the direct, indirect, or cumulative effects could occur as a result of implementing the actions described in the alternatives. These effects are described in chapters 4 and 5. The foreseeable activities where our actions in combination with other activities could result in cumulative effects are described in detail in chapter 3, section 3.9.

1.10 Decisions to Be Made

The Regional Director of the Mountain-Prairie Region will make the final decision on the selected alternative for the CCP. The Regional Director's decision will be based on the analysis of impacts; our legal responsibilities, including the mission of the

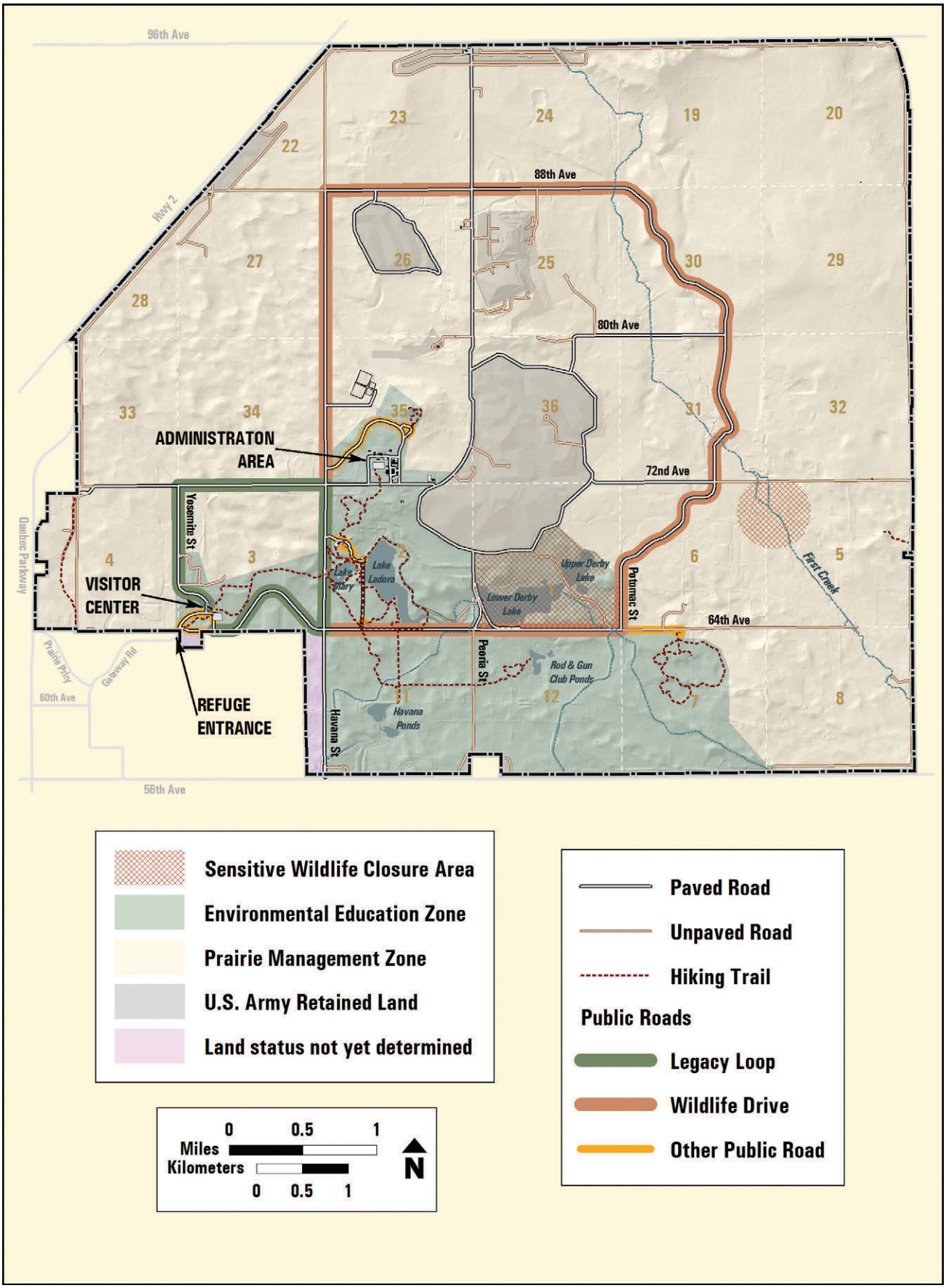

Figure 6. Rocky Mountain Arsenal National Wildlife Refuge, Colorado.

Table 5. Rocky Mountain Arsenal National Wildlife Refuge CCP and EIS decision and analysis areas.

Comprehensive Conservation Plan and Environmental Impact Statement Decision Area
For the purposes of the environmental analysis of this CCP and EIS, the decision area is that encompassed by the Congressionally designated boundary of the Rocky Mountain Arsenal National Wildlife Refuge, excluding the Army-retained areas.
Comprehensive Conservation Plan and Environmental Impact Statement Analysis Area
For the purposes of the environmental analysis of this CCP and EIS, the analysis area for physical impacts includes all areas surrounding the refuge where the management actions described in the CCP could result in a direct and quantifiable impact. It is expected that the smoke generated by prescribed burns or wildfires on the refuge would have the most extensive direct and quantifiable impact of all refuge actions. Furthermore, it is estimated that, under normal conditions and following established prescribed burn guidelines, the greatest distance that smoke would travel outside the refuge boundary would be approximately 1 mile. Accordingly, we established the following 1-mile boundary lines for the CCP and EIS analysis area.
North: 104th Avenue (Commerce City)
Northwest: Interstate 76 (Commerce City)
West: Holly Street (Commerce City)
South: Green Valley Ranch Boulevard (Denver)
East: Tower Road (Denver)
For the purposes of assessing socioeconomic effects, the analysis area encompasses Adams, Arapahoe, Boulder, Broomfield, Denver, Jefferson, Larimer, and Weld Counties.

Service and the Refuge System; other legal and policy mandates; the purposes of the refuge; and the vision and goals identified in this draft CCP and EIS.

Additionally, in accordance with our policy (040 FW 2), the Regional Director will make the decision on whether, for administrative purposes only, to rename the refuge complex.[1]

Our final decision will be documented in a record of decision that will be published in the Federal Register no sooner than 30 days after filing the final CCP and EIS with EPA and distributing it to the public. We will begin to carry out the selected alternative identified in the final EIS immediately following publication of the decision in the Federal Register.

[1] Due to their close proximity, the Rocky Mountain Arsenal, Rocky Flats, and Two Ponds National Wildlife Refuges are administratively managed as one "complex"—the "Rocky Mountain Arsenal National Wildlife Refuge Complex." This name is site-specific to the Rocky Mountain Arsenal and does not accurately reflect our management of all three units. The planning team has proposed a new name for the complex—the "Colorado Front Range National Wildlife Refuge Complex"—but this name change has not been finalized.

Chapter 2—Refuge History

Cindy Souders / USFWS

Rocky Mountain Arsenal National Wildlife Refuge staff

> *We abuse land because we regard it as a commodity belonging to us. When we see land as a community to which we belong, we may begin to use it with love and respect.*
>
> *Aldo Leopold*, A Sand County Almanac

2.1 Establishment and Management History

The Rocky Mountain Arsenal National Wildlife Refuge is an urban wildlife refuge just north of Denver, Colorado. The site neighbors several communities that have historically played an active role in the development and management of the land.

The U.S. Army purchased 19,833 acres from Colorado homesteaders in 1942 with the intent to develop a chemical munitions plant to supply American forces during World War II. The site was selected because of its ideal location: it was far from potential threats to both coasts, easily accessible by rail, and removed from the Denver Metropolitan area. The United States developed the Arsenal as a deterrent to counter the German and Japanese production of chemical weaponry, but the U.S. Army never in fact employed chemical weapons during World War II. Initially, the Arsenal supplied mustard gas, lewisite, and chlorine gas during World War II. During the Cold War and Korean War, the Arsenal was called into action again, producing white phosphorous, distilled mustard, and incendiary bombs.

In addition to the production of chemical munitions, the Arsenal realized the heightened priority of chemical production byproducts and worked simultaneously to demilitarize older products through the 1960s. During the same period, the U.S. Army continually produced GB-Sarin, a highly dangerous and debilitating nerve agent to deter mounting Soviet threats. Later, rocket fuels and hydrazine were produced to aid the Nation in the space race. Chemical weapon production finally came to a close in the 1970s. In 1972, the United Nations Conference on the Human Environment sparked interest in preventing the decline of the environment. Outdated practices of

deep well pumping (pushing the chemicals deep into the earth) resulted in earthquakes around the Denver area. The need for an efficient and effective method of protecting the public from chemical contamination became apparent.

In 1987, the Rocky Mountain Arsenal was placed on EPA's National Priority List (NPL) because of its status as one of the most contaminated sites in the country (Federal Register 1987). EPA, DOI, Agency for Toxic Substances and Disease Registry, the State of Colorado, and the U.S. Army entered into a Federal Facilities Agreement outlining the responsibilities of each party in the cleanup process. Finally, in 1992, Congress passed the Rocky Mountain Arsenal National Wildlife Refuge Act (appendix E). The Act established the Arsenal as a national wildlife refuge and declared that once cleanup was complete and certified by EPA, management responsibility would lie with the Service.

Environmental Cleanup

The impact of manufacturing ordnance and pesticides on the site and the subsequent plans that were developed to clean up contaminants are well documented in the 1996 Record of Decision (ROD) that initiated the environmental cleanup (Foster Wheeler Environmental Corporation 1996). In summary, disposal practices typical of that era included treating and discharging waste products into evaporation basins. However, by the early 1950s, chemical wastes were leaching through the soil into groundwater and were affecting environmental resources. Subsequent cleanup activities have included construction of borrow areas, caps, covers, landfills, and other remediation structures that disturbed thousands of acres on the present-day refuge. These activities, ongoing since 1988, were concluded in fall 2011. In some cases, the surface topography of an entire section of land was completely recontoured to facilitate cleanup and drainage, whereas in other sections borrow areas had to be excavated to depths ranging from 1 foot to more than 20 feet. As lands were fully remediated, EPA removed them from the NPL so they could be added to the refuge (Federal Register 2003; 2004b; 2006; 2010).

The cleanup effort would result in the loss of considerable wildlife habitat. To mitigate these losses, efforts were initiated to restore much of the future refuge to native plant communities. Restoration of native shortgrass and mixed-grass prairie is a difficult undertaking that was guided by a habitat restoration plan (FWS 1999b). In 2012, we entered into a new agreement to assist the U.S. Army in achieving its goals for restoration and mitigation of habitat losses. This agreement funded restoration of approximately 2,122 acres remaining of the planned mitigation of 10,727 acres at the refuge. This work is still underway; we plan to meet this obligation by 2018.

In 2008, the State of Colorado, the U.S. Army, and Shell Oil Company reached a settlement on the natural resource damages associated with the site. This settlement provided approximately $35 million for acquisition, enhancement, and restoration of natural resources in and around the northeast metropolitan area Arsenal site (Colorado Attorney General 2008).

Refuge Establishment

The refuge was officially established on April 21, 2004, when we accepted 4,930 acres of land in the southern and southeastern areas of the site (Federal Register 2004a). Additional lands were added over the years until the refuge reached its current size. Additional transfers are expected in the future, but the U.S. Army will always retain lands associated with their landfills in the center of the refuge.

Today's refuges are managed by the Service with the intent to fulfill the mission and goals of the Refuge System. The goals of the Refuge System together with the interests of the refuge (as designated by the 1992 Act) afford the refuge an opportunity for new growth and wildlife preservation in this phase of its existence. While the 1992 Act is a guiding foundation for the refuge's direction, the refuge is further managed in accordance with the Migratory Bird Treaty Act of 1918, Refuge Recreation Act of 1962, National Wildlife Refuge System Administration Act of 1966, Title 50 CFR, the "Fish and Wildlife Service Manual," and the Improvement Act.

We completed our first comprehensive management plan for the refuge in 1996; this plan provided guidance through the cleanup period (FWS 1996a).

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The refuge was established in 2004.

The end of cleanup signaled a major change in management direction for the refuge. In 2013, we released a new HMP and several supporting plans that will guide current and future refuge management (FWS 2013a, 2013h, 2013i).

Land Use Restrictions

In 1987, pursuant to section 105 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, as amended, the Rocky Mountain Arsenal was listed on the National Priorities List (Superfund). A Federal Facility Agreement was developed in 1989 to guide cleanup activities at the Arsenal; Section 44 of this agreement includes several land use restrictions. The 1996 ROD for the site incorporated many of these land use restrictions (Foster Wheeler Environmental Corporation 1996). In 2003, 2004, 2006, and 2010, EPA completed partial deletions from the NPL of lands that would become the refuge, meaning that the lands have been cleaned up sufficiently to guarantee the health of refuge workers and visitors (Federal Register 2003; 2004b; 2006; 2010). In accordance with Section (2)(2)(b)(2) of the Rocky Mountain Arsenal National Wildlife Refuge Act of 1992, EPA certified that these lands were acceptable for transfer as a national wildlife refuge. Based on the 2004 deletion, the refuge was officially established (Federal Register 2004a).

Land use restrictions found in the 1989 Federal Facility Agreement are as follows:

- Residential development on the Rocky Mountain Arsenal shall be prohibited.
- The use of groundwater located under, or surface water located on, the Rocky Mountain Arsenal as a source of potable water shall be prohibited.
- Consumption of all fish and game taken on the Rocky Mountain Arsenal shall be prohibited, although hunting and fishing on the site for nonconsumptive use may occur if subject to appropriate restrictions.
- Agricultural [sic], including all farming activities such as the raising of livestock, crops, or vegetables, shall be prohibited. Agricultural practices used in Response Action or used for erosion control, however, shall be permitted.
- Wildlife habitat(s) shall be preserved and managed as necessary to protect endangered species of wildlife to the extent required by the Endangered Species Act, 16 U.S.C. §§ 1531 et seq., migratory birds to the extent required by the Migratory Bird Treaty Act, 16 U.S.C. §§ 703 et seq., and bald eagles to the extent required by the Bald Eagle Protection Act, 16 U.S.C. §§ 668 et seq.
- Other than as many [sic] be necessary in connection with a Response Action or as necessary to construct or operate a Response Action Structure, no major alteration shall be permitted in the geophysical characteristics of the Arsenal if such alteration may likely have an adverse effect on the natural drainage of the Rocky Mountain Arsenal for floodplain management, recharge of groundwater, operation and maintenance of Response Action Structures, or protection of wildlife habitat(s).
- The United States shall maintain security at the Rocky Mountain Arsenal adequate to assure the proper construction, operation, and maintenance of Response Action Structures, the proper implementation and monitoring of Response Actions and compliance with the restrictions listed in paragraph 44.2 and the Technical Program Plan. The United States shall take reasonable precautions to assure that only federally authorized access to the Rocky Mountain Arsenal shall occur.

The 1996 ROD incorporates these restrictions more simply as "The Rocky Mountain Arsenal National Wildlife Refuge Act of 1992 and the Federal Facilities Agreement restrict future land use, and prohibit certain activities such as agriculture, use of on-post groundwater as a drinking source, and consumption of fish and game taken at Rocky Mountain Arsenal NWR." The 1989 Federal Facility Agreement states that "The United States [U.S. Army, EPA, USFWS] shall also evaluate the continuing need for such restrictions or requirements to determine if any restriction or requirements may be removed or modified." We are currently working with these organizations to remove or modify unnecessary land use restrictions on the refuge.

Hours of Operation

On May 15, 2014, we expanded the hours of operation of the refuge (FWS 2014c). The refuge is now open daily from sunrise to sunset and will be open on

most Federal holidays (we are closed on Thanksgiving, Christmas, and New Year's Day). We believe that sunrise to sunset hours are easy to understand, and the change provides better access to visitors when they are not at work. Wildlife can be adversely affected when disturbed overnight; these hours will be strictly enforced.

The refuge's Visitor Center is open Wednesday through Sunday from 9:00 a.m. to 4:00 p.m. and is closed on all Federal holidays. The Visitor Center requires staff to operate, and hours were reduced in 2013 due to significant budget cuts.

2.2 Special Values

The following list summarizes many of the unique and special values of the refuge:

- Showcases the transformation of the landscape from heavy industrial development to national wildlife refuge.
- Protects 15,000 acres of diverse habitats–grassland, wetland, riparian, lacustrine, and woodland.
- Supports habitat for breeding neotropical birds in the midst of a highly urbanized area.
- Provides small cottonwood galleries along streams that support a diverse variety of wildlife.
- Provides nesting and winter roosting habitat for bald eagles in the Denver Metropolitan area.
- Provides outstanding bird viewing opportunities as a Colorado State Important Bird Area (designated by the National Audubon Society).
- Provides habitat for more than 350 species of wildlife (see appendix G).
- Provides habitat for a herd of American bison as well as for white-tailed and mule deer populations.
- Features a Visitor Center and exhibit hall focusing on prairie wildlife, regional history, and refuge management.
- Provides a self-guided auto tour and miles of nature trails for wildlife observation and photography with distant views of the Rocky Mountains.
- Offers catch-and-release recreational fishing opportunities in the Denver Metropolitan area.
- Features the historic Egli House, which is listed in the Colorado State Historic Register and is eligible for listing in the National Register for Historic Places (NRHP).
- Provides environmental education opportunities for area students.
- Serves as a gateway to the Refuge System for local, national, and international visitors because of its proximity to Denver International Airport.
- Collaborates and builds partnerships with a large variety of organizations and agencies to enhance the mission of the Refuge System.
- Provides year-round wildlife viewing opportunities of bison, deer, bald eagles, waterfowl, songbirds, and many others.
- Provides research opportunities for a number of wildlife and environmental research organizations.
- Engages more than 80 volunteers who contribute more than 8,000 hours of service annually in support of visitor services, wildlife habitat improvements, trail maintenance, and administrative duties.

2.3 Issues Raised During Scoping

Our scoping process for the draft CCP and EIS identified some of the special values listed above along with issues to address and recommendations to consider. Based on this information, as well as guidance from the Improvement Act, NEPA, and our planning policy, we identified the following issues to address:

- Habitat and wildlife management
- Refuge water rights, water management, and infrastructure
- Connecting people to nature
- Setting clear expectations on what a refuge is and what the refuge can offer
- Improving and expanding visitor services facilities and programs
- Maintaining the sense of retreat of the refuge in the midst of the urban setting
- Interpreting the Arsenal's history
- Improving access and transportation systems to and within the refuge
- Reintroducing black-footed ferrets and other native species
- Improving and increasing breath and types of outreach to neighboring communities
- Increasing partnership opportunities with neighbors and various NGOs
- Making the refuge more welcoming and open to the local and international public

Our planning team considered every comment that was received during the public scoping process. These comments were grouped into related topics and subtopics. Significant issues are those that are within our jurisdiction, that suggest different actions or alternatives, and that will influence our decision (see "Significant Issues to Address" in chapter 1). Our planning team used this list of issues to help us develop the four alternatives presented in this draft CCP and EIS, as well as to choose one of these alternatives as the proposed action. Furthermore, during our analysis of environmental consequences, we sought to address how the management actions proposed under each of the alternatives would affect these and other issues identified internally. Finally, the issues identified internally and during the public scoping process helped us develop the vision and goals to guide the refuge into its next phase (see "Summary").

Chapter 3—Alternatives

Cindy Souders / USFWS

A Service employee controls weeds with a chemical treatment.

> *Our job is to sharpen our tools and make them cut the right way…*
>
> *Aldo Leopold*, The River of the Mother of God and Other Essays

In this chapter we describe the management alternatives that we propose for the Rocky Mountain Arsenal National Wildlife Refuge. Alternatives are different approaches to management that are designed to achieve the purposes of the refuge, promote the vision and goals of the refuge, and further the Refuge System's mission. We have formulated four alternatives, including the no-action alternative, to address significant issues that have been identified by the Service, cooperating agencies, interested groups, and the public during the public scoping period and throughout development of the draft plan, and to meet the goals developed through that process. The "Summary" lists the vision and goals we have developed for the refuge; chapter 1 provides an overview of the issues addressed in this CCP and EIS.

3.1 Criteria for Alternatives Development

Following the initial public scoping process during spring and summer 2013, we held meetings and workshops with the cooperating agencies and identified a range of preliminary alternatives. Eventually, we dropped some of these ideas; we discuss those in section 3.9. We selected the following four alternatives for detailed discussion and analysis in this draft CCP and EIS:

- Alternative A—No-Action Alternative
- Alternative B—Traditional Refuge Alternative
- Alternative C—Urban Refuge Alternative (Draft Proposed Action)
- Alternative D—Gateway Refuge Alternative

In concert with existing refuge plans, these alternatives examine different ways in which we can achieve the goals and address significant issues; provide opportunities for the public to engage in compat-

ible, wildlife-dependent recreation; improve transportation within and access to the refuge; increase outreach and partnerships; and reintroduce native species to the refuge. Each alternative incorporates specific actions that are intended to achieve the goals described in chapter 2. The no-action alternative would continue the current refuge management strategies and may not meet every aspect of every goal. The no-action alternative provides a basis for comparison with action alternatives B, C, and D. The alternatives vary in how well they meet each goal, as discussed in section 3.13.

3.2 Elements Common to All Alternatives

Regardless of the alternative selected, we will comply with all applicable laws, regulations, and policies for management activities that could affect refuge resources such as soil, water, air, threatened and endangered species, and archaeological and historical sites. A list of key legislation and policies is presented in appendix C.

The elements listed below and the sections that follow describe practices and policies that guide refuge management as well as actions that have been approved in other plans and are currently in force. These practices and policies apply to all alternatives, including the no-action alternative.

- We will identify and protect significant cultural resources. Individual projects may require consultation with the Colorado State Historic Preservation Office, tribal historic preservation offices, and other interested parties.

- U.S. Army–retained sites and facilities will continue to be inaccessible to the public.

- As the refuge's budget and personnel duties allow, we will continue to implement the refuge's approved and current HMP and BTPDMP.

- Collaboration with our partner agencies or organizations will continue under established agreements. Cooperation and collaboration with Federal, State, tribal, and local governments; nongovernmental organizations; and adjacent private landowners will continue. Section 3.11 describes existing and potential partnerships.

- All wildfires occurring on the refuge will be managed under a full suppression strategy—accordingly, the potential benefits of naturally occurring wildfires will not be considered in pursuing this suppression strategy.

- Prescribed burns will be conducted in all habitat types on the refuge, and we will carry out all prescribed fire activities under our approved and current FMP, which conforms to DOI and Service policies. While the amount of prescribed burning will vary from year to year based on management objectives and fire conditions (for example, weather and fuel moisture), the refuge will continue to burn up to about 2,500 acres per year.

- In accordance with our approved and current IPMP, we will continue to control invasive weeds and carry out integrated pest management (IPM) using a variety of tools such as grazing and biological, chemical, and mechanical controls. We will continue to work in partnership with others to reduce weed infestations.

- By law and policy, we will continue to abide by all State water regulations regarding the use of surface and groundwater. It is important to note that the use of all water sources on this refuge is subject to the adjudication process of the Colorado Water Court. The resulting court decrees often define when, where, and for what beneficial use water can be diverted, used, and consumed. All changes in water use described in this plan must either be within the limits described in the existing decree for the specific water source or result from a successful application to and approval by the State engineer or the court.

- We will continue to acquire land within the authorized boundary areas of the refuge. These lands will be purchased from willing sellers as funding becomes available.

- We will continue to manage the refuge's fisheries in accordance with Service policy. All persons engaging in fishing activities will be required to possess a valid State-issued fishing license and to carry with them a refuge fishing permit while fishing. Fishing will be allowed only in designated fishing areas as posted and shown on maps.

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Fishing will be allowed under all alternatives.

- The public will be required to park in designated parking areas and must abide by all other refuge-specific regulations.

- We will adhere to all Service polices regarding rules and regulations for oil, gas, and mineral extraction on refuge lands. Access to subsurface minerals is regulated by Federal and State laws, which, in part, require the Service, as owner of the surface estate, to place reasonable restrictions on the mineral access in order to reduce disturbance to the surface estate.

Sustainability

Sustainability is a guiding principle of this CCP. The Service has set a goal for becoming carbon neutral by 2020 through avoiding emitting greenhouse gases, reducing unavoidable emissions, and offsetting any remaining emissions. This region's climate is conducive to the increased use of solar energy as a cost-effective and reliable form of alternative energy. The refuge's Visitor Center—which will be LEED certified in the near future—currently uses both geothermal and solar energy to reduce and offset its energy consumption while incorporating a variety of design techniques to increase energy efficiency. In addition, we use solar energy to power most of our electric wells, and we will continue to retrofit and improve our existing facilities.

By 2018, we anticipate installing new, wildlife-friendly photovoltaic solar arrays to support the refuge's maintenance facilities. If constructed, these solar arrays would occupy already disturbed sites within the refuge's administration area. These arrays might occupy approximately 1–2 acres of previously disturbed lands and will require some minor trenching.

We will also construct a new, more efficient administration office building and improve several other existing facilities that will receive a portion of their electricity from new solar generating systems. The Service recently issued a new Climate Leadership in Refuge (CLIR) tool that we will use to gauge greenhouse gas emissions and to comprehensively assess, and over time reduce, the carbon footprints of operations and of our visitors.

U.S. Army's Dams

Lands associated with four interconnected reservoirs and associated dams in the Irondale Gulch drainage on the refuge have already been transferred to Service ownership, but the responsibility of operation and maintenance of the dams was retained by the U.S. Army pending inspection and repair. These reservoirs are an important part of the refuge for both people and wildlife. Following floods in September 2013, the U.S. Army Corps of Engineers (USACE) completed an updated dam safety report (USACE 2014) on all four dams. This report makes several recommendations that must be completed prior to transfer of these dams to the Service. The U.S. Army is currently working to schedule needed repairs and improvements. Once these are completed, the Service plans to accept transfer of the dams as a part of refuge operation.

Fees

The refuge does not have an entrance fee nor will an entrance fee be considered in this plan. However, under the Federal Lands Recreation Enhancement Act, the refuge may charge reasonable fees for some of its programs. Fees are used to support programs and help pay for facility maintenance, brochures, passes, and fee envelopes. The refuge currently charges the following fees:

- Recreational Fee:
  - Daily Fishing—$3 per day for persons 16 years and older

- Non-Recreational Fees:
  - Facility Fee—$50 per day as a deposit for using refuge facilities, to be returned if there is no damage or need for unreasonable cleaning

- Commercial Photography—$50 dollars per day—a limited number of permits

After conducting a fee analysis, we are proposing the fees listed below based on what similar nearby facilities charge. In addition to daily fishing permits, we intend to offer an annual fishing pass to assist frequent users and reduce paperwork. In the future, we may also offer our facilities to outside organizations for wildlife-dependent presentations, training, and other functions. Due to the popularity of our facilities, we need some assistance in defraying costs and any additional staff time necessary to support events (such as after-hours, holiday, and weekend events). The following fee structure is common to all alternatives and would become effective January 1, 2016:

- Recreational Fees:
  - Daily Fishing (unchanged)—$3 per day for persons 16 years and older
  - Annual Fishing (new)—$50 per year for persons 16 years and older

- Non-Recreational Fees:
  - Facility Fee (new)—$50 per day plus any additional staff time for use of refuge facilities (such as commercial summer camp and fee-based programs)
  - Commercial Photography (changed)—$100 dollars per day

Alternatives B and C include new hunting opportunities. Fees would be assigned to these programs to assist with the cost of management. Fees for the programs would be developed as part of a future Hunt Management Plan.

Federal Duck Stamps and Federal Lands Recreation Passes

We will begin to sell Migratory Bird Hunting and Conservation Stamps (Federal duck stamp) and continue to issue Federal Lands Recreation Passes. The cost of both Federal duck stamps and the various Federal Lands Recreation Passes are determined nationally.

Surrogate Species

The principal purpose of a national wildlife refuge is to conserve fish and wildlife and their habitats. We are entrusted by the American people with conserving and protecting these resources; this commitment involves prioritizing certain trust resources on our refuges. Trust resources—wildlife and habitat for the conservation of which the Service has statutory responsibility—typically refers to federally listed threatened or endangered species, migratory birds, certain marine mammals and fish, and wetlands. The Service issued draft policy (FWS 2013a) focusing our attention on the following conservation priorities:

- recovery of threatened and endangered species
- implementing the North American Waterfowl Management Plan
- conserving migratory birds of conservation concern

As detailed in the refuge HMP (FWS 2013a), restoration and maintenance of habitat are central to accomplishing our mission. The presence and health of wildlife populations are key indicators in measuring the success of these efforts. However, more than 350 wildlife species have been documented on the refuge. With such a broad suite of species, habitat conditions (such as food, cover, and other life history requirements) that provide the needs of all these species individually cannot be managed consistently and reliably (FWS 2013a). Consequently, in 2006 the Service endorsed SHC as its new adaptive management business model. SHC recognizes that future conservation of fish and wildlife species must utilize new tools that function at broader scales, embracing landscape-level approaches. The key to this model is the designation of priority species as a guide for conservation design (National Ecological Assessment Team 2006). The selection of priority species is a valuable tool to assist in the development of conservation efforts.

The Service has further refined its SHC approach to focus conservation design on creating functional landscapes capable of supporting self-sustaining populations of fish and wildlife species (FWS 2012a). This approach is based on the selection of surrogate species, which Caro (2010) defined as "species that are used to represent other species or aspects of the environment." This guidance is still under development, but shows promise for a systematic approach to landscape-level conservation design that would address the essential limiting factors of certain species—in other words, using the surrogate species to help identify and nurture the habitat conditions necessary to preserve other sensitive species that would benefit from the same habitat conditions, thereby supporting biodiversity overall.

For the purposes of this CCP, we will use a limited number of species to inform our goals, objectives, and future management of the refuge. We have

chosen four species as surrogates—lark bunting, Cassin's sparrow, black-tailed prairie dog, and American bison—that are consistent with our focus on threatened and endangered species, declining populations of migratory birds, and the genetic conservation of bison. We believe these four species represent the majority of our habitats (shortgrass and mixed-prairie with a shrubland component) and will serve as good indicators for the application of adaptive management. If we successfully manage for these species, their ecosystems should respond favorably as well.

While the refuge supports other important habitat types (lacustrine, riparian, wetlands, and woodlands), their role on the refuge does not directly relate to national or regional biological goals, and so surrogate species have not been selected for these habitat types.

Lark Bunting

The lark bunting is the selected surrogate for the mosaic of shortgrass and mixed-grass prairie. The lark bunting is associated with Swainson's hawk, western meadowlark, mountain plover, long-billed curlew, short-eared owl, horned lark, and ferruginous hawk. We plan to restore up to 4,500 acres of native shortgrass prairie, providing suitable nesting habitat for the lark bunting and associated species.

Cassin's Sparrow

The Cassin's sparrow is the selected surrogate for mixed-grass prairie and shrubland (which includes sand sagebrush, yucca, and rabbitbrush). The Cassin's sparrow is associated with loggerhead shrike, western meadowlark, grasshopper sparrow, Swainson's hawk, short-eared owl, and vesper sparrow. We plan to restore and establish up to 8,000 acres of mixed-grass prairie, providing suitable nesting habitat for the Cassin's sparrow and associated species.

Black-Tailed Prairie Dog

The black-tailed prairie dog is the selected surrogate for a native vegetation community that not only supports prairie dogs, but also associated species such as burrowing owl, black-footed ferret, prairie rattlesnake, American bison, and many other species that reside on the refuge. We plan to manage a minimum of 2,585 acres (17 percent) of the refuge for prairie dogs.

American Bison

The American bison is the selected surrogate for shortgrass prairie and will be the primary habitat maintenance tool. The bison is associated with prairie dog, burrowing owl, and ferruginous hawks. A second goal of the refuge bison herd will be to serve as a genetic reservoir to lessen the chance of inbreeding depression and reduce the risks of disease and genetic drift. As of July 2014, our herd numbered 80 animals, exceeding the carrying capacity for current pastures. An additional pasture unit was developed in 2014 and, as more infrastructure is constructed, approximately 12,165 acres will eventually be available for bison grazing.

3.3 Structure of Alternative Descriptions

Since each alternative is designed to address the goals described in chapter 2, the description of each alternative is organized by goal:

- Habitat Management
- Wildlife Management
- Visitor Services
- Communications and Outreach
- Partnerships
- Cultural Resources
- Research and Science
- Infrastructure and Operations
- Access and Transportation

3.4 Summary of Alternative A—No Action

Alternative A, the no-action alternative, represents current management of the refuge (figure 7). This alternative provides the baseline against which the other alternatives are compared. It also fulfills the NEPA requirement that a no-action alternative be addressed in an EIS.

Under this alternative, management activities currently conducted by the Service will remain in effect as described in Section 3.2 and below. We would not develop any new management, restoration, or education programs. Current habitat and wildlife practices would not be expanded or changed except as allowed by existing approved plans such as those described in "Section 1.8—Other Planning Documents." Funding and staff levels would remain the same with little change in overall trends. Programs would follow the same direction, emphasis, and intensity as they do now.

The following is a synopsis of the major management actions called for in the HMP that we would continue to implement under all four alternatives.

Habitat Management

Under this alternative, we would continue to use an adaptive management framework to conserve, restore, and enhance the ecological integrity of the Front Range prairie communities, including the wetlands, trees, and native shrubs within those communities. We would use prescribed fire, mowing, grazing, and IPM to restore and then maintain refuge habitats.

We would manage for habitat diversity in fire-maintained ecosystems using management tools like prescribed fire, as described in the fire management plan (FWS 2013i).

Invasive species management would continue through the use of approved biological controls, physical controls, chemical controls, and appropriate cultural controls for the prevention, early detection, monitoring, and control (or eradication) of invasive plant species and other pests on the refuge (FWS 2014d).

Herbivore populations would continue to be managed as necessary to ensure the long-term sustainability of restored prairie and shrubland, contribute to the Service's bison metapopulation goals, and provide suitable habitat for species of concern.

Also, we would pursue a variety of strategies aimed at protecting wildlife habitat (such as fee-title acquisition, leases, and co-management of private lands).

Prairie

We would continue to pursue the goals specified in the 1999 habitat restoration plan and the HMP for restoring native prairie to develop diverse plant community mosaics that differ in composition, height, and density. These activities would promote successful long-term establishment and maintenance of seeded restoration sites, as well as existing native prairies and shrublands, to provide habitat for species of concern. We would continue to work with DIA and adjacent cities on co-management of specific parcels of wildlife habitat (such as the bison viewing area) and to acquire and protect inholdings and lands adjacent to the existing refuge boundary.

Shrubland

Shrubland would be maintained and restored where appropriate to provide suitable nesting habitat for Cassin's sparrow as well as forage and shelter for associated small mammals and deer.

Wetlands

Wetlands would continue to be managed to promote native emergent species, provide opportunistic benefits to wetland-dependent wildlife, and maintain spawning grounds for forage fish. Cattails would be treated when 80 percent or more of shorelines are covered with them within 30 feet of the shoreline.

Riparian Areas

Riparian corridors would be sustained. Surface flow would remain unaltered without actively managing hydrology. We would inventory this habitat.

Wildlife Management

We would maintain healthy wildlife communities in harmony with the refuge's historic cultural landscape—which includes New Mexico locust thickets, old farmstead windbreaks, and other planted trees—as well as with cottonwood galleries, created wetlands and lakes, and restored grasslands.

We would restore habitat for species of concern (such as grassland-dependent birds, burrowing owls, bald eagles, neotropical migratory birds, bats, and black-footed ferrets) using tools such as prescribed fire. We would continue to provide nesting sites for burrowing owls along with long-term quality nesting and roosting habitat for bald eagles. We would provide habitat in the refuge's Environmental Education Zone for neotropical migratory bird species that are losing suitable stop-over areas to urban development in the Denver Metropolitan area. We would implement riparian and prairie habitat recommendations from the HMP addendum to maintain a mosaic of wetland and riparian habitats to provide foraging habitat in support of big brown bat populations. We would discontinue the use of artificial bat roosts, also known as bat boxes.

Black-Footed Ferret

Federally listed black-footed ferrets would not be reintroduced to the refuge.

Surrogate Species

A population of black-tailed prairie dogs (FWS 2013h) would be preserved. This provides functions necessary to perpetuate native grasslands and support associated migratory birds (FWS 2013a).

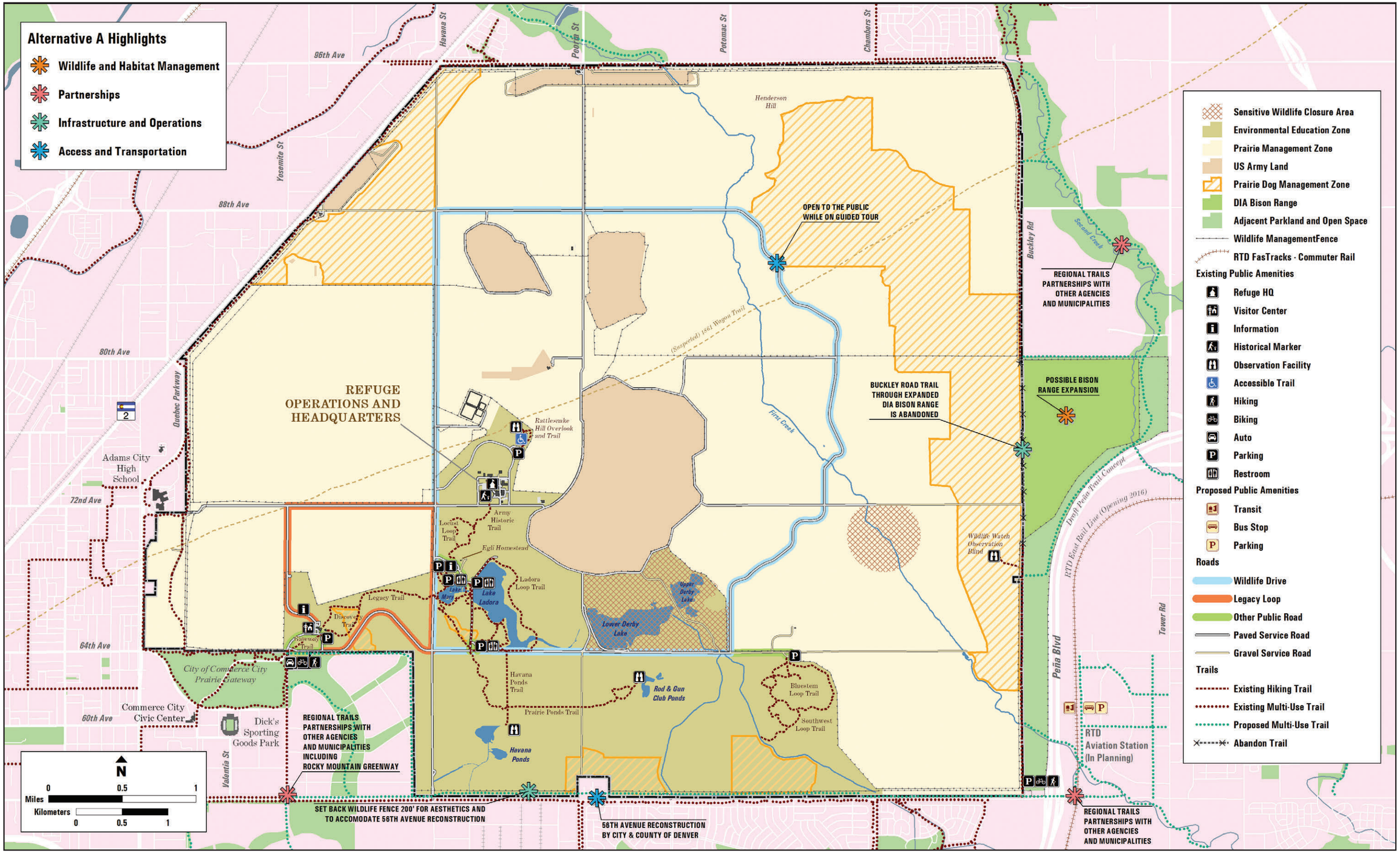

Figure 7. Principal features of alternative A.

We would continue to maintain a bison population that contributes to DOI's Bison Conservation Initiative and helps maintain the structure and composition of native and restored prairies necessary to support priority grassland bird species. Bison populations would be managed at or below the refuge's carrying capacity. The 80 bison currently making up the refuge herd exceed the present carrying capacity. Once additional grazing units are in place, long-term bison populations may range between 110 and 180 and should not exceed 209 individuals.

Other Native Species

No reintroduction of other native species (e.g., greater prairie chicken, sharp-tailed grouse, pronghorn) would be undertaken.

Visitor Services

Under this alternative we would maintain existing facilities and programs.

Hunting

The refuge would remain closed to all hunting and hunting-related activities (such as hunter education).

Fishing

The refuge would continue to be open for catch-and-release fishing from April to October in accordance with State fishing regulations.

Wildlife Observation and Photography

Wildlife observation and photography opportunities would continue to be provided on the refuge, supported by a self-guided auto tour, nature trails, and a wildlife viewing blind near the Rod and Gun Club Pond. Seasonal closures to protect sensitive wildlife areas and reduce disturbance to wildlife would be supported. A limited number of commercial photography permits are available each year; we would continue to evaluate requests for these permits on a case-by-case basis.

Environmental Education and Interpretation

The environmental education program would continue to be opportunistic, depending on the availability of time and staff. An environmental education curriculum is available to teachers, although a limited number of environmental education programs are offered due to our current staff shortage. The refuge has an active interpretation program and offers regular tours and programs. Interpretive panels, brochures, factsheets, Web sites, and maps would be updated as funding allows. We would continue to make use of the Contact Station to provide interpretive programs as well as to provide a venue for teachers to use our environmental education curriculum.

Communications and Outreach

Audiences

With the help of refuge volunteers, we would continue to reach out to traditional refuge visitors and local communities by participating in community outreach events such as Fishing Frenzy, Refuge Day, the Bass Pro Fishing Classic, Colorado Get Outdoors Day, the Aurora Youth Water Festival, the Barr Lake Birding Festival, and other events.

Emphasis of Outreach Message

We would continue to support the Service's Urban Refuge Initiative and to participate in special events and career development programs for local students.

Tools and Approaches

We would continue to manage Web site and social media platforms to reach a broad spectrum of visitors. The Wild News publication, a quarterly list of refuge tours and nature and interpretation programs, would continue to be distributed through an extensive email list; it is also available in hardcopy format in the Visitor Center and locations throughout local communities. The refuge has a current general brochure and rack card, and staff is developing brochures for trails and the auto tour.

Partnerships

Through partnerships with other organizations and municipalities (including those in the Rocky Mountain Greenway Trail Network and Sand Creek Greenway Partnerships), we would continue to create new trails and connect them with existing trails to form a trail network connecting the refuge with Two Ponds NWR and Rocky Flats NWR. Friends of Front Range Wildlife Refuges would continue to support refuge programs and operate the Visitor Center

store—Nature's Nest Books and Gifts. Partnerships with City of Commerce City Parks and Recreation and Bass Pro Shops to sponsor the annual Fishing Frenzy would continue. We would continue to work with the City and County of Denver and the Rocky Mountain Bird Observatory to implement the Urban Bird Treaty. We would continue to implement the Urban Refuge Partnership with Environmental Learning for Kids at their property in Montello. We would continue to develop our partnerships with the Denver Botanical Garden and Butterfly Pavilion for monarch and pollinator programs and outreach. We would continue to work with Mile High Youth Corps and Groundwork Denver for habitat restoration projects. The refuge would continue to employ Arrupe High School students—one student once a week—to assist with operation of the Visitor Center through an agreement managed by our regional diversity and civil rights office.

Cultural Resources

Under Section 106 of the National Historic Preservation Act (NHPA), we would continue to conduct cultural resource reviews for projects that involve ground-disturbing activities or that could affect buildings or structures more than 50 years old. Most of the refuge was intensively surveyed for cultural resources in 1994 and 1995, and the results of those surveys form an excellent basis for these reviews (Clark 1997).

We would avoid disturbing significant cultural resources unless such disturbance is necessitated by unusual circumstances. In addition, we would continue to conduct law enforcement patrols to monitor sensitive sites. We would continue to consult with the Colorado State Historic Preservation Office, Native American tribes, local governments, and members of the general public on matters pertaining to cultural resources. We would continue to adhere to other cultural resource laws; however, research opportunities would be minimal.

Artifacts currently stored at the refuge—both prehistoric and historic items—would be cared for and inventoried. We would explore and possibly implement deaccession of some artifacts.

Significant historic buildings, structures, and sites would be preserved and interpreted using signage and bus tours. The Egli house and garage, listed in the State Register of Historic Properties, would continue to be preserved through some stabilization actions and maintained in a state of arrested decay. This house and other historic sites—including the observation bunker, the old Officer's Club, the guard tower foundation, the weapons storage bunker, homestead sites, a wagon road, historical tree plantings, and farming equipment—would continue to be protected. (See following page for more details on the Egli farmstead.)

Research and Science

We are currently engaged in several research and monitoring programs; these will continue. Some projects support both research and monitoring and inventory programs. All this work is helpful for making management decisions.

Research

Trapping and banding burrowing owls contributes to research on the migratory pathways of burrowing owls in western North America. Other research opportunities arise, often unexpectedly and involving short-term levels of effort.

Monitoring and Inventory Programs

We would continue to conduct the following annual monitoring and inventory programs:

- Trap and band burrowing owls as a monitoring project (as well as for research) that may help evaluate trends in the migratory pathways of burrowing owls in western North America.
- Conduct bald eagle winter roost surveys and nest counts in cooperation with the Rocky Mountain Bird Observatory to help monitor overall riparian health of the refuge and bald eagle reproductive success at the refuge.
- Monitor raptor nests (such as those of Swainson's hawks and burrowing owls) in accordance with objectives in the HMP.
- Assess fish populations through electrofishing and gillnetting in accordance with objectives in the HMP to maintain a quality sport fishery.
- Conduct a deer census each fall to assess populations for inclusion into the refuge forage allocation plan.
- Conduct a bison roundup each fall to assess overall individual health and to evaluate populations for inclusion into the refuge forage allocation plan.

EGLI FARMSTEAD

Shortly after the arrival of the railroad, homesteading and other forms of new settlement began on and around the refuge. Settlement patterns changed over time as land was subdivided. Many of the new residents were recent immigrants from overseas. By the late 1930s, several hundred families were living within the boundaries of what would become the refuge (Hoffecker 2001).

Undated photo of Egli family members in front of their home.

Gottleib Egli was born in Switzerland. He and his family came to the area after 1910 and acquired a relatively large plot of several hundred acres. They built a home and farmed corn, alfalfa, wheat, barley, and millet, as well as pigs and cattle. With the creation of the Rocky Mountain Arsenal, the Federal government acquired the land through condemnation, and the hundreds of families on the property were forced to abandon their homes. By all accounts, most did so without protest, but the pain of the experience was never forgotten (Hoffecker 2001).

The Egli house and garage, near the refuge's Contact Station, are the only surviving pre–World War II structures on the refuge. The house and garage are now listed in the Colorado State Register of Historic Properties, and these structures were determined as potentially eligible for listing in the National Historic Register of Historic Places as representative of twentieth century agriculture in northeast Colorado.

A structural assessment of the buildings was completed in 2004, but little preservation has been carried out since (Preservation Partnership 2004). In 2014, the Friends of Front Range Wildlife Refuges replaced the roof and gutters and repaired the chimney and windows on the second floor.

In this plan we considered a range of alternatives for the Egli farmstead, all of which satisfy our requirements under the National Historic Preservation Act.

- *Alternative A*—we would continue to preserve the Egli House in a state of "arrested decay" and would interpret it in its current, deteriorated condition.
- *Alternative B*—we would preserve and interpret the Egli farmstead in the same was as we would under Alternative A.
- *Alternative C (proposed alternative)*—we would strive to complete a full restoration of the exterior of the Egli farmstead. We would install additional interpretive panels outside the house to explain the significance of the farmstead and past homesteading on the refuge.
- *Alternative D*—we would strive to complete a full restoration of both the interior and exterior of the Egli property to allow for reuse. While we have not identified specific future uses, they could include a variety of interpretational activities.

- Monitor native and invasive vegetation—especially at habitat restoration sites—to determine future management actions that may be necessary.
- Band 200 mourning doves to support national efforts to monitor migratory birds.
- Support Citizen Science projects in connection with the Great Backyard Bird Count in February.
- Conduct a Christmas Bird Count in January to support national efforts to monitor migratory birds.
- Conduct spring and fall bird counts in May and September to support national efforts to monitor migratory birds.

Citizen Science Projects at the Refuge

We will continue to support Citizen Science projects, especially the Christmas Bird Count in January, the Great Backyard Bird Count each February, and spring and fall bird counts in May and September.

Climate Change

We do not conduct research on climate change. However, refuge and U.S. Army personnel do collect meteorological data that may be useful in the future for establishing trends in climate change at the refuge.

Cindy Souders / USFWS

The refuge's Visitor Center houses several exhibits.

Social Science, Social Media, and Emerging Technologies

We do not currently conduct research in social science, social media, or emerging technologies. However, we do occasionally permit social science research that benefits refuge management.

Infrastructure and Operations

Staff and Funding

Tables 7 and 8 in section 3.11 provide information on the refuge's current funding and personnel, which would continue unchanged.

Volunteer Groups and Programs

At present, approximately 80 volunteers actively support refuge operations, including staffing the front desk of the Visitor Center, conducting interpretive tours and programs, performing light maintenance of trails and facilities, assisting with biological surveys, and staffing special events. A fenced pollinator garden behind the Visitor Center is maintained by volunteers and is in good condition. We would encourage the continuation of this project.

Facilities

Our visitor facilities include a Visitor Center, a Contact Station, three information kiosks, two amphitheaters, a fee station (iron ranger), and a wildlife viewing blind. A fenced pollinator garden and amphitheater are located behind the Visitor Center, with a second amphitheater at Lake Mary. No new facilities for observing and photographing wildlife would be developed, but existing facilities would be supported. A new administration building is planned and may be constructed. The Visitor Center includes an exhibit hall, a 73-seat auditorium, and discovery room. The Contact Station offers self-guided learning stations and can accommodate 60 students.

We would continue to host special events and meetings that support the purposes of the refuge and the mission of the Service and the Refuge System. We would consider hosting special events and meetings for DOI and other Federal, State, and local agencies on a case-by-case basis.

Under this alternative we would continue to safeguard the refuge from unnatural sounds and undue light contamination to the extent possible, but would not be able to retrofit existing structures to pursue this objective.

Energy Transmission Towers

In support of the Service's climate change policy, we implement all necessary measures to increase our facilities' energy efficiency and reduce the carbon footprint of our refuge management operations. Additionally, we intend to modify the energy distribution lines (by either burying or relocating them) when redeveloping certain areas of the refuge. If necessary, we will coordinate with the U.S. Army prior to removal of the existing electrical substation on the refuge.

Refuge Signs

Entrance signs are located at the main and Havana gates. Guide and directional signs are posted throughout the refuge. Interpretive panels are located at the Visitor Center, Contact Station, and Wildlife Drive information kiosks. All signs would be maintained.

Water-Control Infrastructure and Water Rights

There are five major dams on the refuge. Upper Derby Lake, Lower Derby Lake, Lake Ladora, and Lake Mary dams are currently owned and operated by the U.S. Army and are slated for transfer to the Service (as noted in section 3.2). Havana Ponds dam is owned and operated by the City of Denver and Urban Drainage and Flood Control District (UDFCD). The refuge will not accept transfer of the U.S. Army dams until the necessary repairs on Lower Derby Lake, Lake Ladora, and Lake Mary dams are complete. Upper Derby Lake dam would be partially breached prior to transfer and would no longer be considered a dam. Havana Pond dam is currently impaired or breached after flooding in 2013, but it is currently being repaired.

Fencing

There would be no changes to the refuge's existing fencing, sign design, and material standards.

Hours of Operation

The refuge would continue to be open from sunrise to sunset. In general, visitors would not be allowed in the refuge during hours of darkness.

Other Operational Topics

The UDFCD would include the refuge in an alert system (text alerts) to notify of emergency water conditions, such as flood threats. We would partner with FHWA and others to investigate the vulnerability of refuge infrastructure to extreme weather events.

Access and Transportation

Points and Types of Access

Currently, automobile, bus, and pedestrian travel are the modes allowed on the refuge. These would continue to be available year-round, unless the refuge is closed due to heavy snows. Recreational biking would continue to be permitted from the main gate—the Prairie Gateway—to the Visitor Center, but all other trails and roads would remain closed to this use. The single existing visitor access point would remain in effect.

Way-Finding and Sign Plan

The refuge would continue to use existing way-finding signs and would not develop a sign plan within the life of the CCP.

Roads and Related Infrastructure

The infrastructure and the type and condition of the existing roads would remain unchanged from the predominantly older asphalt roads left behind by Army operations. The roads would only receive the maintenance necessary to sustain current operations.

Legacy Loop

The Legacy Loop tour route would remain open to the public when the refuge is open.

Wildlife Drive

Under this alternative, the Wildlife Drive auto tour route would generally remain closed to the public, except for tours guided by refuge personnel.

Trail System

The Service would continue to maintain 10 miles of trails in the refuge. Sections of some trails that are currently closed due to flood damage would be repaired. The refuge would remain open to snowshoeing on existing trails.

3.5 Summary of Alternative B—Traditional Refuge

This alternative focuses on providing traditional refuge visitor uses and conveying the importance of conservation, wildlife protection, and the purposes of the Refuge System (figure 8). Access to the refuge would remain more limited than under alternatives C and D, and wildlife-dependent recreation, as well as community outreach, would be minimally expanded.

Habitat Management

Habitat management under this alternative would be similar to that under alternative A.

Wildlife Management

We would manage wildlife much as we would under alternative A, with the exception that we would seek to reintroduce the endangered black-footed ferret and, possibly, other native species.

Black-Footed Ferret

Provided that habitat conditions remain stable and captive ferrets are available for this project, we would hope to release 15–40 ferrets (with an approximate sex ratio of 50:50) during the first year, although that allocation could be staggered over several periods through the year. Subsequent ferret releases would be based on requirements outlined in the refuge's annual ferret allocation request submitted to the BFF Center. Ferrets to be released may come from existing wild ferret populations or from animals held and bred in captivity. Captive animals selected for release would be as genetically redundant as possible with the captive population. All released animals would be marked with passive integrated transponder chips, and some may be fitted with radio transmitters. Both captive-raised and wild-born translocated ferrets (trapped from other authorized ferret reintroduction areas) would be released directly into targeted prairie dog complexes at about 18 weeks of age or older. Releases are likely to take place in the fall when juvenile black-footed ferrets in the wild typically become independent; exhibit dispersal behaviors; and are more capable of killing their own prey, avoiding predators, and adjusting to environmental conditions.

Reintroduction of black-footed ferrets would require the legal safeguarding of neighbors in case of incidental take. Targeted outreach efforts would be used to educate refuge neighbors on ferrets and reintroduction issues. Public access to the northern half of the refuge would be restricted to support ferret and bison populations and research activities. For further detailed information on the reintroduction efforts and safeguards, please see "Appendix H—Biological Assessment."

We would also develop a live ferret exhibit to showcase ferret conservation efforts on the refuge and range-wide. This would generally display two live (preferably nonreproductive) ferrets. The selection of specific ferrets for the exhibit would be decided with the BFF Center and consider both range-wide ferret population goals and management considerations of the refuge (for example, individuals that have a history of repeatedly leaving the refuge would be suitable candidates for the exhibit). The exhibit would be designed for public viewing and to ensure a controlled and secure environment for the ferrets.

Surrogate Species

We would manage surrogate species as described for alternative A.

Other Native Species

We would carry out new feasibility and scientific studies to determine if the greater prairie-chicken, plains sharp-tailed grouse, and pronghorn could be reintroduced. We would reintroduce all native species that studies show could become self-sustaining. We would enforce seasonal closures to safeguard plains sharp-tailed grouse and greater prairie-chicken leks.

Visitor Services

We would foster the public's appreciation of natural resources and provide inclusive, high-quality, wildlife-dependent recreation, education, and interpretation. We would slightly increase accessible trails, reopen Rattlesnake Hill and Wildlife Watch, and add more wildlife viewing facilities. We would continue to conduct visitor use satisfaction surveys.

Hunting

We would use the refuge as a venue for educating visitors about hunting as a management tool and partner with CPW to offer hunting education courses. We would also implement a limited deer and dove

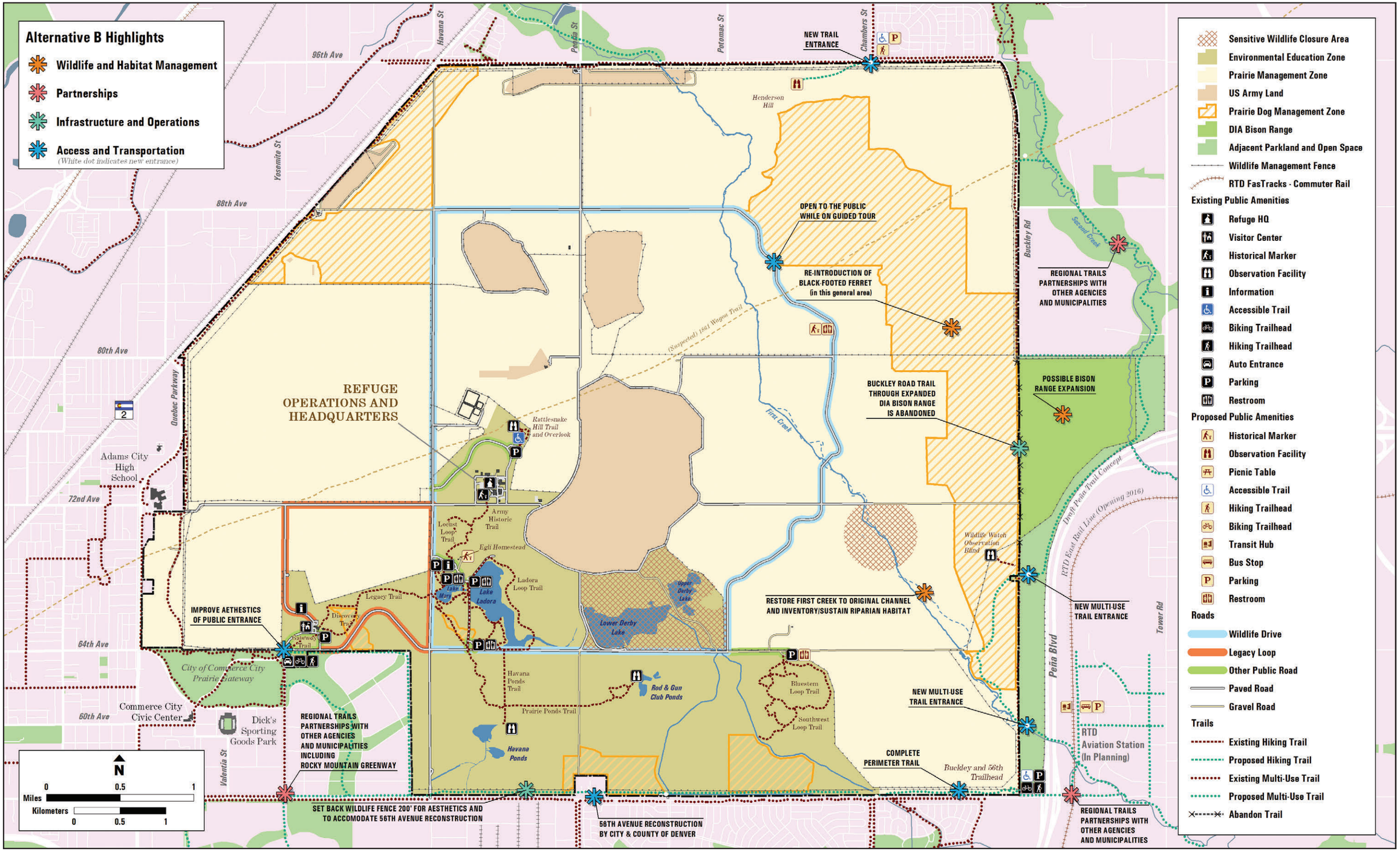

Figure 8. Principal features of alternative B.

hunting program. Hunting would be limited to special programs for youth and people with disabilities.

Deer and dove hunting would be carried out in conjunction with State hunting seasons. Additionally, refuge hunts would be by lottery draw only, restricting the number of hunters and the dates on which hunting is allowed.

Fishing

We would undertake minor renovations to facilities and signage to increase the quality of fishing opportunities. Otherwise, fishing opportunities would remain as described for alternative A. We would assess fishing satisfaction with the assistance of anglers, volunteers, and partners.

Wildlife Observation and Photography

In addition to the opportunities described for alternative A, we would add wildlife viewing facilities and trails at Rattlesnake Hill and Wildlife Watch. We would increase the accessibility of existing trails and facilities. Reintroduction of black-footed ferrets would provide new viewing opportunities for visitors.

Environmental Education and Interpretation

In addition to the opportunities described for alternative A, we would add new curricula covering black-footed ferrets. Implementation would begin with Rhythms of the Refuge, which would offer teacher resources and distance learning. The exhibit featuring live black-footed ferrets described above would contribute to the new environmental education and interpretive programs.

Communication and Outreach

We would continue to use the same communications and outreach tools, resources, messages, and levels of effort as described for alternative A. However, we would enhance our emphasis on the refuge's conservation efforts as well as the overall purposes of the Refuge System.

Audiences

We would target our traditional refuge use audience as well as wildlife enthusiasts. We would also increase public outreach and refuge promotion in neighboring communities to increase the visibility of the refuge and overcome negative perceptions.

Emphasis of Outreach Message

We would focus our outreach messaging to address safety concerns over the cleanup of refuge habitats, invite visitors to participate in refuge activities and programs, and explain the refuge's wildlife and habitat resources.

Tools and Approaches

Our outreach and communications tools and approaches would be similar to those under alternative A. In addition, we would encourage more cross promotion among partners to raise awareness of the refuge. We would also develop more bilingual resources (such as a refuge Web site, signs, and brochures); increase our communications slightly; and disseminate more information through existing outlets and media.

Partnerships

We would maintain our partnerships as described for alternative A.

Cultural Resources

We would manage cultural resources as described for alternative A.

Cindy Souders / USFWS

Refuge Day is an important outreach activity that helps connect members of the public to the overall goals of the Refuge System.

Research and Science

Research

In addition to the research activities described for alternative A, we would develop opportunities to conduct important research on the reintroduced black-footed ferret population in collaboration with the BFF Center.

Monitoring and Inventory Programs

In addition to the programs described for alternative A, we would undertake the following:

- Develop an Inventory and Monitoring Plan.
- Recommence water quality monitoring and data gathering.
- Adopt the findings of the water management plan.
- Reestablish yearly monitoring of cultural resources sites.
- Monitor reintroduced species for success.
- Introduce the use of hand-held devices (such as tablets) to facilitate improvements in data and information collection and monitoring.

Citizen Science Projects

In addition to the projects described for alternative A, we would increase the extent of existing bird counts as other opportunities arise and implement the Big Sit Bird Count—an annual, international, noncompetitive birding event hosted by Bird Watcher's Digest. It involves bird watchers tallying as many bird species as they see and hear from a limited site (17 feet in diameter) that they remain in for 24 hours.

Climate Change

We would initiate research and monitoring of phenological characteristics (that is, the relationship of plant and animal life cycles with seasonal and interannual variations in climate) of various species of plants, birds, and pollinators. We would also be more alert to impacts of climate change on habitat and wildlife regimes at the refuge.

Aaron Rinker / USFWS

Service staff perform a deer health check.

Social Science, Social Media and Emerging Technologies Research

As described for alternative A, we do not undertake such research. However, we do occasionally permit social science research that benefits refuge management.

Infrastructure and Operations

Staff and Funding

Tables 7 and 8 in section 3.11 provide information on the refuge's funding and personnel scenario under alternative B, which would be similar to, but slightly less than, that under alternative A.

Volunteer Groups and Programs

In addition to the groups and programs described for alternative A, we would help develop a reliable core group to staff the Visitor Center desk and lead various tours and programs. We would offer to support Eagle Scout projects and engage various scout volunteers in other ways.

Facilities

We would develop a site plan for a new administration complex, consider a new office building and the removal of unused facilities (such as trailers and some buildings), and replace current temporary bunkhouses.

In all future facility design, we would reduce the addition of nighttime light pollution, maintain existing ambient natural sounds, and avoid introducing sources of unnatural sounds.

Energy Transmission Towers

Our approach to energy transmission towers would be the same as under alternative A.

Refuge Signs

We would maintain the same array of signage as described for alternative A.

Water-Control Infrastructure and Water Rights

Dams and water rights would be managed as described for alternative A.

Fencing

We would develop a branding scheme, entailing a set of standards for fencing and signage design and material to be implemented consistently across the refuge complex.

Hours of Operation

The hours of operation would remain the same as described for alternative A.

Other Operational Topics

Efforts involving the UDFCD and activities relating to our vulnerability to extreme weather events would be the same as described for alternative A.

Access and Transportation

Points and Types of Access

We would enhance and improve the main general visitor access point, the Prairie Gateway entrance. We would maintain or reevaluate the need for three employee entrances (two electronically controlled, one locked). Current travel modes would continue and include Service-owned bus and vans, autos, recreational biking only to the Visitor Center, and pedestrian access. Commercial touring would not be available.

Way-Finding and Sign Plan

We would address navigation and new ways to bring people to the refuge (for example, way-finding, Colorado Department of Transportation [CDOT], marketing). We would also use way-finding to clarify circulation inside the refuge boundary. We would incorporate positive messages into signs—focusing on what is allowed rather than what is not allowed. We would provide rationales to explain road and area closures. Refuge maps in the Visitor Center and at all kiosk locations would be updated.

Roads and Related Infrastructure

The management of roads and related infrastructure would be as described for alternative A, except that we would discontinue maintenance of, or remove, some of the section line roads. Some of these roads have functional use for the U.S. Army and as firebreaks. The Wildlife Drive would be expanded to the northern loop for additional self-guided driving

opportunities. We would also formalize information gathering during the FHWA road inventory program network changes or updates.

Legacy Loop

We would improve way-finding along the route and address safety issues with improved mapping and signage. We would pave the remaining eastern section of the road.

Wildlife Drive

We would continue to provide bus-guided interpretive tours on the weekends (reservations would be required). Opportunities for self-guided tours would be developed.

Trail System

We would increase interpretive opportunities and accessibility on the existing trail system. We would improve and build new trail connections with outlying regional trails, complete the Perimeter Trail (coordinate with 56th Avenue Improvement Project and Stapleton), and continue building a connection with the Rocky Mountain Greenway Trail (figure 9). We would rehabilitate and reopen closed trails, including Rattlesnake Hill trail and those closed due to flood damage.

3.6 Summary of Alternative C—Urban Refuge

This alternative focuses on increasing the visibility of the refuge within the Denver Metropolitan area and welcoming many more nontraditional visitors to the refuge (figure 10).

Through an expanded visitor services program, an abundance of instructional programming, and widespread outreach, we would endeavor to connect more people with nature and wildlife.

Under this alternative, the refuge would be made more accessible to outlying communities with the opening of additional access points and the development of enhanced transportation systems.

Habitat Management

Habitat management under this alternative would be similar to that under alternatives A and B.

Wildlife Management

We would manage wildlife much as we would under alternative B.

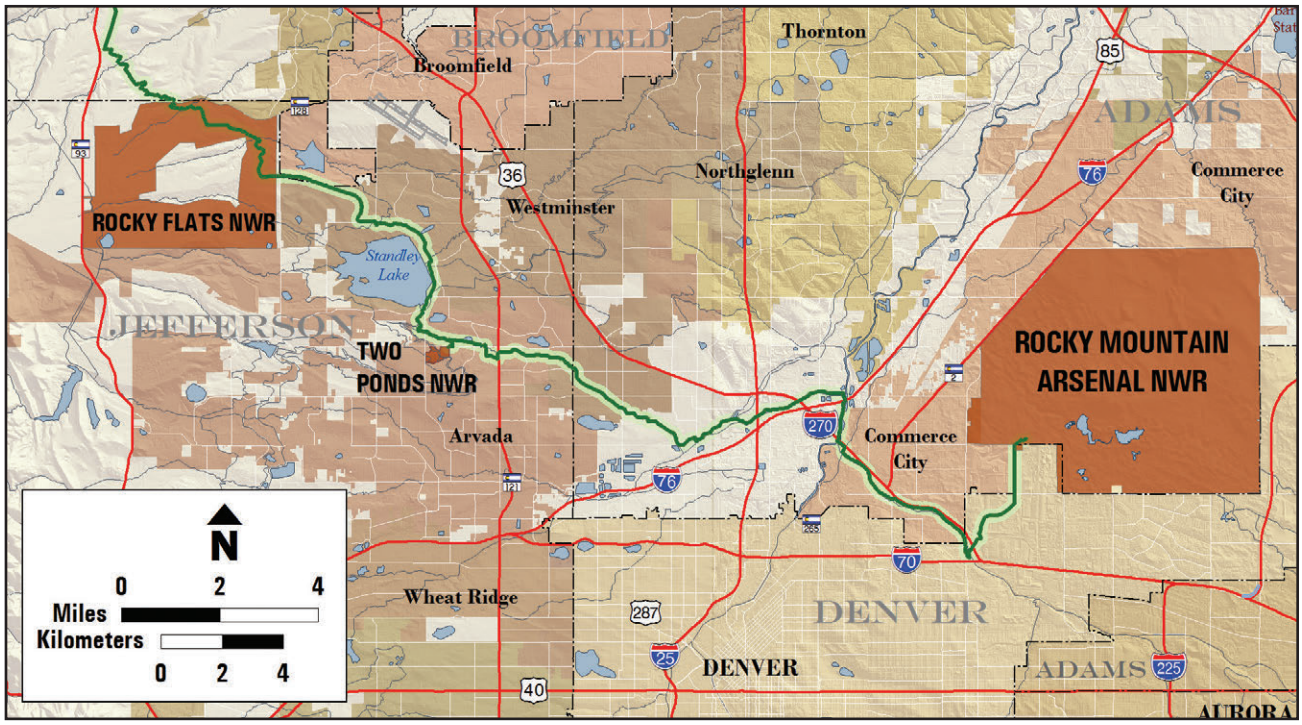

Figure 9. Refuge-to-refuge access on the proposed Rocky Mountain Greenway, Colorado.

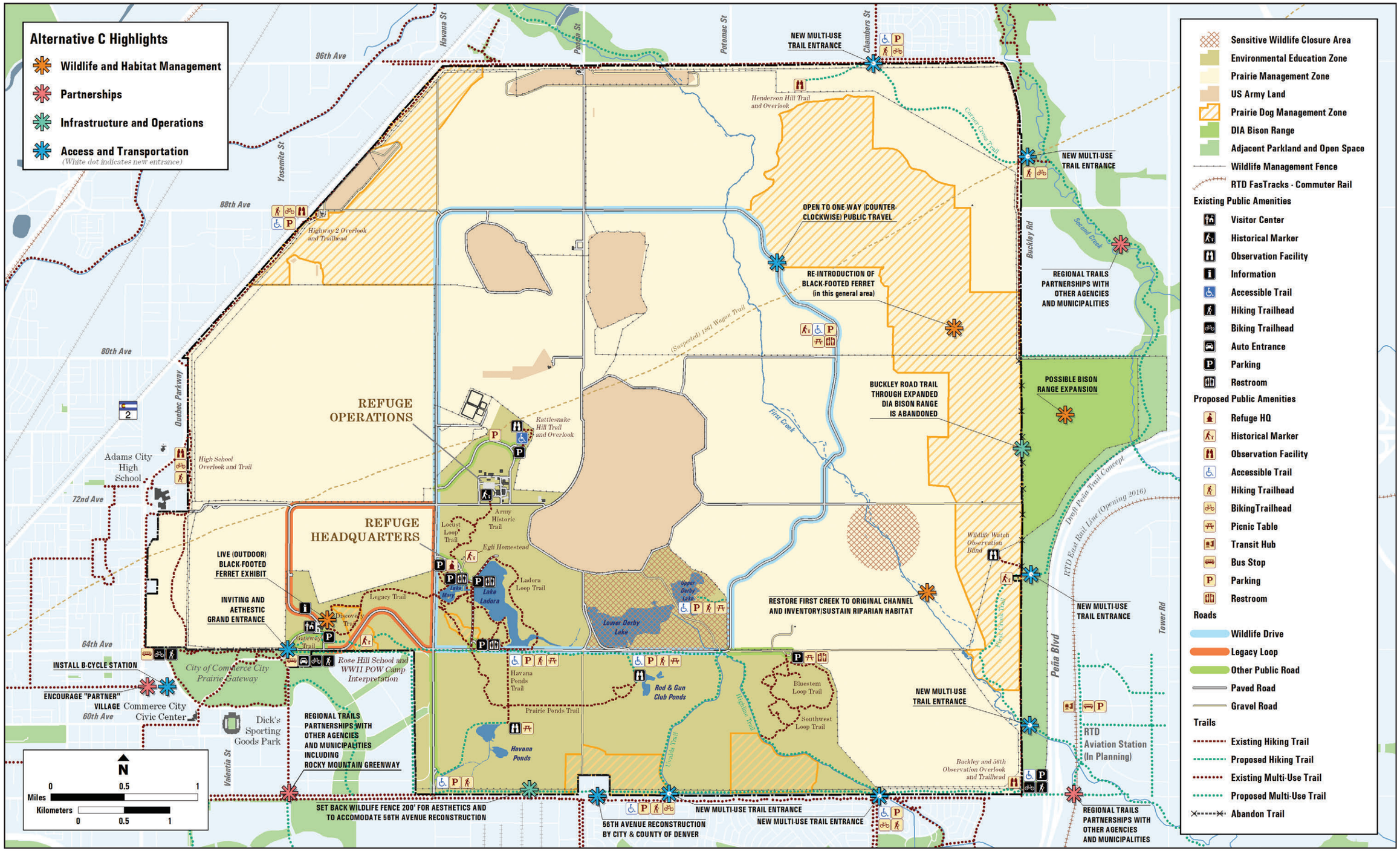

Figure 10. Principal features of alternative C.

Black-Footed Ferret

Our black-footed ferret reintroduction program would be the same as under alternative B. Also, we would investigate opportunities for the public to participate in black-footed ferret spotlighting surveys.

Surrogate Species

We would manage surrogate species as described for alternatives A and B.

Other Native Species

We would seek to reintroduce some or all of the other native species mentioned under alternative A to showcase native prairie ecosystems, even if the populations are not self-sustaining and require further reintroductions.

Visitor Services

Visitor services would include all the features described for alternative B, with the addition of those outlined below.

Hunting

In addition to the hunting-related activities described for alternative B, we would develop an archery range and offer instructional archery classes.

Fishing

In addition to the fishing opportunities described for alternative B, we would offer an annual fishing pass. We would initiate introductory fishing classes or educational opportunities and increase instructional fishing programs in partnership with Environmental Learning for Kids and others. We would consider spring instructional programming, hosting fishing clinics to prepare people for the summer season, and organizing additional fishing derbies.

We would improve access by offering shoreline fishing opportunities—an improvement over the current access that is only available from docks, and would improve Lake Mary as a developmental reservoir with more facilities, a high catch rate, and more user-friendly access.

Wildlife Observation and Photography

We would develop more wildlife observation and photography facilities; these would include a new viewing area, four viewing overlooks, and new trails with accessibility for all new facilities. We would increase access by expanding the Wildlife Drive.

We would develop partnerships to lead more instructional programming and guided tours. We would develop more interpretive panels and brochures to enhance self-guided visitor opportunities. Improved and simplified signs, along with expanded law enforcement, would be used to manage public use and reduce impacts on habitat.

Environmental Education and Interpretation

We would explore nontraditional ways to educate visitors about environmental topics. We would develop partnerships with other organizations and concessionaires to provide environmental education programs and summer camps. We would use current and emerging technology to extend educational "reach" and to connect with a broader audience.

A new Environmental Education Center would be constructed to provide quality experiences. We would deliver more conservation education programs to neighboring communities by partnering with other organizations, such as parks, libraries, recreation centers, and schools. We would expand interpretive programs for adult education as a potential venue for increasing stewardship and volunteerism. We would integrate more art into the refuge programming by developing a Refuge Artist program. We would work with partners to create refuge-inspired nature murals that would help raise the visibility of the refuge in local communities.

Communication and Outreach

Audiences

In addition to audiences targeted under alternative B, we would also target nontraditional refuge visitors and residents of outlying communities. We would strive to improve our understanding of urban demographics of the Denver Metropolitan area to enhance and sharpen our outreach efforts. To this end, we would develop a communications plan for the refuge built on a consistent message for outreach and media.

In support of our efforts to reach nontraditional and underserved audiences, develop messages and approaches to target specific minority groups, and develop outreach specifically tailored to engage youth, we would forge partnerships with groups like Exportiva, Univision, Community Enterprise.

Emphasis of Outreach Message

We would boost the visibility of the refuge and explain the Service's and Refuge System's missions, emphasizing the distinction between a city park and a wildlife refuge. We would emphasize that we invite our neighbors, as well as traditional and nontraditional visitors, to visit the refuge.

We would emphasize how the refuge benefits and serves the community by:

- encouraging better health and school performance by getting kids out in nature;
- improving air and water quality;
- benefitting future generations through the protection and appreciation of natural resources; and
- offering new entry points, expanded hours of operation, and more convenient access.

Tools and Approaches

We would significantly increase communication and disseminate more information through existing outlets and media—like social media, Web sites, and newsletters—while also developing new communication outlets to more effectively reach area residents. We would package refuge experiences into half- or full-day activities that would appeal to the local community, and we would create a monthly Refuge Saturday where organized tours leave from somewhere in the community, tour the refuge, and then return home.

We would use the latest technology to reach and connect with broad audiences, and would build a promotional campaign branding the refuge as a premiere urban refuge with a myriad of opportunities to connect people to nature.

Partnerships

We would focus on more partnerships throughout the Denver area—and especially in surrounding communities and local government agencies—to assist with outreach and to connect more area residents with refuge resources and programs. Encouraging community partners to use the refuge as a resource for educational and interpretive programming as well as for health and wellness activities would nourish their relationships both with their constituents and with us.

We would leverage partnerships to build physical linkages between the outlying communities, regional trails, and the refuge. By focusing on partnerships that will reach nontraditional visitors and supporting more instructional programming, we hope to connect a broader cross section of our community to their natural surroundings.

We would increase the use of Citizen Science and the collaboration between the refuge and local schools to work on habitat restoration.

We would expand partnerships to include Regional Transportation District (RTD), Denver Regional Council of Governments (DRCOG) and commercial partners.

Cultural Resources

We would manage cultural resources as described for alternative A with the additions listed below:

- We would allow additional storage in existing buildings.
- We would consider additional display of World War II and Cold War items at existing refuge facilities.
- We would enter into partnerships with the Native American community to interpret the prehistoric landscape.
- We would strive to complete full restoration of the exterior of the Egli farmstead, enhancing the public's experience.
- We would provide more guided interpretation (without signs) of cultural resources suited for outdoor storage, such as farm equipment and some World War II/Cold War machines.

Research and Science

Research

In addition to the priorities discussed for alternative B, we would evaluate prairie dog densities, especially as they relate to potential reintroduction of black-footed ferrets. We would emphasize the use of public participation and social media as means of acquiring and collating data to support refuge management.

Monitoring and Inventory Programs

In addition to the programs described for alternative B, we would delegate some of the monitoring and data-gathering activities to volunteers and partners, taking advantage of the increased accessibility and visitation at the refuge, and develop Citizen Science projects to support monitoring of the ferret population as well as bald eagle nesting and roosting. We would enhance monitoring of visitation commensurate with the increased access points, trails, and road system. In addition, neighbor satisfaction surveys would be established.

Citizen Science Projects

We would create additional Citizen Science opportunities, such as tracking phenological characteristics and the monitoring efforts mentioned above. In addition, we would investigate opportunities for the public to participate in black-footed ferret spotlighting surveys.

Climate Change

Our pursuit of climate change information would be the same as described for alternative B.

Social Science, Social Media, and Emerging Technologies

We would consider the installation and use of remote cameras to monitor and provide Web-based public viewing of refuge fauna for species like bald eagles and black-footed ferrets. In addition, we would broaden the use of existing and emerging technologies and social media to aid in wildlife management and tracking while also engaging visitors in conservation activities. For example, we would likely use Facebook, Twitter, or a future social media application to report sightings of birds banded on refuge lands.

Infrastructure and Operations

Staff and Funding

Tables 7 and 8 in section 3.11 provide information on the funding and personnel scenario for alternative C. Alternative C would entail the largest staff and budget of all alternatives.

Volunteer Groups and Programs

In addition to the groups and programs described for alternative B, we would strive to increase the number of volunteer projects and substantially grow the number of refuge volunteers by recruiting from neighboring communities and throughout the Denver Metropolitan area; supporting the Denver Parks and Recreation volunteer coordinator in hosting a project or program on the refuge; and using large volunteer projects (such as National Public Lands Day) to draw attention to the refuge. We would increase offerings of programs that allow visitors to drop in without prior reservations. In planning special events and other programs, we would emphasize quality over quantity. Smaller events would allow for more creativity and would cost less.

Facilities

This alternative would entail substantial changes in the refuge's management direction. We would significantly expand the number of visitor amenities such as restrooms, shade structures, and tables to accommodate more visitors. We would develop facilities that are more appealing to family gatherings.

The Contact Station would be replaced with a building better suited to educational programming as well as providing meeting space for an array of user groups. Other new facilities would include additional viewing platforms, observation decks, and wildlife observation and photography facilities. We would reopen and improve the Wildlife Watch area; establish a bison viewing area outside the refuge; construct an overlook at Lower Derby Lake; expand and improve interpretation, photography, and wildlife observation opportunities along the Wildlife Drive by constructing more pullouts that feature interpretive panels and observation facilities; build orientation and interpretive kiosks at new pedestrian entrance points; and, if grouse establish leks, we would establish blinds where visitors can observe the birds without disturbing them.

In addition, we would allow vehicular traffic to exit the refuge at two additional sites: at 56th Avenue and Havana Street, and at 72nd Avenue and Quebec Street.

Energy Transmission Towers

We would work to eliminate transmission towers and lines. We would take additional measures to increase energy efficiency and reduce the carbon footprint of operations by expanding our solar array and by incorporating more sustainable practices when developing or renovating additional or existing infrastructure.

Refuge Signs

We would enhance the primary entrance by coordinating with the City of Commerce City to reduce confusion at the entrance and by developing a refuge monument sign that would draw visitors. We would initiate coordination with neighboring partners to develop a unified signage plan, and would use the perimeter fencing as a communication medium for refuge signs, identification, and interpretation. Way-finding and interpretive kiosks would be built to support transportation improvements.

Water-Control Infrastructure and Water Rights

Dams and water rights would be managed as described for alternatives A and B.

Fencing

Building on the branding scheme mentioned for alternative B, we would construct a new gateway arch at the main public gate, install a split-rail fence in some areas to establish a more aesthetically pleasing boundary, establish wildlife fencing that is set back from roads, and create distinct access points where the fence could be opened to foot traffic.

Hours of Operation

The hours of operation would remain the same as described for alternatives A and B.

Other Operational Topics

Efforts involving the UDFCD and activities pertaining to our vulnerability to extreme weather events would be the same as described for alternatives A and B.

Access and Transportation

Points and Types of Access

Under alternative C, we would add pedestrian and bicycle access points and work with RTD to connect neighborhoods to the refuge via the public transit system. Additional travel modes including cross country skiing, jogging, and expanded bike access would be permitted. We would also consider adding another Service-owned bus with bike racks, as well as a commercial bus and a bike sharing system.

Way-Finding and Sign Plan

In addition to improvements described for alternative B, we would coordinate with neighbors and partners to develop a unified approach to our way-finding and signage program.

Roads and Related Infrastructure

In addition to improvements described for alternative B, we would improve multiple intersections, and we would modify the large Texas Crossing on the northern Wildlife Drive. We would incorporate bike infrastructure into the road system. Signs on the refuge would be enhanced for improved movement and flow.

Legacy Loop

We would add additional pull-outs and add a designated bike/pedestrian path that is paved, detached from the road, and in keeping with accessibility standards.

Wildlife Drive

We would expand scheduled bus or tram service (that is, not requiring reservations) in coordination with RTD. In addition, we would open the entire drive to public vehicles for one-way traffic. This added access would entail building pull-outs, improving interpretive signs and way-finding along the route, and modifying the Texas Crossing for safe public use.

Trail System

We would build new and extend existing trails with additional trailheads and access points, such as expanded trails at Eagle Watch and Henderson Overlook. In addition, we would open some roads and trails to bicycle access. We would coordinate with stakeholders and adjacent landowners to manage pedestrian and bicycle access along the Perimeter Trail.

3.7 Summary of Alternative D—Gateway Refuge

This alternative emphasizes increased visibility of the refuge, the refuge system, and other public lands in the area (figure 11).

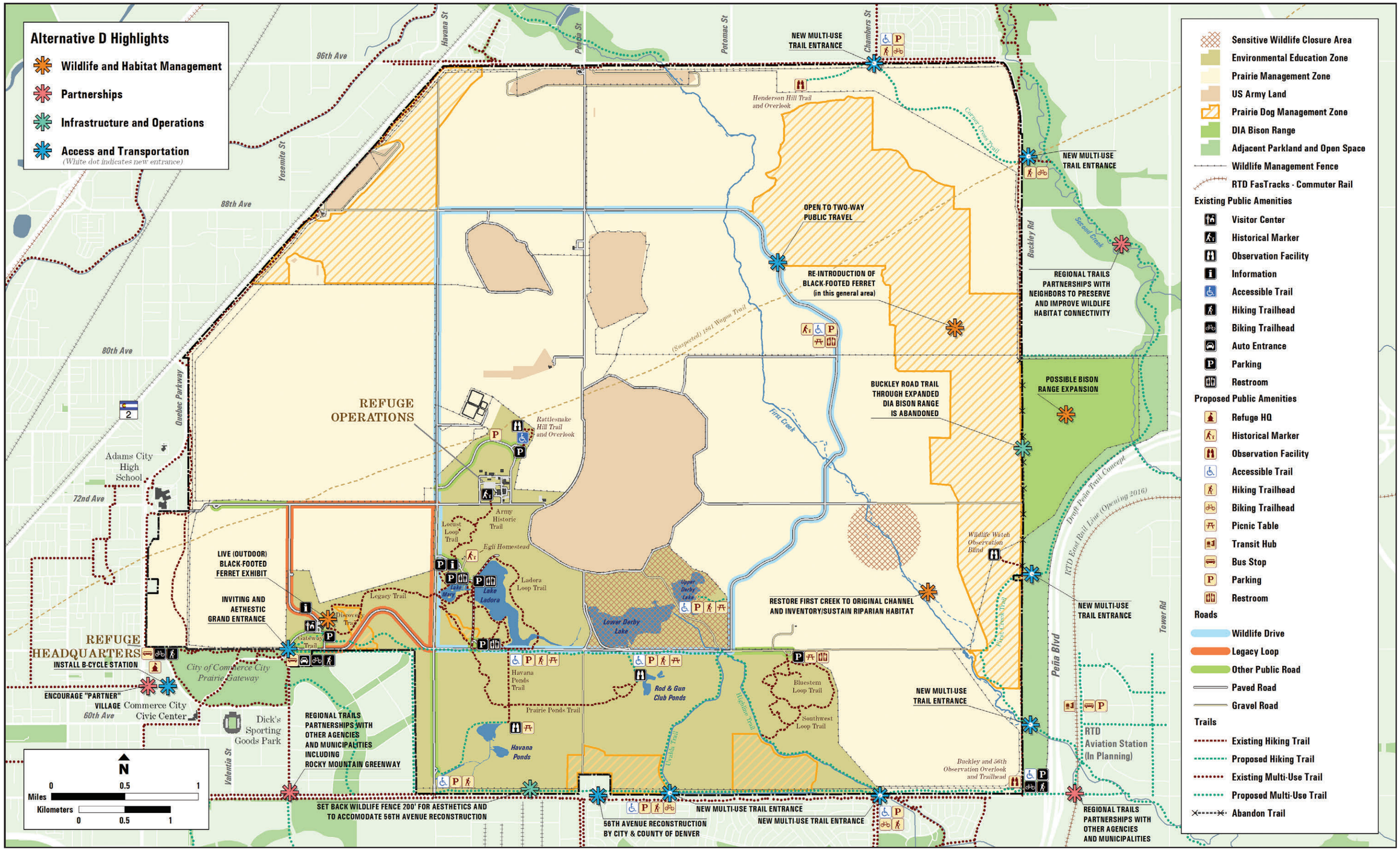

Figure 11. Principal features of alternative D.

There would be less visitor services programming at the refuge than under Alternative C, and we would emphasize offsite programs in conjunction with partners.

Habitat Management

Habitat management under this alternative would be similar to that under alternatives A, B, and C. Additionally, we would pursue collaborative efforts with neighbors and other groups to preserve and improve wildlife habitat connectivity.

Wildlife Management

We would manage wildlife much as we would under alternatives B and C.

Black-Footed Ferret

In addition to the priorities described for alternative C, we would establish a ferret-specific set of partnerships and collaborative activities, sharing knowledge with entities such as CPW, the Denver Zoo, and the BFF Center. In addition, we would develop partnerships with CPW to manage ferrets onsite and offsite.

Other Native Species

In addition to the priorities described for alternative B, we would work with neighboring landowners to extend the range of native species.

Surrogate Species

We would manage surrogate species as described for alternative A.

Visitor Services

Hunting

Hunting-related activities would be similar to those described for alternative A—that is, there would be no hunting or hunter education—but we would promote hunting opportunities throughout Colorado and the Refuge System.

Fishing

In addition to the fishing opportunities described for alternative C, we would explore raising fees to support increased fish stocking rates and expanded programming, as well as increasing fishing days and hours. We would promote fishing opportunities throughout the Refuge System and Colorado, and we would partner with others to implement fishing improvements and expanded programming such as more advanced fishing classes (fly fishing demonstration, fly tying, fish identification) and more partner-run fishing programs and events. We may offer a fishing concession (such as rod rentals and lessons).

Potential partners could include nonprofit organizations such as SPREE: The Greenway Foundation, corporate partners like Bass Pro Shop, and agency partners like CPW.

Wildlife Observation and Photography

In addition to the opportunities described for alternative B, accessibility would be incorporated into all new facilities. We would offer more partner- and concessionaire-led guided tours and programming, as well as advanced photography classes.

We would promote the refuge as a birding destination. If native species—such as greater prairie-chicken, pronghorn, and plains sharp-tailed grouse—are reintroduced, we would offer wildlife viewing and tours to plains sharp-tailed grouse leks led by partners or concessionaires.

Environmental Education and Interpretation

In addition to the opportunities described for alternative B, we would expand environmental education programming at the refuge for youth and adults. We would explore concessionaire- or partner-led summer camps on the refuge, design a career experience program, develop a summer refuge intern program, develop vocational programs for high school and college students, and work with surrounding high schools and community organizations to raise awareness of and promote conservation careers.

We may offer regular educational adult forums (such as invited speakers), possibly charging an admission fee to help entice speakers. We would collaborate with universities to expand learning opportunities, and would support student researchers, whose engagement could include making presentations to visitors. We would offer expanded interpretive programs about refuge history and cultural resources.

We may develop more programs in partnership with neighboring parks and recreation departments and the Sand Creek Greenway. We would encourage partners to cross-promote refuge programs, interpret at their sites, and incorporate nature play into facilities at their sites. We could provide more offsite interpretive programming.

We may explore developing an onsite living history program in collaboration with outside partners, beginning with the rehabilitation of the Egli House as a venue. Such a program could include reenactments of prairie living—such as the settlement era, Native American history, and wagon train prairie crossings.

Communications and Outreach

Audiences

Our target audiences would be similar to those under alternative C. We would develop a communications plan for the entire refuge complex, and we would recruit partners to reach out to their constituencies. We would specifically target birders and history enthusiasts, as well as appealing to international visitors.

Emphasis of Outreach Message

In addition to the message outlined for alternative B, we would emphasize conservation and highlight the refuge's transformation and evolution. We would appeal to history enthusiasts with messaging related to the site's history. We would step up promotion of the entire refuge complex as well as other regional prairie sites, and we would coordinate with regional entities to promote improved regional access to the refuge.

Tools and Approaches

The Colorado Parks and Recreation Association (CPRA) is an untapped resource that we might engage, participating in that entity's state conference and inviting its members to visit the refuge. The CPRA could create a promotional package for the refuge. We could also approach Channel 8, Denver Business Bureau, DIA, and Visit Denver to help us promote the refuge, and we could establish more of a presence at DIA. We could use the refuge Web site as a clearinghouse for regional events and activities.

We would use the latest technology to reach broad audiences and connect with them. Possibilities include:

- employing social marketing to broaden the Service's reach;
- engaging visitors to use social media to share wildlife sightings and plant discoveries (a component of Citizen Science that can also help refuge biologists);
- maintaining and regularly updating the refuge Web site;
- soliciting partners and volunteers to post regularly on Facebook;
- recruiting interns to explore technologies and outreach strategies;
- sharing refuge images and videos (using social media such as Instagram, Pinterest, and YouTube); and
- translating the Web site into multiple languages to help boost international visitation.

Partnerships

We would focus on engaging partners to expand programming and wildlife-dependent recreation and increase their autonomy in conducting these activities. Using this approach, we would support activities such as day camps, the Master Naturalist Program, certified interpretive guide training, Backyard Habitat with the National Wildlife Federation, photography tours and classes, advanced birding with groups such as Audubon, and fishing clinics with groups like Trout Unlimited and Orvis.

USFWS

Secretary of the Interior with members of the Mile High Youth Corps

We would expand our breadth of partnerships to include conservation organizations, local governments, government agencies, and private companies in expanding programming and visitor use activities both on and off the refuge. We would establish a regional prairie coalition to cross-promote programming, activities, and research among conservation groups and natural areas throughout the Front Range. We would engage partnerships to create more physical links connecting outlying communities, regional trails, and the refuge.

We would develop specific partnerships to support black-footed ferret recovery and collaborative activities, working with groups such as CPW, the Denver Zoo, and the BFF Center. We would also develop partnerships with CPW to manage ferrets on- and offsite, enter into collaborative efforts and partnerships with neighbors and other groups to preserve and improve wildlife habitat connectivity, and increase collaboration with other divisions of the Service and other agencies and organizations on issues related to migratory birds and federally listed species. We would seek ways to collaborate with other states and nations to address species concerns that transcend borders (for example, Swainson's hawk research and management in Argentina); leveraging, if possible, nearby cities' international sister cities to share conservation research and practices.

We would build additional partnerships with light rail or Fast Tracks, CDOT, DIA (for outreach to international travelers), and RTD (to promote increased frequency of routes providing refuge access). We would pursue other partnerships (for example, with FHWA, NPS, USFS, USFWS R6 RO, cities, counties, and nonprofit organizations) under the America's Great Outdoors initiative.

We would work with partners and corporate sponsors to host two additional large annual events. We would tie into nationwide events like Public Lands Day, Earth Day, and National Trails Day. We could host some other type of large-scale race, fundraiser, or competition on the refuge that could start and finish offsite to keep the parking and traffic outside the refuge.

Cultural Resources

We would manage cultural resources as described for alternative C with the additions listed below:

- We would work with partners to establish an offsite World War II and Cold War museum owned and operated by an organization other than the Service.
- We would conduct further research on prehistoric sites on the refuge.
- We would undertake full restoration of the interior and exterior of the Egli farmstead to allow for reuse and comprehensive interpretation.
- We would permit and encourage occasional living history interpretation of early homesteading/farming and establish electronic/remote tools to provide interpretation.

Research and Science

Research

In addition to the priorities discussed for alternative C, we would strive to increase collaborative research projects where the refuge serves as a field laboratory for others. We would research prehistoric use of overlooks at First Creek and Second Creek. If possible, we would make existing office trailers available to facilitate research on black-footed ferrets.

We would increase cooperation with universities and other institutions of higher education, both nationally and internationally, on research initiatives. We would explore increasing research programs to study the response of grassland birds (such as lark bunting, grasshopper sparrow, and Cassin's sparrow) and pollinators (bats, insects, and birds) to evolving prairies that have been subjected to habitat restoration activities. We would also study responses of coyotes to changes in prey base, parasitism (such as mange), and wildlife diseases (like rabies, chronic wasting disease, botulism, and avian influenza).

Monitoring and Inventory Programs

In addition to the programs described for alternative C, implement monitoring and inventory for research projects described above. In addition, we would jointly monitor (with organizations like DIA and APHIS) the spread and extent of prairie dog populations.

Citizen Science Projects

In addition to the programs described for alternative C, we would link Citizen Science opportunities with other citizen research that takes place elsewhere on the refuge complex as well as on partners' sites.

Climate Change

In addition to the programs described for alternative B, we would seek information and opportunities to exchange knowledge with neighbors, other agencies, and partners. We would collaborate with DIA, CDPHE, and the Regional Air Quality Council (RAQC) on air quality monitoring.

Social Science, Social Media, and Emerging Technologies

In addition to the efforts described for alternative C, we would, as appropriate, institute the use of the same data collection and modeling platforms that refuge partners and other agencies use, and we would enlarge the range of partners and other agencies with whom we would share wildlife data (such as bison and bird bands).

Infrastructure and Operations

Staff and Funding

Tables 7 and 8 in section 3.11 provide information on the funding and personnel scenario for alternative D.

Staffing would and budget under alternative D would be less than under alternative C but more than under alternatives A and B. We would add commercial transit operators and a partner coordinator would replace the Service-supported volunteer coordinator.

Volunteer Groups and Programs

Although the volunteer programs under alternative D would be similar to those under alternative C, alternative D calls for the largest volunteer program of all the alternatives. In addition to the strategies described for alternative C, we would develop a system for sharing volunteers among the three refuges in the complex, as well as among partnering groups.

Facilities

In addition to the facilities directions described for alternative B, we would develop food concessions and partnerships with food truck businesses. We would also rehabilitate and improve facilities to better interpret cultural resources and enhance the visitor experience. We would rehabilitate the old U.S. Army communications building (Building 112) to house exhibits interpreting the site's history, or perhaps convert it into a Cold War museum. We would improve and interpret the bunker on the northern loop (observation bunker for impact area). We would identify and memorialize the POW internment camp and also memorialize the Ivory Crush event that was held on the refuge in 2013 to dramatize the severity of the illegal wildlife trade.

Energy Transmission Towers

Our approach to energy transmission towers and other energy-related infrastructure would be the same as under alternative C.

Refuge Signs

In addition to the signage priorities described for alternative C, we would develop signs to promote other regional opportunities.

Water-Control Infrastructure and Water Rights

Dams and water rights would be managed as described for alternatives A, B, and C.

Fencing

In addition to the fencing priorities described for alternative C, we would improve the appearance and uniformity of fencing and refuge access points, extend branding across the refuge complex and to adjacent jurisdictions and landowners, and identify additional access points where the fence could be opened to foot traffic to promote regional connections.

Hours of Operation

The hours of operation would remain the same as described for alternatives A, B, and C.

Other Operational Topics

Efforts involving the UDFCD and activities pertaining to our vulnerability to extreme weather events would be the same as described for alternatives A, B, and C.

Access and Transportation

Points and Types of Access

In addition to the priorities described for alternative C, we would add pedestrian and bicycle access points to Henderson Hill overlook and trail (north boundary), add southeast viewing access, create more connections to the Rocky Mountain Greenway, create a trail connection to the Fast Tracks Pena station, and reach out to DIA to improve the physical connections between the airport and the refuge. Travel modes would include snowshoeing, cross-country skiing, road or mountain bikes, and automobiles. We would develop a more robust bike sharing system with links to regional trail systems and regional B-cycle stations, and we would focus on developing and promoting the Rocky Mountain Greenway and ways to physically link the three refuges.

Way-Finding and Sign Plan

The way-finding and sign plan under this alternative would be similar to that described for alternative B.

Roads and Related Infrastructure

In addition to the improvements described for alternative C, we would incorporate bike infrastructure into the road system, including striping bike lanes and an off-street path on the southern loop; we would also stripe for two-way traffic and add pull-outs, traffic control, and speed bumps on the northern portion of the Wildlife Drive.

Legacy Loop

Improvements to Legacy Loop would be the same as those described for alternative C.

Wildlife Drive

In addition to the improvements described for alternative C, we would open the drive to public vehicles for two-way traffic.

Trail System

In addition to improvements described for alternative C, we would develop an even more extensive trail system, coordinate with stakeholders and adjacent landowners to manage access along the Perimeter Trail, work to Connect Rocky Mountain Greenway Trail with First Creek Trail and Second Creek Trail, improve signs, and promote trail links.

3.8 Foreseeable Activities

Denver International Airport

DIA abuts the refuge on the east, the boundary between them defined by Buckley Road. From 56th Avenue to approximately 80th Avenue, Buckley Road is shared by the refuge and DIA: the northern half owned by DIA and the southern half by the refuge. Buckley Road has been vacated in this general area.

Encompassing 53 square miles, DIA is the largest airport in North America and the second largest airport in the world. This extent is intended to minimize the impacts of airport activity on the airport's neighbors and to allow room for the airport to expand. Forecasts indicate that DIA will experience 2.3–2.5% annual growth between 2015 and 2040 (Brandon Howes, senior landside planner, Planning and Environmental Services, Denver International Airport; e-mail; January 2015).

DIA's original master plan, developed in 1988, provided guidance for the airport to a threshold of 50 million annual passengers. Having reached that threshold, DIA completed a master plan update in 2011 that provides development guidelines through 2030. In the short term, DIA will complete a new 519-room on-airport hotel in 2015, build a new fire station, and connect to the East Commuter Rail line by 2016. The construction of a new (seventh) runway and capacity expansion of Peña Boulevard (the airport's entrance road) are anticipated for the intermediate term (Denver International Airport 2009).

In July 2014, Denver Mayor Michael Hancock in his State of the City Address announced that Denver Parks and Recreation would restore nearly 200 acres of habitat between the refuge and Peña Boulevard.

> I am also proud to announce that the city is restoring and preserving nearly 200 acres of habitat between the Rocky Mountain Arsenal National Wildlife Refuge and Peña Boulevard near DIA. Adjacent to the 61st and Peña transit station, we envision an accessible open space area of native grasses and waterways where people can walk with their kids and take in awe-inspiring views. They might even see bison and bald eagles.
>
> I want to thank our partners at the refuge as we launch this project. I hope we will ultimately be able to restore more than 650 acres of open space in this corridor in collaboration with our neighbors in Commerce City and Adams County.

Surrounding Roadways

Section 5(a)(2) of the Rocky Mountain Arsenal National Wildlife Refuge Act of 1992 (Public Law 102-402, 106 STAT 1961) required the U.S. Army to provide up to 100 feet of land to State and local governments to expand existing roads surrounding the refuge. Proposed improvements to State Highway 2, 56th Avenue, and 96th Avenue are described below.

Highway 2

State Highway 2 defines the northwestern boundary of the refuge from Quebec Parkway to 96th Avenue. The refuge perimeter trail and several proposed overlooks are located in this corridor.

In September 2014, the City of Commerce City issued a request for proposals to begin preliminary planning and design to expand Highway 2 between 72nd Avenue and the bridge over the Burlington Northern–Santa Fe railroad (660 feet short of Interstate [I-] 76). This project would include all aspects of planning necessary to begin construction in March 2016.

56th Avenue

The refuge's southern boundary from Buckley Road to Havana Street follows 56th Avenue, a major east–west regional thoroughfare. In addition to its regional function, 56th Avenue serves as an important access route to DIA as well as providing relief to I-70 during freeway incidents.

In 2008, the City and County of Denver, in partnership with FHWA and CDOT, completed the 56th Avenue Corridor Study and associated compliance documents (URS Corporation 2008). This study recommended widening 56th Avenue to six lanes with a raised center median and detached multi-use paths on both the north and south sides of the new roadway. The study also describes and identifies the location of up to four wildlife overlooks to provide increased accessibility to the refuge, opportunities for creating vehicle pullouts and parking for wildlife viewing areas, and access to the area trail system. Concept-level illustrations for these wildlife viewing areas are provided in the study. Each could comprise a small parking area, pedestrian and bicycle trail access, interpretative signing, telescopes, and seating areas (URS Corporation 2008).

Continued expansion of 56th Avenue is anticipated to occur during implementation of this plan. We would coordinate with the City and County of Denver on relocation of existing refuge fences as well as on final placement and design of wildlife overlooks.

96th Avenue

The refuge's northern boundary follows 96th Avenue from Buckley Road to Highway 2. As Commerce City continues to grow, 96th Avenue is emerging as an important transportation corridor.

Residential development is taking place in the Reunion neighborhood near the northeast corner of the refuge.

Commerce City's master plan allows for additional residential and commercial north of 96th Avenue (City of Commerce City 2010). Planned open space includes corridors along both the First Creek and Second Creek drainages (City of Commerce City 2007). Design and construction are underway to expand 96th Avenue from Buckley Road to Tower Road, including construction of a bridge over Second Creek and installing storm sewers, curbs, gutters, sidewalks, street lighting, and traffic signals (City of Commerce City 2013). Expansion of 96th Avenue is anticipated to continue during implementation of this plan.

In 2013, the City of Commerce City notified the refuge that the alignment of this 96th Avenue project had been shifted to protect wetlands in the Second Creek drainage. Continued expansion of 96th Avenue west of Buckley Road would require a minor land exchange to ensure adequate rights-of-way for the refuge's Perimeter Trail. Consistent with our policies (342 FW 5), approximately 12,000 square feet of land in the refuge's northeasternmost corner would be exchanged for lands of equal value that benefit the refuge near our main gate.

Section 10

In 1969, the U.S. Army provided portions of Section 10, in the south-central area of the refuge, to the City and County of Denver to enlarge runways for the Stapleton International Airport. The United States retained certain interests in these lands—primarily easements for railroads and utilities crossing the area. With Stapleton's closure in 1995, the Stapleton Master Development Plan was developed to guide the transition of the former airport to a new community (Stapleton Redevelopment Foundation 1995). A General Development Plan for the site that was approved by the Denver Planning Board in November 2014 will be used as a guide for future development (Matrix Design Group 2014).

Natural Resource Damages

In accordance with Superfund regulations, a natural resource damage assessment of the Rocky Mountain Arsenal Superfund site was completed in October 2007. In May 2008, the State of Colorado, the Federal Government, and Shell Oil Company reached a settlement on the natural resource damages associated with the site. Funds recovered from this settlement represent mitigation for damage to natural resources including fish and wildlife and their habitats. Specifically, restoration can be accomplished by directly restoring the injured resource, or by rehabilitating, replacing, or acquiring equivalent resources (Natural Resource Trustees 2007). This so-called Rocky Mountain Arsenal Recovery Fund was to be managed by the Colorado Natural Resources Trustees. In July 2012, the Trustees awarded 10.15 million dollars in projects; in September 2014, they awarded an additional 17.4 million dollars in projects. These projects generally occur in the refuge's immediate geographic area.

Climate Change

Scientific evidence indicates that the global climate is changing. Most scientists agree that this change will result in a fluctuations in the abundance and distribution of wildlife and their habitats. In response to a rapid warming trend, some species may be able to adapt, some may struggle, and others may disappear forever. The Service's dedication to the conservation of wildlife and their habitats includes reducing, to the extent possible, the impacts that climate change may have on the Nation's natural heritage (FWS 2013j).

The direction and magnitude of ecosystem change in response to climate change will depend on the type and intensity of the disturbance (Backlund et al. 2008). Ecological changes in the phenology and distribution of plants and animals are occurring in all well-studied terrestrial systems. These observed changes appear to be consistent with modeled predictions and have been linked to local or regional climate change (Parmesan 2006). Ecosystem structure and function in the central Great Plains are closely associated with regional climatic gradient, precipitation being the most important climatic variable (Burke et al. 1991).

The potential effects of even small changes in climate could be significant on the refuge in light of the area's history of severe soil disturbance and the abundance of invasive species. Because many native plants and animals that currently inhabit the refuge are near the limits of their current known ranges, small changes in climate may provide a competitive advantage to invasive and nonnative species already established on refuge lands. For example, species that were once limited by elevation or drought tolerances may be able to inhabit new areas (Backlund et al. 2008).

Given these concerns, restoring and maintaining native plant communities is and will continue to be a primary focus of management on refuge. Native communities tend to be more resilient than nonnative communities and consequently represent the best approach for addressing potential long-term climate change (FWS 2013j). In addition, native plant communities provide suitable habitat for wildlife—the Service's primary mission.

Climate Change in Colorado

Colorado's climate is unlike that of any other state—it is characterized by the high elevations and complex topography of the Rocky Mountains, the Colorado Plateau and valleys of the West Slope, and the high plains falling off from the Continental Divide toward the east (Ray et al. 2008). East of the mountains the battle among subtropical, Pacific, and polar continental air masses determines which years are warmer or colder than average. The climate of the plains is comparatively uniform from place to place, with characteristic features of low relative humidity, abundant sunshine, infrequent rains and snow, moderate to high wind movement, and a large daily and seasonal range in temperature (Pielke Sr. et al. 2003). Weather on the refuge is dominated by warm-season precipitation, largely a result of localized convective storms.

In Colorado, statewide temperatures have increased about 2 degrees Fahrenheit (°F) over 30 years. Regionally, the north-central part of the State has been warming fastest (a +2.5 °F change in the annual average over the past 50 years). Minimum temperatures show greater overall warming than maximum temperatures in the last 50 years. In all parts of Colorado, no consistent long-term trends in annual precipitation have been detected in the time periods analyzed (Ray et al. 2008). A widespread and significant increase in the proportion of precipitation falling as rain rather than snow and a reduction in snow water equivalent have been observed elsewhere in the West between 1949 and 2004. In Colorado, however, these changes have been less pronounced (Knowles et al. 2006). Observed warming may have increased the severity of droughts (Andreadis and Lettenmaier 2006) and their impacts (Breshears et al. 2005).

Focusing on Colorado, the multi-model average projects an annual mean warming of about 4 °F [+2.5 to +5.5 °F] by 2050 in Colorado as part of a continent-

wide pattern of warming. The projections show summers warming more (+5 °F [+3 to +7 °F]) than winters (+3 °F [+2 to +5 °F]). Temperature increases are greatest in the summer. Most of the projections suggest that typical summer temperatures will equal or exceed the extreme warm summers of the last half of the twentieth century. The projected temperature changes are somewhat less for winter, and the year-to-year variations are larger. While extreme warm winter months would increase in these projections, most years—even by 2050—will not be extreme by present standards. Mid-twenty-first century summer temperatures on Colorado's eastern plains of projected to shift westward and upslope, bringing into the Front Range temperature regimes that today occur near the Kansas border (Ray et al. 2008). Individual model projections do not agree whether annual mean precipitation will increase or decrease in Colorado by 2050. Projections show a precipitous decline in lower elevation (below 8,200 feet) snowpack across the West by the mid-twenty-first century. The multi-model average shows little change in annual mean precipitation by 2050, although a seasonal shift in precipitation does emerge (Ray et al. 2008).

The State believes that the most serious anticipated impacts of climate change include increasing frequency and severity of forest insect infestations and wildfires (both of which are believed to be occurring already), and changes in the hydrologic cycle that will affect fish and other aquatic organisms. Climate is a key determinant of the spatial distribution and characteristics of ecosystems and species. In both aquatic and terrestrial environments, we should expect northward and upward shifts in the distribution of animal and plant species and ecosystems in response to warming temperatures. Similarly, it is anticipated that warming would shift the phenology (the timing of life-cycle events such as flowering and hibernation) of both plants and animals, independent of changes in range. The most climate-vulnerable ecosystems in Colorado may be short-grass prairie, fire-dependent forests, and aquatic ecosystems (Averyt et al. 2011).

Climate Change Strategies for Surrogate Species in Colorado

The potential effects of climate change on fish and wildlife that currently inhabit the refuge are broad, and many of the stressors occur beyond the refuge's boundaries. Under our circumstances, increasing the size of the refuge is not an option. Accordingly, our principal strategy for mitigating the effects of climate change is to maintain the resilience of short-grass and mixed-grass habitats on the refuge through the use of fire and grazing.

Grassland Birds

The Audubon Society recently announced that of the 588 North American bird species studied, more than half (314 species) are considered "climate endangered or climate threatened" due to loss of habitat (Nijhuis 2014). Similarly, the State of Birds report on climate change (U.S. North American Bird Conservation Initiative 2010) asserts that climate change is expected to exacerbate declines in birds that already suffer declining populations. The lark bunting and Cassin's sparrow are representative of other grassland birds using the refuge and are identified in this report with a medium score for climate vulnerability. Even subtle climate changes are causing northward distributional shifts in both species, and Cassin's sparrow is moving northward at more than half a degree of latitude per decade (about 5 kilometers per year) (Peterson and Baltosser 2003).

Juvenile survival can also have dramatic effects on population dynamics (Robinson et al. 2004). Severe drought has been shown to have multiple impacts on grassland birds (George et al. 1992). Drought reduces post-fledgling survival of lark buntings in northeast Colorado through starvation and increased predation (Yackel Adams et al. 2006). The refuge's habitat restoration program is still in its early stages, but implementation of vegetative monitoring specified in our HMP (USFWS 2013i) as well as new monitoring programs designed for our focal bird species may help illuminate climate change effects on the refuge.

Black-Tailed Prairie Dogs

Black-tailed prairie dogs and their habitat serve as surrogates for many species on the refuge. They also constitute an important food source for many predators. Factors other than predation—such as climatic changes, shifts in the availability of edible plants, and outbreaks of disease—also affect the size

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Prairie dogs

of prairie dog populations. Longer growing seasons, higher temperatures, changes in fire regime, and increased variability in weather will affect prairie dog food sources, increase competition, and increase the risk of plague outbreaks (Davis et al. 2004; Stenseth et al. 2008).

Changes in habitat that result from prairie dog activity could either accelerate or mitigate the consequences of climate change. Accelerated effects could involve the loss of grasslands through increased desertification, while mitigating effects could be manifested as reductions in the spread of exotic species, impediments to shrub encroachment, and maintenance of species diversity (Fahnestock et al. 2003; Larson et al. 2001; Weltzin and McPherson 1997). Our HMP (FWS 2013a) and BTPDMP (FWS 2013b) recommend that, to continue addressing potential effects of climate change, care be taken to retain both large and small and isolated and interconnected prairie dog colonies (Friggens 2011).

Bison

Bison are extremely well adapted to a wide range of environmental conditions. Climate change will affect relationships between C3 (forbs, woody plants, legumes) and C4 (grasses, sedges) plants in North American grasslands (Fischer et al. 2008). Similarly, temperature changes may have greater influence than the amount of precipitation on native prairie forb species (Adler and HilleRisLambers 2008). Impacts on prairie plant species will be particularly difficult to predict, as will be the effect on our bison herd. Bison herbivory is a key ingredient to our habitat restoration objectives, but grazing intensity will need to be monitored and managed to minimize degradation. Of particular concern in the context of the refuge's bison herd is the relationship between climate change and emerging infectious diseases in wildlife. The pressures of human encroachment and shrinking wildlife habitat tend to increase wildlife densities and the emergence of disease (Daszak et al. 2000). The refuge's bison herd is contained and managed, but remains vulnerable to emerging disease threats.

Climate Change Policies

In 2001, the Secretary of the Department of the Interior issued Secretarial Order 3226 (DOI 2001) requiring Federal agencies under its direction that have land management responsibilities to consider potential climate change effects as part of long-range planning endeavors. Recently, this order was replaced by Secretarial Order 3289 (DOI 2009). It left intact many of the planning requirements of Secretarial Order 3226, reiterating the need to analyze climate change effects, but made organizational changes to enable the bureaus and agencies to fulfill the planning requirements. In 2009, President Obama signed Executive Order 13514 requiring Federal agencies to establish an integrated strategy toward sustainability in the Federal Government and to make reduction of greenhouse gas emissions a priority for Federal agencies. In 2010, the Service completed its strategic plan for managing climate change (FWS 2010a). As part of implementing the Refuge System's Conserving the Future document, all this information was synthesized into a document to assist planners and managers fulfill these mandates and incorporate climate change considerations into planning documents (FWS 2014e).

3.9 Elements Considered but Eliminated from Further Consideration

During scoping and alternatives development, our staff, interested groups, cooperating agencies, other Federal and State agencies, and the public suggested several ideas, issues, or elements of alternatives that we considered but eventually eliminated from further analysis. We discuss these elements below.

Divestiture of the Refuge

The unique history of this site and its transformation into a national wildlife refuge are well described. The challenges associated with managing this former Superfund site as a national wildlife refuge are also well documented. When a refuge cannot be managed for the purposes for which it was established and in accordance with the National Wildlife Refuge Administration Act, the Service will consider divesting the property. The land use restrictions (see section 2.1) on this site are a major issue affecting the successful management of these lands as a national wildlife refuge. This plan assumes that our issues can be resolved in the near future. If we are unable to find resolution and we prove unable to properly manage these lands as a national wildlife refuge, divestiture of the refuge would be considered in a different and thorough process.

Rifle Hunting

During the scoping process, and as part of developing draft alternatives, we considered whether

ASSISTANCE WITH SITE PLANNING AND DESIGN

During the CCP process, the planning team recognized the need to explore a variety of options related to refuge planning and design. Specific needs include overall master planning; site planning for individual facilities; development of consistent design guidelines for facilities; and development of a unique brand to increase the refuge's visibility in the broader Denver Metropolitan region. To address these needs and further our goals under the Urban Refuge Initiative—which emphasizes connecting people with nature and engaging local communities—the planning team has sought assistance from the Department of Landscape Architecture at the University of Colorado at Denver (UCD).

Students and professors from the University of Colorado at Denver Landscape Architecture program conduct a site visit in November 2014.

Landscape architecture is the design of outdoor public areas, landmarks, and structures to achieve environmental, social-behavioral, or aesthetic outcomes. It involves the systematic investigation of existing social, ecological, and geological conditions and processes in the landscape, and the design of facilities and structures that will produce the desired outcome.

The Landscape Architecture program at UCD emphasizes design to support human wellbeing and environmental balance.

The planning team envisions a partnership with the Department of Landscape Architecture to assist with planning and design for the refuge as we complete restoration of the site and transition to managing solely for wildlife and welcoming many more visitors to the refuge.

hunting with rifles might be a feasible and compatible outdoor recreational activity at the refuge. While hunting is a priority wildlife-dependent outdoor recreational activity for the Service and is encouraged throughout the Refuge System, the urban character of the refuge's vicinity requires a careful and very specific consideration of human safety. Accordingly, because of public safety concerns, we found this activity not to be compatible in any of the alternatives proposed in the draft CCP and EIS during the 15- to 20-year timeframe for implementing the major actions of this CCP.

Opening More Vehicular Access Points to the Refuge

During the scoping process we were asked to consider if more vehicular access points to the refuge might be necessary, feasible, and appropriate to fulfill the purposes of the refuge, to provide appropriate access to the refuge for the public, and to manage refuge resources. After this matter was discussed and studied by our planning team, we realized and agreed that the environmental and financial costs of

creating and connecting other vehicular access points to the existing refuge roads is unacceptable and unnecessary to carry out the refuge's programs and to fulfil the refuge's purposes. Furthermore, we believe that a road system that connects to other vehicular entrances in the refuge would end up being used as shortcuts by drivers during their commute around the refuge, thereby increasing vehicular traffic and the probability of wildlife–auto collisions and mortality. Consequently, the issue of more vehicular access points in the refuge was considered but eliminated from further consideration in the CCP.

Taking Down the Refuge Perimeter 8-Foot Fence

Questions about the need for, the size of, and the configuration of the refuge's perimeter fence were among the most commonly asked. Often, we also field comments about the uninviting look and feel of the fence and of how it makes people feel unwelcome, regardless that that is not our intent. We have been asked to consider removing the perimeter fence now that the Rocky Mountain Arsenal is no longer a military installation and is open to the public as a national wildlife refuge.

Many of the units of the Refuge System have no perimeter fence encompassing them, and many other units have shorter fences to keep domestic cattle and sheep out of refuge habitats, without impeding wildlife movements to and from the refuge. However, very few units of the Refuge System make use of 8-foot chain link, such as that surrounding and crossing parts of our refuge, as perimeter or internal fences. While most units of the Refuge System allow and encourage wildlife migration and movement between refuge habitats and adjacent lands, this tall fence is necessary to preclude the movement of large ungulates out of the refuge, as well as the influx of non-refuge deer from surrounding areas. The movement of large animals such as bison and deer onto neighboring high-speed roads or into residential, urban, and airport environment and facilities could be very dangerous for humans and animals alike. It is also important to exclude non-refuge deer that might be suffering from chronic wasting disease from entering the refuge and spreading this disease among the refuge deer herd.

Accordingly, removal of the fence was eliminated from further consideration for any of the alternatives of this CCP and EIS. However, we do consider different strategies for modifying the fence to maintain its important function while allowing access to refuge visitors and conveying a more inviting image.

3.10 Plan Amendment and Revision

The final CCP will be reviewed annually to assess whether there is any need for revision. A revision would be warranted if significant information becomes available, such as a change in ecological conditions. Revisions to the CCP and subsequent stepdown management plans will be subject to public review and compliance with NEPA. At a minimum, this plan will be reevaluated every 5 years and revised after 15 years (table 6).

Table 6. Stepdown plans from the Rocky Mountain Arsenal National Wildlife Refuge Comprehensive Conservation Plan.

Name	*Year*
Black-tailed prairie dog management plan	2013
Cultural resources management plan	2014
Fire management plan	2013 (revised)
Habitat management plan	2013
Habitat restoration plan	1999
Integrated pest management plan	2015
Inventory and monitoring plan	needed
Law enforcement plan	needed
Station safety plan	2013 (revised)
Visitor services management plan	needed
Water management plan	2014 (revised)

3.11 Funding and Personnel

Refuge budgets generally include ongoing operational funds for staff, maintenance, and utility needs. Funding for one-time projects (like road construction or major maintenance) is generally provided as needed or when available. Development of future employees is a priority, and student trainees, interns, and other entry-level positions will be used whenever possible. Due to budget cuts, no permanent fire personnel are currently funded at the refuge.

As part of the cleanup and restoration of the refuge, one-time funding was provided to undertake grassland restoration. This funding will be used to support seeding, irrigation, and invasive plant management through 2020.

In general, implementing the Urban National Wildlife Refuge Initiative and aspiring to become the most visited national wildlife refuge in the country will require some additional staff (particularly rangers and maintenance) and funding (tables 7 and 8). A major issue at present is that current staffing does not provide adequate security and visitor safety. A minimum of one additional law enforcement officer is needed to address refuge hours (12–15 hours per day, 7 days a week, 362 days a year) and to ensure appropriate coverage across the three units of the refuge complex.

3.12 Comparison of Alternatives

Table 9 provides a side-by-side comparison of alternatives A, B, C, and D.

Table 7. Costs over 15 years to carry out the Rocky Mountain Arsenal National Wildlife Refuge Comprehensive Conservation Plan alternatives.

Cost	*Alternative A*	*Alternative B*	*Alternative C*	*Alternative D*
Budget Fiscal Year 2014	$2,000,000	$1,900,000	$3,450,000	$2,250,000
Salary expenditures	$1,270,000	$1,200,000	$1,650,000	$1,400,000
Non-salary expenditures	$730,000	$700,000	$1,800,000	$850,000
Staffing 2014 (FTE)				
Permanent full-time	15.5	13.5	19.5	17.5
Seasonal	4.0	3.0	6.0	4.0
Fire program	2.5	2.5	2.5	2.5
Restoration program	9.0	9.0	9.0	9.0

Louie Ocaranza / USFWS

Plowing

Table 8. Personnel to carry out the Rocky Mountain Arsenal National Wildlife Refuge Comprehensive Conservation Plan alternatives.

Alternative A	*Alternative B*	*Alternative C*	*Alternative D*
Management			
Refuge manager	Refuge manager	Refuge manager	Refuge manager
Deputy Refuge manager	Deputy refuge manager	Deputy refuge manager	Deputy refuge manager
None	None	Supervisory refuge officer	Supervisory refuge officer
Refuge officer	Refuge officer	Refuge officer	Refuge officer
None	None	Outreach and partnership specialist	Outreach and partnership specialist
Administration			
Administrative officer	Administrative officer	Administrative officer	Administrative officer
Administrative support	Administrative support	Administrative support	Administrative support
Office clerk (1/2)	Office clerk (1/2)	Office clerk (1/2)	Office clerk (1/2)
Visitor services			
Visitor services manager	Visitor services manager	Visitor services manager	Visitor services manager
Environmental education specialist	Environmental education specialist	Environmental education specialist	Environmental education specialist
Park ranger, GS-9	Park ranger, GS-9	(2) Park ranger, GS-9	Park ranger, GS-9
(3) Park ranger, GS-7	Park ranger, GS-7	(2) Park ranger, GS-7	(3) Park ranger, GS-7
(2) Park ranger*	(2) Park ranger*	(4) Park ranger*	(2) Park ranger*
Operations and maintenance			
Refuge operations specialist, GS-11	Refuge operations specialist, GS-11	Refuge operations specialist, GS-12	Refuge operations specialist, GS-12
Fire management officer	Fire management officer	Fire management officer	Fire management officer
Range technician (fire)	Range technician (fire)	Range technician (fire)	Range technician (fire)
Range technician (fire*)	Range technician (fire*)	Range technician (fire*)	Range technician (fire*)
Equipment operator	Equipment operator	Equipment operator	Equipment operator
Maintenance worker	Maintenance worker	(2) Maintenance worker	Maintenance worker
(2) Maintenance worker*	None	(4) Maintenance worker*	(2) Maintenance worker*
Biology			
None	None	Assistant refuge manager	None
Refuge biologist	Refuge biologist	Refuge biologist	Refuge biologist
(2) Range technician*	(2) Range technician*	(2) Range technician*	(2) Range technician*
(2) Bio science technician*	(2) Bio science technician*	(2) Bio science technician*	(2) Bio science technician*
Restoration program (ends fiscal year 2020)			
Assistant refuge manager	Assistant refuge manager	Assistant refuge manager	Assistant refuge manager
GIS specialist	GIS specialist	GIS specialist	GIS specialist
Range specialist	Range specialist	Range specialist	Range specialist
Wildlife refuge specialist	Wildlife refuge specialist	Wildlife refuge specialist	Wildlife refuge specialist
Bio science technician	Bio science technician	Bio science technician	Bio science technician
Maintenance worker	Maintenance worker	Maintenance worker	Maintenance worker
(6) Tractor operator*	(6) Tractor operator*	(6) Tractor operator*	(6) Tractor operator*
Student trainees			
Student trainee, GS-5	To be determined	To be determined	To be determined
Student trainee, GS-4	To be determined	To be determined	To be determined

* Seasonal

Table 9. Side-by-side comparison of the management alternatives for the Rocky Mountain Arsenal National Wildlife Refuge, Colorado.

Alternative A—No Action	*Alternative B—Traditional Refuge*	*Alternative C—Urban Refuge*	*Alternative D—Gateway Refuge*
Habitat Management Goal: Use an adaptive management framework to conserve, restore, and enhance the ecological integrity of the Front Range prairie communities, including wetlands, grasslands, native shrubs, and trees			
Restore habitat for grassland-dependent birds, bats, black-footed ferrets. Maintain a mosaic of wetland/riparian habitats for big brown bats. Implement riparian and prairie habitats recommendations from HMP addendum to support big brown bat populations. Discontinue use of bat boxes.	Same as A.	Same as A and B.	Same as A, B, and C.
Wildlife Management Goal: Balance and preserve wildlife species of concern through active management.			
Wildlife—Black-Footed Ferret			
BFF would not be reintroduced.	BFF would be reintroduced with legal safeguards for incidental take. Targeted outreach efforts to refuge neighbors. Restrict public access to northern half of RMA in support of BFF and bison populations and research activities. Create live ferret exhibit.	Same as B, plus: Investigate opportunities for public to participate in BFF spotlighting surveys.	Same as C, plus: Establish BFF-specific partnerships and collaborative activities with CPW, Denver Zoo, BFF Center, etc. Develop partnerships with CPW to manage BFF on and offsite.
Wildlife—Surrogate Species			
Preserve population of black-tailed prairie dogs. Maintain bison herd at or below carrying capacity.	Same as A.	Same as A and B.	Same as A, B, and C.
Wildlife—Other Native Species			
Pronghorn would not be reintroduced until prairie is restored. Prairie chicken and sharp-tailed grouse are not likely to be reintroduced.	Conduct studies to determine if these species can be reintroduced. Reintroduce all native species that could become self-sustaining. Enforce seasonal closures to safeguard leks.	Same as B, plus: Reintroduce species to showcase native prairie ecosystems even if populations require further reintroductions.	Same as B, plus: Work with neighboring landowners to extend range of native species.
Visitor Services Goal: Foster the public's appreciation of natural resources and provide inclusive, high-quality, wildlife-dependent recreation, education and interpretation.			
Visitor Services—Hunting			
The refuge is closed to all hunting. No hunter education.	Use the refuge as a venue for hunter education, emphasizing hunting as a management tool. Partner with CPW and offer a hunting education course on site. Implement limited deer and dove hunting program for youth and people with disabilities.	Same as B plus: Develop archery range and offer archery instruction.	Same as C plus or except: Promote hunting opportunities throughout Colorado and the refuge system. No archery range would be developed.

Table 9. Side-by-side comparison of the management alternatives for the Rocky Mountain Arsenal National Wildlife Refuge, Colorado.

Alternative A—No Action	*Alternative B—Traditional Refuge*	*Alternative C—Urban Refuge*	*Alternative D—Gateway Refuge*
Visitor Services—Fishing			
Maintain existing catch-and-release fishing from April to October (according to CO State fishing regulations). Maintain existing programs.	Same as A plus: Improve signage and facilities. Assess fishing satisfaction.	Same as B plus: Offer an annual fishing pass. Offer more introductory fishing classes/educational opportunities/clinics. Develop Lake Mary with more facilities, a high catch rate, and more user-friendly access.	Same as B plus: Explore raising fees and increasing stocking rates. Explore increasing fishing days/hours. Promote fishing opportunities throughout the refuge system and Colorado. Partner with others to implement fishing improvements and expanded programming (such as fly fishing demonstration, fly tying, fish identification).
Visitor Services—Wildlife Observation and Photography			
Maintain self-guided auto tour, nature trails, and wildlife viewing blind with seasonal closures to protect sensitive wildlife. Continue limited issuance of special use permits for commercial photography.	Same as A plus: Add wildlife viewing facilities and trails at Rattlesnake Hill and Wildlife Watch. Improve accessibility of existing facilities. Reintroduction of black-footed ferrets will provide new viewing opportunities.	Same as B plus: Construct accessible new viewing area, four viewing overlooks, and new trails. Develop partnerships to lead more programs and tours. Improve signage and interpretive materials and expand law enforcement to manage use and minimize impacts on habitat.	Same as B plus: Construct new observation facilities (as described for C).Offer more commercially and partner-led guided tours and/or programming. If native species (e.g. prairie chicken, pronghorn, sharp-tailed grouse) are introduced, explore potential to offer wildlife viewing and lek tours led by a commercial tour company.
Visitor Services—Environmental Education and Interpretation.			
Continue to provide on- and offsite environmental education programs based on staff availability. Environmental Education curriculum is available for teachers. Continue interpretive tours and programs; update interpretative materials as funding allows.	Same as A, plus: Add environmental education programming and curricula covering black-footed ferrets. Implement Rhythms of the Refuge, offering teacher resources and distance learning.	Same as B, plus: Explore nontraditional methods. Use partnerships and concessionaires for environmental education programs and summer camps. Upgrade and/or replace the Contact Station to serve as an improved venue for educational programming. Construct new environmental education center. Deliver more programs to neighboring communities, partnering with parks, libraries, recreation centers, and schools. Develop refuge artist program. Create refuge-inspired murals.	Same as B, plus: Expand environmental education programming for youth and adults. Explore partner- and concessionaire-led camps, career experience, summer intern, and vocational programs for local community youth. Explore hosting of adult forums with invited speakers and participation fees. Explore onsite living history program in collaboration with partners with the Egli House as venue.

Table 9. Side-by-side comparison of the management alternatives for the Rocky Mountain Arsenal National Wildlife Refuge, Colorado.

Alternative A—No Action	*Alternative B—Traditional Refuge*	*Alternative C—Urban Refuge*	*Alternative D—Gateway Refuge*
Communications and Outreach Goal: Through effective communication and innovative technology, engage the public and stakeholders to help them better understand the importance of natural resources, operations, and history of the refuge complex so that they are inspired to participate in and support management and restoration efforts.			
Communications and Outreach—Audiences			
Continue outreach to local communities. Participate in Refuge Day, Bass Pro Fishing Classic, CO Get Outdoors Day, Aurora Youth Water Festival, Barr Lake Birding Festival, and other events.	Increase public outreach to increase visibility and overcome negative perceptions.	Same as B plus: Target nontraditional visitors and outlying community residents. Improve understanding of demographics of metropolitan area to inform outreach efforts. Develop a communications plan to reach youth and nontraditional and underserved groups.	Same as B plus: Target birders, history enthusiasts, and international visitors. Develop communications plan for entire refuge complex.
Communications and Outreach—Emphasis of Outreach Message			
Continue to support Urban Refuge Initiative. Participate in special events and career development programs for local students.	Focus on safety concerns, inviting visitors, and explaining wildlife and habitat resources.	Same as B plus: Increase visibility. Distinguish between city park and urban refuge. Emphasize how the refuge benefits and serves the community: Health and school performance benefits. Improved air and water quality. Benefits for future generations. Improved access and expanded hours of operation.	Same as B plus: Emphasize conservation and site's transformation. Emphasize site's history. Promote the entire refuge complex and other prairie sites. Promote improved regional access to the refuge.
Communications and Outreach—Tools and Approaches			
Maintain refuge Web site, Wild News Quarterly, and social media platforms. General brochure, rack card, and fishing brochure (in English and Spanish) are available. Brochures for trails and auto tour are in development.	Same as A, plus: Increase cross promotion with partners. Share website link with partnering agencies and groups and encourage them to link to RMA. Develop bilingual resources: refuge Web site, signs, and brochures. Increase use of existing outlets and media.	Same as B, plus: Significantly increase use of existing outlets and media. Develop new outlets to reach area residents. Explore developing half- or full-day refuge programs. Use latest technology to connect with broad audiences. Develop campaign to promote our premiere urban refuge and the opportunities it presents to connect people to nature.	Same as C, plus: Engage Colorado Parks and Recreation Association (CPRA) to develop promotional package; participate in CPRA state conference. Engage Channel 8, Denver Business Bureau, DIA, and Visit Denver to expand outreach. Use refuge Web site as a clearinghouse for regional events/activities. Employ social marketing. Encourage visitors to use social media to share wildlife sightings and plant discoveries. Solicit partners/volunteers to post regularly on Facebook.

Table 9. Side-by-side comparison of the management alternatives for the Rocky Mountain Arsenal National Wildlife Refuge, Colorado.

Alternative A—No Action	*Alternative B—Traditional Refuge*	*Alternative C—Urban Refuge*	*Alternative D—Gateway Refuge*
			Recruit interns to explore technologies and outreach strategies. Use social media to share refuge images and video. Translate Web site into multiple languages.
Partnerships: Seek and foster strong partnerships to support research and management, enhance wildlife-dependent recreation, and promote appreciation of nature.			
Continue regional trails partnership (e.g., Rocky Mountain Greenway, Sand Creek Greenway) to form trail system connecting refuge with Two Ponds and Rocky Flats NWRs. Friends of Front Range Wildlife Refuges operates Nature's Nest bookstore in the Visitor Center. Continue partnership with Commerce City Parks and Recreation and Bass Pro Shops for annual Fishing Frenzy. Coordinate with City and County of Denver on Urban Bird Treaty. Continue employing Arrupe High School student one day/week.	Same as A.	Same as A plus: Increase partnerships throughout Denver and surrounding communities to assist with outreach, including Regional Transportation District, Denver Regional Council of Governments, and commercial partners. Encourage community partners to use refuge as a resource for educational programming as well and health/wellness activities. Use partnerships to build physical linkages between communities, regional trails, and the refuge. Focus on partnerships to reach nontraditional visitors. Increase use of Citizen Science and collaboration with local schools to work on restoration.	Same as C plus: Engage partners to expand visitor use programming: day camps, Master Naturalist Program, interpretive guide training, Backyard Habitat, photo tours and classes, advanced birding, fishing clinics. Increase partners' autonomy in programming. Expand partnerships to conservation organizations, local governments and agencies, and private companies. Establish "prairie coalition" to cross-promote programming, activities, and research throughout the Front Range. Develop BFF-specific partnerships with CPW, Denver Zoo, BFF Center. Develop partnerships with other states and nations for special-status species issues (e.g., Swainson's hawk research and management in Argentina). Develop two large new special events with partners. Develop partnerships for access and international outreach with Fast Tracks, CDOT, DIA, RTD. Develop partnerships with FHWA, NPS, USFS, USFWS Region 6 Regional Office.
Cultural Resources Goal: Protect artifacts and interpret the archeological, agricultural, military, and industrial histories of the refuge complex and the story of its restoration in order to connect visitors and the community to the area's past.			
Continue cultural resource review for ground-disturbing activities.	Same as A.	Same as A and B, plus: Additional storage in existing buildings.	Same as C, plus: Establish offsite WWII/Cold War museum owned

Table 9. Side-by-side comparison of the management alternatives for the Rocky Mountain Arsenal National Wildlife Refuge, Colorado.

Alternative A—No Action	*Alternative B—Traditional Refuge*	*Alternative C—Urban Refuge*	*Alternative D—Gateway Refuge*
Avoid disturbance of cultural resources. Continue law enforcement monitoring of sensitive sites. Care for and inventory artifacts stored at refuge. Continue protection of historic buildings, including stabilization of Egli House. Continue interpreting cultural resources on bus tour. Explore deaccession of some artifacts.		Additional display of WWII and Cold War items at existing refuge facilities. Develop partnerships with Native American community to interpret prehistoric landscape. Fully restore Egli House exterior. Increase guided interpretation of cultural resources suited for outdoor storage.	and operated by non-Service partner. Fully restore exterior and interior of the Egli House for reuse and interpretation. Permit and encourage living history interpretation events.
Research and Science Goal: Use science and promote research to advance the understanding of natural resource functions and management within the complex and beyond.			
Research and Science—Research			
Continue trapping and banding burrowing owls to support research on migratory pathways. Continue supporting other short-term research opportunities as they arise.	Same as A, plus: Collaborate with BFF Center on reintroduced BFF population.	Same as B, plus: Evaluate prairie dog densities in context of BFF. Use public participation and social media to acquire and collate data supporting refuge management.	Same as C, plus: Increase collaborative projects, where other researchers use refuge. Provide facilities to support BFF research. Research prehistoric use of First and Second Creek overlooks. Increase cooperation with universities and other higher education institutions. Study response of grassland birds and pollinators to prairie restoration. Study response of coyotes to prey base and stressors.
Research and Science—Monitoring and Inventory Programs			
Trap and band burrowing owls. Bald eagle winter roost surveys and nest counts. Raptor nest monitoring. (Swainson's hawk and burrowing owl). Assess fish populations using electrofishing and gillnetting. Conduct fall deer census. Conduct fall bison roundup. Monitor native and invasive vegetation, especially at restoration sites.	Same as A, plus: Develop an Inventory and Monitoring Plan. Recommence water quality monitoring. Adopt findings of Water Management Plan. Reestablish yearly monitoring of cultural resource sites. Reestablish visitor use satisfaction surveys. Monitor reintroduced species for success. Use hand-held electronic devices for data collection.	Same as B, plus: Delegate some monitoring and data gathering activities to volunteers and partners. Develop Citizen Science support for BFF and bald eagle monitoring. Increase monitoring of visitation. Establish neighbor satisfaction surveys.	Same as C, plus: Monitor spread and extent of prairie dog populations jointly with DIA and APHIS. Monitor research efforts identified for this alternative.

Table 9. Side-by-side comparison of the management alternatives for the Rocky Mountain Arsenal National Wildlife Refuge, Colorado.

Alternative A—No Action	*Alternative B—Traditional Refuge*	*Alternative C—Urban Refuge*	*Alternative D—Gateway Refuge*
Band 200 mourning doves. Support Citizen Science participation in Great Backyard Bird Count. Conduct Christmas Bird Count. Conduct spring and fall bird counts.			
Research and Science—Citizen Science Projects			
Christmas Bird Count. Great Backyard Bird Count. Spring and fall bird counts.	Same as A, plus: Increase extent of existing bird counts. Implement Big Sit bird count.	Same as B, plus: Create additional Citizen Science opportunities. Track phenological characteristics associated with BFF and bald eagle monitoring. Participation in BFF spotlighting surveys.	Same as C, plus: Link Citizen Science opportunities with projects throughout refuge complex and partners' sites.
Research and Science—Climate Change			
No active climate change research undertaken on the refuge.	Initiate monitoring and research of phenological characteristics of various species relevant to climate change.	Same as B.	Same as B, plus: Collaborate with neighbors, other agencies, and partners (e.g., DIA, CDPHE, Regional Air Quality Council) on air quality monitoring and data collection.
Research and Science—Social Science, Social Media, and Emerging Technologies			
No active research currently undertaken on the refuge.	Same as A.	Consider installation of remote cameras to monitor and provide Web-based public access to refuge fauna (e.g. bald eagles, BFF). Use emerging technologies and social media to engage visitors and aid in refuge management and wildlife tracking.	Same as C, plus: Coordinate data collection and modeling platforms with refuge partners and other agencies. Share refuge wildlife data (e.g., bison, bird bands) with more partners.
Infrastructure and Operations: Effectively use funding, staff, partners, volunteers, and equipment to restore and manage refuge complex habitats, conduct programs, and improve and maintain all necessary infrastructure.			
Infrastructure and Operations—Staff and Funding			
Budget: $2,000,000 Staffing: Permanent full-time 15.5 Seasonal 4.0 Fire program 2.5 Restoration 9.0 See table 8 for specific staff allocations.	Budget: $1,900,000 Staffing: Permanent full-time 13.5 Seasonal 3.0 Fire program 2.5 Restoration 9.0 See table 8 for specific staff allocations.	Budget: $3,450,000 Staffing: Permanent full-time 19.5 Seasonal 6.0 Fire program 2.5 Restoration 9.0 See table 8 for specific staff allocations.	Budget: $2,250,000 Staffing: Permanent full-time 17.5 Seasonal 4.0 Fire program 2.5 Restoration 9.0 See table 8 for specific staff allocations.

Table 9. Side-by-side comparison of the management alternatives for the Rocky Mountain Arsenal National Wildlife Refuge, Colorado.

Alternative A—No Action	*Alternative B—Traditional Refuge*	*Alternative C—Urban Refuge*	*Alternative D—Gateway Refuge*
Infrastructure and Operations—Volunteer Groups and Programs			
Approximately 80 volunteers: Visitor Center front desk, interpretive programs and tours, maintenance, surveys, special events, pollinator garden.	Same as A, plus: Increase volunteers. Develop reliable core group. Support Eagle Scout projects and engage other Scout volunteers.	Same as B, plus: Increase volunteer projects. Expand volunteer base by recruiting from neighboring communities and metropolitan area. Encourage Denver Parks and Recreation to host a program on the refuge. Increase offerings of drop-in programs. Increase large volunteer projects and events.	Same as C, plus: Build the largest volunteer program of the three action alternatives. Develop system for sharing volunteers among three complex refuges and partner groups.
Infrastructure and Operations—Facilities			
Existing facilities: Visitor Center, Contact Station, three information kiosks, two amphitheaters, fee station, wildlife viewing blind, pollinator garden. Proposed: new administration building.	Same as A, plus: Develop site plan for new administration complex. Remove unused facilities and replace temporary bunkhouses. Reduce light and sound pollution in all future designs.	Same as B, plus: Expand restrooms, shade structures, tables. Develop facilities for large family gatherings. Replace Contact Station with Environmental Education Center. Install new viewing platforms, observation decks, and other wildlife observation and photography facilities. Reopen and improve Wildlife Watch. Establish bison viewing area outside refuge. Construct new overlook at Lower Derby Lake. Construct more pullouts along Wildlife Drive. Build interpretive kiosks at new entrance points. Install viewing blinds if grouse establish leks.	Same as B, plus: Develop food concessions and partnerships with food trucks. Rehabilitate facilities to interpret cultural resources. Rehabilitate Building 112 for interpretive history exhibits or convert into Cold War Museum. Improve and interpret bunker on northern loop. Identify and memorialize POW/internment camp. Memorialize Ivory Crush and continue message regarding wildlife trade.
Infrastructure and Operations—Energy Transmission Towers			
Continue to increase energy efficiency and reduce the carbon footprint of operations. Underground or relocate power lines when redeveloping. Coordinate with army for removal of electrical substation.	Same as A.	Same as A, plus: Eliminate transmission towers and lines. Expand PV solar array. Incorporate sustainable practices when developing or renovating infrastructure.	Same as C.
Infrastructure and Operations—Refuge Signs			
Entrance signs at Main and Havana gates; guide and	Same as A.	Same as B, plus:	Same as C, plus:

Table 9. Side-by-side comparison of the management alternatives for the Rocky Mountain Arsenal National Wildlife Refuge, Colorado.

Alternative A—No Action	*Alternative B—Traditional Refuge*	*Alternative C—Urban Refuge*	*Alternative D—Gateway Refuge*
directional signs throughout refuge; interpretive signs at information kiosks at Contact Station and Lake Mary. All signs would be maintained.		Coordinate with Commerce City to improve primary entrance. Create refuge monument sign to attract visitors. Coordinate with neighbors to develop unified signage plan. Use perimeter fencing as communication medium. Add way-finding and interpretive kiosks to support transportation improvements.	Develop signage to promote other regional opportunities.
Infrastructure and Operations—Water-Control Infrastructure and Water Rights			
Upper Derby, Lower Derby, Lake Ladora, and Lake Mary dams are currently owned and operated by U.S. Army. Havana Pond dam is owned and operated by City of Denver and Urban Drainage and Flood Control District. The refuge will not accept transfer of the U.S. Army dams until repairs are complete. Havana Pond is being repaired.	Same as A.	Same as A and B.	Same as A, B, and C.
Infrastructure and Operations—Fencing			
No change to existing fencing.	Develop fencing and signage design and material standards across complex.	Same as B, plus: Construct new gateway arch at main public gate. Extend branding across complex. (moderate) Install split-rail fence to establish boundaries. Set back wildlife fence from roads. Identify where fence could be opened to foot traffic.	Same as C, plus: Improve appearance and uniformity of fencing and access points. Extend branding across complex and to adjacent jurisdictions/landowners. Identify additional access points to promote regional connections.
Infrastructure and Operations—Hours of Operation			
Normal hours sunrise to sunset.	Same as A.	Same as A and B.	Same as A, B, and C.
Infrastructure and Operations—Other Operational Topics			
UCFCD to include refuge in alert system for emergencies such as flood threats. Partner with FHWA to investigate vulnerability of infrastructure to extreme weather events.	Same as A.	Same as A and B.	Same as A, B, and C.

Table 9. Side-by-side comparison of the management alternatives for the Rocky Mountain Arsenal National Wildlife Refuge, Colorado.

Alternative A—No Action	*Alternative B—Traditional Refuge*	*Alternative C—Urban Refuge*	*Alternative D—Gateway Refuge*
Access and Transportation: Support the improvement of suitable access to the refuges, develop sustainable transportation options, and provide more connections within the refuge complex.			
Access and Transportation—Points and Types of Access			
Single visitor access point at Prairie Gateway. Automobile, bus, and pedestrian modes permitted. Bicycles allowed from main gate to Visitor Center.	Same as A, plus: Enhance/improve main gate. Maintain or reevaluate three employee entrances.	Same as B, plus: Add pedestrian and bicycle access points. Work with RTD to connect neighborhoods to refuge via public transit system. Allow cross-country skiing, jogging, and expanded bike access. Consider bike sharing, commercial bus, addition of Service-owned bus with bike racks.	Same as C, plus: Add pedestrian and bicycle access points to Henderson Hill overlook/trail (north boundary). Add southeast viewing access. Add connections to Rocky Mountain Greenway and promote connectivity among three refuges. Create trail connection to Fast Tracks Pena station. Improve connections between DIA and refuge. Enhance bike-sharing system.
Access and Transportation—Way-Finding and Sign Plan			
Continued use of existing signage.	Improve navigation and way-finding. Incorporate positive messaging into signage. Provide explanations for road and area closures. Update refuge maps.	Same as B, plus: Coordinate with neighbors and partners to develop unified signage and way-finding.	Same as B.
Access and Transportation—Roads and Related Infrastructure			
Maintain current road system.	Discontinue maintenance of and remove some section line roads. Expand Wildlife Drive northern loop for self-guided opportunities. Formalize information gathering for road inventory program.	Same as B, plus: Improve multiple intersections. Modify Texas Crossing on Wildlife Drive. Incorporate bike infrastructure into road system. Improve signage.	Same as C, plus: Southern loop—stripe bike lanes and off-street path Northern portion—stripe for two-way traffic; add pullouts, traffic control, speed bumps.
Access and Transportation—Legacy Loop			
Open to the public.	Same as A, plus: Improve way-finding and address safety issues. Improve map and signage. Pave remaining eastern section.	Same as B, plus: Add additional pull-outs. Add paved, detached, ADA-compliant bike-pedestrian path.	Same as C.
Access and Transportation—Wildlife Drive			
Currently closed to visitors other than Service-led tours.	Same as A, plus: Provide bus service on weekends (reservation required).	Expand scheduled bus tours (not reservation only) in coordination with RTD.	Same as C, plus: Open drive to two-way public traffic.

Table 9. Side-by-side comparison of the management alternatives for the Rocky Mountain Arsenal National Wildlife Refuge, Colorado.

Alternative A—No Action	*Alternative B—Traditional Refuge*	*Alternative C—Urban Refuge*	*Alternative D—Gateway Refuge*
	Develop opportunities for self-guided tours.	Open drive to one-way public traffic. Build pull-outs Improve signage and way-finding. Improve Texas Crossing for safe public use.	
Access and Transportation—Trail System			
Continue to maintain 10 miles of trails. Repair sections of trails, including Rattlesnake Hill, currently closed due to flood damage. Continue to allow snow-shoeing on existing trails.	Increase interpretation and accessibility on existing trails. Improve and build trail connections with regional trails. Complete Perimeter Trail.	Same as B, plus: Extend trail system. Add trailheads and access points (e.g., Eagle Watch, Henderson Overlook). Open some roads and trails to bicycle access. Coordinate with stakeholders and adjacent landowners to manage bike and pedestrian access on Perimeter Trail.	Same as C, plus: Develop more extensive trail system. Connect Rocky Mountain Greenway Trail with First Creek and Second Creek Trails. Improve signage. Promote trail linkages.

3.13 Consistency with Refuge Management Goals

In the following sections we describe how each alternative meets the goals we developed for the refuge. Table 10 summarizes this discussion.

Habitat Management

Goal: Use an adaptive management framework to conserve, restore, and enhance the ecological integrity of Front Range prairie communities, including wetlands, grasslands, native shrubs, and trees.

In all the alternatives, we propose to base all our habitat management actions on the HMP, which we finalized in 2013. Our habitat management aims under the HMP are to:

- Promote successful long-term establishment and maintenance of seeded restoration sites, as well as existing native prairies and shrublands, to provide habitat for the resources of concern.
- Maintain the importance of the refuge as a priority nesting site for burrowing owls along the Front Range of Colorado.
- Preserve a historically representative population of black-tailed prairie dogs.
- Provide additional nesting opportunities for resources of concern, including relevant grassland-dependent bird species exhibiting population declines.
- Use prescribed fire and non-fire treatments to maintain or improve refuge habitats and to manage wildland fuels to protect values at risk.
- Maintain a bison population that contributes to the Department of the Interior's Bison Conservation Initiative and helps maintain the structure and composition of native and restored prairies necessary to support priority grassland-dependent bird species.
- Provide habitat in the refuge's Environmental Education Zone for neotropical migratory bird species that are losing suitable stopover areas to urban development in the Denver Metropolitan area.

Table 10. How the actions in the alternatives meet the goals for the Rocky Mountain Arsenal National Wildlife Refuge, Colorado.

Goals	*How the alternatives adhere to refuge goals**			
	A	*B*	*C*	*D*
Habitat management	▲	▲	▲	▲
Wildlife management	△	▲	▲	▲
Visitor Services	△	△	▲	▲
Communications and outreach	▼	▼	▲	▲
Partnerships	△	△	▲	▲
Cultural resources	△	△	▲	▲
Research and science	△	▲	▲	▲
Infrastructure and operations	△	△	▲	▲
Access and transportation	▼	▼	▲	▲

* Ratings note that an alternative satisfies the goal ▲, partially satisfies the goal △, or does not satisfy the goal ▼

- Provide long-term quality nesting and roosting habitat for bald eagles.

- As one of the Nation's premier urban national wildlife refuges, the Rocky Mountain Arsenal NWR offers a variety of distinctive public education opportunities, including how one of the most environmentally contaminated sites in the United States is being restored to a native prairie ecosystem.

All four alternatives adhere closely to the refuge's habitat management goal.

Wildlife Management

Goal: Balance and preserve wildlife species of concern through active management.

All four alternatives entail similar wildlife management actions. The most salient difference is that only the three action alternatives propose reintroduction of the endangered black-footed ferret and the consideration to reintroduce, under various circumstances and to achieve various ends, prairie chicken, sharp-tailed grouse, and pronghorn if doing so is deemed feasible and ecologically sound.

Under all the alternatives, we would continue to implement the HMP, which instructs us to maintain healthy wildlife communities in a manner consistent with the site's historical and cultural background. Consistency with the historical and cultural background refers to maintaining existing New Mexico locust thickets, old farmstead windbreaks and other planted trees, cottonwood galleries, created wetlands and reservoirs, and restored grasslands.

Under all the alternatives, we would restore and maintain habitat using tools such as prescribed fire. Similarly, we would continue to provide sites for nesting burrowing owls, as well as nesting and roosting habitat for bald eagles. We would also provide appropriate habitat for neotropical migratory birds in our refuge's Environmental Education Zone. Furthermore, we would provide indigenous bat populations with a mosaic of wetland and riparian foraging habitat, while discontinuing use of so-called bat boxes.

Under all the alternatives we would maintain and expand the refuge's bison population to help maintain the structure and composition of native and restored prairies necessary to support priority grassland-dependent bird species. We would manage bison populations at or below carrying capacity. We have determined that by expanding the range of the bison within appropriate refuge habitats we can adequately maintain a bison herd of 110–180 animals, but the herd should not exceed 209 animals.

Under all the alternatives, we would continue to manage the refuge's historically representative prairie dog populations in accordance with our approved 2013 BTPDMP to sustain native grasslands and associated migratory birds.

The three action alternatives, because of their inclusion of reintroduction of native species, adhere more closely to the wildlife management goal for the refuge than does the no-action alternative.

Visitor Services

Goal: Foster the public's appreciation of natural resources and provide inclusive, high-quality, wildlife-dependent recreation, education, and interpretation.

Under all the alternatives we would emphasize public safety and would continue to foster the public's appreciation for natural resources and provide opportunities for the public to engage in the Congressionally identified compatible wildlife-dependent recreational opportunities: fishing, hunting, wildlife observation, photography, environmental education, and interpretation.

However, alternatives A and B would only partially adhere to this goal because neither would increase public access and both would allow for only a modest increase in transportation options. These modest increases would likely result in only modest increases of public participation in wildlife-dependent recreational opportunities. Under both alternatives, most of the refuge would remain closed to the public, except when accompanied by refuge staff.

Conversely, alternatives C and D would closely adhere to this goal because both entail greater access and transportation options to the visiting public, as well as increasing our outreach and communications efforts among our neighbors and the greater Denver Metropolitan area. These efforts are explicitly intended to expand our levels and diversity of partnerships and to make our programs more accommodating and relevant to a more diverse range of visitors.

Communications and Outreach

Goal: Through effective communication and innovative technology, engage the public and stakeholders to help them better understand the importance of natural resources, operations, and history at the refuge complex so that they are inspired to take part in and support management and restoration efforts.

Our existing and proposed visitor services programs aim to help refuge visitors understand the importance of nature, and to instill in them an appreciation for the conservation of our natural and cultural resources. However, to achieve this important objective, we must first succeed in reaching out to and communicating with the diverse people in our surrounding communities and beyond and invite them to visit the refuge. Alternatives A and B would not satisfy the outreach component of this goal because of the lack of sufficient dedicated resources. Because alternatives C and D would prioritize public outreach and communications efforts, both would adhere closely to this goal.

Partnerships

Goal: Seek and foster strong partnerships to support research and management, enhance wildlife-dependent recreation, and promote an appreciation of nature.

We propose to maintain all the partnerships that we currently have with various organizations and agencies. These partnerships are extremely important to us as they allow us to carry out all necessary management and visitor services programs and activities that aim to fulfill the purposes for which this refuge was established. Under alternative A we propose no changes to the current types, number, or purpose of our partnerships. Under alternative B we propose a modest expansion in our partnerships, mostly as they relate to the reintroduction of black-footed ferrets and the management of the local population. Accordingly, both of these alternatives would partially adhere to this goal. Under alternatives C and D, we are proposing to pursue the same partnerships as under alternative B and to explore other partnership opportunities that can support necessary research and management, as well as the expansion and promotion of wildlife-dependent recreational opportunities. Accordingly, both alternatives C and D would adhere closely to this goal.

Cultural Resources

Goal: Protect artifacts and interpret the archeological, agricultural, military, and industrial histories of the refuge complex and the story of its restoration in order to connect visitors and the community to the area's past.

Under all alternatives, we would continue to adhere to cultural resource laws and avoid adverse effects on important resources.

With existing staff resources, it would be difficult for us to increase our protection, monitoring, outreach, interpretation, or partnership efforts beyond the basic adherence to cultural resource laws that is within the capacity of refuge staff and Service cultural resources staff. Without new resources, our staff would have to leave important historical resources—especially from the World War II and Cold War eras—in storage, with little possibility of partnering with appropriate groups and agencies to properly house, curate, and interpret these valuable

artifacts for future generations. Consequently, alternatives A and B would only partially adhere to this goal.

In part because of the increased resources proposed under alternatives C and D, these alternatives would enable the staff to increase outreach and partnership efforts to find suitable groups and agencies that could properly house, curate, and interpret these valuable artifacts for future generations. Accordingly, alternatives C and D would result in the best protection of historical and cultural resources and so better adhere to this goal.

Research and Science

Goal: Use science and promote research to advance the understanding of natural resource functions and management within the refuge complex and beyond.

It is Service policy and our practice at the refuge to base all our management decisions on science. Under all four alternatives, we would continue to use science as a matter of course. However, under alternative A, we propose to continue with the current opportunistic approach to research, because our existing resources and programs constrain us from promoting specific research. Accordingly, alternative A only partially adheres to this goal. However, all three action alternatives propose a proactive approach to the pursuit of specific research to advance our understanding of how best to manage all the units of the refuge complex. Consequently, all three action alternatives would adhere closely to our stated goal for research and science.

Infrastructure and Operations

Goal: Effectively use money, staff, partners, volunteers, and equipment to restore and manage refuge complex habitats, conduct programs, and improve and maintain all necessary infrastructure.

The refuge's staff, funding, and infrastructure are essential to carry out all necessary management and visitor services programs and activities to fulfill the purposes for which the refuge was established. Under alternatives A and B we propose to maintain the current types, number, and configuration of infrastructure and equipment and to maintain staff and funding levels. However, the existing refuge headquarters and staff offices and facilities are not the most conducive to welcoming the public, our partners, and cooperators. Consequently, both alternatives would only partially adhere to this goal. Under alternatives C and D, we propose many advantageous changes to the headquarters, fencing, and other infrastructure that we believe would maximize our resources and allow us to more effectively interact with visitors and partners. Accordingly, both alternatives C and D would adhere closely to this goal.

Access and Transportation

Goal: Support the improvement of suitable access to the refuges, develop sustainable transportation options, and provide more connections within the refuge complex.

A desire for increased access and transportation options to and within the refuge was among the most numerous comments we received from partners, neighbors, and the public. If our refuge is to remain relevant in the context of a twenty-first-century metropolitan setting, we must find ways to provide greater refuge access and to expand and facilitate suitable transportation options for our visitors and staff.

Under alternative A we propose no changes to the existing level of access and transportation options to and within the refuge. Under alternative B we propose to maintain the existing levels, means, and configuration of access points to the refuge, and only minimal expansion of the transportation options and connections within the refuge complex. Accordingly, neither alternative A nor B would adhere to the goal we have set for future conditions of the refuge. Under alternatives C and D we propose new points and types of access to the refuge, as well as a considerable expansion and reconfiguration of the refuge's transportation options. Accordingly, both alternatives C and D would adhere closely to this goal.

3.14 Comparison of Environmental Consequences

Table 11 summarizes the environmental consequences for all alternatives.

Table 11. Comparison of environmental consequences for the Rocky Mountain Arsenal National Wildlife Refuge CCP and EIS alternatives.

Alternative A—No Action	*Alternative B—Traditional Refuge*	*Alternative C—Urban Refuge*	*Alternative D—Gateway Refuge*
Physical Environment			
Physical Environment—Geology and Soils			
Minor, localized, short-term adverse effects from construction of bison fences.	Same as A.	Same as A.	Same as A.
Moderate beneficial effects on prairie restoration from bison presence.	Same as A.	Same as A.	Same as A.
Adverse effects on vegetation from visitors parking off roads because of shortage of designated parking areas.	Same as A.	Reduced effects because of construction of eight new parking areas and added pull-outs.	Same as C.
Moderate short-term adverse and moderate beneficial long-term effects on soil erosion from breaching Upper Derby dam.	Same as A.	Same as A.	Same as A.
—	Minor to moderate effects on soils by trail use, off-trail use, special events, and other activities associated with increased visitation.	Greater than B.	Same as C.
—	Temporary minor adverse effect on soils from new trail construction.	Greater than B.	Greater than C.
—	—	Negligible adverse effects from constructing 11 miles of trails and 8 new parking areas.	Same as C.
—	Moderate adverse effect through loss of soils from modifying or burying distribution lines.	Same as B.	Same as B.
—	Moderate short-term adverse effects on erosion from improving trails accessibility.	Same as B.	Same as B.
—	—	Moderate adverse effect through loss of soils from adding 56th Avenue auto exits.	Same as C.
—	Minor long-term beneficial effects from abandoning 11.7 miles of roads and converting 8.5 miles to emergency use.	Minor beneficial effects from abandoning 14.5 miles of roads and converting 8.5 miles to emergency use.	Same as C.
—	Moderate, localized, adverse effects of soil disturbance from reintroduction of BFF.	Same as B.	Same as B.

Table 11. Comparison of environmental consequences for the Rocky Mountain Arsenal National Wildlife Refuge CCP and EIS alternatives.

Alternative A—No Action	*Alternative B—Traditional Refuge*	*Alternative C—Urban Refuge*	*Alternative D—Gateway Refuge*
Physical Environment—Water Resources			
Major beneficial effect on water quantity from allowing natural surface flow to dominate.	Same as A.	Same as A.	Same as A.
Major beneficial effects from working with DIA and upstream cities on managing stream and surface flow.	Same as A.	Same as A.	Same as A.
Minor to moderate beneficial effects from recycling all drinking water, saving 8 billion gallons per year.	Same as A.	Same as A.	Same as A.
Potential adverse effects on water quality from surrounding development.	Same as A.	Same as A.	Same as A.
Minor adverse effects of siltation from increased visitation.	Greater than A.	Greater than B.	Similar to C.
Major beneficial effects from maintaining water control infrastructure, providing ponds for wildlife and flood control.	Same as A.	Same as A.	Same as A.
Physical Environment—Air Quality			
Beneficial effects on air quality from maintaining and increasing significant grassland habitat.	Same as A.	Same as A.	Same as A.
Minor temporary adverse effects of management and visitation through vehicular and dust emissions.	Similar to but slightly greater than A.	Greater than B.	Similar to C.
Temporary adverse smoke effects from prescribed fires.	Same as A.	Same as A.	Same as A.
Physical Environment—Climate			
Minor beneficial effects of habitat restoration through carbon sequestration.	Same as A.	Adverse effects of increased emissions from increased visitation, partially offset by increased energy efficiency of nonmechanical modes of transport.	Same as C.
Minor beneficial effects of constructing energy-efficient administration building and increased sustainability measures for new facilities.	Same as A.	Similar to A.	Same as C.

Table 11. Comparison of environmental consequences for the Rocky Mountain Arsenal National Wildlife Refuge CCP and EIS alternatives.

Alternative A—No Action	*Alternative B—Traditional Refuge*	*Alternative C—Urban Refuge*	*Alternative D—Gateway Refuge*
Physical Environment—Night Sky			
—	Beneficial effect of removing unnecessary artificial lighting from targeted areas and minimizing evening programming.	Same as B.	Same as B and C.
Physical Environment—Soundscapes			
Minor short-term effects of maintenance involving heavy equipment.	Same as A, plus: Minor beneficial effects from preserving quiet areas of the refuge.	Same as B, plus: Minor adverse effects from increased visitation.	Same as C.
Physical Environment—Cumulative Impacts			
Potential minor to moderate adverse cumulative effects of contaminated runoff from proposed development south of refuge.	Same as A.	Same as A.	Same as A.
Biological Environment			
Biological Environment—Habitat			
Major beneficial effects from HMP implementation.	Same as A.	Same as A.	Same as A.
Adverse effects on grassland birds from preservation of woodlands.	Same as A.	Same as A.	Same as A.
Moderate beneficial effect from inventorying riparian vegetation.	Same as A.	Same as A.	Same as A.
Moderate beneficial effect from continuing partnerships with agencies for restoration.	Same as A.	Same as A.	Same as A.
—	Minor to moderate beneficial impact on habitat restoration from reintroduction of BFF.	Same as B.	Same as B.
—	Minor adverse trampling effects on vegetation associated with increased visitation.	Minor to moderate adverse trampling effects on vegetation associated with increased visitation.	
—	Minor temporary adverse effects of vegetation and soil loss from construction, new trails, burying transmission lines, and installing fences.	Same as B, plus: Long-term minor beneficial effect from burying all transmission lines.	Same as C.
—	Minor beneficial effect of removing 11.7 miles roads.	Minor beneficial effects of removing 14.5 miles of roads and converting 8.4 miles to emergency use.	Same as C.

Table 11. Comparison of environmental consequences for the Rocky Mountain Arsenal National Wildlife Refuge CCP and EIS alternatives.

Alternative A—No Action	*Alternative B—Traditional Refuge*	*Alternative C—Urban Refuge*	*Alternative D—Gateway Refuge*
—	—	Negligible adverse effect of spread of invasive species from increased visitation.	Similar to C.
—	—	Minor adverse habitat disturbance effects from construction of eight new parking areas and 11 miles of trails.	Same as C.
—	—	Minor adverse habitat disturbance from construction of new facilities and amenities.	Same as C.
—	—	Minor adverse effect of disturbance and possible spread of invasive species from opening Wildlife Drive.	Same as C.
—	—	Opening shoreline fishing may require additional parking lots and amenities with minor to moderate negative impact	No effect
—	—	Minor adverse effects of disturbance, fragmentation, and spread of invasive species from increased trail connectivity to areas outside refuge.	Potentially greater than C.
—	—	Potential moderate adverse effect of increased fishing activity from trampling and habitat fragmentation along shorelines.	Same as C.
—	—	Additional trailheads, trails and access would have moderate adverse fragmentation impacts.	Same as Alternative C
—	—	—	Moderate temporary adverse effects from additional large-scale events.
—	—	—	Minor to major beneficial effects from sharing knowledge that leads to improved managements.
Biological Environment—Wildlife			
No effects from reintroduction of BFF.	Moderate to major long-term beneficial effects from reintroduction of BFF.	Same as B.	Same as B.
—	Moderate beneficial effects on other species from closure of BFF reintroduction area.	—	—

Table 11. Comparison of environmental consequences for the Rocky Mountain Arsenal National Wildlife Refuge CCP and EIS alternatives.

Alternative A—No Action	*Alternative B—Traditional Refuge*	*Alternative C—Urban Refuge*	*Alternative D—Gateway Refuge*
Minor to major beneficial effects on grassland bird species from habitat restoration activities.	Same as A.	Same as A.	Same as A.
—	Moderate to major beneficial effects of reintroducing plains sharp-tailed grouse, greater prairie-chicken, and pronghorn.	Same as B.	Same as B.
—	Minor adverse effects of increased visitation on reintroduced species of concern.	Moderate adverse effects of increased visitation on reintroduced species of concern.	Similar to but less than C.
—	—	Moderate adverse effects on species of concern from opening Wildlife Drive.	Similar to C.
Beneficial effects on grassland species from management of bison and prairie dog populations.	Same as A.	Same as A.	Same as A.
Minor adverse disturbance effects on grassland birds from increased visitation.	Greater than A.		
—	Minor adverse effects on prairie dog predators (e.g., raptors, coyotes) from competition from BFF.	Same as B.	Same as B.
		Moderate adverse effects on surrogate grassland bird and other native wildlife species from opening Wildlife Drive. Negligible adverse effects on bison and prairie dogs.	Similar to C.
Potential minor adverse effects on fish from water quality degradation associated with increased visitation.	Similar to but slightly greater than A.	Similar to A and B but potentially increasing to moderate intensity because of high visitation levels.	Similar to but less than C.
Minor adverse effects on reptiles and amphibians from roadkill associated with increased visitation.	Similar to but slightly greater than A.	Similar to A and B but potentially increasing to moderate intensity because of high visitation levels, additional trails, and potential for increased sediment discharge.	Similar to but less than C.
Minor to moderate adverse disturbance effects on birds associated with increased visitation.	Similar to but slightly greater than A.	Similar to A and B but potentially increasing to moderate intensity because of high visitation levels, additional trails, and potential for increased sediment discharge.	Same as C.

Table 11. Comparison of environmental consequences for the Rocky Mountain Arsenal National Wildlife Refuge CCP and EIS alternatives.

Alternative A—No Action	*Alternative B—Traditional Refuge*	*Alternative C—Urban Refuge*	*Alternative D—Gateway Refuge*
Minor, temporary adverse disturbance effects associated with construction of new administration building.	Similar to A.	Similar to but greater than A and B because of greater extent of facility construction.	Same as C.
—	—	—	Moderate temporary adverse disturbance effects associated with two large special events annually.
Beneficial effects on deer populations from culling activities.	Same as A.	Same as A.	Same as A.
—	Minor effects on deer population from hunting program.	Same as B.	Same as B.
Cumulative Impacts			
Beneficial cumulative effects on habitat of other entities (e.g., Sand Creek Greenway, Barr Lake State Park, Prairie Gateway Open Space) undertaking habitat conservation in region.	Same as A.	Same as A.	Same as A.
Beneficial cumulative effects on wildlife of conservation activities on neighboring lands.	Same as A.	Same as A.	Same as A.
Adverse cumulative effects on wildlife associated with residential and commercial development outside refuge.	Same as A.	Same as A.	Same as A.
Visitor Services			
Visitor Services—Hunting			
—	Minor to moderate temporary adverse effects on visitor opportunities from closures during hunts.	Same as B.	—
—	Beneficial effect on young and special-needs visitors interested in hunting.	Same as B.	—
—	Minor to moderate beneficial effects from providing hunter education.	Same as B.	—
—	—	Minor beneficial effect from constructing archery range.	—
—	—	—	Minor beneficial effect from promoting hunting throughout Colorado and Refuge system.
—	No cumulative effects anticipated.	Same as B.	—

Table 11. Comparison of environmental consequences for the Rocky Mountain Arsenal National Wildlife Refuge CCP and EIS alternatives.

Alternative A—No Action	*Alternative B—Traditional Refuge*	*Alternative C—Urban Refuge*	*Alternative D—Gateway Refuge*
Visitor Services—Fishing			
Long-term beneficial effects on visitor experience from ongoing fishing program.	Same as A.	Additional beneficial effects from increased programming and instruction.	Similar to C.
—	—	Adverse effects on wildlife from increased fishing by displacing other wildlife species from fishing areas.	Similar to C.
No cumulative effects anticipated.	Same as A.	Same as A.	Same as A.
Visitor Services—Wildlife Observation and Photography			
Minor adverse effects of unimproved trails system and staff limitations.	Moderate beneficial effects from added facilities, new programs, and reintroduction of native species.	Major beneficial effects of expanded trail system, improved viewing facilities, and improved access.	Similar to C, plus additional beneficial effects of opportunities presented by commercial vendors and partners.
—	—	Moderate beneficial effects from opening Wildlife Drive.	Same as C.
—	—	Minor adverse effects from crowding and potential for conflicts on trails and viewing areas.	Similar to C.
Visitor Services—Environmental Education			
Moderate adverse effects from staff limitations constraining level of offerings.	Similar to A, plus: Beneficial effects of developing new curricula based on BFF reintroduction and exhibit and increased accessibility on existing trails.	Similar to B, plus: Major beneficial effects of expanded onsite programming, addition of Environmental Education Center, additional tours, and additional interpretive materials.	Similar to C, plus: Increased opportunities through collaboration with commercial vendors.
—	—	Major beneficial effects of outreach to nontraditional visitors and increased offsite programming.	Similar to C.
—	—	—	Major beneficial effects of summer camps, adult forums, living history programs, and rehabilitated historical exhibits.
Visitor Services—Interpretation			
Moderate adverse effects from staff and volunteer limitations constraining level of offerings.	Similar to A, plus: Beneficial effects of developing new curricula based on BFF reintroduction and exhibit and increased accessibility on existing trails.	Major beneficial effects of expanded facilities and programming, developing multilingual programming, expanding offsite programming.	Similar to C, plus: Beneficial effects of increased emphasis on linkage with regional sites.

Table 11. Comparison of environmental consequences for the Rocky Mountain Arsenal National Wildlife Refuge CCP and EIS alternatives.

Alternative A—No Action	*Alternative B—Traditional Refuge*	*Alternative C—Urban Refuge*	*Alternative D—Gateway Refuge*
—	—	—	Minor to moderate beneficial effects from incorporating 1861 into the refuge trail system.
Cultural and Historical Resources			
Minor beneficial effects on significant resources from stabilization of Egli House.	Same as A.	Similar to B, plus: Major beneficial effects from restoration of Egli House exterior.	Similar to C, plus: Major beneficial effects from restoration of Egli House interior.
Minimal effects from unanticipated discoveries through Section 106 compliance.	Same as A.	Same as A, except: Increased possibility of unanticipated discoveries associated with increased development of new facilities.	Same as C.
Potential beneficial effects from improved storage, curation, and possible deaccession.	Same as A.	Major beneficial effects from additional artifact storage.	Major beneficial effects from deaccessioning WWII/Cold War artifacts to offsite facility.
No change to research and interpretation.	Moderate beneficial effect from increased interpretation of prehistoric uses of native landscapes.	Moderate to major beneficial effects from increased interpretation opportunities, increased public outreach, partnerships with Native American communities, interpretation of historical resources, use of electronic media, and use of restored Egli House.	Similar to C, plus: Potential minor adverse effects through increased visitation. Beneficial effects from tours of fully restored Egli House. Moderate beneficial effects from additional research on prehistoric sites. Moderate to major beneficial effects from historical interpretation (e.g., 1861 wagon trail, WWII/Cold War history).
Infrastructure and Operations			
Moderate adverse effects from insufficiency of existing infrastructure to support anticipated increased visitation.	Moderate beneficial effects from developing infrastructure to support anticipated visitation increases. Minor temporary adverse effects from construction activities.	Similar to B, but benefits and temporary disturbances will be greater because of more extensive development of facilities.	Similar to C, except: Beneficial effects from partnerships and concessions allowing reallocation of staff for greater operational efficiency.

Table 11. Comparison of environmental consequences for the Rocky Mountain Arsenal National Wildlife Refuge CCP and EIS alternatives.

Alternative A—No Action	*Alternative B—Traditional Refuge*	*Alternative C—Urban Refuge*	*Alternative D—Gateway Refuge*
Access and Transportation			
Major adverse effect from poor signage and uninviting entrance.	Moderate to major beneficial effects from improved directional signage. Moderate adverse effect from existing entrance gate.	Major benefit from new inviting entrance gate and improved signage.	Same as C.
Major adverse effect from existing roadway conditions as visitation increases. Beneficial effects from abandoning 11.7 miles of roads.	Same as A, plus: Beneficial effects from abandoning 14.5 miles of roads and converting 8.4 miles to emergency use.	Same as B, plus: Major beneficial effect from opening Wildlife Drive, adding 9.3 miles of roadway. Moderate beneficial effect from allowing traffic to exit refuge at two additional locations.	Same as C.
Moderate adverse effects from shortage of designated parking areas.	Moderate beneficial effect of creating one new parking area at Rattlesnake Hill.	Major beneficial effects from adding eight new parking areas. Moderate temporary short-term adverse effects associated with construction.	Same as C.
Minor adverse effects on existing trail system from increased visitation.	Moderate beneficial effect on trail system from adding two new trails (2.8 miles) and providing access to local communities.	Moderate beneficial effect from adding 11.2 miles of new trails and six pedestrian and bicycle access points.	Same as C.
Minor adverse effects from restriction of bicycle use to refuge road from main gait to Visitor Center.	Same as A.	Major beneficial effect from allowing bicycle access on some roadways and trails and substantially increasing community access.	Same as C.
Socioeconomic Environment			
111 jobs. $4.7 million in labor income. $7.2 million in value added.	141 jobs. $5.9 million in labor income. $9.1 million in value added.	296 jobs. $12.1 million in labor income. $18.8 million in value added.	165 jobs. $6.8 million in labor income. $10.6 million in value added.

Chapter 4—Affected Environment

© Rich Keen

Hiking on the refuge

The land ethic simply enlarges the boundaries of the community to include soils, waters, plants, and animals, or collectively: the land.

This sounds simple: do we not already sing our love for and obligation to the land of the free and the home of the brave? Yes, but just what and whom do we love? Certainly not the soil, which we are sending helter-skelter downriver. Certainly not the waters, which we assume have no function except to turn turbines, float barges, and carry off sewage. Certainly not the plants, of which we exterminate whole communities without batting an eye. Certainly not the animals, of which we have already extirpated many of the largest and most beautiful species. A land ethic of course cannot prevent the alteration, management, and use of these 'resources,' but it does affirm their right to continued existence, and, at least in spots, their continued existence in a natural state.

Aldo Leopold

This chapter describes the characteristics and resources of the Rocky Mountain Arsenal National Wildlife Refuge in the categories listed below and provides the basis for the environmental analysis presented in chapter 5:

- Physical Environment
- Biological Environment
- Special Management Areas
- Visitor Services
- Communications and Outreach
- Partnerships
- Human History and Cultural Resources
- Research and Science
- Infrastructure and Operations
- Access and Transportation
- Socioeconomic Environment

4.1 Physical Environment

This section describes the physical environment of the refuge. Physical characteristics comprise physiography, water resources, air quality, climate, night sky, and soundscapes.

Physiography

Topography

The surface topography on the refuge has been shaped largely by erosional and depositional processes associated with the South Platte River and its tributaries. The land shape varies from almost level to gently rolling, with slopes typically less than 3 percent and terrace escarpments with slopes up to 10 percent. In general, the land surface slopes to the northwest, with elevations ranging from 5,136 feet along the northwest boundary to 5,340 feet at southeastern boundary (figure 12). Rattlesnake Hill and Henderson Hill are prominent high points in the central and northeastern portions of the refuge, respectively (FWS 1996a). As part of the cleanup of the Rocky Mountain Arsenal, two prominent landfills were constructed in the center of the property at 5,302 and 5,314 feet.

Geology

The refuge lies in the Denver Basin, a north–south fold in the regional geology that extends along the Front Range from Cheyenne, Wyoming, to Colorado Springs, Colorado. Surface geologic deposits consist primarily of unconsolidated river sediments (alluvium) deposited by the South Platte River system and covered partially by windblown (aeolian) sediment. The uppermost bedrock layer is called the Denver Formation. This layer was originally 900 feet thick, but has eroded completely in the nearby South Platte River area, and is 500 feet thick at the southeast corner of the refuge (Morrison-Knudsen Environmental Services Inc. 1989). Wind-deposited material is thickest in the south and southwest sections of the refuge. Most of the alluvial deposits on the refuge are fine-textured, except for remnants of cobble alluvium on Rattlesnake Hill, on Henderson Hill, and in the North Plants Area (James P. Walsh & Associates Inc. 1991).

Soils developed from both wind- and water-deposited material. Soils formed from water-transported material are derived from shales, sandstone, and granite. These soils are generally of clay to loam texture, although cobbly material occurs on hills in the northern portion of the refuge (James P. Walsh & Associates Inc. 1991). Soils developed from wind-deposited material are typically sandy in texture. Throughout the refuge, soils formed under grassland vegetation are typically dark colored with high organic matter content (figure 13).

Bresser soils make up the most common soil series on the refuge. These soils occur on sandy, wind-deposited plains in the southwestern and southern portions of the refuge. Bresser soils are deep and well drained with medium to coarse textures. Weld series soils occur extensively in the northeastern portion of the refuge. These soils are formed from alluvial and wind-deposited material and have fine to medium textures. Ascalon soils are found on old alluvial terraces, escarpments, and aeolian plains in the central and northern areas of the refuge. Satanta soils are similar to Ascalon but are finer textured. The well-drained Nunn soils are found in moderate distribution over the north and east portions of the refuge. The coarse sandy textured Truckton soils are found to a limited extent in the south and west portions of the refuge; they are highly susceptible to wind erosion. Aquic Haplustolls are deep, poorly drained soils occurring primarily along First Creek (James P. Walsh & Associates Inc. 1991).

Refuge soils are subject to wind and water erosion. The Nunn and Satanta soils are the most susceptible to water erosion. Truckton, Bresser, and Ascalon soils have the greatest potential for wind erosion when vegetation is removed. Revegetation potential is moderate for most soils on the refuge, although some soils may have revegetation limitations associated with slope, water holding capacity, or depth.

Effect of Remediation on Soils

The effects of manufacturing ordnance and pesticides on refuge wildlife and habitats, and the subsequent plans that were developed to clean up contaminants, are well documented in the 1996 ROD (Foster Wheeler Environmental Corporation 1996). In summary, disposal practices typical of the production era included treating and discharging waste products into evaporation basins. However, by the early 1950s, chemical wastes were leaching through the soil into groundwater and were affecting wildlife. In 1983, EPA listed the site as a Superfund Cleanup site. Subsequent cleanup activities have included construction of borrow areas, caps, covers, landfills, and other remediation structures that disturbed thousands of acres on the present-day refuge. These activities have been ongoing since 1988 and were concluded in the fall of 2011. In some cases (such as Section 36), the surface topography of an entire section was completely recontoured to facilitate cleanup and drainage from the Integrated Cover System, whereas in other sections borrow areas had to be excavated to depths ranging from 1 to more than 20 feet.

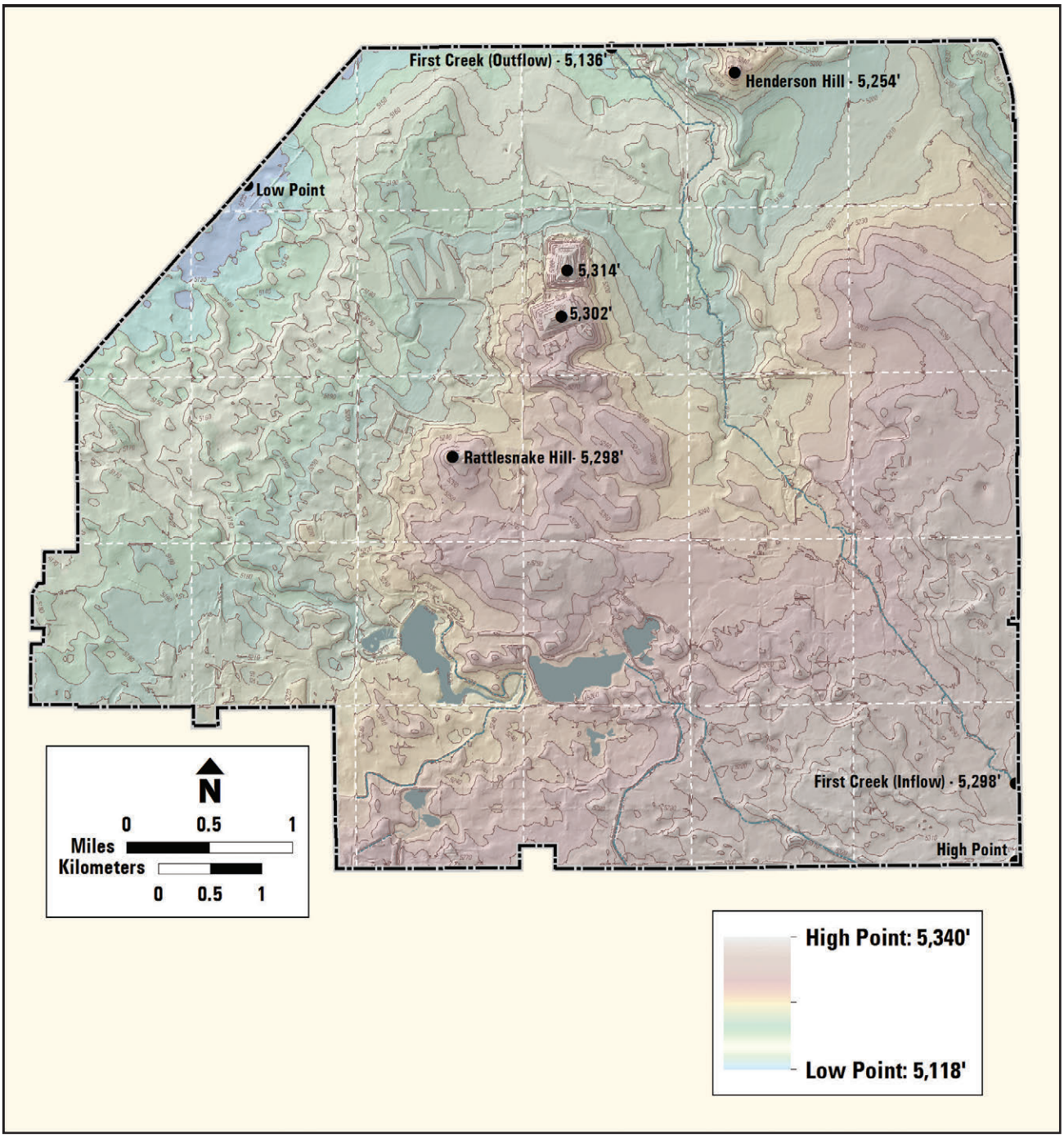

Figure 12. Topography of Rocky Mountain Arsenal National Wildlife Refuge, Colorado.

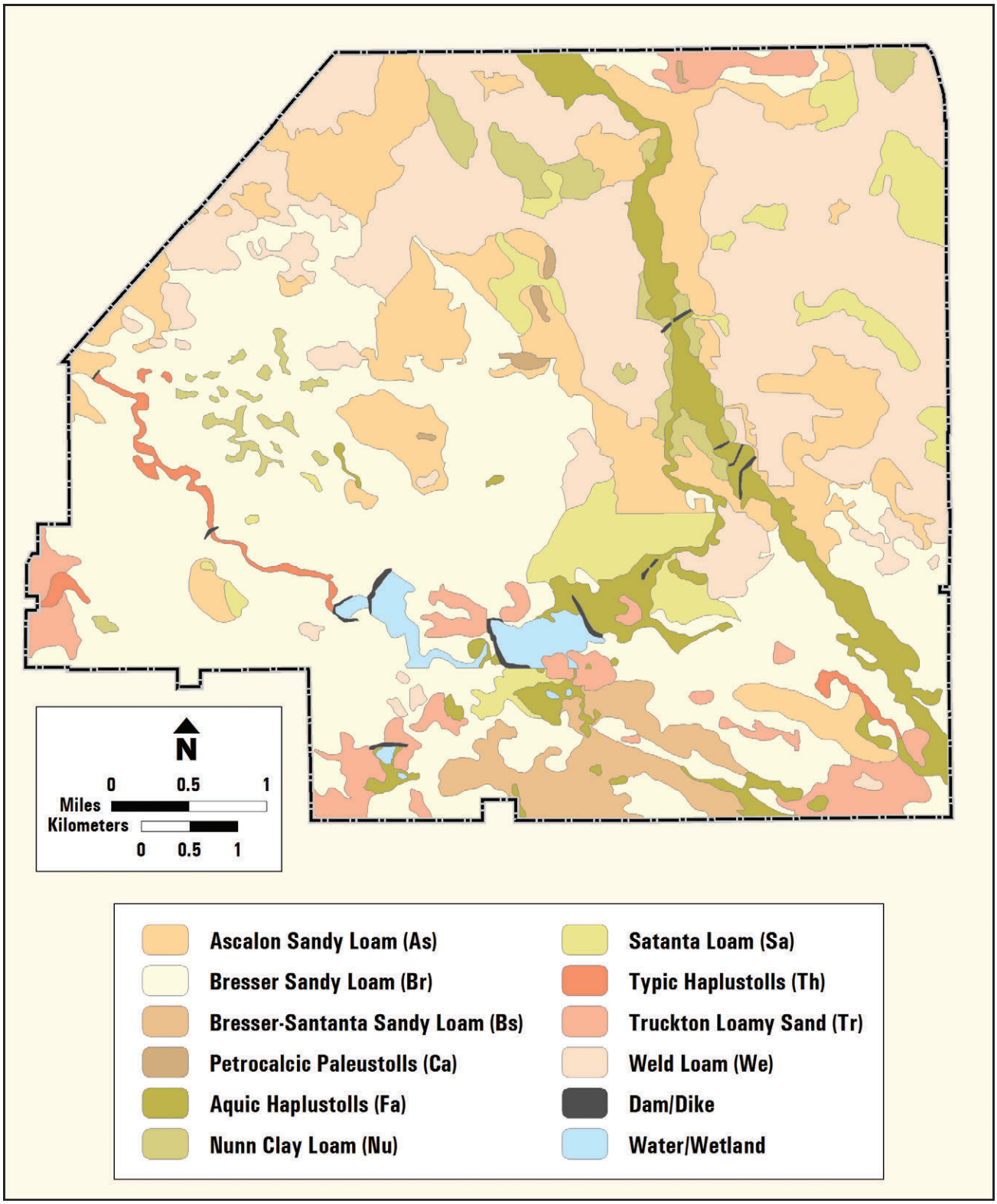

Figure 13. Soil classes in Rocky Mountain Arsenal National Wildlife Refuge, Colorado.

Water Resources

The refuge lies within several drainage basins that are tributary to the South Platte River, less than 2 miles northwest of the refuge. These basins include Irondale Gulch, First Creek, Second Creek, and several small areas that originally drained directly into the South Platte River. As a result of human alterations, some of these latter areas now drain to either Irondale Gulch or First Creek. The Irondale Gulch and First Creek basins cover more than 91 percent of the total refuge area (FWS 1996a).

In the 1870s, homesteaders were well established in the vicinity of the present-day refuge (Hoffecker 2001). Attempts to improve the area for agricultural production were initiated as early as 1883 with the construction of the Sand Creek lateral irrigation canal, which was eventually expanded into an intricate system of irrigation canals, reservoirs, and ponds. Between 1910 and 1920, portions of First Creek were channelized, the Highline Canal system and Ladora ("La Dore") Reservoir were constructed, and the dam forming Derby Lake was built (Hoffecker 2001). During U.S. Army operations and subsequent cleanup, dams and other water management infrastructure were improved.

Water is currently impounded in the refuge's reservoirs: Lake Ladora, Lake Mary, and Upper and Lower Derby Lakes. Water is also stored in the Havana Pond (figure 14). We allow natural processes to take place on the refuge's 119 acres of wetlands to promote native emergent species and provide opportunistic benefits to wetland-dependent wildlife.

- Lake Mary Dam—Lake Mary was created by a U.S. Army equipment operator and has not been significantly modified since.

- Ladora Dam—In the late 1800s, the "La Dore" reservoir was created by homesteaders. In 1942–1943, the U.S. Army raised the elevation of this dam by 5 feet to increase reservoir capacity. In 1998, the Army completed repairs to the dam and added a new outlet works and spillway.

- Lower Derby Dam—Local farmers constructed a dam around 1900. In the 1940s, the U.S. Army raised the crest of the existing embankment, creating what is now known as Lower Derby Dam. The dam was further rehabilitated in 1990 including the addition of a needed spillway.

- Upper Derby Dam—It is unknown if an earlier dam or other impoundment existed in the current location of Upper Derby Dam, but in 1942–1943 the U.S. Army constructed a dam, several canals, and an outlet that matches what exists today. In 1973, Upper Derby Dam overtopped, breached, and was reconstructed (U.S. Army Corps of Engineers 2014). Currently, the dam is in need of major improvements. Many of these improvements require the removal of some trees. For that reason, prior to transfer, Upper Derby Dam will be breached to allow only a small amount of water to be retained behind the structure (FWS 2013a).

- Havana Pond Dam—This dam was constructed in 1973 as a part of the enlargement of the old Stapleton airport, and it began holding water in 1974. This dam is operated and maintained by the City and County of Denver.

Surface Water Quality

Water quality classifications and numeric standards for the refuge's reservoirs are governed by the State of Colorado. In 2009, the Colorado Water Quality Control Commission erred in grouping the refuge's reservoirs into a new segment with other lakes in the Upper South Platte River basin. This change conflicted with prohibitions on the former Superfund site. In 2014, the Commission agreed to a request from the refuge to place its reservoirs into its own segment (Segment 22b–Upper South Platte River).

Both offsite and onsite sources of contamination have adversely affected surface water quality on the refuge (FWS 1996b). USGS has monitored the quality and quantity of incoming streamflow to the refuge since the early 1990s. In most cases, incoming streamflows have failed to meet State standards for water quality (Gordon et al. 2005).

We will attempt to achieve and maintain a water quality standard in all reservoirs (pH = 6.5–9.0 and minimum dissolved oxygen concentration of 5.0 mg/L) (CDPHE 2012) and provide a quality sport fishery for individual reservoirs as defined in our aquatic management stepdown plan (FWS 2006a).

Urban Drainage and Flood Control

Beginning in at least 1987, the Federal Government recognized that flooding in the Irondale Gulch basin was imminent. At that time, USACE recommended that agreements be developed to allow upstream development while protecting on-post interests and requiring that all new upstream development include sufficient storage for total retention of any increased runoff (Sizemore 1987). Ultimately

the decision was made not to accept any additional water from upstream developments in the City of Denver (Heim 1987).

In 2002, the U.S. Army and UDFCD prepared a drainage study for the Irondale Gulch drainage basin in the southern portion of the refuge. The purpose of the drainage study was to provide preliminary design alternatives for a system to convey periodic stormwater discharge, mitigate the effect of 100-year storm events, and enhance water quality on the refuge (ERO Resources Corporation 2002). In 2003, the U.S. Army signed a Finding of No Significant Impact (FONSI) that would increase trash collection features, enlarge the Uvalda Interceptor, and enhance water storage in the so-called Railroad Embankment. This decision document also proposed enlarging storage capacity in Upper Derby Lake, although this modification has been determined to be infeasible. In 2007, all this information was incorporated into an intergovernmental agreement between UDFCD, the City and County of Denver, and the Federal Government.

Development in the northeast Denver area has continued, and periodic flooding occurs on the refuge. In September 2013, northeast Denver experienced historic flash flooding that caused the Havana Pond dam to breach and caused millions of dollars in damage to the refuge. A similar event occurred in 1973 when the Upper Derby dam was overtopped and failed.

Groundwater

The refuge lies within the Denver groundwater basin. Surficial streams and wind-deposited soils contain water, as do several bedrock aquifers. Unconsolidated deposits cover nearly all of the refuge, underlain by the sedimentary Denver Formation. Shallow groundwater flow occurs primarily in the unconsolidated deposits, but also in the weathered outer layer of the Denver Formation. Water levels range from less than 5 feet below ground surface in the area of the reservoirs and First Creek to more than 60 feet on the west side of the refuge. Groundwater level fluctuations are generally less than 2 feet. Groundwater flows are to the north and northwest (FWS 1996a).

Previous human activities and cleanup operations have altered the water table and flow direction locally. These changes include the boundary containment and treatment systems associated with remediation, recharge from surface water impoundments, and subsidence due to well pumping. The shallow aquifer is recharged from precipitation, surface water, and discharges to surface water (principally the South Platte River). It is also recharged from and discharges to the Denver Formation aquifer (FWS 1996a).

The Denver Formation aquifer is separated from the shallow alluvial Row system by relatively impermeable shale or claystone. The Denver Formation, 200–500 feet thick under the refuge, contains water-bearing layers of sandstone and siltstone in poorly defined, irregular, interconnected beds that range in thickness from a few inches to 50 feet. A small amount of recharge occurs from the overly unconfined aquifer and from bedrock outcrops, which occur in only a few locations. Discharge from the Denver Formation occurs by lateral flow into the unconfined aquifer and by leakage to the underlying Arapahoe bedrock aquifer (FWS 1996a).

Surface cleanup of the Rocky Mountain Arsenal was completed in 2011, but the groundwater monitoring and remediation continue. The largest areas of contaminated groundwater—in the north, central, and western parts of the refuge—occur as spatially distinct contaminant plumes. The plumes contain one or more contaminants migrating together through the shallow aquifer. Migration has resulted in the merging of contaminant plumes from individual source areas. At the north and northwest refuge boundaries, contaminated shallow groundwater is being removed, treated, and returned to the flow system downstream. Groundwater intercept-and-treat systems are located at various locations within the refuge (FWS 1996a).

Platte River Depletions

In 2013, we completed formal consultation on our Federal water use pursuant to section 7(a)(2) of the Endangered Species Act of 1973, as amended. This consultation was completed as part of the HMP (FWS 2013a) and is tied to the Service's 2006 programmatic biological opinion for the Platte River Recovery Implementation Program. This biological opinion concluded that the refuge's use of up to 1,400 acre-feet of water per year is not likely to jeopardize the continued existence of the whooping crane, interior least tern, and pallid sturgeon, all federally listed as endangered; or the northern Great Plains population of piping plover or western fringed orchid, both federally listed as threatened, in the central and lower Platte River; nor will it destroy designated critical habitat for the whooping crane.

Air Quality

For air quality planning purposes, the refuge is within the boundary of the Denver Metropolitan

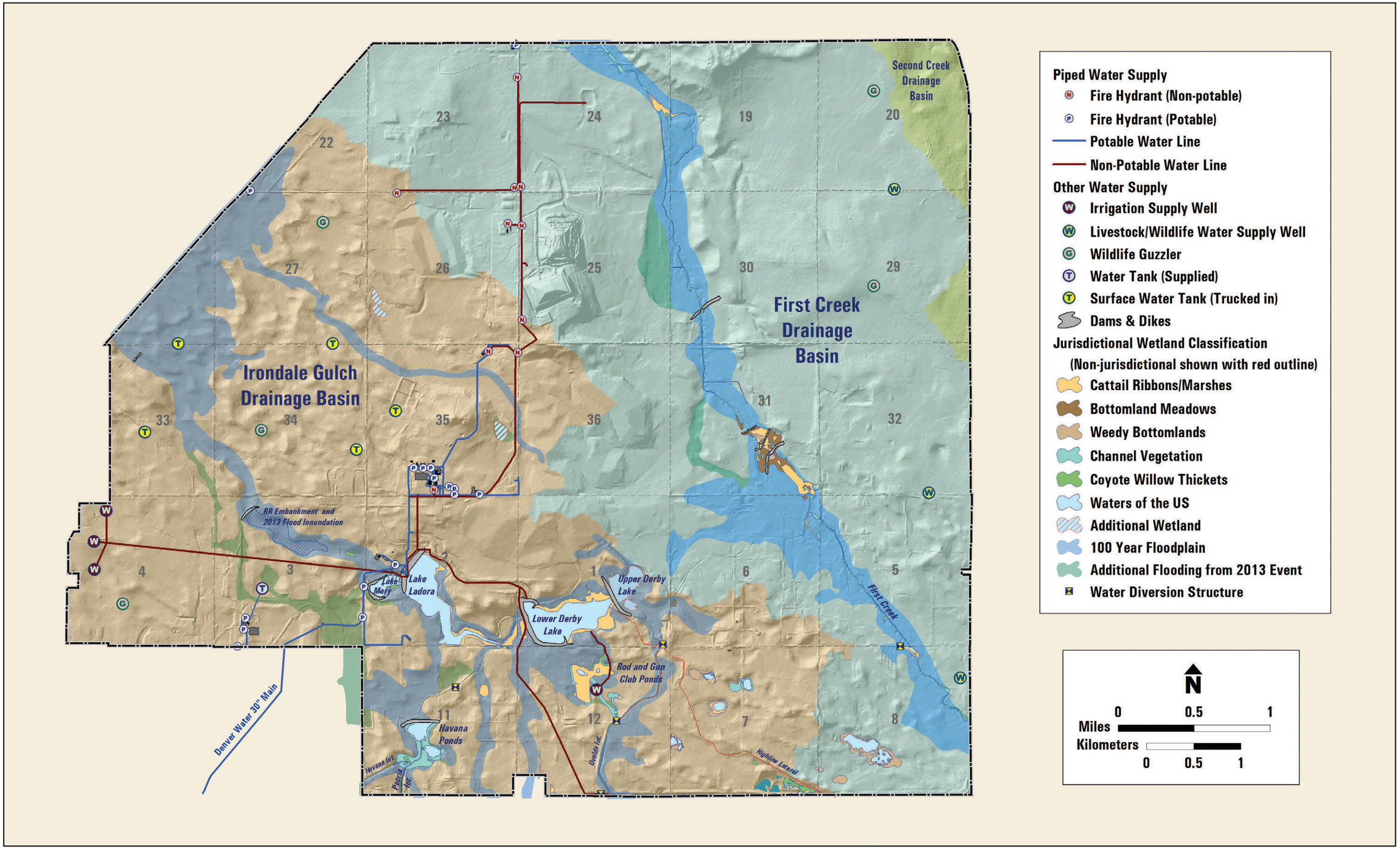

Figure 14. Surface hydrology and water infrastructure on Rocky Mountain Arsenal National Wildlife Refuge, Colorado.

area. For many years, the Denver Metropolitan area has experienced carbon monoxide and particulate matter air pollution as well as visibility problems. In July 2012, EPA classified the metropolitan area as a marginal nonattainment area. A nonattainment area is one in which air quality does not meet the ozone standards set forth by the Federal government in 2008. The primary air quality concern in the region is ozone (CDPHE 2014b).

The refuge is in Adams County, Colorado. In 2011, less than 1 percent of days exceeded the required standards for particulate matter and only 3 days exceeded the daily maximum 8-hour standards for average ozone concentrations (CDPHE 2014a). Further, in 2013, there were 256 days when the air quality in the area was considered good or better. The primary air quality concern in Adams County is ozone (EPA 2013).

Climate

The climate of the refuge is characterized as semiarid with wide variations in seasonal and daily temperatures. January is the coldest month with an average high temperature of 43 °F and an average low of 16 °F. July is the hottest month with an average high temperature of 88 °F and an average low of 59 °F (FWS 1996b).

Colorado's climate is unlike that of any other state—it is characterized by the high elevations and complex topography of the Rocky Mountains, the Colorado plateau and valleys of the West Slope, and the high plains falling off from the Continental Divide toward the east (Ray et al. 2008). The mountains to the west create what is known as a rain shadow—that is, storms forming over the mountains often dissipate before reaching the refuge. Weather on the refuge is dominated by warm-season precipitation, largely a result of localized convective storms. Precipitation varies from 12 to 16 inches annually, with 80 percent occurring from April to September. Average annual precipitation actually increases as one travels eastward from the refuge onto the eastern Colorado plains. May is normally the wettest month, averaging 2.5 inches. Summer precipitation is largely the result of convective thunderstorms, often accompanied by hail. Precipitation from these storms can be quite variable, although 60 percent of the rainfall events occurring from May to August produce less than 0.8 inch per event. In contrast, January is normally the driest month, averaging 0.5 inch (1.2 cm) (FWS 1996b). Winter precipitation (December–February) constitutes a relatively small proportion of the total annual precipitation (Lauenroth and Milchunas 1992).

Night Sky

One of the most rapidly increasing alterations to the natural environment is the alteration of the ambient light levels in the night environment produced by anthropogenic, or artificial, light. At the turn of the century, it was estimated that two-thirds of the country's population live where they cannot see the Milky Way (Cinzano et al. 2001). While you will never be able to see the Milky Way from the refuge, lands in the northeast portion of the refuge offer twice the visibility of surrounding communities. As the Denver Metropolitan area continues to enlarge, this is a value worthy of our protection.

The National Park Service's Natural Sounds and Night Skies Division examined a light pollution model output of the three national wildlife refuges located in the Denver Metropolitan area (figure 15). Under the values predicted by this model, stargazing and other nighttime aesthetic values would be substantially compromised and terrain features would be substantially illuminated. The refuge has a predicted mean Anthropogenic Light Ratio (ALR) of 28.0 (minimum = 20.2, maximum = 37.1). An ALR of 0.0 would be a pristine natural area and an ALR of 28.0 would be 2,800 percent brighter than the natural light from the night sky (Moore et al. 2013). This predicted level is where one would also have heightened concern over ecological impacts, though no specific thresholds are presented (Chad Moore, NPS, Night Sky Program Manager; email communication; February 25, 2014).

Light pollution is a relatively easy environmental problem to resolve. Solutions are immediate and effective, and they often save money. The following practices are recommended to improve lighting: determine if light is needed, and why; use artificial light only when actually needed; use the right amount of light for the task; direct the light only to the places where needed; eliminate glare; minimize obtrusive lighting (also known as light trespass); minimize direct upward light, a major cause of urban sky glow; turn lights off when not needed; use motion sensors when possible; install dimmers or multi-level lighting; use energy-efficient sources; and minimize energy waste (Alvarez del Castillo and Crawford 2001).

Soundscapes

Sound plays a vital role in ecological interactions as well as in visitors' experiences on the refuge. A soundscape refers to the totality of the perceived acoustical environment. A soundscape usually refers to human perception, but the term could also apply to

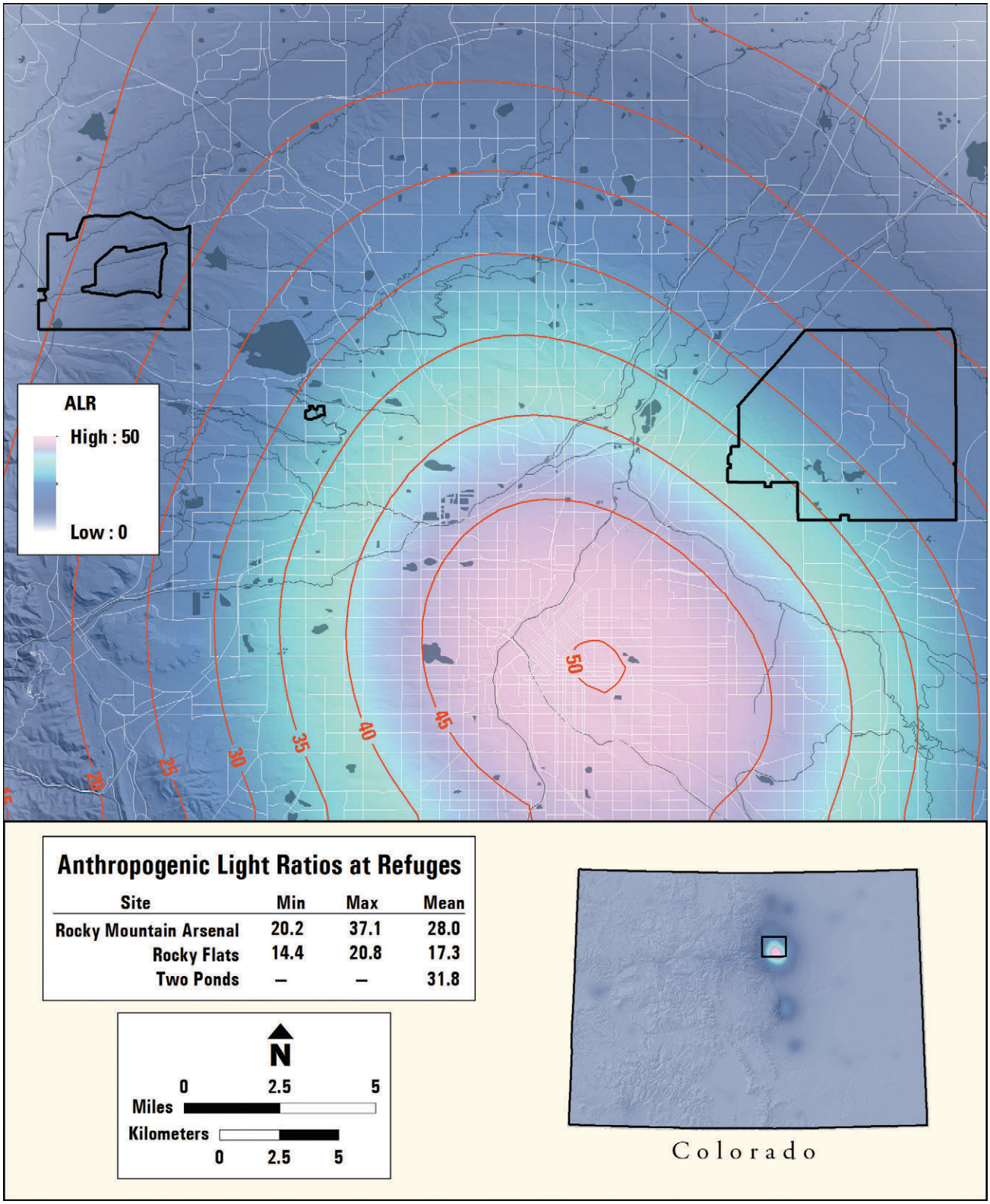

Figure 15. Anthropogenic light ratio of the night sky in the Rocky Mountain Arsenal National Wildlife Refuge Complex vicinity.

other species. A listening area is the area in which a sound can be perceived by an organism; the listening area shrinks when background sound levels increase (Turina et al. 2013). The failure to perceive a sound because other sounds are present is called masking. Masking interferes with wildlife communication, reproductive and territorial advertisement, and acoustical location of prey or predators (Barber et al. 2010). The effects of masking are not limited to wildlife. Masking also inhibits human communication and visitor detection of wildlife sounds. In urban settings, masking can prevent people from hearing important sounds like approaching people or vehicles and can interfere with the way visitors experience cultural sounds or interpretive programs (Turina et al. 2013). Seemingly small increases in sound levels can have substantial effects, particularly when quantified in terms of loss of listening area (Barber et al. 2010; Payne and Webb 1971). Each 3 decibel increase in the background sound level reduces a given listening area by half. Therefore, the presence and levels of nonnatural sounds are an important factor influencing future management of the refuge.

The National Park Service's Natural Sounds and Night Skies Division examined a sound level model output of the three national wildlife refuges in the Denver Metropolitan area (figure 16). This model shows anticipated existing sound levels, natural ambient sound levels, and impact levels from noise across the three units, for an average summer day. While the existing sound level metric reports current conditions (including anthropogenic and natural sound sources), the natural ambient sound level metric reports what conditions would be without human influence. The impact metric reports the difference between existing and natural to estimate the impact of noise on a given location. Based on predicted values, all three sites demonstrate mean impact levels of concern for protected natural areas near urban centers. Conditions at the refuge would warrant moderate concern, as the listening area is likely reduced by about 91 percent (Emma Lynch, NPS, Natural Sounds and Night Skies Division; email communication; February 25, 2014). Despite this concern, the refuge is significantly quieter than surrounding communities, and conditions vary considerably across the site.

Protection of acoustical environments has received growing attention from managers and policy makers as a result of an increased understanding of its role in overall ecosystem health and visitor enjoyment. Soundscape management is becoming more complex and challenging as threats to acoustic resources, both internal and external to park boundaries, increase (National Park Service 2012). Vehicles and aircraft are the largest source of noise on the refuge, but noise is also produced through routine refuge operations.

4.2 Biological Environment

Habitat

Prior to European settlement, most of the area that is now the refuge was shortgrass or mixed-grass prairie, depending on the soil. Post-settlement, much of the land was converted to farming or grazing. Shortly after the U.S. Army took control of the land, the land around the facility was left untouched for several years until the Army planted crested wheatgrass, a nonnative grass species that is perfectly suited to the climate here.

During the cleanup period, thousands of acres of land were disturbed through the remediation process and many more were left in a decadent state. The Service has spent many years, with many more to go, to restore the land to as close to its native condition as possible.

The plant list for the refuge consists of 468 species, including 53 introduced species and 29 noxious weeds (refer to appendix G). Regardless of their origin, these plants represent several dominant habitats on the refuge that are addressed in the HMP (figure 17). Their presence and abundance influence the seed mixes used for prairie restoration and weed control strategies, such as chemical application versus manual removal. No federally listed plant species are known to occur on the refuge at this time.

Federally Listed Plant Species

The Colorado butterfly plant, federally listed as threatened, occurs primarily in southeastern Wyoming, north-central Colorado, and extreme western Nebraska. The Colorado butterfly plant is typically found in wetland habitats along meandering stream channels on the high plains. In undisturbed sites, it grows among native grasses. Its establishment and survival are enhanced when dominant vegetation has been removed by disturbance (FWS 2010b). Two populations have been located near Fort Collins and another population was successfully introduced at the Chambers Preserve in Jefferson County, but surveys of the refuge have not located any populations of this species.

The Ute ladies' -tresses orchid, federally listed as threatened, is found along streams, in wetlands, and in other moist habitats along Colorado's Front Range and plains areas at elevations below 6,500 feet. The refuge contains habitat suitable for the orchid, but surveys of the refuge have not located any populations of this species (FWS 1996a).

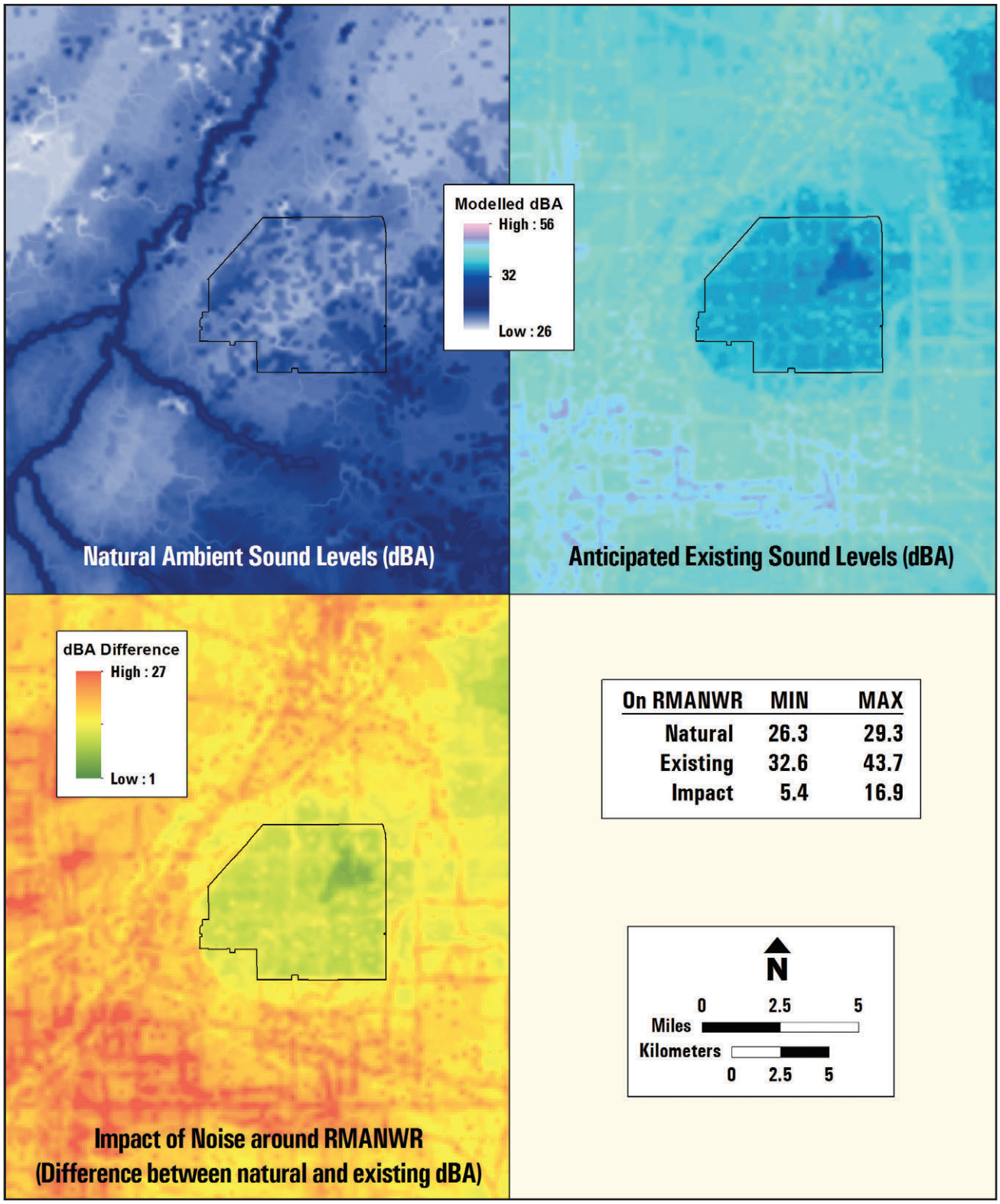

Figure 16. Comparison of natural and ambient sound levels in the vicinity of Rocky Mountain Arsenal National Wildlife Refuge, Colorado.

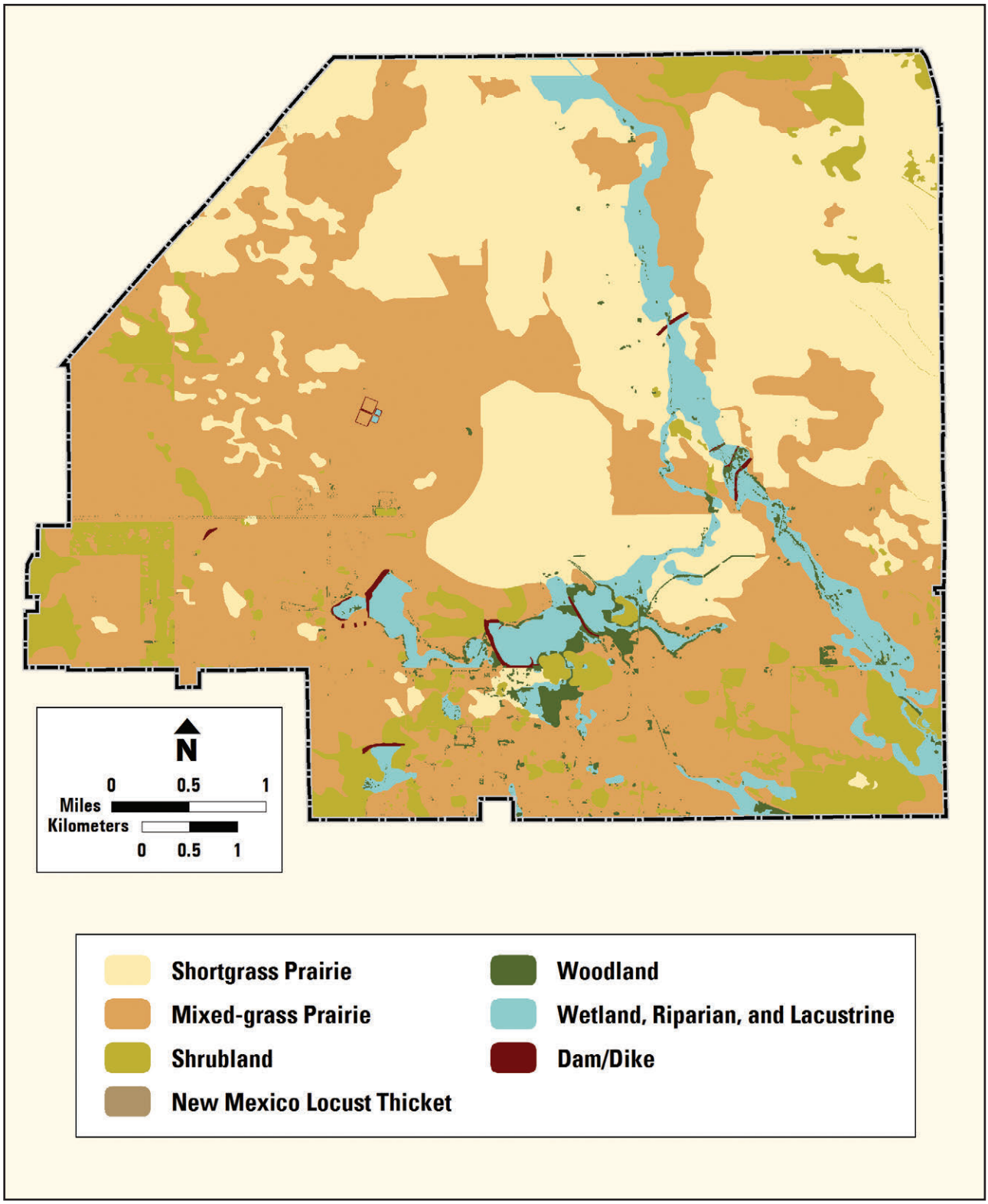

Figure 17. Habitat types on Rocky Mountain Arsenal National Wildlife Refuge, Colorado.

Prairie

Historically, shortgrass prairie with inclusions of mixed-grass prairie and shrubland were the dominant plant communities on refuge lands. However, past activities resulted in the significant degradation of these communities or the conversion of the communities to artificial habitats such as reservoirs, created wetlands, homesteads, buildings, and shelterbelts. Similar losses and conversions have occurred throughout the Great Plains; statewide losses of presettlement shortgrass and mixed-grass prairie range from 29 to 79 percent and from 30 to 75 percent, respectively (Knopf 1994). Future threats to this ecosystem include continued loss to agriculture and other developments, encroachment of nonindigenous species, and loss of genetic diversity (Bachand 2001; Knopf 1994). These prairie ecosystems provide critical habitat for many priority bird species identified by the Service and other conservation entities; accordingly, native prairie was selected as a community of concern. This decision is supported by the Service's Biological Integrity, Diversity, and Environmental Health policy that directs biologists and managers to replicate, to the degree possible, presettlement habitats and ecosystem processes.

The extent of disturbed prairie at the time of refuge establishment was extensive, and the weedy forbs and grasses vegetation type occurred on approximately 10,739 acres (71 percent) of the refuge (FWS 1996a). When restoration is complete, native prairie will comprise approximately 12,680 acres (85 percent) of refuge lands and provide habitat requirements for lark buntings, grasshopper sparrows, burrowing owls, and Swainson's hawks. Prairies containing 5–25 percent live cover of shrubs are found throughout the refuge. Common shrubs include rubber rabbitbrush, sand sagebrush, and four-wing saltbush. In addition, yucca also provides a shrublike function for some grassland birds and is found in both the shortgrass and mixed-grass prairie associations, primarily along ridgelines. These shrublands and associated grasslands provide habitat requirements for Cassin's sparrows.

Riparian Habitat

Riparian habitats in the western states are known for their value as wildlife movement corridors and migration stopover destinations for birds. The only historic aquatic habitat on the refuge is First Creek, which has experienced some alteration to its hydrology, both historically and with current urban development. Approximately 6 miles of the creek traverse refuge property. However, the most prominent aquatic features on the refuge are artificial: Lake Mary, Lake Ladora, Lower Derby Lake, the Highline Canal, Uvalda ditch, and Havana Ponds. Nevertheless, all these water bodies support a riparian plant community, comprising both herbaceous and woody species. Currently, the herbaceous community is dominated by noxious grass and forb species, including Canada thistle, white top, and smooth brome. Reed canarygrass is also found along the lower portions of First Creek, forming pure stands in some areas. Woody species are dominated by plains cottonwood, peach leaf willow, and coyote willow. Russian olive, a list B noxious weed, was also a very noticeable woody plant dominating the riparian understory until removal of nearly 7,000 trees. The cottonwood-willow gallery provides a primary habitat requirement for both nesting and wintering bald eagles. The HMP objective is to establish 1 mile of gallery forest dominated by cottonwoods by 2027. In addition, the value of riparian areas for foraging big brown bats will be investigated.

Lacustrine Habitat

Lacustrine, or lake, habitat consists of five artificially created reservoirs and ponds: Lower Derby (73 surface acres), Upper Derby (0 surface acres), Ladora (48 surface acres), Mary (9 surface acres), Havana Ponds (39 surface acres), and Rod and Gun Club Pond (ephemeral). With the exception of Upper Derby, water sources for these lacustrine habitats are varied and include precipitation, flows from drainage interceptors (Uvalda, Peoria, Havana, and Joliet drainage ditches) that channel stormwater discharge, natural groundwater discharge, and pumped water from wells. The plant communities of reservoirs vary depending on the timing and extent of water level fluctuations. The Upper Derby basin, which only receives water periodically, is dominated by noxious weeds. The remaining reservoirs support emergent vegetation, primarily cattails in shallow water along shorelines, and various rooted and floating-leaved aquatic species in deeper portions of the basins that never dry. The HMP strategies for the reservoirs are to stock forage fish when necessary to maintain the sport fishery, conduct annual water quality monitoring, and control cattails as needed.

Woodlands

Located in the Environmental Education Zone (primarily Sections 11 and 12), the woodland habitat type on the refuge is the result of past land use activities that involved conversion of native prairie to agriculture and the planting of trees around homesteads by settlers. Following transfer of ownership to the U.S. Army, additional trees were planted around new infrastructure, and agricultural lands were abandoned and allowed to revegetate naturally. Dur-

ing this time, additional trees became established as scattered individuals or as small groups in abandoned agricultural fields. Following acquisition by the Service, grasslands have been, or will be, restored to native prairie by seeding appropriate species based on soil type, but in general, trees were not removed. The term woodland is used to characterize interspersion of planted trees and shrub thickets with patches of grassland. The woody component of this habitat type can be classified based on the following species associations: (1) New Mexico locust thickets, (2) American plum and chokecherry thickets, (3) homestead site trees and planted groves, and (4) Russian olive. These created woodland habitats in the midst of restored grasslands are highly valuable for neotropical migrant songbirds as resting and foraging sites. They also provide hunting perches for bald eagles and Swainson's hawks. Deer frequently visit thickets to browse and for shelter.

Wildland Fire

Prior to European settlement, grazing (primarily by bison, prairie dogs, and insects) and wildfire were the primary ecological disturbances that revitalized the grassland. Ignitions for wildfires were caused by both lightning and Native Americans. Depending on weather and fuel conditions, a wildfire could burn thousands of acres, creating a mosaic of burned, unburned, and grazed areas. Historical fire frequency was probably highly variable but has decreased since settlement (Umbanhowar 1996). Evidence that characterizes fire return intervals suggests about every 5–10 years on the moist portions of mixed-grass prairie and about 25 years on dry portions (Frost 1998; Wright and Bailey 1982).

After settlement by Europeans, wildfires were suppressed. However, agricultural burning by farmers in the area continues to this day. We have been using prescribed burning on the refuge since the late 1990s for managing habitats and reducing fuel loads near the wildland urban interface. Prescribed fire is currently used in all habitat types found within the refuge.

Wildlife

Approximately 350 species of wildlife have been documented on the refuge (refer to appendix G). Wildlife species on the refuge have adapted to the many changes in their enclosed, fenced habitat surrounded by increased urbanization. As the fence and cattle guards were added to the perimeter landscape, some large mammals, mainly deer, could no longer enter or exit the refuge. Other wildlife, accustomed to the presence of buildings from farmhouses to factories, had to adjust to the absence of artificial structures and adapt to expanses of bare soil followed by reseeded natural vegetation. It has been difficult to track all the changes in species diversity and abundance. Some wildlife groups have been well documented on this site, while others have not been adequately inventoried.

Threatened and Endangered Species, Resources of Concern, and Surrogate Species

The discovery of the formerly endangered bald eagle using First Creek within the Arsenal boundaries in 1986 was a determining factor in the establishment of this area as a national wildlife refuge. Like many wintering raptors, migrating bald eagles were attracted to the abundant food sources on the Arsenal site—particularly small mammals, and specifically the non-hibernating black-tailed prairie dog. The bald eagle was delisted in 2007 but still resides on the refuge both as a breeder and winter visitor and is identified in the HMP as a resource of concern. The nesting and roosting habitat remain protected from human disturbance during use by eagles.

The black-footed ferret, federally listed as endangered, is also directly linked to the prairie dog, both as a food source and for living space. Although black-footed ferrets were never documented as inhabiting the specific area of the refuge, they are an important component of the shortgrass prairie, and the refuge is within their historic range.

The Mexican spotted owl, federally listed as threatened, is considered a habitat specialist. These owls occur in both forested and rocky canyon habitats. Forests used for roosting and nesting often contain mature or old-growth stands with complex structure. In parts of their range, Mexican spotted owls occupy a variety of steep, rocky canyon habitats (FWS 2012b). In Colorado, spotted owls can be found in the foothills south of Denver and west of Colorado Springs (FWS 2012b). There are no owls on the refuge, nor is there suitable habitat for owls on the refuge.

The Preble's meadow jumping mouse, federally listed as threatened, occurs in riparian areas along Colorado's Front Range. Neither the mouse nor its habitat currently exists on the refuge.

To conceptualize an adaptive management plan for the refuge, we analyzed what wildlife species could benefit from the habitat we were creating and considered their local, regional, and national priorities to the Service. A thorough explanation for our choices and eliminations can be found in the HMP. The list of priority species, or resources of concern, comprised six bird and two mammal species that nest

Table 12. Habitat needs for resources of concern and associated species, Rocky Mountain Arsenal National Wildlife Refuge, 2013.

Resource of Concern	*Associated Species*	*Desired Vegetation Structure*
Bald eagle	Osprey	Riparian gallery cottonwoods
Swainson's hawk	Red-tailed hawk, ferruginous hawk, golden eagle, American kestrel, western and eastern kingbirds, loggerhead shrike	Isolated trees or small groups of trees in open perennial grasslands
Burrowing owl	Black-tailed prairie dog	Perennial grasslands with prairie dog towns
Cassin's sparrow	Loggerhead shrike, lark bunting, western meadowlark, grasshopper sparrow, Swainson's hawk, short-eared owl, vesper sparrow	Perennial grassland and some shrubs
Lark bunting	Swainson's hawk, western meadowlark, long-billed curlew, short-eared owl, horned lark, ferruginous hawk	Perennial grassland
Grasshopper sparrow	Upland sandpiper, vesper sparrow, western meadowlark	Perennial grassland
Black-tailed prairie dog	Burrowing owl, prairie rattlesnake, mountain plover, American bison, black-footed ferret	Perennial grassland
American bison	Black-tailed prairie dog, burrowing owl, ferruginous hawk	Perennial grassland

Note: Wildlife species in bold are surrogate species mentioned in Section 3.2 of this document. At this time, the big brown bat has not been included as a resource of concern for the purposes of this CCP. The refuge might play an important role for this species; however, additional research is needed to determine if the species' fidelity to the site continues post-cleanup.

or breed within the refuge. For this CCP, we adopted four of these as surrogate species to represent the most abundant habitat, the prairie. The priority species and their associated habitats are listed in table 12.

In addition, the presence of the following taxa is significant to the understanding of other habitat uses on the refuge and choices for placement of roads, trails, and infrastructure.

Fishes

Of the 14 fish species in refuge water bodies, 12 are native transplant introductions and 2 are exotic. The three main water bodies are artificial and have been managed to support a catch-and-release recreational fishery. Objectives in the HMP specify that balanced populations of largemouth bass and bluegill should be maintained in Lake Mary. The objective for Lake Ladora adds northern pike to those species. Lower Derby Lake is to be managed as a stocking source and for wildlife use. Three native fishes—channel catfish, fathead minnow, and green sunfish—also share the reservoirs with two nonnative rough fish species—common and grass carps. One more native fish, brook stickleback, and the introduced mosquitofish occupy First Creek and Parkfield Ponds.

Reptiles and Amphibians

Reptiles and amphibians, collectively known as herptiles, total 24 documented species on the refuge, but surveys have not been conducted recently. The 1994 species list included one salamander, three toads, three frogs, five turtles, three lizards, two skinks, and seven snakes. The determinations of occupied habitat and occurrences were based on existing literature for Adams County, Colorado (Hammerson 1986), and a local catch-and-release survey conducted in various habitats prior to the onset of cleanup on the Arsenal. During cleanup, not only were massive amounts of soil and vegetation removed or rearranged, but water sources fluctuated annually due to weather events and the deliberate manipulation of water for irrigation, dust control, flood prevention, and recreational use. Although these detrimental activities have been reduced and habitat has been created, the herptile species list did not increase based on a roadside survey done in 2005. For instance, although the northern leopard frog has not been found on the refuge, it is disappearing from locations in many western states because of threats such as habitat loss, disease, nonnative species, pollution, and climate change. There are no specific objectives for herpetofauna in the HMP, although the reservoirs are recognized as breeding and wintering habitat for some amphibians (USFWS 2013a:59). In addition, control of bullfrogs to improve the sport fishery may be indicated in future aquatic management plans.

Birds

Unlike the residential and stable nature of the fish, herptile, and mammal communities, the bird species that use the refuge are highly mobile and variable. Therefore, although the number of bird species that have used the refuge is presently 282, this could change in the future. To illustrate the point, two species, the dickcissel and bobolink, were sighted on the refuge in spring 2014 for the first time, both in recently restored grassland habitats. Furthermore, upland game birds that were previously stocked for hunting, including ring-necked pheasant, northern bobwhite, chukar, and wild turkey, were removed from the list. Although waterfowl, shorebirds, and warblers have a high representation of species that occur on the refuge, the majority of these groups use the habitats for stopover points on migration to and from their breeding grounds or are rarely counted on surveys. Conversely, a high percentage of raptors and sparrows have been documented as breeding or overwintering on the refuge.

Mammals

The present refuge mammal list comprises 37 species that are representative of the typical fauna of Adams County, Colorado. Recent additions include the bobcat and American beaver. One mammal that has been taken off the original list is the porcupine. Population estimates of some refuge mammals have been well documented by various censuses and surveys, from the heavily viewed deer and bison to the seldom-seen badgers and nocturnal bats. In the past, animal health and abundance were important tools for tracking exposure to contaminants manufactured here. Presently and in the future, the emphasis will be on monitoring the restored prairie habitat to sustain the prominent consumers of grassland vegetation, namely bison, white-tailed deer, mule deer, and prairie dogs (refer to "Appendix H—Forage Allocation Methodology for Use at RMANWR" in the HMP). We must also analyze another grazer, the pronghorn, if it is considered for reintroduction.

4.4 Visitor Services

Visitors to the refuge can enjoy a variety of compatible, wildlife-dependent recreational activities: fishing, wildlife observation, photography, environmental education, and interpretation. The refuge Visitor Center is open Wednesday through Sunday from 9 a.m. to 4 p.m. and is closed on all Federal holidays. The refuge is open to visitors from sunrise to sunset every day and is closed on Thanksgiving, Christmas, and New Year's Day. Information kiosks outside the Visitor Center, on Wildlife Drive, and at the Contact Station provide brochures and maps of the refuge for visitors.

Hunting

Currently the refuge does not have a hunting program. The Federal Facilities Agreement currently prohibits the take of any wildlife on refuge property for consumptive purposes. Until this restriction is removed, a hunting program will not be established.

We are evaluating what animal populations—such as mourning dove, white-winged dove, Eurasian collared dove, mule deer, and white-tailed deer—could be hunted on the refuge. We are also evaluating opening the refuge to host a site for CPW's hunter education programs, especially for youth hunters, with potential outreach to local schools.

Doves

Two of the three dove species (mourning and white-winged) present on the refuge are migratory birds. The Eurasian collared dove is a nonnative, invasive species that is not afforded protection under the Migratory Bird Treaty Act and is hunted year-round in Colorado. The Refuge would only allow hunting of any dove species during the Colorado mourning dove season.

Deer

Both mule deer and white-tail deer are currently present on the refuge. The deer herds on the refuge are isolated from other populations by the 8-foot chain-link fence constructed around the property in 1990. The deer herds, for practical purposes, should be considered closed populations with no immigration or emigration.

Deer hunting is a popular activity throughout Colorado, but because of the refuge's juxtaposition to a large urban area and lack of public lands, most deer hunting in the immediate area surrounding the refuge takes place on private lands.

Fishing

Public fishing is offered as a recreational, fee-based program ($3.00 per day) from mid-April through mid-October. Three fishing piers and a floating boardwalk are located at Lake Mary, and a float-

ing boardwalk is located on the east end of Lake Ladora.

Lake Mary, Lake Ladora, and Lower Derby Lake are stocked annually with fry-sized fish to provide a food source for larger fish. These stockings are intended to maintain a healthy fishery in support of recreational sportfishing. Species stocked include bluegill, channel catfish, and fathead minnow. Fish stockings are coordinated and permitted through CPW.

Events

The refuge hosts several annual fishing events. We host the Annual Fishing Frenzy—in partnership with the City of Commerce City and Bass Pro Shops—to educate and provide fishing opportunities to youth. It offers fishing instruction and classes in knot tying, fish identification, and casting techniques. The average estimated attendance for this one-day event is 900 visitors. We also host Refuge Day in October, attended by more than 500 visitors engaging in wildlife-focused activities to celebrate National Wildlife Refuge Week.

The refuge also hosts weekly therapeutic fishing programs throughout the fishing season on Lake Mary. The refuge's volunteer staff provides hands-on instruction and assistance to anglers. This highly successful program targets special needs groups (Craig Hospital, Children's Hospital, Colorado Veterans Hospital, and Greely Center for Independence).

Rules and Regulations

Current regulations allow fishing on the refuge from April 15 through October 15 annually. Fishing is allowed only on Lake Mary and Lake Ladora. Wading is allowed in Lake Ladora after Memorial Day. Only artificial bait is allowed for fishing on the refuge and all fish hooks must be barbless. Only catch-and-release fishing is allowed. All persons wishing to fish on the refuge must have a valid State fishing license, a fishing fee receipt, and a signed permit/fishing regulations (free). Because of human safety and wildlife disturbance concerns, we currently do not allow the use of boats or other vessels (such as float tubes) on the refuge.

Reservoirs

Lake Mary is the smallest of the refuge's reservoirs at 8.4 acres with a maximum depth of 12.4 feet. It is an excellent resource for beginning anglers. Amenities include a floating boardwalk, fishing pier, and dock. The docks are also accessible, providing equal opportunity for all to participate in and benefit from fishing programs and activities on the refuge. Fish species in Lake Mary include largemouth bass, channel catfish, white and black crappie, bluegill, grass carp, and yellow perch.

Lake Ladora, at 54.9 acres with a maximum depth of 17.6 feet, is open to bank fishing. Wading with calf, hip, or chest waders is allowed after Memorial Day.

© Rich Keen

Lake Mary is the smallest of the refuge's reservoirs at 8.4 acres.

Fish species include northern pike, largemouth bass, and bluegill.

Lower Derby Lake measures approximately 72.7 acres with a maximum depth of 11.5 feet. This reservoir is currently closed to fishing. Fish species include largemouth bass, bluegill, and channel catfish.

Wildlife Observation and Photography

The refuge is open to wildlife observation, but some areas are closed to protect sensitive wildlife. A viewing blind on the edge of Rod and Gun Club Pond is sheltered by cottonwood trees to offer views of wildlife and wetland habitat.

The refuge is open to photography, and an accessible (portable) blind is located at Havana Ponds. We issue a limited number of special use permits annually for commercial photography for a fee of $50 dollars per person per day. We are evaluating this use to determine appropriate numbers of permits, as well as suitable roads for vehicle access because vehicle traffic on some roads and trails could pose safety issues for visitors using them.

Environmental Education and Interpretation

Environmental education is intended to teach visitors the history and importance of conservation. Through this process, we can encourage others' awareness, knowledge, attitudes, skills, motivation, and commitment to conserve our wildlife and natural resources. Environmental education uses onsite and offsite as well as distance learning materials and activities to explain the Refuge System's mission.

The refuge has dedicated curricula for offsite and onsite students, focusing on introducing first through fifth grade students to native wildlife. Students come from Adams County, Montbello, Denver, Commerce City, and area homeschools. We are in the process of developing Rhythms of the Refuge materials to provide refuge-specific activities that will address all grade levels. In addition, we regularly participate in the Aurora Youth Water Festival, with a focus on the value of water resources and habitat for wildlife.

Interpretation is the means by which we can encourage positive visitor attitudes about natural resources and refuges. We provide opportunities for visitors to create their own connections with resources to promote an understanding of the relationship between individuals, resources, and the impacts of human activities. For many visitors, taking part in interpretive programs may be their primary contact with the refuge and their initial contact with conservation and wildlife. Well-designed interpretive programs can also be effective resource management tools. Refuge staff and volunteers conduct a variety of interpretive programs on the refuge through bus tours, hiking tours, and nature programs. Wildlife viewing tours are conducted year-round and are designed for all ages.

Visitor Center

The refuge's 12,500 square-foot Visitor Center, completed in 2011, includes an exhibit hall that features prairie wildlife, history, and refuge management. The discovery room offers drop-in activities (such as tactiles, crafts, and interactive displays). A 73-seat amphitheater has audiovisual capabilities for refuge interpretive programs. The Visitor Center also houses the Nature's Nest Books and Gifts store operated by Friends of Front Range Wildlife Refuges. An accessible amphitheater that seats 150 is adjacent to the Visitor Center, and a fenced pollinator garden is behind it.

Contact Station

This 5,000-square-foot facility can accommodate 60 students. This facility has learning stations, tactiles, and wildlife dioramas that can be used for environmental education. Teachers, scout groups, and other youth or homeschool groups can reserve this facility for environmental education with a refundable deposit. More than 20,000 students and teachers use this facility for self-guided programs each year.

Kiosks

The refuge has a total of four informational kiosks. Three kiosks—at the Visitor Center, Legacy Loop, and the Contact Station—provide maps and information about facilities, programs, and regulations. Interpretive panels are located at the Visitor Center, Contact Station, and Lake Mary kiosks.

Recreation Fee Program

We manage a recreation fee program consisting of fishing fees ($3.00 per day for visitors over 16) and the sale of Federal Recreation Lands Passes. The program's annual revenues of $11,000–$13,000 are used to make improvements to visitor facilities.

Staff

Our visitor services staff consists of a permanent fulltime visitor services manager, an Environmental Education Specialist, a Supervisory Park Ranger, and three seasonal Park Rangers. Other refuge staff, seasonal employees, and volunteers assist in staffing the Visitor Center (see table 8 in chapter 3). Two fellowship positions assisted us in visitor services in 2014.

Our volunteer program is important to our success. Over 60 volunteers contributed more than 8,000 hours in 2013. These volunteers support our visitor services program; maintain facilities and trails; and assist with wildlife surveys, habitat restoration, and administrative duties. We work with Groundwork Denver and Mile High Youth Corps for improvements to facilities, trails, and habitat.

4.5 Communications and Outreach

With the help of our refuge volunteers, we currently reach out to traditional refuge visitors and our neighboring communities through our participation in community outreach events such as Refuge Day, Bass Pro Fishing Classic, Colorado Get Outdoors Day, Aurora Youth Water Festival, Barr Lake Birding Festival, and other such events.

In addition to special events and local career development programs, we carry out our visitor services programs onsite to promote the importance of the Service's new Urban Refuge Initiative.

We manage the refuge's Web site and social media platforms to reach a broad spectrum of visitors. We distribute, both by email and in printed format at the Visitor Center, the quarterly Wild News publication, which contains a list of refuge tours and nature and interpretation programs. We distribute a general brochure and a rack card, and we are in the process of developing brochures for trails and auto tour routes.

Media

The refuge has a Web site (http://www.fws.gov/refuge/rocky_mountain_arsenal) and social media sites (Facebook and Flickr) that provide current information about refuge resources, programs, and activities. Wild News is a quarterly publication that lists interpretive tours and programs, is sent to a 5,000-person mailing list, and is available in hard copy at the Visitor Center, information kiosks, and local community centers. Refuge staff is routinely interviewed by local area media. National Geographic photojournalists have recently completed projects on bison and burrowing owls.

Brochures

Refuge information is available in the general brochure, rack card, trail map, fishing information (English and Spanish), and bird list. The Honker Scavenger Hunt is a popular guide to help youth explore the refuge. Brochures are provided to DIA, the Denver Convention and Visitor Bureau, REI, community recreation centers, and libraries. We are developing an interpretive brochure for the Wildlife Drive.

Cindy Souders / USFWS

The Honker Scavenger Hunt is a popular guide to help youth explore the refuge.

Special Events

We partner with the City of Commerce City to host an annual Fishing Frenzy in April with an estimated 900 participants each year. Refuge Day is an annual event in October to celebrate the Refuge System with a variety of activities and an estimated 400 participants each year.

4.6 Partnerships

We partner with various organizations (such as the Rocky Mountain Greenway Trail Network and Sand Creek Greenway Partnerships) and municipalities to expand and interconnect the various regional trails to form a trail network connecting the refuge with Two Ponds NWR and Rocky Flats NWR. Our existing partnership with the Friends of Front Range Wildlife Refuges supports some of our refuge programs and assists us in operating the Nature's Nest Books and Gifts store in the Visitor Center. We maintain a partnership with the City of Commerce City and with Bass Pro Shops to carry out the annual Fishing Frenzy event on the refuge. We are currently working with the City and County of Denver and Rocky Mountain Bird Observatory to enact the Urban Bird Treaty in the Denver Metropolitan area. We would continue to implement the Urban Refuge Partnership with Environmental Learning for Kids at their property in Montello. We would continue to develop our partnerships with the Denver Botanical Garden and Butterfly Pavilion for monarch and pollinator programs and outreach. We would continue to work with Mile High Youth Corps and Groundwork Denver for habitat restoration projects. We maintain a partnership, through our Regional Office of Diversity and Civil Rights, with Arrupe High School, which allows one student to work with us one day per week at the Visitor Center.

Cindy Souders / USFWS

We rely on partnerships to carry out the annual Fishing Frenzy event on the refuge.

4.7 Human History and Cultural Resources

The site of the refuge has a rich history of human occupation. Native Americans used the site for thousands of years. The area changed drastically with farming, military weapons production, commercial pesticide production, environmental restoration, and eventually habitat restoration and refuge development. Each period made its own impacts on the landscape, some more than others.

Human History

The following is a very brief summary of the prehistory of the Rocky Mountain Arsenal National Wildlife Refuge. Sections of this summary are condensed versions of the background research undertaken as part of the archaeological investigations conducted in preparation for the cleanup of the Arsenal lands and eventual transfer to the Service (Gilmore et al. 1997) and for the proposed Northwest Parkway west of Denver (Painter et al. 2005). Additional detailed information is available in those publications and in the numerous sources cited as a part of that research.

Prehistory

Current archaeological evidence indicates that the earliest humans migrated to the region near the close of the last Ice Age approximately 14,000 years ago. The sites and artifacts left by these early peoples are divided into five general stages:

- Paleoindian: 12,000 B.C.–5,700 B.C.
- Archaic: 5,700 B.C.–A.D. 150
- Late Prehistoric: A.D. 150–A.D. 1540
- Protohistoric: A.D. 1540–A.D. 1750
- Early Historic: A.D. 1750–A.D. 1850

The Paleoindian stage is the earliest evidence of human occupation in Colorado. The traditional view

of the Paleoindian pattern emphasizes a nomadic culture tied to the migration of large game, most notably extinct Pleistocene megafauna, including mammoths and the massive antique bison. Recent studies, however, indicate that Paleoindians also exploited smaller game, fish, and waterfowl, although to a much lesser extent (Kuehn 1998; Walker 1982; Wheat 1979; Wilmsen and Roberts 1978). Perhaps the most readily recognized stone tools in the Americas are associated with the Paleoindian stage—specifically the large, lanceolate, projectile points that are often fluted (i.e., long longitudinal flake scars extending from the base of the point along its centerline) and consistently well crafted. Paleoindian lithic assemblages are predominantly flaked stone tools believed to have been used primarily for hide and meat processing. Because population densities were low during the Paleoindian stage, sites (particularly camp sites) dating to this period are found less frequently than those of the subsequent stages.

The Archaic stage is marked by increasingly diverse food choices, an extensive feature assemblage including fire hearths and storage areas, and a variety of stone tool and projectile point styles. The beginning of the Archaic stage coincides roughly with the onset of the Altithermal climatic episode (approximately 7,000 B.C.–4,000 B.C.): a prolonged period of general warming and drying in western North America (Frison 1991). The change in weather patterns and environments resulted in the replacement of many Pleistocene animals with generally modern species. Collected wild plant foods made up a significant portion of the human diet during the Archaic stage, and small mammals, reptiles, and even insects were utilized as well. Ground stone implements used to process plant material such as nuts, seeds, berries, and fruits became common. Stone boiling pits, storage cists, and architectural features such as basin houses are also associated with the Archaic stage and are likely the result of increasing population density and a general shift toward more long-term settlements (Frison 1991; Metcalf and Black 1991; Shields 1998). Archaic projectile points are generally large and often are not as well crafted as points of the preceding Paleoindian stage.

The introduction of the bow and arrow and the use of pottery mark the onset of the Late Prehistoric stage, while the latter years include the earliest contacts of the native population with Europeans. Throughout the region this was a time of important changes in food choices, artifact types, and population distribution. This time period coincides with the introduction of the bow and arrow and the associated small triangular projectile point. A range of habitation sites with structures has been recorded in eastern Colorado, but there is no evidence of permanently settled villages. Ceramics are varied but in general consist of cord-marked jars. Bone artifacts are common and include awls, fleshers, wrenches, and beads. Ground stone is abundant and varied, including not only manos and metates but also shaft abraders.

Early History

The Protohistoric stage encompasses the span of time between the earliest European influences on the Native Americans and the onset of regular, direct contacts between Native Americans and persons of European descent. The A.D. 1540 date for the beginning of this stage corresponds with Coronado's first expedition to the southern plains of North America and, although the early Spanish explorers did not reach the refuge region, the expedition nevertheless represents the beginning of potential influences. Anglo incursions into the central and western high plains are known to have taken place infrequently during the latter half of the eighteenth century. External pressures in addition to the introduction of the horse and other material goods led to accelerated changes in the traditional cultures. A nomadic, equestrian lifestyle emphasizing bison hunting, generally with firearms, became pervasive among tribes occupying eastern Colorado. The circular arrangements of rock often associated with Protohistoric sites are thought to be primarily the remnants of tipi structures—rock weights used to secure the structure coverings.

Much more information is available for the post–A.D. 1725 periods. Most notably, historically identifiable tribes established a presence in the region. Historical records indicate that this particular span of time is characterized by successive incursions and retreats by various tribes. By 1725, incursions by Comanche and their Ute allies had forced the Apache to withdraw from Colorado. The short-lived Ute/Comanche alliance that successfully pushed the Apache south disintegrated by the late 1740s (Anderson 1989:34). The Comanche subsequently controlled southeastern Colorado until they were pushed south by the Kiowa and Kiowa Apache in the late 1780s (Jones et al. 1998). A later alliance among the Comanche, Kiowa, and Kiowa Apache was, in turn, challenged by Cheyenne and Arapaho entering the region in the first quarter of the nineteenth century. During this rather turbulent period of history, however, trade networks between Native American and Anglo groups became well established despite ongoing hostilities.

Although people of European descent had been in the area sporadically for several decades, in 1806 the U.S. Government funded the first major expedition to investigate central and southern portions of the newly acquired Louisiana Purchase. Led by Lt. Zebulon Pike, the expedition explored both the

Arkansas River and South Platte River basins and, along the eastern slope of the Rocky Mountains, came as far north as the Colorado Springs area before heading west. After Pike's foray, the next significant expedition to the Front Range area occurred in 1820. Commanded by Major Stephen H. Long of the U.S. Army, the exploration had a decidedly scientific emphasis and traveled west along the South Platte River to the foothills before heading south. The first accounts of the Denver area and the foothills to the west were provided by the Long expedition. It is interesting to note that neither man ever set foot on the peaks that were later named after them.

The 1820s and 1830s were also characterized by a flourishing fur trade. Notable mountain men such as Andrew Sublette and Louis Vasquez exploited the abundant animal resources along the Front Range. Vasquez and a band of trappers are reported to have camped at the confluence of the South Platte River and Clear Creek (known originally as the Vasquez River or Vasquez Fork), and from there followed Clear Creek to its source in the mountains. The booming fur trade led to the establishment of a series of trading posts bordering the eastern flanks of the Rocky Mountains from southeastern Colorado to southeastern Wyoming. By the early 1840s a growing scarcity of beaver and changes in European fashion led to a significant decrease in the fur trade.

Throughout much of the 1850s, the Colorado Piedmont and adjacent foothills remained devoid of permanent settlements. The discovery of gold quickly changed this situation. Gold was reportedly first found along the Front Range creeks sporadically during the late 1840s and early 1850s (Mehls 1984:33), particularly by miners on their way to the gold fields of California. However, the 1858 discovery of gold near the confluence of the South Platte River and Cherry Creek provided the initial impetus for large-scale mining in the region (Ubbelohde et al. 1995:56–57).

During the initial gold rush years northeast Colorado above the fortieth parallel (Baseline Road in Boulder, Colorado) was part of the Nebraska Territory, and the portion below the fortieth parallel (which includes the Rocky Mountain Arsenal) was part of the Kansas Territory. Colorado was proclaimed an official territory by the U.S. Congress after Kansas entered the Union in 1861 and became the 38th State in 1876.

Homesteading on what is now the refuge began in 1871. Due to the semiarid conditions, early homesteaders probably ranched more than they farmed. This situation changed when the Highline Canal and associated Sand Creek Lateral were constructed in the late 1870s. Although neither irrigation system provided reliable sources of water, homesteading in the region continued to increase. At its greatest density of occupation in the early 1940s, the site had 474 individual property owners, 241 homes, and 2 schools (Clark 1997). Only one home still exists, built in 1912 by Gottlieb and Rose Egli (Peil 2002; Wright and Wright 2014). The home is being restored as a representation of the early agricultural days of the area.

Recent History

Rocky Mountain Arsenal: Chemical Weapons and Industry (1942–1983)

Following the bombing of Pearl Harbor on December 7, 1941, the United States found itself searching for ways to produce state-of-the-art chemical weapons. While the U.S. did not want to use them, leaders believed that a formidable stockpile of chemical weapons would probably deter Germany and Japan from using them (Hoffecker 2001), a strategy that appeared to work very well.

The U.S. Army needed to find the best place to build such a facility. The Rocky Mountain Arsenal location exhibited several favorable attributes: it was close to major existing railroad lines, had adequate water and electric power, was adjacent to a major metropolitan area that could provide large numbers of skilled laborers, and was too far inland to be bombed (Hoffecker 2001). In June 1942, almost 20,000 acres were condemned, all inhabitants were forced to evacuate their homes, and new facilities began to be constructed. Although this action was devastating to many families, no noticeable complaints were heard. People were willing to make serious sacrifices for the war effort.

The factories (later named South Plants) were constructed and staffed so quickly that the first batch of the blistering chemical known as mustard was produced on New Year's Day 1943 (Hoffecker 2001). Other chemical weapons produced at the Arsenal included lewisite (also a blistering agent) and chlorine. The reluctance of Germany and Japan to use chemical weapons against the U.S. and its closest allies quickly led to a reduced demand for production at the Arsenal. By late 1943, the factories largely produced incendiary weapons rather than poisonous chemicals. At first, magnesium bombs were made, but critical material shortages for those weapons led to napalm production instead. Fire bombs were used most notably on Hamburg and Schweinfurt, Germany, as well as on Tokyo and other Japanese cities—always with devastating results.

Other notable aspects of this period were the large numbers of women working in the factories, freeing up men to fight. This situation provided an excellent opportunity for women to demonstrate that they could essentially do what men could do. The

importance of women working in war materiel factories was embodied in posters of the iconic female worker, Rosie the Riveter. Approximately 70 percent of the Rocky Mountain Arsenal workers in World War II were women (Remediation Venture Office 1999).

The Arsenal became home to approximately 100 German and Italian prisoners-of-war. Rose Hill School in the southwestern portion of the Arsenal became the camp's administration building. POWs were put to work on a variety of tasks, most notably working in the employees' cafeteria.

The Arsenal was put in standby status following World War II. However, South Plants was reactivated for incendiary production less than 2 months after the beginning of the Korean War in 1950 (Hoffecker 2001).

Construction of a new factory complex (North Plants) began in January 1951. While described as an "incendiary oil plant," the facility's secret mission was to produce German Brown nerve agent, also known as Sarin (Hoffecker 2001). The Cold War was in full swing, and the Russians were known to have captured an entire Sarin plant in Germany and reassembled it in the Soviet Union. This organophosphorus compound could kill a person by only contacting a single drop on the skin. The agent was being produced at North Plants by the summer of 1953, and like other poisonous chemical weapons previously produced at the Arsenal, served only as a deterrent.

Several chemical facilities on the Arsenal site became available following World War II and were leased to Julius Hyman and Co. for the production of insecticides. Shell Chemical Co. acquired this company and significantly expanded commercial operations, eventually constructing 150 new buildings in the South Plants area (Remediation Venture Office 1999). Shell produced numerous types of pesticides until 1982 (Wright and Wright 2014).

Environmental Cleanup (1983–2011)

Pollution—from spills, improper disposal, and even disposal practices thought safe at the time—became a serious problem. Buildings, soil, and groundwater all became contaminated, especially in the central core of the Arsenal. Contamination in groundwater and soil was spread through both infiltration and wind erosion, causing widespread issues. Fortunately, a large buffer area around the exterior of the factories kept most windblown contaminants onsite and slowed the movement of groundwater onto other properties.

In 1988, after considerable litigation, the U.S. Army and Shell signed a consent decree that set the way for a comprehensive cleanup. Remedial investigations were initiated in 1983 under CERCLA. The section of land (36) between North Plants and South Plants was described by the Arsenal commander as the "most contaminated square mile in the nation." This statement was later exaggerated to "the most contaminated tract of real estate on the Planet Earth." Later that year, the Rocky Mountain Arsenal was nominated for the National Priorities List under Superfund (Hoffecker 2001).

Numerous actions—known as interim response actions—were conducted during the mid- to late 1980s to prevent further contamination while a formal cleanup plan was developed and approved by regulatory agencies. In 1996, the ROD was signed and intensive cleanup was initiated. The last of the ground projects (structures, soil, and containerized liquids) was completed in 2011. Groundwater cleanup will continue for decades to come (Wright and Wright 2014).

Refuge Development (1992–Present)

Large numbers of bald eagles were discovered on the eastern side of Rocky Mountain Arsenal in December 1986 during a biological survey (Ron Beane, ERO Resources, senior wildlife biologist; email communication). Service biologists were brought to the Arsenal because the bald eagle was listed as endangered at the time, and the communal wintering roost along First Creek in Section 5 met the criteria for critical habitat for this species. Service biologists then discovered impressive numbers of

Cindy Souders / USFWS

Large numbers of bald eagles were discovered on the eastern side of Rocky Mountain Arsenal in 1986.

wildlife species and began efforts to convert the site into a national wildlife refuge. The Rocky Mountain Arsenal National Wildlife Refuge Act was signed into law in 1992, with language stating that it would be managed as if it were a refuge until officially becoming a refuge when declared clean. Jurisdiction of portions of the land was handed over to the Service starting in 2004. While the U.S. Army maintains jurisdiction of approximately 1,000 acres of mostly caps, covers, and groundwater remediation sites, the refuge controls about 15,000 acres (Hoffecker 2001; Wright and Wright 2014)—a very large tract of public land in a very urban area.

Terry Wright / USFWS

The Egli House

Cultural Resources

Known Cultural Resources

The 1994 and 1995 cultural resource survey of 11,725 acres of Arsenal lands identified a total of 235 cultural resources. Forty-two of these resources had been previously identified during earlier surveys. Of the 235 resources, 121 are sites or structures and 114 are isolated artifacts: small groupings of artifacts called Isolated Finds (IFs). The 121 sites or structures consist of 84 historic resources, 23 prehistoric sites, and 14 multi-component sites with both prehistoric and historic remains. The prehistoric sites are all classified as campsites or lithic scatters (stone tools and fragments of stone from tool manufacture). The vast majority of the historic sites are the remains of farmsteads or homesites that dated from 1871 to 1941 and were demolished when the army acquired the land in the early 1940s. Several trash scatters were also recorded, as were laterals and reservoirs associated with the Highline Canal.

The 114 IFs consist of 87 that are historic, 26 that are prehistoric, 1 one that is multi-component. The majority of the historic IFs are locations with the very limited remains of farmsteads and homesites or trash scatters with no research potential. Prehistoric IFs included isolated lithics, small groupings of lithics, or scatters of fire-altered rocks.

In addition to these cultural resources, seven resources representing the World War II and Cold War activities have been extensively recorded (appropriate recordation is legally sound mitigation) and subsequently demolished. Four Districts (South Plant, North Plant, Logistics Complex, and the Munitions Storage Complex); the Post Headquarters; the Fire Station Headquarters; and the Burlington Northern Railroad tracks were determined to be eligible for inclusion in the NRHP (Remediation Venture Office 1999).

Four of the remaining sites are determined eligible for inclusion in the NRHP: two prehistoric sites, the Sand Creek lateral to the Highline Canal, and the pioneer home and garage that Gottlieb and Rose Egli built in the early 1900s (Wright and Wright 2014). Subsurface testing at the two prehistoric sites revealed intact deposits with significant research potential. The Sand Creek Lateral is a part of the much larger Highline Canal system that was instrumental in the settlement of the region. The Egli home, which was listed in the Colorado State Register of Historic Places in 2002, dates to the early years of the twentieth century and is the only remaining example of pre-war historic settlement of the Refuge. The Service and the Friends of the Front Range Wildlife Refuges are renovating portions of the home to protect it from weather and wildlife.

Artifact Collections

Wright and Wright (2014) produced table 13, which not only demonstrates a timeline for the events in the area, but also identifies the artifacts we have accessioned (that is, acquired or added) into our extensive collection. Their paper on the collection, "A Vision for the Future of the Past," follows the theme of John Hoffecker's (2001) book, "Twenty-Seven Square Miles." Using the book as a model, Wright and Wright divided the historical timeline of the Arsenal into six distinct periods: Prehistoric; Explorers, Trappers, and Railroads; Homesteaders and Early Colorado Agriculture; World War II; The Cold War; and Cleanup and Refuge Transition. They made the following observations:

- The Rocky Mountain Arsenal's unique success story seems to be a well-kept—or at best, misunderstood and/or underrepresented—secret. Even many of the employees are unaware of what it means, what it looks

Table 13. Items accessioned into existing collection itemized by historical period, Rocky Mountain Arsenal National Wildlife Refuge, Colorado.

Period	*Historical timelines and events**	*Collection artifacts*
Prehistoric: 12,000 B.P. to A.D. 1350	Native American campsites along First Creek (two prehistoric sites eligible for listing in the NRHP) (Interpretation of this period not available in Visitor Center)	157 Accessions: points, scrapers, mano stones, pottery shards, grinding stone and metate, bison bones, stone flakes, and one stone spear point estimated 7,000 years old.
Explorers, Trappers, and Railroads: 1700s–late 1800s	(Historical events in refuge vicinity) *1820:* Major Stephen Long expedition, 1820, near Brighton, CO. *1860:* Wagon trails cross RMA to reach Denver and gold fields. *1869:* Denver Pacific Railroad reaches to within about one-half mile of the RMA's northwest corner. *1870:* Kansas Pacific RR comes within 2 miles south of RMA. *1881:* Chicago, Burlington and Quincy RR line is built adjacent to RMA's northwest edge, defining diagonal boundary. *1886:* East Colorado RR (narrow gauge) is operational, running roughly along present day 56th street. (Interpretation of this period not available in Visitor Center)	0 Accessions. No artifacts in collection representing this period.
Homesteaders and Early Colorado Agriculture: 1870–1942	*1871:* The first homesteader was Fred Steinhauer, 160-acre homestead in Section 4. Some 474 homesteads eventually occupy land that is to become Rocky Mountain Arsenal.	102 Accessions: mostly bottles and jars; also coins, children's toys, license plates, coins, two rifles, one shotgun. Also includes oral and video histories from homesteaders.
World War II: 1941–1945	*1941 (December 7):* Japanese attack Pearl Harbor. December 7th Avenue—present-day 7th Avenue—is named in remembrance of the Pearl Harbor Attack, first road built into Arsenal. 1942: (May 2) U.S. War Board announces 19,882 acres purchased outside Denver will be the future location of a chemical weapons production facility. In June, the first fully operational building is completed a full year ahead of schedule. *1942 (summer):* All homesteaders are forced to vacate their properties. *1942–1945:* Mustard, lewisite, chlorine, M74s, M47s, and phosgene-containing shells are manufactured. About 70 percent of Arsenal employees are women (Rosie the Riveter and We Can Do It poster). *1943 (January 5):* Building 111 is dedicated by a formal ceremony and flag-raising by Brigadier General Loucks. Workers commended. *1943:* South Plants manufacturing facility becomes operational, producing mustard gas, napalm and incendiary bombs (M47s, M69s, M20s), and "Willie-Peter" (white phosphorous) artillery rounds. 1943 (October): B17 Superfortresses using 1,300 M47 incendiary bombs destroy the Focke-Wulf aircraft assembly plant at Marienburg, East Prussia. M47s were also used for the air raid to the roller bearing plant in Schweinfurt, Germany, as well as the bombing of the Ploesti oil refineries in Rumania. 1943: From November 6, 1943 to April 1946, U.S. Army operates a prisoner-of-war camp, with as many as 300 prisoners (in Section 3, near present-day Visitor Center). Old Rose Hill School converted into an administration complex for the POW camp. *1944:* Marge Brandow and Pete Fox (sisters) begin work at the Arsenal Incendiary Oil Bomb factory (oral history collection).	Accessions: helmets, bottles, 20 mm round, tags for Chemical Warfare Service, signs, Chemical Service insignia, flags. We Can Do It poster at Visitor Center. Partial bomb fin at Visitor Center. One foundation of guard tower still present. One 10- by 10-ft WWII guard tower foundation on the north edge of Lake Ladora that guarded part of the South Plants perimeter. Chalk writing in Section 6 bunker. Oral histories in collection.

Table 13. Items accessioned into existing collection itemized by historical period, Rocky Mountain Arsenal National Wildlife Refuge, Colorado.

Period	*Historical timelines and events**	*Collection artifacts*
	1945 (March): Large-scale air raid by B-29 bombers over Tokyo, using M69 incendiary bombs. The air raid and subsequent firestorm is believed to have killed an estimated 40,000 civilians and destroyed 16 square miles of the city. Raid is regarded as a key turning point in the air war over Japan. *1945 (June):* Nora Ruiz killed in pyrotechnic assembly line; five other women burned, some seriously. *1945 (August):* World War II ends. More than 100,000 tons of incendiary bombs are dropped on Japan, destroying 158 square miles of urban industrial areas and leaving 8.4 million people homeless. U.S. military estimates 40 percent of every Japanese city hit by incendiary bombs is destroyed.	
Cold War: 1946–1982	*1945–1950:* Demilitarization of mustard gas shells begins. *1946:* Arsenal is placed on standby status. 1947: Portions of the facility are leased to private industry, including Shell Chemical Company and Julius Hyman and Company, which uses the facility to manufacture agricultural pesticides. *1947–1949:* Demilitarization of 155mm shells, 75mm shells, ANM76 bombs, M78 bombs, M79 bombs. *1950–1952:* Arsenal reactivated for Korean War. Manufactures M74 (M20A1 Cluster) bombs, M31 clusters, E101 clusters, E101R1 clusters, M15 hand grenades, white phosphorous cups, M23 fire bomb igniters, renovated M19 clusters. 1951: Construction starts on the North Plants complex. 1952: Shell Chemical Co. acquires Julius Hyman and Co, which had been producing agricultural chemicals. Shell continues to manufacture agricultural chemicals until 1982. *1953:* In summer, nerve gas production begins at North Plants Sarin (GB) complex. From 1953 to 1957, the Arsenal produces approximately 500,000 gallons of (GB) nerve agent Sarin, and was the free world's primary stockpile of that chemical agent. 1956: Basin F is constructed, initiation of contamination cleanup efforts. 1957: U.S. Army places the Arsenal on standby status and stops producing munitions. 1959: Hydrazine blending and storage facility is constructed to make rocket fuel for U.S. Air Force, producing until 1982. *1960s:* Biological warfare program starts; collection of wheat rust spores from farmed fields Sections 23–26 for planned release in U.S.S.R. to cripple wheat crop. "Button bombs" and napalm are produced during the Vietnam war. 1961: U.S. Army begins construction of a deep injection well; over the next 4 years 365 million gallons of waste are pumped 12,000 feet underground. *1964–1973:* Biological warfare activities—storage, planting, and destruction of wheat rust spores. 1965: Earthquakes hit Denver area, stopping deep well injection the following year (1966). 1967: Arsenal concentrates on production of rocket fuel for NASA. 1968: President Johnson orders the destruction of excess and obsolete chemical weapons. Arsenal is chosen to demilitarize the U.S. Army's Sarin (GB) and mustard chemical agent supplies: Project Eagle (Phase I) for mustard; Project Eagle (Phase II) for Sarin. Demilitarization of M34 clusters (Sarin), Weteye bombs (Sarin), and Honest John warheads M190 and M139 bomblets (Sarin).	Accessions: approximately 200 Includes: nerve gas manufacturing control panels; robotic arm for de-mil of M34 cluster bombs; munitions scale; X-ray machine; warning signs of all kinds; rubber protective suits; weight scale; wooden cart, wooden dolly, bombproof telephone and clocks; deep injection poster; GB emergency poisoning kit; policeman badges; fire department items; large purple mixer stick, some munitions, many forging tools. Also includes oral and video histories of employees who worked here during this time, not available in VC. Chiller gauges—item now in Butler Building

Table 13. Items accessioned into existing collection itemized by historical period, Rocky Mountain Arsenal National Wildlife Refuge, Colorado.

Period	*Historical timelines and events**	*Collection artifacts*
	1969: Demonstrations against RMA occur for chemical contamination. Denver Post urges U.S. Army to close Arsenal. 1970: North Plants manufacturing facility goes on standby status until closure in 1982. During this time it dismantles and disposes of U.S. Army ordnance. President Nixon promises destruction of all stockpiled chemical weapons. 1971: Incineration of mustard gas begins and destruction of Sarin (Project Eagle). Arsenal's primary mission shifts from national defense and space exploration to destroying munition stockpiles and chemical warfare agents. *1973:* M34 Cluster bombs filled with nerve gas are demilitarized. Stockpile of all biological agents destroyed. *1974–1975:* Reports of pollutants in wells near Arsenal. *1976:* Remaining stocks of phosgene gas are sold to private industry, removed from site. Destruction of Honest John warheads and nerve agent bomblets. 1979: U.S. Army constructs its first groundwater treatment system to treat contaminated groundwater onsite. 1982: All chemical manufacturing and demilitarization at the Arsenal ceases.	Cluster bomblets in collection, one at Visitor Center.
Cleanup and Refuge Transition 1984–2011	*1983:* Cleanup investigations begin under CERCLA. *1984:* Section 36 is described as "the most contaminated square mile in the world" and RMA is nominated to EPA's National Priorities List under Superfund law. 1986: Roosting bald eagles found on RMA. 1987: U.S. Army and Shell implement construction of groundwater treatment plants, cleaning up Basin F, dismantling rocket fuel blending facility, and asbestos removal. RMA is put on EPA's National Priorities List (Superfund). 1989: Congressional members Pat Schroeder and Wayne Allard propose legislation to accelerate Arsenal cleanup and conversion to a national wildlife refuge. 1992: 1992 Refuge Act, the founding legislation of Rocky Mountain Arsenal National Wildlife Refuge, passed by Congress. 1995: The Record of Decision (ROD) directing cleanup is agreed upon by multiple Federal and State agencies. 1997: U.S. Army and Shell undertake 21 specific cleanup projects outlined in the ROD. 1998: Demolition of the U.S. Army's former manufacturing plants begins, eventually involving more than 300 structures and the recycling of 10,000 tons of steel. 2003: Last of the Arsenal's chemical weapons manufacturing facilities and equipment are destroyed. 2004: EPA certifies 5,000 acres for removal from the Superfund list; those acres are transferred to the Service, officially establishing the Rocky Mountain Arsenal National Wildlife Refuge. *2011:* The last and final stages of ground projects associated with cleanup are completed.	Accessions: 2 Map poster, picture, oral histories of Pat Schroeder and others.

* Italicized dates reflect timeline items currently not represented on panels at the visitor center.

like, to have spent 14 years and $2 billion on remediation and what happened before and after that; what 474 homesteads sprinkled across the (then) 25 square-mile landscape and the farm life of settlers looked like in the pre-World War II era; the significant role the Arsenal played in World War II and the Cold War: some of the many events that shaped the Arsenal into the thriving wildlife refuge it is today that hosts over 330 animal species and over 300 native plant species and boasts thousands of visitors per year. That is our heritage and our history. It is also the history of this country.

- This story—the full story and the details that make it interesting—should be told. The variety of historically significant cultural resources that have survived over the years are the original props: the most tangible pieces of the past. They speak volumes to and paint pictures for those who see and touch them. Environmental education opportunities abound. In addition to the public benefit, any items that could be potentially displayed in Service buildings would be seen and appreciated by employees passing through. It would be a unique keepsake for RMANWR employees as a way to have a visible reminder of its past, and a tribute to those whose efforts came before them.

4.8 Research and Science

We are currently engaged in several research and monitoring programs, and some of our management projects assist in research, monitoring, and inventory programs. We know that this work is and will continue to be helpful in making sound management decisions. For example, our burrowing owl trapping and banding activities add to other research underway on the migratory pathways of this species throughout western North America. Other monitoring and inventory activities and programs that we conduct annually on the refuge are listed below:

- Bald eagle winter roost and nest counts (cooperative effort with the Rocky Mountain Bird Observatory) to monitor overall riparian health at the Refuge as well as individual bald eagle reproductive production
- Monitoring of raptor nests (such as Swainson's hawk and burrowing owl)

© Dave Showalter

Bison roundup

- Electrofishing and gillnetting in refuge reservoirs to assess fish populations
- Fall deer census and bison roundup
- Monitoring of vegetation and native and invasive species (especially on restored habitat sites)
- Annual mourning dove banding
- Support of the Great Backyard Bird Count in February
- Christmas Bird Count in January
- Spring and fall bird counts in May and September
- Annual monitoring of black-tailed prairie dog locations and densities

While we do not actively undertake specific climate change research at this time, we work with U.S. Army personnel to collect meteorological data that may be useful in the future for identifying trends in climate change at the refuge. Currently we are not conducting any type of social science, social media, or emerging technologies research. Occasionally we allow social science research that might benefit our management of the refuge.

4.9 Infrastructure and Operations

Our visitor facilities include a Visitor Center, a Contact Station, four information kiosks, two amphitheaters (one behind the Visitor Center and one at

Lake Mary), a fee station (iron ranger), and a wildlife viewing blind.

The refuge has entrance signs at the main gate and the Havana gate, as well as guide and directional signs throughout the refuge. We have installed and maintain interpretive signs at three of the information kiosks, the Contact Station, and Lake Mary.

There are five major dams on the refuge. Upper Derby, Lower Derby, Ladora, and Lake Mary dams are currently owned and operated by the U.S. Army. Havana Pond dam is owned and operated by the City of Denver and UDFCD. We are not planning to accept transfer of the U.S. Army dams until the necessary repairs on Lower Derby, Ladora, and Lake Mary dams have been completed. Upper Derby would be partially breached prior to transfer and would no longer be considered a dam. Because of the damages resulting from floods in 2013, Havana Pond is currently impaired but is undergoing repairs.

The entire refuge is surrounded by 8-foot chain-link fence to preclude deer movement across the refuge boundary and to contain the refuge bison herd within the boundary. Several miles of fencing within the refuge support the refuge's habitat and wildlife management activities.

The refuge is open from sunrise to sunset. Visitors are generally not allowed in the refuge during hours of darkness.

We manage the refuge in adherence to the Service's climate change policy, taking all the necessary measures to increase energy efficiency and reduce the carbon footprint of our operations.

Tables 6 and 7 in "Section 3.11—Funding and Personnel" provide information on the refuge's current funding and personnel (as well as on the different alternatives' scenarios). Every year we have around 80 volunteers who actively support refuge operations by staffing the front desk of the Visitor Center, conducting interpretive tours and programs, performing light maintenance of trails and facilities, assisting with biological surveys, and staffing special events. Together with our volunteers we maintain a fenced pollinator garden behind the Visitor Center.

4.10 Access and Transportation

Roads

Currently there are 7.8 miles of roads open to the public: 7.2 miles of asphalt roads and 0.6 mile of gravel roads. Roads open to the public consist of the entrance road, Legacy Loop, a portion of the Wildlife Drive, and several small access roads to points of interest such as fishing reservoirs. All existing public roads are open to two-way vehicular traffic. There are 43.5 miles of administrative roads—asphalt, gravel, and two-tracks—used to access sites throughout the refuge; these are closed to the public. Roads are maintained by refuge and U.S. Army staff on an as-needed basis.

Cindy Souders / USFWS

Our visitor facilities include a Visitor Center.

Trails

Currently there are 27.1 miles of trails in and surrounding the refuge that are open to the public. Approximately two-thirds of this trail system is the refuge Perimeter Trail. Within the refuge, approximately 10 miles of nature trails are open to hiking and snowshoeing (Legacy, Discovery, Havana Pond, and Prairie Trails). These trails are surfaced with crushed gravel fines material. Bicycle access is only allowed on the entrance road from the main gate to the Visitor Center.

Access

Public access to the refuge is currently limited to the main entrance, known as the Prairie Gateway, at 6550 Gateway Road north of the Dick's Sporting Goods Event Complex. Visitors typically access the refuge from Quebec Street and 64th Avenue. Prairie Parkway heads southeast approximately 0.6 mile to a left turn onto Gateway Road. The main refuge entrance is 0.8 mile farther on Gateway Road. Visitors may have difficulty finding the entrance because of the multiple turns and less than optimal directional signs. Furthermore, Commerce City's Prairie Gateway Open Space Trail follows both Prairie Parkway and Gateway Road, contributing to the confu-

sion: visitors sometimes believe they are at the refuge when in fact they have not yet reached the entrance. Finally, the current refuge entrance gate—a sliding chain link gate—is uninviting, and visitors occasionally leave, believing that it is not the entrance.

For administrative purposes, three additional regular vehicle access points are on the north, west and south sides of the refuge. Several other locked swing gates can be used for emergencies.

Way-Finding within the Refuge

Way-finding within the refuge consists of brown signs that direct visitors along the Wildlife Drive and to points of interest such as fishing reservoirs and trailheads. For their safety, visitors are reminded to stay in their vehicles while in the bison pasture. However, signage across the refuge has been inconsistent because of the change in management from the U.S. Army to the Service. Consequently, a comprehensive signage plan is needed. Visitors can, however, obtain a refuge map at the Visitor Center, the Wildlife Drive kiosk, or the Contact Station kiosk.

4.11 Socioeconomic Environment

Social and Economic Context

The refuge is situated in a diverse area in the Colorado Front Range region. A variety of socioeconomic and cultural barriers may impede residents from participating in outdoor recreation. Community characteristics provide a context for understanding

Table 14. Comparison of U.S. Census data to the results of the Rocky Mountain Arsenal National Wildlife Refuge visitor survey.

	US Census —Aurora	*US Census— Commerce City*	*US Census —Denver*	*2012 Visitor Survey*
Population	339,030	48,421	634,265	N/A
Median Income	$51,048	$60,963	$49,091	$75,000–$99,999
College or higher	26.6%	20.1%	42.2%	48%
Race				
Native American	1.0%	1.5%	1.4%	5%
Asian	4.9%%	2.2%	3.4%	3%
Black or African American	15.7%	3.1%	10.2%	3%
Hispanic	28.7%	46.8%	31.8%	7%
Native Hawaiian or Pacific Islander	0.3%	0.1%	0.1%	1%
White	61.1%	69.1%	68.9%	95%

Table 15. Enrollment and demographics of public school districts surrounding the Rocky Mountain Arsenal National Wildlife Refuge, 2013.

	Aurora Public Schools	*Adams 14*	*School District 27J*	*Denver Public Schools*
Enrollment	37,389	7,321	16,193	81,870
Native American	0.7%	< 1%	0.7%	0.8%
Asian	4.6%	< 1%	2.8%	3.3%
Black or African American	17.9%	2%	1.9%	14.5%
Hispanic	54.7%	83%	45.0%	58.0%
White	17.8%	13%	47.3%	20.3%
Other	4.4%	< 2%	2.1%	2.9%
Free/Reduced Lunch	71%	72.5%	37.7%	68%

potential barriers to visiting and engaging with the refuge. Accordingly, understanding the present characteristics of surrounding communities can help refuge staff determine how best to serve local residents, while exploring trends in community characteristics can assist with planning into the future (USGS 2014a). Tables 14 and 15 provide key demographic data for understanding the refuge vicinity's communities.

Population

In 2012, the total population of the eight-county local area near the Refuge was more than 3.1 million people, or roughly 60 percent of Colorado's total population. However, these eight counties contain a combined area of less than 10 percent of the State's total area (10,200 square miles compared to the State's 103,600 square miles), giving the local area a disproportionately dense population compared to the State overall. In fact, each of the eight counties is more densely populated than the State as a whole. In 2012, Denver County had the largest resident population (619,000) and was also the most densely populated (more than 4,000 people per square mile) of the eight counties. Broomfield County had the smallest population (57,000), but being smallest of the eight counties (153 square miles), it was also the second most densely populated (1,700 thousand persons per square mile). Weld County was the least densely populated county (65 persons per square mile), but it is by far the largest of the eight counties (nearly 4,000 square miles) (USGS 2014b).

Since 1990, population has increased steadily in all eight counties near the refuge, in many instances outpacing the growth rate of the State as a whole. From 2000 to 2010, Adams, Broomfield, Larimer, and Weld Counties all grew at a rate faster than that of the State. The projected growth rates for 2010–2020 for Broomfield, Denver, Larimer, and Weld Counties similarly outstrip that for the State (USGS 2014a).

Race and Ethnicity

The growing population of the eight local area counties has become more diverse over time. Minority populations in all counties have steadily increased over the last few decades. Denver, Adams, Arapahoe, and Weld Counties have the highest percentages of minority residents. In the case of Denver and Adams Counties, minorities constitute almost half the population and, with the exception of Larimer County, minorities make up 20 percent or more of the population in each county. Both Hispanic/Latino and non-white populations have increased in all counties since 1980. Adams, Denver, and Weld Counties have the highest percentages of Hispanic/Latino residents, while Denver, Arapahoe, and Adams have the highest percentages of non-white residents. There are a variety of racial groups within the non-white population; racial and ethnic groups are rarely homogenous and there may be more diversity within a group than between groups (USGS 2014a).

A diversity index (that is, a statistical calculation of the probability that two individuals selected at random from a given census tract are from different racial or ethnic groups) shows how diversity varies from neighborhood to neighborhood. The neighborhoods closest to the refuge include some of the most diverse neighborhoods in the Denver Metropolitan area. Census tracts nearest the refuge have lower percentages of white residents and higher percentages of Hispanic/Latino residents than tracts farther away (USGS 2014a).

Age

Overall, the population around the refuge is aging. The percentage of households with children has decreased over time in all counties. However, the decline in some counties, such as Broomfield, Adams, and Weld, has been minimal since 1990. At the same time, the percentage of the population over the age of 65 has increased in most counties except in Denver and Weld, where it has decreased or remained stable (USGS 2014a). The median age of residents in each of the eight counties ranged from 32.6 in Adams County to 40.6 in Jefferson County (USGS 2014b).

The neighborhoods around the refuge tend to have more households with children under the age of 18 than neighborhoods farther away. The percentages of older residents in the census tracts near the refuge mirror the county averages, with fewer than 15 percent of people aged 65 and over (USGS 2014a).

Education

The percentage of residents with at least some college education in the region has risen over time to more than 50 percent in all counties by 2010. Conversely, in 2010, in some counties, such as Adams, Denver, and Weld, 15 percent or more of the residents had less than a high school degree. Additionally, in 2010 in all counties, except Boulder, a fifth to a quarter of residents had a high school degree or less (USGS 2014a).

While the overall level of education for the region has increased over time, a closer look at the census tracts around the refuge reveals neighborhoods with high percentages of residents age 25 and above without high school degrees. In several census tracts to the west and southwest of the refuge, 41 percent or more of the residents age 25 and above do not have high school degrees (USGS 2014a).

Income, Employment and Poverty

Median incomes (adjusted to 2010 dollars) have generally risen over time in the region, despite a drop in 2010 in all counties except Weld. The gap between the lowest and highest income has widened slightly. In 1980, the highest and lowest median incomes for any individual county were $22,594 apart; in 2010, the highest and lowest median incomes were $28,090 apart. The percentage of people living below the poverty level remained relatively steady over time in the region until 2010, when it increased in all counties. Larimer, Boulder, and Arapahoe Counties saw the biggest increases (4 percent or more) from 2000 to 2010 in the percentage of people living below the poverty level. The decrease in median incomes and increase in percentage of people living below the poverty level from 2000 to 2010 most likely reflects the effects of the recession of 2007–2009 (USGS 2014a).

Though the percentage of residents living below the poverty level is relatively low at the county level, most of the census tracts near the refuge exceed the percentage of impoverished residents in their counties by a substantial amount. In many of the neighborhoods on the west and south sides of the refuge, one-fifth to two-fifths of the residents are living below the poverty level (USGS 2014a).

Comparing the 2013 average unemployment rates between the eight counties further reveals some differences in relative economic health. Across the eight-county region, average 2013 unemployment ranged from a low of 5.2 percent in Boulder County to a high of 7.5 percent in Adams County. The unemployment rate for six of the eight counties is comparatively similar (within one percentage point) to the State's average unemployment rate of 6.8 percent in 2013. Deviating from this trend are Boulder and Larimer Counties, each with unemployment rates at or below 5.4 percent. This suggests a relatively healthier economic situation for employees in those two counties compared to both the State's average and to the other six counties in the eight-county local area (USGS 2014b).

The eight-county area boasted more than 1.5 million full-time jobs in 2012. Accounting for more than one in every five jobs, education, health care, and social assistance was the largest industry category within the eight counties. The region is also a hub for professional and scientific industries, accounting for 14.6 percent of total employment. Additionally, combined employment in all travel and tourism sectors—retail trade, transportation, arts, entertainment and recreation, and accommodation and food—constituted more than 25 percent of total employment in the eight-county region. Construction and manufacturing also have a large combined presence, with nearly 15 percent of total employment falling into one of these sectors (USGS 2014b).

Access to Transportation

The majority of households in the region have access to two or more vehicles, but the percentage of households with access to one or no vehicle has increased slightly in all counties except Larimer and Broomfield. In some counties, such as Denver, Arapahoe, and Boulder, a quarter or more of the households have access to only one or no vehicle. Despite a lack of access to vehicles for these households, in each county only a small percentage of working residents aged 16 and over use public transportation to get to work (USGS 2014a).

The neighborhoods around the refuge tend to have access to fewer vehicles than the county-wide levels. In several census tracts west and south of the refuge, from two-fifths to three-fifths of residents have access to one or no vehicle. Despite a relatively widespread lack of access to vehicles, 10 percent or fewer of workers aged 16 and over in neighborhoods near the refuge use public transportation to get to work (USGS 2014a).

Recreation and Tourism

Outdoor recreation is an important component of Colorado's economy, contributing more than $34.5 billion in total economic output and supporting 313 thousand jobs statewide in 2013. With more than 24 million acres of federally managed lands, Colorado hosts a diverse range of outdoor recreational opportunities. In 2013, 90 percent of Colorado residents participated in some form of outdoor recreation. The three most reported popular outdoor recreational activities in Colorado are walking, hiking/backpacking, and picnicking (USGS 2014b).

Fishing, hunting, and wildlife-viewing are also popular recreational activities within Colorado, with approximately 2.3 million residents and nonresidents

participating in wildlife-related activities in the State during 2011. Approximately 70 percent of people who participated in wildlife-related activities in Colorado reported engaging in wildlife viewing, while 40 percent engaged in either hunting or fishing. In 2011, residents and nonresidents spent a total of 6.9 million days watching wildlife away from home, with residents accounting for 69 percent of wildlife watching days. Colorado residents accounted for 71 percent of the 2.2 million hunting days in 2011, and accounted for 89 percent of the 8.4 million fishing days. Spending associated with all wildlife recreation in Colorado totaled $2.98 billion in 2011; of this amount nearly 42 percent were trip-related expenditures, 52 percent was spent on equipment, and the remaining 6 percent was spent on other related items (USGS 2014b).

Cindy Souders / USFWS

Refuge Day

Chapter 5—Environmental Consequences

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Western kingbird

Luna Leopold (Aldo's son), was a leading geomorphologist and hydrologist who worked for the U.S. Geological Survey until 1972. In response to NEPA, he and others pioneered a tool (the Leopold Matrix) to identify the potential impact of a project on the environment. The system consists of a matrix with columns representing the various activities of the project, and rows representing the various environmental factors to be considered. The intersections are filled in to indicate the magnitude and importance of the impact of each activity on each environmental factor. Variations of this tool are still used today and in this plan.

(See Leopold, L. et al. 1971. A Procedure for Evaluating Environmental Impact. *USGS Circular 645. 16pp.)*

In this chapter we analyze the effects of continuing current management (the no-action alternative or alternative A) and of implementing each of the three action alternatives (alternatives B, C, and D). The environment that would be affected by the four alternatives is described in "Chapter 4—Affected Environment."

The chapter provides information relevant to each impact topic and the methods used to analyze direct and cumulative effects. In accordance with the Council on Environmental Quality (CEQ) regulations implementing NEPA, a summary of the environmental consequences for each alternative is provided in table 11 in chapter 3. The resource issues and topics presented in this chapter, and the way in which they are organized, correspond to the resource discussions in chapter 4.

For more information on the guiding authorities, Federal laws, policies, and regulations providing a framework and process for evaluating the impacts of the alternatives considered in this CCP and EIS, please refer to "Appendix C—Key Legislation and Policies."

5.1 Analysis Methods

In this chapter we analyze the impacts of the proposed changes to current refuge management by evaluating the no-action alternative (alternative A) and the three action alternatives (alternatives B, C, and D). We discuss the actions that may affect refuge resources under each resource topic, and the intensity of change resulting from those actions in all relevant contexts. In general, these are the consequences of the actions that we describe in "Chapter 3—Alternatives." Some actions may affect several resources and may be simultaneously adverse for one resource and beneficial for another. For example, increased visitation to the refuge may have an adverse effect on the experience of solitude some visitors seek, but that same increase may have a beneficial effect on the local economy. Similarly, an effect may be adverse in the short term but beneficial in the long term. For example, loss of vegetation from prescribed fire may constitute a short-term adverse effect, while the long-term improvements in the quality and diversity of vegetation in subsequent growing seasons would be a benefit.

We analyzed the potential environmental consequences at various levels. The term "adverse effect" in assessing impacts under ESA and NHPA has a slightly different and specific meaning than it does under NEPA. We have been careful to note whether an impact on a listed species or a cultural resource is adverse under NEPA or one of these other acts. In our analysis we specified if the effects are direct, indirect, or cumulative—that is, in consideration of other actions being carried out or that could possibly be carried out in the foreseeable future by others. Our conclusions are also guided by the duration of an effect—whether it is of long or short duration.

Our analysis of the environmental consequences follows CEQ and DOI guidelines as well as Service NEPA policies. Our CCP and EIS interdisciplinary planning team reviewed literature and studies applicable to the region, the setting, and the resources being evaluated. We used this information to augment our onsite observations, as well the advice of internal and external resource management experts to support the qualitative and quantitative statements presented in this environmental consequences section.

Direct effects are those that immediately affect the resource and are the direct result of a specific action or activity. Direct effects are defined as those impacts that would occur immediately when the action causing them is taken. For example, the loss of vegetation associated with digging a new foundation or constructing a trail would be a direct effect.

Indirect impacts are those that occur either later in time or at a distance from the action that caused them. For example, breaching a dam at the refuge may lead to changes in the water quantity and quality downstream from the dam site.

Cumulative effects have been defined as "the impact on the environment which results from the incremental impact of our actions when added to other past, present, and reasonably foreseeable actions regardless of what agency (Federal or non-Federal) or person undertakes such actions" (40 CFR 1508.7).

5.2 Analysis Approach

Our assessment was based on a variety of information, including public and private meetings and other communications with natural resource and other professionals, published scientific information, site inventories, agency reports, staff knowledge, public visitation and use data and projections (see appendix I), and computer modeling. Definitions of the following terms apply to our analysis of impacts.

Analysis Period—This draft CCP and EIS establishes the goals and specific implementation actions that we need to manage refuge resources for the next 15 years.

Analysis Area—The geographic study area for the draft CCP and EIS is the Rocky Mountain Arsenal National Wildlife Refuge, which is in Adams County between Commerce City, the community of Reunion, the neighborhoods of Montbello and Stapleton in the City and County of Denver, and DIA lands. The analysis area is fully described in table 5.

Duration and Type of Impacts—The CEQ NEPA regulations, which apply to all federal agencies, note that context, duration, and intensity are important factors in understanding an impact.

- *Context* can provide important comparative information when assessing an impact. For example, while the reintroduction of ferrets at the refuge may not add many individuals to the national population, it would be a substantial increase to the population in Colorado. Although geography is usually an important type of context analyzed in an EIS, the affected population, the agency

mandate, and the pristine or developed nature of the affected environment are other examples that may be relevant in fully understanding the intensity of an impact.

- *Duration* describes the length of time an effect will occur—either short or long term. Although the definition of each can vary for certain resources, we have generally applied the following in our analysis:
  - Short-term effects typically last up to 5 years.
  - Long-term effects last from 5 years to the 15- to 20-year lifetime of the CCP or longer.

- *Intensity* describes the strength or severity of the effect (either positive or negative) on the specific resources or the environment in general:
  - Negligible: an effect would be at the lower level of detection (such as less than 5 percent change from existing conditions).
  - Minor: an effect would be detectable or noticeable (such as somewhere between 5 and 25 percent change from existing conditions).
  - Moderate: an effect would be apparent (such as somewhere between 25 and 50 percent) and would have the potential to become major.
  - Major: The effect would be severe or, if positive, would have exceptional benefits.

Funding and Staff: The Service has defined each of the action alternatives to be reasonable—meaning they are economically and technically feasible. The costs of each and the staff they would require are not outside levels that other urban refuges have funded. However, funding cycles for any federal agency are subject to forces beyond the control of any one refuge, and fully implementing a selected alternative would depend on these cycles.

Plan Review may take place whenever new conditions or important new information influencing management becomes available. Generally, the lifetime of a CCP is 15 years.

We assumed that we will continue to follow standard operating procedures. We also assumed an increase in the number of visitors to the refuge based on our observations and data from current visitation trends and projections (see appendix I).

In the analyses, we address the potential impacts that are common to all alternatives for each resource topic. We then provide a discussion of specific subtopics that are related to the resource being addressed.

In analyzing the impacts, we used the best available science. Information included that from the scientific literature, Service and other agency reports, observations and projections by staff, and consultation with other staff and experts. To the extent possible, we used geographic information system (GIS) data from several sources, including other agencies, organizations, and researchers, to evaluate and calculate measurements. While GIS is a useful tool for evaluating and responding to queries, we realize that it may not be as accurate as a formal land survey. Consequently, discrepancies may exist. When sufficient or specific information was not available for us to assess the effects of an action, we used qualitative or relative assessments based on the scientific literature or professional field experience. Our analysis primarily relied on our staff's site-specific knowledge of the refuge and its resources and their own professional judgment to assess whether the impacts would be negligible, minor, moderate, or major.

Federally Listed and Candidate Species

The ESA (16 USC 1531 et seq.) requires that all Federal agencies consider the potential effects of their actions on species listed as threatened or endangered. If we determine that one of our proposed actions may adversely affect a federally listed species, we will initiate intra-Service Section 7 consultation (per ESA) with our ecological services' Colorado field office to ensure that our actions would not jeopardize the species' continued existence or result in the destruction or adverse modification of its critical habitat.

We used the following information to assess the effects of our proposed activities on federally listed species.

- Federally listed or candidate species found or likely to be reintroduced and that could be affected by the actions described under the alternatives.

- Habitat loss or alteration caused by the actions described under the alternatives.

- Displacement and disturbance potential of the actions and the species' potential to be affected by the activities.

According to ESA, the term "take" means to harass, harm, pursue, hunt, shoot, wound, kill, trap,

capture, or collect, or to attempt to engage in any such conduct. Table 16 shows the ESA definitions of the terminology used to assess impacts on federally listed species. The terms insignificant and adverse as used in the ESA determinations are not the same as the significance determination that may be made for NEPA purposes.

The biological assessment that we prepared for the possible reintroduction of the endangered black-footed ferret is included in this CCP as Appendix H.

Assumptions for Increased Visitation

In 2013, the refuge received approximately 300,000 visits. Under alternative A, annual visits are expected to grow by approximately 2.3 percent each year, resulting in an estimated 420,000 annual visits in 2029. Under alternatives B, C, and D, visits are expected to grow by approximately 4.4 percent, 8.6 percent, and 4.7 percent annually, resulting in 2029 estimates of 575,000, 1.03 million, and 600,000 visits, respectively (USGS 2014b) (see appendix I).

Cumulative Impacts

The CEQ regulations for implementing NEPA require the assessment of cumulative impacts in the decisionmaking process for Federal projects. We have considered cumulative impacts for the no-action alternative as well as for the three action alternatives.

One of the steps in analyzing cumulative impacts is to identify past, present, or reasonably foreseeable future actions that might contribute adverse or beneficial effects on the affected resource. This is the cumulative action scenario. Past actions are those that have been taking place since the establishment of the refuge, while reasonably foreseeable future projects are those that would occur within the life of this CCP. Following CEQ guidance, we included past actions "to the extent that they are relevant and useful in analyzing whether the reasonably foreseeable effects of the agency proposal for the actions and its alternatives may have a continuing, additive, and significant relationship to those effects" (CEQ 2005).

The reasonably foreseeable actions and plans that we identified and considered in our cumulative effects analysis are listed in table 17. We have also included a brief discussion in chapter 3, section 3.8, of those foreseeable activities for which we have enough information to address in a meaningful analysis.

In general, our analysis of cumulative impacts followed the steps listed below:

- *Identify affected resources*. We used the list of affected resources as set out in "Chapter 4—Affected Environment" and "Chapter 5—Environmental Consequences" of this CCP and EIS to evaluate cumulative effects.
- *Set boundaries*. We identified boundaries for considering affected resources as described in table 5.

Table 16. Endangered Species Act terminology.

Term	*Definition*
No effect	When a proposed action would not affect a listed species or designated critical habitat.
May affect or not likely to adversely affect	When effects on listed species are expected to be discountable, insignificant, or completely beneficial—Beneficial effects are contemporaneous positive effects without any adverse effects on the species. Insignificant effects relate to the size of the impact and should never reach the scale where take occurs. Discountable effects are those extremely unlikely to occur. Based on best judgment, a person would not (1) be able to meaningfully measure, detect, or evaluate insignificant effects; or (2) expect discountable effects to occur.
May affect or likely to adversely affect	When any adverse effect on listed species may occur as a direct or indirect result of the proposed action or its interrelated or interdependent actions, and the effect is not discountable, insignificant, or beneficial—If the overall effect of the proposed action is beneficial to the listed species, but is also likely to cause some adverse effects, the proposed action "is likely to adversely affect" the listed species. If incidental take is anticipated to occur as a result of the proposed action, then it "is likely to adversely affect" the species. Incidental take is the take of a listed species that results from, but is not the purpose of, carrying out an otherwise lawful activity.
Is likely to jeopardize species or adversely modify critical habitat	The appropriate conclusion when the Service identifies an adverse effect that could jeopardize the continued existence of a species or destroy or adversely modify critical habitat of a species within or outside the action area

Table 17. Reasonably foreseeable actions in the area of Rocky Mountain Arsenal National Wildlife Refuge, Colorado.

DIA and Denver Parks and Recreation: co-management of open space lands adjacent to the refuge
Highway 2: road work and maintenance
56th Avenue Corridor Improvements (Quebec Street to Peña Boulevard)
96th Avenue: Refurbishment
Refuge's Section 10: General development plan
Natural Resources Damages Assessment
Climate change
Climate change in Colorado
Climate change strategies for surrogate species
Climatic change policies

- *Identify cumulative action scenario.* We determined which past, present, and reasonably foreseeable future actions to include for each affected resource. Reasonably foreseeable future actions include those Federal and non-Federal activities not yet undertaken, but sufficiently likely to occur, that a reasonable official of ordinary prudence would take them into consideration in reaching a decision. These activities include but are not limited to activities for which existing decisions, funding, or proposals have been identified. Reasonably foreseeable future actions do not include those actions that are highly speculative or indefinite (43 CFR 46.30).

- *Analyze cumulative impacts.* We summarized the effects of the actions under the alternatives to arrive at the likely total cumulative impact. We included the analysis for each of the resources that we identified.

5.4 Environmental Consequences for the Physical Environment

Geology and Soils

Alternative A

Currently, the refuge undertakes maintenance activities and habitat or wildlife management actions that may affect soils. For example, we construct fences to keep bison in areas where we want grazing to occur. This action has both minor, localized, short-term adverse impacts on soils associated with the loss of soils during construction, as well as longer term adverse impacts associated with erosion. However, prairie restoration associated with bison presence would be a moderate beneficial effect. Management of our bison herd, requiring construction of additional fencing, will make more lands available to bison for grazing. The presence of bison on a wider area would potentially contribute to successful prairie restoration because soils may be fertilized and mixed by the bison's activity. Habitat restoration work conducted by the refuge under its newly approved HMP is expected to increase native prairie vegetation.

Breaching Upper Derby dam would have both a short-term adverse effect as the flush of water is released, as well as a long-term moderately beneficial effect by reducing erosion associated with the current fluctuating reservoir and overflows. The breaching would also have adverse and beneficial effects on soil characteristics—organic content, depth, porosity, density and compaction—by removing nutrients when the water is released, but adding nutrient-rich soils impounded by the dam.

Visitors parking off roads because of the lack of designating parking areas results in adverse effects on vegetation and underlying soils. Because we only carry out small-scale activities that entail no substantial change to the refuge's landscape, we expect no impacts on the site's geology.

Alternatives B, C, and D

The wildlife and habitat management actions described for alternative A and their effects on soils—both adverse and beneficial—would be continued under all the action alternatives. We are not pro-

posing any major alteration of the landscape, and consequently we anticipate no effect on the geology of the site.

The action alternatives would disturb soils and change their organic content through the addition of black-footed ferrets. These would be moderate, adverse, and localized effects.

All action alternatives assume increased visitation (see appendix I) and use of trails, with the greatest increases projected under alternatives C and D. Because visitors would be largely restricted to trail use, most of this impact would be on built sites (such as fishing piers and docks, the Visitor Center, roads, and boardwalks); highly disturbed sites (like well-used lakeshore fishing spots); and dirt trails. This concentration of visitor activity minimizes the chance for additional soil loss from visitors walking, riding bikes, or driving at the refuge. Because some visitors would occupy new areas or leave trails, the potential for localized, minor to major adverse impacts from increased visitation would be part of any of the action alternatives, but particularly alternatives C and D. Our focus would be to design appropriate infrastructure to support increasing visitation with the goal of reducing visitor impacts on natural resources. Placement and construction of the small number of new enhancements would have a temporary adverse effect on soils and an overall negligible adverse effect. In addition, we are proposing abandoning many roads and incorporating reductions in the miles of the refuge's administrative roads we currently use (table 18). This change would have a minor beneficial effect on soils by reducing road use.

- Alternative B: In addition to the effects described for alternative A, 11.7 miles of roads would be abandoned and 8.5 miles of roads would be converted to emergency use only, resulting in a minor beneficial effect.

- Alternative C: Construction of eight new parking areas and 11 miles of trails would have a negligible impact on soils. 14.5 miles of roads would abandoned and 8.5 miles of roads would be converted to emergency use only, resulting in a minor beneficial effect. Modifying or burying distribution lines and improving the auto route from 56th Avenue would result in minor direct loss of soils.

- Alternative D: Construction of eight new parking areas and 11 miles of trails would have a negligible impact on soils. 14.5 miles of roads would abandoned and 8.5 miles of roads would be converted to emergency use only, resulting in a minor beneficial effect.

Water Resources

Alternative A

Water quantity and quality are among the most important considerations for the refuge's future. Water is also a very complex aspect of management. Our WMP (2014) describes our water rights, sources of water, and our future approach to water management. Continued habitat restoration will have a minor beneficial effect on water quality and quantity both on the refuge and for users downstream of the refuge.

The refuge's current policy of allowing natural surface flows to dominate is in keeping with Service policy to encourage natural conditions; this approach is a profound benefit to refuge water resources. Other beneficial practices include working with DIA and cities upstream of the refuge to manage stream and surface flow, and a refuge proposal to recycling all drinking water—a practice that could save 8 billion gallons of water per year. The refuge also maintains some dams and other water control infrastructure that, although not natural features, offer beneficial effects for wildlife by providing pond habitat.

Much of the water used by the refuge enters from the City of Denver in both the Irondale Gulch and First Creek basins. Overall, the quality of water flowing onto the refuge is good (Gordon et al. 2005). However, increased development surrounding the refuge could adversely affect water quality, and increased water quality monitoring will be needed in the future.

As evidenced by the September 2013 flood that damaged infrastructure in the refuge, urban drainage surrounding the refuge and its impact on the refuge will be an important issue into the future. Figure 14 shows how the flood extended the 100-year floodplain on the refuge. As required by current agreements, we will continue to work with the UDFCD and surrounding local governments on infrastructure improvements. Currently these improvements entail reconstruction of the Havana Pond dam and several other structures damaged by the flood. We will oversee the partial breach of the Upper Derby dam and will explore options for a refuge structure known as the Railroad Embankment, ranging from its removal to reconstruction of the embankment as a nonclassified dam (meaning it may hold some amount of water during extreme events, but will not hold enough water to warrant further consideration). Because the facilities are already in place, theses minor alterations in their use and func-

tion would have only minimal temporary and long-term effects.

In June 2013, we completed formal consultation pursuant to ESA Section 7(a)(2) on the refuge's current and future use of water. This consultation required that we determine the source and any impacts associated with the use of up to 1,400 acre-feet water by the refuge each year for a wide variety of uses, and it concluded that our water use would not affect federally listed endangered species.

Alternatives B, C, and D

Water requirements and management would be the same under the action alternatives as under alternative A. In keeping with our WMP (2014), we would continue to prioritize conservation of water resources on the refuge. When needed improvements are completed by the U.S. Army (U.S. Army Corps of Engineers 2014), we will accept the transfer and management of the dams located on the refuge.

In keeping with 1987 USACE recommendations, the refuge will not accept any additional stormwater retention or runoff. We will continue to work with the UDFCD and surrounding local governments on improvements to existing facilities.

Air Quality

Alternative A

Maintaining significant, intact grassland habitat has a beneficial effect on air quality. Nevertheless, we believe that refuge management and visitation activities under alternative A would have a temporary, negligible, adverse effect on the existing air quality of the planning area and its surroundings. The projected increase in vehicular emissions from visitors to and staff of the refuge would temporarily affect the air quality parameters, but would quickly dissipate or would, for the most part, be absorbed by the vegetation of refuge habitats. The dust generated by visitors and refuge management activities would also have a negligible, temporary, locally adverse effect that would quickly subside as the dust particles settle back to the ground.

Alternative B

Air quality effects would be similar to those described for alternative A.

Alternatives C and D

The effects on air quality under alternatives C and D would be similar to but of somewhat greater magnitude than the same effects under alternatives A and B because of increased visitation and management activities. However, as described for alternatives A and B, vehicular and particulate emissions would quickly dissipate to the surrounding area under normal wind conditions and would be quickly absorbed and sequestered by the refuge's vegetation or, in the case of dust, quickly settle back to the ground.

Climate

Alternative A

As indicated in section 4.10, the projected growth and corresponding traffic congestion in the Denver Metropolitan area are expected to increase 40 percent by 2040, likely leading to an increase in carbon emissions in the area surrounding the refuge. However, none of the alternatives would entail an increase in roadway capacity. Consequently, the impacts of potential increases in visitation would have a negligible impact on air quality because any future emissions would be restricted by the current capacity.

Implementing habitat restoration as called for in the HMP would have a minor beneficial effect on the ecosystem through sequestration of carbon and additional habitat to increase resiliency of local ecosystems. We will also construct a new more efficient administration building and improve several other existing facilities that will receive a portion of their electricity from the new photovoltaic solar arrays planned for implementation at the refuge by 2018 (see "Sustainability" in "Section 3.2—Elements Common to All Alternatives"). Increased energy efficiency and sustainability measures for actions and facilities that support operations will provide a minor long-term beneficial effect by reducing carbon emissions. In addition, we will use the Service's recently issued CLIR tool to gauge greenhouse gas emissions and comprehensively assess, and over time reduce, the carbon footprints of operations and of our visitors.

Alternative B

The effects on climate would be the same as those described for alternative A.

Alternative C

We will increase visitor opportunities in new areas of the refuge and increase opportunities for both nonmotorized access and more energy-efficient methods of travel. Positive impacts associated with reductions in motorized use are likely to be offset by larger increases in overall visitation.

Alternative D

The effects on climate would be the same as those described for alternatives A and B.

Night Sky

Alternative A

Our current plans contain only limited information on visual resources and no discussion of night skies. However, continued implementation of these plans would have no additional impacts on the physical environment.

Alternatives B, C, and D

The refuge's natural setting makes it a notable asset in a large metropolitan community. We desire to protect night skies both for their aesthetic value and to reduce the effects of light pollution on wildlife. While the subtle effects of light pollution on wildlife (beyond several taxa such as sea turtles) remain largely unknown, it is well recognized that light pollution alters natural light regimes in terrestrial and aquatic ecosystems (Rich and Longcore 2005). Animals may either be attracted or repulsed by glare, affecting their foraging, reproduction, communication, and other critical behaviors. These changes then disrupt their interspecies interactions, with serious implications for community ecology (Longcore and Rich 2004). For example, artificial light affects the dawn activities of songbirds and can affect the timing of reproductive behavior (Kempenaers et al. 2010). Artificial light affects bats and other nocturnal animals by reducing their activity, thereby reducing travel distances and food consumption (Beier et al. 2006).

Our analysis has shown that some refuge areas should be targeted for preservation of night skies. We will work to remove existing, unnecessary nonnatural light sources in the refuge, providing a minor beneficial effect on aesthetics and wildlife. Limited evening programs will offer opportunities to experience a (fairly) dark night sky in a metropolitan environment, creating a beneficial effect on visitor experience.

Soundscapes

Alternative A

Current plans address the temporary noise impacts associated with the U.S. Army's final cleanup of the site. This work is now complete, and few proposed projects would entail a comparable level of noise. In the future, the majority of noise impacts on the refuge will originate outside the refuge boundaries. The continued operation and maintenance of the refuge requires the use of some vehicles and heavy equipment, but their use should have negligible, short-lived effects on the environment. However, increases in visitation without a plan of how best to accommodate visitors' travel through the refuge is likely to increase noise impacts.

Alternatives B, C, and D

Substantial research shows that noise affects wildlife (Turina and Barber 2011), and the impacts of chronic anthropogenic noise on wildlife vary by species and by intensity. In general, disturbance evokes anti-predator behaviors, interferes with other activities that enhance fitness, and can lead to population decline (Frid and Dill 2002). In addition, the effects of this type of stressor may be less obvious than would seem apparent. In general, humans on foot are more disturbing than motorized disturbance (Stankowich 2008). Large mammals like bison may spend less time foraging as they must take time to inspect their surroundings that they would otherwise spend searching for food (Fortin et al. 2004). Noise may affect the territory size of certain birds, and birds may be forced to compensate for noise by increasing the amplitude of their vocalizations (Brumm 2004). In fact, noise alone can reduce the richness of species in a given locale and can lead to different urban-adapted avian communities in and around human-altered habitats (Francis et al. 2009).

Based on the data provided, we will focus our attention on preserving the quietest areas of the refuge by limiting noise-producing activities. We will have limited abilities to control noise from adjacent lands, but will continue to remind neighbors of noise impacts on the refuge and its wildlife resources. Preserving quiet places and offering a quiet, natural retreat in an urban setting will result in a beneficial impact on the visitor experience of the refuge.

Cumulative Impacts on the Physical Environment

Alternative A

We are working with the City of Denver to ensure that management of stormwater on the new Section 10 lands (City of Denver lands adjacent to the refuge's southern border) is consistent with our management activities and the goals of this CCP. This new development south of the Visitor Center may have impacts that will be formally explored during the City's planning process. A well-developed long-term plan for regional stormwater is in the interest of the refuge, offering a minor beneficial effect in reducing the severity of property damage (both on and off refuge lands) resulting from storm events. Depending on the quality and quantity of stormwater runoff entering the refuge from neighboring areas, polluted runoff could have minor to moderate adverse effects on refuge resources. We believe that, other than water resources, no other cumulative impacts associated with current plans and activities in the areas surrounding the refuge would affect geology and soils, air quality, climate, night sky, or soundscapes.

Alternatives B, C, and D

As described for alternative A, there would no cumulative impacts, with the possible exception of stormwater runoff associated with Section 10.

5.5 Environmental Consequences for the Biological Environment

Habitat

The refuge recently completed its HMP and accompanying environmental assessment (FWS 2013a) and is already implementing it. The decisions made in the HMP are no longer open for public comment, and implementation will continue regardless of the alternative selected. Relevant decisions are summarized here and elsewhere in this CCP and EIS to provide context. Because the HMP would continue to be implemented under all alternatives, the discussion for alternative A also pertains to the action alternatives. The discussions of the action alternatives only addresses those issues where specific effects differ from those under alternative A.

Alternative A

In keeping with the HMP, we will continue to identify and implement specific treatments necessary to restore and maintain shortgrass and mixed-grass prairie. These treatments include seed plantings, prescribed fire, grazing, mowing, and methods to address the threat of invasive plants and noxious weeds.

Continued implementation of the FMP (FWS 2013i) will ensure that refuge habitats undergo necessary prescribed fire treatments to support habitat restoration, invasive plant species control, and necessary fuel reductions. Additional information on the effects of fire on plants and wildlife species can be found in the 1997 environmental assessment and FONSI (see appendix C of the Fire Management Plan) for the FMP.

Riparian habitats throughout the Great Plains are extremely important to wildlife. The HMP outlines goals and strategies to establish baseline conditions and plant replacement of cottonwood trees on the refuge. These efforts, in conjunction with treatment of invasive plants, will result in substantial beneficial effects on native plant species on the refuge.

Inventory of riparian habitat could lead to control of invasive species with moderate benefits in improving habitat. Continuing partnerships with agencies for restoration activities could have a moderate beneficial effect on habitat. Over time, improvements in habitat related to existing staffing would become more apparent with moderate benefits for habitat quality and extent of native habitat.

While woodlands may provide some habitat for woodland bird species (which were not historically present on the refuge site), these woodlands and locust thickets—currently dominated by cheatgrass—fragment grassland habitat and provide predator perches, resulting in adverse effects on grassland-nesting birds. Our staff spends considerable time and resources trying to reduce cheatgrass infestation.

Alternative B

Increased visitation could result in off-trail use, leading to trampling of native habitats in localized areas. Trampling initially bends and weakens leaves and branches and ultimately breaks them. It directly damages plants by reducing photosynthetic surfaces, seed production, and carbohydrate reserves. Although off-trail use may be infrequent, the greatest increase in damage to plants from trampling

occurs at a low intensity—between the first 100 and 300 passes (Joslin and Youmans 1999). Still, because the increase in visitation is not expected to be as high under this alternative as other action alternatives, impacts are likely to be localized, vegetation is likely to recover each spring, and overall effects would be negligible or minor.

Some loss of soils and vegetation that serve as wildlife habitat could result from small-scale construction, new trails, burying transmission lines, and other actions such as installing and maintaining split-rail boundary fences. These activities are common to the action alternatives and would result in temporary localized minor or moderate effects. Vegetation would return in the spring following construction. All action alternatives include removing some of the section line roads, possibly adding habitat with negligible benefits.

An indirect impact on wildlife habitat could result from reintroduction of black-footed ferrets (common to all action alternatives). If successful, ferret reintroduction could mean a negligible reduction in black-tailed prairie dog populations. Restoration of shortgrass and mixed-grass prairie habitats is considered the primary habitat goal at the refuge, because these habitats provide important stopover spots for migrating birds and other wildlife. To some degree, disturbance of habitat over the years has resulted in a very high prairie dog population, a condition that prevents successful restoration of prairie habitat (FWS 2013h). A more balanced prairie dog population resulting from the reintroduction of ferrets could have widespread minor to moderate beneficial effects on prairie habitat on the refuge.

Alternative C

In addition to the effects described for alternative B, visitation under this alternative is expected to be about double that under alternative B, and the adverse impacts of off-trail use could be more severe, ranging from minor to moderate. Social trails may be created if trail users frequently attempt to access a desirable location by walking off designated trails. If so, vegetation could be permanently lost. At high visitor use levels, the additional spread of invasive plant species by visitors transporting propagules—for example, on shoes, clothing, bicycle tires, and packs—may become problematic. However, because the refuge is already subject to high levels of infestation by invasive nonnative species, the impact compared to current conditions would likely be negligible. Also, alternative C includes efforts to educate the community and visitors about impacts on wildlife and habitat from actions such as off-trail use. A specific targeted effort to inform hikers or bikers would also greatly mitigate impacts of off-trail uses.

Alternatives C and D include the construction of eight new parking areas and 11 miles of trails. Because these facilities would be constructed mostly along existing two-track roads or in prior disturbed areas, the impacts on habitat at the refuge are likely to be localized and minor.

Alternative C also calls for a greater expansion of the number of visitor amenities and facilities than other alternatives. The long-term effect of these facilities would be to reduce the quality of adjacent habitat and to remove habitat in the features' footprints. Because most of these would be created near or even in the footprint of existing structures, impacts would be minor.

We would also abandon 14.5 miles of roads (approximately 105 acres), and 8.4 miles of roads (approximately 62 acres) would be converted to emergency use only. We would choose to abandon roads that provide the greatest extent of habitat connectivity and scale, such as roads that bisect a large block of intact habitat. These abandonments and conversions would result in a minor beneficial effect because they would revert to native landscape, improving habitat conditions for wildlife populations.

Opening the Wildlife Drive to public vehicles would have a minor effect on habitat along the roadsides because it could reduce the quality of habitat through disturbance and increased introduction and spread of invasive species. Making trail connections with trails outside the refuge to bring more visitors could result in minor adverse effects on habitat through fragmentation, disturbance, and the introduction of invasive species. Increased efforts to inform the community about native plant communities could mitigate these impacts, but the extent of this benefit is unknown.

Alternative C calls for the removal of overhead power lines and burying them. Undergrounding power lines would have a minor, long-term beneficial effect by improving nearby habitat; however, installation activities would have a short-term adverse effect.

Increased stocking may induce more fishermen to apply for fishing permits; at the same time, because increased fishing permit fees might also discourage existing fishermen, the net effect could be inconsequential. However, if fishing pressure increases, there could be a moderate, adverse effect on wildlife habitat along shorelines through trampling and increased fragmentation associated with heavier use.

Overall, fragmentation effects on habitats would be primarily limited to already disturbed sites. While fragmentation does affect the overall health and biodiversity of an ecosystem, improving large areas of habitats and preventing further loss—actions that would be implemented in keeping with the HMP under any CCP alternative—are of greater importance than reducing fragmentation (Fahrig 2003).

Alternative D

Impacts on habitat associated with visitation would be similar to those described for alternative B. Impacts associated with new trails and parking lots would be similar to those described for alternative C. Large events under this alternative could cause moderate, short-term adverse effects through disturbance such as trampling of vegetation. Increased outreach and education programs would have a greater beneficial effect then under alternative C through explaining the beneficial values of native ecosystems, but the extent of this benefit is unknown.

Alternative D calls for a more extensive trail system than described for alternative C, and connections between the refuge and other areas would be a focus. Although trails on the refuge would not be more numerous than under alternative C, the connection with other locations may exacerbate the transmission of invasive species either to or from the refuge.

This alternative calls for increased partnering and collaboration with agencies, the public, and academia. Sharing knowledge, data, and activities could improve management of the refuge and increase knowledge of topics such as habitat fragmentation and carrying capacity in a fenced environment. These effects would be beneficial and wide-spread, ranging in intensity from minor to major.

Wildlife

In addition to effects on wildlife habitat, we analyzed impacts on both diversity and populations. The analysis of impacts on animal populations focuses on large-scale impacts, such as birth and death rates, health, and behavior. However, impacts on populations are made up of impacts on individuals. Animals may experience impacts directly from disturbance or displacement. Wildlife responses to disturbance are shaped by six factors:

- the type of activity;
- predictability of the activity;
- frequency and magnitude of the activity;
- timing (such as breeding season);
- relative location (such as above or below the activity on a slope); and
- the type of animal (for example, size, habitat requirements, group size, sex, age) (Knight and Cole 1995).

Impacts on individual animals can be reflected in a population if the impacts are severe enough, resulting in changes to population size, fecundity (that is, reproductive capacity), or health. Community-level impacts—such as species diversity—may also result. More often, other dynamics that affect populations and communities—such as habitat loss or climate variables—obscure noticeable impacts from individual actions like those described under the CCP alternatives, although such impacts may be occurring nonetheless.

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Toad

The analysis of impacts on wildlife considers several factors, such as differences in conditions and management between the refuge's prairie management zone where bison are confined, and the Environmental Education Zone in the southern portion of the refuge. In the prairie management zone, the HMP calls for the use of four surrogate species to assess impacts. Impacts on these four species are indicative of impacts on habitat and the ecosystem in this area. Consequently the wildlife analysis overlaps considerably with the habitat analysis because the approach of using surrogate species is intended to evaluate impacts on grassland habitat as well as the species that depend on it. Across the entire refuge, but particularly outside the bison area, a more generalized analysis—one that addresses fish, herptiles, birds, and mammals as classes—is helpful in understanding the effects of disturbance. Because the HMP would be implemented under all alternatives, the analysis focuses primarily on the management effects associated with aspects of visitor use that would vary under the action alternatives. Accordingly, effects associated with the practices and objectives set forth in the HMP are most heavily discussed under alternative A.

Alternative A

Species of Concern

Ferrets would not be introduced under this alternative, and no management efforts to protect them or to help establish a population would be implemented.

No beneficial effects on this species would occur at the refuge under alternative A.

The inventory of riparian habitats is an ongoing activity that takes place in habitat occupied by bald eagles during certain parts of the year. Impacts from disturbance during the surveys have been and would continue to be avoided by conducting them outside the breeding and winter roosting season.

The HMP calls for removing existing bat boxes originally intended for the big brown bat. This species is not listed, but is considered in assessing mammalian diversity, a factor whose importance is of increasing concern to wildlife managers (FWS 2013a). Removing the boxes is not expected to have any effect on this or other bat species at the refuge, because they have never been observed to be used since they were first installed in 2005.

The HMP identifies Swainson's hawk, burrowing owl, and grasshopper sparrow as species of concern because they currently breed on the refuge or could breed here in the future (in light of future habitat restoration), and because they are exhibiting declining population trends. The refuge supports a robust population of burrowing owls as well as nesting Swainson's hawks, and it may reemerge as a breeding area for grasshopper sparrows. Habitat goals and objectives in the HMP include creating vegetative mosaics of different seral stages in the prairie and grassland communities to support existing and potential future breeding. Implementation of this CCP over its 15-year horizon would likely have refuge-wide benefits, ranging from minor to major depending on the pace and success of habitat restoration.

Surrogate Species

The highest priority goal in the HMP is to restore and maintain more than 10,000 acres of shortgrass and mixed-grass prairie to provide habitat for the four surrogate species—Cassin's sparrow, lark bunting, black-tailed prairie dog, and American bison—and the species for which they are surrogates (such as grassland birds). Fragmentation of habitat—mostly associated with urbanization and development—is considered a primary cause of the decline of grassland bird populations. The HMP points out the importance of maintaining both a large, intact, and unfragmented prairie grassland and a structurally diverse habitat modified by the natural processes of bison grazing and prairie dog activity. Continued management of bison and prairie dog populations will help to keep these two key species in a healthy balance.

Lark buntings are area-sensitive and require large tracts of undisturbed grassland for breeding. Restoring 4,500 acres of shortgrass prairie to high quality habitat as proposed in the HMP is expected to provide substantial benefits for buntings and associated species, including Swainson's hawks. Establishing 8,000 acres of high-quality mixed-grass prairie is expected to provide similarly important benefits for Cassin's sparrows and associated species, including grasshopper sparrows and foraging Swainson's hawks. Additional pasture for bison proposed in the HMP would potentially result in more than 12,000 acres of grazing land, with major localized benefits for this species. Each of these HMP actions has already been incorporated into the planning process and will be implemented as funding becomes available over the lifetime of the CCP.

Fish

Fish and other aquatic or semiaquatic species use the reservoirs and riparian areas on the refuge. The reservoirs (Lake Mary, Lake Ladora, and Lower Derby Lake) are currently managed to balance populations of largemouth bass, bluegill, and northern pike with other species and to provide recreational catch-and-release fishing opportunities. These areas and riparian lands also provide foraging habitat for bald eagles and migratory habitat for waterfowl and shorebirds. We have found some imbalances in the refuge's fish populations, such as larger catfish and smaller bass and bluegill. The HMP sets specific objectives for each sport fish species in each lake to rebalance size and abundance.

Herptiles

No specific management of reptile or amphibian populations is spelled out in the HMP. Because these species are not monitored, information about their relative health or population trends on the refuge is not available. However, in many locations in the Rocky Mountain region, factors such as the presence of nonnative species (including bullfrogs, which prey on native amphibian eggs, larvae, and adults); elevated nitrogen levels (such as from fertilizers upstream); or increased turbidity or contamination from roads or from the management of invasive species with chemical herbicides, may be adversely affecting native species (Maxwell and Hokit 1999). In the HMP, we propose managing lake water quality to maintain minimum dissolved oxygen and maximum water temperatures, actions that would indirectly offset some of these effects on native herptiles. Over the lifetime of the CCP, these improvements could provide minor or moderate benefits for amphibians and other aquatic species throughout the refuge.

Roadkill of slow-moving reptiles and amphibians occurs now, even with relatively few vehicles on the roadways in the refuge. This effect is likely to increase as visitation increases. Restrictions on road access may keep roadkill from rising at the same rate as visitor use, and impacts are likely to be no more

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Western meadowlark

than minor under alternative A. Enhancement of visitor access can also modify habitat use by creating migration barriers and by decreasing breeding, foraging, and overwintering habitat (Maxwell and Hokit 1999).

Birds

The vegetation at the refuge is used by a wide variety of birds, including those that primarily inhabit shortgrass and mixed-grass prairie, shrublands, woodlands, and riparian and wetland areas. A representative sample of bird species and the type of habitat they occupy is shown in table 12, and a list of species is available in Appendix G. Woodland (including riparian forest) and wetlands on the refuge support many species of waterfowl, shorebirds, wading birds, neotropical migrants, and other species such as woodpeckers and jays. The refuge does not contribute substantially to habitat for these latter species, and the HMP focuses restoration and management efforts on grassland species. However, water quality goals identified for lakes, riparian monitoring, and ongoing restoration of woody riparian vegetation along First Creek as described in the HMP would keep the habitat from becoming degraded and continue to provide benefits similar to those currently available.

Birds exhibit many responses to human activity, from habituation to abandonment. Disturbance can be particularly problematic for birds when it disrupts important behaviors such as feeding or breeding. Grassland-shrubland and savannah songbirds may be vulnerable to disturbance from cars or bikes on the road or from people using trails. During the breeding season, effects on birds can include nest desertion, predation, premature fledging, and separation of adults from young. When bird activity concentrates in migration or overwintering habitats, disturbance can change foraging habitats and decrease efficiency of food consumption for energy (Hamann et al. 1999). At least one research team (Miller et al. 1998 as cited in Hamann et al. 1999) found lower nest survival for grassland birds adjacent to hiking trails in Colorado. The presence of a road or trail can create edge habitat that allows access by predators. Johnson and Temple (1990) found predation on nesting grassland birds to be higher in fragmented than in contiguous tallgrass prairie.

Bald eagles can be quite sensitive to disturbance. Depending on the type, intensity, duration, and location of disturbance, as well as the point in the nesting cycle when the disturbance occurs, they can completely abandon a nest or even eggs or chicks (MBEWG 1994 as cited in Hamann et al. 1999).

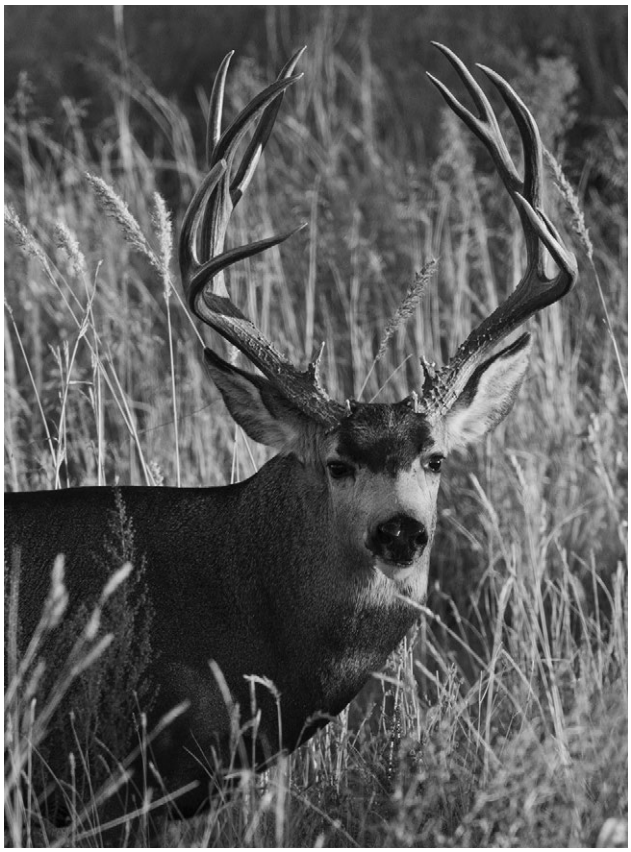
The refuge does not host a large population of breeding waterfowl, marshbirds, or shorebirds. Nests or broods that have been found on the refuge include pied-billed grebe, mallard, American coot, redhead, northern pintail, blue-winged teal, gadwall, northern shoveler, ruddy duck, killdeer, and American avocet. Nonbreeding waterfowl, shorebirds, or wading birds may be flushed from feeding or resting areas or may change food habitats, feed only at night, lose weight, or desert the feeding area, although not all waterbirds are equally sensitive to disturbance. Some may habituate to a distance from ongoing disturbances (such as people fishing).

A predicted 40 percent increase in visitor use over the 15- to 20-year lifetime of the CCP would exacerbate existing adverse effects of human use of the refuge. Effects would remain localized but would increase in severity, perhaps to minor or moderate levels.

Mammals

Small mammals, ungulates, and carnivores can be adversely or beneficially affected by human activities. Since these groups are highly interconnected (mainly by the food they consume), it is understandable that changes to their habitats (fragmentation) or populations (for example, through hunting) can have substantial impacts on an entire ecosystem (Canfield et al. 1999; Hickman et al. 1999). For some species of small mammals, such as porcupines, rabbits, and voles, the mere presence of humans may have adverse effects (Hickman et al. 1999). At least one study (Mainini et al. 1993 as cited in Hickman et al. 1999) found that the presence of hikers could adversely affect the time spent and success of foraging.

Currently, the refuge is closed to hunting and winter sports such as cross-country skiing. Consequently, the primary source of impacts on ungulates (deer and bison) and carnivores (both meso-predators such as skunks and raccoons and larger predators like coyotes) is likely to be vehicles and hikers. Many species spend much of the warm season accumulating



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Mule and deer, confined within the refuge by a perimeter fence, heavily utilize the southern half of the refuge.

fat reserves and supporting young of the year. Mule and white-tailed deer, confined within the refuge by a perimeter fence, heavily utilize the southern half of the refuge, especially in winter. Deer obtain some nutrients in riparian areas and other wet sites, which are scarce at the refuge. Disturbance by hikers or anglers in these locations can be particularly harmful as it may disrupt important feeding or drinking. Adult deer may shift foraging or bedding areas if trail or road use is intense, resulting in unnecessary energy expenditures that are detrimental in both winter and summer. Does may be forced to leave fawns hiding near trails for prolonged periods if human use is extensive. If disturbance persists, ungulates may return only at night or abandon these areas altogether. This can result in the loss of energy for both does and their fawns, particularly if deer move to less productive areas.

Deer and other mammals often manage the threat from recreationists by maintaining a distance between themselves and humans, cars, bikes, roads, or trails. Time of day (morning or evening) and wildlife group size may be significant in predicting response distances. Mule deer alert distance was greater in the evening, but bison flight distance and the distance mule deer moved from disturbances were greater in the morning. Furthermore, bison, deer, and pronghorn reaction was the same to a hiker as to a bicyclist. While animals recognize the human form of a hiker, it is the speed of the bike and not the form of a human that makes cyclists less predictable to wildlife (Taylor and Knight 2003). Currently, visitation at the refuge likely has minor and temporary effects on deer. Closing the refuge at night and low visitation numbers in the early morning likely offset the impact. Under alternative A, the projected increase in visitation is consequently not likely to increase effects on deer beyond minor and localized levels.

Deer populations at the refuge are surveyed regularly but are influenced primarily by natural forces such as fawn predation by coyotes and harsh winters. However, refuge staff may periodically cull deer to maintain desired herd size and structure. Bison are currently managed by forage and water availability. The Service has reserved the right to cull bison if necessary in the absence of the ability to transport live bison out of the refuge (see HMP). These management tools would continue to provide beneficial effects on ungulates by maintaining healthy herds.

Generally, carnivores such as skunks, raccoons, and coyotes have adapted to the presence of humans and human recreation (Claar et al. 1999). These species are likely to be affected only in localized areas of heavy recreational activity, human presence, or development, such as at the Visitor Center and around the fishing lakes.

Alternative B

Generally, alternative B would entail fewer new trails than alternatives C or D. With the exception of activities associated with reintroduction of black-footed ferrets, wildlife management would be similar to that under alternative A.

Species of Concern

The Service's Recovery Plan goal for black-footed ferrets is to establish free-ranging ferrets totaling 1,500 breeding adults in 10 or more populations in at least 6 of 12 states within the species' historical range (FWS 2013k). Ferret reintroduction on the refuge would contribute to the recovery of the species by allowing captive-raised ferrets to be acclimated to natural conditions and potentially establish a naturally self-sustaining population on the refuge. If the reintroduction is successful, it would aid the overall recovery of the species with the ultimate hope of delisting from ESA protection. Any excess ferrets born at the refuge would be used to help in reintroduction efforts at other refuges or public lands where requested by the relevant land management agency. If the refuge reintroduction is successful enough to help in starting populations across a broader region,

the beneficial effect of moving toward the Recovery Plan goal could be wide-ranging and moderate. If the reintroduction effort is confined to the refuge, benefits would be localized and may only be minor in contributing to the nationwide recovery goal. However, the beneficial effect on the native prairie ecosystem of reestablishing this key species would be moderate or even major on the local scale.

Under alternative B we would restrict public access in the black-footed ferret reintroduction area to increase the success of the reintroduction. The Wildlife Drive would only be used by refuge staff and for guided public tours, reducing traffic disturbances for many prairie species during migration, wintering, and breeding seasons. Low traffic volume would also help in minimizing road kill of ferrets. Additional benefits for ferrets may result from visitors viewing the live ferret exhibit that is part of the action alternatives. Viewing the exhibit and learning about black-footed ferrets and their place in a natural prairie ecosystem would increase the desire on the part of the public to support their reestablishment and protection. However, released ferrets and their offspring may be subject to mortality from natural factors (such as predators, adverse weather conditions, disease) and unintentional human factors. Unintentional mortality can include deaths associated with equipment, fire management, prairie dog control, roadkill, and the handling of the ferrets themselves. Furthermore, ferrets that disperse off the refuge may be subject to take (harm or loss) for a variety of reasons, including but not limited to loss of habitat due to development and fatalities caused by domestic animals, collisions with vehicles, and animal control activities necessary to maintain the safe operation of DIA. However, loss of these animals would not jeopardize the species because the animals likely to disperse would be excess to the essential population on the refuge and would be genetically redundant with the refuge population. Additional information on the findings under the Endangered Species Act for ferret reintroduction is available in appendix H.

Alternate B (and all the action alternatives) includes examining the feasibility of reintroducing three species of concern to the refuge: plains sharp-tailed grouse, greater prairie chicken, and pronghorn.

The plains sharp-tailed grouse is one of four species of North American grouse (collectively known as prairie grouse) that inhabit a broad range of plant communities dominated by grasses and shrubs, where males engage in communal breeding displays. Six extant subspecies and one extinct subspecies are recognized (Del Hoyo et al. 1994). In Colorado, the Columbian sharp-tailed grouse, also known as the mountain subspecies, has undergone a significant range-wide decline. The second Colorado subspecies, plains sharp-tailed grouse, is listed as endangered in the state. Historically this species was found in steppe, grassland, and mixed-shrub habitats throughout much of central and northern North America (Connelly et al 1998). Leks form a hub of breeding habitat and usually occur on elevated areas, such as knolls, ridgetops, or openings surrounded by sagebrush with recommended buffer zones of 1.25 miles (Hamann et al. 1999). The species formerly nested over much of the northern two-thirds of the eastern prairie, but the present population consists of only a few hundred birds in Douglas County. The decline is the result of overgrazing and the conversion of grassland to cropland and, more recently, to housing developments. What remains of Colorado's population is now severely threatened by proposed land developments in the area between Denver and Colorado Springs (CPW 2014). A draft management plan for the reintroduction of plains sharp-tailed grouse to the refuge prepared in 2005 (FWS 2005) noted that although the refuge could offer suitable habitat for the species, several factors—such as utility lines, fences, predator populations, and habitat management tools—might deter successful reintroduction. It is unknown where on the refuge they may establish, but the habitat around leks, nesting sites, and brood-rearing areas would require enhancement and protection from human disturbance. Fences built to extend bison grazing pastures could fragment habitats for prairie grouse if the fences provide perch sites for raptors or the grouse inadvertently fly into them. These fences would be installed 18 inches above ground level to allow passage of wildlife (including pronghorn). The Wildlife Drive would only be open to staff and to the public on guided tours, precluding further adverse effects associated with disturbance. If reintroduction is successful, the addition of plains sharp-tailed grouse to the refuge prairie ecosystem could be a moderate or even major beneficial effect.

The greater prairie-chicken is a species of prairie grouse that occupies midgrass sandsage in sandhills. Ideally, greater prairie chickens should be managed on a broad landscape basis with a primary focus on nesting and brooding areas. In much of the current fragmented range, booming grounds have become the focus of management efforts because the majority of year-round locations are within 1 mile of booming grounds (Anderson and Toepfer 1999; Westemeier and Gough 1999). Birds using fragmented grasslands (for example, fragmented by woody plant invasion and conversion of intervening lands to unsuitable habitat) may experience greater predation rates than those using more expansive grassland habitats. Winter roosting habitat consists of shelterbelts and other woody vegetation along cropland edges or drifted snow (Manske and Barker 1988). If it is successful,

the reintroduction of the greater prairie-chicken to the refuge prairie ecosystem could be a moderate or even major beneficial effect.

Pronghorn have been a historic component of North America's grasslands and have created a niche for themselves in remaining habitats. Pronghorn inhabited lands adjacent to what is now the refuge in the twentieth century, and can consequently be considered a lost species to this ecosystem. In 2010, the "Pronghorn (*Antilocapra americana*) Reintroduction and Management Plan" was drafted, examining the feasibility of bringing pronghorn back to the refuge. A compatibility evaluation listed six potential pronghorn management concerns: fencing, genetic viability, disease transmission, interspecific competition, supplemental winter feeding, and population management. If it is successful, the reintroduction of pronghorn to the refuge prairie ecosystem could be a moderate or even major beneficial effect.

The proposed trail to the east side of Upper Derby Lake would be seasonal under alternative B (and all action alternatives) to minimize disturbance to resting bald eagles.

Surrogate Species

Increased visitor numbers would result in some disturbance and could cause grassland birds such as Cassin's sparrows and associated species (such as grasshopper sparrows and foraging Swainson's hawks) to avoid grassland habitat. This type of impact is described in more detail below in "Birds," but the adverse effects are not likely to be more than moderate in intensity under alternative B or the other action alternatives.

Bison may move away from roads, but they would otherwise be less affected by increased visitor numbers than other species because their habitat is fenced and trails or bikes would not be allowed.

If successful, reintroduction of ferrets is likely to have an impact on prairie dog numbers. Black-tailed prairie dogs are an important component of the ecosystem at the refuge. Although the number of prairie dogs at the refuge fluctuates, it is high enough to hinder current prairie restoration efforts. For example, the extent of prairie dog colonies expanded from 1,814 acres in 2007 to nearly 3,100 acres in 2009 (FWS 2013a). To help reduce numbers, the refuge supplied prairie dogs to the BFF Center to assist in their captive breeding program. In our BTPDMP (FWS 2013h), we indicate that reestablishing ferrets would add a natural predator component to the prairie ecosystem, resulting in beneficial effects on prairie ecology, the stability of the prairie dog population, and our ability to continue to restore prairie habitat for all native wildlife. The impact of a single ferret on the prairie dog population can be impressive, as their metabolism runs high and prairie dogs make up about 90 percent of their diet (Clark 1986). For example, a study published in 1983 (Stromberg et al.) estimated that one adult female black-footed ferret with a litter requires 474–1,421 black-tailed prairie dogs per year for sustenance. The authors concluded that this dietary requirement would require 91–235 acres of black-tailed prairie dog habitat for each female black-footed ferret with a litter. The numbers, ages, and sex ratio of ferrets to be introduced at the refuge would be decided following approval of a CCP alternative that includes ferret reintroduction, but the population dynamics would be carefully modeled and designed to ensure maximum success and a balanced prairie dog population size.

Bald eagles, hawks, and other wildlife that feed on prairie dogs would experience some adverse effects from the loss of prey if ferret reintroduction is successful. In addition, monitoring efforts associated with ferrets would include the use of nighttime spotlighting surveys for ferrets in prairie dog zones, some of which are near the bald eagle nesting area. This potentially adverse effect would be temporary but could be of moderate intensity.

Fish

Impacts on water quality associated with increased visitor use would be similar to those described for alternative A but more severe, because both foot and vehicle traffic could increase. Additional visitors to lakes and streams may leave food or trash that could wash into these aquatic systems. Fishing levels would remain essentially the same under alternative B as described for alternative A.

Herptiles

Because access and restrictions would be largely the same as under alternative A, only the projected increase in visitation would have any effect on herptiles. There would be an increased risk of roadkill on those roadways open to vehicular traffic. Because visitor numbers are expected to increase, the resultant levels of activity could have minor, localized adverse effects on amphibians and reptiles, especially along trails.

Birds

As noted above, disturbance from humans can result in increased energy expenditures; disruption of feeding, breeding, rearing, or other important behaviors; and displacement and abandonment of nesting or resting sites. While disturbance could affect individuals or small groups of birds at the refuge, no impacts would be extensive enough to affect populations.

The refuge supports several species of wintering diurnal raptors (golden eagles, rough-legged and ferruginous hawks) that may flush from foraging sites

or loafing perches in the vicinity of year-round trails or roads. Nesting raptors on the refuge include the great horned owl, long-eared owl, burrowing owl, red-tailed hawk, and Swainson's hawk. Currently, most of these birds reuse historic nest sites, providing some predictability of the impacts of specific trails and roads. Known nocturnal raptor roost sites (primarily those of eagles) are somewhat protected by road closures and the refuge's closure after dark.

As visitation increases, some raptors experience increased adverse disturbance effects. For example, burrowing owls may seasonally use prairie dog burrows from April through September.

Tree-nesting raptors, including great horned owls, red-tailed hawks, and Swainson's hawks, currently show tolerance of visitors on nearby trails in the Environmental Education Zone (see HMP), but as visitor numbers grow, these birds may move nesting locations to areas farther from existing trails and human disturbance. These effects are not expected to be more than minor unless visitors leave existing trails and approach nest sites, in which case the effect could increase to a moderate level of intensity on occasion. However, raptors roosting or nesting in trees along the riparian corridor could be subject to nighttime disturbance associated with spotlighting surveys conducted for black-footed ferrets. These disturbances would be intermittent and of short duration but could constitute adverse effects of moderate intensity.

As noted above, waterbirds may be less tolerant of human activity than other types of birds. A study of wintering waterbird distribution on the Ding Darling National Wildlife Refuge (Klein et al. 1995) showed that reactions to human disturbance varied with species, migrant status, and disturbance type (vehicle or pedestrian) and intensity. Migratory waterbirds were more sensitive to humans than were resident populations. Birds adjusted their distance from the disturbance source (road or trail) depending on their tolerance level. Foraging shorebirds and dabbling ducks requiring shallow water were the most severely affected.

At the refuge, resting or feeding waterbirds near reservoir perimeter trails or those close to lake or riparian areas may be flushed by pedestrians during migration if the water is not frozen. Trail use along reservoirs could also affect nesting waterfowl and shorebirds by flushing females off the nests, exposing eggs to environmental conditions and predators. Shoreline activities such as fishing would potentially have adverse effects on waterbirds as well as on species that use shoreline vegetation such as blackbirds, sparrows, and warblers. Alternative B, like all the action alternatives, would include environmental education about roosting and nesting activity to minimize disturbance. Signage proclaiming Sensitive Wildlife would help identify areas where visitors should take extra precaution.

Other bird species could be affected by visitors hiking on trails in the woodlands and prairies. Miller et al. (1998) found that the composition and abundance of birds in both forest and grassland ecosystems were altered adjacent to trails, with habitat-edge species more common than habitat-interior species in the vicinity of trails. Furthermore, the human disturbance associated with trails caused some species to avoid the trail areas entirely.

Habitat fragmentation and its effects on migratory grassland-dependent birds is an important issue for many of the species that occupy habitat on the refuge. In the Front Range of Colorado, urban expansion has meant the loss of extensive areas of native prairies, leaving remaining tracts small and isolated. In this context, the thousands of acres of prairie habitat the refuge offers can be extremely important in supporting grassland species. However, development of visitor facilities, trails, and roads at the refuge can segment this habitat, and to the extent that additional roads, trails, or other facilities are created as part of action alternatives, could have localized adverse effects on grassland birds that require extensive and unbroken habitat.

Riparian species also need intact vegetation along stream corridors for successful roosting or feeding. Hutto (1998) noted that the fragmentation of riparian habitats within human-created corridors had a greater impact on songbirds at a landscape level than division of adjacent forests. On the refuge, such impacts on songbirds would occur on the half-mile section of the First Creek Multiuse Trail near the southeast corner of the refuge. Although there may be more severe localized impacts on individual migratory riparian birds, the impacts on populations would be negligible.

Mammals

The effects on mammals described for alternative A would also occur under alternative B, although to a greater degree because of projected increases in visitation.

The repair and reopening of the Rattlesnake Trail and completion of the Perimeter Trail would bring visitors closer to habitat and provide a corridor for smaller mammals to leave the refuge and be subject to road kill.

Alternative C

Alternative C would entail the most extensive expansion of visitor facilities and services of the action alternatives. In addition, trails and associated parking lots connecting the southern exterior of the refuge with the lakes area inside the refuge (figure

10) would be constructed. Wildlife management would be similar to that under the other action alternatives.

Species of Concern

Generally, the effects of reintroducing ferrets and possibly other native species would be similar to those described for alternative B. However, once these species are reintroduced, we anticipate that visitor viewing, surveying, road traffic, and other human disturbance would have adverse effects on species of concern. These impacts would be most severe under alternative C because visitor use is anticipated to more than triple existing levels.

Impacts on ferrets would be potentially less severe than those on other reintroduced species because ferrets are nocturnal and the refuge closes at sunset. Although the Wildlife Drive would be open to public vehicles, we do not expect any impacts on ferrets from this action because ferrets are nocturnal. However, other reintroduced species could be disturbed by additional car traffic in the vicinity, as well as by visitors stopping in pull-outs and leaving their cars to move closer to observed wildlife. For pronghorn, such disturbances could be particularly adverse because they are shy and maintain large distances from people or cars when they can. Road traffic also acts as a barrier to crossing by pronghorn and prairie grouse and functionally fragments habitat for these species, decreasing carrying capacity. Adverse effects could be locally moderate.

Surrogate Species

The increased presence of trails and parking lots, including the addition of a new trail, overlook, and access point in the northeast corner of the refuge, would have adverse effects on ground-nesting grassland birds, including the lark bunting and Cassin's sparrow. Increased disturbance during the breeding season could reduce successful reproduction of these species, as well as limiting habitat availability and their relative abundance. Opening the Wildlife Drive to public access and the development and use of additional pull-outs would likely drive grassland birds away from this source of disturbance, essentially reducing breeding and feeding habitat for some individuals. These adverse effects could be widespread and moderate.

Opening the Wildlife Drive would have negligible effects on bison and prairie dogs. These prairie species' reproductive success will not likely be influenced by vehicular presence. However, they may alter their foraging behavior, moving away from the disturbance of traffic.

Fish

Although alternative C proposes an increase in fishing licenses, clinics, derbies, and classes, all these programs would continue to be catch and release. Although these activities may result in adverse effects on a few individual fish, overall effects on fish populations would be negligible or minor. With increased visitation, siltation from increased use of new and existing trails leading to the lakes as well as increased contaminant runoff from roads could result in adverse effects on water quality. Because visitor numbers would be highest under this alternative, effects on fish habitat could be locally minor or moderate.

Herptiles

The type of impacts described for alternative A would be considerably more severe under alternative C because of increased visitor use and access. The addition of new trails and parking lots, opening the Wildlife Drive, and opening portions of the refuge to bicyclists would substantially increase the risk of roadkill, particularly for amphibians near water bodies during the breeding season. Increased car access would also increase the probability of contamination of amphibian habitat by contaminated runoff from roadways. Increased trail use could contribute to increased sediment discharge, causing elevated turbidity in refuge lakes. Disturbance from visitor use along trails or near lakes or riparian areas would also be an adverse effect. These conditions would be likely to result in moderate localized adverse impacts on herptiles.

Birds

Birds would be subject to the types of impacts described for alternative B. However, the expanded facilities and access proposed under alternative C would have additional adverse effects. The introduction of cross-country skiing in habitat that has traditionally been left undisturbed during winter could have locally minor to moderate adverse effects on some species if it disrupts their efforts to accumulate necessary energy for overwintering.

The addition of trails and visitor use on them may influence nest site selection, particularly along the Discovery, Uvalda Ditch, Highline Canal, and Peña trails. The addition of bicycles could disturb tree- and ground-nesting bird species and create additional fragmentation if birds are hesitant to occupy habitat near this new source of disturbance. Bicycle traffic on the Uvalda Ditch and Highline Canal Trails may cause some nest abandonment or mortality of nest occupants. Depending on the degree of use and location of bike paths, these adverse effects could range from minor to moderate intensity. This effect would

be exacerbated by an increase in private vehicle traffic along the shared portion of the Wildlife Drive. Collectively, these impacts are likely to be widespread, although they are unlikely to exceed moderate intensity.

Although the northern loop road system intercepts some prairie dog towns in Sections 22, 27, and 30 that are used for nesting by burrowing owls, this species is tolerant of vehicles on set roadways and is not expected to experience more than negligible additional effects from increased vehicle use. Similarly, Swainson's hawks, which have nested in trees bordering many existing refuge roads without detrimental effects, are not expected to experience more than minor adverse effects from the planned northern roadway, provided that traffic does not stop directly underneath nest trees.

The addition of trails near the lakes would bring additional visitors to habitat where shorebirds, waterfowl, and other semi-water-dependent birds rest and nest. In combination with increased fishing and visitor facilities near the water, adverse effects on these relatively sensitive species could be locally moderate. Furthermore, vehicles using the Legacy Loop and Wildlife Drive could disturb ducks and geese coming into nighttime loafing areas of open water at Lake Ladora, Lower Derby Lake, and wetland areas. This could be a particular disturbance at sunset when visitors are likely to be exiting the refuge at closing time. The proposed wildlife observation blind and accompanying parking area on Lower Derby Lake may concentrate the noise disturbance for birds, while alleviating the visual deterrent.

Construction of a new entry and administrative complex, as well as other more minor construction projects, would create noise and likely result in avoidance by birds. These impacts would be temporary and are not likely to be more than localized and minor.

Mammals

Because of increased visitation, facilities, access, and associated human activities, the impact mechanisms described above for alternative A would affect mammals to a much greater degree under alternative C.

Vehicle-mammal collisions are more likely to occur with the opening of the Wildlife Drive, especially when the refuge is open past sunset (as in the case of special events). Disturbance from trail use, including cross-country skiing during winter, could have adverse effects on energy expenditures in mammals attempting to feed, an important activity during the cold months.

Deer may be particularly subject to disturbance and could experience moderate localized impacts on a regular basis. Access to foraging and water during the day when visitors are using the trail or occupying lakeshore or riparian habitat may be reduced or eliminated, causing animals to relocate.

The introduction of bicycle traffic would cause some mammals to run from disturbance, which in turn would drain energy reserves and could disrupt feeding or caring for young. This would be a new and potentially minor to moderate adverse effect on mammals.

Alternative C includes the possibility of a deer-hunting program for youth and people with disabilities. Currently, the refuge deer population is stable, but the HMP calls for maintaining a healthy herd. Allowing unregulated growth of this and other species in the fenced and finite habitat of the refuge could jeopardize the condition of animals in the herd, may increase the incidence of disease, and would jeopardize native prairie and shrubland habitat restoration. The HMP briefly examined the option of an archery hunt for removing excess deer and found it to be an option we should explore further. Alternative C anticipates a hunter education program that would be required before archers are allowed to hunt. Although it is likely that a youth hunt with new archers would not be as effective in reducing deer numbers as staff culling, overall the impact on the deer population would be minor.

Alternative D

Alternative D would be largely similar to alternative C with regard to facilities and access, although the Wildlife Drive would be open to two-way traffic.

Species of Concern

The effects on black-footed ferrets and other reintroduced native species of concern would be similar to those described for alternative C, but their severity would be less because visitation is not expected to be as high.

Working with other agencies to expand the range of the black-footed ferret under alternative D would have a range-wide beneficial effect, but the magnitude of this effect is unknown.

Surrogate Species

The effects on surrogate species would be similar to those described for alternative C, although because visitation is anticipated to be lower, the intensity of the effects would be lower.

Opening the Wildlife Drive to two-way traffic for visitors' vehicles would potentially affect prairie dogs and bison by altering foraging behavior, but the intensity of this effect would be negligible.

Fish

Alternative D includes the potential to raise fishing fees, promote fishing opportunities on other public lands across the state, and increase refuge stocking rates. These changes would be paired with expanded programming, including advanced fishing classes. The combination of education and a catch-and-release fishery would minimize losses to the fish populations at the refuge, and impacts would be negligible or minor. Impacts from siltation related to trail use and contaminant runoff from roads and parking lots would be similar to those described for alternative C, although they might be of somewhat lesser magnitude because of the anticipated lower level of visitation.

Herptiles

The effects would be similar to those described for alternative C. However, because alternative D is anticipated to result in a lower level of visitation than alternative C, the magnitude of these effects would be similarly lower. The siltation and degradation of aquatic habitat associated with disturbance, erosion, and contaminant runoff would constitute a localized minor to moderate adverse effects.

Birds

In addition to the effects on birds described for alternative C, alternative D would include two large annual events on the refuge. Such activities could displace birds and other wildlife at least temporarily. Although such disturbances could be of moderate intensity, they would be of very short duration.

Mammals

The effects on mammals described for alternative C—potential collisions, disturbance from increased pedestrian use, and the addition of bikes and cross-country skiing—would also occur under alternative D, although to a lesser degree because of the lower anticipated level of visitation.

Cumulative Impacts on Biological Resources

Habitat

Many local organizations and governments are working on habitat conservation in areas bordering or near the refuge, such as the Sand Creek Greenway, Barr Lake State Park, and the Prairie Gateway Open Space. We anticipate that these areas will continue to have beneficial effects on the natural environment, providing improved habitat conditions for wildlife. However, wildlife habitat remains at risk as urban sprawl and development continue. The refuge will become more of an island of native grassland and shrublands, providing a niche of ever increasing importance in an urban setting.

Wildlife

Species of Concern

The scope of the refuge's black-footed ferret recovery program is limited to areas within the refuge boundary. However, if the recovery is highly successful, some ferrets born in a given year may be relocated to seed reintroduction efforts on other public lands at the request of the managing agency. Over time, reestablishing ferrets in a wider region could contribute substantially to the Service's Recovery Goal for this species.

Pronghorn would be confined to the refuge by the perimeter fence and cattle guards and would therefore not be affected by outside cumulative effects. However, prairie grouse may fly over the fence. These species would benefit from any natural conservation efforts undertaken on adjacent land tracts or corridors.

Future residential and commercial development outside the refuge would be detrimental to the sustainability of prairie grouse populations.

Surrogate Species

The lark bunting and Cassin's sparrow may be beneficially affected by any conservation efforts on adjacent land tracts, but not by expanded corridors or trails as both are area-sensitive species. The co-management of specific parcels of wildlife habitat would benefit grassland bird species by increasing the amount of high-quality habitat inside the refuge fence, thereby decreasing fragmentation.

Bison could benefit from the Service's co-management of Denver Parks and Recreation open space lands east of the refuge. However, the bison may choose not to use that area if the disturbance factor from the adjacent trails and overlook become excessive. Currently, the prairie dog population on this property may limit the availability of forage.

Fish, Herptiles, Birds, and Mammals

Wildlife may use some of the existing agricultural plantings outside the refuge for forage.

Residential and commercial development along the eastern and northern refuge boundaries would be detrimental to riparian wildlife species outside the refuge as well as in areas co-managed by the refuge and Denver Parks and Recreation. Excessive disturbance would adversely affect bat foraging areas and

songbird nesting sites. Water quality and flow in First Creek may be adversely affected by further development along the banks, especially with increased runoff from artificial structures.

5.6 Environmental Consequences for Visitor Services

Hunting

Alternative A

There would be no effect because hunting would not be allowed. Management of wildlife populations would be accomplished through other methods.

Alternative B

The effects under this alternative would be the Service's and CPW's staff time necessary to carry out a limited, special use hunt (for example, field preparation, hunting zone signage, safety zone signage, hunting brochures, hunter compliance checks, hunter education classes). All hunting would take place in areas closed to the general public, thus minimizing both sound and safety effects on visitors and surrounding neighbors. A 1,000-foot safety buffer around the refuge perimeter would be established (figure 18) to minimize potential impacts or conflicts with activities outside refuge lands. Additionally, a 500-foot safety buffer would be established around all public use refuge roads, minimizing conflicts with other visitors. Some wildlife species may be temporarily displaced by hunter presence and noise disturbance. Hunter access would be allowed only by foot—except for those requiring increased accessibility—thereby minimizing disturbance to wildlife. Shotgun noise during the dove hunts could temporarily displace wildlife in the immediate vicinity of the hunted area. The quiet nature of archery for deer hunts would minimize disturbance of wildlife and neighbors.

This very distinctive opportunity would provide a beneficial effect for visitors interested in hunting. The access for young and disabled metropolitan area residents to be exposed to a new wildlife-dependent recreation, the ability to train in a convenient location, and a high probability of a successful harvest are all benefits not typically associated with an urban environment. Because hunting would require the closure of the refuge to the public and other visitors, there would also a short-term adverse effect.

Alternative C

The effects under this alternative would be similar to those under alternative B, but the addition of an archery range would provide additional opportunities to educate and instruct youth on archery and hunting ethics. This would yield a minor, positive, long-lasting benefit to the public.

Alternative D

The effects under this alternative would be similar to those under alternative A, but we would promote hunting opportunities throughout Colorado and the Refuge System.

Cumulative Impacts on Hunting

There would be no cumulative effects under alternative A. Hunting is only proposed under alternatives B and C. While hunting has impacts on individual animals, because of the limited scope of the proposed hunt program, we anticipate no cumulative effects on populations because State and Federal regulations ensure population viability for regionally and nationally hunted species.

Effects on Fishing

Alternative A

Some fish mortality may result from handling fish after the catch and from fish swallowing hooks or lures. Fish may experience hook injuries when they are caught multiple times. Nonfishing days should provide sufficient healing time to reduce this consequence. Aquatic plants or shoreline vegetation may be trampled or disturbed by wading or shoreline fishing. An increase in litter around the shoreline can be expected as fishing pressure increases. Prohibition of live bait in the reservoirs should reduce litter. Some fishing line may be tangled in trees or lost in the reservoirs, leading to fish and bird mortality around the reservoirs. Monofilament line recycling stations are available at each reservoir open to fishing. Continued public access to fishing would continue to have long-lasting beneficial effects on the visitor experience.

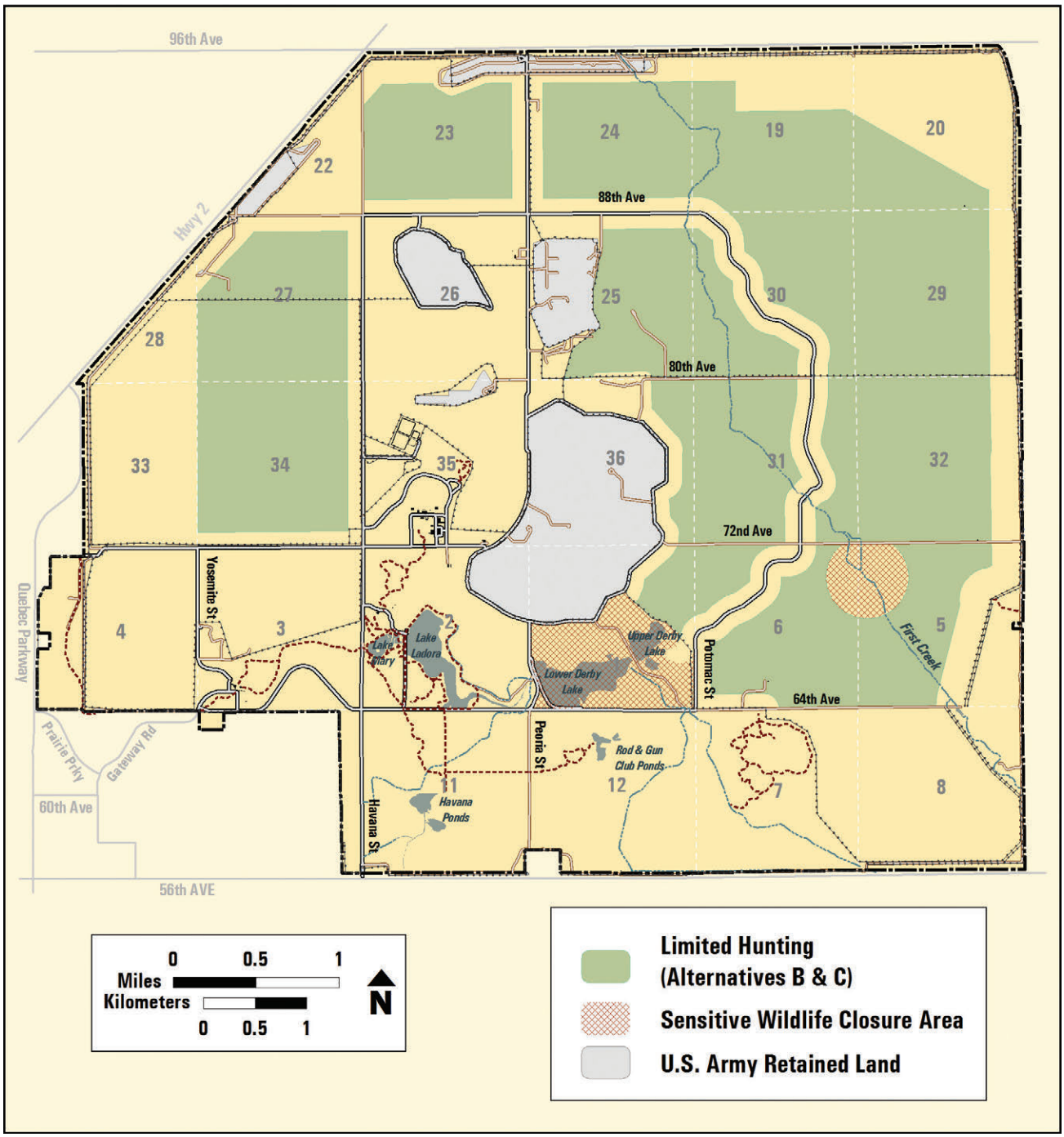

Figure 18. Proposed limited hunting areas on Rocky Mountain Arsenal National Wildlife Refuge, Colorado.

Alternatives B, C, and D

Increased visitation, instructional programming, and public access to fishing would have long-lasting beneficial effects on the visitor experience, but would also cause increased fishing pressure on the refuge's fisheries and would have long-term adverse effects on wildlife access to fishery resources compared to those effects under alternative A. These effects would be more pronounced as visitation increases, with alternative C resulting in the most severe effects, followed by D and B in descending order.

Expanded instructional programming for fishing and beginner-level facilities under alternatives C and D would facilitate skill-building and interest in wildlife-dependent recreation. By creating opportunities to introduce visitors to fishing and building their comfort and skill level with these new endeavors, alternatives C and D would have a substantial long-term beneficial effect. Under alternative B, fishing opportunities would remain essentially unchanged from current management direction.

Cumulative Impacts on Fishing

Because we are not changing fishing regulations and activities, nor are we expecting to carry out activities that would directly affect the water quality of the refuge reservoirs, we anticipate no cumulative impacts on fishing or fisheries.

Effects on Wildlife Observation and Photography

The natural setting of the refuge and more than 350 species of wildlife provide outstanding wildlife observation and photography opportunities. Our goal is to enhance and maintain habitats for diverse wildlife species. Nature trails and facilities provide visitors with unique opportunities to view wildlife year-round. Improvements to interpretive media, programs, trails, and facilities would enhance visitor experience.

Alternative A

No changes are proposed to the visitor experience. Because the refuge is not designed to sustain current or projected visitation, increased visitation could have a major adverse effect on the visitor experience. The lack of pull-outs and parking areas throughout the refuge can lead to traffic congestion. Some of our trails may be too long for visitors with mobility impairments or with small children, and some sections of our trails are closed due to flood damage. Our current staff size and volunteer availability create challenges in accommodating the current volume of tours.

Alternative B

This alternative involves minor to moderate changes that would have moderate beneficial effects on the visitor experience. Added facilities, a minor to moderate increase in programs, and the reintroduction of native species would also have a moderate beneficial effect on the visitor experience.

Alternative C

This alternative proposes major increases of facilities, expanded programming, and the reintroduction of native species, resulting in major beneficial effects on the visitor experience. Direct, increased visitation would have a minor adverse effect on some visitors' experiences. This alternative substantially expands visitors' opportunities by providing new wildlife observation facilities and trails and allowing new modes of transportation: bicycle riding, cross-country skiing, and jogging. Connecting refuge trails to surrounding communities and off-refuge trails will have major beneficial effects of increasing access to the refuge for wildlife viewing and photography. This increased access may result in an increase of new and nontraditional visitors to the refuge. There is also a potential for minor to moderate adverse effects associated with possible conflicts resulting from multiple modes of transportation sharing the same trails. Conflicts may arise as the mix of users may have different paces or interests; for example, bikers and joggers could clash with hikers, small children, or visitors with limited mobility. Some users may be distracted by talking, using cell phones, or viewing wildlife, reducing their reaction time when encountering other trail users. Signs to educate visitors about wildlife observation and trail ethics may help mitigate these conflicts. There is also the potential for bicycling on nature trails to disturb both wildlife and visitors seeking to view wildlife. Overall, the beneficial effect of increased opportunities would be enhanced by the purposeful effort specified under this alternative to engage a more diverse audience with the importance of conservation and the beauty, fun, and ecological intricacies of wildlife.

Alternative D

Effects under this alternative would be generally similar to those described for alternative C. Partnerships would be developed with other organizations to provide photography instruction, and concessionaires

would conduct fee-based wildlife viewing tours. Allowing concessionaire tours would provide visitors with more frequent tour opportunities and provide a financial benefit to local companies. Some visitors may object to paying fees for a tour and may opt to visit the refuge in their private vehicles.

Cumulative Effects on Wildlife Observation and Photography

Alternative A proposes no changes to programs or facilities and would have negligible effects on the visitor experience. There would be no cumulative effects.

Alternative B proposes minor changes to programs and facilities and would have minor beneficial effects on the visitor experience. Accordingly, we expect minor beneficial cumulative effects by increased viewing opportunities, and minor adverse cumulative effects on the visitor's ability to see wildlife because of the increase in visitation.

Alternative C proposes major increases to programs and facilities and would have moderate to major beneficial effects on the visitor experience. Accordingly, we expect moderate positive cumulative effects by increased viewing opportunities, and minor adverse cumulative effects on the visitor's ability to see wildlife because of the increase in visitation.

Alternative D proposes major increases to programs and facilities and would have moderate beneficial effects on the visitor experience. Accordingly, we expect minor positive cumulative effects by increased viewing opportunities, and minor adverse cumulative effects on the visitor's ability to see wildlife because of the increase in visitation.

More wildlife observation and photography programs and facilities under alternatives C and D could result in a substantial increase in visitation. More visitors and crowding on trails and within facilities could detract from visitors' solitude and reduce opportunities to see wildlife. However, more convenient access to the refuge interior and more viewing facilities and programming would present increased opportunities for wildlife viewing, nature study, experiencing the outdoors and natural areas, and learning the techniques of wildlife observation and photography, resulting in a long-term beneficial effect on the visitor experience.

Cindy Souders / USFWS

Opportunities for wildlife photography abound on the refuge.

Effects on Environmental Education

Alternative A

The habitat and wildlife of the refuge offer outstanding environmental education opportunities. Our goal is to enhance and develop conservation education for present and future generations. Improvements to programs and facilities will enhance visitor experience and awareness.

Under alternative A, there would be no changes to the environmental education program. However, because of limited staff we would be unable to lead the level of requested environmental education programs, resulting in a moderate adverse effect on environmental education.

Alternative B

Minor changes to programs and facilities are proposed. New curricula, particularly taking advantage of the new live black-footed ferret exhibit, would be developed, resulting in minor beneficial effects on environmental education. Visitors would have new opportunities to learn about and understand the significance of the refuge system as well as the refuge wildlife and habitats.

Alternative C

Moderate to major changes to programs and facilities are proposed. In addition to the improvements described for alternative B, programs under this alternative would seek to build comfort levels for nontraditional users, promote conservation education in the communities, and increase the use of technology to connect with broader audiences. The development of a new education center and wildlife exhibits would enhance environmental education learning experiences. The reintroduction of native species would offer increased opportunities for education regarding the prairie ecosystem. The expanded educational programming, additional tours, and new interpretive media proposed under this alternative would result in substantial long-term beneficial effects on environmental education.

Alternative D

Moderate to major changes to programs and facilities and moderate are proposed. In addition to the effects described for alternative C, alternative D would further expand environmental education programs and increase collaboration with universities to provide adult education. Concessionaire-led tours may provide even more opportunities for guided tours, thereby increasing the beneficial effects on environmental education. Additional learning opportunities focused on the refuge's history and culture (such as living history programs and rehabilitated historic structures) would expand the range of interpretation and add to the beneficial effects on environmental education.

Cumulative Effects on Environmental Education

Alternative A proposes no changes to programs or facilities and would have negligible effects on environmental education. There would be no cumulative effects.

Alternative B proposes minor changes to programs and facilities and would have minor beneficial effects on environmental education. We expect minor beneficial effects on environmental education associated with the addition of the live ferret exhibit.

Alternative C proposes moderate to major increases in programs and facilities and would have substantial long-term beneficial effects on environmental education. We would expect moderate to major beneficial cumulative effects on environmental education through increased participation.

Alternative D proposes moderate to major increases in programs and facilities and would have substantial long-term beneficial effects on environmental education. We would expect moderate to major beneficial cumulative effects on environmental education through increased participation.

Effects on Interpretation

Alternative A

The habitat and wildlife of the refuge offer outstanding interpretation opportunities. Our goal is to enhance visitor learning and awareness about the refuge and the Refuge System. Improvements to interpretive media, programs, and facilities would enhance the visitor experience.

Under alternative A, no changes to interpretation programs and facilities are proposed.

Limited staffing and reliance on volunteers to meet the demands for interpretive programs would remain a challenge. We rely on volunteers to staff the front desk of the Visitor Center from Wednesday through Sunday and to conduct nature programs. Service funds to cover costs of the volunteer program are minimal and station funds are required to cover the costs of uniforms. If station funds are further reduced, it may reduce or eliminate programming, resulting in a major adverse effect on interpretation.

Alternative B

Minor changes to interpretation facilities and programs are proposed. The effects would be similar to those described for alternative A, except that adding a new live ferret exhibit and interpretive program would result in a minor beneficial effect on interpretation.

Alternative C

Moderate changes to facilities and major changes to programs are proposed. Expanding the scope of interpretive programs and materials to better meet the needs of visitors (such as self-guided interpretive opportunities, increased interpretive media and programs, working with partners to develop multilingual programs, providing interpretive programs offsite, and expanding interpretive opportunities through social media) would have a major beneficial effect on interpretation.

Alternative D

The effects of this alternative would be similar to those described for Alternative C, with an increased

focus toward linking regional sites. Accordingly, there would be a major beneficial effect on interpretation.

Cumulative Effects on Interpretation

Alternative A proposes no changes to programs or facilities and would have adverse effects on interpretation associated with funding shortages. There would be no cumulative effects.

Alternative B proposes minor changes to programs and facilities and would have minor beneficial effects on interpretation. However, there would be no cumulative effects.

The cumulative effects under alternatives C and D would be the same as those under alternative B.

5.7 Environmental Consequences on Cultural and Historical Resources

There are four primary concerns regarding cultural resources on the refuge: preservation of significant resources, unanticipated discoveries, artifact curation, and research and interpretation of sites and artifacts. These are reviewed below to determine the environmental consequences of each alternative.

Alternative A

Significant Resources

Significant sites, buildings, and structures would be protected from adverse effects by construction and visitation. Continued repairs and stabilization of the Egli House, maintaining it in a state of arrested decay, would yield a minor benefit for this historic structure. The roof has recently been replaced and the windows and dormers are being repaired while maintaining as much of the original style as possible.

Unanticipated Discoveries

If previously unrecorded cultural resources are discovered they will be evaluated and managed in accordance with Section 106 of the National Historic Preservation Act, avoiding adverse effects.

Artifact Curation

Artifacts are stored under conditions that sometimes meet legal mandates but often do not. We would also attempt to solicit outside expertise concerning the proper cleaning and storage of items, leading to a moderate to major improvement in storage and curation. The possible deaccession and transfer of some artifacts would be explored and could be a substantial improvement over current conditions.

Research and Interpretation

Research on sites and artifacts would be minimal. Some interpretation of these resources would continue to be conducted on tours of the refuge. We would continue to display and interpret World War II and Cold War history in the Visitor Center. We would attempt to find qualified individuals or organizations to expand our understanding and the interpretation of these items.

Alternative B

Significant Resources

The effects on significant resources would be the same as described for alternative A. Potential future refuge developments, including a new administrative complex, bunkhouse, pipelines, trails, and entrances, would have minor or no adverse effects on significant resources.

Unanticipated Discoveries

The effects pertaining to unanticipated discoveries would be the same as those described for alternative A.

Artifact Curation

The effects pertaining to artifact curation would be the same as those described for alternative A.

Research and Interpretation

In addition to the effects described for alternative A, we would interpret prehistoric uses of native habitats and landscapes, resulting in a moderate beneficial effect.

Alternative C

Significant Resources

In addition to the effects described for alternative B, increased public visitation in areas with significant archaeological sites or to the Egli House would necessitate increased monitoring of those areas. In the case of the Egli House, the effects of retrofitting the building for public use would be negligible if appropriate historic preservation standards are followed. We would restore the exterior of the Egli House, yielding a major preservation benefit beyond that under alternative B.

Unanticipated Discoveries

In addition to the effects described for alternative B, the development of additional administrative or

visitor facilities would increase the likelihood of unanticipated discoveries during construction and through increased public use of the refuge.

Artifact Curation

Possible additional artifact storage under this alternative would result in major beneficial effects on the preservation and storage of these items.

Research and Interpretation

Improved artifact storage would result in moderate to major improvements for potential research and interpretation opportunities. Similarly, increased public outreach would increase the refuge's visibility, in turn offering minor to moderate benefits for interpretation of cultural resources. The establishment of partnerships with Native American communities would have a moderate to major beneficial effect on interpretation of cultural resources on the refuge and in surrounding areas. We would introduce more guided interpretation of currently unidentified historical resources that would be suited for outdoor storage and display, leading to a minor to moderate beneficial effect on interpretation of cultural resources.

We could provide interpretation and access to additional information on the prehistory and history of the refuge through the use of electronic media.

The restoration of the exterior of the Egli House and garage would substantially increase the value of the property for tours, resulting in a moderate beneficial effect on interpretation.

Alternative D

Significant Resources

In addition to the effects described for alternative C, both the exterior and the interior of the Egli House would be restored to its period of significance, resulting in a major preservation benefit.

Unanticipated Discoveries

The effects under this alternative would be the same as those described for alternative C.

Artifact Curation

We would explore the possibility of deaccessioning many of the World War II and Cold War artifacts and donating them to a regional museum or facility to improve their curation and increase the public access to the collection, resulting in a major beneficial effect on these cultural resources.

Research and Interpretation

Additional efforts, through significant increases in communications and multilingual materials, to bring visitors to the refuge would provide a minor to moderate beneficial effect on interpretation, but possibly a minor to moderate adverse effect on cultural resources in the field (through the removal or overuse of sites). Interpretation of the prehistory and history of the refuge would concentrate on its contextual place in regional prehistory and global history.

Tours of the restored Egli House would provide a history of the home in addition to insight into early settlement and farming in the region.

Further research on the prehistoric sites on the refuge would have a moderate beneficial effect on our current understanding of these resources.

We would appeal to history buffs with programming and materials above and beyond what would be offered under the other alternatives. This additional emphasis on history would have moderate to major beneficial effects on the interpretation of historical resources and events. We would also identify and interpret the location of the 1861 wagon trail, especially where it crosses tour routes. We would offer living history demonstrations, providing excellent opportunities for interpreting the site's history.

We would work with regional partners to better display and interpret the World War II and Cold War history of the refuge in an offsite facility that is not owned or operated by the Service.

Cumulative Effects on Historical and Cultural Resources

We have not identified any cumulative effects associated with current plans.

5.8 Environmental Consequences on Infrastructure and Operations

Alternative A

Existing infrastructure is insufficient to support anticipated increases in visitation. Deterioration of assets is expected to increase over time, constituting a major adverse effect.

Alternatives B, C, and D

Future infrastructure will be developed to support growth and utilize transportation planning

tools. There will be a short-term adverse effect associated with construction activities, but there will be a long-term positive effect of appropriate infrastructure to support increased use of the refuge. There are no cumulative effects associated with infrastructure on the refuge.

An increased number of law enforcement officers under alternatives C and D would improve response capabilities for refuge staff, and visitors would be aware of their safety while on the refuge.

Removing facilities not necessary for refuge operations and consolidating administrative operations to new or retrofitted buildings would have a significant beneficial effect on refuge operations by reducing maintenance requirements and resulting in cost savings.

Under alternative D, concessions and partnerships directed toward the co-management of programming and facilities would benefit refuge operations by allowing for the redistribution of staff and greater operational efficiency.

5.9 Environmental Consequences on Access and Transportation

Anticipated changes in the Denver Metropolitan area over the next 25 years from both a land use and a travel demand perspective will greatly influence who visits the refuge and how they get there. DRCOG projects that the local population will grow by 40 percent between now and 2040. Consequently, they also project, the number of congested road miles in the Denver Metropolitan Area will increase by 50 percent. Meeting this increase in auto-based travel demand by increasing road capacity is not feasible from either a cost or environmental perspective. These statistics lead to three important conclusions:

1. The amount of growth in the refuge vicinity and the traffic generated by that growth so far exceeds the amount generated by the refuge under any alternative that the traffic impacts of any alternative will be negligible.

2. The only way to effectively reduce traffic congestion throughout the Denver Metropolitan area is to shift demand away from single-occupancy vehicles to forms of transit and nonmotorized modes where feasible.

3. As the transportation system surrounding the refuge becomes more multimodal over the next 25 years, the system that provides access within the refuge boundary must be designed and built to integrate all modes of transportation in a manner that maximizes connection to the external networks.

Alternative A

Under alternative A, visitors would continue to experience moderate to major difficulty in locating the refuge due to the lack of signs and uninviting entrance. Furthermore, visitors would continue to be confused by the mix of various way-finding signs within the refuge, leading to lost visitors and visitors potentially entering closed areas, posing the risk of damaging biological resources.

Roads would continue to be maintained both by refuge and U.S. Army staff. With the expected increase in visitation, maintenance and repairs of the refuge road are expected to increase slightly. Because the Wildlife Drive would remain closed to the public except for guided tours, impacts on the road would be minor. Nature trails would experience similar slight increases in visitation and public use. Overall, alternative A would result in a major adverse effect on the visitor experience in the context of transportation and access.

Alternative B

Way-finding signs throughout the refuge would be updated to a unified system to create consistency and ease of use by visitors. A locational map would be readily accessible at the entrance gate. In addition, we would work with our neighbors and partners to improve signage outside the refuge to better direct visitors. These actions would have a major beneficial effect on the visitor experience.

One new parking area would be open to the public at Rattlesnake Hill. We would abandon 14.5 miles of administrative roads, and 8.4 miles of roads would be converted to emergency use, resulting in a minor to moderate beneficial effect on wildlife habitat. Two new trails constructed on the southeast and northeast corners of the refuge would have a minor beneficial effect on the overall trail system and visitor experience and a moderate beneficial effect on those local communities through providing them with greater access to the interior of the refuge. Vehicular access to the refuge would continue to be hampered by the uninviting chain link gate, and could adversely affect traffic in neighboring areas (such as Victory Crossing). Road maintenance would increase slightly from current conditions because expected visitation in 2029 under this alternative would be approximately 30 percent greater than projected visitation under alternative A.

Alternative C

In addition to the effects described for alternative B, we would open about 9.3 miles of roads to the public, most notably the closed sections of the Wildlife Drive, more than doubling the amount of roads currently open to the public (table 18). In addition, eight new parking areas would be built or opened, resulting in short-term adverse effects associated with construction and repair, and long-term costs would increase substantially as visitation would more than double over levels projected for alternative A. We would add 11.2 miles to the trail system (table 19), resulting in a moderate beneficial effect, as some of those trails would be built to allow bicycles. This change would greatly enhance access opportunities for visitors, and the trail system would be designed to allow for greater flow and way-finding. Two new bicycle and pedestrian access points would be added to the south side of the refuge that, along with a trail system in the northwest corner, would have a major beneficial effect on our nearby neighbors. Public vehicular access to the refuge would remain the same, but visitors would now be greeted by a new refuge entrance gate that invites and welcomes the public. In addition, the public could access the refuge from six pedestrian and bicycle access points. These access points, primarily on the south and east sides, would provide a much-needed connection to neighboring communities. While the improved main entrance with its new pedestrian and bicycle access points would have major beneficial effects for the public coming to the refuge, the increased visitation could also lead to traffic congestion for our neighbors (for example, at Victory Crossing). At the same time, this impact could improve business opportunities in that area. Way-finding along the Wildlife Drive and new access points and trails would need to be expanded to include these areas now open to the public. They would be a part of the same unified way-finding system described under alternative B. Some of the more specific effects associated with access and transportation under this alternative are discussed below:

- Improved technological resources (such as our Web site and use of social media) in tandem with more rangers and improved signs and way-finding would better orient visitors and help them plan and enjoy their visit.

- The expansion of the refuge's trail system and new observation and interpretive facilities would benefit visitors by providing access to different types of habitats and accommodating a variety of wildlife-dependent recreational uses.

- Opening some trails to multiple uses (such as biking and walking) may adversely affect visitors who prefer to have the trails restricted to walking only; overall, however, this action would invite more use and expand the enjoyment and appreciation of the refuge's habitats and wildlife, resulting in a major long-term beneficial effect.

- The expanded trail system would provide increased opportunities for physical activity. Similarly, more convenient access and the addition of bike lanes and bike sharing would result in more physical activity within the refuge and increased exposure to

Table 18. Miles of roads and new parking areas for each alternative.

Alternative	*Public roads (miles)*	*New public roads (miles)*	*Administrative roads (miles)*	*Abandoned roads (miles)*	*New parking areas*
A	7.8	0.0	43.5	11.7	0
B	8.8	1.0	39.7	14.5	1
C	17.7	10.4	30.8	14.5	8
D	17.7	10.4	30.8	14.5	8

Table 19. Miles of nature trails for each alternative.

Alternative	*Current trails (miles)*	*New trails (miles)*	*Abandoned trails (miles)*	*Total trails (miles)*
A	27.1	0.0	1.3	25.8
B	27.1	2.8	1.3	28.6
C	27.1	11.2	1.3	37.0
D	27.1	11.2	1.3	37.0

natural environments. These proposed improvements to the refuge would benefit community health while also enhancing the visitor experience, resulting in a major long-term beneficial effect.

- New access points in combination with increased outreach and more wildlife-dependent recreation opportunities would likely result in increased visitation and encourage more repeat visits to the refuge. Although increased visitation and congestion may be construed by some as an adverse effect, on balance, the provision of more and improved access would benefit a larger number of visitors, resulting in a major long-term beneficial effect.

Alternative D

The effects under this alternative would be the same as those under Alternative C, except that maintenance costs would be lower due to the lower number of visitors.

Cumulative Effects on Access and Transportation

Alternative A

We expect that alternative A would result in minor long-term adverse effects as refuge trails remain disconnected from the local trail network, presenting a barrier to public movement.

Alternative B

The effects would be the same as those described for alternative A.

Alternative C

We expect minor to moderate beneficial long-term effects for the public as refuge trails would be better connected to the local trail network. Furthermore, a unified sign plan developed in coordination with our partners would produce a major long-term beneficial effect on overall visitor experiences.

Alternative D

The effects would be the same as those described for alternative C.

5.10 Environmental Consequences for the Socioeconomic Environment

Overview of Economic Impact Analysis

The refuge brings new money to the local economy through non-local visitor spending, expenditures on refuge management, refuge personnel's salary spending, and RSS payments. Economic impacts are the measure of the economic activity generated through these expenditures.

Economies are complex webs of interacting consumers and producers in which goods produced by one sector of an economy become inputs to another, and the goods produced by that sector can become inputs to yet other sectors. Thus, a change in the final demand for a good or service can generate a ripple effect throughout an economy as businesses purchase inputs from one another. For example, when visitors come to an area to visit a national wildlife refuge, they spend money to purchase various goods and services. The sales, income, and employment resulting from these direct purchases from local businesses represent the direct effects of visitor spending within the economy.

In order to provide supplies to local businesses for the production of their goods and services, input suppliers must purchase inputs from other industries, thus creating additional indirect effects of visitor spending within the economy. Additionally, employees of directly affected businesses and input suppliers use their income to purchase goods and services in the local economy, generating further induced effects of visitor spending.

The sums of the indirect and induced effects give the secondary effects of visitor spending, and the sums of the direct and secondary effects give the total economic effect of visitor spending in a local economy. Economic input-output models capture these complex interactions between producers and consumers in an economy and describe the secondary effects of spending through regional economic multipliers (USGS 2014b).

For each alternative, regional economic impacts are reported for the following categories:

- *Employment* represents the change in the number of jobs generated in the region from a change in regional output. IMPLAN esti-

mates for employment include both full-time and part-time workers, which together are measured as total jobs.

- *Labor Income* comprises employee wages and salaries, including income of sole proprietors and payroll benefits. For 2015, total labor income for the local eight-county area is estimated at $136 billion ($2015) and total employment is estimated at just over 2 million jobs.

- *Value Added* measures contribution to Gross Domestic Product. Value added is equal to the difference between the amount an industry sells a product for and the production cost of the product, and is thus net of intermediate sales.

The economic impacts reported in this analysis are presented on an annual basis in 2015 dollars ($2015). Large management changes often take several years to achieve. The estimates reported for all alternatives represent the final average annual economic effects after all changes in management have been implemented (USGS 2014b).

Current visitor activities on the refuge include fishing and nonconsumptive uses such as hiking on nature trails, wildlife viewing and photography, driving tours and guided tours, and environmental education and interpretation. Under alternative A, current visitor services programs and facilities would be maintained. These visitor uses would be slightly expanded under alternative B, and would be significantly expanded under alternatives C and D. Under alternative C, an abundance of instructional programming would connect more local residents with nature and wildlife; existing trails would be improved and new trails would be created to facilitate access for pedestrians and connectivity with existing and new regional trails. Under alterative D, as under alternative C, the visitor services program and facilities would be significantly expanded. Whereas alternative C targets improved services for local area residents, alternative D would aim to appeal to a broader range of visitors and would likely draw a larger number of non-local visitors to the refuge. Fishing and nonconsumptive activities would be available under all alternatives. Hunting is not currently allowed on the refuge, and the refuge would remain closed to hunting under alternatives A and D. Limited quota deer and dove hunts are proposed under alternatives B and C (USGS 2014b).

In 2013, the refuge received approximately 300,000 visits. Under alternative A, annual visits are expected to grow by approximately 2.3 percent each year, resulting in an estimated 420,000 annual visits in 2029 (2029 marks the culmination of the 15-year CCP planning horizon) (appendix I). Under alternatives B, C, and D, visits are expected to grow by approximately 4.4 percent, 8.6 percent, and 4.7 percent annually, resulting in 2029 estimates of 575,000, 1.03 million, and 600,000 visits, respectively (USGS 2014b).

The key mechanisms of economic impacts are described below, and the quantified impacts are shown in table 20.

- *Non-Local Visitor Spending.* To determine the local economic impacts of visitor spending, only spending by persons living outside the local eight-county area are included in the analysis. The rationale for excluding local visitor spending is twofold. First, money flowing into the eight-county area from visitors living outside the local area (or non-local visitors) is considered new money injected into the local economy. Second, if residents of the eight-county area visit the refuge more or less due to management changes, it is likely that they will correspondingly change the spending of their money elsewhere in the local area, resulting in no net change to the local economy. These are standard assumptions made in most regional economic impact analyses at the local level. Refuge staff estimated the percent of visits made by non-local visitors (USGS 2014b).

  Annual visit estimates are on a per visit basis, whereas visitor spending profiles are estimated on an average visitor-day (8-hour) basis. Because some visitors only spend short amounts of time visiting the refuge, counting each visit as a full visitor-day would overestimate the economic impact of refuge visitation. To properly estimate visitor spending, annual number visit estimates were converted to visitor-days. It is assumed that visitors primarily engaged in fishing spend an average of 4 hours on the refuge, visitors primarily engaged in hunting would spend an average of 8 hours on the refuge, and visitors primarily engaged in nonconsumptive uses spend an average of 3 hours on the refuge.

  A visitor usually buys a wide range of goods and services while visiting an area. Major expenditure categories include lodging, restaurants, groceries, transportation, and souvenirs. In this analysis we use an average daily visitor spending profile developed

from refuge visitor data collected as part of the 2012 National Wildlife Refuge Visitor Survey. Based on this survey, refuge visitors spend an average of $88.34 per visitor-day. Accounting for average lengths of stay by primary activity, this translates to average visitor expenditures of $44.17 per fishing visit, $88.34 per hunting visit, and $33.13 per nonconsumptive visit.

- *Refuge Operational Budget*. Refuge purchases made in the eight-county area contribute to the local economic impacts associated with the refuge. The refuge incurs both annual (recurring) operational costs and makes one-time expenditures for capital improvement projects, such as improvements to and new construction of trails, roads, and buildings. Many of these purchases are made from businesses within the eight-county area. Refuge employees reside and spend their salaries on daily living expenses in the local area, generating impacts within the local economy.

  Recurring annual expenditures include supplies and utilities, habitat and grounds improvements and treatments, equipment maintenance and repair, and auto repairs, parts, and fuel. Only refuge expenditures that are directly spent in the eight-county area are included in the economic impact analysis.

  - *Capital Improvement Projects*. One-time expenditures for capital improvement projects include improvements to and new construction of trails, roads, and build-

Table 20. Annual economic impacts under the CCP alternatives.

Metric	*Alternative A*	*Alternative B*	*Alternative C*	*Alternative D*
Non-Local Visitor Spending				
Visitor-days	70,000	96,000	211,000	111,000
Jobs	84	115	253	134
Labor income	$3,300,000	$4,500,000	$9,900,000	$5,200,000
Value added	$5,300,000	$7,300,000	$16,000,000	$8,400,000
Refuge Management				
Refuge operational budget (FY2013)	$730,000	$730,000	$1,450,000	$880,000
Jobs	11	11	22	14
Labor income	$491,000	$491,000	$ 988,000	$600,000
Value added	$603,000	$603,000	$1,200,000	$726,000
Capital improvement projects	$253,000	$253,000	$489,000	$363,000
Jobs	3	3	6	4
Labor income	$198,000	$198,000	$382,000	$283,000
Value added	$240,000	$240,000	$465,000	$344,000
Personnel salary expenditures	$1,333,000	$1,333,000	$1,714,000	$1,333,000
Jobs	7	7	9	7
Labor income	$345,000	$345,000	$448,000	$345,000
Value added	$586,000	$586,000	$760,000	$586,000
RSS Payments	$418,000	$418,000	$418,000	$418,000
Jobs	6	6	6	6
Labor income	$341,000	$341,000	$341,000	$341,000
Value added	$454,000	$454,000	$454,000	$454,000
Total Economic Impacts				
Jobs	111	141	296	165
Labor income	$4,700,000	$5,900,000	$12,100,000	$6,800,000
Value added	$7,200,000	$9,100,000	$18,800,000	$10,600,000

ings. Under alternatives A and B, the refuge would make routine maintenance on visitor facilities, roads, and other refuge infrastructure, and would construct a new office and new bunkhouse. Under alternatives C and D, the refuge would make additional visitor enhancements including new trails and interpretive signs and displays. Expenditures on capital improvement projects would be greatest under alternative C, which would include the construction of a new refuge headquarters. Under alternative D, the refuge would rely on commercial ventures (such as concessionaires) along with partners to expand visitor uses and other operations. Average annual capital project costs were estimated by dividing total project costs by 15 years, the planning horizon for the CCP.

- *Personnel Salary Expenditures*. Refuge employees reside and spend their salaries on daily living expenses in the local area, thereby generating impacts within the local economy. In fiscal year (FY) 2013, refuge salaries totaled $1.33 million. Only household spending within the eight-county area is included in impact estimates.

- *RSS Payments*. Counties with lands owned and managed by the Service qualify for reimbursement under the Refuge Revenue Sharing Act of 1935, which allows the Service to make annual payments to local governments in areas where fee title purchases have removed land from the tax rolls. Payments are based on the greater of 75 cents per acre or 0.75 percent of the fair market value of lands acquired by the Service. The exact amount of the annual payment depends on Congressional appropriations, which in recent years have tended to be substantially less than the amount required to fully fund the authorized level of payments. In FY13, actual RRS payments were 25.3 percent of authorized levels. Adams County is compensated for refuge land, and in FY2013, RRS payments to Adams County totaled $418,000.

5.11 Irreversible and Irretrievable Resource Commitments

NEPA requires a discussion of any irreversible or irretrievable commitments of resources that would result from implementing various alternatives. An irreversible commitment of resources means that nonrenewable resources are permanently lost because of CCP implementation. In contrast, an irretrievable commitment of resources is the short-term loss of resources or resource production, or the loss of renewable resources.

All the alternatives, including the no-action alternative, would result in some irreversible loss of soil resources. Depending on the final location of proposed facilities, topsoil could be removed before the facilities' construction (primarily under alternatives C and D), but could be reused in revegetation of disturbed areas. Even with the best management practices, some irreversible soil loss from erosion could occur.

Removal or disturbance of any unknown cultural resources would result in irretrievable and irreversible loss of resources.

Increased emissions from refuge operations could exceed Federal or State air quality standards, but only for a short time. For example, a prescribed fire may exceed 1-hour PM standards but would probably not exceed 24-hour standards. Air quality would return to existing conditions following prescribed fire and other disturbances that result in increased dust or other emissions. Increased visitor access on refuge roads would not affect regional air quality.

Construction of new or expansion of existing trails across and near the refuge would represent a change in the function and production of the vegetation along the trail's path, and would constitute either irreversible or irretrievable commitment of resources—depending on whether the trail is paved—because their use would be temporarily or permanently lost for future generations.

5.12 Short-Term Uses of the Environment and Maintenance of Long-Term Productivity

Short-term factors associated with implementing the CCP include (1) construction, realignment, or refurbishment of facilities or fences; (2) improving and maintaining roads; and (3 building new or renovating existing facilities to support visitor services.

Implementing this CCP, including restoration of disturbed lands to native vegetation, management activities such as prescribed fire, control of wildlife populations, and the control of invasive species, would contribute to the maintenance and enhancement of long-term productivity of the refuge environment. Long-term restoration factors associated with implementing the CCP include (1) restoration of former agricultural, military, and industrial areas; and (2) restoration of the First Creek riparian corridor.

5.13 Unavoidable Adverse Effects

Most negative (or adverse) environmental consequences associated with implementation of the CCP would be short term and minimal, but some long-term adverse effects could occur.

During construction of the new headquarters and other facilities on the refuge under all alternatives, habitats and wildlife would be disturbed and temporarily displaced. This construction would also result in minor, short-term disturbance of soils, and erosion could lead to a spread of invasive species if control measures are not in place. The removal or modification of infrastructure, such as dams, would result in minor, short-term disturbance of soils and erosion, resulting in minor to moderate long-term changes to vegetation, soil chemistry, and presence and use of wildlife species and populations.

The use of prescribed fire would result in short-term losses of vegetation. There is always the potential for prescribed fire to escape the refuge boundary and burn onto private lands, resulting in unavoidable adverse effects. By following prescribed fire plans, maintaining fire breaks, and using approved fire prescriptions, the risk of prescribed fires escaping the established parameters would be greatly reduced.

Cindy Souders / USFWS

The use of prescribed fire would result in short-term losses of vegetation.

Overall, implementation of the CCP under alternatives B, C, or D would result in long-term benefits ranging from minor to major for the biological community and the diversity and productivity of the refuge. Full restoration of former agricultural, military, and chemical production areas on parts of the refuge would increase the amount of native vegetation. Deer hunting on the refuge would result in adverse effects on individual deer but would result in minor to moderate long-term benefits for the overall population by increasing its stability and sustainability. We would expect temporary, minor impacts on the refuge's dove populations from implementation of hunting of these species on the refuge.

The use of prescribed fire on the refuge could adversely affect some wildlife species. Burns during the nesting season would be most detrimental to birds and small mammals, depending on the uniformity and severity of the burn and the ability of the bird to re-nest. In 2014, the refuge applied prescribed fire to a total of about 1,700 acres (including lands owned by the U.S. Army). Under the no-action alternative, the refuge anticipates using prescribed fire on up to about 2,500 acres per year. While the use of prescribed fire would vary from year to year based on management objectives, funding and staffing, weather conditions, and smoke management, prescribed burning would not be significantly increased under any of the action alternatives. Careful consideration of the timing of fires would limit adverse effects on bird species.

Under all alternatives, limiting visitor access to the bald eagle nesting and critical habitat zone during the nesting season would continue to benefit this species. Allowing for a moderate increase in compatible wildlife-dependent uses, particularly under alternatives C and D, could adversely affect some individual eagles. Similarly, the action alternatives are expected to result in beneficial or neutral effects for threatened and endangered species and other species of concern.

While most actions identified for cultural resources would largely be beneficial, some unavoidable adverse effects could occur if undiscovered cultural resources were to be damaged by refuge activities. Under all alternatives, adverse effects on historic properties (resources eligible for inclusion in the NRHP) would be avoided whenever possible. In cases where an adverse effect on a historic property is unavoidable, consultation under Section 106 of the NHPA would be conducted to resolve the adverse effect. In spite of increased monitoring, more survey work, and law enforcement presence, some significant cultural resources could be stolen as a result of increased access, constituting an unavoidable adverse effect.

5.14 Conflicts with Federal, State, Tribal, or Local Agencies

Generally, the actions considered in this CCP and EIS do not appear to specifically conflict with the missions, goals, or other management plans of the FHWA, EPA, NPS, CPW, APHIS, Adams County, City of Commerce City, City and County of Denver, DIA, Colorado Department of Transportation, Tri-County Health Department, UDFCD, or Denver Water. The proposed reintroduction of the black-footed ferret onto the refuge garnered great interest from these and other agencies and municipalities. There is concern that incidental take of individual reintroduced ferrets could trigger ESA-related law enforcement actions. We having been working closely with our neighbors to alleviate those concerns, which are described in the biological assessment for ferret reintroduction (see appendix H).

We work closely with CPW on a range of issues related to hunting, fishing, and wildlife management. The State of Colorado is responsible for mitigating wildlife impacts on neighboring private lands. CPW supports providing hunter's safety education and hunting opportunities on the refuge.

We are not aware of any conflict or issues with Native American tribes who have aboriginal interests in the refuge site. Should any issues with Native American tribes arise, we would begin consultations to resolve the issues in a mutually beneficial way.

5.15 Comparison of Environmental Consequences

Table 11 in chapter summarizes the environmental consequences identified in this chapter for all alternatives.

Glossary

adaptive management—the rigorous application of management, research, and monitoring to gain information and experience necessary to assess and modify management activities.

accessible—pertaining to physical access to areas and activities for people of different (abilities, especially those) with physical impairments.

accession—to record the addition of a new item to a museum or other collection.

alternative—a reasonable way to solve an identified problem or satisfy the stated need (40 CFR 1500.2); one of several different means of accomplishing refuge purposes and goals and contributing to the Refuge System mission (The "Fish and Wildlife Service Manual," 602 FW 1.5).

amphibian—a class of cold-blooded vertebrates including frogs, toads, or salamanders.

anthropogenic—originating in human activity.

appropriate use—a proposed or existing uses on national wildlife refuges that meet at least one of the following—(1) is a wildlife-dependent recreational use; (2) contributes to fulfilling refuge purposes, the Refuge System mission, or goals and objectives outline in a CCP; or (3) the refuge manager has evaluated the use and found it to be appropriate.

baseline—a set of critical observations, data, or information used for comparison or a control.

biological control—the use of organisms or viruses to control invasive plants or other pests.

biological diversity, also biodiversity—the variety of life and its processes, including the variety of living organisms, the genetic differences among them, and communities and ecosystems in which they occur.

biological integrity—biotic composition, structure, and functioning at genetic, organism, and community levels comparable with historic conditions, including the natural biological processes that shape genomes, organisms, and communities.

canopy—a layer of foliage, generally the uppermost layer, in a vegetative stand; midlevel or understory vegetation in multilayered stands. Canopy closure (also canopy cover) is an estimate of the amount of overhead vegetative cover.

compatibility determination—see compatible use.

compatible use—a wildlife-dependent recreational use or any other use of a refuge that, in the sound professional judgment of the Director of the U.S. Fish and Wildlife Service, will not materially interfere with or detract from the fulfillment of the mission of the Refuge System or the purposes of the refuge (The "Fish and Wildlife Service Manual" 603 FW 3.6). A compatibility determination supports the selection of compatible uses and identified stipulations or limits necessary to ensure compatibility.

comprehensive conservation plan (CCP)—a document that describes the desired future conditions of the refuge and provides long-range guidance and management direction for the refuge manager to accomplish the purposes of the refuge, contribute to the mission of the Refuge System, and to meet other relevant mandates (The "Fish and Wildlife Service Manual," 602 FW 1.5).

cultural resources—sites, buildings, structures and objects that are the result of human activities and are generally over 50 years old. They include prehistoric and historic sites, properties, artifacts, historic records, traditional use areas and sacred sites that may or may not have artifactual evidence.

deaccession—to remove an item from the listed holdings of a museum or collection.

ecosystem—a dynamic and interrelating complex of plant and animal communities and their associated nonliving environment; a biological community, together with its environment, functioning as a unit. For administrative purposes, the Service has designated 53 ecosystems covering the United States and its possessions. These ecosystems generally correspond with watershed boundaries and their sizes and ecological complexity vary.

environmental health—composition, structure, and functioning of soil, water, air and other abiotic features comparable with historic conditions, including the natural abiotic processes that shape the environment.

endangered species, Federal—a plant or animal species listed under the Endangered Species Act of 1973, as amended, that is in danger of extinction throughout all or a significant part of its range.

endangered species, State—a plant or animal species in danger of becoming extinct or extirpated in a particular 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.

endemic species—plants or animals that occur naturally in a certain region and whose distribution is relatively limited to a particular locality.

environmental impact statement—a document prepared to describe the effects for proposed activities on the environment. "Environment," in this case, is defined as the natural and physical environment and the relationship of people with that environment.

extirpated – when a species of plant or wildlife ceases to exist in a chosen geographic area (not to be confused with extinction, when a species ceases to exist).

Federal trust species—all species where the Federal Government has primary jurisdiction including federally endangered or threatened species, migratory birds, anadromous fish, and certain marine mammals.

fire management plan (FMP)—a plan that identifies and integrates all wildland fire management and related activities within the context of approved land and resource management plans. The plan defines a program to manage wildland fires (wildfire and prescribed fire).

fitness—the ability of an organism to survive in its habitat and pass those genes on to subsequent generations.

focal species—a multispecies approach where the ecological needs of a suite of species are used to define an ideal landscape to maintain the range of habitat conditions and ecological processes required by landbirds or other species. Focal species are considered most sensitive to or limited by certain ecological processes (such as fire or nest predation) or habitat attributes (such as patch size). The needs of a suite of focal species are then used to help guide management activities.

forb—a broad-leaved, herbaceous plant; a seed-producing annual, biennial, or perennial plant that does not develop persistent woody tissue but dies down at the end of the growing season.

fragmentation—a state of discontinuity throughout a defined habitat.

Friends group—any formal organization whose mission is to support the goals and purposes of its associated refuge and the National Wildlife Refuge Association overall; Friends organizations and cooperative and interpretive associations.

FTE—a full-time equivalent; one or more job positions with tours of duty that, when combined, equate to one person employed for the standard Government work-year.

goal—descriptive, open-ended, and often broad statement of desired future conditions that conveys a purpose but does not define measurable units (The "Fish and Wildlife Service Manual," 620 FW 1.5).

habitat island—an area of wildlife habitat delineated by areas of unsuitable wildlife habitat.

habitat management plan (HMP)—a stepdown plan to a comprehensive conservation plan that identifies in detail how the objectives and strategies for uplands, riparian areas, river bottoms, and shorelines will be carried out.

habitat type, also vegetation type, cover type—a land classification system based on the concept of distinct plant associations.

herbivory—grazing of grass and other plants by any animal.

indigenous—originating or occurring naturally in a particular place.

inholding—non-Service land owned by private, other agency, or other group landowners that is within the boundary of a national wildlife refuge.

integrated pest management—methods of managing undesirable species such as invasive plants; education, prevention, physical or mechanical methods of control, biological control, responsible chemical use, and cultural methods.

introduced species—a species present in an area due to intentional or unintentional escape, release, dissemination, or placement into an ecosystem as a result of human activity.

invasive species—any species, including its seeds, eggs, spores, or other biological material capable of propagating that species, that is not native to that ecosystem; and whose introduction does or is likely to cause economic or environmental harm or harm to human health.

invertebrates—an animal that lacks an internal skeleton or backbone such as insects, butterflies, and aquatic species like snails.

issue—any unsettled matter that requires a management decision; for example, a Service initiative, opportunity, resource management problem, a threat to the resources of the unit, conflict in uses, public concern, or the presence of an undesirable resource condition (The "Fish and Wildlife Service Manual," 602 FW 1.5).

lacustrine—of, relating to, or associated with lakes.

metapopulation—a group of spatially separated populations of the same species which interact at some level.

migration—regular extensive, seasonal movements of birds between their breeding regions and their wintering regions; to pass usually periodically from one region or climate to another for feeding or breeding.

migratory birds—birds that follow a seasonal movement from their breeding grounds to their wintering grounds. Waterfowl, shorebirds, raptors, and songbirds are all migratory birds.

monitoring—the process of collecting information to track changes of selected parameters over time

national wildlife refuge—a designated area of land, water, or an interest in land or water within the National Wildlife Refuge System, but does not include coordination areas; a complete listing of all units of the Refuge System is in the current "Annual Report of Lands Under Control of the U.S. Fish and Wildlife Service."

National Wildlife Refuge System (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, and waterfowl production areas.

native species—a species that, other than as a result of an introduction, historically occurred or currently occurs in that ecosystem.

neotropical migrant—a bird species that breeds north of the United States and Mexican border and winters primarily south of this border.

nest success—the percentage of nests that successfully hatch one or more eggs of the total number of nests initiated in an area.

nongovernmental organization—any group that is not a Federal, State, tribal, county, city, town, local, or other governmental entity.

objective—an objective is a concise target statement of what will be achieved, how much will be achieved, when and where it will be achieved, and who is responsible for the work; derived from goals and provide the basis for determining management strategies. Objectives should be attainable and time-specific and should be stated quantitatively to the extent possible. If objectives cannot be stated quantitatively, they may be stated qualitatively (The "Fish and Wildlife Service Manual," 602 FW 1.5).

patch—an area distinct from that around it; an area distinguished from its surroundings by environmental conditions.

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 soil, temperature, elevation, solar radiation, slope, aspect, and rainfall; denotes a general kind of climax plant community, such as ponderosa pine or bunchgrass.

prescribed fire—a wildland fire originating from a planned ignition to meet specific objectives identified in a written, approved, prescribed fire plan for which NEPA requirements (where applicable) have been met before ignition. These objectives could be hazardous fuel reduction, habitat- or wildlife-oriented, or other objectives in the prescribed fire burn plan.

priority public use—one of six uses authorized by the National Wildlife Refuge System Improvement Act of 1997 to have priority if found to be compatible with a refuge's purposes. This includes hunting, fishing, wildlife observation, wildlife photography, environmental education, and interpretation.

proposed action—the alternative proposed to best achieve the purpose, vision, and goals of a refuge (contributes to the Refuge System mission, addresses the significant issues, and is consistent with principles of sound fish and wildlife management).

public—individuals, organizations, and groups; officials of Federal, State, and local government agencies; Native American tribes; and foreign nations. It may include anyone outside the core planning team. It includes those who may or may not have shown an interest in Service issues and those who do or do not realize that Service decisions may affect them.

public involvement—a process that offers affected 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.

purpose of the refuge—the purpose of a refuge is specified in or derived from the law, proclamation, Executive order, agreement, public land order, donation document, or administrative memorandum establishing authorization or expanding a refuge, a refuge unit, or a refuge subunit (The "Fish and Wildlife Service Manual," 602 FW 1.5).

refuge use—any activity on a refuge, except administrative or law enforcement activity, carried out by or under the direction of an authorized Service employee.

resident species- a species inhabiting a given locality throughout the year; nonmigratory species

resilience—the ability to absorb disturbances, to be changed and then to reorganize and still have the same identity (keep the same basic structure and ways of functioning).

resource of concern—each plant and/or animal species, species groups, or communities specifically identified as worthy of specific management in

refuge purpose(s), System mission, or international, national, regional, state, or ecosystem conservation plans or acts.

restoration—management emphasis designed to move ecosystems to desired conditions and processes, such as healthy upland habitats and aquatic systems.

riparian area or riparian zone—an area or habitat that is transitional from terrestrial to aquatic ecosystems including streams, lakes, wet areas, and adjacent plant communities and their associated soils that have free water at or near the surface; an area whose components are directly or indirectly attributed to the influence of water; of or relating to a river; specifically applied to ecology, "riparian" describes the land immediately adjoining and directly influenced by streams. For example, riparian vegetation includes all plant life growing on the land adjoining a stream and directly influenced by the stream.

scoping—the process of obtaining information from the public for input into the planning process

shorebird—any of a suborder (Charadrii) of birds such as plovers or sandpipers that frequent wetlands.

special use permit—a permit for special authorization from the refuge manager required for any refuge service, facility, privilege, or product of the soil provided at refuge expense and not usually available to the public through authorizations in Title 50 CFR or other public regulations (Refuge Manual, 5 RM 17.6).

stepdown management plan—a plan that provides the details necessary to carry out management strategies identified in the comprehensive conservation plan (The "Fish and Wildlife Service Manual," 602 FW 1.5).

strategy—a specific action, tool, or technique or combination of actions, tools, and techniques used to meet unit objectives (The "Fish and Wildlife Service Manual," 602 FW 1.5).

Superfund—the name given to the environmental program established to address abandoned hazardous waste sites. It is also the name of the fund established by the Comprehensive Environmental Response, Compensation and Liability Act of 1980, as amended (CERCLA).

suppression—all the work of extinguishing a fire or confining fire spread.

surrogate species—species that represent other species or aspects of the environment. These include umbrella, focal, keystone, indicator, and flagship species. It is a commonly-used scientific term for system-based conservation planning that uses a species as an indicator of landscape habitat and system conditions.

threatened species, Federal—species listed under the Endangered Species Act of 1973, as amended, that are likely to become endangered within the foreseeable future throughout all or a significant part of their range.

threatened species, State—a plant or animal species likely to become endangered in a particular State within the near future if factors contributing to population decline or habitat degradation or loss continue.

U.S. Fish and Wildlife Service (Service, USFWS, FWS)—the principal Federal agency responsible for conserving, protecting, and enhancing fish and wildlife and their habitats for the continuing benefit of the American people. The Service manages the 93-million-acre National Wildlife Refuge System comprised of more than 530 national wildlife refuges and thousands of waterfowl production areas. It also runs 65 national fish hatcheries and 78 ecological service field stations, the agency enforces Federal wildlife laws, manages migratory bird populations, restores national significant fisheries, conserves and restores wildlife habitat such as wetlands, administers the Endangered Species Act, and helps foreign Governments with their conservation efforts. It also oversees the Federal aid program that distributes millions of dollars in excise taxes on fishing and hunting equipment to State wildlife agencies.

vision statement—a concise statement of the desired future condition of the planning unit, based primarily on the Refuge System mission, specific refuge purposes, and other relevant mandates (The "Fish and Wildlife Service Manual," 602 FW 1.5).

wildfire—a wildland fire originating from an unplanned ignition caused by lightning, volcanoes, unauthorized and accidental human-caused fires, and escaped prescribed fires.

wildland fire—a general term describing any nonstructure fire that occurs in the wildland.

Appendix A

List of Planning Team, Preparers, and Contributors

This document is the result of extensive and enthusiastic collaboration among members of the planning team, which includes refuge staff and other U.S. Fish and Wildlife Service employees as well as several contributors from our cooperating agencies and other organizations.

We are very grateful to all who have participated in the preparation of this plan, especially our cooperative agencies who attended planning team meetings; helped identify issues; provided input on alternative approaches, objectives, and strategies; helped us assess the environmental consequences of alternatives; reviewed draft planning documents; and provided extensive support and information throughout the planning process.

Table A-1. Core planning team.

Name	*Agency and/or position*	*Contributions*
Jenny Axmacher	City of Commerce City, City Planner	Assistance with development of vision, goals, alternatives, and environmental consequences
Barbara Boyle	U.S. Fish and Wildlife Service, National Wildlife Refuge System, Region 6, Refuge Supervisor	Planning overview and assistance in developing vision, goals, and alternatives
Thomas Butts	Tri-County Health Department, Acting Deputy Director	Assistance with development of vision, goals, alternatives, and environmental consequences
Chris Cramer	City of Commerce City, Community Development, Director	Assistance with development of vision, goals, alternatives, and environmental consequences
Kendra Cross	U.S. Department of Agriculture, Animal and Plant Health Inspection Service, Wildlife Services	Assistance with development of vision, goals, alternatives, and environmental consequences
Traci Ferguson	City of Commerce City, Parks and Recreation, Parks Planner	Assistance with development of vision, goals, alternatives, and environmental consequences
Bernardo Garza	U.S. Fish and Wildlife Service, Division of Biological Resources, Branch of Planning, Planning Team Leader	Lead planner; plan and planning team coordinator; and plan organization, writing, and review
Scott Gilmore	City and County of Denver, Parks and Recreation, Deputy of Parks and Planning	Assistance with development of vision, goals, alternatives, and environmental consequences
Toni Griffin	U.S. Fish and Wildlife Service, Division of Biological Resources, Branch of Planning, Acting Branch Chief	Lead planner; plan and planning team coordinator; and plan organization, writing, and review
Bruce Hastings	U.S. Fish and Wildlife Service, Rocky Mountain Arsenal NWR, Deputy Project Leader	Planning coordination, organization, analysis, writing, and review
Jay Henke	City and County of Denver, Parks and Recreation, Senior Landscape Architect	Assistance with development of vision, goals, alternatives, and environmental consequences
Elijah Henley	U.S. Department of Transportation, Federal Highway Administration, Central Federal Lands Highway Division, Federal Highway Administrator	Assistance with analysis and development of access and transportation alternatives and environmental consequences

Table A-1. Core planning team.

Name	*Agency and/or position*	*Contributions*
Mindy Hetrick	U.S. Fish and Wildlife Service, Rocky Mountain Arsenal National Wildlife Refuge, Wildlife Biologist	Planning development, analysis, writing, and review
Levi Hodson	U.S. Department of Agriculture, Animal and Plant Health Inspection Service, Wildlife Services, Wildlife Biologist	Assistance with development of vision, goals, alternatives, and environmental consequences
Brandon Howes	Denver International Airport, Planning and Environmental Services, Senior Landside Planner	Assistance with development of vision, goals, alternatives, and environmental consequences
John Hughes	U.S. Fish and Wildlife Service, National Black-Footed Ferret Conservation Center, Wildlife Biologist	Assistance with and consultation on the reintroduction of the black-footed ferret
Nick Kaczor	U.S. Fish and Wildlife Service, Rocky Mountain Arsenal National Wildlife Refuge, Assistant Refuge Manager	Planning development, analysis, writing, and review
Melanie Kaknes	Colorado Parks and Wildlife, District Wildlife Manager—Sedalia	Assistance with development of vision, goals, alternatives, and environmental consequences
Edward (Mark) Kalitowski	U.S. Fish and Wildlife Service, Rocky Mountain Arsenal National Wildlife Refuge, Cartography and GIS	GIS analysis and mapping for public meetings and the plan, planning development, analysis, writing, and review
Carolyn Keith	City of Commerce City, Parks and Recreation, Director	Assistance with development of vision, goals, alternatives, and environmental consequences
Mark Kunugi	Denver International Airport, Environmental Services, Environmental Public Health Manager	Assistance with development of vision, goals, alternatives, and environmental consequences
Susan Linner	U.S. Fish and Wildlife Service, Ecological Services Colorado Field Office, former Field Supervisor	Assistance with and consultation on the reintroduction of the black-footed ferret
David Lucas	U.S. Fish and Wildlife Service, Rocky Mountain Arsenal National Wildlife Refuge, Project Leader	Overall planning coordination, organization, analysis, writing, and review
Morgan Malley	U.S. Department of Transportation, Federal Highway Administration, Central Federal Lands Highway Division, Transportation Planner	Assistance with analysis and development of access and transportation alternatives and environmental consequences
David Mallory	Urban Drainage and Flood Control District, Program Manager	Assistance with development of vision, goals, alternatives, and environmental consequences
Melodie Mascarenaz	Tri-County Health Department, Rocky Mountain Arsenal Field Supervisor and former Office Director	Assistance with development of vision, goals, alternatives, and environmental consequences
Shannon McDowell	Adams County, Parks and Community Resources, Open Space Program Manager	Assistance with development of vision, goals, alternatives and environmental consequences
Patsy McEntee	National Park Service, Rivers, Trails and Conservation Assistance Program, Landscape Architect	Assistance with alternatives development, mapping, and workshop coordination
Laurie Miskimins	U.S. Department of Transportation, Federal Highway Administration, Central Federal Lands Highway Division, Transportation Planner	Assistance with analysis and development of access and transportation alternatives and environmental consequences
Scott Morrissey	Denver International Airport, Environmental Services, Director of Environmental Programs	Assistance with development of vision, goals, alternatives, and environmental consequences

Table A-1. Core planning team.

Name	*Agency and/or position*	*Contributions*
Jess Ortiz	City and County of Denver, Denver Public Works Department, Senior Engineer and Project Manager for Capital Projects Management	Assistance with development of vision, goals, alternatives, and environmental consequences
Tom Ronning	U.S. Fish and Wildlife Service, Rocky Mountain Arsenal National Wildlife Refuge, Wildlife Refuge Specialist	Planning coordination, organization, analysis, writing, and review
Cindy Souders	U.S. Fish and Wildlife Service, Rocky Mountain Arsenal National Wildlife Refuge, Supervisory Park Ranger	Planning coordination, organization, analysis, writing, and review
Christopher Spivey	U.S. Fish and Wildlife Service, Rocky Mountain Arsenal National Wildlife Refuge, Federal Wildlife Officer	Planning coordination, organization, analysis, writing, and review
Jeannette Hillaire-Stoufer	Denver International Airport, Planning and Development, Acting Director of Planning	Assistance with development of vision, goals, alternatives, and environmental consequences
Kelly Uhing	City and County of Denver, Parks and Recreation, Natural Areas Program, City Naturalist	Assistance with development of vision, goals, alternatives, and environmental consequences
Rachelle Urso	City of Commerce City, Public Works and Engineering, Development Engineer	Assistance with development of vision, goals, alternatives, and environmental consequences
Sandy Vana-Miller	U.S. Fish and Wildlife Service, Ecological Services Colorado Field Office, Wildlife Biologist—Platte River Recovery Program	Assistance with and consultation on the reintroduction of the black-footed ferret
Vicki Vargas-Madrid	Colorado Parks and Wildlife, District Wildlife Manager	Assistance with development of vision, goals, alternatives, and environmental consequences
Mitchel Werner	(Former) U.S. Fish and Wildlife Service, Division of Biological Resources, Branch of Planning, Writer and Editor	Review, editing, and document layout
Scott Whiteaker	U.S. Fish and Wildlife Service, Rocky Mountain Arsenal National Wildlife Refuge, Wildlife Refuge Specialist	Planning coordination, organization, analysis, writing, and review

Table A-2. Other contributors and reviewers.

Name	*Agency and/or position*	*Contributions*
Crystal Chick	Colorado Parks and Wildlife, District Wildlife Manager—Denver	Document review
Catherine Cullinane Thomas	U.S. Geological Survey, Fort Collins Science Center, Policy Analysis and Science Assistance Branch, Economist	Regional economic profile, analysis of socioeconomic impacts
Susan Drobniak	U.S. Fish and Wildlife Service, Rocky Mountain Arsenal National Wildlife Refuge	Assistance with overview of visitor services
Diane Emmons	U.S. Fish and Wildlife Service, National Wildlife Refuge System, Region 6, Division of Education and Visitor Services, Chief	Assistance with overview of visitor services
Wes Erickson	U.S. Army, Rocky Mountain Arsenal	Document review
Pete Gober	U.S. Fish and Wildlife Service, National Black-Footed Ferret Conservation Center, Recovery Coordinator	Assistance with and consultation on the reintroduction of the black-footed ferret

Table A-2. Other contributors and reviewers.

Name	*Agency and/or position*	*Contributions*
Joelle Greenland	Adams County, Parks and Community Resources, Long Range Planning	Document review
Greg Hargreaves	U.S. Environmental Protection Agency, Rocky Mountain Arsenal, Remedial Project Manager	Document review
Damian Highmam	Denver Water, Recycled Water Section	Document review
Christopher Huber	U.S. Geological Survey, Fort Collins Science Center, Policy Analysis and Science Assistance Branch, Economist	Regional economic profile, analysis of socioeconomic impacts
Tina Jackson	Colorado Parks and Wildlife	Document review
Julie Lyke	U.S. Fish and Wildlife Service, National Black-Footed Ferret Conservation Center, Deputy Recovery Coordinator	Assistance with and consultation on the reintroduction of the black-footed ferret
Heather McDermott	Adams County, Parks and Community Resources, Emergency Management	Document review
Holly Miller	U.S. Geological Survey, Fort Collins Science Center, Policy Analysis and Science Assistance Branch, Social Scientist	Regional economic profile, analysis of socioeconomic impacts
Ken Morgan	Colorado Parks and Wildlife	Document review
Susan Newton	Colorado Department of Public Health and Environment, Hazardous Materials and Waste Management Division, State Project Officer	Document review
Leslie Richardson	U.S. Geological Survey, Fort Collins Science Center, Policy Analysis and Science Assistance Branch	Regional economic profile, analysis of socioeconomic impacts
Charles Scharmann	U.S. Army, Rocky Mountain Arsenal, Program Manager	Document review
Rudy Schuster	U.S. Geological Survey, Fort Collins Science Center, Policy Analysis and Science Assistance Branch, Chief and Social Scientist	Regional economic profile, analysis of socioeconomic impacts
Earlene Swann	U.S. Geological Survey, Fort Collins Science Center, Policy Analysis and Science Assistance Branch, Social Scientist	Regional economic profile, analysis of socioeconomic impacts
Craig Tessmer	Adams County, Parks and Community Resources, Environmental Services	Document review
Melvie Uhland	U.S. Fish and Wildlife Service, National Wildlife Refuge System, Region 6, Division of Education and Visitor Services, Outdoor Recreation Planner	Assistance with overview of visitor services
Traci White	Colorado Department of Public Health and Environment, Hazardous Materials and Waste Management Division, Federal Facilities Remediation and Restoration Unit Leader	Document review

Table A-3. Consultants.

Name	*Agency and/or position*	*Contributions*
Mimi Mather	Root House Studio, Principal	Facilitation of planning team and public meetings; development of visual and printed resources
Heidi West	Total Quality NEPA, Principal	Assistance with NEPA procedures, analysis, environmental consequences, workshops, and other NEPA issues and documentation

Appendix B
Public Involvement

Following the guidance found in NEPA, the Improvement Act, and our planning policies, we have made sure that all interested groups and the public have had an opportunity to be involved in the planning process. This appendix outlines our outreach efforts during the development of the CCP and EIS.

B.1 Public Scoping Activities

A notice of intent to develop a CCP and a request for comments was published in the Federal Register on August 7, 2013 (78 FR Doc. 2013-19052). The notice of intent notified the public of our intent to begin the CCP and EIS process, of how the public may contact us and provide us with comments, and of the several public meetings we would subsequently have in the refuge vicinity.

B.2 Public Outreach

Early in the preplanning phase, we identified a process that would be inclusive of many interests, would involve a range of activities for keeping the public informed, and would ensure meaningful public input. To date, we have used various methods to solicit guidance and feedback from interested citizens, organizations, and government agencies. These methods have included outreach materials; public scoping meetings; agency meetings (planning team); briefings and presentations; and letters, email, and telephone calls.

Planning Updates

A Planning Update was mailed in the middle of June 2013 ahead of the four public meetings we held near the refuge. The planning update outlined the planning process; the dates, times, and locations of the public scoping meetings; and ways for the public to get involved in the planning process and provide us with their comments. We announced the information contained in the planning update during local agency meetings. The planning update distribution list consisted of individuals, agencies, and organizations who previously expressed an interest in refuge activities.

Press Release

Our division of external affairs sent a press release to all appropriate media organizations throughout Colorado including congressional offices, other federal and state agency offices, and tribal agencies announcing the planning process and notifying the public of the schedule and location of the public meetings. News articles about the refuge and the planning process appeared in local newspapers and online publications prior to the meetings.

Project Web Site

The project's planning Web site was established in early May 2013. The site provides information about the public scoping meetings, as well as downloadable versions of all of the available public scoping documents, the notice of intent, the planning update, and the refuge's Comprehensive Management Plan. All interested citizens can sign up to be on the project mailing list or can provide public comment through the planning Web site.

Public Scoping Meetings

The four public scoping meetings (July 25 to August 15, 2013) were a major component of the public scoping process. The purpose of these meetings was to inform the public about our planning process and about the refuge and its resources, and to solicit public concerns and planning ideas that will be considered in the CCP and EIS. The four meetings were held at the following locations:

- July 25, 2013: Public scoping meeting at the Reunion Recreation Center
- July 30, 2013: Public scoping meeting at the Central Park Recreation Center
- August 7, 2013: English and Spanish bilingual public scoping meetings at the Commerce City Recreation Center
- August 15, 2013: English and Spanish public scoping meetings at the Montbello Recreation Center

Following a brief welcome and introduction, Service staff made a 15-minute presentation that outlined the following topics: (1) a description of the Service and the purpose of the Refuge System; 2) a description of the refuge and its purposes, resources, and management; (3) an overview of the CCP and EIS process; (4) the project schedule.

After the presentation, the remainder of the meeting was divided into two components: questions and answers and public comments. During the question and answer session, the facilitator took the audience's questions and we answered all of them. Most of the meeting time was spent in the question and answer session. After all the questions were answered, we took comments from those who wanted to offer them. This format enabled participants to have their questions answered about the planning process and also identified many of the important issues.

Other Briefings

We have briefed or given a presentation to the City of Commerce City Council, the Denver Parks and Recreation Department, the Denver International Airport management, the Rocky Mountain Arsenal Committee, and others.

B.3 Agency and Tribal Coordination

In accordance with the Service's planning policy, the preplanning and scoping process began with formal notification and a personal invitation to Native American tribes; other Federal, State, and local agencies with a land management interest; locally elected officials; and municipalities, inviting them to participate as cooperating agencies and members of the planning team.

Native American Tribes

We sent letters of notification about the planning process, including an invitation to participate on the planning team, to the following tribes: Northern Arapaho Tribe, Northern Cheyenne Tribe, Southern Ute Tribe, and Ute Mountain Tribe. We will work with tribes who are interested in the planning process.

Federal, State, and Local Agencies

We sent letters of notification about the planning process including an invitation to participate on the planning team to the following agencies, groups and municipalities: Environmental Protection Agency, Federal Highway Administration, U.S. Department of Agriculture—APHIS, U.S. Army, Colorado Parks and Wildlife, Colorado Department of Public Health and Environment, Tri-County Health Department, Adams County Board of Commissioners, Commerce City, City and County of Denver, and the Denver International Airport.

B.4 Cooperating Agencies

The following agencies have participated as cooperating agencies in the development of the draft CCP and EIS: Environmental Protection Agency, Federal Highway Administration, U.S. Department of Agriculture – APHIS, U.S. Army, Colorado Parks and Wildlife, Colorado Department of Public Health and Environment, Tri-County Health Department, Adams County Board of Commissioners, City of Commerce City, Denver City and County, and the Denver International Airport. They have provided input on the refuge's vision and goals, alternatives development, environmental consequences, and the internal review of the draft CCP and EIS. We greatly value the input that we have received from the cooperating agencies.

B.5 Scoping Results

The following summarizes the methods for comment collection and analysis and a summary of the comments. The planning team collected comments, questions, and concerns about the future of the refuge through public meetings, letters, email, and other methods as described in "Public Outreach" above.

Methods for Comment Collection and Analysis

The objective of the scoping process is to gather the full range of comments, questions, and concerns that the public has about management of the refuge or the planning process. All comments, questions, or issues—whether from written submissions or recorded at the public meetings—were organized by topic. Every effort was made to document all issues, questions, and concerns. Regardless of whether comments and questions were general or about specific points of concern, they were added to the list one time.

We provided the following optional questions to the public:

- What are the qualities and characteristics that you most value about the Rocky Mountain Arsenal National Wildlife Refuge?
- What do you consider to be the most important issues concerning the Rocky Mountain Arsenal National Wildlife Refuge that should be addressed in the refuge planning process?
- What opportunities exist to manage wildlife habitat, provide for priority wildlife-dependent public uses, and develop partnerships with the community?

All the comments we received from individuals on our NEPA documents become part of the official public record. We handle all requests for information contained in comments in accordance with the Freedom of Information Act, NEPA (40 CFR 1506.6 (f)) and other Department of Interior and Service policies and procedures.

Summary of the Scoping Comments

During the initial scoping process, we received input on a wide array of topics and subtopics. Comments were submitted in writing or offered at the public meetings held in July and August in Denver, City of Commerce City, Stapleton, and Montbello, Colorado.

1. Big Ideas

- Work to connect people to nature, particularly the grasslands. It takes education for people to appreciate the grasslands.
- People see it as a no-man's land and have no idea what is there. We need to get the word out about the beautiful resources.
- It is a challenge to overcome the refuge's history and reputation and to reframe it as a welcoming place for neighbors.
- Set clear expectations. Educate people about what is there (wildlife and habitats). It is not a zoo—seeing wildlife is not a guarantee—it is about experiencing a natural setting.
- Maintain the quiet, the soundscape, and the sense of retreat from the surrounding urban setting.
- Work toward authentic engagement with partnership organizations for environmental education in classrooms and outside. It should be well documented and in place to outlive staffing changes.
- We don't want history to fade into the background. It is an important piece of this unique refuge. Leave behind some of the Arsenal's history. Balance sharing the site's history and the evolution of the property with reassuring people that it is now clean and that visitors are welcome.

2. Suggestions for New or Expanded Facilities

- Add more hiking trails.
- Acquire a mobile visitor center (to take off-site or to have on other parts of the refuge.

It could offer interpretive information and sell snacks).

- Add signs that explain the reasoning behind rules and regulations.

3. Access and Modes of Travel

- Provide access to areas up north that are great for bird watching.
- Allow biking on the roads.
- Expand the bus tour and Wildlife Drive.
- Reopen the Havana Street entrance. The Montbello neighborhood feels cut off. The neighborhood appreciated having access right there instead of having to go on the highway.
- Improve transportation connections to the refuge from neighborhoods (bus, safe bike routes).

4. Ideas for Interpretation

- Offer audio interpretation for the auto tour route.
- Increase the amount of interpretive signs.
- Interpretation should extend outside the Visitor Center. Interpret natural resources and history onsite.
- Interpret the history, evolution, and restoration of the site. We don't want these historical layers to get lost.
- Consider using artwork or interpretive sculptures to spur conversation and reflection about the history and evolution of the site.
- Invite a storyteller to come out and share the site's history.
- Share insights into animal behavior, little facts that enhance the visitors' experience.
- Provide backpacks that families can "check out" at the Visitor Center that are full of activities that get kids excited.

5. Ideas for Environmental Education

- This area of Denver lacks environmental education opportunities.
- Increase outreach to schools and encourage use by school groups.
- Work with schools. Get the kids out there and they will get their parents out there if they get excited about it.
- Have K–8 grassland program set in place.
- Encourage more interactions between the refuge and smaller nature and education organizations.

6. Hunting

- Do not allow hunting.
- Hunting has taken over as the dominant use on other refuges.

7. Outreach and Community Engagement

- Bring in nontraditional visitors.
- Provide more activities for families.
- Create more opportunities for Citizen Science.
- Remove some of the chain link fencing (along 56th Avenue) to make it appear more natural, more welcoming.
- Educate the surrounding communities about what is on the refuge and why we are conserving species.
- Distribute more information about the refuge. Make public announcements.
- Host contests on impressions of the refuge.
- It is important to take a critical look at the messages we are giving to people of color as we go through this process. Show people of color in our communications. Train staff to understand cultural diversity.

Subsequently, we identified eight significant issues or topics to address (please refer to chapter 1):

8. Seize the opportunity to connect people to nature at the refuge.

9. Improve promotions and conduct more outreach about the refuge and what it has to offer.

10. Set clear expectations about what a wildlife refuge is, does, and offers.

11. Maintain the sense of retreat from the surrounding urban setting.

12. Collaborate with partners to improve environmental education opportunities on and off the refuge.

13. Interpret the site's history.

14. Build new visitor facilities and expand programming (such as more trails, better signs, enhanced interpretive media, more environmental education, greater outreach).

15. Improve access and transportation systems (such as more biking opportunities, additional entry points, expanded wildlife drive, neighborhood connections).

B.6 Development of Draft Alternatives

We consider alternatives development as part of an iterative process in the development of a draft CCP and EIS, meaning it will continue to evolve. This phase of the project began in the winter of 2013–2014. The core planning team developed four approaches to managing the refuge. This included three action alternatives, with a proposed action, and the no-action alternative. Each of the draft alternatives presented a different approach for future management with a varied focus on wildlife and habitat management and visitor services. Following further input from other Service staff and our cooperating agencies, we refined and adjusted the alternatives.

B.7 List of Recipients Receiving the Draft CCP and EIS

Federal Elected Officials

Michael Bennett (Senator)
Cory Gardner (Senator)
Ed Perlmutter (Representative—7th District)
Diana DeGette (Representative—1st District)
Jared Polis (Representative—2nd District)

Federal Agencies

Federal Aviation Administration
Martin Hestmark (Environmental Protection Agency)
Greg Hargreaves (Environmental Protection Agency)
Elijah Henley (Federal Highways Administration)
Charlie Scharmann (U.S. Army)
Wes Erickson (U.S. Army)
Sherry Skipper (U.S. Fish and Wildlife Service)
Laurie Miskimins (U.S. Department of Transportation)
Kendra Cross (U.S. Department of Agriculture)
Patsy McEntee (National Park Service)

Native American Tribes

Jim Shakespeare (Northern Arapaho Tribe)
John Robinson (Northern Cheyenne Tribe)
William Walks Along (Northern Cheyenne Tribe)
Jimmy Newton (Southern Ute Indian Tribe)
Steve Whiteman (Southern Ute Indian Tribe)
Gary Hayes (Ute Mountain Ute Tribe)
George Wells, Jr. (Ute Mountain Ute Tribe)

Colorado Elected Officials

Jessie Ulibarri (State Senator—District 21)
Dominick Moreno (State Representative—District 32)

Colorado State Agencies

Bob Broscheid (Colorado Parks and Wildlife)
Melanie Kaknes (Colorado Parks and Wildlife)
Vicki Vargas Madrid (Colorado Parks and Wildlife)
Scott Babcock (Colorado Parks and Wildlife)
Gary Baughman (Colorado Department of Public Health and Environment)
Susan Newton (Colorado Department of Public Health and Environment)
Sarah Gallup (Colorado Department of Public Health and Environment)

Local Government

Sean Ford (City of Commerce City)
James Hayes (City of Commerce City)
Mike Brown (City of Commerce City)
Rene Bullock (City of Commerce City)
Carolyn Keith (City of Commerce City)
Rick Teter (City of Commerce City)
Lysa Gallegos (City of Commerce City)
Tracy Ferguson (City of Commerce City)
Rick Anderson (Adams County)
Heather McDermott (Adams County)
Jeanne Shreve (Adams County)
Abel Montoya (Adams County)
Ronald Pena (Adams County, SAC Fire)
James Jones (Adams County, SACWSD)
Larry Quintana (Adams County, School District 14)
Kandy Steel (Adams County, School District 14)
Dr. Robyn Duran (Adams County, School District 14)
Gionni Thompson (Adams City High School)
Chris Herndon (City and County of Denver)
Jay Henke (City and County of Denver)
Jess Ortiz (City and County of Denver, Public Works)
Scott Gilmore (City and County of Denver, Parks and Recreation)
Kelly Uhing (City and County of Denver, PR Natural Areas)
Damian Higham (City and County of Denver, Denver Water)
Kenneth Conright (Tri-County Health Department)
Courtney Tomlin (Tri-County Health Department)
David Mallory (Urban Drainage and Flood Control District)
Brandon Howes (Denver International Airport)
Jeannette Stoufer (Denver International Airport)
Mark Kunugi (Denver International Airport)
Scott Morrissey (Denver International Airport)
Stapleton Development Corporation

Public Libraries

Brighton Branch Library
Commerce City Branch Library
State Library
Montbello Branch Library
Denver Public Library

Organizations

Carolyn Boller (Friends of the Front Range Wildlife Refuges)
Norma Portnoy (Kids First Program in association with Adams County, School District 14)
National Wildlife Federation
Audubon Society
Rocky Mountain Greenway Steering Committee (15 copies)
Stapleton Citizens' Advisory Board (25 copies)

Appendix C

Key Legislation and Policies

This appendix briefly describes the guidance for the National Wildlife Refuge System (Refuge System) as well as policies and key legislation that guide the management of the Rocky Mountain Arsenal National Wildlife Refuge.

C.1 National Wildlife Refuge System

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

Goals of the National Wildlife Refuge System

- Conserve a diversity of fish, wildlife, and plants and their habitats, including species that are endangered or threatened with becoming endangered.
- Develop and maintain a network of habitats for migratory birds, anadromous and interjurisdictional fish, and marine mammal populations that is strategically distributed and carefully managed to meet important life history needs of these species across their ranges.
- Conserve those ecosystems, plant communities, wetlands of national or international significance, and landscapes and seascapes that are unique, rare, declining, or underrepresented in existing protection efforts.
- Provide and enhance opportunities to participate in compatible wildlife-dependent recreation (hunting, fish, wildlife observation and photography, and environmental education and interpretation).
- Foster understanding and instill appreciation of the diversity and interconnectedness of fish, wildlife, and plants and their habitats.

Guiding Principles of the National Wildlife Refuge System

There are four guiding principles for management and public use of the Refuge System established by Executive Order 12996:

- *Public Use*—The Refuge System provides important opportunities for compatible wildlife-dependent recreational activities involving hunting, fishing, wildlife observation and photography, and environmental education and interpretation.
- *Habitat*—Fish and wildlife will not prosper without quality habitat, and without fish and wildlife, traditional uses of refuges cannot be sustained. The Refuge System will continue to conserve and enhance the quality and diversity of fish and wildlife habitat within refuges.
- *Partnerships*—America's sportsmen and women were the first partners who insisted on protecting valuable wildlife habitat within wildlife refuges. Conservation partnerships with other Federal agencies, State agencies, tribes, organizations, industry, and the public can make significant contributions to the growth and management of the Refuge System.
- *Public Involvement*—The public should be given a full and open opportunity to participate in decisions about acquisition and management of national wildlife refuges.

C.2 Other Legal and Policy Guidance

Management actions on national wildlife refuges are constrained by many mandates, including laws and Executive orders. The more common regulations that affect refuge management are listed below.

- American Indian Religious Freedom Act (1978): Directs agencies to consult with native traditional religious leaders to determine appropriate policy changes necessary to protect and preserve Native American religious cultural rights and practices.

- Americans with Disabilities Act (1992): Prohibits discrimination in public accommodations and services.

- Antiquities Act (1906): Authorizes the scientific investigation of antiquities on Federal land and provides penalties for unauthorized removal of objects taken or collected without a permit.

- Archaeological and Historic Preservation Act (1974): Directs the preservation of historic and archaeological data in Federal construction projects.

- Archaeological Resources Protection Act (1979), as amended: Protects materials of archaeological interest from unauthorized removal or destruction and requires Federal managers to develop plans and schedules to locate archaeological resources.

- Architectural Barriers Act (1968): Requires federally owned, leased, or funded buildings and facilities to be accessible to persons with disabilities.

- Bald and Golden Eagle Protection Act (1940): Provides for the protection of the bald eagle (the national emblem) and the golden eagle by prohibiting, except under certain specified conditions, the taking, possession, and commerce of such birds.

- Clean Air Act (1970, amended 1990): Restricts the amount of pollutants that can be emitted into the air. Designated wilderness areas including the Great Sand Dunes National Park and Preserve (adjacent to portions of Baca National Wildlife Refuge) have the highest standards (class I) for pollution and visibility.

- Clean Water Act (1977): Requires consultation with the U.S. Army Corps of Engineers (404 permits) for major wetland modifications.

- Data Quality Act (2001): Requires government agencies to ensure and maximize the quality, objectivity, utility, and dissemination of information by Federal agencies.

- Dingell-Johnson Act (1950): Authorizes the Secretary of the Interior to provide financial assistance for State fish restoration and management plans and projects. Financed by excise taxes paid by manufactures of rods, reels, and other fishing equipment.

- Emergency Wetlands Resources Act (1986): Promotes wetland conservation for the public benefit to help fulfill international obligations in various migratory bird treaties and conventions. The act authorizes buying wetlands with Land and Water Conservation Fund monies.

- Endangered Species Act (1973): Requires Federal agencies to carry out programs for the conservation of endangered and threatened species.

- Executive Order 11988 (1977): Requires Federal agencies to provide leadership and take action to reduce the risk of flood loss, minimize the impact of floods on human safety, and preserve the natural and beneficial values served by the floodplains.

- Executive Order 12996, Management and General Public Use of the National Wildlife Refuge System (1996): Defines the mission, purpose, and priority public uses of the National Wildlife Refuge System. It also presents four principles to guide management of the Refuge System.

- Executive Order 13007, Indian Sacred Sites (1996): Directs Federal land management and other agencies to accommodate access to and ceremonial uses of Indian sacred sites by Indian religious practitioners, avoid adversely affecting the physical integrity of such sacred sites and, where appropriate, maintain the confidentiality of sacred sites.

- Executive Order 13352, Cooperative Conservation (2004): Directs Federal agencies to implement laws relating to the environment and natural resources in a manner that promotes cooperative conservation with an emphasis on appropriate inclusion of local participation in Federal decision making in accordance with respective agency missions and policies.

- Executive Order 13443, Facilitation of Hunting Heritage and Wildlife Conservation (2007): Directs Federal land management and other agencies to facilitate the expansion and enhancement of hunting opportunities and the management of game species and their habitat.

- Executive Order 13653, Preparing the United States for the Impacts of Climate Change (2013): Directs Federal Government agencies to build on recent progress and pursue new strategies to improve the Nation's preparedness and resilience in preparing and adapting to climate change.

- Federal Noxious Weed Act (1990): Requires the use of integrated management systems to control or contain undesirable plant species and an interdisciplinary approach with the cooperation of other Federal and State agencies.

- Federal Records Act (1950): Requires the preservation of evidence of the Government's organization, functions, policies, decisions, operations, and activities, as well as basic historical and other information.

- Fish and Wildlife Coordination Act (1958): Allows the U.S. Fish and Wildlife Service to enter into agreements with private landowners for wildlife management purposes.

- Migratory Bird Conservation Act (1929): Establishes procedures for acquisition by purchase, rental, or gifts of areas approved by the Migratory Bird Conservation Commission.

- Migratory Bird Hunting and Conservation Stamp Act (1934): Authorizes the opening of part of a refuge to waterfowl hunting.

- Migratory Bird Treaty Act (1918): Designates the protection of migratory birds as a Federal responsibility, and enables the setting of seasons and other regulations including the closing of areas, Federal or non-Federal, to the hunting of migratory birds.

- Native American Policy (1994): Articulates the general principles that guide the U.S. Fish and Wildlife Service's government-to-government relationship to Native American governments in the conservation of fish and wildlife resources.

- National Environmental Policy Act (1969): Requires all agencies, including the U.S. Fish and Wildlife 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 this act with other planning requirements, and prepare appropriate documents to facilitate better environmental decision making. [From the Code of Federal Regulations (CFR), 40 CFR 1500]

- National Historic Preservation Act (1966), as amended: Establishes as policy that the Federal Government is to provide leadership in the preservation of the Nation's prehistoric and historical resources.

- National Wildlife Refuge System Administration Act (1966): 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 for which the refuge was established.

- National Wildlife Refuge System Improvement Act of 1997: Sets the mission and administrative policy for all refuges in the National Wildlife Refuge System; mandates comprehensive conservation planning for all units of the Refuge System.

- Native American Graves Protection and Repatriation Act (1990): Requires Federal agencies and museums to inventory, determine ownership of, and repatriate cultural items under their control or possession.

- Paleontological Resources Preservation Act of 2009: Requires the Secretary of Interior and Agriculture to manage and protect paleontological resources on Federal land using scientific principles and expertise.

- Refuge Recreation Act (1962): Allows the use of refuges for recreation when such uses are compatible with the refuge's primary purposes and when sufficient funds are available to manage the uses.

- Rehabilitation Act (1973): Requires programmatic accessibility in addition to physical accessibility for all facilities and programs funded by the Federal Government to ensure that any person can participate in any program.

- Rivers and Harbors Act (1899): Section 10 of this act requires the authorization of U.S. Army Corps of Engineers before any work in, on, over, or under navigable waters of the United States.

- Rocky Mountain Arsenal National Wildlife Refuge Act of 1992: Created the Rocky Mountain Arsenal NWR out of lands transferred from the U.S. Army and established the purposes of the refuge.

- Volunteer and Community Partnership Enhancement Act (1998): Encourages the use of volunteers to help in the management of refuges within the Refuge System; facilitates partnerships between the Refuge System and non-Federal entities to promote public awareness of the resources of the Refuge System and public participation in the conservation of the resources; and encourages donations and other contributions.

- Wilderness Act (1964): The act (Public Law 88–577) [16 United States Code §§ 1131–36]) defines wilderness as "A wilderness, in contrast with those areas where man and his works dominate the landscape, is hereby recognized as an area where the earth and its community of life are untrammeled by man, where man himself is a visitor who does not remain."

Appendix D
Compatibility Determinations

D.1 Uses

We have developed draft compatibility determinations for the following existing and proposed uses. As per our planning policy, we provide these compatibility determinations in our Draft CCP and EIS as part of the public review. These only apply to the draft proposed action. Refer to chapter 1, section 1.2, for more information on compatible refuge uses.

- Hunting
- Fishing
- Wildlife observation, photography, environmental education, and interpretation
- Commercial photography
- Research
- Refuge Perimeter Trail

D.2 Establishing Authority and Refuge Purposes

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

The refuge was established by the Rocky Mountain Arsenal National Wildlife Refuge Act of 1992 (Public Law 102-402). Section 4 (c) of this Act outlined the following purposes for the refuge:

(1) To conserve and enhance populations of fish, wildlife, and plants within the refuge, including populations of waterfowl, raptors, passerines, and marsh and water birds.

(2) To conserve species listed as threatened or endangered under the Endangered Species Act and species that are candidates for such listing.

(3) To provide maximum fish and wildlife oriented public uses at levels compatible with the conservation and enhancement of wildlife and wildlife habitat.

(4) To provide opportunities for compatible scientific research.

(5) To provide opportunities for compatible environmental and land use education.

(6) To conserve and enhance the land and water of the refuge in a manner that will conserve and enhance the natural diversity of fish, wildlife, plants, and their habitats.

(7) To protect and enhance the quality of aquatic habitat within the refuge.

(8) To fulfill international treaty obligations of the United States with respect to fish and wildlife and their habitats.

D.3 Description of Use

Hunting

The refuge proposes to provide safe and sustainable big game and migratory bird hunting opportunities within designated areas. Under the authority of the National Wildlife Refuge Administration Act, the Secretary of the Interior can authorize hunting on any unit of the National Wildlife Refuge System as long as it is compatible with the purposes for which the refuge was established.

Specifically, the refuge proposes limited programs for white-tailed deer, mule deer, and doves. All hunts would be based on a lottery and would only be offered to youth and hunters with disabilities. The refuge is atypical because it is surrounded by a large fence that prevents big game from entering or exiting the

refuge. In the past, this has allowed deer populations to exceed carrying capacity. Doves are typically migratory and only spend some of their time on the refuge. Hunting would be restricted to areas that are not open to other public uses.

In addition, the refuge proposes a new hunter education program specifically for youth.

Availability of Resources

We will have a full-time law enforcement officer to help administer the hunting program. Other staff would be trained to assist with hunter education programs.

Anticipated Impacts of Use

Big game hunting will be limited to archery only. Upland bird hunting requires the use of shotguns. As with all hunting programs that use firearms, human safety is an important consideration. Hunters, other refuge users, and refuge staff are exposed to potential hazards whenever firearms are present. Harvest of individual animals can have adverse effects on larger populations if sustainable harvest practices are not used. Hunting activity in one area of a refuge often causes animals to move to other portions of the refuge. We often maintain areas that are closed to hunting along with areas where hunting is allowed. Hunter education programs would be offered indoors at existing facilities and would require a temporary archery range.

Determination

Hunting of big game and doves and hunter education programs are compatible uses of the Rocky Mountain Arsenal National Wildlife Refuge.

Stipulations Necessary to Ensure Compatibility

- All hunting will require a permit.
- Plans for specific hunting programs would ensure reasonable human safety by only allowing hunting in areas closed to other public uses, maintaining hunter densities at or below reasonable levels, providing information to hunters regarding areas they are hunting in and associated conditions, and maintaining law enforcement and staff presence to enable response to emergencies and provide information in the field.
- Plans for specific hunting programs would exclude areas from hunting activity if there is a risk to human safety or if there is a risk of property damage from firearm discharge.
- Illegal activities, including hunting violations, would be reduced by providing well-thought-out information and sufficient law enforcement presence.
- All hunting programs would be coordinated with CPW.
- All hunting programs would consider population objectives. Dove hunting would follow seasons and bag limits provided by CPW.
- The refuge manager would have the ability to close or modify entire hunting programs, including access, timing, and methods, in response to unforeseen conditions in order to ensure public safety and best management of natural resources.
- Refuge staff would regularly solicit feedback from hunters regarding safety, the overall quality of their hunting experience, and any suggestions they may have.

Justification

Consistent with our habitat management plan (HMP), there may be a need to manage big game populations on the refuge. The Rocky Mountain Arsenal National Wildlife Refuge Act of 1992 specifically encourages fish and wildlife recreational opportunities, and hunting is one of the wildlife-dependent recreational activities that is encouraged on national wildlife refuges. The refuge also provides a unique venue for hunter education and the exposure of youth to quality hunting opportunities, as defined in the Service's guidelines for wildlife-dependent recreation (FWS 2006b). Under this policy, providing quality experiences is highlighted as an important component of a hunting program (605 FW1, 605FW2). Promoting safety, providing reasonable opportunities for success, and working collaboratively with the State wildlife agencies are just a few of the key elements that should be considered in providing for quality experiences. For example, a quality experience could mean that participants could expect reasonable harvest opportunities, uncrowded conditions, few conflicts between hunters, relatively undisturbed wildlife, and limited interference from or dependence on mechanized aspects of the sport.

Mandatory 15-year reevaluation date: 2030

Fishing

Even prior to the establishment of the refuge, fishing had been a cherished wildlife-dependent recreational opportunity at this site. Over the years, there have been periodic changes to the timing and location of fishing. Fishing is now allowed on Lake Mary and Lake Ladora; it is not allowed on other lakes on the refuge.

Current sport fishing regulations (50 CFR § 32.25) state that fishing be catch and release, requires a permit, and is permitted from sunrise to sunset from April 15 through October 15 annually. Additional conditions are found in the refuge's fishing permit and are modified periodically. Wading is permitted, but the use of boats and other flotation devices is prohibited.

Anticipated Impacts of Use

Fishing occurs in artificial, warm-water lakes on the refuge. The lakes were originally created as irrigation infrastructure and now support a warm-water recreational fishery. All fishing is for warm-water species such as largemouth bass, sunfish, northern pike, and catfish. In accordance with our HMP, fisheries are monitored and stocked to provide a quality sportfishing experience focusing on angler satisfaction. Infrastructure that localizes habitat disturbance and impacts has already been created to support recreational fishing. Our lakes also support a variety of waterfowl and shorebirds and provide needed forage for bald eagles that overwinter at the refuge. Our season (April 15 through October 15) limits fishing-related disturbances to other wildlife.

Availability of Resources

We currently have a full-time law enforcement officer to help administer the fishing program. Other staff and volunteers assist in monitoring fisheries and with special fishing programs.

Determination

Fishing and fishing programs are compatible uses of the Rocky Mountain Arsenal National Wildlife Refuge.

Stipulations Necessary to Ensure Compatibility

- All fishing will require a permit.
- The majority of lakes on the refuge are interconnected and near one another. A fishing season (April 15 through October 15) would limit disturbance to waterfowl, shorebirds, and bald eagles.
- The size and number of fish in our lakes is limited by the lakes' size. To ensure a quality fishing experience, as defined by angler satisfaction and average catch rates, catch-and-release fishing would be needed.
- Illegal activities, including fishing violations, would be reduced by providing well-thought-out information and sufficient law enforcement presence.
- Periodic monitoring of the health and composition of our fisheries would be required. Stocking of both sport and forage fish may be required.
- All fishing programs would be coordinated with CPW.
- The refuge manager would have the ability to close or modify entire fishing programs, including access, timing, and methods, in response to unforeseen conditions to ensure public safety and the best management of natural resources.
- Refuge staff would regularly solicit feedback from those who fish regarding the safety and overall quality of their fishing experience and would solicit suggestions for improvement.

Justification

The Rocky Mountain Arsenal National Wildlife Refuge Act of 1992 specifically encourages fish and wildlife recreational opportunities, and fishing is one of the wildlife-dependent recreational activities encouraged on national wildlife refuges. Due to the refuge's location in a major urban area, fishing is very accessible and is consistent with our goals for connecting with urban populations. Both the refuge's HMP and aquatic management stepdown plan (FWS 2006a) provide goals and strategies for managing lacustrine habitats and providing quality sport fishery on individual lakes. There are only minor costs associated with this program. The majority of costs are recouped through the collection of fishing permit fees.

Mandatory 15-year reevaluation date: 2030

Wildlife Observation, Photography, Interpretation, and Environmental Education

The Improvement Act identifies six wildlife-dependent recreational activities as priority public uses and encourages their implementation on refuges when they are found compatible with refuge purposes and when adequate resources are available to manage these activities on refuge lands. This compatibility determination considers wildlife observation, photography, interpretation, and environmental education. The compatibility of the other two activities identified in the Act, hunting and fishing, are assessed above.

Compatible access for priority public uses would be improved on the refuge. The majority of infrastructure is already in place and would no longer be restricted to public use. Modes of access that facilitate wildlife-dependent uses—walking, jogging, cross-country skiing, snowshoeing, and bicycles—would be favored in the refuge's Environmental Education Zone. Due to the presence of wild bison, vehicle use would be favored in the native prairie areas of the refuge. As needed, seasonal closures would be used to limit disturbances to wildlife.

Additional trails or viewing platforms could be considered to enhance viewing opportunities. Limited commercial opportunities such as nature programming, tours, and photography could be considered.

Specifically:

- Several existing administrative roads would be converted to act as new bicycle and pedestrian trails providing new access to the refuge from surrounding communities.
- A new bicycle and pedestrian trail would be constructed through the Environmental Education Zone. The primary purpose of this trail is to reduce safety risks between vehicles and nonmotorized modes of transportation, but the trail would also provide a connection across the refuge to adjoining trail systems.
- A new accessible trail would be constructed from Lower Derby Lake to the Rod and Gun Pond viewing blind.
- Both auto tour routes would be opened to the public. The smaller loop would be open for all modes of transportation and the larger loop would be open for vehicular use.
- Several new parking areas, trails, and observation platforms would be constructed to improve transportation and provide opportunities for wildlife observation and photography.
- The Wildlife Watch area, previously known as the Eagle Watch, would be reopened and rehabilitated for wildlife viewing and photography access.
- The road to Rattlesnake Hill and accessible trails in this area would be reopened to the public.
- The current environmental education facilities near Lake Mary would be improved.

Anticipated Impacts of Use

The proposed changes seek to better accommodate increasing public use. Additional wildlife disturbance could occur from opening auto tour routes, opening areas to nonmotorized access, expanding wildlife-viewing nature trails, and providing new access to surrounding communities and existing trail systems. Repurposing and improving existing facilities would result in no direct impact, but would likely further increase use.

Increased human presence on the refuge would have impacts on wildlife. There is both inter- and intraspecific variation among wildlife species, especially habitat specialists, which are more susceptible than others to human disturbance. Research has shown that human presence associated with roads and trails can result in a simplification of avian communities (fewer specialists and more generalists), reduced nest success, and reduced habitat quality. Many species are more likely to flush with increased human presence, resulting in less time spent foraging, with a potentially adverse effect on building suitable energy reserves for egg laying and migration; food delivery rates to young; territory establishment and defense; and mate attraction. For many species, especially medium-sized and large mammals, the presence of dogs can greatly magnify the effects of disturbance. Research has shown that various activities result in differing levels of disturbance. Pedestrian and bicycle use results in greater disturbance than vehicle use. Trails and roads create habitat edges, which lead to increased predation, parasitism, and displacement of interior-sensitive birds. Trails and roads can restrict animal movement and dispersal.

Increasing public use of the refuge would require a corresponding increase in law enforcement resources to ensure public safety.

Availability of Resources

We currently have a full-time law enforcement officer to monitor and enforce refuge regulations. Other staff and volunteers would assist with providing information to the public on wildlife disturbance and monitoring of impacts.

Determination

Wildlife interpretation, environmental education, wildlife photography, and wildlife observation are compatible uses of the Rocky Mountain Arsenal National Wildlife Refuge.

Stipulations Necessary to Ensure Compatibility

- Monitoring of focal or surrogate species would be used to ascertain adverse effects on wildlife associated with increased public use on the refuge.
- Dogs would not be allowed out of vehicles on the refuge.
- Visitors on the wildlife observation trails would be required to stay on the trail.
- For safety around bison, visitors on the larger auto tour route would be restricted to their vehicles or the immediate areas outside their vehicles.
- Visitors would not be allowed within our bald eagle management areas or other sensitive habitat during critical periods of the year.
- Existing infrastructure (administrative roads and trails) and footprints would be used as much as possible in the expansion of nonmotorized access to the refuge, reducing ground disturbance, associated habitat loss, and the spread of weeds.
- The refuge manager would have the ability to close or modify any activity, including access, timing, and methods, in response to unforeseen conditions in order to ensure public safety and the best management of natural resources.
- Interpretive information would be posted and included in refuge brochures describing the impact of disturbance on wildlife and simple practices for the visitor to reduce disturbance.

Justification

The urban location, accessibility, and abundant wildlife resources found on the refuge attract many visitors. At present, our bison herd is the largest draw. Historically, access for visitors wanting to participate in nonconsumptive recreation on the refuge has been limited. The Rocky Mountain Arsenal National Wildlife Refuge Act of 1992 specifically encourages wildlife-dependent recreational opportunities and environmental education. Wildlife observation, photography, interpretation, and environmental education are wildlife-dependent recreational activities that are encouraged on national wildlife refuges. It is the intent of this determination and the CCP to provide well-thought-out and desirable access opportunities without materially interfering with achievement of refuge wildlife management goals.

Mandatory 15-year reevaluation date: 2030

Commercial Photography

For many years, the refuge has issued special use permits for commercial photography. Due to our relatively easy access to wildlife, demand for these permits is high. Our permits often provide access to areas of the refuge that are generally closed to the public, but this will occur less as more areas of the refuge are opened to the public.

Commercial filming is defined as the digital recording or filming of a visual image or sound recording by a person, business, or other entity for a market audience, such as for a documentary, television or feature film, advertising, or similar project. It does not include news coverage or visitor use. Still photography is defined as the capturing of a still image on film or in a digital format. These descriptions and further information about these activities are found in 43 CFR Part 5 (Department of the Interior) and 50 CFR Part 27 (Fish and Wildlife Service).

Under the Code of Federal Regulations (50 CFR § 27.71), special use permits for commercial filming and still photography are required when

- it takes place at location(s) where or when members of the public are generally not allowed; or (2) it uses model(s), sets(s), or prop(s) that are not a part of the location's natural or cultural resources or administrative facilities; or (3) the agency would incur

additional administrative costs to monitor the activity; or (4) the agency would need to provide management and oversight to:

- i. avoid impairment or incompatible use of the resources and values of the site; or
- ii. limit resource damage; or
- iii. minimize health or safety risks to the visiting public.

These permit requests are evaluated on an individual basis, using a number of Department of the Interior, Service, and National Wildlife Refuge System policies (for example, 43 CFR Part 5, 50 CFR Part 7, 8 RM 16). Commercial filming would be managed on the refuge through the special use permitting process to minimize the possibility of damage to cultural or natural resources or interference with other visitors to the area.

Anticipated Impacts of Use

Wildlife photography can adversely affect wildlife by altering wildlife behavior, reproduction, distribution, and habitat (Knight and Cole 1995; Purdy et al. 1987). Of the wildlife observation techniques, photographers tend to have the largest disturbance impacts (Dobb 1998; Klein 1993; Morton 1995). While wildlife observers frequently stop to view species, wildlife photographers are more likely to approach wildlife (Klein 1993). Even a slow approach by photographers tends to have behavioral consequences to wildlife species (Klein 1993). Other impacts include the potential for photographers to remain close to wildlife for extended periods of time in an attempt to habituate the wildlife subject to their presence (Dobb 1998) and the tendency of casual photographers, with low-power lenses, to get much closer to their subjects than other activities would require (Morton 1995), including wandering off trails. This usually results in increased disturbance to wildlife and habitat, including trampling of plants. Klein (1993) recommended that refuges provide observation and photography blinds to reduce disturbance to wildlife that can result from approach by visitors. Potential impacts from this use include purposeful or inadvertent disturbance of wildlife. Large commercial activities could also interfere with priority public uses.

Special use permit conditions and associated monitoring of permitted activities would be designed to minimize wildlife and habitat impacts of this use. A special use permit request would be denied if the commercial filming, audio recording, or still photography activities are found not to be compatible with refuge purposes.

Availability of Resources

We currently have a full-time law enforcement officer to monitor compliance of permittees. The refuge would incur minimal expense for administrative costs for review of applications and issuance of a special use permit. Special use permits for commercial filming and still photography would require payment of a location fee and reimbursement for actual costs incurred in processing the permit request and administering the permit.

Determination

Commercial filming, audio recording, and still photography are compatible uses of the Rocky Mountain Arsenal National Wildlife Refuge.

Stipulations Necessary to Ensure Compatibility

- All commercial filming would require a special use permit.
- Special use permits would identify conditions that protect the refuge's values, purposes, and resources; ensure public health and safety; and prevent unreasonable disruption of the public's use and enjoyment of the refuge. Such conditions may include specifying road conditions when access would not be allowed, establishing time limitations, and identifying routes of access into refuges. These conditions would be identified to prevent excessive disturbances to wildlife, damage to habitat or refuge infrastructure, or conflicts with other visitor services or management activities.
- The special use permit would stipulate that imagery produced on refuge lands would be made available to the refuge to use in environmental education and interpretation, outreach, internal documents, or other suitable uses. In addition, any commercial products must include appropriate credits to the refuge, the Refuge System, and the Service.
- Any commercial filming, still photography, or audio recording permits that are requested must demonstrate a means to extend public appreciation and understanding of wildlife or natural habitats; to enhance education, appreciation, and understanding of the Refuge System; or to facili-

tate outreach and education goals of the refuge.

- Aerial filming or photography of wildlife may result in disturbance of animals in violation of applicable regulations.

- Still photography and audio recording would also require a special use permit (with specific conditions as outlined above) under one or more of the following conditions:

- It would occur in places where or when members of the public are not allowed.

- It would use model(s), set(s), or prop(s) that are not part of the location's natural or cultural resources or administrative facilities.

- The refuge would incur additional administrative costs to monitor the activity.

- The refuge would need to provide management and oversight to avoid impairment of the resources and values of the site; limit resource damage; or minimize health and safety risks to the visiting public.

- The photographer(s) would intentionally manipulate vegetation to create a shot (for example cutting vegetation to create a blind).

- To reduce impacts on refuge lands and resources, refuge staff would ensure that all commercial filmmakers, commercial still photographers, and commercial audio recorders comply with policies, rules, and regulations, and refuge staff would monitor and assess the activities of all filmmakers, photographers, and audio recorders.

Justification

Commercial filming, still photography, or audio recording are economic uses that must contribute to the achievement of the refuge purposes, the mission of the Refuge System, or the mission of the Service. Under certain circumstances, providing opportunities for commercial filming, still photography, and audio recording that meet the above requirements should result in increased public awareness of the refuge's ecological importance as well as advancing the public's knowledge and support for the Refuge System and the Service. The stipulations outlined above and conditions imposed in the special use permits issued to commercial filmmakers, still photographers, and audio recorders would ensure that these wildlife-dependent activities occur without adverse effects on refuge resources or refuge visitors.

Mandatory 15-year reevaluation date: 2030

Research

The refuge occasionally receives requests to conduct research. Recent examples include projects assessing the effects of bison grazing, efficacy of plague vaccines, and the use of geolocators on burrowing owls. Priority would be given to studies that contribute to the enhancement, protection, preservation, and management of native plants, fish, wildlife populations, and habitat on the refuge. Research applicants must submit a proposal that outlines (1) the objectives of the study; (2) the justification for the study; (3) a detailed study methodology and schedule; and (4) potential impacts on refuge wildlife and habitat, including disturbance (short- and long-term), injury, or mortality. This proposal must include (1) a description of mitigation measures the researcher would take to reduce disturbances or impacts; (2) personnel required and their qualifications and experience; (3) status of necessary permits (such as scientific collecting permits and endangered species permits); (4) costs to refuge and refuge staff time requested, if any; and (5) product delivery schedules such as anticipated progress reports and end products such as reports or publications. Refuge staff and others, as appropriate, would review research proposals and issue special use permits if approved.

Evaluation criteria would include the following:

- Research that would contribute to specific refuge management issues would be given higher priority than other requests.

- Research that would conflict with other ongoing research, monitoring, or management programs would not be approved.

- Research projects that can be conducted off-refuge would be less likely to be approved.

- Research that causes undue disturbance or is intrusive would likely not be approved. The degree and type of disturbance would be carefully weighed when evaluating a research request.

- Evaluation of the research proposal would determine if any effort has been made to reduce disturbance through study design, including adjusting location, timing, number

of permittees, study methods, and number of study sites.

- Evaluation of the research proposal would determine if any mitigation planning is included to minimize disturbances or impacts or to reclaim resultant disturbed areas.

- Evaluation of the research proposal would determine if staffing or logistics makes it impossible for the refuge to monitor researcher activity in a sensitive area.

- Specific timelines, including the length of the project and product delivery dates, would be considered and agreed upon before approval. All projects would be reviewed annually.

Anticipated Impacts of Use

Some degree of disturbance is expected with all research activities, since they often include areas of the refuge closed to the public or with limited public access, and some research requires collecting samples from, or the direct handling of, wildlife. However, minimal impacts on refuge wildlife and habitats are expected to result from research studies because special use permits would specify conditions to ensure that impacts on wildlife and habitats are reduced.

Availability of Resources

We currently have staff to review and evaluate these requests. Our experience shows us that the nominal cost of issuing special use permits and managing research projects is typically offset by the value of information acquired from the research.

Determination

Research is a compatible use of the Rocky Mountain Arsenal National Wildlife Refuge.

Stipulations Necessary to Ensure Compatibility

- All research would require a special use permit.

- Special use permits would identify the conditions that protect the refuge's values, purposes, and resources; ensure public health and safety; and prevent unreasonable disruption of the public's use and enjoyment of the refuge. Such conditions may include specifying road conditions when access would not be allowed, establishing time limitations, and identifying routes of access into refuges. These conditions would be identified to prevent excessive disturbances to wildlife, damage to habitat or refuge infrastructure, or conflicts with other visitor services or management activities.

- Extremely sensitive wildlife habitat areas and wildlife species would be provided sufficient protection from disturbance by limiting proposed research activities in these areas. All refuge rules and regulations would be strictly enforced unless otherwise exempted by refuge management.

- Refuge staff would use the criteria for evaluating a research proposal, as outlined above, when determining whether to approve a proposed study on the refuge. If proposed research methods are evaluated and determined to have potential impacts on refuge resources (habitat and wildlife), it must be demonstrated that the research is necessary for refuge resource conservation management. Measures to reduce potential impacts would need to be developed and included as part of the study design. In addition, these measures would be listed as conditions and requirements of the special use permit.

- Refuge staff would monitor research activities for compliance with conditions of the special use permit. At any time, refuge staff may accompany the researchers to determine potential impacts. Staff may determine that previously approved research and special use permits should be terminated based on observed impacts. The refuge manager would also have the ability to cancel a special use permit if the researcher is out of compliance, or to ensure wildlife and habitat protection.

Justification

The Rocky Mountain Arsenal National Wildlife Refuge Act of 1992 specifically includes research as a purpose for the refuge. The program as described is determined to be compatible. Potential impacts of research activities on refuge resources would be reduced because sufficient restrictions would be

included in the required special use permits and all activities would be monitored by refuge staff. At a minimum, research activities would have no significant impact on refuge resources and are expected to contribute to the enhancement, protection, preservation, and management of refuge wildlife populations and their habitats.

Mandatory 15-year reevaluation date: 2030

Refuge Perimeter Trail

The idea of a nonmotorized trail following the 26-mile perimeter of the refuge was first envisioned in the refuge's comprehensive management plan (FWS 1996a). Over time, much of this trail has been constructed, and the remainder necessary for completion is still proposed and underway. The majority of this trail is on lands immediately adjacent to the refuge, but not owned by the refuge. There are small sections of the trail that must cross refuge lands.

Anticipated Impacts of Use

The construction of trails would have an immediate and temporary impact. Once constructed, increased human presence would have impacts on wildlife. However, the majority of the perimeter trail exists solely on the periphery of wildlife habitat.

Availability of Resources

The City of Commerce City maintains the portions of the trail that it has constructed in Commerce City and Adams County. Future trail segments will be constructed on City of Denver lands, and maintenance and upkeep will be the City of Denver's responsibility. There will be limited costs involved in the maintenance and upkeep of the perimeter trail system.

Determination

Construction and maintenance of a perimeter trail is a compatible use of the Rocky Mountain Arsenal National Wildlife Refuge.

Stipulations Necessary to Ensure Compatibility

- All activities must be limited to nonmotorized use to reduce or eliminate disturbance of refuge wildlife and visitors.

Justification

The Rocky Mountain Arsenal National Wildlife Refuge Act of 1992 specifically encourages wildlife-dependent recreational opportunities. The perimeter trail provides necessary access to the refuge and creates important connections to other trail networks.

Mandatory 15-year reevaluation date: 2030

D.4 Approval of Compatibility Determinations

Submitted by:

David Lucas, Project Leader — Date
U.S. Fish and Wildlife Service
Rocky Mountain Arsenal NWR
Commerce City, Colorado

Reviewed by:

Barbara Boyle, Refuge Supervisor — Date
U.S. Fish and Wildlife Service
National Wildlife Refuge System
Lakewood, Colorado

Approved by:

Will Meeks, Assistant Regional Director — Date
U.S. Fish and Wildlife Service
National Wildlife Refuge System
Lakewood, Colorado

Appendix E

Rocky Mountain Arsenal National Wildlife Refuge Act of 1992

PUBLIC LAW 102-402—OCT. 9, 1992 106 STAT. 1961-1967

Public Law 102-402
102d Congress

Oct. 9, 1992
[H.R. 1435]

An Act

To direct the Secretary of the Army to transfer jurisdiction over the Rocky Mountain Arsenal, Colorado, to the Secretary of the Interior.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

SECTION 1. SHORT TITLE AND DEFINITIONS.

(a) SHORT TITLE.—This act may be cited as the "Rocky Mountain Arsenal National Wildlife Refuge Act of 1992."

(b) DEFINITIONS.—For purposes of this Act:

(1) The term "Arsenal" means the Rocky Mountain Arsenal in the State of Colorado.

(2) The term "refuge" means the Rocky Mountain Arsenal National Wildlife Refuge established pursuant to section 4(a)

(3) The term "hazardous substance" has the meaning given such term by section 101(14) of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (42 U.S.C. 9601 (14)).

(4) The term "pollutant or contaminant" has the meaning given such term by section 101(33) of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (42 U.S.C. 9601(14)).

(5) The term "response action" has the meaning given the term "response" by section 101(25) of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (42 U.S.C. 9601(25)).

(6) The term "person" has the meaning given that term by section 101(21) of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (42 U.S.C. 9601(21)).

SEC. 2 TRANSFER OF MANAGEMENT RESPONSIBILITIES AND JURISDICTION OVER THE ROCKY MOUNTAIN ARSENAL.

(a) TRANSFER OF MANAGEMENT RESPONSIBILITIES.—(1) Not later than October 1, 1992, the Secretary of the Army and the Secretary of the Interior shall enter into a memorandum of understanding under which—

(A) the Secretary of the Army shall transfer to the Secretary of the Interior, without reimbursement, all responsibility to manage for wildlife and public use purposes the real property comprising the Rocky Mountain Arsenal in the State of Colorado, except the property and facilities required to be retained under subsection (c) or designated for disposal under section 5; and

(B) The Secretary of the Interior shall manage that real property as if it were a unit of the National Wildlife Refuge System established for the purposes provided in section 4. (2) The management of the property by the Secretary of the Interior shall be subject to (A) any response action at the Arsenal carried out by or under that authority of the Secretary of the Army under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (42 U.S.C. 9601 et seq.) and other applicable provisions of law, and (B) any action required under any other statute to remediate petroleum products or their derivatives (including motor oil and aviation fuel) carried out by or under the authority of the Secretary of the Army. In the case of any conflict between management of the property by the Secretary of the Interior and any such response action or other action, the response action or other action shall take priority.

(b) TRANSFER OF JURISDICTION.—(1) Upon receipt of the certification described in paragraph (2), the Secretary of the Army shall transfer to the Secretary of the Interior jurisdiction over the real property comprising the Arsenal, except the property and facilities required to be retained under subsection (c) or designated for disposal under section 5. The transfer shall be made without cost to the Secretary of the Interior and shall include such improvements on the property as the Secretary of the Interior may request in writing for refuge management purposes.

(2) The transfer of real property under paragraph (1) may occur only after the Administrator of the Environmental Protection Agency certifies to the Secretary of the Army that response action required at the Arsenal and any action required under any other statute to remediate petroleum products or their derivatives (including motor oil and aviation fuel) at the Arsenal have been completed, except operation and maintenance associated with those actions.

(3) The exact acreage and legal description of the real property subject to transfer under paragraph (1) shall be determined by a survey mutually satisfactory to the Secretary of the Army and the Secretary of the Interior. The Secretary of the Army shall bear any costs related to the survey.

(c) PROPERTY AND FACILITIES EXCLUDED FROM TRANSFERS.—

(1) PROPERTY USED FOR ENVIRONMENTAL CLEANUP PURPOSES.—The Secretary of the Army shall retain jurisdiction, authority, and control over all real property at the Arsenal to be used for water treatment; the treatment, storage, or disposal of hazardous substances, pollutants, or contaminants; or other purposes related to response action at the Arsenal and any action required under any other statute to remediate petroleum products or their derivatives (including motor oil and aviation fuel) at the Arsenal. The Secretary of the Army shall consult with the Secretary of the Interior regarding the identification and management of all real property retained under this paragraph and ensure that activities carried out on that property are—

(A) consistent with the purposes for which the refuge is to be established under section 4(c), to the extent practicable; and

(B) consistent with the provisions of sections 2(a)(2) and 4(e).

(2) PROPERTY USED FOR LEASE OF PUBLIC FACILITIES.—(A) The Secretary of the Army shall retain jurisdiction, authority, and control over the following real property at the Arsenal:

(i) Approximately 12.08 acres containing the South Adams County Water Treatment Plant and described in Department of the Army lease No. DACA 45-1-87-6121.

(ii) Approximately 63.04 acres containing a United States Postal Service facility and described in Department of the Army lease No. DACA 45-4-71-6185.

(B) Nothing in this Act shall affect the validity or continued operation of leases of the Department of the Army in existence on the date of the enactment of this act and involving the property described in subparagraph (A)

SEC. 3. CONTINUATION OF RESPONSIBILITY AND LIABILITY OF THE SECRETARY OF THE ARMY FOR ENVIRONMENTAL CLEANUP.

(a) RESPONSIBILITY.—Notwithstanding the memorandum of understanding required under section 2(a), the Secretary of the Army shall, with respect to the real property at the Arsenal that is subject to the memorandum, continue to carry out (1) response action at that property under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (42 U.S.C. 9601 et seq.) and other applicable provisions of law, and (2) any action required under any other statute to remediate petroleum products or their derivatives (including motor oil and aviation fuel). The management by the Secretary of the Interior of such real property shall be subject to any such response action or other action at the property being carried out by or under the authority of the Secretary of the Army under such provisions of law.

(b) LIABILITY.—(1) Nothing in this Act shall relieve, and no action may be taken under this Act to relieve, the Secretary of the Army or any other person from any obligation or other liability at the Arsenal under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (42 U.S.C. 9601 et seq.) and other applicable provisions of law. (2) After the transfer of jurisdiction under section 2(b), the Secretary of the Army shall retain any obligation or other liability at the Arsenal under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (42 U.S.C. 9601 et seq.) and other applicable provisions of law and shall be accorded all easements and access as may be reasonably required to carry out such obligation or other liability.

(c) DEGREE OF CLEANUP.—Nothing in this Act shall be construed to restrict or lessen the degree of cleanup at the Arsenal required to be carried out under applicable provisions of law.

(d) PAYMENT OF RESPONSE ACTION COSTS.—Any Federal department or agency that had or has operations at the Arsenal resulting in the release or threatened release of hazardous substance, pollutants, or contaminants shall pay the cost of related response actions or related actions under other statutes to remediate petroleum products or their derivatives, including motor oil and aviation fuel.

(e) CONSULTATION.—In carrying out response actions at the Arsenal, the Secretary of the Army shall consult with Secretary of the Interior to ensure that such actions are carried out in a manner—

(1) to the extent practicable, consistent with the purposes set forth in section 4(c) for which the refuge will be established after the certification required under section 2(b)(2); and

(2) consistent with the provisions of sections 2(a)(2) and 4(e).

(f) EXISTING LAW.—The Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et seq.), the Migratory Bird Treaty Act (16 U.S.C. 703 et seq.), and the Bald Eagle Protection Act (16 U.S.C. 668 et seq.) shall apply to all actions at the Arsenal.

(g) RESPONSE ACTIONS.—(1) The future establishment of the refuge shall not restrict or lessen in any way any response action or degree of cleanup under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 or other applicable provisions of law, or any response action required under any other statute to remediate petroleum products or their derivatives (including motor oil and aviation fuel), required to be carried out by or under the authority of the Secretary of the Army at the arsenal and surrounding areas, including areas, including (but not limited to)—

(A) the substance or performance of the remedial investigation and feasibility study or endangerment assessments;

(B) the contents and conclusions of the remedial investigation and feasibility study or the endangerment assessment reports; or

(C) the selection and implementation of response action and any action required under any other statute to remediate petroleum products or their derivatives (including motor oil and aviation fuel) for the Arsenal and surrounding areas.

(2) All response action and action required under any other statute to remediate petroleum products or their derivatives (including motor oil and aviation fuel) carried out at the Arsenal shall attain a degree of cleanup of hazardous substances, pollutants, and contaminants that, at a minimum, is sufficient to full meet the purposes set forth in section 4(c) for which the refuge will be established and the permit access to all real property comprising the refuge by refuge personnel, wildlife researchers, and visitors.

SEC. 4. ESTABLISHMENT OF THE ROCKY MOUNTAIN ARSENAL NATIONAL WILDLIFE REFUGE.

(a) ESTABLISHMENT.—Not later than 30 days after the transfer of jurisdiction under section 2(b), the Secretary of the Interior shall establish a national wildlife refuge that shall be known as the Rocky Mountain Arsenal National Wildlife Refuge and consist of the real property required to be transferred under such section. The Secretary of the Interior shall publish a notice of the establishment of the refuge in the Federal Register.

(b) ADMINISTRATION.—

(1) IN GENERAL.—The Secretary of the Interior shall manage the refuge in accordance with the National Wildlife Refuge System Administration Act of 1966 (16 U.S.C. 668dd et seq.) and other applicable law.

(2) CONSULTATION.—In developing plans for the management of fish and wildlife at and public use of the refuge, the Secretary of the Interior shall—

(A) consult with the Colorado Department of Natural Resources and local governments adjacent to the refuge; and

(B) provide an opportunity for public comment on such plans.

(3) The Secretary of the Interior and the Administrator of the Federal Aviation Administration shall confer from time to time as necessary to coordinate the management of the refuge with the operations of the Denver International Airport.

(c) PURPOSES OF THE REFUGE.—The refuge is established for the following purposes:

(1) To conserve and enhance populations of fish, wildlife, and plants within the refuge, including populations of waterfowl, raptors, passerines, and marsh and water birds.

(2) To conserve species listed as threatened or endangered under the Endangered Species Act and species that are candidates for such listing.

(3) To provide maximum fish and wildlife oriented public uses at levels compatible with the conservation and enhancement of wildlife and wildlife habitat.

(4) To provide opportunities for compatible scientific research.

(5) To provide opportunities for compatible environmental and land use education

(6) To conserve and enhance the land and water of the refuge in a manner that will conserve and enhance the natural diversity of fish, wildlife, plants and their habitats.

(7) To protect and enhance the quality of aquatic habitat within the refuge.

(8) To fulfill international treaty obligations of the United States with respect to fish and wildlife and their habitats.

(d) LIMITATIONS.—

(1) PROHIBITION AGAINST ANNEXATION.—Notwithstanding section 4(a)(2) of the National Wildlife Refuge System Administration Act of 1966 (16 U.S.C 668dd(a)(2)), the Secretary of the Interior shall not allow the annexation of lands within the refuge by any unit of general local government.

(2) PROHIBITION AGAINST THROUGH ROADS.—Public roads may not be constructed through the refuge.

SEC. 5. DISPOSAL OF CERTAIN REAL PROPERTY AT THE ARSENAL FOR COMMERCIAL, HIGHWAY, OR OTHER PUBLIC USE.

(a) PROPERTY DESIGNATED FOR DISPOSAL UNDER THIS SECTION.—The following areas of real property at the Arsenal are designated for disposal under this section for commercial, highway, or other public use purposes:

(1) An area of real property consisting of approximately 815 acres located at the Arsenal, the approximate legal description of which is section 9, T3S-R67W, and the W2W2 of section 4, the W4E2W2 of section 4, T3S-R67W, and the SW4SW4 of section 33, the W4E2W2 of section 33, and the W2NW4 of section 33, T2SR67W; except that the area designated shall not include the approximately 63.04 acres containing a United States Postal Service facility and described in Department of the Army lease No. DACA 45-4-71-6185 and the water wells located in buildings 385, 386, and 387 at the Arsenal and associated facilities and easements necessary to operate and maintain the water wells, which shall be treated in the manner provided in section 2.

(2) To permit the widening of existing roads, an area of real property of not more than 100 feet inside the boundary of the Arsenal on—

(A) the Northwest side of the Arsenal adjacent to Colorado Highway #2;

(B) the Northern side of the Arsenal adjacent to 96th Avenue; and

(C) the Southern side of the Arsenal adjacent to 56th Avenue.

(b) TRANSFER FOR HIGHWAY PURPOSES.—The Secretary of the Army shall convey those parcels of real property described in subsection (a)(2) to the State or the appropriate unit of general local government at no cost to allow for the improvement of public roads in existence on the date of the enactment of this Act or for the provision of alternative means of transportation.

(c) TRANSFER FOR SALE.—(1) The Secretary of the Army shall transfer to the Administrator of the General Services Administration those parcels of the area of real property described in subsection (a)(1). The transferred property shall be sold in advertised sales as surplus property under the provision of the Federal Property and Administrative Services Act of 1949 (40 U.S.C. 471 et seq.), except that the provisions of such Act relating to reduced- or no cost transfers to other governmental entities shall not apply to this property.

(2) Any amounts realized by the United States upon the sale of property as described in paragraph (1) shall be transferred to the Director of the United States Fish and Wildlife Service to be used, to the extent provided for in appropriation Acts, to supplement the funds otherwise available for construction of a visitor and education center at the refuge.

(d) LIMITATIONS.—

(1) PERPETUAL RESTRICTIONS.—(A) The disposal of real property under this section shall be subject to perpetual restrictions that are attached to any deed to such property and that prohibit—

(i) the use of the property for residential or industrial purposes;

(ii) the use of ground water located under, or surface water located on, the property as a source of potable water;

(iii) hunting and fishing on the property, excluding hunting and fishing for nonconsumptive use subject to appropriate restrictions; and

(iv) agricultural use of the property, including all farming activities such as the raising of livestock, crops, or vegetables, but excluding agricultural practices used in response action or used of or erosion control.

(B) Nothing in subparagraph (A) shall be construed to restrict or lessen the degree of cleanup required to be carried out under applicable provisions of law at the property designated for disposal under this section.

(2) DISPOSAL IN ACCORDANCE WITH CERCLA.—The disposal of real property under this section shall be carried out in compliance with section 120(h) of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (42 U.S.C. 9620(h)) and other applicable provisions of law.

Approved October 9, 1992.

Appendix F

Standards of Excellence for Urban National Wildlife Refuges

F.1 Introduction

Conserving the Future: Wildlife Refuges and the Next Generation sets out an ambitious plan to enhance the relevance of the National Wildlife Refuge System (System) and the U.S. Fish and Wildlife Service (Service) to a rapidly changing America. In particular, it recognizes the importance of building a connected conservation constituency to the future of the System and to conserving natural resources. To build a representative and nationwide constituency, it also recognizes the pressing need to connect with ever growing populations in urban areas. To this end, the Conserving the Future document contains a specific recommendation:

> "RECOMMENDATION 13: Create an urban refuge initiative that defines excellence in our existing urban refuges, establishes the framework for creating new urban refuge partnerships and implements a refuge presence in 10 demographically and geographically varied cities across America by 2015."

The overall goal of the Urban Wildlife Conservation Program is to actively engage urban communities in wildlife conservation in partnership with the Service. The Urban Standards of Excellence serve as a framework for our success in the Urban Program.

The Urban Standards were developed in the past 3 years by the Urban Wildlife Refuge Team, with involvement from Service staff, partners, and the public through discussions during an Urban Academy at the National Conservation Training Center (in West Virginia), a public comment period, and a Directorate review. Each of the standards includes big picture questions, payoffs, and guideposts to check progress along the way. Evaluation tools and best practices are currently in development at several urban wildlife refuges.

The Urban Standards will help us determine if we are achieving our objectives, help us prioritize our work with urban audiences, and give us a way to measure progress in building a connected conservation constituency. The complete standards can be found at www.fws.gov/urban.

In brief, the Urban Standards of Excellence are:

1. Know and Relate to the Community: Understand the values, interests, cultures, and needs of the surrounding/adjacent community.

2. Connect Urban People with Nature via Stepping Stones of Engagement: Engage all demographic groups, providing varied opportunities to connect with and care for nature.

3. Build Partnerships: Utilize diverse partnerships within the community to achieve common goals for land stewardship and conservation of natural resources for the benefit of the community.

4. Be a Community Asset: Contribute resources toward improving the quality of community life, thereby strengthening the urban community as a whole.

5. Ensure Adequate Long-Term Resources: Have sufficient funding and appropriate staffing to attain and maintain excellence.

6. Provide Equitable Access: Accessible to all people living and working in nearby communities.

7. Ensure Visitors Feel Safe and Welcome: Maintain a high standard of facility maintenance, minimize real threats to safety and welcome and engage individuals from all demographic groups.

8. Model Sustainability: Adopt and showcase sustainable practices, proclaim the benefits of connecting with the natural world, and inspire sustainable actions for the benefit of wildlife and people.

The approach to excellence for urban national wildlife refuges must be as flexible and unique as the communities the refuges serve. The Service must strive to understand both human environments and natural environments in order to understand the expectations of the urban community. The Service

must strive to provide programs and leadership on conservation initiatives and projects that are relevant to the community as they conserve wildlife and habitats. Service staff, volunteers, and partners must engage urban communities and make meaningful connections to wildlife, especially in communities where opportunities to learn about and enjoy nature and wildlife are limited. This may start by building awareness, then fostering deeper understanding, followed by growing participation through programs that bring more people from the urban world into the larger conservation community.

Urban refuges are great places to build a broader conservation constituency, but the challenge is far too big for any one agency or organization to tackle alone. The Urban Wildlife Refuge Initiative 2 recognizes the importance of embracing traditional and new partnerships and collaborations. A variety of entities whose interests may be conservation, education, human health, or other subjects ultimately can help achieve conservation of wildlife, plants, and their habitats that are essential to maintaining a healthy planet for people.

F.2 Using The Standards

- The term "urban refuge" is used throughout these standards. However, readers should be mindful that these standards apply not only to Service lands in urban areas, but also, to the greatest extent possible, to all urban projects where the Service is a partner.

- Each urban refuge or partnership is unique. As such, a range of strategies and evaluation tools are provided to choose from.

- The objectives for each standard set Service expectations for urban refuges to plan for the future, to measure success, and to take advantage of the extraordinary opportunities to build a conservation constituency with the urban public.

- These standards are designed to complement other Conserving the Future recommendations and step-down plans. Visit www.americaswildlife.org to reference other plans, particularly the Friends Mentoring Action Plan; Strategic Plan for Volunteers, Friends Organizations, and Community Partners; Environmental Education Strategic Plan; Interpretation Strategic Plan; and Strategic Communications Plan.

- To keep the Standards of Excellence current and relevant, they will be reviewed and updated by the Refuge System at a minimum of every 5 years.

To view the entire document entitled "Draft Urban Standards of Excellence," please visit http://www.fws.gov/urban/soe.php.

Appendix G

List of Plant and Animal Species

Table G-1. Plants found on the Rocky Mountain Arsenal National Wildlife Refuge, 2014.

Common name	*Scientific name*
Maple family	Aceraceae
Box-elder	*Acer negundo*
Silver maple	*Acer saccharinum*
Agave family	Agavaceae
Yucca/Soapweed	*Yucca glauca*
Water plantain family	Alismataceae
Narrowleaf water plantain	*Alisma gramineum*
Arrowhead	*Saggitaria cuneata*
Amaranth family	Amaranthaceae
Tumble pigweed *	*Amaranthus albus*
Sandhill pigweed	*Amaranthus arenicola*
Prostrate pigweed *	*Amaranthus blitoides*
Palmer's pigweed *	*Amaranthus palmerii*
Redroot pigweed *	*Amaranthus retroflexus*
Cottonwool	*Froelichia floridana*
Froelichia/snakecotton	*Froelichia gracilis*
Sumac family	Anacardiaceae
Skunkbush sumac	*Rhus trilobata*
Parsley family	Apiaceae
Cutleaf waterparsnip	*Berula erecta*
Poison hemlock * (C)	*Conium maculatum*
Mountain springparsley	*Cymopterus montanus*
Queen Anne's lace *	*Daucus carota*
Biscuitroot	*Lomatium orientale*
Dogbane family	Apocynaceae
Dogbane/Indian hemp	*Apocynum cannabinum*
Milkweed family	Asclepiadaceae
Swamp milkweed	*Asclepias incarnata*
Little milkweed/Plains milkweed	*Asclepias pumila*
Showy milkweed	*Asclepias speciosa*
Horsetail milkweed	*Asclepias subverticillata*
Butterfly milkweed	*Asclepias tuberosa*
Green milkweed	*Asclepias viridiflora*
Sunflower family	Asteraceae
Yarrow	*Achillea lanulosa*
Russian knapweed * (B)	*Acroptilon repens*

Annual bursage/flatspine bur ragweed	*Ambrosia acanthicarpa*
Common ragweed *	*Ambrosia artemisiifolia*
Western ragweed	*Ambrosia psilostachya*
Tomentose ragweed/skeletonleaf bur ragweed	*Ambrosia tomentosa*
Great ragweed/giant ragweed *	*Ambrosia trifida*
Pearly everlasting	*Anaphalis margaritacea*
Rosy pussytoes/pink pussytoes	*Antennaria rosea*
Wormwood/absinthium * (B)	*Artemisia absinthium*
Field sagewort	*Artemisia campestris*
Tarragon/dragon sagewort	*Artemisia dracunculus*
Sand sagebrush	*Artemisia filifolia*
Fringed sagebrush/prairie sagewort	*Artemisia frigida*
White sagebrush/Louisiana sagewort	*Artemisia ludoviciana*
Big sagebrush	*Artemisia tridentata*
Nodding beggartick/nodding bur-marigold	*Bidens cernua*
Devil's beggartick/beggar's tick	*Bidens frondosa*
False boneset	*Brickellia eupatorioides*
Musk thistle* (B)	*Carduus nutans*
Diffuse knapweed * (B)	*Centaurea diffusa*
Spotted knapweed * (B)	*Centaurea stoebe* ssp. *micranthos*
Chicory * (C)	*Cichorium intybus*
Canada thistle * (B)	*Cirsium arvense*
Prairie thistle/hoary thistle	*Cirsium canescens*
Yellowspine thistle	*Cirsium ochrocentrum*
Wavy-leaf thistle	*Cirsium undulatum*
Bull thistle * (B)	*Cirsium vulgare*
Horseweed	*Conyza canadensis*
Plains coreopsis	*Coreopsis tinctoria*
Garden cosmos *	*Cosmos bipinnatus*
Carelessweed or giant sumpweed *	*Cyclachaena xanthifolia*
Fetid marigold	*Dyssodia papposa*
Purple coneflower	*Echinacea purpurea*
Rubber rabbitbrush	*Ericameria nauseosa* var. *nauseosa*
Spreading fleabane	*Erigeron divergens*
Shaggy fleabane/shaggy daisy	*Erigeron pumilus*
Flat top goldenrod	*Euthamia graminifolia*
Western golden top	*Euthamia occidentalis*
Bighead pygmycudweed	*Evax prolifera*
Blanket flower	*Gaillardia aristata*
Fringed quickweed/shaggy soldier *	*Galinsoga quadriradiata*
Western marsh cudweed/lowland cudweed	*Gnaphalium palustre*
Marsh cudweed *	*Gnaphalium uliginosum*
Curlycup gumweed	*Grindelia squarrosa*
Broom snake weed	*Gutierrezia sarothrae*
Common sunflower/annual sunflower	*Helianthus annuus*
Texas blueweed	*Helianthus ciliaris*

Praire sunflower	*Helianthus petiolaris*
Hairy false goldenaster	*Heterotheca villosa*
Fineleaf hymenopappus	*Hymenopappus filifolius*
Prickly lettuce *	*Lactuca serriola*
Blue lettuce	*Lactuca tatarica*
Dotted gayfeather/dotted blazing star	*Liatris punctata*
Rush skeletonweed/rush skeletonplant	*Lygodesmia juncea*
Bigelow's tansyaster	*Machaeranthera bigelovii* var. *bigelovii*
Hoary tansyaster	*Machaeranthera canescens*
Lacy tansyaster	*Machaeranthera pinnatifida*
Wavy-leaf false dandelion/prairie false dandelion	*Nothocalais cuspidata*
Scotch thistle * (B)	*Onopordum acanthium*
Engelmann's false goldenweed	*Oonopsis engelmannii*
Prairie groundsel/Platte's groundsel	*Packera plattensis*
Threetooth ragwort	*Packera tridenticulata*
Oppositeleaf bahia/plains bahia	*Picradeniopsis oppositifolia*
Wright's Cudweed	*Pseudognaphalium canescens*
Cottonbatting plant/winged cudweed	*Pseudognaphalium stramineum*
Prairie coneflower	*Ratibida columnifera*
Green prairie coneflower	*Ratibida tagetes*
Black-eyed Susan	*Rudbeckia hirta*
Cutleaf vipergrass/false salsify *	*Scorzonera laciniata*
Riddell's ragwort/riddell groundsel	*Senecio riddellii*
Broom groundsel	*Senecio spartioides*
Tall goldenrod	*Solidago altissima*
Giant goldenrod	*Solidago gigantea*
Missouri goldenrod	*Solidago missouriensis*
Soft goldenrod/velvety goldenrod	*Solidago mollis*
Showy goldenrod	*Solidago speciosa*
Perennial sowthistle * (C)	*Sonchus arvensis*
Spiny sow-thistle *	*Sonchus asper*
Wirelettuce/brownplume wirelettuce	*Stephanomeria pauciflora*
White heath aster	*Symphyotrichum ericoides* var. *ericoides*
White prairie aster	*Symphyotrichum falcatum* var. *falcatum*
Common dandelion *	*Taraxacum officinale*
Hopi tea greenthread	*Thelesperma megapotamicum*
Yellow salsify *	*Tragopogon dubius*
Golden crownbeard/cowpen daisy	*Verbesina encelioides*
Baldwin's ironweed	*Vernonia baldwinii*
Rough cocklebur/common cocklebur *	*Xanthium strumarium*
Barberry family	Berberidaceae
Common barberry *	*Berberis vulgaris*
Catalpa family	Bignoniaceae
Northern catalpa/showy catalpa *	*Catalpa speciosa*
Borage family	Boraginaceae
Fendler cryptantha/sanddune cryptantha	*Cryptantha fendleri*

Little cryptantha/small cryptantha	*Cryptantha minima*
Houndstongue/gypsyflower * (B)	*Cynoglossum officinale*
Flatspine stickseed/sand stickseed	*Lappula occidentalis* var. *occidentalis*
Puccoon/narrowleaf stoneseed	*Lithospermum incisum*
Mustard family	Brassicaceae
Desert madwort/desert Alyssum *	*Alyssum desertorum*
Alyssum/ small-flowered alyssum *	*Alyssum simplex*
Shepherd's purse *	*Capsella bursa-pastoris*
Lenspod whitetop *	*Cardaria chalepensis*
Hoary cress * (B)	*Cardaria draba*
Common blue mustard/crossflower *	*Chorispora tenella*
Mountain tansy-mustard	*Descurainia incana*
Pinnate tansy mustard/western tansymustard	*Descurainia pinnata*
Herb sophia/flixweed *	*Descurainia sophia*
Carolina draba/white draba	*Draba reptans*
Western wallflower	*Erysimum asperum*
Sanddune wallflower	*Erysimum capitatum*
Common pepperweed/prairie peppergrass	*Lepidium densiflorum*
Broadleaved pepperweed/perennial pepperweed * (B)	*Lepidium latifolium*
Clasping pepperweed *	*Lepidium perfoliatum*
Foothill bladderpod	*Lesquerella ludoviciana*
Watercress *	*Nasturtium officinale*
Spreading yellowcress	*Rorippa sinuata*
Tall tumble-mustard *	*Sisymbrium altissimum*
Tumble-mustard/hedgemustard *	*Sisymbrium officinale*
Field pennycress *	*Thlaspi arvense*
Cactus family	Cactaceae
Nylon hedgehog cactus	*Echinocereus viridiflorus*
Spinystar/pincushion cactus/ball cactus	*Escobaria vivipara* var. *vivipara*
Plains prickly pear cactus	*Opuntia polyacantha*
Bellflower family	Campanulaceae
Common harebell/bluebell bellflower	*Campanula rotundifolia*
Caper family	Capparaceae
Rocky Mountain beeplant	*Cleome serrulata*
Redwhisker clammyweed	*Polanisia dodecandra*
Honeysuckle family	Caprifoliaceae
Western snowberry	*Symphoricarpos occidentalis*
Carnation family	Caryophyllaceae
Baby's breath *	*Gypsophila paniculata*
Bouncingbet * (B)	*Saponaria officinalis*
Sand spurry *	*Spergularia rubra*
Hornwort family	Ceratophyllaceae
Coon's tail/Hornwort	*Ceratophyllum demersum*
Goosefoot family	Chenopodiaceae
Four-wing saltbush	*Atriplex canescens*
Twoscale saltbush/orache *	*Atriplex heterosperma*

Spear saltbush*	*Atriplex patula*
Fivehorn smotherweed/five hook bassia*	*Bassia hyssopifolia*
Lambsquarters/white goosefoot*	*Chenopodium album*
Netseed lambquarters/pitseed goosefoot	*Chenopodium berlandieri*
Oakleaf goosefoot *	*Chenopodium glaucum*
Mealy goosefoot	*Chenopodium incanum*
Narrowleaf goosefoot	*Chenopodium leptophyllum*
Over's goosefoot *	*Chenopodium overi*
Red goosefoot	*Chenopodium rubrum*
Winged pigweed	*Cycloloma atriplicifolium*
Burningbush/Kochia *	*Kochia scoparia*
Winterfat	*Krascheninnikovia lanata*
Slender Russian-thistle *	*Salsola collina*
Russian-thistle *	*Salsola tragus*
St. John's-Wort family	Clusiaceae
Common St. Johnswort * (C)	*Hypericum perforatum*
Spiderwort family	Commelinaceae
Prairie spiderwort	*Tradescantia occidentalis*
Morning glory family	Convolvulaceae
Field bindweed * (C)	*Convolvulus arvensis*
Shaggy dwarf morning glory	*Evolvulus nuttallianus*
Bush morning glory	*Ipomoea leptophylla*
Cucumber family	Cucurbitaceae
Wild gourd/Stinking gourd	*Cucurbita foetidissima*
Cypress family	Cupressaceae
Rocky Mountain juniper	*Juniperus scopulorum*
Sedge family	Cyperaceae
Slenderbeak sedge	*Carex athrostachya*
Threadleaf sedge	*Carex filifolia*
Dryspike sedge	*Carex siccata*
Woolly sedge	*Carex pellita*
Nebraska sedge	*Carex nebrascensis*
Sun sedge	*Carex inops* ssp. *heliophila*
Clustered field sedge	*Carex praegracilis*
Bearded flat sedge	*Cyperus squarrosus*
Redroot flatsedge	*Cyperus erythrorhizos*
Needle spikerush/slender spikerush	*Eleocharis acicularis*
Common Spikerush/pale spikerush	*Eleocharis macrostachya*
Schweinitz's flatsedge	*Cyperus schweinitzii*
Chairmaker's bulrush	*Schoenoplectus americanus*
Great bulrush	*Schoenoplectus lacustris*
Common threesquare bulrush	*Schoenoplectus pungens*
Rocky Mountain bulrush	*Schoenoplectus saximontanus*
Softstem bullrush	*Schoenoplectus tabernaemontani*
Oleaster family	Elaeagnaceae
Russian-olive * (B)	*Elaeagnus angustifolia*

Silver buffaloberry	*Shepherdia argentea*
Horsetail family	**Equisetaceae**
Smooth horsetail	*Equisetum laevigatum*
Spurge family	**Euphorbiaceae**
Ribseed sandmat	*Chamaesyce glyptosperma*
Spotted sandmat/spotted spurge	*Chamaesyce maculata*
Prostrate sandmat/protrate spurge	*Chamaesyce prostrata*
Thymeleaf sandmat	*Chamaesyce serpyllifolia*
Texas croton	*Croton texensis*
Toothed spurge	*Euphorbia dentata*
Leafy spurge * (B)	*Euphorbia esula* var. *uralensis*
Snow-on-the-mountain	*Euphorbia marginata*
Warty spurge	*Euphorbia spathulata*
Pea family	**Fabaceae**
Lead plant	*Amorpha canescens*
Purple milkvetch	*Astragalus agrestis*
Two-grooved milkvetch	*Astragalus bisulcatus*
Painted milkvetch	*Astragalus ceramicus*
Ground plum	*Astragalus crassicarpus*
Lotus milkvetch	*Astragalus lotiflorus*
Missouri milkvetch	*Astragalus missouriensis*
Golden prairie-clover	*Dalea aurea*
Andean prairie clover/compact prairie-clover	*Dalea cylindriceps*
Purple prairie-clover	*Dalea purpurea*
Honey locust *	*Gleditsia triacanthos*
Wild licorice/American licorice	*Glycyrrhiza lepidota*
Silvery lupine	*Lupinus argenteus*
Black medick*	*Medicago lupulina*
Alfalfa *	*Medicago sativa*
White sweetclover *	*Melilotus albus*
Yellow sweetclover *	*Melilotus officinalis*
Purple locoweed	*Oxytropis lambertii*
Lemon scurfpea/narrowleaf scurfpea	*Psoralidium lanceolatum*
Slimflower scurfpea	*Psoralidium tenuiflorum*
New Mexico locust*	*Robinia neomexicana*
Black locust*	*Robinia pseudoacacia*
Silky sophora	*Sophora nuttalliana*
Strawberry clover*	*Trifolium fragiferum*
American vetch	*Vicia americana*
Wooly vetch *	*Vicia villosa*
Oak family	**Fagaceae**
White oak*	*Quercus alba*
Fumitory family	**Fumariaceae**
Golden smoke/golden corydalis	*Corydalis aurea*
Geranium family	**Geraniaceae**
Redstem filaree/redstem stork's bill * (C)	*Erodium cicutarium*

Gooseberry family	Grossulariaceae
Golden currant	*Ribes aureum*
Water milfoil family	**Haloragaceae**
Shortspike watermilfoil	*Myriophyllum sibiricum*
Iris family	**Iridaceae**
Rocky Mountain iris/blue flag	*Iris missouriensis*
Rush family	**Juncaceae**
Arctic rush	*Juncus arcticus* var. *balticus*
Toad rush	*Juncus bufonius*
Roundfruit rush*	*Juncus compressus*
Inland rush	*Juncus interior*
Poverty rush	*Juncus tenuis*
Mint famlly	*Lamiaceae*
Rough false pennyroyal	*Hedeoma hispida*
American water horehound	*Lycopus americanus*
Field mint/wild mint	*Mentha arvensis*
Spearmint*	*Mentha spicata*
Plains beebalm/pony beebalm	*Monarda pectinata*
Catnip*	*Nepeta cataria*
Blue sage/Azure blue sage	*Salvia azurea*
Lanceleaf Sage/Rocky Mountain sage	*Salvia reflexa*
Marsh skullcap	*Scutellaria galericulata*
Canada germander/western germander	*Teucrium canadense*
Duckweed family	**Lemnaceae**
Common duckweed	*Lemna minor*
Lily family	**Liliaceae**
Garden asparagus *	*Asparagus officinalis*
Common sand lily/common starlily	*Leucocrinum montanum*
Feathery false lily of the valley	*Maianthemum racemosum* ssp. *amplexicaule*
Meadow deathcamas	*Zigadenus venenosus* var. *gramineus*
Flax family	**Linaceae**
Lewis flax/blue flax	*Linum lewisii*
Loasa family	**Loasaceae**
Whitestem blazingstar	*Mentzelia albicaulis*
Bractless blazingstar	*Mentzelia nuda*
Loosestrife famlly	*Lythraceae*
Grand redstem/toothcup	*Ammannia robusta*
Mallow family	**Malvaceae**
Velvetleaf * (C)	*Abutilon theophrasti*
Purple poppymallow/winecups	*Callirhoe involucrata*
Flower of an hour*	*Hibiscus trionum*
Common mallow *	*Malva neglecta*
Alkali mallow *	*Malvella leprosa*
Scarlet globemallow	*Sphaeralcea coccinea*
Pepperwort family	**Marsileaceae**
Hairy water clover	*Marsilea vestita*

Mulberry family	Moraceae
White mulberry*	*Morus alba*
Four-o'clock family	**Nyctaginaceae**
Snowball sand verbena/fragrant sand verbena	*Abronia fragrans*
Narrowleaf four o'clock/narrowleaf umbrella-wort	*Oxybaphus linearis*
Heartleaf four o'clock/heartleaf umbrella-wort	*Oxybaphus nyctagineus*
Olive family	**Oleaceae**
Green ash	*Fraxinus pennsylvanica*
European Privet*	*Ligustrum vulgare*
Common lilac*	*Syringa vulgaris*
Evening primrose family	**Onagraceae**
Yellow sundrops/serrate evening-primrose	*Calylophus serrulatus*
Panicled willow herb/tall annual willowherb	*Epilobium brachycarpum*
American willow-herb/fringed willowherb	*Epilobium ciliatum*
Scarlet beeblossom	*Gaura coccinea*
Velvetweed	*Gaura parviflora*
Pinyon groundsmoke/branching goundsmoke	*Gayophytum ramosissimum*
Prairie evening-primrose/whitest evening primrose	*Oenothera albicaulis*
Tufted evening primrose/stemless evening-primrose	*Oenothera caespitosa*
Crownleaf evening primrose	*Oenothera coronopifolia*
Nuttall's evening-primrose	*Oenothera nuttallii*
Hairy evening primrose	*Oenothera villosa*
Orchid family	**Orchidaceae**
Striped coralroot/hooded coralroot	*Corallorhiza striata*
Poppy family	**Papaveraceae**
Crested prickly poppy	*Argemone polyanthemos*
Pine family	**Pinaceae**
Blue spruce	*Picea pungens*
Austrian pine*	*Pinus nigra*
Ponderosa pine	*Pinus ponderosa*
Scots pine*	*Pinus sylvestris*
Plantain family	**Plantaginaceae**
Narrowleaf plantain*	*Plantago lanceolata*
Broadleaf plantain*	*Plantago major*
Woolly plantain	*Plantago patagonica*
Grass family	**Poaceae**
Indian ricegrass	*Achnatherum hymenoides*
Jointed goatgrass * (B)	*Aegilops cylindrica*
Crested wheatgrass *	*Agropyron cristatum*
Redtop*	*Agrostis gigantea*
Big bluestem	*Andropogon gerardii*
Sand bluestem	*Andropogon hallii*
Poverty threeawn	*Aristida divaricata*
Fendler's threeawn	*Aristida purpurea* var. *fendleriana*
Purple threeawn	*Aristida purpurea* var. *purpurea*
Common oat/cultivated oats *	*Avena sativa*

Sloughgrass	*Beckmannia syzigachne*
Yellow bluestem*	*Bothriochloa ischaemum*
Silver beardgrass	*Bothriochloa laguroides*
Sideoats grama	*Bouteloua curtipendula*
Blue grama	*Bouteloua gracilis*
Smooth brome *	*Bromus inermis*
Japanese brome/field brome *	*Bromus japonicus*
Cheatgrass/downy brome *(C)	*Bromus tectorum*
Buffalograss	*Buchloe dactyloides*
Prairie sandreed	*Calamovilfa longifolia*
Longspine sandbur/mat sandbur	*Cenchrus longispinus*
Tumble windmillgrass	*Chloris verticillata*
Feather fingergrass	*Chloris virgata*
Bermudagrass *	*Cynodon dactylon*
Hairy crabgrass *	*Digitaria sanguinalis*
Inland saltgrass/desert saltgrass	*Distichlis stricta*
Barnyardgrass *	*Echinochloa crus-galli*
Canada wildrye	*Elymus canadensis*
Squirreltail	*Elymus elymoides*
Thickspike wheatgrass *	*Elymus lanceolatus* ssp. *lanceolatus*
Quackgrass * (C)	*Elymus repens*
Slender wheatgrass	*Elymus trachycaulus*
Stinkgrass *	*Eragrostis cilianensis*
Tufted lovegrass	*Eragrostis pectinacea*
Red lovegrass	*Eragrostis secundiflora*
Purple lovegrass	*Eragrostis spectabilis*
Needle and thread	*Hesperostipa comata*
Foxtail barley	*Hordeum jubatum*
Little barley	*Hordeum pusillum*
Junegrass	*Koeleria macrantha*
Rice cutgrass	*Leersia oryzoides*
Perennial ryegrass *	*Lolium perenne*
Alkali muhly/scratchgrass	*Muhlenbergia asperifolia*
Sandhill muhly	*Muhlenbergia pungens*
Marsh muhly	*Muhlenbergia racemosa*
Ring muhly	*Muhlenbergia torreyi*
False buffaloegrass	*Munroa squarrosa*
Green needlegrass	*Nassella viridula*
Witchgrass	*Panicum capillare*
Switchgrass	*Panicum virgatum*
Western wheatgrass	*Pascopyrum smithii*
Dallisgrass *	*Paspalum dilatatum*
Reed canarygrass *	*Phalaris arundinacea*
Timothy *	*Phleum pratense*
Canada bluegrass *	*Poa compressa*
Kentucky bluegrass *	*Poa pratensis*

Sandberg bluegrass	*Poa secunda*
Annual rabbitsfoot grass*	*Polypogon monspeliensis*
Tumblegrass	*Schedonnardus paniculatus*
Tall fescue *	*Schedonorus arundinaceus*
Meadow fescue *	*Schedonorus pratensis*
Little bluestem	*Schizachyrium scoparium*
Cereal rye *	*Secale cereale*
Yellow foxtail*	*Setaria pumila* ssp. *pumila*
Green bristlegrass*	*Setaria viridis*
Yellow indiangrass	*Sorghastrum nutans*
Grain sorghum /Sorghum Sudan hybrid*	*Sorghum bicolor* ssp. *bicolor*
Prairie cordgrass	*Spartina pectinata*
Praire wedgegrass	*Sphenopholis obtusata*
Alkalai sacaton	*Sporobolus airoides*
Sand dropseed	*Sporobolus cryptandrus*
Intermediate wheatgrass/pubescent wheatgrass*	*Thinopyrum intermedium*
Intermediate wheatgrass *	*Thinopyrum intermedium*
Tall wheatgrass *	*Thinopyrum ponticum*
Slim tridens	*Tridens muticus*
Eastern gamma grass	*Tripsacum dactyloides*
Winter wheat *	*Triticum* sp.
Six weeks fescue	*Vulpia octoflora*
Phlox family	Polemoniaceae
Iron ipomopsis	*Ipomopsis laxiflora*
Granite prickly phlox/Prickly gilia	*Linanthus pungens*
Buckwheat family	Polygonaceae
Annual wild buckwheat	*Eriogonum annuum*
Spreading buckwheat	*Eriogonum effusum*
Black bindweed *	*Polygonum convolvulus*var. *Convolvulus*
Oval-leaf knotweed *	*Polygonum arenastrum*
Prostrate knotweed *	*Polygonum aviculare*
Smartweed	*Polygonum lapathifolia*
Pennsylvania smartweed/pinkweed	*Polygonum pensylvanicum*
Spotted lady's thumb *	*Polygonum persicaria*
Bushy knotweed/branched knotweed	*Polygonum ramosissimum*
Curly dock *	*Rumex crispus*
Golden dock	*Rumex maritimus*
Narrowleaf dock *	*Rumex stenophyllus*
Willow Dock/Mexican dock	*Rumex salicifolius* var. *mexicanus*
Veiny dock/wild begonia	*Rumex venosus*
Purslane family	Portlulacaceae
Common purslane/little hogweed*	*Portulaca oleracea*
Prairie fameflower/sunbright	*Phemeranthus parviflorus*
Primrose family	Primulaceae
Fringed loose-strife	*Steironema ciliatum*
Buttercup family	Ranunculaceae

Western virgin's bower/western white clematis	*Clematis ligusticifolia*
Plains larkspur	*Delphinium carolinianum* ssp. *virescens*
Tiny mousetail	*Myosurus minimus*
Rose family	Rosaceae
Common apple *	*Malus pumila*
Norwegian cinquefoil	*Potentilla norvegica*
Cinquefoil *	*Potentilla paradoxa*
Prairie cinquefoil/Pennsylvania cinquefoil	*Potentilla pensylvanica*
American plum	*Prunus americana*
Sand cherry	*Prunus pumila* var. *besseyi*
Black chokecherry	*Prunus virginiana*var. *melanocarpa*
Prairie rose	*Rosa arkansana*
Woods' rose	*Rosa woodsii*
Willow family	Salicaceae
White poplar *	*Populus alba*
Eastern cottonwood/plains cottonwood	*Populus deltoides*
Quaking aspen	*Populus tremuloides*
Peachleaf willow	*Salix amygdaloides*
Coyote willow/narrowleaf willow	*Salix exigua*
Shining willow	*Salix lucida*
Sandalwood family	Santalaceae
Bastard toadflax	*Comandra umbellata*
Figwort family	Scrophulariaceae
Water mudwort	*Limosella aquatica*
Dalmatian toadflax * (B)	*Linaria dalmatica* ssp. *dalmatica*
Butter and eggs/yellow toadflax * (B)	*Linaria vulgaris*
Roundleaf monkeyflower/smooth monkeyflower	*Mimulus glabratus*
White beardtongue/white penstemon	*Penstemon albidus*
Broadbeard beardtongue/narrowleaf penstemon	*Penstemon angustifolius*
Shell-leaf penstemon/large beardtongue	*Penstemon grandiflorus*
Common mullein * (C)	*Verbascum thapsus*
American speedwell	*Veronica americana*
Water speedwell	*Veronica anagallis-aquatica*
Quassia family	Simaroubaceae
Tree-of-heaven *	*Ailanthus altissima*
Nightshade family	Solanaceae
Matrimony bush *	*Lycium barbarum*
Ivyleaf groundcherry	*Physalis hederifolia*
Clammy groundcherry	*Physalis heterophylla*
Prairie groundcherry	*Physalis hispida*
Virginia groundcherry	*Physalis virginiana*
Chinese lantern	*Quincula lobata*
Hairy nightshade/hoe nightshade*	*Solanum physalifolium*
Buffalo bur	*Solanum rostratum*
Cutleaf nightshade	*Solanum triflorum*
Tamarix family	Tamaricaceae

Tamarisk * (B)	*Tamarix* spp.
Cattail family	Typhaceae
Narrowleaf cattail *	*Typha angustifolia*
Broadleaf cattail	*Typha latifolia*
Elm family	Ulmaceae
Netleaf hackberry	*Celtis laevigata* var. *reticulata*
American elm*	*Ulmus americana*
Siberian elm *	*Ulmus pumila*
Nettle family	Urticaceae
Stinging nettle	*Urtica dioica*
Vervain family	Verbenaceae
Wedgeleaf fogfruit/wedgeleaf	*Phyla cuneifolia*
Prostrate vervain/bigbract verbena	*Verbena bracteata*
Swamp vervain/blue vervain	*Verbena hastata*
Violet family	Violaceae
Nuttall's violet/yellow violet	*Viola nuttallii*
Grape family	Vitaceae
Western woodbine	*Parthenocissus vitacea*
Riverbank grape	*Vitis riparia*
Horned pondweed family	Zannichellianceae
Horned pondweed	*Zannichellia palustris*
Creosote bush family	Zygophyllaceae
Puncturevine * (C)	*Tribulus terrestris*

* Introduced species.

(A) (B) (C) Colorado noxious weed listing.

Table G-2. Fish found on the Rocky Mountain Arsenal National Wildlife Refuge, 2014.

Common name	*Scientific name*
Common carp*	*Cyprinus carpio*
Grass carp*	*Ctenopharyngodon idella*
Fathead minnow^	*Pimephales promelas*
Black bullhead	*Amerius melas*
Channel catfish^	*Ictalurus punctatus*
Northern pike	*Esox lucius*
Brook stickleback	*Culaea inconstans*
Black crappie	*Pomoxis nigromaculatus*
Green sunfish	*Lepomis cyanellus*
Bluegill^	*Lepomis macrochirus*
Pumpkinseed	*Lepomis gibbosus*
Largemouth bass^	*Micropterus salmoides*
Western mosquitofish	*Gambusia affinis*
Yellow perch	*Perca flavescens*

* Exotic.

^ Stocked native transplant.

Table G-3. Herptiles found on the Rocky Mountain Arsenal National Wildlife Refuge, 2014.

Common name	*Scientific name*
Amphibians	
Tiger salamander ^	*Ambystoma tigrinum*
Plains spadefoot	*Spea bombifrons*
Great plains toad	*Anaxyrus cognatus*
Woodhouse's toad	*Anaxyrus woodhousii*
Midland chorus frog	*Pseudacris triseriata*
Bullfrog ^	*Lithobates catesbeianus*
Northern leopard frog	*Lithobates pipiens*
Reptiles	
Snapping turtle ^	*Chelydra serpentina*
Western painted turtle	*Chrysemys picta*
Ornate box turtle	*Terrepene ornata*
Red-eared slider *	*Trachemys scripta*
Spiny softshell	*Apalone spinifera*
Lesser earless lizard	*Holbrookia maculata*
Short-horned lizard	*Phrynosoma hernandesi*
Prairie lizard	*Sceloporus undulatus*
Many-lined skink	*Plestiodon multivirgatus*
Six-lined racerunner	*Cnemidiphorus sexlineata*
Yellowbelly racer	*Coluber constrictor*
Western hognose snake	*Heterodon nasicus*
Bullsnake	*Pituophis catenifer*
Western terrestrial garter snake	*Thamnophis elegans*
Plains garter snake	*Thamnophis radix*
Common garter snake	*Thamnophis sirtalis*
Prairie rattlesnake	*Crotalus viridis*

^ Game species.

* Unregulated.

Table G-4. Birds found on the Rocky Mountain Arsenal National Wildlife Refuge, 2014.

Common name	*Scientific name*
Geese, swans, and ducks	
Greater white-fronted goose *	*Anser albifrons*
Snow goose	*Chen caerulescens*
Ross's goose *	*Chen rossii*
Cackling goose	*Branta hutchinsii*
Canada goose +	*Branta canadensis*
Trumpeter swan *	*Cygnus buccinator*
Tundra swan *	*Cygnus columbianus*
Wood duck +	*Aix sponsa*
Gadwall	*Anas strepera*
Eurasian wigeon *	*Anas penelope*
American wigeon	*Anas americana*
Mallard +	*Anas platyrhynchos*

Blue-winged teal +	*Anas discors*
Cinnamon teal	*Anas cyanoptera*
Northern shoveler	*Anas clypeata*
Northern pintail +	*Anas acuta*
Green-winged teal	*Anas crecca*
Canvasback	*Aythya valisineria*
Redhead +	*Aythya americana*
Ring-necked duck	*Aythya collaris*
Greater scaup *	*Aythya marila*
Lesser scaup	*Aythya affinis*
Surf scoter *	*Melanitta perspicillata*
White-winged scoter *	*Melanitta fusca*
Black scoter *	*Melanitta americana*
Bufflehead	*Bucephala albeola*
Common goldeneye	*Bucephala clangula*
Barrow's goldeneye	*Bucephala islandica*
Hooded merganser	*Lophodytes cucullatus*
Common merganser	*Mergus merganser*
Red-breasted merganser	*Mergus serrator*
Ruddy duck	*Oxyura jamaicensis*
Loons	
Pacific loon *	*Gavia pacifica*
Common loon *	*Gavia immer*
Grebes	
Pied-billed grebe +	*Podilymbus podiceps*
Horned grebe *	*Podiceps auritus*
Red-necked grebe *	*Podiceps grisegena*
Eared grebe	*Podiceps nigricollis*
Western grebe	*Aechmophorus occidentalis*
Clark's grebe *	*Aechmophorus clarkii*
Cormorants	
Double-crested cormorant	*Phalacrocorax auritus*
Pelicans	
American white pelican	*Pelecanus erythrorhynchos*
Bitterns, herons, and egrets	
American bittern *	*Botaurus lentiginosus*
Great blue heron	*Ardea herodias*
Great egret *	*Ardea alba*
Snowy egret	*Egretta thula*
Little blue heron *	*Egretta caerulea*
Tricolored heron *	*Egretta tricolor*
Cattle egret *	*Bubulcus ibis*
Green heron *	*Butorides virescens*
Black-crowned night-heron	*Nycticorax nycticorax*
Ibis	
White-faced ibis	*Plegadis chihi*

New world vultures	
Turkey vulture	*Cathartes aura*
Osprey, hawks, and eagles	
Osprey	*Pandion haliaetus*
Bald eagle +	*Haliaeetus leucocephalus*
Northern harrier +	*Circus cyaneus*
Sharp-shinned hawk	*Accipiter striatus*
Cooper's hawk	*Accipiter cooperii*
Northern goshawk *	*Accipiter gentilis*
Broad-winged hawk *	*Buteo platypterus*
Swainson's hawk +	*Buteo swainsoni*
Red-tailed hawk +	*Buteo jamaicensis*
Ferruginous hawk	*Buteo regalis*
Rough-legged hawk	*Buteo lagopus*
Golden eagle	*Aquila chrysaetos*
Rails and coots	
Virginia rail +	*Rallus limicola*
Sora	*Porzana carolina*
American coot +	*Fulica americana*
Cranes	
Sandhill crane	*Grus canadensis*
Stilts and avocets	
Black-necked stilt *	*Himantopus mexicanus*
American avocet +	*Recurvirostra americana*
Plovers	
Black-bellied plover *	*Pluvialis squatarola*
American golden-plover *	*Pluvialis dominica*
Snowy plover *	*Charadrius nivosus*
Semipalmated plover *	*Charadrius semipalmatus*
Killdeer +	*Charadrius vociferus*
Mountain plover *	*Charadrius montanus*
Sandpipers and phalaropes	
Spotted sandpiper +	*Actitis macularius*
Solitary sandpiper	*Tringa solitaria*
Greater yellowlegs	*Tringa melanoleuca*
Willet	*Tringa semipalmata*
Lesser yellowlegs	*Tringa flavipes*
Upland sandpiper *	*Bartramia longicauda*
Whimbrel *	*Numenius phaeopus*
Long-billed curlew	*Numenius americanus*
Marbled godwit *	*Limosa fedoa*
Stilt sandpiper *	*Calidris himantopus*
Sanderling *	*Calidris alba*
Baird's sandpiper	*Calidris bairdii*
Least sandpiper *	*Calidris minutilla*
White-rumped sandpiper *	*Calidris fuscicollis*

Pectoral sandpiper *	*Calidris melanotos*
Semipalmated sandpiper *	*Calidris pusilla*
Western sandpiper *	*Calidris mauri*
Long-billed dowitcher	*Limnodromus scolopaceus*
Wilson's snipe	*Gallinago delicata*
Wilson's phalarope	*Phalaropus tricolor*
Red-necked phalarope *	*Phalaropus lobatus*
Gulls and terns	
Sabine's gull *	*Xema sabini*
Bonaparte's gull *	*Chroicocephalus philadelphia*
Franklin's gull	*Leucophaeus pipixcan*
Ring-billed gull	*Larus delawarensis*
California gull	*Larus californicus*
Herring gull	*Larus argentatus*
Thayer's gull *	*Larus thayeri*
Lesser black-backed gull *	*Larus fuscus*
Caspian tern *	*Hydroprogne caspia*
Black tern *	*Chlidonias niger*
Common tern *	*Sterna hirundo*
Arctic tern	*Sterna paradisaea*
Forster's tern *	*Sterna forsteri*
Pigeons and doves	
Rock pigeon (I) +	*Columba livia*
Eurasian collared-dove (I)+	*Streptopelia decaocto*
White-winged dove *	*Zenaida asiatica*
Mourning dove +	*Zenaida macroura*
Cuckoos	
Yellow-billed cuckoo *	*Coccyzus americanus*
Barn owls	
Barn owl	*Tyto alba*
Typical owls	
Eastern screech-owl *	*Megascops asio*
Great horned owl +	*Bubo virginianus*
Snowy owl *	*Bubo scandiacus*
Burrowing owl +	*Athene cunicularia*
Long-eared owl +	*Asio otus*
Short-eared Owl +	*Asio flammeus*
Northern saw-whet owl *	*Aegolius acadicus*
Nightjars	
Common nighthawk +	*Chordeiles minor*
Common poorwill *	*Phalaenoptilus nuttallii*
Swifts	
Chimney swift *	*Chaetura pelagica*
Hummingbirds	
Broad-tailed hummingbird *	*Selasphorus platycercus*
Rufous hummingbird *	*Selasphorus rufus*

Calliope hummingbird *	*Selasphorus calliope*
Kingfishers	
Belted kingfisher +	*Megaceryle alcyon*
Woodpeckers	
Lewis's woodpecker *	*Melanerpes lewis*
Red-headed woodpecker +	*Melanerpes erythrocephalus*
Red-bellied woodpecker *	*Melanerpes carolinus*
Red-naped sapsucker *	*Sphyrapicus nuchalis*
Downy woodpecker +	*Picoides pubescens*
Hairy woodpecker +	*Picoides villosus*
Northern flicker +	*Colaptes auratus*
Falcons and caracaras	
American kestrel +	*Falco sparverius*
Merlin	*Falco columbarius*
Peregrine falcon	*Falco peregrinus*
Prairie falcon	*Falco mexicanus*
Tyrant flycatchers	
Olive-sided flycatcher *	*Contopus cooperi*
Western wood-pewee +	*Contopus sordidulus*
Willow flycatcher *	*Empidonax traillii*
Least flycatcher *	*Empidonax minimus*
Hammond's flycatcher *	*Empidonax hammondii*
Gray flycatcher *	*Empidonax wrightii*
Dusky flycatcher	*Empidonax oberholseri*
Cordilleran flycatcher *	*Empidonax occidentalis*
Eastern phoebe *	*Sayornis phoebe*
Say's phoebe +	*Sayornis saya*
Ash-throated flycatcher *	*Myiarchus cinerascens*
Great crested flycatcher *	*Myiarchus crinitus*
Cassin's kingbird	*Tyrannus vociferans*
Western kingbird +	*Tyrannus verticalis*
Eastern kingbird +	*Tyrannus tyrannus*
Scissor-tailed flycatcher *	*Tyrannus forficatus*
Shrikes	
Loggerhead shrike +	*Lanius ludovicianus*
Northern shrike	*Lanius excubitor*
Vireos	
Plumbeous vireo *	*Vireo plumbeus*
Cassin's vireo 8	*Vireo cassinii*
Blue-headed vireo *	*Vireo solitarius*
Warbling vireo	*Vireo gilvus*
Philadelphia vireo *	*Vireo philadelphicus*
Red-eyed vireo *	*Vireo olivaceus*
Jays and crows	
Blue jay +	*Cyanocitta cristata*
Western scrub-jay *	*Aphelocoma californica*

Black-billed magpie +	*Pica hudsonia*
American crow	*Corvus brachyrhynchos*
Common raven *	*Corvus corax*
Larks	
Horned lark +	*Eremophila alpestris*
Swallows	
Tree swallow +	*Tachycineta bicolor*
Violet-green swallow	*Tachycineta thalassina*
Northern rough-winged swallow +	*Stelgidopteryx serripennis*
Bank swallow +	*Riparia riparia*
Barn swallow +	*Hirundo rustica*
Cliff swallow +	*Petrochelidon pyrrhonota*
Chickadees and titmice	
Black-capped chickadee +	*Poecile atricapillus*
Mountain chickadee *	*Poecile gambeli*
Nuthatches	
Red-breasted nuthatch *	*Sitta canadensis*
White-breasted nuthatch +	*Sitta carolinensis*
Pygmy nuthatch *	*Sitta pygmaea*
Creepers	
Brown creeper *	*Certhia americana*
Wrens	
House wren +	*Troglodytes aedon*
Rock wren	*Salpinctes obsoletus*
Winter wren *	*Troglodytes hiemalis*
Marsh wren *	*Cistothorus palustris*
Bewick's wren *	*Thryomanes bewickii*
Gnatcatchers	
Blue-gray gnatcatcher +	*Polioptila caerulea*
Kinglets	
Golden-crowned kinglet *	*Regulus satrapa*
Ruby-crowned kinglet	*Regulus calendula*
Thrushes	
Eastern bluebird +	*Sialia sialis*
Western bluebird *	*Sialia mexicana*
Mountain bluebird	*Sialia currucoides*
Townsend's solitaire	*Myadestes townsendi*
Veery *	*Catharus fuscescens*
Gray-cheeked thrush *	*Catharus minimus*
Swainson's thrush	*Catharus ustulatus*
Hermit thrush	*Catharus guttatus*
Wood thrush *	*Hylocichla mustelina*
American robin +	*Turdus migratorius*
Mimic thrushes	
Gray catbird *	*Dumetella carolinensis*
Brown thrasher	*Toxostoma rufum*

Sage thrasher	*Oreoscoptes montanus*
Northern mockingbird +	*Mimus polyglottos*
Starlings	
European starling (I)+	*Sturnus vulgaris*
Pipits	
American pipit *	*Anthus rubescens*
Waxwings	
Bohemian waxwing *	*Bombycilla garrulus*
Cedar waxwing *	*Bombycilla cedrorum*
Longspurs	
Lapland longspur *	*Calcarius lapponicus*
McCown's longspur *	*Rhynchophanes mccownii*
Wood warblers	
Ovenbird *	*Seiurus aurocapilla*
Worm-eating warbler *	*Helmitheros vermivorum*
Northern waterthrush *	*Parkesia noveboracensis*
Black-and-white warbler *	*Mniotilta varia*
Orange-crowned warbler	*Oreothlypis celata*
Nashville warbler *	*Oreothlypis ruficapilla*
Virginia's warbler	*Oreothlypis virginiae*
MacGillivray's warbler *	*Geothlypis tolmiei*
Common yellowthroat +	*Geothlypis trichas*
Hooded warbler *	*Setophaga citrina*
American redstart *	*Setophaga ruticilla*
Bay-breasted warbler *	*Setophaga castanea*
Yellow warbler +	*Setophaga petechia*
Blackpoll warbler +	*Setophaga striata*
Black-throated blue warbler *	*Setophaga caerulescens*
Palm warbler *	*Setophaga palmarum*
Yellow-rumped warbler	*Setophaga coronata*
Prairie warbler *	*Setophaga discolor*
Black-throated gray warbler *	*Setophaga nigrescens*
Townsend's warbler *	*Setophaga townsendi*
Hermit warbler *	*Setophaga occidentalis*
Wilson's warbler	*Cardellina pusilla*
Yellow-breasted chat *	*Icteria virens*
Towhees and sparrows	
Green-tailed towhee	*Pipilo chlorurus*
Spotted towhee	*Pipilo maculatus*
Cassin's sparrow	*Peucaea cassinii*
American tree sparrow	*Spizella arborea*
Chipping sparrow	*Spizella passerina*
Clay-colored sparrow	*Spizella pallida*
Brewer's sparrow	*Spizella breweri*
Field sparrow *	*Spizella pusilla*
Vesper sparrow +	*Pooecetes gramineus*

Lark sparrow +	*Chondestes grammacus*
Black-throated sparrow *	*Amphispiza bilineata*
Lark bunting +	*Calamospiza melanocorys*
Savannah sparrow *	*Passerculus sandwichensis*
Grasshopper sparrow +	*Ammodramus savannarum*
Fox sparrow *	*Passerella iliaca*
Song sparrow +	*Melospiza melodia*
Lincoln's sparrow	*Melospiza lincolnii*
Swamp sparrow *	*Melospiza georgiana*
White-throated sparrow *	*Zonotrichia albicollis*
Harris's sparrow *	*Zonotrichia querula*
White-crowned sparrow	*Zonotrichia leucophrys*
Golden-crowned sparrow	*Zonotrichia atricapilla*
Dark-eyed junco	*Junco hyemalis*
Cardinals, tanagers, and allies	
Scarlet tanager *	*Piranga olivacea*
Western tanager	*Piranga ludoviciana*
Rose-breasted grosbeak	*Pheucticus ludovicianus*
Black-headed grosbeak +	*Pheucticus melanocephalus*
Blue grosbeak +	*Passerina caerulea*
Lazuli bunting	*Passerina amoena*
Indigo bunting *	*Passerina cyanea*
Dickcissel *	*Spiza americana*
Blackbirds and orioles	
Bobolink *	*Dolichonyx oryzivorus*
Red-winged blackbird +	*Agelaius phoeniceus*
Western meadowlark +	*Sturnella neglecta*
Yellow-headed blackbird +	*Xanthocephalus xanthocephalus*
Brewer's blackbird +	*Euphagus cyanocephalus*
Common grackle +	*Quiscalus quiscula*
Great-tailed grackle *	*Quiscalus mexicanus*
Brown-headed cowbird +	*Molothrus ater*
Orchard oriole	*Icterus spurius*
Bullock's oriole +	*Icterus bullockii*
Finches	
House finch +	*Haemorhous mexicanus*
Common redpoll *	*Acanthis flammea*
Pine siskin *	*Spinus pinus*
Lesser goldfinch *	*Spinus psaltria*
American goldfinch	*Spinus tristis*
Evening grosbeak *	*Coccothraustes vespertinus*
Old world sparrows	
House sparrow (I)+	*Passer domesticus*

+ Known to nest on complex.

* Rare or accidental sightings.

(I) Introduced.

Table G-5. Mammals found on the Rocky Mountain Arsenal National Wildlife Refuge, 2014.

Common name	*Scientific name*
Insectivores	
North American least shrew	*Cryptotis parva*
Bats	
Silver-haired bat	*Lasionycteris noctivagans*
Little brown bat	*Myotis lucifugus*
Big brown bat	*Eptesicus fuscus*
Hoary bat	*Lasiurus cinereus*
Lagomorphs	
Desert cottontail	*Sylvilagus audobonii*
Eastern cottontail	*Sylvilagus floridanus*
Black-tailed jackrabbit	*Lepus californicus*
Rodents	
Spotted ground squirrel	*Spermophilus spilosoma*
Thirteen-lined round squirrel	*Spermophilus tridecemlineatus*
Black-tailed prairie dog	*Cynomys ludovicianus*
Fox squirrel	*Sciurus niger*
Northern pocket gopher	*Thomomys talpoides*
Plains pocket gopher	*Geomys bursarius*
Plains pocket mouse	*Perognathus flavescens*
Silky pocket mouse	*Perognathus flavus*
Hispid pocket mouse	*Chaetodipus hispidus*
Ord's kangaroo rat	*Dipodomys ordii*
American beaver	*Castor canadensis*
Western harvest mouse	*Reithrodontomys megalotis*
Deer mouse	*Peromyscus maniculatus*
Northern grasshopper mouse	*Onychomys leucogastor*
House mouse	*Mus musculus*
Prairie vole	*Microtus ochrogaster*
Meadow vole	*Microtus pennslyvanicus*
Common muskrat	*Ondatra ziebethicus*
Carnivores	
Red fox	*Vulpes vulpes*
Coyote	*Canis latrans*
Raccoon	*Procyon lotor*
Long-tailed weasel	*Mustela frenata*
American mink	*Mustela vison*
American badger	*Taxidea taxus*
Striped skunk	*Mephitis mephitis*
Bobcat	*Lynx rufus*
Ungulates	
Mule deer	*Odocoileus hemionus*
White-tailed deer	*Odocoileus virginianus*
Bison	*Bison bison*

Appendix H

Biological Assessment—Black-Footed Ferret Reintroduction

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Rocky Mountain Arsenal National Wildlife Refuge
6550 Gateway Road, Bldg. 121
Commerce City, Colorado 80022-4358
Telephone (303) 289-0232 Fax (303) 289-0579

INTRA-SERVICE SECTION 7 BIOLOGICAL ASSESSMENT FOR RELEASE OF BLACK-FOOTED FERRETS IN THE ROCKY MOUNTAIN ARSENAL NATIONAL WILDLIFE REFUGE, COLORADO

Originating Person: David Lucas, Project Leader, Rocky Mountain Arsenal NWR (Refuge), Commerce City, CO

Telephone Number: (303) 289-0232

Date: January 12, 2015

I. Region: 6

II. Service Activity: Refuges

III. Species/Critical Habitat:

A. Listed species and/or their critical habitat within the action area:

Mexican spotted owl (*Strix occidentalis lucida*) - the Mexican spotted owl is a threatened species and is considered a "habitat specialist." Owls occur in both forested and rocky-canyon habitats. Forests used for roosting and nesting often contain mature or old-growth stands with complex structure. In parts of its range, the Mexican spotted owl occupies a variety of steep, rocky-canyon habitats (U.S. Fish and Wildlife Service 2012). In Colorado, owls can be located in the foothills south of Denver and west of Colorado Springs (U.S. Fish and Wildlife Service 2012). There are no owls on the Refuge, nor is their suitable habitat for owls on the Refuge.

Colorado butterfly plant (*Gaura neomexicana coloradensis*) - the Colorado butterfly plant is a threatened plant species that occurs primarily in southeastern Wyoming, north-central Colorado, and extreme western Nebraska. The Colorado butterfly plant is typically found in wetlands habitats along the meandering stream channels on the high plains. In undisturbed sites, it grows among native grasses. Its establishment and survival is enhanced when dominant vegetation has been removed by disturbance (U.S. Fish and Wildlife Service 2010). Two populations have been located near Fort Collins and another population was successfully introduced at the Chambers Preserve in Jefferson County, but surveys of the Refuge have not located any populations of this species.

Ute ladies'-tresses orchid (*Spiranthes diluvialis*) - The Ute ladies' -tresses orchid is a threatened plant species found along streams, in wetlands, and in other moist habitats along Colorado's

Front Range and plains areas in elevations below 6,500 feet. The Refuge contains habitat suitable for the orchid, but surveys of the Refuge have not located any populations of this species (U.S. Fish and Wildlife Service 1996).

Preble's meadow jumping mouse (*Zapus hudsonius preblei*) - The Preble's meadow jumping mouse is a native species found in the riparian areas along Colorado's Front Range. Neither the mouse nor its habitat currently exists on the Refuge.

Platte River species - Several threatened fish and bird species exist in and along the Platte River both locally and downstream. The Service consulted on actions that may result in depletions to the river (2013a). Bird species, such as whooping crane (*Grus americana*) and piping plover (*Charadrius melodus*) may exist on or near the South Platte River within six miles of the Refuge.

B. Proposed species and/or proposed critical habitat within the action area: None.

C. Candidate species within the action area: None

D. Include species/habitat occurrence on a map: On file in Regional Office.

IV. Geographic area or station name and action:

The proposed reintroduction of black-footed ferrets at the Refuge would occur pursuant to the Regional Director's 10(a)(1)(a) recovery permit and does not designate critical habitat. The Colorado Ecological Services Field Office in Lakewood will serve as the U.S. Fish and Wildlife Service (Service) point of contact. The reintroduction will occur within the current prairie dog management areas located on the Refuge and entirely within the jurisdictional boundaries of Refuge.

V. Location:

A. Ecoregion Name: High Plains

B. County and State: Adams and Denver, Colorado (Figure 1)

C. Latitude and longitude: (39.85°N 104.86°W)

D. Distance (miles) and direction to nearest town: The Refuge is immediately adjacent to the cities of Denver (south and east) and Commerce City (north and west).

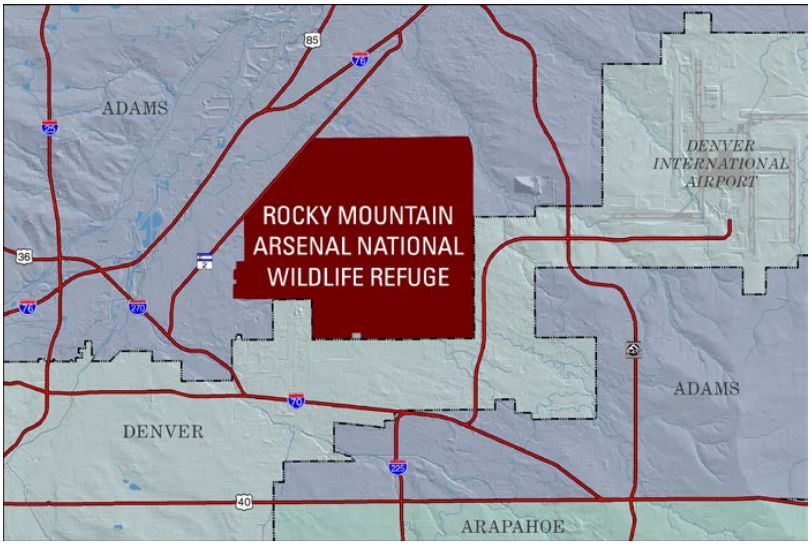

Figure 1. Rocky Mountain Arsenal NWR and vicinity

VI. Description of proposed action:

The Service is analyzing the impacts of reintroducing black-footed ferrets to prairie dog colonies on the Refuge and developing a live ferret exhibit. As the lead agency for BFF recovery, USFWS has an obligation to reintroduce the ferret to suitable habitats under its management, and ferret recovery is a priority of the USFWS Mountain Prairie Region in FY14 (U.S. Fish and Wildlife Service 2013b).

The Refuge is located at the edge of the High Plains Ecoregion and has flat to gently rolling topography. The Refuge was formerly a Department of Defense facility, and a legacy of this was large-scale contamination of the site and its groundwater. While the majority of the resulting remediation is complete, the Refuge is now actively restoring habitat that was disturbed or destroyed during the remedial actions. The Refuge recently completed a habitat management plan (HMP; U.S. Fish and Wildlife Service 2013c) which is guiding this restoration. Historically most of the refuge was short- or mixed-grass prairie, and most of the 12,361 acres in the Prairie Zone described in the HMP will be restored to those vegetation types.

Both the HMP and the black-tailed prairie dog management plan (U.S Fish and Wildlife Service 2013d) were drafted specifically with an eye to managing vegetation and prey in a way that is consistent with potential reintroduction of black-footed ferrets. For the next several years, management of the Refuge under these plans will focus on taking the necessary steps to restore native grassland habitat, including the control of prairie dogs outside of defined prairie dog management zones (Figure 2) because their foraging and other activities could adversely impact restoration efforts. Therefore, while the Refuge encompasses 15,998 acres, the initial reintroduction would be focused on studying the viability of ferret reintroduction on the six prairie dog management zones described in the HMP which total 2,585 acres. Existing prairie dog colonies at the Refuge are free of sylvatic plague, and the Refuge is currently annually dusting the six prairie dog management zones to control the fleas which are a vector for that disease. This dusting is intended to continue into the future.

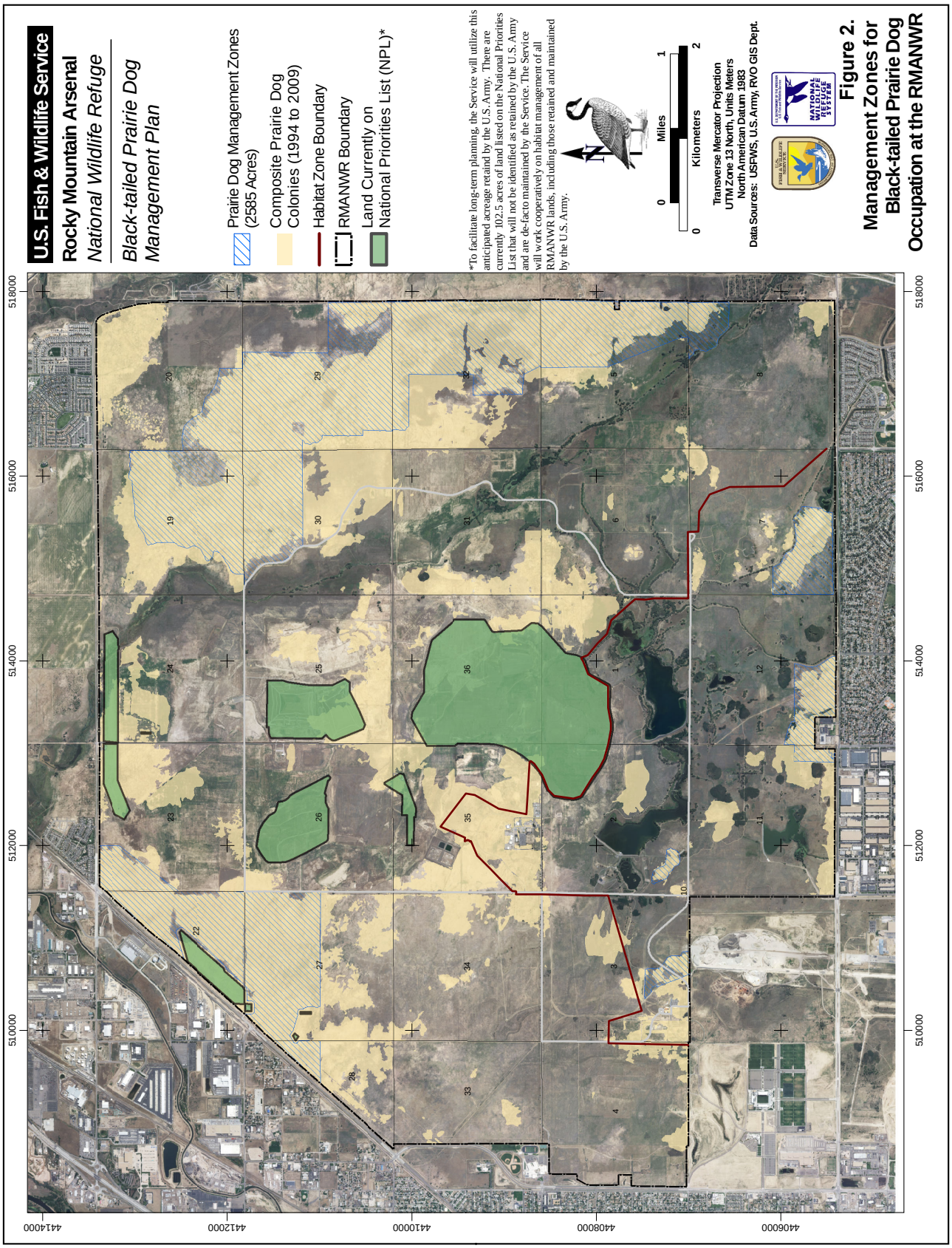

Figure 2. Management Zones for Black-tailed Prairie Dog Occupation at the RMANWR

The Refuge is surrounded on most of three sides by urban and suburban development, but there is some limited suitable ferret habitat adjacent to the Refuge. These include small prairie dog colonies on around the Commerce City's 190 acre Prairie Gateway Open Space in the southwest corner of the Refuge. There are also colonies to the north and northeast of the refuge in the Reunion area of Commerce City extending toward Barr Lake State Park; however, this is a rapidly urbanizing area and will not likely maintain habitat contiguous with the RMA NWR for long. There are larger colonies on the property of Denver International Airport east of the Refuge which may provide habitat for dispersing ferrets; this includes approximately 600 acres of DIA property west of Pena Boulevard. However, much of the prairie dog habitat on DIA lands is separated from the Refuge by the heavily trafficked Pena Boulevard and E-470 freeways which could be a source of mortality for such animals. Further, animal control activities associated with airport operations may cause direct or indirect take of ferrets on that property. It is therefore unlikely that ferrets which disperse off of the Refuge are likely to find persistent prairie dog colonies for long term colonization, and those that leave are subject to a variety of mortality sources in the heavily altered surrounding habitat as detailed in the following section. Accordingly, ferrets that leave the Refuge are expected to be lost, and success or failure of the Refuge ferret reintroduction will rely upon prairie dog acreage within the Refuge. The Refuge, in coordination with Colorado Ecological Services, is currently working on a separate agreement with neighboring agencies to address the take of ferrets off-Refuge if they do leave.

As a part of the Superfund cleanup program, the Refuge was transferred to the USFWS for management. Section 2(a)(2) of the Rocky Mountain Arsenal National Wildlife Refuge Act of 1992 (Public Law 102-402) is clear that if there is ever a conflict between management of the Refuge and a response action (as defined by CERCLA), the response action "shall take priority." Cleanup of the site was officially completed in 2010, but the U.S. Army and its contractors will maintain a long-term legacy management responsibility at the Refuge.

Provided habitat conditions remain stable, and captive ferrets are available for this project, a goal of 15 to 40 ferrets (with an approximate sex ratio of 50:50) would be released during the first year, but that allocation could be divided between different periods throughout the year. Subsequent ferret releases would be based on requirements outlined in the Refuge's annual ferret allocation request submitted to the National Black-footed Ferret Conservation Center. Ferrets to be released may come from existing ferret populations or from animals held and bred in captivity. Captive animals selected for release would be as genetically redundant as possible with the captive population. All released animals would be marked with passive integrated transponder chips (chipped) and some may be fitted with radio transmitters. Both captive-raised and wild-born translocated ferrets (trapped from other authorized ferret reintroduction areas) would be released directly into targeted prairie dog complexes at about 18 weeks of age or older. Releases are likely to occur in the fall when juvenile black-footed ferrets in the wild typically become independent, exhibit dispersal behaviors and are more capable of killing their own prey, avoiding predators, and adjusting to environmental conditions. There may also be opportunities to try other release periods such as in the spring when other ferret reintroduction sites such as Arizona have shown some successes.

Release techniques will be patterned after successful procedures used at other reintroduction sites. All captive raised ferrets will be adequately "preconditioned" prior to

release in the wild. Preconditioning is the process by which ferrets are allowed to live in large outdoor pens which have prairie dog burrow systems. Captive ferrets are either born in pens or are transferred to pens between 60 and 90 days of age. Ferrets exposed to "natural" burrow systems and live prey survive in the wild at significantly higher rates than do ferrets released directly from indoor cages.

A hard release with translocated wild born ferrets would occur if removal of wild born ferrets at other existing experimental reintroduction sites is determined compatible with overall ferret management goals. In such cases, wild born ferrets captured from other reintroduction sites would be transported directly to release sites on the Refuge and released immediately.

Regardless of release technique, ferrets will be placed in separate burrow systems within contiguous prairie dog colonies. Because all animals may not reach the proper age for release at once, black-footed ferrets could likely be released sequentially over a period of 3-8 weeks or longer. Translocated wild ferrets would have minimal holding periods between capture and release. Most releases will occur in September and October, when young ferrets are about 18 weeks old. Releases may also occur later in the fall or other periods throughout the year as deemed appropriate by the black-footed ferret coordinator and depending upon dates that wild ferrets may become available.

Because mortality of released animals can be high, multiple releases over successive years may likely be necessary to establish a population. In the future, some ferrets may be radio-collared to determine dispersal and short term survival, but this is not expected to be a primary means of monitoring. Spotlight and/or snow track monitoring may begin as soon as ferrets are released and would continue for several years, at predetermined survey periods, typically late summer or fall.

The Refuge and its partners will continue to seek advice and test alternative release and management strategies and may make adjustments in the ferret reintroduction as warranted. In subsequent years, alternative reintroduction techniques could be tested as deemed necessary by the Refuge and its partners.

Reintroduced ferrets may be relocated by the Refuge if necessary to: 1) avoid conflict with human activities; 2) with adjacent landowner permission, relocate a ferret that has moved outside the reintroduction area and removal is deemed necessary to protect the ferret or is requested by the affected landowner; 3) improve ferret survival and recovery prospects, 4) if the habitat is filled and surplus ferrets are needed at other sites, or 5) if the reintroduction is deemed unsuccessful, remaining ferrets may be captured and moved to other suitable reintroduction sites in other states as directed by the Service. Ferret reintroduction efforts will be reevaluated should any of the following conditions occur:

- Failure to maintain sufficient habitat to support at least 30 breeding adults after five years.

- Failure to maintain suitable prairie dog habitat.

- An active case of sylvatic plague is discovered in any animal on or near the reintroduction area within six months of the scheduled release.

- Funding is not available to implement reintroduction efforts on the Refuge.

Predator management actions may be taken to reduce predation on ferrets by coyotes, badgers, and great horned owls immediately prior to release but none are planned. If necessary, other predator control efforts may be initiated if excessive predation rates are documented.

Disease surveillance will be conducted annually (beginning within 12 months of the scheduled release, and for up to 5 years post-release) by the Refuge or its partners from the within the area to monitor canine distemper, tularemia and plague occurrence. Released ferrets and captured wild born ferrets would be inoculated against canine distemper and plague.

The action will not affect control of prairie dogs on private land outside the Refuge. Further, the Refuge has an existing prairie dog management plan, which allows for prairie dog control on Refuge lands to address encroachment issues.

The Refuge will also develop a live ferret exhibit that will showcase ferret conservation efforts both at the Refuge and range-wide. This will include, on average, two live ferrets that would preferably be non-reproductive individuals. The selection of the specific individuals for the exhibit will be decided in coordination with the National Black Footed-ferret Conservation Center and take into consideration range-wide ferret population goals and management considerations of the Refuge (e.g., individuals that have a reoccurring history of leaving the Refuge). The exhibit would be designed for the public to view ferrets in a controlled and secure environment for the ferret. The Refuge is currently partnering with experts from the Denver Zoo and the National Black Footed-ferret Conservation Center on the design elements of this facility.

VII. Determination of effects:

A. Explanation of effects of the action on species and critical habitats and candidate species in items III. A, B, C:

1. Listed Species

Black-footed ferret (*Mustela nigripes*): Released ferrets and their offspring will be subject to mortality from natural factors (predators, adverse weather conditions, disease, etc.) and unintentional mortality. However, loss of these animals will not jeopardize the species because the animals selected for release are excess to the captive, essential population and will be genetically redundant with the captive population gene pool. Moreover, since breeding ferrets in captivity is not problematic; any animals lost in this reintroduction effort can be replaced by ferrets excess to captive breeding program objectives or from existing ferret reintroduction sites.

Refuge management activities on the Refuge and adjacent areas may result in the unintentional mortality of reintroduced ferrets or their offspring. This may include mortalities associated with:

- Habitat restoration activities such as disking, plowing, seeding, mowing, spraying, or irrigation. See USFWS 2013c for a full description of habitat management implementation actions.
- Prescribed fire management.
- Prairie dog control. See USFWS 2013d for a full description of prairie dog management implementation actions, and the following paragraph for details on control efforts.
- Unintentionally killing or injuries by authorized agency personnel or agents conducting management actions such as trapping, handling and monitoring of ferrets; or during trapping of other wildlife species (e.g., burrowing owls) may occur.
- Vehicular traffic.
- Regular refuge operations such as the maintenance of operation of facilities and infrastructure. These may include, but are not limited do: fences, buildings, roads, water control structures; but, these impacts to ferrets are expected to be rare.
- Recreational shooting and trapping are not allowed in the Refuge and would therefore not be expected to be an issue.
- General public use allowed on the Refuge consisting of, but not limited to: fishing, hunting (mourning dove and deer by shotgun and archery only), interpretation, environmental education, and wildlife observation and photography; but, this is not expected to be an issue.
- Monitoring of ferrets will occur in the Refuge and if patterns of mortality are noted, the Service will determine appropriate measures that might reduce such losses.

If deemed necessary by the Refuge, prairie dog control will be done only by authorized personnel and in accordance with the approved Refuge Black-Tailed Prairie Dog Management Plan. Prairie dog management is necessary to ensure the success of efforts to restore native vegetation following remediation activities on the Refuge, as well as to maintain the integrity of landfills under Army jurisdiction in areas that are still part of the National Priorities List (U.S. Fish and Wildlife Service 2013d). It is not necessary to restrict prairie dog management activities on other colonies outside of the Prairie Dog Zones (Figure 2) on or off the Refuge because this ferret reintroduction is to determine whether ferrets can be established on colonies within the Refuge. Continued implementation of the existing Prairie Dog Management Plan is also compatible with ferret reintroductions because the Refuge has the mechanism in place to determine where control may occur and move ferrets as might be necessary to avoid conflicts.

The Refuge is located within an urban environment, with developed or developing residential and commercial activities to the north, west, and south, and the Denver International Airport to the east. Ferrets which disperse off of the refuge may be subject to direct or indirect take because of a variety of reasons, including but not limited to loss

of habitat due to development, fatalities caused by domestic animals, collisions with vehicles, and animal control activities necessary to maintain the safe operation of Denver International Airport.

Environmental cleanup of the Refuge was completed in 2010 and no additional response actions are envisioned on Refuge lands. However, if deemed necessary, a response action requiring soil excavation or removal is possible anywhere on the Refuge. This is considered an unlikely scenario. However, the USFWS would be involved in all projects occurring on Refuge lands and would take necessary steps to reduce take of ferrets, but some incidental take of ferrets may occur and therefore may adversely affect black-footed ferrets.

While the long term effects of the ferret reintroduction are expected to be beneficial and contribute to the overall recovery of the species, for the reasons listed above, there could be short and long-term adverse effects to individual ferrets from the reintroduction efforts. Consequently this reintroduction may entail some incidental take of ferrets and therefore may adversely affect black-footed ferrets.

Mexican spotted owl (*Strix occidentalis lucida*): No effect. The Refuge is outside of all Ecological Management Units found in the 2012 recovery plan; species has not been documented on the Refuge, nor is there suitable habitat for owls on the Refuge

Colorado butterfly plant (*Gaura neomexicana coloradensis*): No effect. Species has not been documented on the Refuge; this action will not occur in wetlands or riparian habitat.

Ute ladies'-tresses orchid (*Spiranthes diluvialis*): No effect. Species has not been documented on the Refuge, nor is there currently suitable habitat on the Refuge.

Preble's meadow jumping mouse (*Zapus hudsonius preblei*): No effect. Species has not been documented on the Refuge, nor is there currently suitable habitat on the Refuge.

Platte River species: No additional water is needed for reintroduction of black-footed ferrets. The Refuge completed formal consultation as a part of its habitat management planning (U.S. Fish and Wildlife Service 2013a). The Service concluded that current and future water use for habitat and other management activities were not likely to jeopardize the continued existence of the federally endangered whooping crane, interior least tern, and pallid sturgeon or the federally threatened northern Great Plains population of the piping plover, or western prairie fringed orchid in the central and lower Platte River. Nor is the project likely to destroy or adversely modify designated critical habitat for the whooping crane.

2. Proposed species/critical habitat:

There are no proposed species or proposed critical habitat in the project area.

3. Candidate Species

There are no candidate species in the project area.

B. Explanation of actions to be implemented to reduce potential adverse effect:

No adverse effects are anticipated from the proposed action to listed species other than black-footed ferrets.

We believe that the overall effect of ferret reintroductions to the Refuge will be beneficial to the larger ferret population. Conservation measures to reduce impacts to black-footed ferrets that will be implemented include:

- Ferret populations and overall survival will be monitored twice each year in coordination with the National Black-Footed Ferret Center staff. All data, information and lessons learned will be shared with the greater biology community to improve ferret recovery.
- Plague management (e.g., dusting with deltamethrin, vaccine, etc.) and surveillance will be conducted on an annual, or as needed basis, to reduce potential impact to prairie dog colonies.
- Reoccurring monitoring of prairie dog colonies to obtain information regarding population densities and areas of occupancy will be collected.
- Management of black-tailed prairie dog colonies through the use of prairie dog management zones. This will help the Refuge meet population goals for prairie dogs and ferrets, while also meeting habitat restoration goals.
- Predator management will occur through the removal of unnatural vertical structures that could provide perches for raptors.
- Education will be provided through media releases, displays at the refuge, and other future opportunities.
- Formal (e.g., Memorandum of Agreements) and informal partnerships will be fostered with neighbors and conservation organizations to promote the awareness of black-footed ferrets at the refuge and nationwide.

This biological assessment concludes that the proposed action may adversely affect released black-footed ferrets and their offspring because of mortality potential from otherwise legal activities in the proposed affected area, such as habitat management, ferret monitoring/handling, or vehicle collisions. We do recognize that there may be some incidental take of ferrets that could result from this reintroduction effort both on and off the Refuge. Therefore, we request formal intra-Service section 7 consultation.

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VIII. Effect determination and response requested:

A. Listed species/designated critical habitat:

Determination	Response Requested
No effect/no adverse modification (Species: All other species besides BFF)	__X__ Concurrence
May effect, not likely to adversely affect	_____ Concurrence
May effect, and is likely to adversely affect species/ critical habitat (Species: black-footed ferret)	__X__ Formal Consultation

B. Candidate species: None _____Concurrence

_____ _____
Signature Date
Field Supervisor/CO Ecological Services

IX. Reviewing ESO Evaluation:

A. Concurrence _____ Nonconcurrence _____

B. Formal consultation required _____

C. Conference required_____

D. Informal conference required_____

_____ _____
Signature Date
Section 7 Coordinator, Ecological Services, Regional Office

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Appendix I
Visitor Projections

In April 2014, to assist with this plan, refuge staff developed some projections of future visitation. The following assumptions were used in this exercise:

- Alternative A (no action)—Under this alternative, we expect no significant changes to infrastructure or opportunities, but we still expect an increase in visitation due to word of mouth. Visitation would increase in a linear fashion from the current 300,000 visitors per year.

- Alternative B (traditional refuge)—Under this alternative, we expect minor increases in infrastructure and opportunities with a minor annual increase in visitation and a minor annual increase in programming.

- Alternative C (urban refuge)—Under this alternative, our focus is on increasing opportunities onsite with some offsite work resulting in rather dramatic annual increases in visitation (8% annually—exponential).

- Alternative D (gateway refuge)—Under this alternative, we focus on offsite opportunities, and visitation would be similar to alternative B (4% annually). It is not possible to model the collective impact of visitation in this alternative.

Using these assumptions, we calculated visitor projections; these are shown in the table I-1.

In addition, because we have seen visitation change dramatically with each change in program-

Table I-1. Initial visitor projections.

Alternative	*A*	*B*	*C*	*D*	
2013	300,000	300,000	300,000	300,000	
2014	315,000	325,000	330,000	320,000	
2015	330,000	350,000	360,000	340,000	Implement
2016	345,000	375,000	388,800	353,600	
2017	360,000	400,000	419,904	367,744	
2018	375,000	425,000	453,496	382,454	
2019	390,000	450,000	489,776	397,752	
2020	405,000	475,000	528,958	413,662	
2021	420,000	500,000	571,275	430,208	
2022	435,000	525,000	616,977	447,417	
2023	450,000	550,000	666,335	465,313	
2024	465,000	575,000	719,642	483,926	
2025	480,000	600,000	777,213	503,283	
2026	495,000	625,000	839,390	523,414	
2027	510,000	650,000	906,541	544,351	
2028	525,000	675,000	979,065	566,125	
2029	540,000	700,000	1,057,390	588,770	Year 15
2030	555,000	725,000	1,141,981	612,321	
2031	570,000	750,000	1,233,339	636,814	
2032	585,000	775,000	1,332,006	662,286	
2033	600,000	800,000	1,438,567	688,778	
2034	615,000	825,000	1,553,652	716,329	Year 20

ming and opportunity (for example, opening the auto tour route), we also calculated visitor projections with the following assumptions: adding only a handful of new opportunities under alternative B, increasing opportunities every year or so under alternative C, and providing fewer opportunities under alternative D. Projections are shown in table I-2.

To calculate final visitation projections, we simply used averaged the projections generated by the two methods described above. Final projects are shown in table I-3.

Table I-2. Revised visitor projections.

Alternative	*A*	*B*	*C*	*D*	
2013	300,000	300,000	300,000	300,000	
2014	300,000	300,000	300,000	300,000	
2015	300,000	350,000	450,000	325,000	Implement
2016	300,000	350,000	500,000	325,000	
2017	300,000	350,000	550,000	375,000	
2018	300,000	350,000	550,000	425,000	
2019	300,000	400,000	550,000	425,000	
2020	300,000	400,000	550,000	425,000	
2021	300,000	400,000	750,000	425,000	
2022	300,000	400,000	750,000	425,000	
2023	300,000	400,000	750,000	425,000	
2024	300,000	400,000	750,000	500,000	
2025	300,000	400,000	850,000	500,000	
2026	300,000	450,000	850,000	550,000	
2027	300,000	450,000	850,000	600,000	
2028	300,000	450,000	1,000,000	600,000	
2029	300,000	450,000	1,000,000	600,000	Year 15
2030	300,000	450,000	1,000,000	600,000	
2031	300,000	450,000	1,000,000	600,000	
2032	300,000	450,000	1,250,000	600,000	
2033	300,000	450,000	1,250,000	600,000	
2034	300,000	450,000	1,250,000	600,000	Year 20

Table I-3. Final visitor projections.

Alternative	*A*	*B*	*C*	*D*	
2013	300,000	300,000	300,000	300,000	
2014	307,500	312,500	315,000	310,000	
2015	315,000	350,000	405,000	332,500	Implement
2016	322,500	362,500	444,400	339,470	
2017	330,000	375,000	484,952	371,726	
2018	337,500	387,500	501,748	404,279	
2019	345,000	425,000	519,888	412,142	
2020	352,500	437,500	539,479	420,327	
2021	360,000	450,000	660,637	428,848	
2022	367,500	462,500	683,488	437,718	
2023	375,000	475,000	708,167	446,952	

Table I-3. Final visitor projections.

2024	382,500	487,500	734,821	494,065	
2025	390,000	500,000	813,606	504,072	
2026	397,500	537,500	844,695	539,489	
2027	405,000	550,000	878,271	575,333	
2028	412,500	562,500	989,532	586,621	
2029	420,000	575,000	1,028,695	598,373	Year 15
2030	427,500	587,500	1,070,990	610,606	
2031	435,000	600,000	1,116,670	623,341	
2032	442,500	612,500	1,291,003	636,598	
2033	450,000	625,000	1,344,284	650,398	
2034	457,500	637,500	1,401,826	664,765	Year 20

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