U.S. Fish & Wildlife Service

Ridgefield National Wildlife Refuge

Comprehensive Conservation Plan

Our Vision for the Future

Ridgefield National Wildlife Refuge is a place where people of all abilities can experience nature and share their outdoor traditions with others. This island of habitat with its rich diversity of floodplain forests, freshwater marshes, and meadows, will continue to sustain thriving populations of wintering dusky Canada geese, migrating waterfowl, and other wildlife. With collaboration from our conservation partners, the Refuge will apply sound, scientific principles to sustain the long-term ecological health and integrity of Lower Columbia River floodplain habitats; expand environmental education; encourage participation in wildlife-dependent recreational opportunities; protect and interpret unique cultural resources; and foster natural and cultural resources stewardship. As the rural character of the landscape changes, the Refuge will become even more important to wildlife and those seeking to understand our natural and cultural heritage.

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

Sandhill crane
©Roger Windemuth

Ridgefield
National Wildlife Refuge

Comprehensive Conservation Plan

Prepared by:
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and

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September 2010

Approved: Robyn Thorson
Regional Director, Region 1
Portland, Oregon

September 9, 2010
Date

U.S. Fish and Wildlife Service
Ridgefield National Wildlife Refuge
Comprehensive Conservation Plan
Approval Submission

In accordance with the National Wildlife Refuge System Administration Act, as amended, the U.S. Fish and Wildlife Service completed a Comprehensive Conservation Plan (CCP) for Ridgefield National Wildlife Refuge (Refuge). The purpose of this CCP is to specify a management direction for the Refuge for the next 15 years. The goals, objectives, and strategies for improving Refuge conditions—including the types of habitat we will provide, partnership opportunities, and management actions needed to achieve desired future conditions—are described in the CCP. The Service's preferred alternative for managing the Refuge is described in this CCP and the effects on the human environment were described in the Draft CCP and Environmental Assessment.

This CCP is submitted for the Regional Director's approval by:

9/9/10

Bob Flores, Project Leader
Ridgefield National Wildlife Refuge

Date

Concur: Robin L. West 9-9-10

Robin West
Refuge Supervisor

Date

Concur: Carolyn A. Bohan 9/9/10

Carolyn Bohan
Regional Chief, National Wildlife Refuge System

Date

Finding of No Significant Impact
for the
Ridgefield National Wildlife Refuge Comprehensive Conservation Plan
Clark County, Washington

The U.S. Fish and Wildlife Service (Service) has completed a Comprehensive Conservation Plan (CCP) and Environmental Assessment (EA) for Ridgefield National Wildlife Refuge (Refuge). The CCP will guide management of the Refuge for 15 years. The CCP/EA describes our proposals for managing the Refuge and their effects on the human environment under four alternatives, including the no action alternative.

Decision

Based on our comprehensive review and analysis in the CCP/EA, we selected Alternative 2 for implementation, because it will guide management of the Refuge in a manner that:

- Achieves the mission of the National Wildlife Refuge System, and the purposes, vision, and goals of the Refuge.
- Maintains and restores the ecological integrity of the Refuge's habitats and populations.
- Addresses the important issues identified during the CCP scoping process.
- Addresses the legal mandates of the Service and the Refuge.
- Is consistent with the scientific principles of sound wildlife management and endangered species recovery.
- Facilitates priority public uses appropriate and compatible with the Refuge's purposes and the Refuge System mission.

Summary of the Actions to be Implemented

Implementing the selected alternative will have no significant impacts on the environmental resources identified in the CCP/EA. Refuge management under the selected alternative will protect, maintain, and enhance habitat for priority species and resources of concern, and improve the Refuge's capability to provide food for migrating and wintering waterfowl. Improving the Refuge's floodplain/riparian forest, oak woodland, instream, and wetland habitats will increase the value of lands and waters for a wide variety of native fish and wildlife.

The availability and quality of wildlife-dependent recreation on the Refuge will improve under the selected alternative, but within a regional context, the cumulative change would be small. Implementing the Refuge hunt programs will result in no significant, adverse cumulative population level impacts to hunted or nonhunted wildlife species. A summary of the CCP actions we will implement follows.

Under Alternative 2, the Refuge will:

- Protect, maintain, and where feasible, restore habitat for priority species, including dusky Canada geese and other waterfowl, and imperiled Federal and State listed species.
- Meet Pacific Flyway management plan goals for dusky Canada geese and cackling geese.
- Maintain high-quality green forage for geese in improved pastures and wet meadows, and increase cropland and wet meadow acreage.

- Manage wetlands to increase productivity and reduce water pumping costs.
- Manage invasive species and State- and county-listed noxious weeds.
- Increase enhancement and restoration of bottomland forest and oak woodland habitats.
- Conduct habitat assessments to guide stream and tidally influenced wetland restorations.
- Increase inventory and monitoring efforts.
- Conduct studies to assess the feasibility of reintroducing native species such as Columbian white-tailed deer and western pond turtle.
- Maintain current public use areas and closures.
- Maintain the current waterfowl hunt area.
- Develop a new access point to the Refuge's River 'S' Unit, including a 2-lane bridge and 1-mile entrance road.
- Shorten the auto tour route slightly to provide habitat for dusky Canada geese and cranes.
- Construct a new 1.5-mile dike top walking trail.

Public Involvement and Changes Made to the Selected Alternative Based on Comments

We incorporated a variety of public involvement techniques in developing and reviewing the CCP/EA. This included two open houses, four planning updates, numerous meetings with partners and elected officials, and public review and comment on the Draft CCP/EA. The details of our public involvement program are described in the CCP, in Appendix J.

Based on the public comments we received and considered, Alternative 2 as described in the CCP/EA has been slightly modified. In regards to feasibility studies for establishing a Columbian white-tailed deer population, we changed "nonessential experimental population" to "population." We added a strategy to Chapter 2.4.7, Objective 7.1 (Inventory and Monitoring) related to monitoring sandhill cranes during breeding season and documenting nesting attempts.

Conclusions

Based on review and evaluation of the information contained in the supporting references, I have determined that implementing Alternative 2 as the CCP for Ridgefield National Wildlife Refuge is not a major Federal action that would significantly affect the quality of the human environment within the meaning of section 102(2)(c) of the National Environmental Policy Act of 1969. Accordingly, we are not required to prepare an environmental impact statement.

Acting Regional Director

Sept 10, 2010
Date

Supporting References

U.S. Fish and Wildlife Service. June 2010. Ridgefield National Wildlife Refuge, Draft Comprehensive Conservation Plan and Environmental Assessment.

U.S. Fish and Wildlife Service. 2010. Ridgefield National Wildlife Refuge Comprehensive Conservation Plan.

Note: This Finding of No Significant Impact and supporting references are available for public review at Ridgefield National Wildlife Refuge Complex, 28908 NW Main Avenue, Ridgefield, Washington 98642, and U.S. Fish and Wildlife Service, Division of Planning, Visitor Services, and Transportation, 911 NE 11th Avenue, Portland, Oregon, 97232. These documents can also be found on the Internet at http://pacific.fws.gov/planning/. Interested and affected parties are being notified of our decision.

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Above: Pied-billed grebe/Jim Cruce

Right: An old Oregon white oak on the Carty Unit/USFWS

A dusky Canada goose spreads its wings/Roger Windemuth

Chapter 1. Introduction and Background

1.1 Introduction

The fertile bottomlands of the lower Columbia River have long been vital to both wildlife and people. Over the millennia, the river's floodwaters altered the landscape by braiding new channels, refreshing marshes, and depositing sediments which created a mosaic of bottomland forests, meadows, and marshes, teeming with a rich diversity of fish and wildlife. Native people chose this strategic place to sustain a thriving population and trade goods among Indian tribes along the river. The wealth and prosperity resulting from these abundant natural resources were represented in their magnificent cedar plank houses and canoes. When the Lewis and Clark expedition visited the town of the Cathlapotle nation in 1805 and 1806, they noted this prosperity, as well as the abundant wildlife in the lower reaches of the Columbia River (Moulton 1990, 1991).

The Corps of Discovery's reports of the West's vast natural resources brought new immigrants to the land. The fertile river bottoms were sought out for agricultural uses to feed the burgeoning population. The cities of Portland and Vancouver grew at the confluence of the Columbia and Willamette rivers. Dams and dikes provided power and controlled floods, driving the development of agriculture and industry, but also removing the influence of the river from certain habitats. Today, only remnants remain of the diverse floodplain habitats that once covered the bottomlands of the lower Columbia River.

Today, the Ridgefield National Wildlife Refuge (refuge) preserves both habitat for wildlife, and evidence of the people who once lived here. This island of habitat with its rich diversity of floodplain forests, freshwater marshes, and meadows, continues to sustain thriving populations of wintering dusky Canada geese, migrating waterfowl, and other wildlife. The refuge also preserves the most intact archaeological site on the lower Columbia River, and evidence of at least 2,300 years of continuous human occupation. The refuge is a place where people can share a bond with nature, and each other, by passing on outdoor traditions to new generations. As the population of the region increases, the refuge will become even more important to wildlife and those seeking to connect with nature.

The Ridgefield Refuge's boundary encompasses 6,170 acres of Columbia River bottomlands and uplands in Clark County, Washington (see maps 2 and 3). Of that, the refuge manages 5,217.7 acres, owned in fee title, or managed per agreements or leases. The refuge was established in 1965 for the conservation of dusky Canada geese and other waterfowl. It contains over 5,000 acres of pastures, wetlands, riparian and bottomland forest, and oak woodlands. Ridgefield Refuge is part of the Ridgefield National Wildlife Refuge Complex, which also includes Steigerwald Lake, Pierce, and Franz Lake National Wildlife Refuges.

1.2 Proposed Action

We, the U.S. Fish and Wildlife Service (Service), manage the Ridgefield Refuge as part of the National Wildlife Refuge System. This document is the refuge's CCP. A CCP sets forth management guidance for a refuge for a period of 15 years, as required by the National Wildlife Refuge System Administration Act (16 U.S.C. 668dd et seq.) as amended by the National Wildlife

Refuge System Improvement Act of 1997 (Public Law 105-57). The Administration Act requires CCPs to identify and describe:

- The purposes of the refuge;
- The fish, wildlife and plant populations, their habitats, and the archaeological and cultural values found on the refuge;
- Significant problems that may adversely affect wildlife populations and habitats and ways to correct or mitigate those problems;
- Areas suitable for administrative sites or visitor facilities; and
- Opportunities for fish and wildlife dependent recreation.

National Wildlife Refuge System (Refuge System) planning policy (Service Manual Part 602, 602 FW3, June 21, 2000) states that the purpose of CCPs is to: "describe the desired future conditions of a refuge and provide long-range guidance and management direction to achieve refuge purposes; help fulfill the National Wildlife Refuge System mission; maintain and, where appropriate, restore the ecological integrity of each refuge and the Refuge System; . . . and meet other mandates."

The Service developed and examined alternatives for future management of Ridgefield Refuge through the CCP process. These were presented in the Draft Comprehensive Conservation Plan and Environmental Assessment (USFWS 2010). The various alternatives addressed the major issues and relevant mandates identified during the process and are consistent with the principles of sound fish and wildlife management. We evaluated four alternatives for the refuge's CCP and selected Alternative 2 as the preferred alternative.

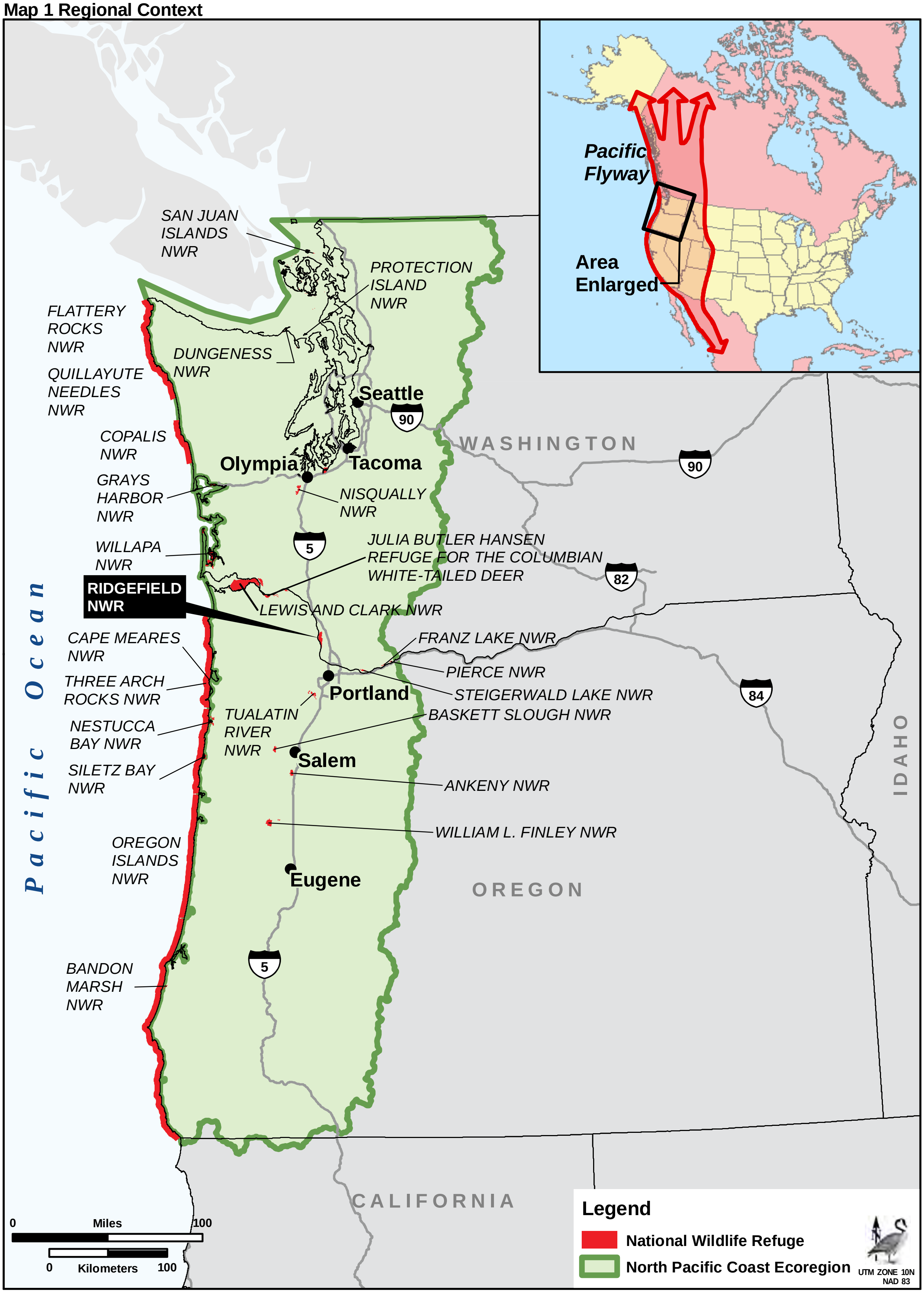
The preferred alternative represents the most balanced approach for: Achieving the refuge's purposes, vision, and goals; contributing to the Refuge System's mission; addressing relevant issues and mandates; and managing the refuge consistent with the sound principles of fish and wildlife management. The preferred alternative was slightly modified between the draft and final documents based upon comments received from the public, other agencies, and organizations. The Service's Regional Director for the Pacific Region made the final decision about the alternative to be implemented.

1.3 Purpose and Need for the CCP

The purpose of the CCP is to provide the Service, the Refuge System, partners, and the public with a 15-year management plan for improving the refuge's habitat conditions and infrastructure, for fish, wildlife, and public use. An approved CCP will ensure that the Service manages the refuge to achieve its purposes, vision, goals, and objectives; and help fulfill the mission of the Refuge System.

The CCP will provide reasonable, scientifically grounded guidance for the long-term conservation of native plants and animals, with emphasis on migratory birds and improving the refuge's grassland, wetland, riparian, and woodland habitats. The CCP will identify appropriate actions for protecting and sustaining the cultural and biological features of the refuge; its wintering waterfowl populations and habitats; the migratory landbird and waterbird populations that use the refuge; and threatened, endangered, or rare species. A final purpose of the CCP is to provide guidance and evaluate the priority public use programs on the refuge, including hunting, fishing, wildlife observation, photography, environmental education and interpretation.

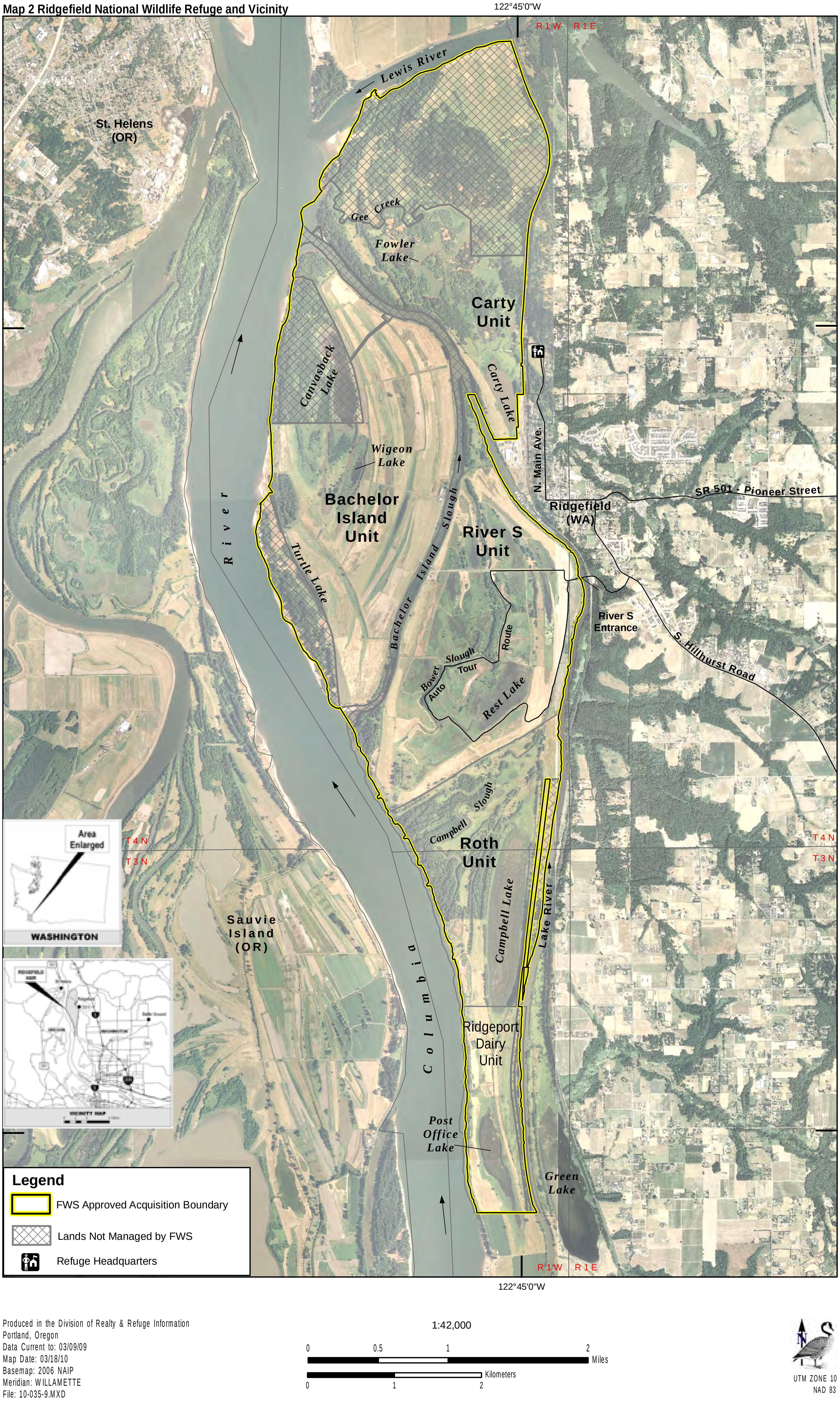
Map 1 Regional Context



Data Sources: Highways, State and Country Boundaries from ESRI; Cities from USGS; USFWS Ecoregions and Refuge Boundaries from USFWS/R1
File: 10-035-11

To preserve the quality of our map, this side was left blank intentionally.

Map 2 Ridgefield National Wildlife Refuge and Vicinity



Produced in the Division of Realty & Refuge Information
Portland, Oregon
Data Current to: 03/09/09
Map Date: 03/18/10
Basemap: 2006 NAIP
Meridian: WILLAMETTE
File: 10-035-9.MXD

The CCP is needed for a variety of reasons. Primary among these is the need to provide migration and wintering habitat for dusky Canada geese and other waterfowl in the lower Columbia River region. There is a need to improve habitat conditions on the refuge's grassland, wetland, riparian, bottomland forest, and oak woodland habitats, many of which are degraded by invasive plants and animals. There is a need to address the refuge's contributions to the recovery of Federal and State listed species native to the lower Columbia River and the Willamette Valley-Puget Trough ecoregion, including Columbian white-tailed deer, water howellia, and western pond turtle. There is a need to protect and restore habitat values for other sensitive, rare, and declining species of the lower Columbia River.

There is a need to analyze refuge public use programs for the Refuge System's wildlife-dependent priority public uses and to determine what improvements or alterations should be made in the pursuit of compatible, higher quality programs, and to accommodate increasing numbers of visitors while providing for the needs of wildlife. The refuge also includes important archaeological sites, and there is a need to address both protection of cultural resources and cultural resources education.

1.4 Content and Scope of the CCP

This CCP provides guidance for management of refuge habitats and wildlife and administration of public uses on refuge lands and waters. This CCP is intended to comply with both the Refuge System Administration Act and the National Environmental Policy Act (NEPA), as amended (42 U.S.C. 4321-4347). The CCP includes the following information.

- An overall vision for the refuge and its role in the local ecosystem (Chapter 1).
- Goals and objectives for specific habitats, research, inventory, monitoring, and public use programs, as well as strategies for achieving the objectives (Chapter 2).
- A description of the refuge's physical environment (Chapter 3).
- A description of the refuge's wildlife species and species groups identified as priority resources of concern and their habitats; their condition and trends on the refuge and within the local ecosystem; the desired ecological conditions for sustaining them, and a short analysis of threats to resources of concern and their habitats (Chapter 4).
- A description of the refuge's administrative and public use facilities, and public use programs (Chapter 5).
- A description of the refuge's historic and cultural resources, socioeconomic environment and special designation areas (Chapter 6).
- Evaluations of existing and proposed public uses for appropriateness and compatibility with the refuge's purposes (Appendices A and B).
- A comprehensive list of plants and vertebrate species known or suspected to occur on the refuge (Appendix C).
- An outline of the projects, staff and facilities needed to support the CCP's implementation (Appendix D).

1.5 Refuge Planning and Management Guidance

The refuge is managed as part of the Refuge System within a framework provided by legal and policy guidelines. This CCP is primarily guided by the provisions of the mission and goals of the Refuge System, the purposes of the refuge as described in its acquisition authority, Service policy, and Federal laws. The following summaries are provided as background for the CCP.

1.5.1 The U.S. Fish and Wildlife Service

The refuge is managed by the Service, an agency within the Department of the Interior. The Service is the principal Federal agency responsible for conserving, protecting and enhancing the Nation's fish and wildlife populations, and their habitats.

The mission of the Service is "working with others, to conserve, protect and enhance fish and wildlife and their habitats for the continuing benefit of the American people." Although we share this responsibility with other Federal, state, tribal, local, and private entities, the Service has specific trust responsibilities for migratory birds, endangered and threatened species, and certain anadromous fish and marine mammals. The Service has similar trust responsibilities for the lands and waters we administer to support the conservation and enhancement of fish, wildlife, plants, and their habitats. The Service also enforces Federal wildlife laws and international treaties for importing and exporting wildlife, assists with state fish and wildlife programs, and helps other countries develop wildlife conservation programs.

1.5.2 National Wildlife Refuge System

The Service manages the 150-million acre Refuge System. The Refuge System is the world's largest network of public lands and waters set aside specifically for conserving wildlife and protecting ecosystems. From its inception in 1903, the Refuge System has grown to encompass more than 550 national wildlife refuges; thousands of small wetlands and other special management areas; and millions of acres of islands and their surrounding marine environments in remote areas of the Pacific Ocean. The needs of wildlife and their habitats come first on refuges, in contrast to other public lands that are managed for multiple uses.

National Wildlife Refuge System Mission and Goals. 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*" (National Wildlife Refuge System Administration Act of 1966, as amended)(16 U.S.C. 668dd et seq.)

Wildlife conservation is the fundamental mission of the Refuge System. The goals of the Refuge System, as articulated in the Mission Goals and Purposes Policy (Service Manual Part 601 (601 FW1)) are to:

- 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 inter-jurisdictional 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, fishing, 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.

Law and Policy Pertaining to the Refuge System. Refuges are guided by various Federal laws and executive orders, Service policies, and international treaties. Fundamental to the management of every refuge are the mission and goals of the Refuge System and the designated purposes of the refuge unit as described in establishing legislation, executive orders, or other documents establishing, authorizing, or expanding a refuge.

Key concepts and guidance of the Refuge System derive from the National Wildlife Refuge System Administration Act of 1966 (Administration Act) as amended (16 U.S.C. 668dd-668ee); the Refuge Recreation Act of 1962 as amended (16 U.S.C. 460k-460k-4); Title 50 of the Code of Federal Regulations; and the Service Manual. The Administration Act is implemented through regulations covering the Refuge System, published in Title 50, subchapter C of the Code of Federal Regulations and policies contained in the Service Manual. These regulations and policies govern general administration of units of the Refuge System.

Many other laws apply to the U.S. Fish and Wildlife Service and management of Refuge System lands. Examples include the Endangered Species Act of 1973, as amended, and the National Historic Preservation Act of 1966, as amended. Brief descriptions of laws pertinent to Ridgefield Refuge are included in this chapter. A complete list of laws pertaining to the Fish and Wildlife Service and the Refuge System can be found at http://laws.fws.gov.

Refuge Recreation Act of 1962 (16 U.S.C. 460k-460k-4). The Refuge Recreation Act authorized the Secretary of the Interior to administer refuges, hatcheries, and other conservation areas for recreational use, when such uses do not interfere with the area's primary purposes. It provided for public use fees and permits, and penalties for violating regulations. It also authorized the acceptance of donated funds and real and personal property, to assist in carrying out its purposes. Enforcement provisions were amended in 1978 and 1984 to make violations misdemeanors in accordance with the uniform sentencing provisions of 18 U.S.C. 3551-3586.

National Wildlife Refuge System Administration Act (16 U.S.C. 668dd et seq.) as amended by the National Wildlife Refuge System Improvement Act* (Public Law 105-57). Of all the laws governing activities on national wildlife refuges, the Refuge Administration Act exerts the greatest influence. The National Wildlife Refuge System Improvement Act of 1997 (Refuge Improvement Act) amended the Administration Act by defining a unifying mission for all refuges, including a new process for determining compatible uses on refuges, and requiring that each refuge be managed under a comprehensive conservation plan. Key provisions of the Refuge Administration Act follow.

- *Comprehensive conservation planning.* A CCP must be completed for each refuge by the year 2012, as is required by the Refuge Administration Act. Each CCP will be revised every 15 years or earlier if monitoring and evaluation determine that changes are needed to achieve the refuge's purposes, vision, goals, or objectives. The Refuge Administration Act also requires that CCPs be developed with the participation of the public. Public comments, issues, and concerns are considered during the development of a CCP, and together, with the formal guidance, can play a role in selecting the preferred alternative. The CCP provides guidance in the form of goals, objectives, and strategies for refuge programs, but may lack some of the specifics needed for implementation. Therefore, step-down management plans will be developed for individual program areas as needed, following completion of the CCP. The step-down plans are founded on management goals, objectives and strategies outlined in a CCP, and require appropriate NEPA compliance.

- *Wildlife conservation; biological diversity, integrity and environmental health.* The Refuge Administration Act expressly states that the conservation of fish, wildlife and plants, and their habitats is the priority of Refuge System lands, and that the Secretary of the Interior shall ensure that the biological integrity, diversity, and environmental health of refuge lands are maintained. House Report 105–106 accompanying the Improvement Act states "… the fundamental mission of our System is wildlife conservation: wildlife and wildlife conservation must come first."

- *Refuge purposes.* Each refuge must be managed to fulfill the Refuge System mission and the specific purpose(s) for which the refuge was established. The purposes of a refuge are specified in or derived from the law, proclamation, executive order, agreement, public land order, donation document, or administrative memorandum establishing, authorizing, or expanding a refuge, refuge unit, or refuge subunit. When a conflict exists between the Refuge System mission and the purpose of an individual refuge, the refuge purpose may supersede the mission.

- *Priority public uses on refuges.* The Administration Act superseded some key provisions of the Refuge Recreation Act regarding compatibility, and also provided significant additional guidance regarding recreational and other public uses on units of the Refuge System. The Refuge Administration Act identifies six priority wildlife-dependent recreational uses. These uses are hunting, fishing, wildlife observation and photography, and environmental education and interpretation. The Service is to grant these six wildlife-dependent public uses special consideration during planning for, management of, and establishment and expansion of units of the Refuge System. When determined compatible on a refuge-specific basis, these six uses assume priority status among all uses of the refuge in question. The Service is to make extra efforts to facilitate priority wildlife-dependent public use opportunities.

Compatibility and Appropriate Refuge Uses Policies (603 FW 2 and 1). With few exceptions, lands and waters within the Refuge System are different from multiple-use public lands in that they are closed to all public access and use unless specifically and legally opened. No refuge use may be allowed or continued unless it is determined to be appropriate and compatible. Generally, an appropriate use is one that contributes to fulfilling the refuge purpose(s), the Refuge System mission, or goals or objectives described in a refuge management plan. A compatible use is a use that in the sound professional judgment of the refuge manager will not materially interfere with or detract from the fulfillment of the mission of the Refuge System or the purposes of the refuge.

The six wildlife-dependent recreational uses described in the Refuge Administration Act (hunting, fishing, wildlife observation and photography, and environmental education and interpretation) are defined as appropriate. When determined to be compatible, they receive priority consideration over other public uses in planning and management. Other nonwildlife-dependent uses on a refuge are reviewed by the refuge manager to determine if the uses are appropriate. If a use is determined appropriate, then a compatibility determination is completed.

When preparing a CCP, refuge managers must re-evaluate all general public, recreational, and economic uses (even those occurring to further refuge habitat management goals) occurring or proposed on a refuge for appropriateness and compatibility. Updated appropriate use and compatibility determinations for existing and proposed uses for the Ridgefield Refuge are in Appendices A (Appropriateness) and B (Compatibility) of this CCP.

Biological Integrity, Diversity, and Environmental Health Policy (601 FW 3). The Refuge Administration Act directs the Service to "ensure that the biological integrity, diversity, and environmental health of the National Wildlife Refuge System are maintained for the benefit of present and future generations of Americans..." The policy is an additional directive for refuge managers to follow while achieving refuge purpose(s) and the Refuge System mission. It provides for the consideration and protection of a broad spectrum of native fish, wildlife, and habitat resources found on refuges and associated ecosystems. When evaluating the appropriate management direction for refuges (e.g., in compatibility determinations), refuge managers will use sound professional judgment to determine their refuge's contribution to biological integrity, diversity, and environmental health at multiple landscape scales. Sound professional judgment incorporates field experience, knowledge of refuge resources, an understanding of the refuge's role within an ecosystem, applicable laws, and best available science, including consultation with others both inside and outside the Service. The policy states that "the highest measure of biological integrity, diversity, and environmental health is viewed as those intact and self-sustaining habitats and wildlife populations that existed during historic conditions."

Wildlife-dependent Recreation Policies (605 FW 1-7). The Refuge Administration Act states that "compatible wildlife-dependent recreation is a legitimate and appropriate general public use of the System." A series of recreation policies provide additional guidance and requirements to consider after a recreational use has been determined to be compatible. These policies also establish a quality standard for visitor services on national wildlife refuges. Through these policies, we are to simultaneously enhance wildlife-dependent recreational opportunities, provide access to quality visitor experiences, and manage refuge resources to conserve fish, wildlife, plants, and their habitats. New and ongoing recreational uses should help visitors focus on wildlife and other natural resources, and provide an opportunity to display resource issues, management plans, and how the refuge contributes to the Refuge System and the Service's mission. The policies also require development of a visitor services plan.

Research Natural Area Policy (8 RM 10). The refuge contains one Research Natural Area (RNA), the 129-acre Blackwater Island RNA, established December 1972 (Wiberg and Green 1981). Research Natural Areas have special status on lands managed by the Service. Guidance for the operation of RNAs is provided in Section 8 RM 10 of the Service's Refuge Manual, the purposes of RNAs are:

(1) "*...to preserve adequate examples of all major ecosystem types or other outstanding physical or biological phenomena;*"
(2) "*To provide research and educational opportunities for scientists and others in the observation, study, and monitoring of the environment;*" and
(3) "*...to preserve a full range of genetic and behavioral diversity for native plants and animals, including endangered or threatened species...*"

The Manual states that "*activities on RNAs are limited to research, study, observation, monitoring, and educational activities that are non-destructive, non-manipulative, and maintain unmodified conditions . . . public uses which contribute to modification of a Research Natural Area should be discontinued or expressly prohibited if such uses threaten serious impairment of research and education values*" (USFWS 1981).

1.5.3 Biological Resource Protection Acts

The refuge's plant and animal species are protected under several Federal laws, including the following.

Endangered Species Act of 1973 (16 U.S.C. 1531-1544). Through Federal action and by encouraging the establishment of state programs, the 1973 Endangered Species Act (ESA) provided for the conservation of ecosystems upon which threatened and endangered species of fish, wildlife, and plants depend. The ESA:

- Authorizes the determination and listing of species as endangered and threatened;
- Prohibits unauthorized taking, possession, sale, and transport of endangered species;
- Provides authority to acquire land for the conservation of listed species, using land and water conservation funds;
- Authorizes establishment of cooperative agreements and grants-in-aid to States that establish and maintain active and adequate programs for endangered and threatened wildlife and plants;
- Authorizes the assessment of civil and criminal penalties for violating the act or regulations; and
- Authorizes the payment of rewards to anyone furnishing information leading to arrest and conviction for any violation of the act or any regulation issued there under.

Both the Service and the National Marine Fisheries Service (NMFS) implement and enforce the ESA. The Service has primary responsibility for terrestrial and freshwater organisms, while NMFS has jurisdiction over most marine and anadromous fish listed under the ESA. Under the ESA, the Service has primary responsibility for the federally threatened water howellia, and NMFS has primary responsibility for listed anadromous fish, including the Lower Columbia River Evolutionarily Significant Units (ESU) of Chinook and coho salmon. Listed species and species of concern found on the refuge are described in Chapter 4, Section 4.9.

Section 7 of the ESA requires Federal agencies to ensure that actions authorized, funded, or carried out by them are not likely to jeopardize the continued existence of listed species, or modify critical habitat. The Service will consult with NMFS regarding potential impacts of visitor use on listed anadromous fish species found within the refuge and consult internally regarding terrestrial species. For candidate species and species of concern, refuge management activities are focused on protecting habitat and reducing threats so that these species do not need the protection of the ESA.

Migratory Bird Treaty Act of 1918 (16 U.S.C. 703-712). The framers of the Migratory Bird Treaty Act were determined to put an end to the commercial trade in birds, and their feathers, that by the early years of the 20th century had wreaked havoc on the populations of many native bird species. The Migratory Bird Treaty Act decreed that all migratory birds and their parts (including eggs, nests, and feathers) were fully protected. It is the domestic law that affirms or implements the United States' commitment to four international conventions (with Canada, Japan, Mexico, and Russia) for the protection of a shared migratory bird resource. Each of the conventions between two nations protect selected species of birds that are common to both countries (i.e., they occur in both countries at some point during their annual life cycle). All of the refuge's bird species are protected under this act, with the exception of nonnative species (European starling, house sparrow, and rock dove).

1.5.4 Historic Preservation Acts

The refuge's historic resources are protected under several Federal laws.

Archaeological Resources Protection Act of 1979, as amended (16 U.S.C. 470aa-470ll). The Archaeological Resources Protection Act largely supplanted the resource protection provisions of the Antiquities Act of 1906 for archaeological items. This act established detailed requirements for issuance of permits for any excavation for or removal of archaeological resources from Federal or Indian lands. It also established civil and criminal penalties for the unauthorized excavation, removal, or damage of any such resources; for any trafficking in such resources removed from Federal or Indian land in violation of any provision of Federal law; and for interstate and foreign commerce in such resources acquired, transported, or received in violation of any State or local law.

Public Law 100-588, approved November 3, 1988, (102 Stat. 2983) lowered the threshold value of artifacts triggering the felony provisions of the act from $5,000 to $500, made attempting to commit an action prohibited by the act a violation, and required the land managing agencies to establish public awareness programs regarding the value of archaeological resources to the Nation.

Archeological and Historic Preservation Act of 1960, as amended (16 U.S.C. 469-469c). To carry out the policy established by the Historic Sites Act, this Archeological and Historic Preservation Act directed Federal agencies to notify the Secretary of the Interior whenever they find that a Federal or federally assisted, licensed, or permitted project may cause loss or destruction of significant scientific, prehistoric, or archaeological data. The act authorized use of appropriated, donated, and/or transferred funds for the recovery, protection, and preservation of such data.

Historic Sites, Buildings and Antiquities Act of 1935 (16 U.S.C. 461-462, 464-467). This act declared it a national policy to preserve historic sites and objects of national significance, including those located on refuges. It provided procedures for designation, acquisition, administration, and protection of such sites. National Historic and Natural Landmarks are designated under authority of this act.

National Historic Preservation Act of 1966 (16 U.S.C. 470-470b, 470c-470n). This act provided for preservation of significant historical features (buildings, objects, and sites) through a grant-in-aid program to the States. It established a National Register of Historic Places and a program of matching grants under the existing National Trust for Historic Preservation (16 U.S.C. 468-468d). The act established an Advisory Council on Historic Preservation, which was made a permanent independent agency in Public Law 94-422, approved September 28, 1976 (90 Stat. 1319). That act also created the Historic Preservation Fund. Federal agencies are directed to take into account the effects of their actions on items or sites listed or eligible for listing in the National Register. As of September 2004, 157 historic sites on national wildlife refuges had been placed on the National Register, and an additional 229 sites have been identified as eligible for listing. The Basalt Cobblestone Quarries at Ridgefield Refuge were listed on the National Register of Historic Places in 1981. The refuge's Cathlapotle town site is eligible for listing.

Native American Graves Protection and Repatriation Act of 1990 (25 U.S.C. 3001-13)
This Act establishes requirements for the treatment of Native American human remains and sacred or cultural objects found on Federal land. In any case where human remains or funerary objects can be associated with specific Tribes or groups of Tribes, the agency is required to provide notice of the item in question to the Tribe or Tribes. Upon request, each agency is required to return any such item to any lineal descendant or specific Tribe with whom such item is associated.

Executive Order 11593 Protection and Enhancement of the Cultural Environment. Signed May 6, 1971, Executive Order 11593 requires that the Federal government provide leadership in preserving, restoring, and maintaining the historic and cultural environment of the Nation. Agencies of the executive branch of the government must:

1. Administer the cultural properties under their control in a spirit of stewardship and trusteeship for future generations;
2. Initiate measures necessary to direct their policies, plans, and programs in such a way that federally owned sites, structures, and objects of historical, architectural, or archaeological significance are preserved, restored, and maintained for the inspiration and benefit of the people; and
3. In consultation with the Advisory Council on Historic Preservation, institute procedures to assure that Federal plans and programs contribute to the preservation and enhancement of nonfederally owned sites, structures, and objects of historical, architectural, or archaeological significance.

1.6 Refuge Establishment and Refuge Purposes

The Refuge Administration Act directs the Service to manage refuges to achieve their purposes. The purposes for which a refuge is established form the foundation for planning and management decisions. Refuge purposes are the driving force in the development of the refuge vision statements, goals, objectives, and strategies in a CCP and are critical to determining the compatibility of existing and proposed refuge uses.

The purposes of a refuge are specified in or derived from the law, proclamation, executive order, agreement, public land order, donation document, or administrative memorandum establishing, authorizing, or expanding a refuge, refuge unit, or refuge subunit. Unless these documents indicate otherwise, purposes dealing with the conservation, management, and restoration of fish, wildlife, and plants, and the habitats on which they depend take precedence over other purposes in the management and administration of any unit.

Where a refuge has multiple purposes related to fish, wildlife, and plant conservation, the more specific purpose will take precedence in instances of conflict. When an additional unit is acquired under an authority different from the authority used to establish the original unit, the addition takes on the purpose(s) of the original unit, but the original unit does not take on the purpose(s) of the newer addition. When a conflict exists between the Refuge System mission and the purpose of an individual refuge, the refuge purpose may supersede the mission. The purposes for Ridgefield Refuge are described below.

1.6.1 Refuge Acquisition History and Authorities

In January 1964, the Service completed a Consolidated Report of the Proposed Ridgefield National Wildlife Refuge. The report was considered at a meeting of the Migratory Bird Commission (MBCC) on February 17, 1964. The report proposed the purchase of 6,538.53 acres of private land in Clark County, Washington, under the funding authority of the Migratory Bird Conservation Act (MBCA) of 1929 (45 Stat. 1222), as amended, to create the Ridgefield Refuge.

The justification for creating the refuge was that "The Western Canada goose has an extremely limited winter range, concentrated along the Willamette and Lower Columbia rivers. This subspecies is limited in numbers and requires protection and habitat to insure its continued existence." (In the later 1965 memorandum establishing the refuge, "western Canada goose" was amended to read "dusky Canada goose.") The report also noted that the human population of the Portland-Vancouver area was rapidly expanding and river bottom lands were being developed for industry and intensive farming. "This process will continue inevitably until all waterfowl habitat is gone unless the land is preserved in public ownership."

Other justifications for establishment of the refuge included providing winter food for waterfowl, providing public hunting, and reducing or insuring against crop depredation by geese and "the large numbers of mallards, pintails, and wigeon which winter in this area." During this time, most of the acreage within the proposed refuge was used for cattle production, except tracts 23 and 23a on Bachelor Island, which were used for potato farming, and tracts 14, 14a, and 24, which were private hunting clubs (see Map 3 for refuge tracts).

The Service's proposed management included creating 1,600 acres of permanent ponds and marsh by placing water control structures on Gee Creek, and by diking existing lakes; creating an additional 300 acres of seasonal ponds within diked areas; farming within diked areas; fall planting of alfalfa and grain which, supplemented by native pasture, would provide winter food for geese and wigeon; and controlling weed on overgrazed pasture land. Grazing would initially be reduced "until pastures recover from present over-use" but presumably, would be resumed in the future.

On May 18, 1965, the MBCC under the authority of the MBCA, approved the establishment of Ridgefield Refuge and identified a 6,130.8-acre refuge acquisition boundary. From the MBCC's Memorandum #1, the purpose of the new refuge was to "Provide wintering habitat for dusky Canada goose and other waterfowl." The memorandum also specified peak populations of migratory waterfowl, including 3,000 geese and 125,000 ducks, and that the refuge would also provide "breeding and migration use" for waterfowl. The importance of the refuge to dusky Canada geese was explicitly recognized: "The dusky Canada goose has an extremely limited winter range, concentrated along the Willamette and lower Columbia rivers. This subspecies is limited in numbers and requires protection and habitat to insure its continued existence." The memorandum also specifically mentioned that the refuge would provide "substantial public shooting." "A portion of the area in line with management findings but not to exceed 40 percent will be considered for waterfowl hunting in the future." A number of tracts on the River 'S' and Carty units, totaling 2,483.03 acres, were acquired under this purchasing authority using MBCA funds. Tract 21-I on the Carty Unit (24.99 acres) was also donated to the Service under authority of the MBCA.

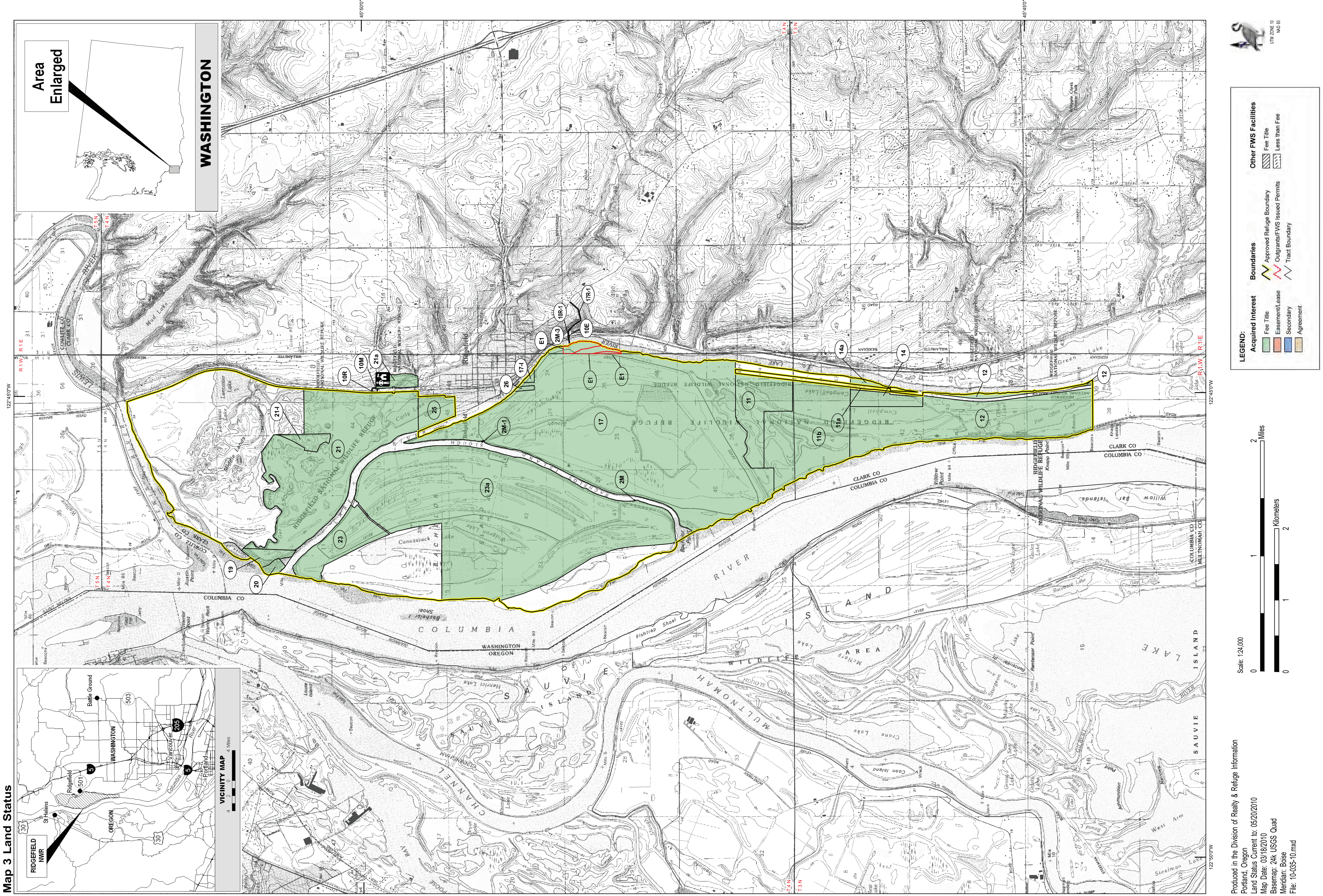
Subsequent MBCC memoranda (Memorandum #4 of August 5, 1965; Memorandum #6 of January 22, 1974; Memorandum #8 of February 5, 1985) reapproved the purchase price of remaining acreage within the acquisition boundary, due to increased land values. In all of these memoranda, the justification for acquisition was "To provide resting and wintering area for migratory waterfowl." Tracts on the Roth Unit totaling 510.4 acres were acquired under this purchasing authority using MBCA funds.

The *Environmental Impact Statement* (EIS), *Land Acquisition—Zimmerly Tract for Addition to Ridgefield National Wildlife Refuge, Washington*, dated March 1980, covered the acquisition of 1,610 acres of Bachelor Island within the approved refuge boundary. In the EIS, the Service stated that its objective for the acquisition was "To preclude uses that would be incompatible with wildlife use, such as industrial, commercial, or residential development, and to gain the capability to manage the land for increased wildlife benefits." The EIS mentioned the following species and species groups as priorities for management: wintering waterfowl, bald eagle, sandhill crane, and great blue heron.

The *Environmental Assessment* (EA), *Acquisition of Remaining Tracts, Ridgefield National Wildlife Refuge, Clark County, Washington*, dated December 1983, applied to 1,609.97 acres of Bachelor Island, and 589.31 acres of the Ridgeport Dairy Unit (the remaining tracts within the approved refuge boundary). In the EA, the Service stated that its objectives for the acquisition were "To preclude activities, such as industrial, commercial, and residential development, that would be incompatible with wildlife use; to prevent changes in the present pattern of land use; and to gain authority to manage the lands for increased wildlife benefits . . . To increase overwintering carrying capacity for dabbling ducks . . . To maintain current capacity in support of existing overwintering use by Canada geese, swans, and diving ducks."

The *Land Protection Plan* (LPP) *for Proposed Acquisitions to the Ridgefield National Wildlife Refuge*, dated November 1984, covered the same areas identified in the December 1983 EA. In the LPP, the Service stated that its objectives for the acquisition were "to preclude human activities that would be incompatible with wildlife use; to prevent major changes in the present pattern of land use; and to manage added refuge lands for increased wildlife benefits." The LPP mentioned the following species and species groups as priorities for management: wintering waterfowl, bald eagle, sandhill crane, and great blue heron. On February 11, 1985, Tracts 23 and 23a (1,609.97 acres) on Bachelor Island were purchased from Bachelor Island Ranch, Inc. with MBCA funds.

The *Preliminary Project Proposal* (May 1989) and the *Decision Document (Categorical Exclusion), Acquisition of Port of Vancouver Tract, Ridgefield National Wildlife Refuge, Clark County, Washington* (October 12, 1989) applied to 520.81 acres (Tract 12) of the Ridgeport Dairy Unit. Described in the Categorical Exclusion for the property transfer, the Service stated its objectives for the acquisition: "To preclude human activities, such as land development and commercial enterprise, (both with potential for altering habitat and polluting areas) that would be incompatible with wildlife use; to prevent major changes in the present pattern of wildlife use; and to manage added refuge land for increased wildlife benefits." The Categorical Exclusion mentioned the following species and species groups as priorities for management: "over 20 species of waterfowl wintering along the lower Columbia River including mallard, pintail, and blue winged teal . . .; six subspecies of Canada geese



Map 3 Land Status
WASHINGTON
Area Enlarged
RIDGEFIELD NWR
VICINITY MAP
LEGEND:
Acquired Interest
Fee Title
Easement/Lease
Secondary
Agreement
Boundaries
Approved Refuge Boundary
Outgrants/FWS Issued Permits
Tract Boundary
Other FWS Facilities
Fee Title
Less than Fee
Scale: 1:24,000
Miles
Kilometers
UTM ZONE 10
NAD 83
Produced in the Division of Realty & Refuge Information
Portland, Oregon
Land Status Current to: 05/20/2010
Map Date: 03/18/2010
Basemap: 24k USGS Quad
Meridian: Boise
File: 10-035-10.mxd
RIDGEFIELD NATIONAL WILDLIFE REFUGE
COLUMBIA
RIVER
WASHINGTON
OREGON
CLARK CO
COLUMBIA CO
SAUVIE ISLAND
MULTNOMAH CHANNEL

(Taverner's, dusky, western, cackling, lesser, and the endangered Aleutian); bald eagle; peregrine falcon; tundra swan; sandhill crane; shorebirds; marshbirds; and songbirds." Tract 12 on the Ridgeport Dairy Unit was purchased from the Port of Vancouver on March 1, 1991, using Land and Water Conservation Funds (LWCF), under the authority of the Fish and Wildlife Act of 1956. This is the only portion of the refuge for which we used this funding source, for all other tracts being purchased, we used MBCA funds.

The MBCC Memorandum #10, dated March 21, 1995, approved the purchase price for 68.5 acres (Tracts 14 and 14a) of the Ridgeport Dairy Unit. The purpose of this acquisition was "To preserve a major wintering area for migratory waterfowl along the Pacific Coast." These tracts were purchased from the Campbell Lake Rod and Gun Club on September 5, 1995, with MBCA funds.

The *Decision Document (Categorical Exclusion), Roth Lowlands Addition to the Ridgefield National Wildlife Refuge* (April 24, 2007) expanded the refuge's acquisition boundary by 42 acres, to include tracts between Campbell Lake and Lake River. The Service stated that its objectives for the boundary expansion were to: "reduce disturbance to roosting sandhill cranes (a State-endangered species) on Campbell Lake; reduce disturbance to dusky Canada geese and other waterfowl using adjacent pastures and wetlands; provide wintering habitat for dusky Canada geese and other migratory birds."

Table 1.1 Land purchases and purchase authorities for Ridgefield Refuge

Date	Legal Document	Direction
May 18, 1965	MBCC Memo #1	The MBCC, acting under authority of the MBCA, authorized the Service to acquire 14 tracts in Clark County, WA, totaling 6,130.08 acres at a price of $2.2 million, "to provide wintering habitat for dusky Canada geese and other waterfowl. Will also provide breeding and migration use and substantial public shooting in area. Estimated peak population: 125,000 ducks and 3,000 geese."
January 27, 1966	Warranty Deed	Tracts 21 and 21a (655.73 acres) purchased from Mary E. Carty et al. under authority of the MBCA. Purpose derived from MBCC Memo #1.
January 31, 1966	Warranty Deed	Tracts 17, 17-I, 17R, 17R-1 (total 1,739.23 acres) purchased from West Coast Farms Company under authority of the Migratory Bird Hunting and Conservation Stamp Act of 1934 (16 U.S.C. 718-718j). Purpose derived from MBCC Memo #1.
February 14, 1966	Warranty Deed	Tract 19 (23.83 acres) purchased from James E. Carty with MBCA funds. Purpose derived from MBCC Memo #1.
March 29, 1966	Warranty Deed	Tract 20 (11.47 acres) purchased from William E. Carty with MBCA funds. Purpose derived from MBCC Memo #1.
September 23, 1966	Warranty Deed	Tract 25 (49.14 acres) purchased from Albert L. Kunz with MBCA funds. Purpose derived from MBCC Memo #1.
November 17, 1966	Warranty Deed	Tract 26 (3.63 acres) purchased from Fred and Elizabeth Laws with MBCA funds. Purpose derived from MBCC Memo #1.
November 29, 1967	Quitclaim Deed	Tract 21-I (24.99 acres) donated to the Service by Constance and Aubrey Morgan under the authority of the MBCA of 1929. Purpose derived from MBCC Memo #1.

Date	Legal Document	Direction
February 22, 1968	Quitclaim Deed	Tract 21-I (24.99 acres) donated to the Service by Mary E. Carty et al. under the authority of the MBCA of 1929. Purpose derived from MBCC Memo #1.
August 5, 1969	MBCC Memo #4	Re-approved purchase of Tracts 11, 12, 14a "to provide resting and wintering area for migratory waterfowl."
October 21, 1969	Agreement Purchase of Lands	Tract 11 (153.78 acres) purchased from Rosa Roth under the authority of the MBCA of 1929 as described within MBCC Memo #1 and #4. *Agreement for Purchase of Lands dated June 16, 1969.
January 13, 1970	Warranty Deed	Tracts 11a, b, (356.62 acres) purchased from Rosa Roth under the authority of the MBCA as described within MBCC Memo #1 and #4.
March 1972	MBCC Memo (no#)	Re-approved purchase "to provide resting and wintering area for migratory waterfowl."
January 22, 1974	MBCC Memo #6	Re-approved purchase "to provide resting and wintering area for migratory waterfowl."
March 1980	EIS, Land Acquisition Zimmerly Tract	Described acquisition of 1,610 acres of Bachelor Island within the acquisition boundary "to preclude uses that would be incompatible with wildlife use, such as industrial, commercial, or residential development, and to gain the capability to manage the land for increased wildlife benefits." Species or species groups specifically mentioned were wintering waterfowl, bald eagle, sandhill crane, and great blue heron.
December 1983	EA, Acquisition of Remaining Tracts, Ridgefield Refuge	Covered acquisition of remaining tracts (12, 14, 18, 22, 23, 23a, 24, 27, 42, 41) within the approved refuge boundary "to preclude activities, such as industrial, commercial, and residential development, that would be incompatible with wildlife use; to prevent changes in the present pattern of land use; and to gain authority to manage the lands for increased wildlife benefits . . . to increase overwintering carrying capacity for dabbling ducks . . . to maintain current capacity in support of existing overwintering use by Canada geese, swans, and diving ducks."
November 1984	LPP, Proposed Acquisitions to the Ridgefield Refuge	Covered acquisition of tracts 12 (tract 41 is a part of this tract), 14, 18, 22, 23, 23a, 24, 27 and 42 within the approved refuge boundary under authority of the MBCA "to preclude human activities that would be incompatible with wildlife use; to prevent major changes in the present pattern of land use; and to manage added refuge lands for increased wildlife benefits." Species and species groups specifically mentioned were wintering waterfowl, bald eagles, sandhill cranes, great blue heron.
February 5, 1985	MBCC Memo #8	Reapproved purchase "to provide resting and wintering area for migratory waterfowl."
February 11, 1985	Warranty Deed	Bachelor Island tracts (23 and 23a with 1,609.97 acres) purchased from Bachelor Island Ranch Inc. under the authority of the MBCA. Attachment to deed states acquisition authority for the tract as "Section 5 of the Act of February 18, 1929 (45 Stat. 1222) as amended by the Improvement Act of 1978 (92 Stat 3110), Section 6 of the Act of February 18, 1929 as amended by the Section 301 of the Act of June 15, 1935 (49 Stat 381) and the Migratory Bird Hunting Stamp Act of March 16, 1934 as amended." MBCC Memos #1, #4, #6, #8 and memo of March 1972; EIS of 1980, and EA of 1983.

Date	Legal Document	Direction
October 12, 1989	CatEx (Decision Document, Acquisition of Port of Vancouver Tract)	Purpose of acquisition of Tract 12 "to preclude human activities, such as land development and commercial enterprise, (both with potential for altering habitat and polluting areas) that would be incompatible with wildlife use; to prevent major changes in the present pattern of wildlife use; and to manage added refuge land for increased wildlife benefits." Species or species groups specifically mentioned were "over 20 species of waterfowl wintering along the lower Columbia River including mallard, pintail, and blue winged teal which are listed in the *North American Waterfowl Management Plan*;" six subspecies of Canada geese (Taverner's, dusky, western, cackling, lesser, and the endangered Aleutian); bald eagle; peregrine falcon; tundra swan; sandhill crane; shorebirds; marshbirds; and songbirds.
March 1, 1991	Warranty Deed	Ridgeport Dairy tract (Tract 12 with 520.81 acres, also called the Port of Vancouver Tract) purchased from the Port of Vancouver using LWCF funding under authority of the Fish and Wildlife Act of 1956. The purposes of lands purchased with LWCF funding are "for the development, advancement, management, conservation and protection of fish and wildlife resources" (Fish and Wildlife Act of 1956, 16 U.S.C 742f(a)(4)). MBCC Memos #1, #4, #6, #8 and memo of March 1972; EA of 1983; CatEx of October 12, 1989.
March 21, 1995	MBCC Memo #10	Price approval for Tracts 14 and 14a (69 acres "to preserve a major wintering area for migratory waterfowl along the Pacific coast").
September 5, 1995	Warranty Deed	Tracts 14 and 14a (68.5 acres) purchased from Campbell Lake Rod and Gun Club under the authority of the MBCA. MBCC Memos #1, #4, #6, #8, #10 and memo of March 1972; EA of 1983.
April 24, 2007	CatEx (Decision Document, Roth Lowlands Addition)	42-acre expansion of acquisition boundary between Campbell Lake and Lake River (Tracts 40 and 40a). Purpose of addition would be to reduce disturbance to roosting sandhill cranes (a State-endangered species) on Campbell Lake; reduce disturbance to dusky Canada geese and other waterfowl using adjacent pastures and wetlands; provide wintering habitat for dusky Canada geese and other migratory birds.

1.6.2 Summary of Purposes and Management Direction for the Refuge

The purposes for Ridgefield Refuge have been identified in legal documentation establishing and adding refuge lands. Because the refuge was originally established to "Provide wintering habitat for dusky Canada goose and other waterfowl," "provide breeding and migration use [by waterfowl]," and "provide substantial public shooting opportunities . . . A portion of the area in line with management findings but not to exceed 40%, will be considered for waterfowl hunting in the future" (MBCC Memorandum 1), these represent the priority for management to achieve refuge purposes. In accordance with Director's Order No.132, all lands acquired since the original establishment of the refuge retain this purpose.

Along with managing for dusky Canada geese and other migratory waterfowl to achieve refuge purposes, legal documentation for including additional lands to the refuge identified the following purposes for specific refuge units:

- "to preclude uses that would be incompatible with wildlife use, such as industrial, commercial, or residential development, and to gain the capability to manage the land for increased wildlife benefits." (Bachelor Island, Ridgeport Dairy Units, Tract 14, Roth Unit)
- "to prevent major changes in the present pattern of wildlife use . . ." (Ridgeport Dairy Unit)
- "for the development, advancement, management, conservation and protection of fish and wildlife resources" (Fish and Wildlife Act of 1956) (Ridgeport Dairy Unit)
- "to preserve a major wintering area for migratory waterfowl along the Pacific coast." (Roth Unit, Tracts 14, 14a)

In addition to dusky Canada geese and other migratory waterfowl, the following species or species groups were identified as management priorities for the Bachelor Island and Ridgeport Dairy units, and Tract 14 of the Roth Unit: bald eagle, sandhill crane, great blue heron, peregrine falcon, shorebirds, marshbirds, and songbirds.

1.7 Relationship to Ecosystem Management Goals

1.7.1 Regional Setting

The lower Columbia River, defined as the river and adjacent bottomlands from Bonneville Dam (at river mile 145) to the mouth of the Columbia west of Astoria, contains approximately 64,000 acres of secure habitat, of which more than half is protected by the following national wildlife refuges (see map 1): Lewis and Clark Refuge (38,000 acres, including 12,167 land acres), Julia Butler Hansen Refuge (6,270 acres), Ridgefield Refuge (5, 218 acres), Franz Lake Refuge (552 acres), Steigerwald Lake Refuge (1,046 acres), and Pierce Refuge (329 acres).

Within the lower Columbia region, the lowlands of the Portland Basin (called the "Wapato Valley" by Lewis and Clark) comprise a unique setting of fertile bottomlands, most of which are now greatly altered by urban, industrial, and agricultural development. The 900-square-mile basin is generally defined as the area of low topography at the confluence of the Willamette and Columbia rivers, including the region along the Columbia River from the Sandy River downstream to the Cowlitz River, and the Willamette River north (downstream) from its falls at Oregon City to its confluence with the Columbia River (Ames 1999). Geologically, the Portland Basin proper begins roughly at the Sandy River and extends downstream to the confluence of the Lewis and Columbia rivers (Evarts et al. 2009). The Basin is considered part of the Willamette Valley-Puget Trough ecoregion, lying between the Willamette Valley to the south, and the Puget Basin to the north. Historically, the Portland Basin was an ecologically rich and productive environment, a complex of riparian and bottomland forests, sloughs, and wetlands that supported a wide diversity of wildlife and the region's densest human population prior to Euro-American contact.

Today much of the Basin is occupied by the Portland-Vancouver metropolitan areas. Outside of these areas, much of the Columbia River bottomlands, including the larger river islands, have been diked and converted to farmland, and in some cases, industrial uses. Approximately 28,000 acres of bottomland habitat of the Portland Basin are natural areas under Federal, State or local ownership, including the Ridgefield National Wildlife Refuge and Shillapoo Wildlife Area in Washington; and the Sauvie Island Wildlife Area, Smith and Bybee Wetlands Natural Area, Government Island, West Hayden Island, and the Sandy River Delta in Oregon (see Table 1.2 below).

Other areas of special biological significance include Burlington Bottoms Wildlife Mitigation Area; McGuire Island; Gary, Flag, and Chatham islands in the Columbia River northeast of the Sandy River Delta; and the Rooster Rock State Park wetlands. Most of these natural areas have a land use history of diking, farming, and/or grazing, therefore, habitat has changed significantly from historic conditions. However, they still have high value to wildlife, including migrating and wintering waterfowl and sandhill cranes, nesting great blue herons, bald eagle, osprey, and anadromous fish. Other smaller habitat areas in the Portland-Vancouver metro area are protected as state and regional parks and green spaces that are managed primarily for recreational use, but also for their scenic and wildlife values. Figure 1.2 displays the refuge and other conservation areas of the Portland Basin.

Table 1.2 Protected Bottomland Habitat in the Portland Basin (Oregon and Washington)

Area	Acres	Ownership
Ridgefield National Wildlife Refuge (WA)	5,218	U.S. Fish and Wildlife Service
Steigerwald Lake NWR (WA)	1,046	U.S. Fish and Wildlife Service
Shillapoo Wildlife Area (WA)	2,371 (Includes 477-acre Vancouver Lake Unit)	Washington Dept. of Fish and Wildlife
Sauvie Island Wildlife Area (OR)	11,500	Oregon Dept. of Fish and Wildlife
Sandy River Delta (OR)	1,400	U.S. Forest Service/Columbia River Gorge National Scenic Area
Burlington Bottoms Wildlife Mitigation Site	417	Bonneville Power Administration
Reed Island State Park (WA)	508	Washington State Parks
Rooster Rock State Park (OR)	570	Oregon Dept. of Parks and Rec.
Wapato Access Greenway State Park (Virginia Lakes, OR)	280	Oregon Dept. of Parks and Rec.
Vancouver Lake Regional Park (WA)	234	Clark County Parks
Oaks Bottom Wildlife Refuge (OR)	160	City of Portland
Big Four Corners Natural Area (OR)	165	City of Portland
West Hayden Island (OR)	370* acres proposed to be maintained as natural area (of 820 total acres) (Port of Portland 2009)	Port of Portland
Vanport Wetlands Mitigation Area (OR)	70	Port of Portland
Government Island, Lemon Island, McGuire Island (OR)	2,000 (includes 432-acre Jewett Lake mitigation area)	Port of Portland (leased to Oregon Dept. of Parks and Rec.)
Smith and Bybee Wetlands Natural Area (OR)	2,000	Metro Regional Parks and Greenspaces
East Government Island (OR)	224	Metro Regional Parks and Greenspaces
	Total 28,163 acres *Proposed site not included in total.	

1.7.2 Regional Conservation Plans

A brief summary of the major regional conservation plans we considered in the development of this CCP follows.

Washington Comprehensive Wildlife Conservation Strategy (2005) and Oregon Comprehensive Wildlife Conservation Strategy (2006). The Washington and Oregon Departments of Fish and Wildlife prepared Comprehensive Wildlife Conservation Strategies (CWCS) (WDFW 2005, and ODFW 2006) in response to two Federal programs–the Wildlife Conservation and Restoration Program and the State Wildlife Grant Program. The CWCS provide a strategic framework for the conservation of each State's wildlife species and their habitats. They include information on the distribution and abundance of priority wildlife and habitats; provide strategies for conserving and monitoring wildlife and habitat; and provide for coordination with the public and Federal, state, tribal, and local agencies. The CWCS emphasize proactive measures to conserve declining species and habitats, and to keep common species common; to "help conserve wildlife and vital natural areas before they become too rare and costly to protect" (WDFW 2005).

A number of species that were identified as Species of Greatest Conservation Need (SGCNs) in the Washington CWCS occur on the refuge, including the great blue heron, northern pintail, lesser scaup, bald eagle, peregrine falcon, Vaux's swift, purple martin, and slender-billed white-breasted nuthatch. The Pacific Townsend's big-eared bat may occur on the Refuge but has not been confirmed. Other priority species that were historically present on the refuge include Columbian white-tailed deer, western pond turtle, western gray squirrel, Mazama pocket gopher, and gray-tailed vole.

Washington Natural Heritage Plan (2007) and Oregon Natural Heritage Plan (2003). The Washington Natural Heritage Plan (WDNR 2007) addresses the State's rare plants, plant associations and landscape features. This program provides the framework for a statewide system of state-owned natural areas that provide habitat for rare and declining species and places for healthy, functioning ecosystems. The primary tool used to develop priorities for individual species is the global and state ranking system used by NatureServe and its member Natural Heritage programs. Global and state ranks have also been assigned to all terrestrial ecosystems and some of the wetland and aquatic ecosystems. The Oregon Natural Heritage Plan (Oregon Natural Heritage Program 2003) is similar in scope and methodology to the Washington Plan.

The refuge hosts two Washington Priority 1 vertebrate species–slender-billed white-breasted nuthatch, streaked horned lark, and Oregon vesper sparrow–although the latter two species are rare; one Priority 2 species–sandhill crane; one Priority 1 ecological community–overflow plain; and one Priority 2 ecological community–Oregon white oak/oval-leaf viburnum/poison oak plant community. Both priority communities occur on the Carty Unit's Blackwater Island RNA.

Willamette Valley–Puget Trough–Georgia Basin Ecoregional Assessment (2004). The Nature Conservancy, the Washington Department of Fish and Wildlife (WDFW), the Nature Conservancy of Canada, the Washington Department of Natural Resources (WDNR), and other partners have developed Ecoregional Assessments for each of Washington's nine ecoregions. The refuge lies within the area covered by the Willamette Valley–Puget Trough–Georgia Basin Ecoregional Assessment (Floberg et al. 2004). Ecoregional assessments identify ecologically significant areas for conservation action with a goal of protecting representative biodiversity. They are the result of rigorous scientific analyses, incorporating an extensive expert review. They represent the most comprehensive effort to set conservation priorities at a regional scale to date. The assessments have resulted in a series of products useful to those working to conserve biodiversity in the Pacific Northwest, including:

- A portfolio of priority conservation areas highlighting the most important and suitable areas for conservation of ecoregional biodiversity;
- Maps of relative conservation value of all lands and waters in each ecoregion; and
- A compilation of the comprehensive biodiversity information and data that were used to develop the assessment.

Lower Columbia Salmon Recovery and Fish and Wildlife Subbasin Plan (2004). The Northwest Power and Conservation Council (NPCC) was formed by the states of Washington, Oregon, Idaho and Montana to protect and mitigate fish and wildlife that are affected by development and operation of the Columbia River hydropower system while assuring an adequate power supply. The council established the Columbia River Fish and Wildlife Program to guide efforts to protect, mitigate, and enhance fish and wildlife resources. Through the Fish and Wildlife Program, the Columbia basin was divided into 62 subbasins for planning purposes. A plan was then developed for each subbasin. These plans contain the strategies that drive the implementation of the Council's Fish and Wildlife Program (NPCC 2004). Two subbasin plans apply to the refuge, the Mainstem and Estuary Subbasin Plan (vol. II.A) and the Lewis Subbasin Plan (vol. II.G) which includes Gee Creek.

The Lewis Subbasin Plan identifies fall Chinook, chum, coho, and summer and winter steelhead as focal species. Gee Creek, part of which lies on the refuge, provides some rearing habitat for native salmonids. The Mainstem Lower Columbia River and Columbia Estuary Subbasin Plan identifies the following focal species: fall Chinook salmon, spring Chinook salmon, chum salmon, coho salmon, winter and summer steelhead, Pacific lamprey, white and green sturgeon, northern pikeminnow, Pacific smelt (eulachon), river otter, Columbian white-tailed deer, Caspian tern, bald eagle, osprey, sandhill crane, yellow warbler, and red-eyed vireo. The focal fish species primarily use waters adjacent to the refuge as migration habitat, although the refuge provides some rearing habitat for Chinook salmon. The refuge is an important habitat for the focal bird species listed in the plan.

Lower Columbia River Estuary Partnership Comprehensive Conservation and Management Plan (1999). The Lower Columbia River Estuary Partnership (LCREP) is part of the National Estuary Program (NEP). The NEP was established to coordinate protection of estuaries of national significance that are threatened with ecological degradation resulting from human activities. The NEP focuses its efforts on the tidally influenced portion of the Columbia–from the river's mouth to Bonneville Dam.

In response to an agreement between the governors of Oregon and Washington, and the Environmental Protection Agency (EPA), the LCREP prepared the Comprehensive Conservation and Management Plan for the estuary (LCREP 1999). The goals of the estuary plan include: increasing habitat and habitat functions; preventing toxic and conventional pollution; improving land use practices to protect ecosystems; monitoring the health of the river and evaluating the impact of actions; strengthening coordination between the states in water quality and species issues; and enhancing educational opportunities about the lower river and estuary to build stewardship among all citizens.

For each of the estuary plan's goals, there are specific actions that may be taken to accomplish the goal. The refuge plays a significant role in achieving the recommended actions, including the following:

- Protect, conserve and enhance identified habitats, particularly wetlands, on the mainstem of the lower Columbia River.
- Preserve and/or restore buffer areas in appropriate locations along tributaries and the mainstem to a condition that is adequate to maintain a healthy, functioning riparian zone for the lower river and estuary.
- Maintain public information and education efforts about the lower river and estuary that focus on endangered species, habitat loss and restoration, biological diversity, and lifestyle practices and connections to the river.

North American Waterfowl Management Plan-Pacific Coast Joint Venture, Lower Columbia River Focus Area (1994): The North American Waterfowl Management Plan is an international action plan, signed by the United States, Canada, and Mexico, to conserve migratory birds throughout the continent. The goal of the plan is to return waterfowl populations to their 1970s levels by conserving wetland and upland habitats. Transforming the goals into on-the-ground actions is accomplished through partnerships called joint ventures. Joint ventures are comprised of individuals, corporations, conservation organizations, and local, state, provincial, and Federal agencies. Habitat joint ventures restore and enhance wetlands and associated upland habitats.

The refuge falls under a focus area plan for the lower Columbia River developed by the Oregon Habitat Joint Venture (1994). It is one of a series of Oregon "focus area" plans developed in the 1990s to provide a broad overview of wetland and wildlife resources, and describe conservation needs and opportunities in general areas identified as "target areas" for Joint Venture action. The plan included objectives to protect low lying pastureland in private ownership to provide waterfowl feeding areas; and to permanently protect, create, restore, and enhance tidal wetlands, freshwater wetlands, and associated uplands.

The plan notes that population goals for most wildlife species are not well defined and are better addressed in terms of habitat goals. The overall objective for waterfowl is to maintain populations equal to the greatest population since 1970. However the plan did state that the lower Columbia River focus area should maintain habitat capable of supporting peak populations of 6,500 tundra swans, 50,000 Canada geese, 90,000 ducks, and 150,000 shorebirds. Nesting populations of colonial birds (for example, great blue herons) should be maintained at or above their present numbers.

In addition to the overall objectives, several of the plan's recommended actions for wetland habitats are pertinent to the refuge, for example, restoring diked former tidelands where feasible and appropriate; encouraging public use of publicly owned, wetland habitat areas at levels consistent with protection of resource values; and supporting "coordinated resource management planning" and other efforts to control purple loosestrife and other invasive, nonnative species. The plan specifically recommended that the refuge "block-up public ownership with Washington Department of Wildlife in Vancouver lowlands to protect and enhance existing habitat values."

Northern Pacific Coast Regional Shorebird Management Plan (2000). The United States Shorebird Conservation Plan (Brown et al. 2001) includes 11 regional plans reflecting major shorebird flyways and habitats within the United States. The Northern Pacific Regional Working Group was formed under the auspices of the national plan to formulate shorebird management goals for the Northern Pacific Region (NPR), which represents western Washington and Oregon. The purpose of this management plan is to address shorebird management needs on a regional basis while considering Pacific Flyway and national levels of need (Drut and Buchanan 2000).

Shorebirds are a minor component of the bird species and populations at the refuge; however, drying and shallow wetlands do provide some foraging opportunities for spring and fall migrating shorebirds, especially dunlin, long-billed dowitcher, yellowlegs, western sandpipers, and least sandpipers. Changes in wetland management will create increased shallow water conditions and moist soil which will provide foraging habitat for shorebirds.

1.7.3 Pacific Flyway Management Plans

The Pacific Flyway Council is an administrative body that forges cooperation among public wildlife agencies for the purpose of protecting and conserving migratory game birds in western North America. The Council has prepared numerous management plans to date for most populations of swans, geese, and sandhill cranes in the Pacific Flyway (www.pacificflyway.gov). These plans typically focus on populations, which are the primary unit of management, but may be specific to a species or subspecies. Management plans serve to:

- Identify common goals;
- Coordinate collection and analysis of biological data;
- Establish the priority of management actions and responsibility for them; and
- Emphasize research needed to improve management.

The Council creates flyway management plans to help state and Federal agencies cooperatively manage migratory game birds under common goals. Management strategies are recommendations, but do not commit agencies to specific actions or schedules. Fiscal, legislative, and priority constraints influence the level and timing of implementation. Pacific Flyway plans generally guide management and research for a 5-year planning horizon. Several of these plans pertain to species found on the refuge. A brief summary of the flyway management plans we considered in the development of this CCP follows.

Pacific Flyway Management Plan for the Dusky Canada Goose (2008). The Pacific Flyway Management Plan for the Dusky Canada Goose (*Branta canadensis occidentalis*) (March 2008) was adopted by the Pacific Flyway Council and is a revision of earlier plans adopted by the Council (1973, 1985, 1992, and 1997). This Management Plan identifies a set of goals and objectives to assist in maintaining and enhancing the dusky Canada goose population.

Dusky Canada geese nest on Alaska’s Copper River Delta and Middleton Island, and primarily winter in the Willamette Valley, lower Columbia River, and select coastal sites in both Oregon and Washington. The population declined steeply in the early 1980s, falling from 26,000 in 1975 to less than 10,000 in 1984 and 1985, as effects of the 1964 Alaska earthquake accelerated changes to breeding ground habitats on the Copper River Delta. An increase in elevation allowed shrubs and trees to establish rapidly, creating conditions favorable to brown bears and other mammalian predators. As a result, predation on nests and adult geese increased significantly.

During the 1990s, the population was moderately stable, at about 15,000. In 2009 the population fell below 10,000, and Action Level 2 (see below) and appropriate management actions were initiated.

With ongoing forest succession on the Copper River Delta and associated predation on geese, impaired production will likely limit the population of dusky geese for the long term. Objectives of this Management Plan are to:

- Manage the number of dusky geese to sustain the population within a range of 10,000 to 20,000 geese, as measured by indices of geese on the Copper River Delta and Middleton Island, with primary consideration to: Maintain the breeding population on Copper River Delta; and maintain the dusky goose population to withstand an incidental harvest of duskys, when harvests of abundant subspecies are desired to assist in depredation control.
- Maintain and enhance breeding ground habitat conditions to achieve average annual production of 20 percent young, measured as the most recent 10-year average.
- Manage and enhance wintering and migration habitat for dusky and other geese, with an emphasis on habitat objectives outlined in the Northwest Oregon/Southwest Washington Canada Goose Agricultural Depredation Control Plan (Pacific Flyway Council 1998).

This Management Plan also identifies three action levels for increasingly intensive management efforts to benefit the population status of dusky Canada geese. These levels are designed to ensure adequate time for management actions to take effect, based on biological constraints and the expected response times of dusky Canada geese to the proposed management actions. The three action levels listed below are population based. Management procedures that relate to the levels are described in the Management Plan:

- Action Level 1: 20,000–10,000
- Action Level 2: 9,999–5,000
- Action Level 3: Below 5,000

In the event that Action Level 3 is reached, the agencies will initiate a thorough population risk assessment, review the conservation status of dusky geese, and re-evaluate all feasible and practical intensive management options.

As a cooperating wildlife agency for the welfare and management of the dusky Canada goose population, refuge management actions for the benefit of duskys will adhere to the recommendations prescribed in the Pacific Flyway Management Plan for the Dusky Canada Goose.

Pacific Flyway Management Plan for the Cackling Canada Goose (1999). The cackling Canada goose, now called the cackling goose[a] (*Branta hutchinsii minima*), is unique to the Pacific Flyway. This subspecies primarily nests in the Yukon-Kuskokwim Delta of Alaska and winters from California to Washington. Between the late 1960s and the late 1970s, cackler populations declined from more than 400,000 birds, to less than 50,000. A record low count of less than 26,000 cacklers was tallied in the fall of 1984. The steady decline likely resulted from the combined effects of spring subsistence hunting in Alaska, and sport harvest primarily in California. Cooperative conservation efforts restored the cackling goose population to about 250,000 by the time the cackler plan was written. However, there was a major shift in wintering areas. Historically, nearly all cackling geese wintered in the Central Valley of California. Since the early 1990s, the majority of cacklers have wintered in western Oregon and southwest Washington. Today cacklers are by far the most abundant goose wintering in the Willamette Valley and lower Columbia River. Over the past decade, the cackler population declined and is well below the restoration goal. The fall estimate for 2009 was 160,000, 17 percent lower than the 2008 estimate (USFWS 2009).

[a] In this CCP the term "cackling goose" refers specifically to the subspecies *B. hutchinsii minima*.

The major objectives of the cackler plan are to achieve a population of 250,000 cackling geese on breeding grounds. The plan targets a 5 to 10 percent average annual population increase toward the population objective. Additional objectives include a distribution of no more than 20 percent of the population to be wintering in the Willamette Valley and lower Columbia River. Where feasible, nesting, migration, and wintering habitat will be maintained, managed, and enhanced to meet population and public use goals. Management of habitat and harvest for cackling geese will minimize agricultural depredation complaints.

Pacific Flyway Management Plan for the Pacific Population of Western Canada Geese (2000). The Pacific population of western Canada geese (*Branta canadensis moffitti*) nest in central and southern British Columbia, northwestern Alberta, northern and southwestern Idaho, western Montana, northwestern Nevada, northern California, and throughout Washington and Oregon. A large segment of this population is nonmigratory and resident throughout the year. In response to human activities, such as transplants and artificial nesting structures, the population has expanded its historic distribution. Agricultural practices, residential expansion, and park development has further expanded this population. In some urbanized areas, the geese have become acclimated to human interaction and reside in parks.

The goals for the Pacific population of western Canada geese are to maintain a level and distribution that will optimize recreation opportunities and minimize depredation and/or nuisance problems in agricultural and urban areas. A management plan for the Pacific population of lesser Canada geese (*B. canadensis parvipes*) and Taverner's cackling geese (*B. hutchinsii taverneri)* was in draft in 1994 but was not finalized.

Pacific Flyway Management Plan for the Pacific Coast Population of Sandhill Cranes (1983). The plan objective is to maintain the wintering population in California at the mid-1980s level of 20,000 to 25,000 birds, and habitat to support that population. These birds have benefited from measures taken to manage migratory birds in general; however, their management is complicated because the relationships between the birds' breeding areas, migration routes, and wintering areas are poorly defined.

Pacific Flyway Management Plan for the Western Population of Tundra Swans (2001). The goal of the tundra swan plan is to ensure the maintenance of the western population of tundra swans, at a size and distribution that will provide for all their benefits to society (Pacific Flyway Council 2001). Objectives of the plan include maintaining a population of at least 60,000 swans in their current geographic distribution to provide suitable public benefits. For the most part, swans use lands which will continue to be managed for waterfowl in general with consideration being given to swans and other waterfowl species that are more dependent upon natural and managed wetlands than agricultural areas. Refuge wetlands provide wintering habitat for up to 3,000 tundra swans. The management practices in the CCP will ensure the continuation of that habitat.

Northwest Oregon/Southwest Washington Canada Goose Agricultural Depredation Plan (1998). This is a comprehensive nine-point plan developed by the Service, ODFW, WDFW, Animal and Plant Health Inspection Service–Wildlife Services, and the Oregon and Washington Farm Bureaus to establish a systematic and comprehensive approach for minimizing depredation losses caused by Canada geese in the Willamette Valley–Lower Columbia River (WV-LCR) area. Major objectives of the plan include the stabilization and eventual reduction in the number of wintering

Canada geese in the WV-LCR. The plan proposes the development and implementation of techniques to assess the population, distribution, and survival rates of Canada geese on both the wintering and breeding grounds.

Additionally, public lands in the WV-LCR were to be managed to provide abundant, high quality goose forage while reducing public use disturbances to increase the amount of geese on public lands, while subsequently decreasing the amount of geese on private lands. Other key components include increasing Canada goose hunting opportunities within the harvest guidelines of other Pacific Flyway population management plans and increased efforts to haze geese from private agricultural lands within the WV-LCR. Specifically, the Federal lands within the WV-LCR are to support the plan's objectives:

- To increase the amount of Canada goose use on public lands, while subsequently decreasing the amount of Canada goose occurrence on private lands;
- To review habitat management programs on refuges and wildlife areas to develop programs to increase and improve goose forage; and
- To decrease disturbance to wintering Canada geese and increase goose use of public lands by implementing public use restrictions.

Strategies identified for the refuge include:

- Implement habitat improvements projects funded as part of the Lower Columbia River-North American Wetlands Conservation Act (NAWCA) grant.
- Implement farming and grazing modifications to provide forage for Canada geese.

1.7.4 Partners in Flight Landbird Conservation Plans

Partners in Flight (PIF) is an international coalition of government agencies, conservation groups, academic institutions, private organizations, and citizens dedicated to the long-term maintenance of healthy populations of native landbirds. Partners in Flight focuses their resources toward goals of improving monitoring and inventory, research, management, and education programs involving birds and their habitats. The PIF strategy is to stimulate cooperative public and private sector efforts in North America and the Neotropics to meet these goals. Specific strategies for accomplishing the goals are contained in regional landbird conservation plans. These plans describe priority habitats and species, and provide recommended management actions to conserve priority habitats and species.

The regional plan applicable to the refuge is the Conservation Strategy for Landbirds in Lowlands and Valleys of Western Oregon and Washington (Altman and Holmes 2000). This plan identifies four priority habitats: grassland-savanna (including agricultural grasslands), oak woodland, riparian, and chaparral. Three of these habitats (riparian, oak woodland and agricultural grasslands) are found on the refuge. Eleven riparian focal species, eight oak woodland species, and four grassland species identified in the plan occur on the refuge (see Chapter 4). Refuge grasslands are heavily altered by past grazing and cropping practices, and are dominated by introduced pasture grasses and reed canarygrass. Most are managed as pastures for the benefit of Canada and cackling geese. However, even in areas dominated by nonnative grasses, suitable habitat for grassland birds exists. Mowing in managed pastures is generally delayed until July 15 after the young of grassland nesting birds have fledged. In addition, unmowed buffer areas provide considerable benefit to grassland birds.

1.7.5 Recovery Plans

Recovery plans are prepared by the Service for most endangered species. These plans specify actions that are believed to be necessary to protect and recover the species. States also prepare plans for state listed species. A brief description of Federal and state recovery plans follows.

Water Howellia (Howellia aquatilis) Recovery Plan (public and agency review draft 1996). Water howellia (*Howellia aquatilis*) was federally listed as threatened in 1994. Critical habitat was not designated, because the Service was concerned about the publication of site-specific maps of critical habitat (USFWS 1994). A recovery plan has not yet been published for this species; however, a draft recovery plan was released for public review and comment in 1996. Several small ponds containing water howellia occur on the Carty Unit (see Chapters 2, 4).

Columbian White-tailed Deer Recovery Plan (1983). The Columbian white-tailed deer (CWT deer) was federally listed as endangered in 1968. The Recovery Plan for the Columbian White-tailed Deer (USFWS 1983) states that the Columbia River population of the deer may be considered recovered if a minimum of 400 individuals can be maintained in at least three viable subpopulations distributed in suitable secure habitat. General guidelines for accomplishing this goal are:

- Maintain overall viability of 400 deer;
- Increase the subpopulation on Tenasillahe Island to a minimum viable herd of 50; and
- Secure the habitat of one additional subpopulation.

Listed stepwise under the general guidelines are specific actions that are recommended to accomplish the deer's recovery. One action that is potentially applicable to management of the refuge is "Transplant CWTD to establish new subpopulations within their historical range." Ridgefield is within the historic range of CWT deer and has been proposed as a potential transplantation site. A feasibility study required for establishing a population of CWT deer on the refuge is included as a strategy in the CCP (see Chapter 2).

Washington State Recovery Plan for the Sandhill Crane (2002). All subspecies of sandhill cranes are listed as endangered in Washington State. While some argue that the true "endangered" population in Washington is breeding greater sandhills (*G. canadensis tabida*), the Canadian sandhill (*G. c. rowani*) is of conservation concern due to its limited numbers, distinct coastal migration path, and habitat issues at breeding, staging, and wintering areas (Ivey et al. 2005). The lower Columbia River region is the only major stopover site for Canadian sandhill cranes between their northern breeding areas and wintering sites in California's Central Valley. In recent years, up to 4,273 cranes have been counted on the lower Columbia during early fall (Littlefield and Ivey 2002). Staging counts may represent the entire population nesting in coastal B.C. and southeast Alaska. The refuge provides important roosting habitat for approximately 30 percent of this population. Protection of sandhill crane roosts are, therefore, an important management issue.

Washington State Recovery Plan for the Western Pond Turtle (1999). The western pond turtle was listed as a sensitive species by WDFW in 1981. This status was changed to threatened in 1983, and endangered in November 1993. The Columbia Gorge National Scenic Area Management Plan has placed a number of identified pond turtle habitats in categories which will protect them from development and alteration. Wetland protection regulations, such as Section 404 of the Clean Water Act that regulates the discharge of fill, also applies to wetland habitat of pond turtles (Hays et al.

1999). The refuge lies within the historic range of the western pond turtle. A single individual was found on the refuge in 2005; however, subsequent surveys failed to locate more individuals.

In 1992, the Service conducted a status review for the western pond turtle in response to a petition (USFWS 1992) to list the species as threatened or endangered under the Endangered Species Act (ESA). This petition to list the species was denied, because although the turtle has declined and is affected by human activity, it still occurs in 90 percent of its historic range and is not in danger of extinction or likely to become so in the foreseeable future (USFWS 1993a). Though the western pond turtle is not protected under the Federal ESA, it is a species of special concern for the Service.

1.8 Issues, Concerns and Opportunities

1.8.1 Major Issues to be Addressed in the CCP

The core planning team evaluated the issues and concerns raised during public scoping. Issues are defined as matters of controversy, dispute, or general concern over resource management activities, the environment, land uses, or public use activities. Issues are important to the planning process because they identify topics to be addressed in the CCP, pinpoint the types of information to gather, and help define alternatives for the Draft CCP/EA. Numerous issues, concerns and opportunities were raised during the public scoping process; we addressed them all in some manner in the CCP. It is the Service's responsibility to focus planning on the major issues. Major issues typically suggest different actions or alternative solutions, are within the refuge's jurisdiction, and have a positive or negative effect on the resource. The following issues, concerns, and opportunities were considered during the development of the CCP.

Wildlife and Habitat Management. What actions should the Service take to sustain and restore priority species and habitats over a period of 15 years? What percentage of the refuge should be maintained as intensively managed habitats that primarily benefit migrating and overwintering waterfowl, and what percentage should be native habitats of the historic lower Columbia River ecosystem? How can the refuge improve the health and productivity of its wetlands, where natural hydrologic fluctuations no longer exist? Are there opportunities to restore riparian and bottomland forest, and restore tidal connections to wetlands?

Invasive Species. How will the refuge control invasive species and prevent new invasives from becoming established? What are the most appropriate strategies for controlling invasive species on the refuge?

Rare and Listed Species Recovery. What is the refuge's role in assisting in the recovery of threatened and endangered species native to the lower Columbia River ecosystem, while at the same time meeting refuge purposes to provide migration and wintering habitat for dusky Canada geese and other waterfowl? What opportunities exist to reintroduce rare and listed native species to the refuge? What actions can be taken to protect and restore habitat values for other declining species?

Impacts of Development and Climate Change. How shall the refuge address the impact of increasing development of adjacent lands on its wildlife and habitat? How will the refuge address the potential impacts of climate change?

Contaminants and Water Quality. How shall the refuge monitor for contaminants and address contaminant and water quality issues? How will the refuge improve conditions in its instream habitat and tidal wetlands for native fish?

Public Use and Access. How will the refuge meet the increasing demand for safe, accessible, high quality wildlife-dependent recreation opportunities in the future? How will the refuge provide visitors with safe and accessible access to the refuge in compliance with the Americans with Disabilities Act (ADA)? How will the refuge improve the quality of its waterfowl hunt program, while minimizing impacts to dusky Canada geese? How will the refuge address the impacts of increasing visitation on wildlife, and minimize impacts to purposes species?

Cultural Resources. How shall the refuge protect its significant archaeological and historic sites? What level and type of cultural resources education should be provided to the public? How will the Cathlapotle Plankhouse fit into interpretation and education programs on the refuge?

1.8.2 Issues Outside the Scope of the CCP

While CCPs are very comprehensive plans, no single plan can cover all issues. The planning team has compiled a list of issues which are currently considered to be outside the scope of this CCP.

Nature Center and Pedestrian Bridge to Carty Unit. In 2009 the refuge received funding to plan a nature center and administrative offices, and a pedestrian bridge to replace the existing office and bridge at the Carty Unit (the existing bridge does not meet ADA standards). The refuge prepared a draft Environmental Assessment (EA) for the construction and operation of these facilities. The EA was prepared because of potential funding timelines. The new facility would provide office space for refuge staff and areas for visitor services and educational programs, display areas, and storage. Both the new building and the bridge would meet current standards of accessibility. In the Preferred Alternative, the proposed facility would be located on the Carty Unit southwest of the existing office trailer, and the bridge would be located south of the existing footbridge. A second alternative proposes a location on Port of Ridgefield property (two other locations, the River ‘S’ Unit and property owned by Taverner LLC, adjacent to Hillhurst Road, were considered but not selected for detailed analyses). The public comment period for the Draft EA began on March 23, 2010, and closed on April 26, 2010. A Finding of No Significant Impact was signed by the FWS Regional Director on April 29, 2010.

Expansion of Refuge’s Acquisition Boundary. A proposal to expand the refuge’s acquisition boundary is not included in this CCP. The Service will analyze additional habitat protection needs and possible additions to the approved refuge boundary in future conceptual studies for habitat protection in the lower Columbia River area. In addition, an expansion will be considered as a part of a feasibility study for restoring a tidal connection to Post Office Lake (see Chapter 2, Goal 6). Priorities for acquisition of lands within the current acquisition boundary are described in Appendix M, Land Protection Plan.

City of Ridgefield Sewer Line. In 2005 the City of Ridgefield began preliminary planning to relocate its existing wastewater treatment plant outfall from its current location in Lake River to a future location in the Columbia River, in anticipation of future needs for increased capacity. As of 2006, the preliminary preferred route for a pipeline to deliver treated effluent to the Columbia River was through the refuge. Concerns about this issue were raised during public scoping. Since that time, other options for a pipeline route have been developed. Development of a new pipeline and outfall would be subject to a separate NEPA process led by the City of Ridgefield. Therefore, this issue is outside the scope of the CCP.

Eroding County Road (SR501) and Dike. Concerns regarding the erosion of the dike road at the south boundary of the refuge (Lower River Road/SR 501) were raised during public scoping. The State closed Lower River Road at the refuge's boundary due to road failure in July of 2005. In January 2006, the State abandoned its right of way from milepost (MP) 11.40 to MP 12.72. The WDOT concluded, "This road serves no useful function at this time, and this portion is unlikely ever to be extended through the RNWR." Ownership of the abandoned section reverted to Clark County, which also owns the dike. The road is barricaded, and portions of this segment have washed away, with significant bank undercutting by the Columbia River. Since the dike and road are owned by Clark County, the Service does not have the authority or the obligation to repair the road or dike. Since the dike is likely to fail in a major flood event, the CCP includes a contingency plan in the case of a dike breach (see Chapter 2).

Waterfront Development on Port of Ridgefield Property. The Port of Ridgefield is planning a mixed use waterfront development on the old Lake River Industrial Park site adjacent to the refuge, just south of Carty Lake. Redevelopment will be conducted in 7 stages over several years (Port of Ridgefield 2009). While this facility is not on refuge lands, there are safety, aesthetic, and resource concerns associated with having a high density public use area and boat launch adjacent to the refuge. On the other hand, this development would provide opportunities to improve refuge access by eliminating dangerous in-grade railroad crossings, and to create links between the refuge and local trail systems, and potentially, with mass transit systems. This issue is outside the scope of the CCP and can be better addressed as part of the planning process for that facility. However trail/access linkages with the Port of Ridgefield property were considered in the CCP (see Chapter 2, Management Direction, and Appendix L, Transportation Analysis).

Management Issues on Adjacent WDNR Land. The Washington Department of Natural Resources (WDNR) owns Turtle Lake and a portion of the shoreline of Bachelor Island. This area has become increasingly popular with hunters and other recreational users, but to date public use has been unregulated. Hunting and beach use have become a source of disturbance to wildlife on adjacent refuge lands. Developing a cooperative agreement to manage WDNR land on Bachelor Island was considered during alternatives development, however, due to limited refuge law enforcement staff, it is not feasible at this time. The Service will continue ongoing consultation with WDNR on law enforcement issues.

Floathouses. A floathouse community is located on Lake River adjacent to refuge lands, outside the refuge boundary. This topic will not be addressed in the CCP because it is outside the Service's jurisdiction. However, the impacts of refuge access alternatives to the floathouse community were considered in the development of transportation alternatives for the refuge (see Chapter 2, Management Direction, and Appendix L, Transportation Analysis).

1.9 Refuge Vision

Our vision of the future refuge follows.

> Ridgefield National Wildlife Refuge is a place where people of all abilities can experience nature and share their outdoor traditions with others. This island of habitat with its rich diversity of floodplain forests, freshwater marshes, and meadows, will continue to sustain thriving populations of wintering dusky Canada geese, migrating waterfowl, and other wildlife. With collaboration from our conservation partners, the refuge will apply sound, scientific principles to sustain the long-term ecological health and integrity of lower Columbia River floodplain habitats; expand environmental education; encourage participation in wildlife-dependent recreational opportunities; protect and interpret unique cultural resources; and foster natural and cultural resources stewardship. As the rural character of the landscape changes, the refuge will become even more important to wildlife and those seeking to understand our natural and cultural heritage.

1.10 Refuge Goals

1.10.1 Wildlife and Habitat Goals

1. Provide and manage a mixture of secure, diverse, productive grassland habitats for foraging migratory waterfowl and grassland-dependent wildlife.
2. Annually provide agricultural crops as forage for migratory waterfowl and sandhill cranes.
3. Provide, manage, and enhance a diverse assemblage of wetland habitats characteristic of the historic lower Columbia River.
4. Protect, manage, and restore a natural diversity of native floodplain forests representative of the historic lower Columbia River ecosystem.
5. Protect, manage, and restore a natural diversity of native upland forests representative of the historic lower Columbia River ecosystem.
6. Protect, enhance, and where feasible, restore riverine habitat and tidal wetlands representative of the historic lower Columbia River ecosystem, to benefit salmonids and other native aquatic species.
7. Collect scientific information (inventories, monitoring, and research) necessary to support adaptive management decisions on the refuge, associated with Goals 1-6.

1.10.2 Cultural Resources Goal

The refuge will protect and manage its cultural resources for their educational, scientific, and cultural values for the benefit of present and future generations of refuge users and communities.

1.10.3 Public Use Goals

1. Waterfowl hunters of all abilities will enjoy a quality, safe hunting program that provides a variety of waterfowl hunting experiences, promotes youth hunting, balances hunt program needs with other public use program needs, and reduces impacts to nontarget species. As a

result of participating in the waterfowl hunting program, hunters will gain a better appreciation of the refuge's mission and its resource management.

2. Visitors of all abilities will have the opportunity to participate in safe, quality wildlife-dependent recreation programs, including wildlife observation, photography, interpretation, and fishing, consistent with the needs of other public use programs, in a manner that limits wildlife disturbances, even with increasing refuge visitation. These programs will focus on enhancing public understanding and appreciation of wildlife, and building support for the Ridgefield Refuge.
3. The refuge's cultural resources and the Cathlapotle Plankhouse will be interpreted to enlighten visitors about the refuge's unique natural and cultural history. Through accurate interpretive and educational opportunities, visitors will gain an understanding and appreciation of the refuge's natural and cultural heritage.
4. Through refuge outreach efforts local residents will have the opportunity to gain an appreciation and understanding of the refuge and Refuge System mission.
5. Environmental Education: Students from southwest Washington will participate in quality environmental education programs on the refuge that meet State educational requirements, and provide safe and memorable experiences that foster a connection with nature and the refuge. As a result of their participation in these programs, students will understand the refuge's role in wildlife conservation and incorporate a conservation ethic into their everyday lives. The refuge's environmental education (EE) program shall:
    - Focus on community groups, schools, and students in southwest Washington;
    - Tier to Washington state educational objectives;
    - Balance class facilitation between refuge staff, teachers, volunteers, and partners;
    - Be fully accessible for all students; and
    - Be coordinated by a permanent full time Environmental Education Specialist.

1.11 Planning Process

A core planning team, consisting of a Project Leader, Refuge Manager, Complex Biologist, Outdoor Recreation Planner, and a Regional Planner, began developing the CCP in the fall of 2005. An extended team assisted in CCP development, particularly in reviewing preliminary goals, objectives and strategies, and in developing alternatives for the Draft CCP/EA. The extended team consisted of various professionals from other agencies and divisions within the Service. A list of core and extended team members is located in Appendix I.

Early in the planning process, the core team identified 15 priority wildlife species (resources of concern) for the refuge, their associated habitats, and other species that would benefit from managing the resources of concern. These resources of concern are listed in Chapter 4 and Appendix F. Wildlife and habitat goals and objectives were designed directly around the habitat requirements of species designated as priority resources of concern. The analytical framework for analyzing the resources of concern and for devising appropriate conservation objectives and strategies was based on the Service's *Identifying Resources of Concern and Management Priorities for a Refuge: A Handbook* (USFWS 2008). The handbook was still in draft form while this CCP was being developed, however, it had been adopted by the Service's Pacific Region as the process to develop wildlife and habitat goals and objectives for CCPs.

Public use planning centered on developing goals, objectives and strategies around the "Big Six" wildlife dependent public uses—hunting, fishing, wildlife observation and photography, and environmental education and interpretation—and the transportation and infrastructure needs associated with those uses.

Public scoping began in the fall of 2006. In September, scoping meetings were held in Ridgefield and Vancouver, Washington. Public comments were also solicited through distribution of a planning update to the refuge mailing list. In the spring of 2009 a public open house meeting was held to gather public comments on preliminary draft alternatives. An internal draft was distributed to Service Region 1 reviewers in January 2010. All changes requested by reviewers and extended team members and actual changes made were documented. The Ridgefield NWR Draft Comprehensive Conservation Plan and Environmental Assessment (DCCP/EA) was issued for public review and comment on June 16, 2010. The plan was provided on CD to a mailing list of 432 recipients, and was made available on the FWS Region 1 Planning website. Printed copies of the DCCP/EA were available upon request. The 30-day review occurred from June 16 through July 16, 2010. All changes made as a result of public and agency comments were documented. A summary of public involvement is included in Appendix J; public comments on the DCCP/EA and the Service's responses to comments are included in Appendix N.

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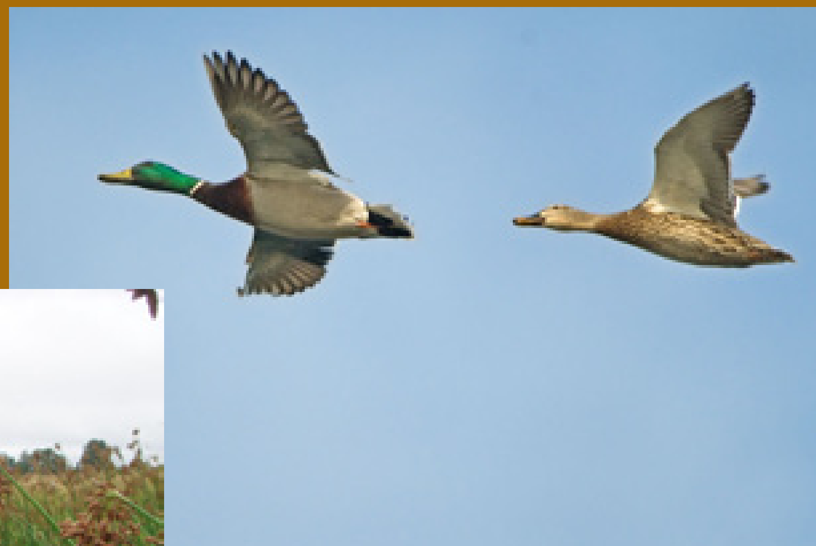
Chapter 2. Management Direction



Mallard pair/Jim Cruce

Refuge staff manages habitat to benefit both wildlife and people/ USFWS

A dramatic encounter between a rough-legged hawk and a red-tailed hawk shows why Ridgefield is a destination for wildlife watchers and photographers. /Jim Cruce

Chapter 2. Management Direction

2.1 Overview

During development of this CCP, the Service reviewed and considered a variety of resource, social, economic, and organizational aspects important for managing the refuge. These background conditions are described more fully in Chapters 3, 4, 5, and 6. As is appropriate for a national wildlife refuge, resource considerations were fundamental in designing alternatives. House Report 105-106 accompanying the Improvement Act states "…the fundamental mission of our System is wildlife conservation: wildlife and wildlife conservation must come first."

The refuge planning team reviewed available scientific reports and studies to better understand ecosystem trends and the latest scientific recommendations for species and habitats. The team met with staff from local, state, and Federal agencies, and elected officials to ascertain priorities and problems as perceived by others. Refuge staff met with refuge users, nonprofit groups, and community organizations to ensure that their comments and ideas were considered during CCP development. Refuge access emerged as an important issue, therefore, the Service commissioned a transportation access analysis that was completed by the Federal Highway Administration's Western Federal Lands Highway Division (see Appendix L). The study identified transportation alternatives that were either carried forward in the CCP or dismissed from further consideration.

2.2 Management Directions Considered but Not Developed

The details of public participation can be found in Appendix J. During development of the alternatives, the planning team considered the actions detailed below. All of these actions were ultimately eliminated for the reasons provided.

Major expansion or reduction of waterfowl hunt program. A significant expansion of the waterfowl hunt area was suggested during scoping and public review of preliminary draft alternatives. This was not included in the alternatives, because of conflicts with resource protection, and the ability of the refuge to provide adequate sanctuary area for dusky Canada geese, cackling geese, and other species. Establishing a hunt area outside the dike on Bachelor Island, in conjunction with closing core dusky Canada goose habitat on the south end of the River 'S' Unit to hunting, was been proposed in Alternative 4 of the Draft CCP/EA; however, the number of hunted acres is only a modest increase (40 acres) over current acreage. The primary rationale for this action was to create a larger contiguous block of sanctuary area for duskys and cranes. Ultimately, Alternative 4 was not selected as the Preferred Alternative.

Increasing the number of blinds within the current hunt area was also proposed in public comments on preliminary draft alternatives. This was not included in the range of alternatives, due to concerns with safety and hunt quality. Closing the refuge to hunting was suggested in public scoping. This was not included in the range of alternatives in the Draft CCP/EA because providing waterfowl hunting is one of the purposes for which the refuge was established (see Chapter 1).

Major expansion or reduction of wildlife observation and photography programs. Closing the auto tour route on hunt days, or for the entire hunting season, was proposed in public comments on the preliminary draft alternatives. This was not included as an alternative in the Draft CCP/EA due to the impacts it would have on the refuge visitors who use the auto tour route to view and photograph wildlife during the waterfowl season.

During scoping, many comments were received requesting the Service to build several additional observation/photography blinds on the River ‘S’ Unit, and/or allow the use of hunt blinds for wildlife observation/photography. These proposals were not included in the range of alternatives in the Draft CCP/EA due to conflicts with resource protection. Many comments were also received requesting that the Service allow self-guided hiking, wildlife observation, and wildlife photography (along with infrastructure to support these uses) in currently closed areas. These were not included in the range of alternatives because of impacts to sensitive species. However, guided tours to these areas (which do not require additional infrastructure) were included in the range of alternatives and appear as strategies in the CCP.

Allowing certain nonwildlife-dependent uses. The planning team considered the appropriateness of providing opportunities for various nonwildlife dependent recreational activities suggested during scoping including bicycling, dog walking, and horseback riding. These activities have been shown to have unacceptable levels of disturbance to wildlife; unacceptable public safety issues; or would interfere with users engaged in compatible wildlife-dependent uses. Therefore, bicycling, dog walking, and horseback riding were not included in the range of alternatives in the Draft CCP/EA. Based on policy guidance in the Service’s Appropriate Refuge Uses Policy 603 FW 1 (2006), these uses were determined not appropriate, and are documented on Service Form 3-2319 in Appendix A.

Developing a southern access point to the refuge. The planning team considered developing a southern access point to the refuge, through the Ridgeport Dairy and Roth units, to replace the current entrance road and bridge to the River ‘S’ Unit. This was not included in the range of alternatives in the Draft CCP/EA because a transportation access analysis (see Appendix L) concluded that such an access point would result in unacceptable impacts to dusky Canada geese and sandhill cranes, and conflict with management needs.

Reconnecting Carty Lake to the Columbia River. Although many wetlands on the River ‘S’ and Bachelor Island units are cut off from tidal influence by the refuge’s levee system, most of the water bodies and large wetlands on the Carty, Roth, and Ridgeport Dairy units are connected to the Columbia River and their water levels fluctuate with river elevations. These fluctuations are associated with hydroelectric plant operations, seasonal fluctuations related to precipitation and snowpack levels, and daily fluctuations associated with tides. The tidal range on the Columbia River near the refuge is approximately 3.3 feet, but varies with weather patterns and lunar phases. Although these wetlands are tidal, they are situated well above the salt front with salinity levels less than 1 parts-per-trillion (ppt).

Restoring tidal influence to refuge waterbodies that are currently cut off from the Columbia River would benefit several fish species such as juvenile coho and Chinook salmon, which use tidal wetlands and waterbodies for cover and foraging during out-migration. Tidal fluctuations would also allow periodic drying, nutrient release, and organic matter transport which benefits wetland plant species such as water plaintain and smartweeds. The refuge is examining the feasibility of reconnecting several wetlands and waterbodies to the Columbia River (see Chapter 2, Goal 6).

Restoring a tidal connection between Carty Lake and the Columbia River was considered but dismissed as a CCP action for several reasons: The reconnection would require dredging and spoil disposal; dredging sediments could release contaminants that originated from the Pacific Wood Treatment site; although carp currently occur in Carty Lake, their numbers are limited, in part by reducing the water's depth during summer and early fall; and a direct connection to the Columbia River would allow carp to emigrate into the lake from the river and speed recolonization. As the clean-up of the Pacific Wood Treatment site progresses and innovative methods of excluding undesirable fish species are developed, we may revisit this decision in the future.

2.3 Description of Management Direction

2.3.1 Summary of Management Direction

Implementation subject to funding availability. After the CCP is completed, actions will be implemented over a period of 15 years as funding becomes available. Project priorities and projected staffing/funding needs are included in Appendix D, Implementation.

State coordination. Under the CCP, the Service will continue to maintain regular discussions with the Washington and Oregon Departments of Fish and Wildlife (WDFW and ODFW). Key topics of discussion will include management of dusky Canada geese, cackling geese, and other waterfowl; depredation; updates of waterfowl management and depredation plans; wildlife monitoring; hunting and fishing seasons and regulations; and management of Federal and State-listed species.

Tribal coordination. The Service will coordinate and consult with the Cowlitz Tribe and the Chinook Tribe on a regular basis regarding issues of shared interest. Other Tribes with interests relating to the traditionally shared resource corridors along the lower Columbia River will also be included in consultations affecting those resources. Local Tribes include the Confederated Tribes of the Grande Ronde, the Shoalwater Bay Tribe, the Confederated Tribes of Warm Springs, and the Yakama Tribe. Currently, the Service seeks assistance from Tribes on issues related to cultural resources education and interpretation, special programs, and the National Historic Preservation Act (NHPA).

Follow recommendations in the Pacific Flyway Management Plan for the Dusky Canada Goose (2008). The Pacific Flyway Council (PFC) prepares management plans for most populations of swans, geese, and sandhill cranes in the Pacific Flyway (www.pacificflyway.gov). These plans help state and Federal agencies cooperatively manage migratory game birds under common goals. The Pacific Flyway Management Plan for the Dusky Canada Goose identifies a set of goals and objectives to assist in maintaining the dusky Canada goose population within a range of 10,000 to 20,000 (see Chapter 1).

The Dusky Canada Goose Plan also identifies three action levels for increasingly intensive management efforts to benefit the population status of dusky Canada geese. These levels are designed to ensure that adequate time is taken for management actions to take effect, based on biological constraints, and the expected response times of dusky Canada geese to the proposed management actions. The action levels listed below are population based, and management procedures that relate to these levels are described in the Dusky Canada Goose Plan:

- Action Level 1: 20,000-10,000
- Action Level 2: 9,999-5,000
- Action Level 3: below 5,000

In 2009 the population fell below 10,000; Action Level 2 and appropriate management actions were initiated. In the event that Action Level 3 is reached, the agencies will initiate a thorough population risk assessment, review the conservation status of dusky geese, and reevaluate all feasible and practical intensive management options.

As a cooperating wildlife agency (the Service) for the welfare and management of the dusky Canada goose population, refuge management actions for the benefit of duskys will adhere to the recommendations prescribed in the Pacific Flyway Management Plan for the Dusky Canada Goose. Management recommendations that will be implemented include:

- Maintaining existing pastures for goose browse: The present acreage of improved pasture will be maintained to provide forage for migrating and wintering geese.
- Continuing to provide sanctuary areas for dusky Canada geese (sanctuary areas are defined as–areas closed to hunting and significant disturbance from other public uses, to provide resting and/or feeding areas for waterfowl during the hunting season);
- Protecting dusky Canada geese, by prohibiting on-refuge goose hunting once the refuge's annual dusky harvest quota (assigned by the State) has been reached (see Appendix B, Compatibility Determination-Waterfowl Hunting).

Follow recommendations in the Pacific Flyway Management Plan for the Cackling Canada Goose (1999)**.** Major objectives of the cackling goose plan are to achieve a population of 250,000 cackling geese on breeding grounds. The plan targets a 5 to 10 percent average annual population increase toward the population objective (see Chapter 1). By the time the cackling goose plan was written, the population was approaching the restoration goal of 250,000. However, populations of cackling geese have declined over the past decade and at the present time are well below the restoration goal. As a result, providing both forage and sanctuary areas for cackling geese in Oregon and Washington is a priority for waterfowl managers. Management recommendations that will be implemented include:

- Maintaining existing pastures for goose browse: The present acreage of improved pasture will be maintained to provide forage for migrating and wintering cackling geese.
- Continue to provide sanctuary areas for migrating and wintering cackling geese.
- Protecting cackling geese by adhering to State bag limits (currently 2 birds with a 4 bird possession limit) and following the recommendations of the Pacific Flyway Management Plan for the Cackling Canada Goose (See Appendix B, Compatibility Determination-Waterfowl Hunting).

Follow recommendations in the Northwest Oregon/Southwest Washington Canada Goose Agricultural Depredation Plan (1998). The depredation plan addresses agricultural depredation caused by the large number of wintering Canada and cackling geese in the Willamette Valley-Lower Columbia River (WV-LCR) area. Public lands in the WV-LCR are to be managed to provide abundant, high quality goose forage, while reducing public use disturbances, to increase the number of geese on public lands, while subsequently decreasing the number of geese on private lands. Specifically, the Federal lands within the WV-LCR are to support the plan's objectives to:

- Increase the amount of Canada goose use on public lands, while subsequently decreasing the

amount of Canada goose occurrence on private lands;
- Review habitat management programs on refuges and wildlife areas to develop programs to increase and improve goose forage; and
- Decrease disturbance to wintering Canada geese and increase goose use of public lands by implementing public use restrictions.

Management recommendations that will be implemented include:
- Maintaining existing pastures for goose browse: The present acreage of improved pasture will be maintained to provide green forage for migrating and wintering geese and reduce depredation.
- Maintain sanctuary areas for migrating and wintering geese.

Invasive Species Control. Because invasive plants and animals currently represent the greatest threat to the refuge's wildlife and habitat, control of invasive species will be a high priority management activity. Invasive species such as ricefield bulrush, and State and County-listed noxious weeds, will continue to be a primary management concern. Nonnoxious weeds such as blackberry, reed canarygrass, and teasel, and introduced animals such as carp and nutria, also limit the refuge's ability to provide high quality habitat for purposes and trust species, and will be controlled to the degree that funding permits. Invasive species control will be initiated prior to or concurrently with habitat restoration efforts. An Integrated Pest Management plan was developed concurrently with the CCP to address invasive species control on the refuge, and is included as Appendix K.

Integrated Pest Management. In accordance with Department of the Interior and Service policy (517 DM 1 and 7 RM 14), an integrated pest management (IPM) approach will be utilized where practicable, to eradicate, control, or contain pest and invasive species (herein collectively referred to as pests) on the refuge. An IPM approach will involve using methods based upon effectiveness, cost, and minimal ecological disruption, which considers minimum potential effects to nontarget species and the refuge environment. Pesticides may be used where physical, cultural, and biological methods or combinations thereof, are impractical or incapable of providing adequate control, eradication, or containment. Furthermore, pesticides will be used primarily to supplement, rather than as a substitute for practical and effective control measures of other types.

If a pesticide is needed on the refuge, the most specific (selective) chemical available for the target species will be used, unless considerations of persistence or other environmental and/or biotic hazards preclude it. In accordance with 517 DM 1, pesticide usage will be further restricted, because only pesticides registered with the Environmental Protection Agency (EPA), in full compliance with the Federal Insecticide, Fungicide, and Rodenticide Act, and as provided in regulations, orders, or permits issued by EPA, may be applied on lands and waters under refuge jurisdiction.

Environmental harm by pest species will refer to a biologically substantial decrease in environmental quality as indicated by a variety of potential factors, including declines in native species populations or communities, degraded habitat quality or long-term habitat loss, and/or altered ecological processes. Environmental harm may result from direct effects to native species from pests, including preying and feeding on native species; causing or vectoring diseases; preventing natives from reproducing or killing their young; out-competing native species for food, nutrients, light, nest sites or other vital resources; or hybridizing with natives so frequently that within a few generations few if any truly native individuals remain.

In contrast, environmental harm can be the result of an indirect effect of pest species. For example, decreased waterfowl use may result from invasive plant infestations reducing the availability and/or abundance of native wetland plants that provide forage for native species during the winter. Environmental harm may also include detrimental changes in ecological processes. For example, reed canarygrass in bottomland ash forest can prevent recruitment of ash, and displace native sedges, grasses, forbs, and shrubs.

See Appendix K for the refuge's IPM program documentation to manage pests. Along with a more detailed discussion of IPM techniques, this documentation describes the selective use of pesticides for pest management on the refuge, where necessary. Throughout the life of the CCP, most proposed pesticide uses on the refuge will be evaluated for potential effects to refuge biological resources and environmental quality. These potential effects will be documented in Chemical Profiles (see Appendix K). Pesticide uses with appropriate and practical best management practices (BMPs) for habitat management as well as cropland/facilities maintenance will be approved for use on the refuge where there likely will be only minor, temporary, and localized effects to species and environmental quality based upon non-exceedance of threshold values in Chemical Profiles. However, pesticides may be used on a refuge where substantial effects to species and the environment are possible (exceed threshold values) in order to protect human health and safety (e.g., mosquito-borne disease).

Contingency plan for dike breach. Post Office Lake, on the Ridgeport Dairy Unit, is a 75-acre former tidal wetland that is now separated from the Columbia River by a dike. The dike is not owned by the Service, and is currently in poor condition. The dike is likely to fail during the next major flood event. A dike breach would re-establish the former tidal connection between the river and the lake. Post Office Lake would be allowed to re-establish a tidal connection to Columbia River through natural processes. The CCP includes the development of a contingency plan that will take effect in the event of a dike breach. Because the southern tip of the lake is outside the current refuge boundary, a boundary expansion will need to be considered. This will be done as part of a larger land protection planning study for the Lower Columbia River area (see below). As part of this study, we will analyze alternatives for possibly expanding the refuge's boundary to include the southern portion of Post Office Lake and adjoining areas.

Participation in Lower Columbia River Land Protection Planning. Within 2 years of CCP completion we will initiate and complete a Land Protection Planning effort within the Lower Columbia River area (Bonneville Dam to the mouth of the Columbia) in cooperation with other refuges, agencies, and interested parties to assess and identify land conservation priorities. Potential additions or expansion of the refuges within this focus area, including Ridgefield NWR, and examination of various land protection tools will be explored. Land Protection as part of the NWRS may include fee title acquisition, conservation easements and cooperative agreements.

Nature center and pedestrian bridge to the Carty Unit. The refuge has prepared a separate Environmental Assessment (EA) for the construction and operation of an administrative site, including staff offices, a nature center, and a pedestrian bridge to replace the existing office and bridge at the Carty Unit (see Chapter 1, Issues Outside the Scope of the CCP). The EA was prepared in a separate planning effort to meet potential funding timelines. The Draft EA was released for public review on March 23, 2010, and the public comment period closed on April 26, 2010. A Finding of No Significant Impact was issued on April 29, 2010. Because the refuge has had an ongoing need for staff offices and visitor facilities, seeking funding for the construction of these facilities is part of the CCP.

Cultural resource protection and Section 106 compliance. Actions with the potential to affect cultural resources will undergo a thorough review before being implemented, as is consistent with the requirements of cultural resource laws. All ground-disturbing projects will undergo a review under Section 106 of the National Historic Preservation Act.

Emphasis on wildlife-dependent public uses. With its close proximity to the cities of Portland and Vancouver, and as the surrounding area is developed, Ridgefield Refuge has become an increasingly “urban” refuge. Refuge visitation has increased 8-fold since the 1980s when approximately 22,000 people visited the refuge annually. The average annual visitation from 2000 to 2007 has been over 162,000 visitors. Most of this increase has been in visitation for nonconsumptive uses (wildlife observation and photography). There is also considerable demand for environmental education programs from local schools. Because of its proximity to a large urban area, the potential for the refuge to connect urban dwellers to nature—and thereby build support for the Refuge System mission—is high. Therefore, providing wildlife dependent public uses is a high priority.

Maintain waterfowl hunting opportunities. Because providing waterfowl hunting opportunities is one of the refuge’s establishing purposes and when compatible, is considered a priority public use on National Wildlife Refuges, and because demand for waterfowl hunting on the refuge has remained constant over the past 40 years despite declining trends elsewhere in the region, the refuge will continue to provide, at a minimum, the same hunting opportunities as it currently does. Location of hunt areas and blinds may be adjusted based on habitat conditions or safety concerns.

Monitor effects of public use programs on wildlife. Monitoring to assess the effects of public use on wildlife will be conducted. Area, timing, and/or conduct of public use will be modified if disturbance to wildlife or habitat degradation reaches unacceptable levels.

Maintenance and updating of existing facilities. Periodic maintenance and updating of refuge buildings and facilities will be necessary. Periodic updating of facilities is necessary for safety and accessibility, reducing the refuge’s carbon footprint, and to support staff and management needs; and is incorporated in the Service Asset Management System.

Reduce the refuge’s carbon footprint. The Service has developed a Strategic Plan for Responding to Accelerating Climate Change in the 21st Century (2009), and a 5 year Action Plan outlining specific actions needed to implement the Strategic Plan. The Action Plan calls for the Service to make its operations carbon-neutral by 2020. The refuge will work toward this goal by replacing its current vehicles with more fuel efficient vehicles, and by building appropriately sized, energy efficient facilities, as funding becomes available. The refuge will also reduce the carbon footprint of land management activities by using energy-efficient techniques, where feasible and in line with management goals. The refuge will also explore ways of offsetting any remaining carbon balance, such as carbon sequestration.

Management of minor recreational uses. Minor recreational activities are occasionally pursued on the refuge. Such recreational activities not specifically addressed in this document may be allowed on refuge lands if the Refuge Manager first finds that they are appropriate and compatible.

Participation in planning and review of regional development activities. The Service will actively participate in planning and studies pertaining to future industrial and urban development, transportation, recreation, contamination, and other potential concerns that may affect refuge resources. The Service will continue to cultivate working relationships with county, State, and Federal agencies to stay abreast of current and potential developments; and will utilize outreach and education as needed to raise awareness of refuge resources and dependence on the local environment.

Volunteer opportunities and partnerships. Volunteer opportunities and partnerships are key components of the successful management of public lands, and are vital to refuge programs, plans, and projects, especially in times of static or declining budgets. Currently the refuge makes extensive use of volunteers in invasive species control, habitat restoration, and public use programs. In the future, successful implementation of native habitat restoration, survey and monitoring activities, and environmental education and interpretation programs will require the use of partnerships and volunteers.

Wilderness review. The Service's CCP policy requires that a wilderness review be completed for all CCPs. If it is determined that the potential for wilderness designation is found, the process moves on to the wilderness study phase. As part of the process for this CCP, the planning team completed a wilderness review which can be found in Appendix E. This review concluded that the refuge is not suitable for wilderness designation.

2.3.2 Summary of Management Direction

A brief description of the management direction follows. Maps displaying the management direction for the refuge follow this description. Maps 4 through 7 display the targets for habitat management over the next 15 years, while map 8 displays public use facilities that will be maintained or developed over the next 15 years.

Wildlife and Habitat. The refuge will continue to protect, maintain, and where feasible, restore habitat for priority species, including dusky Canada geese, other waterfowl, and Federal and State listed species. Sanctuary area (area closed to public use) will remain the same as current management practices (see Public Use and Access).

Winter browse (managed pasture) for Canada and cackling geese will be maintained. The refuge will provide overwintering and migrating waterfowl with high quality, easily accessible food, by maintaining high quality green forage in improved pastures and wet meadows, promoting the growth of food plants in shallow wetlands, and planting crops to supplement natural food production. Management actions to increase forage quality for dusky Canada geese in their primary-use foraging habitats receive the highest priority. Approximately 150 acres of old fields are converted to managed pasture and wet meadow to benefit geese. There is an increase in acres managed as cropland (from the current range of 155-185 acres, to a range of 290-330 acres, including interseeded small grains and corn). These management actions are also expected to benefit sandhill cranes.

Wetlands will be maintained, but management will be enhanced to increase productivity. Managed wetlands will undergo rotation to manage vegetation and control invasive species. Where water control capabilities exist, seasonal wetlands will be managed as moist soil units to promote growth of native food plants for waterfowl. Incremental floodup of seasonal wetlands through the fall and winter will reduce pumping costs, and improve the availability of food for waterfowl.

Invasive species and State and county-listed noxious weeds continue to be a primary management concern. Treatment will focus on existing populations; however, annual priorities for control may change, depending on the extent of current species coverage and the occurrence of new species.

The refuge will increase management to enhance or where feasible, restore native habitats of the lower Columbia River where this does not conflict with management for purposes and trust species. Enhancing and restoring riparian/bottomland forest and oak woodland receive greater emphasis than under current management practice. Invasive species monitoring and control in forest and oak woodland habitats increases. Approximately 160 acres of bottomland forest, 20 acres of oak woodland, and 5 acres of ash forest will be restored over the lifetime of the CCP, mostly on areas currently in old fields. Restoration projects emphasize habitat connectivity (creating larger blocks of contiguous habitat). A tidal wetlands restoration plan, and habitat assessments of Gee Creek, Campbell Slough, and Campbell Lake, will be completed to guide future restoration of instream and tidally influenced habitats.

The refuge will contribute to the recovery of threatened, endangered, or rare species of the lower Columbia River and the Willamette Valley-Puget Trough ecoregion. Feasibility studies for the reintroduction of native species such as Columbian white-tailed deer and western pond turtle will be conducted. Working with partners, the refuge will increase inventory and monitoring efforts and address pressing research needs, for example: inventory and monitoring of waterfowl populations and habitat conditions; habitat assessments of woodland, grassland, and aquatic habitats; and baseline inventories of small mammals, reptiles, and amphibians, and other species groups that have been studied very little to date.

Public Use and Access. The River ‘S’ and Carty units will be open to public use year-round. Current wildlife sanctuary areas (areas closed to public use) will be maintained. The Roth, Ridgeport Dairy, and Bachelor Island units will remain closed to public use. A new access point to the River ‘S’ Unit will be developed (a 2-lane bridge originating from the Port of Ridgefield property). The existing bridge to the River ‘S’ Unit will be removed and the easement abandoned. The waterfowl hunt area/location will remain the same as in current management practice (790 acres, River ‘S’ Unit). The hunter check station will be moved to the current entrance; Teal Marsh will be rehabilitated, and 1 or 2 new blinds will be established on the west side of the River ‘S’ Unit to compensate for losing blind 4 (lost to new bridge construction). Changes in flooding regime will be expected to benefit food plants used by waterfowl; therefore, the hunt program will improve over time. The location of hunting blinds will be adjusted where necessary due to the change in flooding regime.

The existing auto tour route will remain in its current location, and be open year-round; however, the length will be reduced from 4.3 to 4.0 miles by cutting off a small loop at the southeast corner to provide contiguous habitat area for dusky Canada geese and cranes. Walking dates on the River ‘S’ Unit will remain the same as current (May 1-Sept 30). A new 1.5- mile (one way) dike-top walking trail and overlook will be constructed on the north end of the River ‘S’ Unit. Environmental education programs will increase from 2,000-3,000 students served annually to 4,500. Cultural resources education and interpretation programs will increase.

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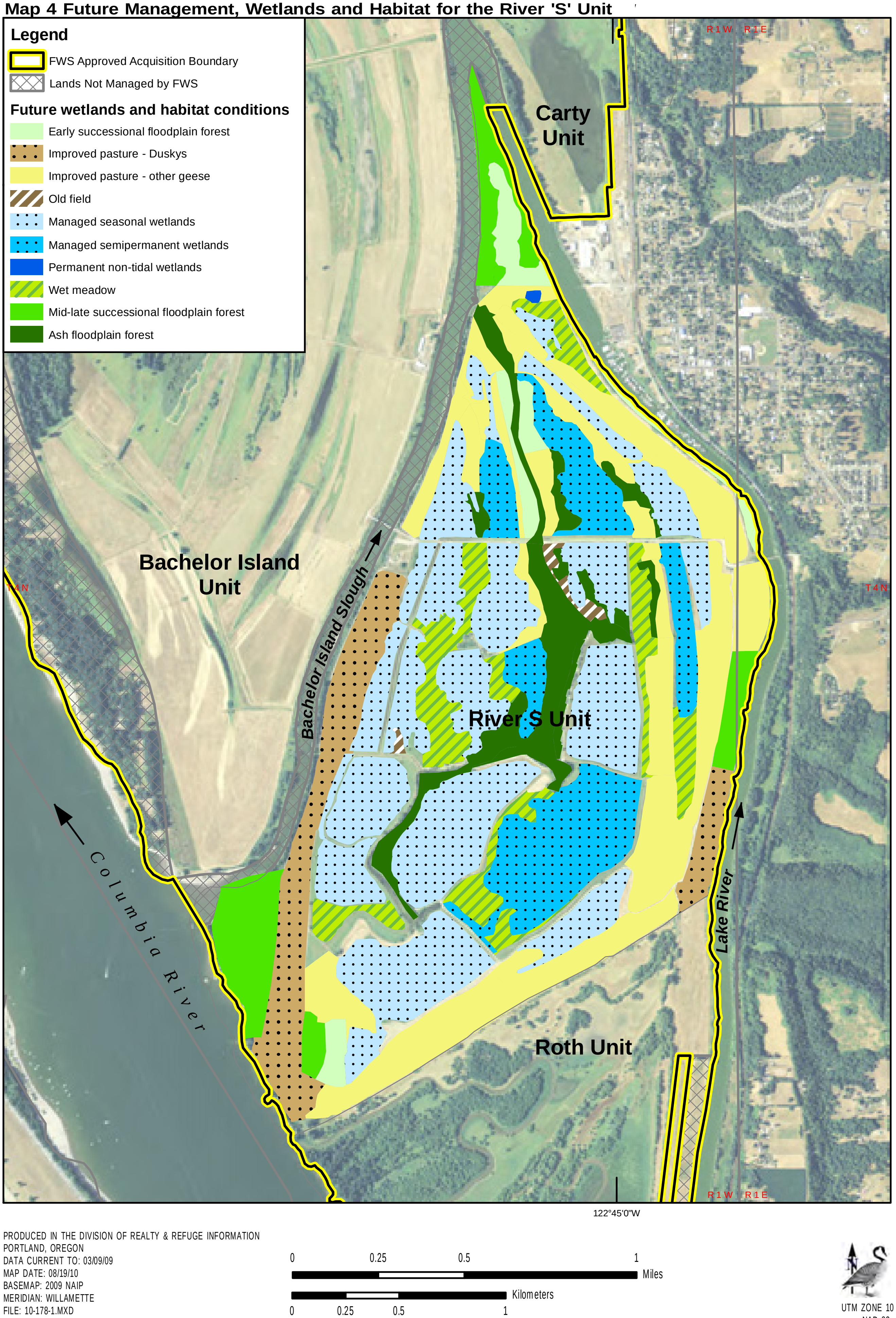
Map 4 Future Management, Wetlands and Habitat for the River 'S' Unit



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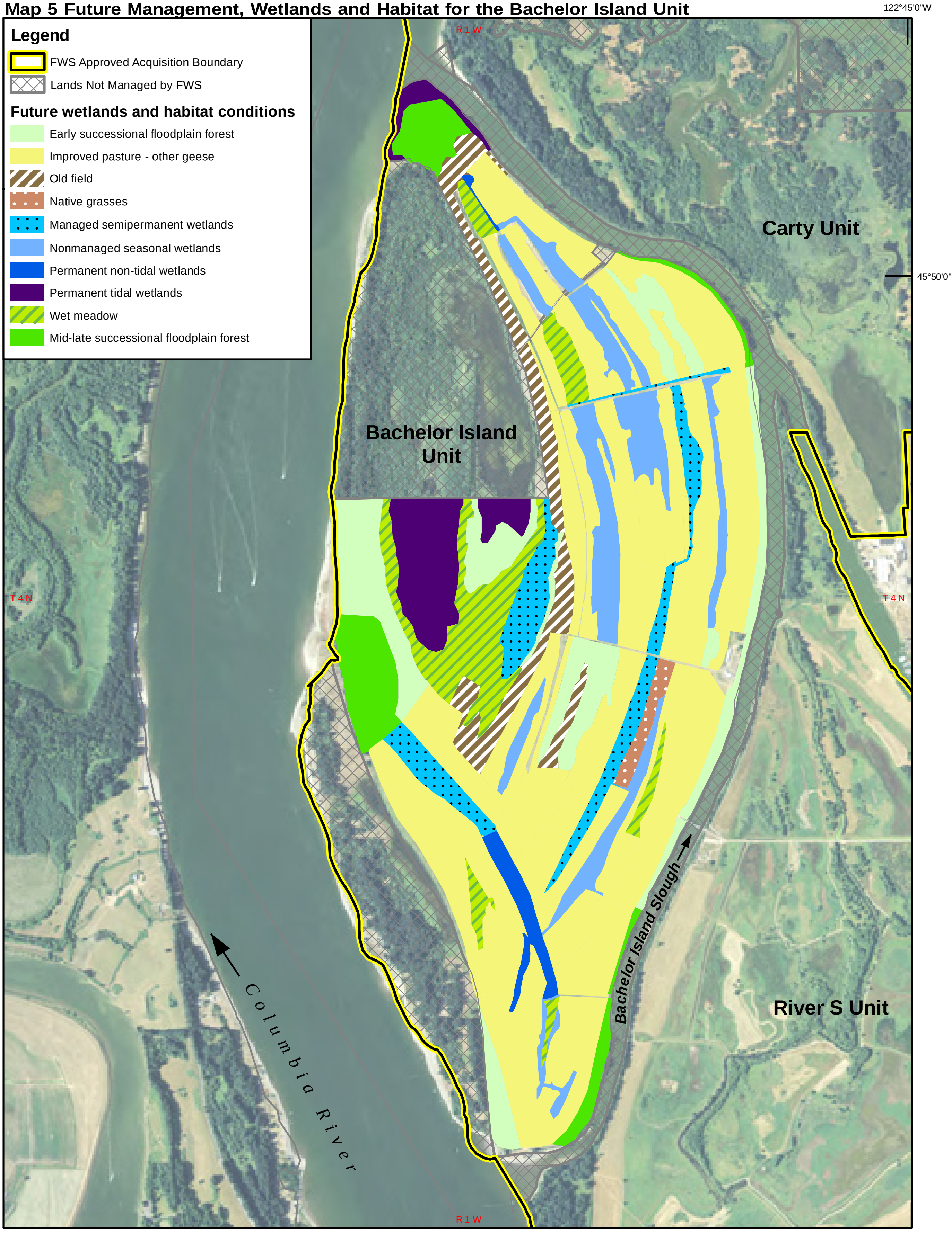
Map 5 Future Management, Wetlands and Habitat for the Bachelor Island Unit



PRODUCED IN THE DIVISION OF REALTY & REFUGE INFORMATION
PORTLAND, OREGON
DATA CURRENT TO: 03/09/09
MAP DATE: 08/19/10
BASEMAP: 2009 NAIP
MERIDIAN: WILLAMETTE
FILE: 10-178-2.MXD

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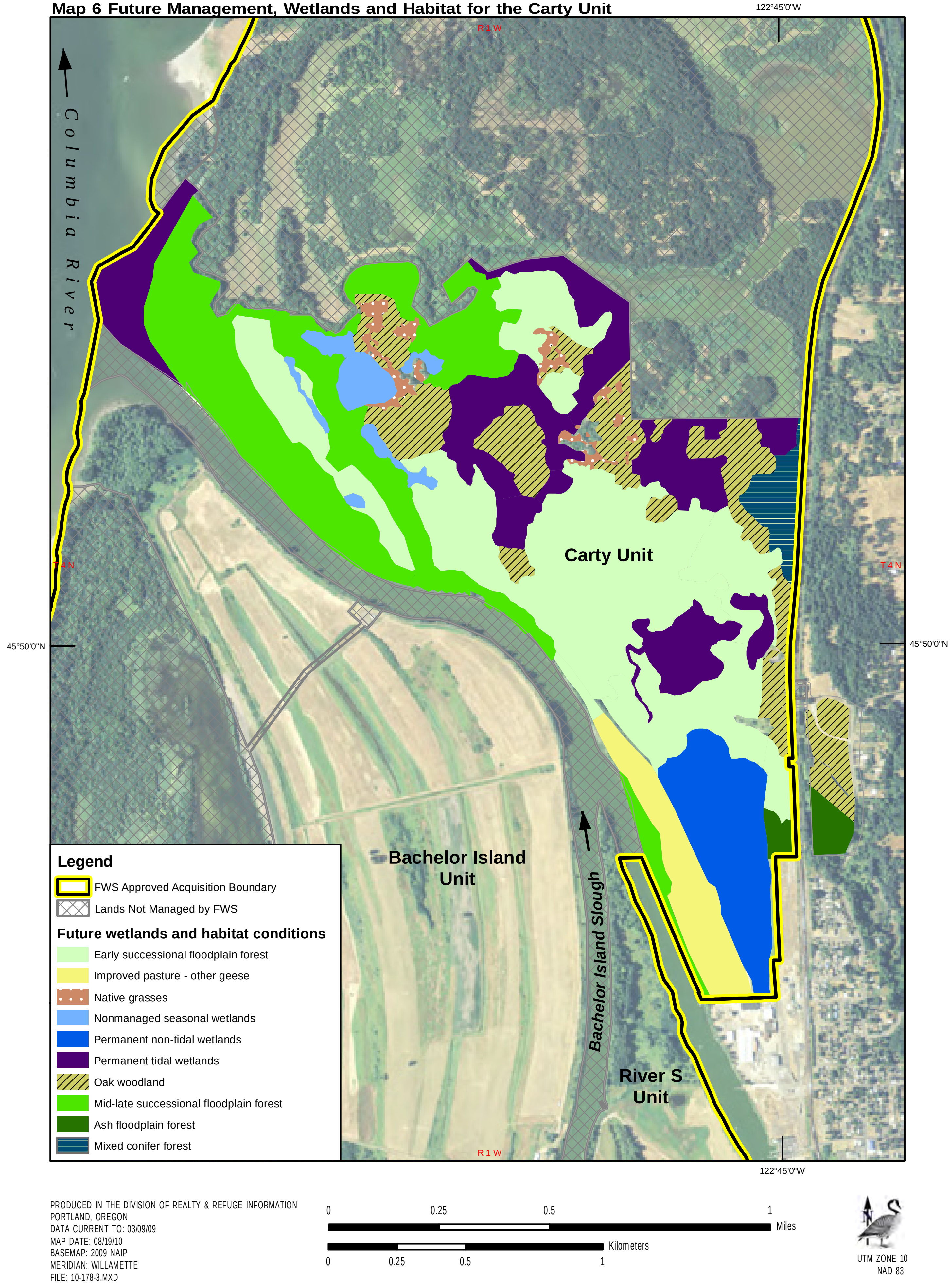
0 0.25 0.5 1 Kilometers

UTM ZONE 10
NAD 83

To preserve the quality of our map, this side was left blank intentionally.

Map 6 Future Management, Wetlands and Habitat for the Carty Unit



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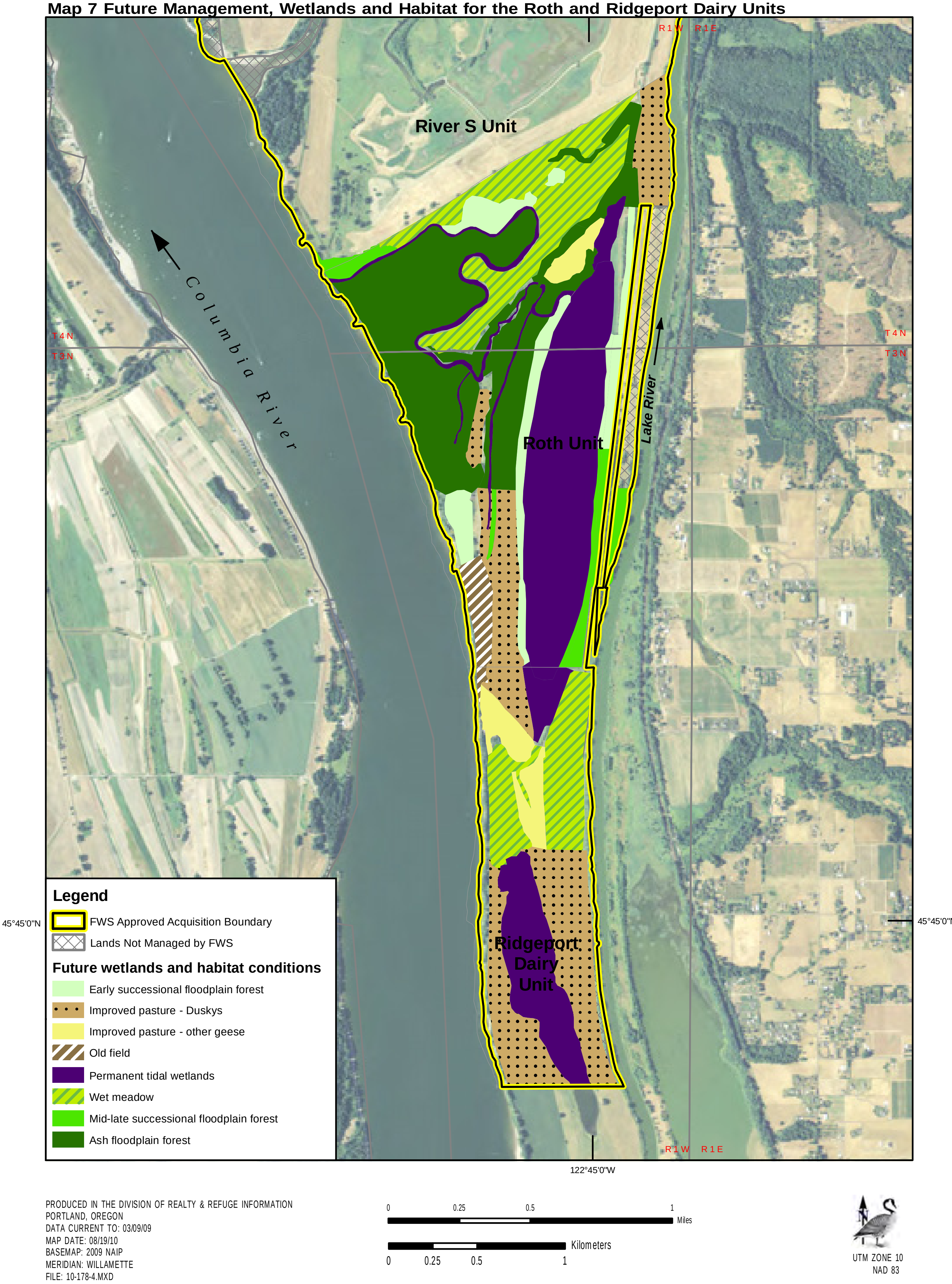
Map 7 Future Management, Wetlands and Habitat for the Roth and Ridgeport Dairy Units



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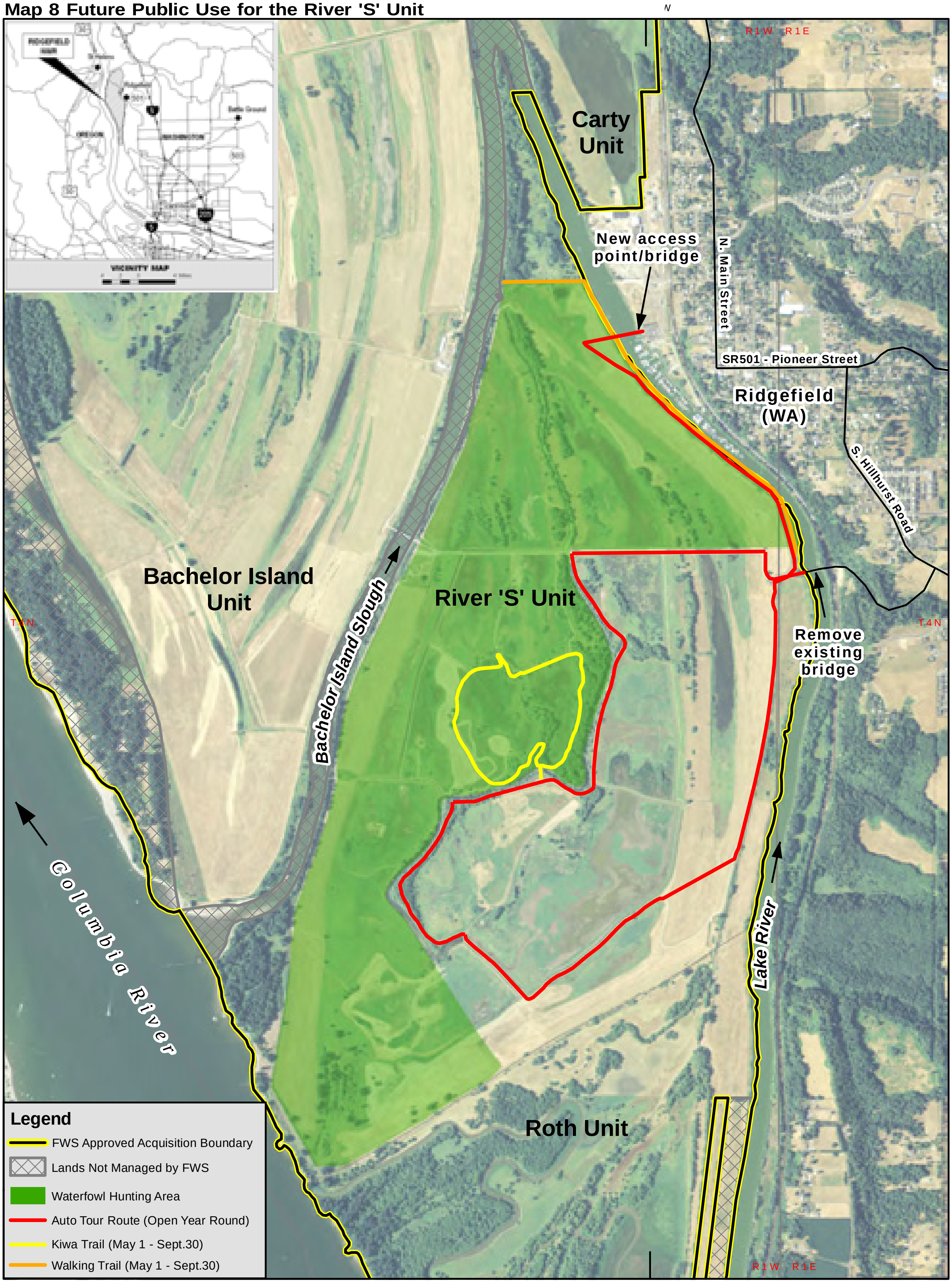
Map 8 Future Public Use for the River 'S' Unit



PRODUCED IN THE DIVISION OF REALTY & REFUGE INFORMATION
PORTLAND, OREGON
DATA CURRENT TO: 04/29/09
MAP DATE: 08/19/10
BASEMAP: 2009 NAIP
MERIDIAN: WILLAMETTE
FILE: 10-178-5.MXD

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0 0.25 0.5 1 Kilometers

UTM ZONE 10
NAD 83

To preserve the quality of our map, this side was left blank intentionally.

Table 2.1 Summary of Management Direction

Issue	Management Direction
How will the refuge maintain and manage wildlife habitat? **What is the appropriate balance of managed habitat (e.g. pastures, managed wetlands) to native habitat?**	• Maintain existing acreage of wetlands (1,700 acres); slight increase in managed pastures (1,525 acres) to benefit dusky Canada geese and other migrating/over-wintering waterfowl.
	• Maintain existing floodplain/riparian forest, oak woodland, and mixed conifer habitat (1,150 acres), and restore an additional 160-185 acres, over 15 years.
	• Over the lifetime of the CCP, convert 265-280 acres of old fields to other habitat types: 90 acres to wet meadow, 65 acres to improved pasture, 85-100 acres to floodplain/riparian forest (willow/cottonwood), 20 acres to oak woodland, and 5 acres to ash forest.
	• Increase cropland to 290-330 acres to benefit waterfowl, and sandhill cranes.
	• Manage wetlands using drawdowns, disking, mowing, and water level manipulation to improve productivity, manage vegetation, and control undesirable plants. • Increase monitoring to determine efficacy of habitat management, need for additional treatments, and document wildlife response. • Hire additional staff to expand volunteer program and partnerships (needed to meet research, monitoring and invasive species control goals).
How will the refuge maintain and restore native habitats of the lower Columbia River?	• Maintain/enhance existing floodplain/riparian forest and oak woodland. Allow natural succession of floodplain forest to continue in select wetland basins. • Restore 165-190 acres of floodplain/riparian forest habitat over lifetime of CCP. • Restore 20 acres of oak woodland over lifetime of CCP. • Increase efforts to maintain and enhance floodplain/riparian forest habitat. • Investigate techniques to enhance recruitment of ash and cottonwood in older, even-aged stands. • Conduct habitat assessments and baseline inventories of native fish, wildlife and vegetation to guide future management actions. • Pursue burning permit to manage/restore oak woodland habitat. • Study feasibility of restoring native wet meadow and grassland. • Allow Post Office Lake to re-establish tidal connection to Columbia River through natural processes. • Restore tidal connection to Duck Lake. • Tidal wetland restoration plan and feasibility studies (see Instream Habitat).
How will the refuge control invasive species and prevent new invasives from becoming established?	• Increase monitoring of all habitat types for invasive species, efficacy of treatment, and need for additional treatment • Conduct studies to investigate control techniques for ricefield bulrush, reed canarygrass, carp, and nutria.
	• Increase application of wetland management techniques (flooding, drying, disking) to reduce reed canarygrass; resume these control methods in areas where ricefield bulrush has been controlled.

Issue	Management Direction
	• Annual invasives monitoring and control on up to 115 acres (approx 10%) of floodplain/riparian forest, oak woodlands, and upland mixed forest.
How will the refuge assist in recovery of endangered and threatened native species of the lower Columbia River ecosystem?	• Continue monitoring ponds containing water howellia. • Continue partnerships to conduct test plantings of Bradshaw's lomatium, and Nelson's checkermallow. • Conduct feasibility studies for reintroducing Columbian white-tailed deer (within 5 years); and western pond turtle. • Conduct baseline surveys to establish presence/absence of rare plants and animals.
How will the refuge address climate change impacts, and increasing development on surrounding lands?	• Acquire land within existing acquisition boundary from willing sellers if funding is available. • Use green building technology in new construction. • Increase habitat connectivity by: - Restoring riparian habitat to link existing blocks of habitat. - Initiating a land protection plan study, to analyze alternatives for potentially expanding the refuge boundary to include a portion of Post Office Lake and adjoining areas south of the current boundary. • Monitor changes in migration patterns; monitor climate-sensitive species (e.g. salmonids) and their key habitat parameters (e.g. stream temperature). • Assist in local/regional planning efforts for facilities that link the refuge to regional walking/bicycling trails, and mass transit. • Develop partnerships/incentives to decrease emissions from auto tour route. • Incorporate climate change messages into communications, interpretation, and environmental education.
How will the refuge improve instream habitat and tidal wetland conditions for native fish?	• Continue Gee Creek watershed partnerships. • Conduct riparian plantings along 0.8 miles of Gee Creek. • Prepare a dike breach contingency plan for Post Office Lake. • Conduct riparian plantings along 0.8-1.25 miles of Gee Creek. • Conduct habitat assessments on Gee Creek, Campbell Slough, and Campbell Lake to guide future restoration. • Develop a tidal wetlands restoration plan. • Initiate a land protection plan study to analyze alternatives for possible refuge boundary expansion to include a portion of Post Office Lake.
How will the refuge address the impacts of increasing visitation on wildlife, and minimize impacts to purposes species?	• Public use footprint and sanctuary area remains same as present. • Hunt area remains at 790 acres in current location. • Auto tour route remains in current location; open year-round; with length reduced from 4.3-4 miles by removing the south end loop to provide contiguous habitat for duskys and sandhill cranes. • Retain closure of Roth, Bachelor Island, and Ridgeport Dairy units to public use, except for guided tours.

Issue	Management Direction
	• River ‘S’ Unit closed to walking Oct 1-April 30. • Refuge closed to bicycling, dog walking, and horseback riding. Monitor wildlife response to public use; change timing/location of use if unacceptable levels of disturbance occur..
How will the refuge provide safe, accessible, high quality wildlife-dependent recreation in the future? *Visitor access (River ‘S’ Unit)*	• Develop a new access point to the River ‘S’ Unit from Port of Ridgefield property with new 2-lane bridge to eliminate in-grade railroad crossing; and new 1-mile entrance road • Abandon existing entrance road and easement to River ‘S’ Unit; and demolish existing bridge.
Visitor facilities, access (Carty Unit)	• Construct new nature center, including environment education classrooms (covered under separate EA) • Replace footbridge to Carty Unit with ADA accessible structure (covered under separate EA). • Create walking and limited (emergency) vehicle access to Carty Unit from Port site, with small bridge over Gee Creek.
Trails	• Maintain existing walking trails (Oaks to Wetlands, Kiwa); River ‘S’ Unit open to walking May 1- Sept 30; and Carty Unit open year-round. • Develop new 1.5-mile dike-top walking trail, running north to an overlook and south to existing River ‘S’ bridge, open May 1-Sep 30 (see maps). • Implement measures to reduce congestion on auto tour route at peak times and encourage use of walking trails (e.g., provide pedestrian access to refuge walking trails from Ridgefield)
Environmental education (EE)	• Expand EE program to serve 4,500 students annually. • Hire full time EE coordinator; and develop curricula and refuge-specific instructor training. • Offer 1-2 annual training sessions to prepare teachers to instruct all/portions of their educational visits • Recruit and train volunteer instructors (with an emphasis on retired educators) to lead EE activities; maintain 30 trained volunteer instructors. • Explore options to partner with the Ridgefield School District to integrate the refuge’s EE programming into the District’s curriculum. • Provide EE shelter and study sites on Carty Unit; and EE classrooms as part of new nature center (pending separate EA and funding).
How will the refuge improve the quality of its waterfowl hunt, while minimizing impacts to dusky Canada geese?	• 790-acre hunt area/ location remain the same as present. • Move hunter check station to current entrance; rehabilitate Teal Marsh; and establish 1-2 new blinds on west side of River ‘S’ Unit to compensate for loss of blind 4 (lost to new bridge construction) • Staged floodup of hunt areas to provide more shallow-water habitat (not all wetlands will have water early in season; reduces pumping needs late in season). • Provide alternate early/late season hunt blinds, and/or movable blinds.

Issue	Management Direction
	• Wetland rotation to improve productivity and habitat conditions for waterfowl.
How will the refuge protect its cultural resources and educate the public about them?	• Explore grant to hire full time plankhouse coordinator; within 7 years have plankhouse staffed at least 4 hours/day on weekends and as needed for EE groups. • Provide at least 2 cultural events (open to general public) at Cathlapotle Plankhouse annually. • Develop interior interpretive plan and quality standards for artifact replicas used in plankhouse. • Develop EE program tailored to the Plankhouse. • Hold semiannual meetings with affected Tribes; and establish protocol for consultation.
	• Pursue funding to provide secure artifact storage and curation on the refuge.

2.4 Goals, Objectives, and Strategies

Goals and objectives are the unifying elements of successful refuge management. They identify and focus management priorities, resolve issues, and link to refuge purposes, Service policy, and the Refuge System mission.

A CCP describes management actions that help bring a refuge closer to its vision. A vision broadly reflects the refuge purposes, the Refuge System mission and goals, other statutory requirements, and larger-scale plans as appropriate. Goals then define general targets in support of the vision, followed by objectives that direct effort into incremental and measurable steps toward achieving those goals. Strategies identify specific tools and actions to accomplish objectives (USDI 2002).

The goals for Ridgefield Refuge for the 15 years following completion of the CCP are presented on the following pages, in tables. Each goal is followed by the objectives that pertain to that goal. Some objectives pertain to multiple goals and have simply been placed in the most reasonable spot. Similarly, some strategies pertain to multiple objectives.

The goal order does **not** imply any priority in this CCP. Priority actions are identified in the staffing and funding analysis (Appendix D).

Readers, please note the following:

Below each objective statement are the strategies that could be employed in order to accomplish the objectives. Symbols used in the following tables include:

% percent sign
> greater than
< less than
≥ greater than or equal to
≤ less than or equal to

2.4.1 Goal 1: Provide and manage a mixture of secure, diverse, productive grassland habitats for foraging migratory waterfowl and grassland-dependent wildlife.

Objective 1.1 Enhance/Maintain Improved Pasture for Dusky Canada Geese
Enhance and annually maintain 340 acres of improved pasture in core dusky Canada goose use areas, with the following attributes: • Field size range from 2 to 45 acres with a minimum predator-detection width of 250 feet. • Field (or portion of field) should be adjacent to accessible wetland* (within 400 ft) or consist of hydric soils. • Short vegetation along the field/wetland interface. • Mix of desirable, palatable grasses* (e.g., perennial ryegrass, orchardgrass, fescues) and forbs (e.g., clover) with a height of < 4 inches by October 15. • < 20% cover of invasive species (e.g., Canada thistle, buckhorn plantain, tansy ragwort, teasel). • No encroaching woody vegetation (e.g., blackberry). • No false indigo and poison hemlock. • Minimal thatch.* • Minimal human disturbance when duskys are present (October 1 to April 1) limited to necessary management activities. *Definitions: **Accessible wetland:** Wetland without fences or vegetative barriers (tall, dense vegetation) at its margins. **Palatable grasses:** Short, actively growing grass preferred as forage by geese. **Thatch:** The dense covering of cut grass that remains after mowing.
Strategies Applied to Achieve Objective
Mow and/or hay pastures after July 15, unless surveys indicate a specific pasture is not being used by nesting grassland birds.
Mow after July 15, as needed, to maintain grass palatability and minimal thatch and provide < 4 inch height by October 15.
Graze (domestic animals) between May 1and October 1 (after geese have migrated and as field conditions allow) to maintain grass palatability, minimal thatch, and provide < 4 inch height by October 15. Grazing will only occur in areas where refuge staff has determined that significant impacts to grassland nesting birds will not occur.
Hay from July 15-September 30 (as conditions allow) to maintain grass palatability, minimal thatch, and provide < 4 inch height by October 15.
Use agricultural practices (e.g., seeding, disking, planting cover crops, fertilizing, soil amendments, and herbicides) to rehabilitate pastures that do not meet the objective.
Use prescribed fire during late summer to eliminate thatch, invasive plants, and rank grasses (contingent upon receiving Southwest Washington Clean Air permit).
Use IPM strategies including mechanical, biological, and chemical means to eradicate, control, or contain invasive plants (see Appendix K, IPM Program).
Continue to cooperate with the County Weed Board to control county-listed invasive weeds.
Control weeds in accordance with the refuge's IPM program using methods such as crop rotation, mechanical treatment, biological controls, and low toxicity approved pesticides (see Appendix K).
Pesticide use must be in compliance with the Service's policy requirements for completing an approved Pesticide Use Proposal, and must meet other State and Federal requirements.
Cooperators that conduct haying, mowing, or grazing on the refuge will only apply herbicides with prior

refuge approval and will provide a record of herbicides used including chemical name, amount used, date, location, and how applied.
Pursuant to the refuge's CLMA, cooperators will provide annual records of animals grazed on and plant products removed from the refuge.
Rationale: The refuge was established to protect and provide wintering habitat for the dusky Canada goose, a subspecies that winters primarily in the Willamette Valley of Washington and Oregon. The dusky Canada goose has experienced substantial declines over the past several decades. While once the predominant goose in the Willamette Valley, dusky Canada geese now comprise > 5% of the overall goose population in its Washington winter range. Population declines coupled with loss of breeding and wintering habitat, has elevated this subspecies to one of management emphasis by the Federal and state governments (Bromley and Rothe 2003, PFC 2008), therefore, they continue to be the primary management focus for the refuge. While many Canada and cackling geese are readily adaptable to foraging in large open agricultural fields and croplands, dusky Canada geese in the northern Willamette Valley continue to utilize more natural habitats reminiscent of the historic Columbia River floodplain. These habitats include small wet meadows and upland grasslands, shorelines and seasonal wetlands, frequently interspersed among riparian bottomland forest. Despite the substantial alterations to the Willamette Valley landscape, dusky Canada geese continue to prove relatively traditional in their habits, their habitat use, and their preference for maintaining relatively small flock associations. These behaviors and preferences negate the ability to manage goose habitats similarly for the eight species and subspecies of geese utilizing the refuge. Due to the dusky Canada goose's penchant for using traditional sites, many portions of the refuge with seemingly suitable habitats are under-utilized. This traditionalism has, however, allowed staff to identify preferred sites through surveys, and focus management on these core use areas. Under the CCP, the Service will increase management of improved pasture in core dusky areas to improve quality of green browse. Wet meadows are also an important foraging habitat for duskys (see Objective 3.6). Minimizing disturbance in core dusky foraging areas is also a high priority. The most recent update of the Pacific Flyway Management Plan for the Dusky Canada Goose (2008) proposes that the Service, WDFW, and ODFW "Develop new public land management guidelines that result in increased goose food production and reduced disturbance of geese during winter, especially for dusky geese." The CCP proposes removing a portion of the auto tour route along the south side of Rest Lake on the River 'S' Unit, reducing disturbance from vehicles, and creating a larger contiguous sanctuary area for duskys. Young grass and forb shoots are preferred forage of Canada and cackling geese. We use management tools (grazing, mowing and haying) in combination to achieve the maximum cover of short, actively growing grass, where appropriate and feasible based on soil condition and other factors. Pastures in need of rehabilitation may be planted with cover crops to break weed cycles (winter wheat, clover, or alfalfa). This treatment will count toward total crop acreage planted (see Objective 2.1). Meeting the habitat quality objectives for pastures (< 20% weed cover, height < 4 inches, and minimal thatch) will ensure that the refuge provides high quality goose habitat. The refuge staff assesses fields at the beginning of the growing season and several times during the summer to determine whether these objectives are being met and treating those fields where the objectives are not being met. For example, thatch inhibits growth of new grass and also inhibits goose foraging. Mowing treatments must either be frequent to minimize thatch, or if less frequent (e.g. once a year) include a means of thatch removal (e.g., raking, mulching, burning.) Haying and grazing preferred to mowing, where feasible, as these treatments eliminate thatch. A field with >20% thatch cover and visible windrows of thatch would be treated by grazing, haying, or prescribed fire depending on the field. The specific treatment would depend on site

conditions; a field that is not fenced or not near a water supply would likely be hayed instead of grazed. Prescribed fire would only be used where it can be accomplished safely, and will require approval from the Southwest Washington Clean Air Agency.

Objective 1.2 Enhance/Maintain Improved Pasture for Other Canada Geese and Waterfowl
Enhance and annually maintain 1,100 acres of improved pasture for other subspecies of Canada geese, cackling geese, American wigeon, and other migratory birds with the following attributes: • Field size of >35 acres with a minimum predator-detection width of 450 feet • Short vegetation along the field/wetland interface • Mix of desirable, palatable grasses (e.g., perennial ryegrass, orchard grass, fescues) and forbs (e.g., clover) with a height of <4 inches by October 15 • <20% cover of invasive species (e.g., Canada thistle, buckhorn plantain, tansy ragwort, teasel) • No encroaching woody vegetation (e.g., blackberry) • No false indigo and poison hemlock • Minimal thatch • Minimal human disturbance in areas closed to public use (limit to necessary management activities from Oct 1 to May 1) • Limit human disturbance areas open to public use
Strategies Applied to Achieve Objective
Mowing and haying will only occur after July 15, unless surveys indicate that the specific pasture is not being used by nesting grassland birds.
Mow after July 15, as needed, to maintain grass palatability and minimal thatch and provide <4 inch height by Oct 15.
Graze (e.g., domestic animals) between May 1and October 1 (after geese have migrated and as field conditions allow) to maintain grass palatability and minimal thatch and provide <4 inch height by Oct 15. Grazing will only occur only in areas where refuge staff has determined that significant impacts to grassland nesting birds will not occur.
Hay from July 15 to Sept 30 (as conditions allow) to maintain grass palatability and minimal thatch and provide < 4 inch height by Oct. 15.
Use agricultural practices (e.g., seeding, disking, planting cover crops, fertilizing, soil amendments, herbicides) to rehabilitate pastures that do not meet the habitat objective.
Use prescribed fire during late summer to eliminate thatch, invasive plants, and rank grasses (Contingent upon receiving permit with Southwest Washington Clean Air).
Maintain the between-field contiguity of grasslands and croplands by minimizing new visual barriers such as tall shrubs and trees, where appropriate.
Use IPM strategies including mechanical, biological, and chemical means to eradicate, control, or contain invasive plants (see Appendix K, IPM Program)
Continue to cooperate with the County Weed Board to control county-listed invasive weeds.
Control weeds in accordance with the refuge's IPM program using methods such as crop rotation, mechanical treatment, biological controls, and low toxicity approved pesticides (see Appendix K-IPM Program).
Pesticide use must be in compliance with the Service policy requirements for completing an approved Pesticide Use Proposal, and must meet other State and Federal requirements.
Cooperators that conduct haying, mowing, or grazing on the Refuge will only apply herbicides with prior refuge approval and will provide a record of herbicides used including chemical name, amount used, date, location, and how applied.
Pursuant to the refuge's CLMA, Cooperators will provide an annual record of animals grazed on, and

plant products removed from, the Refuge.
In portions of fields where Nelson's checkermallow was planted, grazing will not be permitted, mowing will only occur after checkermallow plants have entered senescence.

Rationale: Although Ridgefield NWR was initially established with a focus on management of habitat for dusky Canada geese, management for all waterfowl and their habitats is also a priority. At establishment in 1965, dusky Canada geese were the primary subspecies of goose wintering in the area. Since then, other species and subspecies of geese, namely cackling geese, and Taverner's and lesser Canada geese, have re-distributed their population region-wide and now comprise over 90% of the overall wintering goose population on Ridgefield NWR. Cackling geese are now a subspecies of management concern since the wintering population has shifted north from California to the Willamette Valley and SW Washington. Although the population has increased dramatically since 1984, when less than 26,000 birds were counted in California and Oregon, numbers are still below the flyway population objective of 250,000 (USFWS 2008; Pacific Flyway Council 1999). Therefore, providing secure winter habitat for cackling geese has assumed an increased management priority.

Cackling geese forage in large flocks and tend to prefer large, open pastures for foraging. Therefore, this objective recognizes that larger field sizes with minimal visual barriers are necessary to provide habitat for cackling geese. Issues of grass palatability and thatch reduction are the same as for dusky Canada geese; see discussion in Objective 1.1 above.

This increase in the total goose population has led to increased issues with crop and pasture depredations on private lands along the lower Columbia River. In an effort to alleviate economic losses from depredation on private lands, the refuge has placed an increased emphasis on management for these geese. Unlike dusky Canada geese, cackling, Taverner's and lesser Canada geese (the primary geese associated with depredation issues) prefer large open agricultural fields and croplands. A variety of crops have been grown on the refuge since 1965 including corn, potatoes, winter wheat, barley, alfalfa, and clover. Refuge studies have shown that these crops, though preferred by geese, were quickly depleted while fall planted grass crops were pulled out by the roots. This left little forage for geese refuge-wide during the late winter and spring, when off-refuge crop depredations were more prevalent. This prompted a switch in management during the mid-late 1990s to provide primarily sustainable grass crops (pastures) to target open pasture feeders such as cackling geese, and to ameliorate spring depredation concerns. The impetus for this switch can be found in the Northwest Oregon/Southwest Washington Canada Goose Agricultural Depredation Plan (Pacific Flyway Council 1998).

Objective 1.3 Old Fields and Old Field/Wetland Borders

Annually maintain up to 140 acres of old fields and old field borders to provide thermal cover and nesting habitat for migratory birds (e.g., nesting waterfowl, raptors, short-eared owls, western meadowlarks, savannah sparrows) and dispersal habitat for small mammals and native amphibians with the following attributes:

- Mosaic of vegetation heights between 6-24 inches, > 80% cover of desirable grasses (e.g., perennial ryegrass, orchardgrass, fescues) and forbs (e.g. clover), < 10% cover of shrubs
- > 60% of acres un-manipulated residual cover* remaining annually for nesting species
- Old field size >5 acres
- No poison hemlock and false indigo
- < 30% cover of invasive species (e.g., Canada thistle, buckhorn plantain, tansy ragwort, teasel)

*Definition:
Un-manipulated residual cover: Tall decadent grass and/or forbs left standing through the fall and winter seasons.

Strategies Applied to Achieve Objective
Mowing and haying will only occur after July 15, unless surveys indicate that the specific pasture is not being used by nesting grassland birds.
Use agricultural practice (e.g., seeding, disking, fertilizing, soil amendments, herbicides) to rehabilitate old fields that do not meet the habitat objective.
To keep fields in appropriate successional stage and control/eradicate invasive plants, mow (after July 15) and/or spray herbicides in a 2-3 year rotation (see Appendix K, IPM Program).
Restore old fields and old field/wetland borders that are adjacent to improved pasture undergoing restoration by removing invasive plants such as blackberry, teasel, and reed canarygrass through agricultural practices (see above) and supplement native plant regeneration with pasture grasses listed above, and small numbers of shrubs that are appropriate to the site.
Utilize burning regimes where feasible (recommended frequency is every 2 years). (Contingent upon receiving permit with Southwest Washington Clean Air).
Continue to cooperate with the County Weed Board to control county-listed invasive weeds.
Control weeds in accordance with the refuge's IPM program using methods such as crop rotation, mechanical treatment, biological controls, and low toxicity approved pesticides (see Appendix K, IPM Program).
Pesticide use must be in compliance with the Service policy requirements for completing an approved Pesticide Use Proposal, and must meet other State and Federal requirements.
In portions of fields where Nelson's checkermallow was planted, grazing will not be permitted, and mowing will only occur after checkermallow plants have entered senescence.
Rationale: Old fields are areas formerly used for pasture or crops that are now a mixture of tall decadent grasses, forbs, and shrub. Old field/wetland borders on the Refuge are typically strips of tall decadent grass and/or forbs between fences and roads, or on dikes. Most of the vegetation is nonnative. However, these areas provide nesting and foraging habitat for ground-nesting birds, and winter thermal cover for short-eared owls, small mammals, and other wildlife. These areas also provide migration or dispersal corridors for amphibians and small mammals. For example, red-legged frogs require dispersal habitat between wetland breeding areas and riparian areas. Old fields require regular treatment for weeds (see strategies above), otherwise they become infested with invasive plants and can become a seed source for invasive species. Currently the Refuge has approximately 400 acres in this habitat type. Those fields and field/wetland borders identified as necessary habitat for ground-nesting birds or as migration/dispersal corridors (140 acres) will be maintained in this habitat type. The remainder (260 acres) will be converted into other habitat types that will benefit purposes species (e.g. improved pasture) and/or contribute to the Refuge's biological diversity, integrity and environmental health (riparian habitat, oak woodland).

Objective 1.4 Maintain and Enhance Native Grassland Habitat

Enhance and annually maintain up to 15 acres of native grassland habitat on the Carty Unit for grassland-dependent birds and native plant species. Native grassland habitat is characterized by the following attributes:

- Optimal patch size <u>or</u> contiguity with oak woodland habitat is >50 acres
- Mosaic of vegetation heights between 6-36 inches
- >50% cover of native grasses (e.g., Roemer's fescue, California oatgrass, tufted hairgrass, red fescue) and native forbs (e.g., northwest cinquefoil, common camas, blue eyed Mary, yarrow, largeleaf lupine)
- <20% cover of invasive/undesirable nonnative grasses (e.g., poverty brome), forbs (e.g., ox-eye daisy, thistle and trefoil), and shrubs (e.g., blackberry)

Strategies Applied to Achieve Objective

Conduct survey of native plants in grassland areas of the Carty Unit to determine which native and nonnative species are present, densities, and need for treatment (also see Objective 7.4).
Use IPM strategies including mechanical, biological, and chemical means to eradicate, control, or contain invasive plants (see Appendix K -IPM Program).
Utilize prescribed fire, where feasible and necessary, to maintain native plant communities. (Contingent upon receiving permit with Southwest Washington Clean Air).
Pending survey results, drill native grass seed and plant native forbs (seed or head-started seedlings) to increase proportion of native to nonnative species.
Conduct site monitoring to determine efficacy of restoration and need for follow-up treatments.
Rationale: Small patches of grassland occur on the Blackwater Island RNA (approx.15 acres total) as small openings within oak woodland habitat. These grasslands are dominated by an introduced species (poverty brome), and the native grass component appears to be small. However grassland habitat on the RNA appears to be an important area for native wildflowers. Soils on RNA grassland are thin, overlying basalt bedrock, and well drained. Because of thin soils, some restoration and management techniques that could be utilized on bottomland grasslands with deeper soils (e.g. grazing, mowing, disking) are not appropriate here. Inventories of the Blackwater Island RNA include vegetation surveys and community descriptions developed from the 1970s through the early 1990s, annual surveys for the federally listed water howellia, and pit trap and live trap mammal and amphibian surveys conducted in the 1990s. Updated inventories of native habitats and vegetation, and habitat conditions (including presence of invasive species) are needed in order to manage grasslands and oak woodland habitat on the RNA (also see Objective 7.4: Conduct Baseline Inventories of Native Habitats/Vegetation and Major Fish and Wildlife Groups.)

2.4.2 Goal 2: Provide agricultural crops as forage for migratory waterfowl and sandhill cranes annually.

Objective 2.1 Provide Crops for Waterfowl and Sandhill Cranes
Annually provide 290-330 acres of agricultural crops (e.g., corn, small grains, legumes), including 60-145 acres of corn, as forage for sandhill cranes, dusky Canada geese, and other waterfowl.
Strategies Applied to Achieve Objective
Plant corn in areas outside the hunt area for use by cranes and dusky Canada geese. The cropping program will consist of normal planting, normal harvest, and normal post-harvest manipulation. Corn may be manipulated (knocked down) after the close of the hunt season to make it more available to geese.
Use agricultural practices such as seeding, disking, soil amendments, fertilizing, herbicides, and plant cover crop.
Weeds will be controlled in accordance with the refuge's IPM program using methods such as crop rotation, mechanical treatment, biological controls, and approved low toxicity pesticides (see Appendix K).
The refuge will work to prevent the spread of weeds by cleaning equipment between fields and will continue to cooperate with the County Weed Board to control county-listed invasive weeds.
Pesticide use must be in compliance with Service policy requirements for completing an approved Pesticide Use Proposal, and must meet other State and Federal requirements.
Rotate cropping patterns with planned rehabilitations of improved pastures to break weed cycles, fix nitrogen, and increase soil tilth where appropriate (see Objectives 1.1-1.2).
If additional crops are planted using disking, use existing fields, or old fields currently in fallow, weedy

condition.
In portions of fields where Nelson's checkermallow was planted, no crops will be established.
Continue to pursue cooperative farming agreements (CFA). When the refuge develops a CFA for crop production, the cooperator will provide an annual record of planting efforts, fertilizer and herbicide applications, and plant products removed from the refuge. Cooperators will only apply herbicides and fertilizers with prior refuge approval.
Monitoring of the cropland farming program will be performed by qualified refuge staff.
Rationale: Croplands are managed primarily for the benefit of waterfowl and sandhill cranes, but many other species benefit such as bald eagles, which rely on refuge waterfowl concentrations. Approximately 158 acres of refuge lands are currently farmed using refuge staff and equipment, including 55-85 acres of corn. Formerly, large areas of the refuge were planted in crops via a cooperative farming program, but these massive farming efforts were discouraged by the Oregon/Southwest Washington Canada Goose Agricultural Depredation Plan (PFC 1998). As a result of recommendations in the plan, the refuge began maintaining large areas of pasture, with scattered crops. By providing a variety of foods within close proximity to each other, the refuge is able to hold geese throughout the winter months and reduce depredation on adjacent lands. The small overall acreage, small fields, spread out set-up of crop lands, and the fact that farmers would have to leave a portion of the crops for wildlife, makes the refuge undesirable for cooperative farmers. For these reasons the refuge has not prioritized locating cooperative farmers in the past. The refuge's 2004 Wildlife and Habitat Management Review (USFWS 2004) recommended providing additional grain for wintering waterfowl and cranes. The number of acres planted in corn is limited by high cost (due to soil prep, fertilizer and weed control), the need to rotate crops, and the need for increased weed control activities in fallow cornfields. As a result, the refuge proposes to provide the majority of supplemental food for waterfowl and cranes through increased use of interseeding legumes and small grains such as clover and winter wheat, or planting less resource intensive crops. However, corn is preferred by sandhill cranes and dusky Canada geese; therefore, we propose limited corn planting in key areas utilized by duskys and cranes. Both duskys and sandhill cranes can access standing corn (especially shorter varieties or stunted corn), while the smaller-bodied cackling geese cannot. We propose to increase the quantity of corn produced on the refuge using irrigation as well as evaluating the use of other grains such as milo and buckwheat to increase forage for duskys and cranes. Planting corn outside the hunt area will also help keep duskys out of the hunt area and reduce the harvest of duskys. Given the difficulty in consistently propagating a productive corn crop, the refuge will examine the feasibility of using a cooperative farmer to produce a crop, under refuge supervision. The cooperative farmer will be allowed to remove a predetermined share of the crop as compensation. The refuge's share of the crop will remain in field and be available to wildlife. If the refuge finds cooperative farming to be feasible, it will be conducted in accordance with guidelines, best practices, and acreages outlined in the existing Cropland Management Plan. Per Service law enforcement, hunting can occur on the refuge only if the cropping program consists of: a normal planting; normal harvest; and normal post harvest manipulation. To avoid any issues associated with baiting, crops cannot be manipulated beyond this during the hunt season, regardless of location or distance from hunt program.

2.4.3 Goal 3: Provide, manage, and enhance a diverse assemblage of wetland habitats characteristic of the historic lower Columbia River.

Objective 3.1 Managed Seasonal Wetlands
Enhance and annually maintain a minimum of 445 acres of managed seasonal wetlands for migratory waterfowl, wading birds, shorebirds, and other wetland-dependent wildlife species in the River 'S' Unit. Seasonal wetlands are characterized by the following attributes:

• > 60% cover of desirable and/or native wetland plants including moist-soil annuals (e.g., smartweeds, wild millet, and water plantain), wapato, and nutsedges. • < 20% cover of native emergent species (e.g., cattail, hardstem bulrush) that are > 5 feet tall. • < 40% cover of undesirable/invasive plants including reed canarygrass and ricefield bulrush. • No purple loosestrife and false indigo present. • During initial flood-up (October to November), water depths of 4-12 inches. • Water depths 24-30 inches from late January to May; achieve drawdown by June 15. • Minimal damage to wetland infrastructure by nutria. *Definition: **Managed seasonal wetlands**: Wetlands which have existing infrastructure (pumps, culverts, water control structures) to manipulate water levels on a seasonal basis, relatively independent of water conditions in the surrounding watershed.
Strategies Applied to Achieve Objective
Wetland rotation: As needed, rotate 225 acres of seasonal wetland to semipermanent wetland to control undesirable plants (e.g. reed canarygrass). Flood wetlands to > 24 inches from late January to May. Once control is achieved resume management as seasonal wetland.
Except where needed to control reed canarygrass and ricefield bulrush, incrementally floodup and drawdown (e.g., using water control structures, pumps) to promote waterfowl foraging within the entire basin, and create mudflats for use by shorebirds.
Use mechanical techniques (e.g. disking, mowing) to set back succession of emergent vegetation and promote moist-soil and native plant production as well as control invasive/undesirable plants such as reed canarygrass.
Use IPM strategies including mechanical, cultural, biological, and chemical means to eradicate, control, or contain invasive and undesirable plants, particularly ricefield bulrush (see Appendix K, IPM Program).
As needed, reconfigure water delivery system to allow to enhance water level management
Use IPM techniques to control beaver and nutria from damaging water control structures and dike systems (see Appendix K). Protect desirable trees from beaver using fencing and propagating a dense shrub layer to exclude them from shorelines. Protect levees from nutria by periodically lowering water levels where practicable, and by removing animals in accordance with the refuge's IPM plan and 50 CFR 31.14, Official Animal Control Operations, which allows the take of animals that are detrimental to a refuge's wildlife management program.
Partner with counties for education/weed control along refuge borders and reduce sources.
Rationale: The refuge was established to provide migration and wintering habitat, including wetlands for dusky Canada geese and other waterfowl. Providing a diversity of wetlands is vital to the refuge's purposes. Yet because of the numerous dams along the length of the Columbia River, and the construction of levees to protect private landowners along the lower river, the natural hydrological processes of a free-flowing riverine system have been eliminated. Managed seasonal wetlands Refuge waters inside diked areas of the River 'S' Unit (23 wetlands totaling 445 acres) are now intensively managed to mimic natural disturbance mechanisms, providing and maintaining the cyclical aging and renewal processes of wetlands over time. By maintaining the number of acres of open shallow marsh through active management such as mechanical soil disturbance and wetland infrastructure, the refuge can provide a diversity of early successional vegetation stages that increase overall biodiversity and prevent wetland loss over time. Species benefiting from these seasonal wetland habitats include waterfowl, wading birds, rails, cranes, shorebirds, amphibians, and muskrats. Currently, the refuge spends approximately $10,000 annually to operate electrical pumps to fill and maintain wetland water levels within the waterfowl hunt area on the River 'S' Unit during the hunting

season. Water is pumped onto the managed wetlands in early fall (September). As winter rains add more water to these wetlands, it is necessary to then pump the water off to avoid flooding refuge roads, and other infrastructure. Because out-pumping generally cannot keep pace with inflow from rains, this pumping regime creates relatively deep-water conditions for most of the fall through spring season. Over time, this has caused changes in wetland vegetation. In addition, these depths are not conducive for most foraging waterfowl (for example, mallard, wigeon, and pintail), but instead favor ducks deft of gathering food from near the water's surface (shovellers) and diving ducks (ring-necked ducks and scaup). In contrast to current management, a more natural, gradual floodup regime is proposed. With gradual floodup these wetlands will support foraging by a wider range of waterfowl species. This management change will also result in cost savings (less pumping costs) that can be used for other habitat management activities.

Invasive plants (primarily reed canarygrass) are widespread in many refuge wetlands. Altered plant and animal community composition was identified as a very high stress to refuge wetland systems. Invasive plants limit native plant production and cause impacts to food, nesting, and cover for wildlife. Invasive plants in wetlands reduce waterfowl food availability during the migration and wintering periods. Limiting invasive species will help the refuge to comply with county and state noxious weed ordinances. In wetland basins, reed canarygrass is best controlled by disking followed by prolonged deep flooding (Kilbride and Paveglio 1999, Paveglio and Kilbride 2000, Tu 2004). This has been done in past years; however, recent infestations of ricefield bulrush have reduced the use of this treatment protocol in many areas. As a result, reed canarygrass has spread in refuge wetlands. We propose re-initiating reed canarygrass control in areas with minimal ricefield bulrush and monitoring these areas for ricefield bulrush. A primary method of controlling reed canarygrass and other undesirable species will be periodically managing these wetlands as semipermanent wetlands, with deeper and a longer duration of flooding until control is achieved. Nine wetlands on the River 'S' Unit, totaling 225 acres (about half of the acreage in this habitat type) have sufficient basin depth to allow for this management regime. The interval of rotation will vary according to the wetland, but could typically be expected to be 4-5 years. However, 14 seasonal wetlands on the River 'S' Unit do not have sufficient basin depth or water control capability to allow management as semipermanent wetlands. These will be drawn down and disked approximately every 2 years, or as needed.

Lack of staffing and funding to contain the expansion of invasive species and reduce infested acreage has been an ongoing issue with all wetland habitats on the refuge. An increase in staffing and funding will be needed to meet this and other wetland habitat objectives (see Appendix D, Implementation Analysis).

Objective 3.2 Managed Semi-permanent Wetlands

Enhance and annually maintain 228 acres of managed semi-permanent wetlands* for migratory waterfowl, wading birds, shorebirds, and other wetland-dependent wildlife species. Semi-permanent wetlands are characterized by the following attributes:

- 20-30% cover of desirable and native wetland plants including moist-soil annuals (e.g., smartweeds, wild millet, and water plantain).
- 40-50% cover of submergent plants (e.g., pondweeds).
- 20-40% cover of native emergent species (e.g., cattail, hardstem bulrush, wapato, and bur-reed) that are > 5 feet tall.
- < 20% cover of undesirable/invasive plants including reed canarygrass and ricefield bulrush.
- No purple loosestrife and false indigo present.
- Water depths 24-30 inches by late January to control undesirable plants with no more than 60-80% of wetland bottoms exposed (dry) by October 1.
- Minimal damage to wetland infrastructure by nutria.

*Definition: Managed semi-permanent wetlands: Wetlands which have existing infrastructure (pumps, culverts, water control structures) to manipulate water levels on a seasonal basis, relatively independent of water conditions in the surrounding watershed.
Strategies Applied to Achieve Objective
Wetland rotation (definition): Use mechanical techniques (e.g., disking and mowing) to control undesirable plants, set back succession to maintain a desirable ratio of robust emergent vegetation to open water, and increase wetland productivity. Use heavy equipment to remove mineral and organic deposits to deepen wetlands as necessary.
Except where needed to control reed canarygrass, use water control to incrementally flood-up, to promote waterfowl foraging within the entire basin.
Use water control structures and pumping, where possible, to maintain 24-30 inches water depth by late January.
Use IPM strategies including mechanical, cultural, biological, and chemical means to eradicate, control, or contain invasive and undesirable plants (see Appendix K).
As needed, reconfigure water delivery system to enhance water level management.
Inventory wetland plant communities and annually monitor effectiveness of invasive plant control measures. Control any reinvasion by nonnative plants.
Partner with counties for education/weed control along refuge borders and reduce sources.
Rationale: The refuge was established to provide migration and wintering habitat, including wetlands, for dusky Canada geese and other waterfowl. Providing a diversity of wetlands is vital to the refuge's purposes. Yet because of the numerous dams along the length of the Columbia River, and the construction of levees to protect private landowners along the lower Columbia River, the natural hydrological and floodplain processes of a free-flowing riverine system have been eliminated. Refuge waters inside diked areas of the River 'S' Unit are now intensively managed to mimic natural disturbance mechanisms, providing and maintaining the cyclical aging and renewal processes of wetlands over time. The Refuge's managed semi-permanent wetlands include four wetlands, totaling 133 acres, on the River 'S' Unit; and five wetlands, totaling 58 acres, on the Bachelor Island Unit. The total acreage reflects maintenance of existing managed semi-permanent wetlands, and conversion of 37 acres of other wetlands (Wigeon Lake and Wetland 013E on Bachelor Island) to this type. By maintaining the number of acres of open shallow marsh through active management (e.g. mechanical disturbance and wetland infrastructure), the refuge can provide a mosaic of early to late successional vegetation stages that increase overall biodiversity and prevent wetland loss over time. Species benefiting from these seasonal wetland habitats include waterfowl, wading birds, rails, shorebirds, amphibians, and muskrats. Currently, water is pumped onto the managed wetlands of the River 'S' Unit in early fall (September). As winter rains add more water to these wetlands, it is necessary to pump the water off to avoid flooding refuge roads and other infrastructure. Because out-pumping generally cannot keep pace with inflow from rains, this pumping regime creates relatively deep-water conditions for most of the fall through spring season. These depths are not conducive for most foraging waterfowl. In contrast, a more natural, gradual floodup regime is proposed. This will also result in cost savings (less pumping costs) that can be used for other habitat management activities. The depth and timing of inundating individual wetland units will be determined in annual habitat work plans. In addition, where topography and soils are appropriate and water management capability exists, we propose rotating the four semi-permanent wetlands on the River 'S' Unit, totaling 133 acres, between

semi-permanent and seasonal wetlands. These wetlands will primarily be managed as semi-permanent, however, wetlands with extensive and persistent cover of emergent vegetation, or with more than 50% open water, will be periodically drawn down, disked, and/or mowed to maintain a desirable ratio of robust emergent vegetation to open water and increase wetland productivity. Mineral and organic deposits that lead to filling and wetland loss will be removed as necessary. These actions will help mimic natural cycles of flood and drought and help maintain productivity as organic matter decomposes and nutrients that accumulated during flooded periods are made available to plants during dry periods. As in Objective 3.1, we propose reinitiating reed canarygrass control in areas where good control of ricefield bulrush has been achieved, and monitoring these areas for presence of ricefield bulrush.

Objective 3.3 Seasonal wetlands
Enhance and annually maintain a maximum of 125 acres of seasonal wetlands* for the benefit of migratory waterfowl, wading birds, shorebirds, and other wetland-dependent wildlife species in the Carty and Bachelor Island units. Seasonal wetlands are characterized by the following attributes: Water depths range from saturated soils to 12 inches in winter (December-March) from rainfall. • Naturally dry in summer (June-September). • 40-60% cover of desirable and native wetland plants including moist-soil annuals (e.g., smartweeds, wild millet, and water plantain). • < 20% cover of native emergent species (e.g., cattail, hardstem bulrush) that are > 5 feet tall. • < 40% cover of invasive plants (e.g., reed canarygrass, and ricefield bulrush). • No woody species (e.g., willows). • No purple loosestrife and false indigo present. *Definition: **Seasonal wetlands:** Wetlands that are typically dry in summer (June-September) and fill with rainwater in fall.
Strategies Applied to Achieve Objective
Allow natural flood-up and drawdown (minimal water pumping on Bachelor Island, and none on Carty Unit).
When appropriate, manage water levels of seasonal wetlands on Bachelor Island (using water control structures, and pumps).
Use mechanical techniques such as disking and mowing, to set back succession of emergent vegetation, promote moist-soil and native plant production, control invasive/undesirable plants, and remove woody species.
As needed, reconfigure water delivery system to enhance water level management.
Use IPM strategies including mechanical, biological, and chemical means to eradicate, control, or contain invasive and undesirable plants (see Appendix K).
Rationale: Currently, most of the Refuge's seasonal wetlands (approximately 120 acres) occur on the Bachelor Island Unit. Some smaller seasonal wetlands (approx 20 acres total) occur on the Carty Unit, and one 16-acre seasonal wetland is on the Carty Unit (River 'S' point). Seasonal wetlands on Bachelor Island are generally not supplemented with pumped water, while there are no capabilities to supplement wetlands on the Carty Unit. Wetland basins in the Carty Unit may be inundated during unusually high water events (Columbia River floods), but otherwise are disjunct from the daily fluctuations of the Columbia River and Gee Creek wetland systems. The refuge does not have any capabilities to manage water on these sites. Wetland restoration projects on Bachelor Island in the late 1990s have been only partially successful. Soil

porosity coupled with reduced water levels in the Columbia River since the restoration project was completed, has resulted in some wetland basins having poor water holding capability. Many wetlands are incapable of retaining water until river levels approach 13 feet mean sea level (MSL). Water retention increases in late winter (despite low river levels) in some wetlands, probably due to complete soil saturation and regular inputs of precipitation, but retention is generally short term. As a result of this long-term drying trend, some of these seasonal wetlands are being infested by reed canarygrass and/or upland-adapted invasive plants such as Himalayan blackberry, teasel, tansy ragwort, and Canada thistle. Once established, these invasive plants can only be controlled mechanically or chemically. The River 'S' point wetland is undergoing natural succession to riparian forest; this will be allowed to continue (see Objective 4.1a). Basins with good water holding capabilities will continue to be managed as open, shallow-water areas. It is possible that over time the water-holding capabilities of some of the wetland basins on Bachelor Island will improve as a layer of organic material and silt builds up.

Objective 3.4 Howellia wetlands

Enhance and maintain the four small seasonal wetlands totaling 1.2 acres that support populations of the federally threatened water howellia (*Howellia aquatilis*). Howellia wetlands have the following attributes:

- Water depths range from saturated soils to 20 inches in winter (November-June), drying to mudflats in late summer and fall.
- < 20% cover of emergent wetland plants and shrubs.
- 80% open water with *Howellia* and other native submergent plants.
- < 10% cover of invasive/undesirable plants, primarily reed canarygrass.
- Minimal encroachment by woody species (e.g., spirea).

Strategies Applied to Achieve Objective

Allow natural flood-up (no pumping capabilities).

Use IPM strategies including mechanical, physical, biological, and chemical means to eradicate, control, or contain invasive and undesirable plants (see Appendix K). Timing of treatment (after drying, but before fall rains) and minimizing soil disturbance is critical to protect Howellia seedlings.

As needed, hand-remove or chemically treat spirea and tree seedlings invading the wetlands. This should be accomplished with a minimum of soil disturbance and conducted after basin drying has occurred, but before fall rains begin.

Rationale: Water howellia is a federally threatened, annual submergent plant species that occurs in ephemeral and seasonal wetlands. Federally-listed species are trust resources and are essential to maintaining refuge and regional biological integrity. This species is known from only 3 sites in Washington and has been extirpated from much of its historic range. On the refuge, these plants are part of the submergent plant community, and occur along the shorelines of several small, ephemeral ponds on the Carty Unit. These wetlands fill naturally with rainwater in fall, but dry during the summer months. These wetlands cannot be supplemented with pumped water or artificially dewatered.

Howellia requires wetlands or wetland edges that dry down in late summer and fall, as seed must be exposed to air for fall germination (USFWS 1996). As an aquatic annual plant, howellia plants are fragile, vulnerable to destruction by premature wetland drying and trampling. Moreover, howellia seed is not considered to have a long period of viability, so several years of poor seed production can have negative effects on the population.

Howellia does not persist in wetlands overgrown with emergent vegetation, reed canarygrass, or woody plants. Currently, one of the refuge's four howellia ponds has been largely taken over by reed canarygrass, and growth of woody vegetation (Spirea) is a problem at another pond. Therefore, removal

of these plants to achieve optimal habitat conditions for howellia is proposed. Because of its life history, invasive plant control must occur post-drawdown but prior to fall germination; soil disturbance within the basin should be kept to a minimum during these activities. (Canopy cover from associated upland deciduous trees does not appear to be a limiting factor; in fact one howellia pond on the refuge occurs in a wooded wetland.)

Objective 3.5 Permanent, nontidal wetlands

Enhance and annually maintain 70 acres of permanent wetlands* for the benefit of migratory waterfowl, wading birds, and other wetland-dependent wildlife species. Permanent nontidal wetlands are characterized by the following attributes:

- Maximum water depths of 24-36 inches with potentially increased depths in winter due to precipitation.
- Natural drying may occur in summer.
- Open water with native submergent vegetation (e.g., sago pondweed) covering > 75% of wetland basin.
- < 25% cover of desirable and native emergent (e.g., hardstem bulrush, cattails) and other wetland plants (e.g., annual moist-soil plants, wapato).
- < 10% cover of invasive plants (e.g., reed canarygrass, purple loosestrife, and milfoil).

*Definition:
Permanent wetlands: Wetlands that rarely dry completely via evaporation during the summer, though significant reduction in surface area and depth may occur.

Strategies Applied to Achieve Objective

Maintain/create open water areas: Mechanically reopen areas that have become vegetated with persistent emergent vegetation, to set back succession, and maintain open, shallow water areas.

Use heavy equipment to remove silt and choking vegetation as needed, but retain woody debris (e.g. in Bower Slough).

Use IPM strategies including mechanical, biological, and chemical means to eradicate, control, or contain invasive and undesirable plants.

If needed, utilize appropriate IPM strategies (e.g., drawdown and, if necessary, exclusion followed by rotenone application) to kill carp populations. For effective use of rotenone, and facilitation of equipment needs, exclude any ingress of carp from the source (river) and remove residual vegetation when appropriate. Coordinate with WDFW on rotenone projects, funding initiatives, and partnerships.

Rationale: The refuge has substantial wetland resources that provide habitat for wildlife. Refuge management has traditionally focused on those seasonal and semi-permanent wetlands with water management capabilities. The refuge also contains a system of permanent and tidal wetlands that function somewhat naturally as part of the larger lower Columbia River system.
The wetlands in this category include Carty Lake (52 acres) on the Carty Unit, Post Office Lake (74 acres) on the Ridgeport Dairy Unit, and Bower-Mallard Slough on the River ‘S’ Unit (part of the refuge’s water delivery system). Historically these wetlands were connected to the Columbia River, but are now cut off from the river by dikes and/or cessation of major flooding events. The refuge may or may not have some minimal water management capabilities on these wetlands. The wetlands retain water throughout the summer, though significant reduction in surface area and depth may occur. It appears that water retention is in part a function of the current water levels within the Columbia River system, probably due to seepage/groundwater levels. These wetlands are generally capable of supporting persistent warmwater fish populations; plant communities are primarily comprised of submergent species.

Outside of their extensive use by waterfowl and other migratory birds, little is known about the submerged vegetation and other aquatic species inhabiting Carty and Post Office Lakes. Bower Slough contains abundant woody debris and gets heavy use by hooded mergansers, wood ducks, and waterfowl broods, and is a summer refugium for painted turtles and amphibians.

Due to the loss of the connections these wetlands had with the Columbia River system, their functionality has been reduced, particularly as anadromous fish rearing habitat and native mussel beds. Post Office Lake is currently managed as a nontidal wetland. The dike separating Post Office Lake from the Columbia River is eroding and likely to fail in the next major flood event (the dike is not owned by the refuge). Dike failure would restore a connection between Post Office Lake and the Columbia River (see Objective 6.2). The refuge proposes to develop a contingency plan for Post Office Lake in the event of a dike breach, as part of a larger study to evaluate the feasibility of restoring the lake to a more natural tidal system (see Objective 7.7). As part of the feasibility study, the refuge will examine the potential impacts and benefits of various management actions to fish, waterfowl, amphibians, and wetland vegetation.

Carp, which are widespread in permanent wetlands on the refuge, are thought to represent a high threat to the wetland system's ecological functions due to their impacts on submergent vegetation and water quality. Carp uproot and eliminate submerged vegetation, increase turbidity, and decrease the overall abundance and diversity of the invertebrate community (Miller 2006). Treatments using the natural plant chemical rotenone are expensive, but can be more effective if the amount of water to be treated is minimal, if carp are concentrated in a small area, and if re-establishment can be prohibited through the installation of carp excluders or similar structures.

Objective 3.6 Wet Meadow Habitat

Enhance and annually maintain up to 400 acres of wet meadow habitat to provide feeding and resting habitat for dusky Canada geese and dabbling ducks and migration corridors for native amphibians and reptiles. Restore 90 acres of selected old fields (Wigeon Lake South on Bachelor Island and Dusky Meadow on the Ridgeport Dairy Unit) to wet meadow habitat. Wet meadow is characterized by the following attributes:

- Patch size ranges from 2 to 45 acres with a minimum predator-detection width of 250 feet.
- Hydric soils.
- Flat or very gently sloping topography.
- Mix of palatable forage with a height of < 6 inches by October 1
- > 10% cover of native grasses and forbs such as Columbia sedge, tufted hairgrass, camas, spike bentgrass, dense sedge, California oatgrass, annual hairgrass, meadow barley, American sloughgrass, one-sided sedge, Western mannagrass, spreading rush, wild barley, and buttercup.
- < 5% cover of native shrubs.
- < 20% cover of invasive plants (other than mowed/grazed reed canarygrass).
- Water depths range from moist soil to 4 inches from December through at least March.
- No willows.

Strategies Applied to Achieve Objective
Mow between July 15 and Oct. 1 to maintain grass palatability, minimal thatch, and provide < 4-inch height prior to flood up October 1.
Graze (e.g., domestic animals) from April 15 to September 30 (as conditions allow) to maintain grass palatability, reduce thatch, and provide < 4 inch vegetation height by October 1.
Hay from mid-May to Sep. 30 (as conditions allow) to maintain grass palatability, reduce thatch, and provide < 4-inch height by October 1.
Use IPM strategies including mechanical, physical, biological, and chemical means to eradicate, control, or contain invasive and undesirable plants (see Appendix K. IPM Program).
Pending feasibility study (see Objective 7. 7b) use appropriate restoration techniques to reduce reed canarygrass cover and increase cover of native wet meadow vegetation.

Rationale: Wet meadows are a primary foraging habitat for dusky Canada geese, and can also provide foraging areas for species such as American wigeon, sandhill cranes, and shorebirds; and nesting areas for northern harrier and ducks. The refuge's current wet meadow sites are overflow sites from lakes or wetlands. Native wet meadow vegetation may have included Columbia sedge and tufted hairgrass, but these sites have been largely taken over by reed canarygrass on the lower Columbia River (Christy 2004; and Christy and Putera 1993). If mowed, canarygrass does provide some value to foraging wildlife, especially Canada and cackling geese. Currently, wet meadows on the refuge do get good dusky Canada goose use. Wigeon use these areas when they are grazed, possibly because grazing provides shorter grass than mowing. Target meadows based on dusky Canada goose surveys include: all or portions of Sora Marsh, East-West Meadow, Twining Field, Midlands Meadow, Ruddy Lake, Outer Swartz Meadow, Roth Lowlands, South River Pasture, Roth Field, and Dusky Marsh. In the immediate future, management of these areas will focus on annual mowing and periodic disking (2 consecutive years repeated every 5 years) of wet meadows to provide short grass for goose browse and prevent encroachment of willows. Because mowing may leave significant quantities of thatch, twice annual mowing in high use dusky Canada goose areas is recommended to enhance decomposition. However, mowing alone stimulates additional stem production so under this management regime, wet meadows will continue to be dominated by reed canarygrass. Over the lifetime of the CCP, approximately 90 acres of selected old fields will be converted to wet meadow habitat as well. Future management strategies should target reducing reed canarygrass cover and increasing cover of the native grass and forb species noted in the objective. However, restoring native wet meadow habitat in areas dominated by reed canarygrass is time and resource-intensive, requiring 2-3 years of initial treatments, and continued monitoring and follow-up for 5-10 years to prevent reinfestation (Kilbride and Paveglio 1999, Paveglio and Kilbride 2000, Tu 2004). Therefore, a feasibility study with test treatments and plantings is recommended (see Objective 7.7b).

2.4.4 Goal 4: Protect, manage, and restore a natural diversity of native floodplain forests representative of the historic lower Columbia River ecosystem.

Objective 4.1 Early Successional Floodplain Forest
Protect and maintain at least 330 acres of early successional floodplain forest benefiting migratory and resident landbirds, native reptiles, and native amphibians. Early successional floodplain forest is characterized by the following attributes: • Understory with 30-80% cover of native shrubs (3-12 feet tall) such as red-osier dogwood, willow, snowberry, Douglas' spirea, serviceberry, red elderberry, Indian-plum, cascara, rose with scattered openings containing native herbaceous species (e.g., Columbia sedge, green-sheathed sedge, wooly sedge, retrorse sedge, and stinging nettle). • < 30% cover of invasive plants (e.g., reed canarygrass, false indigo, and blackberry) in understory/herbaceous layer. • < 20% canopy cover of native trees (> 12 feet tall) such as Pacific willow, cottonwood, and red-osier dogwood.
Strategies Applied to Achieve Objective
Monitor and treat up to 10% of early successional forest annually for invasive plants. Use IPM strategies including mechanical, physical, biological, and chemical means to eradicate, control, or contain invasive and undesirable plants.
Allow natural succession via natural willow/cottonwood seedfall.

Pump water to mimic floodplain processes in units with water management capabilities to control invasive plants and promote native seed germination.
Rationale: In presettlement times, Pacific willow (*Salix lucida* ssp. *lasiandra*) swamps were a widespread plant community along the lower Willamette and Columbia rivers. Presettlement components of this plant community probably included Columbia sedge (*Carex aperta*), green-sheathed sedge (*Carex feta*), wooly sedge (*Carex pellita*), retrorse sedge (*Carex retrorsa*), and stinging nettle (*Urtica dioica*) (Guard 1995). Since the arrival of settlers in the early 1800s, between 50% and 90% of riparian habitat in Washington has been lost or extensively modified (Knutson and Naef 1997). This was once a common habitat type on the refuge and contributes to the species diversity. Much of the native understory has been lost or highly degraded by livestock grazing and alterations to natural hydrology (levees, dams). Today Pacific willow and reed canarygrass form a common community type. Intact riparian areas are important to the conservation of Washington's vertebrate species. Of the 118 species of landbird migrants occurring in Washington, 67 (57%) use riparian habitat (Andelman and Stock 1994). Avian densities in riparian forests along the Columbia River can be as high as 1,500 birds per 100 acres (Tabor 1976). Approximately 85% of Washington's terrestrial vertebrate species use riparian habitat for essential life activities (Knutson and Naef 1997). Riparian habitat is additionally important to supporting healthy native fish populations by benefiting instream characteristics including temperature, water quality, water chemistry, cover, and nutrients. The refuge contains approximately 1,100 acres of riparian and/or floodplain forest habitat in various seral stages or conditions. Most of this habitat on the refuge is vulnerable and/or remains in a degraded condition due to invasive plants, past grazing practices, alteration of hydrologic regimes, altered river levels, and poor native plant recruitment/ recovery. The refuge can contribute toward providing habitat or habitat connectivity for species that are dependent on riparian and floodplain forests by enhancing or restoring a mix of early, mid, and late successional floodplain forests on the refuge.

Objective 4.1a Restore Early Successional Floodplain Forest
Within the lifetime of the CCP, restore up to 160 acres of selected old fields, pasture, and nonmanaged wetlands to early successional floodplain forest. Restored early successional floodplain forest is characterized by the following attributes: • Understory with 30-80% cover of native shrubs (3-12 feet tall) such as red-osier dogwood, willow, snowberry, Douglas' spirea, serviceberry, red elderberry, Indian-plum, cascara, and rose with scattered openings containing native herbaceous species (e.g., Columbia sedge, green-sheathed sedge, wooly sedge, retrorse sedge, and stinging nettle). • < 30% cover of invasive plants (e.g., reed canarygrass, false indigo, and blackberry) in understory/herbaceous layer. • < 20% canopy cover of native trees (> 12 feet tall) such as Pacific willow, cottonwood, and red-osier dogwood.
Strategies Applied to Achieve Objective
Seed or plant willow and red-osier dogwood in wetlands, wetland edges, or other appropriate hydric areas. Incorporate techniques to remove competing vegetation such as reed canarygrass by mechanical or chemical methods and use fencing or mats to reduce rodent damage to new plantings. New plantings will focus on connecting or expanding existing riparian stands in areas that are unlikely to be used by focus species such as dusky Canada goose or cranes.
Use IPM strategies including mechanical, cultural, biological, and chemical means to eradicate, control, or contain invasive and undesirable plants (see Appendix K).
Allow natural succession via natural willow/cottonwood seedfall.

Pump water to mimic floodplain processes in units with water management capabilities to control invasive plants and promote native seed germination and survival.
Rationale: The refuge has an opportunity to restore early successional floodplain (bottomland) forest in selected old fields, pastures with low productivity, and wetland basins with poor water holding capabilities. Restored early successional floodplain forest benefits migratory and resident landbirds, native reptiles, and native amphibians. Planting willow and red osier dogwood will accelerate regeneration, enhance habitat quality, and provide habitat connectivity with existing floodplain forest. Highest priority areas for restoration will be based on their size and connectivity on and off the refuge. Though these acreages are relatively small, restoration efforts may provide valuable habitat or habitat connectivity for some species that are dependent on riparian and bottomland forests. New plantings will focus on connecting or expanding existing riparian stands in areas that are unlikely to be used by focus species such as dusky Canada geese or cranes. One seasonal wetland on River 'S' Point (16 acres) is undergoing succession to native trees. Under the CCP, this succession will continue; therefore, this wetland is now included under the early successional floodplain forest habitat type.

Objective 4.2 Mid to Late Successional Floodplain Forest
Protect and maintain 400 acres of mid to late successional floodplain forest benefiting migratory and resident landbirds, native reptiles, and native amphibians. Mid to late successional floodplain forest is characterized by the following attributes: • Understory with > 50% cover in shrub layer that is primarily (> 75%) native species (e.g., red-osier dogwood, snowberry, Douglas' spirea, serviceberry, red elderberry, Indian-plum, cascara, and rose). • > 50% canopy cover of native trees such as black cottonwood, Pacific willow, and Oregon ash. • < 30% cover of invasive plants (e.g., reed canarygrass, blackberry) in understory/herbaceous layer.
Strategies Applied to Achieve
Monitor and treat up to 10% of mid to late successional forest annually for invasive plants. Use IPM strategies including mechanical, cultural, biological, and chemical means to eradicate, control, or contain invasive and undesirable plants (see Appendix K).
Allow succession of early successional floodplain forest to mid-late successional forest.
Promote regeneration of black cottonwood woody and herbaceous understory, using appropriate forestry techniques. If shade is restricting shrub growth and the regeneration of shade intolerant tree species, thin the overstory to 50% to 75% cover and remove competing invasive plants such as reed canarygrass. Consider fencing or tree seedling protection if vole or beaver gnawing or deer browsing is preventing regeneration.
Endorse and partner (where feasible) with public and private agencies and adjacent landowners to maintain and enhance connectivity and forest habitat quality on adjoining lands.
Rationale: As stated above, at least 50% and as much as 90% of riparian habitat in Washington has been lost or extensively modified since the 1800s (Knutson and Naef 1997). Today much of the native understory has been destroyed by livestock grazing and alterations to natural hydrology (levees, dams) and the understory is dominated by reed canarygrass. Pre-settlement components of this plant community probably included Columbia sedge (*Carex aperta*), green-sheathed sedge (*Carex feta*), wooly sedge (*Carex pellita*), retrorse sedge (*Carex retrorsa*), and stinging nettle (*Urtica dioica*) (Guard 1995). Recruitment of cottonwood in particular, is also low due to alterations in hydrology and many stands are composed of old, even aged trees. The refuge currently contains approximately 330 acres of mid to late successional floodplain forest habitat in various conditions. In addition, approximately 70 acres of early successional floodplain forest are expected to attain mid-successional status over the lifetime of the CCP. Most of this habitat on the

refuge is threatened and/or remains in a degraded condition due to invasive plants, past grazing practices, alteration of hydrologic regimes, lower river levels, and poor native plant recruitment/recovery. Management will focus on improving habitat conditions in this existing habitat.

Objective 4.3 Oregon Ash Floodplain Forest

Protect and maintain approximately 330 acres of Oregon ash-dominated floodplain forest for migratory and resident land birds, native reptiles, and native amphibians. Oregon Ash Floodplain forest is characterized by the following attributes:

- Canopy cover > 50% dominated by Oregon ash.
- Shrub layer < 20% cover consisting of native floodplain species such as Douglas' spirea and red-osier dogwood.
- Herbaceous layer > 50% native species (e.g. Columbia sedge, green-sheathed sedge, wooly sedge, retrorse sedge, and stinging nettle).
- < 30% cover of invasive plants (e.g., reed canarygrass, and blackberry) in understory/herbaceous layer.

Strategies Applied to Achieve Objective

Monitor and treat up to 10% of Oregon ash forest annually for invasive plants. Use IPM strategies including mechanical, physical, biological, and chemical means to eradicate, control, or contain invasive and undesirable plants (see Appendix K).

Promote regeneration of Oregon ash, and woody and herbaceous understory using appropriate forestry techniques such as fencing to protect existing mature trees and natural regeneration, removing reed canarygrass and competing vegetation, and supplementing natural re-generation by planting (protect with tubes or fencing as necessary).

Endorse and partner (where feasible) with public and private agencies and adjacent landowners to maintain and enhance connectivity and forest habitat quality on adjacent lands

Rationale: Protecting and maintaining Oregon ash floodplain forest is consistent with the Service's 2001policy on Biological Integrity, Diversity, and Environmental Health (601 FW 3). In presettlement times, seasonally flooded Oregon ash forest was a widespread plant community along the Willamette and lower Columbia rivers. Early survey records indicate that ash forests were a common plant community on the bottomlands of Clark County. Since the arrival of settlers in the early 1800s, at least 50% and as much as 90% of riparian habitat in Washington has been lost or extensively modified (Knutson and Naef 1997).

The refuge contains 330 acres of Oregon ash forest habitat in various conditions. The native understory component has been severely degraded by past livestock grazing and alterations to natural hydrology (levees and dams) and the understory is now dominated by reed canarygrass. Presettlement components of this plant community probably included Columbia sedge (*Carex aperta*), green-sheathed sedge (*Carex feta*), wooly sedge (*Carex pellita*), retrorse sedge (*Carex retrorsa*), and stinging nettle (*Urtica dioica*) (Guard 1995). Recruitment of ash is also low due to alterations in hydrology and many stands on the refuge are composed of old, even aged trees. Strategies to enhance this habitat could involve thinning and planting of young ash to create multi-aged stands, eradicating invasive species, and establishing native understory in existing ash forests. However, establishing native understory is difficult, and study plots will be needed to determine the most appropriate strategies before they are implemented on a large scale (see Objective 7.7).

Objective 4.3a Restore Oregon Ash Floodplain Forest
Restore up to 5 acres of Oregon ash-dominated floodplain forest for migratory and resident land birds, native reptiles, and native amphibians. Oregon Ash Floodplain forest is characterized by the following attributes: • Canopy cover > 50%, dominated by Oregon ash. • Shrub layer < 20% cover, consisting of native species such as Douglas' spirea, and red-osier dogwood. • Herbaceous layer > 50% native species (e.g. Columbia sedge, green-sheathed sedge, wooly sedge, retrorse sedge, and stinging nettle). • < 30% cover of invasive plants (e.g., reed canarygrass and blackberry) in understory/herbaceous layer**.**
Strategies Applied to Achieve Objective
Use IPM strategies including mechanical, cultural, biological, and chemical means to eradicate, control, or contain invasive and undesirable plants (see Appendix K) in restoration area.
Plant Oregon ash and other native trees and shrubs, using exclosures or other devices to protect plantings.
Endorse and partner (where feasible) with public and private agencies and adjacent landowners to maintain and enhance connectivity and forest habitat quality on adjacent lands.
Rationale: Restoring Oregon Ash floodplain forest habitat is consistent with the Service's 2001 policy on Biological Integrity, Diversity, and Environmental Health (601 FW 3). A small but important area is targeted for ash restoration. Though the acreage is relatively small, restoration efforts may provide valuable habitat or habitat connectivity for high priority landbird species that are dependent on riparian and floodplain forests, and allow refuge staff to evaluate efficacy of restoration techniques before implementing them on a larger scale.

2.4.5 Goal 5: Protect, manage, and restore a natural diversity of native upland forests representative of the historic lower Columbia River ecosystem.

Objective 5.1 Oregon White Oak Woodlands
Protect and maintain 70 acres of oak woodlands benefiting migratory and resident land birds (e.g., slender-billed white-breasted nuthatch), as well as other native wildlife. Oak woodland has the following attributes: • Canopy cover of 30%-80%, with no less than 70% oak canopy cover. • No conifers. • Native shrub layer > 40% cover (appropriate native species may include poison oak, snowberry, rose, spirea, and oval-leaf viburnum). • Mean dbh of oaks > 21 inches, with 20% of oaks > 28 inches. • < 20% cover of invasive plants (e.g., reed canarygrass and blackberry) in understory/herbaceous layer.
Strategies Applied to Achieve Objective
Monitor and treat up to 10% of Oregon white oak woodlands annually, for invasive plants. Use IPM strategies including mechanical, cultural, biological, and chemical means to eradicate, control, or contain invasive and undesirable plants.
Use forestry techniques (e.g. hand-pull, girdle, cut, and spray) to remove encroaching conifers, another woody vegetation necessary to maintain canopy dominance of oaks.
In over dense stands, thin overstory trees to achieve 30%-80% canopy cover.
Evaluate need to gather acorns and head-start seedlings for planting as part of subsequent stand maintenance and future habitat expansion.
Use prescribed fire to maintain this fire-dependent habitat. Coordinate with Clean Air District to obtain

permit for controlled burning of oak woodland and native grassland habitat.
Prohibit livestock grazing.
Endorse and partner (where feasible) with public and private agencies and adjacent landowners to maintain and enhance connectivity and forest habitat quality on adjacent lands.
Rationale: Protecting and maintaining Oregon white oak woodland habitat is consistent with the Service's 2001 policy on Biological Integrity, Diversity, and Environmental Health (601 FW 3). Oregon white oak woodlands in the Willamette Valley/Puget Trough ecoregion are threatened and/or remain in degraded conditions due to an extensive history of conversion to agriculture and other land uses, grazing, and fire suppression. In the Willamette Valley, 80% of oak woodlands present in 1850 have disappeared (Floberg et al. 2004; figures are not available for the lower Columbia region). The refuge contains approximately 70 acres of Oregon white oak woodland, all located in the Carty Unit. The basalt knobs in the Carty Unit contain a rare plant community, Oregon white oak/oval-leaf viburnum/poison-oak woodland, which is classified as a Priority 2 ecosystem in the Washington Natural Heritage Plan (WDNR 2009). Most of this habitat lies within the Blackwater Island RNA and the Washougal Oaks Natural Area Preserve/Natural Resource Conservation Area. The slender-billed white-breasted nuthatch has been confirmed in this habitat. This subspecies has declined significantly in the past century and is now limited to oak woodlands in Clark County. It is currently listed by the Service as a subspecies-of-concern, and is a candidate for listing by the WDFW. In addition, a number of rare or uncommon native wildflowers have been found in this habitat. Periodic low intensity fire is one of the key ecological processes affecting the viability of the oak woodland ecosystems. An anthropogenic fire regime by American Indians was probably present historically. Fire maintained open understory conditions in oak woodland, and favored dominance of oak over Douglas fir. The recent history of fire suppression on the refuge has allowed encroachment of Douglas fir and invasive plants in oak woodlands, and may have contributed to a decline in oak recruitment and in native wildflowers. To maintain this rare plant community, control of invasive plants, and planting oak seedlings or saplings, and maintaining sufficient forest floor light conditions by thinning dense, even-aged oak stands may be necessary.

Objective 5.1a Restore Oak Woodlands
Restore 10-20 acres of oak woodlands benefiting migratory and resident land birds, as well as other native wildlife. Restored oak woodland has the following attributes: • Total canopy closure of 30%-80%, with no less than 70% oak canopy. • No conifers. • Native shrub layer > 40% (appropriate native species may include poison oak, snowberry, rose, spirea, and oval-leafed viburnum). • Mean diameter breast height (dbh) of oaks > 21 inches, with 20% of oaks > 28 inches. • < 20% cover of invasive plants (e.g., reed canarygrass and blackberry) in understory/herbaceous layer.
Strategies Applied to Achieve Objective
Use IPM strategies including mechanical, cultural, biological, and chemical means to eradicate, control, or contain invasive and undesirable plants (see Appendix K).
Use forestry techniques (e.g. hand-pull, girdle, cut, and spray) to remove encroaching conifers and other woody vegetation as necessary to maintain canopy dominance of oaks.
Evaluate need to gather acorns and head-start seedlings for planting as part of subsequent stand maintenance and future habitat expansion.
Use prescribed fire to maintain this fire-dependent habitat. Coordinate with Clean Air District to obtain

permit for controlled burning of oak woodland and native grassland habitat.
Prohibit livestock grazing.
Endorse and partner (where feasible) with public and private agencies and adjacent landowners to maintain and enhance connectivity and forest habitat quality on adjacent lands.
Rationale: Restoring oak woodland habitat is consistent with the Service's 2001policy on Biological Integrity, Diversity, and Environmental Health (601 FW 3). Oak woodland provides habitat for the slender-billed white-breasted nuthatch, which has declined significantly in the past century and is now limited to oak woodlands in Clark County. It is currently listed by the Service as a subspecies-of-concern, and is a candidate for listing by the WDFW. In addition, a number of rare or uncommon native wildflowers have been found in this habitat. Oregon white oak woodlands in the Willamette Valley/Puget Trough ecoregion are threatened and/or remain in a degraded condition due to an extensive history of conversion to agriculture and other land uses, grazing, and fire suppression. In the Willamette Valley 80% of oak woodlands present in 1850 have disappeared (Floberg et al. 2004; figures are not available for the lower Columbia region).

Objective 5.2 Upland Mixed Forests
Enhance and annually maintain 15 acres of upland mixed forest benefiting migratory landbirds and other native wildlife. Upland mixed forests are characterized by the following attributes: • > 50% canopy cover of mixed deciduous and coniferous forest species (Douglas-fir, western red cedar, grand fir, Oregon white oak, Oregon ash and bigleaf maple). • > 30% cover of native deciduous shrubs (poison oak, common snowberry, rose, spirea, oval-leafed viburnum, native *Rubus* species, ninebark, Indian-plum, tall Oregon grape, and elderberry) and small sub-canopy trees < 15 feet tall (black hawthorn, vine maple, and beaked hazelnut) collectively cover > 30%. • > 30% herbaceous cover consisting of native forbs and ferns with a major native component of flowering perennial species (e.g., Solomon's-seal, trillium, lilies, columbine, and sanicle). • < 20% cover of invasive plants (e.g., reed canarygrass and blackberry) in understory/herbaceous layer
Strategies Applied to Achieve Objective
Inventory, prevent further spread of, and control encroaching blackberry and other invasive species into existing upland mixed forests. Assess canopy density to provide a mosaic of shade tolerant and moderately tolerant understory species. Annually monitor and treat approximately 20% of existing upland mixed forests for blackberry and other invasives (see Appendix K). Blackberry requires methods of control that are both cost and labor intensive. Habitat restoration of areas invaded by blackberry will require cutting and spraying for several years in a row, and then planting with native vegetation.
Endorse and partner (where feasible) with public and private agencies and adjacent landowners to maintain and enhance connectivity and forest habitat quality on adjacent lands.
Rationale: Maintaining existing upland mixed forest is consistent with the Service's 2001policy on Biological Integrity, Diversity, and Environmental Health (601 FW 3). This habitat provides thermal cover, migration and dispersal corridors for a diverse assemblage of wildlife species, including amphibians, reptiles, and migratory landbirds. A number of rare or uncommon native wildflowers have been found in this habitat. Blackberry has overtaken native understory vegetation in the native mixed forest on the Carty Unit, including habitat for the small-flowered trillium, listed as Sensitive in Washington.

2.4.6 Goal 6: Protect, enhance and where feasible restore riverine habitat and tidal wetlands representative of the historic lower Columbia River ecosystem, to benefit salmonids and other native aquatic species.

Objective 6.1 Instream and Riverine Habitats
Enhance and improve in-stream and riverine conditions of Gee Creek (3.76 miles) and Campbell Slough (2.6 miles) as well as other appropriate areas for the benefit of salmonids and other native aquatic species. Instream and Riverine habitat is characterized by the following attributes: • 7-day mean maximum water temperature < 63.5° F[1]. • Low turbidity (<70 nephelometric turbidity units [NTU][2]). • Lack of barriers to upstream spawning and rearing habitats. • Presence of instream woody debris. • Minimal presence of warm water fishes. [1] WA water quality standards for salmonid spawning, rearing, and migration (WDOE 2006) [2] Threshold for avoidance by juvenile coho salmon (Bisson and Bilby 1982)
Strategies Applied to Achieve Objective
Improve instream habitat conditions by planting riparian trees and shrubs (primarily willow, black cottonwood and Oregon ash) along the 0.8 miles of shoreline of Gee Creek, at a minimum, from the east refuge boundary to Middle Lake (Also see Objectives 4.1a and 4.3a).
In Gee Creek, endorse watershed-wide approaches and partner (where feasible) with private and public agencies, and adjacent landowners to maintain temperature and water quality and reduce in-flow of siltation from upstream sources.
Pending results of study (see Objective 7.3), implement techniques to reduce populations and reproduction of carp without negatively affecting salmonids in Campbell Slough. Coordinate with WDFW on funding initiatives and partnerships.
Based on results of sedimentation and fish passage assessments in lower Gee Creek (see Objective 7.7), implement restoration actions if necessary (e.g., deepen channel near the mouth, excavate historic (1929) channel, and other actions), to improve fish passage.
Based on results of the Campbell Slough assessment for salmonid rearing habitat (see Objective 7.7), implement appropriate restoration actions if necessary (e.g., deepen channel, increase canopy cover, and eliminate passage barriers) to improve salmonid rearing habitat.
Rationale: Under this objective, aquatic habitat management activities will be developed and implemented to protect and restore instream/riverine habitats, for the benefit of salmonids, and other native aquatic species. Over the past 150 years, watershed conditions on the lower Columbia River and its tributaries have been severely degraded as the result of land use practices (e.g. forest clearing, agricultural uses, and urban and industrial development). Hydrologic regimes have also been altered by diking, channelization of streams and rivers, and dam operations. Gee Creek and Campbell Slough represent the major riverine habitats within the refuge that are connected to the Columbia River, and the connectivity is not directly affected by dikes. Approximately 3.76 miles of Gee Creek, and all of Campbell Slough (2.6 miles) lie within refuge boundaries. The refuge also includes riparian areas adjacent to Lake River, Bachelor Slough, and the Columbia River. The refuge boundary extends only to mean high tide of Lake River, Bachelor Slough, and the Columbia River. Therefore, these water bodies are outside the refuge's management control. Watershed-wide approaches and partnerships with private and public agencies and adjacent landowners will be necessary

to maintain or improve habitat conditions in Lake River and Bachelor Slough. Management of the refuge's riparian areas adjacent to Lake River, Bachelor Slough, and the Columbia River will have a slight influence on habitat quality, and nutrient dynamics of these waters.

By being outside the dikes, Gee Creek and Campbell Slough likely possess habitat conditions similar to those historically present in the lower Columbia River, more so than other areas directly affected by dikes, and offer the best opportunities to restore some historic conditions. A comprehensive assessment of habitat conditions is needed to prioritize and guide restoration efforts (see Objectives 7.4 and 7.7). The present physical, chemical, and biological attributes of these habitats, including use by salmonids and other native aquatic species, need to be described and quantified to assess their current status. Implementation of habitat management/restoration strategies under this objective will be contingent upon the results of these studies.

Several species/stocks of anadromous fish including coastal cutthroat trout, Chinook and coho salmon and steelhead spend portions of their life history either on or adjacent to refuge waters and shorelines on the Columbia River. Historically, Gee Creek, Campbell Slough, Lake River, Bachelor Slough, and shallow overflow lakes such as Campbell Lake served as nurseries for young developing salmonids. Spawning chum salmon were noted in a tributary of Gee Creek in the late 1940s, and there was an anecdotal account of coho salmon trying to get past a barrier near Royle Road on Gee Creek "prior to the 1950s." Trout (mostly identified as cutthroat) have been reported anecdotally in the creek for many decades (Cornelius 2006).

Surveys in 1995-1997 found cutthroat trout, juvenile steelhead, and juvenile salmon (coho and Chinook) in lower Gee Creek. More recent surveys (2002-2005) conducted upstream of the earlier ones have found only cutthroat trout and juvenile coho in Gee Creek (Cornelius 2006). A May 2007 survey found juvenile Chinook salmon in Campbell Slough. Numbers of cutthroat trout in Gee Creek are low compared to similar creeks nearby. The creek has stretches of suitable habitat (Hogle 2006), but others appear to be of marginal quality. In addition to degraded habitat, low cutthroat numbers may be due in part to the presence of large numbers of warmwater fish, which compete with or prey upon native fish. The presence and size of cutthroat suggests that spawning occurs in the drainage, and therefore, habitat improvements could enhance populations of this species. The source of the juvenile coho in Gee Creek has not been determined and it is possible though unlikely, that coho spawning habitat may exist in the upper areas of Gee Creek off the refuge.

Although Gee Creek and Campbell Slough offer the best opportunities to restore historical habitat conditions, these areas have been degraded by multiple stressors (both on and off the refuge) influencing water temperature, water quality, sediment transport, habitat complexity, and fish passage. Existing and new information generated by habitat and biological assessments (Objective 7.7) will be used to identify location-specific (e.g., on a stream or slough basis) habitat objectives for which management strategies will be developed. Using these strategies, specific management actions (e.g., protecting habitats, removing fish passage barriers, planting native vegetation, and modifying channel form) will be implemented. This approach will also be applied to areas where it is feasible to establish connectivity with the Columbia River. Because watersheds represent a natural unit for focusing habitat restoration efforts, the Service intends to engage in partnerships at the watershed scale to coordinate activities so that refuge actions are not negated by other activities within the watershed.

The refuge is currently partnering in a project to improve instream habitat throughout the Gee Creek watershed. Although Gee Creek and Campbell Slough are the top priorities for habitat enhancement and restoration, where funding and partnership opportunities become available restoration/enhancement could be undertaken in other tidal and riverine habitat on the refuge.

Conserving and restoring trout, salmon, and steelhead populations is an important regional priority, not only for protecting the species, but also because of their cultural, historical, and ecological value. These fish are important food sources for numerous wildlife species. Protection and/or restoration of instream habitats and tidal wetlands may also benefit turtles, amphibians, and waterbirds. Planting shoreline vegetation will improve water quality by creating shade and reducing shoreline erosion; and will provide habitat for migratory and resident landbirds.

Objective 6.2 Tidal wetlands

Enhance and annually maintain 490 acres of tidally influenced freshwater wetlands for the benefit of anadromous fish, waterfowl, and wading birds. Attributes of this habitat include:

- Hydroperiod and water depth naturally varies with the Columbia River.
- ≥ 70% open water containing submergent plants (e.g., sago pondweed).
- < 30% cover of tall, native emergent plants creating a mosaic.
- Barrier-free passage for juvenile salmonids between the river/main sloughs and the wetlands.
- 7-day mean maximum water temperature < 63.5º F[1] and turbidity < 70 Nephelometric Turbidity Units[2] (NTU) during summer months.
- Carp < 200 pounds per acre.
- < 10% cover of invasive plants (e.g., reed canarygrass).

[1] WA water quality standards for salmonid spawning, rearing, and migration (WDOE 2006)
[2] Threshold for avoidance by juvenile coho salmon (Bisson and Bilby 1982)

Strategies Applied to Achieve Objective

Allow natural processes to re-establish connection between Post Office Lake (approx 75 acres) and the Columbia River. (Also see tidal wetlands restoration and dike breach contingency plans, Objective 7.7.)

Within 2 years of CCP completion, initiate a Land Protection Plan study to analyze alternatives for possible refuge boundary expansion to include the portion of Post Office Lake and adjoining areas south of the current approved refuge boundary. (Also see Summary of Management Direction; tidal wetlands restoration and dike breach contingency plans, Objective 7.7.)

Pending results of habitat assessment (see Objective 7.7), mechanically reopen areas of Campbell Lake that have become vegetated with persistent emergent vegetation, in order to set back succession and maintain open, shallow water areas.

Use IPM strategies including mechanical, cultural, biological, and chemical means to eradicate, control, or contain invasive and undesirable plants including knotweeds, reed canarygrass, yellow flag iris, and false indigo-bush (see Appendix K).

Strategically locate water gaps and improve fencing along Campbell Lake to protect bank vegetation from livestock grazing in improved pastures.

Use rotenone to remove carp from Duck Lake (4.6 acres.). After carp removal, remove blockages between Duck Lake and Gee Creek to re-establish historic connection. Install adult carp exclusion device (while permitting passage of juvenile salmonids) and reintroduce native submergent vegetation.

Rationale: An estimated 90% of tidally influenced freshwater wetlands in the lower Columbia River region have been lost (Floberg et al. 2004). Diking and filling have been a primary cause of decreases in tidal wetland area in the Columbia River estuary. These actions eliminated most of the natural, tidal exchange of water, materials, and organisms between the Columbia River and the adjacent bottomland forests and shallow overflow lakes; however, limited exchange occurs through tide gates.

Tidally influenced freshwater wetlands along the lower Columbia River historically provided important rearing habitat for Chinook and coho salmon, cutthroat trout, and steelhead. Tidal exchange is important not only for the access and use of these habitats by fish, but also for maintenance of habitat-forming processes such as sedimentation and erosion. By restoring tidal exchange, these processes are restored, and the habitats can develop naturally as well as provide their functions to the ecosystem (Johnson et al. 2003).

Outside the dikes, some refuge wetlands retain tidal connections to the Columbia River. Tidal wetlands are currently present on the Roth, Ridgeport Dairy, Carty, and Bachelor Island units. About 40% of this habitat type is one large lake (Campbell Lake is 189.4 acres) on the Roth Unit. Other large tidal wetlands include Canvasback Lake on Bachelor Island (52.1 acres), Campbell Slough on the Roth Unit (29.6 acres), and South Campbell Lake on the Ridgeport Dairy Unit. Tidal wetlands (a network of sloughs, channels and open lakes) are also located on the Carty Unit, totaling 101.9 acres. However, due to lower river levels and altered flooding regimes, water levels are lower than they were historically and some open water areas are being lost to tall emergents. Campbell Lake, in particular, is a tidal wetland that supports large numbers of migratory and overwintering waterfowl as well as an important roost for migrating sandhill cranes. A current concern is that open water is being lost to tall emergents, impacting waterfowl and crane habitat. Average year-round water levels within Campbell Lake appear to be consistently lower since the 1996-1997 flood seasons, when Campbell Lake was predominantly nonvegetated, exposed mudflat. Since then, emergent plant species have colonized much of the shallow wetlands and mudflats once utilized by roosting cranes. The middle and northern portions of the lake are still relatively vegetation-free; however, water levels may be too deep for roosting during the highest tides. This habitat change in Campbell Lake may account for the some cranes shifting their roosting sites to Canvasback Lake beginning in 2003, although additional comprehensive surveys are needed to delineate the roosting pattern with respect to waterfowl hunt days and variable water conditions. It is expected that if the vegetation trend continues on Campbell Lake, the site may lose its value as roosting habitat. Protection of current roost sites is essential as they provide unique features such as proper water depths and isolation that are not located elsewhere along the river (Engler et al. 2003). However, to date little effort has been placed on studying nonmanaged aquatic habitats on the refuge, including Campbell Lake. Effective restoration techniques rely on valid data and knowledge of habitat conditions. Restoration is likely to be difficult and costly. A habitat assessment of Campbell Lake (see Objective 7.7) will be needed to provide refuge staff with necessary scientific information to restore and manage the lake comprehensively.

Post Office Lake is a 73.7-acre permanent wetland on the Ridgeport Dairy Unit. The lake had at least some tidal connection to the Columbia River as late as the mid-1990s. Formerly, this lake had substantial use by diving ducks, but use by divers has declined over the past 10 years. Most of the lake lies within the refuge boundary but a small portion of the lake is on private land. It is separated from the Columbia River by a dike, which is not owned by the Service. The dike is in poor condition and is likely to fail during a major flood event. Dike failure would re-establish the tidal connection between Post Office Lake and the Columbia River, but would also flood private land south of the refuge. Rain-on-snow flood events are relatively common in western Washington. The last major flood of this type was in 1996 and overtopped and breached the Bachelor Island dike (USFWS 1996). Projected warmer, wetter winters associated with climate change suggest further increases in the risk of winter flooding (Mote et al. 2003). Because it is possible that a dike breach will occur within the lifetime of the CCP, this lake has been designated as a tidal wetland. Tidal wetlands restoration planning for the refuge (Objective 7.7) will include a contingency plan for Post Office Lake in the event of a dike breach, as well as evaluating and developing strategies to maintain and/or enhance connectivity between the Columbia River and Post Office Lake. The refuge will also participate in a Land Protection Plan study for the Lower Columbia River area, including options to bring lands currently outside of the refuge boundary, under Service

management, either through cooperative agreement, conservation easement, or fee acquisition. A separate planning process, including public input and agency compliance requirements, will accompany this study (see Summary of Management Direction, page 2-6). The historic connection between Duck Lake (4.6 acres) and Gee Creek will be restored, thereby converting it from a permanent wetland to a tidal wetland. Before the introduction of carp, Duck Lake had abundant wapato beds. Wapato could be reestablished here if carp were controlled before reestablishing the connection to Gee Creek, and fish exclusion devices installed thereafter. Outside of their extensive use by waterfowl and other migratory birds, little is known about submerged vegetation and other aquatic species inhabiting refuge wetlands. Carp enter Campbell Lake via Campbell Slough by the thousands during the breeding season. They probably occur in Post Office Lake as well. Carp are thought to represent a high threat to the functioning of the wetland system due to their impacts on submergent vegetation and water quality. Carp uproot and eliminate submerged vegetation, increase turbidity, and decrease the overall abundance and diversity of the invertebrate community (Miller 2006). However, despite the presence of carp in Campbell Lake, this lake still supports a reasonably high-quality native plant community and receives high waterfowl use. Reducing carp populations and reproduction will be beneficial to these wetlands; however, complete eradication of carp in an open (tidal) system is probably impractical.

2.4.7 Goal 7: Collect scientific information (inventories, monitoring, and research) necessary to support adaptive management decisions on the refuge associated with Goals 1-6.

Objective 7.1 Inventory and Monitoring Activities
Throughout the life of the CCP, conduct high-priority inventory and monitoring (survey) activities that evaluate resource management and public-use activities to facilitate adaptive management. These surveys contribute to the enhancement, protection, use, preservation, and management of wildlife populations and their habitats on- and off-refuge lands. Specifically, they can be used to evaluate achievement of resource management objectives identified under Goals 1-6.
Strategies Applied to Achieve Objective
Conduct surveys on goose foraging and habitat use in relation to habitat management objectives and techniques. Conduct vegetation monitoring on goose pastures utilizing established techniques including but not limited to measuring species composition, percent of vegetation cover, cover height, and palatability.
Monitor composition and distribution of aquatic vegetation in managed wetlands every 2 to 5 years to determine need for and/or efficacy of treatments, and assess benefits to waterfowl.
Inventory wetland plant communities and monitor effectiveness of invasive plant control measures annually in seasonal and semi-permanent wetlands. Control any reinvasion by nonnative plants.
Monitor water quality and temperature in Gee Creek and Campbell Slough. Continue work with the Estuary Partnership to collect and analyze water quality data at Campbell Slough.
Annually monitor vegetation (species composition and condition of plantings) in restored riparian and oak woodland habitat.
Conduct breeding bird surveys, banding, and habitat assessments for grassland, riparian, and woodland species to determine the effects of restoration activities and habitat condition on nesting success and

recruitment.
Monitor and treat up to 10% of floodplain/riparian forest, oak woodland, and mixed conifer forest, annually for invasive plants. Use IPM strategies including mechanical, physical, biological, and chemical means to eradicate, control, or contain invasive and undesirable plants (see Appendix K).
Rationale: Monitoring the wildlife and vegetation response to habitat management practices is necessary to implement adaptive management techniques on the refuge. The Refuge Improvement Act requires the Service to monitor the status and trends of fish, wildlife, and plants on each refuge. An inventory and monitoring plan needs to be developed, and should include as priorities: The monitoring of vegetation and wildlife responses to habitat management activities; and the response of vegetation and wildlife to habitat restoration projects. Existing staff and funds are prioritized to perform the most pressing habitat management projects on the refuge, leaving few resources available to conduct studies of the effectiveness of habitat management or restoration treatments. This lack of data, for managed sites as well as appropriate reference sites that are necessary to account for variability, hinders the refuge's ability to use adaptive management to evaluate the effectiveness of its management practices and make necessary course corrections. Additional staff positions needed to conduct inventory and monitoring activities are identified in Appendix D. Vegetation monitoring in goose pastures was conducted using various techniques between 1995 and 2003. Loss of staff positions and funding has prevented data collection on goose use and vegetation since 2003. This data is necessary to make decisions regarding management of goose habitat on the refuge. An opportunity exists to partner with universities and other refuges to study the relationship between forage quality and goose use. This information will be extremely useful in making decisions regarding the management of goose habitat on the refuge, determining carrying capacity, and conducting landscape level management of Canada geese on their wintering grounds in southwest Washington and Oregon.

Objective 7.2 Conduct surveys
Conduct surveys for purposes species and other species of management concern, including dusky Canada geese: other subspecies of Canada geese and cackling geese; breeding waterfowl; sandhill cranes; bald eagles; and great blue herons.
Strategies Applied to Achieve Objective
Participate in regionally based waterfowl surveys and banding studies, such as the mid-winter waterfowl survey, dusky Canada goose surveys, and other specific waterfowl surveys, following established protocols.
Resume refuge-based goose surveys (all subspecies). Conduct goose surveys from October through May.
Conduct comprehensive regional roost, habitat use and distribution surveys for sandhill cranes to determine if vegetation and elevation changes in Campbell Lake are decreasing the value of the roost.
Conduct annual monitoring for the presence of sandhill cranes during the breeding season (April to August). Any cranes detected will be further monitored to determine nesting status. If nesting and/or brood-rearing activities are confirmed, the Refuge will determine whether any management actions would be appropriate. Non-essential Refuge activities that may increase disturbance and reduce nest success will be avoided to the extent practicable in these areas.
Continue to partner with the Oregon Zoo and other volunteers to conduct semi-annual great blue heron nesting surveys. Monitor size of nesting colony, and identify potential threats to production including loss of nesting habitat, contaminants, and disturbance.
Conduct breeding waterfowl surveys (pair counts and reproduction surveys).
Assist with regional bald eagle nesting surveys. Identify potential short- and long-term threats to

production, including contaminants and disturbance.
Coordinate with other refuges and state wildlife areas in Oregon and southwest Washington to develop uniform survey protocols and collect data on seasonal use patterns and distribution of Canada and cackling geese.
Rationale: Surveys for purposes species and species associated with biological diversity, integrity, and biological health (BIDEH) are necessary to conduct adaptive management for these species on the refuge. **Dusky Canada Geese:** The refuge has participated annually in regional dusky Canada goose surveys. While these surveys provide a population index for the entire population, they are inadequate to discern population shifts on a local level. Dusky use of the refuge appears to be declining. Updated information is needed on seasonal use patterns and distribution of dusky Canada geese in Oregon and southwest Washington to understand how geese are redistributing themselves in wintering areas. Combined with studies of the relationships between goose use and habitat type or forage quality, this will help managers develop regional strategies for managing dusky Canada goose wintering habitat. **Other subspecies of Canada geese and cackling geese:** Although the refuge participates in the Mid-winter Waterfowl Surveys, this survey does not provide a picture of local trends. Data from annual surveys go to the Migratory Bird Office which only provides the refuge with a flyway population total. Wintering Canada geese were surveyed between pre-1993 and 2004. Monitoring was modified in 1999 to collect additional data on all refuge geese and their habitat use. However, these goose surveys were suspended after 2004 due to funding declines resulting in the loss of the biological technician position which conducted the daily surveys. As with duskys, updated information is needed on seasonal use patterns and distribution of Canada geese and cackling geese in Oregon and southwest Washington to understand how these geese are redistributing themselves in wintering areas. Combined with studies of the relationships between goose use and habitat type or forage quality, this will help managers develop regional strategies for managing wintering habitat for geese. Although various local surveys have been done, survey intensity, survey area, and protocols have changed considerably over time, rendering a long-term, direct comparison of survey results on a local basis difficult. A consistent approach and data sharing between refuges and wildlife areas in Oregon and southwest Washington is needed. Data on regional and state-wide habitat alterations/losses are not collected, so resource managers are unable to assess how local changes to goose habitat may affect populations and distribution. **Sandhill Cranes:** The refuge has partnered with The Nature Conservancy of Oregon to conduct sandhill crane roost surveys since 1991. A number of other surveys, studies, and banding projects were terminated between 1998 and 2002 due to lack of staff. Local concern regarding the viability of the migrant and wintering population of sandhill cranes dictates that habitat for this species should be effectively managed on the refuge. Recently, refuge staff has made periodic summer observations of sandhill cranes on the Bachelor Island Unit. In recognition of the breeding potential of sandhill cranes in the region, cranes will be monitored during the breeding season and nesting attempts will be documented. **Great Blue Herons:** Until 2009, Bachelor Island provided nesting habitat for over 400 pairs of great blue herons and great egrets. Only 96 nests were counted on Bachelor Island in 2009, but no adults were present during the survey and it is unclear if any young were fledged that year. Additional active colonies were located on the Ridgeport Dairy Unit during the summer of 2009, and these will be monitored in 2010 to confirm use. Potential causes of the colony decline may include lower availability of prey species, changes to nesting habitat (through natural succession or management changes), proximity to nesting bald eagles and corvids, and human recreation/ disturbance. In addition to these factors, management of water/hydropower, animal and human population changes, and presence of contaminants in river waters and sediments affect waterbird populations. Therefore, these populations

will continue to change and provide a good barometer of habitat integrity. Monitoring these populations is essential for early identification of issues that may impact these populations.

Bald eagle: The refuge provides nesting and/or summer foraging habitat for at least 7 pairs of bald eagles. The reproductive success of these eagles has been monitored since 1990 by the Oregon Cooperative Fish and Wildlife Research Unit at Oregon State University, as a part of larger cooperative state-wide surveys. With the delisting of the bald eagle in 2007, these surveys are expected to be curtailed. If so, the refuge should initiate efforts to continue monitoring current nest sites and expansions on the refuge to ensure compliance with the Bald Eagle Protection Act, and identify potential issues that may jeopardize nesting eagles.

The refuge also supports migrant and wintering bald eagles that utilize the Columbia River floodplain for foraging on salmonids, Pacific smelt, and other fish. The refuge provides a substantial foraging opportunity for eagles via the high populations of waterfowl that utilize the refuge. This food base is important, particularly for subadult eagles, and in between fish runs, when fish resources are scarcer.

Objective 7.3 Partner to conduct invasive species monitoring and control, and studies of invasive species control techniques.
Strategies Applied to Achieve Objective
Pursue funding for a full time volunteer coordinator position to locate, train, effectively utilize, and retain volunteers to assist with invasive species monitoring and control efforts.
Conduct a refuge management study to identify appropriate integrated pest management strategies to control and/or eradicate ricefield bulrush on the refuge.
Monitor and map wetlands for invasive plants such as reed canarygrass, false indigo-bush, purple loosestrife, knotweeds, and yellow flag iris, and annually monitor effectiveness of invasive plant control measures.
Annually monitor the presence and extent of reed canarygrass, other invasive species, and native shrubs within wetlands containing water howellia.
Partner to conduct invasive mammal (beaver and nutria) monitoring and investigate IPM techniques to control damage to water control structures and dike systems.
Monitor effectiveness of treatment for invasive plants in riparian and woodland areas (see Goals 4, 5).
Partner with other agencies to monitor refuge waters for exotic mollusks carried in ship ballast (zebra and quagga mussel).
Partner to conduct carp monitoring to determine current abundance/biomass, seasonal distribution, and spawning habitat.
Develop and/or evaluate suitability of techniques to reduce populations and reproduction of carp and other warmwater fish in wetlands and instream habitat, without negatively affecting salmonids. Coordinate with WDFW on funding initiatives and partnerships.
Rationale: Invasive weeds are the biggest habitat management issue on the refuge (see Chapter 4). A large percentage of the refuge's annual operating budget goes towards control of invasive species, which includes mowing, spraying, disking, water management, and hand grubbing. Nevertheless, existing budgets and staffing levels do not allow as many acres to be treated for weeds as would be desirable. As a result, weeds are kept in check on areas of the refuge that receive treatment, but are spreading elsewhere on the refuge. Volunteers and partners will continue to be essential for controlling weeds on the refuge. However, some significant roadblocks to utilizing volunteers exist. Often the most effective treatment options involve physically taxing work (such as grubbing or hand pulling); application of herbicides; or using heavy equipment (mowing or disking). The number of volunteers willing or able to do this physically taxing work, or who have the necessary permits and certifications for pesticide

application or heavy equipment operation is limited. Many invasives grants are tied to using volunteers for invasive treatment, but these grants are often not feasible because volunteers cannot be used for the most effective treatment options. Finding qualified volunteers, and managing those volunteers requires a significant investment of staff time. A full time volunteer coordinator position is needed to locate, train, effectively utilize, and retain volunteers.

Weeds that have a particularly large impact on refuge habitats include reed canarygrass, Himalayan blackberry, and ricefield bulrush. Teasel, tansy ragwort, Canada thistle, poison hemlock, and Italian thistle are a problem in old fields, especially on the south end of the refuge. These invasives are a major concern for the Clark County Weed Management Program and the adjacent landowner. False indigo-bush was introduced to the upper Columbia River for bank stabilization and has migrated downstream with floods. Indigo bush lines the majority of suitable shoreline around the refuge. Some aquatic plants, for example water milfoil and curly-leaf potamogeton, are also a problem. Although native, horsetail (*Equisetum*) has begun to infest pastures and can be found as dominant vegetation in some fields.

Invasive ricefield bulrush (*Schoenoplectus mucronatus*) was accidentally introduced to refuge wetlands in 1999, and was identified in 2002 (see Chapter 4). Significant refuge resources have been diverted to fighting this weed. Control methods to date have included hand pulling, spraying with herbicide, and altering water management in wetlands. Hand pulling has been successful in eradicating small satellite populations, and therefore, containing spread of ricefield bulrush into new areas. However control of bulrush in wetlands where it was originally seeded has not been attained. New and innovative eradication techniques (such as fire) may need to be used before eradication can occur. Before infestation of ricefield bulrush, management and restoration of wetlands to control canarygrass had included water drawdowns by May 1, followed by disking and rototilling. After the infestation of ricefield bulrush was discovered, this disking rotation regime for wetlands was discontinued. Consequently, canarygrass infestations in refuge wetlands have increased, especially in those units with bulrush.

Invasive animal species are also a concern (see Chapter 4). Nutria damage wetland management infrastructure and eat native vegetation needed by native species, and cause problems with wetland management. Bullfrogs eat or compete with native species such as turtles, ducklings, and frogs. Carp reduce water quality and food availability in wetlands for waterfowl, waterbirds, and native salmonids. The refuge is also concerned about the introduction of exotic mollusks carried in ship ballast (zebra and quagga mussel). Asian clam is abundant in some areas of the refuge and New Zealand mudsnails are likely to be present. Zebra and quagga mussels have not been found in the Columbia Basin to date but are a serious potential threat; a monitoring program should be implemented.

Objective 7.4 Conduct Baseline Inventories of, and Sustain Applied Scientific Research On, Native Habitats, Vegetation, and Major Fish and Wildlife Groups
Conduct baseline inventories of habitat, plant, and wildlife resources on the refuge, with particular emphasis on wetland bathymetry; riparian and bottomland forest; the Blackwater Island RNA; and other areas likely to contain remnant native plant communities. Inventories should focus on determining the presence and abundance of birds, mammals, reptiles, amphibians, fish, rare plants and any key functional areas such as nest and roost sites. Inventories should also map the occurrence of invasive species.
Strategies Applied to Achieve Objective
Pursue cooperative funding and partner contributions for baseline inventories.
Develop and support research projects that explore factors affecting focus wildlife species and their habitats, with the intent to increase our understanding and ability to manage these resources.

Develop program to attract qualified researchers to conduct monitoring, surveys, and other studies on the refuge.
Conduct a wetland basin assessment and topographic survey of aquatic habitats (in conjunction with data collection needed for a tidal wetlands restoration plan; see Objective 7.7).
Update and refine wetland bathymetry data and maps for use in annual habitat work plans and restoration plans. Obtain bathymetric (fine contour) data, perform mass point conversions of existing LIDAR data to obtain 6 inch wetland contours. Prepare spatial template of slough and ditch network, including passage barriers and water control structures, and digital elevation model (DEM) for fine-scale topography mapping.
Annually, monitor populations of water howellia during the blooming season (May-June) to verify population persistence and basin conditions.
Reinstate landbird monitoring station (MAPS) on Bachelor Point.
Conduct breeding bird surveys for grassland birds to determine which pastures are primary nesting sites, and therefore, should be mowed late, remain in an unmanaged condition, or receive other management treatments.
Conduct surveys of fish species, distribution and abundance in Gee Creek, Campbell Lake, and Campbell Slough, with emphasis on salmonids, lamprey, and carp, to assist in identifying habitat restoration priorities (see Objective 7.7, Habitat Restoration Studies).
Conduct aquatic habitat assessments in order to prioritize instream and riverine areas for enhancement or restoration (also see Objective 7.7, Habitat Restoration Studies).
Conduct plant surveys in the Blackwater Island RNA.

Rationale: The Refuge Improvement Act requires the Service to monitor the status and trends of fish, wildlife, and plants on each refuge. Existing staff and funds are prioritized to perform the most pressing habitat management projects on the refuge, leaving few resources available to do baseline surveys. Few biological surveys have been conducted on the refuge in recent years, and older surveys are in need of updating, for example vegetation surveys of the Blackwater Island RNA and riparian areas outside the dikes are needed. Because there are currently no biologists or biological science technicians solely dedicated to the refuge, we will need volunteers and partnerships to conduct most survey activities. Although the avifauna of the refuge has been well described, comparatively little information exists on other fish and wildlife groups. Inventories of plant species occurring in native habitats on the refuge needs to be updated. Habitats, areas, or species groups where work is particularly needed follow.

Nonmanaged wetlands and instream habitat. Effective restoration techniques rely on valid data and knowledge of habitat conditions. To date, little effort has been placed on nonmanaged aquatic habitats on the refuge, therefore, relatively little is known about their health and potential benefits. Habitat assessments of these systems and surveys of aquatic species will provide refuge staff with necessary data to restore and manage these habitats comprehensively.

Water howellia. *Howellia aquatilis* was surveyed in 1995 and again in 1998. The 1995 surveys located two new populations. This species is re-surveyed every year to assess habitat problems, i.e. reed canarygrass encroachment.

Wetland plants. Wetland plant composition was conducted annually until the *Scirpus* issue arose in 2002; the data has never been summarized adequately.

Landbirds. Winter banding of songbirds occurred for many years between 1995 and 2003, providing information on species composition and some habitat use information. A landbird monitoring station (MAPS) was maintained on Bachelor Point for 10 years (1993-2003). A study by DeSante et al. (2004)

showed that this station was one of the most productive and diverse within the Pacific Northwest.

Grassland Birds: Breeding bird surveys for grassland birds are needed to evaluate impacts on these species by weed control alternatives and pasture management techniques. These surveys will also help determine which pastures are primary sites for breeding birds, and therefore, should be mowed late, remain in an unmanaged condition, or receive other management treatments.

Fish and Mollusks. Surveys for fish have occurred over the past 15 years in part through specific fisheries studies conducted by the Service. These studies have occurred primarily on the Carty Unit within the Gee Creek system. The refuge hosts primarily warmwater, nonnative species but also supports rearing habitat for salmonids such as coho and Chinook salmon, and cutthroat trout. Lampreys have also been identified in Gee Creek. Remaining tidal wetlands on the refuge such as Campbell Lake have not been fully surveyed for anadromous fish. Managed wetland units have not been surveyed systematically but are known to host warmwater fishes, as well as native stickleback. Aquatic habitats on the refuge are potentially suitable for native mussels but a systematic inventory has never been conducted.

Blackwater Island RNA. The RNA is known to contain rare habitat types (Oregon white oak/ovalleaf viburnum/poison oak woodland) and support rare and sensitive species such as water howellia and the slender-billed white breasted nuthatch, which is a Federal species of concern, and a candidate for listing in Washington. There is the potential for several rare species of mammal, reptile, and amphibian species to be present as well. Inventories of the Blackwater Island RNA include vegetation surveys and community descriptions developed from the 1970s through the early 1990s (Morrison 1973; Tabor 1976a, b; and Christy and Putera 1993), annual surveys for the federally-listed water howellia, and pit trap and live trap mammal and amphibian surveys conducted in the 1990s. Updated inventories of native habitats and vegetation, and habitat conditions (including presence of invasive species) are needed in order to manage grasslands and oak woodland habitat on the RNA.

Small mammals. The refuge lies within the historic range of the western gray squirrel (State threatened, Federal candidate), the Mazama (Western) pocket gopher (State threatened, Federal candidate), and gray-tailed vole (State species of concern). Clark County is considered core habitat for the gray-tailed vole. Suitable habitat for these species may exist on the refuge, but their presence has not been confirmed. Virtually no information exists on bats occurring on the refuge. Further information will help us to understand refuge species richness and diversity.

Native amphibians. The refuge conducted pitfall trapping for amphibians (frogs and salamanders) and small mammals during 1995-1997 in selected habitats, which provided a good idea of what species occur and what habitats they use. However, not all species are sampled adequately by pitfalls, so gaps remain. The refuge also conducted frog breeding surveys on the River ‘S’ Unit in 2000; this provided additional information on habitats utilized for breeding as well as some data on other amphibian species. Painted turtle trapping occurred from 1996-2000; painted turtle telemetry was conducted in 2001. These studies provided data on population and habitat use on the River ‘S’ and Bachelor Island units. Information on nesting sites and production is lacking. Only the amphibian breeding information has been analyzed with a report written (Beale and Akins 2001).

Objective 7.5 Partner to evaluate feasibility of techniques for reintroduction of rare and listed species native to the lower Columbia River and Willamette Valley/Puget Trough ecoregion.
Partner with Recovery Teams and State agencies to identify potential habitat areas for the reintroduction of rare and listed species; the feasibility of reintroduction; and habitat or population management strategies. If reintroduction is determined to be feasible, prepare specific habitat and wildlife objectives. The following species are currently under consideration for reintroduction: • Columbian white-tailed deer (lower Columbia River population) (Federal endangered, State endangered). • Western pond turtle (Federal species of concern; State endangered). • Bradshaw's lomatium (Federal, State endangered). • Golden paintbrush (Federal threatened, State endangered). • Nelson's checkermallow (Federal threatened, State endangered).
Strategies Applied to Achieve Objective
Continue partnership with the Washington Natural Heritage Program to evaluate feasibility and techniques for introducing Bradshaw's lomatium and Nelson's checkermallow on the refuge. Conduct test plantings of rare plant species to determine suitable reintroduction sites.
Within 5 years, partner with the Columbian White-tailed Deer Recovery Team to conduct a feasibility study for the establishment of a population of CWT deer on the refuge.
Continue partnership with WDFW to survey for western pond turtles to determine if this species is successfully breeding on the refuge, and the age structure of the population.
In partnership with WDFW, conduct a feasibility study to determine whether sufficient habitat exists to establish a breeding population of western pond turtles on the refuge, including evaluation of reintroduction sites for head-started turtles.
Rationale: Restoring populations of species which historically occurred (or may have occurred) on the refuge is consistent with the Service's 2001 policy on Biological Integrity, Diversity, and Environmental Health (601 FW 3). Species were selected for reintroduction feasibility studies primarily due to their sensitive status (threatened, endangered, etc); because they may have historically occurred on the refuge; and/or because suitable habitat exists on the refuge, and therefore, the refuge has an opportunity to contribute to recovery efforts. Specific information is summarized below. **Listed Willamette Valley Plants:** The Draft Recovery Plan for Bradshaw's lomatium specifies that recovery will require at least two stable populations in permanently protected status in southwest Washington (USFWS 2007). The Washington Natural Heritage Program is currently partnering with the refuge to evaluate the feasibility or and techniques for introduction of Bradshaw's lomatium on the refuge. Test plantings were conducted in February 2007, with an additional planting of seedlings in the winter of 2007-2008 (Arnett 2007). A similar approach should be used to determine suitable reintroduction sites for other rare plants. In 2007, the refuge worked with the Service's Ecological Services offices and the Washington Natural Heritage Program to outplant 1,000 seedlings of Nelson's checkermallow on the refuge. The initial planting occurred in fall 2007, with subsequent plantings conducted in following years. Experimental plantings were done in Smith Lake Field (11.5 acres) and Hundred Acre Field (43.6 acres) on Bachelor Island; and Texas Island and the Kiwa Trail on the River 'S' Unit. A Section 7 consultation allows for supplemental plantings only in those plots designated in the original Section 7. Additional plantings would require a new Section 7 consultation. **Columbian White-tailed Deer (CWT deer):** The Columbian White-tailed Deer Recovery Plan (USFWS 1983) recommends that a minimum of 400 deer be maintained in three viable subpopulations

occupying secure habitat. Currently, most of the secure habitat for the lower Columbia River population of CWT deer is on the Julia Butler Hansen Refuge. At present, only 1,600 acres of secure habitat exists outside this refuge. Increasing the deer's range and numbers above the minimum recovery goals will reduce the risk of catastrophic losses to disease and floods, and will be consistent with Service policy on biological integrity and diversity. Ridgefield Refuge has been proposed as a reintroduction site for CWT deer.

A strategy in the CCP is a study to determine the feasibility of establishing a population of CWT deer on the refuge. The study will evaluate: Whether the refuge has enough appropriate habitat to support a self-sustaining CWT deer population; if establishing a population of CWT deer would conflict with managing for refuge purposes; and if habitat management for refuge purposes species and priority resources of concern will also meet the needs of CWT deer. Current habitat management for purposes species, and habitat management proposed in the CCP, will support a mix of habitats suitable for CWT deer. The major issues of concern associated with a reintroduction are:

- Dispersal of deer onto adjacent private lands;
- Presence of predators that could cause undesirable levels of fawn mortality; and
- The lack of connectivity between the refuge and other suitable habitat, leading to an isolated subpopulation.

Refuge staff supports the reintroduction as long as existing management for purposes species can continue, and staff and funding resources are not diverted from purposes species. A nonessential experimental population (NEP) designation would allow more management flexibility should deer move onto private lands adjacent to the refuge; however NEPs must be managed as threatened species on Federal lands. In addition, it may not be possible to determine if Ridgefield deer belong to the reintroduced population or dispersed upriver from the Julia Butler Hansen and Lewis and Clark refuges. Therefore, the designation of reintroduced deer will also be addressed in the feasibility study.

Western Pond Turtle: The refuge may provide suitable habitat for the western pond turtle, a species listed as endangered by the State. A single adult western pond turtle was found on the refuge in 2005, but no others have been found during subsequent trapping. The WDFW has expressed interest in reintroducing western pond turtles to the refuge. The feasibility of an introduction must be assessed, including an evaluation of whether sufficient habitat exists to maintain a breeding population; whether the refuge's management activities are compatible with establishing a breeding population of pond turtles, and whether establishing a breeding population will materially detract from the purposes for which the refuge was established.

Objective 7.6 Partner to conduct mosquito population surveillance to provide for public health and safety concerns.
Strategies Applied to Achieve Objective
Continue to renew Special Use Permits for the Clark County Mosquito Control District to monitor larvae on the refuge and treat ponds for mosquitoes. Follow established and current mosquito surveillance protocols.
Continue to allow Clark County Mosquito Control District to treat ponds on the refuge for mosquitoes, with applications of the larvicide *Bacillus thuringensis* var. *israelensis* (*B.t.i*) via backpack or buggy pack, if dip surveys show an average of 5 mosquito larvae in 10 dips.
Rationale: The public is concerned about mosquitoes as a vector for West Nile virus. Mosquitoes can also be a quality of life issue (a nuisance) when people want to go outside in habitats occupied by mosquitoes. The Clark County Mosquito Control District has responsibility for mosquito control in the local area. The District has an annually renewed Special Use Permit that allows mosquito crew members

to visit the refuge to monitor larvae at specific sites and during specific time periods during the year. Monitoring consists of collecting dip samples from target wetlands; when there is an average of 5 mosquito larvae in 10 dips, treatment can occur. The District currently treats wetlands on the refuge that have been identified through monitoring as significant mosquito breeding sites. Mosquito larvae are treated with applications of the larvicide *Bacillus thuringensis* var. *israelensis* (*B.t.i*) via backpack or buggy pack.

The Service recognizes that mosquitoes are an integral part of the food chain, both adult and larvae, providing a food resource for a multitude of bird, fish, amphibian, and other aquatic species. Mosquito larvae are an important detritivore in many aquatic systems, and therefore, crucial for decomposition of organic matter and ultimately water quality. While difficult to validate in complex aquatic habitats, it can be surmised from basic ecological principles and simplified predator/prey relationships that an abundance of food (mosquito larvae) translates into increased reproduction and survival in predator species. This in turn, can have a significant beneficial effect up the food chain for many species of wildlife. Unfortunately, these periods of increased food resources (mosquito outbreaks) also cause the most consternation with some of the public. The Service is, therefore, working to find a balance between the ecological values of mosquitoes and mosquito control.

Objective 7.7 Conduct studies to determine the feasibility, need, and priorities for habitat restoration projects; and to develop or refine restoration techniques.
Strategies Applied to Achieve Objective
Within 5 years, establish study plots to evaluate techniques for enhancing ash recruitment and restoring native understory in Oregon ash floodplain forests (also see Objective 4.3).
Following wetland basin assessment and mapping and aquatic habitat assessments (Objective 7.4) develop a tidal wetlands restoration plan for the refuge. In the plan, evaluate the feasibility of, and develop strategies to, restore, maintain, and/or enhance connectivity between Columbia River and backwater sloughs, lakes, and ponds, including Post Office Lake. This should include a prioritization of sites for restoration, and a contingency plan in the case of dike breaching caused by a major flood event (see Objective 6.2).
Assess sedimentation and fish passage in lower Gee Creek to determine potential impediments to fish movement, and evaluate appropriate restoration actions (e.g., deepen channel near the mouth, excavate historic (1929) channel, and other actions).
Assess Campbell Slough relative to salmonid rearing habitat (i.e., water temperature, depth, cover, and passage) and evaluate appropriate restoration actions (e.g., deepening channel, and increasing canopy).
Conduct habitat assessment of Campbell Lake, including emergent cover and sedimentation rates, to determine need for vegetation removal, dredging, or other habitat enhancement and restoration actions.
Rationale: Native habitats along the lower Columbia River have been lost or highly degraded by the introduction of nonnative plants and animals, past land management practices (e.g. livestock grazing, and fire suppression) and alterations to natural hydrology (levees, and dams). Alterations to natural hydrology have been particularly problematic for riparian habitat; because without seasonal flooding and periodic scouring events, recruitment of native trees such as black cottonwood and Oregon ash is poor. It is desirable to reduce cover of nonnative vegetation and increase cover of native species in the refuge's extant native plant communities. It is also desirable to restore historic connections between former tidal wetlands and the Columbia River. However, habitat restoration is both costly and labor intensive. Efforts to return highly altered areas to their precontact condition, or to a self-sustaining system, are fraught with difficulties due to the altered nature of the surrounding environment. In some cases, altered or heavily managed habitats (e.g. pasture, and managed wetlands) can meet habitat requirements for native species. Therefore, studies to determine the need and priorities for restoration, and to investigate the feasibility and effectiveness of restoration techniques, are needed before any large scale actions are

undertaken.

Objective 7.7a Grassland restoration feasibility study.

Within 15 years, conduct habitat assessment to determine the feasibility of restoring up to 40 acres of native grassland habitat for grassland-dependent birds and native plant species. Native grassland habitat is characterized by the following attributes:

- Optimal patch size or contiguity with old field/old field border habitat is > 15 acres.
- A mosaic of vegetation heights between 6 and 36 inches.
- > 50% cover of native grass (e.g. Roemer's fescue (*Festuca idahoensis var. roemeri*), red fescue (*Festuca rubra*), prairie junegrass (*Koeleria macrantha*), slender hairgrass (*Deschampsia elongata*), or California oatgrass (*Danthonia californica*); and native forbs (e.g. clover, western bittercress (*Cardamine occidentalis*), and American vetch (*Vicia americana*), western wood strawberry (*Fragaria vesca*), spring beauty (*Claytonia*), chickweed (*Cerastium*), California brome, and blue wild rye.
- < 20% cover of invasive/undesirable nonnative grasses (e.g. reed-canarygrass), forbs (e.g., ox-eye daisy, thistle and trefoil), and shrubs (e.g. blackberry).

Strategies Applied to Achieve Objective

Within 15 years, conduct habitat assessment to assess the feasibility of restoring up to 40 acres of native grassland habitat for grassland-dependent birds and native plant species.

To prioritize areas for grassland restoration, conduct surveys and/or test plantings to identify areas with:

- Little goose use;
- High use by ground nesting birds;
- High potential for use by other native species;
- Existing native plant community components;
- Good potential and appropriate site conditions for establishment of native grasses and forbs;
- Patch size large enough to benefit native ground nesting birds, with adequate adjacent dispersal areas for young; and
- Inactive, formerly grazed or cultivated lands or areas no longer needed for crop production.

Rationale: Currently, approximately 400 acres of old fields (abandoned former pasture and agricultural lands) on the refuge provide nesting habitat for grassland-dependent birds, and migration corridors and thermal cover for amphibians and small mammals. However these fields are dominated by nonnative grasses and forbs, and many are currently in rank, weedy condition with limited value to wildlife. Approximately, 260 acres are suitable for restoration to riparian and other habitat types and are identified as such. The remaining 140 acres of old fields could be restored to a native grassland community. Native grasses and forbs will provide improved habitat for native wildlife. Restoration will involve mechanical and chemical weed control, fall native grass drilling, and selective plantings of native forbs. However, relatively little is known about native upland grassland communities on the refuge, and appropriate species for restoration will need to be determined using existing reference sites in the region with similar soils, hydrology, and climate, followed by test plantings of selected species and site monitoring to determine efficacy of restoration and need for follow up treatments. The long-term feasibility of restoring "islands" of native grassland within large tracts of nonnative pasture grasses should also be assessed. The needs of high priority grassland wildlife species including nesting and/or wintering waterfowl, raptors, short-eared owls, western meadowlarks, and savannah sparrows must also be carefully considered prior to initiating restoration projects.

Objective 7.7b Wet Meadow/Prairie Restoration Feasibility Study
Within 15 years, conduct a study to assess the feasibility of restoring a native wet meadow plant community in areas dominated by reed canarygrass. Wet meadow is characterized by the following attributes: • Hydric soils. • Flat or very gently sloping topography. • > 50% cover of native grasses and forbs such as Columbia sedge, tufted hairgrass, camas, spike bentgrass, dense sedge, California oatgrass, annual hairgrass, meadow barley, American sloughgrass, one-sided sedge, Western mannagrass, spreading rush, wild barley, and buttercup. • < 5% cover of native shrubs (e.g., willow, and Douglas' spirea). • < 20% cover of undesirable nonnative grasses (e.g. reed-canarygrass). • Water depths ranging from moist soil to 4 inches from December through at least March. • No willows.
Strategies Applied to Achieve Objective
Compare the efficacy of techniques to control reed canarygrass (tillage and prolonged flooding, and mowing combined with herbicide treatment).
Identify sites with good potential and appropriate site conditions for native plants by conducting test plantings where reed canarygrass control has been achieved.
Use site monitoring and multiyear follow-up treatments in study areas.
To prioritize areas for wet meadow restoration, conduct surveys and/or test plantings to identify areas with: • High use by dusky Canada geese, or appropriate patch size and proximity to wetlands; • High potential for use by other native species; • Existing native plant community components; • Good potential and appropriate site conditions to contribute to native plant recovery.
Rationale: Wet meadow, or prairie, is a primary foraging habitat for dusky Canada geese. It also can provide foraging areas for species such as American wigeon, sandhill cranes, and shorebirds; and nesting areas for northern harrier and ducks. Wet meadows were once a common habitat type along the lower Columbia River. Columbia sedge was probably the dominant species; however, today Columbia sedge meadows are extremely rare, with only one high quality occurrence along the lower Columbia River (Christy and Putera 1993). Other possible wet meadow species include tufted hairgrass, camas, spike bentgrass, dense sedge, California oatgrass, annual hairgrass, meadow barley, American sloughgrass, one-sided sedge, Western mannagrass, spreading rush, spikerush, sedges, wild barley, and buttercup (Campbell 2004; and Wilson et al. 1998). Current wet meadows on the refuge, for example the Carty Unit's Long Meadow, are overflow sites from lakes or wetlands. These sites are dominated by reed canarygrass. It is desirable to reduce reed canarygrass cover and increase cover of native grass and forb species. Converting reed canarygrass stands into native plant communities is time and resource-intensive, requiring 2-3 years of initial treatments, and continued monitoring and follow-up for up to 5-10 years to prevent reinfestation (Kilbride and Paveglio 1999; Paveglio and Kilbride 2000; and Tu 2004); also see recommendations in Campbell (2004) for restoring native wet prairie. The most effective treatment strategy for controlling reed canarygrass in large areas involves tillage and prolonged deep flooding, which is not practical in the refuge's wet meadow areas. Mowing combined with herbicide treatment is another option; however, multiple applications over several years are likely required to achieve desired habitat conditions. A question remains whether native plant species are in the seed bank, if not native species would need to be planted. Native grassland plantings were attempted in Smith Lake Field (11.5 acres), 8 Spit Field (6.7 acres), and

the far south end of Hundred Acre Field on Bachelor Island. Smith Lake Field was disked and planted to natives in 2002. The native grasses did not persist, and the area was replanted in 2007 before the experimental Nelson's checkermallow planting. The native grass plantings on 8 Spit Field and the far south end of Hundred Acre Field (approx 20 acres total) did not persist and have not been replanted. Long Meadow on the Carty Unit (27.7 acres) is an area where restoration of native wet meadow or prairie could be attempted. Because of the potentially high cost and labor intensive nature of wet meadow restoration, a study to investigate the effectiveness of restoration techniques is recommended before any large scale action is undertaken.

Objective 7.8 Monitor effects of public use programs on the refuge's wildlife and habitat. Periodically monitor and evaluate public use sites and programs to determine if objectives are being met and the resource is being degraded.
Strategies Applied to Achieve Objective
Monitor public use levels by activity on the refuge using established visitor counting techniques; prepare seasonal activity estimates for visitors by type and location.
Monitor effects of visitor activities on wildlife and re-evaluate program every 5 years.
Monitor effects of hunting activities on distribution and habitat of cackling geese and dusky Canada geese, and re-evaluate goose hunting program every 5 years.
Monitor effects of auto tour usage on distribution of sandhill cranes, dusky Canada geese, and other waterfowl, and re-evaluate auto touring program every 5 years.
Conduct systematic monitoring of trail use to determine the amount of usage, trail condition, and the effects of this use on wildlife and habitat.
Conduct systematic monitoring of free-roam hiking on the Carty Unit to determine amount of use and effects on wildlife and habitat.
Further investigate wildlife disturbance effects with on-site studies. Develop protocol for monitoring impacts to habitats at public use sites.
Rationale: A substantial body of scientific literature has documented the disturbance effects of human activities, including recreational activities, on wildlife (Owens 1977; Boyle and Sampson 1985; Bartelt 1987; Cole and Knight 1990; Havera et al. 1992; Klein 1993; Klein et al. 1995; Knight and Cole 1995; Gabrielsen and Smith 1995; Madsen 1995; Madsen and Fox 1995; Hamann et al. 1999; Pease et al. 2005; and USGS 2006). The refuge is mandated by law to provide wildlife-dependent recreational opportunities; however, these should not materially interfere with the refuge's ability to manage for purposes and trust species. Waterfowl, sandhill cranes, nesting bald eagles, and nesting great blue herons are species of particular concern because they are especially sensitive to disturbance. Therefore, the refuge must design public use programs and facilities based on the best available science on disturbance effects, monitor changes in wildlife use patterns following changes to public use programs and facilities, and make adjustments as necessary should disturbance reach unacceptable levels.

2.5 Ridgefield Refuge Cultural Resources Goal and Objectives

2.5.1 Goal 1: The Refuge will protect and manage its cultural resources for their educational, scientific, and cultural values for the benefit of present and future generations of Refuge users and communities.

Objective 1.1 Inventory, evaluate, monitor, and protect the Refuge's cultural resources.
Strategies Applied to Achieve Objective
Identify cultural resources that coincide with existing and planned roads, facilities, public uses areas, habitat projects, and other undertakings in compliance with Section 106 of the National Historic Preservation Act (NHPA). Evaluate threatened and impacted sites for eligibility to the National Register of Historic Places (NRHP). Plan and implement activities to avoid or mitigate impacts to significant cultural resources as necessary.
Evaluate and prioritize areas for shoreline protection. Stabilize cultural resources (as needed) along the banks of Lake River or the Columbia River that are threatened by bank erosion.
Coordinate with the State Historic Preservation Offices (SHPO) and WDNR to protect cultural resources below mean high tide along refuge shorelines.
Complete a comprehensive cultural survey of the refuge as called for in Section 110 of the NHPA, and pull together all previous site surveys, work requests, and reports for easy access by managers.
Submit nomination to place the Cathlapotle village site on the National Register of Historic Places.
Cooperate with others to conduct archaeological investigations for the refuge, as appropriate.
Within one year of hiring, train refuge law enforcement officers in the enforcement of the Archaeological Resources Protection Act (ARPA), Native American Graves Protection and Repatriation Act (NAGPRA), and other State and Federal cultural resource regulations.
Conduct periodic visits to known archaeological and historic sites, and maintain written records and photo documentation.
Bi-annually, provide all refuge staff with 2-4 hours of training on managing historic, archaeological, and cultural resources.
Pursue funding and space to provide secure storage/curation on the refuge that meets Department of the Interior (DOI) museum standards.
Review, and edit if necessary, brochures, flyers, the refuge website, and other outreach materials to strengthen statements on cultural resources protection.
Rationale: The refuge contains several archeological sites including the Cathlapotle Village site which is one of the few sites in the lower Columbia River that has not been lost to erosion, development, or looting (Ames et al. 1999). This site is both regionally and nationally important and should be nominated for inclusion in the NRHP. The refuge also contains a historic basalt quarry district which is on the NRHP. Although further excavations for the purposes of archaeological study are not envisioned, excavations may occur as needed, at new building sites or to protect cultural resources. All such activities will be conducted in compliance with NHPA, NAGPRA, and other applicable federal laws and regulations. Protection of cultural resources on the refuge from looting or shoreline erosion is also an issue of concern. Bank stabilization was completed at the Wapato Portage site; however, anglers are causing damage to riprap placed over the site. Erosion from boat wakes may threaten cultural resources at the refuge. The refuge should explore the potential for shoreline bank stabilization and bioengineering at eroding shoreline areas to protect cultural resources listed on or eligible for listing on the NRHP.

In 1996, the refuge entered into a Memorandum of Understanding (MOA) with the ACHP and the SHPO which stipulated that the artifacts from Cathlapotle could be housed in a facility on or close to the refuge should such a facility become available. The refuge is currently in negotiations with FVNHP to accept the Cathlapotle collection for curation. A stipulation of acceptance is that ownership of the collection will transfer to FVNHP after five years if an acceptable facility has not been created at the refuge. The Tribes want to be informed about the location of artifacts recovered from the refuge (for example if they are loaned out for museum display or study.)

Objective 1.2 Coordinate and Consult with Tribes on Cultural Resources Protection.
Strategies Applied to Achieve Objective
In partnership with Tribes and the Regional Cultural Resources Team, establish "protocols for consultation" to help managers meet NHPA and NAGPRA requirements including consultation, identification, inventory, and evaluation of projects and sites.
Establish NAGPRA protocols and procedures for handling inadvertent discoveries of human remains, burial objects, sacred objects, and objects of cultural patrimony.
Meet at least semiannually to discuss programs and projects with cultural resources staff from the Cowlitz Indian Tribe; Chinook Indian Tribe; and Confederated Tribes of the Grand Ronde.
Coordinate with the Tribal cultural resources programs to identify and plan for protection of significant sites.
Ensure that information generated from archaeological investigations is shared with Tribes.
Rationale: The Chinook Indian Tribe, Cowlitz Indian Tribe, Confederated Tribes of the Grand Ronde, Shoalwater Bay Tribe, Confederated Tribes of the Warm Springs, and the Yakama Indian Nation have a cultural interest in the refuge, either because the refuge lies on lands historically occupied by these Tribes, or because these Tribes have descendants of families that once occupied the refuge. Issues of concern to the Tribes include: Conduct of archaeological investigations, storage of artifacts recovered from the refuge, cultural resource protection, repatriation of human remains and other objects of cultural patrimony, and education and interpretation programs related to Tribal cultures. Although the refuge has had consultations and meetings with Tribes in the past, it is important that communication and consultation become more regular and systematic. At this time, further excavations are not envisioned, except as needed at new building sites or to protect cultural resources. However, the artifacts recovered from the Cathlapotle site continue to be the subject of scientific investigations and are still yielding important information about the lifeways of the people who lived at this site for the past 3,000 years.

2.6 Ridgefield Refuge Public Use Goals and Objectives

2.6.1 Goal 1: Waterfowl hunters of all abilities will enjoy a quality, safe hunting program that provides a variety of waterfowl hunting experiences, promotes youth hunting, balances hunt program needs with other public use program needs, and reduces impacts to nontarget species. As a result of participating in the waterfowl hunting program, hunters will gain a better appreciation of the refuge's mission and its resource management.

Objective 1.1a Provide a quality, safe, waterfowl hunt program on 790 acres of the refuge, capable of supporting approximately 2,000 hunter visits per season, including youth hunts and disabled hunters, and reducing conflicts between hunters, adjacent landowners, and other user groups. **Objective 1.1b Increase opportunities for duck hunters to hunt desirable waterfowl species, for example, mallard, wigeon, and pintail.** **Objective 1.1c Provide goose hunting opportunities on 790 acres of the refuge while reducing the disturbance to, and rate of take of, dusky Canada geese.**
Strategies Applied to Achieve Objective
Limit disturbance to dusky Canada geese in primary foraging habitat by maintaining existing total closure to hunting in the Roth, Ridgeport Dairy, and Bachelor Island units (River 'S' Unit only open to waterfowl hunting).
Allow both goose and duck hunting in south end of River 'S' Unit (207 acres, blinds 17-19).
Only ducks, geese, and coots may be taken in accordance with Washington State bag and possession limits. Hunters will check all harvested waterfowl prior to leaving the refuge.
Hunters will use existing open roads and parking areas to access hunting sites. Camping, overnight use, and fires are prohibited.
Rehabilitate Teal Marsh and establish 1-2 new blinds on west side of River 'S' Unit to compensate for loss of blind 4 to new bridge construction (see Objective 2.6).
Move hunter check station to visitor contact station; rehabilitate the old check station site and habitat to offer greater flexibility in blind spacing and replacement.
Where feasible, use gradual floodup to create shallow-water areas on the River 'S' Unit to increase habitat for desirable waterfowl species; as needed, move blinds or use mobile or alternate high and low water blinds.
Every 2 years, reevaluate ADA access at existing hunt blinds; and upgrade where feasible. Additionally, reevaluate the rate of occupancy and demand for accessible hunting blinds relative to number of blinds reserved for hunters with disabilities.
Rationale 1.1a: The waterfowl hunting opportunities that are currently offered at the refuge are quite popular and allow people of all abilities to enjoy hunting. Since 1965 the refuge's waterfowl hunting program has served an average of 44.7 hunters per hunt day. Over the last decade, the program serves 45.6 hunters per hunt day. By this measure, demand for waterfowl hunting on the refuge has remained relatively constant since the refuge was established. The consistency of this data set counters Statewide projections of declining numbers of waterfowl hunters. This suggests that hunters have moved to

Ridgefield as hunting opportunities elsewhere have declined.

The hunting reservation system is an attractive feature of the refuge's hunt program. This system guarantees reservation holders with up to two guests, access to a hunt blind on the day of the reservation. In addition, the reservation system provides hunters a better selection of blinds and avoids delays. The reservation system is popular with hunters that want assurances they will have access to the blinds on a specific day. The reservation system is currently attracting approximately 175 reservation requests per hunting day. With 19 reservations generated per hunting day, an applicant to the reservation system has about a 1 in 9 chance of being selected on a particular hunting day. It is currently difficult to quantify if demand for the reservation system is increasing. The reservation application system changed three years ago from one to three application periods per season, and from 10 to 30 maximum picks in the reservation lottery. Therefore, long term direct trends in the reservation system are problematic. Since the new reservation system was implemented, there has been an increase in applicants to the reservation system of approximately 10% over three years. By this measure, the new application system is showing increased interest by refuge waterfowl hunters.

When the refuge was established, it was assigned a purpose, to provide wintering habitat for dusky Canada geese and other waterfowl. The importance of the refuge to dusky Canada geese was explicitly recognized: "The dusky Canada goose has an extremely limited winter range, concentrated along the Willamette and lower Columbia rivers. This subspecies is limited in numbers and requires protection and habitat to insure its continued existence." Today, the management of wintering dusky Canada geese and their habitat continues to be the refuge's priority. "Substantial public shooting" was also specifically mentioned as a refuge purpose. Over the years the refuge has also maintained a quality public waterfowl hunting season with approximately 1,760 hunt visits during a typical season. The refuge's waterfowl hunt program represents one of two public waterfowl hunt programs in Clark County. The refuge uses the only public hunting advance reservation system in Washington, west of the Cascades. Comparing the refuge's average duck harvest from 2003 to 2007 (2,917 ducks) to the projected duck harvest for Clark County (9,651 ducks) suggests that the refuge's 790-acre hunt program harvests 30% of all ducks in the 656 square mile county. The refuge has established and continues to maintain a substantial public hunt program within southwest Washington.

A major habitat concern is the loss of suitable habitat for ducks, geese, swans, cranes, and other purposes species. As of the early 1990s over half of the historic riverine wetlands in the lower Columbia River had been lost or substantially degraded as a result of flow regulation, diking, draining, filling, and dredging (Christy and Putera 1993). An estimated 90% of tidally influenced freshwater wetlands in the lower Columbia River region have been lost (Floberg et al. 2004). Losses within the lower Columbia River below Portland, Oregon include 52,000 acres of wetland/marsh and 27,000 acres of forested wetland habitat; these losses have significantly reduced the ecosystem's ability to produce and sustain wildlife resources (USACE 2008). Projected population growth over the next 20 years will add 500,000 people to the Portland-Vancouver metropolitan area. During the life of the CCP, there will be a continuing trend of loss, degradation, and fragmentation of wildlife habitat in the region. This loss will put greater pressure on wetland obligate species, including swans, ducks, geese, herons, and sandhill cranes. Wildlife will place higher demands on the remaining wetlands, as they congregate in greater densities in suitable habitat.

While the Refuge Improvement Act recognizes that wildlife-dependent recreation is an appropriate use of Refuge System lands, the Act also mandates that the needs of wildlife come first on refuges. Opening additional refuge wetland areas to any public use through this planning process would effectively reduce the refuge's value to wintering waterfowl, dusky Canada geese, and other purpose species. Due to current and projected losses of waterfowl habitat in the area related to development and increasing demand for all public uses, it is not feasible to significantly increase the number of acres hunted on the refuge. Safety and hunt quality concerns also limit the number of blinds in the existing area. For these reasons, significant expansion of the size of the hunt area, or increasing the number of blinds within the existing hunt area, was considered but dismissed.

It is our intent to maintain the current number of hunting blinds, thereby, not reducing overall hunter opportunity. Under the CCP, the hunt area and number of blinds will remain the same as present. The number of ADA accessible blinds (2) is reasonable and meets the current need. Additional ADA accessible blinds or programmatic changes concerning access to blinds may be needed over the next 15 years to meet the needs of a growing and aging population.

Reducing User Group Conflicts: Since the refuge was established over 40 years ago, the local population surrounding the refuge, and nonconsumptive uses of the refuge (wildlife observation and photography) have increased significantly. This has led to conflicts between hunters, other user groups, and neighboring landowners. During public scoping, many hunters complained that traffic on the auto tour route decreases the quality of the hunting experience (desire for solitude free from outside distractions) and causes birds to flare away from blinds. However, it has also been argued that auto tour traffic may benefit hunters by keeping birds moving. Hunters have also complained about shot from other blinds raining down on them. In the past, houseboat residents have complained about noise and pellet spray. These conflicts have been resolved to some degree as the public use and hunt programs have evolved. Blinds have been spaced to reduce pellet spray and where necessary, directional blinds have eliminated house boat conflicts. Strategies under this objective will further address resolving those conflicts.

Two strategies to reduce hunter conflicts with nonconsumptive users were considered in the Draft CCP/EA: reducing the length of the auto tour route during the hunt season; and closing the auto tour route on hunt days, or during the entire hunt season. Alternative 4 of the Draft CCP/EA proposed closing the south end of the auto tour route October 1-March 15. However, the primary rationale for this seasonal closure, combined with moving the hunt area north, was to reduce disturbance to duskys and cranes in a core use area. This strategy did not address user group conflicts because auto touring and hunting would still be happening concurrently on most of the River 'S' Unit. Closing the tour route during all or part of the hunt season was considered in the Draft CCP/EA but dismissed from further consideration. This strategy would have addressed hunter concerns, but would have had a very large impact on the majority of visitors to the refuge, by severely limiting wildlife observation and photography opportunities during the peak observation season.

Rationale 1.1b: Currently the refuge spends approximately $10,000 annually to operate electrical pumps to fill and maintain wetland water levels within the waterfowl hunt area during the hunting season. Water is pumped onto the managed wetlands in early fall (September). As winter rains add more water to these wetlands, it is necessary to pump water off to avoid flooding refuge roads, and other infrastructure. Because out-pumping generally cannot keep pace with inflow from rains, this pumping regime creates relatively deep-water conditions for most of the fall through spring season. Water depth coupled with the availability of vegetative food resources have created conditions within the hunt area that favor ducks deft of gathering food from near the water's surface (shovellers) and diving ducks (ring-necked ducks and scaup). Currently, shovellers are the primary bird species harvested on the refuge (30%), whereas statewide, shovellers comprise only 2-3% of hunter bags (USFWS 2005). When the refuge was established, wigeon were the primary bird taken (40% of bags) with mallard and pintail coming in second. Hunters have reported that water is too deep near the blinds, and have expressed a desire for habitat management to create shallower water that enhances availability of food plants and attracts more desirable species of dabblers. Hunting quality will likely improve because changes in wetland management (e.g. rotation, gradual floodup, see Habitat Objective 3.1) could be expected to increase the proportion of desirable species. Savings in pumping costs could be used to address other habitat management needs.

Rationale 1.1c: Sanctuary Area for Dusky Canada Geese and Other Waterfowl: The necessity for sanctuary areas free from human disturbance has been noted in the Pacific Flyway Management Plan for the Dusky Canada Goose (PFC 2008) and the Pacific Flyway Management Plan for the Cackling Canada Goose (PFC 1999). Providing secure feeding and roosting habitat for duskys is the refuge's top priority since it was the primary establishing purpose for the refuge. "Substantial public shooting" is also specifically mentioned in the refuge's purpose, including "A portion of the area in line with management findings, but not to exceed 40%, will be considered for waterfowl hunting in the future" (see Chapter 1). When the refuge was established both wildlife and public use were addressed in the purpose statement. Since the refuge's establishment, hunting and other wildlife-dependent recreation have been identified as priority public uses of Refuge System lands to receive enhanced consideration by the Refuge Improvement Act. Should a conflict arise between a public use and biological purposes of the refuge, the Refuge Improvement Act mandates that the needs of wildlife come first. Additional planning guidance comes from the Dusky Canada Goose management plan, which proposes that the Service, WDFW, and ODFW "Develop new public land management guidelines that result in increased goose food production and reduced disturbance of geese during winter, especially for dusky geese." With the increasing population of southwest Washington and loss of waterfowl habitat, providing sanctuary areas for waterfowl is more critical than ever.

Hunting can alter behavior (e.g., foraging time), population structure, and distribution patterns of wildlife (Owens 1977; Raveling 1979; White-Robinson 1982; Thomas 1983; Bartelt 1987; Madsen 1985; and Cole and Knight 1990). These impacts can be reduced by the presence of adjacent sanctuary areas closed to public use. Sanctuaries or nonhunt areas have been identified as the most common solution to disturbance problems caused from hunting (Havera et al. 1992). Currently, 4,458 acres on the refuge are closed to waterfowl hunting. Monitoring has shown that geese relocate onto these sanctuary areas of the refuge during the hunting season and most geese stay on the refuge during the hunt season rather than relocate to other areas (Anderson 2001). They may also relocate to sanctuary areas on nearby refuges and wildlife management areas. The Roth and Ridgeport Dairy units, in particular, are heavily utilized by dusky Canada geese. Some pastures on Bachelor Island receive use by duskys. Some dusky use has also been noted north of Rest Lake, on the River 'S' Unit outside the hunt area.

The Bachelor Island Unit is heavily utilized by cackling geese, disturbance to and take of cackling geese is a management concern. Recent concerns over declining numbers of cackling geese have made providing sanctuary for this subspecies (in order to meet treaty obligations to Native Alaskans) a high priority for flyway managers. For these reasons, the Service will maintain current sanctuary areas and public use closures, and maintaining the hunt area and auto tour route in their current locations.

Reducing take of dusky Canada geese: In 8 of the past 15 seasons, goose hunting has been closed early on the refuge because the dusky Canada goose quota was met. Duskys have been taken disproportionately from blinds located on the south end of the River 'S' Unit (blinds 15 and 17-19). From 1995 to 1999, four blinds in this area were closed to see if this was effective in reducing take of duskys. While 2 out of 4 seasons had to be closed prematurely during this period, it took significantly longer to meet the quota of 10 duskys (an average of 20 days, versus 13 days in the years when these blinds were not closed.) On the other hand, blinds 17-19 are extremely productive and popular duck blinds. For this reason, the Service will keep blinds 17-19 open for both goose and duck hunting, with the expectation that goose hunting may be closed early in most years.

The State of Washington implemented additional techniques to reduce the take of dusky Canada geese. Nearly a decade ago, all goose hunters in Goose Management Area 2 had their goose hunt authorization revoked. All hunters interested in hunting geese in Management Area 2 in subsequent seasons had to

retest into the program by showing aptitude in goose subspecies identification. This honed hunter identification skills and purged intermittent hunters from the program with presumably less experience or proficiency in subspecies recognition.

2.6.2 Goal 2. Visitors of all abilities have the opportunity to participate in safe, quality wildlife-dependent recreation programs, including wildlife observation, photography, interpretation, and fishing, consistent with the needs of other public use programs, with limited wildlife disturbance in the face of increasing Refuge visitation. These programs will focus on enhancing public understanding and appreciation of wildlife and building support for the refuge.

Objective 2.1 Provide facilities for self-guided wildlife observation and photography opportunities on the River ‘S’ and Carty Units, while limiting the impacts of noise and human activity to sensitive species.
Limit disturbance to sensitive species (dusky Canada geese in primary foraging habitat, roosting sandhill cranes, nesting bald eagles, and nesting great blue herons) as follows: • Roth, Ridgeport Dairy, and Bachelor Island Units: Maintain existing total closure to public use, except for special guided tours. • River ‘S’ Unit: Closed to walking October 1-April 30.
Strategies Applied to Achieve Objective
Evaluate the impacts, compliance and demand and determine the need to expand the photo blind program.
Improve wetland conditions in the vicinity of the observation blind to improve photographic and wildlife observation opportunities.
Where feasible, plant native trees and shrubs to create screening along trails and at observation points to reduce disturbance to wildlife.
Require advance reservations for groups over 20 on the River ‘S’ Unit to avoid conflicts with other groups and management activities.
Require advance reservations for groups requiring staff or volunteer assistance on the Carty Unit to avoid conflicts with other groups and management activities.
Prohibit camping, overnight use, fires, and littering.
Prohibit collection of plants and animals unless a Special Use Permit is obtained from the refuge (except for recreational fishing).
Provide signs, pamphlets, and verbal instructions from refuge staff and volunteers that promote appropriate use of trails, blinds, and platforms to minimize wildlife and habitat disturbance. These materials will clearly state pertinent refuge-specific regulations.
Rationale: Along with Sauvie Island, Jackson Bottoms, and the Sandy River Delta, the refuge is one of the top birding spots in the Portland-Vancouver area. In public scoping there was a high demand for increased opportunities to view and photograph wildlife on the refuge. Refuge records indicate that currently 15% of refuge use is on the Carty Unit and 85% on the River ‘S’ Unit, mostly on the auto tour route. Carefully planned, improved, and expanded wildlife viewing facilities will allow the refuge to manage visitation to limit impacts to wildlife and habitats. Improvements to the Carty Unit (Objective 2.3) will help attract visitors, while reducing public use demands on and impacts to the River ‘S’ Unit. The refuge supports large flocks of migrating or overwintering waterfowl and cranes, and breeding habitat

for several groups of species, including colonial waterbirds, raptors, and waterfowl. The Roth and Bachelor Island units contain important sandhill crane roosts, great blue heron nesting colonies, and bald eagle nesting areas.

Sanctuary area and/or buffers from human activity were identified as a key ecological attribute supporting the refuge's wildlife communities. The necessity for sanctuary areas free from human disturbance have been noted in the Pacific Flyway Management Plan for the Dusky Canada Goose (PFC 2008) and the Pacific Flyway Management Plan for the Cackling Canada Goose (PFC 1999). Management recommendations published by WDFW recommend a 1,640-foot buffer from construction activities for sandhill crane roosts, a 2,620-foot buffer from new construction and increased traffic for crane feeding areas, and an 820- to 985-foot buffer between the outer edge of great blue heron colonies and human activity from nest initiation (February 15) through fledging (July 31) (WDFW 2004).

Recent literature on wildlife disturbance indicates that of public uses currently or formerly allowed on the refuge, hunting, foot traffic, and bicycling have the greatest disturbance effects on waterfowl and waterbirds. People walking or bicycling cause more ducks to fly than vehicular traffic does (Klein 1995; and Pease *et al.* 2005). Distance from the activity is also a factor. (Flight response is of greatest interest because it requires the highest energetic output for birds.) To date, public use on the Roth, Ridgeport Dairy, and Bachelor Island units has been limited to a few guided birding tours annually. Reasons for limiting public use include providing secure feeding and roosting habitat for dusky Canada geese, cackling geese, and for subspecies of Canada geese named in the Canada Goose Depredation Plan (PFC 1998); and limiting disturbance of roosting sandhill cranes, nesting great blue herons, and nesting bald eagles. Effects of public use programs on wildlife and habitat should be monitored and programs adjusted, if needed (see Inventory and Monitoring Objective 7.8).

Objective 2.2. Maintain a 4.0-mile year-round auto tour route that provides visitors opportunities to view and photograph wildlife, and supports a maximum of 200 vehicles on peak use days.
Strategies Applied to Achieve Objective
Auto tour route remains open year-round in current configuration, except a 0.3 mile section on the southeast corner is cut off to reduce disturbance to geese and cranes using Swartz Pasture.
Should regular visitation to the auto tour route regularly exceed 200 vehicles per day, consider alternatives to reduce congestion on the tour route (excluding special events, like BirdFest, that impose anticipated and temporary visitation peaks). Strategies to reduce congestion may include buses, trams, private vehicle reservations, or permits.
Construct pullouts or passing lanes a minimum of one every 0.5 mile so that vehicles can pass more easily.
Pave or apply surface treatment to auto tour route using Refuge Roads funds to minimize summer dust and annual maintenance, if daily average during peak season exceeds 150 cars per day.
Construct a maintenance lane between contact station and Roth Gate to allow refuge staff, cooperators, and equipment to safely access the southern portions of the refuge.
Rationale: The looped configuration of the auto tour route, which opened in 1998, has proven to be extremely popular with wildlife watchers and photographers. Refuge records indicate that currently, 85% of refuge use is on the River 'S' Unit, mostly on the auto tour route. After the auto tour route was established and foot traffic on the River 'S' Unit was limited to the nonwaterfowl season (May 1-September 30) and on designated trails only (Kiwa Trail and auto tour route), visitors reported that they saw more birds, and seemed more satisfied with the quality of wildlife viewing and photography opportunities on the refuge. These observations are consistent with studies of wildlife disturbance that

concluded that many species of waterfowl habituate to vehicle traffic compared with walking and bicycling which cause more disturbance (Klein 1995; and Pease et al. 2005). Use by some wildlife species has decreased in the auto tour route area, (e.g. sandhill cranes and dusky Canada geese), but it is difficult to establish the cause of these declines. Data that show a direct link between the auto tour route expansion and declines in wildlife use are lacking. Goose surveys before and after the tour route was expanded to its current configuration do not show a clear trend. It is likely that a combination of factors including cessation of grain planting in the area, changes in habitat, and establishment of the auto tour route, contributed to declines in use by some wildlife species. Under the CCP, the Service will eliminate a short portion of the tour route adjacent to Schwartz Field, which is frequently used by cranes and dusky Canada geese. This will reduce the length of the tour route from 4.3 to 4.0 miles.

The advantages of the auto tour route are that it allows visitors of all abilities to observe wildlife and it is also a convenient way for visitors with limited time or mobility impairments to observe wildlife. As noted above, slow-moving vehicles cause fewer disturbances to wildlife than pedestrians or bicyclists, and therefore, the auto tour offers visitors a high probability of seeing wildlife. The disadvantages are that auto touring does not provide visitors with a direct, personal experience of nature and the solitude that some prefer. Dust and exhaust emissions are environmental impacts of the auto tour route.

Hunters have complained that traffic on the auto tour route decreases the quality of the hunting experience. Conversely, it has also been argued that auto tour traffic may benefit hunters by keeping birds moving. Two strategies to reduce conflicts between hunters and users of the auto tour route were considered in the Draft CCP/EA: reducing the length of the auto tour route during the hunt season (Alternative 4); and closing the auto tour route on hunt days, or during the entire hunt season. Alternative 4 did not address user group conflicts because auto touring and hunting would still be happening concurrently on most of the River 'S' Unit. Closing the tour route during all or part of the hunt season would have addressed hunter concerns, but would have had a very large impact on the majority of visitors to the refuge, by severely limiting wildlife observation and photography opportunities during the peak observation season. This strategy was considered but dismissed in the Draft CCP/EA. Due to the fact that the auto tour route allows large numbers of visitors of all ages and abilities to observe and photograph wildlife, and the lack of clear evidence that the auto tour route has reduced wildlife use of the area, the auto tour route will remain in its current location and be open year-round, except for a eliminating the portion adjacent to Schwartz Field.

Traffic on the auto tour route has been increasing and is expected to continue to increase over the next 15 years (see Chapter 5). Heavy traffic on the auto tour route is already a problem on holidays and on weekends during peak waterfowl use times, and is likely to increase to the point where a quality wildlife viewing experience can no longer be provided. In the future there are likely to be increasing conflicts between wildlife watchers and photographers vying for the best viewing sites on the auto tour route. The strategies above propose ways to limit auto tour traffic once it reaches unacceptable levels. Unacceptable levels are based on current peak use days associated with special events or attractions. In addition, wildlife use of the area will be monitored and the program re-evaluated as needed (see Inventory and Monitoring Objective 7.8).

Objective 2.3. Provide 6.9 miles of seasonal pedestrian access on refuge trails and roads and 2 miles of year-round pedestrian access on refuge trails.
Enhance and improve wildlife viewing, interpretation, trails, and facilities at the Carty and River 'S' units.
Strategies Applied to Achieve Objective
Add a 1.5-mile (out and back) dike-top walking trail on north end of River 'S' Unit, open between May 1 and September 30.
Construct elevated wildlife viewing platform/observation deck near the end of the new1.5-mile dike-top trail offering views of Bachelor Island Slough and remote views of Bachelor Island, River 'S' Point, and River 'S' Unit.
Partner with City/County to connect the Carty Unit to the City of Ridgefield via a trail being developed. Improve existing spur trail from Gee Creek to the Carty Unit for school groups walking to the refuge.
Continue to allow free-roam walking on the Carty Unit. If the number of annual visitors to the Carty Unit exceeds 40,000, or if resource degradation warrants, limit use through seasonal closures or a quota/permit system (also see Objective 7.8, Monitoring)
Work with the City of Ridgefield, Clark County, and other partners to examine linkages between regional trails and refuge trails, when and where they are compatible with refuge purposes.
Seek joint funding for trail and facility construction.
Improve the service road around the Plankhouse over Gee Creek to facilitate all season passage to Carty Field. Pending development of the Port of Ridgefield property, a trailhead could be developed at the Port of Ridgefield's waterfront, and connected back to town via a 1.5-mile developed refuge trail. Given the elevation of this trail, strategies may include board walks and elevated wetland crossings.
Rationale: Currently, most public use at the refuge is focused on the Carty and River 'S' units. (A limited number of guided tours are conducted on the Roth and Bachelor Island Units but no public use facilities have been developed on these units.) During public scoping there were many requests to allow self-guided access into areas that are currently seasonally or permanently closed to public use. After careful consideration, the planning team has recommended that new facilities–new or improved hiking trails and overlooks–should be confined to the existing public use footprint, in order to preserve existing sanctuary areas. However, guided tours of these areas are proposed (see Objective 2.4). A proposal to build trails and viewing platforms in the Roth and Ridgeport Dairy units was considered but not proposed due to impacts to sensitive species. Linkages to trails south of the refuge will be best accomplished through a cooperative effort to build a trail and overlook on nonrefuge land to the east of Lake River. A variety of tools to prevent trespass into closed areas and disturbance to wildlife will be used, including seasonal closures, design and placement of trails and access points, and public education efforts. The current Oaks to Wetlands Trail on the Carty Unit provides a relatively flat two-mile nature walk through native oak and mixed woodland habitats, and along the shores of several wetlands. However, the trail could be improved with certain modifications. Most pressing is the replacement of an outdated pedestrian bridge with a bridge that is accessible to all users. This was considered in a separate EA due to funding timelines (see Chapter 1). More of the Oaks to Wetlands Trail could be made accessible, and a section of all-weather trail created between Middle and Carty Lake. The CCP proposes improving accessibility of trails within 1/8 mile of the Plankhouse. Users also requested enhancement of viewing areas along the south side of the slough, which can be provided by opening the dense vegetation along the shoreline area. There is an intriguing potential opportunity to connect the Oaks to Wetlands Trail directly to the City of Ridgefield via the Gee Creek spur trail. The trail will facilitate safe pedestrian visits and local school educational visits to the Carty

Unit from town. The refuge, along with the City of Ridgefield and partners, will need to develop bridge and trail accommodations across Gee Creek. Access will also allow bicycle access to the proposed nature center and Carty footbridge. Bicycle access will be limited to the Carty administrative site.

The Carty Unit also provides free-roam walking opportunities year-round. Although much public use on the refuge is structured through facility or program design, some visitors desire a more unstructured experience where they can explore the refuge alone or in small groups. They desire an immersion experience in undeveloped or very lightly developed areas where they can experience solitude, and explore the wildlife and habitats of the refuge with a minimum of distractions from modern life and other user groups. At the present time, the Carty Unit provides this experience since there are some portions of this unit where very few people go. However, given increasing visitation and development surrounding the refuge, there is a question as to whether the refuge can realistically continue to provide these opportunities in the future, while preserving the sanctuary areas necessary to meet wildlife and habitat goals and objectives. Monitoring of visitation, wildlife and habitat will be necessary to ensure that this use continues to be compatible with the needs of wildlife (see Inventory and Monitoring Goal 7.8).

The River 'S' Unit provides excellent viewing of large concentrations of waterfowl in the fall and winter from the auto tour route, as well as waterfowl hunting opportunities. A 1.1-mile seasonal walking trail (Kiwa Trail, open May 1-September 30) is also provided on the River 'S' Unit. Walking is allowed on the 4.3-mile auto tour route between May 1 and September 30, however, relatively few people use this opportunity due to the presence of cars on the route. A proposed 1.5-mile dike-top walking trail on the north end of the River 'S' Unit (Alts 2, 3, and 4) will provide scenic views of the refuge and adjoining waterways while safely removing hikers from the auto tour route.

The refuge will work with Clark County and other partners to plan linkages between local trail systems and refuge trails, when and where they are compatible with refuge purposes. Currently, proposed trails with potential linkages include the Lewis and Clark Greenway Trail, a Vancouver to Ridgefield walking trail (Vancouver-Clark Parks and Recreation 2006), and a Waterfront Trail at the proposed Miller's Landing development at the site of the old Pacific Wood Treatment plant adjacent to the refuge's Carty Unit (Port of Ridgefield 2008). The City of Ridgefield has long-term plans to create a passive trail system along Gee Creek. With several new subdivisions being planned adjacent to Gee Creek, this trail system could greatly increase visitation to the Carty Unit.

There is also an increasingly popular canoeing and kayaking route along the refuge's shoreline and around Bachelor Island via Bachelor Island Slough. Although the refuge has no jurisdiction over these waters, undertaking cooperative efforts to define and advertise a canoe/kayak trail along the refuge shoreline will expand visitor awareness of safe boating opportunities, enhance users' ability to view and enjoy riparian and aquatic birds and other wildlife, and promote good wildlife viewing ethics.

Objective 2.4. Conduct up to 25 volunteer-guided wildlife tours annually, to provide visitors with access to areas of the refuge that are otherwise closed to protect sensitive species. Tours will focus on expanding visitors' awareness of the flora and fauna of riparian, grassland, wetland, and oak woodland habitats.
Tours will focus on expanding visitors' awareness of the flora and fauna of riparian, grassland, wetland, and oak woodland habitats.
Strategies Applied to Achieve Objective
Develop standards and requirements for volunteer guides or the Friends group's Naturalist Corps to conduct guided walks.
Authorize non-Service organizations (Vancouver and Portland Audubon, and Friends Groups) to lead

guided wildlife observation and photography on designated refuge areas.
Develop periodic programs of scheduled tours focusing on areas and times not currently open to the public, or tours to unique resource areas. Tours will be led by refuge staff, qualified volunteers, and/or designated content specialists. Tours may include full moon hikes, night tours for bats/owls, and bird call tours for visually impaired refuge visitors.
Expand current programming for guided natural history hikes, refuge history hikes, and spring/fall guided birding hikes. These hikes will be conducted by qualified personnel/volunteers and will be open to all public at no cost beyond the entrance fee.
Rationale: There is considerable demand from birdwatchers to be able to view wildlife on the Roth, Ridgeport Dairy, and Bachelor Island units. Due to the presence of sensitive species and biological resources, guided/structured wildlife observation and photography opportunities will be emphasized on the Bachelor Island, Roth, and Ridgeport Dairy units. Disturbance to sensitive wildlife species will be limited by providing reasonable buffers between the visiting public and heron and egret colonies, bald eagle nests, crane roosting areas, and areas used by dusky Canada geese and other waterfowl. Refuge management will approve special guided tours considering season, resource impacts, disturbance potential, timing, group size, and frequency of tours. Tours will be guided by refuge staff or authorized representatives that are cognizant of resource concerns and will work to minimize the impacts of each specific tour. As visitation continues to increase, the refuge needs to consider moving toward the concept of controlled or structured visitation. Structured opportunities will allow the refuge to manage visitation more effectively to limit impacts to wildlife and habitats, and to limit conflicts between user groups. The refuge may need to limit the amount of self-guided, unstructured use, and focus resources on developing guided/structured activities. In fact, changing the focus to guided activities will allow the refuge to offer new opportunities in the future, for example allowing public access to trails or viewing areas currently closed.

Objective 2.5 Improve visitor contact and orientation facilities, signage, and interpretation welcoming and orienting visitors to the refuge.
Strategies Applied to Achieve Objective
Construct a new administrative site, including staff offices and a nature center with environmental education classrooms on the Carty Unit (covered under separate EA, see Rationale). (Also see Environmental Education Objective 5.3.)
Co-locate the existing visitor contact station on the River 'S' Unit with the hunter check station (see Objective 1).
With assistance from the Friends group, staff visitor contact stations with volunteers, ensuring that the stations are open consistently, on weekends and during peak public visitation times. Develop a training program and Standard Operating Procedures for volunteers staffing contact stations.
Maintain up to date signage and information brochures with current public use regulations.
Develop an interpretive plan to guide exhibit themes, including interpretive exhibits and associated media at visitor contact points, observation viewpoints, and/or along trails, that increase awareness of the lower Columbia River ecosystem, the wildlife and habitats of the refuge, and instill a sense of stewardship and environmental ethics.
Develop interpretive and orientation exhibits for visitor contact station and kiosks at the River 'S' entrance located at the Oaks to Wetlands Trail head, to orient visitors to the Refuge System, the refuge's recreational opportunities, and wildlife viewing tips/ethics.

Rationale: Staffed visitor contact stations will provide improved service to refuge visitors by providing easily accessible locations where they can purchase annual passes and obtain information. These facilities also increase program visibility, and promote visitor compliance with refuge regulations. By creating a focal point for visitors, these facilities assist refuge staff in gaining a better understanding of visitors, and their use needs and patterns. Because of visitor use patterns and access issues, it is envisioned that staffed visitor contact stations will be needed at both the River 'S' Unit (where there is a small contact station currently) and the Carty Unit. Most refuge visitors access the refuge via the River 'S' Unit. Collocating the visitor contact station and the hunter check station on the River 'S' Unit will reduce the public use footprint by reducing duplication of parking, restrooms, utilities, and structures. Classes participating in EE programs, visitors to the Cathlapotle Plankhouse, and most hikers access the refuge via the Carty Unit. Visitor and EE facilities are also needed on this unit.

In 2009 the refuge received funding for planning a new administrative site, which includes staff offices, a nature center with environmental education classrooms, and a new ADA accessible footbridge to the Carty Unit, to replace the existing bridge which does not meet ADA standards. Due to funding timelines, a separate EA was prepared that included an analysis of site alternatives. The Preferred Alternative under the EA was to construct these facilities on the Carty Unit near the existing office. A Finding of No Significant Impact was issued on April 29, 2010.

Objective 2.6 Improve public facilities
Improve visitor infrastructure to enhance safety, sanitation, comfort, and access for the visiting public, including visitors with disabilities.
Strategies Applied to Achieve Objective
Within the lifetime of the CCP, develop new vehicular access to the River 'S' Unit from the Port of Ridgefield property, including a 2-lane bridge to eliminate the in-grade railroad crossing, and a new 1-mile entrance road. (See Transportation Access Study, Appendix L.)
Within 5 years, replace current footbridge to the Carty Unit with a fully accessible bridge for pedestrians (covered under separate EA, see Rationale). (Bridge should be accessible to small emergency vehicle or ATVs.)
Within 10 years, create walking and limited (emergency) vehicle access to the Carty Unit from the Port site, with a small bridge over Gee Creek.
Construct 700-foot accessible trail from the Carty Unit bridge to the Plankhouse.
Upgrade the trail surfaces of the first loop of the Oak to Wetlands Trail beyond the Plankhouse (approximately 2,500 feet) to allow a portion of this trail to be ADA accessible (may be compacted gravel, hardened surface, boardwalk, or a combination thereof). Establish appropriate resting areas, bump-outs, and/or trail widths as dictated by ADA standards. Seek funding through National Recreation Trails program.
Construct secure bicycle parking areas at refuge entrances. (Bicycle access will be limited to administrative sites.)
Work with Clark County and other partners to address access issues along Lower River Road.
Improve and pave parking lots as needed using Refuge Roads funding.
Address the need for a restroom near Kiwa Trail by constructing a trail between the observation blind restroom and Kiwa Trail parking lot.
Add benches on the Kiwa and Oaks to Wetlands trails, at a minimum one bench for every 1,000 feet of trail.
Review and modify public use and recreation related facilities, interpretive materials, and programs, to be accessible to and usable by persons with disabilities.

Rationale: Universal safe access is important to the refuge and its programs. The refuge faces several access issues related to its aging infrastructure and the lack of funding for major upgrades to existing facilities. Visitors to the River 'S' Unit currently drive along an access road that is not owned by the refuge. Rather, the refuge holds an easement for using the road. The road is flanked by steep slopes subject to slides and slumps. During the winter of 1996, a slide blocked the road and trees fell on refuge equipment working to clear the debris. This event underscores the potential of this access point (in its current condition) to fail, trap visitors, preclude access to the refuge, and potentially risk the safety of visitors and staff. Currently, this road also requires an at-grade railroad crossing. Demand is increasing for high-speed rail traffic from Portland to Seattle along this railroad track. While the crossing is regulated by warning lights and crossing arms, train speeds and train volume along this track is anticipated to increase, creating delays and safety concerns for visitors to the refuge. Lastly, the current access road connects to the River 'S' Unit by a 40-year-old wooden bridge. In November 2008, the bridge required major repairs to sufficiently ensure public safety and to increase its capacity to support refuge equipment, delivery trucks, equipment associated with refuge haying/grazing practices, and school bus crossings. In April 2009, the bridge was again closed to make safety improvements to guardrails.

A transportation access study was completed by Federal Highways in 2009 evaluating access alternatives to the refuge (see Appendix L). This study examined the feasibility of different access alternatives and identified alternatives that conflicted with safety, resource protection, and management needs. Using this study, the planning team brought three access alternatives forward. The access alternatives presented here include a new bridge to the north of the current location from the Port of Ridgefield.

Another major access concern for the refuge is foot access to the Carty Unit. Visitors currently access the Carty Unit via a foot bridge that was constructed in 1981. The bridge is aging, and was not built to meet today's accessibility standards. The grade of the bridge makes footing difficult during wet or inclement weather. Currently, ADA access to the Carty Unit is achieved by allowing visitors to drive to the unit via a service road, which has an in-grade railroad crossing. As noted above, the refuge has concerns with continuing to use in-grade crossings. Due to funding timelines, the planning and site design of a new footbridge was considered in a separate EA, and a FONSI was issued on April 29, 2010 (see Chapter 1).

Objective 2.7 Maintain access to fishing opportunities at the refuge.
Strategies Applied to Achieve Objective
Allow fishing during the State season, daylight hours only, within the Carty Unit, a portion of the River 'S' Unit adjacent to the north side of the Lake River bridge, and on the bridge once it is closed to vehicle traffic and modified into a fishing pier.
Convert existing bridge to River 'S' Unit into a pier after the new 2-lane bridge is constructed and the existing bridge is closed to vehicle traffic.
Provide walk-in access to fishing opportunities. Anglers must park in designated parking areas and walk to fishing areas.
Convert the existing bridge to River 'S' Unit into a pier after the new 2-lane bridge is constructed, and the existing bridge is closed to vehicle traffic.
Explore ADA accessible fishing opportunities.
Create a Web page mapping fishing opportunities at refuge locations.
Pursue cooperative efforts to develop a fishing area in conjunction with the Port of Ridgefield site development.
Continue to define and map fishing locations. Develop tear sheets for the public, including information such as parking, roads, local boat launches, and ADA accessibility. Seek partnerships with State and

private groups for funding and publication.
All persons fishing shall be required to have a valid State license and follow applicable refuge and Washington State regulations.
Law enforcement patrols will be conducted on a regular basis to assure compliance with State and refuge regulations.
Rationale: Currently the refuge provides limited fishing opportunities on Lake River. Because the refuge has relatively limited potential to provide unique fishing opportunities, and because good fishing opportunities exist on nearby public lands and waters, fishing will receive less emphasis than other wildlife-dependent public uses on the refuge. Anglers on the banks of the Carty Unit have left trash and damaged rip-rap protecting the Wapato Portage site. Enhancing communications with the fishing population will provide an opportunity to inform these users about the refuge and Refuge System, and to create greater awareness of good fishing practices.

Objective 2.8 Reduce illegal activities (trespass into closed areas, vandalism, trash dumping).
Strategies Applied to Achieve Objective
Close unauthorized routes and access points. Sign authorized entrance point(s) as is appropriate for a national wildlife refuge.
Increase law enforcement, signing, and education, to cut down on illegal activity, especially dumping.
Increase both law enforcement patrols and regular (scheduled) staff presence on the site by all refuge staff and/or volunteers.
Use increased patrols, brochures, leaflets, signing, and news releases to educate refuge users and deter illegal public uses.
Rationale: Problems with illegal trespass and shooting, trash dumping, and vandalism to refuge and visitor property appear to be increasing. Zone Officers assigned to multiple refuges and large geographic regions work to enforce special refuge regulations, protect resources, and maintain public safety. However, with the loss of law enforcement officers stationed on the refuge, there has been a reduction of field patrols and officer presence. State Route 501 (SR 501) on the south end of the refuge has been a popular site for bird watching. The road is currently eroding and has been closed and fenced off since 2005 to protect visitors and prevent entry into closed areas of the refuge. However, pedestrians and bicyclists routinely trespass into refuge fields to get around fences and eroded areas, and continue down the closed portion of SR-501. At the last turn-around at the refuge's boundary gate, some pedestrians and bicyclists are ignoring boundary signage and gates, and trespass along service roads into the Ridgeport Dairy and Roth units. This isolated "dead end" road has also attracted a variety of illegal uses, including shooting and trash dumping. Trespass by boaters does not appear to be a major problem at this time, although anglers on the banks of the Carty Unit have left trash and caused damage to rip-rap protecting Wapato Portage. Bachelor Slough is not passable in most water levels and is signed as a closed area to hunting. However, it is possible that motorboats may be able to pass at high tide and during high run-off. The sand bar on the southwest perimeter of Bachelor Island is owned by Washington DNR. There is considerable beach use by campers and picnickers on summer weekends and by hunters in the fall and winter. Much trash is left by visitors. This beach is probably a source of trespass problems on the refuge. The bald eagles that nest on Turtle Lake appear to be reacting to people using this beach by repeatedly moving their nests over the past 5 years.

Eliminating illegal uses, defining access routes, and permanently closing informal access routes into closed areas of the refuge, will be necessary to protect sensitive wildlife resources.

2.6.3 Goal 3: The refuge's cultural resources and the Cathlapotle Plankhouse will be interpreted to enlighten visitors about the refuge's unique natural and cultural history. Through accurate interpretive and educational opportunities, visitors will gain an understanding and appreciation of the refuge's natural and cultural heritage.

Objective 3.1 Increase public awareness and appreciation of the refuge's historic, archaeological, and cultural resources.
Strategies Applied to Achieve Objective
Conduct regular communications with the public through lectures and publications about the refuges archaeological discoveries and research.
Where feasible and appropriate, produce exhibits (permanent, temporary or traveling) incorporating artifacts found on the refuge, or replica artifacts.
Continue the partnership with the Friend's Plankhouse Committee to share information about the refuge's archaeological discoveries with area students and community members, through annual outreach events, educational resource kits, and other public outreach products such as CDs, DVDs, and pamphlets.
Partner with Tribes, historical societies, and interested groups to impart the history and interpret the cultural resources of the refuge. Prepare media (pamphlets, exhibits, and multimedia productions) describing the history of American Indians and early settlers in this area, with emphasis on the fish and wildlife resources and their historic uses.
Pursue partnerships with Tribes, local and regional historical museums and organizations, and other Federal agencies to achieve this objective and associated strategies.
Rationale: The refuge preserves a 3,000-year history of human occupation, trade, and commerce, and the interaction between people and their environment (Ames et al. 1999). As a result of sharing information about the refuge's unique and irreplaceable cultural resources, the public will develop an understanding of the importance of these cultural resources and play a role in protecting those resources for future generations.

Objective 3.2 Partner with Tribes, friends groups, and volunteers to provide cultural resources interpretation and education programs and exhibits for both Tribal members and the general public.
Strategies Applied to Achieve Objective
Hire a full time coordinator to conduct programs and oversee maintenance and operations of the Cathlapotle Plankhouse. Explore grants and/or partnerships to create an endowment, to fund the Plankhouse Coordinator and other positions.
With assistance from the Friend's Plankhouse Committee, develop an interior interpretive plan for the Plankhouse, including a list of interpretive themes, a prioritized list of replica artifacts needed to furnish the Plankhouse, and detailed plans to protect exhibitory from the climate and secure items from theft.
Work with partners to hold at least 2 cultural events for the public annually at the Plankhouse that provide authentic experiences delivered by American Indians exercising and demonstrating their culture. Pursue funding for honoraria to support speakers, performers, artisans, and workshop leaders.
Partner with Tribes to develop quality/authenticity standards (i.e. approved samples) for artifact replications used in the Plankhouse.

Work with appropriate artisans to fabricate topical artifact replicas of high quality and accuracy for use in the Plankhouse.

Partner with Tribes to conduct artifact replication workshops. Workshop products that meet quality/authenticity standards may become part of the Plankhouse education collection, used to furnish and interpret the Plankhouse.

Work with all Tribes with cultural interests in the region to develop interpretive exhibits on the Carty Unit that increase awareness of the history and cultural resources of the refuge, and interactions between wildlife and people over time.

Rationale: The Portland/Vancouver metro area does not have a historical venue that focuses on local native lifeways of the Columbia River. The Cathlapotle Plankhouse could help fill that gap.

The Chinook Tribe has been a partner in the design, construction, and interpretation of the Plankhouse and has a deep interest in and connection with the Cathlapotle Village site. Therefore, it is appropriate that the Chinook Tribe and the refuge maintain a cooperative partnership to maintain the cultural integrity, vision, and interpretation of the Plankhouse. Other tribes also have a cultural interest in the region (such as the Cowlitz Tribe and the Confederated Tribes of the Grand Ronde) and should also be included in developing and implementing interpretive programs and exhibits as they pertain to their heritage. All existing MOUs will be honored in developing cultural presentations.

The Plankhouse is already nationally recognized for its quality, its artistic merit, and its potential for heritage tourism and education. The refuge shall continue to ensure that interpretive products and programs delivered at the Plankhouse continue to meet established high standards of quality and accuracy. Currently, the scarcity of trained artisans who can produce high quality artifact replicas has been an obstacle to furnishing the Plankhouse. Strategies that will allow the refuge to acquire these furnishings are suggested here.

Objective 3.3 Integrate the Plankhouse into the refuge's interpretation and environmental education programs.

Integrate the Plankhouse into the refuge's interpretation and environmental education programs by developing programs that deliver wildlife and habitat messages through the lens of cultural resources. Through participation in this program, visitors can learn about the links between cultures and the natural resources they depend upon, and develop a lasting bond with the refuge.

Strategies Applied to Achieve Objective

Establish a fulltime position to develop and implement an environmental and cultural education program, including teacher training, classroom materials, and site visits. Explore grants and/or partnerships to fund this position.

Utilize volunteers to deliver environmental interpretation and education programs at the Cathlapotle Plankhouse. Within 7 years, have the Plankhouse staffed by volunteers and grant-funded staff, at a minimum of 4 hours per day on weekends from spring through fall, and as needed for environmental education groups.

Work with partners to incorporate environmental education into educational programs and special events held at the Plankhouse.

Develop approved interpretive and educational scripts to ensure the consistency and accuracy of messages conveyed to the public.

Develop volunteer training; conduct at least two volunteer training workshops annually.

Conduct at least 2 summer gathering workshops for plants traditionally used for food, shelter, and tools. Integrate messages about wildlife, habitat protection, and conservation into these workshops.

Rationale: From its inception, the Plankhouse was envisioned to serve as a venue where visitors could discover the refuge's natural and cultural heritage. Therefore, one appropriate use of the Plankhouse is as a venue to educate visitors about the natural history of the refuge (wildlife and habitat, habitat management and change over time) and to explore natural themes through the lens of native cultures–how people used and interacted with the local environment. The Plankhouse provides a unique and evocative place to convey these messages. As with cultural programs, all existing MOUs with Tribes will be honored in developing these presentations.

Given staff and budget limitations, implementing the strategies listed above will be contingent upon having a full-time Plankhouse coordinator. In addition to the Plankhouse Coordinator, a committed corps of volunteers and an active Friends Group will be needed to effectively implement this objective. Education programs at the Plankhouse should be run by trained educators funded through an endowment. Other potential sources for staffing and volunteers to conduct cultural resources education programs include AmeriCorps students; university or MA thesis candidates; or the Center for Columbia River History.

2.6.4 Goal 4: Through Refuge outreach efforts local residents will have the opportunity to gain an understanding of and appreciation for the refuge and Refuge System mission.

Objective 4.1 Conduct Public Outreach.
Provide at least 20 outreach programs annually to inform the public about the refuge and help them understand the differences between national wildlife refuges and other public lands, and their respective missions. Engage all staff in face-to-face outreach events/opportunities; talks or briefings with focus audiences annually.
Strategies Applied to Achieve Objective
Designate focus audiences, including adjacent landowners, watershed interests, community political, economic and social leaders, members of local conservation organizations, and interest groups.
Develop outreach themes focusing on the wildlife, habitat, and conservation needs of the lower Columbia River ecosystem; the mission of the Refuge System and how it differs from that of other public lands; practical conservation advice and tips; and how to become involved in conservation efforts both on and off the refuge.
Develop portable outreach presentation kit.
Develop outreach materials (website) showing local canoeing and kayaking opportunities.
Hire part-time outreach specialist or contractor to perform the above tasks. Pursue a grant to fund this position.
Work with the Friends Group to create a volunteer speakers bureau that would give presentations to groups on behalf of the refuge.
Maintain a refuge presence at community events that have high potential to deliver refuge messages to key audiences. Staff a booth at a minimum of 3 events annually. Where possible, coordinate with friends groups, other natural resource agencies, and Service offices to ensure coverage at key events. The refuge has participated in BirdFest, Ridgefield's 4th of July celebration, the Clark County Fair, Ideas Fair, Wapato Days, Sturgeon Festival, Earth Day, Heritage Days, and Ridgefield Night Out.
Develop a welcome package for new residents inviting them to the refuge, explaining the refuge's role and mission, and articulating public use opportunities on the refuge.
Update and maintain the refuge's web page.
Update and maintain refuge brochures.

Rationale: The area surrounding the refuge is becoming increasingly developed; as a result the refuge has many new neighbors who may have little knowledge of the Refuge System or the differences between refuges and local parks. Outreach is needed to this new and growing audience. Outreach programs are an effective tool in educating the public about how refuges enhance natural resources, improve water quality, and provide educational and economic benefits to communities. When the public knows and understands these qualities, they are more likely to support the refuge. Outreach will also improve visitors' awareness of regulations and policies, and the reasons for them (i.e. closed/sanctuary areas; why certain activities are not allowed on refuges) and hopefully, reduce law enforcement violations on the refuge.

Objective 4.2 Continue recruiting, training, retaining, and utilizing volunteers for support of refuge programs and activities.
Build volunteer participation so that within 7 years, the number of active and engaged volunteers that regularly participate in refuge programs and projects on a recurring basis exceeds 150 annually.
Strategies Applied to Achieve Objective
Work with the Friends Groups to pursue funding for a full time position to coordinate volunteers, create work plans for volunteers, and develop training and certification. Consider hiring through the Americorps program. (Note: If this is achieved the refuge can support a larger volunteer program.)
Continue to work with the Friends group to provide volunteer coordination.
Hold at least 12 annual community work days for habitat improvement/restoration projects per year.
Effectively utilize volunteers to maintain and improve trails. Continue volunteer programs with partners to work on at least 2 trails per year.
Create and promote opportunities for advanced/master hunters to donate conservation hours.
In conjunction with the Friends Groups, develop 5 long-term volunteer restoration/habitat projects that support refuge needs. Projects will be led by Friends organizations and entirely dependent upon volunteers in all phases (planning, funding, implementation, maintenance, monitoring, and evaluation).
Train a project leader volunteer via the Friends Groups to coordinate and manage the refuge's purple martin and duck box nesting programs.
Rationale: Currently, more than 500 volunteers participate in refuge programs, or assist with habitat projects such as tree plantings or invasive species control activities annually. However, most of these volunteers participate on a one time basis. The number of volunteers that participate on a recurring basis is estimated at 100. These repeat volunteers have an excellent knowledge of the refuge and its resources, and often add value to the programs by working on more than one project and better knowing the resource. For example, in recent years volunteers working on Christmas Bird Counts, also identified invasive species. Increasing this core of dedicated repeat volunteers will provide major benefits to both habitat management and public use programs.

Objective 4.3 Establish and Maintain Partnerships
Establish and maintain a diversity of partnerships within the private sector, with nongovernmental organizations, educational institutions, and government agencies that have common goals for the lower Columbia River ecosystem. Partners could assist the refuge in fundraising and providing matching funds where appropriate.
Strategies Applied to Achieve Objective
Through outreach efforts enlist partners to undertake at least 2 refuge conservation or public use projects annually. Focus on projects that restore, maintain, or improve habitat or public use facilities.
Facilitate partnerships between hunting and birding groups that emphasize joint interests and support refuge programs and activities.

Cooperate with the City of Ridgefield to produce interpretive materials for an off-refuge visitor contact site to interpret the wildlife, history, and cultural resources of the lower Columbia River. Develop an interpretive prospectus to guide exhibit themes. (Site may consist of an off-refuge kiosk, booth, or center.)
Continue programs with waterfowl organizations to work on at least 4 projects per year to maintain or improve hunting facilities or habitat in the hunt area.
Create, foster, and/or maintain strategic community and conservation partnerships to address resource issues impacting refuge resources beyond the refuge's jurisdictional boundaries (e.g. watershed protection, fisheries restoration, habitat protection).
Work with the City of Ridgefield and adjacent landowners to develop a viewing platform on the bluffs overlooking the refuge's east side and Campbell Lake.

2.6.5 Goal 5: Students from southwest Washington will participate in quality environmental education programs on the refuge that meet State educational requirements and provide safe and memorable experiences that foster a connection with nature and the refuge. As a result of participating in EE programs, students will understand the refuge's role in wildlife conservation and incorporate a conservation ethic into their everyday lives.

The refuge's EE program shall:

- Focus on community groups and schools in southwest Washington;
- Tier to the State's educational objectives;
- Feature class facilitation balanced between refuge staff, teachers, volunteers, and partners;
- Be fully accessible for all students; and
- Be coordinated by a permanent fulltime environmental education specialist.

Objective 5.1 Provide quality environmental education opportunities.
Provide quality environmental education opportunities for up to 4,500 annual student visits from southwest Washington, tiered to the State's Essential Academic Learning Requirements (EALRs) for grades 2 through 12.
Strategies Applied to Achieve Objective
Seek grant opportunities to staff a full time EE coordinator/specialist.
By the end of 15 years, the refuge will implement measures (e.g. curricula development, trainings, and workshops) needed to empower teachers to lead 75% of educational visits. Teachers will lead field activities/lessons for their students; thereby, reducing the refuge's EE staffing needs by 25%. (Depending upon group size, visiting teacher(s) would have to lead 1-3 activities/lessons.)
Within 3 years, refine the refuge's scope of educational programming to those Grade Level Expectations (GLEs) and EALRs that are best suited for refuge field trips. Eliminate educational programming that is better suited to other educational venues or is delivered in other local educational sites. (Currently the program is too broad.)
Within 7 years, develop up-to-date EE curricula to be used with teacher-led classes. Design instructional materials to encourage the development of an environmental ethic and commitment to land stewardship in addition to conveying scientific knowledge. Enlist local teachers to help develop curricula to ensure that educational requirements are met. (Note: Existing Clark County education materials could be integrated.)

Within 7 years, ensure that all refuge EE curricula is age appropriate, has clear linkages to age level content, is supplemented by teacher workshops/trainings, is user-friendly to the instructor, and is supported by backpacks that can be checked out from the refuge to implement lessons onsite.
During the life of the plan, partner with Ridgefield School District to develop educational programming for multiple disciplines and grade levels to maximize the refuge as an educational resource.
Within 5 years, develop refuge specific instructor training for teachers ("teach the teacher" programs).
Annually offer 2 teacher training workshops and establish a program to encourage and select trained teachers to use the refuge's facilities, curricula, and programs for teacher led EE.
Foster long-term support for environmental education by ensuring the refuge has a minimum of 10 committed teachers and 30 qualified trained volunteers available for the program.
Develop and implement evaluation techniques with volunteers, students, and teachers to maintain program quality.
Every two years, review EE curricula with focus groups of educators at appropriate levels. Update curricula and materials as necessary to ensure specific, age-appropriate learning objectives are articulated and that proper emphasis is placed on the Refuge System, current science of lower Columbia River ecosystems, current management issues, and adherence to current State environmental education standards.
Develop EE program for children with disabilities (for example a program for identifying birds by sound).
Rationale: Currently the refuge provides EE for 2,000-3,000 students annually, primarily in grades 3-6. The number of students served is limited by the availability of staff and volunteers needed to manage the program. Existing EE materials need to be reviewed and updated. With a rapidly increasing population in the local area, demand for EE programs on the refuge is increasing. With limited staff time available to run EE programs, teacher-led programming is needed. An EE program that focuses on teaching the teacher has the potential to both expand the number of potential students participating in EE and to broaden the base of knowledgeable EE instructors in the community. Indirectly, this will have the effect of broadening support for the Ridgefield Refuge Complex within the community. Because it takes time for teachers to receive training and become familiar with the educational materials and environment, we anticipate slowly but gradually moving toward a 75% mark over the life of the CCP. Currently, the Refuge Complex's Instructional Systems Specialist and Volunteer Coordinator spend approximately 750 hours per year total coordinating and implementing the current EE program. The support needs of the program would be better served by a full time EE Specialist, who could potentially evaluate, refine, and improve the program. There is an increasing awareness in the Service and the conservation community, of the need to get children outdoors to experience nature directly. Today, many children are distanced from nature, which over time will result in lack of awareness of, and support for wildlife conservation. The refuge has a unique opportunity to reach school children because of its proximity to the town of Ridgefield and the Portland-Vancouver metro area. Therefore, EE will receive high emphasis. The refuge will focus on providing activities that are educational and experiential. A scattered approach to environmental education should be avoided. Instead, a progressive EE program that builds a relationship between the refuge and local communities and schools should be designed. EE programs on the refuge should get students outdoors and foster a connection with nature. In the future, if resources permit, the EE program could be expanded to serve students outside the local area.

Objective 5.2 Effectively utilize volunteers, Friends Groups, and partnerships to create a high quality and self-sustaining refuge environmental education program.
Strategies Applied to Achieve Objective
Foster long-term support for environmental education by ensuring that the refuge always has a minimum of 30 committed, qualified, and trained volunteers available to implement high-quality educational experiences for local school visits and youth group outings (e.g. scouts, and summer camps).
With the assistance of the Friends group, hold at least two teacher workshops per year to train educators and facilitators.
Maintain annual Naturalist Corps training to ensure volunteer base has skills and knowledge necessary to effectively work with children.
Maintain Committee for Ridgefield Refuge Environmental Education Development (CRREED) to improve Ridgefield's EE program.
Through the Friends Group, seek continued grants to provide transportation funding for school groups to visit the refuge.
Maintain involvement in Clark County's Environmental Education Coordination Council (EECC) to assess and coordinate local EE programs, venues, and needs.
Continue to support the Friends partnership with supplies and facility space.
Rationale: The Friends group plays a critical role in supporting the refuge's EE program, annually funding thousands of dollars of bus transportation to the refuge, acquiring educational materials, funding educational programs, and funding interpretive/educational contract personnel. The Friends group recently voted to make assisting the refuge with environmental education efforts their main focus for the near future. With increasing demand for EE, the support of the Friends Group will be more important than ever. Supporting the Friends with needed office space, supplies, and an available staff partnership is vital to allow the Friends to continue to provide this critical service. In addition, because the Friends group is comprised mainly of retired citizens, for the long-term health of the EE program it is essential to recruit and maintain additional volunteers.

Objective 5.3 Expand environmental education facilities.
Expand EE facilities on the Carty Unit to support on-refuge EE programs. Within 15 years build a designated, covered gathering area or classrooms, and several study sites in a variety of habitats on the Carty Unit. These facilities allow use by 2 groups of up to 40 students and teachers at a time.
Strategies Applied to Achieve Objective
Build a covered, open-air shelter with seating for EE classes; shelter should accommodate groups of up to 40.
Within the lifetime of the CCP, build 1-2 EE classrooms as part of an administrative site (see Objective 2.5), in addition to an open-air shelter.
Maintain a vault toilet at the main gathering area, and maintain parking areas to accommodate buses.
Maintain four EE study sites, with one in rest/rotation at any given time.
Utilize alternative funds to construct EE sites at the Carty Unit. Explore opportunities to apply for wildlife-dependent use grants through the Fish and Wildlife Foundation.
Develop backpacks with lesson plans and materials for each study site.
Ensure that all EE facilities are accessible to individuals with disabilities.
Rationale: The refuge currently lacks facilities dedicated to EE. The EE program is currently concentrated at the Plankhouse. In 2009 the refuge has received funding to plan a new administrative site with EE classrooms (see Objective 2.5). Due to funding timelines, a separate EA was prepared for the site.

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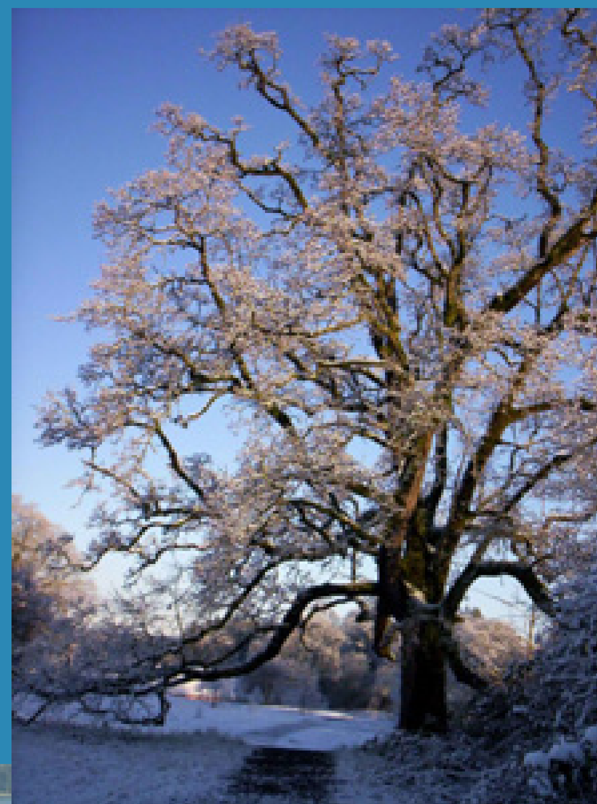
Chapter 3. Physical Environment

Above: A rare tornado damaged Refuge facilities in 2004.
Right: The Refuge receives snow about once every six years./USFWS



Gee Creek winds through the Carty Unit/USFWS

Chapter 3. Physical Environment

3.1 Climate

The maritime climate in Ridgefield, Washington produces mild temperatures, wet winters, and relatively dry summers. The region's climate is greatly influenced by the Pacific Ocean which moderates temperatures throughout the Pacific Northwest. From fall through early spring, prevailing winds bring warm, moist, marine air into western Washington. The Coast Range buffers the interior valleys of western Washington from severe winter storms moving inland from the Pacific. This results in a predominantly mild and rainy winter climate at the refuge.

Periodic cold weather, with temperatures at or below freezing for days or very rarely weeks at a time, occurs in the winter when cold, dry air from eastern Washington funnels through the Columbia River Gorge into the valleys of western Washington and Oregon. Days with temperatures below 32°F are infrequent and are usually associated with the strong east winds from the Columbia Gorge. When warm, moist air masses moving onshore from the ocean overtop cold air from the Gorge, snow or ice storms may occur.

From late spring through September, prevailing winds flow from the northwest. This cold and relatively dry air becomes warmer and drier as it moves inland, resulting in a dry season from late spring to September. Summer high temperatures during July and August are generally around 80°F. The drier conditions result in only 20 percent of the annual precipitation occurring between June 1 and September 30. Relative humidity is typically high in the winter and spring, but can reach single digits in the summer and fall months.

Meteorological measurements have been taken at the St. Helens Meteorological Station in Oregon since 1971, which lies 5.1 miles from the refuge. This station can be considered representative of the general climate of the refuge because it is on the Columbia River. Data collected at this station between 1971 and 2006 are used below to discuss weather patterns on the refuge (Oregon Climate Service 2007).

3.1.1 Temperature

Based on data collected from 1971 through 2000, the average monthly temperatures range from a low of 40°F in January to a high of 69°F in August. The highest average winter temperature recorded for one month was 44°F in December 1979, and the lowest average winter temperature recorded for one month was 31.6°F in January 1979. The highest summer average temperature recorded for one month was 73.6°F in July 1996, and the lowest average summer temperature was 64°F in July 1993.

Daily maximum temperatures vary from an average of 46°F in late December and early January to 83°F in August. There are on average, 2 days between November and February with a maximum of 32°F or below. There is an average of 18 days during the summer months with maximum temperatures of 90°F or above. The greatest number of consecutive days on record with maximum daily temperatures of 90°F or above was 16 days in 1994. The record maximum temperature was 107°F, recorded on August 10, 1981.

The average daily minimum in January is 33°F. On average, the daily minimum temperature drops to 32°F or below 47 days per year, with more than half of these days in December and January. The greatest number of consecutive days on record with minimum daily temperatures of 32°F or below is 28 days in 1979. The record minimum temperature recorded at the St. Helens station was 1°F, recorded on March 20, 2002.

3.1.2 Precipitation

Annual precipitation at Ridgefield Refuge is approximately 46 inches, the majority (about 80 percent) falling as rain from October through April. More than half of annual rainfall occurs from November through February, and less than 7 percent of annual precipitation falls during June, July, and August. On average, precipitation greater than 0.50 inches occurs 30 days per year. The wettest season on record was the winter of 1996-1997, with 60.13 inches of precipitation between October 1996 and May of 1997. The wettest year on record, 1996, precipitation measured 64.39 inches. There was widespread flooding in 1996, with the highest floods on record for many southwest Washington rivers (see below). In 2004, the driest year, only 25 inches of precipitation was measured. The driest season was the summer of 1987, with only 1.84 inches of precipitation.

Snow events are infrequent. Over the past 30 years, measurable precipitation as snow has occurred once every 6 years on average, which contributed to a 30 year average of 2.9 inches per year. A record monthly snowfall of 24.3 inches occurred in January 1980.

3.1.3 Climate Cycles in the Pacific Northwest

Two climate cycles have major influences on the climate and hydrologic cycles in the Pacific Northwest: the El Niño/La Nina Southern Oscillation (ENSO) and the Pacific Decadal Oscillation (PDO). El Niño/La Nina events are linked to ocean temperatures in the tropical Pacific and last 6-18 months. In El Niño years, ocean temperatures are warmer than average; in La Nina years, cooler. A single warm or cool PDO phase lasts 20-30 years, and the strongest signal for the PDO is in the north Pacific. The triggering cause of the PDO phase shift is not understood. The potential for temperature and precipitation extremes increases when ENSO and PDO are in the same phases and thereby reinforce each other. This additive effect is also seen in the region's stream flow and snowpack. When ENSO and PDO are in opposite phases, their opposite effects on temperature and precipitation can cancel each other out, but not in all cases and not always in the same direction (Climate Impacts Group 2009b).

The ENSO and PDO cycles have significant effects on both Columbia River flows at The Dalles, and on sediment transport. For example, Columbia River flows at The Dalles are approximately 25 percent higher during La Niña/cold PDO years than during El Niño/warm PDO years. This effect is even strong in the Willamette River. La Niña/cold PDO years have more than a 150 percent higher sediment transport rate than El Niño/warm PDO years. Winter freshets in La Niña/cold PDO years are especially effective in delivering fine sediment (Jay 2001).

Between 1900 and 1998, PDO phase shifts occurred on a 20-30 year cycle. Since 1999, the PDO has shifted every few years between cool and warm phases, making it difficult to determine at this time if the 1998 shift was a true shift to a cold phase. The 1999-2002 time period was relatively cool, while 2003-2005 was a warm period (Climate Impacts Group 2009a).

3.1.4 Floods

Northwestern Oregon and southwest Washington are one of the most active areas for flooding in the United States. Flooding is most common during the rainy season (October through April), when storms from the Pacific Ocean, 60 miles away, bring intense rainfall to the area. The consistent, drenching rains saturate the soil and often fill rivers and streams. When rivers and streams rise and exceed their channel capacity, water spills out onto surrounding floodplains. Larger floods result from heavy rains that continue over the course of several days, increased by snowmelt at a time when the soil is near saturation from previous rains. Frozen topsoil also contributes to flooding (Clark County 2009).

Most of the region's major flood events since 1860 have been rain-on-snow events that occur during the winter months, when heavy rainfall over a short period of time accelerates snowmelt runoff. Periods of intense cold, followed by a rapid transition to a warm and wet weather pattern, have produced the most severe flooding. The floods of February 1996 followed this pattern.

The winter of 1995-1996 was wet, with precipitation in northwest Oregon and southwest Washington at about 125 percent of the average. Soils became saturated and streams and reservoirs were running high. Between January 15 and 31, average snowpack went from 29 percent of average to 112 percent of average. An intense cold spell froze soil during the last week of January. From February 6-9, a warm, moisture-laden air mass from the tropics—the "Pineapple Express"—hit the region, producing record rainfall. Freezing levels rose to 7,000-8,000 feet and nighttime temperatures hit the 50s. This major rain-on-snow event resulted in significant snowmelt and runoff, and record flooding (Wilde 2006). Many rivers and creeks throughout the region rose to 100-year flood levels. The average river level for the Columbia River is usually 7-8 feet in winter; it crested at just over 26 feet in February 1996. Overall damage to Clark County businesses, residences and infrastructure was estimated to be roughly $25 million (Clark County 2009). In the February 1996 flood, the Bachelor Island dike was overtopped and breached, inundating the entire island and all of its croplands (USFWS 1996). Water was 15-20 feet deep in some fields. In December 1996, mild subtropical moisture once again led to extensive flooding.

While the 1996 floods were devastating, the floods of December1861 (the "Great Flood"), February 1890, and December 1964-January 1965 exceeded the 1996 events in terms of velocity and volume of water (Clark County 2009). During the Christmas Flood of 1964, the Columbia River reached 27.6 feet at Vancouver, caused $157 million in damage, and the loss of 47 lives in Clark County and the Portland metro area.

Major spring floods have also occurred on the Columbia River during years of unusually heavy snowpack, followed by heavy spring rains. In June 1894 the Columbia River reached 33.6 feet at Vancouver, the highest flood stage ever recorded there. If the Columbia River dams had been in place during that event, the river would have reached only a maximum elevation of 26 feet (Port of Vancouver 1965). During the Memorial Day (Vanport) Flood of May 1948, the river reached 30.2 feet at Vancouver (Taylor and Hatton 1999). Columbia River dams and flow regulation now make major spring floods unlikely.

Flood control projects on the refuge: Shortly after construction of the Bonneville Dam on the mainstem Columbia River, diking projects were initiated on lower Columbia River bottomlands. Diking of the River 'S' Unit was completed by local interests in 1941, protecting 1,565 acres of bottomlands from flooding. In 1947, the River 'S' dike was strengthened, drainage ditches were improved, a tide box was installed, and an expulsion pump was constructed. The levees were overtopped in 1948 and 1956, with emergency repairs to the dikes and pump stations completed by the Corps after each of these floods. In 1959, interior drainage was improved and a new pump was added to an existing pumping station. During 1963 and 1964 the dike was improved to 25.4 feet National Geodetic Vertical Datum (NGVD) and the expulsion pump station was relocated. The last breach of the River 'S' dike occurred in June of 1972. Due to funding constraints, the dike remained open until late 1974, when repairs were completed by the Army Construction Battalion from Fort Lewis, Washington. The River 'S' dike is considered safe for river levels to 16 feet NGVD (Army Corps of Engineers 1978). However, in February of 1996 the River 'S' dike withstood flooding of 23.0 feet NGVD (USFWS 1996).

On Bachelor Island, the initial diking started in 1942 with the construction of five miles of levee protecting 1,120 acres. In 1947 flood prevention activities included strengthening and enlarging the dike, excavating a one-half mile drainage canal, and installing an expulsion pump station. During the Vanport Flood of 1948, the Columbia River reached 32.8 feet NGVD at the Vancouver gage, and overtopped the Bachelor Island dike, damaging it in several locations. From 1950 to 1956 the owners of Bachelor Island reinforced and raised the levee to approximately 25 feet NGVD. Floods during 1956, 1964, and 1996 breached the Bachelor Island dike, causing significant damage to infrastructure and facilities. The February 1996 flood overtopped and breached the Bachelor Island dike, inundating the entire island and causing significant damage to infrastructure and facilities (USFWS 1996). The current dike around Bachelor Island has structural deficiencies relating to free board, crest width, slope, and erosion. While the top elevation of the dike is approximately 25.0 NGVD, it is only operationally safe at river levels of 20.0 feet NGVD (USACE 1978, USFWS 1983).

3.1.5 Wind and Severe Weather Events

Prevailing winds over most of Clark County are northwesterly during the summer and southeasterly during the winter. In general, winds are lower from late spring through September and higher during the fall and winter. From late spring through September, high pressure over the Pacific Ocean brings a prevailing flow of cold and relatively dry air from the northwest, with the winds being more moderate than during the winter. From fall through early spring, prevailing winds from the west bring warm, moist, marine air into western Washington. However, under certain conditions, strong east winds may occur when an intense pressure gradient develops between a high pressure center over the Upper Columbia River Basin and a strong low pressure area over the eastern Pacific Ocean. The Columbia Gorge funnels the winds, resulting in strong winds at the exit point of the gorge.

Although high winds can come from the east, the most destructive winds blow from the southwest, and are associated with storms moving into the coast from the Pacific Ocean. On average, south wind storms that cause significant property damage occur about once every decade. The worst storm of the 20th century, the Columbus Day storm of October 12, 1962, was a classic example of a south wind storm. It originated as a tropical storm that formed in the central Pacific Ocean, and then became an extratropical cyclone as it moved into colder waters and interacted with the jet stream. Gusts of 92 mph were recorded in Vancouver and 116 mph in Portland (National Weather Service 2007). A windstorm on Dec 12, 1995, was compared with the Columbus Day storm. Many trees on the refuge were felled by this storm, including cottonwoods in the heron rookery on Bachelor Island (USFWS 1996).

Thunderstorms are infrequent. Tornadoes are infrequent and generally small in the northwestern part of the United States. The worst tornado on record in southwest Washington, with a magnitude of F3, touched down in Vancouver on April 5, 1972. Six deaths and $50 million in property damage were recorded. On May 31, 1977, a record 6 tornados touched down in Washington in a single day, including an F0 tornado in Vancouver. On September 13, 2004, a small tornado touched down on the River 'S' Unit. The tornado caused approximately $300,000 in damage to refuge facilities. A trailer was lifted off its foundation by the tornado and moved 30 feet (USFWS 2004, NOAA 2004).

3.2 Climate Change

A growing body of scientific evidence has emerged supporting the theory of human-caused global climate change. During the 20th century, the global environment experienced increases in average worldwide temperatures, sea levels, and chemical concentrations. Average annual air temperatures on the earth's surface have increased by 1.3°F since the mid 19th century (Solomon et al. 2007). Furthermore, the increasing trend in global temperatures over the last 50 years is approximately twice the trend of the previous 50 years (IPCC 2007). Globally, during 11 of 12 years from 1995 to 2006, surface temperatures are the warmest on record since 1850 (IPCC 2007).

During the next 20-40 years, the climate of the Pacific Northwest (Washington and Oregon) is projected to change significantly. Global climate models project mid- 21st century temperatures in the northwest that are well outside the range of temperature observed in the 20th century. Important changes in future precipitation are also predicted: nearly all the climate models project wetter winters and drier summers in the 2020s and the 2040s (Mote et al. 2003).

3.2.1 Predicted Future Ecological Trends

Projected temperature increases for the coming century are expected to increase the proportion of winter precipitation falling as rain, increase the frequency of winter flooding, reduce snowpack, increase winter stream flow, result in earlier peak stream flow, and decrease late spring and summer stream flows (Hamlet and Lettenmaier 1999, Mote et al. 2003, Payne et al. 2004, Mote et al. 2005, Hamlet et al. 2007, Tague et al. 2008).

Summer stream flow reduction is expected to continue and become more widely spread (Mote et al. 1999, Miles et al. 2000, Snover et al. 2003, Mote 2003, Stewart et al. 2004, Climate Impacts Group 2008, 2009c). For example, July-October decreases in the Tualatin Basin stream flows are expected to reach 10-20 percent by 2040 (Climate Impacts Group 2008).

While the region is forecasted to become wetter overall, the projected increase in precipitation is less than the precipitation range associated with natural decadal variability (Hamlet et al. 2005). Furthermore, most increases in precipitation are projected for the winter months. Likewise, increases in winter stream flows have the potential to increase the risk of winter floods, and streambed scouring events (Climate Impacts Group 2008, 2009c). Secondary to warmer temperatures, some of the changes/effects in the Pacific Northwest that we are likely to see over the next 20-40 years follow (Climate Impacts Group 2008, 2009c):

Changes in water resources
- Decreased mountain snowpack
- Earlier snowmelt
- Higher winter stream flow in rivers that depend on snowmelt
- Higher winter stream flow in rain-fed river basins if winter precipitation increases in the future as projected
- Lower summer stream flow in rivers fed by snowmelt (most rivers in the Pacific Northwest)
- Earlier peak (spring) stream flow in rivers fed by snowmelt (most rivers in the Pacific Northwest)
- Decreased water for irrigation, fish, and summertime hydropower production

Changes in salmon
- Increased difficulties due to increased winter floods, decreased summer stream-flow, and increased water temperature

Changes in forests
- Tree growth.
- Seed regeneration.
- Potential increases in forest fires.
- Overall increased forest growth region-wide over the next few decades followed by decreased forest growth as temperature increases overwhelm the ability of trees to make use of higher winter precipitation and higher carbon dioxide.
- Potential for extinction of local tree populations and loss of biological diversity if environmental shifts outpace tree species migration rates and interact negatively with population dynamics.

Changes along the coasts
- Increased coastal erosion and beach loss due to rising sea levels.
- Increased landslides due to increased winter rainfall.
- Permanent inundation, especially in south Puget Sound around Olympia.
- Increased coastal flooding due to sea level rise and increased winter stream-flow from interior and coastal watershed.

Temperature Changes
- Temperature has increased. Average annual temperature increased 1.5°F in the Pacific Northwest between 1920 and 2003. The warming has been fairly uniform and widespread, with little difference between warming rates at urban and rural weather monitoring stations. Only a handful of locations recorded cooling. Although the warmest year was 1934, the warmest decade was the 1990s (Mote et.al. 2003).
- Warming trends have been most evident between 1930 and 1995 during the months of January-March. Minimum daily temperature rose faster than maximum daily temperature through the mid-20th century. In the second half of the 20th century, minimum and maximum temperatures rose at about the same rate (Mote et.al. 2003, Hamlet and Lettenmaier 2007).

Precipitation Changes

- Decadal variability has dominated annual precipitation trends. Annual precipitation increased 14 percent for the period 1930-1995 for the Pacific Northwest region. Sub-regional trends ranged from 13 percent-38 percent (Mote et.al. 2003). However, these trends are not statistically significant and depend on the time frame analyzed. Decadal variability is therefore the most important feature of precipitation during the 20th century.
- Cool season precipitation variability has increased. Cool season precipitation in the Pacific Northwest is more variable from year to year, displays greater persistence, and is more strongly correlated with other regions in the West since about 1973 (Hamlet and Lettenmaier 2007).
- Between 1950 and 2000, April 1 snow water equivalent (SWE) declined at nearly all sites in the Pacific Northwest. The declines are strongest at low and middle elevations, and can be explained by observed increases in temperature and declines in precipitation over the same period of record (Mote et al. 2003, Hamlet et al. 2005, Mote 2006). Many low elevation stations showed SWE declines of 40 percent or more (Mote et al. 2003, Mote et al. 2005). Timing of peak runoff has shifted. Timing of the center of mass in annual river runoff in snowmelt basins shifted 0-20 days earlier in much of the Pacific Northwest between 1948 and 2002 (Stewart et al. 2005). The largest change in these trends occurred in the Pacific Northwest, including the mountain plateaus of Washington, Oregon, and western Idaho. These findings are corroborated by modeling studies which show similar changes in runoff timing (Hamlet et al. 2007).

3.2.2 Detailed Future Climate Change in the Pacific Northwest

Temperature/Precipitation Changes. Global climate models scaled to the Pacific Northwest project an increase in average temperature on the order of 0.2°-1.0°F (0.1°-0.6°C) per decade throughout the mid-21st century with a best estimate average of 0.3°C (0.5°F) per decade (Table 3.2). Temperature increases occur across all seasons with the largest increases in summer.

The best estimate rate of warming in the Pacific Northwest through the mid-21st century—0.5°F (0.3°C) per decade—is three times the rate of change per decade observed in the Pacific Northwest during the 20th century (0.15°F [0.8°C] per decade). The rate of change per decade for the second half of the 21st century is dependent on the choice of emissions scenarios.

Precipitation changes are projected to be small compared to the inter-annual and decadal variability observed during the 20th century. Most of the models analyzed by Climate Impacts Group (CIG) project showed decreases in summer precipitation and increases in winter precipitation with little change in the annual mean. Analysis of future storm tracks indicates a basis for more confidence in wet season increases, particularly in the second half of the 21st century (Salathé 2006).

Coastal sea surface temperature (SST) helps determine the biological and physical conditions of the marine environment and estuaries of the Pacific Northwest. Climate models project warming in summer SSTs for the 2040s on the order of 2.7°F (1.5°C). This change is somewhat less than the warming projected in the 2040s for Pacific Northwest land areas (3.5°F [2.0°C]), but is significant relative to the small inter-annual variability of the ocean.

Table 3.1 Projected Changes in the Pacific Northwest Climate (Data from CIG 2008)

Changes in Annual Mean		
	Temperature	**Precipitation**
2020s		
Low	+ 1.1ºF (0.6ºC)	- 9%
Average	+ 2.2ºF (1.2ºC)	+ 1%
High	+ 3.4ºF (1.9ºC)	+ 12%
2040s		
Low	+ 1.6ºF (0.9ºC)	- 11%
Average	+ 3.5ºF (2.0ºC)	+ 2%
High	+ 5.2ºF (2.9ºC)	+ 12%
2080s		
Low	+ 2.8ºF (1.6ºC)	- 10%
Average	+ 5.9ºF (3.3ºC)	+ 4%
High	+ 9.7ºF (5.4ºC)	+ 20%

Average changes in Pacific Northwest climate from 20 climate models and two greenhouse gas emissions scenarios (B1 and A1B) for the 2020s, 2040s, and 2080s (Climate Impacts Group 2008). All changes are benchmarked to average temperature and precipitation for 1970-1999. Model values are weighted to produce the “average.”

3.2.3 Potential Changes to the Refuge

There have been no specific studies documenting potential effects to the refuge from future climate change. There have already been major and irreversible changes to refuge habitats and wildlife due to Columbia River flow regulation, diking, introduced species, land conversion to agriculture, and surrounding land uses. The impacts of climate change will be difficult to distinguish from these other impacts, at least in the near term. However based on the various climate modeling scenarios for the Pacific Northwest, several potential problems are envisioned.

One of the main concerns is the River ‘S’ Unit and the Bachelor Island Unit, which are protected by flood control dikes. The dikes prevent the Columbia River from flooding the units during periods of high water. In addition to refuge administrative facilities, critical waterfowl habitat and the infrastructure to maintain that habitat is protected by the dikes. Rain-on-snow events are a normal feature of Pacific Northwest climate. However, projected warmer, wetter winters associated with climate change suggest further increases in the risk of winter flooding (Mote et al. 2003). The 1996 flood completely overtopped refuge dikes, and breached the Bachelor Island dike. This dike may be vulnerable to breaching in future flood events. The dike underlying Lower River Road, which is not owned by the Service, is eroding and a breach of this dike is considered likely in the next major flood event (see Chapter 2).

A recent National Wildlife Federation study of potential habitat changes associated with sea-level rise in coastal Oregon and Washington projected that the average sea level at the study locations in the Willapa Bay, lower Columbia River, and Tillamook Estuary could increase by 0.69 meters (27.3 inches) by 2050 (Glick et al. 2007). At Julia Butler Hansen Refuge, approximately 30 river miles downstream from Ridgefield, managers believe this would cause severe recurring flooding problems during periods of high tide, and likely in time undermine the integrity of the dikes. Projected sea level rise would probably have little effect on Columbia River levels at Ridgefield in the near future. Flow regulation (through operation of Columbia River dams) would continue to dominate river levels.

A second concern is the increasing temperatures projected by many of the climate models. The CIG at the University of Washington has averaged a large number of climate models. When averaged, the predicted average annual temperature increase is 3.5° F by 2040. Numerous changes to the refuge's habitat and wildlife would likely result from increases in the ambient temperature and precipitation over the next 50 to 100 years. However, until a more detailed analysis of the effects of global climate change can be completed on specific refuge units, more generalized modeling will continue to be used to assess how and what the refuge should do to prepare for upcoming changes to the natural environment. While this CCP covers a 15-year time span, it is clear that for us to adequately plan for climate change, we will have to look further into the future. It is also clear that to address an issue of this magnitude, land managers must plan collaboratively on a regional level. During the 15-year time span of this CCP, Ridgefield and other refuges will develop strategies to address climate change effects on the lower Columbia River.

3.3 Hydrology

3.3.1 Columbia River and Changes due to Hydropower Operations

The Columbia River Basin is the most hydroelectrically developed river system in the world (Center for Columbia River History 2009). Eleven dams on the mainstem of the Columbia River, and hundreds of major and modest structures on the Columbia, Snake, and their tributaries, now impose water level fluctuations to meet demand for hydroelectricity, agriculture, navigation, pool recharge, recreation, fisheries, and water quality priorities (Scherer 1991). Rock Island Dam, completed in 1932, was the first major hydropower producer on the Columbia, followed by the much larger Bonneville and Grand Coulee dams, completed in 1938 and 1941, respectively. The last dams built on the Columbia came on line during the 1960s and 1970s. In 1973, Canada completed the last of the mainstem dams, Mica Dam on the upper river. These dams, along with four dams on the lower Snake River, created large reservoirs that provide water for vast irrigation systems on the Columbia Plateau, and power that fueled the growth of cities and industries in the Pacific Northwest.

Historically, flooding within the Columbia River was the product of regional precipitation, the rate and volume of snowmelt, and synchronization of runoff between the Columbia and Snake River drainages. Prior to dam construction, average spring floods (freshets) regularly inundated 170,000 acres of bottomland along the lower Columbia River for periods of up to 60 days. Major spring flood events would have inundated up to 300,000 acres of the lower Columbia River floodplain (Christy and Putera 1993). The linear, shallow troughs and low ridges of Bachelor Island, which run roughly parallel to the Columbia River, are relics of high energy floods that occurred prior to flood control. Due to short and long term climate cycles in the Pacific Northwest (ENSO and PDO), and snowpack, the volume of the spring freshet varied greatly from year to year, or decade to decade (see section 3.1.C above).

Construction of over 200 dams on the Columbia River and its tributaries radically altered the flow regime of the river during the 20th century. Reservoir storage projects have created an active storage capacity equivalent to 1/3 of the mean annual flow of the river, as measured at The Dalles, Oregon (WDOE and WDFW 2004). Dams now impose additional water level fluctuations to meet demands for hydro-electricity, agriculture, navigation, pool recharge, recreation, fisheries, and water quality priorities. Spring flood elevations on the lower Columbia River average 37 percent lower today than prior to dam construction (Habegger et al. 1998). Regulated winter flows are typically less than

200,000 cubic feet per second (cfs). Peak flows in May and June have declined from about 600,000 cfs to 350,000 cfs (Christy and Putera 1993). In the 30-year period between 1975 and 2005, the historic average annual spring flood level of 21.5 feet was only achieved twice (NOAA 2005).

In the pre-dam era, the river typically had relatively low flows during the fall and winter (October through March) and much higher flows during the snowmelt runoff period (the spring freshet) in the spring and summer (April through September). In the post-dam era, normal high water flows have been reduced with the peaks flattened out. Rather than peaking strongly during late spring and summer, spring runoff is contained within numerous storage reservoirs and gradually released over the year. There are now relatively higher flows in the winter, as the stored water is tapped for power generation, and lower summer flows than occurred historically. Figure 3-1 illustrates the change in the hydrograph from historic to current times.

Today, the lowest river flows occur during September and October, when rainfall and snowmelt are lowest (NPCC 2004). The highest flows occur from April to June and result from snowmelt runoff. High flows also occur between November and March and are caused by heavy winter precipitation. Discharge at the mouth of the river currently ranges from 100,000 to 500,000 cfs. Historically, unregulated flows were both lower and higher—with lows of 79,000 and highs of 1 million cfs, respectively (Neal 1972 and LCREP 2002 as cited in NPCC 2004).

3.3.2 Wetlands Hydrology

The refuge is located within the floodplain of the lower Columbia River near the confluence of the Willamette River. Historically, the area's hydrology was dynamic and subject to natural influences including river levels, precipitation, evaporation, tides, runoff, soil saturation, and soil permeability.

Before dam construction within the Columbia River system, spring floods would have been the primary hydrological influence within the lower Columbia River. The average annual spring flood reached a stage of 21.5 feet at the gage at Vancouver, Washington. The History of Clarke County (Alley and Munro-Fraser 1885) notes that the bottomlands along the Columbia were "subject to the annual overflow, which reaches its highest in June." Historically, spring flooding would have annually inundated most of the refuge, recharging broad, shallow overflow lakes and ponds. Deeper ponds and sloughs would have retained water year-round, while shallow overflow lakes would have dried up by late summer.

Overbank flows, formerly an annual event on the Columbia River bottomlands, occur much less frequently now than they did historically, in part because flow regulation, water diversions, and diking have reduced the number of high flows in the river. The construction of dikes or levees along the Columbia River and its tributaries has also reduced the frequency of overbank flows, because more river water is needed to cause overbank flow. Historically the bankfull level was 18,000 cubic meters per second (m3 s-1), while today it is 24,000 m3 s-1—fully one-third more. Only five overbank events have occurred since 1948 (Kukulka and Jay 2003a, b). In the absence of spring floods, most of the refuge's wetlands are recharged by precipitation or by pumping from the river.

Today, only the Carty, Roth, and portions of the Ridgeport Dairy Units remain in the floodplain of the Columbia River. Most wetlands in these units are directly or indirectly connected to the Columbia River. Water level patterns in these wetlands, therefore, generally follow the water level pattern of the Columbia River. For those wetlands that lack a direct connection to the river, for

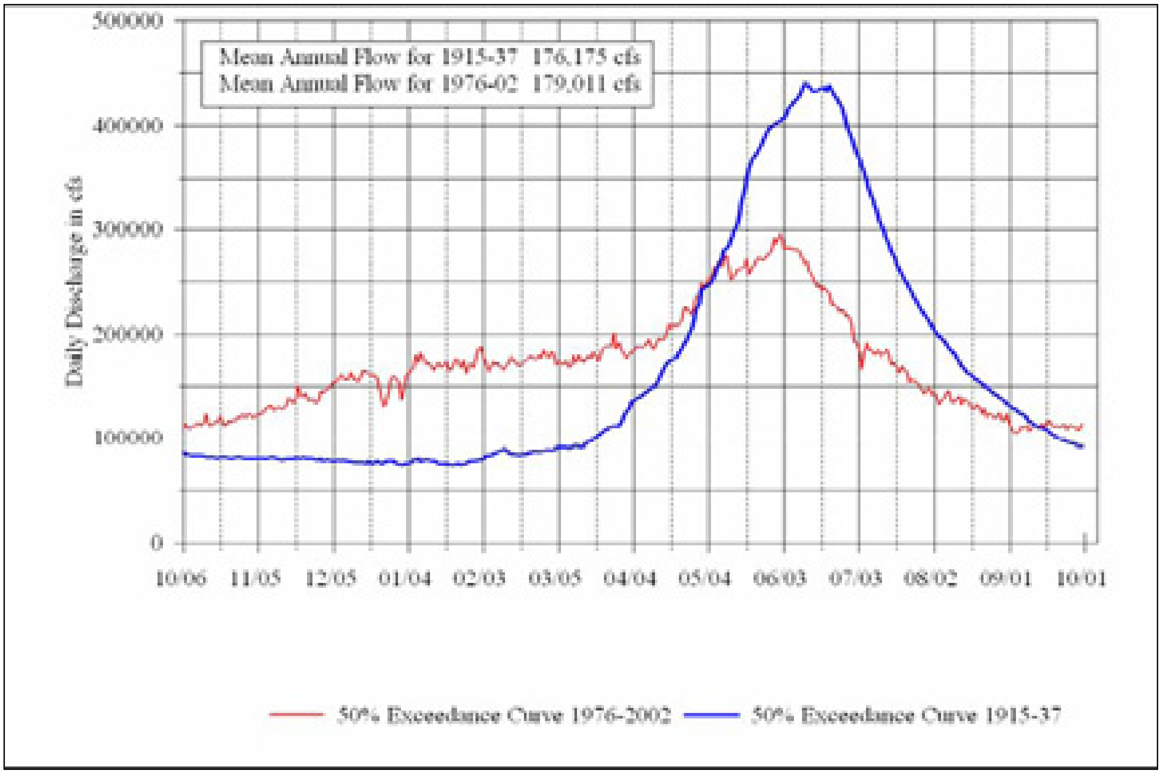


Figure 3.1 Historic and current hydrograph of the Columbia River
Exceedence curve: A flow exceedence curve shows the percent of time a flow has occurred historically. In this case, during 50 percent of the years, the flow equaled or exceeded the value shown. Source: Managing the Columbia River: Instream Flows, Water Withdrawals and Salmon Survival (2004) by Committee on Water Resources Management, Instream Flows, and Salmon Survival in the Columbia River Basin, National Research Council, 268 pages.

example Post Office Lake and Carty Lake, water fluctuations are generally muted relative to the river, with increases and decreases occurring more gradually.

The River 'S' Unit and Bachelor Island were diked while in private ownership to increase the agricultural values of the lowlands. Diking began in 1941 when 1,565 acres of the River 'S' Unit were diked; in 1942, 1,120 acres of Bachelor Island were diked. Within the dikes of the River 'S' and Bachelor Island units, and portions of Ridgeport Dairy Unit, the hydrology is highly manipulated to provide wetland habitat for migratory waterfowl. The Service installed impulsion pumps to increase wetland habitat on the River 'S' unit in 1976. The River 'S' system was expanded in 1999 with the construction of a second pump station. In 1999, water delivery systems and pump stations were also constructed on Bachelor Island and Ridgeport Dairy. Expansion of the irrigation system allows water manipulation within individual wetland basins to support habitat, wildlife, and public use priorities (for more detail on refuge water control infrastructure, see Chapter 5). However, the pumping costs and efficacy of the delivery system are major limiting factors in the movement of water within these units. Natural factors including soils, temperature, precipitation, elevation, tides, and river levels impose additional limitations to water delivery and retention within the diked units of the refuge.

Due to their soil composition, some wetland basins within the diked portion of the Bachelor Island Unit do not retain water unless river levels are high. This is because they have layers of poorly drained, clay soils interspersed with permeable layers of sand. When river levels are high, this sandy substratum allows water to move underground to interior portions of diked land. The water table rises and the wetlands hold water. Conversely, when river levels are low, water pumped into these wetlands dissipates rapidly. In most years, these wetlands only hold water in late winter and early spring.

3.3.3 Gee Creek and Campbell Slough

Gee Creek, a 4th order tributary of the Columbia River, lies in western Clark County between the East Fork Lewis River and other smaller streams draining to Lake River. Gee Creek occupies a watershed basin of approximately 12,000-acres in size. The drainage consists of a main stem of approximately 11.5 miles in length, which branches into headwater tributaries, and a small mid-reach tributary locally named Tee Creek. The headwaters are located in the southernmost portion of the basin just west of the Interstate 5 freeway (I-5). After following I-5 north for about one mile and recrossing the freeway several times, the creek turns northwest through canyons and the City of Ridgefield, crosses Main Street and the Burlington Northern Santa Fe (BNSF) Railroad tracks via a culvert, and enters the Columbia River floodplain on the refuge's Carty Unit. The lower 3.76 miles of Gee Creek meanders through the refuge in a series of lakes and ponds before emptying into the Columbia River at approximately river mile 87, a ¼ mile upstream from the mouth of the Lewis River. The lower reach of Gee Creek is tidally influenced. Gee Creek is part of the Terrace hydrogeologic unit, characterized by rain-dominated precipitation, west to southwesterly trending groundwater flow, and a large delta (now a terrace) formed by glacial floods consisting of gravels, sand, silts and clay (WDOE 2007).

The Gee Creek watershed is composed of three subwatersheds: Cathlapotle (the portion of Gee Creek on the refuge, from its confluence with the Columbia River to Main St. in Ridgefield); Lower Gee (Main St. to Royle Road); and Upper Gee (upstream of Royle Road to the headwaters east of I-5). The Cathlapotle subwatershed occupies the Columbia flood plain, and includes both the Carty Unit and privately held forestland north of refuge lands. Upper and Lower Gee are rural and urban areas above the Columbia River flood plain. Lower Gee includes the rapidly growing City of Ridgefield. The I-5 corridor bisects Upper Gee Creek subwatershed. An assessment of the geomorphology and hydrology of the upper Gee Creek watershed was done in 2008 for the Clark County Clean Water program (Clark County 2008a), but a detailed hydrologic assessment of the other subwatersheds has not been done.

Portions of Gee Creek upstream from the refuge have been straightened and/or channelized. Grading and filling of the original watershed contours began with road and bridge construction in the late 1800s, and was expanded with the construction of I-5 in the late 1950s and early 1960s. Currently, Gee Creek is restricted and confined by I-5, passing through two culverts, running in the divider between the north- and south-bound lanes for a ½ mile, and finally passing through a third culvert beneath the entire road grade before exiting the freeway corridor. By the 1960s, Gee Creek had been straightened to accommodate Pioneer Street and Abrams Park in Ridgefield. The Main Street Bridge, which crossed Gee Creek, was replaced with a culvert in the 1950s when the road was straightened. The Northern Pacific Railroad crosses the Gee Creek floodplain on a fill roadbed-dike more than 15 feet tall, confining and constricting the creek through an 8-foot diameter concrete culvert as it enters the Columbia River floodplain and the refuge (Cornelius 2006).

The hydrology of Gee Creek is impacted by the reduction in forest cover and an increase in the impervious surface in the watershed compared to historic conditions. Total forest cover in the upper and lower subwatersheds is 18 and 29 percent respectively, and forest cover in the Cathlapotle subwatershed is 38 percent (Clark County 2008b). This percent cover is well below the level at which watershed processes become degraded (less than 65 percent cover, Booth and Jackson 1997). Total impervious area (TIA) in upper and lower subwatersheds is 16 and 19 percent respectively. (The NOAA Fisheries standard is less than five percent TIA for fully functional watersheds; watersheds with greater than 15 percent TIA are considered nonfunctional habitat for anadromous fish.)

Data from the stream gauge on Gee Creek at Abrams Park, about one stream-mile upstream of the refuge, suggests that Gee Creek is a relatively flashy stream. Examination of a simple hydrology metric, the TQmean (percent of a year when mean discharge was exceeded), showed that only 25 percent of the daily flows were greater than the mean daily flow. This is indicative of a flashy urban or unforested rural watershed (Clark County 2008b). Most reaches of Gee Creek are incised but relatively stable at present; however, many are susceptible to future erosion. Projected increases in effective impervious area in the watershed will cause increased rates of channel incision, bank failures, and accelerated channel migration unless adequate runoff controls are in place.

Campbell Slough, which connects Campbell Lake to the Columbia River, was originally a backwater slough of the Columbia River. The slough is approximately 2.6 miles long and lies entirely within the refuge. Campbell Slough retains its connection to the Columbia River and is considered a permanent tidal riverine system.

3.4 Topography and Bathymetry

The topography of Ridgefield Refuge is largely flat to gently rolling, with most areas below 20 feet in elevation. The topography of the River 'S' and Bachelor Island units is generally sloping from south to north; wetlands fill on the south and drain to the north. Bachelor Island is notable for a series of roughly north-south trending ridges and swales (scroll bars) created by past high-energy flood events. The Carty Unit is a mosaic of shallow lakes and small knolls, with elevations varying from 0 to 60 feet above mean sea level. This hummocky topography, combined with fluctuating river levels and variable soil permeability, create an exceptionally patchy, fine-grained habitat where relatively small variations in elevation are associated with major shifts in vegetation type (see Chapter 4).

A land cover mapping project was completed for the Ridgefield Refuge Complex by Ducks Unlimited in 2000. This included developing land cover maps from Airborne Data Acquisition and Registration (ADAR) imagery (2 meter resolution) acquired in 1997. As part of a project plan for proposed wetland restoration on Bachelor Island, elevation contours for Bachelor Island were created (intermediate contours between 5-foot index contours) and 350 acres of wetlands on Bachelor Island were restored in 1998, including recontouring of several wetland basins. Therefore, mapping does not reflect current conditions and needs to be updated.

Fine scale topographic and bathymetric mapping for use in habitat management and habitat restoration plans is identified as a priority in this CCP (see Chapter 2, objective 7.4). This will include collecting fine-contour bathymetric data and performing mass point conversions of existing

Light Detection And Ranging (LIDAR) data to obtain 6-inch wetland contours, and preparing a spatial template of the slough and ditch network, including passage barriers and water control structures, and digital elevation model (DEM) for fine-scale topography mapping.

3.5 Geology and Geomorphology

3.5.1 Physical Setting

The Ridgefield Refuge lies within the lower Columbia River ecosystem, which extends 146 river miles from Bonneville Dam to the Pacific Ocean. After it emerges from the Columbia River Gorge at river mile 126, the Columbia River widens to include a broad floodplain, and flows west and north through the Portland Basin, the broad, nearly level to undulating valley occupied by Portland and Vancouver and the confluence of the Columbia and Willamette Rivers. The Portland Basin is the northernmost of several sediment-filled basins that collectively constitute the Willamette Valley segment of the Puget-Willamette Lowland. The Basin is approximately 37 miles (60 km) long and 18.6 miles (30 km) wide, with its long dimension oriented northwest. The Basin is flanked on the west by the uplifted marine rocks of the Coast Range and the Willapa Hills, and on the east by the volcanic Cascade Range (Ames 1999).

Elongated islands divide the Columbia River and form sloughs and side channels in the formerly marshy lowlands. Where the Willamette River meets the Columbia, the floodplain expands. Here, the sloughs and lakes of North Portland, the Vancouver lowlands, Sauvies Island, and Ridgefield Refuge contain the Portland metropolitan area's last major remnants of the wetland and riparian system formerly nourished by annual flooding of the non-dammed rivers.

About 10 miles (16 km) north of Saint Helens, the Columbia River exits the Portland Basin through a confined bedrock valley less than 1.5 miles (2.5 km) wide. Here it cuts through the Coast Range, a passage marked by steep-shouldered bluffs and broad alluvial floodplains. The river channel, dotted with low islands of deposited sediments throughout its lower reaches, opens out below Skamokawa, Washington, into several broad bays that extend more than 30 miles to the Pacific Ocean. At its mouth below Astoria, Oregon, the river passes between two jetties approximately two miles apart as it enters the Pacific Ocean.

3.5.2 Geomorphology

The landscape of the lower Columbia River Basin, and the refuge, is defined by cataclysmic basalt flows, Ice Age floods, and tectonic uplift of the Coast Range. During Pleistocene time, cataclysmic floods that originated in western Montana when ice dams on Glacial Lake Missoula broke, periodically flowed down the Columbia River drainage and inundated the Willamette Lowland. These floods deposited up to 250 feet of silt, sand, and gravel in the Portland Basin (Gannett and Caldwell 1999).

The refuge is part of the Willamette Lowland, a 5,680-square-mile trough that lies between uplifted marine rocks of the Coast Range to the west and volcanic rocks of the Cascade Range to the east. In the northern two-thirds of the lowland, marine sedimentary rocks and Cascade Range volcanic rocks are overlain by up to 1,000 feet of lava of the Columbia River Basalt Group, deposited during mid-Miocene times. Folding and faulting during and after incursion of the basalt formed four major basins, including the Portland Basin where the refuge lies. Portions of these basins have accumulated more than 1,600 feet of fluvial sediment derived from the Cascade and Coast Ranges, or transported into the region by the Columbia River.

3.5.3 Geologic History

Basins and Ranges Form. The collision of the Juan de Fuca tectonic plate, off the coast of Oregon, with the North American plate is the dominant geologic force in the region. The Cascadia subduction zone, where the dense oceanic Juan de Fuca plate subducts, or dives below, the lighter North American plate, is responsible for producing the broad features of the landscape in western Oregon and Washington: the Willamette-Puget Trough, the Coast Range, and the volcanoes of the Cascade Range. The subduction zone lies 50 miles (80 km) off the West Coast and stretches 680 miles (1,094 km) from mid-Vancouver Island to Northern California. The two plates move at a relative rate of approximately 0.4 inches (10 mm) per year at a somewhat oblique angle to the subduction zone (USGS 2004).

The subduction zone began moving north to its current position about 35 million years ago. Evidence of this northward movement may be seen in the roughly 50 mile (80 km) northward offset of the Columbia River at Portland (Pacific Northwest Ecosystem Research Consortium 2002). The volcanoes of the Cascade Range, which formed above the subduction zone, made their first appearance 36 million years ago. At that time, the ancestral Columbia River drained the relatively low Columbia River Plateau. As the Cascades rose, the river was able to keep pace, creating the gorge and major pass through the Cascade Range and coast ranges seen today (USGS 2004). The Coast Range rose as sediments carried eastward by the subducting oceanic plate were forced under the western edge North American plate, pushing it upward. During this process, the future Willamette Valley also rose. Originally a bay, the valley became dry land about 20 million years ago.

The Portland Basin began to form about 20 million years ago, as a broad concave fold, or syncline, related to uplift of the Oregon Coast Range. The Basin formed as the Earth's crust spread and sank between two fault zones (Thorson et al. 2003, Evarts 2004). Over the course of 20 million years, the shallow (less than 0.3 mile) basin was filled by sediments deposited by the Columbia River, and flows of volcanic material that followed the river's course (Evarts 2007). Between 5.3 million and 1.6 million years ago, the Willamette-Puget Lowland, the Cascade Range, and the Coast Range were in their modern locations, although today the original peaks of the Cascades are long gone, replaced by younger volcanoes.

Subduction Zone Earthquakes. The process of subduction is also responsible for earthquakes that periodically hit the region. The coastal portion of the Cascadia Subduction Zone, between the leading edge of the continent and the Cascade Mountains, is where the most powerful earthquakes in the Pacific Northwest occur. In common with most other subduction zones, the outer continental margin along the Cascadia subduction zone is slowly being compressed, like a giant spring. When the stored energy is suddenly released by slippage across the fault at irregular intervals, very large earthquakes can occur. According to the geologic record, subduction earthquakes occur along the coast of the Pacific Northwest every 200 to 600 years (Dawes and Dawes 2001). The magnitude 9 Cascadia earthquake of 1700 is the largest quake known to have occurred along this subduction zone (USGS 2004). The most recent large earthquake that occurred in the subducting plate was the

Nisqually earthquake in February of 2001, which knocked down parts of buildings in Olympia and Seattle (Dawes and Dawes 2001).

Columbia River Basalts Enter the Portland Basin. About 18 million years ago, the Cascades were in their present location and the Columbia River flowed through a pass in the range, to the sea. The Portland Basin had begun to form, but major uplift of the Coast Range had yet to occur. At this time, one of the major events to shape the landscape of the Pacific Northwest occurred. Starting in early Pliocene times (18 million years ago) and continuing to the late Miocene (5 million years ago), one of the largest flood basalts ever to appear on the earth's surface engulfed about 63,000 square miles (160,000 km^2) of the Pacific Northwest (USGS 2004).

The second-oldest of these flows, 16.5 million to 15.6 million years old, make up the Grand Ronde Basalt. Geologists estimate that the Grand Ronde Basalt comprises about 85 percent of the total flow volume. The weight of this flow caused central Washington to sink, creating the broad Columbia Basin (Carson and Pogue 1996, Alt and Hyndman 1995). The Grande Ronde Basalt and later flows travelled down the ancestral Columbia River, traversed the Cascade Range through a broad lowland, and spread out to cover large areas of the Coast Range province. Some of the basalt even reached the Pacific Ocean and flowed into Willapa Bay and Grays Harbor (Lasmanis 1991).

Within the Portland Basin, the basalt lies more than 1,000 feet below the surface, and may be as much as 200 meters thick (Evarts 2004). Both upstream and downstream from Vancouver, at the edge of the basin, there are exposures of Columbia River basalt (Lasmanis 1991). At the refuge, much of the basalt bedrock is overlain by sedimentary deposits. However, basalts in the Carty Unit were exposed by Ice Age floods (see below). The rock is typically fine-grained, dark gray, and dense. Vertical columnar structures with polygonal cross sections formed as the lava cooled. Basalt provides a good building or foundation material, and beginning about 1880, basalt from the refuge's Carty Unit was quarried to provide ship ballast and cobblestones for Portland streets (see Chapter 6).

After the Columbia River basalts were deposited, the Portland Basin continued to subside, becoming narrower and accumulating several hundred meters of fine-grained Columbia River deposits (Sandy River Mudstone), volcanic debris (Rhododendron Formation, 8-13 million years ago), and a thick layer of cobbly gravel (the older part of Troutdale Formation, 1.6-5 million years ago). There followed an episode of uplift and incision by the Columbia River, which narrowed the basin to approximately its present width (Evarts 2007).

Three to four million years ago, the Simcoe volcanoes to the east erupted. Lava flowed into the Columbia River where it was explosively quenched, forming volcanic glass (hyaloclastic) sands. The volcanic sand was flushed downstream, creating an alluvial fan (the younger part of Troutdale Formation) in the eastern Portland Basin. This was followed by a period of volcanic activity around the margins of the Portland Basin 2.6 to 1.3 million years ago. Subsequent uplift of the Cascade Range and coincident subsidence of the Portland Basin resulted in a westward tilt of the region east of the basin, causing the river to entrench this fan, and creating the modern Columbia River Gorge (Evarts 2007).

Ice Age Floods. The last major chapter in the story of the Portland Basin was written quite recently in geologic time. With the beginning of the Pleistocene time (about 1.6 million years ago), cooling temperatures provided conditions favorable for the creation of continental glaciers. A vast ice sheet covered part of the North American continent. Enormous pressure on the ice caused it to flow outward as glaciers. One such glacier dammed the Clark Fork River in northern Idaho, forming the huge Glacial Lake Missoula in present-day Montana, the lake is 3,000 square miles (7,770 km^2) in size (Bjornstad 2006).

During multiple ice ages, the last being 18,000 to 12,000 years ago, a series of cataclysmic floods, popularly called the Spokane, Missoula, or Bretz Floods, inundated large portions of the Pacific Northwest. Periodically, perhaps every 40 to 140 years, waters from Lake Missoula breached the ice dams and travelled west, scouring the Channeled Scablands of Washington, and eventually emptying through the Wallula Gap. In a typical release occurring over less than two weeks, a quantity of water equal to half the present volume of Lake Michigan, more than the modern annual volume of all the world's rivers, poured down the Columbia channel (Pacific Northwest Ecosystem Research Consortium 2002).

On reaching the Columbia River Gorge, the flood waters reached elevations of at least 1,000 feet (300m). As the floodwaters rose, they were constricted by the narrow reach of the Columbia downstream of the Portland Basin, the Kalama Gap. This forced flood waters to back up into the Portland Basin and Willamette Valley. At times ponded floodwaters in the Willamette Valley reached 400 feet (122 m) above current sea level. The suspended load of fine sand and silt settled out of the ponded floodwaters, covering the older deposits of the Troutdale Formation. Collectively, the Ice Age floods deposited up to 250 feet (76m) of well-sorted silt, sand, and gravel in the Portland Basin, and up to 130 feet (40m) of silt elsewhere in the Willamette Lowland (Lasmanis 1991, Gannett and Caldwell 1999). Much of Vancouver, Washington, and Portland, Oregon, are built on sand and gravel bars left by these Ice Age floods. The basalt quarries on the refuge's Carty Unit are an example of Bretz Flood scabland, created when these high energy floods scoured away soil and exposed the underlying bedrock.

During the last glacial maximum, sea level was about 394 feet (120m) lower than at present and the Columbia River cut a narrow valley about 246 feet (75m) below the present floodplain. Following the last Ice Age, sea and river levels rose and the once deeply entrenched valley of the lower Columbia River filled with sand and silt, forming the broad floodplain seen today. Seismic reflection profiles and other studies indicate that as much as 1,800 feet (550m) of late Miocene and younger sediments have accumulated in the deepest part of the Portland Basin near Vancouver; about 230 feet (70 m) are late Pleistocene and Holocene alluvium deposited by the Columbia River and its tributaries after the last glacial period (Evarts 2004). With the exception of areas of exposed Grande Ronde basalt on the Carty Unit, the present-day refuge is overlain by alluvium deposited by the Columbia River after the last glacial period. The Columbia River continued to sculpt the landscape. A notable recent feature are the parallel, linear ridges and swales of Bachelor Island (scroll bars), created by past high-energy flood events.

3.6 Soils

Historically, a combination of shallow depressions, poorly drained clay soils, precipitation, elevated water tables, and annual flooding created and maintained natural wetland complexes within the Columbia River bottomlands. Refuge soils are mapped and described in the Soil Survey of Clark County, Washington (NRCS 2007). Most of the soils on the refuge are derived from alluvial deposition, as fine materials transported by the Columbia River settle out upon the low elevation bottomlands.

The principal soil types on the refuge are Sauvie silty clay loam (high in both silt and clay with 7-27 percent clay particles, 28-50 percent silt, and less than 52 percent sand) with slopes of 0-8 percent, and Sauvie silt loam, with slopes of 3-8 percent. These are deep, somewhat poorly to moderately well-drained alluvial soils. Sauvie silty clay loam has medium texture and high clay content, which results in low permeability and high moisture capacity. Below the surface layer of Sauvie silt loam is a substratum of fine sandy loam which occurs at a depth below 36 inches. A 1972 Clark County soil survey noted that "Diking is difficult on this soil because of the permeable fine sandy loam substratum. If this zone is not cut off in diking, water will move through it and break out in areas known locally as 'boils' within the diked area in periods when the water level is high."

Most of the River 'S' unit is Sauvie silt loam, however, on the south end of the unit, Sauvie silty clay loam is found. The Roth Unit, where most of the refuge's ash forests occur, is also Sauvie silty clay loam. On the south end of the refuge, between Post Office Lake and Campbell Lake, Newberg silt loam occurs. This is a deep, well drained alluvial soil on 3-8 percent slopes.

Most of the Carty Unit is composed of Sauvie silty clay loam and Sauvie silt loam. A small area of Gee silt loam occurs where Gee Creek enters the Carty Unit. This is a deep, moderately well drained alluvial soil found on terraces, with slopes of 0-8 percent. Most soil inside the Bachelor Island dike is Sauvie silty clay loam. Some Sauvie silt loam occurs on the east side and north tip of the island. Accreted dredge spoils on the southwest shoreline of Bachelor Island (owned by Washington DNR) are classified as Pilchuck fine sand.

Periodically, sand transported by the river would deposit in localized areas of the floodplain which would be subsequently topped with layers of finer sediments. The resulting soils are poorly drained with interspersed permeable layers. When river levels are high, this sandy substratum allows water to move underground to interior portions of diked land. In extreme examples 'boils' will form as the water surfaces from underground. Boils were noted during the flood of 1996 on the River 'S' Unit in South Big Lake. Conversely, when river levels are low, water pumped into these wetlands dissipates rapidly. Wetlands with these soil characteristics occur on Bachelor Island.

The Carty Unit's soils within the Blackwater Island Research Natural Area (RNA) are unique compared to most of the refuge (Wiberg and Greene 1981). These elevated terraces are generally outside the floodplain; therefore, they are not alluvial in origin. These shallow soils overtop basalt bedrock and were formed in place. The soils of the RNA are classified as Olympic very stony clay loam. This soil type is derived from colluvium and residuum from igneous rock and is shallow and well drained, with slopes of 5-15 percent. It has up to 12 percent basalt fragments by volume and an average depth of 30 inches. Because of its stoniness and shallow depth, this soil is very well drained, and supports Oregon white oak woodlands.

3.7 Environmental Contaminants

3.7.1 Air Quality

In summer and fall, air inversions and idle air masses are common to the valleys of southwest Washington and the Portland metropolitan area. Stagnant air masses can accumulate pollutants and emissions to unhealthy levels. These pollutants are largely generated by motor vehicles and industries in the Portland-Vancouver Air Quality Maintenance Area. During the summer of 2002, Portland exceeded air quality standards considered safe for some groups on three days. These patterns are often improved by moderate westwardly breezes which disperse pollutants from the metropolitan areas up the Columbia River Gorge.

3.7.2 Water Quality and Contaminants

Columbia River Mainstem and Lake River. Like many sites in the Portland-Vancouver area, Ridgefield Refuge has contaminant issues related to the Columbia River mainstem and Lake River. Fish and wildlife in the lower Columbia River are exposed to a range of pollutants known to cause adverse health effects via contaminated water, sediments, and prey. In The Health of the River (Tetra Tech 1996), the Bi-State Water Quality Program summarized results from a six-year study to assess the state of the lower Columbia River. Major conclusions of the study were:

- Fish and wildlife in the Lower Columbia River basin are exposed via water, sediments, and prey to a wide range of potentially harmful pollutants. The pollutants include heavy metals, dioxin and related compounds, PCBs, DDT and other pesticides.
- Bald eagles nesting along the Columbia are not reproducing as successfully as eagles nesting in other areas of Oregon and Washington. River otter are accumulating contaminants at levels that are limiting their ability to reproduce.
- The Willamette River is a major source of pollutants to the lower Columbia River and contributes pesticides, bacteria, and during high river flows, metals. The Columbia River above Bonneville Dam contributes the majority of metals, dioxins and related compounds.
- Most pollutants entering the lower Columbia River come from diffuse sources, such as urban and agricultural runoff. Examples include DDT which has accumulated in soil and is released through erosion, and PCBs which come from abandoned landfills and hazardous waste sites. Some pollutants come primarily from industrial and municipal wastewater discharges. These include dioxins and related compounds, and some heavy metals such as silver and cadmium.
- Bacteria levels in the river are generally not a health hazard for contact recreation except possibly along shorelines following rain storms. Bacteria comes from many sources including combined sewer overflows, urban storm runoff, municipal and industrial discharges, septic systems, marinas, boats, and other diffuse sources such as agricultural runoff.

A study of food-chain effects of contaminants in the Columbia River (Buck 2004) found that DDE and DDD were the most commonly detected and most elevated compounds in invertebrates, fish, and bird eggs collected from or adjacent to the river. Polychlorinated biphenyls (PCBs) were found frequently in fish and bird egg samples, but were rarely detected in sediment or invertebrates. The PCBs and DDE found in most fish samples exceeded estimated guidance values for the protection of avian predators, and concentrations in eggs of some piscivorous birds exceeded estimated no-observed-adverse-effect levels (NOAELs). Nearly all fish sampled also contained dioxins and furans in excess of guideline values derived for the protection of avian predators, and concentrations in eggs of some piscivorous birds exceeded estimated NOAELs. Although bioaccumulative contaminants were near or below detection limits in sediment and invertebrates, the results documented biomagnification of some organochlorines to concentrations likely resulting in adverse impacts to some piscivorous bird species.

The report recommended that refuges located along the Columbia River provide adequate riparian or vegetative buffers on any land supporting agriculture or pasture, or land formerly used for these purposes, to prevent erosion of soil associated with DDT or its metabolites from entering waterways. The report also recommended that population monitoring or nest counts of breeding terns, cormorants, and bald eagles continue, and that eggs of piscivorous birds be monitored for contaminants every five years.

A 1999 Fish and Wildlife Service study reported on the productivity of bald eagles nesting along the Lower Columbia River, including pairs nesting on Ridgefield Refuge, and contaminant levels in eggs collected in 1994 and 1995. Eggshell thickness was determined, and egg contents were analyzed for organochlorine pesticides, total PCBs, polychlorinated dibenzo-p-dioxins (PCDDs), polychlorinated dibenzofurans (PCDFs), planar PCBs, and halogenated dioxin-like compounds. Buck found that although total productivity increased due to the success of new nesting pairs moving into the region, organochlorine contaminants were continuing to impact the breeding success of lower Columbia River eagles (USFWS 1999). A study of contaminant effects on great blue herons nesting along the lower Columbia and Willamette rivers, including the Bachelor Island colony (Thomas and Anthony 1999) found organochlorines (DDE), PCBs, dioxins, furans, and trace elements in heron eggs, however, reproduction at the colony level was not impaired.

Another potential contaminant issue for the refuge is contaminants originating from houseboats. About 50 residents live in houseboats on Lake River, on moorage leased from WDNR. A Washington State Department of Ecology (WDOE) study shows a contaminated water site just north of the houseboats.

Pacific Wood Treatment Site Contaminant Plume and Remediation (Carty Lake, Lake River). The primary contaminant issue at the Ridgefield Refuge is the former Pacific Wood Treating Corporation (PWT) facility. Several site and facility investigations conducted over the years have shown groundwater contamination on and off the PWT site (Hart Crowser 1992, Kleinfelder 1993, Ecology and Environment 1996, Buck 2000.) The site is located directly adjacent to Carty Lake and is a Washington State Model Toxics Control Act (MTCA) cleanup site contaminated with wood-treating related chemicals. The site is located at 111 West Division Street, Ridgefield, Washington. Burlington Northern Railroad is on the east border of the site, and Ridgefield Marina is on the south. Lake River, a side channel of the Columbia River, forms the west border, and Carty Lake and Ridgefield Refuge are on the north border. In 1963, the Port of Ridgefield leased a portion of its 39-acre Lake River property to PWT. Wood-treating operations at the PWT site began in 1964 and involved a variety of chemical preservatives including penatchlorophenol (PCP), creosote, chromated copper arsenate, and copper napthenate. Until the 1980s, chemicals were allowed to drain directly onto the open ground as part of the wood treatment process. In 1985, the U.S. Environmental Protection Agency (EPA) required PWT to begin cleaning up the contamination. Preliminary investigations on this site began in 1986 when potential contaminants were identified as petroleum hydrocarbons; volatile and semi-volatile organics; chlorinated phenols and related compounds; trace elements such as arsenic, chromium, and copper; and dioxins and furans. A Resource Conservation and Recovery Act (RCRA) facility investigation was conducted in the early 1990s (Kleinfelder 1993; see Contaminants Investigations below). In 1993, PWT declared bankruptcy and ceased operations.

In 1995, the Port and WDOE reached an agreement to begin cleaning the site. Cleanup was implemented by the current landowner, the Port of Ridgefield, under the WDOE Toxics Cleanup Program and the MTCA. In 1996, the Port of Ridgefield signed an Agreed Order with WDOE to conduct investigations and remediation of the site. That year, the Port began removal of onsite contaminated sediment in the stormwater system. In 1997, some contaminated soils were removed and others were stockpiled on site in the former tank farm treatment cell. The initial phase of cleanup (removal of treating chemicals and equipment) was completed in 2000. However contaminants remained in soil and groundwater.

In 2001 a Federal Housing and Urban Development grant allowed construction of a remediation system to remove contaminants from soil. Clean-up efforts were focused on the removal of a contaminant plume estimated to be approximately four acres in size and contain some 100,000 gallons of wood treating chemicals. The plume was in a shallow underground aquifer, but threatened to contaminate a deeper, regional aquifer as well as Carty Lake and Gee Creek (Port of Ridgefield 2009a).

The remediation technology involved installation of a vapor and liquid extraction system, and a steam injection system for removal of contaminants (Steam Tech 2000). The Service's 2000 report recommended installing additional groundwater monitoring wells in Carty Lake to evaluate the success of cleanup efforts, and to ensure that operation of the steam remediation system did not increase contamination of Carty Lake. In the fall of 2000, EPA installed three clusters of monitoring wells (three wells per cluster) in the south end of Carty Lake. Analytic results from groundwater collected from the middle well cluster revealed contamination with wood-treating chemicals and PCP exceeded guidance criteria for groundwater. The Service installed three new wells in the fall of 2001, two approximately 82 feet (25m) north of the EPA well clusters and one south of the EPA wells and closer to the PWT site. Well monitoring showed that the plume of contaminated groundwater in the shallow aquifer had moved north toward Carty Lake and the refuge. Maximum levels of 16 micrograms per liter of water (µg/L) PCP and 9.4 µg/L trichloroethylene (TCE) were found in off-site groundwater wells near Carty Lake and the refuge (Buck 2000, WDOE 2001). Baseline data was collected from the wells in January 2002, and wells were sampled on a quarterly basis thereafter, until September 2003.

The Port of Ridgefield (Port) has continued surveying for contaminants in the vicinity of the Lake River Industrial Site. In May 2009, the Port began an assessment along the west side of Lake River on the refuge to characterize indicator hazardous substances in deep groundwater. In November 2009, the Port collected sediment samples from Carty Lake on the refuge. Results of these sampling efforts will be provided to the refuge by the Port.

Installation of the steam remediation system began in 2002 and was completed in 2004. The first steam injections took place in May 2004. Cleanup efforts continue to the present, with 2-4 years estimated to completion (Port of Ridgefield 2009a). The Port of Ridgefield expects that some cleanup of site soils and sediments in Lake River adjacent to the site will likely continue after 2011. The Port expects that final clean-up of soils and sediments will occur simultaneously with site redevelopment (Port of Ridgefield 2009b).

Contaminants Investigations. A facility investigation conducted by Kleinfelder (1993) documented onsite contaminants including PCP, volatile and semi-volatile organics, copper, chromium, and arsenic. It also documented wood-treating chemicals and trace elements in sediment and water in and around surface water outfalls in both Carty Lake and Lake River. While PWT was still in operation, PCP was detected in sediment samples collected from Lake River and the Ridgefield Refuge. Concentrations of 34 to 38 µg PCP per kg were detected on the refuge and near the stormwater outfall. The highest PCP concentrations were 410 and 2,200 µg/kg found in sediment near two outfalls draining into Lake River. Sediment conditions were evaluated using the State of

Washington's Marine Sediment Standards for PCP, and equilibrium theory based on chronic ambient freshwater criteria for comparison. Both comparisons indicated a potential for adverse effects to benthic organisms from the 2,200 μg/kg concentration. The results from this investigations documented that contaminants had moved off the PWT site and could potentially harm trust resources.

A study conducted for the EPA in 1996 concluded that contaminants originating from the PWT site had migrated off-site and into refuge lands, including Carty Lake and adjacent wetlands (Ecology and Environment 1996). Site contaminants had contacted soil, sediment, surface water, and groundwater on the refuge. A single release of a PCP-containing liquid from an overflowing tank was observed entering the refuge in 1995. Groundwater in wells installed on the border of the refuge and the site at Carty Lake contained up to 12 μg/L of PCP, which was well above the risk-based concentration for PCP of 0.56 μg/L.

A study was conducted by the Service in 1999 to document environmental contaminants which had entered the refuge from the PWT site through the groundwater or surface water, in order to request appropriate cleanup activities from the Port of Ridgefield (Buck 2000). In June and July 1999, sediment and fish (largescale sucker) were collected from Carty Lake, Lake River adjacent to the PWT site, and a nearby reference area. The fish and sediment samples were analyzed for organochlorine pesticides, total PCBs, PCP, chlorophenoxy acid herbicides, and trace elements. Sediment samples indicated that organochlorine contaminants and chlorophenoxy acid herbicides were at or below detection limits, or similar to concentrations in sediment from the reference area. However, the results indicated that PCP and the trace elements arsenic, chromium, copper and possibly lead and zinc exceeded guidance values and were elevated on the refuge as a result of migration from the PWT site. In fish tissue samples, most chemical constituents were below detection limits, or similar to values outside Carty Lake. The data suggested that trace elements are locked in sediment, and therefore, not available to fish in Carty Lake, although sample sizes of fish were limited.

The results indicated that PCP and some trace elements in sediment at the south end of Carty Lake could be impacting or limiting the occurrence of some benthic fauna in the area adjacent to the PWT facility. Concentrations of PCP, based on sediment samples from this study and water samples from previous investigations, could also impact fish eggs, developing embryos, or sensitive fish species such as trout and other salmonids. The implication of these findings was that management activities that disturb sediments in Carty Lake should be avoided. Salmonids are highly sensitive to PCP in the water column. Contaminant concentrations in Carty Lake currently prevent restoration activities from occurring at the site, including activities that would benefit listed salmonids (for example, reestablishing the former connection between Carty Lake and the Columbia River). Even if no such activities take place, salmonids could be exposed to PCP from Carty Lake during periods of overflow into the outfall area near Gee Creek.

Gee Creek. Under current Washington State water quality standards, Gee Creek is to be "protected for the designated uses of: Salmonid spawning, rearing, and migration; primary contact recreation; domestic, industrial, and agricultural water supply; stock watering; wildlife habitat; harvesting; commerce and navigation; boating; and aesthetic values" (WAC 173-201A-600, WDOE 2006).

In the first county-wide assessment of general water quality (Clark County 2004), overall stream health in the West Slope Watershed, including Gee Creek, scored in the poor to very poor range.

Segments of Gee Creek are listed under Section 303(d) of the Clean Water Act: Category 5 (fails to meet clean water standards) for fecal coliform, and Category 2 listed (waters of concern) for dissolved oxygen and temperature (WDOE 2009). Segments of Gee Creek are also Category 1 listed (meets tested standards for clean waters) for dissolved oxygen, pH, and ammonia-N (Clark County 2008b).

As part of a subwatershed needs assessment report (Clark County 2008b), existing data on the geomorphology, hydrology, water quality, and macro-invertebrate diversity of Gee Creek were collected and analyzed. Water quality data for the portion of Gee Creek running through the refuge were not available, however, data collected from two monitoring stations at Abrams Park in Ridgefield, about one mile upstream of the refuge, were included in the assessment and provide an indication of the impacts of upstream activities on the water quality of Gee Creek as it enters the refuge. Recent data (2002-2006) from the Abrams Park stations indicate that Gee Creek has significant water quality issues related to temperature, dissolved oxygen, turbidity, and fecal coliform bacteria. Observed levels of these characteristics were high enough to have negative impacts on macro-invertebrate populations; salmonid spawning, rearing, and migration; primary contact recreation; wildlife habitat; and aesthetic values.

Temperature. Elevated temperatures have a detrimental impact on salmonid rearing, as juveniles are exposed to elevated summer temperatures. Resident cutthroat trout are exposed at all age classes. Temperature-related impacts to salmonids begin to occur at stream temperatures greater than 64°F. Impacts include decreased or lack of metabolic energy for feeding, growth or reproductive behavior; increased exposure to pathogens; decreased food supply; and increased competition from warm-water tolerant species (ODEQ, 2004 draft). Continuous summer water temperature monitoring from 2002 through 2006 at Abrams Park indicated that temperatures exceeded the state criterion of 63.5° F for protecting salmonid habitat every year, and remained elevated over substantial periods. Seven-day average maximum temperatures recorded at Abrams Park in the summers of 2002-2006 exceeded the state criterion by 3°F to 8°F. Due to the negative effects of chronic high temperatures on salmonids and other cold-water animals, the amount of time spent with elevated temperatures is also of interest. The number of days with temperatures exceeding 64° F ranged from 39 to 81 at Abrams Park over the four years of monitoring (Clark County 2008b).

Turbidity. Turbid water may limit foraging ability of fish, and indicates the presence of fine silt that clogs gills and spawning beds. Fine sediment deposits compromise gravel spawning areas, smother eggs, and impact food availability by suppressing benthic macroinvertebrate populations. Natural background turbidity in most Clark County streams was probably in the range of 0.5 to 2 Nephelometric Turbidity Unit (NTU); currently the summer median for Gee Creek is 4.5 NTU and the fall-winter-spring median is 8.5 NTU. Turbidity readings in the 20-40 NTU range are common during storm events. The primary sources of excessive turbidity and silt load in Gee Creek are probably related to soil and bank erosion. Off-site erosion (development, agriculture, recreational vehicle use), and in-stream erosion (bank scour, slumping, re-suspension of sediments during high flows) likely contribute significantly to the elevated turbidity during rain events. Extremely high turbidity values have been associated with specific sediment sources during rainfall events. The highest recorded value in Gee Creek since 2002 was 4,660 NTU, collected at Abrams Park in August 2004. The source of this event was insufficient erosion controls at a subdivision construction project a mile upstream. The event caused lasting damage to the creek, and substantial sediment from this source is still present (Clark County 2008b).

Fecal coliform. Elevated counts of fecal coliform bacteria are a concern associated with water-based recreation, especially during the summer months when the majority of water contact recreation occurs. A manure spill in 2001 was severe enough to cause a major fish kill in the creek below Royle Road (Cornelius 2006). Quarterly fecal coliform values from 2003 through 2006 indicate 36 percent of fall-winter-spring (FWS) samples and 100 percent of summer samples exceeded 200 cfu/100mL. Ninetieth percentile values for FWS and summer seasons were 500 and 1,380 cfu/100mL, respectively, 2.5 to 7 times the criterion. The extent of elevated fecal coliform results during 2007 and 2008 suggest the presence of fairly widespread and consistent sources that will likely require considerable effort to control (Clark County 2008b).

Nutrients. Phosphorus and nitrogen in excess may contribute to elevated levels of algal or plant growth, especially in slower moving, low gradient streams or in downstream water bodies. Nutrients (phosphorus and nitrogen) have not been assessed for lower Gee Creek; however, 85 percent of samples from upper Gee Creek exceeded the EPA criterion of 0.100 mg/L. Groundwater in Gee Creek is naturally high in phosphorus, tending to increase in the deeper aquifers (Turney 1990). As shallow sources deplete during the summer, these deeper aquifers contribute a greater share of surface flows. Naturally elevated concentrations may be augmented by nutrients from fertilizers, leaking septic tanks and sewer infrastructure, wildlife, and direct livestock access. Despite high nutrient levels, algae growth does not appear to contribute greatly to observed turbidity in Gee Creek. However, the downstream impacts of high phosphorus concentrations may be more significant than local effects. High nutrients may contribute to blue-green algal blooms in the lower end of the Gee Creek watershed in the Columbia River floodplain, where high-nutrient water enters slower-moving areas (Clark County 2008b).

Other Water Quality Issues. Although not a contaminant issue, an associated water quality problem involves carp, because they stir up the bottom, it prevents establishment of aquatic vegetation and the development of the invertebrate community that would provide a food source for various diving waterfowl, as well as numerous dabblers during the breeding season.

3.8 Surrounding Land Uses

The refuge borders the communities of Ridgefield and Vancouver Washington and is located within Clark County Washington. Although the refuge falls outside of the City limits, the community of Ridgefield borders the south end of Carty Unit and is located directly across Lake River from most of the River ‘S’ Unit. The City of Ridgefield was incorporated in 1909 and began as an agricultural and forestry based community. In 1964, the Pacific Wood Treatment facility began operations adjacent to the refuge’s present-day Carty Unit.

Bachelor Island Unit. Bachelor Island is bordered by the Columbia River to the west, Bachelor Slough to the East, and Lake River to the Northeast. The closest nonrefuge land use occurs across the Columbia River on Sauvie Island, Oregon. Sauvie Island is a mix of private and public land holdings. Oregon Department of Fish and Wildlife manages over 12,000 acres of the island as Sauvie Island Wildlife Area. Sauvie Island is an important stop during fall and spring migration of waterfowl, as well as an important wintering area for several species of cackling and Canada geese. Sauvie Island Wildlife Area works with cooperators to produce wildlife food crops. Waterfowl and sandhill cranes are known to fly between the refuge and Sauvie Island as disturbance or their food supply warrants. Public uses such as hunting, hiking, fishing, and boating are allowed on this portion of the island. Privately held land on Sauvie Island is still largely agricultural.

Carty Unit. The Carty Unit "lowlands" are bordered by Lake River to the west, Gee Creek to the north, the Port of Ridgefield to the south and BNSF Railroad tracks to the east. The Morgan family is the only major landowner between refuge lands of the Carty Unit and the Lewis River; a portion of their property lies within the refuge's acquisition boundary. The Morgan family primarily utilizes their 1,500-acre property, purchased in 1941, for livestock grazing and tree farming.

The Port of Ridgefield owns the Lake River industrial site, 40 acres of underdeveloped waterfront property along Lake River in downtown Ridgefield, adjacent to Carty Lake on the Carty Unit. The property is zoned for waterfront mixed use development under Ridgefield Development Code Chapter 18.30, and the Port has developed a comprehensive plan for the property (Port of Ridgefield 2001, revised 2008). The Port of Ridgefield administrative and facilities management offices and staff are currently located at this site. Although owned by the Port of Ridgefield, the land bordering the southern boundary of the Carty Unit was operated by PWT from 1964 until their bankruptcy in 1993. Further development of the Port property cannot occur until remediation of soil and groundwater contamination at the PWT site is completed. The City of Ridgefield also owns a small piece of property adjacent to the Port on the eastern shore of Carty Lake. The property currently houses the City's wastewater treatment facility.

The Port's comprehensive plan was revised in 2008 (Port of Ridgefield 2009b) and included the goal of redeveloping the Lake River property as a 'mixed-use waterfront employment center' with a diversity of job types and high-wage jobs. The Miller's Landing project would be a mixed use waterfront development including public green spaces, office space, light industrial, moorage, retail, and an Environmental Science research and development facility (a cooperative project between Washington State University, the Port and the Confluence Project). Before redevelopment can occur, individual areas must meet the clean-up criteria set forth by WDOE. The Port is currently pursuing a "development-based remediation" strategy on the waterfront where final clean up of the Lake River Industrial Site occurs with redevelopment.

In 2006 the Port began planning a rail overpass to provide new, direct access to the Lake River waterfront from downtown Ridgefield. The project would extend Pioneer Street to the west via a curving overpass that would touch-down near Mill Street. This project would allow the at-grade crossings at Mill and Division Streets to be closed. Planning and construction of the overpass project is part of the overall waterfront redevelopment project (Port of Ridgefield 2009b).

The clamor of trains on the BNSF railroad tracks, which separates the main body of the Carty Unit from the parking area, often disrupts educational programs at the plankhouse and can be a general annoyance for visitors searching for an undisturbed nature walk. The bridge that is necessary to span the railway is non-ADA compliant and acts as a barrier to many visitors with physical disabilities. Visitors with disabilities must be "flagged" across the at-grade crossing upon request. The refuge has created conceptual plans for a new ADA accessible bridge. Trains parked in front of the at-grade crossing have been a barrier to disabled visitors and refuge management on the Carty Unit.

The Carty Unit parking area is currently located on the Ridgefield National Wildlife Refuge Complex site. This area is bordered to the north by the Carty family property, to the east by Main Avenue and low-density housing, and to the south by Gee Creek.

Ridgeport Dairy Unit. Ridgeport Dairy Unit is bordered on the south by farm land owned by the Fazio family. Lake River borders the unit to the east with the BNSF railroad tracks running on the opposing bank. Developed properties are perched atop steep graded hillsides. The unit is bordered on the west by the Columbia River, with the closest nonrefuge land use at Sauvie Island (See description under Bachelor Island Unit). A small portion of the northeast corner of the unit is bordered by cattle grazing property owned by the Roth family.

Lower River Road, owned by Clark County, runs along the levee that separates the southwest portion of the unit from the Columbia River. In June 1962 the Washington State Department of Highways published its survey report of the state legislature's joint fact finding committee on highways, streets, and bridges. The State proposed to upgrade and extend River Road, which would have passed through the middle of the current River 'S' Unit, crossed the Lewis River on a new bridge, and connected with U.S. 99 at Woodland (Clark County-Vancouver Regional Planning Commission 1963). In 1963 the state legislature authorized the designation of Lower River Road and its future extension as far as Ridgefield as State Highway 1-T. This extension was never completed. Lower River Road dead-ends within the refuge and was utilized by visitors until 2004. At that time, portions of the levee slumped, causing the road to become impassable. At this time, the county has no plans for levee or road reconstruction. The road and parking area have always been a magnet for illegal garbage dumping, trespass, and vandalism. The State of Washington owns a right of way along the east side of Ridgeport Dairy unit (see Appendix M, Figure 1). This right of way is 140 feet wide in most places.

River 'S' Unit. Lake River and Bachelor Slough form most of the west, north, and east borders of this unit. Across Lake River to the east lies the BNSF railway, Port of Ridgefield property (see description under Carty Unit), McCuddy's Marina (which provides boat slips and houseboat moorages), and steep sloping hillsides. Just beyond the marina and Port property lies downtown Ridgefield. The entrance of the River 'S' Unit meanders through a steeply sloping draw with high density housing developments planned for the upland pastures that surround its intersection with S. 9th Avenue. These developments are currently zoned as UH-10 properties. The population of the City of Ridgefield in 2004 was estimated at 2,602 residents and is projected to hit 26,200 residents by 2024 (City of Ridgefield 2005).

Roth Unit. The Roth Unit is bordered to the east by Lake River and the west by the Columbia River. The north and south boundaries of the unit border refuge lands. Forty two acres to the east of Campbell Lake are owned by the Roth family and used primarily for grazing. The BNSF railway runs along the eastern banks of Lake River. Residential development is located atop the steeply sloped hillside above the railroad. Sauvie Island lies on the opposing shores of the Columbia River (see description under Bachelor Island Unit). The State of Washington owns a right of way along the east side of Roth unit. This right of way is 140 feet wide in most places (see Appendix M, Figure 1).

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Chapter 4. Refuge Biology and Habitat

Above: Scrub jays help disperse and plant Oregon white oaks/Jim Cruce

Above right: A red-tailed hawk hunts refuge grasslands/Jim Cruce

Right: A green-backed heron captures a non-native bullfrog in a refuge wetland/Jim Cruce

Chapter 4. Refuge Biology and Habitat

This chapter addresses the biological resources and habitats found on the refuge. However, it is not an exhaustive overview of all species and habitats. The chapter begins with a discussion of biological integrity (historic conditions and ecosystem function), as required under the Improvement Act. The bulk of the chapter is then focused on the presentation of pertinent background information for habitats used by each of the 15 Priority Resources of Concern (ROCs) and other benefitting species designated under the CCP. That background information includes descriptions, conditions and trends of habitats; key ecological attributes of habitats; and finally, threats (stresses and sources of stress) to the habitats and/or associated ROCs. This information was used to develop goals and objectives for the CCP.

4.1 Historic Wildlife and Habitat Conditions and Changes Since 1800

The lower Columbia River ecosystem, of which Ridgefield Refuge is a part, has undergone dramatic alteration over the past 200 years. The three most discernible changes include:

- Changes in the hydrology of the Columbia River due to dam operations;
- Conversion of Columbia River bottomlands to agricultural lands (including diking and draining) and residential, commercial, and industrial development; and
- Loss of native species, accompanied by a large influx of nonnative and invasive plants and animals into the system.

The Service manages a highly altered ecosystem at the refuge, due in large part to:
- **Artificial river operations;**
- **Widespread nonnative invasive species; and**
- **Extensive land use conversion and fragmentation.**

Many habitat changes and the spread of invasive species were underway long before dams were built and the refuge was established. This section discusses the connection between these landscape level changes and the current vegetation and wildlife on the lands and waters occupied by the refuge. This summary is not a complete analysis of all factors related to changes in native vegetation, fish and wildlife. Much of the information presented here is based upon the team's knowledge of the area.

4.1.1 Historic Descriptions of Habitat and Wildlife

Before dam construction within the Columbia River system, spring floods, or freshets, were the primary hydrological influence on the lower river. Overbank flooding, scouring and sediment deposition created and maintained a mosaic of wetlands and bottomland forests along the river. The average annual spring flood reached a stage of 21.5 feet at the gage at Vancouver, Washington. Average spring flooding in the lower river would have inundated up to 170,000 acres for periods of up to 60 days, and major floods inundated up to 300,000 acres of bottomland floodplain (Christy and Putera 1993). Historically, spring flooding would have annually inundated most of the refuge. The *History of Clarke County* (Alley and Munro-Fraser 1885) notes that the bottomlands along the Columbia River were "subject to the annual overflow, which reaches its highest in June . . ."

Vegetation. The earliest written description of refuge lands dates from November 5, 1805, when Lewis and Clark described Bachelor Island (which they called Green Bryor Island) as "Covered with tall trees & green briers" (Moulton 1990). A general description of habitat in the Portland Basin is found in the journal of another expedition member, John Ordway. On November 3, 1805, he described Government or McGuire Island, opposite and upstream from present-day Portland as "mostly prarie and large ponds, which is full of Swan Gees brants and ducks &C" (Moulton 1996). Lewis's journal entry of March 29, 1806, noted that the people of the Cathlapotle nation took "great quantities" of wapato (*Saggitaria latifolia*) "from the neighboring ponds, which are numerous and extensive in the river bottoms and islands" (Moulton 1991). Clark also made reference to a "large pond" (Carty Lake) where wapato grew in abundance, and a "butifull grassy area" between Carty Lake and Lake River, where the expedition encamped on March 29, 1806 (Moulton 1991). Ordway described the campsite as "a handsom Green where had once been a village" (Moulton 1996). Lewis described the vegetation of Sauvies Island (which the expedition called Wapato Island) in some detail on March 30: " . . . the land is high and extremly fertile and intersected in many parts with ponds which produce great quantities of the sagittaria Sagittifolia, the bulb of which the natives call wappetoe. there is a heavy growth of Cottonwood, ash, the large leafed ash and sweet willow on most parts of this island" (Moulton 1991).

Maps and survey notes from the General Land Office, made between 1851 and 1865, are the only reliable source for information about original vegetation of the Ridgefield bottomlands; however, these reports mainly contain information on tree species and little information on shrubs and herbaceous vegetation. Maps and survey notes from the General Land Office made in the 1850s indicate that the present-day refuge contained a mixture of bottomland forest, riparian forest, and shallow overflow lakes (Bureau of Land Management 2007a, b; and Christy and Putera 1993). The vegetation of much of the present day refuge was described as "W. ash, Cotton-wood, willow &c, undergrowth Grass, Briars, Willows &c." An August 1853 survey of the area noted "Land level bottoms, subject to inundation from 1 to 4 ft. deep . . . West half prairie or meadow, [remainder] timbered with ash balmgelead [cottonwood] crabapple & undergrowth willow briers vines &c." (BLM 2007b). An 1854 map (Figure 4.1) shows the vegetation of Bachelor Island (then called Columbia Island) as "Balm Gilead, Ash, Thorn with dense undergrowth" (BLM 2007a). Oral histories of Bachelor Island described the Island as a thick bottomland forest cut by meandering sloughs prior to the 1940s (Cornelius 2006). Shrub swamps were probably another habitat type once common on the refuge. Christy (2004) noted that "Historically, willow swamps were the second most abundant wetland vegetation (after wet prairies) [in the Willamette Valley], forming a wet landscape described by early explorers and land surveyors of the region. Many of these systems were maintained or enhanced by beavers and have since been lost to drainage and conversion to farming."

These early survey notes indicate that much of the present day refuge, like much of the Portland-Vancouver Basin, was originally covered by bottomland and riparian forest dominated by black cottonwood, Oregon ash and willow. The forest was interspersed with tidal sloughs, wet meadows, and broad, shallow overflow lakes and ponds. Most of the area flooded in June when the Columbia River overflowed its banks.

Most of today's refuge was originally floodplain and riparian forest, interspersed with tidal sloughs, shallow overflow lakes, and meadows.

Little data exists on the original wetland vegetation, except that several early writers noted the presence of extensive stands of wapato (*Saggitaria latifolia*) growing in shallow lakes throughout the region. "Wapato Valley" was the name Lewis and Clark gave the region from the downstream end of the Columbia Gorge to the confluence of the Columbia River with the Cowlitz River at Kelso-Longview. Lewis and Clark reported extensive harvest of this plant from Carty Lake by the inhabitants of Cathlapotle village (Moulton 1991[7]:26-30). Jewett (1927) reported Canvasback Lake on Bachelor Island as "being shallow and supporting a wealth of aquatic vegetation, is essentially a 'mallard lake."

Wet meadows on the shallow, drying margins of overflow lakes were probably dominated by Columbia sedge (*Carex aperta*), which was described by Piper and Beattie (1915) as "the common 'hay sedge' of the Columbia River bottoms where it was first collected by *Douglas*." Pacific willow (*Salix lasiandra* ssp *lucida*) grew on wet flats along channels and around overflow lakes. Oregon ash (*Fraxinus latifolia*) occurred on slightly higher sites protected by natural levees. Higher banks and the tops of natural levees were dominated by associations of Oregon ash, black cottonwood (*Populus trichocarpa*), with red-osier dogwood (*Cornus stolonifera*), snowberry (*Symphoricapos albus*) and stinging nettle (*Urtica dioica*) (Christy and Putera 1993).

Terraces and wetland margins were covered by a mixture of prairie; oak savannah/woodland with understory dominated by red fescue (*Festuca rubra)* and California oatgrass (*Danthonia californica)*; Douglas-fir; and Oregon ash. It is possible that the prairie and oak woodland communities were maintained by anthropogenic fire, as was the case throughout the Willamette Valley/Puget Trough region. GLO survey notes from the 1850s (Bureau of Land Management 2007b) describe oak woodlands on higher ground of the present-day Carty Unit.

Little data exists on native prairie vegetation of the present-day refuge. Before flood control, wet meadows or prairies on the Columbia River bottoms were frequently flooded well into summer, and little is known about their original composition, because widespread invasion of reed canarygrass (*Phalaris arundinacea)* has displaced many native species. Depending on elevation and soil characteristics, some areas were likely dominated by tufted hairgrass (*Deschampsia caespitosa)* while others were dominated by Columbia sedge (*Carex aperta)* which intergraded with a complex of marshes and sloughs on the river bottoms (Christy 2004).

Figure 4.1 General Land Office map of Bachelor Island, Gee Creek, Sauvie Island, and the Scappoose Flats, 1854. Source: Bureau of Land Management, Oregon State Office, Land Status and Cadastral Records, Willamette Meridian-Oregon and Washington.

4.1.2 Changes to Lower Columbia River Wildlife and Habitats Since 1850

Although people have lived on the present-day refuge for at least 2,300 years, the influence of human activity on the landscape was relatively minimal. Towns were relatively small in size; Lewis and Clark reported in 1805 that Cathlapotle, the third largest town on the lower Columbia, had about 900 inhabitants. A limited number of western red cedars were felled to supply materials for houses and canoes, but bottomland forests remained largely intact. People may have set fires to manage oak woodlands and grasslands, as was the case elsewhere in the Willamette Valley and Puget Trough.

The Fur Trade. The pace of landscape change accelerated rapidly following Euro-American settlement in the 19^{th} century. Britain's Hudson's Bay Company established a fur-trading post at Fort Vancouver in 1825. The fur trade affected populations of certain mammals harvested for fur and food, but no species was affected more than the beaver. Beaver were an important factor in the creation of wetlands, and many wetlands developed on sediments trapped by beaver dams. Historically, willow swamps were the second most abundant habitat (after wet prairies) in the Willamette Valley and probably were common in the Portland-Vancouver Basin as well, forming a wet landscape described by early explorers and land surveyors of the region. Many of these wetland complexes were maintained or enhanced by beavers. Although beavers seem common today, historic populations in Oregon were probably ten times larger than current. Their numbers were decimated first by commercial trapping prior to 1845, then by diminishing wetland acreage caused by their trapping, and finally by widespread agricultural drainage projects (Christy 2004).

Agricultural Development. From the mid 1800s on, bottomland forests were gradually cleared for agriculture, and to supply firewood and wood products. Cottonwood harvested from Clark County bottomlands was made into staves and barrels (Alley and Munro-Fraser 1885) and later was used in paper production. Oregon ash was primarily used for firewood, but it was also made into wagon frames, furniture, barrel staves, and tools. Christy and Putera (1993) noted that most present day stands of Oregon ash on the lower Columbia River appear to have originated between 1910 and 1930.

Bachelor Island was settled in the 1850s (see Chapter 6, Refuge History). By the late 1800s much of Bachelor Island's bottomland forest had been logged off, and the island was being used for pasture and for growing hay and grain. When Portland businessmen Ladd and Reed bought 1,000 acres on Bachelor Island in 1876, these uses were well established. In 1942, 1,120 acres of the island were diked. Subsequently, the original ridge-and-swale topography of the island was muted by removing soil on the tops of ridges and using it to partially fill the swales. In the early 1980s between 900 and 1,000 acres of potatoes and barley were being grown on the island. By the time the refuge acquired a portion of Bachelor Island in 1985, the original wetlands had been filled and drained, and the original ash/cottonwood forest was reduced to a remnant outside the dikes.

In 1872 James E. Carty settled on the area currently known as the Carty Unit. The Carty family primarily used their land for grazing. Former Refuge Manager Bruce Wiseman reported that the Carty family had logged cottonwood trees from the high bench ground along Lake River in what is now the Carty Unit. However, the Carty Unit was never diked, and habitats there remained in a relatively natural condition. The River 'S' Unit was diked in 1941, and ash forests were logged from the unit in the 1950s to clear land for pastures. Up to 600 cow/calf pairs, and at times hundreds of sheep, grazed on improved and canarygrass pastures.

Livestock grazing had major effects on wildlife and habitat. Native grasses and forbs were not adapted to heavy grazing pressure; grazing therefore opened the door to the spread of exotic plant species. Exotic pasture and forage grasses were also intentionally introduced. These grasses had a competitive advantage under heavy grazing pressure, and permanently altered many plant communities. Livestock grazing in riparian areas allowed exotic reed canarygrass to invade and largely replace the native understory plant community.

On the other hand, livestock grazing benefitted some native wildlife species. Until the mainstem Columbia River dams were built, and widespread levee construction along the lower Columbia River was completed, healthy and productive wetlands supported large numbers of migrating and wintering waterfowl. The juxtaposition of wetlands and adjacent pasture and croplands may have actually been favorable to geese and certain ducks that preferred short, nutritious grasses. During the 1950s and 1960s, pastures on the present-day refuge were used heavily by migratory and wintering Canada geese (mostly duskys), tens of thousands of American wigeon, and other ducks. Some wildlife species responded to changing land uses by altering their wintering areas and migration routes. Bromley and Rothe (2003) discussed changes in the distribution of dusky Canada geese during the 20th century. A summary follows.

Until the late 1930s, dusky Canada geese apparently wintered primarily along the Oregon coast (Gabrielson and Jewett 1940). From the late 1930s through the mid-1940s, large dark geese, presumably duskys, were commonly observed spring and fall migrants and winter visitors in the southern Willamette Valley (Gullion 1951). Jewett (1953) reported observations and harvest of duskys from the Willamette Valley and Sauvie Island, Oregon, from 1931 through 1952. He noted that “this coastal species [is] fairly common along the ocean beaches the entire length of Oregon, but is becoming either better known to hunters, or is actually increasing during the fall and winter months in the Willamette Valley and Lower Columbia River Valleys.” Finally, Hansen (1962) compiled an extensive data set based on more than 1,000 recoveries of duskys banded on the Copper River Delta (CRD), and demonstrated that CRD duskys wintered primarily in the Willamette Valley. By the mid-1960s, just prior to the effective establishment of refuges in the Willamette Valley and the lower Columbia River, concentrations of duskys wintering in the Willamette Valley had shifted from the southern end of the valley, to the middle valley near Corvallis and Albany (Chapman et al. 1969). In part, this change in distribution may have been due to both increases in pasture, and later, grass seed production in the Willamette Valley and lower Columbia River; and decreases in suitable habitat on the coast (Pacific Flyway Council 2008).

Ornithologist Stanley Jewett published a report on waterfowl on Bachelor Island based on his observations during the fall and winter of 1926-1927. Jewett reported that Canvasback Lake on Bachelor Island “is essentially a ‘mallard lake.’ This species outnumbers all other species of ducks there.” He also noted that pintail, American wigeon, and green-winged teal were common; lesser scaup were somewhat common; and that the wood duck was both common and a permanent resident. Ducks which were less common, or of “irregular occurrence” included cinnamon teal, shoveller, canvasback, [greater] scaup–“nowhere near as plentiful as the [lesser scaup]”–ring-necked duck, and ruddy duck (Jewett 1927).

While intensive agricultural development resulted in benefits to geese and certain ducks, it had negative effects on other native species, including salmon and trout, landbirds associated with large tracts of riparian forest (e.g. yellow-billed cuckoo), and large mammals. Columbian white-tailed deer, once common in the bottomlands, had become rare in the Ridgefield area by the 1940s. They did persist in the lowlands further downriver, where they were known to local farmers and sportsmen as “tideland, or cottontail deer” (DOI 1941). The total white-tail population on the lower Columbia River was estimated at 375 in 1975, with most of the population in Columbia County. The subspecies was present, but in very low numbers between Bonneville Dam and the Columbia County line. A single white-tailed deer was seen on the refuge during big game surveys in 1974-1975, “in grazed pasture near ash/cottonwood habitat” (Tabor 1976a).

Historically, the upper reach of Gee Creek was used by chum and coho salmon and coastal cutthroat trout for spawning. By the 1940s few salmon utilized the creek, due to forest clearing and agricultural activities that reduced water quality, and barriers to upstream migration. An oral history identified a few chum salmon spawning in a tributary of Gee Creek in the 1940s. A second-hand story was reported about coho salmon trying to get past a barrier in the upper reach of Gee Creek, near Royle Road, “prior to the 1950s.” A 1951 fisheries report said that “silvers and chums utilize [Gee Creek]” and that “fair to good spawning areas” occurred above the lower two miles of Gee Creek slough. Cutthroat trout, which had been reported anecdotally in Gee Creek for many years, declined to very low numbers by the 1990s (Cornelius 2006).

Hydropower Operations and Diking. Development of the Columbia River to provide flood control and hydroelectric power began in 1932 with the completion of Rock Island Dam. Bonneville Dam, 56 river miles upstream from the refuge, was completed in 1938. Construction of dams made large scale diking projects to expand or protect farmland on the lower Columbia River feasible (see Chapter 3). On Bachelor Island, diking started in 1942 with the construction of five miles of levee protecting 1,120 acres. In the 1940s and 1950s floods damaged the levees, and landowners reinforced and raised the levee several times. The River ‘S’ Unit was diked in 1941 with further improvements in 1947, 1963, and 1964.

Hydro operations and diking contributed to wetland loss in the lower Columbia River bottomlands, both through direct loss (conversion to agriculture and other uses) and altered hydrology. Flow regulation, along with structural modifications to river shorelines and channels, has changed patterns of scouring and sediment deposition. Historically, spring flooding of the Columbia River created tremendous annual scouring with large annual flows flushing out small fine sediments. The lack of scouring inhibits successional processes. For example, natural cottonwood recruitment has been greatly reduced, and the refuge contains mainly older even-aged stands. Likewise, Oregon ash forests on the refuge are older, even-aged stands. Overflow lakes formerly dominated by large expanses of submergent vegetation or open water were gradually overtaken by dense stands of emergent vegetation (cattail, bulrush) or willow. In 1993, Christy and Putera estimated that over half of the historic riverine wetlands in the lower Columbia River below Bonneville Dam have been lost or substantially degraded as a result of flow regulation, diking, draining, filling, and dredging.

Levee construction has had severe consequences for ocean-type juvenile salmonids, for example, lower Columbia River fall Chinook. Historically, flows that topped the river’s bank provided juvenile salmonids with access to low-velocity areas they used as refugia and for rearing. Overbank flows also contributed key food web inputs to the ecosystem and influenced wood recruitment, predation, and competition in the estuary (Fresh et al. 2005). The lower Columbia River today serves mainly as a migration corridor to and from the Pacific Ocean for adult and juvenile salmonids.

Sediment transport below the dams has been greatly reduced. Since the late nineteenth century, sediment transport from the interior basin to the Columbia River estuary has decreased by 60 percent and total sediment transport has decreased by 70 percent (Jay and Kukulka 2003). This reduction in the amount of sediment transport has affected habitat-forming processes in the Columbia River estuary. Food webs are also affected, since sediment provides important nutrients that support food production. Although the consequences of the reduced transport of sediment through the estuary are not fully understood, the magnitude of change is very large compared to historical benchmarks (Fresh et al. 2005).

Urban and Industrial Development. Columbia River hydropower stimulated significant economic growth in the Pacific Northwest. During World War II, electricity from the Columbia River powered aluminum plants and shipyards in the Portland-Vancouver area (Center for Columbia River History 2009). Since 1948, the most notable habitat changes have occurred in the Portland/Vancouver area (Tetra Tech 1996). Urban and other developed habitat has increased dramatically, with a corresponding decrease in wetland, riparian scrub-shrub, coniferous forest, broadleaf forest, and agricultural habitat.

Although the refuge itself maintained its rural character, lands along its eastern boundary have largely been converted from farm and pasture land to residential development, with the pace of development increasing dramatically in the 1990s. The refuge's relatively small size, along with adjacent residential and commercial development, and the presence of manmade barriers to dispersal (e.g., roads and railroads along the eastern boundary of the refuge), affects the refuge's future potential to support some native wildlife species, especially those requiring large contiguous blocks of habitat, or with limited dispersal ability. Water quality is an ongoing issue associated with urban and industrial development both immediately adjacent to the refuge and in the Columbia River corridor (see Chapter 3).

The Columbia River is a major transportation corridor for barges carrying grain and other products from the interior northwest to worldwide markets. Because of the 40-foot-deep shipping channel in the lower river, ocean freighters can navigate up the Columbia and Willamette rivers to Portland. Navigation locks on Columbia and Snake River dams, and slackwater lakes behind the dams, allow barges to transport goods more than 465 miles from the Pacific to the inland port of Lewiston, Idaho.

Not only does shipping have direct effects on habitat (e.g. shoreline hardening and channel dredging) but waves from commercial and recreational boats cause bank erosion. This had been a particular problem for the refuge on the Carty Unit along Lake River. As the site is located near the Port of Ridgefield and a marina, boat traffic is heavy and the damage significant. This site suffered significant impacts from floods in 1996 which exacerbated the continuing problem of boat wakes. Large cottonwood trees which protected the site were ripped out of the bank. As of 2004, the steep cutbank along the site's western edge was eroding rapidly (USFWS 2004) and riprap had to be placed to stabilize the shoreline. Lake River is also eroding Bachelor Island and closing up its own outlet into the Columbia River (Oftedahl 2005).

The combined effects of Columbia River hydropower operations, bank hardening and stream channelization, industrial and agricultural activity, introduction of exotic species, and urbanization, have led to dramatic changes in historic habitats and associated wildlife of the Columbia River and its floodplain. The refuge now provides habitat for wildlife in a highly altered system.

4.1.3 History of Refuge Management

By the 1960s, reduction in waterfowl habitat (and therefore, waterfowl hunting opportunities) on the lower Columbia River was noted by the Migratory Bird Conservation Commission (MBCC). The MBCC noted the limited winter range of the dusky Canada goose and the need for protection of wintering areas. These two factors were the major justifications for the establishment of the refuge (MBCC 1964).

River S, Roth, Ridgeport Dairy, and Carty Units. The Service acquired its first Ridgefield Refuge property in 1965. This property, the River 'S' Unit, had historically been a ranch, with extensive improved and canarygrass pastures, which the MBCC noted were in an overgrazed condition. The Carty Unit was acquired in 1966 and had also been used primarily for grazing. Until 1972, management activities in these units did not change substantially from management under prior ownership. Grazing pressure was historically heavy on the Carty Unit, but was reduced considerably after the lands were acquired by the Service. However, the unit was still accessible to cattle, especially during the periods of low water. On the River 'S' Unit grazing was used to maintain both improved (grass-legume) and reed canarygrass dominated pastures in short-grass conditions that favored both Canada geese and American wigeon. The 1970 refuge report stated that the "majority of pintails and wetland populations" used Sauvie Island for "its flooded croplands, while the refuge provides for the migration of wigeon, swans, and dusky Canada geese" (USFWS 1996a).

Grazing continued as a management tool for maintenance of short-grass habitat for foraging geese and waterfowl until 1972, when flooding destroyed most of the improved pastures on the River 'S' Unit. At that time, the River 'S' dike failed, and for the next 3 years the entire unit flooded annually. Due to funding constraints, the dike remained open until late 1974 when repairs were completed by an Army Construction Battalion from Fort Lewis, Washington. The prolonged flooding destroyed the improved pastures and the unit became severely infested with weeds, especially thistle and tansy. After the dike was repaired, more then 600 acres of pasture on River 'S' were rehabilitated. Farming grains and hay for waterfowl and geese on 600-700 acres of the River 'S' Unit was implemented until the early 1980s. Annual winter grains were planted by cooperative farmers to reduce noxious weeds prior to planting a pasture mix. This planting was minimally successful because geese destroyed most of the fall plantings. Corn was then introduced to provide an economically viable crop for cooperative farmers while at the same time providing weed control and winter waterfowl feed.

As the Flyway's populations of ducks and geese changed, habitat management practices on the refuge were modified to meet needs identified by flyway managers. Between 1965 and 1972, habitat management was dominated by grazing to provide short grass for dusky Canada geese and wigeon. Because objectives for dusky populations were being met in the late 1970s, refuge management objectives were rewritten in an attempt to increase habitat and food production for dabbling ducks.

During 1980-1981, dusky populations began another serious decline; and a low of 10,100 birds was recorded in the lower Columbia River and Willamette Valley in the winter of 1983-1984. Clover and alfalfa were planted in 1983 to provide forage for geese. Grazing was reinitiated on the River 'S' Unit in 1984 and maintained until 1996 to provide short-grass habitat for foraging ducks and geese through grazing reed canarygrass areas. Grazing was also the primary pasture management tool on the Roth and Carty Units until 1996. Between the early 1980s and 1996, cattle were turned out about

April 15 and removed during October/November. Cattle were rotated through several pastures. Mowing was used to reduce weeds and excessive growth not removed by grazing. Water levels were drawn down by mid-April to enable cattle to begin grazing in reed canarygrass wetlands. In a 1996 habitat review, the review team found that grazing was an appropriate management tool to provide short green browse for Canada geese, cranes, and other waterfowl. However, they noted several problems with the grazing program, including impacts to riparian areas (loss of understory vegetation, loss of tree recruitment, bank erosion, and declining water quality in Gee Creek); disturbance to wildlife in fall; cattle and geese competing for forage in late spring; promotion of monotypic stands of reed canarygrass; and other weed problems.

As a result of recommendations made by the habitat review team in 1996, a number of modifications to the grazing program were made. Grazing on the Carty Unit was phased out; no grazing has occurred on the Carty Unit since 2001. Grazing on the Ridgeport Dairy Unit was phased out in 1996. Grazing was removed from all wetland units on the River 'S' Unit following the summer of 1999. Some grazed areas on River 'S' were recontoured as wetlands while other pastures were improved. Most uplands on the River 'S' Unit are now mowed to maintain goose browse, and wetlands are drawn down later in the season (or receive supplemental inundation) to suppress reed canarygrass growth. A very limited cooperative grazing program was reinstated on the River 'S', Bachelor Island, and Ridgeport Dairy units in 2003. A 2004 wildlife and habitat management review recommended that limited grazing be used to maintain desirable conditions in managed pastures. In 2009 236 head of cattle and horses were grazed between May and October on approximately 1,700 acres of the refuge.

The River 'S' Unit has 25 wetlands. Prior to 1998, these wetlands were lacking in effective water control capabilities, and had an inefficient water delivery system. Little vegetation management occurred. As a result these wetlands were not meeting their potential to provide quality habitat for migratory birds and associated wetland flora and fauna. Between 1998 and 2000, both the River 'S' and Ridgeport Dairy units underwent massive wetland restoration efforts to produce and maintain better functioning wetlands near sustainable pastures. These activities included construction and/or rehabilitation of contour dikes, rehabilitation of the main delivery canal, installation of water control structures, disking of almost 450 acres of reed canarygrass, and installation of 6,500 feet of PVC pipeline with 5 delivery valves. A new pump station providing approximately 15 cubic feet per second (cfs) of water to the River 'S' wetlands via the PVC pipe was installed in July 1999. A new 30 hp expulsion pump was installed during the 2000 field season. This was tied to the western expulsion pump that is capable of recirculating water out of Bower Slough into Plantain Marsh. As a result of this rehabilitation, water depths on most wetlands increased. Irrigation within the River 'S' Unit was typically initiated four to five weeks prior to the opening day of duck season. However, with current low river levels, irrigation has started five to six weeks prior to the hunting season to ensure there are adequate sanctuary wetlands within optimal target levels. In most cases, the initial irrigation is adequate until late spring when additional inundation is needed to suppress reed canarygrass growth. Disking to control reed canarygrass was discontinued on the River 'S' Unit when ricefield bulrush was discovered in 2002 (see section 4.5).

Historically, the refuge provided a variety of winter foods for waterfowl and cranes (clover, alfalfa, corn, potatoes, winter grains, orchard grass, and perennial ryegrass) through the use of cooperative farming. As of 1996, several different crops were grown on the River 'S' Unit, including corn, winter wheat, alfalfa, and clover. A small amount of grain was grown on the River 'S' Unit until 2003, when this was discontinued due to baiting issues. By 2009, less than 50 acres of corn were grown on the refuge, (15 acres on Bachelor Island, 2 acres planted on the River 'S' Unit, and 30 acres on the Ridgeport Dairy Unit). Declines in sandhill crane use of the River 'S' Unit from the late 1990s on may have been linked to loss of corn and other crops.

Bachelor Island Unit. In 1985 the Bachelor Island Unit was purchased from the Zimmerly family. The island was cooperatively farmed until the end of 1999. When the land was purchased, the primary crops of potatoes and grain (mostly barley) were grown on approximately 900 acres of cropland. After harvest, waste grain and potatoes provided feed for thousands of ducks, geese and swans. Within weeks, the birds would strip the fields bare and move on. The entire island was essentially winter fallowed.

Between the mid 1980s and the mid 1990s, goose populations increased by three to four times on the refuge (USFWS 1996b), concurrently, with the northward shift in the winter range of cackling geese from California to the Willamette Valley. Canada goose management again became the primary management objective for the refuge (at that time cackling geese were considered a subspecies of Canada goose). Beginning in 1986, the refuge began to incorporate grasses and clovers into the cooperative farming program to provide additional green forage to meet Canada goose objectives. The long range (10 year) goal was to convert most of the farmed acres (1,000 acres) to crops that would provide sustained green forage for geese. Potatoes were phased out by 1992 and red clover was planted in their place. In 1994, the refuge began to convert crops to approximately 800 acres of clover and 100 acres of grass (orchard grass, annual and perennial ryegrass). Some wheat and barley was grown as well. As of 1996, more than half the Bachelor Island fields were planted in clover and the rest were in permanent pasture.

The refuge was also under increasing pressure to provide additional forage to reduce goose depredation on surrounding private lands. The Northwest Oregon-Southwest Washington Canada Goose Agricultural Depredation Control Plan (Pacific Flyway Council 1998) mandated that the refuge provide sustained green forage for Canada geese. In 1998 the refuge converted the 800 acres of short-lived clover to more sustainable crops of perennial ryegrass and pasture mixes. This decision led to the cooperative farmer terminating his obligations after the 1999 field season. By 2003, the clover fields had been converted to permanent pasture; however, three fields were planted in corn. The refuge experimented with barley, corn, and pea-barley crops in the late 1990s and early 2000s, but budget limitations eliminated this management regime from the 2004 field season. By 2009, acres planted in corn on Bachelor Island had dropped to 15, with two acres planted on the River 'S' Unit and 30 acres on the Ridgeport Dairy Unit. After the cooperative grazing program was reinstated in 2003, the refuge had one cooperative grazer who grazed a few pastures with 12-16 head of cattle and hayed approximately 400 acres on Bachelor Island, River S, and Ridgeport Dairy units. In 2009, 236 head of cattle and horses grazed on approximately 1,700 acres (total for the three units), between May and October.

In 1996, floods breached the Bachelor Island dike, causing significant damage to infrastructure and facilities. In 1998, the refuge worked cooperatively with Ducks Unlimited to restore approximately 350 acres of wetlands on the Bachelor Island Unit, with the installation of a pumping facility and earthwork/water control structures made possible through a North American Wetlands Conservation Act (NAWCA) grant. However, pumping costs and efficacy of the delivery system are major limiting factors. Natural factors including soils, precipitation, elevation, tides, and river levels impose additional limitations to water delivery and retention on Bachelor Island wetlands. Eight of these wetlands, totaling approximately 145 acres, exhibit good to excellent water holding tendencies, and have proven to be successful in providing necessary loafing and watering areas in close proximity to productive pastures. Five wetlands have failed to adequately hold water upon irrigation, four exhibited poor water holding capabilities, and three exhibited fair capabilities. Some of these wetlands are incapable of retaining water until river levels approach 13 feet Mean Sea Level (MSL). For these wetlands to cost effectively maintain optimal water levels, the Bachelor Slough staff gage reading must reach 7.00; this has not happened since 2000.

Water retention improves in late winter (despite low river levels) in some wetlands, probably due to complete soil saturation and regular precipitation, but retention is generally short term. With the current trend of low river levels, irrigating wetlands with fair to poor water holding capabilities is not cost effective. However, a rain event in February 2003 irrigated Bachelor Island wetlands to optimal levels in two to three days (this would have taken weeks to a month of pumping). Currently, five wetlands totaling approximately 70 acres on Bachelor Island are irrigated. Wetlands with fair to poor water holding tendencies fill naturally with rainwater and are managed as seasonal wetlands or wet meadows.

Wetlands on the Bachelor Island Unit have been primarily managed through water management with minimal disking of a few designated wetlands prior to 2001. In the summer of 2001 intensive disking occurred on nine wetland units. In 1999, ricefield bulrush was introduced to one borrow site (wetland 011) on Bachelor Island as part of a supplemental seeding. The spread of ricefield bulrush on Bachelor Island has been minimal, with 43 plants detected in 2003. However until the refuge staff is confident that ricefield bulrush is contained, disking on Bachelor Island will be limited to select wetlands.

4.1.4 Changes in Wildlife Populations after Refuge Establishment

Canada and Cackling Geese. Wintering Canada and cackling goose populations in the lower Columbia River and Willamette Valley have changed significantly since the refuge was established. At the time of refuge establishment, the dusky Canada goose (*B. canadensis occidentalis*) was the most abundant goose subspecies on the refuge. Total numbers of Canada geese in the Willamette Valley and lower Columbia River were estimated at 20,000-30,000 (mostly duskys) in the mid 1960s. Although the effects of the 1964 Alaska earthquake on dusky breeding habitat would not be apparent for a decade; managers were already concerned about duskys due to their limited winter range and loss of wintering habitat.

Historically, nearly all cackling geese (*B. hutchinsii minima*) wintered in California's Central Valley. Between the late 1960s and the late 1970s, cackler populations declined from more than 400,000 birds, to less than 50,000. A record low count of less than 26,000 cackling geese was tallied in the fall of 1984. The steady decline likely resulted from the combined effects of spring subsistence hunting in Alaska, and sport harvest primarily in California. Since then, cooperative conservation efforts have restored the cackling goose population to about 200,000 birds. Since the early 1990s, the majority of cacklers have wintered in western Oregon and southwest Washington. Today cacklers are by far the most abundant goose wintering in the Willamette Valley and lower Columbia River. The number of Taverner's geese (*B. hutchinsii taverneri)* and lesser Canada geese (*B. canadensis parvipes*) wintering in the Willamette Valley increased in the 1980s. The population of resident western Canada geese (*B. canadensis moffitti*) increased steadily.

Historically, midwinter population indices for the dusky goose increased from less than 10,000 in the early 1950s to over 26,000 in 1975, largely as a result of cooperative harvest management, expansion of winter foraging habitats, and creation of refuges in southwest Washington and western Oregon. The population declined steeply in the early 1980s, falling below 10,000 in 1984 and 1985, as effects of the 1964 Alaska earthquake accelerated changes to breeding ground habitats. The result was an increase in the elevation of the breeding grounds used by dusky Canada geese. Rapidly expanding shrubs and trees were favorable to brown bears and other mammalian predators that significantly increased predation on nests and adult geese. During the 1990s, low levels of production and a gradual decline in breeding birds resulted in a moderately stable population of about 15,000 duskys. Over the past five years, annual production has remained low, now primarily from nest predation by bald eagles, but the population has been maintained by a couple of productive years. In 2009 the population fell to fewer than 10,000; the total estimated population was 6,709 birds and the three-year running average was 8,682 birds (USFWS 2009). As a result, Action Level 2 management actions were initiated, as described in the Pacific Flyway Management Plan for the Dusky Canada Goose (USFWS 2008). With ongoing forest succession on the Copper River Delta and associated predation on geese, impaired production will likely limit the population of dusky geese for the long term.

In addition to concerns about the diminished population, management of dusky geese on their wintering grounds is complicated by the concurrent use by other goose subspecies, including lesser, Vancouver, and western Canada geese; and Taverner's, cackling, and Aleutian cackling geese. Large numbers of mixed white-cheeked geese cause problems in conducting winter inventories, designing optimal harvest regulations, controlling crop depredation, and assessing carrying capacity of winter habitats for all geese.

Between 1970 and 2000, peak numbers of geese using the refuge in winter increased by more than 10 times. As in the Willamette Valley, most of this increase was due to a large influx of cackling geese. In 1970, weekly surveys documented peak counts of approximately 3,300 geese, of which 60 percent (approximately 2,000 birds) were duskys. In 1976, surveys estimated a total of 13,000 geese wintered in the area between Bonneville Dam and river mile 79, eight miles north of the refuge (Tabor 1976). Goose surveys on the refuge from 1999 to 2000 identified peak numbers of approximately 35,000 geese in mid-November and 45,000 in mid-April, 79 percent of which were cacklers. Approximately 16 percent were Taverners and lessers, and only 3 percent were duskys (also see Section 4.3, Waterfowl.)

Other Waterfowl. In 1927, Stanley Jewett noted that the mallard was by far the most common duck on Bachelor Island wetlands; pintail, American wigeon, and green-winged teal were also common (Jewett 1927). By the time the refuge was established in the 1960s, American wigeon was the most common duck and the most abundant species harvested on the refuge by hunters. The expansion of pasture lands on the Ridgefield bottomlands since Jewett's time favored this species. In the 1960s it was not uncommon to see flocks of 10,000-20,000 wigeon feeding on the grazed pastures of the River 'S' Unit. In 1970, wigeon accounted for 62 percent of duck use days on the refuge, while mallard and pintail made up only 14 percent and 10 percent respectively (USFWS 1973). With the dike failure in 1972, the subsequent elimination of grazing, and conversion of weed-infested pastures to croplands, wigeon numbers declined significantly. By 1994 only 124,000 wigeon use days were recorded, compared to over 900,000 in 1966.

Waterfowl surveys of the lower Columbia River from Bonneville Dam to river mile 79 estimated that 250,000 waterfowl wintered in the area (Tabor 1976); most were on Sauvie Island but the refuge was also an important area. The top two species were pintail (58,000 or 23 percent), wigeon (55,000 or 20 percent), and mallard (35,000 or 14 percent). For waterfowl trends in recent years, see Section 4.3 below.

4.1.5 Influx of Exotic and Invasive Species

One of the most striking features of the refuge is the extent to which invasive plants and animals have taken hold. Invasive plant species displace native vegetation, altering the composition and structure of vegetation communities, affecting food webs, and modifying ecosystem processes (Olson 1999), resulting in considerable impacts to native wildlife.

Exotic Plants in Upland Habitats. The spread of invasive plant species in upland habitats was facilitated by the rapid increase in land clearing and grazing that followed Euro-American settlement. By 1825 there was a small herd of cattle at Fort Vancouver; by 1836, the herd had increased enough to allow cattle to be killed for beef for the first time. In 1839, the Hudson's Bay Company imported cattle and sheep from California with the objective of exporting wool, hides, and tallow. Herds expanded rapidly in the 1850s, and by 1860 there were nearly 200,000 cattle in Oregon and the territory of Washington (Galbraith and Anderson 1971). Cattle have been grazed on Bachelor Island since the 1850s and the Carty Unit since the 1870s. During the first half of the 20th century, dairy farming became an important industry in the Ridgefield area. Livestock grazing is a major factor in habitat change, because native grasses and forbs were not adapted to heavy grazing pressure and soil disturbance. This gave exotic grasses and forbs a competitive advantage over native species.

Exotic pasture and forage grasses were also intentionally introduced. Today, most grasses on the refuge are introduced "tame" pasture grasses, for example perennial ryegrass, orchardgrass, and fescues. These grasses do, however, provide benefits to native wildlife. Short grazed or mowed pasture grasses are extensively browsed by Canada geese and are the most important winter food source for Canada and cackling geese on the refuge. Of the intentional grass introductions, reed canarygrass has been by far the most problematic. It has become thoroughly entrenched in wetland and riparian habitats throughout western Oregon and Washington (see below).

State-listed noxious weeds occurring on refuge's uplands include Canada thistle (*Cirsium arvense*), tansy ragwort (*Senecio jacobaea*) and poison hemlock (*Conium maculatum*). These weeds are commonly found in pastures, old fields, roadsides and dikes, especially on the south end of the refuge. These invasives are a major concern for the Clark County Weed Management Program and the adjacent landowner. Although not classified as a noxious weed, Himalayan blackberry (*Rubus armeniacus*) is an introduced species with major impacts to refuge uplands. Repeated treatments (mechanical and chemical) are required to keep it from encroaching into pastures. It has also become a problem in some woodland areas, especially on the Carty Unit. Horsetail (*Equisetum*) and common rush (*Juncus effusus*) are considered undesirable in pastures and are a problem in some fields, even though they are native species.

Exotic Plants in Riparian and Wetland Systems. Exotic plants that have proliferated in riparian and wetland areas include reed canary grass (*Phalaris arundinacea*), yellow flag iris (*Iris pseudacorus*), fragrant water lily (*Nymphaea odorata* ssp. *tuberosa*), and false indigo or indigobush (*Amorpha fruiticosa*) which was introduced to the upper Columbia River for bank stabilization and has migrated downstream with floods. Indigo bush now lines the majority of suitable shoreline around the refuge. Purple loosestrife (*Lythrum salicaria)* was brought onto the refuge in 1993, probably as seed on hunters' boots. The plants were removed in 1994 (USFWS 1996). Purple loosestrife has been detected in low numbers in Bull Lake, a small wetland on the River 'S' Unit, since 1997. As of 2004, 20-30 plants were hand-pulled and sprayed each year (USFWS 2004). Scattered Japanese knotweeds (*Polygonum cuspidatum*) were first noted in the Carty Unit along Gee Creek in 2000. While numbers on the refuge are low, it is a significant problem in the upper Gee Creek watershed. Aquatic areas likely host the invasive submergent, Eurasian water milfoil (*Myriophyllum spicatum*) and curly pondweed (*Potamogeton crispus*).

Reed canarygrass is the most abundant invasive plant on the refuge, typically forming dense monocultures in seasonally-flooded wetlands, wet pastures, and the understory of open canopy riparian forests. Based on generalized vegetation mapping conducted in 1997, approximately 390 acres of seasonally- and semi-permanently-flooded wetlands, 530 acres of wet meadows, and 200 acres of riparian forest support dense stands of reed canarygrass. Reed canarygrass is native to the Pacific Northwest but its distribution was originally limited to river systems in Montana, Idaho, and Wyoming. It is likely that the reed canarygrass that is ubiquitous today in low-lying areas of the Pacific Northwest descends from European cultivars. Reed canarygrass trials and plantings began in Oregon as early as 1918 for pasture and erosion control (Tu 2004). By the time of refuge establishment this species was well entrenched on bottomlands throughout the lower Columbia River.

Reed canarygrass is highly competitive in shallow, seasonal wetlands, posing a major threat to native vegetation. This species often forms monocultural stands in suitable areas. Once established, its creeping rhizomes typically form a thick sod layer which excludes all other plants (Tu 2004, Kilbride and Paveglio 1999). Some native wetland plants, for example, common spikerush (*Eleocharis palustris*), cattail (*Typha latifolia*), marsh speedwell (*Veronica scutellata*), and Columbia sedge (*Carex aperta*) can survive within canarygrass infestations, but wetlands without canarygrass tend to have a much higher diversity of native species. Reed canarygrass does provide some benefit to wildlife, for example thermal and nesting cover. Short, mowed or grazed reed canarygrass has some value as goose browse. However it is not preferred by geese and they utilize it less than other pasture grasses.

On the lower Columbia River, the native riparian understory has been almost completely supplanted by reed canarygrass, and it is impossible to reconstruct the species composition of native understory with any degree of certainty (Christy and Putera 1993). Until 1996 grazing occurred in riparian areas of the refuge. This allowed reed canarygrass to become established in the understory. Following the 1996 habitat review, grazing was discontinued in riparian areas.

Ricefield bulrush, also known as bog bulrush or pointed bulrush (*Schoenoplectus mucronatus*) is another introduced species that has had substantial impacts on refuge management. In 1999, ricefield bulrush was introduced to the refuge as part of a supplemental seeding. In conjunction with a wetland rehabilitation project on the refuge, rice screenings from California's San Joaquin Valley were applied to approximately 51 acres in eight wetlands on the refuge (six on the River 'S' Unit and one each on the Bachelor Island and Ridgeport Dairy units). Rice screenings are primarily composed of moist soil plant seeds and non-rice vegetation remaining after cleaning and processing rice. These screenings typically contain wild millet and smartweeds which are considered high quality waterfowl foods. These screenings were intended to replenish the seed source lost during wetland expansion and construction. During the spring/summer of 2000, the seeds germinated in refuge wetlands. Subsequent identification of ricefield bulrush in refuge wetlands was attributed to the applications of rice screenings. Because this species had not been previously recorded in the Pacific Northwest, this infestation represented the introduction of a new invasive species in the region. After its accidental introduction to eight refuge wetlands, ricefield bulrush had expanded to 14 new wetlands by August 2002. The total extent of ricefield bulrush on the refuge was 78 acres in 2002 (USFWS 2003). Control efforts, including water level management, hand pulling, and herbicide application began in 2003. As of 2009, ricefield bulrush was common in two wetlands and present in five other wetlands. The refuge will continue to monitor all 22 wetlands originally infested to ensure that the seedbank is depleted and that there are no new occurrences.

Mammals. Nutria (*Myocastor coypus*) is a large nonnative, semi-aquatic rodent that is native to South America. This species was reportedly introduced or escaped into the Pacific Northwest via the fur farming business during the 1930s to 1950s, and now resides along the Columbia River upriver to at least to the Bonneville Dam and northward into the Puget Sound. It also has a disjunct distribution in the Columbia Basin. Although nutrias are known to occur on all of the refuges managed by the Ridgefield Refuge Complex, there have been no surveys conducted to document actual numbers. In Washington, nutria are considered a nonnative, prohibited aquatic animal (WAC 220-12-090).

This species is semi-aquatic, constructing den systems in the sides of stream embankments and dike systems which it enters from beneath the water surface. These large den excavations can contribute to erosion problems and pose significant maintenance and budget issues on refuges through dike and road damage, unintended water diversions, and structural damage to water-control facilities. These problems also pose significant safety hazards to staff and refuge visitors due to dike and roadway collapse. Nutria burrows can undermine roadbeds, stream banks, dams, and dikes, which may collapse when the soil is saturated or when subjected to the weight of heavy objects on the surface, such as vehicles, farm machinery, or grazing livestock (LeBlanc 1994).

Nutrias are extremely prolific, breeding year-round and producing two to three litters per year. Normal litter size is 4.5 young, but depending on conditions, up to 13 young per litter has been recorded. They eat tremendous quantities of herbaceous vegetation, plant stems, roots and rhizomes, both in wetlands and along the shorelines. At high densities, nutrias can damage stands of desirable, wetland vegetation used by native wildlife. The destruction of wetland vegetation and decline in general marsh health caused by nutria has been documented throughout the United States. In some cases, nutria-caused damage to marsh vegetation and soils is so severe that these resources are permanently lost (APHIS 2005). Nutrias have also been implicated in the destruction of seedling trees and shrubs planted for habitat restoration purposes. Nutrias have been documented to cause significant damage to croplands in some parts of the country. The nutria's aggressive behavior can also eliminate or greatly reduce native muskrat populations where nutrias are established (Bounds 2000, and Evans 1970).

Eastern gray squirrels are a nonnative species that occur in oak woodland and mixed coniferous-deciduous forest on the refuge. They compete with native western gray squirrels and are considered to be a factor in the decline of this species (Linders and Stinson 2007). Opossum and eastern cottontail are common nonnative mammals on the refuge. Opossums prey on native ground-nesting birds (Altman and Holmes 2000).

Birds. Nonnative bird species occurring on the refuge include house sparrow, rock dove, and European starling. House sparrows and starlings are both cavity nesting species, and compete with native wildlife for nest locations. As resident species, house sparrows and starlings select nesting territories early in the breeding season. Native cavity nesting birds often arrive from migration to find prime cavities occupied and breeding territories aggressively defended by these species. Recently, house sparrows have been linked with the spread of human diseases and may be a vector in the transmission of West Nile virus (Pimentel et al. 1999). Control of nonnative birds has not been conducted on the refuge.

Reptiles and Amphibians. Bullfrogs (*Rana catesbeiana*), native to the eastern United States, were introduced to the Pacific Northwest in the 1920s or 1930s to be raised as food. Bullfrogs prey on native amphibians, turtle hatchlings, and even ducklings. Bullfrogs introduced in the western United States have been implicated in localized declines of a number of native amphibian species through predation and competition (Bury and Whelan 1984, and Kupferberg 1997). A recent study by Pearl et al. (2005) in the Willamette Valley found little evidence supporting negative effects of the presence of breeding populations of bullfrog on native amphibians. However, bullfrogs are a known predator of, and threat to the State endangered western pond turtle (Hays et al. 1999). Skink tails have been found in the stomach contents of bullfrogs captured on the refuge. Control of bullfrogs has not been conducted on the refuge.

Fish. Between 1880 and 1930, at least 15 species of exotic, warm water fish species (e.g. bluegill, crappie, bass, carp) were introduced to the Columbia River and its backwater lakes and sloughs, with the original intent of providing food for human consumption, forage for other fish, biological control of animal or plant pests, or sport-fishing opportunities (Wydoski and Whitney 2003). Mainly transplanted from eastern North America, most of the exotics have been extremely successful in the relatively warm, slow, backwater habitats of the lower river. The backwater aquatic system has also been greatly altered in the past 150 years. Diking and mainstem dams on the Columbia River greatly reduce seasonal flooding and create conditions that are extremely attractive to exotic fish (Li et al. 1987). These fish may prey directly on adults or juveniles of native species, or compete with them for food. Pearl et al. (2005) found that the occurrence of two native amphibians, the Pacific chorus frog (*Pseudacris regilla*) and long-toed salamander (*Ambystoma macrodactylum*), was best predicted by the absence of nonnative fish. Largemouth bass also prey on western pond turtle hatchlings.

Nonnative fish are abundant within the waterways of the refuge. Nonnative species found in surveys of Gee Creek from 1993 on, include brown bullhead (*Ameiurus nebulosus*), bluegill (*Lepomis macrochirus*), pumpkinseed (*L. gibbosus*), largemouth bass (*Micropterus salmoides*), smallmouth bass (*M. dolomieu*), black crappie (*Pomoxis nigromaculatus*), and goldfish (*Carassius auratus*). In addition, carp, black bullhead, mosquitofish, white crappie, walleye, and yellow perch have been reported in Gee Creek (Cornelius 2006). Nonnative species found in fish surveys of Campbell Slough in 2007-2008 include carp, yellow perch, banded killifish, crappie, largemouth bass, bluegill, and American shad.

The common carp (*Cyprinus carpio*), originally native to Eurasia, was introduced as a food fish in the Pacific Northwest in the late 1800s. It is widespread in the lower Columbia River, and is a major pest in wetlands. Carp consume vegetation and invertebrates, competing with native wildlife for food. Their foraging activities degrade water quality by increasing turbidity (Wydoski and Whitney 2003). This has negative effects on both native fish and waterfowl. Carp are especially abundant on the refuge during the spring, as they congregate in Gee Creek and Campbell Slough seeking shallow, warm habitat for spawning. Little control of nonnative fish has been conducted on the refuge; however, Post Office Lake was drawn down in the summer of 2000 to control carp and other rough fish, and allow submergent vegetation to re-establish.

Invertebrates. Exotic mollusks carried in ship ballast (Asian clam, New Zealand mudsnail, zebra mussel) are a potential threat to wetlands connected to the Columbia River. The Asian clam (*Corbicula fluminea*) was introduced to the Columbia River in 1938; it is abundant in some areas of the refuge. The New Zealand mudsnail (*Potamopyrgus antipodarum*) was established in the lower Columbia River by 2002 (Benson and Kipp 2010), however, it has not been documented on the refuge. To date, the zebra mussel (*Dreissena polymorpha*) and the quagga mussel (*Dreissena bugensis*) have not invaded the Columbia River basin, but could be introduced via trailered boats; this is a threat of high concern to river managers.

Control Efforts. In accordance with Service policy 7 RM 14 (Pest Control), wildlife and plant pests on units of the Refuge System can be controlled to assure balanced wildlife and fish populations in support of refuge-specific wildlife and habitat management objectives. An Integrated Pest Management (IPM) approach is used, which includes a variety of tools: prevention of new introductions or the spread of established pests to areas not infested, mechanical or physical control methods, cultural methods, biological controls, pesticides, and habitat restoration/maintenance. The current draft IPM program for the refuge is included as Appendix K. Control efforts are planned annually and Pesticide Use Proposals (PUPs) are submitted to regional and/or national IPM coordinators for approval.

Reed Canarygrass. In the 1990s a study of reed canarygrass control methods was conducted on refuge wetlands (Kilbride and Paveglio 1999). The authors evaluated mechanical disking or mowing, chemical applications (Rodeo®), and combinations of disking and chemical methods, along with water-level manipulation, for three growing seasons. Canarygrass was reduced most by spraying and disking with a follow-up application of Rodeo during the next growing season. Disking with a follow-up application of Rodeo during the next growing season generally provided a similar level of control. Canarygrass that germinated and grew from viable rhizomes following drawdown after the initial Rodeo application or disking made a follow-up treatment with herbicide imperative for effective control. They recommended that, in order to prevent canarygrass re-infestation, treatments should not be initiated until managers have the ability to manage consistent water levels in wetlands throughout the winter and early spring.

Before 2003, management and restoration of wetlands to control canarygrass included water drawdowns by May 1, followed by disking and rototilling. After ricefield bulrush was accidentally introduced (see below), this rotation regime for wetlands was discontinued to reduce the potential of spreading ricefield bulrush. Consequently, canarygrass infestations in the refuge's wetlands have increased, especially in those units with bulrush.

Ricefield Bulrush. Significant refuge resources have been diverted to fighting this weed since its discovery in 2002. Control methods to date have included hand pulling, spraying with herbicide, and altering water management in wetlands. Since 2003, the refuge has been using staff and volunteers to search for and control ricefield bulrush. A volunteer-based control program was initiated in 2004 that consisted of searches, mapping ricefield bulrush occurrences, and hand pulling nearly 44,000 plants. In addition, herbicide was applied to four wetlands. Hand pulling has been successful in eradicating small satellite populations, and therefore, containing spread of ricefield bulrush into new areas, but the technique is inadequate to control larger infestations.

Test plots were established in 2007 to identify effective herbicide treatments, and significant herbicide treatments were initiated in 2009. In 2009, almost 15,000 plants were pulled (down from nearly 44,000 in 2004). Three wetlands had sufficient populations that herbicide applications were conducted. Starting in 2010, wetlands with large populations (Wetland #6 and Canvasback Lake in the River ‘S’ Unit) will be treated with herbicide, disked, and re-sprouting plants sprayed again in an attempt to rapidly deplete the seed bank. These efforts will be continued aggressively for several years, since ricefield bulrush propagules exhibit long-term seedbank viability. The refuge is also monitoring outfalls and adjacent areas in the Columbia River in the vicinity of the refuge to ensure that this species does not escape the River ‘S’ Unit and infest other habitats. This monitoring will continue annually until the seedbank is depleted and the species eradicated. The refuge has hired a seasonal volunteer coordinator to organize searching and hand-pulling efforts. These efforts are coordinated with refuge staff members, who oversee herbicide applications and water level control.

Himalayan Blackberry. Repeated treatments (mechanical and chemical) are required to keep blackberry from encroaching into pastures. Mowing following by spraying with glyphosate or triclopyr has been used to control this species.

Canada Thistle, Poison Hemlock, Tansy Ragwort. Canada thistle (*Cirsium arvense*), poison hemlock (*Conium maculatum*), tansy ragwort (*Senecio jacobaea*), and bull thistle (*Cirsium vulgare)* have been designated Class B noxious weeds in Washington, and control of these species is mandatory in Clark County. Mowing prior to seed set, or a combination of mowing and spraying with 2,4-D and Garlon 3A herbicides have been used successfully. Biological control of these weeds was attempted in the early 1990s. Insects introduced for biological control were thistle stem gall fly (*Urophora cardui*) for Canada thistle; seedhead weevil (*Larinus planus*) for Canada thistle; poison hemlock moth (*Agonopterix alstroemeriana*); thistle-feeding shield beetle (*Cassida rubignosa*); and cinnabar moth (*Tyria jacobaeae*) for tansy ragwort (USFWS 1996c). No releases of biological control agents have been made since 2000. Seedhead weevil and cinnabar moths are still present on the refuge, but not in sufficient numbers to significantly reduce the infestation.

Nutria. The refuge has used nonlethal measures, such as dike sloping, to help reduce erosion and dike damage caused by nutria, but this is only effective in limited areas and is associated with loss of wetland area. In addition, nonlethal methods do not address habitat degradation or competition with and displacement of native wildlife. Shooting by trained staff members has been used in the past to reduce the population where substantial dike damage has occurred, while not creating a safety hazard. In April 2008 a categorical exclusion was signed to reinitiate nutria control throughout the Ridgefield Refuge Complex. Control activities include shooting and carcass removal by staff and refuge-authorized agents, such as professionals of the U.S. Department of Agriculture’s Wildlife Services Division (USDA), and the development and initiation of innovative reduction technologies by USDA. Carcasses, including pelts, are to be disposed of on-refuge to allow scavenging by native wildlife such as vultures, raptors, and coyotes. No carcasses or pelts are be removed from the refuge or utilized for economic purposes.

4.2 Selection of Priority Resources of Concern

4.2.1 Selection Process

Early in the planning process, the planning team cooperatively identified 15 priority species for the refuge, as recommended under the Service's Habitat Management Planning policy (620 FW1). These priority resources of concern (ROCs) frame the development of goals and objectives for wildlife and habitat. Resources of concern may be species, species groups, or features that the refuge will actively manage to conserve and restore over the life of the CCP; or species that are indicators of habitat quality for a larger suite of species (see "Other Benefitting Species," Table 4.1). Negative features of the landscape, such as invasive plants, may demand a large part of the refuge management effort, but are not designated as resources of concern.

The main criteria for selecting priority ROCs included the following requirements.

- The resource must be reflective of the refuge's establishing purposes and the Refuge System mission.
- The resource must include the main natural habitat types found at the refuge;
- The resource must be recommended as a conservation priority in the Wildlife and Habitat Management Review (2004); and
- The resource must be federally or State listed, a candidate for listing, or a species of concern.

Other criteria that were considered in the selection of the resources of concern included the following.

- Species groups and/or refuge features of special management concern.
- Species contributing to the biological diversity, integrity and environmental health of the lower Columbia River ecosystem.
- Species where it is feasible to estimate population size (needed for future monitoring and adaptive management).

Table 4-1 displays the resources of concern that were selected and are the main focus of this CCP, as well as other species that will benefit from management of habitat for the ROCs.

Table 4.1 Priority Resources of Concern for the CCP

Focal Species	Habitat	Other Benefitting Species
Dusky Canada goose	Improved (agricultural) pastures of small patch size, with adjoining water	Other Canada geese, American wigeon, great blue heron, American pipit, streaked horned lark, short-eared owl, raptors, coyote, great egrets, sandhill crane, black-bellied plover, semipalmated plover, Wilson's phalarope
	Wet meadow	American wigeon, mallard, rails, herons, snipe, stilt, shorebirds
Cackling goose (*Branta hutchinsii minima*)	Improved (agricultural) pastures—large patch size	Other cackling geese, Canada geese, great blue heron, American pipit, streaked horned lark, short-eared owl, raptors, coyote, great egret, sandhill crane, black-bellied plover, semipalmated plover, Wilson's phalarope
Savannah sparrow	Old fields/buffers (tall grass/forbs, nonnative)	Northern harrier, short-eared owl, gray-tailed vole, western meadowlark, streaked horned lark, Oregon vesper sparrow, western pond turtle, lazuli bunting, nesting waterfowl
	Upland (dry) prairie	

Focal Species	**Habitat**	**Other Benefitting Species**
Northern harrier	Bottomland (wet) prairie	Common yellowthroat, American bittern, nesting waterfowl, dusky Canada goose, rare plant species (Bradshaw's lomatium, Nelson's checkermallow), short-eared owl, savannah sparrow, common snipe, song sparrow, western meadowlark
Mallard	Seasonal emergent wetlands	Other dabbling ducks, tundra swans, western painted turtle, yellow-headed blackbird, common snipe, long-billed dowitcher, black-necked stilt, rails
Tundra swan	Semi-permanent emergent wetlands (Rest Lake, Mantrap Lake)	Mallard, trumpeter swan, wapato, amphibians, turtles, yellow-headed blackbird
Lesser scaup	Permanent wetlands (Post Office Lake, Carty Lake)	Ring-necked duck
Canadian sandhill crane (*Grus canadensis rowani*)	Tidal wetlands (Boot Lake, Campbell Lake, Fowler Lake)	Coho (Lower Columbia ESU), Chinook salmon (Lower Columbia ESU), geese, herons, shorebirds, all dabbling ducks, swans
	Agricultural Croplands	Canada geese, American wigeon, mallard
Water howellia (Federal Threatened)	Ephemeral vernal ponds, Carty Unit	Amphibians
Coastal cutthroat trout (SW WA/ Columbia River ESU)	Riverine/Instream habitats (tidally connected–Gee Creek, Campbell Slough)	Coho (Lower Columbia ESU), Chinook salmon (Lower Columbia ESU), Pacific lamprey, western brook lamprey, steelhead, bald eagle (foraging)
Willow flycatcher	Early successional floodplain forest (willow, red-osier dogwood)	Yellow warbler, song sparrow
Swainson's thrush	Mid-late successional floodplain forest (black cottonwood, Oregon ash) (*Fraxinus latifolia/ Populus trichocarpa/ Cornus stolonifera/ Urtica dioica*)	Song sparrow, Bewick's wren, house wren, pileated woodpecker, downy woodpecker, black-headed grosbeak, red-eyed vireo, Pacific-slope flycatcher, tree swallow, great blue heron, bald eagle
Bewick's wren	Oregon ash floodplain forest (*Fraxinus latifolia/Carex deweyana/ Urtica dioica*)	Slender-billed white-breasted nuthatch, western wood-peewee, house wren, tree swallow, song sparrow, downy woodpecker, pileated woodpecker
Slender-billed white-breasted nuthatch	Oregon white oak woodland	Western pond turtle, Bewick's wren, western skink, northern alligator lizard, western gray squirrel, house wren
Orange-crowned warbler	Upland mixed forest	Rufous hummingbird, Wilson's warbler, MacGillivray's warbler, willow flycatcher, Bewick's wren, song sparrow, spotted towhee

4.2.2 Analysis of Priority Resources of Concern

Wildlife and habitat goals and objectives were designed directly around the habitat requirements of species designated as "priority resources of concern." (Resources of concern are called *conservation targets* in conservation planning methodologies used by other agencies and NGOs). In developing objectives, the team followed the process outlined in the Service's–Identifying Resources of Concern and Management Priorities for a Refuge: A Handbook (USFWS 2008). While this document was still in draft form while this CCP was being developed, it had been adopted by the Service as the process to develop wildlife and habitat goals and objectives for CCPs.

As defined in the Service's *Policy on Habitat Management Plans* (620 FW 1), resources of concern are:
"all plant and/or animal species, species groups, or communities specifically identified in refuge purpose(s), System mission, or international, national, regional, State, or ecosystem conservation plans or acts. For example, waterfowl and shorebirds are a resource of concern on a refuge whose purpose is to protect 'migrating waterfowl and shorebirds.' Federal or State threatened and endangered species on that same refuge are also a resource of concern under terms of the respective endangered species acts (620 FW 1.4G)."

The Handbook goes on to say that "Habitats or plant communities are resources of concern when they are specifically identified in refuge purposes, when they support species or species groups identified in refuge purposes, when they support NWRS resources of concern, and/or when they are important in the maintenance or restoration of biological integrity, diversity, and environmental health." Therefore, resources of concern for a refuge may be a species or species group, or the habitat/plant community that supports a priority species/species group.

In developing its listing of Priority Resources of Concern, the planning team selected not only species mentioned in establishing documents for the refuge, but also species that captured the ecological attributes of habitats required by larger suites of species. The team analyzed the ecological attributes of habitats that are necessary to meet the life history requirements of ROCs, and are therefore, critical to sustain the long-term viability of the ROC and other benefitting species. Ecological attributes of habitats include vegetation structure, species composition, age class, and seral stage; patch size and/or contiguity with other habitats; hydrologic regime; and disturbance events (e.g. flooding, fire). These provide measurable indicators that strongly correlate with the ability of a habitat to support a given species. Tables listing the desired conditions for habitat types found on the refuge are included in the following sections of this chapter. "Desired" conditions were based on scientific literature review and team members' professional judgment. These desired conditions for specific ecological attributes were then used to help design habitat objectives, as presented in Chapter 2. However, not all ecological attributes or indicators were deemed ultimately feasible or necessary to design an objective around. Other factors, such as feasibility and the refuge's ability to reasonably influence or measure certain indicators, played a role in determining the ultimate parameters chosen for each habitat objective. Thus, ecological attributes should be viewed as a step in the planning process. The ultimate design of objectives was subject to further discussion and consideration.

Limiting factors were also considered in developing objectives. A limiting factor is a threat to, or an impairment or degradation of, the natural processes responsible for creating and maintaining plant and animal communities. In developing objectives and strategies, the team gave priority to mitigating or abating limiting factors that presented high risk to ROCs. In many cases limiting factors occur on a regional or landscape scale and are beyond the control of individual refuges. Therefore, objectives and strategies may seek to mimic, rather than restore, natural processes. For example pumps and water control structures may be used to control water levels in wetlands in areas where natural hydrology has been altered by hydropower operations and dike construction. The structure of plant communities utilized by ROCs can be created, rather than restoring the original native species composition. For example, mowing and/or grazing may be used to maintain a desirable vegetation structure, when restoring native grassland communities may be impractical.

4.3 Waterfowl and Supporting Habitat-Improved Pasture and Croplands

4.3.1 Description and Location

Thousands of waterfowl use the refuge during fall, winter, and spring. Abundant wintering species include Canada geese, cackling geese, tundra swan, mallard, American wigeon, gadwall, northern shoveler, northern pintail, and green-winged teal. The refuge also attracts significant numbers of diving ducks largely ring-necked duck, lesser scaup, and bufflehead. Tundra swans are also a wintering species on the refuge with peak populations of up to 3,000 birds observed.

Western Canada geese are the only resident goose on the refuge. All other geese spend the winter months on the refuge and migrate to nesting areas for the spring and summer. Public use is restricted on the refuge from October 1 to May 1 to limit disturbance to wintering waterfowl. Informal staff observations of migrating geese since 1994 have noted arrival, departure, and peak migration dates for select waterfowl. Annually, these dates have been variable but are subsequently expressed as an average date to suggest typical dates for migrational events. The average arrival date for cackling geese has been September 24 and the average departure date has been May 6. The average date for the peak of goose use on the refuge has been November 1 and again on April 20. Dusky Canada geese have a slightly shorter wintering period on the refuge. The average arrival and departure dates for dusky Canada geese are October 11 and April 11, respectively. Tundra swans have a wintering period that is generally November to March. Arrival and departure trends for other migrating waterfowl are not monitored and are presumably variable by species, weather patterns, and other climatic conditions.

The refuge also has several species of duck that nest on the refuge in limited numbers. The most common nesting waterfowl species include wood duck, mallard, blue-winged teal, and cinnamon teal. Additionally, nesting has been confirmed for gadwall, American wigeon, northern shoveler, hooded merganser, common merganser, and ruddy duck. Production levels are not presumed to be high compared to other breeding areas along the flyway, but there is little data on this aspect.

4.3.2 Condition and Trends

Regular wintering goose surveys were conducted by refuge personnel from 1998 to 2003. Primarily, these surveys supported regional efforts to obtain information about geese that had been captured and fitted with coded plastic neck collars. However, data from these surveys were also used to assess flock compositions, peak populations, average populations, and goose utilization of individual wetland/field units. These goose surveys have counted an average of more than 13,000 geese on the refuge during the wintering periods of 1998 to 2003. Peak numbers occur as geese stage on the refuge during fall and spring migration. Goose surveys during 1999 and 2000 identified peak geese numbers of 34,747 in mid-November and 45,500 in mid-April. The composition of the goose flock was calculated using the older naming convention of one Canada goose species with five subspecies (cackling, Taverner's, lesser, dusky, and western) commonly found on the refuge.

Surveys from the winter of 1999 to the spring of 2000 determined the subspecies composition of geese examined on the refuge to consist of 3.0 percent dusky Canada geese, 2.3 percent Taverner's Canada geese, 0.7 percent lesser Canada geese, 79.3 percent cackling Canada geese, 1.3 percent western Canada geese, and 13.3 percent that were not differentiated between Taverner's or lesser Canada geese. With the current naming convention for geese, the cackling and Taverner's subspecies are treated under the species of cackling geese. The lesser, dusky, and western subspecies still belong with Canada geese. Recalculation of this data to represent the new naming convention would be complicated with the large percentage of undifferentiated lesser and Taverner's Canada geese, which are currently considered separate species.

Geese in the lower Columbia River have shown a significant change in wintering habitat use patterns and distribution. Documents relating to the establishment of the refuge describe dusky Canada geese as the primary subspecies. An annual narrative from 1970, noted the composition of dusky Canada geese on the refuge, which consisted of the Carty and River 'S' Units, had risen to about 60 percent in 1970. Refuge surveys from the fall of 1999 to the spring of 2000 determined that dusky Canada geese comprised approximately 3 percent of the total flock, and cackling geese more than 79 percent. This data shows that cackling geese are more prevalent on the refuge while dusky Canada geese are less prevalent. This trend is partly due to the shift in migration patterns by cackling geese. Since the early 1990s cackling geese shifted from wintering in California and the Klamath basin to wintering in the Willamette Valley and lower Columbia River (Harb and Trost 1995). Therefore, throughout western Oregon and Washington, cackling geese now represented a larger proportion of the overall goose composition largely due to the influx of wintering cackling geese that formerly wintered elsewhere. Refuge narrative reports also suggest that fewer dusky Canada geese utilize the refuge than historically recorded. Weekly surveys conducted during the winter of 1970 documented peak counts of wintering dusky Canada geese of more than 2,000 birds on the refuge, comprising approximately 3,000 acres. The average number of dusky Canada geese observed during the surveys of 1998 to 2003 was 267 birds on the refuge, comprising approximately 5,200 acres.

Midwinter waterfowl surveys have been regularly conducted on the refuge since the 1980s. These surveys count waterfowl populations utilizing the refuge and surrounding area. Since waterfowl are highly migratory and can change wintering locations quickly and frequently, the data generated from these surveys represent a snapshot of the numbers of waterfowl using the refuge on that particular day of survey and do not represent total refuge wintering populations. The cumulative data taken over the years may provide an index to the numbers of waterfowl the refuge has attracted and their trend over time. The midwinter waterfowl data set contains considerable detail about distribution of birds at various scales from specific refuge unit to overall region. Figure 4.2 identifies the overall number of geese, dabbling ducks, swans, and diving ducks counted on the entire refuge during a single flight in January of each particular year. The data for 2004 is an anomaly to the data set. Weather in 2004 kept the aerial survey from occurring. Therefore, the 2004 data set represent a ground based count which may not have adequately surveyed remote locations of the refuge. Additionally, it should be noted the data could not be located for the 2005 survey. The midwinter waterfowl survey data set shows that the refuge has counted over 33,000 ducks on the refuge during one flight. Calculating the average number of birds counted since 1998 suggests an average midwinter population of 1,595 diving ducks, 9,791 dabbling ducks, 8,069 geese, and 1,619 swans.

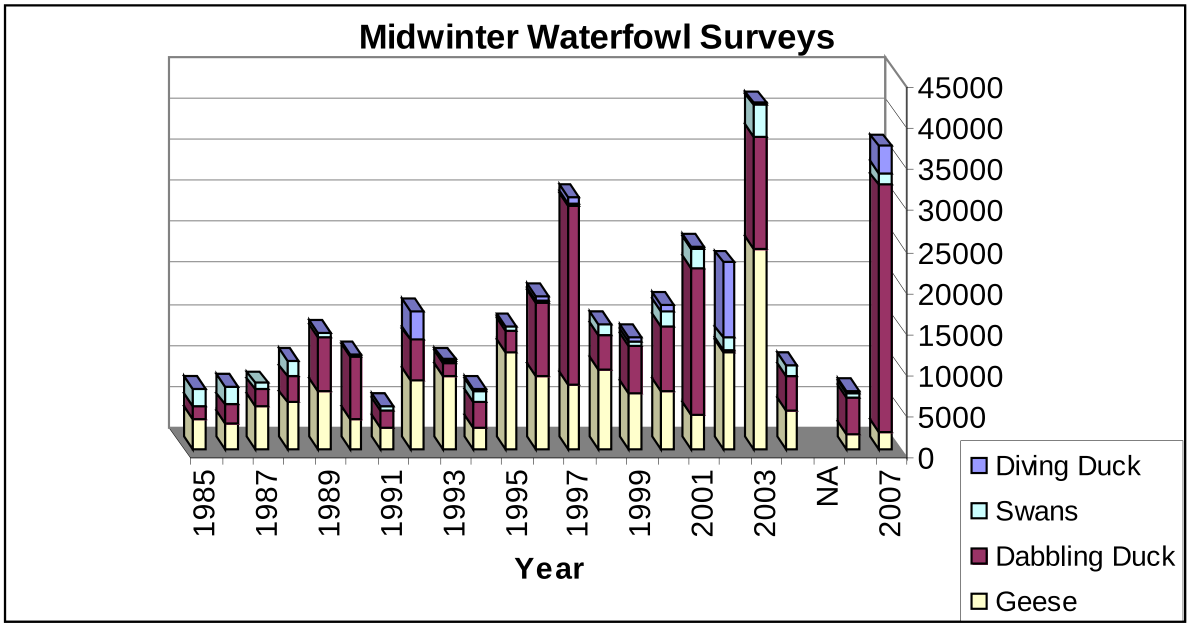

Figure 4.2 Midwinter Waterfowl Populations at Ridgefield Refuge. Source: Midwinter Waterfowl Survey data, 1985–2007

Contribution to Flyway Management Plans. The Ridgefield Refuge contributes to several waterfowl management plans developed by the Pacific Flyway Council. A summary and the major goals/objectives of each of the following plans are described in Chapter 1.

- Northwest Oregon/Southwest Washington Canada Goose Agricultural Depredation Plan (1998)
- Pacific Flyway Management Plan for the Cackling Canada Goose (1999)
- Pacific Flyway Management Plan for the Dusky Canada Goose (2008)
- Pacific Flyway Management Plan for the Pacific Population of Western Canada Geese (2000)

The 2004 Strategic Guidance (NAWMP Committee 2004), a 15-year plan, does contain species-specific population targets as a step-down from the NAWMP and evaluations of whether the continental population is currently short or over the target. There are also flyway goals for production by species. Annually there are population reports available based on the spring breeding surveys in the northern U.S. and Canada. According to the NAWMP Strategic Plan, pintail and scaup are decreasing at the flyway level. The western population of tundra swans exceeds the population objective by about 22,000. Population objectives have not been established for most of the Pacific Flyway's Canada geese subspecies. However consistent with the Pacific Flyway Management Plan for the Cackling Canada Goose (1999), the population objective for cackling Canada geese in the 2004 Strategic Guidance is 250,000 birds (autumn population). Dusky Canada geese have no numeric population objective within the 2004 Strategic Guidance. Rather, the stated objective of the plan is to avoid listing of dusky Canada geese under the Endangered Species Act.

4.3.3 Habitats Utilized

Wetlands. Waterfowl are a diverse group of birds with widely divergent habitat requirements throughout the year. Waterfowl utilize both lacustrine and palustrine wetland habitats on the refuge. (For detailed information on management, habitat conditions and trends of refuge wetlands, see section 4.5 of this chapter.) Generally, lacustrine habitats support invertebrates and/or submergent vegetation and are utilized by select diving ducks. Diving ducks can utilize food resources in the deeper water associated with lacustrine wetlands. Select dabblers may consume invertebrates and vegetation high in the water column within lacustrine wetlands, but these conditions are not considered optimal for foraging. With their deep open water, lacustrine wetlands offer long sight distances and are free of mammalian predators. Therefore, they provide important loafing, resting, and roosting habitats for wintering waterfowl.

Healthy and productive refuge palustrine wetlands host a rich diversity of emergent wetland plants including smartweeds, bulrushes, wapato, sedges, rushes, wild millet, bur-reed, cattail, and water plantain. Additionally, floating aquatics such as duckweed and water fern are valuable waterfowl food resources produced within palustrine wetlands. Waterfowl both directly consume wetland vegetation and selectively consume portions of plants including seeds, tubers, rhizomes, and roots. The detritus and submerged microclimates formed by seasonally flooded, emergent vegetation create an important substrate for the production of aquatic invertebrates. Consumption of invertebrates for protein and lipid content is seasonally significant to female ducks for egg development and laying (Fredrickson and Reed 1988).

Appropriate water depths are important for effective waterfowl management. Geese, especially dusky Canada geese, frequently forage in shallow wet meadow conditions or sheet water conditions with less than six inches of water. Management of seasonal wetlands is valuable for producing emergent wetland vegetation that is a primary food resource for wintering waterfowl. These wetlands are generally slowly drawn down through the spring, with the intent of creating moist soil areas where the seeds of annual emergent plants, such as millet and smartweed, can germinate. Once these plants are mature, the basins are reflooded or allowed to flood naturally with rainwater. Water depths of 2-10 inches are optimal for foraging by dabblers, allowing them access to seed heads. Various duck species have preferred foraging depths within this range; for example preferred water depths for mallards are 2.75-5.5 inches, while northern shovellers prefer depths of 6.3-9.5 inches (Frederickson 1991).

Swans feed on wapato and other aquatic tubers. For successful feeding, water depths must allow swans to reach the submerged tubers with their bills. Conversely, divers including ring-necked ducks and lesser scaup are capable of locating food resources throughout the water column, from near the surface to depths of many feet.

Managed Pasture. An establishing purpose of the Ridgefield Refuge is to provide migration and wintering habitat for waterfowl, especially dusky Canada geese. Additionally, the refuge is identified within several Flyway goose management plans for its role in attracting and supporting wintering Canada and cackling geese. To meet these goals, a primary strategy at Ridgefield is managing short pastures or grasslands. Wintering geese frequently graze upon large, short-grass pastures. Presumably, these conditions afford the geese access to young green plants and forbs, improved sight distances for predator detection, reduced concealment cover for predators, and clear flight paths for escape.

The refuge achieves short grass conditions for wintering geese through multiple strategies including haying, grazing, and mowing. Haying and grazing are achieved by initiating Cooperative Land Management Agreements. In exchange for the grazing and haying the refuge, the cooperator repairs fences, maintains infrastructure, controls weeds, and mows additional fields. Ultimately, the refuge achieves short grass conditions and additional improvements without the cost of performing these activities. The amount of grazing and haying is annually variable upon the number of cooperating farmers participating with the program and their annual business obligations. In all the refuge manages up to 1,432 acres of pastures within 55 fields on all units of the refuge. Generally, refuge fields are mowed after July 15 to avoid conflicts with ground nesting birds. While late mowing is favorable for ground nesting birds, it also leaves heavy residual thatch and coarse stems after mowing. Eventually the fields green up during the fall and spring, but initially upon the return of wintering geese the conditions are not optimal for goose browse. Select fields that are considered core dusky Canada goose wintering habitat are targeted for either grazing or repeat mowing during the spring and summer. These techniques keep the fields low and green, recycle nutrients into the field, and reduce heavy thatch accumulations.

Subtle differences exist between the utilization of managed grasslands between cackling geese and Canada geese. These differences are likely greatest between cackling geese and dusky Canada geese. Generally, cackling geese use large short-grass pastures. Cackling geese often favor highly manipulated green fields including cow pastures, golf courses, soccer fields, and open parklands. These habitats are large open fields with minimal trees and shrubs. In many instances, these areas are used by cackling geese during poor weather or off hours when the public is absent. At the refuge cackling geese use large open fields but have acclimated to vehicular traffic. Cacklers will feed in close proximity to the auto tour route and often will pick grit off of the road when the road is vacant.

Like cacklers, dusky Canada geese will join into mixed flocks of Canada and/or cackling goose subspecies in large open fields and croplands. However, dusky Canada geese will use small fields in relatively close proximity to shrub and trees. Duskys frequent habitat highly influenced by water and water features, such as wet meadow, sheet water, and shorelines. Duskys utilize mosaics of shallow water and roughly cut vegetation, reed canarygrass, and spikerush stubble, below six inches in height. In spring, dusky Canada geese can be found in shallow flooded reed canarygrass, and it is surmised that duskys forage on young green spring growth of canarygrass.

Croplands. A limited amount of croplands are annually planted to provide forage for Canada geese and sandhill cranes. Generally, the refuge manages approximately 175 acres of croplands, planting between 50 and 150 acres of crops annually. These crops may include barley, wheat, corn, oats, and clover. Cropping has included field planting and inter-seeding of small grain into existing pastures. Interseeded crops are left for geese to consume during the growing season. Field crops, especially corn, are planted in the spring and allowed to grow into the fall. Corn is then mowed in blocks during fall and winter allowing geese, ducks, and cranes access to the downed ears. Cropped fields must be carefully placed on the refuge to avoid baiting violations in both the refuge's and surrounding hunt areas. Cropped lands we intend to mow between September and February to expose waterfowl food must be selected in a manner that does not attract birds to hunted areas.

Cooperative farming was largely practiced on the Bachelor Island and River 'S' units until 1996, with the objective of providing grain and green feed to migrating and wintering waterfowl. In 1996 approximately 718 acres of winter wheat, corn, clover, and alfalfa were planted by cooperative farmers from the refuge. The crops grown in all the cooperatively farmed fields were mutually agreed upon by the refuge and farmer, with the refuge receiving shares (usually 20 percent). The refuge's shares were made up of grains and green forage, as determined by the refuge to meet wildlife objectives, while maintaining a viable cooperative agreement. The refuge received additional wildlife benefits, although not counted as refuge shares, through the availability of waste grains, green forage, and the growth of understory crops (e.g. clover) following the harvest of the cooperator's portion of the crops. Over time the refuge's farming capacity grew with large investments in tractors, seeders, sprayers, mowers, tillers, and disks. The refuge also constructed a bridge to Bachelor Island, eliminating the need to ferry supplies and equipment to the island. Collectively, the investment in equipment and construction of the bridge allowed the refuge to plant, manage, and maintain its own pastures and crops. All cropping is now done through force account. Due to the relatively high cost and inputs required to grow corn, only a small acreage is planted.

4.3.4 Key Ecological Attributes

Table 4.2 Habitat Attributes, Indicators, and Condition Parameters for Waterfowl*

Key Ecological Attributes	Indicators	Desired Conditions
Upland Food Availability (Improved Pasture, Croplands)	• Green browse • Crops (corn, small grains, legumes) • Crops provided off-refuge	• See Table 4.3 below for pasture habitat attributes • Mix of corn, small grains, legumes; normal planting, harvest, and post-harvest manipulation • Corn provided on nearby State wildlife areas (Shillapoo, WA; Sauvies Island, OR).
Water depth and hydroperiod	• Variety of water depths to accommodate swans, dabblers and divers; incremental floodup and drawdown to promote waterfowl foraging within entire basin • Provide managed seasonal wetlands (moist soil units) with water depths of 4-12 inches during initial floodup (Oct-Nov); 24-30 inches late Jan. to May; achieve drawdown by June 15 • Also see Wetlands Table 4.6 below	
Vegetation Diversity, Structure	• Wet meadows with mix of desirable, palatable grasses, sedges and rushes; if reed canarygrass is present, mow to shorter than 6 inches • Managed seasonal wetlands (moist soil units) with more than 60% cover of moist-soil annuals (e.g., smartweeds, wild millet, water plantain), wapato, and nutsedges • Semipermanent and permanent wetlands with less than 40% cover of native emergent species (e.g., cattail, hardstem bulrush, wapato, bur-reed) and more than 60% open water and native submergent vegetation • Minimal woody vegetation (e.g. willow, spirea)	
Invertebrate diversity	• Macroinvertebrate abundance and diversity preferably high; invertebrate diversity will partially be determined by hydroperiod.	
Invasive plants and animals	• Limit or exclude habitat-altering species (e.g. carp, nutria) • Limit or exclude exotic vegetation (e.g. reed canarygrass, yellow flag iris, purple loosestrife) that form persistent monocultures.	
Human Disturbance	• Minimize disturbance to preferred waterfowl feeding, roosting, and nesting areas; provide waterfowl sanctuary area during hunt season	

Source: Planning Team, Fredrickson and Drobney 1979, Fredrickson and Reed 1988, Frederickson1991, Korschgen and Dahlgren 1992

***Note:** For the preceding and following tables, not all ecological attributes or indicators were deemed ultimately feasible or necessary to design a habitat objective around. While the ecological attribute identifies a desired condition for most indicators, other factors, such as feasibility and the ability to reasonably influence certain indicators, played a role in determining the ultimate parameters and condition levels chosen for habitat objectives (Chapter 2).

Table 4.3 Habitat Attributes, Indicators, and Condition Parameters for Improved Pasture (managed for dusky and cackling geese).

Key Ecological Attributes	Indicators	Desired Conditions
Community Structure	• Average grass height • Thatch • Shrub cover • Field/wetland interface	• Shorter than 6 inches by October 1 • Minimal • No encroaching woody vegetation • Short vegetation along interface
Patch Size **-Dusky pasture** **-Cackler pasture**	• 2-45 acres (duskys) • 35 acres or more (cackling geese)	
Security	• Area clear of tall/ woody vegetation to allow for predator detection • Human disturbance	• Predator detection width 250 feet (duskys) • Predator detection width 450 feet (cackling geese) • Minimal disturbance in sanctuary areas Oct 1-April 1 (duskys) • Minimal disturbance in sanctuary areas Oct 1-May 1 (cackling geese)
Connectivity	Distance to accessible wetlands	400 feet or less (duskys)
Plant Species	• Mix of desirable palatable grasses and forbs • Invasive species	• Perennial ryegrass, orchardgrass, fescues, clover • Less than 20% cover of invasive species(e.g. Canada thistle, buckhorn plantain, tansy ragwort, teasel); no false indigo or poison hemlock

Source: Planning Team

4.3.5 Threats

The lower Columbia River provides important habitat for migrating and overwintering waterfowl that use the Pacific Flyway. Other threats are associated with breeding and migration areas in Canada and Alaska, and are treated in detail in other documents. Threats to wetland habitat are discussed in section 4.5. Threats to waterfowl and their associated habitats in the lower Columbia River region follow.

- Loss, degradation, or fragmentation of wetland and grassland habitat (see section 4.4 below).
- Development of grasslands or conversion to less suitable or unsuitable agricultural habitats.
- Human disturbance to key foraging and roosting areas.
- Wildlife diseases.

Specific threats to improved pasture on the refuge include:

- Lack of ability to fully utilize prescribed fire or cooperative grazing and haying as

management tools, leading to encroachment by woody plants, thatch accumulation, and increased prevalence of invasive and noxious weeds that reduce food availability and palatability for geese; and
- Invasive and noxious weeds, which compete with or exclude desirable grasses and forbs utilized by waterfowl.

4.4 Native Grasslands

4.4.1 Description and Location

Due to changes caused by conversion to agriculture (diking, draining, and logging of bottomlands; soil disturbance; grazing; and introduction of exotic grasses), grasslands on the refuge are highly altered from presettlement conditions. Before Euro-American settlement, most of the refuge was covered by a mosaic of floodplain forest, wetlands, sedge meadows, and wet prairie. Upland (dry) prairie likely occurred only in small patches of well drained soils in oak woodland, while wet meadow or prairie likely covered larger tracts of seasonally inundated ground.

Reconstructing the species composition of the refuge's historic grassland and prairie habitats is difficult due to their early conversion to agriculture. Early survey notes recorded patches of "wet prairie or meadow" on lower Columbia River bottomlands. Some of these were likely Columbia sedge meadows (Christy 2004). Another possible vegetation type was native wet prairie dominated by tufted hairgrass (*Deschampsia cespitosa)* (Christy 2004).

Small patches (approximately 10 acres total) of unmanipulated upland (dry) grassland occur as openings in oak woodland habitat in the Carty Unit. These grassland patches occur on shallow, well drained soil. Characteristic grasses associated with this habitat type include red fescue (*Festuca rubra*) and California oatgrass (*Danthonia californica*) (Christy 2004, and Altman and Holmes 2000). These small patches are dominated by introduced grasses, for example, poverty brome (*Bromus sterilis*) and orchardgrass (*Dactylis glomerata*); however, native wildflowers such as camas and Nuttall's larkspur occur in these grassy openings.

When the refuge was established, much of the area of former riparian forest and wetland had been converted to pastures, hayfields, and croplands. Many wetlands were restored on the refuge, but agricultural lands continued to be managed as such. Today, most of these lands are managed as improved pasture. These pastures are dominated by introduced "tame" pasture grasses such as perennial ryegrass, orchardgrass, and fescues, and are managed to provide short browse for Canada and cackling geese. Winter wheat, alfalfa, and/or clover have been planted in select areas as cover crops to rehabilitate pastures and to provide additional forage for geese and sandhill cranes. Management emphasis has been to manipulate vegetation structure through mowing, managed grazing, and other techniques. Ecological attributes, indicators, and condition parameters for improved pastures and croplands are discussed in Section 4.3 (Waterfowl). Some areas (old fields and buffers) have been left unmowed to provide nesting habitat for grassland-dependent birds, such as savannah sparrow and western meadowlark. The refuge currently contains approximately 400 acres of this "old field" habitat (see Table 4.5 below).

4.4.2 Condition and Trends

Only small remnants of native grassland still exist in western Oregon and Washington. Less than 1 percent of Willamette Valley grassland and savannah habitat remains. In western Washington, only about 8 percent of the original prairie still supports grassland vegetation and about 2-3 percent is still dominated by native prairie vegetation (Stinson 2005). More than 99 percent of the prairies in Clark, Lewis, and Cowlitz Counties have been converted to agriculture and other uses (Caplow and Miller 2004). As is the case elsewhere in the region, little remains on Ridgefield's native grassland plant communities. However, there has been some expansion of suitable habitat for grassland birds through the creation of agricultural grassland habitat where grasslands did not previously exist. This occurred primarily from extensive wetland draining, which converted wetlands and floodplain forest into agricultural lands. This also occurred on the refuge; upland grassland has increased as a habitat type compared to historic conditions due to human modifications of the habitat prior to refuge establishment (logging followed by diking, draining, introduction of nonnative pasture grasses, grazing, and cropping). The refuge currently manages these lands as improved pasture (see section 4.3, Waterfowl) with some areas left unmowed as habitat for grassland-nesting birds (see table 4.5 below). Columbia sedge meadows, likely a common refuge habitat type historically, have been almost completely replaced by nonnative reed canarygrass. These areas are mowed to provide short browse for geese. There is currently no known occurrence of native wet prairie on the refuge.

In select areas, habitat conditions may favor restoration of native grassland. However, such habitat restoration would be expensive, limiting the size of restored areas; and maintaining small patches of native grassland in a "sea" of pasture dominated by nonnative grasses is problematic. Approximately 30 acres of nonnative pasture areas on Bachelor Island were planted to native grasses in 2002. Wetland 8A (12 acres) and the southern portion of Wetland 8 (3.2 acres) were planted to a native moist soil grass community; and Smith Lake Field and a small portion of South Warehouse (13.5 acres) were planted in a native dry prairie grass community (blue wildrye 60 percent, red fescue 30 percent, and California brome, 10 percent). (Note: Portions of Wetlands 8 and 8A and Hundred Acre Field were later included in 8 Spit Field (24 ac), under the "old field" habitat designation.) The native grass plantings on 8 Spit Field and Smith Lake did not persist and were not replanted. In 2007 experimental plantings of Nelson's checkermallow, a species native to wet prairie in the Willamette Valley, were conducted in Smith Lake Field and Hundred Acre Field. Vegetation inventories and test plantings presented in Chapter 2 Objectives 7.7a and 7.7b, will help identify areas with the best potential for and feasibility of restoration.

4.4.3 Associated Wildlife

Birds. About 100 bird species can occur in grassland habitats in western Washington and Oregon. Of these, 44 species are highly associated breeding species in grasslands (Altman 1997; and Altman and Holmes 2000). Examples of obligate grassland species include western meadowlark, savannah sparrow, Oregon vesper sparrow, streaked horned lark, grasshopper sparrow, common nighthawk, western bluebird, lazuli bunting, northern harrier, western kingbird, killdeer, and short-eared owl. Many of the species have shown declining trends for decades, and are State listed or candidate species in Oregon and/or Washington. However, the savannah sparrow has shown an increasing trend (Altman and Holmes 2000). Many other birds occur in grasslands, but are not dependent on it, for example, predator birds (red-tailed hawk) attracted by rodents; generalist or edge species such as song sparrows; or open-country aerial foragers such as barn swallows (Altman 1997).

Grassland-associated birds known to occur on the refuge are northern harrier, killdeer, short-eared owl, common nighthawk, western kingbird, streaked horned lark, western bluebird, vesper sparrow, savannah sparrow, lazuli bunting, and western meadowlark. These species utilize improved pasture and old fields. Of these species, only northern harrier, killdeer, and savannah sparrow are common and are known to breed on the refuge. Western meadowlark is uncommon but is a confirmed breeder. The remaining species are occasional to rare, and breeding has not been confirmed.

Mammals. Limited data is available on mammals occurring in this habitat. The refuge occurs within the historic range of the Mazama (western) pocket gopher (*Thomomys mazama*), Brush Prairie (northern) pocket gopher (*Thomomys talpoides douglassii*), and gray-tailed vole (*Microtus canicaudus*), however, data on their occurrence is lacking. Further work to gather baseline data on small mammals is needed.

4.4.4 Key Ecological Attributes

Tables 4-4a, b, and 4-5 describe key ecological attributes of grasslands and old fields, and associated indicators. For each indicator, the conditions that would represent "good" or better are shown.

Table 4.4a Upland (Dry) Prairie Ecological Attributes, Indicators, and Condition Parameters

Key Ecological Attributes	Indicators	Desired Conditions
Vegetation structure	• Average grass/forb heights • Percent grass/forb cover • Percent woody vegetation cover	• Variable grass heights 6-30 in tall • More than 50% but variable, with areas of bare or sparsely vegetated ground and areas of dense (e.g. more than 80%) grass cover (western meadowlark) • Shrub-tree cover less than 10%
Native plant composition	Roemer's fescue, red fescue, California oatgrass, California brome, blue wild rye, western bittercress, American vetch, western wood strawberry, spring beauty, chickweed, Nuttall's larkspur, camas	
Invasive species	Less than 20% cover of invasive/undesirable nonnative grasses (e.g. poverty brome), forbs (e.g., ox-eye daisy, thistle and trefoil), and shrubs (e.g. blackberry)	
Soils	Well drained soils	
Disturbance Events	• Fire intensity • Fire return interval • Grazing • Human disturbance	• Low • Frequent (2-5 years) after July 15; fire is the preferred tool to maintain habitat where feasible • Light to moderate non-uniform grazing to meet desired conditions • Minimize management and recreational activities during the breeding season, April 15-July 15. • Delay mowing, haying until after July 15
Patch Size/ Connectivity	• Patch size • Contiguity with agricultural grasslands (e.g., fallow fields, pastures, hayfields)	• Larger than 25 ac • Larger than 200 ac (western meadowlark)

Source: Altman and Holmes 2000 (Grassland-Savannah Conservation Strategies, pp. 36-40; Biological Objectives for Western Meadowlark, pp 40-43; Oregon vesper sparrow, p 50), Christy 2004, USFWS 1993, Wilson et al. 1998a, Altman 1999

Table 4.4b Bottomland (Wet) Prairie Ecological Attributes, Indicators, and Condition Parameters

Key Ecological Attributes	Indicators	Desired Conditions
Vegetation Structure	• Average grass/forb heights • Percent grass/forb cover • Percent woody vegetation cover	• Short to medium (6-36 inches); mosaic of vegetation heights • More than 50% • Less than 5%; no willows
Native plant composition	• Native grass and forb species • Native shrub/tree species	• Mix of grasses and forbs including tufted hairgrass, rushes, sedges, camas, Bradshaw's lomatium, Nelson's checkermallow. • Scattered shrub component e.g. Douglas' spirea
Invasive species	Less than 20% cover of invasive/undesirable nonnative grasses (reed canarygrass), forbs, and shrubs	
Soils/ Hydrology	• Poorly drained (hydric) soils • Seasonal flooding; water depths range from moist soil to 4 inches from December through at least March	
Disturbance Events	• Fire intensity • Fire return interval • Grazing • Human disturbance	• Low • Frequent (2-3 times every 6 years needed to maintain viability of Bradshaw's lomatium • No grazing to light rotational grazing depending on vegetation and soil conditions. Limit grazing during spring and early summer in areas where harriers are nesting to protect nests from trampling • Minimize or avoid agricultural field operations and recreational activities during breeding season; April 15-July 15. Delay mowing/haying until after July 15. • Provide a no activity buffer of more than 400 feet around harrier nests
Patch Size/ Connectivity	• Patch size • Contiguity with wetland, wet meadow and old field habitat	• 200 ac (northern harrier, short-eared owl) • Maintain mosaic of wetland, wet meadow and non-managed field in greater than 400 acre blocks farther than a quarter mile from human development or recreational activities

Source: Altman and Holmes 2000 (Grassland-Savannah Conservation Strategies, pp. 36-40; Biological Objectives for northern harrier, pp 54-56). Christy 2004, USFWS 1993, Wilson et al. 1998b, Altman 1999

Table 4.5 Old Field Ecological Attributes, Indicators, and Condition Parameters

Key Ecological Attributes	Indicators	Desired Conditions
Vegetation structure	• Average grass/forb heights • Shrub cover • Grass/forb cover • Unmanipulated residual cover	• 6-24 inches • Less than 10% • More than 80% • More than 60% remaining annually (residual duff is preferred for nesting habitat)
Plant species composition	• Mix of desirable native and/or nonnative grasses (e.g., perennial ryegrass, orchardgrass, fescues) and forbs (e.g. clover)	
Invasive species	• Less than 30% cover of invasive species (e.g. Canada thistle, buckhorn plantain, tansy ragwort, teasel); no false indigo or poison hemlock	
Disturbance Events	• Fire intensity • Fire return interval • Mowing/Grazing • Human disturbance	• Frequent • 2-5 years • May be used as management tool after nesting season; no mowing before July 15; light to moderate rotational grazing • Minimize or avoid agricultural field operations (mowing, tilling, spraying) and recreational activities during breeding season; April 15-July 15.
Patch Size/ Connectivity	• Minimum Patch Size • Connectivity Contiguity with wetland or agricultural grasslands (fallow fields, pastures, hayfields)	• 5 ac • Within or adjacent to managed pasture, croplands, or wetlands • Within 200 acre contiguous mosaic of native and agricultural grasslands

Source: Planning Team, Altman and Holmes 2000

4.4.5 Threats

The following threats to native prairie and agricultural grassland habitat are summarized from Altman and Holmes (2000):

- Direct habitat loss from urban, residential, and agricultural development;
- Altered fire regimes and intensities, leading to habitat issues such as encroachment by woody plants, thatch accumulation, and increased prevalence of exotic plant species;
- Invasion by introduced plant species, which compete with or exclude native plants and alter vegetation structure (e.g., percent cover, vegetation height);
- Conversion of agricultural grasslands (e.g., fields dominated by exotic grasses and usually managed for a crop or for grazing) to less suitable or unsuitable agricultural habitats;
- Habitat fragmentation of remaining grasslands to sizes that may be insufficient to maintain healthy populations of birds;
- Proximity to agricultural and residential areas that may have a high density of nest parasites (brown-headed cowbird), exotic nest competitors (European starling) and predators (opossums), and domestic predators (cats), and may be subject to high levels of human disturbance; and
- Timing and extent of agricultural practices (e.g. mowing, haying, grazing, tilling, pesticide application) that results in direct and indirect reproductive failures of grass-land-nesting birds.

4.5 Wetlands and Deepwater Habitats

For the purposes of the CCP, wetlands are defined according to the classification system (Cowardin et al. 1979) used by the National Wetlands Inventory (NWI), but exclude all riparian habitats which might be included under this classification, that is, those areas dominated by woody perennial shrubs or trees. Deepwater habitats are permanently flooded lands lying below the deepwater boundary of wetlands. According to Cowardin et al. (1979) wetlands are lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is covered by shallow water. A positive indicator of wetland status requires the presence of one of the following:

- hydrophytic plants;
- hydric soils; or
- saturated or flooded soils during part of the growing season.

The key divisions of the NWI classification relevant to the refuge include the lacustrine, palustrine, and riverine systems. Lacustrine wetlands are generally permanently flooded and are identified as those areas lacking trees, shrubs, or emergent vegetation with greater than 30 percent areal coverage and measuring greater than 20 acres. Smaller areas can be defined as lacustrine if the water depth in the deepest part of the basin exceeds 6.6-feet at low water. Palustrine areas may or may not be permanently flooded, but they are typically recognized by the presence of trees, shrubs, or herbaceous emergent vegetation. Under the NWI classification, shallow marsh includes the following palustrine types:

- Class = Aquatic bed (water regime modifier = permanently flooded)
- Class = Aquatic bed (water regime modifier = semipermanently flooded)
- Class = Emergent wetland (water regime modifier = semipermanently flooded)
- Class = Emergent wetland (water regime modifier = seasonally flooded)
- Class = Emergent wetland (water regime modifier = temporarily flooded)
- Class = Emergent wetland (water regime modifier = seasonal-tidal)

Aquatic bed wetlands are wetlands that are dominated by vegetation that is floating and/or submerged and can be either palustrine or lacustrine; however, the refuge contains only the palustrine type. See the glossary for a complete definition of these three system types according to the NWI.

4.5.1 Description and Location

Permanent Wetlands. Permanently flooded wetlands occupy approximately 600 acres of the refuge. Three of these wetlands fall into the Lacustrine System under the NWI based on size (larger than 20 acres), and lack of persistent woody or emergent vegetation (less than 30% cover):

- Campbell Lake (189 acres) on the Roth Unit;
- Post Office Lake (74 acres) on the Ridgeport Dairy Unit; and
- Fowler Lake (36 acres) on the Carty Unit.

Lacustrine habitats support fish, aquatic invertebrates and/or submergent vegetation and are utilized by diving ducks and various fish-eating birds. With their deep open water, lacustrine wetlands offer long sight distances and are free of mammalian predators. Therefore, they provide important loafing, resting, and roosting habitats for wintering waterfowl. Other permanent wetlands fall into the

Palustrine category based on vegetation types. These include Carty Lake (52 acres) on the Carty Unit and Wigeon Lake (25 acres) on the Bachelor Island Unit. Two other large permanent palustrine wetlands on Bachelor Island, Canvasback Lake and Turtle Lake, lie mostly or entirely off Service-owned lands.

Approximately 450 acres of permanent wetlands lie outside the dikes on the Roth, Ridgeport Dairy, Carty, and Bachelor Island units, and therefore, are tidally influenced. The refuge has no management control of water levels in these wetlands. These include Campbell Lake (189 acres) and Campbell Slough (30 acres) on the Roth Unit; South Campbell Lake (15 acres) on the Ridgeport Dairy Unit; wetlands in the Gee Creek system on the Carty Unit (approximately 100 acres total); and Canvasback Lake-West (52 acres) and Wigeon Lake (25 acres) on Bachelor Island. All of these wetlands have an unconsolidated bottom, with the exception of Wigeon Lake which is classified as an aquatic bed in the NWI.

Campbell Lake is a floodplain wetland with direct connection to the Columbia River via Campbell Slough. Campbell Slough is considered a permanent tidal riverine system in the NWI. Wigeon Lake and Canvasback Lake West are connected to the Columbia River via Canvasback Lake. Gee Creek winds through the Carty Unit in a network of sloughs, channels and open lakes before emptying into the Columbia River. The larger wetlands in this unit include Fowler Lake (36 acres), Beaver Pond (18 acres), Middle Lake and its channel (19 acres), and Quarry Lake (20 acres). The degree and timing of inundation of these wetlands depends upon tides, river levels, and rainfall.

Permanent nontidal wetlands on the refuge include approximately 150 acres of wetlands and slough remnants historically connected to the Columbia River, but cut off from the river by dikes and/or cessation of major flooding events. These wetlands currently include Post Office Lake (74 acres) on the Ridgeport Dairy Unit, Carty Lake (52 acres) on the Carty Unit, and Bower-Mallard Slough on the River ‘S’ Unit. Bower Slough was originally a backwater slough of the Columbia River, but was cut off from the river by diking and is now filled through precipitation and pumping. It is part of the water delivery system for managed wetlands on the River ‘S’ Unit. Post Office Lake formerly had a tidal connection to the Columbia River, but this ceased when a stop log structure was installed in the mid 1990s. However, the County-owned dike separating Post Office Lake from the Columbia River is deteriorating and will likely breach in the next major flood event.

The refuge may or may not have some minimal water management capabilities on these permanent, nontidal wetlands. These wetlands rarely dry completely via evaporation during the summer, though significant reduction in surface area and depth may occur. It appears that water retention in these wetlands is in part a function of the current water levels within the Columbia River system, probably due to seepage/ground water levels. Post Office Lake has partial water management capabilities in that it has a water control structure on its drain. Post Office Lake was also fitted with a ‘duckbill’ tide gate in 1999, to prevent floodwater from backfilling into the basin and avoid fish entrapment within the wetland. The Service’s ability to manage Post Office Lake is limited because a portion of the lake is privately owned. Outside of their extensive use by waterfowl and other migratory birds, little is known about the submerged vegetation and other aquatic species inhabiting Carty and Post Office Lakes. Bower Slough contains abundant woody debris and gets heavy use by hooded mergansers, wood ducks, and waterfowl broods. It is a summer refugium for painted turtles and amphibians.

Semipermanent and Seasonal Wetlands. Most semipermanent and seasonal wetlands on the refuge are classified as palustrine emergent wetlands in the NWI. Timing and depth of inundation depends on basin depth, rainfall, soil characteristics, and water delivery capabilities. Semipermanent and seasonal wetlands occupy approximately 1,100 acres of the refuge and offer high habitat values. These values include productive foraging habitat for seed-eating waterfowl, breeding habitat for waterfowl, and in the spring, muddy exposed substrates which support shorebirds. These wetlands can be highly productive for various invertebrates because of temperature and water fluctuation cycles and decaying vegetation. They include approximately 650 acres of managed seasonal and semipermanent wetlands (mostly on the River 'S' Unit), 150 acres of nonmanaged seasonal wetlands (mostly on Bachelor Island), and 300 acres of wet meadow (mostly on the River 'S', Roth, and Ridgeport Dairy Units).

Managed Seasonal and Semipermanent Wetlands. Refuge waters inside diked areas of the River 'S', Bachelor Island, and Ridgeport Dairy units are managed to mimic natural disturbance mechanisms, providing and maintaining the cyclical aging and renewal processes of wetlands over time. By maintaining open shallow marsh through artificial means such as mechanical and hydrological operations, the refuge can provide a diversity of early successional vegetation stages that increase overall biodiversity and prevent wetland loss over time. Managed seasonal and semipermanent wetlands have existing infrastructure (pumps, culverts, water control structures) to manipulate water levels on a seasonal basis, relatively independent of water conditions in the surrounding watershed. Because of the widely divergent habitat requirements of waterfowl and waterbirds throughout the year (see section 4.3.3 above), refuge wetlands are managed to provide a range of water depths. Water depths, surface area, and hydroperiods within these managed wetlands can generally be independently regulated with a network of pumps, ditches, and water control structures. In all, the refuge has the ability to manipulate water within 48 individual wetland basins and over 971 surface acres. Generally, managed wetlands are irrigated in the fall and winter to desired depths and surface areas. These elevations are maintained until spring. Periodically, spring water depths within managed wetlands are increased to negatively impact reed canarygrass. Select basins may be dewatered in early spring to facilitate management actions including dike repair, or invasive species control measures.

Most of the River 'S' wetlands are seasonally flooded with water pumped from Bachelor Slough, which serves as the reservoir for filling most of the wetlands. Water availability can be limited during low tides. In recent years, water has been pumped into the wetlands to achieve desired water depths for the waterfowl hunting program by mid-October. When winter rains commence, the wetlands can become over-full and water must be pumped off the unit. Since the River 'S' Unit is generally sloping from south to north, water is expulsed from pumps on the north end of the unit. (For detailed information on water control infrastructure, see Chapter 5). The largest wetland on the River 'S' Unit, Rest Lake (86 acres) is classified as a semipermanent emergent wetland, but has generally been managed as a permanent wetland. However, it may be drawn down when needed for management purposes (for example, it was drawn down in 1999 for restoration and disking).

The River 'S' Unit contains most of the refuge's managed seasonal wetlands, which provide food for migrating and overwintering waterfowl. Managed seasonal wetlands are generally slowly drawn down through the spring to create moist soil areas where the seeds of annual emergent plants (e.g., smartweeds, wild millet, and water plantain) can germinate in summer. In fall, the wetland basins are reflooded or allowed to flood naturally with rainwater. Water depths of 2-10 inches are optimal for foraging by dabbling ducks. Preferred water depths for foraging waterfowl range from 2.75 to 5.5 inches for mallard and 6.3 to 9.5 inches for northern shoveller (Frederickson 1991).

The wetland system on Bachelor Island was largely redesigned in 1998. New wetlands were created, other wetland basins were expanded, and several steep banked wetlands were recontoured. Additional improvements were made to the water delivery and control systems. There are 21 wetland basins on Bachelor Island with water management potential. At full capacity, the refuge could manage nearly 400 acres of wetlands on Bachelor Island. However, due to a soil structure of alternating sandy and clayey layers, some wetland basins only hold water during high river levels, when water can percolate through the sand layers. When river levels are low, water percolates out through these same layers, draining the wetlands. The cost of pumping water into these wetlands is prohibitive. Therefore, active irrigation on Bachelor Island is reserved for wetlands with proven water retention capabilities, and where good water control capability exists. Most Bachelor Island wetlands are not actively managed (see below, “Nonmanaged Seasonal Wetlands”).

Wetland improvements were initiated on the Ridgeport Dairy Unit in 1998 with the recontouring and disking of the Hillocks, Fingers, and Dusky marshes, and the installation of a pump station and water delivery system for these marshes. These three basins, totaling 80 acres represent the managed wetlands of the Ridgeport Dairy Unit. A water control structure on the south end of Campbell Lake facilitates drainage for the Hillocks and Fingers marshes. These shallow wetlands are classified as wet meadow.

Nonmanaged Seasonal Wetlands. Unmanaged or nonmanaged seasonal wetlands are those that are typically dry in summer (June-September) and fill with rainwater in fall. Most of this wetland type (approximately 120 acres) occurs on the Bachelor Island Unit. Some small seasonal wetlands (approximately 20 acres total) occur on the Carty Unit, and one 16-acre seasonal wetland is on the Carty Unit (River ‘S’ Point). Seasonal wetlands on Bachelor Island are generally not supplemented with pumped water, and there are no capabilities to supplement wetlands on the Carty Unit. The small seasonal wetland basins in the Carty Unit may be inundated during unusually high water events (Columbia River floods) but otherwise are disjunct from the daily fluctuations of the Columbia River and Gee Creek wetland systems.

Most of Bachelor Island is maintained as managed pasture, however, a series of linear, generally north-south trending basins contain seasonally flooded emergent wetlands. Formerly, these were filled by spring floods from the Columbia River and by rainwater in winter. These basins are shallower at present than they were historically. In the 1940s and 1950s the low ridges between the basins were partially leveled to facilitate farming. Soil from the ridge tops was used to partially fill the basins. This decreased the depth of seasonal wetlands on Bachelor Island and probably affected their water-holding capabilities as well. Because the cost of pumping water into these wetlands is prohibitive, the Columbia River’s level, seasonal rainfall, and soil characteristics of each wetland basin dictate the overall acreage of wetlands on Bachelor Island. Most wetland basins on Bachelor Island collect water from seasonal rainfall, with approximately 250 acres of wetlands by mid-winter.

Wet Meadows. Wet meadows are shallowly flooded wetland edges with little to no slope. On the refuge they occur within both managed and unmanaged units. Due to the generally short duration and shallow flooding of these sites, reed canarygrass proliferates, and little if any native wet meadow vegetation (e.g. Columbia sedge) persists. However, wet meadow is a favored habitat of dusky Canada geese, and high use of these areas has been documented despite the dominance of reed canarygrass. The largest contiguous tracts of wet meadow are on the Roth Unit (113 acres) and the Ridgeport Dairy Unit (60 acres). As noted above, the refuge has water management capabilities on the Ridgeport Dairy wetlands. The River 'S' Unit contains about 85 acres of wet meadows, broken up among several small (10 acres or less) tracts. There is also about 20 acres of this habitat on the Carty Unit, in the overflow plain north of Carty Lake, but this area receives little goose use.

Howellia Wetlands. Howellia wetlands are generally small, isolated basins that fill with rainwater in fall and dry during the summer months, providing habitat for the endangered water howellia (*Howellia aquatilis*). Drying to a mudflat stage in the late summer or early fall is essential for successful germination of howellia seed. These wetlands cannot be supplemented with pumped water or artificially dewatered. The Carty Unit contains several small (less than 1 acre) perched wetlands that contain water howellia. These small wetlands generally contain open water (shallower than 1 foot) from November through June, with sparse emergent and submergent vegetation, e.g. aquatic grasses, sedges, pondweeds, and burreeds. The refuge's howellia ponds occur in a matrix of dense forest vegetation, typically Oregon ash with a well-developed shrub component of red-osier dogwood and Douglas' spirea. Howellia does not persist in wetlands overgrown with emergent vegetation or woody plants. Deeper ponds that remain wet for the majority of the growing season may undergo succession to cattail, which eventually excludes howellia; where howellia occurs with cattail, populations are less vigorous (Shelly and Moseley 1988). With increasing sedimentation and accumulation of organic matter, and the lowering of the water table, shallower ponds eventually develop into seasonal emergent wetlands dominated by sedges and grasses, and howellia is not present. Because howellia habitat is ephemeral, the availability of clusters of closely adjacent ponds in a variety of successional stages, with corridors between ponds for animal movement to facilitate seed dispersal, is essential for the persistence of this species (Roe and Shelly 1992).

4.5.2 Condition and Trends

Construction of dams and levees caused several significant changes in wetland habitats along the lower Columbia River. Natural fluvial processes that occurred along the river were lost, such as seasonal flooding and scouring that helped maintain river-associated wetlands by setting back succession. The timing of seasonal flows were also severely altered, which prior to the dams, included high water flows during spring and summer and low flows during fall and winter (see Chapter 3). Under this highly altered system, refuge wetlands lack natural renewing processes and will age in terms of succession, unless they are actively managed to set back succession. Diversity in vegetation structure (e.g. a mix of submergent and emergent plants) will gradually give way to dominant monocultures of tall, persistent emergent plants, that when combined with sedimentation, causes the infill and eventual loss of shallow wetlands.

Permanent Tidal Wetlands. Although some wetlands at the refuge retain tidal connections to the Columbia River, water levels are lower than they were historically due to lower river levels and altered flooding regimes. The presence of nonnative fish, especially carp, has decreased water quality for native salmonids that use these habitats for rearing, and has probably negatively impacted the native mussel community. The decline of wapato in permanent wetlands is probably due to a combination of altered hydrology and the foraging activities of carp and nutria.

Campbell Lake and Slough (Roth Unit). Campbell Lake supports large numbers of migratory and overwintering waterfowl, as well as being an important roost for migrating sandhill cranes. Carp enter Campbell Lake via Campbell Slough by the thousands during the breeding season. However, despite the presence of carp, Campbell Lake still supports a reasonably high-quality native plant community and receives high waterfowl use. Average year-round water levels within Campbell Lake appear to be consistently lower since the 1996-1997 flood seasons, when Campbell Lake was predominantly a nonvegetated, exposed mudflat. Since then, tall emergent plants have colonized much of the shallow wetlands and mudflats once utilized by roosting cranes. The middle and southern portions of the lake are still relatively open; however, water levels may be too deep for roosting. This habitat change in Campbell Lake may account for the shift in roosting to Canvasback Lake on Bachelor Island from 2003 on. If the current vegetation trend continues, the site may lose its value as roosting habitat.

Canvasback Lake (Bachelor Island Unit). Historically, Canvasback Lake was a large, shallow lake heavily used by mallard and other dabbling ducks (Jewett 1927). The lake retains some hydrologic connection to the Columbia River; however, with lower average river levels and cessation of annual spring flooding, the condition of the lake has been gradually deteriorating. The deepest area of the lakebed holds water year-round, and lies on private land. The shallower south end of Canvasback Lake (approximately 60 acres total) is on refuge land. Because most of the lake, and a small dike and water control structure, is on private land, the Service does not have management control of this lake. Without the ability to control water levels, the southern portion is now becoming a water smartweed (*Polygonum amphibium*) monoculture, and yellow flag iris has begun to invade. The southernmost portion of the wetland is currently in a degraded, weedy condition. Habitat improvement, specifically the creation of shallow open water areas, could increase waterfowl and crane use.

Wigeon Lake (25 acres) is connected to Canvasback Lake and is dependent on Columbia River levels. It is not actively managed at this time. Although it has an independent water delivery system, a hydraulic and topographic survey is needed. The primary vegetation is water smartweed and spikerushes. The area surrounding Wigeon Lake is currently in degraded, weedy condition.

Permanent Nontidal Wetlands. Due to the loss of connection permanent nontidal wetlands once had with the Columbia River system, their functionality has been reduced, particularly with respect to anadromous fish rearing habitat, wapato beds, and native mussel beds.

Post Office Lake (Ridgeport Dairy Unit). For many years Post Office Lake was managed as a permanent wetland with little submergent vegetation. A “duckbill” tide gate was installed in 1999, and in 2000 the lake was drawn down to control carp and other rough fish. It was hoped that this would allow submergent vegetation to re-establish and improve habitat quality for swans, diving ducks, and wading birds. A biological survey is needed to determine the success of the restoration effort. Formerly, the lake was grazed to the shoreline, which had negative impacts to water quality but the short, grazed grass did encourage heavy wigeon use. Currently, the lake is surrounded by a “fence” of tall vegetation which makes the lake less attractive to waterfowl and cranes.

Carty Lake (Carty Unit). Carty Lake formerly contained a large wapato bed; currently, wapato is confined to small areas of the lake. As with other permanent wetlands on the refuge, water quality and aquatic plants have been negatively impacted by carp. Restoring a tidal connection could improve habitat conditions; however, contaminants present in sediment (see Chapter 3) limits management options.

Managed Seasonal and Semipermanent Wetlands. Between 1998 and 2000, many refuge wetlands on the River 'S', Bachelor Island, and Ridgeport Dairy units were restored. Basins were recontoured, and water control infrastructure was repaired or added. An improved water control infrastructure enhanced the refuge's ability to manage for desirable, moist-soil plants, and also control reed canarygrass, which had been a persistent management issue since the refuge was established. The most effective control techniques for reed canarygrass involve dewatering wetland basins, followed by disking and multiple herbicide treatments. Extensive disking of wetland basins was conducted to control reed canarygrass between 1999 and 2002, including 450 acres on the River 'S' Unit. In many cases, wetland basins responded positively with decreased reed canarygrass cover and an increase in desirable moist-soil plants.

The accidental introduction of ricefield bulrush forced the refuge to change the reed canarygrass control regime. After ricefield bulrush was discovered in 2002, disking was discontinued in most of the refuge's managed wetlands (including most wetlands on the River 'S' Unit) to prevent the spread of this plant. Water management was also changed to prevent the spread of bulrush seed through delivery/drainage ditches. Where possible, water was not pumped off but rather allowed to recede only through evaporation, transpiration, or ground water seepage (USFWS 2003). To control reed canarygrass, water was held in wetland basins for extended periods (until at least June). While this is an effective control method, it also creates deeper water conditions unfavorable for the production of moist-soil plants.

In addition, water was pumped onto the managed wetlands of the River 'S' Unit in early fall (September) to ensure that hunt units were flooded by mid-October. As winter rains added more water to these wetlands, it was necessary to pump the water off to avoid flooding refuge roads, and other infrastructure. Because out-pumping generally could not keep pace with inflow from rains, this pumping regime created relatively deep-water conditions for most of the fall through spring season. These depths are not conducive for most foraging waterfowl. The combined effects of water management for the waterfowl hunt program and invasive species control have made conditions less favorable for dabbling ducks. This has been reflected in an increase in species that prefer deeper water for foraging or are adept at gleaning food from the water's surface (e.g. northern shoveller, green-winged teal, American coot, and ringneck ducks) and a decrease in dabbling ducks that prefer shallower water (e.g. mallard, American wigeon).

Nonmanaged Seasonal Wetlands. Since these wetlands vary in water-holding capability and are not actively managed, habitat conditions vary. In general, those with fair to poor water holding capability have a higher abundance of reed canarygrass, while those that hold water for longer periods have a higher abundance and diversity of moist soil plants. Four Bachelor Island wetlands with very poor water retention are now classified as wet meadows (see below) and two (Wigeon No Man's Land and Canvasback Lake south) are classified as old fields and are in rank, weedy condition. In some cases, shallow wetland benches are undergoing succession to riparian forest. Ricefield bulrush was introduced to Wetland 11 on Bachelor Island in 1999 and discovered in 2002; since then the wetland has been managed as a semipermanent wetland.

Wet Meadows. Due to the generally short duration and shallow flooding of these sites, reed canarygrass proliferates and little if any native wet meadow vegetation persists. However, areas of short mowed or grazed reed canarygrass do receive high use by dusky Canada geese. Three seasonal wetlands on the Ridgeport Dairy Unit (the Hillocks, Fingers, and Dusky Marshes, 60 acres) have water management capabilities, but hold water poorly at low river levels. The Dusky and Fingers marshes quickly become dominated by reed canarygrass without frequent disking and rototilling treatments, while native wetland plants (e.g. knotgrass and nodding beggartick) remain common in Hillocks. Ricefield bulrush was introduced into Fingers Marsh in 1999; subsequent control efforts favored the dominance of reed canarygrass. The Dusky and Hillocks marshes have been important loafing and foraging areas for dusky Canada geese in recent years. Several Bachelor Island wetlands (approximately 30 acres total) with shallow basins and poor water holding capacity are currently classified as wet meadows; reed canarygrass dominates in these wetlands.

Howellia Wetlands. Currently, one of the refuge's four howellia ponds has been largely taken over by reed canarygrass. Woody vegetation (Douglas' spirea) is encroaching on another pond.

4.5.3 Associated Wildlife

Birds. Thousands of waterfowl representing more than 30 species use the refuge during winter or as stopover sites during spring and fall migrations. Twelve species of waterfowl breed on the refuge. The deeper semipermanent wetlands on the River 'S' Unit (Rest Lake and Mantrap Lake) are well known foraging and roosting sites for tundra swans (For detailed information on waterfowl use of wetlands, see section 4.3 of this chapter).

Campbell Lake on the Roth Unit is a regionally significant roosting site for sandhill cranes; as many as 1,500 cranes may use this site in early fall (see section 4.9.2). Refuge wetlands provide both nesting and foraging habitat for marsh birds such as pied-billed grebe, American bittern, American coot, Virginia rail, and sora. Common songbirds breeding in refuge wetlands include marsh wren, common yellowthroat, red-winged blackbird, and yellow-headed blackbird. Refuge wetlands get limited use by migrating shorebirds (dunlin, western and least sandpipers, yellowlegs, and long-billed dowitcher). However, killdeer, black-necked stilt, spotted sandpiper, common snipe, and Wilson's phalarope are known breeders on the refuge. Other common waterbird species that use refuge wetlands primarily for foraging and/or resting include double crested cormorant, great blue heron, great egret, ring-billed gull, California gull, Thayer's gull, and glaucous-winged gull.

Fish. A number of nonnative warmwater fish are present in the refuge's permanent wetlands. They enter Campbell Lake through Campbell Slough, and are also common throughout the Gee Creek system in the Carty Unit. Common introduced fishes include common carp, largemouth bass, brown bullhead, mosquitofish, black crappie, white crappie, bluegill, and yellow perch. It is likely that refuge lakes with tidal connections were historically used as rearing habitat by juvenile salmonids. A recent survey (June 2007) found juvenile Chinook salmon (most without fin clips, indicating a wild origin) in Campbell Slough.

Mammals. American beaver (*Castor canadensis*), muskrat (*Ondatra zibethicus*), mink (*Mustela vison*), and river otter (*Lutra canadensis*) inhabit wetlands on the refuge. Nonnative nutria (*Myocastor coypus*) are the most commonly observed mammal on the River 'S' Unit and cause considerable damage to dikes.

Reptiles and Amphibians. Species known to occur in suitable habitat include the nonnative bullfrog (*Rana catesbeiana*), northern red-legged frog (*Rana aurora*), western chorus frog (*Pseudacris regilla*), northwestern salamander (*Ambystoma gracile*), long-toed salamander (*Ambystoma macrodactylum*), and western painted turtle (*Chrysemys picta*). Red-legged frogs require relatively long wetland inundation (November-June) while long-toed salamanders and western chorus frogs utilize wetlands with a shorter hydroperiod (3-4 months inundation).

Wapato is a good indicator of suitable red-legged frog breeding habitat since it requires a similar water depth and hydroperiod. Permanent wetlands could provide suitable habitat, however, habitat value is limited by the presence of nonnative warmwater fish, e.g. bluegill and pumpkinseed, and bullfrogs. Three wetlands on the River ‘S’ Unit have been historically significant in terms of amphibian production: Southeast Lake, a 14-acre managed semipermanent wetland; Bull Lake, a 15-acre managed seasonal wetland; and Middle Lake, a 23-acre managed seasonal wetland (USFWS 2004). Southeast Lake is well known for producing large numbers of red-legged frog egg masses. Bull Lake has produced northwestern salamanders and red-legged frogs, although northwestern salamander breeding was low as of 2000 (Beale and Akins 2001).

Painted turtles use permanent ponds and waterways on the refuge; however, they require sandy areas with good sun exposure for nesting. Therefore, scouring events are important in maintaining turtle nesting habitat. Currently, most western painted turtle nesting occurs on Turtle Lake on Bachelor Island, which is owned by WDNR.

Plants. The refuge’s large permanent and semipermanent wetlands support stands of persistent emergent vegetation such as cattail and softstem bulrush. Wapato was formerly abundant in refuge wetlands but habitat conditions do not favor this species at its former abundance. Some stands of wapato can be found in permanent and semipermanent wetlands, including Carty Lake and other Carty Unit wetlands, and Mantrap Lake on the River ‘S’ Unit. Common and widespread species in the refuge’s shallower seasonal wetlands include spikerushes (*Eleocharis acicularis, E. palustris, E. ovata*), water smartweed, swamp smartweed, nodding beggartick, Mexican mosquitofern, and common duckweed. Common species in particular wetland basins include (introduced species are noted with an *): American waterplantain, common mare's-tail, toad rush, knotgrass, spotted ladysthumb*, bur-reed, spike bentgrass*, wild millet*, rice cutgrass, western marsh cudweed, marsh cudweed*, skullcap (or marsh) speedwell, creeping jenny (or moneywort)*, and marsh seedbox (or false loosestrife). Good quantified information on submerged plants is lacking.

4.5.4 Key Ecological Attributes

Table 4.6a Wetland Ecological Attributes, Indicators, and Condition Parameters

<table>
<tr><th>Key Ecological Attributes</th><th>Indicators</th><th>Desired Conditions</th></tr>
<tr><td>Hydrology</td><td colspan="2">• Natural fluvial cycle approximating natural hydrograph (annual spring flooding with overbank flows; flood waters peaking in June) or direct artificial manipulation that mimics this cycle
• Major flood events every 10+ years deposit sediment or rework sediment to create depressions or use of mechanical techniques (e.g., drawdown, disking, mowing) to set back succession</td></tr>
<tr><td>Water depth and hydroperiod</td><td>• Wet meadows
• Seasonal wetlands</td><td>• Moist soil to shallow sheet water (0-4 inches) Dec-March
• Early-season flooding and summer drying (June-Sept.). Incremental floodup; 4-12 inches during initial floodup (Oct.-Nov.); winter depth 4-18 inches over 75% of wetland; drawdown by June 15</td></tr>
</table>

Key Ecological Attributes	Indicators	Desired Conditions
	• Semi-permanent wetlands	• Seasonal fluctuations in water levels; 24-30 inches by late Jan; summer depths several inches; no more than 60-80% of wetland bottoms dry by Oct. 1.
	• Permanent wetlands (nontidal)	• Maximum water depths 24-36 inches with potentially increased depths in winter due to precipitation; natural drying in summer may reduce depth and area of wetlands
	• Permanent wetlands (tidal)	• Perennial water flows, wetlands connected to Columbia River irrigated by daily freshwater tides; hydroperiod and depth variable with river.
Vegetation Diversity, Structure	• Wet meadows	• Native grasses and forbs, e.g. Columbia sedge, tufted hairgrass, camas; less than 5% cover of native shrubs; less than 20% cover of invasive plants (other than mowed/grazed reed canarygrass); reed canarygrass if present is mowed (preseason) to shorter than 6 inches.
	• Seasonal wetlands	• More than 60% cover of moist-soil annuals (e.g., smart-weeds, wild millet, water plantain), wapato, and nutsedges; less than 20% cover of tall persistent emergent species (e.g., cattail, hardstem bulrush)
	• Semi-permanent wetlands	• 60%-80% cover of desirable and native wetland plants including moist-soil annuals and submergent plants (e.g., pondweeds); 20%-40% cover of tall persistent emergent species (e.g., cattail, hardstem bulrush, wapato, bur-reed)
	• Permanent wetlands (nontidal, tidal)	• Open water and native submergent vegetation covering more than 70-75% of wetland basin during peak water elevations; less than 25% cover of native emergent vegetation • Minimal woody vegetation (e.g. willow, spirea)
	• All types	• Avoid monocultures of tall persistent emergent vegetation and aggressive smartweeds (e.g. *Polygonum amphibium*)
Optimal patch size or contiguity with wetland/ riverine habitat	• Maintain mosaic of wetland, wet meadow and non-managed field in greater than 400-acre blocks. • Wet meadow patch size ranges from 2 to 45 acres with a minimum predator-detection width of 250 feet. • Barrier-free fish passage between permanent tidal wetlands and Columbia River/main sloughs	
Invertebrate diversity	• Macroinvertebrate abundance and diversity preferably high; invertebrate diversity will partially be determined by hydroperiod.	
Invasive plants and animals	• Limit or exclude habitat-altering species, e.g. carp, nutria. Carp in permanent wetlands less than 200 lbs/acre. • Less than 40% cover of invasive plants (e.g., reed canarygrass, ricefield bulrush) in wet meadows and seasonal wetlands. • Less than 20% cover of undesirable/invasive plants (e.g., reed canarygrass, ricefield bulrush) in semipermanent wetlands. • Less than 10% cover of invasive plants (e.g., reed canarygrass, milfoil) in permanent wetlands. • No purple loosestrife and false indigo present. • Limit or exclude exotic vegetation (e.g. reed canarygrass, yellow flag iris) that form persistent monocultures.	

Key Ecological Attributes	Indicators	Desired Conditions
Water quality	• Water temperature (permanent tidal wetlands) • Turbidity (permanent tidal wetlands) • Toxics (all wetlands)	• 7-DAD Max temperature ≤22°C (71.6°F) and the 1-day maximum (1-DMax) temperature of 23°C (73.4°F) or less to protect juvenile salmonids from acute lethality*. • Maximum turbidity less than 70 NTU (Threshold for avoidance by juvenile coho salmon). • Toxic substances below levels that would cause acute or chronic toxicity to the most sensitive biota

Source: Planning Team, Frederickson1991, Fredrickson and Drobney 1979, Fredrickson and Reed 1988, Kilbride and Paveglio 1999, Christy 2004, Altman 2000, Wilson 1998, Washington Dept. of Ecology 2006

**WDOE Criterion in water bodies designated for salmonid spawning, rearing and migration unless otherwise specified

Table 4.6b Ecological Attributes, Indicators, and Condition Parameters for Ephemeral Ponds (Howellia ponds)

Key Ecological Attributes	Indicators	Desired Conditions
Hydrologic Regime	• Small (<1 acre) perched wetlands (pothole ponds) • Ephemeral ponds filled by rain; Water depths range from saturated soils to 20 inches in winter (November-June); dry in late summer/early fall • Depth generally <36” in spring, but occasionally up to 6 ft (2 m) deep	
Plant Community Structure and Composition	• Cover: water ratio • Canopy cover	• Open water without dense emergent vegetation (e.g. cattail) • 80% open water with Howellia and other native submergent plants, e.g. pondweeds; less than 20% cover of emergent wetland plants, e.g. cattail, aquatic grasses, sedges, and burreeds; minimal woody species (e.g., spirea) within ponds • Greater than 30% canopy cover, predominately Oregon ash with well-developed shrub component (e.g. red-osier dogwood, Douglas’ spirea); maintain forested buffers of 300 feet around ponds
Disturbance Events	• Fire • Grazing • Logging, Brush Clearing	• Fire early in the growing season may offset organic mat build-up in ponds, benefiting the population. • No grazing • Minimize logging and vegetation disturbing activities within 300 feet of ponds
Invasive species	No noxious weeds, e.g. purple loosestrife, reed canarygrass	
Habitat connectivity	• Maintain clusters of closely adjacent ponds in a variety of successional stages • Create and maintain corridors between ponds for animal movement to facilitate seed dispersal between ponds	

Source: Planning Team, Shelly and Moseley 1988, Roe and Shelly 1992, Lesica 1992, USFWS 1994, 1996, Washington Natural Heritage Program 1999, Center for Plant Conservation 2009

4.5.5 Threats

Because of the numerous dams along the length of the Columbia River, and the construction of levees to protect private landowners along the lower Columbia River, the natural fluvial processes of a free-flowing riverine system have been eliminated. Diking and filling, in conjunction with agricultural development, have been a primary cause of decreases in tidal wetland area in the Columbia River estuary. These actions eliminated most of the natural, tidal exchange of water, materials, and organisms between the Columbia River and the adjacent floodplain forests and shallow overflow lakes; however, limited exchange occurs through tide gates. An estimated 90 percent of tidally influenced freshwater wetlands in the lower Columbia River region have been lost (Floberg et al. 2004). Exchange is important not only for the access and use of these habitats by fish, but also for maintenance of habitat-forming processes such as sedimentation and erosion. Even where tidal connections persist, water levels in refuge wetlands are lower than they were historically due to lower river levels and altered flooding regimes.

Altered plant and animal community composition was identified as a very high stress to refuge wetland systems. Invasive plants limit native plant production and cause impacts to food, nesting, and cover for wildlife. Invasive plants in wetlands reduce waterfowl food availability during the migration and wintering periods. Reed canarygrass, in particular, out-competes native wetland vegetation in seasonally flooded areas, often forming dense monotypic stands (see page 15). Lack of staffing and funding to contain the expansion of invasive species and reduce infested acreage has been an ongoing issue with all wetland habitats on the refuge.

Carp, which are widespread in permanent wetlands on the refuge, are a high threat to the ecological functions of the wetland system, due to their impacts on submergent vegetation and water quality. Carp uproot and eliminate submerged vegetation, increase turbidity, and decrease the overall abundance and diversity of the invertebrate community (Miller 2006). Some invasive mollusks (e.g Asian clam) have been present in the Columbia River basin for decades and have probably decreased the abundance or species richness of native mollusks. Other species, such as zebra and quagga mussels, have not been reported to date but represent a serious potential threat in the Columbia River basin.

4.6 Riparian and Floodplain Forests

4.6.1 Description and Location

Riparian and floodplain forest habitats occupy the edges of some wetlands and sloughs, the Columbia River shoreline of the refuge, and most of the Roth Unit. These habitats total approximately 1,060 acres of the refuge. Oregon ash (*Fraxinus latifolia*), black cottonwood (*Populus trichocarpa*), Pacific willow (*Salix lasiandra* ssp. *lucida*), other willows (*Salix* spp.), red-osier dogwood, red alder, Nootka rose, cascara, western red cedar, snowberry, rose (Douglas') spirea, and red elderberry are the primary tree and shrub species. The three major types include early successional floodplain forest dominated by Pacific willow and other willow species (willow flycatcher was selected as the ROC for this habitat); mid to late successional floodplain forest dominated by Oregon ash and black cottonwood (Swainson's thrush was selected as the ROC); and Oregon ash floodplain forest (Bewick's wren was selected as the ROC).

The CCP team identified several blocks of riparian and floodplain forest habitat on the refuge that merit high consideration for conservation and restoration during the life of the CCP. Criteria for consideration included adjacency to other blocks of riparian habitat; being able to establish contiguous riparian corridors; contribution to stream conditions that enhance salmonid habitat; structural condition; size or width; and/or degree of exotic invasion.

4.6.2 Condition and Trends

Woody riparian habitats, interspersed with sloughs, overflow lakes, sedge meadows, and wet prairie originally covered a large portion of the lower Columbia River floodplain. Prior to 1900, riparian and floodplain habitats occupied a large percentage of bottomlands in the Portland-Vancouver Basin and Willamette Valley (Christy 2004). Clearing, diking and draining for agricultural development are primarily responsible for the decline (Altman and Holmes 2000). Likewise, riparian and floodplain forests occupy a smaller portion of the refuge than they formerly did, due to agricultural development prior to refuge establishment.

The condition of the remaining riparian habitat and floodplain forest on the refuge has deteriorated compared to historic conditions. Most stands on the refuge are second growth following clearing, although some Oregon ash trees are unquestionably older. Historically, Columbia sedge (*Carex aperta*) and stinging nettle (*Urtica dioica*) were dominant understory species in Oregon ash floodplain forests; these have been almost entirely replaced by reed canarygrass (Christy and Putera 1993). Stands of Oregon ash and black cottonwood suffer from poor recruitment due to the diminishing of flood events caused by dam operations, and therefore, the dynamic changes that occur in natural fluvial systems are being reduced. As a result, ash and cottonwood are represented mainly by dense, even-aged stands. Cottonwood recruitment requires new mineral soil deposited by flooding events (Braatne and Jamieson 2001), but can be stimulated by other means. For example, cottonwoods and willows recruited naturally in Wetland 008 on Bachelor Island (28 acres), following soil disturbance (disking associated with a wetland restoration project in 1999).

Early successional floodplain forest has also regenerated in the area west of Wigeon Lake South (“Wigeon Scrub” approximately 20 acres). North Rookery Field (33 acres) was a thick cottonwood/ash/ willow forest in the 1960s but was cleared prior to acquisition by the Service. By 2004 the extreme western portion had reverted to forest. Smaller areas of regeneration on Bachelor Island have occurred in Shop Pond, the south and east side of Wetland 11, and the northwest edge of Wetland 12. Natural regeneration and high survivorship of willow was noted in the Sand Pit Ponds (14.4 acres) on the Ridgeport Dairy Unit in 2004. Intensive wetland and pasture management on the River ‘S’ Unit has largely precluded riparian from establishing, however, the nonmanaged River ‘S’ Point wetland (16 acres) has been undergoing succession to forest. Willows regenerated naturally in Long Lake after a 2000 drawdown. A small willow stand has established in North Quigley Lake, and ash trees established naturally in the southwest section of West Hall Pasture, near the Millet Marsh levee, in 2003-2004.

The refuge has also undertaken a number of riparian and floodplain forest restoration projects since 1995. The purposes of these projects have included bank stabilization along Bachelor Slough and Wapato Portage; expanding riparian corridors along Gee Creek, Lake River, and the Columbia River; expanding nesting habitat for great blue herons and bald eagles; and buffering public use areas. Successful plantings include Wetland 14 and Great Horned Owl Field on Bachelor Island; North

River Pasture, Borrow Field, Sora Marsh East and Teal Marsh on the River ‘S’ Unit; and Gee Creek on the Carty Unit. The largest tract of Oregon ash floodplain forest is in the Roth Unit, it is approximately 300 acres. The Oregon ash on the refuge are second growth and not especially old, but if current trends continue, it is likely that older mature trees will not be replaced by new growth. At higher elevations there is a well developed understory of native shrubs, e.g. snowberry, Nootka rose, and oceanspray, with some nonnative blackberry invading the margins (USFWS 2004). However, due to past grazing practices, the understory of lower areas is dominated by reed canarygrass (*Phalaris arundinacea*), which has almost completely replaced native understory vegetation.

4.6.3 Associated Wildlife

Birds. The refuge’s riparian and floodplain forests host large numbers of breeding landbirds. Common breeding species in these habitats include downy woodpecker, northern flicker, western wood-pewee, Pacific slope flycatcher, tree swallow, common bushtit, Bewick’s wren, American robin, Swainson’s thrush, cedar waxwing, common yellowthroat, Wilson’s warbler, spotted towhee, song sparrow, and black-headed grosbeak. The nest-parasitic brown-headed cowbird commonly occurs in riparian habitats during spring and summer. As many as 50 bald eagles have been sighted using riparian trees on or near the refuge for roosts from December through March, and up to 6 pairs nest on or near the refuge. Until 2009, cottonwood forest on Bachelor Island supported one of the largest nesting colonies of great blue heron on the Columbia River.

Riparian areas are disproportionately important to bird species (Johnson and O’Neil 2001). Forty-nine native species are considered to be highly associated breeding species in riparian forest and shrub habitats in the Conservation Strategy for Landbirds in Lowlands and Valleys of Western Oregon and Washington (Altman and Holmes 2000). The following 11 species are considered by Altman to be focal species (those species highly associated with important attributes within each habitat and used to represent highly functioning ecosystems) for riparian woodland and shrub habitat in western Oregon and Washington (Table 4.2). Nine of the 11 species occur on the refuge and five are confirmed breeders.

Table 4.7 Focal Species for Riparian Woodland and Shrub Habitat in Western Oregon and Washington (adapted from Altman and Holmes 2000)

Habitat Type	Habitat Attribute	Species	Status on Refuge
Riparian Shrub	dense shrub layer	Willow flycatcher (D)*	B, S, F
	dense shrub layer	Yellow-breasted chat	S
Riparian Woodland	large canopy trees	Red-eyed vireo	B, S, F
	large canopy trees	Bullock’s oriole (D)	S, F
	subcanopy, tall shrub foliage	Yellow warbler	B, S
	dense shrub understory	Swainson’s thrush** (D)	B, S, F
	dense shrub understory	Wrentit (D)	Not confirmed
	snags	Downy woodpecker	B, R
	Large, structurally diverse patches	Yellow-billed cuckoo	Historically present in area; not confirmed
	Large, structurally diverse patches	Red-shouldered hawk	S, F, W
	Large, structurally diverse patches	Cooper’s hawk	R

*Selected as Priority ROC for early successional floodplain forest. **Selected as Priority ROC for mid-late successional floodplain forest. D=Significantly declining population trend in the Southern Pacific Rainforest BBS Physiographic Region. Refuge Status: B= Confirmed breeder on Refuge; S,F=Spring/fall migrant; W= winter; R=resident

A Monitoring Avian Productivity and Survivorship (MAPS) station operated on Bachelor Point between 1993 and 2003 (also see section 4.10, Research). This station sampled birds in floodplain forest habitat (cottonwood/ash forest), and was a relatively productive station with capture rates and number of species captured well above the average for stations in the region (DeSante et al. 2004).

A diverse suite of landbirds was captured at this site, included habitat generalists, species associated with early-successional or disturbed sites, and species highly associated with lowland riparian habitat, such as Swainson's thrush, Bullock's oriole, and willow flycatcher. These three species are considered to be focal species for riparian woodland and shrub habitat in western Oregon and Washington (Altman 2000). The data suggest that although riparian and floodplain forest on the refuge is degraded compared to historic conditions, it nevertheless retains significant value as habitat for riparian obligate species.

Table 4.8 Mean annual capture rates of target landbird species at Bachelor Point MAPS Station, 1993-2003.

Species	**Mean Annual Capture Rate** (1993-2003)	**Population Trend** (Southern Pacific Rainforest BBS Region) – = Declining, + = Increasing Significance Level in ( )
Willow Flycatcher	8.00	– (0.01<P≤0.05)
"Western" Flycatcher	4.11	– (0.05<P≤0.10)
Bewick's Wren	9.00	– (P>0.10)
House Wren	13.33	– (P>0.10)
Swainson's Thrush	31.22	– (P>0.10)
American Robin	16.22	– (P>0.10)
Common Yellowthroat	9.56	+
Wilson's Warbler	7.89	– (P≤0.01)
Spotted Towhee	4.67	+
Song Sparrow	47.89	– (P>0.10)
Black-headed Grosbeak	8.22	+
Brown-headed Cowbird	4.67	– (P>0.10)
Bullock's Oriole	6.56	– (P≤0.01)
House Finch	6.33	
American Goldfinch	21.00	– (P>0.10)
Total Number of species: 15 Number of target species: 14	Total capture rate 198.67. Capture rate of target species: 192.34	

Species shown in bold are focal species in PIF Bird Conservation Plans in one or more states. Data from DeSante et al. 2004.

Mammals. The most common large mammal occurring on the refuge is the mule deer. Riparian areas provide both forage and cover for this species and other mammals. Historically, Columbian white-tailed deer occurred on the refuge. Carnivores such as coyote (*Canis latrans*), raccoon (*Procyon lotor*), and striped skunk (*Mephitis mephitis*) are frequently seen on the refuge. An occasional cougar (*Felis concolor*) may visit the refuge.

Reptiles and Amphibians. Red-legged frogs (*Rana aurora*) use mid to late successional riparian and floodplain forest habitat, especially cottonwood with a relatively sparse, low understory structure, within 1-2 km of suitable breeding habitat. Many red-legged frogs were noted near the Bachelor Point MAPS station when it was in operation.

4.6.4 Key Ecological Attributes

Table 4.9 Early Successional Floodplain Forest Ecological Attributes, Indicators, and Condition Parameters

Key Ecological Attributes	Indicators	Desired Conditions
Vegetation structure and cover	• Mean canopy closure • Canopy tree heights • Shrub layer cover (woody veg 3-12 feet tall) • Openings • Age classes	• Less than 20% • Taller than 12 feet • 30%-80% • Scattered openings with herbaceous vegetation • Persistent early successional shrub
Native plant composition	• Trees • Shrubs • Herbaceous vegetation	• Primarily Pacific willow; also red-osier dogwood, young cottonwood. • Red-osier dogwood, willow, snowberry, Douglas' spirea, serviceberry, red elderberry, Indian-plum, cascara, rose. • Columbia sedge, green-sheathed sedge, wooly sedge, retrose sedge, stinging nettle.
Invasive species	Less than 30% cover of invasive plants (e.g. reed canarygrass, false indigo, and blackberry in understory/herbaceous layer)	
Hydrologic Regime	• Fluvial processes, timing • Water table height	• River and floodplain functions and processes intact or maintained artificially with structures; timing follows natural flooding hydrograph (historically, overbank flooding in spring with floodwaters persisting through summer) • Scouring and deposition of silts by floods; deposition occurs in patterns mimicking natural; no perched floodplain. • Water table available to trees and shrubs for most of the year
Disturbance Events	• Flooding • Public use • Grazing • Management activities	• Historically floods were major disturbance event' major floods every 10+ years • Restricted in breeding season (April 15-July 31) • None • Conduct habitat restoration, exotics control/erad-ication outside nesting season (April 15-July 31)
Patch Size/ Connectivity	• Patch size *or* contiguity with other riparian/floodplain forest • Riparian width • Distance from urban/residential areas	• Larger than 50 acres • Greater than 100 feet • Greater than 0.6 miles from urban/residential areas and greater than 3 miles from high-use cowbird areas

Source: Altman and Holmes 2000 (Biological Objectives for Willow Flycatcher, pg 87; General Conservation Strategies for Riparian Habitat, pp 82-83), Altman 1999, Chappell et Al. 2001, Guard 1995.

Table 4.10 Mid-late Successional Floodplain Forest Ecological Attributes, Indicators, and Condition Parameters.

Key Ecological Attributes	Indicators	Desired Conditions
Vegetation structure and cover	• Mean canopy closure • Dominant tree heights • Understory (shrub layer) cover • Snags and woody debris • Age classes • Vertical structural complexity	• Greater than 50% (Swainson's thrush) • Mean canopy tree height of 50 feet (Bullock's oriole) • Greater than 50% • More than 1.2 snags/ha (3/ac) greater than 30 cm (12 in) dbh and >6 m (20 ft) high (above water) (Purple martin) • Mature forest or a mix of early successional and older forest • Distinct canopy, subcanopy, understory layers, with a well developed understory shrub layer comprised primarily of native species
Native plant composition	• Canopy tree species • Subcanopy trees • Native shrub understory	• Black cottonwood, Pacific willow, Oregon ash • Black hawthorn, vine maple, big leaf maple, willow, ninebark, hazelnut, and young canopy trees. • More than 75% native species in shrub layer, including red-osier dogwood, snowberry, Douglas' spirea, serviceberry, red elderberry, Indian-plum, cascara, Nootka rose, willow, red alder, and saplings of native canopy trees.
Invasive Species	Less than 30% cover of invasive plants (e.g. reed canarygrass, blackberry) in understory/herbaceous layer	
Hydrologic Regime	• Fluvial processes, timing • Water table height	• As in Early Successional Riparian
Disturbance Events	• Flooding • Public use • Grazing • Management activities	• Historically floods were major disturbance event; major floods every 10+ years create areas of bare mineral soil needed for cottonwood recruitment • Low impact recreational activities that are not likely to adversely affect wildlife; prohibit public use in key areas (e.g. heron rookeries) during breeding season • None • Conduct habitat restoration, exotics control/ eradication outside the nesting season (i.e., April 15 - July 31)
Patch Size/ Connectivity	• Patch size *or* contiguity with other riparian/floodplain forest • Riparian width	• Greater than 100 acres, or greater than 0.5 miles in length (yellow-billed cuckoo) • Width of riparian woodland and shrub vegetation zone greater than 330 feet (yellow-billed cuckoo)

Source: Altman and Holmes 2000 (Biological Objectives for Swainson's thrush, pg 94; yellow-billed cuckoo, page 98; Bullock's oriole, page 90; purple martin, page 85); Chappell et al. 2001, Guard 1995.

Table 4.11 Oregon Ash Floodplain Forest Ecological Attributes, Indicators, and Condition Parameters.

Key Ecological Attributes	Indicators	Desired Conditions
Vegetation structure and cover	• Mean canopy closure • Dominant tree heights • Understory (shrub layer) cover • Snags and woody debris • Age classes • Vertical structure complexity	• >50% • >12 ft. overstory, large Oregon ash >12" DBH • <20% • Snags or old ash trees with cavities in or adjacent to open water (wood duck, tree swallow, purple martin); >5 snags/ac >6 in dbh and >6 ft tall; of these >2/ac should be >10 in dbh (downy woodpecker) • Mix of mature and young Oregon ash • Overstory of Oregon ash with sparse shrub layer
Native plant composition	• Canopy tree species • Native species in understory (shrub layer) • Herbaceous vegetation	• Oregon ash is dominant species • Native floodplain species such as Douglas' spirea, red-osier dogwood, snowberry, Nootka rose, and young (recruitment) sapling ash • >50% native species (e.g. stinging nettle, Columbia sedge, green-sheathed sedge, wooly sedge, retrorse sedge)
Invasive species	<30% cover of invasive plants (e.g. reed canarygrass, false indigo, and blackberry in understory/herbaceous layer)	
Hydrologic Regime	• Fluvial processes, timing • Water table height	• As in Early Successional Riparian
Disturbance Events	• Flooding • Public use • Grazing • Management activities	• Historically floods were major disturbance event; major floods every 10+ years • Low impact recreational activities that are not likely to adversely affect wildlife • None • Conduct habitat restoration, exotics control/ eradication outside the nesting season (April 15-July 31)
Patch Size/ Connectivity	• Patch size *or* contiguity with other riparian/floodplain forest • Riparian width	• >50 acres • >100 feet

Source: Altman and Holmes 2000 (Biological Objectives for downy woodpecker, pg 96; purple martin, page 85; General Conservation Strategies for Riparian Habitat, pp 82-83), Altman 1999, Chappell et al. 2001, Christy 2004, Guard 1995.

4.6.5 Threats

The primary threats to riparian and floodplain forests are a nonfunctioning floodplain, combined with intensive development of the floodplain. Historically, flooding was the primary natural disturbance regime in lower Columbia River bottomlands. Overbank flooding occurred annually in spring, and major spring floods occurred at longer intervals. Floodwaters scoured some areas, creating bare soil suitable for recruitment of black cottonwood, and deposited sediment in other areas. This dynamic system created a patchy mosaic of late and early-successional shrub and forest habitat. Hydropower operations have changed the hydrograph of the Columbia River so that major spring floods no longer occur, and dikes and levees have nearly eliminated overbank flows. Other threats include grazing, invasive species that compete with native plants and bind soil, habitat fragmentation, and proximity to sources of predators and nest competitors. The following threats to riparian and floodplain forest are summarized from Altman and Holmes (2000):

- Direct habitat loss due to clearing for farmland and urban development;
- Habitat alteration from (1) hydrological diversions and control of natural flooding regimes (e.g., dams) resulting in reduction of overall area of riparian habitat, loss of vertical stratification in riparian vegetation, and lack of recruitment of young cottonwoods, ash, willows, etc.; and (2) stream bank stabilization (e.g., riprap) which narrows stream channel, reduces the flood zone, and reduces extent of riparian vegetation habitat;
- Invasive exotic plants such as reed canary grass and blackberry, which compete with or completely exclude native understory plants and reduce recruitment of canopy tree saplings;
- Habitat degradation from overgrazing which can widen channels, raise water temperatures, reduce understory cover, and lead to exotic species replacing native understory vegetation;
- Fragmentation and loss of large tracts necessary for area-sensitive species such as yellow-billed cuckoo;
- Reductions in riparian corridor width which decreases habitat suitability for some species and may increase encroachment of nest predators and nest parasites to the interior of the stand;
- Proximity to agricultural and residential areas, may have high density of nest parasites (brown-headed cowbird), exotic nest competitors (European starling), and domestic predators (cats), and be subject to high levels of human disturbance;
- Recreational disturbances, particularly during nesting season of sensitive species such as great blue herons; and
- Increased use of pesticides and herbicides associated with agricultural practices, which may reduce insect food base for many landbirds.

4.7 Oregon White Oak Woodlands, Upland Mixed Woodlands

4.7.1 Description and Location

Oak Woodland. Oak woodlands can be found on the Carty Unit, including the Blackwater Island RNA. Oak woodlands are found in areas above the floodplain, 20 foot elevation and above, on well-drained Olympic stony clay loam overlying basalt outcrops (Wiberg and Greene 1981). The refuge's oak woodlands are classified as the Oregon white oak/ovalleaf viburnum/poison oak plant association (Chappell 2006). This habitat occupies approximately 70 acres of the refuge.

The Carty Unit's varied topography and soils creates a mosaic of plant communities and habitat types. Gee Creek winds its way through the Carty Unit in a series of tidally influenced, shallow lakes. The lakes are surrounded by seasonally flooded willow lowlands, bordering Oregon white oak stands on basalt islands. There is a narrow belt of Oregon ash between the willow and white oak stands. The basalt islands also contain ephemeral ponds and small patches (approximately 10 acres total) of grassland. The grassland patches occur on thin, well drained soil, and are dominated by introduced species, for example, poverty brome (*Bromus sterilis*) and orchardgrass (*Dactylis glomerata*). Some ephemeral ponds are habitat for the water howellia (*Howellia aquatilis*), federally listed as threatened in 1994 (Wiberg and Greene 1981; and USFWS 1994).

Two plant species listed as sensitive in Washington occur in Oregon white oak woodlands: the smallflower wakerobin (*Trillium parviflorum*) and tall bugbane (*Cimicifuga elata*). *T. parviflorum* has been found on the refuge, but tall bugbane has not. The slender-billed white-breasted nuthatch (*Sitta carolinensis aculeata*), a candidate for listing in Washington, occurs in this habitat. Wiberg and Greene (1981) also listed the western gray squirrel (*Sciurus griseus*) as likely to occur here, but its presence has not been confirmed.

Upland Mixed Forest. A small tract (approximately 15 acres) of upland mixed forest occurs on the refuge's Carty Unit. The forest type corresponds to the low elevation western hemlock forest of Franklin and Dyrness (1988). However, western hemlock typically does not become dominant or codominant until late successional stages; typical of early successional forest of this type, Douglas fir is the dominant conifer in this stand. Also typical of low elevation early to mid successional forest of this type, canopy trees are a mix of conifers (Douglas fir, western red cedar) and deciduous trees (e.g. bigleaf maple, red alder, and Oregon white oak, depending on site conditions). This forest has a well developed subcanopy of shrubs and smaller trees.

4.7.2 Condition and Trends

In western Washington, Oregon white oak woodland is a plant community of major conservation concern. Oak woodlands have declined in extent and have been significantly degraded by land conversion, fire suppression and subsequent conifer invasion, grazing, and invasion of nonnative plant species. The Oregon white oak/ovalleaf viburnum plant association was classified as a Priority 1 (endangered) ecosystem in the Washington Natural Heritage Plan (WDNR 2007). With the inclusion of the 115-acre Washougal Oaks Natural Area Preserve/Natural Resource Conservation Area in the Washington Natural Areas Program in 2008, this plant association was reclassified to Priority 2 (WDNR 2009).

Until the early 1800s, anthropogenic fire of various frequencies was probably characteristic of this habitat. Fire reduced encroachment by conifers and other competing species. Fire also opened up the understory, enhancing establishment and survival of oak saplings. In areas with short fire intervals the oak canopy was more open and the understory was dominated by grasses, while areas with longer intervals had a denser canopy and shrub understory. Historically, this area probably had had a relatively long fire interval compared to oak woodlands in the Willamette Valley. Fire has been absent from the Carty Unit for many decades, and possibly well over 100 years. As a consequence, Douglas fir has become more prevalent in the overstory.

The major disturbance to oak woodlands on the Carty Unit has been from livestock grazing. Grazing pressure was historically heavy but was reduced considerably after the refuge was established. Within the Carty Unit, lands within the Blackwater Island RNA received the least grazing pressure, but even this area was still accessible to cattle during periods of low water. Grazing was phased out on the Carty Unit starting in 1996, and has not occurred on the unit since 2001. Grazing resulted in changes to oak woodlands through decreased oak recruitment, reduction or loss of plant species not adapted to heavy grazing pressure, and the spread of exotic species, especially Himalayan blackberry, in the understory. Encroachment by blackberry is a major issue in upland mixed forest habitat as well. In some areas it dominates the shrub layer, excluding native shrubs and forbs.

4.7.3 Associated Wildlife

The refuge's oak woodlands are known to provide habitat for a suite of oak-associated landbird species that are now rare in western Washington, including the slender-billed white-breasted nuthatch, western scrub jay, and house wren. Other landbird species found in this habitat include Bewick's wren, western wood-pewee, downy woodpecker, and common bushtit. Refuge oak woodland may provide habitat for western gray squirrel, although the presence of this species has not been confirmed. Oak woodland is also utilized by reptiles such as northern alligator lizard and western skink. It potentially could provide habitat for the sharp-tailed snake, although its presence has not been confirmed. The Carty Unit's patchy mix of oak woodland, grassy openings, and ponds could provide suitable habitat for western pond turtles. Upland mixed forest provides habitat for landbirds associated with deciduous trees in multi-layered mature coniferous forests, such as orange-crowned warbler, Wilson's warbler, MacGillivray's warbler, Bewick's wren, song sparrow, spotted towhee, and rufous hummingbird.

4.7.4 Key Ecological Attributes

Table 4.12 Oregon White Oak Woodland Ecological Attributes, Indicators, and Condition Parameters

Key Ecological Attributes	Indicators	Desired Conditions
Vegetation structure	• Total canopy closure • Oak size • Shrub layer cover • Other	• 40-80%, primarily Oregon white oak • Mean dbh larger than 21 inches with 20% of oaks larger than 28 inches; young subcanopy oaks present • Greater than 40% • Large oaks with cavities
Native plant composition	• Non-oak cover in canopy • Shrub understory species	• Less than 10%; conifer cover less than 5% • Snowberry, poison oak, rose, Douglas' spirea, oval-leafed viburnum
Invasive species	Less than 20% cover of invasive plants (e.g., reed canarygrass, blackberry); less than 10% blackberry cover in shrub layer	
Animal species	Presence of acorn dispersing animals (e.g., squirrels, scrub jays)	
Patch Size	Contiguous minimum stand size 100 acres	
Disturbance Events	• Fire frequency and severity • Public use • Herbivory/grazing • Ground disturbance • Management activities	• Frequent (e.g. return interval approx. 5 years) low intensity fire; moderate or mosaic pattern • Low impact recreational activities that do not compromise oak regeneration and are not likely to adversely affect wildlife • No grazing or low density grazing for limited periods (Larsen and Morgan 1998) • None; leaf litter supports acorn germination • No thinning/brush removal during nesting season

Source: Altman and Holmes 2000, pp 61-63, 65-68* (Biological Objectives for White-breasted Nuthatch), Chappell et al. 2001, Larsen and Morgan 1998, Planning Team

Table 4.13 Upland Mixed Forest Ecological Attributes, Indicators, and Condition Parameters.

Key Ecological Attributes	Indicators	Desired Conditions
Vegetation structure	• Canopy cover • Subcanopy cover • Ground cover (forbs, ferns) • Snags • Downed woody debris • Age classes • Vertical structural complexity	• Greater than 50% • Greater than 30% cover deciduous shrubs and small trees (smaller than 15 feet tall) • Greater than 30% • For pileated woodpecker: Greater than 0.2 snag/acre greater than 30 inches dbh, and 12 foraging snags/acre greater than 10 inches dbh • 4 down logs per acre greater than 24 inches dbh for winter wren • Mix of mature forest and openings/edges in earlier successional stages • Multi-layered forests; well developed understory of shrubs and small trees
Native plant composition	• Canopy tree species • Subcanopy tree species (in addition to above) • Shrub species • Ground cover species (forbs and ferns)	• Mixed deciduous trees and conifers, e.g. Douglas-fir, western red cedar, grand fir, Oregon white oak, Oregon ash and bigleaf maple. • Black hawthorn, vine maple, beaked hazelnut. • Native species including poison oak, snowberry, rose, spirea, oval-leafed viburnum, native *Rubus* spp, ninebark, Indian-plum, tall Oregon grape, elderberry). • Major native component of flowering perennial herbaceous plants (e.g. Solomon's seal, trillium, lilies, columbine, sanicle)
Invasive species	• Less than 20% cover of invasive plants (e.g., reed canarygrass, blackberry) in understory layer	
Patch Size	• Patch size	• More than 74 acres for varied thrush, winter wren, brown creeper; 1,500 acres within 60% of landscape as suitable habitat for pileated woodpecker
Disturbance Events	• Fire • Drought • Public use • Grazing • Management activities	• Infrequent • Not frequent or severe • Low impact recreational activities that are not likely to adversely affect wildlife • None • No thinning/brush removal during nesting season

Source: Altman 1999, Planning Team

4.7.5 Threats

Oak Woodland. The two most significant threats to oak woodland communities are habitat loss from rural, residential, and urban development, and habitat loss and degradation due to fire suppression (Altman and Holmes 2000). Oak habitats were formerly maintained by fires of various frequencies which reduced encroachment by conifers and other competing species, and increased establishment and survival of oak saplings. Over the past 150 years, fire suppression has led to conifer encroachment, canopy closure, and reduced oak recruitment. Fire suppression has also promoted the spread of exotic shrubs (e.g. Himalayan blackberry) in the understory of oak woodland habitat, which results in decreased recruitment of young oaks. Overgrazing of oak seedlings by livestock also leads to reduced oak recruitment. Today, conifer and mixed deciduous/coniferous forests occupy large areas of former oak woodland habitat. These forests are often dominated by an overstory of Douglas fir, and an understory of exotics such as Himalayan blackberry.

Much oak woodland habitat is in private ownership, and the current distribution of oak woodland is patchy and discontinuous, with variable-sized patches of different quality. Oak woodland in close proximity to agricultural and residential areas may have a high density of nest parasites (brown-headed cowbird), exotic nest competitors (European starling), and domestic predators (cats), and be subject to high levels of human disturbance. Competition with European starlings for nest cavities may reduce reproductive success of species such as white-breasted nuthatch and western bluebird (Altman and Holmes 2000). Oak diseases such as anthracnose disease (*Gnomonia quericina*), which has caused significant damage to white oaks in Washington, are a potential concern (Campbell 2004). Reed canarygrass encroachment and canopy closure are the major threats to ephemeral ponds that support the federally threatened water howellia.

Free roam hiking is a potential source of soil and vegetation disturbance, reducing recruitment of oak seedlings, and spreading introduced plants. Free roam hiking is allowed on the Carty Unit, but current use appears to be low (public use on the Carty Unit accounts for only 15 percent of total refuge use). An increase in this use is expected if facility improvements and linkages to local trail systems are made; therefore, impacts to habitat will need to be monitored, and if the use is causing undesirable impacts to habitat, refuge management adjustments will be made.

Mixed Coniferous-Deciduous Forest. Much low-elevation coniferous forest in western Washington has been lost or greatly altered due to growth and expansion of urban, residential, and agricultural areas. Forest practices that truncated succession at rotation age (40-70 years) have resulted in a landscape dominated by early and mid-successional forests, with limited amounts of late-successional forests (Bunnell et al. 1997). Deciduous vegetation increases structural heterogeneity and vegetative diversity of early successional habitats (Morrison and Meslow 1983), which in turn increases overall biodiversity. A number of landbird species use the deciduous component of mixed coniferous-deciduous stands for foraging or nesting (Altman 1999). In managed forests, deciduous vegetation has been traditionally managed against, and as a result, some bird species highly associated with deciduous vegetation in early-successional habitats, such as orange-crowned warbler, rufous hummingbird, and MacGillivray’s warbler, have significantly declining populations in western Oregon and Washington. Currently, invasive plants are the most significant threat to upland mixed forest habitat on the refuge. Plants such as English ivy and Himalayan blackberry compete with native understory plants and forbs for light and space and may completely exclude them if left unchecked.

4.8 Instream Habitat

4.8.1 Description and Location

Gee Creek is a low-elevation, 4th order tributary of the Columbia River and occupies a watershed basin of approximately 12,000 acres, and empties into the Columbia River approximately a quarter mile upstream from the mouth of the Lewis River in Clark County, Washington. The drainage consists of a mainstem of approximately 11.5 miles in length, which branches into headwater tributaries, and a small mid-reach tributary locally named Tee Creek. The headwaters of Gee Creek are located in the southernmost portion of the watershed, just west of the Interstate 5 freeway (I-5). The creek crosses under I-5 several times before heading west-northwest toward the City of Ridgefield and the Columbia River (Clark County 2008). Gee Creek enters the Columbia River floodplain on the refuge's Carty Unit. The lower 3.75 miles of Gee Creek winds its way through the refuge in a series of lakes and ponds before emptying into the Columbia River. The lower reach of Gee Creek is tidally influenced. The creek joins the Columbia River between the mouth of Lake River and the mouth of the Lewis River, at approximately river mile 87.

Campbell Slough, which connects Campbell Lake to the Columbia River, was originally a backwater slough of the Columbia River. The slough is approximately 2.6 miles long and lies entirely within the refuge. Campbell Slough retains its connection to the Columbia River and is considered a permanent tidal riverine system.

4.8.2 Condition and Trends

Gee Creek's overall health is ranked as poor (Clark County 2004), reflecting 170 years of concentrated land use in the watershed that have reduced the quality and complexity of instream habitat. The primary land-use activities responsible for habitat degradation include forest clearing, agriculture, road building, and development. Much of the level and mildly sloping areas in the Gee Creek watershed were probably cleared for agriculture in the late 1800s and early 1900s. Forest cover in the lower (refuge), middle, and upper Gee Creek subwatersheds are 38 percent, 29 percent, and 18 percent respectively, all well below the threshold of 50 percent for a nonfunctioning watershed (Clark County 2008). Forest cover in the watershed is generally limited to narrow bands along streams. Since the 1950s the watershed has become increasingly developed, from mostly agricultural lands to a mix of agriculture, residential development, and industry. Portions of Gee Creek were straightened and culverts installed as part of various road projects (see Chapter 3). Collectively, these activities have increased water temperatures and turbidity, reduced woody debris, and changed run-off patterns (flashier flows in winter and reduced stream flow in summer). Flooding has probably increased in severity compared to historic conditions, as forest cover was reduced and impervious surface area in the basin increased (Clark County 2008).

Data from two monitoring stations at Abrams Park in Ridgefield, approximately one stream mile upstream of the refuge, indicate that Gee Creek has significant water quality issues related to temperature, dissolved oxygen, turbidity, and fecal coliform bacteria (see Chapter 3, Water Quality). The biological integrity of the benthic macroinvertebrate community measured at Abrams Park was on the low end of the moderate range (Clark County 2008); invertebrate assessments have not been conducted for the refuge portion of Gee Creek.

Gee Creek currently gets very limited use by anadromous fish and has been given a low regional recovery priority. The presence of nonnative warmwater fish is a significant issue in both Gee Creek and Campbell Slough (see section 4.1.5). Poor water quality in Gee Creek, including high turbidity and summer water temperatures, gives these fish a competitive advantage over native species. Cutthroat trout surveys in reaches of Gee Creek above the refuge (2002-2005) yielded low cutthroat numbers and high populations of warmwater fish, an unusual situation compared to other streams studied (Cornelius 2006). A report by the Bureau of Reclamation also identified a sediment barrier at the mouth of Gee Creek and channel disconnection/aggradation as significant issues (BOR 2004).

Restoration Efforts. In the spring of 2006, the Service and Washington State University's Clark County Extension initiated the Gee Creek Watershed Restoration Project to improve instream and riparian habitat throughout the Gee Creek watershed. Cooperators in the project included the Lower Columbia River Estuary Partnership, the Friends of Ridgefield National Wildlife Refuge, the City of Ridgefield, area schools, and local residents (WSU 2009). Funding for in-stream work on the refuge, other than site assessments and preliminary planning activities, has not been available. Most of the restoration work currently consists of invasive species control (primarily Japanese knotweed, Himalayan blackberry, and fragrant water lily) and streamside and floodplain plantings to increase forest cover and reduce stream temperature and bank erosion.

4.8.3 Associated Wildlife

Anecdotal evidence indicates that coho and chum salmon historically spawned in the upper reach of Gee Creek, but the last reported spawning was in the 1940s (Cornelius 2006). Although Gee Creek is heavily impacted by agricultural and urban development, it does provide some rearing habitat for juvenile salmonids, and year-round habitat for coastal cutthroat trout. A 1993 survey found juvenile Chinook salmon, and 1995-1997 surveys yielded juvenile Chinook, coho, and steelhead. A few juvenile coho salmon have been found in recent years (2002-2005) in the mid-lower reaches of the creek and juvenile Chinook salmon have recently been documented in the lower reaches during downstream migration (Cornelius 2006).

Coastal cutthroat trout have been reported for decades in Gee Creek and continue to use it in low numbers. In a recent Service study, juvenile coastal cutthroat were trapped in three lower Columbia River tributaries (2002-2004), including a 5-mile (8-km) stretch of Gee Creek, and fitted with Passive Integrated Transponder (PIT) tags to monitor their movements (Johnson et al. 2008). The study found that coastal cutthroat were an order of magnitude less abundant in Gee Creek than the two other streams sampled (only 132 cutthroats were captured over three seasons, compared to more than 1,000 in each of the other streams). Other native fish documented in Gee Creek during surveys conducted in the 1990s included northern pikeminnow, threespine stickleback, Western brook lamprey, largescale sucker (*Catostomus macrocheilus*), and sculpins (*Cottus* spp.) (Cornelius 2006). Other native fish that have been found in Gee Creek include Pacific smelt (eulachon), redside shiner, peamouth, speckled dace, longnose dace, and warmouth. Gee Creek also provides foraging habitat for bald eagle, osprey, river otter, and mink.

In general, during fish surveys of Campbell Slough conducted by NOAA/NMFS in 2007-2009, the most abundant species collected were carp, threespine stickleback, banded killifish, yellow perch, American shad, and juvenile Chinook salmon. Most of the juvenile salmon lacked fin clips, indicating a wild origin. Both juvenile Chinook and chum salmon were captured in 2008.

Several species of native anadromous salmonids, including Chinook and coho salmon, use waters adjacent to the refuge (Columbia River, Lake River, and Bachelor Slough) during their migrations upstream to spawning areas and downstream to the Pacific Ocean. Other native fish that use waters adjacent to the refuge include green and white sturgeon, Pacific lamprey, mountain whitefish, chiselmouth, longnose sucker, and bridgelip sucker.

4.8.4 Key Ecological Attributes

Intact riparian forest and total forest cover within watersheds are the most critical factors contributing to the quality of instream habitat. Research in the Pacific Northwest has shown that when forest cover declines below approximately 65 percent, watershed forming processes become degraded (Booth and Jackson 1997). These include reduced riparian shade, less delivery of woody debris to streams, increased storm water runoff, and increased fine sediment delivery. Riparian forest prevents erosion, keeping sediment loads in streams low; provides shade, reducing water temperatures in summer; provides a food source for aquatic invertebrates; and is a source for large woody debris. Large woody debris plays an important role by creating deep, low-velocity pools, providing fish cover, and trapping spawning gravel.

Table 4.14 Instream Ecological Attributes, Indicators, and Condition Parameters (Gee Creek, Campbell Slough)

Key Ecological Attributes	Desired Conditions
Hydrologic Regime	• Perennial water flows, tidal and periodic flooding. • Open, generally flowing water.
Habitat connectivity	• Connectivity between spawning areas, rearing areas, and ocean migration routes.
Habitat complexity (structure within the aquatic habitat)	• Large quantities of large woody debris in stream channel throughout the watershed. • High channel sinuosity. • Off-channel areas and/or large pools (larger than 50 square yards and deeper than 6 feet) available as rearing and adult holding areas for salmonids (WDFW 2000).
Water depth/velocity	• Velocities should not scour redds. • Egg deposition optimally is within a range of depths/velocities that minimizes risk of desiccation as water levels recede. • Multiple low velocity areas available as refugia for salmonid rearing during periods of high flow.
Water temperature	• 17.5°C (63.5°F) or colder, 7-day average of daily maximum temperatures (7-DADMax) * • 7-DADMax temperature 22°C (71.6°F) or colder and the 1-day maximum (1-DADMax) temperature 23°C (73.4°F) or colder to protect adult and juvenile salmonids from acute lethality*
Dissolved oxygen (DO)	• 1 day minimum DO 8.0 mg/L* (6.5 mg/L for rearing and migration only)*
Channel stability	• Gravels with low concentrations of fine sediments and organic materials are important for salmon spawning and incubation.
Turbidity	• Less than 5.5-7 NTU (Likely criterion for Gee Creek based on State standard for salmonid spawning, rearing and migration; Clark County 2008);

Key Ecological Attributes	Desired Conditions
	Less than 10.5-12NTU for rearing and migration only. • Maximum turbidity less than 70 NTU (Threshold for avoidance by juvenile coho salmon) • Fine sediments should not impact developing redds or negatively change the composition of invertebrates and other prey for salmonids. Sediment levels should not be high enough to cause salmon to delay or abandon spawning runs.
pH	• 6.5–8.5 units, with a human-caused variation within the above range of less than 0.5 units *
Toxics	• Toxic substances below levels that would cause acute or chronic toxicity to the most sensitive biota.
Riparian vegetation cover	• Intact mid-late successional riparian corridor. • Stream shading of 70% or more (moderately shaded).
Benthic macroinvertebrate diversity	• B-IBI (Benthic Macroinvertebrate Index of Biological Integrity) (Karr 1998) 25 or more (moderate biological integrity).
Nonnative fish and invertebrates	• Limit or exclude nonnative warmwater fish, including members of the sunfish family, bass, and crappie. • Limit or exclude habitat altering exotic fish and invertebrates, e.g. carp, zebra mussel.

Sources: EPA 1986, WDOE 2006, Clark County 2008, Bjornn and Reiser 1991, Karr 1998, WDFW 2000, Bisson and Bilby 1982
*WDOE Criterion in water bodies designated for salmonid spawning, rearing and migration unless otherwise specified

4.8.5 Threats

The most significant threats to instream habitat are upstream activities (forest clearing, residential and commercial development, and farming) that reduce water quality. Threats to instream habitat identified in Clark County's Steam Health Report (2004) include:

- Flashier runoff due to forest clearing, impervious surfaces of roads and buildings;
- High summer water temperatures and low dissolved oxygen, due to loss of riparian vegetation;
- High nitrogen and phosphorus levels, due to livestock, croplands, landscaped areas, broken sewer lines, and failing septic systems;
- E. coli and fecal coliform bacteria, due to livestock, broken sewer lines, and failing septic systems;
- Increased sediment in streams, due to land clearing, bare fields, construction projects, and channel erosion; and
- Toxic substances from urban areas and agricultural activities.

Increases in fine sediment in streams in the watershed have decreased survival of cutthroat trout eggs and alevins, reduced stream productivity and ultimately food availability, and decreased size and depth of pools which are important rearing and adult holding areas for cutthroat trout (WDFW 2000). A major erosion event in 2004, caused by insufficient erosion controls at a subdivision construction project a mile upstream of Abrams Park in Ridgefield, caused lasting damage to Gee Creek (WDOE 2008). A manure spill in 2001 caused a major fish kill in the creek (Cornelius 2006). Other threats to instream habitat are barriers to upstream spawning and rearing habitats, reduced structural complexity of habitat (due to channel straightening and lack of large woody debris), and presence of nonnative fish (see above).

4.9 Threatened, Endangered, and Sensitive Species

4.9.1 State or Federally Listed Species Known to Occur on the Refuge

One goal of the Refuge System is "To conserve, restore where appropriate, and enhance all species of fish, wildlife, and plants that are endangered or threatened with becoming endangered." In the policy clarifying the mission of the Refuge System, it is stated "We protect and manage candidate and proposed species to enhance their status and help preclude the need for listing." In accordance with this policy, the CCP planning team considered species with Federal or State status, and other special status species, in the planning process. Since the refuge occurs within the Willamette-Puget Trough ecoregion of Oregon and Washington, species listed in both states are included. Tables 4-15 through 4-19 list special status species known to occur on or historically occupy the refuge. Discussion follows the tables in section 4.9.2.

Table 4.15 Special Status Bird Species Known to Occur or Likely to Have Occurred on the Refuge Historically

Species	Federal	WA	OR	Current Occurrence on Refuge
Aleutian Canada goose	BCC	T (Rec. for State delisting)		Present fall-spring in very low numbers, in mixed flocks of geese. Observed on refuge in 1995, 2002-2003, 2005
American white pelican		E		Infrequently seen Jan.-July; wintering and migrant birds; nonbreeding subadults
Bald eagle		T	T	30-50 eagles winter on or near the refuge; 6 pairs nest on or near the refuge
Band-tailed pigeon	BCC			Occasional year-round.
Caspian tern	BCC			Infrequent observations
Common loon		S		Rare, Fall/winter/spring
Golden eagle		C		Rare
Lewis's woodpecker	BCC	C	S-Critical	Rare, fall/winter/spring.
Loggerhead shrike	BCC	C	S-Vulnerable	Rare, spring.
Long-billed curlew	BCC			Rare
Merlin		C		Occasional observations
Northern goshawk	BCC	C		Rare
Olive-sided flycatcher	BCC		S-Vulnerable	Occasional seasonal migrant, spring/summer/fall.
Oregon vesper sparrow	BCC	C	S-Critical	Rare, spring/fall.
Peregrine falcon, American	BCC	S	E	Occasional observations, all seasons; displaced birds reared on refuge

Species	Federal	WA	OR	Current Occurrence on Refuge
Pileated woodpecker		C		Resident and nests on refuge
Purple martin		C		Uncommon, spring/summer/fall. Breeding; 15 pairs nest on refuge.
Rufous hummingbird	BCC			Nests on refuge
Sandhill crane, Canadian (*G. c. rowani*)		E		The refuge and Sauvie Island, Oregon is a significant migration and wintering area. Fall roost averages 1,700 birds; winter population 700-800. Occasionally seen in summer. Unconfirmed breeding record from Bach. Island, late 1970s.
Short-billed dowitcher	BCC			Rare
Slender-billed white-breasted nuthatch	BCC	C		Resident, nests on refuge. Mainly confined to Vancouver vicinity, especially the refuge.
Streaked horned lark	BCC, C	E	S-Critical	Rare, fall.
Vaux's swift		C		Seasonal migrant; Uncommon summer/fall; occasional winter
Western bluebird		Monitored	S-Vulnerable	Rare, spring.
Western grebe		C		Occasional, fall/winter/spring
Western meadowlark			S-Critical (WV)	Occasional summer; uncommon fall-spring. Breeds on refuge
Willow flycatcher (ssp brewsteri)	BCC		S-Vulnerable	Uncommon spring/summer/fall. Breeds on refuge.
Yellow-breasted chat	BCC		S-Critical	Rare, spring/summer.

Key to Codes: E=Endangered, T=Threatened, C=Candidate, S=Sensitive, BCC=Birds of Conservation Concern,

Table 4.16 Special Status Mammals Known or Likely to have Occurred on the Refuge Historically

Species	Federal	WA	OR	Current Occurrence on Refuge
Brush Prairie (Northern) pocket gopher (*Thomomys talpoides douglassii*)		C		A subspecies known to Clark County, not confirmed on refuge
Columbian white-tailed deer	E	E	S-Vulnerable	Historically occurred on refuge; last confirmed sighting on refuge 1974-75 (Tabor 1976)
Gray-tailed vole *(Microtus canicaudus)*		C		A species known to Clark County, not confirmed on refuge
Mazama (Western) pocket gopher *(Thomomys mazama)*	C	T		A species historically present in Clark County; probably extinct in southwest Washington
Townsend's big-eared bat (Pacific ssp.)	SC	C	S-Critical	Within range of species; not confirmed on refuge

Species	Federal	WA	OR	Current Occurrence on Refuge
Western gray squirrel *(Sciurus griseus)*	SC	T	S-Undet. status	The refuge is in historic range and contains suitable oak habitat; not confirmed on refuge. Two or more reliable reports in Clark County in the last 5 years (Linders and Stinson 2006).
Yuma myotis	SC			Within range of species; not confirmed on refuge

Key to Codes: E=Endangered, T=Threatened, C=Candidate, S=Sensitive, SC=Species of Concern

Table 4.17 Special Status Reptiles and Amphibians Known to Occur or Likely to Have Occurred on the Refuge Historically

Species	Federal	WA	OR	Current Occurrence on Refuge
Western painted turtle			S-Critical	Occurs on the refuge, common
Western pond turtle	SC	E	S-Critical	Refuge in historic range, contains suitable habitat. Single adult found in 2005.
Western toad	SC	C	S-Vulnerable	Refuge in historic range. No documented occurrences in Clark Co. after 1984.
Northern red-legged frog	SC		S-Vulnerable (WV)	Occurs on refuge, uses suitable wetland and riparian habitat
Oregon spotted frog	C	E	S-Critical	Refuge in historic range. No documented occurrences in Clark Co. after 1984.

Key to Codes: E=Endangered, T=Threatened, C=Candidate, S=Sensitive, SC=Species of Concern, WV=Willamette Valley

Table 4.18 Special Status Fishes Occurring on the Refuge and in Surrounding Waters

Species	Federal	WA	OR	Current Occurrence on Refuge
Bull trout	T	SC		Records from Clark County, use of refuge unlikely
Chinook salmon (Lower Columbia ESU)	T	C	S-Critical	Columbia River migration takes fish past refuge. Refuge waterways may be utilized for rearing habitat. Juveniles trapped in Gee Creek in 1990s but not in 2002-2005 surveys. Juveniles trapped in Campbell Slough June 2007.
Chum salmon (Col R ESU)	T	C (Lwr Col R)	S-Critical	Refuge not utilized. Columbia River migration takes fish past refuge. Reported in Gee Creek in 1940s; extirpated.
Coastal cut-throat trout (SW WA/Col R DPS)	SC		S-Critical	Spawning documented in Gee Creek. Gee Creek utilized for rearing habitat.
Coho salmon (Lower Columbia ESU)	T		E	Refuge waterways may be utilized for rearing habitat. Juveniles trapped in Gee Creek in 1990s and 2002-2005 surveys. Spawning not known in watersheds adjoining the refuge.
Sockeye salmon (Snake R ESU)	E	C		Refuge not utilized. Columbia River migration takes fish past refuge.
Steelhead trout (Lower Columbia ESU)	T	C	S-Critical	Refuge not utilized. Columbia River migration takes fish past refuge. Spawning not known in watersheds adjoining the refuge. Juveniles trapped in Gee Creek in 1990s, not in 2002-2005 surveys.
Pacific smelt (Southern DPS)	T			Present in Gee Creek in low numbers; Columbia River migration takes fish past refuge
Western brook lamprey	SC			Large numbers of adults and ammocetes trapped in Gee Creek, 1995-1997; no adults and only 2 larvae in 2005

Key to Codes: E=Endangered, T=Threatened, C=Candidate, S=Sensitive, SC=Species of Concern

Table 4.19 Special Status Plants Known to Occur or Likely to have Occurred on the Refuge Historically

Species	Federal	WA	OR	Current Occurrence on Refuge
Bradshaw's desert parsley (*Lomatium bradshawii*)	E	E	E	Two known locations in Washington, both in Clark County; not documented on refuge. Experimental plantings on refuge in 2007. <u>Habitat:</u> Wet, seasonally flooded prairies and grasslands around creeks and small rivers. Associated species include tufted hairgrass, slender rush, sawbeak sedge, and one-sided sedge.
Golden paintbrush (*Castilleja levisecta*)	T	E	E	Historic record from Clark County; not documented on refuge. <u>Habitat:</u> Open grasslands, esp. glacial soils; often associated with *Festuca idahoensis* and *F. rubra* (Wentworth 2000).
Nelson's checker-mallow (*Sidalcea nelsoniana*)	T	E	T	Occurs in Cowlitz and Lewis counties; not documented on refuge. Experimental plantings on refuge in 2007. <u>Habitat:</u> A variety of open of habitats that undergo periodic flooding or soil saturation for extended periods of time; associated with tall fescue, common velvet grass, common rush, oxeye daisy, sweet vernal grass, and Canada thistle.
Pale larkspur (*Delphinium leucophaeum)* Syn: *D. nuttallii* ssp. *ochroleucum*	SC	E	E	One record from Lewis County. *D. nuttallii* noted on refuge (Wiberg and Greene 1981) but subspecies not noted. <u>Habitat:</u> Undisturbed sites on dry bluffs, open ground, and moist lowland meadows; now mostly confined to roadsides
Smallflower wakerobin (*Trillium parviflorum)* Syn: *T. chloropetalum*		S		Occurs on refuge. <u>Habitat:</u> Moist shady environments at upper elevations of riparian zones. Found in association with hardwoods, especially under ash, alder; and in Oregon white oak/oval leaf viburnum/poison oak plant association (Chappell 2006).
Tall bugbane (*Cimicifuga elata* var. *elata*)	SC	S		Occurs in Clark County, not documented on refuge. <u>Habitat:</u> Openings in or margins of mixed, mature or old growth stands of mesic coniferous forest, or mixed coniferous-deciduous forest. Associated species include Douglas fir, western red cedar, bigleaf maple.
Water howellia (*Howellia aquatilis*)	T	T		Occurs in small vernal ponds in the Carty Unit (only Clark County record). <u>Habitat:</u> Vernal pools and seasonal ponds
Wheeler's bluegrass (*Poa nervosa*)		S		Three known locations in Washington, in Clark and Cowlitz counties; not documented on refuge. <u>Habitat:</u> Rock outcrops and sparsely vegetated sites in woods that are dominated by Douglas fir, bigleaf maple, and Oregon white oak.

Key to Codes: E=Endangered, T=Threatened, C=Candidate, S=Sensitive, SC=Species of Concern. <u>Source:</u> Washington Natural Heritage Program

4.9.2 Condition and Trends of Washington State and Federally Listed Species and Habitats Utilized on the Refuge

Birds

Aleutian cackling goose (*Branta hutchinsii leucopareia*). The Aleutian cackling goose (formerly named Aleutian Canada goose) was delisted by the Service in 2001 and by the State of Oregon in 2005. The subspecies is still listed as threatened in Washington State but is recommended for delisting. Aleutian cackling geese migrate along the coastline of the Pacific Ocean. Washington provides stopover habitats for Aleutians during the fall and spring migration. The principal stopover location in Washington is Willapa National Wildlife Refuge and the fields surrounding Willapa Bay. Peak numbers of Aleutians are associated with the fall migration with up to 380 birds observed in November 1996 (Hays 1997). Infrequently, Aleutians have been observed inland at the Ridgefield Refuge. Occurrences of Aleutians in the vicinity of Ridgefield are most often several birds mixed within a larger flock of geese. Documented observations of Aleutians at Ridgefield Refuge include one neck-collared bird in 1995, four unmarked birds during the winter of 2002-2003, and two unmarked birds during the spring of 2005. In 1994, three Aleutians were shot during the State's hunt season. One bird was shot on Ridgefield Refuge and the other two were harvested from private lands near the refuge (Pitkin and Lowe 1995).

American white pelican (*Pelecanus erythrorhynchos*). American white pelicans are seen infrequently in southwest Washington with observations ranging from single birds to small flocks. Since the mid-1990s, pelicans have been observed on the refuge from January into July. All current and historic breeding colonies for American white pelicans have been documented on the east side of the State. The presence of pelicans at the refuge relates to wintering, migrant, or nonbreeding subadult birds.

Bald eagle (Haliaeetus leucocephalus). The bald eagle was delisted from threatened status by the Service in 2007, but is still listed by the State as threatened. Six pairs of bald eagles nest on the refuge or on adjoining private and public lands. Territories utilized by these nesting pairs presumably overlays portions of the refuge. Summer populations are comprised primarily of nesting birds, their offspring, and a few nonbreeding subadults. During the fall and winter, bald eagle populations at Ridgefield increase as migrant birds move into the area to feed on waterfowl and a variety of fish, including salmon and smelt. The nonbreeding population of eagles is not monitored at the refuge, however, bald eagles are commonly found throughout the fall and winter months, with an estimated 30 to 50 eagles spending portions of the migration and winter periods on or near the refuge. Many of these migrant eagles forage on salmonids during the period when fish are entering the Lewis River and Gee Creek. Bald eagles have been observed foraging along the major waterways around the refuge including Gee Creek, Lewis River, Bachelor Slough, Lake River, and the Columbia River. Eagles are observed regularly roosting in trees along these waterways. Eagles regularly roost along the section of Lake River between the River 'S' bridge north to the Ridgefield marina. Bald eagles also forage extensively on waterfowl within refuge boundaries.

Canadian sandhill crane (Grus canadensis rowani). All subspecies of sandhill cranes are listed as endangered in Washington State. Sandhill cranes on the refuge belong to a population that breeds in coastal British Columbia and southeast Alaska and migrates west of the Cascades. Morphometric and migration studies support assigning these birds to the Canadian subspecies (*Grus canadensis rowani)* (Littlefield and Ivey 2002; and Ivey et al. 2005). The lower Columbia River region is the only major stopover site for Canadian sandhill cranes between their northern breeding areas and wintering sites in California's Central Valley. Cranes generally forage primarily on corn crops and loaf along wetland edges. Canvasback Lake, on the Roth Unit, is an especially important roost site.

In recent years, up to 4,273 cranes have been counted in the area of Ridgefield Refuge and Sauvie Island, Oregon, during early fall (Littlefield and Ivey 2002). Local migrant populations peak from early to mid-October, with peaks of 1,500 cranes utilizing the refuge at this time. The only wintering areas for sandhill cranes in Washington are long the Columbia River between Woodland and Vancouver. Since the mid-1990s the number of wintering cranes on the lower Columbia River has been increasing. In the 1980s approximately 100 sandhill cranes wintered on the refuge and nearby Sauvie Island. That number has increased to a current level of approximately 700 to 800 birds.

There are no historical accounts of breeding sandhill cranes in southwest Washington. However, periodically cranes have been noted during the summer months on Ridgefield Refuge. The occasional presence of cranes on the refuge during the nesting season is presumed to be nonbreeding subadult birds. However, an unconfirmed breeding record of a nesting pair raising one chick was noted on Bachelor Island from the late 1970s (USFWS 1980).

The taxonomic status of the Canadian sandhill has been debated. Recent studies of crane genetics do not support a separate subspecies designation for *rowani*, and one study suggests that *rowani* is a hybrid of greater and lesser sandhill cranes (*tabida* and *Canadensis)* (Peterson et al. 2003). On the other hand, the "Canadian" sandhill differs from other subspecies in a variety of ways, including morphology, migration routes and timing, and chick development rates. Its breeding distribution is also distinct from the other subspecies (Ivey et al. 2005).

While some argue that the true "endangered" population in Washington is breeding greater sandhills (*G. c. tabida*), the Canadian sandhill is nevertheless of conservation concern due to its limited numbers, distinct coastal migration path, and habitat issues at breeding, staging, and wintering areas (Ivey et al. 2005). If Ivey's conclusions of *G. c. rowani* using the lower Columbia River are correct, then staging counts may represent the entire population nesting in coastal B.C. and southeast Alaska.

Peregrine falcon (Falco peregrinus): The peregrine falcon was delisted from threatened status by the Service in 1999 and is considered a Bird of Conservation Concern. However, peregrines are still State listed as endangered. Falcons are not known to nest on the refuge, but they are known to nest on cliffs in the Columbia River Gorge, and multiple bridges in the Portland metropolitan area. Peregrine falcons may utilize the refuge throughout the year, but occur more frequently from fall through spring as migrants move into the area to hunt for waterfowl and other prey.

Periodically, bridge repair and maintenance projects coincide with falcon nesting season. When conflict with a bridge project is imminent, falcon eggs are removed from the nest and hatched at a local wildlife care facility. In support of the falcon conservation project, a peregrine falcon hack tower was constructed on the refuge during spring 2003 by the Portland Audubon Society and other partners. As the young falcons mature, they are transported to an enclosure from which they are slowly acclimated and released to the wild, a process called hacking. Once the birds are mature enough to fly, the enclosure is opened and the falcons are allowed to fledge. In 2003, five peregrine falcons were hacked from the tower. In 2004, osprey nested on top of the hack tower and peregrines were released from an alternate location. No releases have been conducted on the refuge since 2003.

Mammals

Of 23 verified species of mammals on the refuge, none are federally or State listed. However the refuge lies within the historic range of one federally listed and one State listed species and may provide suitable habitat.

Columbian white-tailed deer (Odocoileus virginianus leucurus). Columbian white-tailed deer (CWT deer) occurred historically on the refuge. A 1971 survey reported that the subspecies was present in Columbia River bottomlands between Bonneville Dam and the Columbia County line in very low numbers. A single CWT deer was sighted on the refuge, in "grazed pasture near ash/cottonwood habitat" during a large mammal survey in 1974-1975 (Tabor 1976a). The revised recovery plan for the CWT deer noted that the refuge "may also have potential as a transplant site, although the existing habitat has not been evaluated for CWT deer suitability" (USFWS 1983). A feasibility study for the reintroduction of CWT deer, which will include an evaluation of habitat suitability, is part of this CCP.

Western gray squirrel (Sciurus griseus). The refuge lies within the historic range of the western gray squirrel and contains suitable habitat; however, its presence has not been confirmed. Western gray squirrels have been extirpated from much of their historic range due to habitat loss and competition with nonnative eastern gray squirrels.

Reptiles and Amphibians

Of 13 verified species of amphibians and reptiles on the refuge, none are federally or State listed. However, the refuge lies within the historic range of two State listed species and may provide habitat.

Western pond turtle (Actinemys marmorata) (Syn: Clemmys marmorata): The refuge lies within the historic range of the western pond turtle. The Carty Unit features a relatively large area of suitable habitat: Wetlands interspersed with uplands and islands of basalt rock. The thin, well-drained soils on the uplands support plant communities that typify the best pond turtle nesting habitat (Oregon white oak, wild rose, snowberry and poison oak with a limited amount of nonnative blackberry). Western pond turtles have been extirpated from much of their historic habitats in the lower Columbia River due to over-exploitation for food, habitat loss, altered river hydrology, invasive plants (which impede turtle migration between ponds), and introduction of nonnative, warmwater game fish and bullfrogs that prey upon turtle hatchlings and juveniles (Hays et al. 1999). A single turtle was captured by a refuge volunteer in fall 2005. In the summer of 2006, WDFW biologists attempted to locate western pond turtles on the refuge without success. Therefore, it is unclear if the single turtle was a relic of the original population or a released pet. The WDFW supports reintroduction of western pond turtles on the refuge due to the presence of suitable habitat.

Oregon spotted frog (Rana pretiosa). The refuge lies within the historic range of the Oregon spotted frog. Oregon spotted frogs have been extirpated from at least 78 percent of its historic range due to wetland loss, invasive plants such as reed canarygrass that reduce the value of wetland habitat, and introduced warmwater game fish and bullfrogs, which compete with or directly prey upon spotted frogs. This species has not been documented in Clark County since a specimen was collected in Brush Prairie, Washington, in 1962 (McAllister and Leonard 1997).

Fish

Because the refuge is located along the lower Columbia River, listed anadromous fish from upstream Evolutionary Significant Units (ESUs) may be present adjacent to the refuge in the Columbia River, Lake River, or Bachelor Slough at certain times of year. An ESU is a distinct population segment which is substantially reproductively isolated and represents an important component in the evolutionary legacy of the biological species.

Gee Creek, Campbell Slough, and Campbell Lake maintain connectivity to the Columbia River and may provide spawning or rearing habitat for federally listed and state listed species of fish (Table 4.17). Surveys of Gee Creek have documented use by salmonids and western brook lamprey during rearing and migration. Pacific smelt have also been documented in Gee Creek in low numbers. In June 2007, juvenile Chinook salmon were trapped in Campbell Slough. However, the suitability of this habitat for native fish, and the degree of utilization, has not been fully assessed. Fish are excluded from both the River ‘S’ Unit and Bachelor Island. The units are diked and lack designs to accommodate fish egress back to the Columbia River. Ingress of fish into these units is precluded by fish screens maintained on all input pumping stations.

Bull trout (Salvelinus confluentus). Bull trout occur in the mainstem of the Columbia River, but the species has not been found in refuge waterways. Habitat conditions apparently preclude spawning by bull trout and would not support an anadromous or resident population.

Chinook salmon (Oncorhynchus tshawytscha) Lower Columbia River ESU. The lower Columbia River Chinook salmon is the only Chinook ESU with the potential of occurring in refuge waters. Most of the ESU is represented by fall-run fish; it is unclear if any spring Chinook of natural origin still exist in this ESU. Other Chinook salmon ESUs migrating in the Columbia River include Snake River fall-run, Snake River spring/summer-run, and Upper Columbia River spring-run. In the late 1990s juvenile Chinook were sampled in Gee Creek by screw trap and electrofishing, however, electrofishing from 2002-2005 failed to locate any juveniles (Cornelius 2006). In June 2007, juvenile Chinook were trapped in Campbell Slough; these appeared to be of natural origin because only one had a clipped fin. No adult spawning occurs on the refuge; therefore, these juvenile Chinook were rearing in Campbell Slough rather than produced within the watershed.

Chum salmon (Oncorhynchus keta) Columbia River ESU. Chum salmon were historically abundant in the Lewis River basin and presumably, nearby tributaries of the Columbia, including Gee Creek. Historical adult populations produced from the Lewis Basin (including the mainstem, North, and East Forks of the Lewis River) are estimated from 120,000-300,000. Current natural spawning is estimated at less than 100 fish (Lower Columbia Fish Recovery Board 2004). The Lower Columbia Salmon Recovery and Fish and Wildlife Subbasin Plan (2004) lists chum use as “presumed” in the lower reach of Gee Creek and “potential” in the upper reach. There are historic accounts of chum and possibly coho spawning in Gee Creek prior to the 1950s (Cornelius 2006). The Columbia River ESU is known to migrate in the Columbia River past the refuge, but recent surveys have not indicated any use in refuge waters. Habitat conditions within refuge waters are apparently not suitable for chum salmon.

Coho salmon (Oncorhynchus kisutsch) Lower Columbia River ESU. A second-hand story was reported about coho salmon trying to get past a barrier in upper Gee Creek, near Royle Road, “prior to the 1950s" (Cornelius 2006). A 1951 fisheries report said that "silvers and chums utilize [Gee Creek]" and that "fair to good spawning areas" occurred above the lower 2 miles of Gee Creek slough. Coho juveniles are known to use Gee Creek within the refuge; it is also possible that they use the pond complex within the Carty Unit as rearing areas. In the late 1990s juvenile coho were sampled in Gee Creek by screw trap and electrofishing. Electrofishing during 2002-2005 also located juvenile coho in Gee Creek (Cornelius 2006); however, numbers were low compared to two other streams sampled on the lower Columbia. These coho are of uncertain origin. The absence of adult coho during surveys and lack of habitat within Gee Creek suggests that these juvenile coho were rearing in Gee Creek rather than produced within the watershed.

Sockeye salmon (Oncorhynchus nerka) Snake River ESU. The Snake River ESU is known to migrate in the Columbia River past the refuge, but surveys have not indicated any use of refuge waters.

Steelhead (Oncorhynchus mykiss) Lower Columbia ESU. Both adult and juvenile steelhead may be present year-round within the Columbia River, its tributaries, and adjoining aquatic habitats. The Upper Columbia River, Middle Columbia River, and Snake River Basin ESUs are known to migrate in the Columbia River past the refuge, but have not been collected on the refuge. Transient steelhead may enter lower Gee Creek from the Columbia during periods of juvenile freshwater rearing. In the late 1990s juvenile steelhead were sampled in Gee Creek by screw trap and electrofishing, however, electrofishing in 2002-2005 failed to locate any juveniles (Cornelius 2006). No adult spawning occurs on the refuge. All steelhead found within Gee Creek are assumed to be transient and spawned from another watershed.

Pacific smelt (Thaleichthys pacificus) Southern DPS. Pacific smelt were historically abundant in tributaries of the lower Columbia River. Like salmon, smelt are anadromous, returning to the Columbia at 3, 4, and 5 years of age, to spawn in the mainstem and its tributaries downstream of Bonneville Dam. Peak tributary abundance is usually in February, with variable abundance through March. Smelt typically spawn every year in the Cowlitz River, with inconsistent runs and spawning events occurring in the Grays, Elochoman, Lewis, Kalama, and Sandy rivers (Columbia Basin Bulletin 2009). Presumably, spawning occurred historically in Gee Creek as well. Smelt also migrate in the Columbia River past the refuge. Pacific smelt have been found in low numbers in surveys of Gee Creek (Cornelius 2006). Smelt abundance dropped precipitously in 2005 and has remained low since, prompting Federal listing of the species' southern population, which ranges from the Mad River in Northern California to the Skeena River in British Columbia (NOAA 2010).

Plants

Water howellia, Nelson's checkermallow, and Bradshaw's desert-parsley are the only listed plants known to occur on Ridgefield Refuge. Bradshaw's desert-parsley and Nelson's checkermallow may have been present historically; and experimental plantings were conducted in 2007. The refuge occurs within the historic range of the State-listed pale larkspur (see Table 4.18 above) however, its presence has not been verified.

Water howellia (Howellia aquatilis). This aquatic annual was discovered in 1897 by Thomas and Joseph Howell on Sauvie Island, Oregon. Water howellia is found in California, Washington, Idaho, and Montana, with over 150 known occurrences (since its discovery, it has become extinct in Oregon). However, the entire species occupies a total area of less than 200 acres of a very particular, ecologically fine-tuned, and easily disrupted habitat (Center for Plant Conservation 2009). The species is restricted to small pothole ponds or orphaned river oxbows that are seasonally inundated yet dry out in late summer or early fall. This annual inundation may help keep competing vegetation from becoming too well established (Washington Natural Heritage Program 1999). In Washington, water howellia has a limited distribution with remnant populations in the Columbia Basin and Puget lowlands. Water howellia was documented in several small ponds in the Carty Unit in the late 1970s (Wiberg and Greene 1981). This area is a complex mix of oak woodland, Oregon ash, and shrub. Reed canarygrass encroachment is a threat to water howellia in these ponds.

Bradshaw's desert-parsley (Lomatium bradshawii). This perennial plant was formerly common in native prairies of the Willamette Valley and the Puget Trough, and likely occurred on or in the vicinity of Ridgefield Refuge. Bradshaw's desert-parsley reproduced only by seed which germinates soon after falling from the flower; therefore, seed persistence in the soil is low. Frequent (2-3 times every 6 years) low intensity burns are required to maintain viability of this species (USFWS 1993). Restoration of historic wet meadow or prairie habitat would benefit this species. Experimental plantings were conducted in February 2007, with an additional planting of seedlings in the winter of 2007-2008.

Pale larkspur (Delphinium leucophaeum) Syn: *D. nuttallii* ssp. *ochroleucum*. This species is State listed as endangered in both Washington and Oregon. In Washington, there is one record of this species from Lewis County (Washington Natural Heritage Program 2005). *D. nuttallii* was noted as occurring on the refuge's Carty Unit by Wiberg and Greene (1981) but the subspecies was not noted. The habitat for this species includes undisturbed sites on dry bluffs, open ground, and moist lowland meadows. It is now mostly confined to roadsides. Threats to this species include land conversion to agriculture, grazing, and introduced species. Updated plant surveys are needed to confirm which *Delphinium* species occur on the Refuge.

4.9.3 Condition and Trends of Sensitive Species and Habitats Utilized on the Refuge

Great Blue Herons. The Bachelor Island Unit contains riparian (cottonwood) forest that for many years was home to the largest heron colony on record in Washington, and one of the largest on the Columbia River. Other refuge habitats, including seasonal and permanent wetlands, managed pastures, and grasslands, provide year-round foraging areas for herons. A 1972 survey found more than 500 nests in the colony, with an estimated production of 975 young (Tabor 1976). In 1973 the Bachelor Island colony reportedly had 773 active nests. The 2001 observation for this colony on file with WDFW reports 557 active nests (P. Thompson WDFW pers. comm. in Vennesland and Norman 2006). The rookery had 96 nests in 2009, but no adults were present during the survey and it is unclear if any young were fledged this year. Given the reduction in heron use, the refuge is minimizing trips into the site and not collecting fledgling rate data. Additional active colonies were located on the Ridgeport Dairy Unit during the summer of 2009 and will be monitored in 2010 to confirm use.

The most significant sources of stress to nesting great blue herons include human disturbance, predation by bald eagles and corvids (which can be exacerbated by human disturbance and habitat fragmentation), loss of foraging areas, and environmental contaminants (Vennesland and Norman 2006). Great blue herons are extremely sensitive to human disturbance during the nesting period, from nest initiation in February through fledging in late July. Herons may temporarily abandon nests in response to disturbance, which increases risk of predation by bald eagles and corvids. In some cases, wholesale colony abandonment may occur. Proximity to nesting bald eagles can also cause colony abandonment. Potential impact to great blue herons from recreational disturbance and recreation-induced habitat modification on adjacent WDNR land on Bachelor Island has been a concern.

Condition and Trends of Nesting Habitat. The primary great blue heron rookery on Bachelor Island was depleted in 2009 compared to the past 30 years, with only 96 active nests recorded during the spring survey. It is not yet known whether the colony will reform or the birds have relocated to another site. Rookeries at the north end of Bachelor Island and the west side of Carty Unit had six and seven nests respectively. At least two other small colonies (6 to 12 nests) were located in the Ridgeport Dairy Unit during the summer of 2009 and will be monitored for use in 2010.

Table 4.20 Ecological Attributes, Indicators, and Condition Parameters for Great Blue Heron Nesting Colonies and Associated Foraging Areas

Key Ecological Attributes	Indicators	Desired Conditions
Security	• Distance from human activity • Timing of public use • Amount/type of public use • Bald Eagles	• An 820–985-foot buffer between outer edge of colony and human activity from nest initiation (Feb 15) through fledging (July 31) (WDFW 2004). Herons are most sensitive to disturbance during nest initiation and early incubation.
Size	• Acres • Proximity to alternate nesting sites	• 10 acres or more • Several alternate forest stands at least 10 acre in size with dominant trees at least 56 feet tall within 2.5 miles of nesting colonies (Colonies with more than 50 nests will require a greater number of stands) (WDFW 2004)
Vegetation structure	• Tree height, structure, species	• Dominant trees at least 56 feet tall (WDFW 2004) • Trees of suitable size to provide nest platforms 6.6-100 feet (2-30 meters) above the ground (Butler 1997) • Open branch structure to provide access by adult birds; black cottonwood, bigleaf maple, and Douglas fir preferred
Food availability	• Proximity to foraging sites (wetlands, instream/riverine, improved pastures)	• Less than 9.3 miles (15 km) from suitable foraging areas (Butler 1991, 1992, and 1997)

Sources: WDFW 2004, Vennesland and Norman 2006, Quinn and Milner 2004

4.9.4 Key Ecological Attributes and Threats

Key ecological attributes and threats differ for each listed species, and are not described here in the interest of space. Federal and State recovery plans and other species specific documents are the best source for in-depth information on these species.

4.10 Wildlife and Habitat Research and Monitoring Efforts

A number of research and monitoring projects have been conducted at the refuge since it was established. Many are collaborative efforts between the refuge and other Service programs, other agencies, nongovernment organizations (NGOs), and universities. A number of refuge-specific monitoring projects were discontinued in 2004 due to cuts in staffing and funding.

4.10.1 Waterfowl Surveys

Mid-winter Waterfowl Surveys (1985-present)**.** The refuge has participated in the Mid-winter Waterfowl Surveys every year since 1985, with the exception of 2004, when weather prevented aerial surveys from occurring. These surveys count waterfowl populations utilizing the refuge and surrounding area. Surveys are conducted by the Migratory Bird Management Office (MBMO) with the Refuge Biologist serving as an aerial observer. Data from the annual surveys go to the MBMO, which calculates a flyway population total. The flyway totals do not provide a picture of local trends. However, the midwinter waterfowl data set contains considerable detail about distribution of birds at various scales, from a specific refuge unit to overall region. Even though the data generated from these surveys represent a snapshot of the numbers of waterfowl using the refuge on the particular day of the survey, and not total refuge wintering populations, the cumulative data taken over the years may provide an index to the numbers of waterfowl on the refuge and their trends over time. For midwinter counts of waterfowl on the refuge, see Figure 4.2.

Dusky Canada Goose Surveys (1999-present)**.** The refuge has participated annually in regional dusky Canada goose surveys conducted by the MBMO. This consists of weekly surveys conducted between October and March or April, done in conjunction with goose collar surveys. While these surveys provide a population index for the entire population, they are inadequate to discern population shifts on a local level. Updated information is needed on seasonal use patterns and distribution of Canada geese and cackling geese in Oregon and southwest Washington to understand how dusky Canada geese are redistributing themselves in wintering areas.

Canada and Cackling Goose Surveys (1993-2004)**.** In an effort to discern local trends, wintering Canada and cackling geese were surveyed on the refuge between 1993 and 2004. Monitoring was modified in 1999 to collect additional data on all refuge geese and their habitat use. These surveys supported regional efforts to obtain information about geese that had been captured and fitted with coded plastic neck collars. Data from these surveys were also used to assess flock compositions, peak populations, average populations, and goose utilization of individual wetland/field units. However, these goose surveys were suspended after 2004, due to funding declines that resulted in the loss of the biological technician position needed to conduct the daily surveys.

Multi-agency Goose Projects–Canada Goose Collar-reading Project (usually funded by MBMO) (1999-present)**:** Canada goose collar surveys have been conducted since 1999 on the refuge and consist of weekly surveys from October to March. Volunteers survey the majority of the refuge's goose habitat, recording numbers of each subspecies, the number of collared birds, and collar numbers/letters if readable. Data is submitted to the MBMO and reviewed by refuge staff to improve goose management on site.

4.10.2 Surveys for Listed Species and Other Species of Management Concern

Lower Columbia River Sandhill Crane Roost Survey (1991-present)**.** The refuge has partnered with The Nature Conservancy of Oregon to conduct sandhill crane roost surveys since 1991. The surveys are conducted in early October. A number of other crane surveys, studies and banding projects were terminated between 1998 and 2002 due to lack of staff.

Ridgefield Refuge Great Blue Heron Rookery Survey (1990-2009)**.** This survey is performed by volunteers in March. Bachelor Island had recently provided nesting habitat for over 400 pairs of great blue herons and great egrets. In 2009, the rookery was largely abandoned, and it is not clear if the birds will return or whether they have relocated. Heron colonies are quite sensitive to human disturbance, as well as availability of prey species, presence of raptors, water management, and presence of contaminants in river waters and sediments. Therefore, heron populations will continue to change and provide a good barometer of habitat integrity. Natural succession and habitat management regimes also affect these species' utilization of the refuge for foraging, roosting and nesting. Monitoring the rookery is essential for early identification of issues that may impact these populations.

Bald Eagle Nest Monitoring (1990-2009)**.** The refuge provides nesting and/or summer foraging habitat for up to 7 pairs of bald eagles. The reproductive success of these eagles has been monitored since 1990, by the Oregon Cooperative Fish and Wildlife Research Unit at Oregon State University as part of larger, cooperative, state-wide surveys that are still being conducted. Although the bald eagle has been delisted, monitoring of current nest sites and expansions on the refuge should continue, to ensure compliance with the Bald Eagle Protection Act, and to identify potential issues that may jeopardize nesting eagles.

Water Howellia Surveys (1995, 1998, annually since 2005)**.** Water howellia (*Howellia aquatilis*) was surveyed in 1995 and again in 1998. The 1995 surveys located two new populations. This species is resurveyed every year to verify species presence and assess habitat issues such as reed canarygrass encroachment.

Purple Martin Nest Monitoring (1998-present)**.** The refuge maintains four purple martin nest structures with 12 artificial nests (gourds). Volunteers set up the nests and report on any incidental observations. Nest occupancy has been more than 75 percent, achieving 100 percent most years.

4.10.3 Habitat and Vegetation Inventories, Surveys, and Monitoring

Pasture Vegetation Monitoring (1995-2003) and Wetland Plant Surveys. Vegetation monitoring in goose pastures was conducted using various techniques between 1995 and 2003. Loss of staff positions and funding has prevented collection of data on goose use and vegetation since 2003. Wetland plant surveys were conducted annually until the ricefield bulrush issue arose in 2002; it has never been summarized adequately.

Lower Columbia River Natural Area Inventory (1993)**.** Plant communities of several sites on the refuge (Blackwater Island RNA, Canvasback Lake, Campbell Lake, and the outlet of Campbell Lake) were described by Christy and Putera as part of their inventory of remnant native habitats on the floodplain of the lower Columbia River (river miles 0-143). As part of this study, sites were ranked by relative importance for use in setting priorities for protection.

Columbia River Riparian Habitat Inventory (1976)**.** Tabor (1976 a, b) surveyed riparian plant communities and associated wildlife of the refuge (including large and small mammals, and birds) as part of a habitat inventory along the Columbia and Snake rivers.

Blackwater Island Research Natural Area Vegetation Descriptions (1973 and 1981)**.** A vegetation description of the Blackwater Island RNA was developed by an undergraduate student from Portland State University (Morrison 1973). Subsequently, Wiberg and Greene (1981) published a description of the physical environment and plant communities of the RNA. The RNA is known to contain rare habitat types (Oregon white oak/ovalleaf viburnum/poison oak woodland and overflow plains) and support rare and sensitive species such as the threatened water howellia, and the slender-billed white breasted nuthatch, which is a Federal species of concern and a candidate for listing in Washington. Updated inventories are needed.

4.10.4 Habitat Restoration and Monitoring (Multi-agency coordination projects)

Gee Creek Restoration Project (2006-present)**.** In the spring of 2006, the Service and Washington State University's Clark County Extension initiated a joint effort to fund expanded watershed enhancement efforts, including the Gee Creek Watershed Restoration Project. Cooperators in the project include the Lower Columbia River Estuary Partnership (LCREP), the Friends of Ridgefield National Wildlife Refuge, the City of Ridgefield, area schools, and local residents. These partners work to maintain and enhance water quality and habitat conditions in Gee Creek by educating watershed residents about best management practices and identifying, prioritizing and developing watershed restoration projects; and by executing on-the-ground restoration, including tree plantings, stream habitat restoration, invasive plant control, water quality monitoring, and field assessments (WSU Clark County Extension 2009). Restoration project volunteers planted trees along Gee Creek on the refuge in 2006, 2007, and 2008, and have also conducted invasive plant control on the refuge.

Bachelor Slough Project (2003)**.** The refuge and the U.S. Army Corps of Engineers (ACE) partnered to evaluate channel improvements to Bachelor Slough that would improve channel flushing and the ability of the refuge to use the south Bachelor Island pump station. Elevation survey data were collected, but the project was not funded, and therefore, it was not implemented.

4.10.5 Invasive Species Monitoring and Studies of Control Techniques

Ricefield bulrush Monitoring and Eradication (2002-2009)**.** A volunteer-based control program was initiated in 2004 that consisted of searching, identifying, and mapping ricefield bulrush occurrences, and hand-pulling with some herbicide applications. Test plots were established in 2007 to identify effective herbicide treatments resulting in initiating significant herbicide treatments in 2009. These efforts will be continued aggressively for several years, since ricefield bulrush propagules exhibit long-term seedbank viability. It is expected that surveys and control efforts will be required at some level for years until the seedbank is depleted and the species is eradicated.

Reed Canarygrass Control Techniques (1994-1997)**.** Service biologists studied reed canarygrass control techniques on the refuge from 1994 to 1997 (Paveglio and Kilbride 2000, Kilbride and Paveglio 1999). Treatments (mowing, disking, herbicide application plus disking, and both single and multiple herbicide application), were performed in select seasonal wetlands in 1994 and 1995. Mean densities of reed canarygrass (stems per square meter) were monitored in the treated areas for three seasons (1995-1997). The authors concluded that the most effective treatment was a combination of herbicide (Rodeo) and disking, with a follow-up herbicide application during the next growing season.

4.10.6 Baseline Inventories of Major Fish and Wildlife Groups

Landbird Banding (1995-2003**).** Winter banding of songbirds occurred for many years between 1995 and 2003, providing information on species composition and some habitat use information.

Reptile and Amphibian Surveys (1995-2001**).** The refuge conducted pitfall trapping for amphibians (frogs and salamanders) and small mammals from 1995 to 1997 in selected habitats, which provided a good idea of what species occur and what habitats they use. However, not all species are sampled adequately by pitfalls, so gaps remain. The refuge also conducted frog breeding surveys on the River 'S' Unit in 2001; this provided additional information on habitats utilized for breeding as well as some data on other amphibian species. Painted turtle trapping occurred from 1996 to 2000; painted turtle telemetry was conducted in 2001. These studies provided data on turtle populations and habitat use on the River 'S' and Bachelor Island units. Information on nesting sites and production is lacking. Only the amphibian breeding information has been analyzed with a report written.

Fish Surveys (1993-2009**).** Surveys for fish have occurred over the past 15 years in part through specific fisheries studies conducted by the Columbia River Fisheries Program Office (CRFPO). These studies have occurred primarily on the Carty Unit within the Gee Creek system. Fish surveys were conducted for Gee Creek in 1993, 1995-1997, and 2002-2005 (Cornelius 2006). These surveys showed that while Gee Creek hosts primarily warm-water, nonnative species, it also supports rearing habitat for salmonids such as coho and Chinook salmon, and cutthroat trout. The National Marine Fisheries Service (NMFS) conducted general fish surveys in Campbell Slough in 2007, 2008, and 2009. Juvenile Chinook salmon (most without fin clips, indicating a wild origin) were found in the 2007 and 2008 surveys, and juvenile chum were found in 2008, as well as many species of introduced warmwater fish.

Inventory of Odonates for the Ridgefield Refuge Complex. Dennis Paulson (Slater Museum of Natural History, University of Puget Sound) and Jim Johnson (a local entomologist) collected odonates (dragonflies and damselflies) on the refuge.

4.10.7 Experimental Reintroductions

Experimental Reintroduction of Bradshaw's Lomatium and Nelson's Checkermallow (2007-2008**).** The Washington Natural Heritage Program has partnered with the Service's Ecological Services Office located in Lacey, Washington, to evaluate the feasibility and techniques for introducing two endangered Willamette Valley plants, Bradshaw's lomatium and Nelson's checkermallow. The refuge was identified as a site with good potential for reintroduction. An experimental planting design was developed for Bradshaw's lomatium (Arnett 2007). Test plantings were conducted in February 2007, with an additional planting of seedlings in the winter of 2007-2008. In fall 2007, 1,000 Nelson's checkermallow seedlings were outplanted on the refuge. Subsequent plantings were conducted in following years. During surveys conducted in 2009, plants were found on three sites on the refuge. A fourth site was surveyed, but no surviving plants were located. An evaluation of the refuge indicated that some marginal habitat for Bradshaw's lomatium was present along the Auto Tour Route, and seeding occurred in 2007. No plants have been detected during subsequent visits and no replanting has occurred.

4.10.8 Other Research Projects

Monitoring Avian Productivity and Survivorship (MAPS) (1993-2003)**.** Monitoring Avian Productivity and Survivorship (MAPS) is a research program created by the Institute for Bird Populations to assess and monitor the vital rates and population dynamics of North American landbirds. Partners in the MAPS program include the Service, the USDA Forest Service, the National Park Service, the U.S. Geological Survey's Biological Resources Division, the Department of Defense Legacy Resource Management Program, the National Audubon Society, and the International Neotropical Migratory Bird Conservation Initiative's Partners in Flight. The MAPS Program utilizes constant-effort mist netting and banding at hundreds of banding stations throughout North America. Analyses of MAPS data provide critical information relating to the ecology, conservation, and management of North American landbird populations and the factors responsible for changes in their populations. A MAPS station was maintained on Bachelor Point on the refuge for 10 years (1993-2003). This station sampled birds in lowland riparian habitat (cottonwood/ash riparian forest), one of five priority habitats in the region indentified in Partners in Flight Bird Conservation Plans.

A study of MAPS stations on national wildlife refuges (DeSante et al. 2004) showed that the Bachelor Point station was one of the most productive and diverse within the Pacific Northwest. The mean annual capture rate (199 adults per year) was well above the average of 90 adults per year, and the number of species captured annually (15 per year) was also well above the average (9), second only to William Finley Refuge in Oregon. Because of the relatively large number and species diversity of birds captured, the authors recommended that the Bachelor Point station be reinitiated if funding becomes available.

Study of Paternity in American Kestrels (2004-2006)**.** This study, conducted by students at Warner Pacific College in Portland, Oregon, examined paternity patterns of American Kestrels nesting on the refuge during the 2004-2006 breeding seasons (Alston et al. 2006, and Smith et al. 2006). Nest boxes were placed on the refuge in 2004 and 2006. Adult birds and chicks were banded, standard morphometric data was collected, and blood samples were collected. A DNA analysis was then conducted to determine the paternity of chicks.

Malformed Amphibian Study. Frogs were collected on the refuge in 2000 as part of a nationwide survey to determine the extent of abnormal frogs on national wildlife refuges (Hayes et al. 2001). Simple first-tier assessments of frog abnormalities were conducted in ponds, wetlands, puddles, and other water bodies on more than 145 refuges in 47 states (USFWS 2008). Analysis of data from this study may demonstrate trends that will help focus additional studies.

4.10.9 Contaminants Studies

Study of Food-chain Effects from Contaminants in the Columbia River (Buck 2004)**.** The purposes of this study were to:

- Determine and compare contaminant concentrations in sediment, aquatic invertebrates, fish, and bird eggs within various segments of the Columbia River (the lower Columbia River, below Bonneville Dam, and the mid-Columbia River associated with Umatilla Refuge);

- Compare concentrations in biota to guidance or reference levels, to identify primary contaminants of concern and resources at risk; and
- Derive biomagnification factors (BMFs) and target fish concentrations (TFCs, or concentrations in fish that would be protective of fish-eating birds) for persistent, bioaccumulative compounds. In 1990 and 1991, sediment, invertebrates (crayfish and clams), fish, and eggs of piscivorous and nonpiscivorous birds were collected from various river segments to determine contaminant concentrations, identify concentrations in biota that exceed guidance or reference levels, and derive apparent biomagnification factors (BMFs) for persistent, bioaccumulative compounds. Fish (carp, peamouth, and suckers), invertebrates (clams and crayfish), and sediment were sampled at the refuge in 1991. The author concluded that although bioaccumulative contaminants were near or below detection limits in sediment and invertebrates, the biomagnification of some organochlorines would likely result in adverse impacts to some piscivorous bird species.

Contaminants Studies of Carty Lake and Lake River (Kleinfelder 1993, Ecology and Environment 1996, Buck 2000, ongoing monitoring of groundwater wells). These studies documented contamination of groundwater and sediments resulting from operations of the Pacific Wood Treating (PWT) facility from 1964 to 1993. A Resource Conservation and Recovery Act (RCRA) facility investigation conducted for the PWR Corporation (Kleinfelder1993) documented wood-treating chemicals in sediment and water in and around surface water outfalls in both Carty Lake and Lake River. Contaminants documented onsite included PCP, volatile and semi-volatile organics, copper, chromium, and arsenic. A study conducted for EPA concluded that contaminants originating from the PWT site had migrated off-site and into refuge lands, including Carty Lake and adjacent wetlands (Ecology and Environment 1996). Groundwater in wells installed on the border of the refuge and the site at Carty Lake contained high levels of PCP.

A Preliminary Contaminants Assessment was conducted by the Service (Buck 2000). The objective of this study was to document environmental contaminants which may have entered the refuge from the adjacent PWT site through groundwater or surface water. The investigation included chemical analysis of sediment and fish collected adjacent to the PWT site and on the refuge. The main contaminants looked at in this study were PCP and trace elements, but it also looked at organochlorine pesticides, total PCBs, and chlorphenoxy herbicides. Sediment and fish samples were collected from Carty Lake, Bachelor Slough, Lake River, and a reference area near the refuge in June and July 1999. The data indicated that PCP and the trace elements arsenic, chromium, copper, and possibly lead and zinc were elevated on the refuge as a result of contaminant migrations from the PWT site.

Several monitoring wells have been installed in and around the PWT site to collect baseline data and monitor movement of contaminants off the PWT site during the steam-injection cleanup process. In the fall of 2000, EPA installed three clusters of monitoring wells (three wells per cluster) in the south end of Carty Lake. The Service installed three new wells in the fall of 2001, two approximately 82 feet (25m) north of the EPA well clusters, and one south of the EPA wells and closer to the PWT site. Baseline data was collected from the wells in January 2002, and wells were sampled on a quarterly basis thereafter, until September 2003.

Bald Eagle Productivity Study (USFWS 1999**).** This study examined the productivity of bald eagles nesting along the lower Columbia River, including pairs nesting on the refuge, and contaminant levels in eggs collected in 1994 and 1995. Although total productivity increased due to the success of new nesting pairs moving into the region, results indicated that organochlorine contaminants were continuing to impact the breeding success of eagles in the lower Columbia River. The Service, in cooperation with Oregon Cooperative Wildlife Research Unit at Oregon State University and the Lower Columbia River Estuary Program, planned to continue monitoring these eagles to see if the conditions of the Columbia River are improving for all species.

Effects of Contaminants on Great Blue Herons (Thomas and Anthony 1999)**.** The purpose of this study was to determine whether great blue herons would serve as a good monitoring species for contaminants in piscivorous (fish eating) birds from the Columbia and Willamette basins. A good indicator species should have a wide distribution, high food-chain status, nest fidelity, and low sensitivity to contaminants. Great blue herons on the lower Columbia and Willamette rivers meet all four criteria. Heron eggs were collected from six colonies in Oregon and Washington during 1994 and 1995, including the Bachelor Island colony. Eggs were analyzed for organochlorines (DDE), PCBs, dioxins, furans, and trace elements. Heron reproductive success (number of chicks fledged per occupied nest) was also studied. The authors concluded that contaminants do not impair great blue heron reproduction at the colony level in the Columbia and Willamette rivers, only at the individual level. The study demonstrated that herons can be used as an indicator species of environmental contamination.

4.10.10 Other Monitoring

Mosquito Population Surveillance. The Clark County Mosquito Control District, which has responsibility for mosquito control in the local area, has an annually renewed Special Use Permit with the refuge that allows mosquito crew members to visit the refuge to monitor larvae at specific sites and during specific time periods during the year. Monitoring consists of collecting dip samples from target wetlands.

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Chapter 5. Refuge Facilities and Public Use Programs

Wildlife observation, wildlife photography, waterfowl hunting, and environmental education are popular public uses on the Refuge/ USFWS

Chapter 5. Refuge Facilities and Public Use Programs

5.1 Infrastructure and Administrative Facilities

The infrastructure and facilities discussed in this section include boundary fences and markers, entrances, roads, trails, administrative buildings, easements and rights of way, and water-related structures.

5.1.1 Boundary Fences and Markers

The Ridgefield Refuge encompasses 5,218 acres. Its boundary is marked with Service boundary signs. Generally, the refuge's perimeter borders sloughs, creeks, and the Columbia River. It is the intent to accurately post the refuge's boundary; however, in select locations the boundary may be posted slightly inside the actual property line on high ground or dikes to avoid the potential loss of a sign due to flooding and bank erosion. Periodically, boundary signage is checked to identify and replace damaged and missing signs. Because much of the refuge's perimeter borders waterways, boundary fences are not maintained. Select fencing for the refuge's grazing program has been erected and is maintained. In portions of the Roth, River 'S', and Carty units, cattle fences may coincide with the refuge's boundary.

Entrances and Access Points. There are three official entrances to the refuge. Boating of navigable water surrounding the refuge is common; however, accessing the refuge from these waters is not allowed and constitutes trespass beyond the refuge boundary.

Carty Unit. The Carty Unit is accessed from Main Avenue approximately one mile north of the town of Ridgefield. The entrance is posted with a standard double-sided brown entrance sign with a footer board printed with the unit name. The sign was new in the summer of 2008 replacing a badly faded entrance sign with a bullet hole. Access to the Carty Unit is limited to daylight hours which are seasonally variable and announced on the refuge's website. Additionally, gate closure times are physically posted on the gate to avoid entrapments. Access is regulated by an automatic programmable gate off of Main Avenue at the road entrance to the Carty Unit.

Ridgeport Dairy Unit. The Ridgeport Dairy Unit is accessed from northwest Lower River Road approximately eight miles northwest of Vancouver, Washington. Formerly, Lower River Road (a State road) entered the refuge and terminated approximately 1.25 miles into the refuge boundary at a turn-around. Through an agreement with the State, the refuge was allowed to construct an automatic programmable gate at the boundary to preclude access to road segments bordering the refuge after dusk. The road was constructed on top of a flood control dike offering elevated overlooks over the Columbia River and refuge. Within the refuge, the road offered three parking lots for wildlife observation. These lots were additionally popular with anglers that used them to access the shore of the Columbia for sturgeon fishing. In 2004, erosion along the river's edge had narrowed the dike width to the road's edge. By July 2004, the road was collapsing and in 2005 the State closed the last 1.25 miles of road at the refuge's boundary with signage and concrete barriers. The former entrance is posted with a standard single-side brown entrance sign. This sign has been subject to considerable vandalism and is in poor condition.

River 'S' Unit. The River 'S' Unit is accessed from S. 9th Avenue (Hillhurst Road) approximately one mile southeast of Ridgefield, Washington. The entrance is posted with a standard double-sided brown entrance sign with a footer printed with the unit name. The sign was new in the summer of 2008 replacing an older single-sided sign facing the north. The single-sided sign facing south was stolen and had been missing for several years. Access to the River 'S' Unit is limited to daylight hours which are seasonally variable and announced on the refuge's website. Additionally, gate closure times are physically posted on both the gate and on a secondary sign near the start of the auto tour route to prevent entrapments. Access to the River 'S' Unit is regulated by an automatic programmable gate off of 9th Avenue across the entrance road.

Roads and Parking Areas

Carty Unit. There are 0.3 miles of gravel roads maintained for public access on the Carty Unit. Prior to 2005, the road was a loop road of approximately 0.2 miles. The road and parking lot was expanded in the spring of 2005 to accommodate additional parking needs for Cathlapotle Plankhouse events and relocation of the refuge complex's headquarters to the Carty Unit. The Carty Unit has two parking areas accessible from the public roads. The lower parking lot serves the restroom facilities, Cathlapotle Plankhouse, and Oaks to Wetlands trailhead. The upper parking lot functions as overflow parking for the lower lot and serves as parking for the headquarters. Three gates regulate public access from public roads within the Carty Unit. The primary gate is at the refuge's entrance off of Main Avenue allowing public access during daylight hours by means of an automatic programmable gate. Another gate precludes public access to the Carty Unit from the parking area above the BNSF railroad tracks, while allowing vehicular access for railroad, refuge, refuge-approved, and public safety personnel. A third gate accommodates easement-granted access to adjoining private land while routing general public access through the automated programmable entrance gate.

Ridgeport Dairy Unit. Until 2005, the public had access to the Ridgeport Dairy from Vancouver, Washington, along Lower River Road (SR 501). The State closed Lower River Road at the refuge's boundary due to road failure in July of 2005. In January 2006, the State abandoned its right of way from milepost (MP) 11.40 to MP 12.72, and transferred jurisdiction for that road segment to Clark County. Prior to the closure, Lower River Road offered elevated views of both the Columbia River and refuge. The paved road was utilized by the public for driving, hiking, and biking. The refuge maintained three parking areas along the margins of the road for wildlife observation. The parking areas were additionally popular with anglers, for accessing to the Columbia River.

Prior to the Lower River Road closure, the refuge maintained four gates along the terminal 1.25-mile segment of the road that bordered the Ridgeport Dairy Unit. Three of these gates restricted public access from Lower River Road to Service-owned roads, fields, facilities, and closed areas within the Ridgeport Dairy Unit. The fourth gate was an automatic programmable gate that limited access to the Ridgeport Dairy Unit to daylight hours. With the road closure, only one of three parking areas is functional along Lower River Road. All other parking areas are beyond the road closure. The automatic gate has fallen to disrepair and road access is blocked near the boundary by concrete barriers the State installed.

River 'S' Unit: The River 'S' Unit has a graveled 4.3-mile auto tour route open to the general public year-round. The auto tour route is restricted to vehicle traffic from October 1 to April 30, with foot traffic additionally allowed from May 1 to September 30. The auto tour route has three developed parking areas. The first parking area near the beginning of the auto tour route serves the visitor contact station, restroom, and entrance fee collection kiosk. The next lot is paved and allows year-round access to a restroom, short trail, and observation blind. The last parking lot of the auto tour route offers seasonal, May 1 to September 30, access to the Kiwa hiking trail. The auto tour route also has several established turnouts to facilitate safe passage for faster moving vehicles. Off of the auto tour route, all service and hunter access roads are gated or cabled to prevent access into closed areas of the unit. Access to the River 'S' Unit is allowed during daylight hours and regulated by an automatic programmable gate off of 9th Avenue. The remaining road segment open to the general public is a road easement that connects 9th Avenue to the auto tour route. This 0.4-mile road segment parallels a forested canyon, crosses an easement over the railroad tracks, and accesses the River 'S' Unit by bridge.

Approximately one mile into the auto tour route, a programmable gate regulates access to the River 'S' Unit's waterfowl hunt area and hunter check station. The gate only allows hunter access to the hunt area on refuge hunt days during the general waterfowl hunting season, currently Tuesdays, Thursdays, and Saturdays from mid-October to late January. Within the hunt area, there are approximately 2.8 miles of graveled road and 7 parking areas developed to serve the hunting area. In addition, a programmable gate near the hunter check station limits access at the Bachelor Island Bridge to refuge staff and authorized volunteers.

Trails

Carty Unit. Starting near the headquarters office is the 2-mile Oaks to Wetlands Trail. The Oaks to Wetlands trail starts with a pedestrian bridge over the BNSF railroad tracks and passes the Cathlapotle Plankhouse. Beyond the Plankhouse, the route is a series of braided trails that transect coniferous forests, oak woodlands, wetlands, and basalt outcroppings. With numerous loop options the trail can range from flat and developed to steep and rustic, as the visitor gets farther from the trailhead. The trail surface ranges from asphalt at the trailhead, to compacted gravel up to the Plankhouse, to native soil beyond the Plankhouse. The trail is open year-round during daylight hours except the north loop. The north loop is located on private property and is open with permission from the landowner from March 1 to September 30. The trail closure is posted along the trail during the winter months. The Oaks to Wetlands Trail was recognized by the Department of the Interior in June 2005 as a National Recreation Trail in the National Trail System.

River 'S' Unit. The River 'S' Unit offers several trail options. The primary trail of the River 'S' Unit is the 1.1-mile Kiwa Trail. The Kiwa Trail is a loop trail open to the public seasonally from May 1 to September 30. The trail surface is flat consisting of compacted gravel and two short boardwalks and is well suited for visitors of all abilities. The trail provides visitors opportunities to view wildlife in a mix of floodplain habitats, including emergent wetlands, grasslands, and Oregon ash forests. Visitors are also currently allowed to seasonally hike the auto tour route from May 1 to September 30. Generally, the seasonal use of the auto tour route by pedestrians is for short walks from parked cars or parking lots to facilitate wildlife observation and photography. The length of the route, seasonal dust, and distraction of vehicles likely limits the use of the auto tour route as a major hiking trail. The other trail open to the general public on the River 'S' Unit is a short year-round asphalt trail through a gallery of Oregon ash connecting the observation blind to the parking area.

Within the River 'S' Unit's fee hunt area a trail network is seasonally mowed by refuge staff to provide waterfowl hunters access to designated hunting blinds. These trails are several miles in length and to the fullest extent possible utilize secondary maintenance roads and internal dikes to reduce annual trail maintenance needs.

Administrative Facilities

Bachelor Island Unit. The Bachelor Island Unit contains the majority of the infrastructure associated with refuge maintenance and operations. The island has a large maintenance shop with four offices for refuge staff and partners. Other structures to support refuge maintenance include an equipment storage building, a hazmat building, a pump house, and fueling stations. Within the compound containing these facilities is one small government-owned farmhouse that serves as temporary quarters for refuge staff and volunteers.

Carty Unit. The refuge's headquarters is located off of Main Avenue one mile north of downtown Ridgefield. The headquarters currently consists of a prefabricated building with five offices accommodating seven staff members including contractors. The only other structure on the Carty Unit is the Cathlapotle Plankhouse, a replica Native American longhouse. The Plankhouse serves a primary environmental education function for the refuge, providing a tangible educational experience for sharing information about the refuge's valuable cultural and natural resources.

Roth Unit. The Roth Unit is undiked and remains in the floodplain of the Columbia River. Therefore, construction of permanent facilities has been limited. With the acquisition of Roth Unit parcels, the refuge acquired a small barn. Due to its remote location, the barn is not particularly functional and is generally not used by the Refuge.

Ridgeport Dairy Unit. The Ridgeport Dairy Unit had a government-owned residence that provided living quarters for refuge staff and volunteers. The closure of Lower River Road limited access to this location and precluded residential use. Once the house was vacated, it became a frequent target of vandalism and break-ins. Evidence of illicit and criminal activities prompted the Service to demolish the building in 2008.

River 'S' Unit. There are several administrative facilities on the River 'S' Unit. Largely, these structures are used for storage. They include a nine-bay shed, a three-bay covered area, and two small storage sheds. Near the entrance to the River 'S' Unit is a small building that serves as the visitor contact station. This building is staffed by refuge volunteers offering visitor information and orientation. The other administrative site on the River 'S' Unit is the hunter check station that serves as a seasonal office for a temporary check station employee.

Easements and Rights-of-Way

The Service has been granted several important easements critical to accessing various units of the refuge. The 0.4-mile road that provides access to the River 'S' Unit from 9th Avenue is an easement that was granted when the unit was acquired. Additionally, River 'S' access is achieved via an easement for at-grade crossings over the railroad tracks east of the River 'S' Bridge. Access to the Carty Unit for visitors is achieved via an easement for a pedestrian bridge over the railroad tracks. At-grade crossings over the railroad tracks to the Carty Unit are allowed by easement, but crossings are to be controlled by a locked gate. Other right-of-ways on record relate to water intake or discharge over second class tidelands in State jurisdiction, and utilities (phone/electric) crossing the refuge to serve refuge facilities.

Dikes, Irrigation, and Water Control Structures

Bachelor Island Unit. The wetland system on Bachelor Island was largely redesigned in 1998. New wetlands were created, select wetland basins were expanded, and several steep banked wetlands were re-contoured. Additional improvements were made to the water delivery and control systems including two new intake pumps, buried delivery pipes, delivery valves, and water control structures. There are 21 wetland basins on Bachelor Island with water management potential, including water control structures and water delivery capability. At full capacity, the refuge could manage nearly 400 acres of wetlands on Bachelor Island. Realistically, the Columbia River's water level, seasonal rainfall, and soil characteristics of each wetland basin dictate the overall acreage of wetlands managed on Bachelor Island. Most wetland basins on Bachelor Island collect water from seasonal rainfall, with approximately 250 acres of wetlands by mid-winter. Active irrigation of wetlands on Bachelor Island is reserved for select wetlands with proven water retention capabilities. All Bachelor Island wetlands drain with the island's natural topography to the north, eventually feeding to a common drainage pond equipped with a series of expulsion pumps.

Carty Unit. The Carty Unit is part of the Columbia River floodplain with no water management.

Roth Unit. The Roth Unit is part of the Columbia River floodplain with no water management.

Ridgeport Dairy Unit. Wetland improvements were initiated on the Ridgeport Dairy Unit in 1998 with the re-contouring and disking of the Hillocks, Fingers, and Dusky marshes. The water system was improved with the installation of a pump station, delivery pipes, valves, and water control structures on the marshes. The three marshes (or basins) represent the managed wetlands of the Ridgeport Dairy Unit, designed with water delivery structures and dewatering infrastructure to regulate water levels.

Campbell Lake has a water control structure on its south end that facilitates drainage for the Hillocks and Fingers marshes, but this structure is not intended to manage levels within Campbell Lake. Campbell Lake is still a floodplain wetland with direct connection to the Columbia River via Campbell Slough. Post Office Lake has partial water management capabilities in that it has a water control structure on its drain. Water delivery to the lake could be achieved by routing water through Dusky Marsh. The inefficiencies of this delivery mechanism coupled with the size of Post Office Lake make this water delivery option tenuous. Post Office Lake is additionally fitted with a 'duckbill' tide gate to prevent floodwater from backfilling into the basin and fish entrapment within the wetland.

River 'S' Unit. The River 'S' Unit is generally sloping from south to north. Water is expelled from the unit by pumps on the north end. Water intake is achieved through three pumps at two pumping stations. Both pump stations take water from Bachelor Slough. Tides impact operation of both pump stations limiting water availability during low tides. The northern pump station supplies a network of pipes and valves designed to either independently deliver water to four wetlands or to supplement water delivery to the main fill ditch. The southern pump station directly fills the main fill ditch. Water delivered to the main fill ditch gravity feeds into Bower Slough. When filled, Bower Slough serves as the water reservoir for filling most of the wetlands of River 'S' Unit. Earthen dikes and ditches from Bower Slough fitted with water control structures supply water to the wetland network.

5.2 Recreation Overview

5.2.1 Open and Closed Areas

Open Areas. The Carty Unit is open year-round during daylight hours for wildlife-dependent recreation with most use occurring along the Oaks to Wetlands Trail. The auto tour route of the River 'S' Unit is open to vehicles year-round during daylight hours for wildlife observation and photography. Off of the auto tour route, the observation blind is open year-round for pedestrian access from the parking lot to the blind.

Seasonally Open Areas. The Kiwa Trail and auto tour route on the River 'S' Unit are both open for hiking from May 1 to September 30 during daylight hours. The refuge was established primarily to offer wintering habitat for waterfowl, particularly dusky Canada geese. The selection of trail dates on the River 'S' Unit is strategic to separate pedestrians from wintering concentrations of waterfowl utilizing the area. The refuge provides a regulated, spaced-blind waterfowl hunt program on approximately 760 acres of the River 'S' Unit. Access to the 21-blind hunt area is permitted three days a week by fee during the regular State waterfowl season (mid-October to late-January). Hours for waterfowl hunter access in the hunting area are extended sufficiently before and after daylight to accommodate check-in and check-out procedures and provide hunting opportunities during all hunting hours.

Closed Areas. Refuge-owned portions of the Bachelor Island, Ridgeport Dairy, and Roth Units are closed to public use.

5.2.2 Annual Recreation Visitors

In close proximity to the refuge is the Portland metropolitan area with a combined population of over 2 million people. During the 2007 fiscal year, the refuge had an estimated 93,241 visitors. Overall annual visitation of the refuge is rapidly growing. Figure 5.1 shows visitation trends expressed in averages for each decade since the refuge was established. Admittedly, the means and methods of reporting visitation data have been variable over the years, but the graph suggests a significant increase in public use with time. The data shows that the average annual visitation in the 1960s was just over 8,800 visitors. Visitation in the 1980s had grown to 22,000 visitors annually. The average number of visitors annually from 2000 to 2007 has been more than 162,000. The apparent decline in visitation in 2007 relates to both different methodologies in reporting visitation and to the closure of the end of Lower River Road. From 2000 to 2005, the public had access to the south end of the refuge from Vancouver, Washington. Recreational opportunities occurring along Lower River Road bordering the refuge formerly included wildlife observation, photography, hiking, jogging, fishing, and biking. The road closure in 2005 closed a popular access point to refuge parking areas and overlooks for multiple recreational opportunities and has reduced overall reported refuge visitation in recent years.

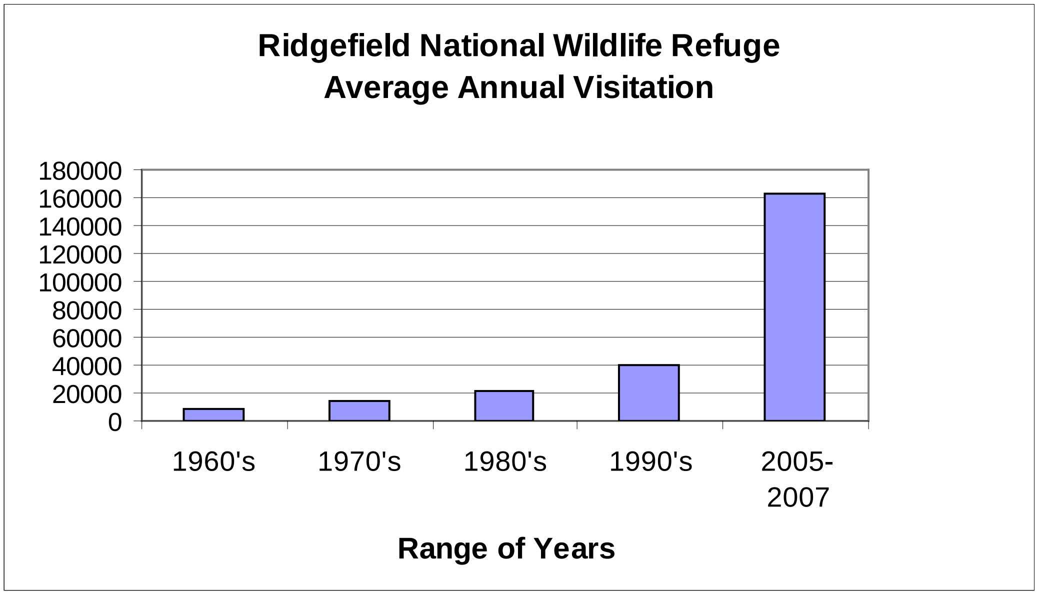


Figure 5.1 Average annual visitation to Ridgefield Refuge, 1965-2007

5.2.3 Annual Recreation Visits

Recreational visits differ from overall annual visitors. A visitor is a member of the public coming to the refuge to participate in an activity. In most instances, a visitor may engage in multiple activities. For example, one visitor may watch birds along the Oaks to Wetlands Trail, visit the Plankhouse, and drive the auto tour route on their trip home. In this example, the visitor actually visited three distinct locations. The activities of the visitor are considered visits. One visitor can register multiple visits in one trip and the annual sum of visits is always more than the number of visitors. Visits are measured by a variety of direct and indirect methods. Trail and vehicular visits are measured by counters installed along these routes. Plankhouse, educational, hunting, and special event visits are directly counted by staff or volunteers conducting these activities. Other visit numbers may be estimated by staff and volunteers via informal observations of the frequency of an activity. The overall Ridgefield Refuge visit trends for Fiscal Year 2007 are exhibited in Figure 5.2.

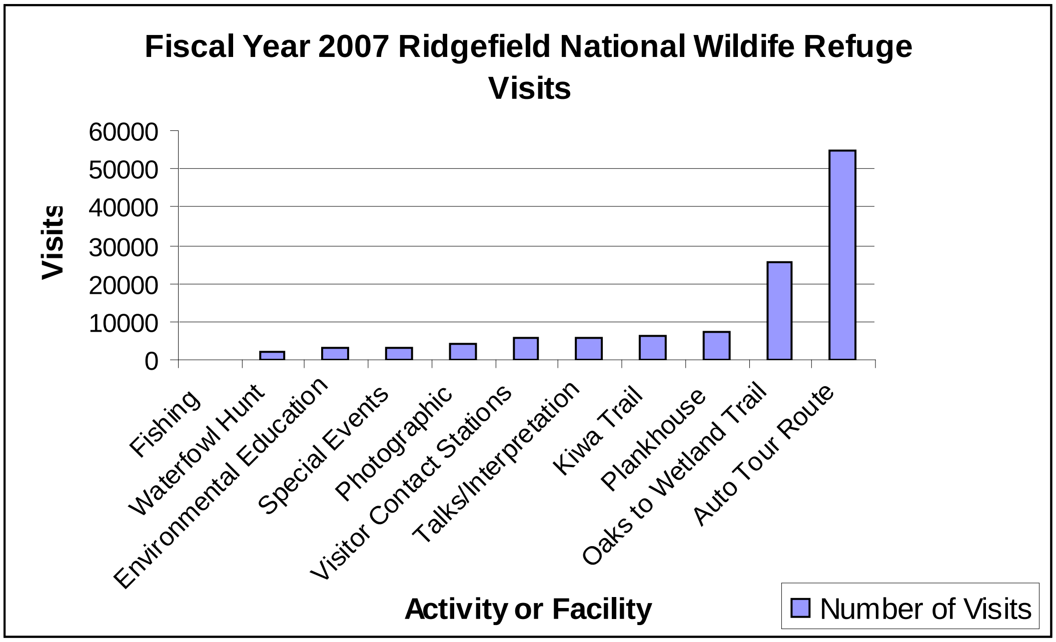


Figure 5.2 Recreational visits to Ridgefield Refuge in fiscal year 2007, by type of visit

5.2.4 Recreation and Entrance Fee Program

The Federal Lands Recreation Enhancement Act authorizes Entrance and Recreation Fees for national wildlife refuges. The Ridgefield Refuge implemented a recreation fee of $3.00 per hunter for waterfowl hunting in 1976. The fee increased to $5.00 per hunter in 1980. From 1980 to 2006, the recreation fee for waterfowl hunting experienced some minor programmatic changes such as fees for the reservation lottery, annual waterfowl hunting passes, and a minimum blind fee. In October 2006, the recreation fee for waterfowl hunting increased to $8.00 per hunter or $10.00 per blind, whichever sum is greatest. With a maximum capacity of three, a typical hunting blind may cost from $10.00 to $24.00. Using a Golden Age Passport, Golden Access Passport, Interagency Senior Pass, or Interagency Access Pass issued under the National Parks and Federal Recreation Lands Annual Pass program will reduce the recreation fee for waterfowl hunting for the individual passholder. The refuge offers an annual pass that covers the recreation fee for the passholder for the entire waterfowl season. Waterfowl hunters may optionally enter a lottery for reservations to hunt the refuge. The fee for lottery picks is $1.00 per date selected with a maximum of 30 potential picks per person per season.

The refuge added an entrance fee to its fee program in October 2006. The daily entrance fee for the refuge is $3.00 per vehicle. Additionally, an annual pass was established for entrance to the refuge for $15.00. The refuge pass was priced comparably to a Federal Duck Stamp, which waives the entrance fee at any national wildlife refuge. Consistent with the Federal Lands Recreation Enhancement Act, the refuge additionally honors passes from the National Parks and Federal Lands Pass Program including the Interagency Annual Pass, Interagency Senior Pass, Interagency Volunteer Pass, Interagency Access Pass, Golden Age Passport, and Golden Access Passport. Fees collected under authority of the Federal Lands Recreation Enhancement Act are to be used by the refuge for very specific expenditures including visitor services, visitor information, signs, interpretation, law enforcement, visitor facility maintenance/enhancement, and habitat restoration directly related to wildlife-dependent recreation.

5.2.5 Accessibility of Recreation Sites and Programs for People with Disabilities

The refuge contains facilities that are accessible to persons with disabilities. Some of the facilities are for persons with permanent disabilities who qualify under WAC 232-12-828. A brief description of accessible facilities follows.

Hunt Program Accessibility. Blinds 1A and 8 are accessible to persons with disabilities, as are restrooms within most parking lots in the hunt area. Blind 1A is reserved exclusively for persons with permanent disabilities who qualify under WAC 232-12-828. Non-disabled hunters may only access blind 1A as a hunting companion of a disabled hunter. Disabled hunters with reservations may select blind 1A without any competition for this blind. Multiple disabled hunters, who do not possess reservations, may compete in a random lottery specifically for blind 1A; hunters who do not win a spot for blind 1A may re-enter the general lottery to vie for blind 8. Blind 8, while accessible, is not specifically reserved for persons with disabilities and is subject to the reservation/lottery system imposed on the general waterfowl-hunting public.

Accessibility of Wildlife Observation and Photography. The public use facilities on the River 'S' Unit have been designed for accessibility. The auto tour route is designed for wildlife observation from the comfort and safety of one's personal vehicle. The two permanent restrooms along the auto tour route are of modern accessible design with paved approaches to the facilities. The parking lot for the River 'S' observation blind is paved with an asphalt trail connecting the lot to the ramps of the blind. Lastly, the Kiwa Trail consists of compacted fine aggregate and wood boardwalks over flat terrain suitable for visitors with disabilities.

Accessibility of Interpretive Programming at the Cathlapotle Plankhouse. The Plankhouse is designed to be fully accessible for persons with disabilities. Visitors with permanent disabilities, who qualify under WAC 232-12-828, may request an accommodation to access the Cathlapotle Plankhouse by contacting the refuge headquarters. For special programming and events at the Plankhouse qualified flaggers are secured to facilitate railroad crossings in private vehicles to provide access to the Plankhouse.

5.2.6 Law Enforcement

The refuge receives law enforcement coverage from a Service Zone Officer to support major public events, peak visitation periods, and hunting seasons. Zone Officers are assigned to multiple refuges and large geographic regions. They enforce special refuge regulations via periodic patrols of refuge lands, protect resources, and maintain public safety. With the loss of law enforcement officers stationed on the refuge, there has been a reduction of field patrols and officer presence.

The most common law enforcement issues encountered are violations of refuge closures (trespass into closed areas, present on the refuge after hours, and out of vehicles along the auto tour route during seasonal restrictions), waterfowl hunting violations (bag limit violations, taking birds out of season, and failure to check-out), vandalism (defaced signs), littering, trash dumping (household and commercial), and Entrance Fee Program noncompliance.

5.3 Waterfowl Hunting

The National Wildlife Refuge System Improvement Act, passed by Congress in 1997, identified hunting as a wildlife-dependent, priority public use for the National Wildlife Refuge System. At the Ridgefield Refuge the waterfowl hunting program is operated in a manner that is consistent and compatible with the refuge's purposes and goals, and provides a quality experience for the hunter. This program contributes to the continuation of America's traditions and heritage in wildlife conservation and outdoor recreation.

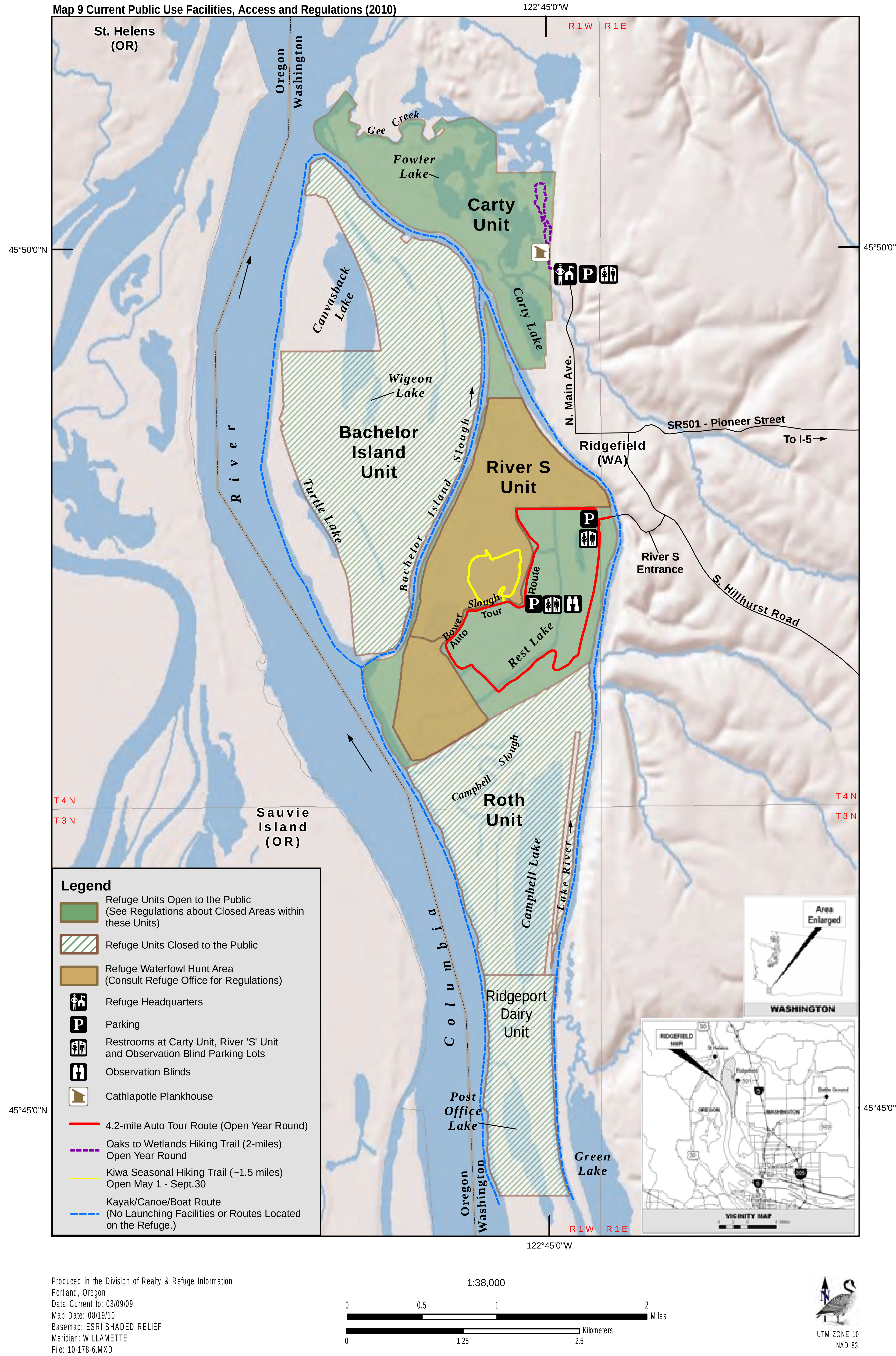
The refuge's waterfowl hunting program is designed to maintain hunt quality by regulating hunter density, while affording equal opportunity to all participants. The refuge has provided a public waterfowl hunting area since it was established. When the Migratory Bird Conservation Commission approved the establishment of the refuge on May 18, 1965, they included a provision that the refuge would provide "substantial public shooting" opportunities (see Chapter 1, Refuge Purposes). The establishing documents defined the public shooting opportunity as waterfowl hunting. The refuge's waterfowl hunting program represents the only spaced–blind public hunt area in the local area. Currently, the refuge's waterfowl hunting program permits the hunting of ducks, geese, and coot on approximately 790 acres, from 21 spaced blinds. The refuge continues to provide a prominent waterfowl hunting program in southwest Washington. Thirty-three percent of all ducks and 20 percent of all geese harvested in Clark County from 2002 to 2006 were harvested on the refuge (analysis compared to statistics reported in the State of Washington, Migratory Waterfowl and Upland Game Seasons, 2007-2008 Pamphlet Edition [WDFW 2007]).

Please note: The following hunting statistics and program descriptions are inclusive of the 2006/2007 hunting season, but do not capture more recent hunting datasets.

Facilities. The refuge operates 12 box blinds and 10 pit blinds within its hunting area. There are a maximum of 21 blinds assigned on any particular hunt day. Blind 7 has both a pit or box option, allowing hunters to select between the blind styles based upon their preference. Due to proximity, it is not safe for a hunting party to split between the box and pit at blind 7. Blind 15 is a field blind best suited for hunting of geese and is typically not made available until the opening of goose season. Blinds 1A and 8 are accessible for people with disabilities. Blind 1A is reserved exclusively for persons with qualified permanent disabilities. Hunter volunteers and the Washington Waterfowl Association Lower Columbia Chapter have conducted annual maintenance on the refuge's hunt blinds. The refuge conducts annual preparations for the hunt blinds, including mowing in areas surrounding the blinds to create open water, and managing water to flood the hunt area.

Supporting access to the hunting blinds is a network of seasonally mowed trails, covering approximately 3.25 miles. These trails are mowed by refuge staff to provide waterfowl hunters access to designated hunting blinds. This trail network attempts to utilize secondary maintenance roads and internal dikes to reduce annual trail maintenance efforts. Sign maintenance to orient hunters to the designated blinds is conducted annually by hunter volunteers. Hunting facilities additionally include approximately 2.8 miles of graveled road and 7 parking areas utilized to support the hunting program. These roads are periodically graded, graveled, cleared, and mowed by refuge staff. The refuge owns 3 standard portable restrooms and 3 accessible portable toilets that are placed at major parking lots. Twice a month during the hunting season, these facilities are cleaned and maintained by a contractor.

Map 9 Current Public Use Facilities, Access and Regulations (2010)



The refuge staffs and operates a hunter check station within the hunting area of the River 'S' Unit during the waterfowl hunting season. To accomplish daily check station functions, a seasonal employee is hired to manage daily operations including sales of passes and duck stamps, blind assignments, reservations, fee collection, material and information distribution, and harvest and hunting data collection.

Hunt Program History. Since the establishment of the refuge hunt program, measures have been implemented to manage the number of hunters and frequency of hunting to increase hunt quality. In 1965, hunting occurred on Saturday, Sunday, and Wednesday. A maximum of 50 hunters were allowed on the hunt unit at any given time. There were no developed blinds and hunters constructed blinds from natural materials in the immediate landscape. During the 1967 to 1968 season the refuge modified the hunt program by implementing a reservation/permit system for waterfowl hunting. This programmatic change was derived from issues associated with the previous first-come, first-served format that caused overnight 'sweat' lines, hunter confrontations, and vehicles parked on the one-lane bridge and railroad crossing. Starting the 1967 to 1968 season, hunters possessing reservations were given priority for access to the hunt area over other hunters. Additionally, hunter distribution was regulated by the assignment of blind locations and the installation of 15 permanent blinds. Blinds were filled with two hunters either by partners appearing on the reservation card or forced pairings of single hunters on the day of the hunt. By 1969, the number of blinds had increased to 31, located approximately within the footprint of the current hunt unit of about 790 acres.

The hunting program changed significantly in 1972 when flooding breached the River 'S' dike and destroyed the infrastructure of the hunt unit. During this hunt season, the hunt area became an open hunt replacing a controlled reservation hunt. During the 1972 season, the staff noted a loss of traditional hunters with an influx of inexperienced hunters and a general decline in hunting quality. After the season, the refuge received two petitions from hunting groups to rebuild the hunting infrastructure, restore habitat, and return to a controlled hunt. In 1974 a reservation system was reinstated and hunt areas had implemented requirements for steel shot. In 1975 the refuge started to restrict the number of shells that an individual hunter could possess and shoot on a particular hunt day to 25. Since the 1975 season, the number of shells had been limited to 20 to 25 shells per hunter, and a trial period of either a 12- or 20-shot limit depending upon the blind selected.

The refuge's hunt days have included a three-days-per-week schedule (including Saturday/Sunday/Wednesday, Tuesday/Thursday/Saturday, and Monday/Wednesday/Saturday) and an alternating day schedule. The total number of hunting days has ranged from 29 to 46. Variability in the number of hunt days in a particular season may be subject to many elements, including length and framework of annual seasons, number of hunting days per week, holiday closures, severe weather events, and habitat conditions. In 1976, hunting did not occur until October 30th due to insufficient water in the hunt unit.

Since the 1967-1968 season the refuge has regulated hunter distribution and density through blind assignments, except from 1972 to 1974 when infrastructure was lost to flooding. The number of blinds on the refuge has ranged from 31 to 19 over the years. Designated blinds have included a variety of styles including box blinds, stilt blinds, pit blinds, and 'natural' blinds concealed by surrounding vegetation.

Number of hunters and harvest statistics. The refuge waterfowl hunting program has maintained hunter visit statistics over the years. The annual number of hunting visits is influenced by the number of hunt days in an individual season, which has ranged from 29 to 47 days since 1965. Additionally, annual visitation is also subject to the number of blinds available and maximum blind occupancy, which has been variable over the years. In an extreme situation, the refuge program could accommodate over 5,000 hunt visits in a single season. This would represent all blinds filled to capacity on every hunt day, with the refuge vacating hunters from the blinds midday for occupation by new hunt parties. Figure 5.3 shows the annual number of hunt visits to the refuge. This graph shows high visitation during the 1972 flood event that destroyed the infrastructure of the hunt program.

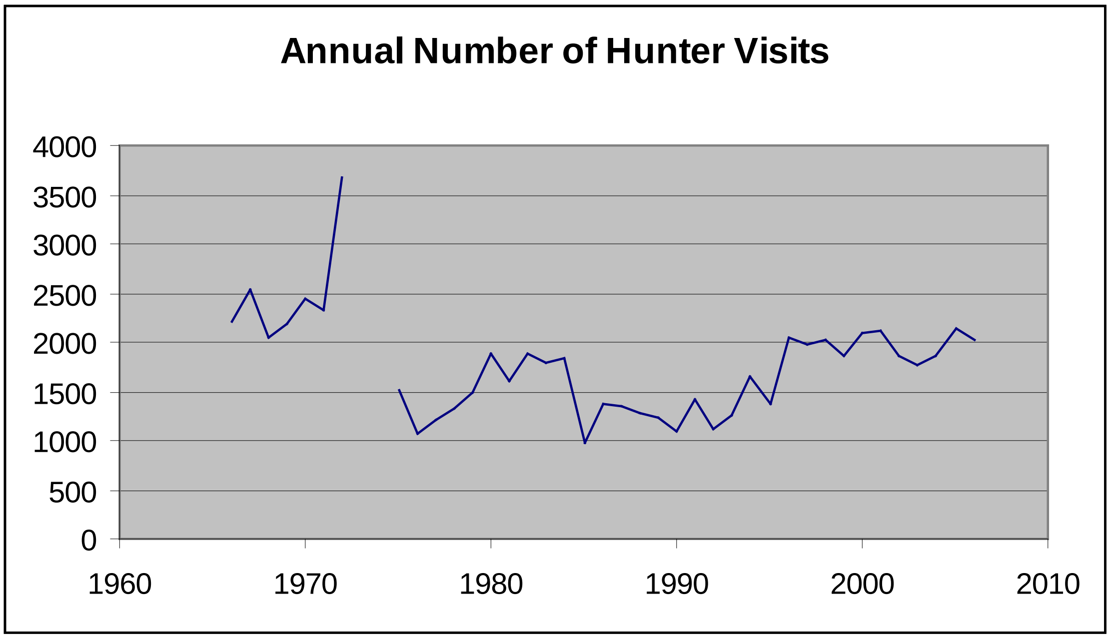


Figure 5.3 Annual number of hunter visits to the refuge, 1965-2007.

During 1972 to 1974 the reservation system was suspended while infrastructure was being repaired, and the refuge hunt temporarily became an open free range hunt program. During this time, there was a general concern that the quality of the hunt program had declined. There was a dip in hunt visits during the mid 1980s, probably reflecting lower hunt participation during a period of poor nesting conditions and a consequent continent-wide depression in duck populations. Hunting participation increased as duck populations recovered and hunters returned to the field.

Currently, the number of annual hunter visits to the refuge is approximately 2,000. This level of visitation represents a season ranging from 41 to 45 hunt days, a typical hunting party of 2 persons, selecting from up to 21 blinds (one blind is reserved for disabled hunters), and approximately 25 to 30 blind assignments on each hunt day. Should every blind be selected on a hunting day, there would be 21 blind selections for that day. Therefore, 25 to 30 blind assignments suggests that most blinds were selected for a morning hunt and choice blinds that became vacant throughout the day were refilled. Refuge hunting statistics from the 1997 to 2001 hunt season show that 80 percent of the blinds were occupied during the morning draw and 65 percent of the blinds were occupied sometime after 10:00 am.

Figure 5.3 also shows a stable to increasing number of hunting visits to the refuge's waterfowl hunting program over time, despite declining participation in waterfowl hunting statewide (Moore 2007). The stability in hunting visitation relative to statewide declines may reflect diminishing public waterfowl hunting opportunities in the area. It could be inferred that as public hunting areas have become fewer, hunters become concentrated into the remaining areas.

A 2003 projection for future participation in outdoor recreation in Washington State identifies a 15 percent decline in the number of participants in hunting and shooting activities from current levels over the next 10 years, and a 21 percent decline over the next 20 years (IAC 2003). In addition, fewer young hunters are being recruited into the sport. These statewide trends may eventually be reflected in a decline in numbers of hunters using the refuge, but no sign of decline has been noted to date.

Harvest Information: Review of annual refuge narrative reports and hunting reports show harvest trends for the refuge's waterfowl program. While the harvest trends may suggest patterns, many complex variables may be governing the annual harvest of waterfowl. The harvest trends do not account for variability in Flyway populations, daily bag limits, seasonal closures, weather patterns, migration patterns, cropping regimes, and changes in hunt program and/or refuge management. These variables individually, or in tandem, may profoundly change the harvest trends over time. As an example, the daily bag limits for cackling geese has ranged from zero to four in the past decade. During this period, annual harvest of cackling geese was largely governed by annual hunting regulations, rather than the abundance or distribution of geese. The information reported in this section is used to estimate the size, scope, and nature of the refuge hunt program. Only simple data computations have been completed to show simple trend, user, and harvest statistics. Hunting statistics over the years have been gathered and reported in various formats. Incomplete data sets or breaks in the data reported have been omitted from the graphs.

Over the years, the annual harvest of waterfowl has been recorded as birds harvested (ducks and geese) per hunter visit. The refuge's average harvest since 1966 has been 1.46 birds per hunter. Since the 2000 hunt season, the annual harvest has been 1.56 birds per hunter. The range of annual harvest has been 0.7 birds per hunter in 1966 to 2.1 birds per hunter in 1969. The annual harvest of birds per hunter is shown in Figure 5.4.

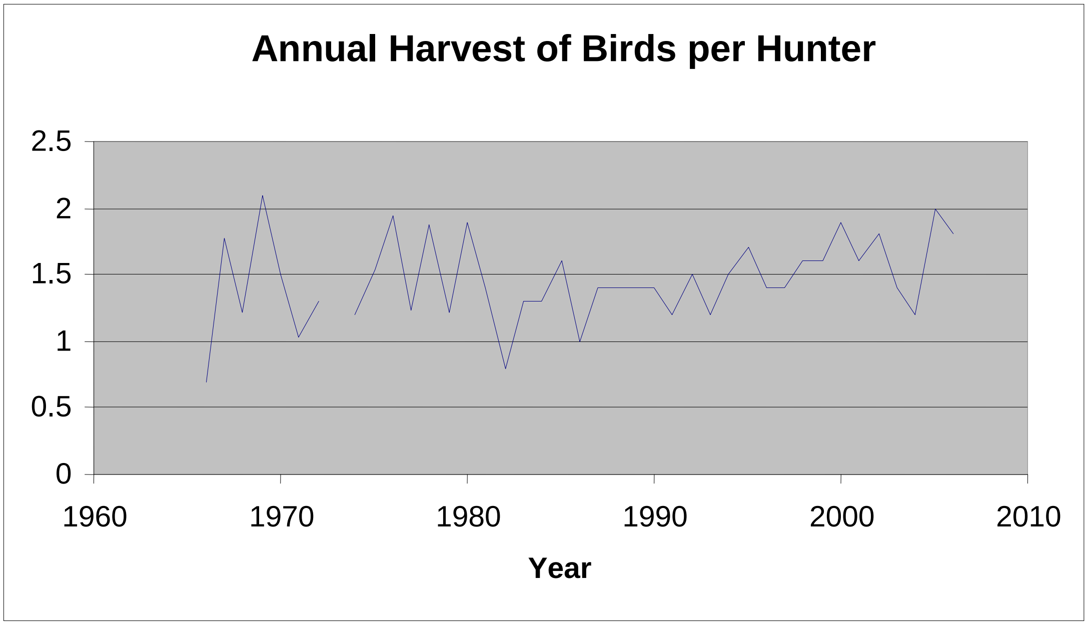


Figure 5.4. Annual harvest of birds per hunter at Ridgefield Refuge, 1965-2007.

Over the years, the refuge's waterfowl hunters have harvested an average of 2,376 ducks per year. Figure 5.5 shows the annual harvest of ducks at the refuge gathered from multiple reports and narratives. Data was not available for all years and has been omitted from the figure. The annual duck harvest has ranged from 1,256 ducks in 1986 to 4,425 ducks in 1969. Generally, the harvest of ducks has been increasing since the mid-1990s. Recently, the program averaged 3,928 ducks per year since the 2000 season.

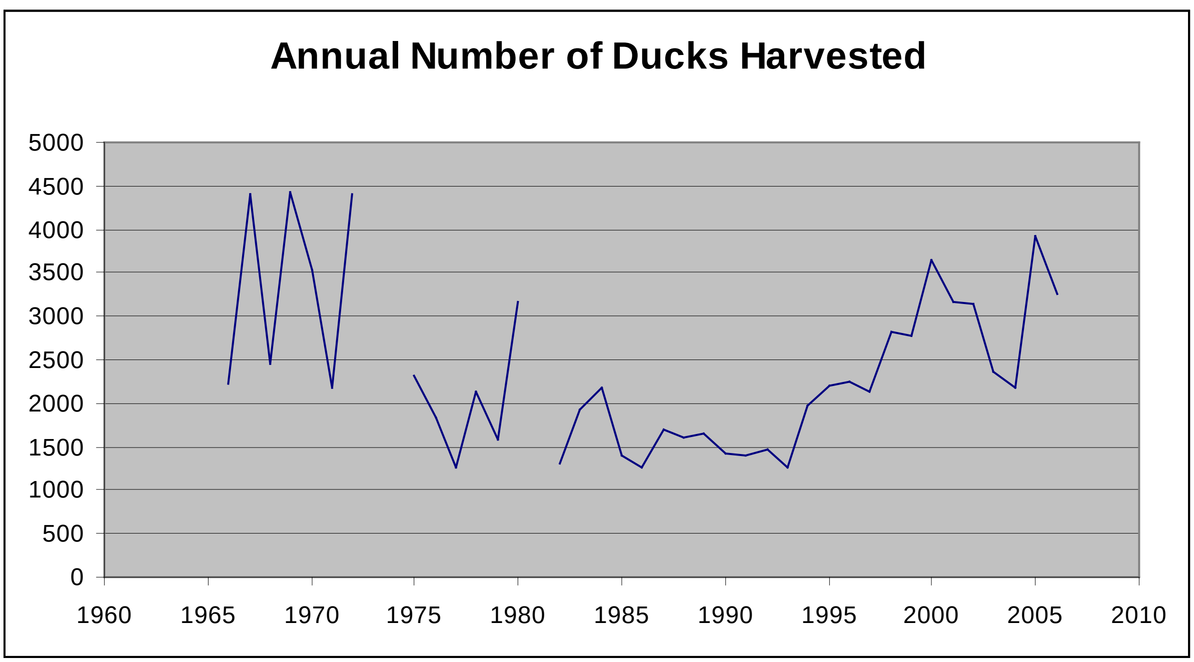


Figure 5.5 Annual number of ducks harvested at the Ridgefield Refuge, 1965-2007.

The refuge waterfowl hunt program harvests a variety of duck species. Most of the ducks harvested from the refuge are dabbling ducks. Northern shoveler, northern pintail, mallard, American wigeon, green-winged teal, and gadwall are the most commonly harvested species. Select diving ducks are harvested on the refuge, most commonly including ring-necked ducks, buffleheads, and lesser scaup. Figure 5.6 shows the composition of most commonly harvested duck species from the refuge's waterfowl hunt program over time. Data was not available for all years and has been omitted from the figure. The figure shows that shoveler, pintail, mallard, and wigeon collectively comprise roughly 75 percent of the ducks harvested. The relative distribution of the species harvest has changed over time. From 1966 to 1972, American wigeon represented 36 percent of all ducks harvested. Since the 2000 season, wigeon have comprised only 12 percent of all birds harvested. During the same time periods, harvest of shoveler has increased from 11 percent to 32 percent of the birds harvested. Mallard harvest has ranged over the years from 10 percent to 37 percent with an average harvest over the years of 20 percent of all birds harvested. Pintail harvest has ranged from 13 percent to 19 percent with an average harvest over the years of 13 percent. Over the years bag limits and seasonal closures have been implemented to protect mallards and pintails from overharvesting. Changes in these annual regulations have an influence on the overall annual harvest of these species.

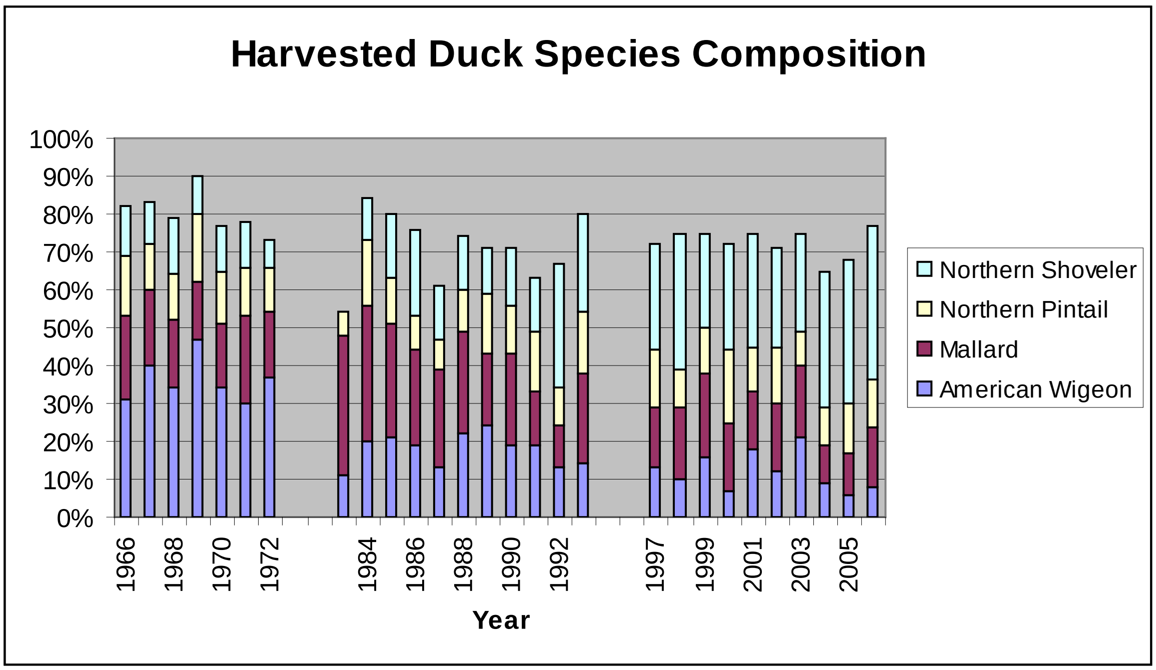


Figure 5.6 Species composition of ducks harvested at Ridgefield Refuge, 1966-2007.

Prior to 2004 Canada geese were considered to be one species that was subdivided into numerous subspecies based on geographic range and variability in plumage and size. In 2004, smaller-bodied birds were split into a separate species, called the cackling goose (*Branta hutchinsii*). Larger-bodied birds retained the name Canada goose (*Branta canadensis*). In the Pacific Flyway, the Aleutian, cackling, and Taverner's subspecies were reassigned to the cackling goose species. The lesser, dusky, western, and Vancouver subspecies remained within the Canada goose species. Goose data collected over the years from the refuge hunt program was largely gathered when the species was described as the Canada goose with 7 subspecies. To re-categorize this historic data into the current species nomenclature would be a considerable project. Therefore, for the purpose of the following discussions, the goose harvest on the refuge will utilize the older nomenclature (Canada goose with seven subspecies).

The refuge's waterfowl hunting program allows harvest of geese consistent with State regulations and special conditions of the Western Washington Goose Management Area 2A. Nearly all geese harvested on the refuge are Canada and cackling geese. The harvest of snow geese and white-fronted geese is very rare, with none harvested in recent years. Figure 5.7 shows the annual harvest of geese attributed to the refuge's hunt program. Over time the refuge's hunt program has had an average harvest of 240 geese per year. The number of geese harvested in a particular season ranged from 50 in 1974 to 666 in 1996. Since the 2000 season, the refuge has averaged 243 geese per year. The number of geese harvested annually is highly dependent upon the number of goose hunting days in a season. The refuge's waterfowl hunt program is within Western Washington Goose Management Area 2A. Management Area 2A operates a quota system to reduce harvest of dusky Canada geese. The refuge is currently assigned a harvest quota consistent with the Dusky Management Plan. Should dusky harvest exceed the refuge's quota, the refuge is authorized to implement an emergency area closure to its goose hunt season. In some seasons the refuge goose season has closed after 11 goose hunting days to avoid overharvesting dusky Canada geese.

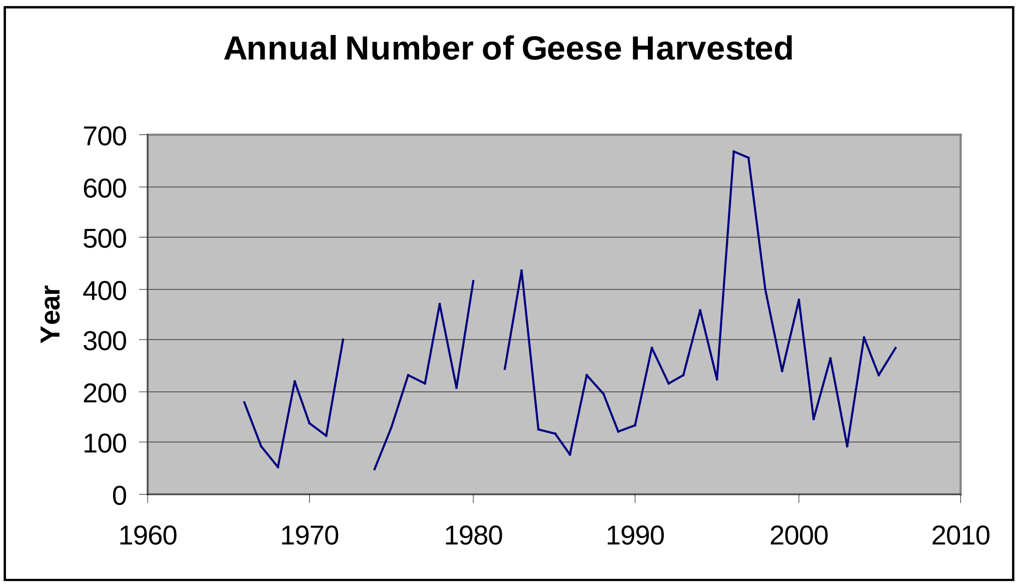


Figure 5.7 Annual number of geese harvested at Ridgefield Refuge, 1966-2007.

Historically, the refuge's hunt program harvested a high percentage of dusky Canada geese. During the 1971 and 1972 seasons, the percentage of dusky Canada geese exceeded 60 percent of the overall Canada goose harvest. In comparison, duskys comprised 76 percent of the geese during the midwinter surveys of the lower Columbia River and Willamette Valley in 1971 and 1972 (Pacific Flyway Council 1997). Over time, limited dusky populations coupled with population increases in some other subspecies of Canada and cackling geese have diluted the overall percentage of dusky Canada geese wintering in the region. Since the 1970s, a northwardly change in the wintering distribution of cackling geese to the lower Columbia River and Willamette Valley has additionally reduced the composition of dusky Canada geese in the local area. In 1980, surveys located more than 99 percent of the cackling geese wintering in California and near Klamath, Oregon. In 1998, more than 93 percent of cackling geese were surveyed on wintering grounds in the lower Columbia River and Willamette Valley (Pacific Flyway Council 1999). Overall these variables have considerably changed the composition of geese on the refuge. In 1969 dusky Canada geese were reported to represent from 30 to 60 percent of the wintering geese on the refuge. Data from 1998 and 1999 show dusky Canada geese comprising 3.4 percent of the geese wintering on the refuge. The increase in other subspecies in the region, too some degree, has reduced the harvest of the dusky subspecies.

Cackling geese have comprised 66 percent of all geese harvested on the refuge since 2000. This is not surprising since cacklers are both numerous and relatively identifiable. Various game management strategies have been utilized over the years to reduce the harvest on dusky Canada geese. Wintering areas for the dusky subspecies operate a quota system, that when exceeded, can trigger area closures for goose hunting. Hunters are required to possess goose harvest permits that are revoked when a hunter harvests a dusky; therefore, the individual hunter is not allowed to hunt geese in the management area for the remainder of the season. Hunters must take a goose identification course and pass a test to obtain a permit to harvest geese in the wintering range for dusky geese. Collectively, these management measures and changes in the composition and distribution of wintering Canada geese may have reduced the annual dusky harvest. Since 2000 dusky Canada geese represent 5 percent of all geese harvests. Figure 5.8 shows the subspecies composition of Canada geese harvested from the refuge's waterfowl hunt program over time. Data was not available for all years and has been omitted from the table.

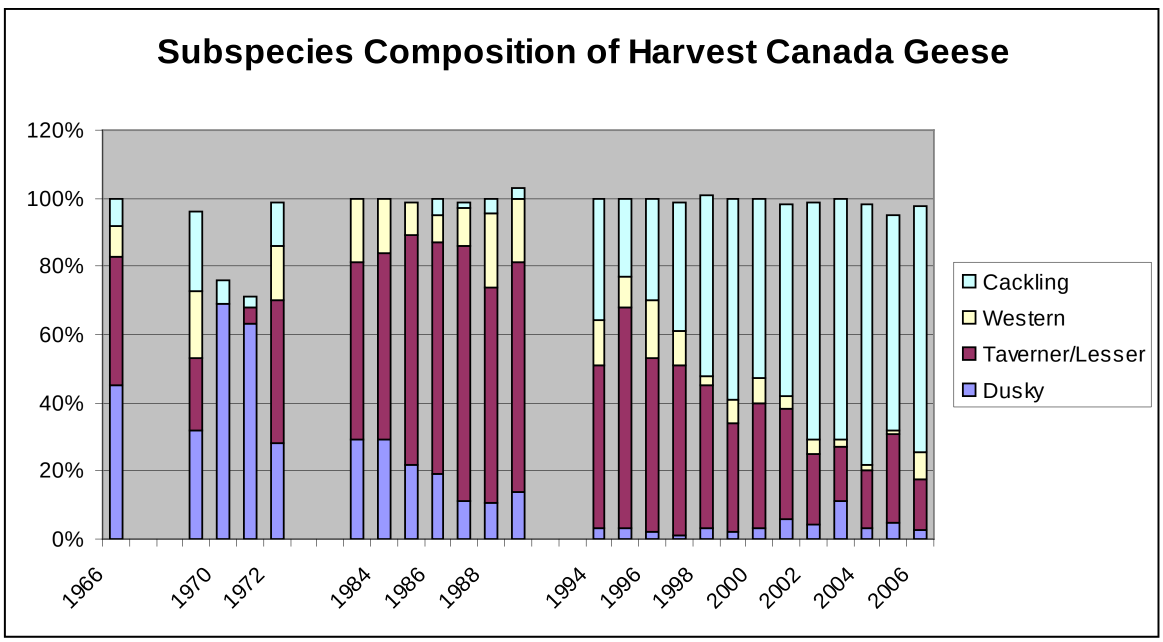


Figure 5.8 Subspecies composition of Canada geese harvested on Ridgefield Refuge, 1966-2007.

Current Hunt Program. Waterfowl hunting (ducks, geese, and coots) is permitted on approximately 790 acres of the Ridgefield Refuge in accordance with Washington, Federal, and special refuge regulations. The refuge operates 21 spaced blinds that are assigned on both a reservation and standby system. Hunting is allowed on Tuesday, Thursday, and Saturday (excluding Federal holidays) during the regular State waterfowl season. The refuge's goose season may close early if the dusky Canada goose harvest exceeds the refuge's harvest quota. Duck and coot hunting will continue to the end of the regular State season, regardless of the status of the goose season.

- *Hunting Reservations.* Hunters may elect to participate in a random drawing for reservations to hunt the refuge. The season is split into three hunt periods, with a different application due date for each hunt period. Each hunter may select up to 10 hunt days per hunt period for entry into the reservation lottery. Each date picked for the lottery costs the hunter one dollar. After the due date a computer generated lottery is run for each hunt date in the hunt period. The computer selects 19 reserved names for each hunt date in the hunt period and a reservation number between 1 and 19. The reservation number corresponds to the order in which the hunter will select a blind on the day of the hunt, with the lowest number selecting first. A post card is generated for each hunter identifying their reservation date(s) and reservation number. During the 1997/1998 hunt season, the refuge received between 350 and 400 applications per hunt period.

- *Program Operations.* The gates to the hunt area open two hours before legal shoot time on refuge hunt days. Reservations are valid until 1 hour and 45 minutes before legal shooting hours on the reservation date. All hunters present must record their name and address by 1 hour and 45 minutes before shooting time on a register. After a brief orientation, blind selection commences with the reservation hunter holding the lowest reservation number for that day selecting a blind first. The reservation holder may invite hunting partners up to the blind's capacity of 3 persons. This process continues until all reservation holders have selected blinds. Typically, about half of the reservation holders attend for a particular hunt day leaving blinds available for other hunters.

- *Standby Hunters.* Hunters present at 1 hour and 45 minutes before legal shooting time with their information recorded on the register may vie for unoccupied blinds during the morning hunt. Each hunt party is assigned a number that corresponds to a numbered ping pong ball. The balls are blindly drawn from a bucket establishing the order in which standby hunters will select blinds. In the event that a standby hunter does not like their blind options or all blinds are occupied. The standby hunter may secure a picking order on the 10 a.m. waiting list.

- *10 a.m. Lottery.* Once blinds have been assigned in the early morning additional entry is allowed until 10 a.m. This allows hunters arriving early a quality hunting experience without additional hunters moving past their blind or throughout the hunt unit. At 10 a.m. hunters on the 10 a.m. waiting list may fill vacant blinds or pass on available blinds and reserve their picking order on the waiting list. Any new arriving hunters are subjected to an additional ping pong ball lottery that completes the waiting list for blinds. As blinds vacate throughout the day, blinds are refilled according to the order established by the waiting list. Typically, by midday all hunters from the waiting list and 10 a.m. lottery have selected blinds. Hunters arriving after the waiting list is exhausted, may select blinds on a first-come first-served basis.

- *Refuge Specific Regulations.* The refuge imposes regulations specific to its hunt program with the intent of maintaining program quality, safety, and equality. These regulations are posted at the check station, announced during hunter orientation, printed on hunting fact sheets, and maintained on the refuge website.

- *Recreation User Fees.* Hunting fees are assessed at $10 per blind or $8 per hunter; whichever sum is greater. This fee structure encourages higher occupancy in each blind, while potentially making more blinds available. The refuge's hunt program additionally offers a season pass for hunting for $100. Golden Age Passports, Golden Access Passports, Interagency Senior Passes, or Interagency Access Passes issued under the National Parks and Federal Recreation Lands Annual Pass program will reduce the Recreation User Fee for waterfowl hunting for passholders by 50 percent. There is no fee for youth hunters, 15 years of age or younger. The Recreation User Fee was raised in 2006 from $10 per blind or $5 per hunter and $50 for season passes. The last major change in the fee structure was in 1980. With increases in costs for staff, maintenance, and supplies the fee increase in 2006 was required to make the program fiscally self-sustaining.

- *Youth Waterfowl Hunt.* A youth hunt waterfowl hunting day is offered one day a year at Ridgefield Refuge. Hunting is free to all participants in the youth waterfowl hunting day. Reservations are accepted for the youth hunt by postcard early in the season. Reservations are generated by random drawing and selected youth are assigned a reservation number that determines the order in which they select blinds on youth hunt day. In 2007, the refuge received 21 requests for participation in youth hunt day, all of which were issued reservations. A total of 17 youth participated in the program. To improve hunting success, the youth waterfowl hunting day is conducted in late October or November. Because of the low water levels on the refuge during the typical September youth hunts, the refuge could not offer a quality hunting experience during September. The youth hunt day is typically offered on a Sunday to avoid conflicting with both the refuge's regular hunting schedule and school events.

5.4 Fishing

Fishing is allowed in areas open to the public on the Carty Unit, consistent with State fishing regulations. Under the CCP, the refuge will modify the existing Lake River Bridge in the River 'S' Unit to create a fishing pier from which anglers can access the State-owned waters of Lake River. Any other permanent or semi-permanent wetlands within the River 'S' Unit are within closed areas. Fishing in the Carty Unit occurs in various permanent water bodies throughout the unit. The lack of a significant native fishery on the refuge largely limits angling opportunities to warm water species including carp, bullhead, bass, and crappie. Fishing for salmon, steelhead, sturgeon, and other cold water fish is popular in the waters of the Columbia River. Fishing from boats and along the shorelines of Lower River Road and Bachelor Island is very popular seasonally. This use is adjacent to refuge lands utilizing either navigable waters or shorelines under State jurisdiction.

5.4.1 Number of Visits

Staff estimates that the refuge has 260 fishing visits annually. This is a remarkable decline from when the refuge was established. From 1966 to 1970 the refuge narratives report an average of 2,343 annual fishing visits accounting for approximately 25 percent of all recreational visits. During these years the average number of fishing and hunting visits were approximately the same.

5.4.2 Facilities

Salmon, steelhead, and sturgeon fishing is very popular in the region. Angling for these cold water species requires direct access to the Columbia River or its tributaries and shorelines. Multiple agencies in the area have developed facilities supporting this type of angling, including boat launches, cleaning stations, docks, parking areas, restrooms, and trails within very close proximity to the Columbia River. Within 10 aerial miles of the refuge boundary there are 9 public boat launches into the Columbia or its tributaries in Washington State. Additionally, there are many more public recreation sites with shoreline or dock-based public fishing facilities within close proximity of the refuge. The refuge has no developed facilities specifically for fishing. The parking lot and restroom facilities at the River ‘S’ Unit entrance serve shoreline anglers of Lake River. Similarly, the Carty Unit parking lot, restrooms, and footbridge facilitate fishing of this portion of the refuge.

5.5 Wildlife Viewing and Photography

5.5.1 Number of Visits

Most visits associated with wildlife observation and photography occur along the 4.3-mile auto tour route. Currently, the auto tour route has about 55,000 visits per year. Visitors to the auto tour route have year-round access to the observation blind for wildlife viewing and photography. Additionally, The auto tour route provides seasonal access (May 1 to September 30) to the 1.1-mile Kiwa Trail, which has approximately 6,500 annual visits. The Carty Unit’s Oaks to Wetlands Trail is open year-round for wildlife observation. Visitation to the Oaks to Wetlands Trail is estimated at approximately 25,000.

Currently, the number of photographic visits is estimated at 4,030. Photographic visits are difficult to quantify since visitors engaged in hunting, fishing, education, or wildlife observation may additionally be taking pictures. Without extensive surveys, the number of photographic visits is a rough estimate based on staff observations. It seems apparent in recent history, that the development of digital photographic equipment has increased wildlife photography visits on the refuge. More frequently, visitors have cameras or camera phones as part of their recreational equipment. Increasingly, the refuge has been attracting professional or serious recreational photographers using window mounts, high-power lenses, and digital single-lens reflex camera equipment along the auto tour route. The auto tour route provides photographers and wildlife observers access to a mix of habitats, close proximity to wildlife, and open sight lines from the shelter and comfort of their own vehicle.

5.5.2 Facilities

The auto tour route, Oaks to Wetlands Trail, and Kiwa Trail are maintained to accommodate wildlife observation and photography. The River ‘S’ Unit’s observation blind is an additional facility designed to offer wildlife viewing over sanctuary areas. In 2006 the aging observation blind was demolished, redesigned, and replaced by refuge and community partners as a memorial of a long time refuge advocate. In addition to the viewing opportunities from the designated facilities mentioned above, informal wildlife viewing and photography is also available from the parking lot at the end of Lower River Road. Wildlife observation and photography can occur from open undeveloped portions of the Carty Unit. The refuge is bordered by navigable rivers attracting a growing number of canoeists and kayakers. Staff-led access to closed areas for wildlife observation and photography is granted for special events and tours, including BirdFest.

5.6 Environmental Education

5.6.1 Number of Visitors

The environmental education program at Ridgefield provides programs to more than 3,100 students and adults annually.

5.6.2 Facilities

Educational visits are primarily served on the Carty Unit. Select schools will elect to drive the auto tour route enroute back to school. The Plankhouse and Oaks to Wetlands Trail is the primary attraction for educational visits. Most schools elect to divide their groups to alternate visitation between the trail and the Plankhouse. Other simple necessities utilized by educational visits include parking lots and restrooms.

5.6.3 Environmental Education Program Details

The refuge’s support groups–the Friends of Ridgefield National Wildlife Refuge and the Friends of the Cathlapotle Plankhouse (Friends groups)–have significantly contributed to the development and support of the education program. They have also raised transportation funds to reimburse schools for bussing costs to the refuge. The Friends groups have been instrumental in scheduling and conducting teacher workshops. They have offered specific training for volunteers working with educational visits and have formed a committee to improve the refuge’s education program to better align with grade levels and State standards. Collectively, the Friends groups are working to supply interpretive and educational equipment, supplies, and materials. They have additionally funded a Plankhouse Coordinator position for two years. The Plankhouse Coordinator has been invaluable in scheduling educational visits, developing activities/content, and directly working with students.

For cost and logistical efficiencies, schools frequently send an entire grade to the refuge in a single visit. This might consist of 3 or 4 classes of 75 to 120 students. Staffing such visits is problematic. Typical staffing for these groups draws upon the Plankhouse Coordinator, the refuge’s Instructional Systems Specialist, and volunteers. The large magnitude of such a visit is difficult to program and compromises the quality of students’ experiences. When possible, groups of under 60 students are encouraged to attain a high ratio of adult chaperones to students (1 chaperone for every 10 students). Currently, all grades are welcome; however, we are working on revising the educator’s guide, to focus on specific grade level content particularly suited to a refuge visit (e.g. Native American Studies, Plants, Animal Adaptations).

The cool and wet weather of the Pacific Northwest makes winter educational visits to the refuge challenging. During the winter, the only shelter for any educational programming is within the Plankhouse. Because replica items, mats, and skins are stored in the Plankhouse, educational groups are not allowed to eat in the facility due to the potential of stains, spills, and attracting pests. Therefore, all other educational activities, programming, and lunch is outside without seating or shelter. As a result, most education visit requests come in the spring. During 2007 56 percent of all educational visits during the school year were scheduled during May and June.

5.7 Interpretation/Outreach

The refuge has produced and maintains an inventory of general brochures and wildlife checklists. The refuge's Web site (www.fws.gov/ridgefieldrefuges) is managed by the Refuge Complex, current refuge information can be obtained at any time. Annually, the refuge produces a 'tear-sheet' with refuge regulations and a map for the waterfowl hunt program. The refuge is lacking in interpretive signage with most signage focused on visitor orientation (i.e. maps) and regulation. Previous interpretive signs at the refuge were very dated and in poor condition. They were removed several years ago and replaced with temporary signs produced on large format laminated paper. These signs were deteriorating and were removed, leaving interpretive kiosks empty. The need for interpretive signage will be addressed in this plan.

Refuge volunteers staff a visitor contact station at the entrance to River 'S' Unit roughly 4 to 6 days a week. Those staffing the contact station are particularly interested in wildlife, wildlife observation, and photography. As a visitor service, they maintain and post significant wildlife sightings and offer visitor orientation. It is conservatively estimated that volunteers made 3,500 to 4,000 visitor contacts in 2007.

Refuge outreach includes off-site talks and presentations upon request. These are conducted by both refuge staff and volunteers. The refuge annually participates in the Fourth of July Celebration in Ridgefield. This is a very popular event attracting thousands of people. The refuge designs a float for the parade and staffs a booth during the events of the day. The refuge attends other local outreach events like the Hometown Celebration and Night Out barbeque. Periodically, staff and volunteers will participate in other regional events such as the Clark County Fair, Home and Garden Ideas Fair, Wapato Days, and the Sturgeon Festival.

In October the Friends of the Ridgefield National Wildlife Refuge hold a wildlife festival, known as BirdFest. BirdFest celebrates with National Wildlife Refuge Week and coincides with the peak migration of sandhill cranes through the area. The festival is in its seventh year and continues to grow, attracting approximately 3,500 visitors in 2007. Events are scheduled for an entire weekend and include guided van tours, hikes, wildlife viewing, tours of sanctuary areas, archeological/Native American interpretation, kayak tours, raptor shows, exhibits, and children's activities. BirdFest has become a premier opportunity for the public to learn more about the refuge, wildlife, and the Refuge System.

5.8 Cultural Resources Interpretation

Since its construction in 2004 the Cathlapotle Plankhouse continues to attract thousands of visitors annually. Over the past two years, there have been approximately 7,500 annual visits to the Plankhouse for interpretation. This count is actually the number of contacts made by trained Plankhouse docents with members of the public when the facility was open and staffed. The number of visits to the Plankhouse outside the hours of operation is difficult to assess. Typically, the Plankhouse is staffed by volunteers on Friday, Saturday, and Sunday afternoons (noon to 4:00 p.m.) from late March to early November for walk-in visitation by the public. This schedule is variable upon the availability of a minimum of 2 docents to have the facility adequately staffed. An advance schedule of operation is maintained by the Plankhouse Coordinator on a website (www.plankhouse.org). Visitors with disabilities requiring access accommodations, or groups can prearrange to visit the Plankhouse during other times of the week. Specially arranged group and educational visits continue throughout the winter months.

Programming at the Plankhouse is quite variable. At a minimum, a walk-in visitor is able to talk with a trained docent and experience artifacts, replica goods, and the artwork within the facility. Prearranged groups will additionally have a brief presentation in the Plankhouse about cultural resources or related topics. To some degree, these presentations are driven by the individual group's interest or expertise of the presenter. The Plankhouse Coordinator also regularly schedules Native American craft/skills workshops with limited enrollment for volunteer and visitor enrichment. Annually, content specialists offer tours and presentations for special events like BirdFest. These events are very popular, often attracting capacity crowds to the Plankhouse. Topics for these presentations include refuge archeology, local history, Native American culture, ethnobotany, cultural resources, and Tribal interpretation. Grants received in 2007 expanded the opportunity for cultural interpretation during the spring and summer of 2008. Other outreach and educational materials related to the Cathlapotle Plankhouse include monthly newsletters, a website, and fact sheets.

The Chinook Tribe was an active partner in Plankhouse since its inception. The Tribe and the refuge work together to interpret, educate, and recover the natural and cultural history of the refuge through the historical-representative Chinookan Plankhouse. Creating an opportunity for the Tribe to practice their cultural heritage is one of the purposes of the Plankhouse, and currently, it is used by the Tribe for activities and cultural events.

5.9 Nonwildlife-Dependent Recreation

5.9.1 Recreational Boating and Waterskiing

Pleasure boating, waterskiing, canoeing, and kayaking are popular activities on the navigable waterways adjacent to the refuge. When these activities are conducted within navigable waters of Lake River, Bachelor Slough, and the Columbia River, they have minor, direct impacts to the refuge's wildlife resources. However, over the years the refuge is experiencing habitat loss along the shorelines of the Carty, Roth, and Ridgeport Dairy units as wakes from ships and recreational boats are eroding some high banks. Short sections of rip-rap have already been used as an armament along Bachelor Slough and Lake River in areas exhibiting erosion.

5.9.2 Camping, Beach Use, and Swimming

Beach use along Bachelor Island has occurred for many years. Seasonally, the Bachelor Island shoreline attracts anglers, hunters, boaters, and campers. In 2007 the refuge was alerted about an internet blog promoting the shores of Bachelor Island as a satellite location for nudists from Sauvie Island, Oregon. All of the Island's user groups access the shoreline by boat. These activities primarily occur on WDNR property bordering the refuge. However, trespass into sanctuary areas of Bachelor Island has been observed. A primary concern is disturbance of wildlife within closed areas of the refuge. Additionally, no facilities are present to serve these groups and temporary 'out houses' made of tarps and driftwood are found throughout the area. Summer campers also assemble makeshift houses out of scrap wood and tarps. At the end of the camping season, these sites are abandoned along with considerable trash and discarded camping gear.

5.9.3 Horseback Riding, Bicycling, Jogging, and Dog Walking.

Horses and horseback riding, bicycling, jogging, and dog walking were all discontinued in 1998. Waterfowl hunters are encouraged to use retrievers as an effective method of recovering harvested waterfowl. Hunting dogs must remain on a leash except when at the blind and must be under the control of its owner at all times.

5.10 Illegal Uses

The Ridgefield Refuge has been negatively affected by vandalism, theft, garbage dumping, area closure violations, after-hours trespass, illegal shooting, drug activity, and off-road vehicle use. These illegal uses may occur in any location; however, a problematic site is the Ridgeport Dairy Unit. Illegal uses persist partly because of the remoteness of the site, inadequacy of physical barriers (i.e. for off-road vehicles), and limited law enforcement capability.

5.11 Area Outdoor Recreational Opportunities and Trends

5.11.1 Nearby Recreational Opportunities

The refuge, located approximately 20 miles from the Portland Metropolitan area, is within a reasonable driving distance for recreational day visits. It is estimated that 66 percent of all refuge users are from Clark County Washington and Multnomah, Clackamas and Washington counties in Oregon. The proximity to these population centers creates a high demand for recreational opportunities. Local and regional governments have developed recreation departments to support the recreational demand of the local citizenry. Collectively, the recreation programs for nearby metropolitan areas (Clark County, Vancouver, Portland, and Tualatin Hills) manage approximately 18,000 acres of parks and 300 miles of multiple-use trails for hikers, bicyclists, and equestrians (City of Portland 2009; Clark County Parks and Recreation 2006 and 2007; and Metro Regional Government 2003 and 2009). Clark County has other significant lands managed as open public space by Washington Department of Fish and Wildlife, Gifford Pinchot National Forest, National Park Service, WDNR, State Parks, Clark County Parks, and other entities totaling over 60,000 acres (Clark County Parks and Recreation 2007). Other popular recreation locations within southwest Washington include the Mt. St. Helens National Monument and recreational sites within the Columbia River Gorge National Scenic Area.

5.11.2 Outdoor Recreation Rates and Trends

A small State agency, the Recreation and Conservation Office (RCO) (formerly known as the Interagency Committee for Outdoor Recreation, or IAC), advises the State of Washington on matters of outdoor recreation. The RCO conducts an inventory of outdoor recreation sites and opportunities, conducts studies of recreational participation and preferences, and periodically releases the State Comprehensive Outdoor Recreation Plan (SCORP) and related documents.

Current Participation Rates. The most recent SCORP (RCO 2008) and associated recreation survey (Clearwater Research 2007) identified 15 major categories (activity areas) of outdoor recreation, subdivided into more than 170 recreational activities. Of these 15 major categories, surveys identified walking/hiking and nature activities as the most popular, with 73.8 percent and 53.9 percent of Washington state residents participating in these activities, respectively. In terms of specific recreational activities, the RCO study indicated that walking without a pet in a park or trail setting was the most popular activity (47.8 percent of Washington residents participated in 2006) while observing/ photographing nature and wildlife was the second most popular activity, with participation rates of 39 percent. Table 5.1 shows participation prevalence and frequency for activities that are either currently allowed at the refuge or were allowed in the past but discontinued.

Table 5.1 Participation Frequency for Selected Outdoor Recreational Activities in Washington State. (Table includes those recreational activities which currently or formerly occurred on the refuge and adjoining lands and waters.)

Major Activity Area Recreational Activity	**Rank**	**Percent of WA Residents Participating (2006)**	**Number of Participants (2006)**	**Participation Frequency[1] (2006)**
A. Current Refuge Activities				
Walking/Hiking				
- Walking without a pet, in a park or trail setting	1	47.8%	3,002,421	13,513,508
- Hiking in a rural trail setting[2]		15%	941,208	2,125,099
Nature Activities				
- Visit nature/interpretive center		15.9%	999,287	1,141,213
- Observe/photograph wildlife/nature	2	39%	2,453,243	35,212,304
- Gather/collect berries/mushrooms		11.8%	742,512	1,314,800
Fishing				
- Fishing from a bank, dock, jetty (freshwater)		13.6%	853,534	1,860,886
Hunting / Shooting				
- Hunting Waterfowl		2.5%	156,729	172,810
Water Activity				
- Canoeing/kayaking—freshwater[3]		16.2%	1,019,678	920,451
B. Past Refuge Activities				
Walking/Hiking				
- Walked with a pet (site not designated)	3	31.1%	1,961,279	1,961,279
Team/Individual Sports, Physical Activity				
- Jogging/Running on a trail		17.5%	1,099,247	5,086,921
Bicycle riding				
- Bicycle riding, rural trail system[2]		10.7%	671,723	1,589,353
Equestrian Activity				
-Horseback riding, rural trail system[2]		2.4%	150,998	376,578

Source: Washington State Recreation and Conservation Office 2006 Outdoor Recreation Survey (Clearwater Research 2007)
1. Frequency is defined as the number of times the activity was performed annually, based on peak month data for that activity; therefore, this describes a lower bound for the activity (Clearwater Research 2007). 2. "Rural trail system" was chosen rather than "mountain or forest trail" as better representing the activity on the refuge. 3. Occurs on waters adjacent to the refuge

It must be noted that there is a major discrepancy between the estimated number of waterfowl hunters in 2006 as reported in the RCO study (projections based on survey data), and actual numbers reported by WDFW (WDFW 2007). The RCO estimated than more than 156,000 Washington residents participated in waterfowl hunting in 2006 while WDFW reported that approximately 27,000 residents participated in this activity. This raises the question of whether RCO's survey methodology resulted in a higher percentage of hunters being surveyed than are present in the general population, or whether estimated participation is higher than actual participation in multiple categories. The RCO survey may have captured individuals who formerly hunted but no longer do so. Still, the study does provide a broad basis of comparison of participation in recreational activities.

Forecast of Future Regional Recreation Demand and Key Recreation Needs. Overall, outdoor recreation activity in most activities continues to increase at high growth rates. In a recent technical report (IAC 2003), IAC projected future participation in 13 of 14 major outdoor recreation use categories over periods of 10 and 20 years. Nine of these activities will experience double digit growth (see Table 5.2).

These most recent estimates of recreation trends were based on the National Survey on Recreation and the Environment Projections for the Pacific Region (NSRE), which includes Washington. The NRSE's projections were adjusted by IAC as necessary based on age group participation, estimates of resource and facility availability, user group organization and representation, land use and land designations; and "other factors" including the economy and social factors. Table 5.2 shows the percent change expected for Washington State by activity as reported in the 2003 IAC report.

Many outdoor activities generally permitted on refuges are expected to show increases of 20 percent to 40 percent over the next 20 years. The exceptions are hunting, in which participation is expected to fall by about 20 percent within the next 20 years, and fishing, in which participation is expected to fall by about 10 percent within the next 20 years.

Trends in Waterfowl Hunting in Washington. Note: The following discussion is based on data collected by the Washington Department of Fish and Wildlife (Moore 2007). Between 1962 and 1971, there was an increase in the number of waterfowl hunters in Washington, from 70,000 to 100,000. This increase, along with the loss of waterfowl habitat and hunting opportunities in southwest Washington, added weight to the MBCC's decision to name waterfowl hunting, along with protection of migration and wintering habitat for waterfowl, as a refuge purpose in 1964.

Throughout the 1970s, the number of waterfowl hunters in Washington was relatively stable at approximately 90,000. Beginning in 1980 there was a precipitous decline; by 1990 numbers had dropped to 30,000. While some ascribe the decline to more restrictive regulations and lower bag limits, the WDFW report notes that the decline actually began at a time of liberal regulations and bag limits. Other factors which could explain the decline include increasing urbanization and loss of waterfowl habitat in Washington, and declines in duck populations due to low nesting success in the mid 1980s, which caused some hunters to abandon the sport. As duck populations recovered, some hunters did return; this may account for the modest rise in numbers between 1990 and 1999 (from 30,000 to 40,000). The years 2001-2005 saw continued declines, down to a low of 22,000 waterfowl hunters in the 2004-2005 season. Numbers increased between 2005 and 2007 to approximately 27,000 hunters. While the number of waterfowl hunters remains low compared to historic highs of the 1970s, the success rate (number of ducks harvested per hunter) has actually increased. This could be due to lower numbers of hunters in the field, and the most dedicated and skilled hunters remaining in the sport. Participation in hunting is expected to decline in Washington by approximately 20 percent by 2022 (see Table 5.2) for a number of reasons, including an increasingly urban population with no established hunting tradition, fewer hunt opportunities, and no recruitment of new hunters.

While the number of waterfowl hunters in Washington State has declined greatly since 1970, the number of waterfowl hunt visits at the refuge has remained remarkably constant over the past 30 years, at approximately 2,000 visits annually (see page 12). This implies that with fewer public hunting opportunities in southwest Washington, waterfowl hunters are crowding into remaining areas. Convenience and ease of access may also make Ridgefield attractive to waterfowl hunters.

Table 5.2 Projected Future Changes in Participation for Selected Outdoor Recreation Activities

Activity	Estimated Change, 10 years (2002-2012)	Estimated Change, 20 Years (2002-2022)
Walking[1]	+23%	+34%
Hiking[1]	+10%	+20%
Nature Activities[1] (includes outdoor photography, observing wildlife and fish, gathering and collecting, gardening, and visiting nature interpretive centers)	+23%	+37%
Bicycle riding[2,3]	+19%	+29%
Canoeing/kayaking[3]	+21%	+30%
Fishing[1]	-5%	-10%
Hunting / Shooting[1]	-15%	-21%
Equestrian[2]	+5%	+8%

Source: IAC (2003). 1 Use allowed on refuge in select areas. 2. Use formerly allowed on select areas of refuge but discontinued. 3 Use not allowed on refuge but occurs or public lands or waters adjacent to the refuge

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Chapter 6. Special Designation Lands, Cultural Resources, and Social/Economic Environment

Roots of the wapato plant were a major trade item and a "staff of life" for the Cathlapotle Chinookans / USFWS

A replica plankhouse gives visitors glimpses of life at Cathlapotle, a Chinookan town that stood on the Refuge until the 1830s. /USFWS

Chapter 6. Special Designation Lands, Cultural Resources, and Social/Economic Environment

6.1 Special Designation Lands

This section discusses sites or areas on the Ridgefield Refuge that have been assigned special designations by local, county, State, Federal or international governments, and in some cases nongovernmental organizations, so that these sites receive special management consideration. The areas discussed in detail below include the Blackwater Island Research Natural Area (RNA), sites listed under the National Register of Historic Places, and sites identified as Important Bird Areas.

6.1.1 National Register of Historic Places

Established under the National Historic Preservation Act of 1966 (NHPA), the National Register includes nearly 77,000 districts, sites, buildings, structures, and objects that are significant in American history, architecture, archaeology, engineering, and culture. The register's entries were identified and documented in partnership with State, Federal, and tribal preservation programs. The documentation provided for each property consists of photographs, maps, and a registration form which provides a physical description of the place, information about its history and significance, and a bibliography. Documentation is now available online through the National Register Information System at http://www.nr.nps.gov.

The Basalt Cobblestone Quarries District, on the Refuge's Carty Unit, was listed in the National Register of Historic Places on Dec 14, 1981. It includes six geographically distinct basalt quarry sites recorded as one site (45CL161H). An application to add the Cathlapotle Indian Town Site to the National Register of Historic Places is being drafted.

6.1.2 Important Bird Areas (IBA)

The Important Bird Areas (IBA) program is a global effort to identify the most important areas for maintaining bird populations and focusing conservation efforts on protecting these sites. Within the U.S., the program has been promoted and maintained by the American Bird Conservancy (ABC) and the National Audubon Society (NAS). The ABC is coordinating the identification of nationally significant IBAs while NAS is working to identify sites in individual states. The NAS is working within each state to identify a network of sites across the U.S. that provide critical habitat for birds. This effort recognizes that habitat loss and fragmentation are the most serious threats to birds across North America and around the world. By working through partnerships, principally the North American Bird Conservation Initiative, to identify those places that are critical to birds during some part of their life cycle (breeding, wintering, feeding, migrating), the hope is to minimize the effects that habitat loss and degradation have on bird populations. The IBA program has become a key component of many bird conservation efforts. More information is available at http://www.audubon.org/bird/iba/index.html.

In Washington, the goals of the IBA program are to: Identify the sites that are the most essential for long-term conservation of birds, and to take action to ensure the conservation of these sites (Cullinan 2001). An IBA is a site that provides essential habitat for one or more species of birds. The IBA selection process examines sites based on: The presence and abundance of birds; and/or the condition and quality of habitat. The IBAs are chosen using standard biological criteria and expert ornithologists' review. All sites nominated as potential IBAs are rigorously evaluated to determine whether they meet the necessary qualifications. The IBAs represent discrete sites, both aquatic and terrestrial, that are critically important to birds during their annual life cycle (e.g. breeding, migration, and/or wintering periods).

The Ridgefield Refuge is listed as a Washington State-level IBA based on large concentrations of migrating and wintering waterfowl (up to 45,000 geese, 20,000 ducks, and 1,000 tundra swans). Also cited are a significant number of bald eagles (20) and sandhill cranes (500) spending the winter at the refuge, a major fall sandhill crane roost (up to 1700 birds), and nesting colonies of great blue heron (500 pairs). The IBA criteria applicable to the refuge include:

- Site for endangered or threatened species, or species of special concern in Washington;
- Site containing species assemblages associated with a representative, rare, or threatened natural-community type in Washington;
- Site where birds regularly concentrate in significant numbers (at least 2,000 waterfowl in fresh water habitats; or 5,000 waterfowl in marine/estuarine habitats for short periods during any season; At least 50 Great Blue Heron nests during breeding season).

The IBA website notes that "The refuge is valuable primarily as a wintering and migration staging area for waterfowl, and also provides habitat for many other birds. It is a wintering area for the Aleutian Canada Goose, a federally threatened subspecies [delisted in 2001 but still State listed]; and two percent of the global population of Dusky Canada Geese winters here. Ridgefield and the surrounding area support Washington's only wintering population of Sandhill Cranes, and supports a large concentration of wintering Bald Eagles. The refuge is important for a variety of wetland-associated songbirds; and the oak woodlands provide habitat for an assemblage of species rare in western Washington, including Scrub Jay, House Wren, and the Slender-billed White-breasted Nuthatch, a candidate for listing as a threatened subspecies."

Table 6.1 Significant Concentrations of Birds Noted to Identify the Ridgefield Refuge as a Washington State Important Bird Area

Species or Group	Season	Average	Maximum
Great Blue Heron	B	500 pairs	--
Great Egret	FM	--	100
Tundra Swan	W	1,000	--
Dusky Canada Goose	W	359	--
Geese	W	--	45,000
Ducks	W	--	20,000
Bald Eagle	W	12	20
Sandhill Crane	W	500	--
Sandhill Crane	FM	--	1,700
Purple Martin	B	15 pairs	--

Source: http://wa.audubon.org/science_IBAWashington.html

6.1.3 Research Natural Area

The refuge contains one Research Natural Area (RNA), the Blackwater Island RNA (129 acres) located on the Carty Unit. The refuge's RNA was established in December 1972. Activities on RNAs are limited to scientific and educational activities that are non-destructive, non-manipulative, and maintain unmodified conditions. The purposes of RNAs are:

- To preserve examples of major ecosystem types or other outstanding physical or biological phenomena;
- To provide research and educational opportunities; and
- To preserve a full range of genetic and behavioral diversity for native plants and animals, including endangered or threatened species (USFWS 1981).

The Blackwater Island RNA exemplifies the floodplain communities of the lower Columbia River, with Oregon white oak occupying the basalt knolls and ridges above the flood zone. Pacific willows fringe the permanent lakes and channels, and a narrow belt of Oregon ash is found in the inter-flood zone between the Pacific willow and the oak. An herbaceous aquatic community is found along the shallow shorelines and in ephemeral ponds on the islands (Wiberg and Greene 1981). Ephemeral ponds on the RNA host the federally threatened water howellia. The RNA also contains an example of the Oregon white oak/ovalleaf viburnum/poison oak plant association, which is classified as a Priority 2 ecosystem in the Washington Natural Heritage Plan (WDNR 2009).

6.2 Archaeological and Cultural Resources

With its strategic position on the Columbia River, the area that would eventually become the Ridgefield Refuge occupied an important fishing and trade route location that attracted early peoples. The river was a crucial link in a thriving trade network that extended inland to the Rocky Mountains, and as far north as Vancouver Island. The region would later attract early British and American explorers and traders, and eventually American settlers. This section can, therefore, serve only to present a brief outline of the refuge's rich history and cultural heritage.

Archaeological and other cultural resources are important components of our nation's heritage. The Service is committed to protecting valuable evidence of plant, animal, and human interactions with each other and the landscape over time. These may include previously recorded or yet undocumented historic, cultural, archaeological, and paleontological resources as well as traditional cultural properties and the historic built environment. Protection of cultural resources is legally mandated under numerous Federal laws and regulations. Foremost among these are the National Historic Preservation Act (NHPA) as amended, the Antiquities Act, the Historic Sites Act, the Archaeological Resources Protection Act (ARPA) as amended, and the Native American Graves Protection and Repatriation Act (NAGPRA). The Service's Native American Policy (1994) articulates the general principles guiding the Service's relationships with Tribal governments in the conservation of fish and wildlife resources. Additionally, the refuge seeks to maintain a working relationship and consult on a regular basis with the Tribes that are or were traditionally tied to lands and waters within the refuge.

Since cultural resources encompass many elements and time periods, the following simple temporal divisions were used to distinguish and categorize this brief review of the following resources.

- Pre-recorded History
- Pre-Contact Native American Traditions
- Post-Contact Traditions (Native American, Early British and United States)
- Recent U.S. Settlement and Economic Development Period
- Historic and Prehistoric Sites on the Refuge

6.2.1 Pre-recorded History

Presence of Paleo-Indian Peoples. Although people have probably occupied the Portland Basin for 12,000 years, evidence for ancient occupation has not been found. Rising sea levels after the last Ice Age and river flooding have erased or deeply buried low-elevation sites, making the discovery of Paleo-Indian sites in the Basin unlikely. Urban and industrial development, dredge spoils dumping, and construction of dikes along the Columbia River have also destroyed or buried the archaeological record (Gilsen 2007).

Archaeological research has demonstrated that Native peoples have been living in the Portland Basin for at least 9,000 to 10,000 years (Ames 1994), although evidence of human occupation earlier than 2,550 years before present (BP) is sparse. The earliest evidence of human presence in the area comes from sites that ring the outer edges of the Basin. For example, at the Burnett site (35CL96), located in the city of Lake Oswego, Oregon, artifacts were stylistically similar to those found in the Cascades and on the Columbia Plateau that date from 8000 to 10,000 BP (Burnett 1991). The Sunset Ridge site (45CL488), located in eastern Washougal, dates from approximately 8000 to 4500 BP (Ozbun and Reese 2003).

Another site, 45CL631, located south of Ridgefield on Vancouver Lake, produced a radiocarbon date (C14) of about 3400 BP in association with Cascade-like points and cobble tools (Smith et al. 2005). The Merrybell site (35MU9) on Sauvie Island has produced C14 dates ranging from 850 to 2880 plus or minus 90 and 155 years respectively (Pettigrew 1981). Overlapping in age with the Merrybell site, the refuge's Wapato Portage site (45CL4) preserves evidence of human occupation dating back at least 2,300 years. Stratified cultural deposits above the oldest dates and the presence of 19th century trade goods tell us that the Chinookan people used the Wapato Portage site for more than 2,000 years (Minor and Toepel 1985). Intact, stratified sites of this age are very rare in the active floodplain of the Columbia River.

The archaeological evidence shows a gradual change from a focus on big game hunting to a mixed gathering, hunting, and fishing economy in western Oregon and Washington. During the Middle Archaic period (6000-2000 BP) people began to settle into patterns that were noted by Euro-Americans when they first entered the region. Large houses, indicating higher population densities, and evidence of fishing technology appear, as well as an increased abundance of tools used to process plant foods. Evidence of an increasingly large and sophisticated trade network also appears in the archaeological record.

Late Period Settlements. The Late Archaic period, beginning 2,000 years ago, shows increasing development of the cultural traits that culminated in the cultures and present-day tribal structures of the region (Gilsen 2007). Reliance on fishing (for salmon, eulachon and sturgeon), plant gathering, and hunting for large game is evident, as is use of larger plankhouses in more concentrated villages. By the time Euro-American explorers and traders arrived in the Wapato Valley, it was one of the most densely occupied areas of North America (Pettigrew 1981:6). Several sites from this period have been described in the Portland Basin, including the Cathlapotle site (45CL1) on the refuge's Carty Unit (Ames et al. 1999; see section 6.2.5 below for a site description).

6.2.2 Pre-contact Native American Traditions

The Portland Basin, called the “Wapato Valley” by Lewis and Clark, was the site of a particularly rich grouping of early Native American settlements. The refuge is within the area occupied by Chinookan-speaking groups at the time of Euro-American contact. The term “Chinookan” refers to the speakers of several closely related languages who occupied the Columbia River from the upstream end of the Columbia Gorge (near the present town of The Dalles, Oregon), to the river’s mouth, and adjacent portions of the coasts of Washington and Oregon. Lower Chinook was spoken by peoples living on both sides of the river’s mouth, and Upper Chinook was spoken along both sides from the river's estuary upriver through the Gorge. Upper Chinook in turn was divided into the Cathlamet, Multnomah and Kiksht languages. Multnomah was spoken in the Wapato Valley, including Cathlapotle (Silverstein 1990). At the time of Lewis and Clark’s expedition, the Salishan-speaking Hul-lu-et-tell (Cowlitz) lived north of the entrance of the Lewis River and on the Cowlitz River (Hodge 1910[1]:577 in Minor et al. 2008). As traders, the residents of villages along the Columbia River were multi-lingual, speaking languages or dialects from both up and down river.

There is consensus among anthropologists that prior to 1851 (when treaty negotiations began with the Indian tribes of the region) local Indian peoples were not organized into “tribes” (political units encompassing multiple villages with a common identity, sense of purpose, or territorial claim). Rather, it is believed people identified themselves as members of the village where they were born or raised (Hunn 2000).

Villages were politically independent, headed by a chief who exercised influence through his wealth and personal skills. The chief, along with shamans, warriors, and traders, formed the small upper class. The bulk of the population consisted of “commoners,” and at the bottom of the social ladder were slaves, who were obtained through trade, and usually owned only by wealthy families. Slaves came from tribes that did not practice head flattening; their round heads distinguished them from the upper class and commoners (Hajda 1984:178). At different times of the year members of these villages might travel to areas beyond their territory. Chinookan villages consisted of one or more cedar plankhouses occupied by multiple extended families. Families at summer camps occupied temporary shelters of mats or brush (Silverstein 1990).

Boyd and Hajda (1987) reported 16 named Chinookan villages in Portland Basin, based on Lewis and Clark's journals (see Figure 6.1). In the fall of 1805, Lewis and Clark estimated the population of the villages at 3,400 people, while they reported a figure of 8,040 during their return trip upstream in the spring. Boyd and Hajda believe that the lower figure represented the permanent population of the basin, and the higher figure reflected seasonal shifts in population during the spring, when people from neighboring areas moved in to share in the abundant fish runs and to collect camas in the upland prairies. The figure of 8,040 represent a minimum figure for the pre-epidemic permanent population of the Wapato Valley, since Lewis and Clark arrived after the smallpox epidemics of the 1770s and 1801. The actual pre-epidemic population was probably closer to 12,000 to 14,000 (Ames 1994). One of these villages listed by Lewis and Clark was “Quathlapotle” at the mouth of the Lewis River. The true name of the village was probably Nahpooitle, the Chinookan name for the Lewis River; “Cathlapotle” meant “people of the Lewis River” (Silverstein 1990). Over time, the true name of the village became obscured and the village was referred to as Cathlapotle. At the time of the Lewis and Clark expedition, Cathlapotle was the third largest Chinookan village in the Wapato Valley, with an estimated peak population of 900.

Much of the social, political, and economic culture of the Chinookan Indians focused on their role as traders. Cathlapotle lies at the confluence of the Columbia River, Multnomah Channel, Lake River, and the Lewis River, an excellent location to access natural resources and coordinate trade. Cathlapotle is a prime settlement location where long and continuous habitation might be expected.

The importance of the lower Columbia River to native systems of trade is evidenced by the large number of strategically placed villages along major waterways, and a network of trails in areas where travel by water was impractical. Later, these trails would be developed by Euro-American traders and settlers; but their beginnings were the trails used by Native Americans for trade and travel. Wapato was an extremely important trade item produced by the inhabitants of the Portland Basin, and contributed much to their wealth. Indeed, Meriwether Lewis wrote in 1806 that "the wappetoe furnishes the principal article of traffic with these people which they dispose of to the nations below in exchange for beads cloth and various articles. The natives of the Sea coast and lower part of the river will dispose of their most valuable articles to obtain this root" (Moulton 1991 [7]: 26-29).

6.2.3 Post-Contact Traditions

The Columbia River first appeared on European maps in the early 17th century when the Spanish explorer Martin de Aguilar described a major river near the 42nd parallel, but the river remained unexplored and unknown to Europeans for almost 200 years. In April 1792, the American Captain Robert Gray detected a strong current flowing outward near the mouth of the Columbia River. Later that month, Gray encountered Capt. Vancouver's British expedition and told him that he suspected the existence of a major river. Vancouver, believing Gray was mistaken, continued north. Within two weeks, Capt. Gray became the first documented Euro-American to navigate the bar and enter the Columbia River. Gray gave a copy of his chart to the commander of the Spanish garrison on Vancouver Island, where Capt. Vancouver saw the chart and recognized his error (Oldham 2003).

In October 1792, Vancouver sent Lt. William Broughton in the *Chatham*, with a copy of Gray's chart, to explore the Columbia River. Broughton sailed up the lower Columbia River from its mouth to Point Vancouver, which he named for his Captain, and back, charting and naming many features along the way (Oldham 2003). On October 28th, during his return trip downstream, Broughton and his crew met a group of Chinookan Indians at the lower end of Sauvie Island, near present day Warrior Rock, immediately downstream of Ridgefield Refuge. He called the site:

"...Point Warrior, in consequence of being there surrounded by twenty three canoes carrying from three to twelve persons each, all attired in their war garments and in every other respect prepared for combat. On these strangers discoursing with the friendly Indians that attended our party, they soon took off their war dress, and with great civility disposed of their arms and other articles for such valuables as we presented to them, but would other niether part with their copper swords nor a kind of battle axe made of iron."

From Warrior Point, Lt. Broughton described a large Indian village on the north shore. This is presumed to be the first written account of the Cathlapotle Chinookans:

"At Point Warrior the river is divided into three branches; the middle one was the largest, about a quarter of a mile wide, and was considered as the main branch; the next most capacious took an easterly direction and seemed extensive; to this the name of Rushleigh's River was given . . . On the banks of Rushleigh's River was seen a very large Indian village and such of the strangers as seemed

to belong to it strongly solicited the party to proceed thither; and to enforce their request, very unequivocally represented that if the party persisted in going to the southward they would have their heads cut off. The same entreaties, urged by similar warnings had been before experienced by Mr. Broughton during his excursion, but having found them to be unnecessary cautions he proceeded up that which he considered to be the main branch of the river..." (Vancouver 1926:21-22)

The next written account of the people of the "Quathlapotle nation" was from November 5, 1805, during Lewis and Clark's journey down the Columbia River. On November 5, Lt. Clark described a substantial town of cedar plankhouses, occupying one-quarter mile of shoreline. Clark wrote:

"*...passed an Isld. Covered with tall trees & green briers Seperated from the Stard. Shore by a narrow Chanel at 9 [8?] miles I observed on the Chanel which passes on the Stard Side of this Island a Short distance above its lower point is Situated a large village, the front of which occupies nearly 1/4 of a mile fronting the Chanel, and closely Connected, I counted 14 houses [NB: Quathlapotle nation] in front here the river widens to about 1/2 miles. Seven canoes of Indians came out from this large village to view and trade with us, they appeared orderly and well disposed, they accompanied us a fiew miles and returned back..."* (Moulton 1990[6]:23)

On March 29, 1806, Lewis and Clark visited the town for approximately two hours. They enjoyed a meal of wapato and eulachon (prized for its fine flavor and high oil content), and presented gifts. Lewis wrote:

"...at the distance of three miles above the entrance of the inlet on the N. side behind the lower point of an island we arrived at the village of the Cath [X: Quath]-la-poh-tle wich consists of 14 large wooden houses. here we arrived at 3 P.M. the language of these people as well as those on the inlet and wappetoe Island differs in some measure from the nations on the lower part of the river. tho' many of the words are the same, and a great many others with the difference only of accent. the form of their houses and dress of the men, manner of living habits custom &c as far as we could discover are the same. . . .

"the floors of most of their houses are on level with the surface of the earth tho' some of them are sunk two or 3 feet beneath. the internal arrangement of their houses is the same with those of the nations below. they are also fond of sculpture. various figures are carved and painted on the peices which support the center of the roof, about their doors and beads [beds] . . . "

" . . . they had large quantities of dried Anchovies strung on small sticks by the gills and others which had been first dryed in this manner, were now arranged in large sheets with strings of bark and hung suspended by poles in the roofs of their houses; they had also an abundance of sturgeon and wappatoe; the latter they take in great quantities from the neighbouring bonds [ponds], which are numerous and extensive in the river bottoms and islands . . ."

"they have a number of large symeters [scimitars, or swords] of Iron from 3 to 4 feet long which hang by the heads of their beads [beds]; the blade of this weapon is thickest in the center tho' thin even there. all it's edges are sharp and it's greatest width which is about 9 inches from the point is about 4 inches. the form is thus. this is a formidable weapon. they have heavy bludgeons of wood made in the same form nearly which I presume they used for the same purpose before they obtained metal. we purchased a considerable quantitiy of wappetoe, 12 dogs, and 2 Sea otter skins of these people.

"they were very hospitable and gave us anchovies and wappetoe to eat. notwithstanding their hospitality if it deserves that appellation, they are great begers, for we had scarcely finished our repast on the wappetoe and Anchovies which they voluntarily sat before us before they began to beg. we gave them some small articles as is our custom on those occasions with which they seemed perfectly satisfyed. we gave the 1st Cheif a small medal, which he soon transfered to his wife. after remaining at this place 2 hours we set out & continued our rout between this island, which we now call Cath-lah-poh-tle after the nation, and the Lard shore. at the distance of 2 miles we encamped in a small prarie on the main shore, having traveled 19 miles by estimate..." (Moulton 1991[7]:26-29)

Clark described this small prairie as:

"a butifull grassy plac, where the nativs make a portage of their Canoes and Wappato roots to and from a large pond at a short distance. in this pond the nativs inform us they Collect great quantities of wappato, which the womin collect by getting into the water, Sometimes to their necks holding by a Small canoe and with their feet loosen the wappato or bulb of the root from the bottom from the Fibers, and it imedeately rises to the top of the water. they collect & throw them into the Canoe, those deep roots are the largest and best roots. Great numbers of the whistling swan, Gees and Ducks in the Ponds. Soon after we landed 3 of the nativs came up with wappato to sell a part of which we purchased..." (Moulton 1991[7]:30)

Today Lewis and Clark's campsite is known as Wapato Portage, and like Cathlapotle, it is situated on the refuge's Carty Unit.

The Fur Trade and Epidemics. After Lewis and Clark returned to the United States, Euro-American traders were not long in gaining a foothold on the Columbia River, which they recognized as key to control of the fur trade. In 1811, the Pacific Fur Company established Fort Astoria on at the mouth of the Columbia. Only three months later, on July 15, 1811, Canadian explorer and surveyor David Thompson, representing the competing Northwest Company, completed his "Columbia Expedition" from the Spokane House trading post to the Pacific Ocean (Oldham 2003b). Fort Astoria was sold to the Northwest Company in 1813, which in turn merged with the British Hudson's Bay Company in 1821. The Chinookan Indians living along the lower Columbia River were active participants in the fur trade (Ruby and Brown 1976). Early on, the powerful traders successfully resisted attempts by the Americans and British to control the upriver trade. But by 1825, with their numbers weakened by epidemics, the Chinookans were unable to stop British efforts to gain control of trade networks.

The Hudson's Bay Company established a fur-trading post at Fort Vancouver in 1825. Initial land claimed by the Hudson's Bay Company extended along the Columbia to its confluence with Lake River. Therefore, the River 'S', Ridgeport Dairy, and Roth Units were once land belonging to the Hudson's Bay Company. Fur traders used the same trails and water routes that had been developed by Native Americans for trade and travel. The Wapato Portage site visited by Lewis and Clark became a river crossing along the Fort Vancouver to Cowlitz Prairie Trail, constructed by the Hudson's Bay Company in the 1820s. Crossing Lake River near Carty Lake, it functioned as a landing for cargo being transported along the trail.

The list of early explorers, expeditions, and scientists passing through the area is large and only highlights can be given here. Several notable scientists visited the area during the first half of the 19th century. David Douglas, of the London Horticulture Society, arrived at Fort Vancouver on April

20, 1825, in the company of the Hudson Bay Company's chief factor, Dr. John McLoughlin (Douglas was familiar with the reports of Archibald Menzies, who served as surgeon and naturalist on Vancouver's 1792 expedition.). That year, Douglas collected plants up the Columbia, Willamette, Chehalis and Cowlitz rivers, often assisted by Indian guides. He revisited the region in 1830, when he witnessed the terrible epidemic that swept away most of the region's original inhabitants; and again in 1832-1833 (Oregon Historical Society 1905). In his 11 years as a botanist he described 250 plant species unknown in Europe and introduced many species of Northwestern plants to British gardens—from the Douglas-fir which bears his name, to camas.

In 1834, two more naturalists, ornithologist John Kirk Townsend and botanist Thomas Nuttall, accompanied Nathaniel Wyeth on his expedition to Oregon (Townsend 1839). Nuttall had resigned a professorship at Harvard to join the expedition. They explored Sauvie Island, the Willamette Valley, Walla Walla, and the Blue Mountains. On his arrival back in Philadelphia in 1837, Townsend sold 93 bird specimens to John James Audubon, who described them in his *Birds of America*. In all, Townsend supplied 74 of the 508 species Audubon described (Oregon Historical Society 2002).

Epidemics on the Lower Columbia River. Documents left by explorers, traders, and residents from Astoria and Fort Vancouver occasionally mention Cathlapotle and its Chinookan inhabitants. But increasingly, their accounts recorded disaster. Because their towns were located on the major trade route of the Columbia, Chinookan peoples were devastated by a series of epidemics, including smallpox, influenza, and malaria that killed perhaps as much as 95 percent of the precontact population. Smallpox epidemics started in the 1770s and continued into the next century. The worst of the epidemics, from the standpoint of the Chinookans, began in 1830 and continued to rage until 1833. It hit the Wapato Valley worst of all. Described in contemporary accounts as "fever and ague" or "intermittent fever," the disease was probably malaria (Boyd 1999). In a letter dated October 11, 1830, botanist David Douglas describes the epidemic of 1830, which began in late July of that year:

"*... A dreadfully fatal intermittent fever broke out in the lower parts of this river about eleven weeks ago, which has depopulated the country. Villages, which had afforded from one to two hundred effective warriors are totally gone; not a soul remains. The houses are empty and flocks of famished dogs are howling about, while the dead bodies lie strewn in every direction on the sands of the river.*" (Oregon Historical Society 1905).

Some estimate that as few as 30 to 40 Chinookan survivors were left in the Wapato Valley after the malaria epidemics swept through (Taylor and Hoaglin 1962). By 1840, only 280 Chinookans, including slaves, remained (Ruby & Brown 1976:194). This included Chinook living on the coast.

Sometime during the 1830s, the few inhabitants of Cathlapotle that had survived the malaria epidemic abandoned the site. In 1833, William Tolmie, a Hudson's Bay Company doctor, observed of Cathlapotle that "only its superior verdure distinguished the spot from the surrounding country." However, another HBC doctor, Meredith Gairdner, claimed that Cathlapotle was still occupied in 1835 (cited in Wuerch 1979). Ceramic trade goods found at the site indicate abandonment circa 1834 (Kaehler 2002).

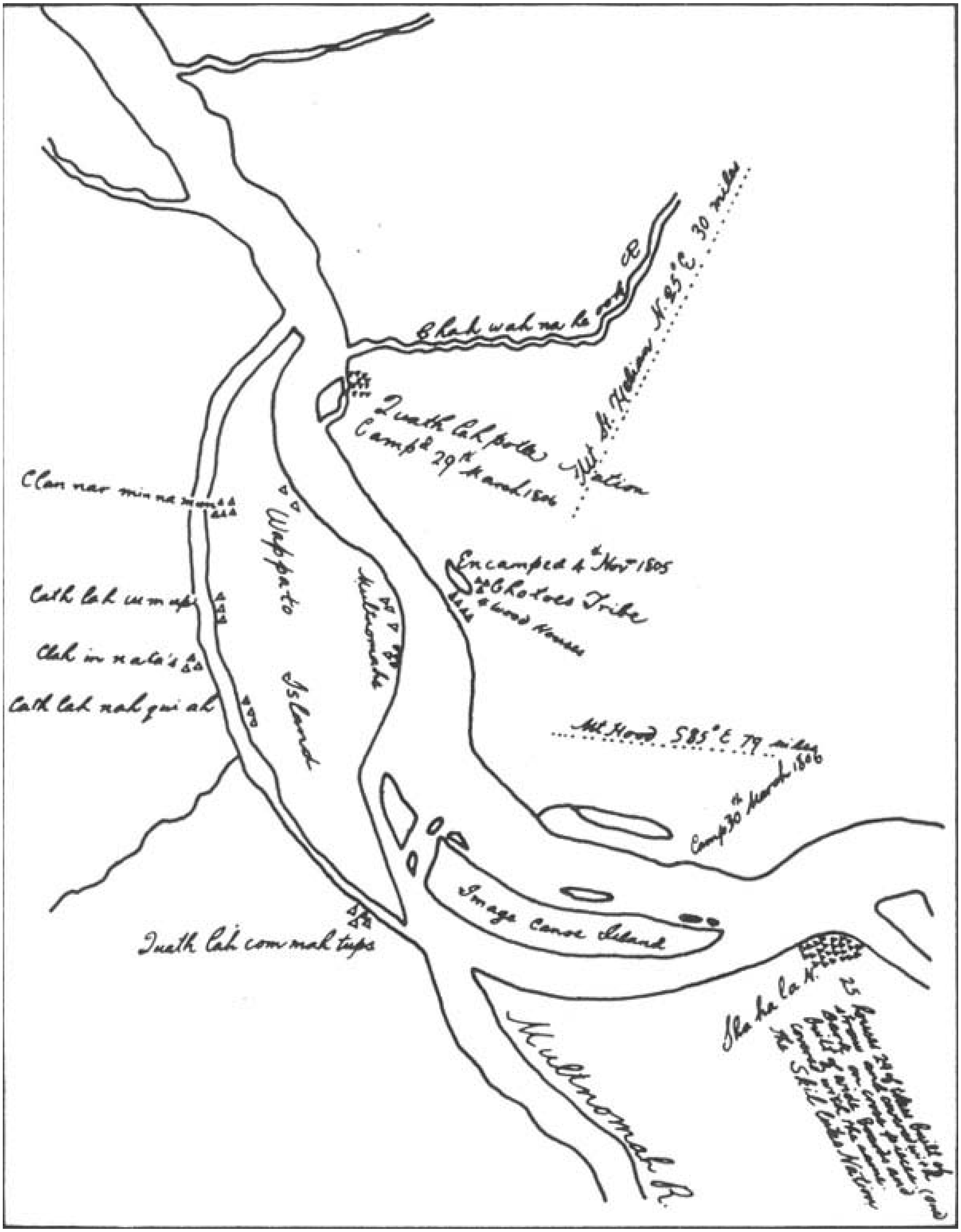

Figure 6.1 William Clark's map of the "Wapato Valley," including the site of the "Quathlapotle nation." Adapted from Moulton (1983), Maps 79 and 80. Reproduced courtesy Center for Columbia River History.

Charles Wilkes, who visited the area in 1841, wrote, "I satisfied myself that the accounts given of the depopulation of this country are not exaggerated; for places were pointed out to me where dwelt whole tribes, that have been entirely swept off . . ." (Wilkes 1845). Wilkes wrote that prior to the epidemics, Chief Cassino (also written as Casenov or Kiesno), chief of the Multnomahs on Sauvie Island, was able to muster close to 500 warriors. When Wilkes met him in 1841, he was alone, "his land, tribe and property all departed." The artist Paul Kane, who visited the region in 1846-1847, wrote that "Kattlepootle" (Cathlapotle) and other Chinookan towns of the lower Columbia River were "entirely extinct as villages" (Kane 1855). Nevertheless, Kane produced a record of Chinookan culture in his paintings and writings. In 1853 and 1854, General Land Office surveyors noted an "Indian lodge" on the southeastern bank of Gee Creek where it enters the Lewis River (Bureau of Land Management 2007). However, by that time the inhabitants may not have been Chinookan.

As the Chinookan people living along the Columbia River were decimated by disease, survivors dispersed and intermarried with other groups, and other peoples moved into depopulated areas. The expansion of Salish-speaking Cowlitz and Sahaptin-speaking Taitnapams into the Wapato Valley following the decimation of Chinookan populations is well documented (Ames et al. 1999). Prior to the malaria epidemic, Chinookans occupied the shorelines of the lower Columbia River, while the Cowlitz lived further inland. But by 1834, naturalist John K. Townsend encountered "...several large lodges of Kowalitsk Indians, in all probably one hundred persons" on a plain below Warrior's Point (Townsend 1839). William Curtis wrote in 1911 that "a few of the [Cowlitz] villages near [the Cowlitz River's] mouth were partly inhabited by Chinookan people married to Cowlitz" (Curtis 1911).

Another group to migrate into the area following the epidemics was the Sahaptin-speaking Teitnapum (Taitnapam). Most 19th century writers referred to them as a branch or subgroup of the Klickitats. Others state that they were not originally Sahaptin speakers, but rather adopted the Sahaptin language through intermarriage (Ray 1966, Irwin 1994). Today they are part of the Cowlitz Tribe. Ethnographer and translator George Gibbs wrote, "After the depopulation of the Columbia tribes by congestive fever, which took place between 1820 and 1830, many of that tribe [Klickitat] made their way down the Kathlaputl [Lewis River], and a part of them settled along the course of that river . . . The present generation, for the most part, look upon the Kathlaputl as their proper country, more especially as they are intermarried with the remnant of the original proprietors [Chinookans]" (Gibbs 1877:170-171). In an 1854 letter to territorial governor Isaac Stevens, Indian agent William Tappan referred to "Tai tin a pams at the mouth of the Cathlapoodle" and estimated that 140 to 200 Taitnapams were living in the valley of the Lewis River (Tappan 1854). Gibbs's and Tappan's statements were supported by relatives of Tyee Umtuch (Umtux), who is generally identified as the chief of the Taitnapams. Tyee Umtuch's niece, Catherine Cosike, claimed to be a member of the "Cathlapodle Tribe" when she was interviewed by the *Portland Oregonian* in 1915 (Ruby and Brown 1992).

Family histories of the Lancasters (who settled on the south bank of the Lewis River) and Shoberts (who ran a ferry and lodging house on Lake River) recall that they were on friendly terms with their Indian neighbors. Judge Columbia Lancaster even hosted Umtuch and his people in the new mansion he built in 1850. However they became uneasy in 1855, with reports that Indians under Umtuch were planning raids. They and other families fled to the blockhouse across the Columbia River in St. Helens, which had been built for that purpose (Standal 2009). In October of 1855, the U.S. Army ordered the Indians living on the Lewis River (identified as Klickitats and Umtuch's band of Taitnapams) to go to Fort Vancouver for their own safety and to quiet the white settlers' fears.

A group of Yakamas came to the Fort and convinced the Klickitats and Taitnapams to leave with them. The Army pursued, and though the Indians were persuaded to return to the fort, Umtuch was killed, apparently accidentally.

After Tyee Umtuch was killed, "the remainder of his band, consisting of women and children, were transported to the Yakima Reservation" (Fitzpatrick 2004). However, Indian people continued to live in the vicinity of Cathlapotle. A local history recounts that due to the disastrous flooding along Lake River in 1867 and 1876, "the remaining Indians were forced to move to the mouth of the Lewis River" (Standal 2009). Mrs. Cosike, who was living near Battle Ground in 1915, recalled that by that time "this little handfull [of Cathlapodle Indians] does not number more than a dozen, although with their roving disposition, there are always a few of them coming and going on the trail leading to the Yakima Indian Reservation" (Ruby and Brown 1992). Fred Umtuch, the great grandson of Tyee Umtuch, was reported to have been buried in an Indian cemetery near "Cathlapoodle" (Oregonian 1925).

Tribal Treaties. Middle Chinookans were parties to a series of treaties negotiated during the early 1850s (all would have removed them from their homelands), but none were successfully implemented or ratified. In 1855, Territorial Governor Isaac Stevens held the Chehalis River Council with 843 Indians representing the "Upper and Lower Chehalis, Queniolts, Chenooks and Cowlitz." Swan reported that 100 Indians were "all that remained of the Chenook tribe," although it was unclear if all bands of the Chinook were represented (Swan 1969). Treaty negotiations were broken off and treaties were never signed with these tribes. Reservations were established by executive orders for the Upper Chehalis and Cowlitz on the Chehalis River near Oakville in 1864 and on northern Willapa Bay in 1866 for the Lower Chehalis, Chinooks, and others. Many Indians, however, refused to be moved to these reservations (Hajda 1990:514-515).

Even though the Oregon treaties were likewise never ratified, most of the remaining Chinookans in the Portland Basin in Oregon were relocated either to the Grand Ronde, Siletz, or Warm Springs reservations (Beckham 1990). Relocations started in 1856 when Oregon Territory Superintendent of Indian Affairs Joel Palmer, under pressure from settlers and fearful of "Indian raids," ordered the remaining Middle Chinookans to be sent to the Grand Ronde reservation (Wuerch 1979:119-139). Not all complied with the relocation orders and instead dispersed throughout the region, integrating with other Native communities such as the Yakama, Cowlitz, and Lower Chinook who resided on the coast, both on and off reservation (Daehnke 2006). Today Chinookan descendants are located on several reservations including the Shoalwater Bay, Quinault, Grand Ronde, and Chehalis Reservations, and on off reservation communities (BIA 2002). Tribal affiliations with lands now part of the refuge are shown in Table 6-2.

Table 6.2 Tribal Affiliations With Lands Now Part of Ridgefield Refuge

Reservation	Tribes
Chinook Indian Tribe* (No treaty; lands for Chinook allocated in the **Quinault Reservation** in 1931. Quinault Reservation established by Treaty of Olympia, July 1, 1855; expanded by Executive Order Nov 4, 1873.) (Recognized 2001, rescinded 2002, vote on "Chinook Nation Restoration Act" pending in House 2010)	Chinook
Cowlitz Tribe (No treaty) (Recognized 2002)	Lower Cowlitz, Upper Cowlitz (Taidnapam)
Shoalwater Bay Tribe (Executive Order of Sept 22, 1866, under authority of Treaty of Olympia, July 1,1855; ratified1859)	Willapa Bay Chinook, Lower Chehalis
Confederated Tribes and Bands of the Yakama Indian Nation (Yakama Treaty of 1855)	Yakama, Palouse, Pishquitpah. Some Cowlitz, Taidnapam enrolled in early 1900s (Irwin 1994).
Confederated Tribes of the Grand Ronde Reservation (Grand Ronde reservation established by treaty arrangements in 1854 and 1855 and an Executive Order of June 30, 1857)	Umpqua, Molalla, Rogue River, Kalapuya, and Chasta. Also: Chinook (four Oregon bands), Tillamook, Klickitat
Confederated Tribes of Warm Springs (Treaty of Wasco, Columbia River, Oregon Territory with the Taih, Wyam, Tenino, & Dock-Spus Bands of the Walla-Walla, and the Dalles, Ki-Gal-Twal-La, and the Dog River Bands of the Wasco. June 25, 1855. Ratified Mar. 8, 1859. Proclaimed Apr. 18, 1859)	Warm Springs Indians (four bands), Wasco (Upper Chinookan speakers, two bands), and Northern Paiutes. Some Chinookans and Cowlitz moved to Warm Springs (Irwin 1994)

*Nonfederally Recognized Tribe

6.2.4 Recent Settlement and Economic Development Period

Following the first wave of American settlers to arrive via the Oregon Trail in 1843, Americans quickly grew to outnumber British inhabitants. The Chief Factor of Ft. Vancouver, John McLoughlin, aided the settlers and in doing so helped pave the way for American control of the region. In 1846 Britain and the United States settled on the 49th parallel as the line dividing British and American possessions in the Pacific Northwest. In 1849 the Hudson's Bay Company relocated its Columbia Department headquarters to British territory. The town of Vancouver was incorporated in 1857. In 1860, the United States Army established Columbia (later Vancouver) Barracks adjacent to Fort Vancouver (Hanable 2004).

The first Euro-American to settle in what would later become the town of Ridgefield was Irish immigrant James Carty, who took up residence on Lake River in 1839 (see "Carty Unit," page 15). After Congress passed the U.S. Donation Land Claim Act in 1850, more settlers arrived. In 1849, bachelors Stillman Hendrick, B.O. Teal, and George Thing settled on the island across Lake River from Carty's land claim, thereby giving "Bachelor Island" its name. They were followed by Arthur Quigley in 1852 and Frederick Shobert in 1853. Both Quigley and Shobert established mud landings on their properties adjoining Lake River where river steamers could offload their goods and take on loads of farm products. Thus, "Shobert's Landing" became the common name for the area for the next 10 years. Ferry crossings were also established in the 1850s. James Carty began running a ferry service across Lake River in 1851 (Standal 2009).

The little community got its next name, “Union Ridge,” during the Civil War. According to a reporter who visited the area in 1875, this was because “all the settlers, save one, were outspoken Union men” (Standal 2009). When the first post office was established in 1865, the name became official. An 1886-1887 gazetteer listed Union Ridge as “a post village on Lake river . . . Settled in 1853. Ships farm produce. Population, 65.” It had a general store and post office run by Stephen Shobert, and a church (Clark County Genealogical Society 2008). The post office name was changed to Ridgefield in 1890 at the urging of the new postmaster, S.P. Mackey, who was originally from Virginia, and not keen on the name Union Ridge (Standal 2009). The City of Ridgefield was incorporated in 1909.

After the departure of the Hudson’s Bay Company, Clark County developed as a mostly agricultural area. Farming and forestry dominated land uses. Wood products manufacturing was a dominant industry during the first half of the 20th century, and accounted for the highest economic output in the county by the 1950s. As forests were cleared, farmland spread. In the 20th century, important farm products grown in Clark County included tree and berry fruit, potatoes, dairy, beef cattle, hay, and grain. County farms more than doubled from 907 in 1890 to 1,873 farms totaling 192,700 acres in 1900 (Hanable 2004). The number of farms continued to grow steadily from 1900 to 1950. By 1945, there were 4,934 farms with 204,850 acres in the county. The peak year for acreage in farms was 1950 when the census reported that almost 220,000 acres of Clark County were in farms–about 54 percent of the county’s total land base. By mid-century, dairy farming was the most important agriculture in the Ridgefield area, eclipsing potatoes in importance. Roy Garrison, a 74 year old Ridgefield resident who was born and raised in the Ridgefield area, recalled that in the late 1940s “everyone was a dairy farmer in the area at the time” (Cornelius 2006). Its prominence continued until the 1970s; the 1972 Clark County soil survey stated that 40 percent of farm income in Clark County came from dairy farming (McGee 1972).

The region also continued to develop as a trade and transportation hub. In 1870, the Northern Pacific Railway connected Vancouver to Puget Sound. In the 1880s, initiation of railroad ferry service across the Columbia linked Vancouver with Oregon and California by rail. In 1908, a rail bridge replaced the railroad ferries. Following construction of a railroad through the town of Ridgefield in 1903, the little town began to grow, reaching a population of 620 in 1920. In 1917, a highway bridge linked Vancouver to the Oregon side of the Columbia (Hanable 2004). Vancouver’s role in shipping grain, lumber, and other products from the interior Northwest to worldwide markets expanded throughout the 20th century.

Until 1890, most of Washington’s population lived in Clark County: 11,000 out of a total state population of 18,000. Ten years later, Washington’s total population ballooned to more than 500,000, but Clark County’s population rose only modestly, to 13,419. Two world wars brought additional industries and expanded population. During World War I, the U.S. government built the world’s largest spruce mill on the grounds of Vancouver Barracks to supply lumber for thousands of warplanes. The Standifer Shipyard constructed ships for the war effort, but closed in 1921. World War II brought the West’s first aluminum manufacturing plant, the Aluminum Company of America (Alcoa) and a significant shipyard, the Vancouver Kaiser Shipyard. Beginning in 1943, Clark County yards built 50 escort carriers, 90 other ships, and two dry docks (Hanable 2004). The population of Vancouver skyrocketed during World War II. In 1941, Clark County’s population was 18,000 people. By January 1944 it was more than 95,000, as workers swarmed into the area in search of jobs.

At the end of World War I, Ridgefield had a creamery and cheese factory, shingle mill, saw mill, boat building factory, and a railroad tie loading plant. But the main north-south highway ran four miles to the east in the 1920s and 1930s, which limited growth. Between the World Wars, the town made practically no gain in population, and only modest growth after World War II. The 1990s saw rapid growth as Ridgefield became a bedroom community for Vancouver, Washington. From 1990 to 1999, the population grew 59 percent and annexation added over 2,200 acres to the city (Standal 2009).

History of Refuge Units

Carty Unit. Irish immigrant James Carty settled on Lake River in 1839. In 1851, he filed a Donation Land Claim on the property south of the refuge (DLC 48), and established a ferry crossing Lake River. He lived on the land until his death in 1873. The DLC 44, on the present-day Carty Unit, was settled by Charles Reed in 1854. Columbia Lancaster and his wife filed a claim on the south bank of the Lewis River in 1854. The Cathlapotle area may still have been occupied by Indians after these claims were filed. The 1853-1854 survey notes of the General Land Office (GLO) refer to an “Indian lodge” on the southeastern bank of Gee Creek, where it enters the Lewis River, approximately 800 meters north of Cathlapotle (Bureau of Land Management 2007). An 1853 GLO map shows a trail from Vancouver which passes directly alongside Cathlapotle. However, the Cathlapotle townsite is not marked on the map.

The 1863 Washington Territory cadastral survey of T4N R1W, Willamette Meridian, shows the following claims on the present-day Carty Unit: William Gee (No. 44), F.A. Fowler (No. 47), and James Carty (No. 48). In 1873, James Carty’s nephew (also named James) acquired the DLC 48 land claim from his uncle, as well as DLC 44 and portions of DLC 57, including the site of the Cathlapotle village. At least two structures were built on DLC 44 by the Carty family. Archaeological site 45CL285H, recorded by Larson and Sneed (1979), is thought to be part of the Carty family homestead. The remains of structures associated with site 45CL285H are marked on the 1888 U.S. Coast and Geodetic Survey Map (Stutte and Raymond 2003). The primary land use during this time appears to have been as pasture for livestock, although gardens and orchards were also cultivated. Upon Carty’s death, the land was left to his widow and his only son William.

Beginning about 1880, basalt blocks were quarried on the present-day Carty Unit and barged upriver to Portland for use as paving material. The basalt was chipped into brick-shaped pieces of a standard size, called Belgian Block, and laid on the streets. The blocks were also used for sewer line construction. John (Jack) McKie operated the quarries, working under contract to the Portland Contracting Company. In 1885, blocks quarried from Carty’s land lined the streets of Portland on Front, First, and Second Streets from G to Jefferson Streets (Scott 1890). The use of Belgian Block paving was eventually discontinued as other paving materials became available. The quarries were still in operation in 1903 (Clark County 2009) and were probably abandoned circa 1909 (USFWS 1997).

The U-Haul Company had its beginnings on the refuge, in the winter of 1945-1946. The post World War II housing boom created a widespread need for do-it-yourself moving equipment. U-Haul co-founders L.S. “Sam” Shoen and his wife, Anna Mary Carty Shoen capitalized on that need. The Shoens launched U-Haul in the summer of 1945, after Sam was discharged from the Navy. That winter, Sam and Anna Mary moved to her parents’ home, the Carty ranch. Using war-surplus steel from a Navy yard, Sam built the first U-Haul trailer. The new trailers were a success, and the business grew rapidly (U-Haul International 2009). The building where Sam Shoen built the first U-Haul trailer has been moved off the Carty Unit and now stands just to the north of the Carty Unit parking lot (USFWS 1997).

In 1964, the Pacific Wood Treating Company began operations on Lake River, adjacent to the present-day Carty Unit, on a 39-acre site leased from the Port of Ridgefield. It was one of the city's biggest employers until it filed for bankruptcy and went out of business in 1993. The Port of Ridgefield began cleanup of toxic chemicals at the site in 1997; cleanup efforts via a steam remediation system were ongoing as of 2009 (see Chapter 3).

Bachelor Island. William Clark first called Bachelor Island "Green Bryor Isd" on November 5, 1805 (Moulton 1990[6]) but Meriwether Lewis changed the name to "Quathlahpotle Island" in his journal entry of March 30, 1806 (Moulton 1991[7]). Bachelor Island got its current name from three unmarried men who claimed land on the island from 1849 to 1850. In the 1885 *History of Clarke County Washington Territory* (Alley and Munro-Fraser 1983) the authors wrote:

"*... BACHELORS' ISLAND. This is called Columbia Island on the maps, but is more generally known as Bachelors' Island, it having received this name from the fact that its original settlers were three, unmarried men named S. Hendricks, B. O. Teal and George Thing, who took possession in 1849 or 1850. In 1851 a man named Northrup took up his abode on the island, and in 1853, George W. Burrow, a pioneer of 1850, located on the farm now occupied by his son, John Burrow, while, in 1854, Robert Conolly came to the place.*"

The 1863 Washington Territory cadastral survey of Bachelor Island shows five claims: George W. Burrows (Claim No.39), Benjamin Teel (Claim No.40), Robert Connelly (Claim No.41), S. [Stillman] Hendricks (Claim No.42), and George Thing (Claim No.43) (BLM 2007). An 1888 Plat Map for "Bachelors Island" also shows five Donation Land Claims (DLC)–the northernmost claim being that of G. Burrow, B. Teele, G.M. Irving, H. Hendricks, and the southernmost that of R. Connoly. George Burrow's son John lived on the farm to his death in 1898. Burrow family members lived on the island until 1921 (Cornelius 2006).

For more than 100 years, cattle, hay and grain were produced on Bachelor Island. Alley and Munro-Fraser (1885) noted that the island was owned by "John Burrow, G.E. Tyszkiewicz and Messrs Ladd & Reed of Portland." Reed, Ladd, and Tyszkiewicz were wealthy businessmen from Portland who purchased 1,000 acres of Bachelor Island in 1876. Reed had an interest in raising purebred shorthorn cattle and used the island to grow grain and provide pasturage for his animals, under the supervision of hired farm managers (Lyman 1948). Reed built an elegant 20-room farm house, "Queen," on the island, later purchased by the Zimmerly family along with other property on the island (Figure 6.3). They restored the house but unfortunately, it burned down in 1978 (Clark County Historical Museum 2009).

As the populations of Portland and Vancouver boomed during World War II, so did the demand for farm products. In the 1940s, numerous diking projects were undertaken to protect and expand farmland along the lower Columbia River. The Zimmerly family began large scale farming operations on Bachelor Island in the 1940s and made many improvements. In 1942, five miles of levee were built, protecting 1,120 acres. They grew potatoes and grains (primarily barley) until the refuge acquired Bachelor Island in 1985. They continued to farm cooperatively on Bachelor Island until 1999.

River 'S,' Roth, and Ridgeport Dairy Units. As noted above, land that would later become the River 'S', Roth, and Ridgeport Dairy Units was claimed by the Hudson's Bay Company under the treaty of 1846. The first American settler on the unit was Arthur Quigley in 1852. The 1863 cadastral survey of T4N R1W, Willamette Meridian shows the Quigley claim (No. 38) and Preston Laws claim (No. 46) on the present day River 'S' Unit; and the James Bowers (No. 45) and J.H. Campbell claim (No. 47) on the present day Roth Unit (BLM 2007).

Diking of the River 'S' Unit was completed in 1941, protecting 1,565 acres from floodwaters. The unit had historically been a ranch until its purchase in 1965. Up to 600 cow/calf pairs, and at times hundreds of sheep, grazed on its improved and canarygrass pastures. The resulting short grass was used heavily by migratory and wintering Canada geese, tens of thousands of American wigeon, and other ducks. The Vanport flood of 1948 provided additional stimulus for dike building. In that year, Congress authorized funds for flood control projects on the lower Columbia River. In June 1952 the U.S. Army Corps of Engineers proposed flood control projects (diking and draining) on the present-day River 'S' Unit ("Lake River Delta Area" 1565 acres), Bachelor Island (1883 acres), and Carty Unit ("Lewis River Area" 1700 acres) to prevent flood damage to existing uses and further promote use of these lands for agricultural production. However, detailed engineering studies concluded that the projects had an unfavorable benefit-to-cost ratio and they were classified as inactive (Port of Vancouver, 1965).

Figure 6.2 Haying on the John Burrow Ranch on Bachelor Island, 1912. (Clark County Historical Society, Image No. P03.5.1)

Figure 6.3 Farm house built by Simeon Reed and William Ladd on Bachelor Island in the 1870s. The house burned down in 1976. (Clark County Historical Society, Image No. P15.40.1)

Refuge Establishment. In March 1962 the DOI announced that the northern portion of the Vancouver lowlands was under consideration as a potential wildlife refuge and hunting area. By the 1960s, reduction in waterfowl habitat (and therefore, waterfowl hunting opportunities) on the lower Columbia River was noted by the Migratory Bird Conservation Commission (MBCC). In 1964, the population of Vancouver was 34,750 and 40 percent of Clark County was devoted to agriculture, the dominant land use. Agriculture was dominated by row crops, grain, hay, and pasture, which all provided some benefit to wildlife (Port of Vancouver, 1965). But farm acreage had been declining since the 1950s, and the Commission could see the writing on the wall: urban and developed areas would expand, while farmland and wildlife habitat would shrink. The Commission also noted the limited winter range of the dusky Canada goose and the need for protection of wintering areas. These two factors were the major justifications for the establishment of the refuge (MBCC 1964 and 1965).

At the time of refuge establishment, the State Department of Game provided for fishing and hunting on its Shillapoo Game Refuge, on Vancouver Lake, and on a tract that included the present-day Ridgeport Dairy Unit and a portion of the Roth Unit, therefore, most of Post Office Lake and half of Campbell Lake could be hunted. Adjacent State tidelands were also reserved for hunting and fishing.

These public hunting areas were supplemented by private hunting rights and duck clubs. In a 1965 planning report, it was noted that "fishing and hunting use of the area is probably less extensive than it might be, due to the lack of easy access to much of the area" (Port of Vancouver, 1965).

The Service acquired its first Ridgefield Refuge property in 1965. This property, the River 'S' Unit, had been a cattle ranch and was mostly pastureland. The Carty Unit was acquired in 1966 and had also been used primarily for grazing. In 1985, the Bachelor Island Unit was purchased from the Zimmerly family. Tracts of land for the Roth and Ridgeport Dairy units were purchased between 1969 and 1995.

6.2.5 Prehistoric and Historic Sites

The Refuge encompasses 17 known prehistoric sites (this number includes a site on private property on Bachelor Island) and 11 historic sites (FWS 1997). The most significant sites documented to date are the Wapato portage site and the Cathlapotle Indian Town site (45CL1) in the refuge's Carty Unit. Aside from the Meier site (35CO5) and the Broken Tops site (35MU57), no extensive excavations of a Chinookan town have occurred below the Columbia Gorge, making Cathlapotle an important source of archaeological information about the region. It is one of the few archaeological sites on the Columbia River that has not been lost to looting, development, or flooding, and may be one of the best preserved native town sites in the northwest United States (Ames et al. 1999).

As Federal property, stewardship of Cathlapotle and other sites on the refuge is mandated and guided by Sections 106 and 110 of the National Historic Preservation Act (NHPA) as well as other relevant Federal cultural resource laws. As part of the stewardship program for the resource, archaeological work began at the site in 1991. A partnership between the Service, Portland State University, and the Chinook Nation soon developed, and by 1995 this partnership–the Cathlapotle Archaeological Program–was formally codified by a memorandum of agreement (MOA). Over the course of six field seasons the remains of six plankhouses, as well as thousands of artifacts, were recovered and catalogued (Ames et al. 1999).

The site occurs in forested riparian habitat of the Carty Unit, 15-20 feet above mean sea level. Covered by stands of cottonwood, willow, alder, and ash trees, with a tangled understory of elderberry and stinging nettle, the site is bounded on the west by Lake River and on the east by Long Meadow. Radiocarbon dates indicate that the town was occupied at its current location around 1450 A.D. (Lyman and Ames 2004). In comparison to the Meier Site, a larger proportion of European trade items appear to be present at Cathlapotle, suggesting that Cathlapotle was occupied well into the historic period, while the Meier house was not (Ames et al., 1995). Seriation of ceramic trade goods indicates that the Cathlapotle site was abandoned circa 1834 AD (Kaehler 2002).

Archaeologists located 11 house depressions on the surface, laid out in two rows on a ridge running parallel to Lake River. The largest of the house depressions measures 200 feet by 45 feet (10m x 63m), while the smallest is 60 feet by 30 feet. At least four are divided into compartments, as Lewis and Clark described when they visited the town in 1806 (Moulton 1991[7]). Other features described at the site include storage pits, cobble ovens, postholes marking temporary structures such as sheds and drying racks, middens, and debris fields. Although the site was periodically flooded, it was high enough not to be subject to annual flooding, and the archaeological record indicates that it was continuously occupied.

The Wapato Portage site (45CL4) is also an important site, preserving evidence of 2,300 years of continuous occupation. None of the 14 smaller prehistoric sites have been intensively investigated. Evidence from these sites, characterized as fire hearths, habitation sites, or activity stations, suggests that these were temporary or seasonal camps established in the course of fishing, root collecting or processing, hunting, or tool manufacture.

Seven historic basalt quarry sites on the Carty Unit were placed on the National Register of Historic Places in 1981 as the "Basalt Cobblestone Quarries District." Of the seven only one, 45CL113H, was formally recorded. The other six are grouped together, possibly under the site 45CL161H, but the Service does not have a site record which verifies this. The basalt cobbles from these seven quarries, mined from 1880 to 1903, were used for ship ballast and to pave the streets of Portland, Oregon. The quarries represent not only an important turn-of-the-century industry in Ridgefield, but also a significant step in the development of Portland from a frontier settlement to an urban and commercial center.

Historic sites 45CL112H, 45CL114H, and 45CL285H are old house sites. The 45CL286H site is a refuse dump dating to the late 19th century. Many of these sites have been subjected to looting and amateur excavation. It is very likely that other unrecorded historic (and prehistoric) sites are located on Bachelor Island under the Lake River levee. The island is significant for its early Euro-American settlement, dating to the 1850s (see section 6.2.4 above).

6.3 Social/Economic Environment

6.3.1 Population, Housing, and Income

The refuge is located in Clark County, Washington approximately 15 miles north of Vancouver, Washington. The nearest community is Ridgefield which adjoins the refuge. Table 6.3 shows the population of Clark County, growth rates, and other social statistics collected by the U.S. Census. Some of the more striking differences between Clark County and the state as a whole are highlighted.

Clark County has outpaced the nation in terms of both population and economic growth as it transitions from a small urbanized area surrounded by a rural farm population to a suburban-urban setting. Between 2000 and 2006 the rate of population growth was more than double the state average (U.S. Census Bureau). Clark County was the most rapidly developing county in the state of Washington in the 1990s and is one of the faster growing areas nationwide. In 1980, its 192,227 residents accounted for 4.7 percent of the state's population. As of April 2004, the county's population had grown to 383,800, representing 6.2 percent of the state-wide total. If the recent growth rates of 2-3 percent annually continue, the county's population could reach 621,763 by 2025 (State of Washington Office of Financial Management 2001).

Clark County is one of six counties included in the Portland-Vancouver, Oregon-Washington, Metropolitan Statistical Area (MSA). The other five counties are Clackamas, Columbia, Multnomah, Washington, and Yamhill—all in Oregon. In 2004, the metropolitan area population was 2,040,550. Clark County represents 18.8 percent of the total metropolitan population (Clark County 2005).

Current growth in Clark County has mostly occurred in the cities of Battle Ground, Camas, Washougal, and along the urban fringe of Vancouver in areas such as Felida, Hazel Dell, Orchards, and Salmon Creek. The City of Vancouver is increasing in size largely due to annexation of areas along the urban fringe and increases in building activity. The cities of Battle Ground, Camas, and Washougal and surrounding areas are also continuing to grow.

Recently, growth has spread to rural areas where people are looking to find a more rustic and peaceful setting. Growth in rural areas is concentrating around small cities and towns, such as Battle Ground and Ridgefield, and to a lesser degree, La Center and Yacolt. The population of Ridgefield jumped from 1,062 in 1980 to 1,332 in 1990 and 1,510 in 1994 (The Columbian 1994). The rate of population growth increased in the 1990s as Ridgefield increasingly became a bedroom community for Vancouver. Between 1995 and 2005 the population almost doubled. Ridgefield's population was projected to increase from 2,900 in 2005 to some 25,000 people in 2025, bringing some 16,000 new jobs to the area over that same time span (Port of Ridgefield 2005).

Growth in Clark County can be attributed to a number of factors. Some of the key factors include its proximity to the Portland, Oregon metropolitan area; access to major transportation routes and services (including Interstates 5 and 205, the Portland International Airport, and major north-south and east-west railroad lines); quality schools; and quality of life. Clark County has a number of parks and open space areas. The opportunity to drive a few minutes and be in a rural setting is appealing to many. There are a number of recreational opportunities within a short drive, including the Cascade Mountains for skiing and other outdoor activities, the Pacific Ocean, numerous rivers and streams, the Columbia River Gorge, and the activities of downtown Portland.

As the county continues to grow, the population is becoming more diversified with an increase in minority and ethnic groups. Although the county is still less ethnically diverse than the state as a whole; the white population for the county is about 90 percent. However, recent trends show an increase in all minority groups, particularly in the Asian and Pacific Islander, Black, and Hispanic origin categories, as well as an influx of eastern Europeans (Clark County 2005).

The level of educational attainment is slightly lower than the State average. In 2000, Clark County had a slightly lower percentage of households in poverty than the State average, and the mean housing value was slightly lower than the State average. However, property values have been rising in recent years, which have caused repercussions for industries such as farming.

Table 6.3 Selected Population and Associated Social Statistics, Local Counties

Population Parameter	Clark County	Washington
Population, 2006 estimate	412,938	6,395,798
Population, percent change, April 1, 2000 to July 1, 2006	19.6%	8.5%
Population, 2000	345,238	5,894,121
Population, percent change, 1990 to 2000	13.9%	21.1%
Persons under 18 years old, percent, 2005	26.0%	23.6%
Persons 65 years old and over, percent, 2005	9.9%	11.5%
White persons, percent, 2005	90.2%	85.0%
Black or African American persons, percent, 2005	2.0%	3.5%
American Indian and Alaska Native persons, percent, 2005	0.9%	1.7%
Asian persons, percent, 2005	3.7%	6.4%
Native Hawaiian and Other Pacific Islander, percent, 2005	0.4%	0.5%
Persons reporting two or more races, percent, 2005	2.7%	3.0%

Population Parameter	Clark County	Washington
Persons of Hispanic or Latino origin, percent, 2005	5.8%	8.8%
White persons not Hispanic percent, 2005	85.0%	77.1%
Living in same house in 1995 and 2000, percent age 5+	44.2%	48.6%
Foreign born persons, percent, 2000	8.5%	10.4%
Language other than English spoken at home, percent age 5+, 2000	11.5%	14.0%
High school graduates, percent of persons age 25+, 2000	87.8%	87.1%
Bachelor's degree or higher, percent of persons age 25+, 2000	22.1%	27.7%
Homeownership rate, 2000	67.3%	64.6%
Housing units in multi-unit structures, percent, 2000	22.5%	25.6%
Median value of owner-occupied housing units, 2000	$156,600	$168,300
Households, 2000	127,208	2,271,398
Persons per household, 2000	2.69	2.53
Median household income 2004	$52,120	$48,438
Per capita money income 1999	$21,448	$22,973
Persons below poverty, percent, 2004	11.2%	11.6%

Source: U.S. Census Bureau, State and County QuickFacts. Data derived from Population Estimates, 2000 Census of Population and Housing, 1990 Census of Population and Housing http://quickfacts.census.gov/.

6.3.2 Employment and Business

Table 6.4 displays some pertinent business statistics for Clark County. In 2002, the retail sales per capita were 26 percent lower than the state's average. Because median household income was slightly higher than the state average in 2004, it may reflect the fact that Clark County is a "bedroom community" and residents could be making purchases outside the county. Clark County grew rapidly in the period from 1994 to 2004, both in population and in the size of its economy. Although population increased nearly 40 percent, the local economy was able to expand to meet the demands of that growth. The county's total industrial output nearly doubled in this period from just over $11 billion in 1994 to nearly $20.3 billion in 2004.

Labor income also nearly doubled, from $3.6 billion in 1994 to $6.8 billion in 2004. Other value added, which includes corporate and property income as well as taxes, increased from $2.4 billion in 1994 to $11.2 billion in 2004 (Globalwise 2007). Table 6.5 shows relative contributions of various industries to the economy of Clark County. Construction is the leading contributor to the County's economy, generating $1.9 billion in output in 2004. The largest employers in the county are in public administration, retail sales, health care, social assistance, and construction.

Table 6.4 Clark County Business Statistics

Business QuickFacts	Clark County	Washington
Private nonfarm establishments, 2004	8,936	171,529
Private nonfarm employment, 2004	102,357	2,268,913
Private nonfarm employment, percent change 2000-2004	4.5%	0.1%
Nonemployer establishments, 2004	22,757	369,860
Manufacturers shipments, 2002 ($1000)	3,320,125	79,313,884
Retail sales, 2002 ($1000)	2,946,201	65,262,333
Retail sales per capita, 2002	$7,961	$10,757
Minority-owned firms, percent of total, 2002	7.0%	10.9%
Women-owned firms, percent of total, 2002	29.2%	29.4%
Building permits, 2005	3,771	52,988
Federal spending, 2004 ($1000)	1,576,147	44,840,842

Source: U.S. Census Bureau, State and County QuickFacts. Data derived from Small Area Income and Poverty Estimates, County Business Patterns, 1997 Economic Census, Minority- and Women-Owned Business, Building Permits, Consolidated Federal Funds Report, and 1997 Census of Governments http://quickfacts.census.gov/.

Table 6.5 Clark County Output, Employment, Labor Income, and Other Value Added, 2004

Industry	Output ($ Millions)	Employment	Labor Income ($ Millions)	Other Value Added ($ Millions)
Construction	1,901.697	16,524	798.369	945.421
Manufacturing - Wood Products	1,624.888	3,576	274.281	468.461
Manufacturing - Miscellaneous	1,393.844	5,656	296.320	417.206
Health Care and Social Assistance	1,390.168	17,219	752.248	874.060
Utilities	1,236.136	2,213	244.167	918.282
Public Administration	1,227.031	20,039	964.597	1,102.010
Manufacturing - High Tech. and related	1,182.322	4,966	277.403	328.199
Retail Trade	1,148.239	17,229	449.525	742.002
Special Sectors	1,072.754	0	0.000	870.073
Professional, Scientific, and Tech. Services	1,027.755	9,293	572.895	594.621
Real Estate and Rental and Leasing	1,016.043	6,272	223.250	610.217
Wholesale Trade	870.693	5,348	327.189	595.172
Finance and Insurance	832.734	3,939	256.533	559.790
Information	783.970	2,585	172.133	384.666
Manufacturing - Food and Beverages	679.163	1,193	67.820	173.687
Other Services	658.130	10,138	262.332	375.105
Accommodation and Food Services	613.940	12,602	206.243	301.955
Transportation and Warehousing	607.462	5,230	237.046	315.057
Administrative and Support Services	577.300	10,311	274.350	347.611
Arts, Entertainment and Recreation	201.189	3,197	71.552	126.397
Forestry, Logging and Mining	108.126	582	29.940	54.632
Educational Services	59.342	1,644	25.978	35.308
Beef and Dairy Cattle	21.681	499	1.011	3.581
Crop Production	20.673	380	5.065	12.227

Industry	Output ($ Millions)	Employment	Labor Income ($ Millions)	Other Value Added ($ Millions)
Greenhouse and Nursery Production	18.972	511	9.728	14.621
Poultry and Egg Production	14.767	82	2.265	7.155
Other Animal Production	4.039	307	0.365	0.640
Agriculture and Forestry Services	3.492	79	2.657	2.459
Clark County Totals	**20,296.552**	**161,613**	**6,805.265**	**11,180.613**
Agricultural Totals	**83.624**	**1,858**	**21.091**	**40.683**

Source: IMPLAN using 2004 Clark County data.

Over the past 50 years, the economy of Clark County has changed dramatically, from being dependent largely on the wood products industry and agriculture, to a diversified economic base. The wood products industry has declined since the early 1980s. At the same time, new industries located in the county. A number of high-tech companies have built plants in Clark County. These industries and others have diversified the employment base, stabilized the economy, and reduced the reliance on a single timber-dependent employment base.

The Port of Vancouver, a major deepwater shipping port, continually handles record tonnage, as it expands its port facility and industrial park. As of 2008, more than 15,500 jobs were generated by the maritime and industrial activities at the Port of Vancouver. This included manufacturers sited on the port’s industrial property, and the maritime and shipping industries. It is estimated that port activities generate $940 million in business revenue in Clark County annually, with a total economic impact of $1.6 billion into the local and regional economy (Port of Vancouver 2009). In addition to the Port of Vancouver, the Port of Camas-Washougal and the Port of Ridgefield provide numerous services in their industrial parks and have experienced continual industrial growth (Clark County 2005).

A number of business and industrial parks are situated around the county, with concentrations in east Clark County and along the I-5/I-205, Fourth Plain, and Mill Plain corridors, and the Ridgefield Junction. There are also plans for a large multiuse development on Port of Ridgefield property (the old Pacific Wood Treatment site) adjacent to the refuge’s Carty Unit. Given Clark County’s geographic location, access to major transportation routes and services, and growing population, economic growth is expected to continue.

As Clark County has become increasingly developed, the number and acreage of farms has declined. The U.S. Census of Agriculture, conducted in either five or 10 year intervals between 1900 and 1954, showed the number of farms in the county grew steadily from 1,873 farms with 192,700 acres in 1900 to 4,934 farms with 204,850 acres in 1945. (The census counted all entities as “farms” so long as there is at least $1,000 of sales.) The peak year for acreage in farms was 1950 when the census reported that almost 220,000 acres of Clark County were in farms. This was 54.1 percent of the county’s total land base. A sizeable amount of woodlands were included in the total acreage estimate along with cropland, pasture and grass fields. In the 1950s, small farms were characteristic of agriculture in Clark County. Over two thirds of all farms in the county were less than 50 acres in size.

By the early 1970s, about 168,000 acres (42 percent of the county) were in farmland. The 2002 Agriculture Census reported that Clark County had 1,596 farms totaling 70,694 acres (17.6 percent of the county). Although historical statistics show that Clark County has always been dominated by small farms, the trend has been towards even smaller farms. In 2002 the census data shows 80 percent of all farms were less than 50 acres in the county. In 1954 the average size of farms in the county was 51 acres; and in 2002 the average size was 44 (Globalwise 2007).

The types of agricultural products produced in the county have also changed. In 1957 Clark County was the leading western Washington orchard growing area and had a diverse agricultural economy including livestock, poultry, and field crops (Clark County 1957). By the early 1970s, less fruit was being grown, and dairy products accounted for more than 40 percent of the value of farm products (USDA 1972). For many years there has been a loss of the larger traditional commercial farms including dairies, berry farmers, fruit producers, field crops, and others. The county's dairy industry has steadily declined. In 1984, there were 84 dairies in the county. As of 2007, there were only seven remaining.

In recent years, Christmas trees and berries have been key crops produced in Clark County. Ornamental nurseries have experienced growth in recent years, propelled in large part by the growth in new housing. New small scale agriculture has not made up for the loss of traditional farmers and the total amount of land devoted to commercial agriculture continues to decrease. Many factors have contributed to the decline in the county's agriculture. The most basic factor is that agricultural producers in other areas can grow, process, and market crops at a lower cost. Another key factor is the limited access to affordable, high quality agricultural land. Rapidly escalating land prices in the County, fueled by development, have created a major barrier for new farmers to enter the business. Farmers will not bid for land at prices equal to what buyers for homes and other development will pay (Globalwise 2007).

The changes in local land use patterns have caused a number of management implications for the refuge. Fewer local acres in pasture and row crops, and more acres in housing, commercial, and industrial development, nurseries, Christmas tree farms, and berry farms, means that while depredation complaints have decreased, the refuge has an ever more important role in providing forage for migrating and overwintering Canada and cackling geese. Populations of birds may also shift as geese, in particular, seek grain and green forage. Declines in dairy and ranch operations mean that it has become increasingly difficult for the refuge to find cooperative grazers. Increasing land prices has also affected the ability of the refuge to acquire lands within its acquisition boundary.

6.3.3 Refuge Impact on Local Economies

In 1997, and again in 2004, a national study was completed to estimate the economic effect refuges have on local economies. In both reports, the refuge was featured. Data from the reports showed a significant level of expenditures within Clark County and across the Oregon border in Multnomah County, stemming from recreational visits to the refuge. The following tables (6.5 and 6.6) summarize the level of expenditures made within the counties to support recreational visits to the refuge in 2004. Total expenditures during FY 2004 were $1.38 million, with nonresidents accounting for 56 percent of this expenditure. The majority of expenditures ($1.3 million or 95.2 percent of the total) were attributed to nonconsumptive uses, while waterfowl hunting generated $60,800 (4.4 percent) and freshwater fishing accounted for $5,300, or 0.4 percent of the total.

Spending generates jobs and multiplier effects in the economy. The total monetary effect of economic activity generated in the counties by refuge visitors' expenditures totaled $2.2 million.

This final demand generated 25 jobs, with a total employment income of $748,100. Based on the 2004 refuge budget, we estimated the ratio of economic effects per dollar of refuge expenditure to be 2.8. This means that for every one dollar of budget expenditures, approximately $2.80 of total economic effects was generated.

Although hard data like Table 6.6 is lacking, it appears that the majority of visitors are local residents, who do not spend as much as nonresidents when visiting the Refuge.

Table 6.6 Ridgefield Refuge Visitor Recreation-related Expenditures (2004)

Activity	Resident	Non-Resident	Total
Nonconsumptive	$570.61	$743.36	$1,313.97
Hunting			
Big game	$0.00	$0.00	$0.00
Small game	$0.00	$0.00	$0.00
Migratory bird	$25.80	$35.00	$60.80
Total hunting	$25.80	$35.00	$60.80
Fishing	$5.30	$0.00	$5.30
Total	**$601.70**	**$778.40**	**$1,380.10**

Source: Caudill and Henderson (2005). All figures in thousands

Table 6.7 Ridgefield Refuge Economic Effects Associated with Visitation

Economic Effect	Nonresidents	Total
Final Demand	$1,214,800	$2,169,100
Jobs	13	25
Job Income	$415,200	$748,100

Source: Caudill and Henderson (2005).

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Appendix A. Appropriate Use Determinations

Introduction

The Appropriate Refuge Uses Policy outlines the process that the Service uses to determine when general public uses on refuges may be considered. Priority public uses previously defined as wildlife-dependent uses (hunting, fishing, wildlife observation and photography and environmental education and interpretation) under the National Wildlife Refuge System Improvement Act of 1997, are generally exempt from appropriate use review. Other exempt uses include situations where the Service does not have adequate jurisdiction to control the activity and refuge management activities.

In essence, the appropriate use policy, 603 FW 1 (2006), provides refuge managers with a consistent procedure to first screen and then document decisions concerning a public use. When a use is determined to be appropriate, a refuge manager must then decide if the use is compatible before allowing it on a refuge. The policy also requires review of existing public uses. During the CCP process the refuge manager evaluated all existing and proposed refuge uses at Ridgefield National Wildlife Refuge using the following guidelines and criteria as outlined in the appropriate use policy:

- Do we have jurisdiction over the use?
- Does the use comply with applicable laws and regulations (Federal, State, tribal and local)?
- Is the use consistent with applicable Executive orders and Department and Service policies?
- Is the use consistent with public safety?
- Is the use consistent with goals and objectives in an approved management plan or other document?
- Has an earlier documented analysis not denied the use or is this the first the use has been proposed?
- Is the use manageable within available budget and staff?
- Will this be manageable in the future within existing resources?
- Does the use contribute to the public's understanding and appreciation of the refuge's natural or cultural resources, or is the use beneficial to the refuge's natural or cultural resources?
- Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality, compatible, wildlife dependent recreation into the future?

Using this process and these criteria, and as documented on the following pages, the refuge manager determined the following use(s) are not appropriate: allowing dogs on refuge (other than dogs used for waterfowl hunting, bicycling, jogging, horseback riding, providing a kayak launching facility, and berry picking. The refuge manager also determined the following refuge use(s) were appropriate, and directed that compatibility determinations be completed for each use: crop production, haying and mowing, grazing (cattle and/or horses), research, and mosquito management.

FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: Ridgefield National Wildlife Refuge

Use: Allowing dogs on Refuge (other than dogs used for waterfowl hunting)

This form is not required for wildlife-dependent recreational uses, take regulated by the State, or uses already described in a refuge CCP or step-down management plan approved after October 9, 1997.

Decision Criteria:	**YES**	**NO**
(a) Do we have jurisdiction over the use?	✓	
(b) Does the use comply with applicable laws and regulations (Federal, State, tribal, and local)?	✓	
(c) Is the use consistent with applicable Executive orders and Department and Service policies?	✓	
(d) Is the use consistent with public safety?		✓
(e) Is the use consistent with goals and objectives in an approved management plan or other document?	✓	
(f) Has an earlier documented analysis not denied the use or is this the first time the use has been proposed?	✓	
(g) Is the use manageable within available budget and staff?	✓	
(h) Will this be manageable in the future within existing resources?	✓	
(i) Does the use contribute to the public's understanding and appreciation of the refuge's natural or cultural resources, or is the use beneficial to the refuge's natural or cultural resources?		✓
(j) Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see section 1.6D, 603 FW 1, for description), compatible, wildlife-dependent recreation into the future?		✓

Where we do not have jurisdiction over the use ("no" to (a)), there is no need to evaluate it further as we cannot control the use. Uses that are illegal, inconsistent with existing policy, or unsafe ("no" to (b), (c), or (d)) may not be found appropriate. If the answer is "no" to any of the other questions above, we will **generally** not allow the use.

If indicated, the refuge manager has consulted with State fish and wildlife agencies. Yes ✓ No ___

When the refuge manager finds the use appropriate based on sound professional judgment, the refuge manager must justify the use in writing on an attached sheet and obtain the refuge supervisor's concurrence.

Based on an overall assessment of these factors, my summary conclusion is that the proposed use is:

Not Appropriate ✓ **Appropriate** ____

Refuge Manager: [signature] Date: 9/9/10

If found to be **Not Appropriate**, the refuge supervisor does not need to sign concurrence if the use is a new use.

If an existing use is found **Not Appropriate** outside the CCP process, the refuge supervisor must sign concurrence.

If found to be **Appropriate**, the refuge supervisor must sign concurrence.

Refuge Supervisor: [signature] Date: 9-9-10

A compatibility determination is required before the use may be allowed.

FWS Form 3-2319
02/06

Appropriate Uses Justification, Attachment 1

Refuge: Ridgefield National Wildlife Refuge (NWR)

Use: Allowing Dogs

Summary: Allowing dogs on Ridgefield NWR has been determined to be not appropriate because of disturbance to other users, disturbance to wildlife (especially waterfowl), and as a safety concern to users.

For findings listed on FWS Form 3-2319 and if deemed necessary a justification has been provided below:

d. Is the use consistent with public safety?

Wheeled access by public users is restricted to the River 'S' Unit Auto Tour Route, an established gravel roadway where popular wildlife viewing and photography opportunities are provided. Since 1994 when the last compatibility determination was made, automobile numbers on the Auto Tour Route have more than doubled. Because of driving habits associated with the gravel single lane road, automobile users are often aware of the slow moving, stop-and-go habits other automobile drivers exhibit. Because these same drivers are engaged in wildlife viewing activities, the faster moving, far less detectable and uncontrolled dogs could create an unsafe traffic situation.

Pedestrian foot travel is permitted in the Carty Unit where there is no public automobile access. Dogs may increase conflicts between users and may pose a safety problem when aggressive or out-of-control dogs encounter other users.

f. Has an earlier documented analysis not denied the use or is this the first time the use has been proposed?

This use had a compatibility determination completed in 1994. This determination collectively included seven other uses and the treatment of dogs involved two sentences. The use was determined to be compatible because of its infrequency.

I. Does the uses contribute to the public's understanding and appreciation of the refuge's natural or cultural resources, or is the use beneficial to the refuge's natural or cultural resources?

Dogs also elicit a greater response from wildlife than pedestrians alone (MacArthur et al. 1982; Hoopes 1993). In the case of birds, the presence of dogs may flush incubating birds from nests (Yalden and Yalden 1990), disrupt breeding displays

(Baydack 1986), disrupt foraging activity in shorebirds (Hoopes 1993), and disturb roosting activity in ducks (Keller 1991). Many of these authors indicated that dogs with people, dogs on-leash, or loose dogs provoked the most pronounced disturbance reactions from their study animals. Despite thousands of years of domestication, dogs still maintain instincts to hunt and chase. Given the appropriate stimulus, those instincts can be triggered. Dogs that are unleashed or not under the control of their owners may disturb or potentially threaten the lives of some wildlife. In effect, off-leash dogs increase the radius of human recreational influence or disturbance beyond what it would be in the absence of a dog. A group of Australian researchers determined that dog-walking can have a significant impact on avian abundance and species diversity, and were quite surprised by the magnitude of the impact. The team found that dog-walking caused bird numbers to drop by an average of 41% at each site studied, while the numbers of species counted fell by 35%. The results were similar in sites often frequented by dog-walkers and those where the practice was prohibited, suggesting that birds did not get habituated to the dogs' presence, despite frequent encounters (Banks and Bryant 2007).

The role of dogs in wildlife diseases is poorly understood. However, dogs host endo- and ectoparasites and can contract diseases from, or transmit diseases to, wild animals. In addition, dog waste is known to transmit diseases that may threaten the health of some wildlife and other domesticated animals. Domestic dogs can potentially introduce various diseases and transport parasites into wildlife habitats (Sime 1999).

h. Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see section 1.6D, 603 FW1 for description), compatible, wildlife-dependent recreation into the future?

At a minimum, the quality of the visitor experience would be degraded and there could be direct conflicts with certain priority public uses. Disturbance to waterfowl and wildlife by the presence of dogs have been noted (MacArthur et al. 1982; Hoopes 1993; Keller 1991). Due to flushing distance, a conflict may occur between users, resulting in the quality of the other user's experience being impaired. This situation will create what Moore (1994) summarized: Trail conflicts can occur among different user groups, among users within the same user group, and as a result of factors not related to trail user activities at all. Conflict has been found to related to activity style, focus of trip, expectations, attitudes toward and perceptions of the environment, level of tolerance for others, and different norms held by different users. This loss of expectation of a quality wildlife dependant experience could result in use avoidance of the refuge by wildlife watchers and photographers who have encountered dogs using the same or alternate trail(s).

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FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: Ridgefield National Wildlife Refuge

Use: Bicycle Use

This form is not required for wildlife-dependent recreational uses, take regulated by the State, or uses already described in a refuge CCP or step-down management plan approved after October 9, 1997.

Decision Criteria:	**YES**	**NO**
(a) Do we have jurisdiction over the use?	✓	
(b) Does the use comply with applicable laws and regulations (Federal, State, tribal, and local)?	✓	
(c) Is the use consistent with applicable Executive orders and Department and Service policies?	✓	
(d) Is the use consistent with public safety?		✓
(e) Is the use consistent with goals and objectives in an approved management plan or other document?		✓
(f) Has an earlier documented analysis not denied the use or is this the first time the use has been proposed?	✓	
(g) Is the use manageable within available budget and staff?	✓	
(h) Will this be manageable in the future within existing resources?	✓	
(i) Does the use contribute to the public's understanding and appreciation of the refuge's natural or cultural resources, or is the use beneficial to the refuge's natural or cultural resources?	✓	
(j) Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see section 1.6D, 603 FW 1, for description), compatible, wildlife-dependent recreation into the future?		✓

Where we do not have jurisdiction over the use ("no" to (a)), there is no need to evaluate it further as we cannot control the use. Uses that are illegal, inconsistent with existing policy, or unsafe ("no" to (b), (c), or (d)) may not be found appropriate. If the answer is "no" to any of the other questions above, we will **generally** not allow the use.

If indicated, the refuge manager has consulted with State fish and wildlife agencies. Yes ✓ No ___

When the refuge manager finds the use appropriate based on sound professional judgment, the refuge manager must justify the use in writing on an attached sheet and obtain the refuge supervisor's concurrence.

Based on an overall assessment of these factors, my summary conclusion is that the proposed use is:

Not Appropriate ✓ **Appropriate**_____

Refuge Manager: [signature] Date: 9/9/10

If found to be **Not Appropriate**, the refuge supervisor does not need to sign concurrence if the use is a new use.

If an existing use is found **Not Appropriate** outside the CCP process, the refuge supervisor must sign concurrence.

If found to be **Appropriate**, the refuge supervisor must sign concurrence.

Refuge Supervisor: [signature] Date: 9-9-10

A compatibility determination is required before the use may be allowed.

FWS Form 3-2319 02/06

Appropriate Uses Justification, Attachment 1

Refuge: Ridgefield National Wildlife Refuge (NWR)

Use: Bicycle Use

Summary: Use of bicycles on Ridgefield NWR has been determined to be not appropriate because of the disturbance to wildlife, especially waterfowl, and as a safety concern to users.

For findings listed on FWS Form 3-2319 and if deemed necessary a justification has been provided below:

d. Is the use consistent with public safety?

Wheeled access by public users is restricted to the River 'S' Unit Auto Tour Route, an established gravel roadway where popular wildlife viewing and photography opportunities are provided. Since 1994, when the last compatibility determination was made, automobile numbers on the Auto Tour Route have more than doubled. Because of driving habits associated with the gravel single lane road, automobile users are often aware of the slow moving, stop-and-go habits other automobile drivers exhibit. Because these same drivers are engaged in wildlife viewing activities, the faster moving, far less detectable bicycles could create an unsafe traffic situation.

In the Carty Unit foot travel is permitted and there is no public access for automobiles. The narrow trail though wetland and forest habitats is not suitable for shared bicycle and pedestrian use due to line-of-sight limitations. Thus there is the potential for fast-moving bicyclists to collide with or disturb pedestrians.

f. Has an earlier documented analysis not denied the use or is this the first time the use has been proposed?

This use had a compatibility determination completed in 1994. This determination collectively included seven other uses and the treatment of bicycles involved two sentences. The use was determined to be compatible because of its infrequency.

h. Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see section 1.6D, 603 FW1 for description), compatible, wildlife-dependent recreation into the future?

At a minimum, the quality of the visitor experience would be degraded and there could be direct conflicts with certain priority public uses. Disturbance to waterfowl by bicycles have been noted (Pease et al. 2005). Due to flushing distance, a conflict may occur between users, resulting in the quality of the other user's experience being impaired. When wildlife react by moving away from a fast moving activity such as biking, or alter behavior by hiding, they will be less likely to be observed (Bennett and Zuelke 1999). This situation will create what Moore (1994) summarized: Trail conflicts can occur among different user groups, among users within the same user group, and as a result of factors not related to trail user activities at all. Conflict has been found to related to activity style, focus of trip, expectations, attitudes toward and perceptions of the environment, level of tolerance for others, and different norms held by different users. This loss of expectation of a quality wildlife dependent experience could result in use avoidance of the refuge by wildlife watchers and photographers who have encountered bicyclists using the same or alternate trail(s).

Literature Cited

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FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: Ridgefield National Wildlife Refuge

Use: Crop Production

This form is not required for wildlife-dependent recreational uses, take regulated by the State, or uses already described in a refuge CCP or step-down management plan approved after October 9, 1997.

Decision Criteria:	**YES**	**NO**
(a) Do we have jurisdiction over the use?	✓	
(b) Does the use comply with applicable laws and regulations (Federal, State, tribal, and local)?	✓	
(c) Is the use consistent with applicable Executive orders and Department and Service policies?	✓	
(d) Is the use consistent with public safety?	✓	
(e) Is the use consistent with goals and objectives in an approved management plan or other document?	✓	
(f) Has an earlier documented analysis not denied the use or is this the first time the use has been proposed?	✓	
(g) Is the use manageable within available budget and staff?	✓	
(h) Will this be manageable in the future within existing resources?	✓	
(i) Does the use contribute to the public's understanding and appreciation of the refuge's natural or cultural resources, or is the use beneficial to the refuge's natural or cultural resources?	✓	
(j) Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see section 1.6D, 603 FW 1, for description), compatible, wildlife-dependent recreation into the future?	✓	

Where we do not have jurisdiction over the use ("no" to (a)), there is no need to evaluate it further as we cannot control the use. Uses that are illegal, inconsistent with existing policy, or unsafe ("no" to (b), (c), or (d)) may not be found appropriate. If the answer is "no" to any of the other questions above, we will **generally** not allow the use.

If indicated, the refuge manager has consulted with State fish and wildlife agencies. Yes ✓ No ___

When the refuge manager finds the use appropriate based on sound professional judgment, the refuge manager must justify the use in writing on an attached sheet and obtain the refuge supervisor's concurrence.

Based on an overall assessment of these factors, my summary conclusion is that the proposed use is:

Not Appropriate_____ **Appropriate** ✓

Refuge Manager: [signature] Date: 9/9/10

If found to be **Not Appropriate**, the refuge supervisor does not need to sign concurrence if the use is a new use.

If an existing use is found **Not Appropriate** outside the CCP process, the refuge supervisor must sign concurrence.

If found to be **Appropriate**, the refuge supervisor must sign concurrence.

Refuge Supervisor: [signature] Date: 9-9-10

A compatibility determination is required before the use may be allowed.

FWS Form 3-2319
02/06

Appropriate Uses Justification, Attachment 1

Refuge: Ridgefield National Wildlife Refuge (NWR)

Project: Use of a private cooperator to produce crops for wildlife forage

Summary: The refuge manages pastures, wetlands, and agricultural fields to provide a variety of foods that will meet the needs of wintering and migratory waterfowl. Current refuge farming practices include grazing, haying, and planting of crops such as cereal grains and clover. Agricultural crops grown on the refuge (primarily winter wheat and corn) are selected primarily to provide waterfowl with an easily-accessible source of high-energy carbohydrates. The refuge proposes to increase crop production acreages from the current range of 155 to 185 ac (including 55 to 85 ac in corn) to 290 to 330 acres (including 60 to 145 ac of corn).

The refuge has little capacity currently to irrigate croplands and in some years rainfall during the growing season is insufficient to produce a successful corn crop. Corn is favored by both geese and cranes as a high carbohydrate food, and the 2004 Wildlife and Habitat Management Review recommended increasing the acreage in corn. Given the high costs of producing a successful corn crop, the refuge proposes to evaluate the feasibility of implementing a cooperative farm program for crop production, whereby a private farmer (cooperator) would raise a Refuge-specified crop in a designated field or fields, and would be entitled to a share of the harvest. As an example, 75% of the crop would go to the cooperator and 25% to the Refuge, although this would be negotiated with the cooperator as part of the development of a Cooperative Farming Agreement (CFA). CFAs are typically multi-year agreements that are used to implement cooperative programs that help achieve refuge purposes as well as an economic benefit to the farmer. The CFA involves a negotiated agreement between the Refuge and private farmer to manage lands for both parties. To benefit wildlife, the Refuge share would be left in the field where it would be available to wildlife. Any fields that are double-cropped (two or more crops raised in a single season) would be subject to the same pre-determined Refuge/cooperator split for each crop.

For each of the findings listed on FWS Form 3-2319, a justification has been provided below:

a. Do we have jurisdiction over the use?

All proposed activities would take place within refuge boundaries and under the supervision of refuge staff.

b. Does the use comply with applicable laws and regulations (Federal, State, tribal, and local)?

The proposed activities would comply with all applicable laws and regulations and would be spelled out in the CFA.

c. Is the use consistent with applicable Executive orders and Department and Service policies?

The proposed use would provide high energy and readily available forage for wintering and migrating waterfowl and cranes within close proximity to other natural food sources and high quality roosting habitat. Crops can provide wildlife with easily-accessible high energy foods, are more digestible than native plants, and can reduce foraging time required to meet caloric demands (Raveling 1979, Alisauskas and Ankney 1992, Baldassare and Bolen 2006). Because these conditions cannot be met by singularly managing natural foods, the production of non-genetically modified crops is consistent with the Service's Biological Integrity, Diversity and Environmental Health Policy (601 FW 3) and will help achieve the refuge purposes.

d. Is the use consistent with public safety?

The proposed use is consistent with public safety and would be sited in areas closed to the general public.

e. Is the use consistent with goals and objectives in an approved management plan or other document?

The proposed use is consistent with the 2004 Wildlife and Habitat Management Review conducted by the Service as well as the Northwest Oregon/Southwest Washington Canada Goose Depredation Plan (Pacific Flyway Council 1998).

g. Is the use manageable within available budget and staff?

The proposed use is manageable with available budget and staff. The use of a cooperator may save staff time and resources and increase the reliability of successful crop production.

h. Will this be manageable in the future within existing resources?

The proposed use would be manageable in the future with the existing resources and may save staff time and resources (see above).

i. Does the uses contribute to the public's understanding and appreciation of the refuge's natural or cultural resources, or is the use beneficial to the refuge's natural or cultural resources?

The proposed use is beneficial to the refuges natural resources because crop production would help achieve refuge purposes by providing wintering and migrating waterfowl and cranes with a high energy, easily accessible food source in close proximity to natural foods and roosting sites.

j. Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see section 1.6D, 603 FW 1, for description), compatible, wildlife-dependent recreation into the future?

The proposed use will not impair existing or future wildlife-dependent recreational use of the refuge. A maximum of 330 acres (approximately 6% of the refuge area) would be used for crop production and much of this area would be sited on Bachelor Island or Roth Units which are closed to the general public.

<u>Literature Cited</u>

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FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: Ridgefield National Wildlife Refuge

Use: Grazing

This form is not required for wildlife-dependent recreational uses, take regulated by the State, or uses already described in a refuge CCP or step-down management plan approved after October 9, 1997.

Decision Criteria:	**YES**	**NO**
(a) Do we have jurisdiction over the use?	✓	
(b) Does the use comply with applicable laws and regulations (Federal, State, tribal, and local)?	✓	
(c) Is the use consistent with applicable Executive orders and Department and Service policies?	✓	
(d) Is the use consistent with public safety?	✓	
(e) Is the use consistent with goals and objectives in an approved management plan or other document?	✓	
(f) Has an earlier documented analysis not denied the use or is this the first time the use has been proposed?	✓	
(g) Is the use manageable within available budget and staff?	✓	
(h) Will this be manageable in the future within existing resources?	✓	
(i) Does the use contribute to the public's understanding and appreciation of the refuge's natural or cultural resources, or is the use beneficial to the refuge's natural or cultural resources?	✓	
(j) Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see section 1.6D, 603 FW 1, for description), compatible, wildlife-dependent recreation into the future?	✓	

Where we do not have jurisdiction over the use ("no" to (a)), there is no need to evaluate it further as we cannot control the use. Uses that are illegal, inconsistent with existing policy, or unsafe ("no" to (b), (c), or (d)) may not be found appropriate. If the answer is "no" to any of the other questions above, we will **generally** not allow the use.

If indicated, the refuge manager has consulted with State fish and wildlife agencies. Yes ✓ No ___

When the refuge manager finds the use appropriate based on sound professional judgment, the refuge manager must justify the use in writing on an attached sheet and obtain the refuge supervisor's concurrence.

Based on an overall assessment of these factors, my summary conclusion is that the proposed use is:

Not Appropriate_____ **Appropriate** ✓

Refuge Manager: [signature] Date: 9/9/10

If found to be **Not Appropriate**, the refuge supervisor does not need to sign concurrence if the use is a new use.

If an existing use is found **Not Appropriate** outside the CCP process, the refuge supervisor must sign concurrence.

If found to be **Appropriate**, the refuge supervisor must sign concurrence.

Refuge Supervisor: Rob L. West Date: 9-9-10

A compatibility determination is required before the use may be allowed.

FWS Form 3-2319
02/06

Appropriate Uses Justification, Attachment 1

Refuge: Ridgefield National Wildlife Refuge (NWR)

Project: Use of a private cooperator to graze pastures to manage and improve goose habitat.

Summary: The refuge manages pastures, wetlands, and agricultural fields to provide a variety of foods that will meet the needs of wintering and migratory waterfowl and cranes. Geese in particular, use refuge pastures for most of their foraging activity, preferring young shoots that are higher in protein and lower in fiber than mature stems (Mclandis and Raveling 1981). Pasture grasses serve as an important source of amino acids and carbohydrates to meet the energy and nutrient requirements of geese (Baldassare and Bolen 2006). To provide high quality forage for wintering and migrating geese and cranes, the refuge uses grazing to ensure that young shoots less than 4 inches tall are available by early October each year and to reduce the accumulation of thatch (thatch can reduce the number of available shoots). Other tools used by the refuge include mowing and haying, which are discussed in detail in a separate appropriate use determination.

The refuge provides approximately 1,450 ac of pasture in 55 fields. Of these, approximately 540 ac (193 head, cattle and horses combined) were grazed in 2009 to help achieve refuge goals. Grazing by cattle and/or horses is allowed in fields between May 1 and October 1, subject to approval by the refuge biologist and manager, and only after surveys conducted by refuge staff indicate that introducing livestock to an area will not significantly affect grassland nesting birds. Stock is removed when the vegetation height is <4 inches over 90% of the pasture.

Cooperative Land Management Agreements (CLMA) are used to implement cooperative farming, grazing, and haying programs that help achieve refuge purposes. The CLMA, signed in 2009, described the negotiated agreement between the Refuge and a private farmer to manage lands for both parties. The amount of stock grazed on the Refuge varies, but 120 to 250 of cows and horses (combined) are allowed to graze on approximately 740 acres, but not all acres will be grazed each year.

For each of the findings listed on FWS Form 3-2319, a justification has been provided below:

a. Do we have jurisdiction over the use?

All proposed activities would take place within refuge boundaries and under the supervision of refuge staff.

b. Does the use comply with applicable laws and regulations (Federal, State, tribal, and local)?

The proposed activities would comply with all applicable laws and regulations and would be spelled out in the CLMA.

c. Is the use consistent with applicable Executive orders and Department and Service policies?

The proposed use would provide high quality forage for wintering and migrating waterfowl and cranes within close proximity to high quality roosting habitat. The use of a private cooperator to graze refuge pastures helps provide high quality forage and removes thatch that would be left behind if mowing was used as the only management technique. Other methods such as prescribed fire may remove thatch and mimic natural processes, but given local air quality concerns, the widespread and consistent use of prescribed fire is not practicable. Given the difficulty in using prescribed fire for pasture management, grazing is consistent with the Service's Biological Integrity, Diversity and Environmental Health Policy (601 FW 3).

d. Is the use consistent with public safety?

The proposed use is consistent with public safety and would be sited in areas closed to the general public. Grazing would occur in hunt areas, but all livestock would be removed prior to the hunt seasons.

e. Is the use consistent with goals and objectives in an approved management plan or other document?

The proposed use is consistent with the 2004 Wildlife and Habitat Management Review conducted by the Service as well as the Northwest Oregon/Southwest Washington Canada Goose Depredation Plan (Pacific Flyway Council 1998) and the Pacific Flyway Management Plan for the Dusky Canada Goose (Pacific Flyway Council 2008).

g. Is the use manageable within available budget and staff?

The proposed use is manageable with available budget and staff. The use of a cooperator may save staff time and resources. Grazing also removes thatch and therefore can increase the pasture habitat quality over what could be achieved by only mowing by refuge staff.

h. Will this be manageable in the future within existing resources?

The proposed use would be manageable in the future with the existing resources and may save staff time and resources (see above).

i. Does the uses contribute to the public's understanding and appreciation of the

refuge's natural or cultural resources, or is the use beneficial to the refuge's natural or cultural resources?

The proposed use is beneficial to the refuges natural resources because grazing would help achieve refuge purposes by providing wintering and migrating waterfowl and cranes with a high quality food sources in close proximity to roosting sites.

j. Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see section 1.6D, 603 FW 1, for description), compatible, wildlife-dependent recreation into the future?

The proposed use will not impair existing or future wildlife-dependent recreational use of the refuge. As stated above, this activity would be sited in areas closed to the general public.

Literature Cited

Alisauskas, R.T. and C.D. Ankney. 1992. The cost of egg laying and its relationship to nutritional reserves in waterfowl. Pages 30-61 *in* B.D.J. Batt, A.D. Afton, M.G. Anderson, C.D. Ankney, D.H. Johnson, J.A. Kadlec, and G.L. Krapu, eds. Ecology and management of breeding waterfowl. Univ. of Minnesota Press, Minneapolis.

Baldassare, G.A, and E.G. Bolen. 2006. Waterfowl ecology and management. John Wiley and Sons, Inc.

Pacific Flyway Council. 1998. Pacific Flyway management plan for Northwest Oregon - Southwest Washington Canada goose agricultural depredation control. Canada goose agricultural depredation working group, Pacific Flyway Study Comm. [c/o USFWS], Portland, OR 97232-4181. Unpubl. Rept. 31pp. + appendices.

Pacific Flyway Council. 2008. Pacific Flyway management plan for the dusky Canada goose. Dusky Canada Goose Subcomm., Pacific Flyway Study Comm. [c/o USFWS], Portland, OR. Unpubl. rept. 38 pp.+ appendices.

Raveling, D.G. 1979. The annual energy cycle of the Cackling Canada Goose. pages 81-93 *in* R.I. Jarvis and J.C. Bartonek, eds. Management and biology of Pacific Flyway geese. Oregon State University, Corvallis.

FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: Ridgefield National Wildlife Refuge

Use: Haying and Mowing

This form is not required for wildlife-dependent recreational uses, take regulated by the State, or uses already described in a refuge CCP or step-down management plan approved after October 9, 1997.

Decision Criteria:	YES	NO
(a) Do we have jurisdiction over the use?	✓	
(b) Does the use comply with applicable laws and regulations (Federal, State, tribal, and local)?	✓	
(c) Is the use consistent with applicable Executive orders and Department and Service policies?	✓	
(d) Is the use consistent with public safety?	✓	
(e) Is the use consistent with goals and objectives in an approved management plan or other document?	✓	
(f) Has an earlier documented analysis not denied the use or is this the first time the use has been proposed?	✓	
(g) Is the use manageable within available budget and staff?	✓	
(h) Will this be manageable in the future within existing resources?	✓	
(i) Does the use contribute to the public's understanding and appreciation of the refuge's natural or cultural resources, or is the use beneficial to the refuge's natural or cultural resources?	✓	
(j) Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see section 1.6D, 603 FW 1, for description), compatible, wildlife-dependent recreation into the future?	✓	

Where we do not have jurisdiction over the use ("no" to (a)), there is no need to evaluate it further as we cannot control the use. Uses that are illegal, inconsistent with existing policy, or unsafe ("no" to (b), (c), or (d)) may not be found appropriate. If the answer is "no" to any of the other questions above, we will **generally** not allow the use.

If indicated, the refuge manager has consulted with State fish and wildlife agencies. Yes ✓ No ___

When the refuge manager finds the use appropriate based on sound professional judgment, the refuge manager must justify the use in writing on an attached sheet and obtain the refuge supervisor's concurrence.

Based on an overall assessment of these factors, my summary conclusion is that the proposed use is:

Not Appropriate_____ **Appropriate** ✓

Refuge Manager: [signature] Date: 9/9/10

If found to be **Not Appropriate**, the refuge supervisor does not need to sign concurrence if the use is a new use.

If an existing use is found **Not Appropriate** outside the CCP process, the refuge supervisor must sign concurrence.

If found to be **Appropriate**, the refuge supervisor must sign concurrence.

Refuge Supervisor: [signature] Date: 9-9-10

A compatibility determination is required before the use may be allowed.

FWS Form 3-2319
02/06

Appropriate Uses Justification, Attachment 1

Refuge: Ridgefield National Wildlife Refuge (NWR)

Project: Use of a private cooperator to hay and mow pastures to manage and improve goose habitat.

Summary: The refuge manages pastures, wetlands, and agricultural fields to provide a variety of foods that will meet the needs of wintering and migratory waterfowl and cranes. Geese in particular, use refuge pastures for most of their foraging activity, preferring young shoots that are higher in protein and lower in fiber than mature stems (Mclandis and Raveling 1981). Pasture grasses serve as an important source of amino acids and carbohydrates to meet the energy and nutrient requirements of geese (Baldassare and Bolen 2006). To provide high quality forage for wintering and migrating geese and cranes, the refuge uses mowing and haying to ensure that young shoots less than 4 inches tall are available by October 15 each year.

The refuge provides approximately 1,450 ac of pasture in 55 fields that are managed by haying (approximately 215 ac) and/or mowing (1,235 ac); the difference being that in haying, cut grass stems are removed from the pasture, whereas the stems are left behind as thatch in mowed fields. Grazing is also used to manage some pasture lands and is described in a separate appropriate use determination. To reduce impacts to grassland nesting birds, mowing and haying are conducted after July 15, by which time most nesting has been completed. In most dry pastures, a single mowing or haying is adequate, but if the late summer precipitation is heavier than typical, a second cutting may need to be done.

Cooperative Land Management Agreements (CLMA) are used to implement cooperative farming, grazing, and haying programs that help achieve refuge purposes. The CLMA, signed in 2009, described the negotiated agreement between the Refuge and private farmer to manage lands for both parties. The cooperator is responsible for pasture management, and installing and maintaining fencing. The refuge installs the underground water delivery system, maintains pumps, supplies fencing materials, and constructs and maintains access roads. The cooperator is allowed to harvest hay and raise stock animals for personal use. The amount of hay and stock grazed on the Refuge varies, but approximately 200 to 400 tons of hay are removed from approximately 1,200 acres.

For each of the findings listed on FWS Form 3-2319, a justification has been provided below:

a. Do we have jurisdiction over the use?

All proposed activities would take place within refuge boundaries and under the supervision of refuge staff.

b. Does the use comply with applicable laws and regulations (Federal, State, tribal, and local)?

The proposed activities would comply with all applicable laws and regulations and would be spelled out in the CLMA.

c. Is the use consistent with applicable Executive orders and Department and Service policies?

The proposed use would provide high quality forage for wintering and migrating waterfowl and cranes within close proximity to high quality roosting habitat. The use of a private cooperator to hay refuge pastures helps provide high quality forage and removes thatch that would be left behind if mowing was used as the only management technique. Other methods such as prescribed fire may mimic natural processes, but given local air quality concerns, the widespread and consistent use of prescribed fire is not practicable. Given the difficulty in using prescribed fire for pasture management, haying is consistent with the Service's Biological Integrity, Diversity and Environmental Health Policy (601 FW 3).

d. Is the use consistent with public safety?

The proposed use is consistent with public safety and would be sited in areas closed to the general public. Haying would occur in hunt areas, but this activity would be concluded prior to the hunt seasons.

e. Is the use consistent with goals and objectives in an approved management plan or other document?

The proposed use is consistent with the 2004 Wildlife and Habitat Management Review conducted by the Service as well as the Northwest Oregon/Southwest Washington Canada Goose Depredation Plan (Pacific Flyway Council 1998) and the Pacific Flyway Management Plan for the Dusky Canada Goose (Pacific Flyway Council 2008).

g. Is the use manageable within available budget and staff?

The proposed use is manageable with available budget and staff. The use of a cooperator may save staff time and resources and increase the pasture habitat quality over what could be achieved by only haying with refuge staff.

h. Will this be manageable in the future within existing resources?

The proposed use would be manageable in the future with the existing resources and may save staff time and resources (see above).

i. Does the uses contribute to the public's understanding and appreciation of the refuge's natural or cultural resources, or is the use beneficial to the refuge's natural or cultural resources?

The proposed use is beneficial to the refuge's natural resources because haying would help achieve refuge purposes by providing wintering and migrating waterfowl and cranes with a high quality food sources in close proximity to roosting sites.

j. Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see section 1.6D, 603 FW 1, for description), compatible, wildlife-dependent recreation into the future?

The proposed use will not impair existing or future wildlife-dependent recreational use of the refuge. As stated above, this activity would be sited in areas closed to the general public.

<u>**Literature Cited**</u>

Alisauskas, R.T. and C.D. Ankney. 1992. The cost of egg laying and its relationship to nutritional reserves in waterfowl. Pages 30-61 *in* B.D.J. Batt, A.D. Afton, M.G. Anderson, C.D. Ankney, D.H. Johnson, J.A. Kadlec, and G.L. Krapu, eds. Ecology and management of breeding waterfowl. Univ. of Minnesota Press, Minneapolis.

Baldassare, G.A, and E.G. Bolen. 2006. Waterfowl ecology and management. John Wiley and Sons, Inc.

Pacific Flyway Council. 1998. Pacific Flyway management plan for Northwest Oregon - Southwest Washington Canada goose agricultural depredation control. Canada goose agricultural depredation working group, Pacific Flyway Study Comm. [c/o USFWS], Portland, OR 97232-4181. Unpubl. Rept. 31pp. + appendices.

Pacific Flyway Council. 2008. Pacific Flyway management plan for the dusky Canada goose. Dusky Canada Goose Subcomm., Pacific Flyway Study Comm. [c/o USFWS], Portland, OR. Unpubl. rept. 38 pp.+ appendices.

Raveling, D.G. 1979. The annual energy cycle of the Cackling Canada Goose. pages 81-93 *in* R.I. Jarvis and J.C. Bartonek, eds. Management and biology of Pacific Flyway geese. Oregon State University, Corvallis.

FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: Ridgefield National Wildlife Refuge

Use: Horseback Riding

This form is not required for wildlife-dependent recreational uses, take regulated by the State, or uses already described in a refuge CCP or step-down management plan approved after October 9, 1997.

Decision Criteria:	**YES**	**NO**
(a) Do we have jurisdiction over the use?	✓	
(b) Does the use comply with applicable laws and regulations (Federal, State, tribal, and local)?	✓	
(c) Is the use consistent with applicable Executive orders and Department and Service policies?	✓	
(d) Is the use consistent with public safety?		✓
(e) Is the use consistent with goals and objectives in an approved management plan or other document?	✓	
(f) Has an earlier documented analysis not denied the use or is this the first time the use has been proposed?	✓	
(g) Is the use manageable within available budget and staff?		✓
(h) Will this be manageable in the future within existing resources?	✓	
(i) Does the use contribute to the public's understanding and appreciation of the refuge's natural or cultural resources, or is the use beneficial to the refuge's natural or cultural resources?	✓	
(j) Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see section 1.6D, 603 FW 1, for description), compatible, wildlife-dependent recreation into the future?		✓

Where we do not have jurisdiction over the use ("no" to (a)), there is no need to evaluate it further as we cannot control the use. Uses that are illegal, inconsistent with existing policy, or unsafe ("no" to (b), (c), or (d)) may not be found appropriate. If the answer is "no" to any of the other questions above, we will **generally** not allow the use.

If indicated, the refuge manager has consulted with State fish and wildlife agencies. Yes ___ No ✓

When the refuge manager finds the use appropriate based on sound professional judgment, the refuge manager must justify the use in writing on an attached sheet and obtain the refuge supervisor's concurrence.

Based on an overall assessment of these factors, my summary conclusion is that the proposed use is:

Not Appropriate ✓ **Appropriate** ____

Refuge Manager: [signature] Date: 9/9/10

If found to be **Not Appropriate**, the refuge supervisor does not need to sign concurrence if the use is a new use.

If an existing use is found **Not Appropriate** outside the CCP process, the refuge supervisor must sign concurrence.

If found to be **Appropriate**, the refuge supervisor must sign concurrence.

Refuge Supervisor: [signature] Date: 9-9-10

A compatibility determination is required before the use may be allowed.

FWS Form 3-2319
02/06

Appropriate Uses Justification, Attachment 1

Refuge: Ridgefield National Wildlife Refuge (NWR)

Use: Horseback Riding

Summary: Horseback Riding on Ridgefield NWR has been determined to be not appropriate because of the disturbance to wildlife (especially waterfowl), impacts to habitat, and as a safety concern to users.

For findings listed on FWS Form 3-2319 and if deemed necessary a justification has been provided below:

d. Is the use consistent with public safety?

Wheeled access by public users is restricted to the River 'S' Unit Auto Tour Route, an established gravel roadway where popular wildlife viewing and photography opportunities are provided. Since 1994 when the last compatibility determination was made, automobile numbers on the Auto Tour Route have more than doubled. The presence of horses on the road could create an unsafe traffic situation.

Pedestrian foot travel is permitted in the Carty Unit, where there is no public automobile access, and on the Kiwa Trail on the River 'S' Unit. Horseback riding may increase conflicts between users and may pose a safety problem when horseback riders encounter other users.

f. Has an earlier documented analysis not denied the use or is this the first time the use has been proposed?

This use had a compatibility determination completed in 1994. This determination included seven other uses, and the treatment of impacts from horseback riding involved a single sentence. The use was determined to be compatible because of its infrequency.

g. Is the use manageable within available budget and staff?

Horseback riding has the potential to introduce exotic plants through seed dispersal from manure and horse equipment and forage brought onto the refuge. Soil disturbance and compaction caused by horses' hooves can aid in the establishment of non-native plants (Beck 1993, Hammitt and Cole 1987, Bainbridge 1974, Hendee et al. 1990). The possible establishment of invasive exotic plant species will require staff attention and a monetary requirement for equipment and chemicals needed for control or elimination. With limited staff and resources, a need to control exotic plant species introduced as a result of horseback riding would compete against other priority needs on the refuge.

h. Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see section 1.6D, 603 FW1 for description), compatible, wildlife-dependent recreation into the future?
At a minimum, the quality of the visitor experience would be degraded and there could be direct conflicts with certain priority public uses. Impacts related to horseback riding include exotic plant seed dispersal (Beck 1993, Hammitt and Cole 1987), soil compaction and erosion (Bainbridge 1974, Hendee et al. 1990, Hammitt and Cole 1987), stream sedimentation (Wilson and Seney 1994), trail widening (Whitaker 1978), vegetation trampling (Nagy and Scotter 1974, Weaver and Dale 1978, Whitaker 1978), aesthetic concerns relative to horse manure (Lee 1975), direct wildlife disturbance (Owen 1973), and direct and indirect conflicts with other recreationists. Exotic plants can also be spread to new sites through forage (e.g., hay brought in to feed horses, which contains seeds of exotic plants) and manure (Beck 1993). Exotic plant establishment is further facilitated by increased trail disturbance, as many exotic plants gain a competitive advantage in highly disturbed sites. This soil disturbance is often created through soil compaction. Additionally, hoof action tends to dig up and puncture the soil surface (McQuaid-Cook 1978), which causes greater sediment loss than any other form of recreational trail use (Wilson, J.P., and J.P. Seney 1994) and increases the potential for disturbance-tolerant vegetation (e.g., exotic plant) establishment. Additionally, possible biological impacts of horseback riding are disturbance to wildlife and habitat and the reduction in quality of compatible wildlife dependant recreation. Wildlife can be affected through the sight and sound of recreationists (Boyle and Sampson 1985). Some of the effects of disturbance to wildlife from recreational activities include changes in foraging behavior; reduction of productivity; abandonment or alteration of breeding territories; alteration of animal distribution; alteration of flight behavior; energy depletion; and disruption of nest and brood rearing attentiveness (Klein 1989, Knight and Skagen 1988).

Literature Cited

Bainbridge, D.A. 1974. Trail management. Ecological Society of America Bulletin 55:8-10.

Beck, K.G. 1993. How do weeds affect us all. Proceedings of the Eighth Grazing Lands Forum. Washington, District of Columbia. December 2, 1993, pages 5-13.

Boyle S.A., and F.B. Samson. 1985. Effects of non-consumptive recreation on wildlife: A review. Wildlife Society Bulletin 13:110-116.

Hammitt, W.E., and D.N. Cole. 1987. Wildland Recreation: Ecology and Management. John Wiley and Sons, New York, New York. 341 pages.

Hendee, J.C., G.H. Stankey, and R.C. Lucas. 1990. Wilderness Management. North American Press, Golden, Colorado.

Klein, M.L. 1989. Effects of high levels of human visitation on foraging waterbirds at J.N. "Ding" Darling National Wildlife Refuge, Sanibel, Florida. Final Report to the U.S. Fish and Wildlife Service. 103 pages.

Knight, R.L., and S.K. Skagen. 1988. Effects of recreational disturbance on birds of prey: A review. Pages 355-359 *in* Proceedings of the Southwest Raptor Management Symposium Workshop. National Wildlife Federation, Washington, District of Columbia.

Lee, R.G. 1975. The management of human components in the Yosemite National Park ecosystem. Yosemite National Park, California. 134 pages.

McQuaid-Cook, J. 1978. Effects of hikers and horses on mountain trails. Journal of Environmental Management 6:209-212.

Nagy, J.A.S., and G.W. Scotter. 1974. A quantitative assessment of the effects of human and horse trampling on natural areas, Waterton Lakes National Park. Canadian Wildlife Service, Edmonton, Alberta, Canada. 145 pages.

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Weaver, T., and D. Dale. 1978. Trampling effects of hikers, motorcycles, and horses in meadows and forests. Journal of Applied Ecology 15:451-457.

Whittaker, P.L. 1978. Comparison of surface impact by hiking and horseback riding in the Great Smoky Mountain National Park. National Park Service Management Report 24.

Wilson, J.P., and J.P. Seney. 1994. Erosional impact of hikers, horses, motorcycles, and off-road bicycles on mountain trails in Montana. Mountain Research and Development 14(1): 77-88.

FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: Ridgefield National Wildlife Refuge

Use: Jogging on Refuge

This form is not required for wildlife-dependent recreational uses, take regulated by the State, or uses already described in a refuge CCP or step-down management plan approved after October 9, 1997.

Decision Criteria:	YES	NO
(a) Do we have jurisdiction over the use?	✓	
(b) Does the use comply with applicable laws and regulations (Federal, State, tribal, and local)?	✓	
(c) Is the use consistent with applicable Executive orders and Department and Service policies?	✓	
(d) Is the use consistent with public safety?		✓
(e) Is the use consistent with goals and objectives in an approved management plan or other document?		✓
(f) Has an earlier documented analysis not denied the use or is this the first time the use has been proposed?	✓	
(g) Is the use manageable within available budget and staff?	✓	
(h) Will this be manageable in the future within existing resources?	✓	
(i) Does the use contribute to the public's understanding and appreciation of the refuge's natural or cultural resources, or is the use beneficial to the refuge's natural or cultural resources?	✓	
(j) Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see section 1.6D, 603 FW 1, for description), compatible, wildlife-dependent recreation into the future?		✓

Where we do not have jurisdiction over the use ("no" to (a)), there is no need to evaluate it further as we cannot control the use. Uses that are illegal, inconsistent with existing policy, or unsafe ("no" to (b), (c), or (d)) may not be found appropriate. If the answer is "no" to any of the other questions above, we will **generally** not allow the use.

If indicated, the refuge manager has consulted with State fish and wildlife agencies. Yes ✓ No ___

When the refuge manager finds the use appropriate based on sound professional judgment, the refuge manager must justify the use in writing on an attached sheet and obtain the refuge supervisor's concurrence.

Based on an overall assessment of these factors, my summary conclusion is that the proposed use is:

Not Appropriate ✓ **Appropriate**_____

Refuge Manager: [signature] Date: 9/9/10

If found to be **Not Appropriate**, the refuge supervisor does not need to sign concurrence if the use is a new use.

If an existing use is found **Not Appropriate** outside the CCP process, the refuge supervisor must sign concurrence.

If found to be **Appropriate**, the refuge supervisor must sign concurrence.

Refuge Supervisor: [signature] Date: 9-9-10

A compatibility determination is required before the use may be allowed.

FWS Form 3-2319
02/06

Appropriate Uses Justification, Attachment 1

Refuge: Ridgefield National Wildlife Refuge (NWR)

Project: Jogging on Refuge

Summary: Jogging on Ridgefield NWR has been determined to be not appropriate, due to increased disturbance to wildlife and reduction of quality to other compatible wildlife-dependent public uses.

For each of the findings listed on FWS Form 3-2319, a justification has been provided below:

d. Is the use consistent with public safety?

Wheeled access by public users is restricted to the River 'S' Unit Auto Tour Route, an established gravel roadway where popular wildlife viewing and photography opportunities are provided. Since 1994 when the last compatibility determination was made, automobile numbers on the Auto Tour Route have more than doubled. Because of driving habits associated with the gravel single-lane road, automobile users are often aware of the slow moving, stop-and-go habits other automobile drivers exhibit. Because these same drivers are engaged in wildlife viewing activities, the faster moving, far less detectable joggers could create an unsafe traffic situation.

In the Carty Unit foot travel is permitted and there is no public access for automobiles. The narrow, muddy trail though wetland and forest habitats is not a good surface for jogging or running for significant portions of the year. The limited line-of-sight may result in conflicts between pedestrians and joggers/runners as described below.

f. Has an earlier documented analysis not denied the use or is this the first time the use has been proposed?

This use had a compatibility determination completed in 1994. This determination collectively included seven other uses and the treatment of jogging involved two sentences. The use was determined to be compatible because of its infrequency.

h. Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see section 1.6D, 603 FW1 for description), compatible, wildlife-dependent recreation into the future?

It has been determined that animals show greater flight response to humans moving unpredictably than to humans following a distinct path (Gabrielsen and Smith 1995) and that rapid movement by joggers is more disturbing to wildlife than slower moving hikers (Bennett and Zuelke 1999). Burger (1981) examined the effects of human activity on roosting and migrating birds at a coastal bay refuge along the Atlantic coast. Human activities which involved rapid movements or close proximity to roosting birds, such as jogging even when on the pathway, caused the birds to flush; in comparison, slow walking bird watchers and people walking on the path around the ponds did not usually cause birds to flush. Wildlife learn to avoid humans or other stimuli when encounters result in negative interactions. Avoidance is influenced by a number of factors including: 1) type, distance, movement pattern, speed, and duration of the disturbance; 2) time of day, time of year, weather; and 3) food, cover, energy demands, and reproductive status (Knight and Cole, 1991).

Other compatible wildlife-dependent activities such as wildlife watching, photography, and environmental education, will be negatively affected because of the expected responses by wildlife to the fast moving activity associated with jogging. When wildlife react by moving away from jogging activity or alter behavior by hiding they will be less likely to be observed (Bennett and Zuelke 1999). This situation will create what Moore (1994) summarized: Trail conflicts can occur among different user groups, among users within the same user group, and as a result of factors not related to trail user activities at all. Conflict has been found to related to activity style, focus of trip, expectations, attitudes toward and perceptions of the environment, level of tolerance for others, and different norms held by different users. This loss of expectation of a quality wildlife dependent experience could result in avoidance of the refuge by wildlife watchers and photographers who have encountered joggers using the same trail.

Literature Cited

Bennett, KA and E. Zuelke . 1999. The effects of recreation on birds: a literature review. Delaware Natural Heritage Program, Smyrna, DE 1977.

Burger, J. 1981. The effect of human activity on birds at a coastal bay. Biol. Cons. 21:231-241

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FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: Ridgefield National Wildlife Refuge

Use: Provide Kayak Launching Facility

This form is not required for wildlife-dependent recreational uses, take regulated by the State, or uses already described in a refuge CCP or step-down management plan approved after October 9, 1997.

Decision Criteria:	YES	NO
(a) Do we have jurisdiction over the use?		✓
(b) Does the use comply with applicable laws and regulations (Federal, State, tribal, and local)?	✓	
(c) Is the use consistent with applicable Executive orders and Department and Service policies?	✓	
(d) Is the use consistent with public safety?	✓	
(e) Is the use consistent with goals and objectives in an approved management plan or other document?	✓	
(f) Has an earlier documented analysis not denied the use or is this the first time the use has been proposed?		✓
(g) Is the use manageable within available budget and staff?	✓	
(h) Will this be manageable in the future within existing resources?	✓	
(i) Does the use contribute to the public's understanding and appreciation of the refuge's natural or cultural resources, or is the use beneficial to the refuge's natural or cultural resources?	✓	
(j) Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see section 1.6D, 603 FW 1, for description), compatible, wildlife-dependent recreation into the future?	✓	

Where we do not have jurisdiction over the use ("no" to (a)), there is no need to evaluate it further as we cannot control the use. Uses that are illegal, inconsistent with existing policy, or unsafe ("no" to (b), (c), or (d)) may not be found appropriate. If the answer is "no" to any of the other questions above, we will **generally** not allow the use.

If indicated, the refuge manager has consulted with State fish and wildlife agencies. Yes ✓ No ___

When the refuge manager finds the use appropriate based on sound professional judgment, the refuge manager must justify the use in writing on an attached sheet and obtain the refuge supervisor's concurrence.

Based on an overall assessment of these factors, my summary conclusion is that the proposed use is:

Not Appropriate ✓ **Appropriate**_____

Refuge Manager: ____________ Date: 9/9/10

If found to be **Not Appropriate**, the refuge supervisor does not need to sign concurrence if the use is a new use.

If an existing use is found **Not Appropriate** outside the CCP process, the refuge supervisor must sign concurrence.

If found to be **Appropriate**, the refuge supervisor must sign concurrence.

Refuge Supervisor: ____________ Date: 9-9-10

A compatibility determination is required before the use may be allowed.

FWS Form 3-2319
02/06

DRAFT
Appropriate Uses Justification

Refuge: Ridgefield National Wildlife Refuge (NWR)

Project: Provide Kayak Launching Facility

Summary: Request to provide public with a facility where kayak users could enter the NWR from public waters.

For each of the findings listed on FWS Form 3-2319, a justification has been provided below:

a. Do we (USFWS) have jurisdiction over the use?

The NWR does not have jurisdiction over lands below high water elevation and as such would preclude the construction of facilities on State lands**.**

f. Has an earlier documented analysis not denied the use or is this the first time the use has been proposed?

The development of a Kayak Launching Facility has never been proposed until this request.

FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: Ridgefield National Wildlife Refuge

Use: Research

This form is not required for wildlife-dependent recreational uses, take regulated by the State, or uses already described in a refuge CCP or step-down management plan approved after October 9, 1997.

Decision Criteria:	YES	NO
(a) Do we have jurisdiction over the use?	✓	
(b) Does the use comply with applicable laws and regulations (Federal, State, tribal, and local)?	✓	
(c) Is the use consistent with applicable Executive orders and Department and Service policies?	✓	
(d) Is the use consistent with public safety?	✓	
(e) Is the use consistent with goals and objectives in an approved management plan or other document?	✓	
(f) Has an earlier documented analysis not denied the use or is this the first time the use has been proposed?	✓	
(g) Is the use manageable within available budget and staff?	✓	
(h) Will this be manageable in the future within existing resources?	✓	
(i) Does the use contribute to the public's understanding and appreciation of the refuge's natural or cultural resources, or is the use beneficial to the refuge's natural or cultural resources?	✓	
(j) Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see section 1.6D, 603 FW 1, for description), compatible, wildlife-dependent recreation into the future?	✓	

Where we do not have jurisdiction over the use ("no" to (a)), there is no need to evaluate it further as we cannot control the use. Uses that are illegal, inconsistent with existing policy, or unsafe ("no" to (b), (c), or (d)) may not be found appropriate. If the answer is "no" to any of the other questions above, we will **generally** not allow the use.

If indicated, the refuge manager has consulted with State fish and wildlife agencies. Yes ✓ No ___

When the refuge manager finds the use appropriate based on sound professional judgment, the refuge manager must justify the use in writing on an attached sheet and obtain the refuge supervisor's concurrence.

Based on an overall assessment of these factors, my summary conclusion is that the proposed use is:

Not Appropriate_____ **Appropriate** ✓

Refuge Manager: [signature] Date: 9/9/10

If found to be **Not Appropriate**, the refuge supervisor does not need to sign concurrence if the use is a new use.

If an existing use is found **Not Appropriate** outside the CCP process, the refuge supervisor must sign concurrence.

If found to be **Appropriate**, the refuge supervisor must sign concurrence.

Refuge Supervisor: [signature] Date: 9-9-10

A compatibility determination is required before the use may be allowed.

FWS Form 3-2319
02/06

Appropriate Uses Justification, Attachment 1

Refuge: Ridgefield National Wildlife Refuge (NWR)

Project: Conducting research on refuge lands and waters

Summary: The Refuge receives requests to conduct scientific research on refuge lands and waters. Research applicants must submit a proposal that would outline: 1) objectives of the study; 2) justification for the study; 3) detailed methodology and schedule; 4) potential impacts on Refuge wildlife and/or habitat, including disturbance (short and long term), injury, or mortality; 5) personnel required; 6) costs to Refuge, if any; and 7) end products (i.e. reports, publications). Research proposals would be reviewed by Refuge staff, Regional Office Branch of Refuge Biology, and others as appropriate prior to the refuge issuing a special use permit (SUP). Projects will not be open-ended, and at a minimum, will be reviewed annually.

For each of the findings listed on FWS Form 3-2319, a justification has been provided below:

a. Do we have jurisdiction over the use?

Some or all of the proposed activities would take place within refuge boundaries. The refuge has jurisdiction over those research projects that are sited within refuge boundaries.

b. Does the use comply with applicable laws and regulations (Federal, State, tribal, and local)?

Any proposed research activities would comply with all applicable laws and regulations and any restrictions or qualifications that are required to comply with law and regulations would be specified in the SUP.

c. Is the use consistent with applicable Executive orders and Department and Service policies?

Through the review of individual projects, the refuge would ensure that they are consistent with applicable policies, especially Research on Service Lands Policy (803 FW 1).

d. Is the use consistent with public safety?

Through individual project review, the refuge will ensure that each project is consistent with public safety. If necessary, stipulations to ensure public safety will be included in the project's SUP.

e. Is the use consistent with goals and objectives in an approved management plan or other document?

Research activities are approved in instances where they can provide meaningful data that may contribute to refuge management and public appreciation of natural resources.

g. Is the use manageable within available budget and staff?

The refuge receives fewer than 6 requests per year for this activity and it is manageable with available budget and staff.

h. Will this be manageable in the future within existing resources?

The proposed activity at current levels would be manageable in the future with the existing resources (see above).

i. Does the uses contribute to the public's understanding and appreciation of the refuge's natural or cultural resources, or is the use beneficial to the refuge's natural or cultural resources?

The proposed use is beneficial to the refuge's natural and cultural resources because the types of research projects approved are those which have the distinct likelihood to help achieve refuge purposes by providing information useful for the management of trust resources and may contribute to the public's understanding and appreciation of natural and/or cultural resources.

j. Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see section 1.6D, 603 FW 1, for description), compatible, wildlife-dependent recreation into the future?

The refuge will ensure that the research activities will not impair existing or future wildlife-dependent recreational use of the refuge during individual project review, prior to issuing a SUP for the project.

FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: Ridgefield National Wildlife Refuge

Use: Berry Picking

This form is not required for wildlife-dependent recreational uses, take regulated by the State, or uses already described in a refuge CCP or step-down management plan approved after October 9, 1997.

Decision Criteria:	**YES**	**NO**
(a) Do we have jurisdiction over the use?	✓	
(b) Does the use comply with applicable laws and regulations (Federal, State, tribal, and local)?	✓	
(c) Is the use consistent with applicable Executive orders and Department and Service policies?	✓	
(d) Is the use consistent with public safety?		✓
(e) Is the use consistent with goals and objectives in an approved management plan or other document?	✓	
(f) Has an earlier documented analysis not denied the use or is this the first time the use has been proposed?	✓	
(g) Is the use manageable within available budget and staff?	✓	
(h) Will this be manageable in the future within existing resources?	✓	
(i) Does the use contribute to the public's understanding and appreciation of the refuge's natural or cultural resources, or is the use beneficial to the refuge's natural or cultural resources?	✓	
(j) Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see section 1.6D, 603 FW 1, for description), compatible, wildlife-dependent recreation into the future?	✓	

Where we do not have jurisdiction over the use ("no" to (a)), there is no need to evaluate it further as we cannot control the use. Uses that are illegal, inconsistent with existing policy, or unsafe ("no" to (b), (c), or (d)) may not be found appropriate. If the answer is "no" to any of the other questions above, we will **generally** not allow the use.

If indicated, the refuge manager has consulted with State fish and wildlife agencies. Yes ✓ No ___

When the refuge manager finds the use appropriate based on sound professional judgment, the refuge manager must justify the use in writing on an attached sheet and obtain the refuge supervisor's concurrence.

Based on an overall assessment of these factors, my summary conclusion is that the proposed use is:

Not Appropriate ✓ **Appropriate** _____

Refuge Manager: ______________ Date: 9/9/10

If found to be **Not Appropriate,** the refuge supervisor does not need to sign concurrence if the use is a new use.

If an existing use is found **Not Appropriate** outside the CCP process, the refuge supervisor must sign concurrence.

If found to be **Appropriate**, the refuge supervisor must sign concurrence.

Refuge Supervisor: ______________ Date: 9-9-10

A compatibility determination is required before the use may be allowed.

FWS Form 3-2319
02/06

Appropriate Uses Justification, Attachment 1

Refuge: Ridgefield National Wildlife Refuge (NWR)

Use: Berry Picking

Summary: Berry Picking on Ridgefield NWR has been determined to be not appropriate because of the safety and health concern to users.

For findings listed on FWS Form 3-2319 and if deemed necessary a justification has been provided below:

d. Is the use consistent with public safety?

As part of the Refuge's Invasive Species Eradication program blackberry species are sprayed up to multiple times per year and normally annually until control results are attained. Garlon 3a is the main pesticide used to accomplish blackberry control. This product is considered a Hazardous Chemical by OSHA also by EPA under it's Hazardous Categories Under sections 311 and 312 of the Superfund Amendment and Reauthorization Act of 1986 and meets the following threat categories; 1) An immediate health hazard 2) a delayed health hazard and 3) a fire hazard.

Because of the toxicity to unaware berry collectors the Refuge does not allow berry picking. Although signs are posted where pesticides are used the public may not see the signs or because of language barriers not understand the warnings and will inadvertently put themselves in harms way.

f. Has an earlier documented analysis not denied the use or is this the first time the use has been proposed?

This use had a determination completed in 1994. This determination collectively included other uses and the treatment to berry picking involved two sentences. Use was determined to be compatible because of the infrequent use.

Literature Cited

Garlon 3a Material Safety Data Sheet (MSDS)
http://www.cdms.net/LabelsMsds/LMDefault.aspx?pd=1923

Appendix B. Compatibility Determinations

B.1 Introduction

The compatibility determinations (CDs) we developed during the CCP planning process evaluate uses as projected to occur under Alternative 2, the Preferred Alternative in the Draft EA for the Ridgefield National Wildlife Refuge CCP/EA, which has carried forward as the management direction for the Refuge in this CCP (Chapter 2). The evaluation of funds needed for management and implementation of each use is described in Appendix D, Implementation. Chapter 7 of the Draft CCP/EA also contained an analysis of the impacts of public uses to wildlife and habitats. That document is incorporated through reference into this set of CDs.

B.1.1 Uses Evaluated At This Time

The following section includes full CDs for all Refuge uses that are required to be evaluated at this time. According to Service policy, compatibility determinations will be completed for all uses proposed under a CCP that have been determined to be appropriate. Existing wildlife-dependent recreational uses must also be reevaluated and new CDs prepared during development of a CCP. According to the Service's compatibility policy, uses other than wildlife-dependent recreational uses are not explicitly required to be reevaluated in concert with preparation of a CCP, unless conditions of the use have changed or unless significant new information relative to the use and its effects have become available or the existing CDs are more than 10 years old. However, the Service planning policy recommends preparing CDs for all individual uses, specific use programs, or groups of related uses associated with the proposed action. Accordingly, the following CDs are included in this document.

Table B-1. Summary of Compatible Use Determinations.

Refuge Uses	Page	CD#	Compatible?	Year Due for Re-evaluation
Wildlife Observation, Photography, Interpretation, and Environmental Education—River 'S' Unit	B-5	B1	yes	2025
Wildlife Observation, Photography, Interpretation, and Environmental Education—Carty Unit	B-12	B2	yes	2025
Waterfowl Hunting	B-19	B3	yes	2025
Recreational Fishing	B-29	B4	yes	2025
Environmental Education and Interpretation—Cathlapotle Plankhouse	B-34	B5	yes	2020
Crop Production	B-49	B6	yes	2020
Haying and Mowing	B-56	B7	yes	2020
Grazing	B-63	B8	yes	2020
Research	B-70	B9	yes	2020
Mosquito Management	B-76	B10	yes	2020

B.1.2 Compatibility–Legal and Historical Context

Compatibility is a tool Refuge managers use to ensure that recreational and other uses do not interfere with wildlife conservation, the primary focus of Refuges. Compatibility is not new to the Refuge System and dates back to 1918, as a concept. As policy, it has been used since 1962. The Refuge Recreation Act of 1962 directed the Secretary of the Interior to allow only those public uses of Refuge lands that were "compatible with the primary purposes for which the area was established."

Legally, Refuges are closed to all public uses until officially opened through a compatibility determination. Regulations require that adequate funds be available for administration and protection of Refuges before opening them to any public uses. However, wildlife-dependent recreational uses (hunting, fishing, wildlife observation and photography, environmental education, and interpretation) are to receive enhanced consideration and cannot be rejected simply for lack of funding resources unless the Refuge has made a concerted effort to seek out funds from all potential partners. Once found compatible, wildlife-dependent recreational uses are deemed the priority public uses at the Refuge. If a proposed use is found not compatible, the Refuge manager is legally precluded from approving it. Economic uses that are conducted by or authorized by the Refuge also require compatibility determinations.

Under compatibility policy, uses are defined as recreational, economic/commercial, or management use of a Refuge by the public or a non-Refuge System entity. Uses generally providing an economic return (even if conducted for the purposes of habitat management) are also subject to compatibility determinations. The Service does not prepare compatibility determinations for uses when the Service does not have jurisdiction. For example, the Service may have limited jurisdiction over Refuge areas where property rights are vested by others; where legally binding agreements exist; or where there are treaty rights held by tribes. In addition, aircraft overflights, emergency actions, some activities on navigable waters, and activities by other Federal agencies on "overlay Refuges" are exempt from the compatibility review process.

New compatibility regulations, required by the National Wildlife Refuge System Improvement Act of 1997 (Improvement Act), were adopted by the Service in October, 2000 (http://Refuges.fws.gov/policymakers/nwrpolicies.html). The regulations require that a use must be compatible with both the mission of the System and the purposes of the individual Refuge. This standard helps to ensure consistency in application across the Refuge System. The Act also requires that compatibility determinations be in writing and that the public have an opportunity to comment on most use evaluations.

The Refuge System mission emphasizes that the needs of fish, wildlife, and plants must be of primary consideration. The Improvement Act defined a compatible use as one that ". . . in the sound professional judgment of the Director, will not materially interfere with or detract from the fulfillment of the mission of the System or the purposes of the Refuge." Sound professional judgment is defined under the Improvement Act as ". . . a finding, determination, or decision, that is consistent with principles of sound fish and wildlife management and administration, available science and resources . . ." Compatibility for priority wildlife-dependent uses may depend on the level or extent of a use.

Court interpretations of the compatibility standard have found that compatibility is a biological standard and cannot be used to balance or weigh economic, political, or recreational interests against the primary purpose of the Refuge (Defenders of Wildlife v. Andrus [Ruby Lake Refuge]).

The Service recognizes that compatibility determinations are complex. For this reason, Refuge managers are required to consider "principles of sound fish and wildlife management" and "best available science" in making these determinations (House of Representatives Report 105-106). Evaluations of the existing uses on the Ridgefield National Wildlife Refuge are based on the professional judgment of Refuge and planning personnel including observations of Refuge uses and reviews of appropriate scientific literature.

In July 2006, the Service published its Appropriate Refuge Uses Policy (603 FW1). Under this policy, most proposed uses must also undergo a review prior to compatibility. Uses excepted from the policy include priority wildlife-dependent recreational uses, and uses under reserved rights – see policy for more detail. Appropriate uses reviews are included in Appendix A.

Compatibility Determinations for Ridgefield National Wildlife Refuge

This section contains Compatibility Determinations for the following uses on Ridgefield National Wildlife Refuge:

- Wildlife Observation, Photography, Interpretation, and Environmental Education (River 'S' Unit)
- Wildlife Observation, Photography, Interpretation, and Environmental Education (Carty Unit)
- Waterfowl Hunting
- Recreational Fishing
- Environmental Education (Cathlapotle Plankhouse)
- Crop Production
- Haying and Mowing
- Grazing
- Research
- Mosquito Management

Refuge Location

Location: Clark County, Washington
Date Established: 1965

Establishing and Acquisition Authorities

- Migratory Bird Conservation Act of 1929, as amended (16 U.S.C. 715-715s)
- Migratory Bird Hunting and Conservation Stamp Act of 1934 (16 U.S.C. 718-718j) [Funding for primary acquisition]
- Fish and Wildlife Act of 1956 (16 U.S.C. 742a-742j, not including 742d-l) (Ridgeport Dairy Unit)

Refuge Purpose(s)

- "... for use as an inviolate sanctuary, or for any other management purpose, for migratory birds." 16 U.S.C. § 715d (Migratory Bird Conservation Act)
- "... to provide wintering habitat for dusky Canada goose and other waterfowl. Will also provide breeding and migration use and substantial public shooting in area. Estimated peak population: 125,000 ducks and 3,000 geese." (Migratory Bird Conservation Commission Memorandum Number 1, May 18, 1965.)
- "...for the development, advancement, management, conservation, and protection of fish and wildlife resources..." 16 U.S.C. 742f(a)(4) (Fish and Wildlife Act of 1956) (Ridgeport Dairy Unit)

B.2 References

Defenders of Wildlife v. Andrus (Ruby Lake Refuge I). 11 Envtl. Rptr. Case 2098 (D.D.C. 1978), p. 873.

House of Representatives Report 105-106 (on NWRSIA) - http://refuges.fws.gov/policyMakers/mandates/HR1420/part1.html

Compatibility regulations, adopted by the Service in October, 2000: (http://Refuges.fws.gov/policymakers/nwrpolicies.html)

U.S. Fish and Wildlife Service. 2010. *Ridgefield National Wildlife Refuge, Draft Comprehensive Conservation Plan and Environmental Assessment*.

B1. Compatibility Determination for Wildlife Observation, Photography, Interpretation, and Environmental Education on the River 'S' Unit, Ridgefield National Wildlife Refuge

Uses: Wildlife Observation, Photography, Interpretation, and Environmental Education.

Station Name: Ridgefield National Wildlife Refuge

Date Established: 1965

Establishing and Acquisition Authority(ies):

Migratory Bird Conservation Act of 1929, as amended (16 U.S.C. 715-715s)

Migratory Bird Hunting and Conservation Stamp Act of 1934 (16 U.S.C. 718-718j) [Funding for primary acquisition]

Refuge Purpose(s):

"... for use as an inviolate sanctuary, or for any other management purpose, for migratory birds." 16 U.S.C. § 715d (Migratory Bird Conservation Act)

"... to provide wintering habitat for dusky Canada goose and other waterfowl. Will also provide breeding and migration use and substantial public shooting in area. Estimated peak population: 125,000 ducks and 3,000 geese." (Migratory Bird Conservation Commission Memorandum Number 1, May 18, 1965.)

National Wildlife Refuge System Mission:

The mission of the 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.

Description of Uses:

Non-consumptive wildlife dependent recreation (defined here as wildlife observation, photography, and interpretation) are defined as priority public uses under the Refuge Improvement Act and can enhance the users' appreciation of the Refuge, the National Wildlife Refuge System, wildlife, their habitats, and the human environment. The Refuge would provide opportunities for these activities on a 4.0-mile Auto Tour Route. The Auto Tour Route would be open to non-consumptive wildlife dependent recreational activities year-round. From October 1 to March 31 visitors would be required remain in their vehicle along the Auto Tour Route to reduce disturbance to wintering wildlife. The exception to this seasonal restriction is the observation blind, restroom facilities, visitor contact station, entrance kiosk, and associated walkways. The remaining months of the year users are not restricted to their vehicles but would be required to stay on the road surface of the Auto Tour Route. From May 1 to September 30 non-consumptive wildlife dependent recreation would also be facilitated along the 1.1-mile walking only Kiwa Trail. In addition planned future non-consumptive wildlife dependent recreation would be developed along a new out and back walking trail segment (~1.5 miles) that follows the dike-top along the north end of the River 'S'. In conjunction with this trail would be an elevated viewing platform near the trail's terminus. Similar to the Kiwa Trail, this new trail segment would only be open between the May 1 and September 30 timeframe.

Non-consumptive wildlife dependent recreation would be largely self-guided and would be restricted to the Auto Tour Route, designated trails, and developed parking areas. Off-trail activities would require a Special Use Permit from the Refuge. At times, users engaged in these activities would be accompanied by Refuge staff and/or trained volunteers (*i.e.* tours conducted during BirdFest). Interpretive materials are also available to visitors through interpretive panels, stations along the Oak to Wetlands Trail, the Refuge Office/Visitor Contact Station, and brochures.

Collection of plant material and the removal of wildlife or their parts (except fish captured while engaged in recreational fishing; see Compatibility Determination – Fishing) would be prohibited unless the Refuge issues a Special Use Permit to the user(s). Special conditions are put in place to reduce impacts of these activities.

Availability of Resources:

The River 'S' Unit of the Refuge is open for wildlife photography, fishing, interpretation, hunting, and wildlife observation. Facilities to separate consumptive and non-consumptive users have been developed, although access trails, parking lots, signage and other facilities are often used for multiple purposes. The Service has two employees dedicated to the Visitor Service program (i.e. Visitor Services). Additional Refuge staff also assist in trail and parking area maintenance, facility and road maintenance, sign posting, construction projects, talking to and answering questions from the public, developing and implementing Refuge management programs. The Refuge is a Recreation Fee site, as authorized by the Federal Lands Recreation Enhancement Act, with fees supporting visitor services, habitat restoration, and maintenance related to the visitor's experience. These funds help offset the expenses related to maintaining and operating a visitor services program.

Costs to Administer and Manage the River 'S' Unit Public Use Programs at the Refuge under the Preferred Alternative (Alternative 2)

Activity or Project	One Time Expenses ($)	Recurring Expenses ($/year)
Provide facilities for self-guided wildlife observation and photography opportunities on the Refuge's River 'S' and Carty Units, while limiting the impacts of noise and human activity to sensitive species.		$17k
Provide 6.6 miles of seasonal pedestrian access on Refuge trails and roads and 2 miles of year-round pedestrian access on Refuge trails.		$53k
Conduct up to 25 volunteer-guided wildlife tours annually to provide visitors with access to areas of the Refuge that are otherwise closed.		$31K
Maintain and improve visitor contact and orientation facilities, signage, and interpretation		$50K
Maintain and improve public facilities: Improve visitor infrastructure so as to enhance safety, sanitation, comfort, and access for the visiting public, including visitors with disabilities.		$82K

Activity or Project	One Time Expenses ($)	Recurring Expenses ($/year)
Maintain a 4.0-mile year-round auto tour route that provides visitors opportunities to view and photograph wildlife, and supports a maximum of 200 vehicles on peak use days. Reroute .3 Miles	 $310k	
Provide 6.6 miles of seasonal pedestrian access on Refuge trails and roads and 2 miles of year-round pedestrian access on Refuge trails. 1.5 Mile Dike-top Trail Construct Elevated Observation Deck TOTAL	 $276k $55k $331k	
Totals	972k	233k

Anticipated Impacts of Uses:

Impacts resulting from the proposed uses include both direct and indirect impacts to wildlife resources and the associated habitat. Direct impacts have an immediate effect on wildlife and generally result from the public's interaction with wildlife. Indirect impacts would include actions taken by the public that would impact habitat or reduce access to habitat.

Direct Impacts

We expect these impacts to include the presence of humans disturbing wildlife, which typically results in a temporary displacement of individuals. Some species such as sandhill cranes will avoid the areas people frequent, such as the developed trails and the Auto Tour Route during periods of moderate to heavy traffic, while others such as raccoons seem unaffected by or even drawn to the presence of humans.

Negative impacts to wildlife have been documented when migratory birds and humans are present in the same areas (Boyle and Samson 1985). Responses of wildlife to human activities include: departure from site, use of suboptimal habitat, altered behavior (Burger 1981, Morton et al. 1989, Klein 1993), and increase in energy expenditure (Morton et al. 1989, Belanger and Bedard 1990).

McNeil et al. (1992) found that many waterfowl species avoid disturbance by feeding at night instead of during the day. The location of recreational activities impacts species in different ways. Miller et al. (1998) found that nesting success was lower near recreational trails, where human activity was common, than at greater distances from the trails. A number of species have shown greater reactions when pedestrian use occurred off trail (Miller, 1998). In addition, Burger (1981) found that wading birds were extremely sensitive to disturbance in the northeastern US. Klein (1989) found migratory dabbling ducks to be the most sensitive to disturbance and migrant ducks to be more sensitive when they first arrived, in the late fall, than later in winter. She also found gulls and sandpipers to be apparently insensitive to human disturbance, with Burger (1981) finding the same to be true for various gull species.

Gutzwiller et al. (1997) found that singing behavior of some songbirds was altered by low levels of human intrusion. Pedestrian travel can impact normal behavioral activities, including feeding, reproductive, and social behavior. Studies have shown that ducks and shorebirds are sensitive to pedestrian activity (Burger 1981, 1986). Resident waterbirds that are regularly exposed to human disturbance tend to be less sensitive than migrants, especially when migrants first arrive at a site (Klein 1993). In areas where human activity is common, birds tolerated closer approaches than in areas receiving less activity.

To help mitigate this impacts, the Refuge closes the 1.5-mile hiking trail (Kiwa Trail) and prohibits visitors from leaving their vehicle (except to access the observation blind) from October 1 to April 30, which is the time when wintering waterfowl and sandhill cranes are present on the Refuge in the greatest numbers. Research has indicated that waterfowl are less likely to be flushed or swim away from slow moving vehicles than from pedestrians (Klein 1993, Pease *et al.* 2005).

Indirect Impacts

People can be vectors for invasive plants by moving seeds or other propagules from one area to another. Once established, invasive plants can out-compete native plants, thereby altering habitats and indirectly impacting wildlife. The threat of invasive plant establishment will always be an issue requiring annual monitoring and treatment when necessary. Refuge staff will work at eradicating invasive plants and educating the visiting public.

Providing and maintaining access points indirectly impacts wildlife by creating barriers to movement, through vegetation removal and management, and abrupt edge creation which may lead to increased predation (Ratti and Reese 1988). Trail edges may concentrate prey species and may be used by predators as travel corridors.

Other indirect impacts may include the deposition of litter and erosion caused by the damage to vegetation from trampling. These have not been a significant problem at the current level of use.

Public Review and Comment:

This determination was issued for public review and comment as part of the Ridgefield NWR Draft Comprehensive Conservation Plan and Environmental Assessment (DCCP/EA). The plan and associated compatibility determinations were also provided as CDs to a mailing list of 432 recipients, and were made available on the FWS Region 1 Planning website. Printed copies of the DCCP/EA were available upon request. The 30-day review occurred from June 16 through July 16, 2010. We did not receive specific comments regarding the compatibility determinations; however, several commenters suggested that the Auto Tour Route be shortened during the waterfowl hunting season. No changes have been made at this time, since data showing a link between the auto tour route and reduced wildlife use of the area is lacking. However the Refuge staff will consider seasonal closures of the auto tour route if monitoring shows unacceptable levels of disturbance to sensitive wildlife species.

Determination (check one below):

_____ Uses are Not Compatible

__x__ Uses are Compatible with Following Stipulations

Stipulations Necessary to Ensure Compatibility:

- Activities associated with these proposed uses are restricted to portions of the River 'S' Unit that are open to the general public during daylight hours.
- Adherence to seasonal use restrictions to reduce disturbance to wintering waterfowl and other wildlife.
- Camping, overnight use, and fires are prohibited.
- Littering is prohibited.
- Collection of plants and animals is prohibited unless a Special Use Permit is obtained from the Refuge (except fish captured while engaged in recreational fishing).
- The Refuge will require advance reservations for groups over 20 to avoid conflicts with other groups and management activities.
- The Refuge will provide signs, pamphlets, and verbal instructions from Refuge staff and volunteers will promote appropriate use of trails, blinds, and platforms to minimize wildlife and habitat disturbance. These materials will clearly state pertinent Refuge-specific regulations.
- The Refuge will periodically monitor and evaluate sites and programs to determine if objectives are being met and the resource is not being degraded.
- Where feasible, native trees and shrubs will be planted to create screening along trails and at observation points to reduce disturbance.

Justification:

Wildlife Photography, Observation, Interpretation and Environmental Education, when compatible, are wildlife-dependent recreational activities, and when compatible, considered priority public uses for the National Wildlife Refuge System. Although these activities can result in disturbance to wildlife, disturbance will be intermittent and short-term. There is a sufficient amount of undisturbed habitat available to refuge wildlife for escape and cover. In consideration of the limited areas open to public in the context of the amount of refuge which serves as sanctuary, effects associated with allowing public uses on the refuge would not be significant. It is anticipated that wildlife populations will find sufficient food resources and resting places such that their abundance and use of the Refuge will not be measurably lessened from allowing these activities to occur. The relatively limited number of individual animals and plants expected to be adversely affected will not cause wildlife populations to materially decline, the physiological condition and production of refuge species will not be impaired, their behavior and normal activity patterns will not be altered dramatically, and their overall welfare will not be negatively impacted. Thus, allowing wildlife photography, observation, interpretation and environmental education to occur under the stipulations described above will not materially detract or interfere with the purposes for which the refuge was established or the refuge mission.

Mandatory 10- or 15-year Reevaluation Date: (provide month and year for "allowed" uses):

9/2025___Mandatory 15-year re-evaluation date (for wildlife-dependent public uses)

________Mandatory 10-year reevaluation date (for all uses other than wildlife-dependent public uses)

References:

Belanger, L., and J. Bedard. 1990. Energetic cost of man-induced disturbance to staging snow geese. Journal of Wildlife Management. 54:36.

Boyle, S.A., and F.B. Samson. 1985. Effects of nonconsumptive recreation on wildlife: A review. Wildlife Society Bulletin 13:110.

Burger, J. 1981. The effect of human activity on birds at a coastal bay. Biological Conservation. 21:231-241.

Burger, J. 1986. The effect of human activity on shorebirds in two coastal bays in northeastern United States. Environmental Conservation. 13:123-130.

Gutzwiller, K.J., R.T. Wiedenmann, K.L. Clements. 1997. Does human intrusion alter the seasonal timing of avian song during breeding periods? Auk. 114:55-65.

Havera, S.P., L.R. Boens, M.M. Georgi, and R. T. Shealy. 1992. Human disturbance of waterfowl on Keokuk Pool, Mississippi River. Wildlife Society Bulletin. 20:290-298.

Klein, M.L. 1993. Waterbird behavioral responses to human disturbances. Wildlife Society Bulletin. 21:31-39.

McNeil, Raymond; Pierre Drapeau; John D. Goss-Custard. 1992. The occurrence and adaptive significance of nocturnal habitats in waterfowl. Biological Review. 67: 381-419.

Miller, S.G., R.L. Knight, and C.K. Miller. 1998. Influence of recreational trails on breeding bird communities. Ecological Applications. 8(1) 162-169.

Morton, J.M., A.C. Fowler, and R.L. Kirkpatrick. 1989. Time and energy budgets of American black ducks in winter. Journal of Wildlife Management. 53:401-410.

Pease, M.L., R.K. Rose, and M.J. Butler. 2005. Effects of human disturbances on the behavior of wintering ducks. Wildlife Soc. Bulletin. 33:103-112

Ratti. J.T. and K.P. Reese. 1988. Preliminary test of the ecological trap hypothesis. J. of Wildlife Management, 52:484-491.

Signatures:

Signatures for B1. Compatibility Determination for Wildlife Observation, Photography, Interpretation, and Environmental Education on the River 'S' Unit, Ridgefield National Wildlife Refuge. Uses are compatible with stipulations.

Prepared by:	(Signature)	9/8/10 (Date)
Approved by Refuge Manager/ Project Leader:	(Signature)	9/9/10 (Date)

Concurrence:

Refuge Supervisor:	(Signature)	9-9-10 (Date)
Regional Chief, National Wildlife Refuge System:	(Signature)	9/14/10 (Date)

B2. Compatibility Determination for Wildlife Observation, Photography, Interpretation, and Environmental Education on the Carty Unit, Ridgefield National Wildlife Refuge

Uses: Wildlife Observation, Photography, Interpretation, and Environmental Education

Station Name: Ridgefield National Wildlife Refuge – Carty Unit

Date Established: 1965

Establishing and Acquisition Authority(ies):

Migratory Bird Conservation Act of 1929, as amended (16 U.S.C. 715-715s)

Migratory Bird Hunting and Conservation Stamp Act of 1934 (16 U.S.C. 718-718j) [Funding for primary acquisition]

Refuge Purpose(s):

"... for use as an inviolate sanctuary, or for any other management purpose, for migratory birds." 16 U.S.C. § 715d (Migratory Bird Conservation Act)

"... to provide wintering habitat for dusky Canada goose and other waterfowl. Will also provide breeding and migration use and substantial public shooting in area. Estimated peak population: 125,000 ducks and 3,000 geese." (Migratory Bird Conservation Commission Memorandum Number 1, May 18, 1965.)

National Wildlife Refuge System Mission:

The mission of the 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.

Description of Uses:

Non-consumptive wildlife dependent recreation (defined here as wildlife observation, photography, and interpretation) when compatible with refuge purposes are defined in the National Wildlife Refuge System Administration Act, as amended, as priority uses to be encouraged on national wildlife refuges. These activities can enhance the users' appreciation of the Refuge, the National Wildlife Refuge System, wildlife and wildlife habitat, and the human environment. These activities would be allowed year-round in the Refuge's Carty Unit where these activities would be largely self-guided. Non-consumptive wildlife dependent recreation would be encouraged along the Oaks to Wetland Trail but not restricted to the trail system. The Carty Unit would continue to provide unstructured year-round free-roam walking opportunities. Improvements to the surface of the Oaks to Wetland Trail would connect the parking area, Plankhouse, and the first loop (~2500 feet) of the Oaks to Wetland Trial. Connecting trails over Gee Creek and over the north tip of Carty Lake would link the City of Ridgefield, Port of Ridgefield, and Refuge for non-consumptive wildlife dependent recreation. Pending a separate Environmental Assessment, an office/Nature Center would be constructed near the current office's location and the Carty Unit footbridge would be replaced. Cumulatively, these improvements could increase visitation to the Carty Unit and heighten the need for resource impact monitoring related to public use.

Pre-arranged interpretative and educational visits (i.e. school groups, scouts) and periodic outreach activities (*i.e.* tours conducted during BirdFest) involving the Plankhouse would continue to be guided by Staff and/or trained volunteers. Interpretation would also be available to visitors through interpretive panels, websites, stations along the Oak to Wetlands Trail, the Refuge Office/Visitor Contact Station, and brochures.

Collection of plant material and the removal of wildlife or their parts (except fish captured while engaged in recreational fishing; see Compatibility Determination – Fishing) would prohibited unless the Refuge issues a Special Use Permit to the user(s). Special conditions would be put in place to reduce impacts of these activities.

Availability of Resources:

The Carty Unit of the Refuge is open for environmental education, interpretation, wildlife photography, fishing, and wildlife observation. Access trails, parking lots, signage and other facilities are often used for multiple purposes. The Service has two employees dedicated to the Visitor Service program. Other Refuge staff assist in trail and parking area maintenance, facility and road maintenance, sign posting, construction projects, talking to and answering questions posed by the public, and developing and implementing Refuge management programs. The Refuge is Recreation Fee site, as authorized by the Federal Lands Recreation Enhancement Act, with fees supporting visitor services, habitat restoration, law enforcement, and maintenance related to the visitor's experience. These funds help offset the expenses related to maintaining and operating a visitor services program. The Refuge has sufficient funds for managing current levels of these uses.

Costs to Administer and Manage Carty Unit Public Use Programs at the Refuge under the Preferred Alternative (Alternative 2)		
Activity or Project	**One Time Expenses ($)**	**Recurring Expenses ($/year)**
Provide 2 miles of year-round pedestrian access on Refuge trails.		15,000
Law Enforcement - Reduce illegal activities		52,500
Integrate the Plankhouse into the Refuge's interpretation and environmental education programs.		47,000
Continue recruiting, training, retaining, and utilizing volunteers for support of Refuge programs and activities		31,000
Provide quality environmental education opportunities (staff)		58,000
Effectively utilize volunteers, Friends Groups, and partnerships to create a high quality and self-sustaining Refuge environmental education program.		39,000
Totals		242,500

Anticipated Impacts of Uses:

Impacts resulting from the proposed uses include both direct and indirect impacts to wildlife resources and the associated habitat. Direct impacts have an immediate effect on wildlife and generally result from the public's interaction with wildlife. Indirect impacts would include actions taken by the public that would impact habitat or reduce access to habitat.

Direct Impacts

We expect these impacts to include the presence of humans disturbing wildlife, which typically results in a temporary displacement of individuals. Some species such as sandhill cranes will avoid the areas people frequent, such as the developed trails and the buildings, while others such as raccoons seem unaffected by or even drawn to the presence of humans.

Negative impacts have been shown to arise when migratory birds and humans are present in the same areas (Boyle and Samson 1985). Response of wildlife to human activities includes: departure from site, use of suboptimal habitat, altered behavior (Burger 1981, Morton et al. 1989, Klein 1993), and increase in energy expenditure (Morton et al. 1989, Belanger and Bedard 1990).

McNeil et al. (1992) found that many waterfowl species avoid disturbance by feeding at night instead of during the day. The location of recreational activities impacts species in different ways. Miller et al. (1998) found that nesting success was lower near recreational trails, where human activity was common, than at greater distances from the trails. A number of species have shown greater reactions when pedestrian use occurred off trail (Miller, 1998). In addition, Burger (1981) found that wading birds were extremely sensitive to disturbance in the northeastern US. Klein (1989) found migratory dabbling ducks to be the most sensitive to disturbance and migrant ducks to be more sensitive when they first arrived, in the late fall, than later in winter. She also found gulls and sandpipers to be apparently insensitive to human disturbance, with Burger (1981) finding the same to be true for various gull species.

Gutzwiller et al. (1997) found that singing behavior of some songbirds was altered by low levels of human intrusion. Pedestrian travel can impact normal behavioral activities, including feeding, reproductive, and social behavior. Studies have shown that ducks and shorebirds are sensitive to pedestrian activity (Burger 1981, 1986).

Some studies have indicated that individuals may become acclimated to the presence of humans. Resident waterbirds that are regularly exposed to human disturbance tend to be less sensitive than migrants, especially when migrants first arrive at a site (Klein 1993). In areas where human activity is common, birds tolerated closer approaches than in areas receiving less activity.

Indirect Impacts

People can be vectors for invasive plants by moving seeds or other propagules from one area to another. Once established, invasive plants can out-compete native plants, thereby altering habitats and indirectly impacting wildlife. The threat of invasive plant establishment will always be an issue requiring annual monitoring and treatment when necessary. Our staff will continue work at eradicating invasive plants and educating the visiting public about the impacts these species have on the Refuge.

Providing and maintaining access points indirectly impacts wildlife by creating barriers to movement, through vegetation removal and management, and abrupt edge creation that may lead to increased predation (Ratti and Reese 1988). Trail edges may concentrate prey species and may be used by predators as travel corridors.

Other indirect impacts may include the deposition of litter and erosion caused by the damage to vegetation from trampling. These have not been a significant problem at the current level of use.

Threatened and Endangered Species

Within the Blackwater Island Research Natural Area (located in the Carty Unit), there are three sites where the federally-listed threatened plant water howellia (*Howellia aquatilis*) is known to occur. The Refuge will perform an intra-service consultation pursuant to the Section 7 of the Endangered Species Act (87 Stat. 884, as amended; 16 U.S.C. 1531 et seq.) regarding the proposed uses and water howellia.

Public Review and Comment:

This determination was issued for public review and comment as part of the Ridgefield NWR Draft Comprehensive Conservation Plan and Environmental Assessment (DCCP/EA). The plan and associated compatibility determinations were also provided as CDs to a mailing list of 432 recipients, and were made available on the FWS Region 1 Planning website. Printed copies of the DCCP/EA were available upon request. The 30-day review occurred from June 16 through July 16, 2010. We did not receive specific comments regarding the compatibility determinations, and no changes have been made at this time.

Determination (check one below):

_____ Uses are Not Compatible

__x__ Uses are Compatible with Following Stipulations

Stipulations Necessary to Ensure Compatibility:

- Activities associated with these proposed uses are restricted to portions of the Carty Unit that are open to the general public during daylight hours.
- Camping, overnight use, and fires are prohibited.
- Littering is prohibited.
- Collection of plants and animals is prohibited unless a Special Use Permit is obtained from the Refuge (except fish captured while engaged in recreational fishing).
- The Refuge will require advance reservations for groups in need of staff and volunteer participation to avoid conflicts with other groups and management activities.
- The Refuge will provide signs, pamphlets, and verbal instructions from Refuge staff and volunteers will promote appropriate use of trails, blinds, and platforms to minimize wildlife and habitat disturbance. These materials will clearly state pertinent Refuge-specific regulations.

- The Refuge will periodically monitor and evaluate sites and programs to determine if objectives are being met and the resource is not being degraded.
- Where it is determined necessary, native trees and shrubs will be planted to create visual screening along trails and at observation points to reduce disturbance to wildlife.
- Most of the refuge is closed to public entry affording wildlife ample amounts of sanctuary habitat.

Justification:

Wildlife Photography, Observation, Interpretation and Environmental Education, when compatible, are wildlife-dependent recreational activities, and when compatible, considered priority public uses for the National Wildlife Refuge System. Although these activities can result in disturbance to wildlife, disturbance will be intermittent and short-term. There is a sufficient amount of undisturbed habitat available to refuge wildlife for escape and cover. In consideration of the limited areas open to public in the context of the amount of refuge which serves as sanctuary, effects associated with allowing public uses on the refuge would not be significant. It is anticipated that wildlife populations will find sufficient food resources and resting places such that their abundance and use of the Refuge will not be measurably lessened from allowing these activities to occur. The relatively limited number of individual animals and plants expected to be adversely affected will not cause wildlife populations to materially decline, the physiological condition and production of refuge species will not be impaired, their behavior and normal activity patterns will not be altered dramatically, and their overall welfare will not be negatively impacted. Thus, allowing wildlife photography, observation, interpretation and environmental education to occur under the stipulations described above will not materially detract or interfere with the purposes for which the refuge was established or the refuge mission.

Mandatory 10- or 15-year Reevaluation Date: (provide month and year for "allowed" uses):

9/2025 Mandatory 15-year re-evaluation date (for wildlife-dependent public uses)
_______ Mandatory 10-year reevaluation date (for all uses other than wildlife-dependent public uses)

References:

Belanger, L., and J. Bedard. 1990. Energetic cost of man-induced disturbance to staging snow geese. Journal of Wildlife Management. 54:36.

Boyle, S.A., F.B. Samson. 1985. Effects of nonconsumptive recreation on wildlife: A review. Wildlife Society Bulletin 13:110.

Burger, J. 1981. The effect of human activity on birds at a coastal bay. Biological Conservation. 21:231-241.

Burger, J. 1986. The effect of human activity on shorebirds in two coastal bays in northeastern United States. Environmental Conservation. 13:123-130.

Gutzwiller, K.J., R.T. Wiedenmann, K.L. Clements. 1997. Does human intrusion alter the seasonal timing of avian song during breeding periods? Auk. 114:55-65.

Havera, S.P., L.R. Boens, M.M. Georgi, and R. T. Shealy. 1992. Human disturbance of waterfowl on Keokuk Pool, Mississippi River. Wildlife Society Bulletin. 20:290-298.

Klein, M.L. 1993. Waterbird behavioral responses to human disturbances. Wildlife Society Bulletin. 21:31-39.

McNeil, Raymond; Pierre Drapeau; John D. Goss-Custard. 1992. The occurrence and adaptive significance of nocturnal habitats in waterfowl. Biological Review. 67: 381-419.

Miller, S.G., R.L. Knight, and C.K. Miller. 1998. Influence of recreational trails on breeding bird communities. Ecological Applications. 8(1) 162-169.

Morton, J.M., A.C. Fowler, and R.L. Kirkpatrick. 1989. Time and energy budgets of American black ducks in winter. Journal of Wildlife Management. 53:401-410.

Ratti. J.T. and K.P. Reese. 1988. preliminary test of the ecological trap hypothesis. J. of Wildlife Management, 52:484-491.

Signatures:

Signatures for B2. Compatibility Determination for Wildlife Observation, Photography, Interpretation, and Environmental Education on the Carty Unit, Ridgefield National Wildlife Refuge. Uses are compatible with stipulations.

Prepared by: ______________________ 9/8/10
(Signature) (Date)

Approved by Refuge Manager/ Project Leader: ______________________ 9/10/10
(Signature) (Date)

Concurrence:

Refuge Supervisor: ______________________ 9-9-10
(Signature) (Date)

Regional Chief, National Wildlife Refuge System: ______________________ 9/9/10
(Signature) (Date)

B3. Compatibility Determination for Waterfowl Hunting on Ridgefield National Wildlife Refuge

Use: Hunting (Ducks, Geese, Coots)

Station Name: Ridgefield National Wildlife Refuge

Date Established: 1965

Establishing and Acquisition Authorities:

Migratory Bird Conservation Act of 1929, as amended (16 U.S.C. 715-715s)

Migratory Bird Hunting and Conservation Stamp Act of 1934 (16 U.S.C. 718-718j) [Funding for primary acquisition]

Refuge Purposes:

"... for use as an inviolate sanctuary, or for any other management purpose, for migratory birds." 16 U.S.C. § 715d (Migratory Bird Conservation Act)

"... to provide wintering habitat for dusky Canada goose and other waterfowl. Will also provide breeding and migration use and substantial public shooting in area. Estimated peak population: 125,000 ducks and 3,000 geese." (Migratory Bird Conservation Commission Memorandum Number 1, May 18, 1965.)

National Wildlife Refuge System Mission:

The mission of the 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.

Description of Use:

The U.S. Fish and Wildlife Service (Service) proposes to continue to allow hunting of ducks, geese, and coots in accordance with State and Federal regulations and Refuge-specific special conditions. Waterfowl and migratory bird hunting in the United States is guided by an established regulatory process that involves numerous sources of waterfowl population and harvest data. Harvest data are reported by hunters to the State and season and bag limits are adjusted accordingly to ensure that overall populations of game species remain healthy into the future.

Interagency management plans for refuge focus species like dusky Canada goose and cackling goose have been developed and are also used to determine seasons and bag limits (Pacific Flyway Council 1999, Pacific Flyway Council 2008). Furthermore, goose hunters in Washington Area 2 (includes Areas 2A and 2B) must pass an identification course that will help hunters in the field distinguish between the various goose subspecies. The State, in cooperation with the Service, establishes an annual quota and requires individuals hunting in Washington Area 2 to check all harvested geese. Hunters are currently allowed to take one dusky Canada goose each year. If a hunter takes a dusky Canada goose, he/she is not permitted to hunt geese in Washington Area 2 for the remainder of that year and must retake the identification course and pass the test prior to obtaining a permit for the following year. The State also assigns a dusky harvest quota specific to the Refuge. During the 16 seasons between the 1994/95 and 2009/10 seasons, the quota has been met 9 times. When the quota is reached, goose hunting is no longer permitted at the Refuge, although hunters can still harvest ducks and coots.

Waterfowl hunting is further regulated on Ridgefield National Wildlife Refuge with hunting allowed in specific areas of the Refuge and only on a limited number of days per week. Blinds are assigned by lottery. The refuge currently maintains 21 blinds located on approximately 760 acres of the River 'S' Unit. Because of limited space and the presence of other refuge users (primarily on the Auto Tour Route), hunters are required to hunt from established blinds. We anticipate relocating some of the blinds to ensure public safety once the new access road and bridge are constructed, but are proposing to maintain a similar number of blinds. Although dogs are prohibited on the Refuge they are a vital part of the waterfowl hunting tradition and can reduce the loss of waterfowl to the hunter's bag and hence can reduce the overall impact to the resource. Because of their role, both traditional and effect on retrieval of waterfowl shot, dogs used in the act of hunting are allowed on the Refuge.

In addition to restricting hunting to established blinds and limiting the number of hunt days per week, the Refuge has sited hunt areas away from sensitive resources such as Federally-listed species habitat, bald eagle nest sites, heron rookeries, and sandhill crane roosts; limited the number of shells each hunter may bring afield; and requiring hunters to use established parking areas rather than allowing them to drive through fields.

Why Is This Use Being Proposed

Hunting is identified as a Refuge purpose in the establishing documents for Ridgefield NWR (see above) and thus receives special consideration. Also, under the National Wildlife Refuge System Administration Act, as amended, hunting is a wildlife dependent recreational activity which is to be encouraged on national wildlife refuges if compatible with refuge purposes. The following public uses (hunting, fishing, wildlife observation, photography, environmental education, and interpretation), when determined to be compatible, are encouraged and receive consideration in planning and management on national wildlife refuges. The Service recognizes that hunting has given many people a deeper appreciation of wildlife and a better understanding of the importance of conserving their habitat, which has ultimately contributed to the Refuge System mission.

Availability of Resources

Administering the Refuge hunt program requires substantial staff time, equipment, and funding. In order to provide a quality hunting experience, access trails, parking lots, signs and other facilities must be maintained at least annually. The Refuge must exercise its water rights and adjust habitat management activities to provide suitable hunt areas. The Refuge does not have a law enforcement officer on staff and must rely on Zone Officers or partnering law enforcement agencies to ensure compliance with State and Federal regulations and refuge-specific special conditions. A portion of the funding used to support this program is provided by monies collected as part of the hunt lottery and by blind fees charged to participants. Funding associated with facilities maintenance (roads, parking areas, signs, etc.) is included in other Refuge programs requiring the same support.

Costs to Administer and Manage Waterfowl Hunt Program at the Refuge under the Preferred Alternative (Alternative 2)		
Activity or Project	**One Time Expenses ($)**	**Recurring Expenses ($/year)**
Operation of Check Station (Check Station Operator, staff involvement with management of the program)		40,000
Maintain Facilities (roads, blinds, water delivery)		56,000
Totals		106,000

Anticipated Impacts of the Use

Harvest of Waterfowl

Hunting, by its nature, results in the intentional take of individual animals, as well as wounding and disturbance (DeLong 2002). Indirect impacts such as displacement of animals by hunters or disturbance from gunfire also occurs in and adjacent to, areas opened for hunting. It can also alter behavior (e.g., foraging time), population structure (young birds are generally more susceptible), and distribution patterns of wildlife (Owens 1977, Raveling 1979, White-Robinson 1982, Thomas 1983, Bartlett 1987, Madsen 1985, and Cole and Knight 1990). Prolonged and extensive disturbances may cause large numbers of waterfowl to leave disturbed areas and migrate elsewhere (Madsen 1995, Paulus 1984).

The Refuge seeks to reduce the magnitude of these impacts by providing sanctuary areas on Bachelor Island, Roth, and Ridgeport Dairy Units where hunting and visitation does not occur and birds can feed and rest relatively undisturbed. Portions of the Columbia River adjacent to the refuge and floodplain habitats on the west side of the Columbia River provide open water sanctuary areas that are suitable habitat for some waterfowl species and are not subject to intense hunting pressure. The Refuge also attempts to mitigate these impacts by restricting hunting to established blinds and only allowing hunting a limited number of days per week.

In 2008/2009 season waterfowl hunters at the Refuge, harvested an estimated 2,308 ducks and 365 geese. These harvest numbers represent 0.6 percent of the Washington duck harvest of 410,257 birds in 2008/2009. Goose harvest at Ridgefield for the 2008/2009 season was less than 0.7 percent of the Washington harvest of 55,692

The most heavily harvested duck species on the refuge are northern shoveler, mallard, northern pintail, American widgeon, and green-winged teal. In 2009, continental populations of northern shoveler, green-wing teal and mallard were all above their long term averages (USFWS 2009). American widgeon were slightly below their long-term average. Northern pintails were 20% below the long-term average. Given the low harvest rates of these species relative to the State harvest, the refuge hunt program does not significantly contribute to the population changes of these species and the refuge proposes to continue to conform to State bag limits for ducks.

Seven subspecies of geese are harvested on the refuge. Between 1994 and 2009, cackling geese were the most commonly harvested subspecies with 2,212 birds taken. Taverner's geese are second with 1,512 taken during that period. Relatively small numbers of western (356), dusky (132), Vancouver (22), lesser (184), and Aleutian geese (3) are taken. Hunters are permitted to harvest coots, but while this species is common on the refuge, coots are not popular with hunters and fewer than 25 are harvested most years.

Impacts to Dusky Canada Goose and Cackling Goose

Two focus species on the refuge, dusky Canada geese and cackling geese, are below their population targets as identified by the Pacific Flyway Council (Pacific Flyway Council 1999, Pacific Flyway Council 2008). Each of these species has flyway-wide management plans to direct efforts to help these species reach population targets. In response to substantial agricultural damage resulting from wintering geese depredating cropland, the Pacific Flyway Council has developed a depredation management plan (Pacific Flyway Council 1998) which provides additional recommendations. The refuge is committed to following the management recommendations and compatible actions specified in these plans.

Historically, dusky Canada geese were one of the most abundant subspecies in the Lower Columbia River/Willamette Valley. The 1964 "Good Friday" earthquake in Alaska uplifted this subspecies' breeding grounds on the Copper River Delta allowing predators such as coyote, eagle, and bear better access to the nesting sites, greatly decreasing gosling recruitment rates. Accordingly, the numbers of these birds have been below the breeding ground population target of 10,000 to 20,000 birds based on a three-year average since 2007 (Pacific Flyway Council 2008). The 2008 Pacific Flyway Management Plan for the Dusky Canada Goose (Plan) specifies three action levels based on breeding ground population thresholds. In 2009/2010, the population was estimated at 6,700 birds and the three-year average dropped below 9,999 and triggered more restrictive harvest quota pursuant to Action Level 2 (175 birds in primary dusky use areas in WA, OR, and AK). The refuge quota was reduced from 10 to 5 birds. Once the quota is reached, goose hunting is no longer permitted on the refuge, though hunters can still harvest ducks. Although the number of dusky Canada geese harvested on the refuge does not have a significant effect on the population as a whole, hunting does cause some disturbance in addition to direct mortality. To further reduce impacts to dusky Canada geese, the refuge has also prohibited goose harvest at three blinds where approximately 45% of the dusky harvest has traditionally occurred. As stated in the Plan, Action Level 2 restrictions remain in place until the three-year average exceeds 12,500. Should the population continue to decline, Action Level 3 would take effect when the breeding ground population is below 5,000. Pursuant to Action Level 3 of the Plan, the refuge would minimize the harvest of dusky Canada geese.

Cackling geese nest on the Yukon-Kuskokwim Delta in Alaska and historically wintered in the Central Valley of California. In the 1990s, most cackling geese have wintered in the Willamette and Lower Columbia River valleys in Washington and Oregon and they are currently one of the most abundant subspecies of geese on the refuge. The population decreased from about 400,000 in the late 1960s to less than 20,000 in the mid-1980s. The population has increased and the 2009 estimate was 160,600 (USFWS 2009). The current population is contributing to agricultural damage in the Lower Columbia River and Willamette Valley (Pacific Flyway Council 1998). The Pacific Flyway Management Plan for the Cackling Canada Goose (Pacific Flyway Council 1999) has established a three-year average population target of 250,000 birds.

To help reach the population target while still providing hunting opportunities and reducing agricultural crop depredation as described in the Pacific Flyway Management Plan for Northwest Oregon - Southwest Washington Canada Goose Agricultural Depredation Control (Pacific Flyway Council 1998), the State, in cooperation with the Service has instituted a 2 bird bag limit and 4 bird possession limit for cackling geese. As stated above, the goose hunting season would be closed when the quota for dusky geese is reached.

Impacts to Non-Target Species

The refuge hunt program indirectly impacts species other than those targeted by hunters. The presence of hunters and dogs, sounds of gunfire, and the sight of hunters traveling to and from hunt areas can disturb other wildlife species such as pied-billed grebe, great blue heron, sandhill crane, bald eagle, great egrets, northern harrier, which forage in refuge wetlands and waterbodies. This disturbance, especially when repeated over a period of time, may result in some wildlife species altering food habits or moving to other areas. Hunting would occur outside of the breeding season for these species and hunt areas are located away from known eagle nests, crane roosts, and heron rookeries to limit disturbance to these sensitive areas. Accidental shootings of non-game birds are believed to be negligible. No significant effects are expected for refuge fish populations.

Other Impacts

The need to have sufficient water available near hunt blinds limits the management options of wetlands in the hunt area. In general, refuge wetlands in the diked portions of the refuge, are managed by alternating drawdown and flooded conditions. Drawdowns expose soil, release nutrients, and allow propagules of native wetland plants to germinate. Flooding stresses wetland plants resulting in additional seed production as well as suppressing reed canarygrass growth. Wetlands in hunt areas must have sufficient water depths by the start of the hunting season to attract waterfowl provide a reasonable opportunity for successful hunts. This precludes the opportunity for the refuge to use extended drawdowns as a management tool on 48% or wetland acres on the River 'S' Unit. Over time, in the absence of any management changes this may result in changes to the vegetation community such as a reduction in species diversity and plant density, which would result in a reduction of habitat quality for species such as Pacific tree frog, marsh wren, and northern harrier. The refuge further reduces the scope of these impacts by using pumps to reduce the time required to "flood-up" wetlands in the hunt area and provide some opportunities for seasonal drawdowns. To mitigate these impacts, the refuge will work to adjust blind locations and the timing of water level management to provide more flexibility in wetland management and enhance habitat conditions. Although water management of the hunt areas has some effects on species in the River 'S' Unit, it should be noted that majority of the refuge provides suitable, undisturbed habitats for the species affected by hunt area water management. Thus, overall effect to these species is not significant.

In addition to impacts on wildlife, the hunting program can impact other Refuge visitors using the Auto Tour Route in the River 'S' Unit. Several hunt blinds are located within sight of the Auto Tour Route and visitors may see ducks being harvested. The sound of shots may flush some birds from nearby portions of the Auto Tour Route reducing wildlife observation opportunities for people on the Tour Route. However, closing the Auto Tour Route during the hunt periods would eliminate a number of visitor opportunities and based on comments received during the scoping process (see Appendix J), was a less desirable option. In the context of the limited number of hunt days when the above noted impacts occur, the adverse effects to wildlife observation opportunities for people on the Tour Route is considered to be minor.

Public Review and Comment:

This determination was issued for public review and comment as part of the Ridgefield NWR Draft Comprehensive Conservation Plan and Environmental Assessment (DCCP/EA). The plan and associated compatibility determinations were also provided as CDs to a mailing list of 432 recipients, and were made available on the FWS Region 1 Planning website. Printed copies of the DCCP/EA were available upon request. The 30-day review occurred from June 16 through July 16, 2010. We did not receive specific comments regarding the compatibility determinations; however, several commenters suggested that the waterfowl hunt area and number of blinds be expanded, specifically that the southern end of Bachelor Island be added to the existing hunt area. No changes have been made at this time, since the refuge has decided that maintaining the existing sanctuary area on Bachelor Island is necessary to meet refuge goals and objectives for purposes species, and to support goals and objectives in the Pacific Flyway Management Plan for the Dusky Canada Goose (2008), the Pacific Flyway Management Plan for the Cackling Canada Goose (Pacific Flyway Council 1999), and the Northwest Oregon/Southwest Washington Canada Goose Agricultural Depredation Control Plan (1998).

Determination

______The use is not compatible.
__X___The use is compatible with the following stipulations.

Stipulations Necessary to Ensure Compatibility

The Refuge hunting programs is designed to provide a safe, quality experience with reasonable harvest opportunities, while avoiding significant impacts to other users and non-target wildlife resources. The Refuge has developed the following stipulations to reduce impacts and promote safety:

- The refuge will continue to support the management actions specified in the Pacific Flyway Management Plan for the Dusky Canada Goose (Pacific Flyway Council 2008). To protect dusky Canada geese, the refuge will prohibit on-refuge goose hunting once the annual quota has been reached.

- To protect cackling geese, the refuge will adhere to State bag limits (currently 2 birds with a 4 bird possession limit) and follow the recommendations of the Pacific Flyway Management Plan for the Cackling Canada Goose (Pacific Flyway Council 1999).

- Hunting will only be permitted from established blinds on the River 'S' Unit. Bachelor Island, Roth, and Ridgeport Dairy Units will continue to provide wildlife with sanctuary areas that are relatively free of disturbance.

- Only ducks, geese, and coots may be taken in accordance with Washington State bag and possession limits. Hunters will check all harvested waterfowl prior to leaving the Refuge.

- Hunters will use existing open roads and parking areas to access hunting sites. Camping, overnight use, and fires are prohibited.

Justification

Providing a quality hunting program contributes to achieving one of the refuge's purposes (as stated in the establishing documents) and one of the Refuge's management goals. When determined compatible, hunting is one of the six priority public uses of the National Wildlife Refuge System. Refuge hunting programs are designed to provide high-quality, safe experiences, with a reasonable opportunity to harvest game species.

State and Federal regulations and refuge-specific special conditions will help reduce or eliminate any unwanted impacts of the use and help ensure that harvest levels of waterfowl do not harm long-term populations. The refuge has developed specific special conditions such as limiting the number of hunt days per week and siting hunt locations away from sensitive areas such as crane roosts, heron rookeries, and eagle nests, to protect sensitive wildlife resources, reduce impacts to other Refuge visitors, and allow the refuge to continue to provide high quality wintering habitat for dusky Canada geese and other waterfowl species. Additionally, the refuge allows hunting on approximately 15% of the total refuge acreage leaving an adequate amount of quality, non-hunted habitat that would serve as a sanctuary for both hunted and non-hunted wildlife species.

The harvest of waterfowl on the refuge does not significantly increase the cumulative impacts of hunting on the population of various waterfowl species. With the exception of northern pintail, the most-commonly harvested duck species are at or above their long-term averages. As populations rise and fall, the State, in cooperation with the Service adjust bag limits to maintain duck populations.

The relatively limited number of individuals of priority species (i.e. dusky Canada goose and cackling goose) that are removed from wildlife populations due to hunting will not cause wildlife populations to materially decline, the physiological condition and production of hunted species will not be impaired, their behavior and normal activity patterns will not be altered dramatically, and their overall welfare will not be negatively impacted. The refuge is committed to following the recommendations contained in the management plans for dusky and cackling geese to help reach target population levels. In response to low dusky numbers, which fell below 9,999 and thus triggered Action Level 2, the refuge hunt program operated under a reduced dusky quota (from 10 to 5 birds) and closed three blinds where traditionally, nearly half of the duskys were harvested. If dusky numbers continue to decline to the point where Action Level 3 is triggered, the refuge will minimize the harvest of duskys. The refuge limits the harvest of cackling geese, while still reducing depredation of off-refuge fields (as specified in the 1998 Pacific Flyway Management Plan for Northwest Oregon - Southwest Washington Canada goose Agricultural Depredation Control) by adhering to the bag limits for Washington State

Thus, allowing waterfowl hunting to occur with the stipulations described above will not materially detract or interfere with the purposes for which the refuge was established or the refuge mission.

Mandatory 10- or 15-year Reevaluation Date: (provide month and year for "allowed" uses):

9/2025___Mandatory 15-year re-evaluation date (for wildlife-dependent public uses)

________Mandatory 10-year reevaluation date (for all uses other than wildlife-dependent public uses)

NEPA Compliance for Refuge Use Decision

______Categorical Exclusion without Environmental Action Statement.
______Categorical Exclusion and Environmental Action Statement.
___X__Environmental Assessment and Finding of No Significant Impact.
______Environmental Impact Statement and Record of Decision.

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Signatures:

Signatures for B3. Compatibility Determination for Waterfowl Hunting on Ridgefield National Wildlife Refuge. Use is compatible with stipulations.

Prepared by: (Signature) 9/8/10 (Date)

Approved by Refuge Manager/ Project Leader: (Signature) 9/9/10 (Date)

Concurrence:

Refuge Supervisor: Lori J. West (Signature) 9-9-10 (Date)

Regional Chief, National Wildlife Refuge System: Carolyn A. Bohan (Signature) 9/9/10 (Date)

B4. Compatibility Determination for Recreational Fishing on Ridgefield National Wildlife Refuge

Use: Recreational Fishing

Station Name: Ridgefield National Wildlife Refuge

Date Established: 1965

Establishing and Acquisition Authority(ies):

Migratory Bird Conservation Act of 1929, as amended (16 U.S.C. 715-715s)

Migratory Bird Hunting and Conservation Stamp Act of 1934 (16 U.S.C. 718-718j) [Funding for primary acquisition]

Refuge Purpose(s):

"... for use as an inviolate sanctuary, or for any other management purpose, for migratory birds." 16 U.S.C. § 715d (Migratory Bird Conservation Act)

"... to provide wintering habitat for dusky Canada goose and other waterfowl. Will also provide breeding and migration use and substantial public shooting in area. Estimated peak population: 125,000 ducks and 3,000 geese." (Migratory Bird Conservation Commission Memorandum Number 1, May 18, 1965.)

National Wildlife Refuge System Mission: "To administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans." (National Wildlife Refuge System Administration Act of 1966, as amended (16 U.S.C. 668dd et seq.).

Description of Use: The Refuge provides access for recreational fishing during daylight hours on the Carty Unit. Fishing opportunities are available in permanent waterbodies of the Carty Unit in accordance with seasons and catch limits established by State regulations. Many waterbodies within the unit are seasonally to semi-permanently flooded and provide limited fish habitat. Permanent waterbodies that provide fishing opportunities include Gee Creek, Carty Lake, and Lake River, which is a tributary to the Columbia River and primarily accessed on the refuge through Wapato Portage.

The Refuge also proposes to provide access to state-waters in Lake River in the River 'S' Unit. The Refuge proposes to construct a fishing platform when the existing Lake River bridge is decommissioned. Anglers must park at the Visitor Contact Station Parking Area and walk to the fishing platform. Anglers must comply with all refuge-specific regulations and Washington State regulations.

Availability of Resources:

The Carty Unit and portions of the River 'S' Unit of the Refuge are open for environmental education, interpretation, wildlife photography, and wildlife observation as well as fishing. Access trails, parking lots, signage and other facilities are often used for multiple purposes. Most of the costs associated with administering a recreational fishing program are part of other use programs. Relative to other uses, fishing is not as popular a visitor activity and does not cost a great deal of time and expense at current levels (approximately 260 angler-days/year). The Carty and River 'S' Units are fee areas, which helps offset program expenses.

Costs to Administer and Manage Fishing Program at the Refuge under the Preferred Alternative (Alternative 2)		
Activity or Project	**One Time Expenses ($)**	**Recurring Expenses ($/year)**
Law Enforcement		5,000
Signage and pamphlet design to accommodate fishing.		1,000
Totals		6,000

Anticipated Impacts of Use:

Recreational fishing can impact the aquatic community by direct and indirect mortality (both of target and non-target species), changes in species composition and other trophic effects, and changes within species (stunting, changes in behavior) when fishing occurs at high levels (Blaber *et al.* 2000, Allen *et al.* 2005, Lewin *et al.* 2006). Many of the targeted species at the Refuge are introduced warmwater species such as carp, largemouth bass, bluegill, and black crappie that compete with native coldwater fish species. Removal of individuals of these non-native species may benefit native species by reducing competition and predation (Cornelius 2006). Given the low numbers of anglers using the Refuge, and the opportunity for most species to move freely into and out of the Refuge into the Columbia River, it is not likely that there are significant impacts (positive or negative) to the fish community.

Fishing can cause disturbance to birds and other wildlife that use refuge waterbodies and adjacent shoreline habitat in a similar manner to the disturbance caused by visitors participating in wildlife-dependent recreational activities. Species likely to experience some level of disturbance include foraging wading birds (great blue heron, American bittern, and great egret) foraging and nesting waterfowl (mallard, wood duck, cinnamon teal, gadwall, Canada goose, ring-necked duck), foraging and nesting passerines (red-winged blackbird, marsh wren), foraging raptors (osprey and bald eagle), and large mammals (black-tail deer). Very little angling activity occurs during the winter months when waterfowl use on the Unit is highest.

Most research studies have focused on short-term responses to human disturbance such as flushing, nest abandonment, site avoidance, etc. Little information is available on long-term or large scale responses such as relocation of major staging areas, changes in productivity and demographics, or changes in prey/forage selection. Fishing has been shown to affect the reproduction, distribution, behavior, and abundance of bird species (Bell and Austin 1985; Cooke 1987, Korschgen and Dahlgren 1992). Anglers often fish in shallow, sheltered bays and creeks that birds prefer, negatively impacting distribution and abundance of waterfowl, grebes, and coots (Cooke 1987).

Shoreline activities, such as human noise, would cause some birds to flush and go elsewhere. In addition, vegetation trampling, and deposition of litter or lost gear are likely to occur. Disturbance and destruction of riparian vegetation, and impacts to bank stability and water quality, have not been documented at current participation levels, but may occur should levels increase in the future.

As stated above, the number of anglers using the refuge is relatively low because there are limited places available for fishing opportunities. Since the level of fishing activity is low, there is very limited disturbance to birds and limited impacts to vegetation through trampling. Thus, impacts to fish and wildlife resources associated with this activity are not significant.

Public Review and Comment:

This determination was issued for public review and comment as part of the Ridgefield NWR Draft Comprehensive Conservation Plan and Environmental Assessment (DCCP/EA). The plan and associated compatibility determinations were also provided as CDs to a mailing list of 432 recipients, and were made available on the FWS Region 1 Planning website. Printed copies of the DCCP/EA were available upon request. The 30-day review occurred from June 16 through July 16, 2010. We did not receive specific comments regarding the compatibility determinations, and no changes have been made at this time.

Determination (check one below):

_____ Use is Not Compatible

__x__ Use is Compatible with Following Stipulations

Stipulations Necessary to Ensure Compatibility:

- Fishing access is permitted only during daylight hours within the Carty Unit and a portion of the River 'S' Unit adjacent to the north side of the Lake River Bridge and on the bridge once it is closed to vehicle traffic and modified into a fishing pier.
- Anglers must park in designated parking areas and walk to fishing areas.
- Camping, overnight use, and fires are prohibited.
- Littering is prohibited.
- All persons fishing shall be required to have a valid State license and follow applicable refuge and Washington State regulations.
- Law enforcement patrols will be conducted on a regular basis to assure compliance with State and Refuge regulations.

Justification:

Fishing, when compatible with refuge purposes, is listed as a priority public use in the National Wildlife Refuge Administration Act and is to be encouraged as wildlife dependent recreational activity on national wildlife refuges. Stipulations will help reduce or eliminate any unwanted impacts of the use. State regulations and the ability for fish to move out of or into the Refuge from the Columbia River, will help ensure that harvest levels of fish do not harm long-term populations.

Although fishing activities can result in disturbance to wildlife, disturbance will be intermittent and short-term. Most of the shoreline areas are densely vegetated and/or associated with a nearly vertical bank and not easily accessed. Of the two miles of Lake River 'S'horeline that borders the Carty Unit, only about 0.5 miles (25%) is accessible. Only about 40 feet of shoreline would be accessible from the platform at the River 'S' Unit. There is more than an adequate amount of undisturbed habitat available to the majority of waterfowl, waterbirds, and other wildlife for escape and cover.

It is anticipated that wildlife populations will find sufficient food resources and resting places such that their abundance and use of the Refuge will not be measurably lessened from fishing activities. The relatively limited number of individuals expected to be adversely affected will not cause wildlife populations to materially decline, the physiological condition and production of refuge species will not be impaired, their behavior and normal activity patterns will not be altered dramatically, and their overall welfare will not be negatively impacted. Thus, allowing fishing to occur with stipulations will not materially detract or interfere with the purposes for which the refuge was established or the refuge mission.

Mandatory 10- or 15-year Reevaluation Date: (provide month and year for "allowed" uses):

9/2025___Mandatory 15-year re-evaluation date (for wildlife-dependent public uses)
________Mandatory 10-year reevaluation date (for all uses other than wildlife-dependent public uses)

References:

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Signatures:

Signatures for B4. Compatibility Determination for Recreational Fishing on Ridgefield National Wildlife Refuge. Use is compatible with stipulations.

Prepared by:	(Signature)	9/8/10 (Date)
Approved by Refuge Manager/ Project Leader:	(Signature)	9/9/10 (Date)

Concurrence:

Refuge Supervisor:	Rob S. West (Signature)	9-9-10 (Date)
Regional Chief, National Wildlife Refuge System:	Carolyn A. Bohan (Signature)	9/9/10 (Date)

B5. Compatibility Determination for Environmental Education and Interpretation (Cathlapotle Plankhouse)

Appendix 2

Compatibility Determination

Use: Environmental Education and Interpretation (Cathlapotle Plankhouse)

Refuge Name: Ridgefield National Wildlife Refuge, Clark County, Washington

Establishing and Acquisition Authority(ies):

Migratory Bird Conservation Act, 16 U.S.C. Sec. 715d

Migratory Bird Conservation Commission (created under the Migratory Bird Conservation Act), May 18, 1965 meeting minutes (14 tracts defined boundary including the Carty Unit)

Refuge Purpose(s):

(A)... for use as an inviolate sanctuary, or for any other management purpose, for migratory birds. (Migratory Bird Conservation Act)

(B)...Provide wintering habitat for dusky Canada geese and other waterfowl. (Migratory Bird Conservation Commission, May 18, 1965 meeting minutes)

Refuge Operational Goal Statements:

1. Provide high quality wintering habitat for all Canada geese, especially the dusky subspecies, to ensure healthy, viable goose populations that minimize damage to private agricultural lands in the Lower Columbia River area.
2. Protect, restore and develop habitats for and otherwise support the recovery of federally listed endangered species and threatened species and help prevent the listing of candidate species and special of management concern.
3. Protect, restore and develop a diversity of habitats for all other migratory birds such as neotropical songbirds, wading birds, shorebirds and waterfowl, as well as indigenous fish and plant species of the Lower Columbia River ecosystem.
4. Provide high quality opportunities for wildlands and wildlife-dependent recreation and environmental education to enhance public appreciation, understanding and enjoyment of refuge fish, wildlife, habitats and cultural resources.

Mission of the National Wildlife Refuge System

The mission of the National Wildlife Refuge System is *"...to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife and plant resources and their habitats within the United States for the benefit of present and future generations of Americans"* (National Wildlife Refuge System Administration Act of 1966, as amended [16 U.S.C. 668dd-668ee]).

Description of Use:

Environmental Education and Interpretation are considered simultaneously in this compatibility determination as they relate to the proposed construction and operation of an authentic Chinookan-style cedar plankhouse on the Carty Unit of the Ridgefield National Wildlife Refuge (refuge). These two uses, along with four others (hunting, fishing, wildlife observation, and photography), receive priority consideration on national wildlife refuges pursuant to the National Wildlife Refuge System Improvement Act of 1997. Environmental education typically denotes a guided or instructed educational opportunity, with refuge personnel or a trained instructor leading a tour, workshop, school group, or related endeavor. Interpretation provides an opportunity for self-guided educational experience using signs, kiosks, brochures, and other written publications to deliver key messages to visitors through a building, wildlife observation trail, or auto tour route. The following is a brief description of both types of opportunities as they relate to the proposed Chinookan-style cedar plankhouse. A full description of the proposed plankhouse project is described in Section II of the Environmental Assessment for Building and Interpreting the Cathlapotle Plankhouse, which is incorporated by reference.

An environmental education and interpretation Compatibility Determination was originally established in 1994 for the refuge. The refuge staff proposes to expand the current environmental education and interpretation program with the addition of a proposed Chinookan-style cedar plankhouse on the refuge. This Compatibility Determination only covers the minor expansion of the environmental education and interpretation program as it relates to the proposed construction, operation, and visitation of the proposed Cathlapotle Plankhouse project. The former 1994 Environmental Education and Interpretation Compatibility Determination is still in effect for the entire refuge. The proposed plankhouse location would be near the parking area of the Carty Unit, adjacent to State Route 503, one-quarter mile north of the city of Ridgefield, Washington.

The plankhouse would serve to interpret the history of the refuge, including the cultural heritage of the Native American people of the Lower Columbia River and the natural resources of the refuge. By supporting an active education and interpretation program, schools and other interest groups would be offered a unique opportunity to learn about the natural and cultural resources of the refuge including its habitats, wildlife, and cultural resources. The focus of the plankhouse environmental education and interpretation would be to bring to life, through staff, volunteer/docent-led tours and demonstrations, the daily lives of the people who once lived where the refuge is now located. The enhancement of the environmental education and interpretation program with the proposed plankhouse would meet refuge operational goal #4 (Provide high quality opportunities for wildlands and wildlife-dependent recreation and environmental education to enhance public appreciation, understanding and enjoyment of refuge fish, wildlife, habitats and cultural resources).

The current refuge environmental education program specifically addresses the needs of the schools/educators for use of an outdoor classroom. From 2000-2003, approximately

1000 individuals/students annually participated in environmental education programs on the refuge. Environmental education programs are coordinated by the schools and lessons are generally focused on the refuge habitats and wildlife. The refuge currently offers educators a comprehensive reference guide to enhance classroom and refuge learning experiences for grades 4 through 6. Lessons outlined in the Educators Guide meet the State of Washington curriculum guidelines and are taught by the teachers on the refuge as part of a field trip experience or to enhance classroom learning. The refuge staff offers on-site volunteer and teacher training sessions annually and upon request. Teachers are required to register with staff prior to a field trip on the refuge, so that a staff member or volunteer may provide orientation and control the total number of classes utilizing the refuge.

Expanded education programs and their associated activities would take place inside or in the vicinity of the proposed plankhouse and established refuge trails, minimizing the areas for potential human impacts to wildlife and habitats on the refuge. These programs would include guided tours for all age groups and led by a teacher, volunteer, and/or staff member. The lesson plans provided to teachers and volunteers would be expanded to include components in social sciences and cultural history as they relate to the plankhouse and history of the refuge. It is anticipated that local educators would include a field trip to the plankhouse as part of their cultural history lessons. The proposed plankhouse and expanded educators guide may increase student field trips by 1000 students annually, bringing the total annual student visits to the refuge to 2000.

With the publicity surrounding the Lewis and Clark Bicentennial Commemoration and interest in cultural history of the local area, requests from groups and schools for educational programs have initiated the need for expansion of the environmental education programs. The staff anticipates a general increase in total refuge visitation by 10% annually. This increase coincides with the continued population growth within the county and local surrounding communities. Increased visitor interest in the refuge's history during the Lewis and Clark Bicentennial Commemoration, 2005-2006, may increase visitation, with the addition of the proposed plankhouse, by an estimated 10-20,000 visitors. School programs would continue to be arranged by individual teachers during the fall and spring months with field trips averaging 60-120 students, including a parent/teacher and student ratio of 1:10. Special guided tours or programs of the plankhouse would need to be prearranged and scheduled. General daily operations of the plankhouse would also be dependent on the availability of volunteers/docents and availability of staff. One goal for the proposed plankhouse project, specifically during the Bicentennial Commemoration, is to hire an interpreter/guide to operate the facility on a daily basis. Funding is being sought to accomplish this goal through local nonprofit organizations, grants, and foundations.

Guided programs and presentations would be expected to last approximately one hour. Self-guided tours may last approximately 20 minutes. Special events may occur seasonally or coincide with local community events, such as living history presentations/demonstrations that would continue throughout an entire day. Special programs/tours and operational hours would be during daylight hours only, between the hours of 10:00am and 4:00pm. Prearranged tours and group size would be managed by the staff and/or volunteer guides to enhance the educational experience for the group. Special use permits may be required from the refuge manager for educational activities that occur outside the standard procedures or operations of the plankhouse such as large groups or tours outside designated areas.

To develop a historically accurate educational and interpretive plan for the refuge, a team of educators, Tribal members, volunteers, refuge staff, and professional historians has been established. This Education and Interpretation Team may work with a professional contractor that would develop interpretation and educational messages, materials, and programs for the refuge and its facilities, including the proposed plankhouse. The contractor would be responsible for working with and training staff and volunteers. Development of educational/interpretive themes written or presented orally would be identified and evaluated by the Team to ensure accuracy of information. All educational materials and programs would integrate appropriate curriculum standards for Oregon and Washington schools. Interpretation proposals include a self-guided brochure, upgraded and expanded web site, and interpretive panels that may be developed as funding is secured through future grants and donations by local non-profits. Ultimately, the specific education and interpretation materials to be provided would be determined by the Education and Interpretation Team.

Special events are being proposed during the Lewis and Clark Bicentennial Commemoration. The refuge staff and partners are working together to develop two special events that would require attendance limits and/or multiple programs during this period. These events would involve an initial opening ceremony for the proposed plankhouse, guided walks on the refuge, and potentially living history demonstrations.

Proposed development of this unique living history/educational facility is consistent with the goals of the National Wildlife Refuge System Improvement Act 1997. While other historic tourism destinations in the Portland/Vancouver Metro area highlight historic events and periods, none specifically focuses on the Native American history of the local area.

Availability of Resources:

Direct annual costs to administer this expansion of the refuge's environmental education and interpretation program are primarily in the form of staff time and volunteer support. It is estimated that the following level of involvement by Full Time Equivalent (FTE) refuge staff would be required and is currently available to adequately manage and monitor the environmental education and interpretation program over the long-term on the refuge:

Position and GS/WG Level	Involvement	FTE	Cost
Project Leader/Deputy Project Leader (GS 12/13)	Oversight, coordination with the public use groups, and maintenance	0.04	$ 2,656
Outdoor Recreation Planner (GS-9/11)	Oversight and coordination of program, monitoring, training, and volunteer management	0.5	$27,341
Heavy Equipment Operator (WG-8)	Oversight, coordination, and support of volunteers for maintenance activities	0.1	$ 5,067
10+ Volunteers/Docents	Staffing plankhouse, education program guides, public use monitoring, and maintenance	1.0	$ 5,000
Wildlife Biologist	Program consultation and habitat monitoring.	0.02	$ 1,328
Total FTEs and Costs:		1.66	$41,392

Funding for construction (approximately $400,000) and a future maintenance endowment ($100,000) have been and would continually be acquired through actively pursuing grants and donations. Currently the Lewis and Clark Bicentennial Committee of Vancouver/Clark County and volunteers have been successful at raising funds for construction, education, and interpretation ($14,000), as well as long-term maintenance of the proposed plankhouse ($100,000). The funds for education and interpretation would be used, in part, to implement a contract for development of a refuge environmental education and interpretation plan, which would include appropriate education and interpretation materials. The refuge staff has set a goal to develop a dedicated group of trained docents and volunteers to operate and maintain the plankhouse and to staff it at all times that it is open for public viewing and tours. Volunteers continue to step forward and show support by volunteering for the refuge and have attended tour guide/docent/volunteer training sessions. Staff is seeking funding through grants, foundations, and local non-profit groups to fund a full-time interpreter/guide to staff the proposed plankhouse during the Bicentennial Commemoration. If funding is not found to hire an interpreter/guide, the proposed plankhouse daily operations would rely solely on volunteers and staff availability.

Additional funding is required for ongoing special hands-on environmental education/interpretation programs and construction of an accessible bridge ($500,000). An endowment ($100,000) has been established through a local community foundation for future activities associated with education and long-term maintenance of the facility. Full-time staff oversight would be available at current staffing levels, with the support of current and future volunteer assistance.

The current maintenance staff and volunteers would maintain the proposed plankhouse and associated facilities. Facilities and area management would require a minimal increase over current levels in mowing, restroom maintenance, trash collection, trail maintenance, and occasionally facilities repair. This funding is currently available in the refuge budget.

Annual-Recurring Maintenance Activities	Staff / Volunteer Hours	Contracted Activities	Annual Costs
Restroom (Carty Unit) maintenance/upkeep	1 hour per Week	Yes	$2000
Mowing and Trails Maintenance/Parking Area	100 hours Annually	No	$5,067
Totals	152 hours		$7,067

Developing an accessible trail to the proposed plankhouse site would include replacing the current footbridge to allow for access to the trail. Plans have been designed for an accessible bridge, but funding for this proposal ($500,000) is still needed and being sought for construction. The funds for the replacement and construction of an accessible bridge on the Carty Unit are identified in the refuge Maintenance Management System (MMS; project number 99017). Meanwhile, visitors requiring assistance to access the site can prearrange it with staff/volunteers.

A current Refuge Operations and Needs System (RONS) request includes the approximate annual expense of $30,000 to establish a Volunteer Coordinator position for the refuge complex, project number 03003. Currently the Outdoor Recreation Planner manages and coordinates all volunteer activities and education programs with the temporary assistance of an Americorps volunteer. It is not expected that the budget will allow for future Americorps volunteer positions on the refuge beyond Fiscal Year 2004. Over 30 active volunteers are currently working with refuge staff on a variety of projects and activities on the refuge.

Current staffing levels are adequate for plankhouse program management based on additional community volunteer support for operations. To mitigate potential budget shortfalls and increases in facilities costs, the staff may consider implementing a

Recreation Fee Program for the plankhouse personnel and facilities operations in the future. Initially plans are underway to explore funding opportunities through grants and private donations to provide a full-time interpreter during the Lewis and Clark Bicentennial Commemoration.

Anticipated Impacts of Use:

This summary is intended to examine impacts resulting from the proposed plankhouse facility and its additional education and interpretive programs and activities. A full analysis of the Need for and Alternatives to the construction of the plankhouse, as well as a description of the Affected Environment, and the Environmental Consequences of each alternative are presented in Sections I, II, III, and IV, respectively, of the Environmental Assessment for Building and Interpreting the Cathlapotle Plankhouse (EA).

The proposed use would result in minimal disturbance to wildlife and habitat as described in Section III (Affected Environment) of the EA. The total footprint of the building would be approximately 2800 square feet with an additional 1000 square feet of outdoor area used for interpretation, educational presentations, and living history presentations. Public use on the site would affect upland habitat and would use an established trail to the current parking lot and restroom facility. All exterior construction proposed would take place during the mid to late summer season (late August-October). Upgrading the trail system and the accessible bridge are described in the EA and would provide for hardened surface trail accessibility to the plankhouse site.

Historically, since the mid-1800s, the Carty Unit was periodically used as pasture for cattle grazing. The area of upland was once the homestead of the Carty Family and they maintained the family home near this site. The popular Oaks to Wetlands hiking trail has gone through the area for approximately 30 years. Within recent years, this trail has attracted an estimated 40,000 visits per year. Proposed upgrades and small adjustments to the trail system between the proposed plankhouse and the trailhead would cause minor changes to the habitat to allow for continued trail and plankhouse access.

Most species of mammals, amphibians, reptiles, and birds common to the Carty Unit utilize the area near the project site on an intermittent, seasonal basis. The site of the proposed plankhouse is located in and adjacent to the last stand of Oregon oak woodlands on the refuge and one of the few remaining oak stands in the Willamette Valley portion of Washington. This habitat type is important to a variety of oak-dependent species; the most notable of these species on the refuge is the slender-billed white-breasted nuthatch. Some short and long-term disturbance caused by human presence in the habitat, although not significant, may occur in the surrounding oak trees due to the anticipated increase in public visitation.

Water howellia (federally threatened plant) and the American bald eagle (federally threatened) both occur on the refuge. Occurrence of these species and the impact of the proposed construction are described in the Section 7 determination prepared pursuant to the Endangered Species Act (see Appendix 3 of the EA), which is incorporated by reference. Water howellia occurs 1600 meters northwest of the proposed plankhouse and would not be impacted by construction or with increases in public use. Threats to this species occur primarily from direct trampling of shorelines or severe disruptions of the natural water regimes that may inhibit seed set and germination. Neither of these scenarios would occur with this plankhouse project.

Migrant and wintering bald eagle populations on the refuge may reach twenty or more birds depending on the food supply, as eagles often follow the salmon and eulachon (smelt) runs up the Columbia River and they follow these fish off-refuge up the Lewis River. The refuge provides ample hunting perches and roost sites in large cottonwood and ash trees bordering the River, as well as additional prey in the form of wintering waterfowl. The Carty Unit of the refuge supports one active nest at the confluence of Gee Creek and the Lake and Columbia Rivers approximately one and a half miles from the plankhouse construction site. A second nest is located on private property adjacent to the Carty Unit, the estimated distance from the construction site is 600 meters. The nest site on the private property adjacent to the refuge is heavily forested and there is no visibility of the nest from the refuge construction location. All exterior construction proposed would take place during the mid to late summer season (late August-October). The noise associated with heavy equipment during construction activities should not last more than two weeks in duration, although activities at the site may take several months to complete construction. This equipment would include trucks delivering logs/posts to the site, auger for postholes, crane to lift posts into place, and concrete truck to fill footings. Implementation/construction of the proposed plankhouse project, improved trail access, and an accessible bridge would have minor or negligible effects on foraging, nesting, migrating, and wintering bald eagles, as described in the Section 7 determination for the proposed project.

Pacific salmon and anadromous trout are found within the Carty Unit, where the proposed plankhouse would be constructed. Sea-run cutthroat trout and coho salmon have been identified on the refuge. Adult cutthroat trout occur within the waters of Gee Creek, however spawning by other salmonid species is undocumented. Habitat suitable for salmonid spawning is not known to exist on the refuge itself, although Gee Creek upstream of the refuge offers suitable gravels for coho salmon but poor water quality may limit overall habitat suitability. The primary benefit of the refuge waters are as rearing habitat for juvenile salmonids. The wetland adjacent to the construction site is seasonal in nature and supports small populations of mainly non-native, warm-water fishes. The construction of the plankhouse would occur primarily when the wetland is almost dry, thus reducing or eliminating any direct or indirect impact to fishes or the wetland. Environmental education activities associated with the plankhouse would be expected to have only minor or negligible effects on Gee Creek or the seasonal wetlands on the refuge.

Many species of migratory birds and waterfowl, including dusky Canada geese utilize specific habitats on the refuge. As these species are included in the refuge purposes, the dusky Canada goose is one of the priority species on the refuge, along with federally listed species. The Carty Unit does not provide the necessary habitat requirements for the dusky Canada goose. Public use activities within this area of the Carty Unit may only cause minimal disturbance to migratory birds, including waterfowl.

During construction of the proposed plankhouse as well as an occasional increase in visitation by large tour groups and special events, some bird species may be temporarily displaced to other areas of the refuge. There is currently adequate sanctuary for these birds in the event of temporary disturbance during construction or special tours. Construction activities would take place outside breeding or nesting season, so no impacts would be anticipated. Refuge staff recommendations based on biological monitoring of wildlife resources would establish appropriate times and locations for tour groups and special events, thereby ensuring that the impacts to these species remain within acceptable levels.

Environmental education programs would occur generally inside the plankhouse, next to the building, and on the improved accessible trail. Disturbance from human intrusion may include noise, activities under the trees, and tree climbing. Disturbance to this area would be reduced by re-routing the trail away from the oaks while also providing accessible trail access to the plankhouse, as proposed. Native shrubs and trees would be planted along the trail system and under the tree canopy to deter and minimize off-trail use by visitors, while enhancing habitat values for wildlife, reducing the potential for increased erosion and associated water quality problems. Educational messages about habitat protection and stewardship of the natural resources would be presented as part of the programs, interpretation, and written materials. As previously stated, programs may be limited to specific areas seasonally to reduce disturbance impacts to wildlife and habitat. Messages would inform and direct visitors away from sensitive habitats and concentrate visitor activities in specific areas. Enhancing the habitat with native plantings adjacent to the site and trails may also become a valuable tool to educate the public about historic cultural uses of various plants, while protecting and improving habitat.

Anticipated public use impacts associated with the proposed building and education programs would be minimal, but stipulations would be required to ensure that wildlife resources are adequately protected from the proposed environmental education and interpretation programs. Education programs would be designed so that they avoid sensitive populations or sites.

Groups and individuals can affect the habitat by compaction of soils and trampling of vegetation, which increase the potential for erosion, reduce seedling growth, and may alter vegetation composition/structure. Programs and sites would be coordinated and monitored closely by biological staff to minimize disturbance and potential impacts to habitat/wildlife. The refuge staff would establish a few specific educational and interpretive areas/sites around the proposed plankhouse for group presentations to reduce impacts to soils and vegetation; coordination of site selection, seasonal use, and program development would be in concurrence with biological staff. Group size would be managed as needed and staff would monitor the impacts of increased public use to wildlife and habitat closely and the program would be adaptively managed over time to ensure impacts remain within acceptable levels.

Aside from a projected increase in general refuge visitation by 10%, in addition to an estimated 10,000 additional visits during the Lewis and Clark Bicentennial Commemoration years of 2005 and 2006, the addition of the proposed education and interpretive program at the proposed plankhouse would increase by 1000 students per year, with an estimated total of 2000 student visits to the entire refuge per year. Visitation by students, however, is much more likely to continue for a longer period beyond the Bicentennial years than visits attributed to those following the footsteps of Lewis and Clark. This combined increase in visitation over the short and long-term would increase human impacts to refuge resources utilized for these programs and activities, albeit within acceptable levels.

With the increase in visitation during the Bicentennial Commemoration, 2005-2006, it is anticipated that interested visitors following the Lewis and Clark Trail will visit the refuge to "stand in the footsteps" of the explorers. Establishing an educational program about the rich cultural history would provide a focus site for these visitors through docent/volunteer-led tours. It is anticipated that school groups would utilize the plankhouse during the school year on weekdays and the general refuge visitors would primarily utilize the plankhouse programs on weekends and for special events. Parking and restroom facilities are available on the Carty Unit at the trailhead. The parking area can seasonally accommodate up to 150 vehicles if necessary for special events in the open field, including tour/school buses. Year round, the parking area can accommodate approximately 40 vehicles. Special events and tours during the Bicentennial period may have the potential to draw up to 150 visitors or more to the site. Special event parking and shuttle service or buses may be required to pick up visitors off-site to accommodate large crowds for special events.

The increasing visitation and associated vehicles may disrupt refuge visitors that routinely walk the trails on this portion of the refuge. The activities of these different user groups (i.e., school groups, birdwatchers, photographers, etc.) may overlap periodically throughout the week. As previously stated, the school groups would primarily utilize the refuge during the week when visitation by other user groups is less likely to occur. The expansion of the current environmental education and interpretation program would result in only minimal impacts in the short-term to visitors engaged in other public uses, and no long-term impacts to these users would be anticipated.

The increase in visitation to the refuge plankhouse and associated trail use would potentially have a positive impact on the local economy.

Public Review and Comment:

A series of public events/meetings took place beginning in June 2002 and again in September 2002, when the refuge staff, Chinook tribal members, and volunteers presented the proposed refuge project to the public. Approximately 135 people attended the June event and at that time a model of the proposed Plankhouse, as well as plans for the future Natural and Cultural Heritage Visitor Center, were introduced to the community. Monthly meetings were subsequently announced in the local newspapers and were arranged at the Fort Vancouver Public Libraries. Meetings in October, November, and December 2002, were set up to introduce the proposed project to the public and answer questions and concerns with an average of 40 participants attending each meeting. Beginning in January 2003, the meetings were focused toward volunteers and community members who wanted to donate their time to the proposed project.

These meetings, accompanied by an initial pole-raising on the refuge, provided a good segue for raising several issues related to the proposed project. These issues of concern were accompanied by new information from members of the public and Tribes, and included; 1) trail alignment, as it relates to the Americans with Disabilities Act (ADA) accessibility standards, 2) integrity and security of the Cathlapotle archaeological site, 3) accurate historic and cultural interpretation of the refuge by several Tribes, 4) economic impacts to local community, and 5) visitor safety as it relates to the plankhouse design. Each of these issues has been analyzed within alternatives as they relate to the refuge purposes, National Wildlife Refuge System mission, and existing refuge uses in the associated Environmental Assessment (Building and Interpreting the Cathlapotle Plankhouse).

Determination:

_____ Use is Not Compatible

__X__ Use is Compatible With the Following Stipulations*

* This use has been found compatible assuming adherence to the stipulations identified below. Not all circumstances can possibly be anticipated, and therefore, discretion must be left up to the refuge manager to manage the environmental education and interpretation program.

Stipulations Necessary to Ensure Compatibility:

While anticipated impacts to habitat and resources are assumed light, stipulations would still be required to ensure that wildlife and habitat resources are adequately protected within this portion of the overall refuge environmental education and interpretation program.

At a minimum, the Outdoor Recreation Planner (ORP) would be responsible for supervising and ensuring volunteer management of the facility, educational and interpretive programs, staffing, and trail maintenance, as well as ensuring refuge compatibility of all associated activities. The ORP would also be responsible for monitoring activities associated with the public use, environmental education, and interpretation by routinely monitoring visitor safety, quality of educational programs (content and presentation), and facility operations. Issues would be addressed and operations adjusted as required by the situation by qualified staff. Plankhouse goals include developing a fully trained volunteer core of docents to educate students and the public, ensuring a safe and high quality environmental education and interpretation experience for all who participate in plankhouse, environmental education, and interpretation programs. Written standards for operational procedures would be established as a guide outlining clear staff/volunteer guidance for all aspects of operations. These guidance standards would be part of the training standards, which would be met by all qualified volunteers. Additionally, the ORP will work with the Education and Interpretation Team to fully develop the environmental education and interpretation program for the proposed plankhouse.

The plankhouse would only be opened to the public when staff and/or trained volunteers/docents are available to operate the building and provide educational programs, information, and security. There will be established hours of operation (as volunteers are trained and scheduled) for scheduled programs and tours. The refuge is only open from dawn to dusk and the gates close at posted hours.

The environmental educational programs would be designed such that they identify populations or sites (e.g., areas with high densities of migrating waterfowl, cultural resources, etc.) so they are avoided. Close coordination with biologists and archaeological staff is required prior to implementing any new educational program. Programs may be established in the future with attendance limits to ensure a quality experience and to protect the habitat and reduce disturbance. Potential impacts to vegetative resources by trampling would be mitigated by the construction of a semi-impermeable accessible trail surface and group gathering area adjacent to the plankhouse. Security measures (security systems, cameras, alarms) may be initiated to protect replica living history props (e.g., elk hides, baskets, bowls, mats, and carvings), the structure, and the artistic elements associated with the structure. Volunteers and staff will monitor visitor activities inside and outside the plankhouse as part of their duties.

Wildlife disturbance caused by human intrusion into wildlife habitat is one impact associated with the environmental education and interpretation program; however, it is through interpretation and environmental education that visitors would receive an understanding of proper etiquette (e.g., no collection of refuge resources, remain on designated trails, etc.) and visitor impacts on habitat, wildlife, and cultural resources. This information would be made available through a variety of media including visitor contacts, brochures, and interpretive panels/kiosks, as determined by the Education and Interpretation Team. Lesson plans that are provided to teachers and volunteers would be expanded to include components in social sciences and cultural history as they relate to the plankhouse and history of the area where the refuge now sits. Continued monitoring of the education program by staff would identify issues that may affect resources and initiate needed changes to eliminate disturbance.

Teachers must prearrange school trips to the refuge with refuge staff and ensure they have the appropriate 1:10 parent/teacher to student ratio while on the refuge. Refuge staff will encourage teachers to utilize the lesson plans and environmental education/interpretation materials the refuge will provide. Similarly, large groups must be prearranged with refuge staff, and special use permits may be necessary, depending on the request and other scheduled refuge activities. Individuals or groups requiring assistance in reaching the Carty Unit must prearrange this with the refuge to ensure adequate assistance is made available.

Stipulations that are still applicable from the 1994 Compatibility Determination remain in effect and state:

1) Activities are held on the Carty Unit which has been identified as the primary environmental education site. This area has the Oaks to Wetlands Trail and a variety of habitats for nature study. 2) The teachers guide should be reviewed before activities are conducted. 3) Teachers are required to register their class attendance with the refuge to avoid the use of the Carty Unit by more than one school group at a time.

Justification:

Environmental education and interpretation are two of the six wildlife-dependent public uses mandated by the National Wildlife Refuge System Administration Act of 1966, as amended (1997) to be given priority consideration on National Wildlife Refuges. These are also included in operational goal #4 for the refuge. Development of a carefully designed and managed environmental education and interpretation program will help the refuge meet this mandate and one of its operation goals. Resources to administer the program would be minimal and supported through current staffing levels, a strong active volunteer program, funded through an established endowment, and/or though a recreational fee program. Additional funding will continually be sought through grants, partnerships, etc. As long as the stipulations to ensure compatibility are followed, the expanded program would remain compatible until such time that public use monitoring data suggest that modifications to the program are advisable.

Considering the minimal anticipated impacts of implementation of the proposed plankhouse environmental education and interpretation program, including those to the refuge's priority wildlife resources, and the benefits the refuge would receive through public education, participation, and involvement, the expanded program is deemed compatible. Environmental education allows staff to educate the public about the mission of the National Wildlife Refuge System, the refuge purposes, and to highlight messages that convey the mission of the Refuge System and the goals and objectives of the Ridgefield National Wildlife Refuge. By designating a facility to focus and direct visitors and tour/school groups, it would allow staff to direct visitation away from sensitive habitats/resources and to concentrate human activities in a smaller area of the refuge. This would minimize potential seasonal impacts throughout most of the refuge habitats while providing visitors with a high quality educational experience.

The proposed plankhouse environmental education and interpretation program would offer a tangible link between the human dependence on the natural environment historically, as well as today. The proposed plankhouse and associated facilities and activities are not expected to result in unacceptable impacts to refuge resources or compatible public uses. Using monitoring data, the program will be adaptively managed to ensure impacts remain within acceptable levels.

Mandatory Re-Evaluation Date:

__X_ Mandatory 15-year Re-Evaluation Date (for priority public uses)

____ Mandatory 10-year Re-Evaluation Date (for all other uses other than priority public uses)

NEPA Compliance for Refuge Use Decision:

____Categorical Exclusion without Environmental Action Statement

____ Categorical Exclusion and Environmental Action Statement

__X_ Environmental Assessment and Finding of No Significant Impact

____Environmental Impact Statement and Record of Decision

References:

U.S. Fish and Wildlife Service. 2004. Draft Environmental Assessment for Building and Interpreting the Cathlapotle Plankhouse.

U.S. Fish and Wildlife Service. 2004. Section 7 Determination. (May 26,2004).

Refuge Determination:

8-31-04

Prepared by Rebecca Young
Deputy Project Leader

Date

8-31-04

Thomas J. Melanson

Date

Acting Project Leader

Concurrence:

8-30-04

for Forrest Cameron
Refuge Supervisor

Date

8-31-04

Carolyn Bohan

Date

Acting Regional Chief, National Wildlife Refuge System

B6. Compatibility Determination for Crop Production on Ridgefield National Wildlife Refuge

Use: Crop Production

Station Name: Ridgefield National Wildlife Refuge

Date Established: 1965

Establishing and Acquisition Authority(ies):

Migratory Bird Conservation Act of 1929, as amended (16 U.S.C. 715-715s)

Migratory Bird Hunting and Conservation Stamp Act of 1934 (16 U.S.C. 718-718j) [Funding for primary acquisition]

Refuge Purpose(s):

“... for use as an inviolate sanctuary, or for any other management purpose, for migratory birds.” 16 U.S.C. § 715d (Migratory Bird Conservation Act)

"... to provide wintering habitat for dusky Canada goose and other waterfowl. Will also provide breeding and migration use and substantial public shooting in area. Estimated peak population: 125,000 ducks and 3,000 geese." (Migratory Bird Conservation Commission Memorandum Number 1, May 18, 1965.)

National Wildlife Refuge System Mission:

The mission of the 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.

Description of Use:

The refuge manages pastures, wetlands, and agricultural fields to provide a variety of foods that will meet the needs of wintering and migratory waterfowl. Native vegetation provides higher levels of protein, fiber, and water than most agricultural crops. However, crops can provide wildlife with easily-accessible high energy foods, are more digestible than native plants, and can reduce foraging time required to meet caloric demands (Raveling 1979, Alisauskas and Ankney 1992, Baldassare and Bolen 2006). Waterfowl are able to exploit a variety of habitats to meet their daily and seasonal food requirements and the refuge provides a diversity of food supplies in relatively close proximity to each other.

Current refuge farming practices include grazing, haying, and planting of crops such as cereal grains and clover. Agricultural crops grown on the refuge (primarily winter wheat and corn) are selected primarily to provide waterfowl with an easily-accessible source of high-energy carbohydrates. The refuge proposes to increase crop production acreages from the current range of 155 to 185 ac (including 55 to 85 ac in corn) to 290 to 330 acres (including 60 to 145 ac of corn). The refuge has tried propagating millet and clover in some fields with mixed results.

The Refuge will continue to work to improve crop production and availability to wildlife by:
1) testing different crops such as spring wheat, buckwheat, and milo and
2) implementing irrigation, where practicable.

Soil amendments (fertilizer, lime, etc.) and weed control methods are used as necessary to improve the growth of desirable vegetation and reduce competition from weed species. The refuge will test soils in crop fields and use this information to determine the need for soil amendments, as well as the amount needed based on local recommendations such as those provided by Washington State University Extension or Oregon State University Extension Service. Best Management Practices (BMPs) will be used to avoid undesirable effects such as fertilizer leaching into groundwater or sedimentation of streams and waterbodies. Examples of BMPs include avoiding nitrogen fertilizer applications in the fall to help avoid waste and prevent fertilizer from leaching into groundwater, and leaving buffer strips of dense vegetation between cropland and wetlands to filter runoff and prevent sedimentation. Crop varieties adapted for local conditions and disease resistance will be selected for refuge use (for example Yamhill and Cashup are winter wheat varieties that are rust-resistant and locally adapted).

Invasive weed species have the potential to reduce habitat quality and forage opportunity and have been identified as one of the most serious threats to refuge habitats. Activities such as crop production that disturb soils may provide opportunities for weeds to sprout and become established. Preventing infestations is the most effective strategy. Early detection followed by rapid response (ED/RR) helps prevent new invasive plant occurrences from becoming established. The refuge staff and volunteers conduct searches of refuge lands and waters on an annual basis to identify new occurrences and implement efforts to eradicate these species. Current examples of species being targeted for eradication through ED/RR are jimsonweed (*Datura stramonium*), purple loosestrife (*Lythrum salicaria*), pampas grass (*Cortaderia jubata*), and fragrant water lily (*Nymphaea odorata*).

A variety of methods including mechanical and cultural treatments and herbicide applications are used to reach refuge goals of <20% weed cover and no new infestations in managed pastures and old fields. The refuge uses an integrated pest management (IPM) approach to control weeds (Appendix K), whereby management options are selected based on site conditions and not implemented until established thresholds (such as percent weed cover) are exceeded.

For species that are or become established, mechanical, cultural, and biological control methods are evaluated in that order. If these methods are not expected to be effective or would have undesirable consequences (such as impacting nests of grassland-nesting birds), then the refuge may decide to use a herbicide. As described in detail in Appendix K, the refuge uses the most efficacious herbicide available with the least potential to degrade environment quality (soils, surface water, and groundwater) as well as least potential effect to native species and communities of fish, wildlife, plants, and their habitats. All applications of herbicides will conform to the specific pesticide label requirements.

The refuge reviews pesticide use annually and submits pesticide use proposals for all applications conducted on refuge lands. With the exception of larvicides applied for mosquito control by the county mosquito management agency, herbicides are the only pesticides currently used on the refuge. Herbicides are not applied to each field every year. In 2009, the refuge applied 60 gallons of glyphosate to control weeds on approximately 118 acres of cropland.

The refuge has little capacity currently to irrigate croplands and in some years rainfall during the growing season is insufficient to produce a successful corn crop. Corn is favored by both geese and cranes as a high carbohydrate food and the Wildlife and Habitat Management Review (USFWS 2004) recommended increasing the acreage in corn. Given the high costs of producing a successful corn crop, the refuge proposes to evaluate the feasibility of implementing a cooperative farm program for crop production, whereby a private farmer (cooperator) would raise a Refuge-specified crop in a designated field or fields, and would be entitled to a share of the harvest. As an example, 75% of the crop would go to the cooperator and 25% to the Refuge, although this would be negotiated with the cooperator as part of the development of a Cooperative Farming Agreement (CFA). CFAs are typically multi-year agreements that are used to implement cooperative programs that help achieve refuge purposes as well as an economic benefit to the farmer. The CFA involves a negotiated agreement between the Refuge and private farmer to manage lands for both parties. To benefit wildlife, the Refuge share would be left in the field where it would be available to wildlife. Any fields that are double-cropped (two or more crops raised in a single season) would be subject to the same pre-determined Refuge/cooperator split for each crop.

The Oregon/Southwest Washington Canada Goose Depredation Plan (Pacific Flyway Council 1998) discourages establishing expansive agricultural crop fields on refuge lands and in response, the refuge has maintained relatively small (<50 ac) and scattered fields. This factor and the need to set up an irrigation system may increase the difficulty in locating a cooperating farmer who is able to produce sufficient forage for wildlife and provide an attractive return on their investment of time and money. However, given the importance of corn as a highly available, high energy, and easily digestible forage crop for geese and cranes, the refuge believes that a examining the feasibility of cooperative crop farming is worthwhile.

Availability of Resources:

The refuge staff currently operates the crop program. The refuge biologist plans crop production and evaluates the condition of the crop throughout the growing season. The refuge equipment operator and tractor operators prepare fields for cropping, seed the crop, and control weeds, as well as maintain access roads to the fields. If the refuge implements an irrigation system, the equipment operator and tractor operators, and biologist would work together to maintain and operate the system(s). In the event that using a cooperator was determined to be feasible, the cooperator would be responsible for field preparation (including the application of any soil amendments), weed control, seeding, irrigation, and harvesting.

Costs to Administer and Manage Farming Programs at the Refuge under the Preferred Alternative (Alternative 2)

Activity or Project	One Time Expenses ($)	Recurring Expenses ($/year)
Enhance/Maintain Improved Pasture for Dusky Canada Geese		89,500
Enhance/Maintain Improved Pasture for Other Canada Geese and Waterfowl		179,000
Maintain Old Fields and Old Field/Wetland Borders		25,400
Provide Crops for Waterfowl and Sandhill Cranes		76,500 – 104,500

Activity or Project	One Time Expenses ($)	Recurring Expenses ($/year)
Enhance/Maintain Improved Pasture for Waterfowl. 3yr Upland Restoration Project	208,000	
Develop Irrigated Farming to Provide Crops for Waterfowl and Sandhill Cranes.	204,600	
Totals	412,600	370,400 – 398,400

Anticipated Impacts of Use:

The Refuge was established in part to provide habitat for wintering geese, especially the dusky Canada goose subspecies. As cropland in the lower Columbia River is converted to residential and commercial land cover types, agricultural lands suitable for wintering waterfowl and crane use are declining. Invasive pasture weeds such as Italian thistle and tansy ragwort further degrade the ability of existing pasture to support wintering geese. Producing high quality forage on Refuge lands is becoming increasingly important and the Refuge's farming program is designed to provide areas of high-energy grain crops and green forage grasses to meet the food energy needs of wintering waterfowl and cranes and reduce crop depredation in nearby agricultural lands. In periods of severe weather, having a readily available source of high-energy foods can sustain wintering waterfowl and cranes during critical periods of nutritional and physical stress when other food sources generally are unavailable.

The Refuge's farming program does impact various grassland birds, small mammals, reptiles and amphibians. Not only are these species subject to mortality from farm machinery, but the conversion of unmowed grasslands/old fields to cropland causes habitat loss. The Refuge will reduce impacts of cropland by restricting the amount of cropland, protecting waterbodies and groundwater using BMPs and controlling weeds using the refuge's IPM program (Appendix K)

Invasive species may be spread by moving equipment from site to site. These species may also become established where soils and existing plant cover is disturbed. The refuge equipment operators are required to clean equipment before moving between fields to reduce the spread of seeds and plant parts. Cooperators will also be responsible for cleaning their equipment prior to moving between fields. The refuge will continue to monitor farming sites for invasive weeds and will maintain an aggressive approach to invasive plant control and restoring sites to vegetation with high wildlife value. In addition, the refuge will continue to work with the County Weed Board to prevent, identify, and eradicate new infestations.

Threatened and Endangered Species

Within the River 'S' and Bachelor Island Units, the Service has established populations of the Federally-listed threatened Nelson's checkermallow by planting individual seedlings in three separate pasture sites. Areas where this plant has been established will not be cropped to avoid impacts to these planted populations. The Refuge has completed an intra-service consultation pursuant to the Section 7 of the Endangered Species Act (87 Stat. 884, as amended; 16 U.S.C. 1531 et seq.) regarding the proposed use and Nelson's checkermallow.

Public Review and Comment:

This determination was issued for public review and comment as part of the Ridgefield NWR Draft Comprehensive Conservation Plan and Environmental Assessment (DCCP/EA). The plan and associated compatibility determinations were also provided as CDs to a mailing list of 432 recipients, and were made available on the FWS Region 1 Planning website. Printed copies of the DCCP/EA were available upon request. The 30-day review occurred from June 16 through July 16, 2010. We did not receive specific comments regarding the compatibility determinations, and no changes have been made at this time.

Determination (check one below):

_____ Use is Not Compatible

__x__ Use is Compatible with Following Stipulations

Stipulations Necessary to Ensure Compatibility:

The following stipulations ensure that the proposed use is compatible:

- Crops will not occupy more than 10% of the refuge acreage.
- In portions of fields where Nelson's checkermallow was planted, no crops will be established
- Weeds will be controlled in accordance with the refuge's IPM program using methods such as crop rotation, mechanical treatment, biological controls, and low toxicity approved pesticides (Appendix K).
- Pesticide use must be in compliance with the Service policy requirements for completing an approved Pesticide Use Proposal, and it must meet other State and Federal requirements.
- Cooperators will only apply herbicides and fertilizers with prior refuge approval.
- In the event that the refuge develops a CFA for crop production, the cooperator will provide an annual record of planting efforts, fertilizers and herbicide applications, and plant products removed from the Refuge.
- The refuge will work to prevent the spread of weeds by cleaning equipment between fields and will continue to cooperate with the County Weed Board to control county-listed invasive weeds.
- Monitoring of the cropland farming program will be performed by qualified Refuge staff.

Justification:

Crop production has been shown to provide a cost-effective means of providing high quality food source for target wildlife species at the Refuge. Specifically, crop production provides high energy grain and forage crops, as well as green forage crops that are highly digestible and easily accessible. Wintering and migrating geese and cranes readily use agricultural crop fields to help meet their energetic needs. The use of a cooperator to produce grain crops, primarily corn, would increase the likelihood of a successful crop and providing irrigation capability that is not currently available. In addition, the food support crop production provides for target wildlife species indirectly supports several wildlife dependent recreational activities such as wildlife observation and photography.

By conducting the crop production program under the practices and stipulations described above, it is anticipated that wildlife species which could be adversely affected would find sufficient food resources and resting places so their abundance and use will not be measurably lessened on the refuge. Additionally, it is anticipated that monitoring, as needed, will prevent unacceptable or irreversible impacts to fish, wildlife, plants, and their habitats.

The combination of management practices and stipulations identified above will ensure that crop production contributes to the enhancement, protection, conservation, and management of native wildlife populations and their habitats on the refuge. As a result, crop production contributes to achieving refuge purpose(s); contributes to the Mission of the NWRS; and helps maintain the biological integrity, diversity, and environmental health of the refuge.

Mandatory 10- or 15-year Reevaluation Date: (provide month and year for "allowed" uses):

_________ Mandatory 15-year re-evaluation date (for wildlife-dependent public uses)

9/2020____Mandatory 10-year reevaluation date (for all uses other than wildlife-dependent public uses)

References:

Alisauskas, R.T. and C.D. Ankney. 1992. The cost of egg laying and its relationship to nutritional reserves in waterfowl. Pages 30-61 *in* B.D.J. Batt, A.D. Afton, M.G. Anderson, C.D. Ankney, D.H. Johnson, J.A. Kadlec, and G.L. Krapu, eds. Ecology and management of breeding waterfowl. Univ. of Minnesota Press, Minneapolis.

Baldassare, G.A, and E.G. Bolen. 2006. Waterfowl ecology and management, 2nd edition. Krieger Publishing Company, Malabar, FL

Raveling, D.G. 1979. The annual energy cycle of the Cackling Canada Goose. pages 81-93 *in* R.I. Jarvis and J.C. Bartonek, eds. Management and biology of Pacific Flyway geese. Oregon State University, Corvallis.

USFWS. 1998. Recover Plan for the Threatened Nelson's Checkermallow (*Sidalcea nelsoniana*). Dept. of Interior, Fish and Wildlife Service. Portland, Oregon. 38 pages.

Signatures:

Signatures for B6. Compatibility Determination for Crop Production on Ridgefield National Wildlife Refuge. Use is compatible with stipulations.

Prepared by:	(Signature)	9/8/10 (Date)
Approved by Refuge Manager/ Project Leader:	(Signature)	9/9/10 (Date)

Concurrence:

Refuge Supervisor:	Rob L. West (Signature)	9-9-10 (Date)
Regional Chief, National Wildlife Refuge System:	Carolyn A. Bohan (Signature)	9/9/10 (Date)

B7. Compatibility Determination for Haying and Mowing on Ridgefield National Wildlife Refuge

Uses: Haying and Mowing

Station Name: Ridgefield National Wildlife Refuge

Date Established: 1965

Establishing and Acquisition Authority(ies):

Migratory Bird Conservation Act of 1929, as amended (16 U.S.C. 715-715s)

Migratory Bird Hunting and Conservation Stamp Act of 1934 (16 U.S.C. 718-718j) [Funding for primary acquisition]

Refuge Purpose(s):

“... for use as an inviolate sanctuary, or for any other management purpose, for migratory birds.” 16 U.S.C. § 715d (Migratory Bird Conservation Act)

"... to provide wintering habitat for dusky Canada goose and other waterfowl. Will also provide breeding and migration use and substantial public shooting in area. Estimated peak population: 125,000 ducks and 3,000 geese." (Migratory Bird Conservation Commission Memorandum Number 1, May 18, 1965.)

National Wildlife Refuge System Mission:

The mission of the 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.

Description of Uses:

The refuge manages pastures, wetlands, and agricultural fields to provide a variety of foods that will meet the needs of wintering and migratory waterfowl and cranes. Geese in particular, use refuge pastures for most of their foraging activity, preferring young shoots that are higher in protein and lower in fiber than mature stems (McLandis and Raveling 1981). Pasture grasses serve as an important source of amino acids and carbohydrates to meet the energy and nutrient requirements of geese (Baldassare and Bolen 2006). To provide high quality forage for wintering and migrating geese and cranes, the refuge uses mowing and haying to ensure that young shoots less than 6 inches tall are available by October 15 each year. We also use these methods to help reach our goal of <20% coverage of weed species and to remove thatch, which can reduce the number of available shoots.

The refuge provides approximately 1,450 ac of pasture in 55 fields that are managed by haying (approximately 215 ac) and/or mowing (1,235 ac); the difference being that in haying, cut grass stems are removed from the pasture, whereas the stems are left behind as thatch in mowed fields. Grazing is also used to manage some pasture lands and is described in a separate compatibility determination. To reduce impacts to grassland nesting birds, mowing and haying are conducted after July 15, by which time most nesting has been completed. In most dry pastures, a single mowing or haying is adequate, but if the late summer precipitation is heavier than typical, a second cutting may need to be done. In wetter pastures two or three cuttings or a combination of haying and grazing (see separate compatibility determination for grazing) is used to meet the habitat objectives for the pastures. By early October, pastures should contain dense (>90% areal coverage) of short (<6 inches tall) grasses and clovers, with <20% coverage of invasive weeds (Himalayan blackberry, Canada thistle, tansy ragwort, etc.) to provide suitable wintering and migratory goose habitat.

Invasive weed species have the potential to reduce habitat quality and forage and have been identified as one of the most serious threats to refuge habitats. Preventing infestations is the most effective strategy. Early detection followed by rapid response (ED/RR) helps prevent new invasive plant occurrences from becoming established.

A variety of methods including mechanical and cultural treatments and herbicide applications are used to reach the refuge objective of <20% weed cover and no new infestations in managed pastures and old fields. The refuge uses an integrated pest management (IPM) approach to control weeds (Appendix K), whereby management options are selected based on site conditions and not implemented until established thresholds (such as percent cover) are exceeded.

For species that are or become established, mechanical, cultural, and biological controls methods are evaluated in that order. If these methods are not expected to be effective or would have undesirable consequences (such as impacting nests of grassland-nesting birds), then the refuge may decide to use a herbicide. The refuge may only use the most efficacious herbicide available with the least potential to degrade environment quality (soils, surface water, and groundwater) as well as least potential effect to native species and communities of fish, wildlife, plants, and their habitats. All applications of herbicides conform to the specific pesticide label requirements.

The refuge reviews pesticide use annually and submits pesticide use proposals for all applications conducted on refuge lands. With the exception of larvicides applied for mosquito control by the county mosquito management agency, herbicides are the only pesticides used on the refuge. Herbicides are not applied to each field every year. In 2009, the refuge applied 266 gallons of 2, 4-D butoxyethyl ester and 52 gallons of triclopyr triethylamine to control weeds on approximately 850 acres of pasture.

Pastures are periodically interseeded (seeds are drilled into the soil without removing all the existing vegetation, or preparing the seedbed through plowing or disking) with plants such as barley or clover to maintain a mix of vegetation species and quickly restore vegetation cover after broadleaf weeds are controlled to prevent weeds from re-establishing. Interseeding occurs approximately every three to four years in pastures.

Cooperative Land Management Agreements (CLMA) are used to implement cooperative farming, grazing, and haying programs that help achieve refuge purposes. The CLMA, signed in 2009, described the negotiated agreement between the Refuge and private farmer to manage lands for both parties. The cooperator is responsible for pasture management, and installing and maintaining fencing. The refuge installs the underground water delivery system, maintains pumps, supplies fencing materials, and constructs and maintains access roads. The cooperator is allowed to harvest hay and raise stock animals for personal use. The amount of hay and stock grazed on the Refuge varies, but approximately 200 to 400 tons of hay are removed and 120 to 250 cows and horses (combined) are allowed to graze on approximately 1,200 acres.

Availability of Resources:

Refuge staff and equipment are required to manage pasture land and support the CLMA program. The Refuge Manager and Wildlife Biologist would be required to design the mowing and haying program each year. The Refuge Manager also negotiates an agreement with the cooperator. The Refuge Equipment Operator and Tractor Operators would be required to mow some fields, control weeds, and maintain access roads and water delivery systems pursuant to any cooperative agreements. If the Refuge implements irrigation systems, the Equipment Operator, Tractor Operators, and Wildlife Biologist would work together to maintain and operate the system(s).

The use of cooperators' facilitates the management of pastures by reducing the amount of mowing and thatch removal that would otherwise require additional staff time and equipment not currently available. Options for thatch removal are limited by the slow rates of thatch decomposition relative to growth rates, high water table in many wetlands that precludes disking for much of the year, and the complexity of using prescribed fire in a region with air quality concerns. The removal of the thatch in the form of hay, results in improved availability of young shoots that provide high quality forage for wintering geese. The use of cooperators has proven to be a cost-effective means of managing specific pastures for wintering geese and cranes and helping the Refuge provide high quality habitat.

Costs to Administer and Manage Farming Programs at the Refuge under the Preferred Alternative (Alternative 2)		
Activity or Project	**One Time Expenses ($)**	**Recurring Expenses ($/year)**
Enhance/Maintain Improved Pasture for Dusky Canada Geese		89,500
Enhance/Maintain Improved Pasture for Other Canada Geese and Waterfowl		179,000
Maintain Old Fields and Old Field/Wetland Borders		25,400
Provide Crops for Waterfowl and Sandhill Cranes		76,500 – 104,500
Enhance/Maintain Improved Pasture for Waterfowl. 3yr Upland Restoration Project	208,000	
Develop Irrigated Farming to Provide Crops for Waterfowl and Sandhill Cranes.	204,600	
Totals	412,600	370,400 – 398,400

Anticipated Impacts of Uses:

The Refuge was established in part to provide habitat for wintering geese, especially the dusky Canada goose subspecies. As cropland and grassland in the lower Columbia River region is converted to residential and commercial land cover types, lands suitable for wintering waterfowl and crane use are declining. Invasive pasture weeds such as Italian thistle and tansy ragwort further degrade the ability of existing pasture to support wintering geese. Managing existing pastures on Refuge lands to provide high quality forage is becoming increasingly important and the Refuge's pasture management program is designed to provide areas of green forage grasses to meet the needs of wintering waterfowl and cranes and reduce crop depredation in nearby agricultural lands. Managed pastures also provide wintering habitat for a variety of migratory bird species including western meadowlark, rough-legged hawk, and short-eared owl.

In the absence of disturbance, refuge grasslands would revert to shrublands or woodlands that do not supply appropriate habitat for wintering and migratory geese. Historically, grasslands would have been maintained through disturbances such as grazing, wildfire, and scouring (in areas where rivers flooded with sufficient energy to remove thatch and plant litter). Haying and mowing simulate some of the effects of natural disturbances by removing woody vegetation, reducing thatch, and encouraging the production of young shoots which are preferred forage for Canada and cackling geese (Raveling 1979).

The refuge pasture management program does impact various grassland birds, small mammals, reptiles and amphibians. Not only are these species subject to mortality from machinery, but the conversion of tall pasture grasses to mowed grasses results in habitat loss. The Refuge reduces impacts of pasture management by delaying haying/mowing operations until after most grassland bird species have completed nesting (approximately July 15) and using approved low toxicity chemical agents and only when needed, as specified in the refuge IPM program description (Appendix K).

Invasive species may be spread by moving animals and equipment from site to site. These species may also become established where soils and existing plant cover is disturbed. The refuge equipment operators are required to clean equipment before moving between fields to reduce the spread of seeds and plant parts. The refuge will continue to monitor farming sites for invasive weeds and will maintain an aggressive approach to invasive plant control and restoring sites to vegetation with high wildlife value. In addition, the refuge will continue to work with the County Weed Board to prevent, identify, and eradicate new infestations.

Threatened and Endangered Species

Within the River ‘S’ and Bachelor Island Units, the Service has established populations of the Federally-listed threatened Nelson’s checkermallow by planting individual seedlings in managed pastures. Areas where this plant has been planted will not be grazed and will only be mowed after the checkermallow plants have entered senescence to prevent the encroachment of competing weeds and woody vegetation pursuant to the Recovery Plan (USFWS 1998). If necessary, weed control will be accomplished by hand-pulling (preferred, if practicable) or spot-treatment with pursuant herbicides, as specified in the refuge’s IPM program description (Appendix K). The Refuge has performed an intra-service consultation pursuant to the Section 7 of the Endangered Species Act (87 Stat. 884, as amended; 16 U.S.C. 1531 et seq.) regarding the proposed uses and Nelson’s checkermallow.

Public Review and Comment:

This determination was issued for public review and comment as part of the Ridgefield NWR Draft Comprehensive Conservation Plan and Environmental Assessment (DCCP/EA). The plan and associated compatibility determinations were also provided as CDs to a mailing list of 432 recipients, and were made available on the FWS Region 1 Planning website. Printed copies of the DCCP/EA were available upon request. The 30-day review occurred from June 16 through July

16, 2010. We did not receive specific comments regarding the compatibility determinations, and no changes have been made at this time.

Determination (check one below):

_____ Uses are Not Compatible

__x__ Uses are Compatible with Following Stipulations

Stipulations Necessary to Ensure Compatibility:

The following stipulations ensure that the proposed uses are compatible:

- Mowing and haying will only occur after July 15, unless surveys indicate that the specific pasture is not being used by nesting grassland birds.
- In portions of fields where Nelson's checkermallow was planted, mowing will only occur after checkermallow plants have entered senescence.
- Weeds will be controlled in accordance with the refuge's IPM program using methods such as crop rotation, mechanical treatment, biological controls, and low toxicity approved pesticides (Appendix K).
- Pesticide use must be in compliance with the Service policy requirements for completing an approved Pesticide Use Proposal, and it must meet other State and Federal requirements.
- Cooperators will only apply herbicides with prior refuge approval and will provide a record of herbicides used including chemical name, amount used, date, location, and how applied.
- Pursuant to the refuge's CLMA, Cooperators will provide an annual record of animals grazed on, and plant products removed from, the Refuge.
- The refuge will continue to cooperate with the County Weed Board to control county-listed invasive weeds.

Justification:

Mowing and haying are two important tools for providing high quality pasture habitat for wintering geese and cranes. These species prefer young shoots that are higher in protein and carbohydrates to meet their energy and nutrient requirements. They also prefer to forage and rest in areas with good visibility to better detect predators such as coyotes. Haying and mowing remove tall vegetation that would restrict visibility. These methods also remove encroaching woody vegetation and help control weeds. Haying also provides the benefit of thatch removal. The refuge establishes seasonal restrictions on mowing and haying to protect nesting grassland birds. In pastures where mechanical, cultural, and biological methods of weed management are not effective that the refuge may use approved herbicides. The refuge also restricts the use of herbicides to low-toxicity compounds that have the least potential to degrade environment quality and the least potential effect to native species and communities of fish, wildlife, plants, and their habitats.

The use of a cooperator to assist with pasture management by haying and providing weed control, allows the refuge to manage more pasture acreage than could be done by existing staff and equipment. The cooperator also removes 200 to 400 tons of hay, which reduces the amount of thatch present, and increases the amount of preferred forage by encouraging the growth of young shoots.

By conducting the haying and mowing program under the practices and stipulations described above, it is anticipated that wildlife species which could be adversely affected would find sufficient food resources and resting places so their abundance and use will not be measurably lessened on the refuge. Additionally, it is anticipated that monitoring, as needed, will prevent unacceptable or irreversible impacts to fish, wildlife, plants, and their habitats.

The combination of management practices and stipulations identified above will ensure that haying and mowing contributes to the enhancement, protection, conservation, and management of native wildlife populations and their habitats on the refuge. As a result, haying and mowing contributes to achieving refuge purpose(s); contributes to the Mission of the NWRS; and helps maintain the biological integrity, diversity, and environmental health of the refuge.

Mandatory 10- or 15-year Reevaluation Date: (provide month and year for "allowed" uses):

________Mandatory 15-year re-evaluation date (for wildlife-dependent public uses)
__9/2020 Mandatory 10-year reevaluation date (for all uses other than wildlife-dependent public uses)

References:

Alisauskas, R.T. and C.D. Ankney. 1992. The cost of egg laying and its relationship to nutritional reserves in waterfowl. Pages 30-61 *in* B.D.J. Batt, A.D. Afton, M.G. Anderson, C.D. Ankney, D.H. Johnson, J.A. Kadlec, and G.L. Krapu, eds. Ecology and management of breeding waterfowl. Univ. of Minnesota Press, Minneapolis.

Baldassare, G.A, and E.G. Bolen. 2006. Waterfowl ecology and management, 2nd edition. Krieger Publishing Company, Malabar, FL.

Raveling, D.G. 1979. The annual energy cycle of the Cackling Canada Goose. pages 81-93 *in* R.I. Jarvis and J.C. Bartonek, eds. Management and biology of Pacific Flyway geese. Oregon State University, Corvallis, OR.

USFWS. 1998. Recover Plan for the Threatened Nelson's Checkermallow (*Sidalcea nelsoniana*). Fish and Wildlife Service. Portland, OR. 38 pages.

Signatures:

Signatures for B7. Compatibility Determination for Haying and Mowing on Ridgefield National Wildlife Refuge. Uses are compatible with stipulations.

Prepared by: _______________ (Signature) 9/8/10 (Date)

Approved by Refuge Manager/ Project Leader: _______________ (Signature) 9/9/10 (Date)

Concurrence:

Refuge Supervisor: _______________ (Signature) 9-9-10 (Date)

Regional Chief, National Wildlife Refuge System: _______________ (Signature) 9/9/10 (Date)

B8. Compatibility Determination for Grazing on Ridgefield National Wildlife Refuge

Use: Grazing

Station Name: Ridgefield National Wildlife Refuge

Date Established: 1965

Establishing and Acquisition Authority(ies):

Migratory Bird Conservation Act of 1929, as amended (16 U.S.C. 715-715s)

Migratory Bird Hunting and Conservation Stamp Act of 1934 (16 U.S.C. 718-718j) [Funding for primary acquisition]

Refuge Purpose(s):

“... for use as an inviolate sanctuary, or for any other management purpose, for migratory birds.” 16 U.S.C. § 715d (Migratory Bird Conservation Act)

"... to provide wintering habitat for dusky Canada goose and other waterfowl. Will also provide breeding and migration use and substantial public shooting in area. Estimated peak population: 125,000 ducks and 3,000 geese." (Migratory Bird Conservation Commission Memorandum Number 1, May 18, 1965.)

National Wildlife Refuge System Mission:

The mission of the 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.

Description of Use:

The refuge manages pastures, wetlands, and agricultural fields to provide a variety of foods that will meet the needs of wintering and migratory waterfowl and cranes. Geese in particular, use refuge pastures for most of their foraging activity, preferring young shoots that are higher in protein and lower in fiber than mature stems (McLandis and Raveling 1981). Pasture grasses serve as an important source of amino acids and carbohydrates to meet the energy and nutrient requirements of geese (Baldassare and Bolen 2006). To provide high quality forage for wintering and migrating geese and cranes, the refuge uses grazing to ensure that young shoots less than 6 inches tall are available by early October each year and to reduce the accumulation of thatch (thatch can reduce the number of available shoots). Other tools used by the refuge include mowing and haying, which are discussed in detail in a separate compatibility determination.

The refuge provides approximately 1,450 acres of pasture in 55 fields. Of these, approximately 490 ac (193 cattle and horses, combined) were grazed in 2009 to help achieve refuge goals. Grazing by cattle and/or horses is allowed in fields between May 1 and October 1, subject to approval by the refuge biologist and manager, and only after surveys conducted by refuge staff indicate that introducing livestock to an area will not significantly affect grassland nesting birds. Stock is removed when the vegetation height is <6 inches over 90% of the pasture. Depending on rainfall and vegetation growth, grazing may occur more than once in a pasture as necessary to achieve habitat goals. By early October, pastures should contain dense (>90% areal coverage) of short (<6 inches tall) grasses and clovers, with <20% coverage of invasive weeds (Himalayan blackberry, Canada thistle, tansy ragwort, etc.) to provide suitable wintering and migratory goose habitat.

Cooperative Land Management Agreements (CLMAs) are used to implement cooperative farming, grazing, and haying programs that help achieve refuge purposes. The CLMA, signed in 2009, described the negotiated agreement between the Refuge and a private farmer to manage lands for both parties. The cooperator is responsible for pasture management, weed control, and installing and maintaining fencing. The refuge installs the underground water delivery system, maintains pumps, supplies fencing materials, and constructs and maintains access roads. The cooperator is allowed to harvest hay and raise stock animals for personal use. The amount of stock grazed on the Refuge varies, but 120 to 250 cows and horses (combined) are allowed to graze on approximately 740 acres, but not all acres will be grazed each year.

Availability of Resources:

Refuge staff and equipment are required to manage pasture land and support the CLMA program. The refuge manager and wildlife biologist would be required to design the grazing program each year. The refuge manager also negotiates an agreement with the cooperator. The refuge equipment operator and tractor operators would be required maintain access roads and water delivery systems pursuant to any cooperative agreements. As stated above, the cooperator would manage pasture lands, install and maintain fences, and ensure that the pasture meets the refuge habitat goals for migrating and wintering geese and cranes (dense young grasses, <6 inches tall and <20% weed cover) by October 1 each year.

The use of cooperators facilitates the management of pastures by reducing the amount of mowing and thatch removal that would otherwise require additional staff time and equipment not currently available. Thatch reduction by mowing alone, is limited by the slow rates of thatch decomposition relative to growth rates, high water table in many wetlands that precludes mowing and discing for much of the year, and the complexity of using prescribed fire in a region with air quality concerns. The removal of vegetation by grazing, results in thatch reduction and in improved availability of young shoots that provide high quality forage for wintering geese. The use of cooperators has proven to be a cost-effective means of managing specific pastures for wintering geese and cranes and helping the Refuge provide high quality habitat.

Costs to Administer and Manage Farming Programs at the Refuge under the Preferred Alternative (Alternative 2)

Activity or Project	One Time Expenses ($)	Recurring Expenses ($/year)
Enhance/Maintain Improved Pasture for Dusky Canada Geese		89,500
Enhance/Maintain Improved Pasture for Other Canada Geese and Waterfowl		179,000
Maintain Old Fields and Old Field/Wetland Borders		25,400
Provide Crops for Waterfowl and Sandhill Cranes		76,500 – 104,500
Enhance/Maintain Improved Pasture for Waterfowl. 3yr	208,000	

Activity or Project	One Time Expenses ($)	Recurring Expenses ($/year)
Upland Restoration Project		
Develop Irrigated Farming to Provide Crops for Waterfowl and Sandhill Cranes.	204,600	
Totals	412,600	370,400 – 398,400

Anticipated Impacts of Use:

The Refuge was established in part to provide habitat for wintering geese, especially the dusky Canada goose subspecies. As cropland in the lower Columbia River is converted to residential and commercial land cover types, agricultural lands suitable for wintering waterfowl and crane use are declining. Invasive pasture weeds such as Italian thistle and tansy ragwort further degrade the ability of existing pasture to support wintering geese. Managing existing pastures on Refuge lands to provide high quality forage is becoming increasingly important and the Refuge's farming program is designed to provide areas of high-energy grain crops and green forage grasses to meet the needs of wintering waterfowl and cranes and reduce crop depredation in nearby agricultural lands. Managed pastures also provide wintering habitat for a variety of migratory bird species including western meadowlark, rough-legged hawk, and short-eared owl.

In the absence of disturbance, refuge grasslands would revert to shrublands or woodlands that do not supply appropriate habitat for wintering and migratory geese. Historically, grasslands would have been maintained through disturbances such as grazing, wildfire, and scouring (in areas where rivers flooded with sufficient energy to remove thatch and plant litter). Grazing by livestock simulates some of the effects of natural disturbances by removing woody vegetation, reducing thatch, and encouraging the production of young shoots which are preferred forage for Canada and cackling geese (Raveling 1979).

Grazing has been demonstrated to impact various grassland birds, nesting waterfowl, and small mammals (Fleischner 1994). Not only are these species subject to injury and mortality from trampling, but the conversion of tall pasture grasses to short-cropped grasses results in habitat loss for some species. The Refuge reduces impacts of pasture management by limiting grazing operations to <10% of available lands and restricting the introduction of cattle during the breeding season in areas where significant impacts to grassland nesting birds would occur.

Invasive species may be spread by moving animals and equipment from site to site. These species may also become established where soils and existing plant cover is disturbed. The refuge equipment operators are required to clean equipment before moving between fields to reduce the spread of seeds and plant parts. Weed control measures are conducted prior to introducing livestock into pastures to reduce the likelihood of spreading invasive plant seeds.

The refuge will continue to monitor pasture lands for invasive weeds and will maintain an aggressive approach to invasive plant control and restoring sites to vegetation with high wildlife value. In addition, the refuge will continue to work with the County Weed Board to prevent, identify, and eradicate new infestations.

Threatened and Endangered Species

Within the River 'S' and Bachelor Island Units, the Service has established populations of the Federally-listed threatened Nelson's checkermallow by planting individual seedlings in managed pastures. Areas where this plant has been planted will not be grazed and will only be mowed after the checkermallow plants have entered senescence to prevent the encroachment of competing weeds and woody vegetation pursuant to the Recovery Plan (USFWS 1998). If necessary, weed control will be accomplished by hand-pulling (preferred, if practicable) or spot-treatment with pursuant herbicides, as specified in the refuge's IPM program description (Appendix K). The Refuge has performed an intra-service consultation pursuant to the Section 7 of the Endangered Species Act (87 Stat. 884, as amended; 16 U.S.C. 1531 et seq.) regarding the proposed use and Nelson's checkermallow.

Public Review and Comment:

This determination was issued for public review and comment as part of the Ridgefield NWR Draft Comprehensive Conservation Plan and Environmental Assessment (DCCP/EA). The plan and associated compatibility determinations were also provided as CDs to a mailing list of 432 recipients, and were made available on the FWS Region 1 Planning website. Printed copies of the DCCP/EA were available upon request. The 30-day review occurred from June 16 through July 16, 2010. We did not receive specific comments regarding the compatibility determinations, and no changes have been made at this time.

Determination (check one below):

_____ Use is Not Compatible

__x__ Use is Compatible with Following Stipulations

Stipulations Necessary to Ensure Compatibility:

The following stipulations ensure that the proposed use is compatible:

- Grazing will only occur between May 1 and October 1 and only in areas where refuge staff have determined that significant impacts to grassland nesting birds will not occur.

- In portions of fields where Nelson's checkermallow was planted, grazing will not be permitted.

- Weeds will be controlled in accordance with the refuge's IPM program using methods such as crop rotation, mechanical treatment, biological controls, and low toxicity approved pesticides (Appendix K).

- Pesticide use must be in compliance with the Service policy requirements for completing an approved Pesticide Use Proposal, and it must meet other State and Federal requirements.

- Cooperators will only apply herbicides with prior refuge approval and will provide a record of herbicides used including chemical name, amount used, date, location, and how applied.

- Pursuant to the refuge's CLMA, Cooperators will provide an annual record of animals grazed on, and plant products removed from, the Refuge.

- The refuge will continue to cooperate with the County Weed Board to control county-listed invasive weeds.

Justification:

The refuge uses grazing as a tool to achieve specific habitat objectives for wintering and migrating waterfowl (specifically Canada and cackling geese) and cranes. These species prefer young shoots that are higher in protein and carbohydrates to meet their energy and nutrient requirements. They also prefer to forage and rest in areas with good visibility to better detect predators, such as coyotes. Grazing reduces residual thatch, and tall vegetation thus enhancing visibility. This method also removes encroaching woody vegetation and helps control weeds by preventing seed production in species such as reed canarygrass. The refuge establishes restrictions on grazing to protect nesting grassland birds by only allowing grazing to occur in areas where impacts to nesting grassland birds are not significant.

In pastures where mechanical, cultural, and biological methods of weed management are not effective that the refuge may use approved herbicides. The refuge also restricts the use of herbicides to low-toxicity compounds that have the least potential to degrade environment quality and the least potential effect to native species and communities of fish, wildlife, plants, and their habitats.

The use of a cooperator to assist with pasture management by grazing, haying, and providing weed control, allows the refuge to manage more pasture acreage than could be done by existing staff and equipment. Also, because grazing results in thatch removal and stimulates shoot growth more than mowing, the refuge (and migratory and wintering geese and cranes) benefits from the increased habitat quality.

By conducting the grazing program under the practices and stipulations described above, it is anticipated that wildlife species which could be adversely affected would find sufficient food resources and resting places so their abundance and use will not be measurably lessened on the refuge. Additionally, it is anticipated that monitoring, as needed, will prevent unacceptable or irreversible impacts to fish, wildlife, plants, and their habitats.

The combination of management practices and stipulations identified above will ensure that grazing contributes to the enhancement, protection, conservation, and management of native wildlife populations and their habitats on the refuge. As a result, grazing contributes to achieving refuge purpose(s); contributes to the Mission of the NWRS; and helps maintain the biological integrity, diversity, and environmental health of the refuge.

Mandatory 10- or 15-year Reevaluation Date: (provide month and year for "allowed" uses):

_____ Mandatory 15-year re-evaluation date (for wildlife-dependent public uses)
9/2020 Mandatory 10-year reevaluation date (for all uses other than wildlife-dependent public uses)

References:

Alisauskas, R.T. and C.D. Ankney. 1992. The cost of egg laying and its relationship to nutritional reserves in waterfowl. Pages 30-61 *in* B.D.J. Batt, A.D. Afton, M.G. Anderson, C.D. Ankney, D.H. Johnson, J.A. Kadlec, and G.L. Krapu, eds. Ecology and management of breeding waterfowl. Univ. of Minnesota Press, Minneapolis.

Baldassare, G.A, and E.G. Bolen. 2006. Waterfowl ecology and management, 2^{nd} edition. Krieger Publishing Company, Malabar, Florida.
Fleischner, T.L. 1994. Ecological costs of livestock grazing in western North America. Conservation Biology 8(3): 629-644

Raveling, D.G. 1979. The annual energy cycle of the Cackling Canada Goose. pages 81-93 *in* R.I. Jarvis and J.C. Bartonek, eds. Management and biology of Pacific Flyway geese. Oregon State University, Corvallis.

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Signatures:

Signatures for B8. Compatibility Determination for Grazing on Ridgefield National Wildlife Refuge. Use is compatible with stipulations.

Prepared by:	(Signature)	9/8/10 (Date)
Approved by Refuge Manager/ Project Leader:	(Signature)	9/9/10 (Date)

Concurrence:

Refuge Supervisor:	Rob J. West (Signature)	9-9-10 (Date)
Regional Chief, National Wildlife Refuge System:	Carolyn A. Bohan (Signature)	9/9/10 (Date)

B9. Compatibility Determination for Research on Ridgefield National Wildlife Refuge

Use: Research

Refuge Name: Ridgefield National Wildlife Refuge

Establishing and Acquisition Authorities:

- Migratory Bird Conservation Act of 1929, as amended (16 U.S.C. 715-715s)
- Migratory Bird Hunting and Conservation Stamp Act of 1934 (16 U.S.C. 718-718j) [Funding for primary acquisition]

Refuge Purposes:

"... for use as an inviolate sanctuary, or for any other management purpose, for migratory birds." 16 U.S.C. § 715d (Migratory Bird Conservation Act)

"... to provide wintering habitat for dusky Canada goose and other waterfowl. Will also provide breeding and migration use and substantial public shooting in area. Estimated peak population: 125,000 ducks and 3,000 geese." (Migratory Bird Conservation Commission Memorandum Number 1, May 18, 1965.)

National Wildlife Refuge System Mission

The mission of the 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.

Description of Use

The Refuge receives periodic requests (less than six per year) to conduct scientific research. Priority would be given to studies that support refuge purposes, goals and objectives. This would include, for example, studies that contribute to the enhancement, protection, use, preservation, and management of native Refuge wildlife populations and their habitats. The refuge receives an annual request to monitor and collect mosquito larvae from Clark County. This action is discussed in a separate compatibility determination. Research applicants must submit a proposal that would outline: 1) objectives of the study; 2) justification for the study; 3) detailed methodology and schedule; 4) potential impacts on Refuge wildlife and/or habitat, including disturbance (short and long term), injury, or mortality; 5) personnel required; 6) costs to Refuge, if any; and 7) end products (i.e. reports, publications). Research proposals would be reviewed by Refuge staff, Regional Office Branch of Refuge Biology, and others as appropriate. Evaluation criteria will include, but not be limited to, the following: 1) Research that will contribute to management will have higher priority than other requests. 2) Research that will conflict with higher priority research, monitoring or management programs may not be granted. 3) Research projects that can be done elsewhere off-Refuge, and outside wilderness, are less likely to be approved. 4) Research which causes undue disturbance or is intrusive, will likely not be granted. Level and type of disturbance will be carefully weighed when evaluating a request. 5) Research evaluation will determine if any effort has been made to minimize disturbance through study design, including considering adjusting location, timing, scope, number of permittees, study methods, number of study sites, etc. 6) If staffing or logistics make it impossible for the Refuge to monitor researcher activity in a sensitive area, this may be reason to deny the request. 7) The length of the project will be considered and agreed upon before approval. Projects will not be open-ended, and at a minimum, will be reviewed annually.

Availability of resources: Direct costs to administer research activities are primarily in the form of staff time, transportation, and equipment acquisition and maintenance. It is estimated that the following level of involvement by Refuge staff will be required annually to adequately manage and monitor research activities over the long term.

Costs to Administer and Manage Research Program at the Refuge.		
Activity or Project	**One Time Expenses ($)**	**Recurring Expenses ($/year)**
Staff assistance to Researcher (i.e. permit initiation, review and administrative support and compliance)		10,000
Totals		10,000

Anticipated Impacts of the Use

Impacts would be project- and site-specific, where they will vary depending upon nature and scope of the field work. Data collection techniques will generally have minimal animal mortality or disturbance, habitat destruction, no introduction of contaminants, or no introduction of non-indigenous species. In contrast, projects involving the collection of biotic samples (plants or animals) or requiring intensive ground-based data or sample collection will have short-term impacts. To reduce impacts, the minimum number of samples (e.g., water, soils, vegetative litter, plants, macroinvertebrates, and vertebrates) will be collected for identification and/or experimentation and statistical analysis. Where possible, researchers would coordinate and share collections to reduce sampling needed for multiple projects.

There also could be localized and temporary effects from vegetation trampling, collecting of soil and plant samples, or trapping and handling of wildlife. Impacts may also occur from infrastructure necessary to support a projects (e.g., permanent transects or plot markers, exclosure devices, monitoring equipment, solar panels to power unattended monitoring equipment). Some level of disturbance is expected with these projects, especially if investigator(s) enter areas closed to the public and collect samples or handle wildlife. However, wildlife disturbance (including altered behavior) will usually be localized and temporary in nature. Where long-term or cumulative unacceptable effects cannot be avoidable, the project will be found not compatible. Project proposals will be reviewed by refuge staff and others, as needed, to assess the potential impacts (short, long-term, and cumulative) relative to benefits of the investigation to refuge management issues and understanding of natural systems.

Spread of invasive plants and/or pathogens is possible from ground disturbance and/or transportation of project equipment and personnel, but it will be minimized or eliminated by requiring proper cleaning of investigator equipment and clothing as well as quarantine methods, where necessary. If after all practical measures are taken and unacceptable spread of invasive species is anticipated to occur, then the project will be found not compatible without a restoration or mitigation plan.

Public Review and Comment:

This determination was issued for public review and comment as part of the Ridgefield NWR Draft Comprehensive Conservation Plan and Environmental Assessment (DCCP/EA). The plan and associated compatibility determinations were also provided as CDs to a mailing list of 432 recipients, and were made available on the FWS Region 1 Planning website. Printed copies of the DCCP/EA were available upon request. The 30-day review occurred from June 16 through July 16, 2010. We did not receive specific comments regarding the compatibility determinations, and no changes have been made at this time.

Determination

______The use is not compatible.
__X__The use is compatible with the following stipulations.

Stipulations Necessary to Ensure Compatibility

If the proposed research methods would impact or potentially impact refuge resources (habitat or wildlife), it must be demonstrated that the research is and the researcher must identify the issues in advance of the impact. Highly intrusive or manipulative research is generally not permitted in order to protect native plant and wildlife populations. Potential researchers must submit a written study proposal with their request. In addition the following must be met:

- Researchers are responsible for acquiring and/or renewing any necessary State and Federal permits prior to beginning or continuing their project.

- Research will adhere to current species protocols for data collection.

- Approved research projects will be conducted under a refuge-issued special use permit which will have additional project-specific stipulations.

- Special use permits will be valid for one year only. Renewals will be subject to refuge manager review of research data, status reports, and compliance with compatibility determination and permit stipulations, and permits.

- Refuge Manager can suspend/modify conditions/terminate on-refuge research that is already permitted and in progress, should unacceptable impacts or issues arise or be noted.

- Investigator(s) obtaining required State, and/or Federal collecting permits will also ensure minimal impacts to fish, wildlife, plants, and their habitats. If after incorporating the above strategies, projects will not be compatible if they will result in long-term or cumulative effects. A Section 7 consultation under the Endangered Species Act (16 U.S.C. 1531-1544, 87 Stat. 884, as amended Public Law 93-205) will be required for activities that may affect a federally listed species and/or critical habitat. Only projects which have no effect or will result in not likely to adversely affect determinations will be considered compatible.

- At least 6 months before initiation of field work (unless an exception is made by prior approval of the Refuge Manager), project investigator(s) must submit a detailed proposal using an approved format. Project proposals will be reviewed by refuge staff and others, as needed, to assess the potential impacts (short, long-term, and cumulative) relative to benefits of the investigation to refuge management issues and understanding of natural systems. This assessment will form the primary basis for allowing or denying a specific project. Projects which result in unacceptable refuge impacts will not be found compatible. If allowed and found compatible after approval, all projects also will be assessed during implementation to ensure impacts and conflicts remain within acceptable levels.

- If the proposal is approved, then the Refuge Manager will issue a SUP(s) with required stipulations (terms and conditions) of the project to avoid and/or minimize potential impacts to refuge resources as well as conflicts with other public-use activities and refuge field management operations. After approval, projects also are monitored during implementation to ensure impacts and conflicts remain within acceptable levels based upon documented stipulations.

Justification

Use of the refuge to conduct research, scientific collecting, and surveys will generally provide information that would benefit fish, wildlife, plants, and their habitats. Scientific findings gained through these projects provide important information regarding life-history needs of species and species groups as well as identify or refine management actions to achieve resource management objectives in refuge management plans (especially CCPs). Reducing uncertainty regarding wildlife and habitat responses to refuge management actions in order to achieve desired outcomes reflected in resource management objectives is essential for adaptive management in accordance with 522 DM 1.

Research, scientific collecting, and surveys on refuge lands are inherently valuable to the Service because they will expand scientific information available for resource management decisions. In addition, only projects which directly or indirectly contribute to the enhancement, protection, use, preservation, and management of refuge wildlife populations and their habitats generally will be authorized on refuge lands. In many cases, if it were not for the refuge staff providing access to refuge lands and waters along with some support, the project would never occur and less scientific information would be available to the Service to aid in managing and conserving the refuge resources. By allowing the use to occur under the stipulations described above, it is anticipated that wildlife species which could be disturbed during the use would find sufficient food resources and resting places so their abundance and use will not be measurably lessened on the refuge. Additionally, it is anticipated that monitoring, as needed, will prevent unacceptable or irreversible impacts to fish, wildlife, plants, and their habitats.

The combination of stipulations identified above and conditions included in any SUP(s) will ensure that proposed projects contribute to the enhancement, protection, conservation, and management of native wildlife populations and their habitats on the refuge. As a result, these projects will help fulfill refuge purpose(s); contribute to the Mission of the NWRS; and maintain the biological integrity, diversity, and environmental health of the refuge.

Mandatory 10- or 15-year Reevaluation Date: (provide month and year for "allowed" uses):

______ _ Mandatory 15-year re-evaluation date (for wildlife-dependent public uses)

__9/2020__ Mandatory 10-year reevaluation date (for all uses other than wildlife-dependent public uses)

Signatures:

Signatures for B9. Compatibility Determination for Research on Ridgefield National Wildlife Refuge. Use is compatible with stipulations.

Prepared by: ______ 9/8/10
(Signature) (Date)

Approved by Refuge Manager/ Project Leader: ______ 9/9/10
(Signature) (Date)

Concurrence:

Refuge Supervisor: ______ 9-9-10
(Signature) (Date)

Regional Chief, National Wildlife Refuge System: ______ 9/9/10
(Signature) (Date)

B10. Compatibility Determination for Mosquito and Disease Vector Management on Ridgefield National Wildlife Refuge

Use: Mosquito and Disease Vector Management

Station Name: Ridgefield National Wildlife Refuge

Date Established: 1965

Establishing and Acquisition Authority(ies):

Migratory Bird Conservation Act of 1929, as amended (16 U.S.C. 715-715s)

Migratory Bird Hunting and Conservation Stamp Act of 1934 (16 U.S.C. 718-718j) [Funding for primary acquisition]

Refuge Purpose(s):

"... for use as an inviolate sanctuary, or for any other management purpose, for migratory birds." 16 U.S.C. § 715d (Migratory Bird Conservation Act)

"... to provide wintering habitat for dusky Canada goose and other waterfowl. Will also provide breeding and migration use and substantial public shooting in area. Estimated peak population: 125,000 ducks and 3,000 geese." (Migratory Bird Conservation Commission Memorandum Number 1, May 18, 1965.)

National Wildlife Refuge System Mission:

The mission of the 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.

Description of Use:

With the spread of mosquito-borne diseases across the country, National Wildlife Refuges have come under increasing pressure to manage mosquito populations that are bred or harbored within refuge boundaries. The Director of the Service has produced Interim Guidance for refuges (USFWS 2005) until the Service policy document is finalized. The refuge will adhere to the Director's interim guidance and our mosquito management program will follow the response matrix presented in Table 1.

The refuge in cooperation with Clark County Mosquito Control District (District) proposes to monitor and control larval mosquito species that have the potential to serve as disease vectors that may affect public health, adjacent to portions of the refuge. Monitoring generally takes place between early April and late September, by which time most of the seasonally-flooded wetland areas are too dry to support large numbers of mosquito larvae.

The District staff proposes to monitor and control mosquito larvae with *Bacillus thuringiensis* var. *israelensis*, which is frequently referred to as *B.t.i.* [EPA Registration No. 73049-10]) when established thresholds are exceeded as indicated through monitoring. Monitoring and larval treatments will be restricted to shallowly flooded (<8 inches) vegetation that represent mosquito breeding habitat. In 2004 through 2009, the following specific areas (956 acres) on the refuge were monitored for potential treatment: portions of the Carty Unit, the southern portion of the Ridgefield Dairy Unit near Post Office Lake, and a small area at the north edge of the River 'S' Unit (Figure 1). Approximately 18% of the refuge area was monitored for potential mosquito treatment. However, only a small portion of the monitoring area would be treated in a given year (see below). An additional 2,970 acres are currently monitored but are not treated because of high water levels or sensitive waterbodies. These areas are subject to change depending on monitoring results or new information on the occurrence of sensitive resources. To protect sensitive wildlife resources such as eagle nests and heron rookeries and reduce the spread of invasive plant species, sampling periods and frequency as well as type of access (4wd vehicle, ATV, foot traffic only) will be determined by the refuge in late winter/early spring. Because the locations of sensitive resources (e.g., bald eagle nests, heron rookeries, and listed species occurrences) may change over time, the refuge will establish sampling and treatment stipulations on an annual basis through the Special Use Permit (SUP) process described in 5 RM 17.

The District also monitors adult mosquito populations from May to September using dry ice traps, one each in the Carty and Roth Units, as part of the county-wide surveillance for the presence of mosquito borne-diseases. Common species collected include *Aedes vexans, Amopheles punctipennis, Anopheles freeborni, Culex pipiens, Culex incidens*, *Culex tarsalis,* and *Ochlerotatus sticticus*.

The current protocol for southwest Washington mosquito control districts when monitoring wetlands for mosquito larvae is to treat with the larvicide *B.t.i.* when the larvae reach established threshold levels**.** The current treatment threshold used by the District is five mosquito larvae per dip net sample. On other national wildlife refuges, threshold levels used by mosquito control districts range from 1 to 15 larvae per dip, with an average of five (M. Higgins 2002, Pers. Comm.).

Mosquito larvae numbers within the refuge are affected by a number of factors such as weather conditions, precipitation, and time of year. The primary factor contributing to the production of the mosquitoes, however, is the water level fluctuation along shorelines, where mosquitoes lay their eggs and subsequently hatch. Water fluctuations are primarily due to precipitation, tidal influences, and refuge water management activities. Due to the uncertainty of the water levels resulting from the above factors, and subsequent mosquito hatches, the total amount of larvicide to be used, and the times, dates, and exact locations of application (magnitude and frequency) cannot be predicted. In some cases, certain areas may need repeated treatments.

The refuge and the District established larval abundance thresholds through the Special Use Permit process to protect public health and reduce impacts to fish and wildlife populations. If mosquito larvae dip numbers reach threshold levels (currently, 5 larvae/dip), District staff request approval from the Refuge Manager to apply *B.t.i*, at a rate of 2.5 to 5 lbs/ac. District staff estimates that *B.t.i*. treatment of areas described above would generally take 2 to 6 hours, and it would be done as soon as possible after threshold levels are exceeded.

B.t.i. is a selective microbial insecticide targeting mosquito larvae; however, studies during the mid-1990s in the Midwest (Hershey el al. 1998) had found that other Dipteran species (flies) can also be impacted, including chironomids, an important fish and wildlife food source. *B.t.i.* has practically no acute or chronic toxicity to mammals, fish, birds, or vegetation (USEPA 1998). *B.t.i.* produces protein endo-toxins that, when ingested by the susceptible insect, cause paralysis of cells in the gut, interfering with normal digestion and feeding. As proposed, *B.t.i* may be applied (2.5 to 5 lbs pounds/acre) as often as once every two to three weeks depending on larval mosquito populations. The bacteria are grown on high-protein bases (fishmeal, soy flour), which are then formulated onto corncob pellets enabling it to be broadcast over the treatment area by a hand-held or all terrain vehicle-mounted spreader.

All applications are required to be reported to the refuge and included in an annual report submitted to the refuge from the District. The areal extent of treatments and frequency of treatments is likely to vary annually in response to water levels, weather conditions, and larvae distribution. In 2007, for example, the District treated a 9.25 ac of wetlands and no site was treated more than 3 times during the season. In 2008, the Columbia River reached an elevation of 15 feet (approximately 1 foot below flood stage) and 58 acres were treated with larvicide.

In accordance with the 2005 Interim Mosquito Management Policy and the response matrix (Table 1), the Service may also permit the use of approved adulticides and/or pupacides on refuge lands in response to a declaration of a human health threat or emergency by a Federal, State or local public health agency (see Table 1). A health emergency indicates an imminent risk of serious human disease or death, or an imminent risk to populations of wildlife or domestic animals. A health emergency represents the highest level of mosquito-associated health threats. Health emergencies will be determined by Federal, State, or local public health authorities and documented with local and current mosquito population and disease monitoring data. With the exception of vaccines to protect horses against West Nile virus and western equine encephalomyelitis, there are no vaccines that provide specific protection against these diseases. Mosquito control is the only practicable method currently available to protect the public from these diseases.

To date, the refuge staff has not needed to permit the application of pupacides or adulticides, and all adult sampling tests for West Nile Virus were negative. Clark County does not currently use pupacides (such as methoprene), although, adulticides have been applied in Clark County to control nuisance mosquitoes. As per the Director's guidance, the refuge does not permit the treatment of nuisance mosquitoes on refuge lands. In 2007, the District applied 1,390 gallons of Anvil 2+2 (a synthetic pyrethroid) using a fogger system.

The refuge will continue to evaluate measures to control mosquitoes that pose a threat to human health while limiting the risk associated with the use of chemical control. Most of the mosquito-producing areas on the refuge are outside the levee system, and the refuge cannot manipulate water levels to effectively reduce larvae production in these areas. Water level manipulation is possible in portions of the River 'S' Unit where mosquito larvae have been found. In the event that a human health emergency is declared, and the use of adulticides is authorized, the refuge will work with the District to identify which portions of the refuge are supporting species of mosquitoes that may serve as disease vectors and reduce the treatment area to the extent practicable.

Why this Use is being Proposed:

On wetland habitats of the refuge, annual precipitation and Columbia River high water flows flood much of the bottomlands on the refuge. This water permeates the ground cover vegetation that provides vegetative debris as egg-laying sites for two major species of floodwater mosquitoes, *Aedes vexans* and *Ochlerotatus sticticus*. When high-water levels recede, the eggs hatch, larvae grow rapidly, and adults feed for two weeks or more until they breed, lay eggs, and then die. Under certain conditions the Refuge may provide suitable habitat for multiple hatches of mosquitoes in a single summer.

Arboviral (arthropod-borne viral) diseases are a potential concern. These include West Nile virus, western equine encephalitis and St. Louis encephalitis. The last reported human infection western equine encephalitis acquired in the state was in 1988. St. Louis encephalitis has been documented in the past, primarily east of the Cascade Mountains (Washington State Department of Health 2009).

Although West Nile virus was first documented in the eastern states, it has been moving west since that time. In the state of Washington, birds and horses have been confirmed with West Nile Virus (Duffy 2006, pers. comm.). During 2002, a common raven from Pend Oreille County tested positive for the virus, as well as one American crow from Thurston, Snohomish, and Pierce Counties, and two horses, one from Island County and one from Whatcom County. During 2005, a magpie and two horses were reported from Yakima County. In 2009, there were 36 human cases state-wide of West Nile virus. None of these reported cases were in Clark or Skamania Counties**.** The only known case of West Nile virus in Clark County was a single case in 2006 (Washington State Department of Health 2009). Moreover, less than 1 percent of humans who are exposed and infected with West Nile virus become seriously ill. The fatality rate of those who do develop serious illness is 3 to 15 percent. Most human infections of West Nile virus are asymptomatic or characterized by mild flu-like symptoms. The elderly and persons with compromised immune systems are more likely to develop severe illness (Ashe 2002).

Availability of Resources:

The District is responsible for staffing and expenditures for sampling and pesticide applications (mainly *B.t.i.*). Refuge staff resources are needed to review annual proposals, prepare SUPs, and monitor District personnel to ensure compliance.

Costs to Administer and Manage Vector Control Programs at the Refuge under the Preferred Alternative (Alternative 2)		
Activity or Project	**One Time Expenses ($)**	**Recurring Expenses ($/year)**
Development and issuance of SUP		$500.00
Totals		$500.00

Anticipated Impacts of Use:

This use has three principle, potential impacts on refuge lands, waters or interests: the disturbance of wildlife caused by the monitoring efforts and application of pesticides, the impacts on wildlife from the periodic elimination of mosquito larvae from the wetland community, and the impacts of pesticides on non-target organisms.

Impacts associated with disturbance of wildlife caused by the monitoring efforts

The disturbance of wildlife by District staff is minimized to the extent practicable by restricting access to sensitive areas and by controlling the type of access (4wd vehicle, ATV, or foot traffic). The impacts anticipated from the logistical activities resulting from the proposed monitoring and treatment actions on wildlife are minimal. One or two Control Board employees using an all-terrain vehicle (ATV) would conduct these activities and would be restricted to refuge service roads and a minimum of trails. By using an all-terrain vehicle to access the area, the District reduces the number of trips needed on foot for monitoring and treatment, thereby, reducing disturbance to wildlife. The speed limit for the District staff using ATVs is restricted to 5 miles per hour. Monitoring activities would occur once a week, and take approximately 2-6 hours. Subsequent treatments, if necessary, would occur as soon as possible after monitoring activities and take an estimated 4 hours (Williams 2006). These activities cause short-term and temporary disturbance to wildlife. In the event of an identified public health threat or emergency (e.g., West Nile Virus) by the Washington State Public Health Agency, the data from these monitoring efforts would be used by the refuge for determining an appropriate course of action.

Impacts associated with application of pesticides

Where necessary and in accordance with the response matrix (Table 1), pesticides (larvicides, pupacides, and adulticides) would only be used on refuge lands for mosquito control after approval of a pesticide use propose (PUP). The Service's Pest Control policy (7 RM 14) requires preparation and approval of a PUP before pesticides can be applied on refuge lands. In general, proposed pesticide uses on refuge lands would only be approved where there would likely be minor, temporary, or localized effects to fish and wildlife species as well as minimal potential to degrade environmental quality. Potential effects to listed and non-listed species would be evaluated with quantitative ecological risk assessments and other screening measures. Potential effects to environmental quality would be based upon pesticide characteristics of environmental fate (water solubility, soil mobility, soil persistence, and volatilization) and other quantitative screening tools. Ecological risk assessments as well as characteristics of environmental fate and potential to degrade environmental quality for pesticides would be documented in Chemical Profiles (see Appendix K). These profiles would include threshold values for quantitative measures of ecological risk assessments and screening tools for environmental fate that represent minimal potential effects to species and environmental quality. In general, only pesticide uses with appropriate BMPs on refuge lands that would potentially have minor, temporary, or localized effects on refuge biological and environmental quality (threshold values not exceeded) would be approved. However, pesticides may be used on refuge lands where substantial effects to species and the environment are possible (exceed threshold values) in order to protect human health and safety (e.g., mosquito-borne disease).

The Service does not anticipate any short-term effects of the proposed use directly on non-target invertebrates or indirectly to fish. Tamayo et al. (2005) did not observe significant negative effects of *B.t.i.* applications on the invertebrate community at the south shoreline of Franz Lake National Wildlife Refuge (a nearby refuge within the Ridgefield National Wildlife Refuge Complex). Application of *B.t.i* for the study followed protocols identified by the Control Board for the proposed use and was conducted at the same location during periods of water elevations lower than 20 feet MSL.

Adulticides and pupacides have not been used for mosquito control on the refuge. The refuge will develop an IPM plan to manage mosquito populations. Based on adult mosquito control conducted in Clark County, pyrethroids such as Anvil are the most likely adulticides to be used to address a human health emergency. Pyrethroids are synthetic molecules that mimic natural pyrethrins that are extracted from plants in the chrysanthemum family. Pyrethroids are generally less toxic to terrestrial wildlife than other families of adulticides such as organophosphates. However, they are toxic to fish and aquatic invertebrates. The County has not used pupacides in recent years. Methoprene, a commonly-used pupacide, is an insect growth regulator that prevents pupae from metamorphosizing into adults. Methoprene has been found to be practically non-toxic to people and terrestrial vertebrates and minimal chronic and acute risk to fish, freshwater invertebrates (other than mosquitoes and closely-related chironomids), and estuarine species at the doses tested (USEPA 2001). Detailed mapping of areas where disease-carrying mosquitoes are present and the use of an ultra-low volume fogger will reduce the impacts to non-target organisms. Other practices to reduce impacts to non-target wildlife include application in the evening hours (when many insect pollinators are less active) and conducting applications when winds speeds are steady and low, and temperatures lower.

<u>Impacts on wildlife from the periodic elimination of mosquito larvae from the wetland community.</u>

The Service does not anticipate long-term impacts to result from the proposed use. Hershey *et al*. (1998) conducted a six-year study on 27 wetlands in Wright County, Minnesota, consisting of three years of pre-treatment sampling of aquatic invertebrates and other parameters, followed by three years of treatment with *B.t.i.*. Insect densities and diversity were reduced by 57 to 83 percent in the second and third years of treatment. During this study, 179 genera of aquatic insects were examined, with chironomids (primarily midges) representing about half of the insect genera present at the beginning of the study. By the end of the study, however, only one to six genera dominated the treatment sites. Adverse impacts were primarily observed in the invertebrate tribes Chironomini and Tantarsini. These tribes are ubiquitous and are represented in almost every wetland with chironomids. Although Hershey et al. (1998) found negative effects of *B.t.i.* on non-target invertebrates; this study is not applicable in the case of Ridgefield NWR for the following reasons:

1. Entire wetlands were treated with *B.t.i.* multiple times within and over several consecutive years in the Minnesota study. In contrast, the proposed maximum number of acres to be treated at Ridgefield 925 acres, which represents 18% of the total acres of the refuge. In practice, only about 15% of the maximum treatment area is impacted in a given year.

2. Because of fluctuating water levels changing the location of the shallow flooded shoreline, it is unlikely *B.t.i.* applications would occur in the same areas more than three times in a single year and most areas would receive a single application. Stipulations in the SUP will limit the number of applications in a specific location during one season.

The recently completed invertebrate and salmonid research along the south Franz Lake shoreline (Franz Lake NWR) has provided valuable information regarding the cumulative impacts of mosquito treatment and control measures that are applicable to the program at the refuge. The invertebrate study was conducted during the latter part of the application period (July–September) when lower Columbia River elevations eliminate the flows from the river through Arthur Lake to Franz Lake, representing minimal opportunity for an influx of new invertebrate communities. Furthermore, during the single treatment season of this study, stable water levels during July-September resulted in three applications of *B.t.i.* to the same locations. Consequently, it is unlikely there will be negative cumulative direct impact on the invertebrate community or indirectly on fish and wildlife.

During the two years of monitoring fish resources at Franz Lake NWR, 2,357 individuals were collected in six sampling locations. Of those, 121 salmon were collected, with one Chinook salmon and one coho salmon collected in the proposed treatment area during the treatment period (April through September). Because there were no impacts to non-target invertebrates from *B.t.i.* treatment, it is unlikely that other native fish would be impacted from applications.

Although mosquito larva were reduced from *B.t.i.* treatments, there were no significant differences in the over 40 taxa of invertebrates, with 50 percent of the taxa represented by other insects, which had been represented at shallow water sites where treatments would occur prior to treatment. Based on the results of the invertebrate survey, it would be expected that alternative prey would be available for native fishes (including salmonids), as well as other wildlife, that depend on larval or adult mosquitoes as forage. Consequently, the Service believes that the proposed monitoring and subsequent applications of *B.t.i.* would not have substantial short-term, long-term or cumulative impacts on refuge fish and wildlife resources.

Impacts to Biological Integrity, Diversity, and Environmental Health

Biological integrity, diversity, and environmental health can be simply defined as native fish, wildlife, plants, and their habitats as well as natural processes that support them. As described above, the impacts from larvicide application to most fish, wildlife, and plants will be temporary and localized. Mosquito populations which are part of the biological integrity, diversity, and environmental health of the refuge, will be impacted from control actions. However, these impacts will only occur on a maximum of 18% percent of the entire refuge in any given year. Although numbers of mosquitoes will be temporarily and locally reduced, there will likely be no long-term or cumulative effects to mosquitoes and the species that feed upon them at the refuge. As part of the refuge's mosquito management plan the refuge will assess the impacts of adulticide applications on biological integrity, diversity, an environmental health.

Public Review and Comment:

This determination was issued for public review and comment as part of the Ridgefield NWR Draft Comprehensive Conservation Plan and Environmental Assessment (DCCP/EA). The plan and associated compatibility determinations were also provided as CDs to a mailing list of 432 recipients, and were made available on the FWS Region 1 Planning website. Printed copies of the DCCP/EA were available upon request. The 30-day review occurred from June 16 through July 16, 2010. We did not receive specific comments regarding the compatibility determinations, and no changes have been made at this time.

Determination (check one below):

_____ Use is Not Compatible

__x__ Use is Compatible with Following Stipulations

Stipulations Necessary to Ensure Compatibility:

- The District must apply for and receive a SUP annually from the Refuge Manager. The permit will specify conditions including, but not limited to access restrictions, timing of applications, measures that will be required to limit the spread of invasive plants.
- Mosquito management will follow an IPM approach and any compatible cultural and/or mechanical control methods will be identified and implemented before chemical control is permitted.
- Larvae control is to be conducted only when the District determined that breeding in specific units is widespread.
- Only Service-approved pesticides may be applied on refuge wetlands and only after Pesticide Use Proposals have been approved.
- The District will contact the Refuge Manager at least one day in advance of each application. The Refuge Manager has final approval over all pesticide treatments.
- The District will notify the Refuge Manager in the event that virus activity is detected within or near the refuge and will work with the refuge to determine whether additional surveillance or control actions are necessary.
- The District must provide the Refuge Manager with a monthly report of all control activities on the refuge.
- The refuge may rescind this compatibility determination (CD) at any time based on future Service policy determinations or scientific studies of the effects of pesticides on the environment or non-target organisms.
- This CD will be reviewed when the Service finalizes its pending policy on mosquito management, and a new CD will be issued if this CD is not in full compliance with the new policy.

Justification:

Several suburban communities occur near the refuge within the flight range of adult mosquitoes (5-10 miles). Several species capable of transmitting diseases to people are present on the refuge, though the risk of transmission is generally low. The refuge's mosquito control program is consistent with the Service's 2005 Interim Mosquito Management Policy and will help manage nuisance mosquito population.

The Refuge will ensure that its mosquito management program is consistent with national policies for disease control. We will prepare a mosquito management plan that includes an IPM approach to adult mosquito control. We will work with the District to continue to identify new ways to use compatible mechanical and cultural control methods, reduce larvicide applications, and avoid impacts to sensitive resources.

In the event that compatible mechanical and cultural control methods are not effective or practicable, the use of the larvicide *B.t.i.* will help avoid ecologically significant impacts to non-target organisms and help the District avoid the need to apply adulticides which are generally more toxic to non-target organisms. For the following reasons, mosquito monitoring and *B.t.i.* treatments for control of mosquitoes on the Refuge will not materially interfere with or detract from fulfilling the NWRS mission or achieving Refuge purposes:

- Under the worst-case scenario a maximum of 18 % of the total Refuge acreage would be impacted by mosquito monitoring and treatment activities annually from April 1 through September 30.

- Results of the invertebrate *B.t.i.* study indicate that no impacts to non-target invertebrates were associated with three *B.t.i.* treatments for control of mosquito larva on the shallowly flooded south shoreline of Franz Lake NWR.

- Although mosquito larvae will be reduced from *B.t.i.* treatments, over 40 taxa of invertebrates, with 50 percent of the taxa represented by other insects, were found at shallow water sites (where treatments would occur) after treatment. Therefore, alternative prey is likely available for fish as well as other wildlife species.

- Monitoring and treatment activities will likely result in only temporary and localized disturbance to fish and wildlife.

- The localized and temporary impacts of the mosquito monitoring and treatments will be conducted in areas closed to public use and thus will likely not conflict with any wildlife-dependent public uses in the future. Wildlife-dependent uses include hunting, fishing, wildlife observation, wildlife photography, environmental education, and interpretation.

Mandatory 10- or 15-year Reevaluation Date: (provide month and year for "allowed" uses):

_________ Mandatory 15-year re-evaluation date (for wildlife-dependent public uses)

__9/2020__ Mandatory 10-year reevaluation date (for all uses other than wildlife-dependent public uses)

Table 1. Example of Mosquito-Borne Disease Health Threat and Response Matrix

Current Conditions		Threat Level	Refuge Response
Health Threat Category[1]	**Refuge Mosquito Populations**[2]		
No documented existing or historical health threat/ emergency	No action threshold	**1**	Remove/manage artificial mosquito breeding sites such as tires, tanks, or similar debris/containers. Allow compatible monitoring.
Documented historical health threat/emergency	Below action threshold	**2**	Response as in threat level 1, plus: evaluate compatible nonpesticide management options such as water level management and vegetation removal to reduce mosquito production.
	Above action threshold	**3**	Response as in threat level 2, plus: allow compatible site-specific larviciding of infested areas as determined by monitoring.
Documented existing health threat (specify multiple levels, if necessary; e.g., disease found in wildlife, disease found in mosquitoes, etc.)	Below action threshold	**4**	Response as in threat level 2, plus: increase monitoring and disease surveillance.
	Above action threshold	**5**	Response as in threat levels 3 and 4, plus: allow compatible site-specific larviciding, pupaciding, or adulticiding of infested areas as determined by monitoring data. Identify ways to minimize treatment area to avoid non-target effects
Officially determined existing health emergency	Below action threshold	**6**	Maximize monitoring and disease surveillance.
	Above action threshold	**7**	Response as in threat level 6, plus: allow site-specific larviciding, pupaciding, and adulticiding of infested areas as determined by monitoring.

[1] Health threat/emergency as determined by Federal and/or State/local public health or wildlife management authorities with jurisdiction inclusive of refuge boundaries and/or neighboring public health authorities.
[2] Action thresholds represent mosquito population levels that may require intervention measures. Thresholds will be developed in collaboration with Federal and/or State/local public health or wildlife management authorities and vector control districts. They must be species and life stage specific (see text).

Ridgefield National Wildlife Refuge
2004 Mosquito Treatment & Monitoring Areas

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Signatures:

Signatures for B10. Compatibility Determination for Mosquito and Disease Vector Management on Ridgefield National Wildlife Refuge. Use is compatible with stipulations.

Prepared by: ______________________ 9/8/10
(Signature) (Date)

Approved by Refuge Manager/ Project Leader: ______________________ 9/9/10
(Signature) (Date)

Concurrence:

Refuge Supervisor: ______________________ 9-9-10
(Signature) (Date)

Regional Chief, National Wildlife Refuge System: ______________________ 9/9/10
(Signature) (Date)

Appendix C. Wildlife and Plants of Ridgefield National Wildlife Refuge

Birds

Common Name	Scientific Name	Subspecies
Greater White-fronted Goose	*Anser albifrons*	
Emperor Goose	*Chen canagica*	
Snow Goose	*Chen caerulescens*	*caerulescens*
Ross's Goose	*Chen rossii*	
Brant	*Branta bernicla*	*nigricans*
Cackling Goose	*Branta hutchinsii*	*taverneri, minima, leucopareia*
Canada Goose	*Branta canadensis*	*moffitti, parvipes, occidentalis, fulva*
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*	
Tufted Duck	*Aythya fuligula*	
Greater Scaup	*Aythya marila*	
Lesser Scaup	*Aythya affinis*	
Surf Scoter	*Melanitta perspicillata*	
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*	
Ring-necked Pheasant	*Phasianus colchicus*	
Ruffed Grouse	*Bonasa umbellus*	*sabini*
California Quail	*Callipepla californica*	
Red-throated Loon	*Gavia stellata*	
Pacific Loon	*Gavia pacifica*	
Common Loon	*Gavia immer*	
Pied-billed Grebe	*Podilymbus podiceps*	
Horned Grebe	*Podiceps auritus*	

Common Name	Scientific Name	Subspecies
Red-necked Grebe	*Podiceps grisegena*	
Eared Grebe	*Podiceps nigricollis*	
Western Grebe	*Aechmophorus occidentalis*	
American White Pelican	*Pelecanus erythrorhynchos*	
Double-crested Cormorant	*Phalacrocorax auritus*	
American Bittern	*Botaurus lentiginosus*	
Great Blue Heron	*Ardea herodias*	
Great Egret	*Ardea alba*	
Snowy Egret	*Egretta thula*	
Cattle Egret	*Bubulcus ibis*	
Green Heron	*Butorides virescens*	
Black-crowned Night-Heron	*Nycticorax nycticorax*	
White-faced Ibis	*Plegadis chihi*	
Turkey Vulture	*Cathartes aura*	
Osprey	*Pandion haliaetus*	*carolinensis*
White-tailed Kite	*Elanus leucurus*	*majusculus*
Bald Eagle	*Haliaeetus leucocephalus*	
Northern Harrier	*Circus cyaneus*	
Sharp-shinned Hawk	*Accipiter striatus*	
Cooper's Hawk	*Accipiter cooperii*	
Northern Goshawk	*Accipiter gentilis*	
Red-shouldered Hawk	*Buteo lineatus*	*elegans*
Red-tailed Hawk	*Buteo jamaicensis*	*harlani, calurus*
Rough-legged Hawk	*Buteo lagopus*	
Golden Eagle	*Aquila chrysaetos*	
American Kestrel	*Falco sparverius*	*sparverius*
Merlin	*Falco columbarius*	*suckleyi, columbarius*
Peregrine Falcon	*Falco peregrinus*	*tundrius, pealei, anatum*
Prairie Falcon	*Falco mexicanus*	
Virginia Rail	*Rallus limicola*	
Sora	*Porzana carolina*	
American Coot	*Fulica americana*	
Sandhill Crane	*Grus canadensis*	*canadensis, tabida, rowani*
Black-bellied Plover	*Pluvialis squatarola*	
American Golden-Plover	*Pluvialis dominica*	
Pacific Golden-Plover	*Pluvialis fulva*	
Semipalmated Plover	*Charadrius semipalmatus*	
Killdeer	*Charadrius vociferus*	
Black-necked Stilt	*Himantopus mexicanus*	
American Avocet	*Recurvirostra americana*	
Greater Yellowlegs	*Tringa melanoleuca*	
Lesser Yellowlegs	*Tringa flavipes*	
Solitary Sandpiper	*Tringa solitaria*	
Spotted Sandpiper	*Actitis macularius*	
Whimbrel	*Numenius phaeopus*	
Long-billed Curlew	*Numenius americanus*	
Marbled Godwit	*Limosa fedoa*	

Common Name	Scientific Name	Subspecies
Red Knot	*Calidris canutus*	
Sanderling	*Calidris alba*	
Semipalmated Sandpiper	*Calidris pusilla*	
Western Sandpiper	*Calidris mauri*	
Least Sandpiper	*Calidris minutilla*	
Baird's Sandpiper	*Calidris bairdii*	
Pectoral Sandpiper	*Calidris melanotos*	
Sharp-tailed Sandpiper	*Calidris acuminata*	
Dunlin	*Calidris alpina*	
Stilt Sandpiper	*Micropalama himantopus*	
Buff-breasted Sandpiper	*Tryngites subruficollis*	
Ruff	*Philomachus pugnax*	
Short-billed Dowitcher	*Limnodromus griseus*	
Long-billed Dowitcher	*Limnodromus scolopaceus*	
Wilson's Snipe	*Gallinago delicata*	
Wilson's Phalarope	*Steganopus tricolor*	
Red-necked Phalarope	*Phalaropus lobatus*	
Red Phalarope	*Phalaropus fulicarius*	
Bonaparte's Gull	*Larus philadelphia*	
Mew Gull	*Larus canus*	
Ring-billed Gull	*Larus delawarensis*	
California Gull	*Larus californicus*	
Herring Gull	*Larus argentatus*	
Thayer's Gull	*Larus thayeri*	
Western Gull	*Larus occidentalis*	
Glaucous-winged Gull	*Larus glaucescens*	
Glaucous Gull	*Larus hyperboreus*	
Caspian Tern	*Sterna caspia*	
Forster's Tern	*Sterna forsteri*	
Black Tern	*Chlidonias niger*	
Rock Pigeon	*Columba livia*	
Band-tailed Pigeon	*Patagioenas fasciata*	*monilis*
Mourning Dove	*Zenaida macroura*	
Barn Owl	*Tyto alba*	
Western Screech-Owl	*Megascops kennicottii*	
Great Horned Owl	*Bubo virginianus*	
Northern Pygmy-Owl	*Glaucidium gnoma*	
Barred Owl	*Strix varia*	
Long-eared Owl	*Asio otus*	
Short-eared Owl	*Asio flammeus*	
Northern Saw-whet Owl	*Aegolius acadicus*	
Common Nighthawk	*Chordeiles minor*	*hesperis*
Black Swift	*Cypseloides niger*	
Vaux's Swift	*Chaetura vauxi*	
Black-chinned Hummingbird	*Archilochus alexandri*	
Anna's Hummingbird	*Calypte anna*	
Rufous Hummingbird	*Selasphorus rufus*	

Common Name	Scientific Name	Subspecies
Belted Kingfisher	*Ceryle alcyon*	
Lewis's Woodpecker	*Melanerpes lewis*	
Acorn Woodpecker	*Melanerpes formicivorus*	
Red-naped Sapsucker	*Sphyrapicus nuchalis*	
Red-breasted Sapsucker	*Sphyrapicus ruber*	*ruber*
Downy Woodpecker	*Picoides pubescens*	*gairdnerii*
Hairy Woodpecker	*Picoides villosus*	*harrisi*
Northern Flicker	*Colaptes auratus*	*cafer, auratus*, hybrid
Pileated Woodpecker	*Dryocopus pileatus*	*picinus*
Olive-sided Flycatcher	*Contopus cooperi*	
Western Wood-Pewee	*Contopus sordidulus*	
Willow Flycatcher	*Empidonax traillii*	*brewsteri*
Least Flycatcher	*Empidonax minimus*	
Hammond's Flycatcher	*Empidonax hammondii*	
Dusky Flycatcher	*Empidonax oberholseri*	
Pacific-slope Flycatcher	*Empidonax difficilis*	*difficilis*
Black Phoebe	*Sayornis nigricans*	
Say's Phoebe	*Sayornis saya*	
Vermilion Flycatcher	*Pyrocephalus rubinus*	
Western Kingbird	*Tyrannus verticalis*	
Loggerhead Shrike	*Lanius ludovicianus*	
Northern Shrike	*Lanius excubitor*	
Cassin's Vireo	*Vireo cassinii*	
Hutton's Vireo	*Vireo huttoni*	
Warbling Vireo	*Vireo gilvus*	
Red-eyed Vireo	*Vireo olivaceus*	
Steller's Jay	*Cyanocitta stelleri*	*stelleri*
Western Scrub-Jay	*Aphelocoma californica*	*immanis*
Black-billed Magpie	*Pica hudsonia*	
American Crow	*Corvus brachyrhynchos*	
Common Raven	*Corvus corax*	
Horned Lark	*Eremophila alpestris*	
Purple Martin	*Progne subis*	*arboricola*
Tree Swallow	*Tachycineta bicolor*	
Violet-green Swallow	*Tachycineta thalassina*	
N. Rough-winged Swallow	*Stelgidopteryx serripennis*	
Bank Swallow	*Riparia riparia*	
Cliff Swallow	*Petrochelidon pyrrhonota*	
Barn Swallow	*Hirundo rustica*	
Black-capped Chickadee	*Poecile atricapilla*	
Chestnut-backed Chickadee	*Poecile rufescens*	
Bushtit	*Psaltriparus minimus*	
Red-breasted Nuthatch	*Sitta canadensis*	
White-breasted Nuthatch	*Sitta carolinensis*	*aculeata*
Brown Creeper	*Certhia americana*	
Bewick's Wren	*Thryomanes bewickii*	
House Wren	*Troglodytes aedon*	

Common Name	**Scientific Name**	**Subspecies**
Winter Wren	*Troglodytes troglodytes*	
Marsh Wren	*Cistothorus palustris*	
Golden-crowned Kinglet	*Regulus satrapa*	
Ruby-crowned Kinglet	*Regulus calendula*	
Blue-gray Gnatcatcher	*Polioptila caerulea*	
Western Bluebird	*Sialia mexicana*	
Mountain Bluebird	*Sialia currucoides*	
Swainson's Thrush	*Catharus ustulatus*	*ustulatus* (breeding)
Hermit Thrush	*Catharus guttatus*	
American Robin	*Turdus migratorius*	
Varied Thrush	*Ixoreus naevius*	
European Starling	*Sturnus vulgaris*	
American Pipit	*Anthus rubescens*	
Cedar Waxwing	*Bombycilla cedrorum*	
Orange-crowned Warbler	*Vermivora celata*	
Nashville Warbler	*Vermivora ruficapilla*	
Yellow Warbler	*Dendroica petechia*	
Chestnut-sided Warbler	*Dendroica pensylvanica*	
Yellow-rumped Warbler	*Dendroica coronata*	
Black-throated Gray Warbler	*Dendroica nigrescens*	
Townsend's Warbler	*Dendroica townsendi*	
Palm Warbler	*Dendroica palmarum*	
Blackpoll Warbler	*Dendroica striata*	
Black-and-white Warbler	*Mniotilta varia*	
American Redstart	*Setophaga ruticilla*	
Northern Waterthrush	*Seiurus noveboracensis*	
MacGillivray's Warbler	*Oporornis tolmiei*	
Common Yellowthroat	*Geothlypis trichas*	
Wilson's Warbler	*Wilsonia pusilla*	
Yellow-breasted Chat	*Icteria virens*	
Western Tanager	*Piranga ludoviciana*	
Spotted Towhee	*Pipilo maculatus*	
American Tree Sparrow	*Spizella arborea*	
Clay-colored Sparrow	*Spizella pallida*	
Chipping Sparrow	*Spizella passerina*	
Vesper Sparrow	*Pooecetes gramineus*	
Savannah Sparrow	*Passerculus sandwichensis*	*brooksi* (breeding); *sandwichensis, anthinus*
Fox Sparrow	*Passerella iliaca*	
Song Sparrow	*Melospiza melodia*	*morphna* (breeding)
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*	

Common Name	Scientific Name	Subspecies
Lapland Longspur	*Calcarius lapponicus*	
Black-headed Grosbeak	*Pheucticus melanocephalus*	
Lazuli Bunting	*Passerina amoena*	
Red-winged Blackbird	*Agelaius phoeniceus*	
Western Meadowlark	*Sturnella neglecta*	
Yellow-headed Blackbird	*Xanthocephalus xanthocephalus*	
Rusty Blackbird	*Euphagus carolinus*	
Brewer's Blackbird	*Euphagus cyanocephalus*	
Brown-headed Cowbird	*Molothrus ater*	
Bullock's Oriole	*Icterus bullockii*	
Purple Finch	*Carpodacus purpureus*	
House Finch	*Carpodacus mexicanus*	
Red Crossbill	*Loxia curvirostra*	
Common Redpoll	*Carduelis flammea*	
Pine Siskin	*Carduelis pinus*	
Lesser Goldfinch	*Carduelis psaltria*	
American Goldfinch	*Carduelis tristis*	
Evening Grosbeak	*Coccothraustes vespertinus*	
House Sparrow	*Passer domesticus*	

Mammals

Common opossum*	*Didelphis virginiana*
Vagrant shrew	*Sorex vagrans*
Townsend’s mole	*Scapanus townsendii*
Coyote	*Canis latrans*
Red fox	*Vulpes vulpes*
Mountain lion	*Puma concolor*
Striped skunk	*Mephitis mephitis*
River otter	*Lontra canadensis*
Long-tailed weasel	*Mustela frenata*
Mink	*Mustela vison*
Raccoon	*Procyon lotor*
Roosevelt elk	*Cervus elaphus*
Black-tailed deer	*Odocoileus hemionus*
Eastern gray squirrel*	*Sciurus carolinensis*
Beechey ground squirrel	*Spermophilus beecheyi*
Townsend’s chipmunk	*Tamias townsendii*
Beaver	*Castor canadensis*
Pacific jumping mouse	*Zapus trinotatus*
Townsend’s vole	*Microtus townsendii*
Muskrat	*Ondatra zibethicus*
House mouse*	*Mus musculus*
Deer mouse	*Peromyscus maniculatus*
Nutria*	*Myocastor coypus*
Eastern cottontail*	*Sylvilagus floridanus*

*=Introduced species

Reptiles and Amphibians

Long-toed salamander	*Ambystoma macrodactylum*
Northwestern salamander	*Ambystoma gracile*
Rough-skinned newt	*Taricha granulosa*
Ensatina	*Ensatina eschscholtzii*
Western red-backed salamander	*Plethodon vehiculum*
Pacific treefrog	*Pseudacris regilla*
Bullfrog*	*Rana catesbeiana* (non-native)
Northern red-legged frog	*Rana aurora*
Western painted turtle	*Chrysemys picta*
Western pond turtle	*Actinemys marmorata*
Western skink	*Eumeces skiltonianus*
Northern alligator lizard	*Elgaria coerulea*
Common (red-spotted) garter snake	*Thamnophis sirtalis concinnus*
Northwestern garter snake	*Thamnophis ordinoides*
Rubber boa	*Charina bottae*

*=Introduced species

Fish

Common Name	Scientific Name	Verified Occurrence
Western brook lamprey	*Lampetra richardsoni*	G, C
Pacific lamprey	*Lampetra tridentata*	C, L
White sturgeon	*Acipenser transmontanus*	G, C
Green sturgeon	*Acipenser medirostris*	C
American shad*	*Alosa sapidissima*	C, R (CS)
Mountain whitefish	*Prosopium williamsoni*	C, L
Brown trout*	*Salmo trutta*	C, L
Coastal cutthroat trout	*Oncorhynchus clarkii clarkii*	G, C
Steelhead	*Oncorhynchus mykiss*	G, C
Coho salmon	*Oncorhynchus kisutsch*	G, C
Chinook salmon	*Oncorhynchus tshawytscha*	G, C, R (CS)
Sockeye salmon	*Oncorhynchus nerka*	C
Chum salmon	*Oncorhynchus keta*	C
Pacific smelt (Eulachon)	*Thaleichthys pacificus*	G, C
Common carp*	*Cyprinus carpio*	G,C, R
Goldfish*	*Carassius auratus*	G, R
Chiselmouth	*Acrocheilus alutaceus*	C, L
Redside shiner	*Richardsonius balteatus*	G
Northern pikeminnow	*Ptychocheilus oregonensis*	G, C
Peamouth	*Mylocheilus caurinus*	G
Speckled dace	*Rhinichthys osculus*	G
Longnose dace	*Rhinichthys cataractae*	G, R
Longnose sucker	*Catostomus catostomus*	C, L
Bridgelip sucker	*Catostomus columbianus*	C
Largescale sucker	*Catostomus macrocheilus*	G,C, R
Channel catfish*	*Ictalurus punctatus*	C, L
Brown bullhead*	*Ameiurus nebulosus*	G,C, R

Common Name	Scientific Name	Verified Occurrence
Black bullhead*	*Ameiurus melas*	G
Western Mosquitofish*	*Gambusia affinis*	G, R
Banded killifish*	*Fundulus diaphanus*	R (CS)
Threespine stickleback	*Gasterosteus aculeatus*	G, R
Sand Roller	*Percopsis transmontana*	C, L
Largemouth bass*	*Micropterus salmoides*	G, R (CS)
Smallmouth bass*	*Micropterus dolomieu*	G, C
Black crappie*	*Pomoxis nigromaculatus*	G,C, R (CS)
White crappie*	*Pomoxis annularis*	G, R
Bluegill*	*Lepomis macrochirus*	G, R (CS)
Pumpkinseed*	*Lepomis gibbosus*	G, C
Warmouth*	*Lepomis gulosus*	G
Walleye*	*Sander vitreus*	G, C
Yellow perch*	*Perca flavescens*	G,C, R (CS)
Prickly sculpin	*Cottus asper*	G
Riffle sculpin	*Cottus gulosus*	G
Reticulate sculpin	*Cottus perplexus*	G
Starry flounder	*Platichthys stellatus*	C

*=Introduced species

G= Gee Creek (Refuge waters)
R= Other Refuge waters
C= Columbia River (outside Refuge)
L= Lake River (outside Refuge)
CS=Campbell Slough

Odonata (Damselflies and Dragonflies)

Common Name	Scientific Name	Notes
Spotted Spreadwing	*Lestes congener*	X
Lyre-tipped Spreadwing	*Lestes unguiculatus*	X
Common Spreadwing	*Lestes disjunctus*	X
Western Forktail	*Ischnura perparva*	X
Pacific Forktail	*Ischnura cervula*	X
Tule Bluet	*Enallagma carunculatum*	X
Olive Clubtail	*Stylurus olivaceus*	X
Common Green Darner	*Anax junius*	X
Blue-eyed Darner	*Rhionaeschna multicolor*	V
Paddle-tailed Darner	*Aeshna palmata*	X
Shadow Darner	*Aeshna umbrosa*	X
California Darner	*Rhionaeschna californica*	X
Common Whitetail	*Libellula lydia*	X
Twelve-spotted Skimmer	*Libellula pulchella*	X
Widow Skimmer	*Libellula luctuosa*	X
Eight-spotted Skimmmer	*Libellula forensis*	X
Western Pondhawk	*Erythemis collocata*	X
Red-veined Meadowhawk	*Sympetrum madidum*	X
Striped Meadowhawk	*Sympetrum pallipes*	X
Variegated Meadowhawk	*Sympetrum corruptum*	V

Common Name	Scientific Name	Notes
Yellow-legged Meadowhawk	*Sympetrum vicinum*	X
Cardinal Meadowhawk	*Sympetrum illotum*	X
Blue Dasher	*Pachydiplax longipennis*	X

X = specimen collected
V= sight record

Plants

Vascular Plants
Aquatic Plants

Common Name	Scientific Name
American waterplantain	*Alisma plantago-aquatica*
Mexican mosquitofern	*Azolla mexicana*
Nodding beggartick	*Bidens cernua*
Devil's (leafy) beggartick	*Bidens frondosa*
Big devils beggartick (tall bur marigold)	*Bidens vulgata*
Twoheaded water-starwort	*Callitriche heterophylla*
Columbia sedge	*Carex aperta*
Greensheath sedge	*Carex feta*
Greenfruit sedge	*Carex interrrupta*
Slough sedge	*Carex obnupta*
Blister sedge	*Carex vesicaria*
Coon's tail	*Ceratophyllum demersum*
Needle spikerush	*Eleocharis acicularis*
Ovate spikerush	*Eleocharis ovata*
Common spikerush	*Eleocharis palustris*
Canadian waterweed	*Elodea canadensis*
Common mare's-tail	*Hippuris vulgaris*
Howellia	*Howellia aquatilis*
Toad rush	*Juncus bufonius* (N/weedy)
Common (soft) rush	*Juncus effusus*
Jointleaf rush	*Juncus articulatus*
Poverty (slender) rush	*Juncus tenuis*
Common duckweed	*Lemna minor*
Eurasian watermilfoil	*Myriophyllum spicatum** NOX
Knotgrass	*Paspalum distichum*
water smartweed	*Polygonum amphibium* (Syn: *P. coccineum*)
Japanese knotweed	*Polygonum cuspidatum** NOX
Marshpepper knotweed	*Polygonum hydropiper*
Swamp smartweed	*Polygonum hydropiperoides*
Spotted ladysthumb	*Polygonum persicaria**
Dotted smartweed	*Polygonum punctatum*
Curly pondweed	*Potamogeton crispus** NOX
Wapato, arrowhead	*Sagittaria latifolia*
Woolgrass	*Scirpus cyperinus*
Cosmopolitan (seacoast) bulrush	*Schoenoplectus (Scirpus) maritimus*
Common threesquare (American bulrush)	*Schoenoplectus pungens* (Syn:*Scirpus americanus*)

Common Name	Scientific Name
Panicled bulrush	*Scirpus microcarpus*
Ricefield bulrush, bog bulrush, pointed bulrush	*Schoenoplectus mucronatus**
Softstem bulrush	*Scirpus tabernaemontani* (Syn: *S.validus*)
Bur-reed	*Sparganium* spp.
Common duckmeat	*Spirodela polyrrhiza*
Sago pondweed	*Stuckenia (Potamogeton) pectinatus*
Broadleaf cattail	*Typha latifolia* (N/weedy)
Columbian watermeal	*Wolffia columbiana*
Grasses	
Spike bentgrass	*Agrostis exarata**
Colonial bentgrass	*Agrostis capillaris* (Syn: *A. tenuis*)*
Seashore (thin) bentgrass	*Agrostis pallens* (Syn: A.*diegoensis*)
Rough (winter) bentgrass	*Agrostis scabra*
Shortawn foxtail	*Alopecurus aequalis*
Sweet vernalgrass	*Anthoxanthum odoratum**
Wild oat	*Avena fatua***
Common oat	*Avena sativa**
Soft brome	*Bromus hordeaceus* (Syn: *B.mollis*)**
Poverty brome	*Bromus sterilis**
Orchardgrass	*Dactylis glomerata**
Barnyardgrass	*Echinochloa crus-galli***
	Elymus spp.
Bearded wheatgrass	*Elymus caninus** (Syn: *Agropyron caninum*)
Teal lovegrass	*Eragrostis hypnoides*
Red fescue	*Festuca rubra*
Small floating mannagrass	*Glyceria borealis*
Common velvetgrass	*Holcus lanatus***
Meadow barley	*Hordeum brachyantherum*
Rice cutgrass	*Leersia oryzoides*
Italian ryegrass	*Lolium perenne* ssp. *multiflorum***
Perennial ryegrass	*Lolium perenne* ssp. *perenne**
Witchgrass	*Panicum capillare***
Reed canarygrass	*Phalaris arundinacea*** NOX
Timothy	*Phleum pratense*
Canada bluegrass	*Poa compressa*
Fowl bluegrass	*Poa palustris*
Kentucky bluegrass	*Poa pratensis*
Tall fescue	*Schedonorus phoenix*** (Syn: *Festuca arundinacea*)
Brome fescue	*Vulpia (Festuca) bromoides**
Trees and Shrubs	
Vine maple	*Acer circinatum*
Bigleaf maple	*Acer macrophyllum*
Red alder	*Alnus rubra*
Saskatoon serviceberry	*Amelanchier alnifolia*
False indigo (indigobush)	*Amorpha fruticosa*** NOX
Tall Oregongrape	*Berberis aquifolium*
Cascade Oregongrape	*Berberis nervosa*
Pacific dogwood	*Cornus nuttallii*

Common Name	**Scientific Name**
Red-osier dogwood	*Cornus stolonifera*
California hazelnut	*Corylus cornuta* var. *californica*
Black hawthorn	*Crataegus douglasii*
English hawthorn	*Crataegus monogyna**
Scotch broom	*Cytisus scoparius***
Oregon ash	*Fraxinus latifolia*
Salal	*Gaultheria shallon*
Oceanspray	*Holodiscus discolor*
American holly	*Ilex opaca*
Indian plum	*Oemleria cerasiformus*
Lewis's mock-orange	*Philadelphus lewisii*
Pacific ninebark	*Physocarpus capitatus*
Black cottonwood	*Populus trichocarpa*
Bitter cherry	*Prunus emarginata*
Douglas-fir	*Pseudotsuga menziesii*
Crabapple	*Pyrus fusca*
Apple	*Pyrus malus**
Oregon white oak	*Quercus garryana*
Cascara	*Rhamnus purshiana*
Poison oak	*Rhus diversiloba*
Prickly currant, Swamp gooseberry	*Ribes lacustre*
Redflower currant	*Ribes sanguineum*
Sweetbrier	*Rosa eglanteria**
Nootka rose	*Rosa nutkana*
Cluster rose	*Rosa pisocarpa*
Himalayan blackberry	*Rubus armeniacus** (Syn: *R.discolor*)
Cutleaf (Evergreen) blackberry	*Rubus laciniatus**
Whitebark raspberry	*Rubus leucodermis*
Largeleaf blackberry	*Rubus macrophyllus**
Thimbleberry	*Rubus parviflorus*
Salmonberry	*Rubus spectabilis*
California (trailing) blackberry	*Rubus ursinus*
Pacific willow	*Salix lasiandra* ssp. *lucida*
Northwest sandbar willow	*Salix sessilifolia*
Blue elderberry	*Sambucus nigra* ssp. *cerulea*
Red elderberry	*Sambucus racemosa*
Rose spiraea (Douglas' spiraea)	*Spiraea douglasii*
Common snowberry	*Symphoricarpos albus*
Western redcedar	*Thuja plicata*
Western hemlock	*Tsuga heterophylla*
Red huckleberry	*Vaccinium parvifolium*
Common (oval leaf) viburnum	*Viburnum ellipticum*
Herbaceous Plants, Wildflowers	
Common yarrow	*Achillea millefolium* (N/weedy)
Vanilla leaf	*Achlys triphylla*
Nodding onion	*Allium cernuum*
Pearly everlasting	*Anaphalis margaritacea*
Stinking chamomile (mayweed)	*Anthemis cotula***
Western columbine	*Aquilegia formosa*

Common Name	**Scientific Name**
Lesser (common) burdock	*Arctium minus***
Silverweed cinquefoil	*Argentina (Potentilla) anserina*
Pacific silverweed	*Argentina edegii* (Syn: *Potentilla pacifica*)
Clasping arnica	*Arnica amplexicaulis*
Bride's feathers (goatsbeard)	*Aruncus dioicus* (Syn: *A. sylvester*)
British Columbia wildginger	*Asarum caudatum*
American yellowrocket (wintercress)	*Barbarea orthoceras*
Lawndaisy (English daisy)	*Bellis perennis***
Crown brodiaea	*Brodiaea coronaria*
Small (common) camas	*Camassia quamash*
Pale (Scouler's) bellflower	*Campanula scouleri*
Giant mountain aster	*Canadanthus (Aster) modestus*
Shepherd's purse	*Capsella bursa-pastoris***
Palmate toothwort	*Cardamine nuttallii* var. *nuttallii*
Slenderflower thistle	*Carduus tenuiflorus** NOX
Doubtful chickweed	*Cerastium dubium***
Sticky chickweed	*Cerastium glomeratum*
Fireweed	*Chamerion angustifolium*
Pigweed	*Chenopodium album***
Western water hemlock	*Cicuta douglasii*
Chicory	*Cichorium intybus***
Canada thistle	*Cirsium arvense*** NOX
Bull thistle	*Cirsium vulgare*** NOX
Farewell-to-spring	*Clarkia amoena*
Miner's lettuce	*Claytonia (Montia) perfoliata*
Siberian springbeauty (candyflower)	*Claytonia (Montia) sibirica*
Giant blue eyed Mary	*Collinsia grandiflora*
Maiden (small-flowered) blue eyed Mary	*Collinsia parviflora*
Spinster's (few-flowered) blue eyed Mary	*Collinsia sparsiflora*
Poison hemlock	*Conium maculatum*** NOX
Field bindweed (morning-glory)	*Convolvulus arvensis*** NOX
False bindweed (lady's nightcap)	*Convolvulus sepium***
Atkinson's tickseed (Columbia coreopsis)	*Coreopsis tinctoria var. atkinsoniana*
bunchberry dogwood	*Cornus canadensis*
Water pygmyweed	*Crassula (Tillaea) aquatica*
Bristly hawksbeard	*Crepis setosa***
Common spring-gold (goldstar)	*Crocidium multicaule*
Pacific hound's tongue	*Cynoglossum grande*
Queen Anne's lace	*Daucus carota*** NOX
Upland (Nuttall's) larkspur	*Delphinium nuttallii*
Pacific bleeding heart	*Dicentra formosa*
Forktooth ookow	*Dichelostemma (Brodiaea) congesta*
Purple foxglove	*Digitalis purpurea***
Fuller's teasel	*Dipsacus fullonum*** (Syn: *D. sylvestris*)
Cascade calicoflower	*Downingia yina*
Spring draba (whitlow-grass)	*Draba verna*
Fringed (common) willowherb	*Epilobium ciliatum* ssp. *glandulosum*
Small-flowered willowherb	*Epilobium minutum*
Watson's willowherb	*Epilobium ciliatum* ssp. *watsonii*

Common Name	Scientific Name
Philadelphia fleabane	*Erigeron philadelphicus*
Common wooly sunflower (Oregon sunshine)	*Eriophyllum lanatum*
Redstem stork's-bill (filaree)	*Erodium cicutarium***
Giant white fawnlily	*Erythronium oregonum*
California poppy	*Eschscholzia californica*
Woodland strawberry	*Fragaria vesca*
Virginia strawberry	*Fragaria virginiana*
Checker lily	*Fritillaria affinis* (Syn: *F.lanceolata*)
Cleavers	*Galium aparine***
Northern bedstraw	*Galium boreale*
Oregon bedstraw	*Galium oreganum*
Threepetal (small) bedstraw	*Galium trifidum*
Fragrant bedstraw	*Galium triflorum*
Rainier pleated gentian (explorer's gentian)	*Gentiana calycosa*
Longstalk cranesbill	*Geranium columbinum**
Cutleaf geranium	*Geranium dissectum**
Dovefoot geranium	*Geranium molle**
Small geranium	*Geranium pusillum**
Largeleaf avens	*Geum macrophyllum*
Bluehead (globe) gilia	*Gilia capitata*
Ground ivy (creeping Charlie)	*Glechoma hederacea**
Western marsh cudweed	*Gnaphalium palustre* (N/weedy)
Marsh cudweed	*Gnaphalium uliginosum**
Western rattlesnake plantain	*Goodyera oblongifolia*
Clammy hedgehyssop	*Gratiola neglecta*
English ivy	*Hedera helix** NOX
Common sneezeweed	*Helenium autumnale*
Common cowparsnip	*Heracleum lanatum*
Pacific waterleaf	*Hydrophyllum tenuipes*
Common St. Johnswort	*Hypericum perforatum*** NOX
Hairy cat's ear	*Hypochaeris radicata*** NOX
Jewelweed	*Impatiens capensis*
Paleyellow iris (yellow flag)	*Iris pseudacorus** NOX
Purple deadnettle	*Lamium purpureum***
Common nipplewort	*Lapsana communis***
Perennial pea	*Lathyrus latifolius***
Leafy pea	*Lathyrus polyphyllus*
Oxeye daisy	*Leucanthemum vulgare*** NOX (Syn: *Chrysanthemum leucanthemum*)*
Columbia lily (tiger lily)	*Lilium columbianum*
Water mudwort	*Limosella aquatica*
Dalmatian toadflax	*Linaria dalmatica*** NOX
Butter and eggs, yellow toadflax	*Linaria vulgaris*** NOX
Yellowseed false pimpernel	*Lindernia dubia*
Twinflower	*Linnaea borealis*
Smallflower woodland-star	*Lithophragma parviflorum*
Orange honeysuckle	*Lonicera ciliosa*

Common Name	Scientific Name
Bird's-foot trefoil	*Lotus corniculatus**
Desert deervetch (miniature lotus)	*Lotus micranthus*
American bird's-foot trefoil	*Lotus unifoliolatus* (Syn: *L.purshianus*)
Marsh seedbox (false loosestrife)	*Ludwigia palustris*
Broadleaf lupine	*Lupinus latifolius*
American skunkcabbage	*Lysichiton americanus*
Creeping jenny (moneywort)	*Lysimachia nummularia**
Spatulaleaf loosestrife (water purslane)	*Lythrum portula**
Feathery false lily of the valley (Solomon's seal)	*Maianthemum racemosum*
Disc mayweed (pineapple weed)	*Matricaria discoidea*** (Syn: *M.matricarioides*)
Black medick	*Medicago lupulina***
Alfalfa	*Medicago sativa**
Wild mint	*Mentha arvensis*
Pennyroyal	*Mentha pulegium**
Peppermint	*Mentha x piperita*
Coastal (tooth-leaved) monkey-flower	*Mimulus dentatus*
Seep (common) monkey-flower	*Mimulus guttatus*
Largeleaf sandwort	*Moehringia (Arenaria) macrophylla*
Narrowleaf minerslettuce	*Montia linearis*
Changing forget-me-not	*Myosotis discolor**
Bay forget-me-not	*Myosotis laxa*
Skunkbush	*Navarretia squarrosa*
Smallflower nemophila	*Nemophila parviflora*
Catnip	*Nepeta cataria**
Rocky Mountain (yellow) pond-lily	*Nuphar lutea* ssp. *polysepala*
Fragrant water lily	*Nymphaea odorata* ssp. *tuberosa**NOX
Water parsley	*Oenanthe sarmentosa*
Hooker's evening-primrose	*Oenothera elata* (Syn: *O.hookeri*)
Oneflowered broomrape	*Orobanche uniflora*
Dwarf owl's-clover	*Orthocarpus pusillus*
Sweetcicely	*Osmorhiza berteroi* (Syn: *O.chilensis*)
Redwood-sorrel	*Oxalis oregana*
Oriental poppy	*Papaver orientale**
Yellow glandweed	*Parentucellia viscosa**
Common (Gairdner's) yampah	*Perideridia gairdneri*
Shade phacelia	*Phacelia nemoralis*
Western false dragonhead	*Physostegia parviflora*
Narrowleaf plantain	*Plantago lanceolata***
Common plantain	*Plantago major***
Shortspur seablush	*Plectritis congesta*
Sticky cinquefoil	*Potentilla glandulosa*
Hooker's drops of gold (fairy-bell)	*Prosartes (Disporum) hookeri*
Common selfheal	*Prunella vulgaris*
Crowfoot	*Ranunculus aquatilis*
Greater creeping spearwort	*Ranunculus flammula*
Western buttercup	*Ranunculus occidentalis*
Straightbeak buttercup	*Ranunculus orthorhynchus*
Creeping buttercup	*Ranunculus repens***

Common Name	Scientific Name
Hairy buttercup	*Ranunculus sardous*
Woodland buttercup	*Ranunculus uncinatus*
Curvepod yellowcress	*Rorippa curvilisqua*
Northern marsh yellowcress	*Rorippa islandica*
Clustered dock	*Rumex conglomeratus**
Curly dock	*Rumex crispus***
Bitter dock	*Rumex obtusifolius**
Western dock	*Rumex aquaticus var. fenestratus* (Syn: *R.occidentalis*)
Bouncingbet	*Saponaria officinalis***
Wholeleaf saxifrage	*Saxifraga integrifolia*
Alberta (redwood) saxifrage	*Saxifraga occidentalis*
Leiberg stonecrop	*Sedum leibergii*
Stinking willie (tansy ragwort)	*Senecio jacobaea*** NOX
Woodland ragwort	*Senecio sylvaticus*
Blue fieldmadder	*Sherardia arvensis**
Bladder (white) campion	*Silene latifolia*** NOX (Syn: *Lychnis alba*)
Blessed milkthistle	*Silybum marianum*** NOX
Hedgemustard	*Sisymbrium officinale**
Starry false lily of the valley	*Smilacina stellatum*
Climbing nightshade	*Solanum dulcamara***
American black nightshade	*Solanum americanum* (Syn: *S.nigrum*) (N/weedy)
Canada goldenrod	*Solidago canadensis* (N/weedy)
Western goldentop	*Solidago occidentalis*
Common sowthistle	*Sonchus oleraceus***
Red sandspurry	*Spergularia rubra**
Cooley's hedgenettle	*Stachys chamissonis* var. *cooleyae*
Common chickweed	*Stellaria media***
Hall's aster	*Symphiotrichum (Aster) hallii*
Douglas' aster	*Symphiotrichum (Aster) subspicatum* var. *subspicatum*
Common tansy	*Tanacetum vulgare*** NOX
Common dandelion	*Taraxacum officinale***
Bigflower tellima (fringecup)	*Tellima grandiflora*
Western meadow-rue	*Thalictrum occidentale*
Youth on age	*Tolmiea menziesii*
Lesser baby innocence	*Tonella tenella*
Broadleaf starflower	*Trientalis borealis* ssp. *latifolia*
Rabbitfoot clover	*Trifolium arvense**
Golden clover	*Trifolium aureum** (Syn: *T. agrarium*)
Alsike clover	*Trifolium hybridum**
Field clover	*Trifolium campstre**(Syn: *T. procumbens*)
White clover	*Trifolium repens**
Subterranean clover	*Trifolium subterraneum**
Pacific trillium	*Trillium ovatum*
Smallflower wakerobin	*Trillium parviflorum*
White brodiaea	*Tritelia (Brodiaea) hyacinthina*
Stinging nettle	*Urtica dioica* (N/weedy)
Lewiston cornsalad	*Valerianella locusta**

Common Name	Scientific Name
White insideout flower	*Vancouveria hexandra*
Moth mullein	*Verbascum blattaria***
Common mullien	*Verbascum thapsus***
American speedwell	*Veronica americana*
Threadstalk speedwell	*Veronica filiformis**
Skullcap (Marsh) speedwell	*Veronica scutellata*
American vetch	*Vicia americana*
Tiny vetch	*Vicia hirsuta**
Garden vetch	*Vicia sativa**
Pioneer (stream) violet	*Viola glabella*
Aleutian violet	*Viola langsdorffii*
Northern woodland violet	*Viola septentrionalis*
Rough cocklebur	*Xanthium strumarium***
Ferns	
Northern maidenhair fern	*Adiantum pedatum*
Ladyfern	*Athyrium filix-femina*
Coastal woodfern	*Dryopteris arguta*
Licorice fern	*Polypodium glycyrrhiza*
Western swordfern	*Polystichum munitum*
Western brackenfern	*Pteridium aquilinum* (N/weedy)
Cryptograms	
California antitrichia moss	*Antitrichia californica*
Dendroalsia moss	*Dendroalsia abientina*
Rough goose neck moss	*Rhytidiadelphus triquetris*
Beard lichen	*Usnea barbata*
Bryophytes	
Tree climacium moss	*Climacium dendroides*
Dichelyma moss	*Dichelyma sp.*
Drepanocladus moss	*Drepanocladus*
Antifever fontinalis moss	*Fontinalis antipyretica*
Leucolepis umbrella moss	*Leucolepis acanthoneuron*
Rough goose neck moss	*Rhytidiadelphus triquetrus*
A liverwort	*Ricciocarpos natans*
Wallace's spikemoss	*Selaginella wallacei*

Notes:
*Introduced species
**Introduced and listed in Whitson T.D. (ed) *et al.* 2000
NOX=Listed as noxious weed in state of Washington
N/weedy=Native but listed in Whitson T.D. (ed) *et al.* 2000

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Appendix D. Implementation

D.1 Overview

Implementation of the CCP will require increased funding, which will be sought from a variety of sources. This plan will depend on additional Congressional allocations, partnerships and grants. There are no guarantees that additional federal funds will be made available to implement any of these projects. Other sources of funds will need to be obtained (both public and private). Activities and projects identified will be implemented as funds become available.

Many of the infrastructure and facility projects will be eligible for funding through construction or Federal Lands Highway Program funds (i.e. Refuge Roads).

The Comprehensive Conservation Plan proposes several projects to be implemented over the next 15 years. All of these projects are included in the Refuge Management Information System (RONS- Refuge Operational Needs System or MMS- Maintenance Management System) which are used to request funding from Congress. Currently, a large backlog of maintenance needs exists on the Refuge. An attempt at reducing this backlog needs to be addressed and is included here in the analysis of funding needs. The Refuge Operational Needs System (RONS) documents proposed new projects to implement the CCP to meet Refuge goals and objectives and legal mandates.

Annual revenue sharing payments to Clark County will continue. If the Refuge expands through the purchase of inholdings (privately owned lands within the current approved boundary) or through an expanded refuge boundary, additional in lieu of tax payments will be made to the county.

Monitoring activities will be conducted on a percentage of all new and existing projects and activities to document wildlife populations and changes across time, habitat conditions and responses to management practices. Actual monitoring and evaluation procedures will be detailed in step-down management plans.

D.2 Step-Down Plans

The Comprehensive Conservation Plan is one of several plans necessary for Refuge management. The CCP provides guidance in the form of goals, objectives, and strategies for several Refuge program areas but may lack some of the specifics needed for implementation. Step-down management plans will be developed for individual program areas within approximately 5 years after CCP completion. All step-down plans require appropriate NEPA compliance; implementation may require additional permits. Step-down plans for the Refuge follow. Project-specific plans, with appropriate NEPA compliance, may be prepared outside of these step-down plans.

Step Down Management Plan	**Status (Date Completed and/or Date to be Prepared/Updated)**
Habitat Management Plan	2010 (CCP meets requirements for HMP)
Fish and Wildlife Monitoring Plan	2015
Waterfowl Hunt Plan	
Fishing Plan	
Visitor Services Plan	

Environmental Education Plan?
IPM Plan 2010 (prepared concurrently with CCP, Appendix K)
Occupational Safety and Health Plan
Fire Management Plan 2011 (in progress)
Cultural Resources Management Plan

Step Down Plans Identified in CCP Strategies:
Contingency plan for dike breach
Tidal wetlands restoration plan (includes feasibility study, wetland basin assessment and topographic survey of aquatic habitats) 2016 (dependent on ACOE feasibility study to be completed in 2011)
Land Protection Plan to analyze alternatives for expansion of refuge boundary to the south Initiate by 2012
Feasibility study for reintroduction of Columbian white-tailed deer Initiate by 2015
Feasibility study for reintroduction of western pond turtle 2013
Feasibility study for native wet meadow restoration Within 15 years
Interior interpretive plan for Cathlapotle Plankhouse

D.3 Costs to Implement CCP

The following sections detail both one time and recurring costs for various projects. One time costs reflect the initial costs associated with a project, such as the purchase of equipment, contracting services, construction, purchase of land, etc. Recurring costs reflect the future operational and maintenance costs associated with the project.

D.3.1 One-Time Costs

One time costs are project costs that have a start up cost associated with them, such as purchasing a new vehicle for wildlife and habitat monitoring or designing and installing an interpretive sign. Some are full project costs for those projects that can be completed in 3 years or less. One time costs can include the cost of temporary or term salary associated with a short term project. Salary for new positions and operational costs are reflected in operational or recurring costs.

Funds for one time costs will be sought through increases in Refuge base funding, special project funds, grants, etc. Some projects also might require land acquisition funds, or other special appropriations or grants.

Projects listed below in Table D-1 show one time costs, such as those associated with building and facility needs such as offices, public use facilities, road improvements, and new signs. One time costs are also associated with habitat restoration and protection projects such as specific forestry and wetland projects, research and land acquisition. New research projects, because of their short term nature, are considered one time projects, and include costs of contracting services or hiring a temporary for the short term project. Some project costs are displayed as ranges since there are many factors that will influence the number of acres managed per year.

Table D-1. Estimates of one time costs under current management, and under the CCP (future management). This data is separated into two tables, Wildlife and Habitat and Public Use, and each is organized by goals and objectives.

Goal 1. Grasslands	***Provide and manage a mixture of secure, diverse, productive grassland habitats for foraging migratory waterfowl and grassland-dependent wildlife***			
	Current Management	***Future Management***	***Priority***	***Funding***
1.1 & 1.2 Enhance/Maintain Improved Pasture for Waterfowl				
Total Number of Acres	1426	1450		
Number of Acres Treated	1426	1450		
3yr Upland Restoration Project	$0	$208,000	**H**	1260 RONS
Total One-time Cost	**$0**	**$208,000**		
1.3 Rehabilitate Old Fields and Wetland Borders				
Number of Acres	400	140		
Number of Acres Rehabilitated	0	260	**H**	1260
Total One-time Cost	**$0**	**$12,550**		
1.4 Enhance Native Grassland Habitat				
Number of Acres	15	15		
Number of Acres Enhanced	0	15	M	1260
Total One-time Cost	**$0**	**$21,500**		

Goal 2. Crops	***Provide agricultural crops as forage for migratory waterfowl and sandhill cranes***			
	Current Management	***Future Management***	***Priority***	***Funding***
2.1 Provide Crops for Waterfowl and Sandhill Cranes				
Number of Acres	185	330		
Number of Corn Acres	85	145		
Number of new Pasture to Corn Acres	0	60	M	1260
Total One-Time Cost	**$100,000**	**$204,600**		
Goal 3. Wetlands	***Provide and manage a mixture of secure, diverse, productive grassland habitats for foraging migratory waterfowl and grassland-dependent wildlife.***			
	Current Management	***Future Management***	***Priority***	***Funding***
3.1 - 3.3 Enhance and Maintain Managed Seasonal and Semipermanent Wetlands, and Seasonal Wetlands				
Number of Acres	790	800		
Monitor/Treat Plant and Animal Invasives	$125,000	$185,000	**H**	1260
Reconfigure Water Delivery		$200,000	M	1260
Disk 5 Wetlands Annually for 3 years		$198,373	**H**	RONS
Total One-time Cost	**$125,000**	**$583,373**		
3.4 Howellia Wetlands				
Number of Ponds	4	4		
Maintain high water	$8,000	$8,000	M	1260
Total One-time Cost	**$0**	**$8,000**		
3.5 Permanent, non-tidal wetlands				
Number of Acres	150	70		
Monitor for Carp	$0	$50,000	M	1260
Total One-time Cost	**$0**	**$50,000**		
3.6 Maintain Wet Meadow Habitat				
Number of Acres	300	400		
Number of new acres restored	0	100		
Graze	$3,000	$3,000	M	6860
Restore Wet Meadow	$0	$75,000	**H**	1261
Increase Native Wet Meadow Vegetation	$0	$3,000	**H**	1261
Total One-time Cost	**$3,000**	**$81,000**		
Goal 4. Floodplain Forests	***Protect, manage, and restore a natural diversity of native floodplain forests representative of the historic lower Columbia River ecosystem.***			
	Current Management	***Future Management***	***Priority***	***Funding***
4.1 Protect/Maintain Early Successional Floodplain Forest				
Number of Acres	0	165		
Restore Gee Creek Watershed	$0	$123,477	**H**	RONS
Plant Trees/ Understory, Protect from Beaver, etc	$0	$1,740,750	**H**	RONS

Total One-time Cost	**$0**	**$1,864,227**		
Goal 5. Upland Forest	***Protect, manage, and restore a natural diversity of native upland forests representative of the historic Lower Columbia River ecosystem.***			
	Current Management	***Future Management***	***Priority***	***Funding***
5.1 & 5.1a Protect/Maintain/Restore Oak Woodland				
Number of Acres	0	10-20		
Remove Encroaching Trees	$0	$20,000	M	1261
Plant Trees/Understory	$0	$156,000	**H**	1261
Total One-time Cost	**$0**	**$176,000**		
Goal 6. Riverine Habitat/Tidal Wetlands	***Protect, enhance and, where feasible, restore riverine habitat and tidal wetlands representative of the historic lower Columbia River ecosystem to benefit salmonids and other native aquatic species.***			
	Current Management	***Future Management***	***Priority***	***Funding***
6.1 Enhance/Improve Instream/Riverine Habitat				
Number of Stream Miles	0.8	0.8		
Implement Restoration for fish passage	0	$200,000	M	1261
Gee Creek Assessment (1.5 yr Project)	0	$73,000	M	RONS
Improve Rearing Habitat	0	$20,000	M	1261
Total One-time Cost	**$0**	**$293,000**		
6.2 Enhance/Maintain Tidal Wetlands				
Number of Acres	490	497		
Acquisition	$0	$50,000	**H**	MBTA
Reduce carp w/o neg. effect on salmonids	$100,000	$100,000	M	1261
Total One-time Cost	**$100,000**	**$150,000**		
Goal 7. Research	***Collect Scientific Information for Adaptive Management***			
	Current Management	***Future Management***	***Priority***	***Funding***
7.1 Inventory and Monitoring Activities				
Monitor water quality and temp of Gee Creek and Campbell Slough	$0	$5,000	M	1261
Conduct banding	$0	$2,000	M	1261
Total One-Time Cost	**$0**	**$7,000**		
7.2 Conduct Surveys				
Participate in regional waterfowl surveys and banding studies (mid-winter, dusky, others)	$1,500	$1,500	M	1261
Total One-time Cost	**$1,500**	**$1,500**		
Total One-Time Cost	**$329,500**	**$3,660,750**		

Table D-1. Public Use Alternatives - One-Time Costs				
Goal 1. Waterfowl Hunting	***Waterfowl hunters of all abilities will enjoy a quality, safe hunting program that provides a variety of waterfowl hunting experiences, promotes youth hunting, balances hunt program needs with other public use program needs, and reduces impacts to non-target species. As a result of participating in the waterfowl hunting program, hunters will gain a better appreciation of the refuge's mission and its resource management.***			
1.1a. Provide a quality, safe waterfowl hunt program on the Refuge, capable of supporting approximately 2000 hunter visits per season, including master, youth, and disabled hunters, and reduces conflicts between hunters, adjacent landowners, and other user groups.				
1.1b. Increase opportunities for duck hunters to hunt desirable waterfowl species, for example, mallard, wigeon, and pintail.				
1.1c. Provide goose hunting opportunities on *790 acres* of the Refuge while reducing the disturbance to, and rate of take of, dusky Canada geese.				
	Current Management	***Future Management***	***Priority***	***Funding***
1.1a. Number of Acres—duck hunting	790	790		
1.1c. Number of Acres—goose hunting	790	790		
Open Waterfowl Hunt on Bachelor Island.				1261, 1263, 8081
Co-Locate Check Station and VCS		$329,000	M	1261, 1263, 8081
Move Blind 15 North				1261, 1263, 8081
Add 2nd Blinds for Gradual Flood-up		$35,000	M	1261, 1263, 8081
Evaluate/upgrade ADA Blinds Bi-annually		$95,450	M	1261, 1263, 8081
Total Cost	**$0**	**$459,450**		
Goal 2. Wildlife Dependent Recreation	***Visitors of all abilities will have the opportunity to participate in safe, quality wildlife-dependent recreation programs, including wildlife observation, photography, interpretation, and fishing, consistent with the needs of other public use programs and which limit wildlife disturbance in the face of increasing Refuge visitation. These programs will focus on enhancing public understanding and appreciation of wildlife, and building support for the Ridgefield National Wildlife Refuge.***			
2.2 Maintain a *4.0-mile year-round* auto tour route that provides visitors opportunities to view and photograph wildlife, and supports a maximum of 200 vehicles on peak use days.				
	Current Management	***Future Management***	***Priority***	***Funding***
Year-round Miles	4.3	4		
Reroute .3 Miles		$310,000	M	Refuge Roads
Reroute South End Oct 1-March 15				Refuge Roads

2.2 Auto Tour Route (cont.)	***Current Management***	***Future Management***	***Priority***	***Funding***
Pullouts every .5mi		$16,000	**H**	Refuge Roads
Pave ATR		$1,280,000	M	Refuge Roads
Roth Maintenance Lane		$450,000	M	Refuge Roads
Total Cost	**$0**	**$2,056,000**		
2.3 Provide *6.9 miles* of seasonal pedestrian access on Refuge trails and roads and 2 miles of year-round pedestrian access on Refuge trails.				
1.5 Mile Dike-top Trail, River 'S' Unit		$275,880	M	Refuge Roads, Special Project Funding
Construct Elevated Observation Deck, River 'S'		$55,000	M	Refuge Roads, Special Project Funding
Trail Through Time on Carty		$200,000	**H**	Refuge Roads
Maintain/Improve Carty Road		$10,450,000	M	Refuge Roads
Total Cost		**$10,980,880**		
2.5 Improve visitor contact and orientation facilities, signage, and interpretation				
Construct Visitor Center (pending separate EA/funding)	$8,623,833	$8,623,833	**H**	1261, MMS
Update Kiosk		$15,000	M	1261, 1263, 8081
Interpretive Exhibits at Visitor Contact Station/Kiosks		$20,000	M	1261, 1263, 8081
Total Cost	**$8,623,833**	**$8,658,833**		
2.6 Improve public facilities: Improve visitor infrastructure so as to enhance safety, sanitation, comfort, and access for the visiting public, including visitors with disabilities.				
New Entrance Road/Bridge from Port of Ridgefield, elim in grade crossing		$17,420,000	**H**	Refuge Roads, Special Project Funding
Repair/Replace Existing Bridge	$6,000,000		**H**	Refuge Roads
New Carty Unit Footbridge		$1,700,000	**H**	Refuge Roads
ADA Oaks to Wetlands Trail (2500ft)		$90,000	M	1261, 1263, 8081
Bike Parking		$2,700	M	1261, 1263, 8081
Pave Refuge Parking Lots		$248,000	M	Refuge Roads

2.6 Visitor Infrastructure (cont)	***Current Management***	***Future Management***	***Priority***	***Funding***
Kiwa Bathroom Trail		$16,533	M	1261, 1263, 8081
Benches every 1000 ft of trail		$8,800	M	1261, 1263, 8081
Total Cost	**$6,000,000**	**$19,486,033**		
Goal 4. Outreach	***Through Refuge outreach efforts local residents will have the opportunity to gain an appreciation and understanding of the Ridgefield National Wildlife Refuge and National Wildlife Refuge System missions***			
	Current Management	***Future Management***	***Priority***	***Funding***
Portable Outreach Presentation Kit	0	$10,000	M	1261
Welcome Package for New Residents	0	$1,000	M	1261
Total Cost	**$0**	**$11,000**		
Goal 5. Environmental Education	***Students from southwest Washington schools will participate in quality on-refuge environmental education programs that meet State educational requirements and provide safe and memorable experiences that foster a connection with nature and the Refuge.***			
	Current Management	***Future Management***	***Priority***	***Funding***
5.1 Provide Quality Environmental Education Opportunities				
3yr EE/Cultural Education Project	0	$245,828	**H**	RONS
Total Cost	**$0**	**$245,828**		
5.2 Expand environmental education facilities				
EE Shelter (groups of 40)	0	$210,000	**H**	1261, 1263, 8081
Total Cost	**$0**	**$210,000**		
Total One-Time Costs	**$14,623,833**	**$42,119,024**		

D.3.2. Operational (Recurring) Costs

Operational costs reflect Refuge spending of base funds allocated each year. These are also known as recurring costs and are usually associated with day to day operations and projects that last longer than three years.

Table D-2 displays projected operating costs under the CCP. The CCP reflects increased funding needs for proposed increases in public uses and facilities, new land acquisitions, increased habitat restoration and conservation activities, and new monitoring needs. This table includes such things as salary, operational expenditures such as travel, training, supplies, utilities and annual maintenance costs.

Table D-2 includes costs for permanent and seasonal staff needed year after year. It does not include staff costs associated with special projects; these are summarized in Table D-1. Table D-2 is also related to the Refuge Comprehensive Accomplishment Report. The table does not project costs other than operational. This data is separated into three tables, Wildlife and Habitat, Cultural Resources, and Public Use, and each is organized by goals.

Table D2. Wildlife and Habitat Recurring Costs					
Goal 1. Grasslands	***Provide and manage a mixture of secure, diverse, productive grassland habitats for foraging migratory waterfowl and grassland-dependent wildlife.***				
	Current Management	***Future Management***	***New Staff***	***Priority***	***Funding***
1.1 Enhance/Maintain Improved Pasture for Dusky Canada Geese					
Number of Acres	186	340			
Number of Acres Enhanced	186	340	Supv Bio	H	1260, 6860
Total Cost	**$50,700**	**$89,500**			
1.2 Enhance/Maintain Improved Pasture for Other Canada Geese and Waterfowl					
Number of Acres	1240	1110			
Number of Acres Enhanced	1240	1110		H	1260, 6860
Total Cost	**$209,000**	**$179,000**			
1.3 Maintain Old Fields and Old Field/Wetland Borders					
Number of Acres	400	140			
Number of Acres Maintained	400	140	Supv Bio	H	1260
Total Cost	**$30,300**	**$25,395**			
1.4 Maintain and Enhance Native Grassland Habitat					
Number of Acres	15	15			
Number of Acres Enhanced	15	15		M	1260
Total Cost	**$13,800**	**$13,800**			
Goal 2. Crops	***Provide agricultural crops as forage for migratory waterfowl and sandhill cranes***				
	Current Management	***Future Management***	***New Staff***	***Priority***	***Funding***
2.1 Provide Crops for Waterfowl and Sandhill Cranes					
Total Acres of Crops	155-185	290-330	Supv. Bio	H	1260
Acres Planted in Corn	55-85	60-145	Supv. Bio	H	1260
Total Cost	**$49,000-$56,500**	**$76,500-$104,500**			

Goal 3. Wetlands	***Provide and manage a mixture of secure, diverse, productive grassland habitats for foraging migratory waterfowl and grassland-dependent wildlife.***				
	Current Management	***Future Management***	***New Staff***	***Priority***	***Funding***
3.1 - 3.2 Enhance and Maintain Managed Seasonal and Semipermanent Wetlands					
Total Acres Managed Seasonal Wetlands	445	445			
Total Acres Managed Semipermanent Wetlands	190	230	Supv. Bio	H	1260
Total Acres Seasonal Wetland in Seasonal-Semipermanent Rotation	0	365	Supv. Bio	H	1260
Total Cost	**$99,700**	**$128,800**			
3.3 Enhance and Annually Maintain Seasonal Wetlands					
Total Acres of Enhanced/Maintained Seasonal Wetlands	155	125		M	1260
Total Cost	**$13,800**	**$15,800**			
3.4 Howellia Wetlands					
Total Number of Ponds	4	4			
Number of Ponds Managed	0	4	Supv. Bio	M	1260
Total Cost	**$5,000**	**$11,600**			
3.5 Permanent, non-tidal wetlands					
Total Acres Permanent Non-tidal wetlands	150	70			
Mechanically open areas that have become vegetated w/emergent veg	0	20		M	1260
Total Cost	**$15,100**	**$16,100**			
3.6 Maintain Wet Meadow Habitat					
Total Acres of Wet Meadow Habitat	300	400	Supv. Bio, Biotech	**H**	1260
Total Cost	**$35,600**	**$42,600**			

Goal 4. Floodplain Forests	***Protect, manage, and restore a natural diversity of native floodplain forests representative of the historic lower Columbia River ecosystem.***				
	Current Management	***Future Management***	***New Staff***	***Priority***	***Funding***
4.1 Protect/Maintain Early Successional Floodplain Forest					
% Acres Monitored and Treated Annually for Invasives	5%	10%			
Acres Monitored and Treated Annually for Invasives	16	31	Supv. Bio, Biotech	M	1260
Total Cost	**$15,100**	**$24,300**			
4.1a Restore Early Successional Floodplain Forest					
Total Acres Restored	0	160	Supv. Bio, Biotech	M	1260
Total Cost	**$0**	**$24,300**			
4.2 Protect/Maintain Mid to Late Successional Floodplain Forest					
Total Acres of Mid-Late Successional Riparian Forest	400	400			
% Acres Monitored and Treated Annually for Invasives	5%	10%			
Acres Monitored and Treated Annually for Invasives	20	40	Supv. Bio, Biotech Partners Bio	M	1260, Partners
Total Cost	**$13,400**	**$55,000**			
4.3 Protect/Maintain Oregon Ash Floodplain Forest					
Total Acres Oregon Ash	330	335			
Acres Monitored and Treated Annually for Invasives	33	34	Biotec Partner, Bio	M	1260, Partners
Total Cost	**$15,750.00**	**$55,800.00**			
4.3a Restore Oregon Ash Floodplain Forest					
Total Acres of Ash Forest Planted	0	5	Biotech	M	1260
Total Cost	**$0**	**$16,000**			

Goal 5. Upland Forest	***Protect, manage, and restore a natural diversity of native upland forests representative of the historic Lower Columbia River ecosystem.***				
	Current Management	***Future Management***	***New Staff***	***Priority***	***Funding***
5.1 Protect/Maintain Oak Woodland					
Total Oak Woodland	70	90			
% Acres Monitored and Treated Annually for Invasives	5%	10%			
Total Acres Monitored and Treated Annually for Invasives	3	9	Supv. Bio, Biotech	H	1260
Total Cost	**$14,120**	**$23,360**			
5.1a Restore Oak Woodland					
Total Acres of Oak Woodland Planted	0	10-20	Supv. Bio, Biotech	M	1260
Total Cost	**$0**	**$18,500**			
Goal 6. Riverine Habitat/Tidal Wetlands	***Protect, enhance and, where feasible, restore riverine habitat and tidal wetlands representative of the historic lower Columbia River ecosystem to benefit salmonids and other native aquatic species.***				
	Current Management	***Future Management***	***New Staff***	***Priority***	***Funding***
6.1 Enhance/Improve Instream Riverine Habitat					
Improve instream habitat by planting riparian trees and shrubs.	0.8 (stream miles)	0.8 (stream miles)	Supv. Bio Partners Biotech	M	1260, Partners
Total Cost	**$16,100**	**$56,700**			
6.2 Enhance/Maintain Tidal Wetlands					
Total Acres of Tidal Wetlands	490	490			
Mechanically remove encroaching vegetation and maintain open areas	100	100		H	1260
Total Cost	**$18,600**	**$18,600**			
Goal 7. Research	***Collect Scientific Information for Adaptive Management***				
	Current Management	***Future Management***	***New Staff***	***Priority***	***Funding***
7.1 Inventory and Monitoring Activities					
Total Cost	**$0**	**$24,000**	Supv. Bio, Biotech, Planner	M	1260
7.2 Conduct Surveys					
Total Cost	**$11,500**	**$24,500**	Supv. Bio, Biotech, Planner	M	1260

	Current Management	*Future Management*	*New Staff*	*Priority*	*Funding*
7.3 Invasive species monitoring and control and studies of techniques					
Total Cost	**$87,200**	**$138,500**	Supv. Bio, Biotech, Planner, GIS Con-tractor	M	1260, Grants
Total Recurring Costs	**$702,270**	**$1,082,855**			

Table D.2. Cultural Resources Program — Recurring Costs					
Goal 1. Cultural Resources	***The Refuge will protect and manage its cultural resources for their educational, scientific, and cultural values for the benefit of present and future generations of Refuge users and communities.***				
	Current Management	*Future Management*	*Priority*	*New Staff*	*Funding*
1.1 Inventory, evaluate, monitor, and protect the Refuge's cultural resources.					
Total Cost	**$20,000**	**$88,000**	**H**	Supv. PR, 1/2 FTE Planner, GIS	1260
1.2 Coordinate and Consult with Tribes on Cultural Resources Protection					
Total Cost	**$20,000**	**$39,000**	**H**	LE Officer	1260
Total Recurring Costs	**$40,000**	**$127,000**			

<table>
<tr><th colspan="6">Table D2. Public Use Programs - Recurring Costs</th></tr>
<tr><td>Goal 1. Waterfowl Hunting</td><td colspan="5">Waterfowl hunters of all abilities will enjoy a quality, safe hunting program that provides a variety of waterfowl hunting experiences, promotes youth hunting, balances hunt program needs with other public use program needs, and reduces impacts to non-target species. As a result of participating in the waterfowl hunting program, hunters will gain a better appreciation of the refuge's mission and its resource management.</td></tr>
<tr><td colspan="6">1.1a Provide a quality, safe waterfowl hunt program on the Refuge, capable of supporting approximately 2000 hunter visits per season, including master, youth, and disabled hunters, and reduces conflicts between hunters, adjacent landowners, and other user groups.</td></tr>
<tr><td colspan="6">1.1b Increase opportunities for duck hunters to hunt desirable waterfowl species, for example, mallard, wigeon, and pintail.</td></tr>
<tr><td colspan="6">1.1c Provide goose hunting opportunities on <u>790 acres</u> of the Refuge while reducing the disturbance to, and rate of take of dusky Canada geese.</td></tr>
<tr><td></td><td>Current Management</td><td>Future Management</td><td>Priority</td><td>New Staff</td><td>Funding</td></tr>
<tr><td>1.1a. Number of Acres--Duck Hunting</td><td>790</td><td>790</td><td></td><td></td><td></td></tr>
<tr><td>1.1c. Number of Acres—Goose Hunting</td><td>790</td><td>790</td><td></td><td></td><td></td></tr>
<tr><td>Total Cost</td><td>$53,200</td><td>$76,200</td><td>H</td><td>Supv. PR, Maintenance Worker, LE Officer, 1/2 FTE Planner</td><td>1260, 8081</td></tr>
<tr><td>Goal 2. Wildlife Dependent Recreation</td><td colspan="5">Visitors of all abilities will have the opportunity to participate in safe, quality wildlife-dependent recreation programs, including wildlife observation, photography, interpretation, and fishing, consistent with the needs of other public use programs and which limit wildlife disturbance in the face of increasing Refuge visitation. These programs will focus on enhancing public understanding and appreciation of wildlife, and building support for the Ridgefield National Wildlife Refuge.</td></tr>
<tr><td colspan="6">2.1 Provide facilities for self-guided wildlife observation and photography opportunities on the Refuge's River 'S' and Carty Units, while limiting the impacts of noise and human activity to sensitive species.</td></tr>
<tr><td></td><td>Current Management</td><td>Future Management</td><td>Priority</td><td>New Staff</td><td>Funding</td></tr>
<tr><td>Total Cost</td><td></td><td>$17,000</td><td>M</td><td>Supv. PR, Maintenance Worker, 1/2 FTE Planner</td><td>1260, 8081</td></tr>
<tr><td colspan="6">2.2 Maintain a <u>4.0-mile year-round</u> auto tour route that supports a maximum of 200 vehicles on peak use days.</td></tr>
<tr><td>Total Cost</td><td>$21,100</td><td>$65,100</td><td>H</td><td>Supv. PR, Maintenance Worker, 1/2 FTE Planner</td><td>1260, 8081</td></tr>
</table>

2.3 Provide *6.9 miles* of seasonal pedestrian access on Refuge trails and roads and 2 miles of year-round pedestrian access on Refuge trails.					
	Current Management	***Future Management***	***Priority***	***New Staff***	***Funding***
Total Cost	**$12,000**	**$53,000**	**H**	Supv. PR, Maintenance Worker, 1/2 FTE Planner, Fee Collection, LE Officer	1260, 8081
2.4 Conduct *up to 25* volunteer-guided wildlife tours annually to provide visitors with access to areas of the Refuge that are otherwise closed.					
Total Cost	**$22,000**	**$31,000**	**M**	Supv. PR	1260, 8081
2.5 Improve visitor contact and orientation facilities, signage, and interpretation.					
Total Cost	**$18,500**	**$50,000**	**H**	Supv. PR, Maintenance Worker, 1/2 FTE Planner	1260, MMS, 8081
2.6 Improve public facilities: Improve visitor infrastructure so as to enhance safety, sanitation, comfort, and access for the visiting public, including visitors with disabilities.					
Total Cost	**$23,000**	**$82,000**	**H**	Fee Collector, Supv. Park Ranger, Maintenance Worker, LE Officer, 1/2 FTE Planner	1260, 8081
2.7 Maintain access to fishing opportunities at Ridgefield National Wildlife Refuge.					
Total Cost	**$6,000**	**$18,500**	**M**	Supv. PR, LE Officer, 1/2 FTE Planner	1260, 8081
2.8 Reduce illegal activities					
Total Cost	**$14,500**	**$52,500**	**H**	LE Officer, Supv. PR, Maintenance Worker	1260, 8081
Goal 3. Cultural Resources	***Preserve, evaluate, and interpret its cultural resources and heritage. Cultural resources and the Cathlapotle Plankhouse will be interpreted to enlighten visitors about the Refuge's unique natural and cultural history. Through accurate interpretive and educational opportunities, visitors will gain an understanding and appreciation of the Refuge's natural and cultural heritage.***				
	Current Management	***Future Management***	***Priority***	***New Staff***	***Funding***
3.1 Increase public awareness and appreciation of the Refuge's historic, archaeological and cultural resources.					
Total Cost	**$59,000**	**$86,000**	**H**	Supv. PR, Maintenance Worker	1260, 8081
3.2 Partner with Tribes, friends groups, and volunteers to provide cultural resources interpretation and education programs and exhibits for both Tribal members and the general public.					
Total Cost	**$26,000**	**$112,000**	**H**	Supv. PR, Ed Specialist, 1/2 FTE Planner	1260, 8081, Grants

3.3 Integrate the Plankhouse into the Refuge's interpretation and environmental education programs.					
Total Cost	**$19,000**	**$47,000**	**H**	Ed Specialist	1260, 8081, Grants
Goal 4. Outreach	***Through Refuge outreach efforts local residents will have the opportunity to gain an appreciation and understanding of the Ridgefield National Wildlife Refuge and National Wildlife Refuge System missions***				
	Current Management	***Future Management***	***Priority***	***New Staff***	***Funding***
4.1 Conduct Public Outreach					
Total Cost	**$29,100**	**$47,100**	**M**	Ed Specialist, Supv. PR, .5 FTE Planner	1260
4.2 Continue recruiting, training, retaining, and utilizing volunteers for support of Refuge programs and activities.					
Total Cost	**$30,000**	**$39,000**	**H**		1260
4.3 Establish and Maintain Partnerships					
Total Cost	**$21,000**	**$31,000**	**H**		1260
Goal 5. Environmental Education	***Students from southwest Washington schools will participate in quality on-refuge environmental education programs that meet State educational requirements and provide safe and memorable experiences that foster a connection with nature and the Refuge.***				
	Current Management	***Future Management***	***Priority***	***New Staff***	***Funding***
5.1 Provide quality environmental education opportunities					
# Student Visits Annually	2000-3000	4500			
Total Cost	**$28,000**	**$58,000**	***H***	*Ed Specialist, Supv. PR, .5 FTE Planner*	1260, 8081, Grants
5.2 Effectively utilize volunteers, Friends Groups, and partnerships to create a high quality and self-sustaining Refuge environmental education program.					
Total Cost	**$38,000**	**$39,000**	**H**		1260, 8081, Grants
5.3: Expand environmental education facilities					
Total Cost	**$15,000**	**$34,000**	**H**	Supv. PR, Maintenance Worker	1260, 8081, Grants
Total Recurring Costs	**$435,400**	**$938,400**			

D.3.3 Staffing

Staff is needed to conserve and enhance the quality and diversity of indigenous wildlife habitats on the Ridgefield NWR. With the proper staffing to implement this plan, habitat management practices can be implemented and monitoring of flora and fauna responses to management can be applied, which will allow us to apply adaptive management strategies that are crucial for long term success in meeting the mission, goals and objectives of the Refuge.

Staff will interact with the public for education purposes and to provide for public safety. Maintenance staff will maintain facilities and equipment. Training of staff and coordination among staff, volunteers and partners will ensure the mission and guiding principles of the National Wildlife Refuge System endure.

The following proposed full development level staffing plan would achieve CCP goals within 15 years. The rate at which this station achieves its full potential to fulfill the objectives and strategies contained in the plan is totally dependent upon receiving adequate funding and staffing.

Table D-3 below shows the staffing levels needed to fully implement the CCP, and associated staffing costs. **Note that these costs are already included (project by project) in the recurring costs.** The table simply provides a picture of how the staff structure would look and provides an indication of what percent of the total recurring costs would be allocated towards staff.

Table D3. Staffing to Implement the CCP, Ridgefield NWR			
Project Leader	PFT	GS-0485-13	$134,000
Visitor Services Manager	PFT	GS-0025-11/12	$108,000
Wildlife Biologist	PFT	GS-0486-12	$108,000
LE Officer	PFT	GS-0025-7/9	$102,000
Deputy Project Leader	PFT	GS-0485-12	$97,000
Wildlife Biologist	PFT	GS-0486-11	$94,000
Education Specialist	PFT	GS-1001-7/9/11	$94,000
Geographic Information Specialist	PFT	GS-9/11	$94,000
Private Lands Biologist	PFT	GS-0401-7/9	$81,000
Administrative Officer	PFT	GS-0341-09	$81,000
Engineering Equipment Operator	PFT	WG-5716-10	$81,000
Instructional Systems Specialist	PFT	GS-1750-11	$75,000
Tractor Operator	PFT	WG-5716-7	$75,000
Maintenance Worker	PFT	WG-4749-6/7/8	$75,000
Volunteer Coordinator	PFT	GS-0024-5/7	$61,000
Bio Tech	PFT	GS-0404-5/7	$61,000
Fee Collections Officer	PFT	GS-5/6/7	$61,000
Planner	.5 PFT	GS-11/12	$54,000
Office Automation Clerk	FTE	GS-4/5	$50,000
YCC Crew	Seasonal	GS-4/5	$21,500
Hunter Check Station	Seasonal	GS-0404-4/5	$15,000
Tractor Operator	Seasonal	WG-5716-5	$15,000
Totals			**$1,637,500**

D.3.4. Partnership Opportunities

The Refuge's location next to a large metropolitan area facilitates many opportunities for partnerships with other agencies, interest groups and schools. Coordinated partnership efforts will focus on habitat restoration, land protection, environmental education, fish and wildlife monitoring, outreach, and quality wildlife-dependent recreation. Current and past partners include local schools, and non-profit groups (such as The Audubon Society, Friends of Ridgefield NWR, Lower Columbia River Estuary Partnership, Washington State University, and many others). Future partners will include these groups as well as state and tribal agencies. Partnerships like these will increase our effectiveness, knowledge, and community support, as well as reduce Refuge operating costs.

In order for the Service to be effective in the Stewardship area around the Refuge we will strive to exchange information and provide technical assistance to neighboring landowners to promote protection of valuable wildlife habitat on neighboring properties. Volunteers will continue to assist with various Refuge programs, as detailed in Chapter 5 of the CCP.

D.3.5. Budget Summary

Table D-4 summarizes the data from the above tables and displays the total funding need, over the 15 year lifetime of the CCP, for Ridgefield National Wildlife Refuge to implement the CCP in full, as described in Chapter 2.

Table D4. Budget Summary: Funding Needed to Implement the CCP

Budget Category	Current Management	Future Management
One Time Expenditures		
Wildlife & Habitat	$329,500	$3,660,750
Public Use	$14,623,833	$42,119,024
Subtotal	***$14,953,333***	***$45,779,774***
Recurring Costs (Annual costs totaled over 15 year lifetime of CCP)		
Wildlife & Habitat	$10,534,050	$16,239,825
Public Use	$7,131,000	$15,981,000
Subtotal	***$17,665,050***	***$32,220,825***
Total CCP Cost	**$32,618,383**	**$78,000,599**

Appendix E. Wilderness Review for Ridgefield National Wildlife Refuge

E.1 Introduction

The Ridgefield National Wildlife Refuge (Refuge) is located in southwest Washington at an elevation ranging from 0 - 60 feet. It is situated at the northern end of the Willamette Valley, approximately 15 miles north of Portland, Oregon. The majority of the refuge lies within the floodplain of the Columbia River. The Refuge's acquisition boundary encompasses 6,170 acres, of which 5,218 acres has been acquired through fee title, agreement, or lease. The Refuge consists of three primary management units that are separated by water or private lands. These units include the 768-acre Carty Unit, the 1,610-acre Bachelor Island Unit, and the 1,739-acre River S Unit, the 511-acre Roth Unit, and the 590-acre Ridgeport Dairy Unit. (The River S, Roth, and Ridgeport Dairy units are contiguous and are hereafter called the River Unit.)

The Carty Unit is situated at the northern end of the refuge. It is comprised of riparian forests, flooded meadows, ponds, and meandering sloughs; all components of the Gee Creek watershed. The north end of the unit is comprised of unique basaltic upliftings and is managed as the Blackwater Island Research Natural Area (RNA).

The Bachelor Island Unit is situated west of the mainland refuge and as its name implies, is an island within the Columbia River. The island is approximately 1-1/3 miles wide at its widest point, by 3 miles long. This unit is comprised primarily of upland pastures and croplands with some sloughs and wetland impoundments. The northwest quarter of the island lies within the acquisition boundary but is privately owned.

The River Unit is the primary mainland portion of the refuge and consists mostly of meandering sloughs, riparian corridors, man-made impoundments, croplands, and managed pastures. It also contains two relatively large lake systems.

E.1.1 Policy and Direction for Wilderness Reviews

U.S. Fish and Wildlife Service policy (Part 602 FW 3.4 C.(1) (c)) requires that wilderness reviews be completed as part of the Comprehensive Conservation Planning process. This review includes the re-evaluation of refuge lands existing during the initial 10-year review period of The Wilderness Act of 1964, as amended (16 U.S.C. 1131-1136) as well as new lands and waters added to the NWRS since 1974. A preliminary inventory of the wilderness resources is to be conducted during pre-acquisition planning for new or expanded refuges (341 FW 2.4 B., "Land Acquisition Planning"). NWRS policy on Wilderness Stewardship (610 FW 1-5) includes guidance for conducting wilderness reviews (610 FW 4 – Wilderness Review and Evaluation).

A wilderness review is the process of determining whether the Service should recommend NWRS lands and waters to Congress for wilderness designation. The wilderness review process consists of three phases: wilderness inventory, wilderness study, and wilderness recommendation.

Wilderness Inventory
The inventory is a broad look at a refuge to identify lands and waters that meet the minimum criteria for wilderness - size, naturalness, and outstanding opportunities for solitude or primitive and unconfined type of recreation. All areas meeting the criteria are preliminarily classified as Wilderness Study Areas (WSAs). If WSAs are identified, the review proceeds to the study phase.

Wilderness Study
During the study phase, WSAs are further analyzed:

1) for all values of ecological, recreational, cultural, economic, symbolic
2) for all resources, including wildlife, vegetation, water, minerals, soils
3) for existing and proposed public uses
4) for existing and proposed refuge management activities within the area,
5) to assess the Refuge's ability to manage and maintain the wilderness character in perpetuity, given the current and proposed management activities. Factors for evaluation may include, but are not limited to staffing and funding capabilities, increasing development and urbanization, public uses, and safety.

We evaluate at least an "All Wilderness Alternative" and a "No Wilderness Alternative" for each WSA to compare the benefits and impacts of managing the area as wilderness as opposed to managing the area under an alternate set of goals, objectives, and strategies that do not involve wilderness designation. We may also develop "Partial Wilderness Alternatives" that evaluate the benefits and impacts of managing portions of a WSA as wilderness.

In the alternatives, we evaluate:

1) the benefits and impacts to wilderness values and other resources
2) how each alternative will achieve the purposes of the Wilderness Act and the NWPS
3) how each alternative will affect achievement of refuge purpose(s) and the refuge's contribution toward achieving the Refuge System mission
4) how each alternative will affect maintaining and, where appropriate, restoring biological integrity, diversity, and environmental health at various landscape scales
5) other legal and policy mandates
6) whether a WSA can be effectively managed as wilderness by considering the effects of existing private rights, land status and service jurisdiction, refuge management activities and refuge uses and the need for or possibility of eliminating Sec 4 (c) prohibited uses

Wilderness Recommendation
If the wilderness study demonstrates that a WSA meets the requirements for inclusion in the National Wilderness Preservation System, a wilderness study report should be written that presents the results of the wilderness review, accompanied by a Legislative Environmental Impact Statement (LEIS). The wilderness study report and LEIS that support wilderness designation are then transmitted through the Secretary of Interior to the President of United States, and ultimately to the United States Congress for action. Refuge lands recommended for wilderness consideration by the wilderness study report will retain their WSA status and be managed as "… wilderness according to the management direction in the final CCP until Congress makes a decision on the area or we amended the CCP to modify or remove the wilderness recommendation" (610 FW 4.22B). When a WSA is revised or eliminated, or when there is a revision in "wilderness stewardship direction, we include appropriate interagency and tribal coordination, public involvement, and documentation of compliance with NEPA" (610 FW 3.13).

The following constitutes the inventory phase of the wilderness review for the Ridgefield National Wildlife Refuge.

E.1.2 Previous Wilderness Reviews

There have been no previous wilderness reviews conducted for the refuge.

E.1.3 Lands Considered Under This Wilderness Review

All Service-owned lands and waters (in fee title) within the Ridgefield National Wildlife Refuge acquired boundary were considered during this wilderness review.

E.2 Wilderness Inventory

E.2.1 Criteria for Evaluating Lands for Possible Inclusion in the National Wilderness Preservation System

The Wilderness Act of 1964, as amended (16 U.S.C. 1131-1136) provides the following description of wilderness:

"*A wilderness, in contrast with those areas where man and his own 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. An area of wilderness is further defined to mean in this Act as an area of undeveloped Federal land retaining its primeval character and influence, without permanent improvements or human habitation, which is protected and managed so as to preserve its natural conditions...*"

The following criteria for identifying areas as wilderness are outlined in Section 2(c) of the Act and are further expanded upon in NWRS policy (610 FW 4). The first three criteria are evaluated during the inventory phase; the fourth criterion is evaluated during the study phase.

1. generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable;
2. has outstanding opportunities for solitude or a primitive and unconfined type of recreation;
3. has at least five thousand acres of land or is of a sufficient size as to make practicable its preservation and use in an unimpaired condition; and
4. may also contain ecological, geological, or other features of scientific, educational, scenic, or historic value.

Criterion 3 is further defined in Section 3(c) of the Act as 1) a roadless area of 5,000 contiguous acres or more, or 2) a roadless island. Roadless is defined as the absence of improved roads suitable and maintained for public travel by means of 4-wheeled, motorized vehicles that are intended for highway use.

E.2.2. Process of Analysis

The following evaluation process was used in identifying the suitability of refuge units for wilderness designation:

- Determination of Refuge unit sizes.
- Assessment of the units' capacity to provide opportunities for solitude or primitive and unconfined recreation.
- Assessment of "naturalness" of Refuge units.

More detail on the actual factors considered and used for each assessment step follows.

E.2.2.1 Unit Size: Roadless areas meet the size criteria if any one of the following standards apply:

- An area with over 5,000 contiguous acres solely in FWS ownership.

- A roadless island of any size. A roadless island is defined as an area surrounded by permanent waters or an area that is markedly distinguished from the surrounding lands by topographical or ecological features.

- An area of less than 5,000 contiguous Federal acres that is of sufficient size as to make practicable its preservation and use in an unimpaired condition, and of a size suitable for wilderness management.

- An area of less than 5,000 contiguous Federal acres that is contiguous with a designated wilderness, recommended wilderness, or area under wilderness review by another Federal wilderness managing agency such as the Forest Service, National Park Service, or Bureau of Land Management.

The 768-acre Carty Unit does not meet the minimum size requirements for a wilderness area.
The 1,610-acre Bachelor Island Unit does not meet the minimum size requirements for a wilderness area.
The 2,840-acre River Unit does not meet the minimum size requirement for a wilderness area.

E. 2.2.2 Outstanding Solitude or Primitive or Unconfined Recreation:

A designated wilderness area must provide outstanding opportunities for solitude, or a primitive and unconfined type of recreation. Possession of only one of these outstanding opportunities is sufficient for an area to qualify as wilderness, and it is not necessary for one of these outstanding opportunities to be available on every acre. Furthermore, an area does not have to be open to public use and access to qualify under these criteria.

Opportunities for solitude refer to the ability of a visitor to be alone and secluded from other visitors in the area. Primitive and unconfined recreation means non-motorized, dispersed outdoor recreation activities that are compatible and do not require developed facilities or mechanical transport. Primitive recreation activities may provide opportunities to experience challenge and risk, self reliance, and adventure.

All but the Bachelor Island Unit is open to public use. Current public use exceeds 93,000 visits per year. Hunting and other wildlife-dependent recreational activities are allowed. The River and Carty units have extensive public use facilities, including an auto tour route, walking trails, information kiosks, hunting blinds, and a wildlife observation/photography blind. Walking and hiking is allowed on designated roads and trails; camping is not allowed. The individual units are small in size, the refuge sits adjacent to an urban area (including an active port area), and the two mainland units are adjacent to an active railroad line. In addition, auto touring is allowed on the River Unit and is a popular activity, with visits exceeding 55,000 annually. These units would not provide any significant amount of solitude, and their recreational values above the current uses are limited. None of these units provide outstanding opportunities for solitude, and do not provide opportunities for a primitive or unconfined type of recreation.

E. 2.2.3 Naturalness and Wildness: the area generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable.

This criterion must be evaluated in the context of current natural conditions and societal values and expectations without compromising the original intent of the Wilderness Act. It is well recognized that there are few areas remaining on the planet that could be truly classified as primeval or pristine, with even fewer, if any, existing in the conterminous United States. Likewise, few areas exist that do not exhibit some impact from anthropogenic influences, be it noise, light, or air pollution; water quality or hydrological manipulations; past and current land management practices; road or trails, suppression of wildfires; invasions by non-native species of plants and animals; or public uses. While allowing for the near-complete pervasiveness of modern society on the landscape, the spirit of the Wilderness Act is to protect lands that still retain the wilderness qualities of: 1) natural, 2) untrammeled, 3) undeveloped. These three qualities are cornerstones of wilderness character. For areas proposed or designated as wilderness, wilderness character must be monitored to determine baseline conditions and thereafter be periodically monitored to assess the condition of these wilderness qualities. Proposed and designated wilderness areas by law and policy are required to maintain wilderness character through management and/or restoration in perpetuity.

Defining the first two qualities (natural and untrammeled) requires a knowledge and understanding of the ecological systems which are being evaluated as potential wilderness. Ecological systems are comprised of three primary attributes – composition, structure, function. Composition is the components that make up an ecosystem, such as the habitat types, native species of plants and animals, and abiotic (physical and chemical) features. These contribute to the diversity of the area. Structure is the spatial arrangement of the components that contribute to the complexity of the area. Composition and structure are evaluated to determine the naturalness of the area. Function is the processes that result from the interaction of the various components both temporally and spatially, and the disturbance processes that shape the landscape. These processes include but are not limited to predator-prey relationships, insect and disease outbreaks, nutrient and water cycles, decomposition, fire, windstorms, flooding, and both general and cyclic weather patterns. Ecological functions are evaluated to determine the wildness or untrammeled quality of the area.

The third quality assessment is whether an area is undeveloped. Undeveloped refers to the absence of permanent structures such as roads, buildings, dams, fences, and other man-made alterations to the landscape. Exceptions can be made for historic structures or structures required for safety or health considerations, providing they are made of natural materials and relatively unobtrusive on the landscape.

General guidelines used for evaluating areas for wilderness potential during this wilderness inventory process include:

1. The area should provide a variety of habitat types and associated abiotic features, as well as a nearly complete complement of native plants and wildlife indicative of those habitat types. Non-native and invasive species should comprise a negligible portion of the landscape.

2. The area should be spatially complex (vertically and/or horizontally) and exhibit all levels of vegetation structure typical of the habitat type, have an interspersion of these habitats, and provide avenues for plant and wildlife dispersal.

3. The area should retain the basic natural functions that define and shape the associated habitats including but not limited to flooding regimes, fire cycles, unaltered hydrology and flowage regimes, basic predator-prey relationships including herbivory patterns.

4. Due to their size, islands may not meet the habitat guidelines in 1. and 2. above. Islands should, however, exhibit the natural cover type with which it evolved and continue to be shaped and modified by natural processes. Islands should be further analyzed during the study portion of the review, if they provide habitat for a significant portion of a population, or key life cycle requirements for any resources of concern, or listed species.

5. Potential wilderness areas should be relatively free of permanent structures or man-made alterations. Areas may be elevated to the study phase if existing structures or alterations can be removed or remediated within a reasonable timeframe, and prior to wilderness recommendation to the Secretary of the Interior.

The Carty Unit is comprised predominately of riparian forest, one relatively large pond, and meandering tidal sloughs and wetlands typical of the Columbia River floodplain. The overstory canopy is primarily native trees, however much of the understory is comprised of both native and invasive plants such as Himalayan blackberry. The ground component is dominated by invasive reed canarygrass, though some native grasses and forbs persist at the higher, drier elevations of the RNA. The unit retains significant portions of remnant fences. The primary lake on this unit has significant contamination from toxic chemicals once utilized in the adjacent lumber processing facility. The refuge's headquarters and visitor facilities also exist on this unit. The unit contains a hardpacked gravel road that bisects length-wise much of the unit. The Carty Unit does not meet the 'naturalness and wildness' standards for wilderness designation.

The Bachelor Island Unit is comprised almost wholly of intensively managed cattle pastures, hay lands, and croplands. All of the wetland entities are man-made or have been significantly altered; they are intensively managed through the use of water control structures. The riparian conditions have a natural component to the overstory, however the understory and shorelines are dominated by invasive plants such as Himalayan blackberry and false indigo-bush. The ground component is almost wholly introduced pasture grasses and non-native plants. This island also contains adjacent private and state lands. The unit contains several miles of permanent roads and high dike systems. This unit does not meet the 'naturalness and wildness' standards for wilderness designation.

The River Unit consists of a combination of natural and man-made wetlands; all are intensively managed through water control structures. As with the other two units, the overstory is primarily native trees, however the shrub, grass and forb component is mostly non-native plants and introduced forage grasses. The upland portion of this unit is intensively managed through mowing, haying, and cattle grazing. Fences are still utilized for the cattle operation and an old barn is still utilized on the site. Portions of this unit receive extremely intensive public use and include a 4-mile long auto tour route and 2 miles of trails. Much of this unit contains permanent roads and high dikes that prohibit natural flooding of the wetlands. This unit does not meet the 'naturalness and wildness' standards for wilderness designation.

E.2.2.4 Inventory Summary and Conclusion:

Based on this inventory, the Refuge Unit does not meet the basic criteria for inclusion into the National Wilderness Preservation System. The overall refuge is approximately 5,218 acres and is divided into three separate tracts of land, none of which meet the minimum size for wilderness. The refuge lands are actively managed for wetland and upland habitat characteristics using a variety of techniques, including grazing, haying, croplands, herbicide use for invasive plants, prescribed fire, and mechanical manipulations. Much of the refuge lands have undergone significant degradation due to nearly a century of livestock grazing, hydrologic alterations, and invasions by non-native plant species. These lands do not fulfill the criteria for naturalness and wildness, and therefore do not possess outstanding wilderness character. The refuge provides wildlife-dependent recreational opportunities, as well as opportunities to walk or hike on trails; however, these opportunities are not considered to be outstanding in terms of solitude, and do not provide a primitive and unconfined type of recreation.

Table E1. Results of Wilderness Inventory for Ridgefield National Wildlife Refuge

Refuge Unit	(1) Unit Size: has at least 5,000 acres of land or is of sufficient size to make practicable its preservation and use in an unconfined condition, or is a roadless island	(2) Naturalness and wildness: generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unoticeable	(3a) Outstanding opportunities for solitude	(3b) Outstanding opportunities for primitive and unconfined recreation	(4) contains ecological, geological or other features of scientific, educational, scenic, or historical value	Area qualifies as a wilderness study area (meets criteria 1,2, and 3a or 3b)
Carty Unit	No	No	No	No	Yes	No
Bachelor Island	No	No	No	No	No	No
River Unit	No	No	No	No	No	No

Appendix F. Biological Resources of Concern

F.1 Introduction

Early in the planning process, the team cooperatively identified species, species groups, and communities of concern for the Refuge. A comprehensive list of these resources was compiled based upon review of numerous plans (see Section 1.7 of the Draft CCP/EA), many of which highlight priority species or habitats for conservation. The Comprehensive Resources of Concern list is contained in Table F.3. In addition, a table of species and species groups specifically identified in establishing documents for the Refuge was compiled (Table F.1).

The Comprehensive Resources of Concern table was further culled in developing a more targeted assemblage of Priority Resources of Concern. Most of the biological emphasis of the CCP is focused on maintaining and restoring these priority resources. Table F.4 contains the Priority Resources of Concern identified for the Ridgefield National Wildlife Refuge.

Definitions for the column headings in Table F.4 are as follows:

Focal Species: Species selected as representatives or indicators for the overall condition of the conservation target. In situations where the conservation target may include a broad variety of habitat structures and plant associations, several different conservation focal species may be listed. In addition, species with specific “niche” ecological requirements may be listed as a focal species. Management will be focused on attaining conditions required by the focal species. Other species utilizing the conservation target will generally be expected to benefit as a result of management for the focal species.
Habitat Type: The general habitat description utilized by the focal species.
Habitat Structure: The specific and measurable habitat attributes considered necessary to support the focal species.
Life History Requirement: The general season of use for the focal species.
Other Benefiting Species: Other species that are expected to benefit from management for the selected focal species. The list is not comprehensive; see the Table of Potential Resources of Concern for the Refuge for a more complete list.

Table 1. Identification of Refuge Purpose Resources of Concern

Conservation Target (Species/Species Group or Habitat)	Supporting Habitat Type	Life History Requirement	Supporting Documentation*
Wintering: 125000 Ducks, 3000 Geese	Old Fields, Bottomland Prairie, emergent wetlands, agricultural pastures	Wintering habitat	MBCC 1
Breeding, Migration, Resting, Wintering Waterfowl	Old Fields, Bottomland Prairie, emergent wetlands, agricultural pastures, croplands	Migration and wintering Habitat	MBCC 1
Dusky Canada Goose - wintering	Old Fields, Bottomland Prairie, emergent wetlands, agricultural pastures	Migration and wintering Habitat	MBCC 1, MBCC 8, RPD PPP/ Cat Ex.
Other Canada Geese – resting and wintering	Old Fields, Bottomland Prairie, emergent wetlands, agricultural pastures, croplands	Migration and wintering Habitat	MBCC 4 BI/RPD EA
Taverner's, dusky, western, cackling, lesser	Old Fields, Bottomland Prairie, emergent wetlands, agricultural pastures, croplands	Migration and wintering Habitat	RPD PPP/ Cat Ex.
Aleutian	Old Fields, Bottomland Prairie, emergent wetlands, agricultural pastures, croplands	Migration and wintering Habitat	RPD Cat Ex.
Tundra Swans - roosting	Emergent wetlands, tidal riverine	Migration and wintering Habitat	BI/RPD EA, RPD PPP/Cat. Ex.
Trumpeter Swans	Emergent wetlands, tidal riverine	Migration and wintering Habitat	RPD PPP
Dabbling ducks – resting and nesting	emergent wetlands, bottomland prairie, dry prairie	Migration and wintering Habitat	MBCC 1 BI/RPD EA
Wintering habitat- mallard, pintail, blue-winged teal	Emergent wetlands, tidal riverine	Wintering habitat	RPD PPP/Cat. Ex.
Diving Ducks- wintering	Emergent wetlands, tidal riverine	Migration and wintering Habitat	BI/RPD EA
Wigeon – Native Pasture	Dry prairie, bottomland prairie	Wintering habitat	MBCC 1
Sandhill Crane	Emergent wetlands	Nesting	MBCC 8, BI EIS
Sandhill Cranes– resting/roosting	Tidal riverine, bottomland prairie, croplands, agricultural pastures	Migration and wintering Habitat	MBCC 8, 10, BI EIS, BI/RPD EA, RPD PPP/Cat. Ex
Bald Eagles - nesting	Bottomland forest	Nesting	
Great Blue Herons– nesting	Bottomland forest	Nesting	MBCC 8
Resting, feeding, wintering waterfowl	Old Fields, Bottomland Prairie, emergent wetlands, agricultural pastures	Resting, feeding, wintering	MBCC 4, 6, 8, 10, unnumbered MBCC memo circa 1972
Bald Eagle	Bottomland forest	Roosting, nesting	MBCC 8, BI EIS, BI/RPD EA, RPD PPP/Cat. Ex
Great blue heron	Bottomland forest	Nesting	MBCC 8, BI EIS
Preserve Major Wintering Area for Waterfowl	Old Fields, Bottomland Prairie, emergent wetlands, agricultural pastures, croplands	wintering MBCC	10
Feeding and Resting dusky and cackling geese	Old Fields, Bottomland Prairie, emergent wetlands, agricultural pastures, croplands	Migration and wintering	MBCC 10
Preserve Wintering grounds	Old Fields, Bottomland Prairie, emergent wetlands, agricultural pastures, croplands	wintering BI	EIS

Conservation Target (Species/Species Group or Habitat)	Supporting Habitat Type	Life History Requirement	Supporting Documentation*
Resting, Feeding waterfowl	Wetland, agricultural Old Fields, Bottomland Prairie, emergent wetlands, agricultural pastures, croplands	Migration and wintering	BI EIS
Shorebird, raptors, marsh and waterbirds, mammals, riparian	Wetland, agricultural Old Fields, Bottomland Prairie, emergent wetlands, agricultural pastures, croplands, bottomland forests	BI	EIS BI/RPD EA
Shorebirds, marshbirds, songbirds, black-tailed deer, coyote, fox, raccoon, skunk, beaver, otter, brush rabbit	Wetland, agricultural Old Fields, Bottomland Prairie, emergent wetlands, agricultural pastures, croplands, bottomland forests	Spring and fall migrations and resident populations	RPD PPP
Shorebirds, marshbirds, songbirds	Wetland, agricultural Old Fields, Bottomland Prairie, emergent wetlands, agricultural pastures, croplands, bottomland forests	Spring and fall migrations	RPD Cat. Ex.
Provide and protect wintering habitat	winteri	ng	BI/RPD EA
Peregrine falcon		wintering	BI/RPD EA RPD PPP/ Cat. Ex.
Common loon		wintering	RPD PPP
Water howellia *(Howellia aquatilis)*			RPD PPP
Smallflower wakerobin *(Trillium parviflorum)*			RPD PPP
Giant white fawnlily *(Erythronium oregonum)*			RPD PPP
Upland (Nuttall's) larkspur *(Delphinium nuttallii)*			PRD PPP
Olive-sided flycatcher			RPD PPP

***Documents establishing purposes of the Refuge and/or Refuge units:**
MBCC 1: Migratory Bird Conservation Commission Memorandum 1, May 18, 1965
MBCC 4: Migratory Bird Conservation Commission Memorandum 4, August 5, 1965
MBCC 6: Migratory Bird Conservation Commission Memorandum 6, January 22, 1974
MBCC 8: Migratory Bird Conservation Commission Memorandum 8, February 5, 1985
MBCC 10: Migratory Bird Conservation Commission Memorandum 10, March 21, 1995
BI EIS: Environmental Impact Statement (EIS), Land Acquisition—Zimmerly Tract for Addition to Ridgefield National Wildlife Refuge, Washington, March 1980
BI/RPD EA: Environmental Assessment (EA), Acquisition of Remaining Tracts, Ridgefield National Wildlife Refuge, Clark County, Washington, December 1983
RPD PPP/Cat Ex.: Preliminary Project Proposal (May 1989) and the Decision Document (Categorical Exclusion), Acquisition of Port of Vancouver Tract, Ridgefield National Wildlife Refuge, Clark County, Washington (October 12, 1989)

Table 2. Biological Diversity, Integrity and Environmental Health

Habitats (plant communities that Represent Existing BIDEH)	**Population/Habitat Attributes (Age class, structure, serial stage, species composition)**	**Natural processes responsible for these conditions**	**Limiting Factors**
Bottomland Forest	Subtypes: • Black cottonwood with appropriate native shrub understory • Pacific willow pure stand (wet sites) • Ash/nettle/sedge community; Ash with dense herbaceous and shrub understory, overstory >12" DBH with >40% canopy coverage General Attributes of Bottomland Forest: Native shrub layer dominants include willow, snowberry, cascara, Nootka rose, red-osier dogwood, red alder, spirea, and red elderberry and saplings of native canopy trees. Native sub-canopy trees include black hawthorn, vine maple, big leaf maple, willow, ninebark, hazelnut, and young canopy trees. Native canopy trees include Oregon ash and black cottonwood.[2] *Potential Conservation Species: song sparrow (all stages), Swainson's thrush (dense shrub), willow flycatcher (shrub/young seral), purple martin (snag/low competition by non-native birds, nearby water) , Columbian white-tailed deer*	Functioning floodplain major flood events, scour of trees/herbaceous layers, deposition of silts Frequency of flooding: Historically, overbank flooding annually (spring) Flooding is the primary natural disturbance regime in Columbia River bottomland forest.[6]	Non-Functioning Floodplain Dike construction and dams reduce/alter flood events Past grazing, agriculture, invasive species (competition and soil binding), lack of silt deposition
Bottomland (wet) Prairie (*Deschampsia caespitosa* prairie)	Native herbaceous species, (e.g. Columbia sedge, tufted hairgrass, rushes). Unique: Willamette daisy, Bradshaw's lomatium, Nelson's checkermallow *Potential Conservation Species: rails, northern harrier*	Periodic fire and poorly drained soils; seasonal flooding. Transition zone above mean high gauge, throughout refuge	Invasive species (especially reed canarygrass) displace/out compete native communities; lack of periodic fire
Upland (Dry) Prairie	*Agropyron caninum, Bromus sterilis, Holcus, Hordeum*	Periodic fire, shallow well drained soils	Invasive species encroachment, lack

Habitats (plant communities that Represent Existing BIDEH)	**Population/Habitat Attributes (Age class, structure, serial stage, species composition)**	**Natural processes responsible for these conditions**	**Limiting Factors**
	brachyantherum, Poa palustris. Unique: basalt outcrops, northern alligator lizard, *Camassia* spp, Nuttall's larkspur *Potential Conservation Species: Mazama pocket gopher, gray-tailed vole*		of fire, grazing/soil disturbance
Western Hemlock Forest	Mixed forest, Douglas-fir, Western red cedar, Indian plum, Oregon white oak. Unique: smallflower wakerobin, giant white fawnlily	Infrequent fire, light grazing/browsing by large ungulates	Blackberry encroachment; canopy closure
Oak Woodlands (unique habitat based on basalt outcrops and transitional floodplain habitat)	Understory of *Symphoricarpos albus, Holodiscus discolor, Rhus diversiloba, Rosa* spp., *Festuca rubra, Danthonia californica, Agropyron caninum, Bromus sterilis*. Unique: Wheeler's bluegrass, slender-billed white-breasted nuthatch *Potential Conservation Species: slender-billed white-breasted nuthatch, western gray squirrel*	Frequent low intensity fire (approx every 5 years); absence of ground disturbance; presence of acorn dispersing animals (squirrels, jays, acorn woodpeckers); light grazing/browsing by native ungulates Oak habitats were formerly maintained by fires of various frequencies. Areas of infrequent fire supported shrub cover. Fire reduced encroachment by conifers and other competing species. Post-fire establishment and survival of oak saplings is increased.	Invasive species (e.g. blackberry) displace/out compete native communities; lack of fire; conifer encroachment; competition by native trees/canopy closure; lack of light grazing/browsing pressure by large ungulates; overgrazing during summer (oak seedlings eaten); oak diseases (sudden oak death fungus, anthracnose disease)
Emergent Wetlands	Subtypes: Seasonal, Semi-permanent, Permanent *Potential Conservation Species: waterfowl, Canada geese, dusky Canada goose, cackling goose, tundra swan, Canadian sandhill*	Periodic flooding/ scouring; seasonal fluctuations/drying but more permanent water situation than typical seasonal wetlands	Invasive plants, (e.g. reed canarygrass); nutria; dams on river change hydrological regime; lack of

Habitats (plant communities that Represent Existing BIDEH)	**Population/Habitat Attributes (Age class, structure, serial stage, species composition)**	**Natural processes responsible for these conditions**	**Limiting Factors**
	crane, great blue heron, and other species identified in Purpose document (rails, shorebirds)		spring flooding/scouring; diking; reduced tidal connection to Columbia River; flood depth and duration
Tidal Riverine	Open, generally flowing water; potentially supporting rearing anadromous fish; affording fish passage throughout watershed *Potential Conservation Species: coastal cutthroat trout, Chinook salmon (Lower Columbia ESU), coho salmon (Lower Columbia ESU)*	Tidal and periodic flooding, open water, submergent vegetation, perennial water flows	Residental/commercial development, lack of major flooding, siltation, invasive species encroachment (e.g. reed canarygrass); contaminants; water quality/temperature
Ephemeral Ponds	Small (<1 acre) perched wetlands located on RNA/Carty Unit providing habitat for *Howellia aquatilis* *Potential Conservation Species: Howellia aquatilis*	Generally open water (< 1’ depth) from November through June (rainfall) with sparse emergent and submergent vegetation	Reed canarygrass encroachment ; canopy closure
Croplands	Row crops (grain, legumes) for waterfowl and cranes *Potential Conservation Species: Dusky Canada goose, cackling goose, Canadian sandhill crane; most species identified in Purpose documents*	NA Invasive	plant species, cost and labor intensive
Agricultural Pastures	Mixed non-native/native upland grasses w/ legume/forbs; restoration every 5-10 years *Potential Conservation Species: Dusky Canada goose, cackling goose, Canadian sandhill crane; most species identified in Purpose documents*	NA Invasive	plant species; lack of fertilization, fire, lack of coop farmers (grazing and haying), thatch accumulation
Large flocks of migrating/wintering waterfowl	Native prairie, expansive emergent wetlands and wooded wetlands within the lower Columbia River	Predominant, historical Canada goose subspecies (dusky) adapted to small fields and wet	Diking, draining and leveling of ridges/swales resulting in reduced wetland area;

Habitats (plant communities that Represent Existing BIDEH)	Population/Habitat Attributes (Age class, structure, serial stage, species composition)	Natural processes responsible for these conditions	Limiting Factors
		meadows interspersed with riparian communities. Anthropogenic fire maintained native prairie. Emergent wetlands and wet meadows abundant in LCR. Dynamic flooding regime of lowland areas. Historical accounts describe area as the Wapato Valley.	damming; manipulated river hydrology; lack of periodic fire; development within floodplain

Table 3. Ridgefield National Wildlife Refuge Potential Resources of Concern

Species / Species Groups / Communities	Refuge Purposes	Biol. Diversity, Integrity and Envir Health	Federal Status	Washington Status	Oregon Status	WA NHP Rank	Flyway Waterfowl Plans	N. American WMP (2004)	Canada Goose Depredation Plan	Birds of Conservation Concern 2002 (USFWS)	Comprehensive Wildlife Conservation (WDFW)	NPC Regional Shorebird Plan 2000	Landbird Cons Strat- 2000	Grassland Birds/W.V 1999	TNC-WV/PT/GB Ecoregional Assessment	BCC National (Table 48)	Species Occurrence in following Habitats:	Managed Grasslands	Wetlands-Nontidal	Wetlands -Tidal	Agricultural Habitat	Wet Meadow, Prairie	Oak Woodland	Floodplain/Riparian Forest	Mixed Conifer Forest	Rivers/Streams
Wintering waterfowl	X	X																x	x	x	x	x				
Dusky Canada Goose	X						X		X	GBBDC								x	x		x	x				
Aleutian Cackling Goose	X		FCo	ST		SNA	X		X									x	x		x					
Cackling Goose	X						X		X	GBBDC			I					x	x		x	x				
Western Canada Goose	X						X		X				I					x	x		x					
Taverner's Cackling Goose	X						X		X				I					x	x		x					
Lesser Canada Goose	X						X		X				I					x	x		x					
Pacific White-fronted Goose										GBBDC								x	x		x					
Snow Goose										GBBDC (Wrangel Is.)								x	x							
Trumpeter Swan	X					S3				GBBDC (Interior, Rocky Mts)	X				X				x		x					
Tundra Swan	X					S4	X												x		x					
Dabbling ducks	X	X													X				x	x	x					
Wood Duck						S3				GBBDC									x		x			x		
Mallard	X						X			GBBDC								x	x		x			x		
Northern Pintail	X					S5	X	D		GBBDC	X								x		x					
American Wigeon	X					S4				GBBDC					X			x	x		x					
Blue-winged Teal	X																		x							
Diving ducks	X	X													X				x	x						x
Ring-necked Duck						S4				GBBDC	X								x	x				x	x	
Lesser Scaup						S4		D		GBBDC	X								x	x						
Canvasback										GBBDC									x	x						
Canadian Sandhill Crane	X			SE		S1B,S3N												x	x	x	x	x				
Common Loon	X			SS		S2B,S4N					X									x						x
Raptors		X													X			x	x		x	x		x	x	x
Bald Eagle, Bald Eagle Roosts	X	X	FCo	SS	ST	S4B,S4N				T	X				X				x	x				x	x	x
Northern Harrier													X1			X			x		x	x				
American Kestrel						S4							X1								x	x				
American Peregrine Falcon	X		FCo	SS	SE	S1B,S3N				BCC/BCR	X		X2c		X	X			x			x		x		
Red-shouldered Hawk													X2										x		x	
Cooper's Hawk													X2										x		x	
Short-eared Owl						S3					X		X			X					x	x				
Western Screech-owl						S4							X2										x	x	x	
Pileated Woodpecker				SC		S4					X		X1										x	x	x	

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Downy Woodpecker													X2										x	x	x	
Shorebirds--concentrations		X													X				x	x						
Common Snipe						S4						4							x		x	x				
Black-bellied Plover						S4						4							x		x					
Dunlin						S4						4							x		x					
Greater Yellowlegs						S4						4							x		x					
Lesser Yellowlegs												2							x		x					
Killdeer						S4						4							x		x					
Western Sandpiper						S4						4							x		x					
Least Sandpiper						S4						4							x		x					x
Wilson's Phalarope						S3						3				X			x							
Semi-palmated Plover												3							x							
Spotted Sandpiper						S3						3							x		x					
Long-billed Dowitcher						S4						3							x		x					
Black-necked Stilt				M		S3B					X	1							x							
Great Blue Heron, GBH nesting	X			M		S4					X				X			x	x		x	x		x	x	
Olive-sided flycatcher	X		FCo		SV	S4				BCC/BCR			X1		X	X								x		
Pacific-slope flycatcher						S4							X2a		X								x	x	x	
Willow flycatcher			FCo		SU	S4B							X1		X									x		
Western Wood Peewee						S5							X1		X								x	x	x	
Purple Finch													X2a										x	x	x	
Bullock's Oriole													X2		X								x	x	x	
Swainson's Thrush						S5							X1										x	x	x	
House Wren													X2										x	x	x	
Bewick's Wren													X1			X							x		x	
Oregon Vesper Sparrow			FCo	SC	SC	S1B				BCR	X		X1	X								x				
Spotted Towhee													X2a										x	x	x	
Streaked Horned Lark(ssp. *Strigata*)			FC	SE	SC	S1				BCC/BCR	X		X1	X		X					x	x				
Western Meadowlark					SC	S4N,S4S5B					X		X1 (D)	X	X						x	x				
Lazuli Bunting						S4							X2a									x				
Black-headed Grosbeak													X2b											x		
Yellow Warbler						S4							X1											x		

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Table 3. Ridgefield National Wildlife Refuge Potential Resources of Concern

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Red-eyed Vireo													X1											x		
Western Purple Martin			FCo	SC	SC	S3B					X		X1		X				x						x	
Band-tailed Pigeon			FCo			S3S4B,S4N				GBBDC	X		X1		X								x		x	
Mourning Dove						S5				GBBDC											x		x			
Vaux's Swift				SC		S3					X		X2b		X				x			x	x		x	
Tree Swallow													X2 (D)						x			x	x		x	
Rufous Hummingbird						S4				BCC/BCR			X1		X	X						x	x	x	x	
S-Billed White-breasted Nuthatch			FCo	SC		S1					X		X1		X								x			
Common Bushtit													X1										x	x	x	
Western gray squirrel			FCo	ST	SU	S2																	x		x	
Columbian white-tailed deer			FE	SE	SV	S1					X															
Townsend's big-eared bat			FCo	SC	SC	S2S3					X				X										x	
Yuma myotis			FCo			S5									X									x	x	
Western pocket gopher			FC	ST		S2					X															
Gray-tailed vole				SC		S2					X				X											
Northwestern pond turtle			FCo	SE	SC	S1					X				X				x					x		x
Northern red-legged frog			FCo		SV	S4					X				X				x			x		x		
Pacific lamprey			FCo		SV	S3S									X											x
Steelhead (LCR ESU)-winter			FT	SC	SC	SNR																				x
Steelhead (LCR ESU)-summer			FT	SC	SC	SNR																				x
Coho (LCR ESU)			FC		SE	SNR																				x
Chinook (LCR ESU)-fall			FT	SC	SC	SNR														x						x
Coastal cutthroat trout (SW WA/Columbia River ESU)			FCo		SE	SNR																				x
Pacific smelt			FT	SC		S4																				
Golden paintbrush (*Castilleja levisecta*)			FT	SE	SE	S1					X				X								x			
Nelson's checkermallow (*Sidalcea nelsoniana*)			FT	SE	ST	S1					X				X				x			x		x		

Table 3. Ridgefield National Wildlife Refuge Potential Resources of Concern

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Bradshaw's desert parsley *(Lomatium bradshawii)*			FE	SE	SE	S1					X				X							x	x			
Water Howellia *(Howellia aquatilis)*	X		FT	ST	ST	S2S3					X				X				x							
Trillium parviflorum	X			SS		S2S3																	x		x	
Erythronium oregonum	X																						x		x	
Delphinium nuttallii	X					S1 (OR)																	x		x	
Wheeler's bluegrass (*Poa nervosa*)				SS		S2																				
Oregon white oak-(Oregon ash)															X											
Oregon white oak/oval leaf viburnum woodland		X				S2									X											
Bottomland (Wet) prairie		X													X											
Upland (Dry) prairie		X													X											
Riparian forest/shrubland		X													X											
Oregon ash/Carex deweyana/Urtica dioica assoc		X				S2																				
Depressional wetland		X													X											
Freshwater marshes		X													X											
Freshwater wetlands, tidally influenced		X													X											
Freshwater aquatic beds		X													X											
Mudflats, autumnal freshwater		X													X											
Vernal pools		X													X											

Definition of Resources of Concern table: From approx 16 wildlife conservation plans, assessments, and/or lists: Species, species groups, or plant communities/habitats that were ranked highly within those documents for conservation concern or management action, and currently or historically occurred on the Refuge.

Table 3. Category Codes:

Federal Status: FE-Endangered; FT-Threatened; FC-Candidate; FCo-Species of Concern

Washington Status: SE-State Endangered; ST-State Threatened; SC-State Candidate; SS-State Sensitive; M-Monitor

Oregon Status: SC-Critical; SV-Vulnerable; SP: Peripheral/naturally rare; SU-Undetermined Status

Washington Natural Heritage Program:
S1: Critically imperiled because of extreme rarity or because it is somehow especially vulnerable to extinction or extirpation, typically with 5 or fewer occurrences.
S2: Imperiled because of rarity or because other factors demonstrably make it very vulnerable to extinction (extirpation), typically with 6-20 occurrences.
S3: Rare, uncommon or threatened, but not immediately imperiled, typically with 21-100 occurrences.
S4:Not rare and apparently secure, but with cause for long-term concern, usually with more than 100 occurrences.
S5:Demonstrably widespread, abundant, and secure.
SNR = Not yet ranked; B= breeding; N= nonbreeding

NPC Reg. Shorebird Plan: 4: High concern; 3: Mod concern; 2: Low concern; 1-no risk

Landbird Conservation Plan: I: Increasing; D: Declining

Birds of Management Concern, Region 1 USFWS:
BCC/BCR: BCC/Birds of Conservation Concern/Regional
BCC/N: BCC/National
BCC: Birds of Conservation Concern
GBBDC: Gamebirds below desired condition

N. American Waterfowl Management Plan: D-decreasing long-term trend

Willamette Valley/Puget Trough/Georgia Basin Ecoregional Assessment (TNC):
Number indicated Refuge contribution (as percent) of total known occurrence (EO) score. Species for which the Refuge contributes <10% for either measure are not indicated on this sheet.

Other Plans: X- Addressed in Plan, no specific category

Table 3. Sources/Criteria for Potential Resources of Concern Table:

North American Waterfowl Management Plan, 2004 Strategic Guidance. Long term trends in breeding populations (1970-2003). All species occurring on RNWR with a decreasing long-term trend.

USFWS Birds of Conservation Concern 2002 . Table 41, Region 1 (Pacific Region) BCC 2002 List; Table 8. Bird Conservation Region (BCR) 5 (Northern Pacific Forest-U.S. only) BCC 2002 List; USFWS Division of Migratory Bird Management 2007 (Draft), Gamebirds Below Desired Condition (GBBDC). All species occurring on RNWR.

Conservation Strategy For Landbirds in Lowlands and Valleys of Western Oregon and Washington. March 2000. Bob Altman, American Bird Conservancy. Prepared for Oregon-Washington Partners in Flight. All species occurring on RNWR with significantly declining trends.

North Pacific Coast Regional Shorebird Management Plan. 2000. Martin Drut and Joseph Buchanan. All species occurring on RNWR with a regional score above 1 (no risk).

Washington Natural Heritage Plan. 2007, revised 2009. All species and community types occurring on RNWR.

Pacific Flyway Management Plan for the Cackling Canada Goose. Pacific Flyway Council, USFWS. 1999.

Pacific Flyway Management Plan for the Dusky Canada Goose. Pacific Flyway Council, USFWS. 2008.

Pacific Flyway Management Plan for the Aleutian Canada Goose. Pacific Flyway Council, USFWS. 1999.

Washington Comprehensive Wildlife Conservation Strategy. Washington Dept. of Fish and Wildlife, Olympia, WA. 2005. All species ocurring on RNWR.

Willamette Valley- Puget Trough- Georgia Basin Ecoregional Assessment. The Nature Conservancy, Portland, OR. 2004.

Species with >10% occurrences of each analysis area on RNWR.

Northwest Oregon-Southwest Washington Canada Goose Agricultural Depredation Control Plan. Pacific Flyway Council, USFWS/USDA. Portland, OR 1998.

Rare, Threatened and Endangered Species of Oregon. Oregon Natural Heritage Program, March 2007.

Table 4. Priority Resources of Concern

Focal Species	Habitat Type	Habitat Structure	Life History Requirement	Other Benefiting Species
Riparian				
Swainson's thrush	Bottomland Forest -mid to late successional with intact understory (*Fraxinus latifolia*/*Populus trichocarpa*/ *Cornus stolonifera*/ *Urtica dioica*)	Shrub layer cover >50% with >60% of native shrubs; canopy cover >50% (Ref: PIF 2000 p. 81)	Breeding	song sparrow, Bewick's wren, house wren, pileated woodpecker, downy woodpecker, black-headed grosbeak, red-eyed vireo, Pacific-slope flycatcher, tree swallow, great blue heron (nesting), bald eagle (nesting, roosting)
Willow flycatcher	Bottomland Forest - early successional, willow (*Salix lasiandra*/*Urtica dioica*)	Patchy shrub layer, 1-4 m tall, with 30-80% cover and scattered herbaceous openings; canopy trees >4 m covering <20% of landscape (Ref: PIF 2000 pp 75)	Breeding	yellow warbler, song sparrow
Bewick's wren	Bottomland Forest - Ash Forest with little shrub layer (*Fraxinus latifolia*/*Carex deweyana*/*Urtica dioica*)	Canopy cover >50% ash dominated, Shrub layer <20% consisting of native floodplain species (snowberry, rose, spirea), herb layer >50 native species consisting of nettle and *Carex* (based on Christy 2004)	Breeding, year-round for benefiting species	s.-b. white-breasted nuthatch, western wood-peewee, house wren, tree swallow, song sparrow, downy woodpecker, pileated woodpecker
Grassland/Pasture/Old Field/Wet Meadow				
Savannah sparrow (western ssp)	Dry (Native) Prairie – moderate to tall	Manage fallow fields, pastures, and/or native prairies in variable heights of 6-24 inch, >90% grass forb cover, <5% shrub cover, patches of >50 acres (PIF 2000 pp 44)	Breeding	savannah sparrow, northern harrier, short-eared owl, western meadowlark, gray-tailed vole, streaked horned lark, Oregon vesper sparrow, western pond turtle, lazuli bunting, nesting waterfowl
Dusky Canada goose	Agricultural pastures – small adjoining water	Short grass (<6"); pastures <100 acres adjacent to wetlands, (legumes?) (*refine with Dusky meeting*)	Foraging	other Canada geese, American wigeon, great blue heron, American pipit, streaked horned lark (pipits and larks prefer grazed pasture), short-eared owl, raptors, coyote, great egrets, sandhill crane (feed on voles), black-bellied plover, semipalmated plover, Wilson's phalarope

Focal Species	Habitat Type	Habitat Structure	Life History Requirement	Other Benefiting Species
Northern Harrier	Bottomland (wet) Prairie	Short-medium height native emergent wetland plant species Buffer >122 m radius for harrier nests, residual duff preferred for nesting habitat, but no mowing before July 15 (see pg 45 PIF 2000)	Breeding, wintering	Common yellowthroat, American bittern, nesting waterfowl, dusky Canada goose (feeding), rare plant species (lomatium, checkermallow), short-eared owl, savannah sparrow, common snipe, song sparrow, western meadowlark
Cackling goose	Agricultural Pastures	Short grass (<6"); pastures >100 acres, (legumes?)	Foraging	other Canada and cackling geese, great blue heron, American pipit, streaked horned lark (pipits and larks prefer grazed pasture), short-eared owl, raptors, coyote, great egret, sandhill crane (feed on voles), black-bellied plover, semipalmated plover, Wilson's phalarope
Forest Types				
Orange-crowned warbler	Mixed Coniferous/ Deciduous Forest	In early successional forests provide an average of >30% cover of deciduous shrubs and small trees (<15 feet tall)	All, breeding	Rufous hummingbird, Wilson's warbler, MacGillivray's warbler, willow flycatcher, Bewick's wren, song sparrow, spotted towhee
Slender-billed white-breasted nuthatch	Oak Savannah/ Woodland	Maintain and provide: Contiguous minimum stand size 100 acre. Canopy 40 to 80% with non-oak cover less than 10%. Mean DBH of oak should exceed 21 inches with 20% greater than 28 inches. (RNA 129 ac) (Ref: PIF 2000, pp 55)	Breeding, year-round	western pond turtle, Bewick's wren, western skink, northern alligator lizard, western gray squirrel, house wren
Wetland Types				
Mallard	Emergent wetlands – winter water depth 4-18 inches	Shallow water depths averaging 4-18" over 75% of the wetland; largely native emergent vegetative community Dabbling ducks use 4-9 inches with most species using lower end of range (Ref: Frederickson in	wintering	Other ducks, tundra swans, western painted turtle, yellow-headed blackbird (could be focal species), common snipe, long-billed dowitcher, black-necked stilt, rails

Focal Species	Habitat Type	Habitat Structure	Life History Requirement	Other Benefiting Species
		Bookout), low/no velocity; (flood strategy could include incremental flood-up to allow dabblers staged access to appropriate depths), >40% cover of >10 genera of native (or desirable non-native) short and tall emergent plants		
Dusky Canada goose	Wet meadow (Emergent wetlands - <4 inches of water)	Potential plants species include *Carex obnupta*, *Juncus effusus*, reed canarygrass (mowed), *Juncus bufonus*. Mowed (preseason) to <6 inch, flooding of critical dusky areas to <4 inch of water, minimal hydroperiod early Dec. to mid March, willow management may be necessary with encroachment.		American wigeon, mallard, rail, heron, snipe, stilt, shorebirds
Lesser Scaup	Permanent wetlands (Post Office Lake, Carty Lake)	Water depths 3-10 feet, mixed open water and submergent vegetation, water present in summer months, winter depths variable with precipitation		Ring-necked duck
Mallard - Swans	Emergent wetlands – Semi-permanent (Rest Lake, Mantrap Lake)	Summer depths may be several inches, winter depths 18-36 inches, vegetation includes tall emergents, wapato, submergent vegetation	Mallard – brood water (summer)	Mallard, tundra swan, trumpeter swan, wapato, amphibians, turtles, yellow-headed blackbird
Water Howellia – (Federal Threatened)	Ephemeral Vernal ponds	Seasonal pools <20% reed canary grass, water depth dry in late summer, depths <36 inches spring, >30% canopy cover predominately ash, fish absent	all	Amphibians
Sandhill crane	Tidally influenced wetlands (Campbell Lake, Fowler Lake, Boot Lake)	Hydroperiod and depth variable with river. Water body has open water, submergent, and emergent wetland types. Tall emergents <40% of wetland	Wintering	Anadromous fish, geese, herons, shorebirds, all dabbling ducks, swans

Focal Species	Habitat Type	Habitat Structure	Life History Requirement	Other Benefiting Species
Agricultural				
Sandhill cranes	Croplands	Corn and other grain crops	Foraging	Canada geese, American wigeon, mallard
Riverine Habitat				
Coastal cutthroat trout	(tidally connected) Riverine habitats (Gee Creek, Campbell Slough)	Barrier free, water quality/chemistry/ Temperature, intact riparian corridor, Seven day minimum intragravel DO 6.5 mg oxygen/liter, Temperature <73 Fahrenheit	Anadromous fish rearing, lamprey spawning, connectivity between spawning habitat/river	Coho (Lower Columbia ESU), Chinook salmon (Lower Columbia ESU), Pacific lamprey, western brook lamprey, steelhead, bald eagle (foraging)

Appendix G. Statement of Compliance

STATEMENT OF COMPLIANCE
for Implementation of the
Ridgefield National Wildlife Refuge, Clark County, Washington
Comprehensive Conservation Plan

The following executive orders and legislative acts have been reviewed as they apply to implementation of the Comprehensive Conservation Plan for the Ridgefield National Wildlife Refuge, located in Washington state.

1. **National Environmental Policy Act (1969). (42 U.S.C. 4321 et seq.).** The planning process has been conducted in accordance with National Environmental Policy Act Implementing Procedures, Department of the Interior and Service procedures, and has been performed in coordination with the affected public. The requirements of the National Environmental Policy Act (NEPA)(42 U.S.C. 4321 et seq.) and its implementing regulations in 40 CFR Parts 1500-1508 have been satisfied in the procedures used to reach this decision. These procedures included: the development of a range of alternatives for the CCP; analysis of the likely effects of each alternative; and public involvement throughout the planning process. An environmental assessment (EA) was prepared for the project that integrated the Draft CCP management objectives and alternatives into the EA and NEPA process. The Draft CCP and EA was released for a 30-day public comment period, which ended on July 16, 2010. The affected public was notified of the availability of these documents through a Federal Register notice, news releases to local newspapers, the Service's refuge planning website, and a planning update. Copies of the Draft CCP/EA and planning updates were distributed to an extensive mailing list. The CCP was revised based on public comment received on the draft documents.

2. **National Historic Preservation Act (1966). (16 U.S. C.470 et seq.).** The management of archaeological and cultural resources of the refuge will comply with the regulations of Sections 106 and 110 of the National Historic Preservation Act. The Refuge contains a number of prehistoric and historic sites, one site included in the National Register of Historic Places (NRHP), and one site eligible for inclusion in the NRHP. No historic properties are known to be affected by the proposed action, based on the criteria of an effect or adverse effect as an undertaking defined in 36 CFR 800.9 and Service Manual 614 FW2. However, determining whether a particular action has the potential to affect cultural resources is an ongoing process that occurs as step-down and site-specific project plans are developed. The Service will comply with the National Historic Preservation Act if any management actions have the potential to affect any historic properties which may be present.

3. **Executive Order 12372. Intergovernmental Review.** Coordination and consultation with affected Tribal, local and State governments, other Federal agencies, and local interested persons has been completed through personal contact by the Project Leader and Refuge Manager.

4. **Executive Order 13175. Consultation and Coordination with Indian Tribal Governments.** As required under Secretary of the Interior Order 3206 American Indian Tribal Rights, Federal-Tribal Responsibilities, and the Endangered Species Act, the Project Leader consulted and coordinated with Chinook and Cowlitz Tribes regarding the proposed action. Specifically, the Service coordinated with the Chinook and Cowlitz Tribes throughout the Service's planning process

over the past 4 years in developing the Refuge's Comprehensive Conservation Plan. The Tribes had the opportunity to review and provide input to the CCP Alternatives.

5. **Executive Order 12898. Federal Actions to Address Environmental Justice in Minority and Low-Income Populations.** All Federal actions must address and identify, as appropriate, disproportionally high and adverse human health or environmental effects of its programs, policies, and activities on minority populations, low-income populations, and Indian Tribes in the United States. The CCP was evaluated and no adverse human health or environmental effects were identified for minority or low-income populations, Indian Tribes, or anyone else.

6. **Wilderness Act.** The Service has evaluated the suitability of the Refuge for wilderness designation and concluded that the Refuge does not meet the basic criteria for inclusion into the National Wilderness Preservation System (see Appendix E, Wilderness Review).

7. **National Wildlife Administration Act of 1966, as amended by The National Wildlife Refuge System Improvement Act of 1997 (16 U.S.C. 668dd-668ee).** The National Wildlife Refuge System Improvement Act (Public Law 105-57, Improvement Act) requires the Service to develop and implement a CCP for each refuge. The CCP identifies and describes refuge purposes; refuge vision and goals; fish, wildlife, and plant populations and related habitats; archaeological and cultural values of the refuge; issues that may affect populations and habitats of fish, wildlife, and plants; actions necessary to restore and improve biological diversity on the refuge; and opportunities for wildlife-dependent recreation, as required by the Act.

During the CCP process the Project Leader and Refuge Manager evaluated all existing and proposed refuge uses. Priority wildlife-dependent uses (hunting, fishing, wildlife observation and photography, environmental education and interpretation) are considered automatically appropriate under Service policy and thus exempt from appropriate uses review. Uses that were found Not Appropriate include: allowing dogs on refuge (other than dogs used in waterfowl hunting); jogging; bicycle use; horseback riding; berry picking; and providing a kayak launching facility (Appendix A).

Compatibility Determinations have been prepared for the following uses: waterfowl hunting, fishing, nonconsumptive uses (wildlife observation and photography, interpretation, and environmental education), mosquito and disease vector management, grazing, haying, crop production, research, and environmental interpretation at the Cathlapotle Plankhouse. All of these were found to be compatible with refuge purposes and the System mission with stipulations specified in each of the compatibility determinations (Appendix B).

8. **EO 13186. Responsibilities of Federal Agencies to Protect Migratory Birds.** This order directs departments and agencies to take certain actions to further implement the Migratory Bird Treaty Act. A provision of the order directs Federal agencies to consider the impacts of their activities, especially in reference to birds on the Fish and Wildlife Service's list of Birds of Conservation (Management) Concern (BCC). It also directs agencies to incorporate conservation recommendations and objectives in the North American Waterbird Conservation Plan and bird conservation plans developed by Partners in Flight into agency planning. The effects of all alternatives to refuge habitats used by migratory birds were assessed within the Draft CCP and EA.

9. **Endangered Species Act. (16 U.S.C. 1531-1544).** This Act provides for the conservation of threatened and endangered species of fish, wildlife, and plants by Federal action and by encouraging the establishment of state programs. Section 7 of the Act requires consultation before initiating

projects which affect or may affect endangered species. One Federally listed species currently occurs on the Refuge, water howellia (*Howellia aquatilis*, Federal threatened). Proposed activities do not differ from current management for this species. Consultation on specific projects will be conducted prior to implementation to avoid any adverse impacts to this species and its habitat. CCP implementation may result in intermediate positive effect to the Columbian white-tailed deer (Federal endangered) depending on results of feasibility studies for the establishment of a population of this species. The Refuge would perform appropriate consultations before Columbian white-tailed deer are introduced to the Refuge.

10. **Executive Order 11990. Protection of Wetlands.** The CCP is consistent with Executive Order 11990 because CCP implementation would protect and enhance existing wetlands and associated bottomland forest.

11. **Executive Order 11988. Floodplain Management.** Under this order Federal agencies "shall take action to reduce the risk of flood loss, to minimize the impact of floods on human safety, health and welfare, and to restore and preserve the natural and beneficial values served by floodplains." The CCP is consistent with Executive Order 11988 because CCP implementation would protect floodplains from adverse impacts as a result of modification or destruction. A breach of the dike separating Post Office Lake from the Columbia River is likely if a major flood event were to occur; however, the dike is not owned by the Service and therefore outside the Service's management control. The CCP supports feasibility study of a project to reestablish hydrologic connections between Post Office Lake and the Columbia River. The study is currently not funded; however, the Service intends to pursue funding and other technical support to examine the feasibility of restoring floodplain function to Post Office Lake.

12. **Integrated Pest Management (IPM), 517 DM 1 and 7 RM 14.** In accordance with 517 DM 1 and 7 RM 14, an integrated pest management (IPM) approach has been adopted to eradicate, control, or contain pest and invasive species on the refuge. In accordance with 517 DM 1, only pesticides registered with the US Environmental Protection Agency (USEPA) in full compliance with the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) and as provided in regulations, orders, or permits issued by USEPA may be applied on lands and waters under refuge jurisdiction.

Chief, Division of Planning,
Visitor Services, and Transportation

9/9/10
Date

Appendix H. Glossary

Abbreviations

Act	National Wildlife Refuge System Improvement Act of 1997 (also Improvement Act or NWRSIA)
ABC	American Bird Conservancy
ADA	Americans with Disabilities Act
AHPA	Archaeological and Historic Preservation Act
ARPA	Archaeological Resources Protection Act
ATV	All Terrain Vehicles
AUD	Appropriate Use Determination
BCC	Birds of Conservation Concern
BIDEH	Biological Diversity, Integrity and Environmental Health
BP	Before Present
CCP	Comprehensive Conservation Plan
CD	Compatibility Determination
CFR	Code of Federal Regulations
CRFPO	Columbia River Fisheries Program Office
COE	U. S. Army Corps of Engineers
CWCS	Comprehensive Wildlife Conservation Strategy
CWTD	Columbian white-tailed deer
DO	Dissolved oxygen
DPS	Distinct Population Segment
EA	Environmental Assessment
EE	Environmental Education
EPA	U.S. Environmental Protection Agency
ESU	Evolutionarily Significant Unit
FCRPS	Federal Columbia River Power System
FWS	U.S. Fish and Wildlife Service (also, Service, USFWS)
GAP	Gap Analysis Program
GIS	Geographic Information System
IAC	Interagency Committee for Outdoor Recreation (Washington State)
IBA	Important Bird Area
Improvement Act	National Wildlife Refuge System Improvement Act of 1997 (also Act, NWRSIA)
IPM	Integrated Pest Management
LE	Law Enforcement
MAPS	Monitoring Avian Productivity System
MBCC	Migratory Bird Conservation Commission
MMS	Maintenance Management System
MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
NAGPRA	Native American Graves Repatriation Act
NAS	National Audubon Society
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NRHP	National Register of Historic Places

NTU	Nephelometric turbidity unit, a measure of water turbidity
NWR	National Wildlife Refuge
NWRS	National Wildlife Refuge System
NWRSIA	National Wildlife Refuge System Improvement Act of 1997
ODFW	State of Oregon Department of Fish and Wildlife
PCJV	Pacific Coast Joint Venture
PIF	Partners in Flight
R1	Region 1 of the FWS (WA, OR, CA, HI, NV, ID)
RNA	Research Natural Area
ROC	Resource of Concern
RONS	Refuge Operating Needs System
ROS	Recreational Opportunity Spectrum
SCORP	Statewide Comprehensive Outdoor Recreation Plan
Service	U.S. Fish and Wildlife Service (also FWS, USFWS)
TES	Threatened and Endangered Species
TNC	The Nature Conservancy
USFWS	U.S. Fish and Wildlife Service
WDFW	State of Washington Department of Fish and Wildlife
WNHP	Washington Natural Heritage Program

Glossary

Accessible wetland. Wetland without fences or vegetative barriers (tall, dense vegetation) at its margins.

Alluvium. Sediment transported and deposited in a delta or riverbed by flowing water.

Adaptive Management. The rigorous application of management, research, and monitoring to gain information and experience necessary to assess and modify management activities. A process that uses feedback from refuge research and monitoring and evaluation of management actions to support or modify objectives and strategies at all planning levels. (Service Manual 602 FW 1.4)

Alternative. Different sets of objectives and strategies or means of achieving refuge purposes and goals, helping fulfill the Refuge System mission, and resolving issues. (Service Manual 602 FW 1.6). The "no action" alternative is current refuge management, while the "action" alternatives are all other alternatives.

Appropriate Use. A proposed or existing use on a refuge that meets at least one of the following four conditions:
(1) The use is a wildlife-dependent recreational use as identified in the Improvement Act.
(2) The use contributes to fulfilling the refuge purpose(s), the Refuge System mission, or goals or objectives described in a refuge management plan approved after October 9, 1997, the date the Improvement Act was signed into law.
(3) The use involves the take of fish and wildlife under State regulations.
(4) The use has been found to be appropriate as specified in section 1.11 of the USFWS Appropriate Use Policy (603FW1).

Approved Refuge Boundary. A National Wildlife Refuge boundary approved by the National or Regional Fish and Wildlife Service Director. Within this boundary, the Service may negotiate with landowners to acquire lands not already owned by the Service. (Modified from Region 1 Landowner Guide, USFWS Division of Refuge Planning.)

Archaeology. The scientific study of material evidence remaining from past human life and culture. (Webster's II)

Basalt. A dark dense volcanic rock. (Webster's II)

B.P. (Before Present). Used as a designation following radiocarbon dates to express the point from which radiocarbon years are measured. This measuring point is arbitrarily taken to be 1950. A date of 5,200±200 B.P. means that it dates to 5,200 (plus or minus 200) years before 1950.

Benefiting resources. Those species, species groups, or resources expected to benefit from actions taken for a Resource of Concern.

Birds of Conservation Concern. A category assembled by the U.S. Fish and Wildlife Service Division of Migratory Birds identifying the migratory and non-migratory species (beyond those already designated as Federally threatened or endangered) that represent the Division's highest conservation priorities. (FWS, Division of Migratory Birds)

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 (FWS Manual 601FW3). The System's focus is on indigenous species, biotic communities, and ecological processes.

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. (FWS Manual 601FW3)

Candidate species. Plant or animal species for which FWS or NOAA Fisheries has on file sufficient information on biological vulnerability and threats to support a proposal to list as endangered or threatened. (FWS, Endangered Species Glossary, http://www.fws.gov/endangered/glossary.html)

Categorical Exclusion. A category of actions that do not individually or cumulatively have a significant effect on the human environment and have been found to have no such effect in procedures adopted by a Federal agency pursuant to the National Environmental Policy Act (40 CFR 1508.4).

Chinookan. The speakers of several closely related languages who historically occupied the Columbia River from the upstream end of the Columbia Gorge (near the present town of The Dalles, Oregon), to the river's mouth, and adjacent portions of the coasts of Washington and Oregon. Lower Chinook was spoken by peoples living on both sides of the river's mouth, and Upper Chinook spoken along both sides from the river's estuary upriver through the Gorge. (Silverstein 1990)

Colonial nesting birds. Birds that nest in groups. At Ridgefield, colonial nesting birds are waterbirds (great blue herons and great egrets).

Columbia Basin. The region drained by the Columbia River system.

Compatible Use. A wildlife-dependent recreational use or any other use of a refuge that, in the sound professional judgment of the Director, will not materially interfere with or detract from the fulfillment of the Mission of the System or the purposes of the refuge (Service Manual 603 FW 3.6). A compatibility determination supports the selection of compatible uses and identifies stipulations or limits necessary to ensure compatibility.

Composition (plant). The inventory of plant species found in any particular area.

Comprehensive Conservation Plan. A document that describes the desired future conditions of a refuge or planning unit and provides long-range guidance and management direction to achieve the purpose(s) of the refuge; helps fulfill the mission of the System; maintains and, where appropriate, restores the biological integrity, diversity, and environmental health of each refuge and the System; helps achieve the goals of the National Wilderness Preservation System, if appropriate; and meets other mandates. (FWS Habitat Management Planning policy, 602 FW 1.4)

Connectivity. The arrangement of habitats that allows organisms and ecological processes to move across the landscape; patches of similar habitats are either close together or linked by corridors of appropriate vegetation. The opposite of **fragmentation.**

Conservation Targets (also see **Resources of Concern; Priority Species, Species Groups,** and **Communities).** Term used by land management agencies and conservation organizations to describe the resources (ecological systems, ecological communities, species, species groups, or other natural resources) selected as the focus of conservation actions. (Adapted from Low, Functional Landscapes, 2003.)

Consumptive use. Recreational activities, such as hunting and fishing that involve harvest or removal of wildlife or fish, generally to be used as food by humans.

Contaminants or **Environmental contaminants.** Chemicals present at levels greater than those naturally occurring in the environment resulting from anthropogenic or natural processes that potentially result in changes to biota at any ecological level. (USGS, assessing EC threats to lands managed by USFWS.) Pollutants that degrade other resources upon contact or mixing. (Adapted from Webster's II.)

Cooperative Agreement. An official agreement between two parties.

Cover. The estimated percent of an area, projected onto a horizontal surface, occupied by a particular plant species.

Cultural Resources. The physical remains, objects, historic records, and traditional lifeways that connect us to our nation's past. (USFWS, Considering Cultural Resources)

Cultural Resource Inventory. A professionally conducted study designed to locate and evaluate evidence of cultural resources present within a defined geographic area. Inventories may involve various levels, including background literature search, comprehensive field examination to identify all exposed physical manifestations of cultural resources, or sample inventory to project site distribution and density over a larger area. Evaluation of identified cultural resources to determine eligibility for the National Register follows the criteria found in 36 CFR 60.4. (Service Manual 614 FW 1.7)

Decadence. Marked by decay or decline. For plants, showing little or no new growth. (Adapted from Merriam-Webster online dictionary.)

Deciduous. Describes trees and shrubs which shed all of their leaves each year.

Distinct population segment (DPS). A subdivision of a vertebrate species that is treated as a species for purposes of listing under the Endangered Species Act. To be so recognized, a potential distinct population segment must satisfy standards specified in a FWS or NOAA Fisheries policy statement (See the February 7, 1996, Federal Register, pages 4722-4725). The standards require it to be separable from the remainder of and significant to the species to which it belongs. (FWS, Endangered Species Glossary, http://www.fws.gov/endangered/glossary.html)

Disturbance. Significant alteration of habitat structure or composition, or of the behavior or wildlife. May be natural (e.g., fire) or human-caused events (e.g., aircraft overflight).

Drawdown. A lowering of the ground-water surface caused by pumping.

Ecosystem. A dynamic and interrelating complex of plant and animal communities and their associated non-living environment.

Ecosystem Management. Management of natural resources using system-wide concepts to ensure that all plants and animals in ecosystems are maintained at viable levels in native habitats and basic ecosystem processes are perpetuated indefinitely.

Environmental Assessment. A concise public document, prepared in compliance with the National Environmental Policy Act, that briefly discusses the purpose and need for an action, alternatives to such action, and provides sufficient evidence and analysis of impacts to determine whether to prepare an environmental impact statement or finding of no significant impact (40 CFR 1508.9).

Endangered Species (Federal). An animal or plant species in danger of extinction throughout all or a significant portion of its range. (FWS, Endangered Species Glossary)

Endangered Species (State). A plant or animal species in danger of becoming extinct or extirpated in a state within the near future if factors contributing to its decline continue. Populations of these species are at critically low levels or their habitats have been degraded or depleted to a significant degree.

Environmental Education Study Sites. Outdoor locations where groups of students engage in hands-on activities within an environmental education curriculum.

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. (FWS Manual 601FW3)

Enhance. To improve the condition of an area or habitat, usually for the benefit of certain native species.

Evolutionarily significant unit (ESU). A Pacific salmonid stock that is substantially reproductively isolated from other stocks of the same species and which represents an important part of the evolutionary legacy of the species. Life history, ecological, genetic, and other information can be used to determine whether a stock meets these two criteria. NOAA Fisheries uses this designation. (FWS, Endangered Species Glossary)

Experimental population. A population (including its offspring) of a listed species designated by rule published in the Federal Register that is wholly separate geographically from other populations of the same species. An experimental population may be subject to less stringent prohibitions than are applied to the remainder of the species to which it belongs. (FWS, Endangered Species Glossary)

Extirpated species. A species that no longer survives in regions that were once part of its range, but that still exists elsewhere in the wild or in captivity. (FWS, Endangered Species Glossary)

Finding of No Significant Impact (FONSI). A document prepared in compliance with the National Environmental Policy Act, supported by an environmental assessment, that briefly presents why a Federal action will have no significant effect on the human environment and for which an environmental impact statement, therefore, will not be prepared (40 CFR 1508.13).

Fee hunt (also reservation hunt; regulated hunt). Areas containing designated blinds for waterfowl hunting, which are allocated via a lottery system and available for a fee.

Floodplain. Mostly level land along rivers and streams that may be submerged by floodwater. A 100-year floodplain is an area which can be expected to flood once in every 100 years.

Fluvial processes. Referring to the physical interaction of flowing water and the natural channels of rivers and streams. (Adapted from Brittanica Online Encyclopedia http://www.britannica.com/memberlogin.)

GAP analysis. Analysis done to identify and map elements of biodiversity that are not adequately represented in the nation's network of reserves. It provides an overview of the distribution and conservation status of several components of biodiversity, with an emphasis on vegetation and terrestrial vertebrates. (Cassidy et al.1997)

Goal. Descriptive, open-ended, and often broad statement of desired future conditions that conveys a purpose but does not define measurable units. (Service Manual 620 FW 1.6)

Habitat. Suite of existing environmental conditions required by an organism for survival and reproduction. The place where an organism typically lives.

Habitat Management Plan. A plan that provides refuge managers a decisionmaking process; guidance for the management of refuge habitat; and long-term vision, continuity, and consistency for habitat management on refuge lands. (FWS Habitat Management Planning policy 620FW1.4)

Habitat Restoration. Management emphasis designed to move ecosystems to desired conditions and processes, and/or to healthy ecosystems.

Historic Conditions. Composition, structure, and functioning of ecosystems resulting from natural processes that we believe, based on sound professional judgment, were present prior to substantial human related changes to the landscape. (FWS Manual 601FW3)

Hydrograph. The annual flow pattern of a river.

Hydrologic Regime. The normal pattern of rainfall and runoff occurring in an area.
Important Bird Area (IBA). A site that provides essential habitat for one or more species of birds; program coordinated by The American Bird Conservancy and The National Audubon Society.

Indicator. A measurable characteristic of a key ecological attribute that strongly correlates with the status of the key ecological attribute.

Inholding. Refers to lands within an Approved Refuge Boundary that are not owned by the U.S. Fish and Wildlife Service. These can be private lands or lands owned by city, county, state, or other federal agencies.

Integrated Pest Management (IPM). The use of pest and environmental information in conjunction with available pest control technologies to prevent unacceptable levels of pest damage by the most economical means and with the least possible hazard to persons, property and the environment. (U.S. EPA Pesticide Glossary)

Interpretation. A teaching technique that combines factual information with stimulating explanation (yourdictionary.com). Frequently used to help people understand natural and cultural resources.

Invasive. Nonnative species disrupting and replacing native species. (thebiotechdictionary.com)

Inventory. A survey of the plants or animals inhabiting an area.

Issue. Any unsettled matter that requires a management decision, e.g., an initiative, opportunity, resource management problem, threat to the resources of the unit, conflict in uses, public concern, or the presence of an undesirable resource condition. (Service Manual 620 FW 1.6)

Key ecological attribute. Those aspects of the environment, such as ecological processes or patterns of biological structure and composition that are critical to sustain the long-term viability of the target. These key ecological attributes are further divided into measurable indicators.

Keystone species. Species who enrich ecosystem function in a unique and significant manner through their activities, and the effect is disproportionate to their numerical abundance. Their removal initiates changes in ecosystem structure and often loss of diversity. These keystones may be habitat modifiers (i.e. Cottonwoods or beavers), predators (ie. puma and coyote) or herbivores (i.e. prairie dog). (Sonoran Desert Conservation Plan)

Lacustrine wetlands. Those areas that are generally permanently flooded and lacking trees, shrubs, or emergent vegetation with greater than 30% areal coverage and measuring greater than 20 acres. Smaller areas than this can be included if the water depth in the deepest part of the basin exceeds 6.6 feet at low water. (National Wetlands Inventory)

Landform. A natural feature of a land surface. (yourdictionary.com)

Maintenance. The upkeep of constructed facilities, structure and capitalized equipment necessary to realize the originally anticipated useful life of a fixed asset. Maintenance includes preventative maintenance; cyclic maintenance; repairs; replacement of parts, components, or items of equipment, periodic condition assessment; periodic inspections, adjustment, lubrication and cleaning (non-janitorial) of equipment; painting, resurfacing, rehabilitation; special safety inspections; and other actions to assure continuing service and to prevent breakdown.

Maintenance Management System (MMS). A national database of refuge maintenance needs and deficiencies. It serves as a management tool for prioritizing, planning, and budgeting purposes. (RMIS descriptions)

Managed seasonal or **semipermanent wetlands.** Those wetlands which have existing infrastructure (pumps, culverts, water control structures) to manipulate water levels on a seasonal basis, relatively independent of water conditions in the surrounding watershed.

Migration. The seasonal movement from one area to another and back.

Migratory birds. Those species of birds listed under 50 CFR section 10.13. (FWS Manual 720FW 1, Policies and Responsibilities of the Migratory Bird Program)

Monitoring. The process of collecting information to track changes of selected parameters over time.

National Environmental Policy Act of 1969. Requires all Federal agencies, including the Service, to examine the environmental impacts of their actions, incorporate environmental information, and use public participation in the planning and implementation of all actions. Federal agencies must integrate NEPA with other planning requirements, and prepare appropriate NEPA documents to facilitate better environmental decision making. (40 CFR 1500)

Native. With respect to a particular ecosystem, a species that, other than as a result of an introduction, historically occurred or currently occurs in that ecosystem. (FWS Manual 601FW3)

National Geodetic Vertical Datum (NGVD). (1) As corrected in 1929, a vertical control measure used as a reference for establishing varying elevations. (2) Elevation datum plane previously used by the Federal Emergency Management Agency (FEMA) for the determination of flood elevations. FEMA currently uses the North American Vertical Datum Plane. (USGS Water Science Glossary)

National Geodetic Vertical Datum of 1929 (NGVD-29). A geodetic datum derived from a general adjustment of the first order level nets of the United States and Canada. It was formerly called "Sea Level Datum of 1929" or "mean sea level" (MSL) in the USGS series of reports. Although the datum was derived from the average sea level over a period of many years at 26 tide stations along the Atlantic, Gulf of Mexico, and Pacific Coasts, it does not necessarily represent local mean sea level at any particular place. (USGS Water Science Glossary)

National Register of Historic Places. The Nation's master inventory of known historic properties administered by the National Park Service. Includes buildings, structures, sites, objects, and districts that possess historic, architectural, engineering, archeological, or cultural significance at the national, state, and local levels. (USFWS, Considering Cultural Resources)

National Wildlife Refuge. A designated area of land, water, or an interest in land or water within the Refuge System, excluding coordination areas. (FWS Manual 601FW1.3)

National Wildlife Refuge System. Various categories of areas administered by the Secretary of the Interior for the conservation of fish and wildlife, including species threatened with extinction; all lands, waters, and interests therein administered by the Secretary as wildlife refuges; areas for the protection and conservation of fish and wildlife that are threatened with extinction; wildlife ranges; game ranges; wildlife management areas; or waterfowl production areas.

National Wildlife Refuge System Improvement Act of 1997 (Public Law 105-57). A federal law that amended and updated the National Wildlife Refuge System Administration Act of 1966 (16 U.S.C. 668).

Nephelometric turbidity unit (NTU). Unit of measure for the turbidity of water. Essentially, a measure of the cloudiness of water as measured by a nephelometer. Turbidity is based on the amount of light that is reflected off particles in the water. (USGS Water Science Glossary of Terms)

Nonconsumptive recreation. Recreational activities that do not involve harvest, removal or consumption of fish, wildlife or other natural resources.

Noxious Weed. A plant species designated by Federal or State law as generally possessing one or more of the following characteristics: aggressive or difficult to manage; parasitic; a carrier or host of serious insect or disease; or non-native, new, or not common to the United States, according to the Federal Noxious Weed Act (PL 93-639), a noxious weed is one that causes disease or had adverse effects on man or his environment and therefore is detrimental to the agriculture and commerce of the United States and to the public health.

Objective. A concise statement of what we want to achieve, how much we want to achieve, when and where we want to achieve it, and who is responsible for the work. Objectives derive from goals and provide the basis for determining strategies, monitoring refuge accomplishments, and evaluating the success of strategies. Make objectives attainable, time-specific, and measurable. (Service Manual 620 FW 1.6)

Operations. Activities related to the normal performance of the functions for which a facility or item of equipment is intended to be used. Costs such as utilities (electricity, water, sewage) fuel, janitorial services, window cleaning, rodent and pest control, upkeep of grounds, vehicle rentals, waste management, and personnel costs for operating staff are generally included within the scope of operations.

Pacific Flyway. One of several major north-south travel corridors for migratory birds. The Pacific Flyway is west of the Rocky Mountains.

Palatable grass. Short (generally less than 6 inches tall) actively growing grass preferred by Canada geese and certain other waterfowl (e.g., American wigeon).

Palustrine Wetlands. Wetlands that may or may not be permanently flooded and typically recognized by the presence of trees, shrubs, or herbaceous emergent vegetation. May include non-vegetated areas measuring less than 20 acres in extent and with water depths shallower than 6.6 feet in the deepest part of the basin at low water (Cowardin et al. 1979).

Planning Team. The primary U.S. Fish and Wildlife staff and others who played a key role in developing and writing the CCP. Planning teams are interdisciplinary in membership and function. Teams generally consist of a Planning Team Leader, Refuge Manager and staff biologists, a state natural resource agency representative, and other appropriate program specialists (e.g., social scientist, ecologist, recreation specialist). We also will ask other Federal and Tribal natural resource agencies to provide team members, as appropriate. The planning team prepares the CCP and appropriate NEPA documentation. (Service Manual 620 FW 1.6)

Plant Association. A classification of plant communities based on the similarity in dominants of all layers of vascular species in a climax community (e.g., Oregon white oak/ovalleaf viburnum/poison oak plant association).

Plant Community. An assemblage of plant species unique in its composition; occurs in particular locations under particular influences; a reflection or integration of the environmental influences on the site such as soils, temperature, elevation, solar radiation, slope, aspect, and rainfall; denotes a general kind of climax plant community (e.g., Oregon white oak woodland).

Polychlorinated biphenyls (PCBs). A group of synthetic, toxic industrial chemical compounds once used in making paint and electrical transformers, which are chemically inert and not biodegradable.

PCBs were frequently found in industrial wastes, and subsequently found their way into surface and ground waters. As a result of their persistence, they tend to accumulate in the environment. In terms of streams and rivers, PCBs are drawn to sediment, to which they attach and can remain virtually indefinitely. Although virtually banned in 1979 with the passage of the Toxic Substances Control Act, they continue to appear in the flesh of fish and other animals (USGS Water Science Glossary).

Portland Basin or **Portland-Vancouver Basin.** A 900 square mile basin generally defined as the area of low topography at the confluence of the Willamette and Columbia Rivers, including the region along the Columbia River from the Sandy River downstream to the Cowlitz River, and the Willamette River north (downstream) from its falls at Oregon City to its confluence with the Columbia River (Ames 1999). Geologically, the Portland Basin proper begins roughly at the Sandy River and extends downstream to the confluence of the Lewis and Columbia rivers. (Evarts et al. 2009).

Preferred Alternative. This is the alternative determined [by the decision maker] to best achieve the Refuge purpose, vision, and goals; to best contribute to the Refuge System mission; to best address the significant issues; and to be consistent with principles of sound fish and wildlife management.

Priority Public Uses. Hunting, fishing, wildlife observation and photography, environmental education and interpretation, where compatible, are identified under the National Wildlife Refuge System Improvement Act of 1997 as the six priority public uses of the National Wildlife Refuge System.

Public. Individuals, organizations, and groups; officials of Federal, State, and local government agencies; Indian tribes; and foreign nations. It may include anyone outside the planning team. It includes those who may or may not have indicated an interest in Service issues and those who may be affected by Service decisions.

Raptor. A category of carnivorous birds, most of which have heavy, sharp beaks, strong talons, and take live prey (e.g., peregrine falcon, bald eagle).

Refuge Operating Needs System (RONS). A national database of unfunded refuge operating needs required to meet and/or implement station goals, objectives, management plans, and legal mandates. It is used as a planning, budgeting, and communication tool describing funding and staffing needs of the Refuge System.

Refuge Purpose(s). The purposes specified in or derived from the law, proclamation, executive order, agreement, public land order, donation document, or administrative memorandum establishing, authorizing, or expanding a refuge, refuge unit, or refuge subunit. For refuges that encompass congressionally designated wilderness, the purposes of the Wilderness Act are additional purposes of the refuge. (Service Manual 620 FW 1.6).

Research Natural Area (RNA). Special designation areas on NWRs established to: (1) Preserve examples of major ecosystem types or other outstanding physical or biological phenomena; (2) Provide research and educational opportunities; and (3) Preserve a full range of genetic and behavioral diversity for native plants and animals, including endangered or threatened species. (USFWS 1981).

Residual cover. In pastures or grasslands, tall decadent grass and/or forbs left standing through the fall and winter seasons.

Resource of Concern (ROC). All plant and/or animal species, species groups, or communities specifically identified in refuge purpose(s), System mission, or international, national, regional, State, or ecosystem conservation plans or acts. For example, waterfowl and shorebirds are a resource of concern on a refuge whose purpose is to protect "migrating waterfowl and shorebirds." Federal or State threatened and endangered species on that same refuge are also a resource of concern under terms of the respective endangered species acts. (FWS Habitat Management Planning policy, 620 FW1.4).

Restore. To bring back to a former or original condition. (Webster's II).

Revenue Sharing. Service payments (government lands are exempt from taxation) made to counties in which national wildlife refuges reside. These payments may be used by the counties for any governmental purpose such as, but not limited to, roads and schools. (USFWS Revenue sharing pamphlet.)

Riparian. Refers to 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 which 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 any and all plant life growing on the land adjoining a stream and directly influenced by the stream.

Shorebirds. Sandpipers, plovers, and their close relatives of similar size and ecology, often associated with coastal and inland wetlands. (Sibley Guide to Birds 2000.)

Songbirds (Also **Passerines**). A category of medium to small, perching landbirds. Most are territorial singers and migratory.

Source. An extraneous factor that causes a stress (the most proximate cause). (TNC 2000)

Species of concern (Federal). An informal term referring to a species that might be in need of conservation action. This may range from a need for periodic monitoring of populations and threats to the species and its habitat, to the necessity for listing as threatened or endangered. Such species receive no legal protection and use of the term does not necessarily imply that a species will eventually be proposed for listing. (FWS, Endangered Species Glossary)

Step-down Management Plan. A plan that provides specific guidance on management subjects (e.g., habitat, public use, fire, safety) or groups of related subjects. It describes strategies and implementation schedules for meeting CCP goals and objectives. (Service Manual 620 FW 1.6)

Strategy. A specific action, tool, technique, or combination of actions, tools, and techniques used to meet unit objectives. (Service Manual 620 FW 1.6)

Stress. The impairment or degradation of a key ecological attribute for a conservation target. (TNC 2000)

Thatch. The dense covering of cut grass that remains after mowing. Thatch inhibits growth of new grass and also inhibits goose foraging.

Threatened Species (Federal). An animal or plant species likely to become endangered within the foreseeable future throughout all or a significant portion of its range. (FWS, Endangered Species Glossary)

Threatened Species (State). A plant or animal species likely to become endangered in a State within the near future if factors contributing to population decline or habitat degradation or loss continue.

Turbidity. The amount of particulate matter that is suspended in water, measured in NTUs (nephelometric turbidity units). Clear water generally measures less than 10 NTU.

Vegetation Type (Also **Habitat Type**, **Forest Cover Type**). A land classification system based upon the concept of distinct plant associations.

Vision Statement. A concise statement of what the planning unit should be, or what we hope to do, based primarily upon the Refuge System mission and specific refuge purposes, and other mandates. The vision statement for the refuge is tied to the mission of the Refuge System; the purpose(s) of the refuge; the maintenance or restoration of the ecological integrity of each refuge and the Refuge System; and other mandates. (Service Manual 620 FW 1.6)

Wapato Valley. Name given by Lewis and Clark to the lowlands (floodplain) of the Portland Basin; an ecologically rich area characterized by annual spring flooding and a mosaic of wetlands, wet meadows and prairies, shrub swamps, and bottomland forest. (Ames 1999)

Waterfowl. Resident and migratory ducks, geese, and swans.

Water quality. A term used to describe the chemical, physical, and biological characteristics of water, usually in respect to its suitability for a particular purpose.

Watershed. The land area that drains water to a particular stream, river, or lake. It is a land feature that can be identified by tracing a line along the highest elevations between two areas on a map, often a ridge. Large watersheds, like the Mississippi River basin contain thousands of smaller watersheds.

Wetlands. Wetlands are lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water at some time during the growing season of each year. (Service Manual 660 FW 2; Cowardin et al. 1979)

Permanent wetland. A wetland basin or portion of a basin that is covered with water throughout the year in all years except extreme drought. At Ridgefield, these are wetlands and slough remnants historically connected to the Columbia River but since cut off from the river by dikes and/or cessation of major flooding events.

Permanent tidal wetlands. On the Refuge, these are freshwater wetlands connected to, and having tidal exchange with, the Columbia River.

Semi-permanent wetland. A wetland basin or portion of a basin where surface water persists throughout the growing season of most years.

Seasonal wetland. A wetland basin or portion of a basin where surface water is present in the early part of the growing season but is absent by the end of the season in most years. At Ridgefield, seasonal wetlands are typically dry in summer (June-September) and fill with rainwater in fall.

Wet meadows. Shallowly flooded wetland edges with little to no slope. Flooding is generally of short duration. Historically on the lower Columbia River bottomlands, this habitat was dominated by Columbia sedge. Today the dominant vegetation is reed canarygrass.

Wildlife-dependent recreational use. A use of a refuge involving hunting, fishing, wildlife observation and photography, or environmental education and interpretation. These are the six priority public uses of the Refuge System as established in the National Wildlife Refuge System Administration Act, as amended. Wildlife-dependent recreational uses, other than the six priority public uses, are those that depend on the presence of wildlife. The Service will also consider these other uses in the preparation of refuge CCPs; however, the six priority public uses always will take precedence. (Service Manual 620 FW 1.6)

Appendix I. CCP Team Members

The CCP was developed primarily by core team members. The core planning team consisted of persons responsible for the preparation and completion of the Comprehensive Conservation Plan and Environmental Assessment. They are the primary strategists, analysts, and writers, and attended all team meetings. To avoid scheduling and logistical conflicts, the core team had a limited number of participants.

The extended team, which included professionals from several different agencies, organizations, and Fish and Wildlife Service programs, played a supporting role to the core team. Extended team members provided critical input early in the alternatives development process, and continued to provide review and comment as the document evolved. They attended periodic planning meetings, compiled information for use in the plan, and provided comment on portions of the plan within their areas of expertise. Extended team members' varied responsibilities include providing technical expertise and assisting with development of objectives, strategies, and alternatives; analysis; writing; and reviewing. In addition, content specialists from other agencies, universities, or organizations were contacted as needed by members of the core and extended teams for specific planning needs.

Core and extended team members are listed below.

Table I.1 Ridgefield NWR CCP/EA Core Team Members

Name	Title (Team Role)	Address
Bob Flores	Project Leader (May 14, 2007-present) (Main Refuge contact/lead)	U.S. Fish and Widlife Service Ridgefield NWR Complex 29808 NW Main Avenue Ridgefield, WA, 98642
Tim Bodeen	Project Leader (through October 1, 2006) (Main Refuge contact/lead)	U.S. Fish and Widlife Service Ridgefield NWR Complex 301 N. Third Ridgefield, WA 98642
Jennifer Brown	Refuge Manager (through September 2009) (Refuge Resources and Operations; Main Refuge contact/lead, Oct 2, 2006-May 2007)	Same as Bob Flores
Joe Engler	Complex Wildlife Biologist (through October 2007) (Refuge Resources)	Same as Bob Flores
Alex Chmielewski	Complex Wildlife Biologist (March 2009-present) (Refuge Resources)	Same as Bob Flores

Eric Anderson	Outdoor Recreation Planner (through Feb. 2007) Instructional Systems Specialist (Refuge Resources and Visitor Services Programs) (March 2007-present)	Same as Bob Flores
Ken Morris	Conservation Planner (Team Leader)	U.S. Fish and Wildlife Service Division of Planning,Visitor Services and Transportation 911 NE 11th Ave Portland, OR 97213

Table I.2 Extended Team Members

Name	Title	Address
Fred Paveglio	Regional Biologist	U.S. Fish and Wildlife Service 1211 SE Cardinal Ct., Suite 100 Vancouver, WA 98683
Kevin Kilbride	Assistant Regional Biologist (Regional IPM Coordinator)	Same as Fred Paveglio
Joe Engler	Assistant Regional Biologist (October 2007-present)	Same as Fred Paveglio
Sam Lohr	Fish biologist, Columbia River Fisheries Program	U.S. Fish and Wildlife Service Columbia River Fisheries Program Office 1211 SE Cardinal Ct., Suite 100 Vancouver, WA 98683
Mike Marxen	Chief, Branch of Visitor Services	U.S. Fish and Wildlife Service Division of Planning,Visitor Services and Transportation 911 NE 11th Ave Portland, OR 97213
Brad Bortner	Chief, Division of Migratory Birds and Habitat Programs	U.S. Fish and Wildlife Service Division of Migratory Birds and Habitat Programs 911 NE 11th Ave. Portland, OR 97232-4181
Virginia Parks	Cultural Resources	U.S. Fish and Wildlife Service Cultural Resources Team 20555 SW Gerda Lane Sherwood, OR 97140

David Anderson	District Wildlife Biologist Washington Dept of Fish and Wildlife	Washington Dept. of Fish and Wildlife PO Box 68 Trout Lake, WA 98650
Brian Calkins	Acting Regional Wildlife Program Manager Washington Dept of Fish and Wildlife	WDFW 2108 Grand Blvd. Vancouver, WA 98661
Eric Holman	Regional Wildlife Biologist Washington Dept of Fish and Wildlife	Same as Brian Calkins
Brad Bales	Migratory Game Bird Coordinator, Oregon Dept. of Fish and Wildlife	Oregon Dept. of Fish and Wildlife 3406 Cherry Ave NE Salem, OR 97303
Mark Nebeker	Manager, Sauvie Island Wildlife Area Oregon Dept. of Fish and Wildlife	Oregon Department of Fish and Wildlife 18330 NW Sauvie Island Road Portland, OR 97231
Mike Iyall	Cowlitz Indian Tribe	Cowlitz Indian Tribe P.O. Box 2547 Longview, WA 98632-8594
Nathan Reynolds	Natural Resources Specialist Cowlitz Indian Tribe	Same as Mike Iyall
Greg Robinson (assisted by Tony Johnson, Sam Robinson)	Chinook Indian Nation	Chinook Indian Nation P.O. Box 228 Chinook, WA 98614
Kendra Maty	GIS Specialist	U.S. Fish and Wildlife Service Division of Realty and Refuge Information 911 NE 11th Ave Portland, OR 97232
Todd Welker	Aquatics Region Rivers District Manager, Washington Dept. of Natural Resources	Washington Dept. of Natural Resources PO Box 280 Castle Rock, WA 98611-0280
Lynn Cornelius	Gee Creek Watershed Coordinator, WSU Clark County Extension (March 2006- Dec. 2009)	Ridgefield NWR Complex 29808 NW Main Avenue Ridgefield, WA, 98642

Appendix J. Public Involvement

Public involvement was sought throughout the development of the CCP, starting in March 2006 with the preparation of a Public Outreach Plan. Public involvement strategies included face to face meetings with key agencies, federally elected officials, Tribal representatives, and local Refuge users. The Refuge also held open houses, sent planning updates, and gave presentations to community organizations to inform the public, invite discussion and solicit feedback.

A mailing list of approximately 450 persons and organizations is maintained at the Refuge and was used to distribute planning updates and public meeting announcements. Below is a brief summary of the events, meetings, and outreach tools that were used in our public involvement efforts.

Meetings with Congressional Representatives and/or their Aides:

- September 2006. Project Leader Tim Bodeen met with Kelly Love, aide for Congressman Brian Baird, WA 3rd District, to discuss the planning process, and talked with both Congressman Baird’s and Senator Patty Murray’s aides by phone.
- July 2008. Project Leader Bob Flores met with Congressman Brian Baird, WA 3rd District, and staff from Senator Patty Murray's office. Purpose of meeting: Discuss overpass project for Ridgefield (Port, City, Refuge) and potential locations for Refuge bridge to cross.
- Sept 16, 2008. Project Leader Bob Flores met with Congressman Brian Baird, WA 3rd District, and staff, Port of Ridgefield, and Federal Highways. Purpose of meeting: Ridgefield NWR access and community transportation needs.
- Oct 29, 2008. Project Leader Bob Flores and Port of Ridgefield staff met with Senator Patty Murray’s staff. Purpose of meeting: Ridgefield NWR access and community transportation needs.
- Feb 9, 2009. Project Leader Bob Flores met with Congressman Brian Baird, WA 3rd District, and staff from Senator Patty Murray's office. Purpose of meeting: Transportation issues and general public use programs as they relate to CCP.

Meetings with Tribal Officials:

- Sept 2006. Refuge staff briefed representatives of the Chinook Tribe on the CCP planning process.
- Feb 21, 2007. Ridgefield NWR CCP Extended Team Meeting, WDFW Office, Vancouver, WA. Purpose: Alternatives development. Cowlitz Tribal representative attended this meeting.
- April 9, 2007. Ridgefield NWR CCP Extended Team Meeting, Vancouver, WA. Purpose: Alternatives development. Cowlitz Tribal representative attended this meeting.
- May 23, 2007. Refuge Manager Jennifer Brown and USFWS Cultural Resources representative meet with Chinook Tribe to discuss preliminary alternatives. Location: RNWR Office, Ridgefield, WA.
- April 6, 2008. Project Leader Bob Flores met with Cowlitz Tribal Chairman John Barnett and other members. Purpose of meeting: Discuss interpretation of cultural resources and Cowlitz Tribal history on and around Ridgefield NWR in our planning efforts.
- Feb 26, 2009. Project Leader Bob Flores met with Cowlitz Tribal Chairman Bill Iyall and other members. Purpose of meeting: To discuss the CCP as it relates to cultural resources and interpretation.

- Feb 3, 2010. Project Leader Bob Flores met with Cowlitz Tribal Councilman/Attorney Philip Harju and other members. Purpose of meeting: To discuss CCP planning as it relates to cultural management and restoration of native plants and animal species.
- Mar 6, 2010. Project Leader Bob Flores met with Chinook Tribal Vice-Chairman Sam Robinson. Purpose of meeting: Overview of CCP.

Meetings with Local Elected Officials:

- 2006. Project Leader Tim Bodeen met with the City of Ridgefield and the Port of Ridgefield to discuss the planning process.
- Oct 23, 2007. Refuge and FWS Planning staff met with Port of Ridgefield and Federal Highways to discuss bridge proposal (affects access to River S Unit). Location: Port of Ridgefield Office, Ridgefield, WA.
- Feb 18, 2009. Project Leader Bob Flores, Region 1 Refuges Chief Carolyn Bohan and Refuge Supervisor Forrest Cameron met with Port of Ridgefield. Location: Port of Ridgefield Office, Ridgefield WA.
- March 26, 2009. Public open house, CCP preliminary draft alternatives. In attendance: Ridgefield Mayer Ron Onslow and City Manager Justin Clary, representative from the Port of Ridgefield.
- April 27, 2009. Project Leader Bob Flores attended Miller's Landing Redevelopment Conference. In attendance: Port of Ridgefield Commissioners, Director Grening and other staff, City of Ridgefield Manager, local and county residents. Purpose of meeting: Discussion of Port of Ridgefield planning of proposed Miller's Landing. Discussion of community trails, transportation, access to public lands, including Ridgefield NWR.
- June 9, 2009. Project Leader Bob Flores met with Port of Ridgefield's Commissioners, Director Grening and other staff. Purpose of meeting: Discuss Refuge CCP planning as it pertains to transportation, access to refuge and community trail development.
- Feb 8, 2010. Project Leader Bob Flores met with County staff and Commissioner. Purpose of meeting: Proposed community access trail through Ridgefield NWR. Discussed CCP and Service/Refuge purposes and goals.

Meetings with Local Community Organizations involving CCP Issues:

- August 14, 2006. Lead planner gave presentation at the Friends of Ridgefield NWR Board Meeting to discuss the planning process.
- October 5, 2006. Refuge staff and lead planner attend meeting hosted by the Friends of Ridgefield NWR to discuss hunting issues. Location: Ridgefield Community Center, Ridgefield, WA.
- Nov 2006. Refuge staff and lead planner meet with representative of local birding groups to discuss scoping comments.
- March 6, 2009. Project Leader Bob Flores met with members of the Friends of Ridgefield NWR. Purpose of meeting: Discussion of future needs of the refuge and actions planned by the group to assist the refuge. General CCP topics were discussed.
- March 26, 2009. Public open house, CCP preliminary draft alternatives.
- April 30, 2009. Project Leader Bob Flores attends regular meeting of Washington Waterfowl Association to discuss the preliminary draft alternatives outlined in CCP Planning Update #3.
- May 18, 2009. Project Leader Bob Flores presented draft alternatives to members of the Ridgefield Junction Association.

- May 28, 2009. Project Leader Bob Flores and staff host a meeting on refuge with Washington Waterfowl Association members to discuss CCP alternatives.
- January 21, 2010. Project Leader Bob Flores attends regular meeting of Washington Waterfowl Association to discuss the final draft alternatives outlined in CCP Planning Update #4.
- March 2, 2010. Project Leader Flores described alternatives and general CCP process to the City of Ridgefield Gateway Committee (downtown revitalization).
- April 4, 2010. Project Leader Bob Flores presented the draft alternatives to members of the Vancouver Audubon Society.
- April 26, 2010. Project Leader Bob Flores met with and answered questions concerning the planned Overlook Park and connection to alternatives in the CCP.
- June 14, 2010. Project Leader Bob Flores presented draft alternatives to board members of the Friends of Ridgefield NWR.

Meetings with Agency Representatives:

- March 22-26, 2004. Representatives from WDFW, ODFW, and other State agencies participated in the Ridgefield NWR Wildlife and Habitat Review.
- February 2005. Representatives from the R1 Regional Office and Refuge Project Leaders met with the Washington Department of Fish and Wildlife's (WDFW) Regional Directors for Regions 1 and 3, and the Oregon Department of Fish and Wildlife (ODFW), to discuss the CCP process and other issues of interest.
- January 2006. Representatives from the R1 Regional Office and Refuge Project Leaders met with the Oregon Department of Fish and Wildlife (ODFW) to discuss the CCP process and other issues of interest.
- January 24, 2007. Ridgefield NWR CCP Extended Team Meeting, USFWS Regional Office, Portland, OR. Purpose: Alternatives development. WDFW and ODFW representatives at meeting.
- Feb 21, 2007. Ridgefield NWR CCP Extended Team Meeting, WDFW, Vancouver, WA. Purpose: Alternatives development. WDFW, ODFW, and Washington DNR representatives at meeting.
- April 9, 2007. Ridgefield NWR CCP Extended Team Meeting, WDFW, Vancouver, WA. Purpose: Alternatives development. WDFW, ODFW, and Washington DNR representatives at meeting.
- May 15, 2007. Ridgefield NWR CCP Extended Team Meeting, Columbia River Fisheries Resource Office, Vancouver WA. Purpose: Alternatives development. WDFW and ODFW representatives at meeting.
- Oct 23, 2007: Refuge and FWS Planning staff meets with Port of Ridgefield and Federal Highways to discuss bridge proposal (affects access to River S Unit). Location: Port of Ridgefield Office, Ridgefield WA.
- Nov 1, 2007. National Wildlife Refuge System/Washington Department of Fish and Wildlife Comprehensive Conservation Planning Coordination Meeting. Refuge Manager Jennifer Brown presents progress on Ridgefield NWR CCP to date.
- Dec 6, 2007: Core planning team meeting with Federal Highways. Location: Ridgefield NWR. Purpose: Discuss scope of transportation study.
- Dec 19, 2007: Core planning team meeting with Federal Highways. Location: Ridgefield NWR. Purpose: Develop transportation study.

- Jan 24, 2008: Core planning team meeting with Federal Highways. Location: Vancouver, WA. Purpose: Attend presentation on Ridgefield transportation study.
- August 12, 2008: Ridgefield Transportation alternatives meeting.
- May 19, 2009. Project Leader Bob Flores and planning team lead meet with WDFW to obtain WDFW's feedback on preliminary draft alternatives.
- May 27, 2009. Project Leader Bob Flores attended a multi-agency goose depredation meeting hosted by ODFW to discuss goose depredation issues and goose management recommendations for CCP.
- Sept 16, 2009. National Wildlife Refuge System/Washington Department of Fish and Wildlife Comprehensive Conservation Planning Coordination Meeting. Location: Nisqually NWR, Olympia, WA. Purpose: Update WDFW on CCP progress to date on Washington NWRs. Draft alternatives for Ridgefield NWR were presented.
- July 27, 2010. Project Leader Bob Flores and refuge staff meet with WDFW and ODFW to discuss States' comments to the final draft CCP and alternatives.

Public Open Houses/Scoping Sessions:

- September 14, 2006. Public scoping meeting at the Ridgefield Community Center, 210 North Main Avenue, Ridgefield, Washington 98642

- September 20, 2006. Public scoping meeting at the Vancouver Community Library, 1007 East Mill Plain Boulevard, Vancouver, Washington 98663
  Format: The public scoping meetings were in an open-house format. At the open house, Refuge staff and the lead planner explained the CCP process; Refuge purposes, vision, and management; and preliminary management issues, concerns and opportunities that had been identified early in the planning process. They also answered questions from attendees and took written comments.
  Attendance: A total of 44 private citizens and representatives from various organizations attended the open houses, providing comments on the issues and opportunities presented. 28 people attended the event in Ridgefield and 16 people attended the event in Vancouver.
  Comments Received: During scoping a total of 91 responses were received from individuals or organizations in writing from September through November 3, 2006. Seventy of these were comment forms returned by mail or fax, at the public meetings, or hand delivered to the Refuge. Twenty-one of the responses were letters (one of which was signed by 21 individuals) sent by e-mail or mail.

- March 26, 2009. Public open house at the Ridgefield Community Center, 210 North Main Avenue, Ridgefield, Washington 98642
  Purpose of open house: To gather public input on the draft alternatives for Ridgefield NWR.
  Format: Following introductions by the Project Leader, Bob Flores, lead planner Ken Morris gave a presentation on the CCP process, progress to date, how the draft alternatives were developed, and future opportunities for public input. The public was invited to submit comments either in writing or verbally. The attendees then had the opportunity to visit four tables staffed by Refuge staff (Bob Flores, Jennifer Brown, Alex Chmielewski, and Eric Anderson) and the lead planner. Each table had a scribe to record verbal comments.
  Interest Groups in Attendance: Approximately 60 people attended the meeting. Most of the attendees identified themselves as hunters, birdwatchers, and/or wildlife photographers. Members of the Washington Waterfowlers (Lower Columbia chapter) and the Vancouver

Wildlife League were in attendance.
Comments Received: A total of 188 verbal comments were transcribed at the open house. Written comments were received until April 10, 2009. Eighty-six written comments were received, 76 by email and the remainder mailed or faxed to the refuge. Organizations submitting written comments included Washington Waterfowlers (Lower Columbia chapter), Vancouver Wildlife League, Vancouver Audubon, and Washington DNR.

Other Meetings:

- January 24, 2007. Ridgefield NWR CCP Extended Team Meeting, USFWS Regional Office, Portland, OR. Purpose: Alternatives development.
- Feb 21, 2007. Ridgefield NWR CCP Extended Team Meeting, WDFW, Vancouver, WA. Purpose: Alternatives development.
- April 9, 2007. Ridgefield NWR CCP Extended Team Meeting, WDFW, Vancouver, WA. Purpose: Alternatives development.
- May 15, 2007. Ridgefield NWR CCP Extended Team Meeting, Columbia River Fisheries Resource Office, Vancouver WA. Purpose: Alternatives development.
- June 4, 2007. Alternatives briefing for Region 1 Refuges Chief and staff, USFWS Regional Office, Portland, OR.
- Sept 11, 2007. Alternatives briefing for Region 1 Refuges Chief and staff, USFWS Regional Office, Portland, OR.
- March 6, 2008. Briefing for Region 1 Refuges Chief on transportation access alternatives, USFWS Regional Office, Portland, OR.
- April 8, 2008. Core planning team meeting with Branch of Refuge Biology to refine alternatives.
- April 17, 2008. Core planning team meeting with Branch of Refuge Biology to refine alternatives.
- April 30, 2008. Core planning team meeting with Branch of Refuge Biology to refine alternatives.
- Sept 25 2008. Alternatives briefing for Region 1 Refuges Chief and staff, USFWS Regional Office, Portland, OR.
- Nov 6, 2008. Alternatives briefing for Region 1 Refuges Chief and staff, USFWS Regional Office, Portland, OR.
- May 28, 2009. Project Leader meets with Regional Office staff to obtain approval on draft alternatives, in order to proceed with CCP development.

Press Coverage:

- September 5, 2006. News release announcing public scoping meetings sent to four daily newspapers (the *Oregonian*, the *Columbian*, the *Longview Daily News*, and the *Camas-Washougal Post-Record*) and two weekly papers (the *Reflector* and the *Woodland-Kalama Daily News*). Notices of public meetings appeared in the *Oregonian* and the *Columbian*.
- September 2006. *Columbian* article describing changes at the Ridgefield NWR Complex and the CCP process.
- April 2, 2009. "Change is coming to Ridgefield National Wildlife Refuge" – Online article in *Natural Oregon*.
- April 16, 2009. "Groups seek more hunting at Ridgefield Refuge" – *The Columbian*.

- June 17, 2010. News release announcing the availability of the Draft CCP/EA and requesting public comments was sent to four daily newspapers (the *Oregonian*, the *Columbian*, the *Longview Daily News*, and the *Camas-Washougal Post-Record*) and two weekly papers (the *Reflector* and the *Woodland-Kalama Daily News*). The news release was also posted on the FWS Region 1 website and the national FWS Virtual News Room.
- July 8, 2010. "Ridgefield refuge plan opts for status-quo hunting" – *The Columbian*.
- July 15, 2010. "Hunters unhappy with draft Ridgefield refuge plan" – *The Columbian*.

Planning Updates:

- August 30, 2006. Planning Update 1 sent to a mailing list of approximately 450 recipients, including private individuals, government agencies, and non-governmental organizations. The planning update included a comment form. In addition, the Planning Update was posted on the Refuge website, and copies were available at the CCP open houses, the refuge office and entrance, the hunter check station, and at the Refuge information table at the annual BirdFest event on October 14-15, 2006.
- Jan 23, 2007. Planning Update 2, summarizing the results of public scoping, was distributed to a mailing list of approximately 450 recipients. In addition, the Planning Update and a detailed report on the results of public scoping were posted on the Refuge website.
- March 13, 2009. Planning Update 3, summarizing preliminary draft alternatives, was distributed to a mailing list of approximately 400 recipients. In addition, the Planning Update was posted on the Refuge website.
- June 16, 2010. Planning Update 4, summarizing the draft CCP, was distributed to a mailing list of 432 recipients. In addition, the Planning Update was posted on the Region 1 planning website (a link was posted on the Refuge website).

Other Tools:

- Sept 2006: Letters sent from Refuge to ODFW and WDFW notifying them of the planning process and inviting their participation.
- August 25, 2006: Letters sent from Refuge to the following Tribal governments notifying them of the planning process and inviting their participation: the Chinook Indian Tribe, Cowlitz Indian Tribe, Confederated Tribes of Grande Ronde, Shoalwater Bay Indian Tribe, Confederated Tribes of Warm Springs, and the Confederated Tribes and Bands of the Yakama Nation, The Chinook Indian Tribe and the Cowlitz Indian Tribe agreed to appoint representatives to the Extended Planning Team.
- August 30, 2006: Comment form sent to approx 450 people in conjunction with Planning Update 1. Comment form was also posted on Refuge website, and distributed during public scoping meetings.
- Sept 2006: Article on CCP process published in Refuge Friends Group newsletter.
- October 14-15, 2006: Information on CCP process, Planning Updates, and comment forms at refuge information table at the annual BirdFest event.
- Oct 24, 2006: Followup calls to Tribes made and original letters inviting Tribes to participate as planning team members resent as needed.
- Jan 4, 2007: Letter sent by acting Refuge Manager (Eric Anderson) to representatives of WDFW, ODFW, the Cowlitz Indian Tribe, the Chinook Indian Nation, Washington DNR, and other programs in the Fish and Wildlife Service requesting participation in extended team meetings.

- Jan 7, 2007: Scoping briefing statement sent to FWS Washington DC Office.
- June 4, 2009: Alternatives status report sent to FWS Washington DC Office.
- March 29, 2010: Information Memorandum on the Draft CCP/EA sent to FWS Washington DC office.

Federal Register Notices:

- August 2, 2006: Federal Register published Notice of Intent to Prepare a Draft Comprehensive Conservation Plan and Associated NEPA Document; and Notice of Public Meetings (71 FR 43787).
- June 16, 2010: Federal Register published Notice of Availability of the Draft Comprehensive Conservation Plan and Environmental Assessment; and request for comments (75 FR 34154).

Appendix K. Ridgefield NWR CCP Integrated Pest Management (IPM) Program

1.0 Background

IPM is an interdisciplinary approach utilizing methods to prevent, eliminate, contain, and/or control pest species in concert with other management activities on refuge lands and waters to achieve wildlife and habitat management goals and objectives. IPM is also a scientifically based, adaptive management process where available scientific information and best professional judgment of the refuge staff as well as other resource experts would be used to identify and implement appropriate management strategies that can be modified and/or changed over time to ensure effective, site-specific management of pest species to achieve desired outcomes. In accordance with 43 CFR 46.145, adaptive management would be particularly relevant where long-term impacts may be uncertain and future monitoring would be needed to make adjustments in subsequent implementation decisions. After a tolerable pest population (threshold) is determined considering achievement of refuge resource objectives and the ecology of pest species, one or more methods, or combinations thereof, would be selected that are feasible, efficacious, and most protective of non-target resources, including native species (fish, wildlife, and plants), and Service personnel, Service authorized agents, volunteers, and the public. Staff time and available funding would be considered when determining feasibility/practicality of various treatments.

IPM techniques to address pests are presented as CCP strategies (see Chapter 2) in an adaptive management context to achieve refuge resource objectives. In order to satisfy requirements for IPM planning as identified in the Director's Memo (dated September 9, 2004) entitled *Integrated Pest Management Plans and Pesticide Use Proposals: Updates, Guidance, and an Online Database*, the following elements of an IPM program have been incorporated into this CCP:

- Habitat and/or wildlife objectives that identify pest species and appropriate thresholds to indicate the need for and successful implementation of IPM techniques; and
- Monitoring before and/or after treatment to assess progress toward achieving objectives including pest thresholds.

Where pesticides would be necessary to address pests, this Appendix provides a structured procedure to evaluate potential effects of proposed uses involving ground-based applications to refuge biological resources and environmental quality in accordance with effects analyses presented in Chapter 7 (Environmental Consequences) of the Draft CCP and Environmental Assessement (USFWS 2010). Only pesticide uses that likely would cause minor, temporary, or localized effects to refuge biological resources and environmental quality with appropriate best management practices (BMPs), where necessary, would be allowed for use on the refuge.

This Appendix does not describe the more detailed process to evaluate potential effects associated with aerial applications of pesticides. Moreover, it does not address effects of mosquito control with pesticides (larvicides, pupacides, or adulticides) based upon identified human health threats and presence of disease-carrying mosquitoes in sufficient numbers from monitoring conducted on a refuge. However, the basic framework to assess potential effects to refuge biological resources and environmental quality from aerial application of pesticides or use of insecticides for mosquito management would be similar to the process described in this Appendix for ground-based treatments of other pesticides.

2.0 Pest Management Laws and Policies

In accordance with Service policy 7 RM 14 (Pest Control), wildlife and plant pests on units of the National Wildlife Refuge System can be controlled to assure balanced wildlife and fish populations in support of refuge-specific wildlife and habitat management objectives. Pest control on federal (refuge) lands and waters also is authorized under the following legal mandates:

- National Wildlife Refuge System Administration Act of 1966, as amended (16 USC 668dd-668ee);
- Plant Protection Act of 2000 (7 USC 7701 *et seq*.);
- Noxious Weed Control and Eradication Act of 2004 (7 USC 7781-7786, Subtitle E);
- Federal Insecticide, Fungicide, and Rodenticide Act of 1996 (7 USC 136-136y);
- National Invasive Species Act of 1996 (16 USC 4701);
- Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990 (16 USC 4701);
- Food Quality Protection Act of 1996 (7 USC 136);
- Executive Order 13148, Section 601(a);
- Executive Order 13112; and
- Animal Damage Control Act of 1931 (7 USC 426-426c, 46 Stat. 1468).

Pests are defined as "…living organisms that may interfere with the site-specific purposes, operations, or management objectives or that jeopardize human health or safety" from Department policy 517 DM 1 (Integrated Pest Management Policy). Similarly, 7 RM 14 defines pests as "Any terrestrial or aquatic plant or animal which interferes, or threatens to interfere, at an unacceptable level, with the attainment of refuge objectives or which poses a threat to human health." 517 DM 1 also defines an invasive species as "a species that is non-native to the ecosystem under consideration and whose introduction causes or is likely to cause economic or environmental harm or harm to human health." Throughout the remainder of this CCP, the terms pest and invasive species are used interchangeably because both can prevent/impede achievement of refuge wildlife and habitat objectives and/or degrade environmental quality.

In general, control of pests (vertebrate or invertebrate) on the refuge would conserve and protect the nation's fish, wildlife, and plant resources as well as maintain environmental quality. From 7 RM 14, animal or plant species, which are considered pests, may be managed if the following criteria are met:

- Threat to human health and well being or private property, the acceptable level of damage by the pest has been exceeded, or State or local government has designated the pest as noxious;
- Detrimental to resource objectives as specified in a refuge resource management plan (e.g., comprehensive conservation plan, habitat management plan), if available; and
- Control would not conflict with attainment of resource objectives or the purposes for which the refuge was established.

From 7 RM 14, the specific justifications for pest management activities on the refuge are the following:

- Protect human health and well being;
- Prevent substantial damage to important to refuge resources;
- Protect newly introduced or re-establish native species;
- Control non-native (exotic) species in order to support existence for populations of native species;
- Prevent damage to private property; and
- Provide the public with quality, compatible wildlife-dependent recreational opportunities.

In accordance with Service policy 620 FW 1 (Habitat Management Plans), there are additional management directives regarding invasive species found on the refuge:

- "We are prohibited by Executive Order, law, and policy from authorizing, funding, or carrying out actions that are likely to cause or promote the introduction or spread of invasive species in the United States or elsewhere."
- "Manage invasive species to improve or stabilize biotic communities to minimize unacceptable change to ecosystem structure and function and prevent new and expanded infestations of invasive species. Conduct refuge habitat management activities to prevent, control, or eradicate invasive species..."

Animal species damaging/destroying federal property and/or detrimental to the management program of a refuge may be controlled as described in 50 CFR 31.14 (Official Animal Control Operations)**.** Based upon 7 RM 14.7E, a pest control proposal is required, in some cases, to initiate a control program on refuge lands. The required elements of a pest control proposal are described in 7 RM 14.7A-E. However, a pest control proposal is not required under the following scenarios:

- Routine protection of refuge buildings, structures (e.g., dikes, levees, water control structures), and facilities not involving prohibited chemicals.
- Incidental control of exotics (e.g., non-native rats, non-native rabbits) or feral animals on refuge lands that are not protected by either federal or state laws, except where chemicals may he used.
- The use of routine habitat management techniques, selective trapping, on-refuge transfer, and physical and mechanical protection such as barriers and fences (including electric fences).

For example, the incidental removal of beaver damaging refuge infrastructure (e.g., clogging with subsequent damaging of water control structures) and/or negatively affecting habitats (e.g., removing woody species from existing or restored riparian) managed on refuge lands may be conducted without a pest control proposal. We recognize beavers are native species and most of their activities or refuge lands represent a natural process beneficial for maintaining wetland habitats. Exotic nutria, whose denning and burrowing activities in wetland dikes causes cave-ins and breaches, can be controlled using the most effective techniques considering site-specific factors without a pest control proposal. Along with the loss of quality wetland habitats associated with breaching of impoundments, the safety of refuge staffs and public (e.g. auto tour routes) driving on structurally compromised levees and dikes can be threaten by sudden and unexpected cave-ins.

Trespass and feral animals also may be controlled on refuge lands. In accordance with 7 RM 14.9B(1), animals trespassing on refuge lands may be captured and returned to their owners or transferred to humane societies or local animal shelters, where feasible. Based upon 50 CFR 28.43 (Destruction of Dogs and Cats), dogs and cats running at large on a national wildlife refuge and observed in the act of killing, injuring, harassing or molesting humans or wildlife may be disposed of in the interest of public safety and protection of the wildlife. In accordance with 7 RM 14.9B(2), feral animals should be disposed by the most humane method(s) available and in accordance with relevant Service directives (including Executive Order 11643).

Disposed wildlife specimens may be donated or loaned to public institutions. Donation or loans of resident wildlife species will only be made after securing State approval (50 CFR 30.11 [Donation and Loan of Wildlife Specimens]). Surplus wildlife specimens may be sold alive or butchered, dressed and processed subject to Federal and State laws and regulations (50 CFR 30.12 [Sale of Wildlife Specimens]).

As previously stated for controlling animals damaging/destroying federal property and/or detrimental to the management program of a refuge, incidentally removing such animals from refuge lands does not require a pest control proposal.

3.0 Strategies

To fully embrace IPM, the following strategies, where applicable, would be carefully considered on the refuge for each pest species:

Prevention. This would be the most effective and least expensive long-term management option for pests. It encompasses methods to prevent new introductions or the spread of the established pests to un-infested areas. It requires identifying potential routes of invasion to reduce the likelihood of infestation. Hazard Analysis and Critical Control Points (HACCP) planning can be used determine if current management activities on a refuge may introduce and/or spread invasive species in order to identify appropriate BMPs for prevention. See http://www.haccp-nrm.org/ for more information about HACCP planning.

Prevention may include source reduction, using pathogen-free or weed-free seeds or fill; exclusion methods (e.g., barriers) and/or sanitation methods (e.g., wash stations) to prevent re-introductions by various mechanisms including vehicles, personnel, livestock, and horses. Because invasive species are frequently the first to establish newly disturbed sites, prevention would require a reporting mechanism for early detection of new pest occurrences with quick response to eliminate any new satellite pest populations. Prevention would require consideration of the scale and scope of land management activities that may promote pest establishment within un-infested areas or promote reproduction and spread of existing populations. Along with preventing initial introduction, prevention would involve halting the spread of existing infestations to new sites (Mullin et al. 2000). The primary reason of prevention would be to keep pest-free lands or waters from becoming infested. Executive Order 11312 emphasizes the priority for prevention with respect to managing pests. The following methods would prevent the introduction and/or spread of pests on refuge lands:

- Before beginning ground-disturbing activities (e.g., disking, scraping), inventory and prioritize pest infestations in project operating areas and along access routes. Refuge staff would identify pest species on site or within reasonably expected potential invasion vicinity. Where possible, the refuge staff would begin project activities in un-infested areas before working in pest-infested areas.
- The refuge staff would locate and use pest-free project staging areas. They would avoid or minimize travel through pest-infested areas, or restrict to those periods when spread of seed or propagules of invasive plants would be least likely.
- The refuge staff would determine the need for, and when appropriate, identify sanitation sites where equipment can be cleaned of pests. Where possible, the refuge staff would clean equipment before entering lands at on-refuge approved cleaning site(s). This practice does not pertain to vehicles traveling frequently in and out of the project area that will remain on roadways. Seeds and plant parts of pest plants would need to be collected, where practical. The refuge staff would remove mud, dirt, and plant parts from project equipment before moving it into a project area.
- The refuge staff would clean all equipment, before leaving the project site, if operating in areas infested with pests. The refuge staff would determine the need for, and when appropriate, identify sanitation sites where equipment can be cleaned.
- Refuge staffs, their authorized agents, and refuge volunteers would, where possible, inspect, remove, and properly dispose of seed and parts of invasive plants found on their clothing and equipment. Proper disposal means bagging the seeds and plant parts and then properly discarding of them (e.g., incinerating).
- The refuge staff would evaluate options, including closure, to restrict the traffic on sites with on-going restoration of desired vegetation. The refuge staff would revegetate disturbed soil (except travel ways on surfaced projects) to optimize plant establishment for each specific site.

Revegetation may include topsoil replacement, planting, seeding, fertilization, liming, and weed-free mulching as necessary. The refuge staff would use native material, where appropriate and feasible. The refuge staff would use certified weed-free or weed-seed-free hay or straw where certified materials are are reasonably available.

- The refuge staff would provide information, training and appropriate pest identification materials to refuge staffs, permit holders, and recreational visitors. The refuge staff would educate them about pest identification, biology, impacts, and effective prevention measures.
- The refuge staff would require grazing permittees to utilize preventative measures for their livestock while on refuge lands.
- The refuge staff would inspect borrow material for invasive plants prior to use and transport onto and/or within refuge lands.
- The refuge staff would consider invasive plants in planning for road maintenance activities.
- The refuge staff would restrict off road travel to designated routes.

The following methods would prevent the introduction and/or spread of pests into refuge waters:

- The refuge staff would inspect boats (including air boats), trailers, and other boating equipment. Where possible, the refuge staff would remove any visible plants, animals, or mud before leaving any waters or boat launching facilities. Where possible, the refuge staff would drain water from motor, live well, bilge, and transom wells while on land before leaving the site. If possible, the refuge staff would wash and dry boats, downriggers, anchors, nets, floors of boats, propellers, axles, trailers, and other boating equipment to kill pests not visible at the boat launch.
- Where feasible, the refuge staff would maintain a l00-foot buffer of aquatic pest-free clearance around boat launches and docks or quarantine areas when cleaning around culverts, canals, or irrigation sites. Where possible, the refuge staff would inspect and clean equipment before moving to new sites or one project area to another.

These prevention methods to minimize/eliminate the introduction and/or spread of pests were taken verbatim or slightly modified from Appendix E of US Forest Service (2005).

Mechanical/Physical Methods. These methods would remove and destroy, disrupt the growth of, or interfere with the reproduction of pest species. For plant species, these treatments can be accomplished by hand, hand tool (manual), or power tools (mechanical) and include pulling, grubbing, digging, tilling/disking, cutting, swathing, grinding, sheering, girdling, mowing, and mulching of the pest plants. Thermal techniques such as heating, steaming, super-heated water, and hot foam may also be viable treatments.

For animal species, Service employees or their authorized agents could use mechanical/physical methods (including trapping) to control pests as a refuge management activity. Based upon 50 CFR 31.2, trapping can be used on a refuge reduce surplus wildlife populations for a “balanced conservation program” in accordance with federal or state laws and regulations. In some cases, non-lethally trapped animals would be relocated to off-refuge sites with prior approval from the state. A pest control proposal (see 7 RM 14.7A-D for required elements) is needed before initiation of trapping activities, except those operations identified in 7 RM 14.7E. In addition, a separate pest control proposal is not necessary if the required information can be incorporated into an EA (or other appropriate NEPA document).

Each of these tools would be efficacious to some degree and applicable to specific situations. In general, mechanical controls can effectively control annual and biennial pest plants. However, to control perennial plants, the root system has to be destroyed or it would resprout and continue to grow and develop. Mechanical controls are typically not capable of destroying a perennial plants root system. Although some mechanical tools (e.g., disking, plowing) may damage root systems, they may stimulate regrowth producing a denser plant population that may aid in the spread depending upon the target species (e.g., Canada thistle). In addition, steep terrain and soil conditions would be major factors that can limit the use of many mechanical control methods.

Some mechanical control methods (e.g., mowing), which would be used in combination with cultural methods and/or herbicides, can be a very effective technique to control some perennial species. For example, mowing perennial plants followed sequentially by treating the plant regrowth with a systemic herbicide often would improve the efficacy of the herbicide compared to herbicide treatment only.

Cultural Methods. These methods would involve manipulating habitat to increase pest mortality by reducing its suitability to the pest. Cultural methods would include water-level manipulation, mulching, winter cover crops, changing planting dates to minimize pest impact, prescribed burning (facilitate revegetation, increase herbicide efficacy, and remove litter to assist in emergence of desirable species), flaming with propane torches, trap crops, crop rotations that would include non-susceptible crops, moisture management, addition of beneficial insect habitat, reducing clutter, proper trash disposal, planting or seeding desirable species to shade or out-compete invasive plants, applying fertilizer to enhance desirable vegetation, prescriptive grazing, and other habitat alterations.

Biological Control Agents. Classical biological control would involve the deliberate introduction and management of natural enemies (parasites, predators, or pathogens) to reduce pest populations. Many of the most ecologically or economically damaging pest species in the United States originated in foreign countries. These newly introduced pests, which are free from natural enemies found in their country or region of origin, may have a competitive advantage over cultivated and native species. This competitive advantage often allows introduced species to flourish, and they may cause widespread economic damage to crops or out compete and displace native vegetation. Once the introduced pest species population reaches a certain level, traditional methods of pest management may be cost prohibitive or impractical. Biological controls typically are used when these pest populations have become so widespread that eradication or effective control would be difficult or no longer practical.

Biological control has advantages as well as disadvantages. Benefits would include reducing pesticide usage, host specificity for target pests, long-term self-perpetuating control, low cost/acre, capacity for searching and locating hosts, synchronizing biological control agents to hosts' life cycles, and the unlikelihood that hosts will develop resistance to agents. Disadvantages would include the following: limited availability of agents from their native lands, the dependence of control on target species density, slow rate at which control occurs, biotype matching, the difficulty and expense of conflicts over control of the target pest, and host specificity when host populations are low.

A reduction in target species populations from biological controls is typically a slow process, and efficacy can be highly variable. It may not work well in a particular area although it does work well in other areas. Biological control agents would require specific environmental conditions to survive over time. Some of these conditions are understood; whereas, others are only partially understood or not at all.

Biological control agents would not eradicate a target pest. When using biological control agents, residual levels of the target pest typically are expected; the agent population level or survival would be dependent upon the density of its host. After the pest population decreases, the population of the biological control agent would decrease correspondingly. This is a natural cycle. Some pest populations (e.g., invasive plants) would tend to persist for several years after a biological control agent becomes established due to seed reserves in the soil, inefficiencies in the agents search behavior, and the natural lag in population buildup of the agent.

The full range of pest groups potentially found on refuge lands and waters would include diseases, invertebrates (insects, mollusks), vertebrates and invasive plants (most common group). Often it is assumed that biological control would address many if not most of these pest problems. There are several well-documented success stories of biological control of invasive weed species in the Pacific Northwest including Mediterranean sage, St. Johnswort (Klamath weed) and tansy ragwort. Emerging success stories include Dalmatian toadflax, diffuse knapweed, leafy spurge, purple loosestrife and yellow star thistle. However, historically, each new introduction of a biological control agent in the United States has only about a 30% success rate (Coombs et al 2006). Refer to Coombs et al (2006) for the status of biological control agents for invasive plants in the Pacific Northwest.

Introduced species without desirable close relatives in the United States would generally be selected as biological controls. Natural enemies that are restricted to one or a few closely related plants in their country of origin are targeted as biological controls (Center et al. 1997, Hasan and Ayres 1990).

The refuge staff would ensure introduced agents are approved by the applicable authorities. Except for a small number of formulated biological control products registered by USEPA under FIFRA, most biological control agents are regulated by the US Department of Agriculture (USDA)-Animal Plant Health Inspection Service, Plant Protection and Quarantine (APHIS-PPQ). State departments of agriculture and, in some cases, county agricultural commissioners or weed districts, have additional approval authority.

Federal permits (USDA-APHIS-PPQ Form 526) are required to import biocontrols agents from another state. Form 526 may be obtained by writing:

USDA-APHIS-PPQ
Biological Assessment and Taxonomic Support
4700 River Road, Unit 113
Riverdale, MD 20737

Or through the internet at URL address: http://www.aphis.usda.gov/ppq/permits/bioligical/weedbio.html.

The Service strongly supports the development, and legal and responsible use of appropriate, safe, and effective biological control agents for nuisance and non-indigenous or pest species.

State and county agriculture departments may also be sources for biological control agents or they may have information about where biological control agents may be obtained. Commercial sources should have an Application and Permit to Move Live Plant Pests and Noxious Weeds (USDA-PPQ Form 226 USDA-APHIS-PPQ, Biological Assessment and Taxonomic Support, 4700 River Road, Unit 113, Riverdale, MD 20737) to release specific biological control agents in a state and/or county. Furthermore, certification regarding the biological control agent's identity (genus, specific epithet, sub-species and variety) and purity (e.g., parasite free, pathogen free, and biotic and abiotic contaminants) should be specified in purchase orders.

Biological control agents are subject to 7 RM 8 (Exotic Species Introduction and Management). In addition, the refuge staff would follow the International Code of Best Practice for Classical Biological Control of Weeds (http://sric.ucdavis.edu/exotic /exotic.htm) as ratified by delegates to the X International Symposium on Biological Control of Weeds, Bozeman, MT, July 9, 1999. This code identifies the following:

- Release only approved biological control agents,
- Use the most effective agents,

- Document releases, and
- Monitor for impact to the target pest, nontarget species and the environment.

Biological control agents formulated as pesticide products and registered by the USEPA (e.g., *Bti*) are also subject to PUP review and approval (see below).

A record of all releases would be maintained with date(s), location(s), and environmental conditions of the release site(s); the identity, quantity, and condition of the biological control agents released; and other relevant data and comments such as weather conditions. Systematic monitoring to determine the establishment and effectiveness of the release is also recommended.

NEPA documents regarding biological and other environmental effects of biological control agents prepared by another federal agency, where the scope is relevant to evaluation of releases on refuge lands, would be reviewed. Possible source agencies for such NEPA documents include the Bureau of Land Management, US Forest Service, National Park Service, US Department of Agriculture-Animal and Plant Health Inspection Service, and the military services. It might be appropriate to incorporate by reference parts or all of existing document(s) from the review. Incorporating by reference (43 CFR 46.135) is a technique used to avoid redundancies in analysis. It also can reduce the bulk of a Service NEPA document, which only must identify the documents that are incorporated by reference. In addition, relevant portions must be summarized in the Service NEPA document to the extent necessary to provide the decision maker and public with an understanding of relevance of the referenced material to the current analysis.

Pesticides. The selective use of pesticides would be based upon pest ecology (including mode of reproduction), the size and distribution of its populations, site-specific conditions (e.g., soils, topography), known efficacy under similar site conditions, and the capability to utilize best management practices (BMPs) to reduce/eliminate potential effects to non-target species, sensitive habitats, and potential to contaminate surface and groundwater. All pesticide usage (pesticide, target species, application rate, and method of application) would comply with the applicable federal (FIFRA) and state regulations pertaining to pesticide use, safety, storage, disposal, and reporting. Before pesticides can be used to eradicate, control, or contain pests on refuge lands and waters, pesticide use proposals (PUPs) would be prepared and approved in accordance with 7 RM 14. PUP records would provide a detailed, time-, site-, and target-specific description of the proposed use of pesticides on the refuge. All PUPs would be created, approved or disapproved, and stored in the Pesticide Use Proposal System (PUPS), which is a centralized database only accessible on the Service's intranet (https://systems.fws.gov/pups). Only Service employees would be authorized to access PUP records for a refuge in this database.

Application equipment would be selected to provide site-specific delivery to target pests while minimizing/eliminating direct or indirect (e.g., drift) exposure to non-target areas and degradation of surface and groundwater quality. Where practicable, target-specific equipment (e.g., backpack sprayer, wiper) would be used to treat target pests. Other target-specific equipment to apply pesticides would include soaked wicks or paint brushes for wiping vegetation and lances, hatchets, or syringes for direct injection into stems. Granular pesticides may be applied using seeders or other specialized dispensers. In contrast, aerial spraying (e.g., fixed wing or helicopter) would only be used where access is difficult (remoteness) and/or the size/distribution of infestations precludes practical use of ground-based methods.

Because repeated use of one pesticide may allow resistant organisms to survive and reproduce, multiple pesticides with variable modes of action would be considered for treatments on refuge lands and waters. This is especially important if multiple applications within years and/or over a growing season likely would be necessary for habitat maintenance and restoration activities to achieve resource objectives.

Integrated chemical and non-chemical controls also are highly effective, where practical, because pesticide resistant organisms can be removed from the site.

Cost may not be the primary factor in selecting a pesticide for use on a refuge. If the least expensive pesticide would potentially harm natural resources or people, then a different product would be selected, if available. The most efficacious pesticide available with the least potential to degrade environment quality (soils, surface water, and groundwater) as well as least potential effect to native species and communities of fish, wildlife, plants, and their habitats would be acceptable for use on refuge lands in the context of an IPM approach.

Habitat restoration/maintenance. Restoration and/or proper maintenance of refuge habitats associated with achieving wildlife and habitat objectives would be essential for long-term prevention, eradication, or control (at or below threshold levels) of pests. Promoting desirable plant communities through the manipulation of species composition, plant density, and growth rate is an essential component of invasive plant management (Masters et al. 1996, Masters and Shelly 2001, Brooks et al. 2004). The following three components of succession could be manipulated through habitat maintenance and restoration: site availability, species availability, and species performance (Cox and Anderson 2004). Although a single method (e.g., herbicide treatment) may eliminate or suppress pest species in the short term, the resulting gaps and bare soil create niches that are conducive to further invasion by the species and/or other invasive plants. On degraded sites where desirable species are absent or in low abundance, revegetation with native/desirable grasses, forbs, and legumes may be necessary to direct and accelerate plant community recovery, and achieve site-specific objectives in a reasonable time frame. The selection of appropriate species for revegetation would be dependent on a number of factors including resource objectives and site-specific, abiotic factors (e.g., soil texture, precipitation/temperature regimes, and shade conditions). Seed availability and cost, ease of establishment, seed production, and competitive ability also would be important considerations.

4.0 Priorities for Treatments

For many refuges, the magnitude (number, distribution, and sizes of infestations) of pest problems is too extensive and beyond the available capital resources to effectively address during any single field season. To manage pests in the refuge, it would be essential to prioritize treatment of infestations. Highest priority treatments would be focused on early detection and rapid response to eliminate infestations of new pests, if possible. This would be especially important for aggressive pests potentially impacting species, species groups, communities, and/or habitats associated refuge purpose(s), NWRS resources of concern (federally listed species, migratory birds, selected marine mammals, and interjurisdictional fish), and native species for maintaining/restoring biological integrity, diversity, and environmental health.

The next priority would be treating established pests that appear in one or more previously un-infested areas. Moody and Mack (1988) demonstrated through modeling that small, new outbreaks of invasive plants eventually would infest an area larger than the established, source population. They also found that control efforts focusing on the large, main infestation rather than the new, small satellites reduced the chances of overall success. The lowest priority would be treating large infestations (sometimes monotypic stands) of well established pests. In this case, initial efforts would focus upon containment of the perimeter followed by work to control/eradicate the established infested area. If containment and/or control of a large infestation is not effective, then efforts would focus upon halting pest reproduction or managing source populations. Maxwell et al. (2009) found treating fewer populations that are sources represents an effective long-term strategy to reduce of total number of invasive populations and decreasing meta population growth rates.

Although state listed noxious weeds would always of high priority for management, other pest species known to cause substantial ecological impact would also be considered. For example, cheatgrass may not be listed by a state as noxious, but it can greatly alter fire regimes in shrub steppe habitats resulting in large monotypic stands that displace native bunch grasses, forbs, and shrubs. Propagules of many invasive plant species can remain viable in the seedbank for years or decades. Therefore, pest control would likely require a multi-year commitment from the refuge staff. Essential to the long-term success of pest management would be pre- and post-treatment monitoring, assessment of the successes and failures of treatments, and development of new approaches when proposed methods do not achieve desired outcomes.

5.0 Best Management Practices (BMPs)

BMPs can minimize or eliminate possible effects associated with pesticide usage to non-target species and/or sensitive habitats as well as degradation of water quality from drift, surface runoff, or leaching. Based upon the Department of Interior Pesticide Use Policy (517 DM 1), Pesticide Users Safety Policy (242 FW 7), and the Service Pest Management Policy and Responsibilities (30 AM 12), the use of applicable BMPs (where feasible) also would likely ensure that pesticide uses may not adversely affect federally listed species and/or their critical habitats through determinations made using the process described in 50 CFR part 402.

The following are BMPs pertaining to mixing/handling and applying pesticides for all ground-based treatments of pesticides, which would be considered and utilized, where feasible, based upon target- and site-specific factors and time-specific environmental conditions. Although not listed below, the most important BMP to eliminate/reduce potential impacts to non-target resources would be an IPM approach to prevent, control, eradicate, and contain pests.

5.1 Pesticide Handling and Mixing

- As a precaution against spilling, spray tanks would not be left unattended during filling.
- All pesticide containers would be triple rinsed and the rinsate would be used as water in the sprayer tank and applied to treatment areas.
- All pesticide spray equipment would be properly cleaned. Where possible, rinsate would be used as part of the make up water in the sprayer tank and applied to treatment areas.
- The refuge staff would follow label recommendations when disposing of empty, triple rinsed pesticide containers.
- All unused pesticides would be properly discarded at a local “safe send” collection.
- Pesticides and pesticide containers would be lawfully stored, handled, and disposed of in accordance with the label and in a manner safeguarding human health, fish, and wildlife and prevent soil and water contaminant.
- The refuge staff would consider the water quality parameters (e.g., pH, hardness) that are important to ensure greatest efficacy where specified on the pesticide label.
- All pesticide spills would be addressed immediately using procedures identified in the refuge spill respond plan.

5.2 Applying Pesticides

- Pesticide treatments would only be conducted by or under the supervision of Service personnel and non-Service applicators with the appropriate state or BLM certification to safely and effectively conduct these activities on refuge lands and waters.
- The refuge staff would comply with all applicable pesticide use laws and regulations as well as

Departmental, Service, and NWRS pesticide-related policies. For example, the refuge staff would use application equipment and apply rates for the specific pest(s) identified on the pesticide label as required under FIFRA.

- Before each treatment season and prior to mixing or applying any product for the first time each season, all applicators would review the labels, MSDSs, and Pesticide Use Proposal (PUPs) for each pesticide, determining the target pest, appropriate mix rate(s), PPE, and other requirements listed on the pesticide label.
- Use no-spray buffers as specified on product labels.
- Use low impact herbicide application techniques (e.g., spot treatment, cut stump, oil basal, Thinvert system applications) rather than broadcast foliar applications (e.g., boom sprayer, other larger tank wand applications), where practical.
- Use low volume rather than high volume foliar applications where low impact methods above are not feasible or practical, to maximize herbicide effectiveness and ensure correct and uniform application rates.
- Applicators would use the largest droplet size that results in uniform coverage while minimizing drift and runoff.
- Applicators would use drift reduction technologies such as low-drift nozzles, where practicable.
- Per label recommendations, spraying would occur during low (average<7mph and preferably 3 to 5 mph) and consistent direction wind conditions with moderate temperatures (typically <85 °F).
- Where possible, applicators would avoid spraying during inversion conditions (often associated with calm and very low wind conditions) that can cause large-scale herbicide drift to non-target areas.
- Equipment would be calibrated regularly to ensure that the proper rate of pesticide is applied to the target area or species.
- Spray applications would be made at the lowest height for uniform coverage of target pests to minimize/eliminate potential drift.
- Spray applications would not be conducted on days with >30% forecast for rain within 6 hours, except for pesticides that are rapidly rain fast (e.g., glyphosate in 1 hour) to minimize/eliminate potential runoff.
- Where practicable, applicators would use drift retardant adjuvants during spray applications, especially adjacent to sensitive areas.
- Where practicable, applicators would use a non-toxic dye to aid in identifying target area treated as well as potential over spray or drift. A dye can also aid in detecting equipment leaks. If a leak is discovered, the application would be stopped until repairs can be made to the sprayer.
- For pesticide uses associated with cropland and facilities management, buffers, as appropriate, would be used to protect sensitive habitats, especially wetlands and other aquatic habitats as required by the pesticide label.
- When drift cannot be sufficiently reduced through altering equipment set up and application techniques, buffer zones may be identified to protect sensitive areas downwind of applications.
- Applicators would utilize scouting for early detection of pests to eliminate unnecessary pesticide applications.
- The refuge staff would consider timing of application so native plants are protected to the extent practicable, while effectively treating invasive plants.
- Where practicable, rinsate from cleaning spray equipment after application would be recaptured and reused or applied to an appropriate pest plant infestation.
- Application equipment (e.g., sprayer, ATV, tractor) would be thoroughly cleaned and PPE would be removed/disposed of on-site by applicators after treatments to eliminate the potential spread of pests.

6.0 Safety

6.1 Personal Protective Equipment

All applicators would wear the specific personal protective equipment (PPE) identified on the pesticide label. The appropriate PPE will be worn at all times during handling, mixing, and applying. Because exposure to concentrated product is usually greatest during mixing, extra care should be taken while preparing pesticide solutions.

Protective clothing used during an application would be laundered separately from other laundry items. Transporting, storing, handling, mixing and disposing of pesticide containers will be consistent with label requirements, USEPA and OSHA requirements, and Service policy.

If a respirator is necessary, then the following requirements would be met in accordance with Service safety policy: a written Respirator Program, fit testing, physical examination (including pulmonary function and blood work for contaminants), and proper storage of the respirator.

6.2 Notification

The restricted entry interval (REI) is the time period required after the application at which point someone may safely enter a treated area without PPE. Refuge staff, authorized management agents of the Service, volunteers, and members of the public who could be in or near a pesticide treated area within the stated re-entry time period on the label would be notified about treatment areas. Posting would occur at any site where individuals might inadvertently become exposed to a pesticide during other activities on the refuge within the stated re-entry period. Where required by the label and/or state-specific regulations, sites would also be posted on its perimeter and at other likely locations of entry. The refuge staff would also notify appropriate private property owners of an intended application, including any private individuals who have requested notification. Special efforts would be made to contact nearby individuals who are beekeepers or who have expressed chemical sensitivities.

6.3 Medical Surveillance

Medical surveillance may be required for Service personnel and approved volunteers who mix, apply, and/or monitor use of pesticides (see 242 FW 7 [Pesticide Users] and 242 FW 4 [Medical Surveillance]). In accordance with 242 FW 7.12A, Service personnel would be medically monitoring if 1 or more of the following criteria is met: exposed or may be exposed to concentrations at or above the published permissible exposure limits or threshold limit values (see 242 FW 4); use pesticides in a manner considered "frequent pesticide use"; or use pesticides in a manner that requires a respirator (see 242 FW 14 for respirator use requirements). In 242 FW7.7A, "**Frequent Pesticide Use** means when a person applying pesticide handles, mixes, or applies pesticides, with a Health Hazard rating of 3 or higher, for 8 or more hours in any week or 16 or more hours in any 30-day period." Under some circumstances, individuals may be medically monitored who use pesticides infrequently (see section 7.7), experience an acute exposure (sudden, short term), or use pesticides with a health hazard ranking of 1 or 2. This decision would consider the individual's health and fitness level, the pesticide's specific health risks, and the potential risks from other pesticide-related activities. Refuge cooperators (e.g., cooperative farmers) and other authorized agents (e.g., state and county employees) would be responsible for their own medical monitoring needs and costs.

Standard examinations (at refuge expense) of appropriate refuge staff would be provided by the nearest certified occupational health and safety physician as determined by Federal Occupational Health.

6.4 Certification and Supervision of Pesticide Applicators

Refuge staff or approved volunteers handling, mixing, and/or applying or directly supervising others engaged in pesticide use activities would be trained and state or federally (BLM) licensed to apply pesticides to refuge lands or waters. In accordance with 242 FW7.18A, certification is required to apply restricted use pesticides based upon USEPA regulations. For safety reasons, all individuals participating in pest management activities with general use pesticides also are encouraged to attend appropriate training or acquire pesticide applicator certification. The certification requirement would be for a commercial or private applicator depending upon the state. Documentation of training would be kept in the files at the refuge office.

6.5 Record Keeping

6.5.1 Labels and material safety data sheets

Pesticide labels and material safety data sheets (MSDSs) would be maintained at the refuge shop and laminated copies in the mixing area. These documents also would be carried by field applicators, where practicable. A written reference (e.g., note pad, chalk board, dry erase board) for each tank to be mixed would be kept in the mixing area for quick reference while mixing is in progress. In addition, approved PUPs stored in the PUPS database typically contain website links (URLs) to pesticide labels and MSDSs.

6.5.2 Pesticide use proposals (PUPs)

A PUP would be prepared for each proposed pesticide use associated with annual pest management on refuge lands and waters. A PUP would include specific information about the proposed pesticide use including the common and chemical names of the pesticide(s), target pest species, size and location of treatment site(s), application rate(s) and method(s), and federally listed species determinations, where applicable.

In accordance with 30 AM 12 and 7 RM 14, PUPs would be required for the following:

- Uses of pesticides on lands and facilities owned or managed by the Service, including properties managed by Service personnel as a result of the Food Security Act of 1985;
- Service projects by non-Service personnel on Service owned or controlled lands and facilities and other pest management activities that would be conducted by Service personnel; and
- Where the Service would be responsible or provides funds for pest management identified in protective covenants, easements, contracts, or agreements off Service lands.

In accordance with Service guidelines (Director's memo [December 12, 2007]), a refuge staff may receive up to 5-year approvals for Washington Office and field reviewed proposed pesticide uses based upon meeting identified criteria including an approved IPM plan, where necessary (see http://www.fws.gov/contaminants/Issues/IPM.cfm). For a refuge, an IPM plan (requirements described herein) can be completed independently or in association with a CCP or HMP if IPM strategies and potential environmental effects are adequately addressed within appropriate NEPA documentation.

PUPs would be created, approved or disapproved, and stored as records in the Pesticide Use Proposal System (PUPS), which is a centralized database on the Service's intranet (https://systems.fws.gov/pups). Only Service employees can access PUP records in this database.

6.5.3 Pesticide usage

In accordance with 30 AM 12 and 7 RM 14, the refuge Project Leader would be required to maintain records of all pesticides annually applied on lands or waters under refuge jurisdiction. This would encompass pesticides applied by other federal agencies, state and county governments, non-government applicators including cooperators and their pest management service providers with Service permission. For clarification, pesticide means all insecticides, insect and plant growth regulators, dessicants, herbicides, fungicides, rodenticides, acaricides, nematicides, fumigants, avicides, and piscicides.

The following usage information can be reported for approved PUPs in the PUPS database:
- Pesticide trade name(s)
- Active ingredient(s)
- Total acres treated
- Total amount of pesticides used (lbs or gallons)
- Total amount of active ingredient(s) used (lbs)
- Target pest(s)
- Efficacy (% control)

To determine whether treatments are efficacious (eradicating, controlling, or containing the target pest) and achieving resource objectives, habitat and/or wildlife response would be monitored both pre- and post-treatment, where possible. Considering available annual funding and staffing, appropriate monitoring data regarding characteristics (attributes) of pest infestations (e.g., area, perimeter, degree of infestation-density, % cover, density) as well as habitat and/or wildlife response to treatments may be collected and stored in a relational database (e.g., Refuge Habitat Management Database), preferably a geo-referenced data management system (e.g., Refuge Lands GIS [RLGIS]) to facilitate data analyses and subsequent reporting. In accordance with adaptive management, data analysis and interpretation would allow treatments to be modified or changed over time, as necessary, to achieve resource objectives considering site-specific conditions in conjunction with habitat and/or wildlife responses. Monitoring could also identify short- and long-term impacts to natural resources and environmental quality associated with IPM treatments in accordance with adaptive management principles identified in 43 CFR 46.145.

7.0 Evaluating Pesticide Use Proposals

Pesticides would only be used on refuge lands for habitat management as well as croplands/facilities maintenance after approval of a PUP. In general, proposed pesticide uses on refuge lands would only be approved where there would likely be minor, temporary, or localized effects to fish and wildlife species as well as minimal potential to degrade environmental quality. Potential effects to listed and non-listed species would be evaluated with quantitative ecological risk assessments and other screening measures. Potential effects to environmental quality would be based upon pesticide characteristics of environmental fate (water solubility, soil mobility, soil persistence, and volatilization) and other quantitative screening tools. Ecological risk assessments as well as characteristics of environmental fate and potential to degrade environmental quality for pesticides would be documented in Chemical Profiles (see Section 7.5). These profiles would include threshold values for quantitative measures of ecological risk assessments and screening tools for environmental fate that represent minimal potential effects to species and environmental quality. In general, only pesticide uses with appropriate BMPs (see Section 4.0) for habitat management and cropland/facilities maintenance on refuge lands that would potentially have minor, temporary, or localized effects on refuge biological and environmental quality (threshold values not exceeded) would be approved.

7.1 Overview of Ecological Risk Assessment

An ecological risk assessment process would be used to evaluate potential adverse effects to biological resources as a result of a pesticide(s) proposed for use on refuge lands. It is an established quantitative and qualitative methodology for comparing and prioritizing risks of pesticides and conveying an estimate of the potential risk for an adverse effect. This quantitative methodology provides an efficient mechanism to integrate best available scientific information regarding hazard, patterns of use (exposure), and dose-response relationships in a manner that is useful for ecological risk decision-making. It would provide an effective way to evaluate potential effects where there is missing or unavailable scientific information (data gaps) to address reasonable, foreseeable adverse effects in the field as required under 40 CFR Part 1502.22. Protocols for ecological risk assessment of pesticide uses on the refuge were developed through research and established by the US Environmental Protection Agency (2004). Assumptions for these risk assessments are presented in Section 6.2.3.

The toxicological data used in ecological risk assessments are typically results of standardized laboratory studies provided by pesticide registrants to the US Environmental Protection Agency (USEPA) to meet regulatory requirements under the Federal Insecticide, Fungicide and Rodenticide Act of 1996 (FIFRA). These studies assess the acute (lethality) and chronic (reproductive) effects associated with short- and long-term exposure to pesticides on representative species of birds, mammals, freshwater fish, aquatic invertebrates, and terrestrial and aquatic plants. Other effects data publicly available would also be utilized for risk assessment protocols described herein. Toxicity endpoint and environmental fate data are available from a variety of resources. Some of the more useful resources can be found in Section 7.5.

Table 1. Ecotoxicity tests used to evaluate potential effects to birds, fish, and mammals to establish toxicity endpoints for risk quotient calculations.

Species Group	**Exposure**	**Measurement endpoint**
Bird	Acute	Median Lethal Concentration (LC_{50})
	Chronic	No Observed Effect Concentration (NOEC) or No Observed Adverse Effect Concentration (NOAEC)[1]
Fish	Acute	Median Lethal Concentration (LC_{50})
	Chronic	No Observed Effect Concentration (NOEC) or No Observed Adverse Effect Concentration (NOAEC)[2]
Mammal	Acute	Oral Lethal Dose (LD_{50})
	Chronic	No Observed Effect Concentration (NOEC) or No Observed Adverse Effect Concentration (NOAEC)[3]

[1]Measurement endpoints typically include a variety of reproductive parameters (e.g., number of eggs, number of offspring, eggshell thickness, and number of cracked eggs).
[2]Measurement endpoints for early life stage/life cycle typically include embryo hatch rates, time to hatch, growth, and time to swim-up.
[3]Measurement endpoints include maternal toxicity, teratogenic effects or developmental anomalies, evidence of mutagenicity or genotoxicity, and interference with cellular mechanisms such as DNA synthesis and DNA repair.

7.2 Determining Ecological Risk to Fish and Wildlife

The potential for pesticides used on the refuge to cause direct adverse effects to fish and wildlife would be evaluated using USEPA's Ecological Risk Assessment Process (US Environmental Protection Agency 2004). This deterministic approach, which is based upon a two-phase process involving estimation of environmental concentrations and then characterization of risk, would be used for ecological risk assessments. This method integrates exposure estimates (estimated environmental concentration [EEC] and toxicological endpoints [e.g., LC_{50} and oral LD_{50}]) to evaluate the potential for adverse effects to species groups (birds, mammals, and fish) representative of legal mandates for managing units of the NWRS. This integration is achieved through risk quotients (RQs) calculated by dividing the EEC by acute and chronic toxicity values selected from standardized toxicological endpoints or published effect (Table 1).

$$RQ = EEC/\text{Toxicological Endpoint}$$

The level of risk associated with direct effects of pesticide use would be characterized by comparing calculated RQs to the appropriate Level of Concern (LOC) established by US Environmental Protection Agency (1998 [Table 2]). The LOC represents a quantitative threshold value for screening potential adverse effects to fish and wildlife resources associated with pesticide use. The following are four exposure-species group scenarios that would be used to characterize ecological risk to fish and wildlife on the refuge: acute-listed species, acute-nonlisted species, chronic-listed species, and chronic-nonlisted species.

Acute risk would indicate the potential for mortality associated with short-term dietary exposure to pesticides immediately after an application. For characterization of acute risks, median values from LC_{50} and LD_{50} tests would be used as toxicological endpoints for RQ calculations. In contrast, chronic risks would indicate the potential for adverse effects associated with long-term dietary exposure to pesticides from a single application or multiple applications over time (within a season and over years). For characterization of chronic risks, the no observed concentration (NOAEC) or no observed effect concentration (NOEC) for reproduction would be used as toxicological endpoints for RQ calculations. Where available, the NOAEC would be preferred over a NOEC value.

Listed species are those federally designated as threatened, endangered, or proposed in accordance with the Endangered Species Act of 1973 (16 USC 1531-1544, 87 Stat. 884, as amended-Public Law 93-205). For listed species, potential adverse effects would be assessed at the individual level because loss of individuals from a population could detrimentally impact a species. In contrast, risks to nonlisted species would consider effects at the population level. A RQ<LOC would indicate the proposed pesticide use "may affect, not likely to adversely effect" individuals (listed species) and it would not pose an unacceptable risk for adverse effects to populations (non-listed species) for each taxonomic group (Table 2). In contrast, a RQ>LOC would indicate a "may affect, likely to adversely affect" for listed species and it would also pose unacceptable ecological risk for adverse effects to nonlisted species.

Table 2. Presumption of unacceptable risk for birds, fish, and mammals (US Environmental Protection Agency 1998).

Risk Presumption		Level of Concern	
		Listed Species	Non-listed Species
Acute	Birds	0.1	0.5
	Fish	0.05	0.5
	Mammals	0.1	0.5
Chronic	Birds	1.0	1.0
	Fish	1.0	1.0
	Mammals	1.0	1.0

7.2.1 Environmental exposure

Following release into the environment through application, pesticides would experience several different routes of environmental fate. Pesticides which would be sprayed can move through the air (e.g., particle or vapor drift) and may eventually end up in other parts of the environment such as non-target vegetation, soil, or water. Pesticides may be bound to soil particles or organic matter and may be transformed by soil micro-organisms or chemical processes. Pesticides applied directly to the soil may be washed off the soil into nearby bodies of surface water (e.g., surface runoff) or may percolate through the soil to lower soil layers and groundwater (e.g., leaching) (Baker and Miller 1999, Pope et. al. 1999, Butler et. al. 1998, Ramsay et. al. 1995, EXTOXNET 1993*a*). Pesticides which would be injected into the soil may also be subject to the latter two fates.

The aforementioned possibilities are by no means complete, but it does indicate movement of pesticides in the environment is very complex with transfers occurring continually among different environmental compartments. In some cases, these exchanges occur not only between areas that are close together, but it also may involve transportation of pesticides over long distances (Barry 2004, Woods 2004).

7.2.1.1 Terrestrial exposure

The estimated environmental concentration (ECC) for exposure to terrestrial wildlife would be quantified using an USEPA screening-level approach (US Environmental Protection Agency 2004). This screening-level approach is not affected by product formulation because it evaluates pesticide active ingredient(s). This approach would vary depending upon the proposed pesticide application method: spray or granular.

7.2.1.1.1 Terrestrial-spray application

For spray applications, exposure would be determined using the Kanaga nomogram method (US Environmental Protection Agency 2005*a*, US Environmental Protection Agency 2004, Pfleeger et al. 1996) through the USEPA's Terrestrial Residue Exposure model (T-REX) version 1.2.3 (US Environmental Protection Agency 2005*b*). To estimate the maximum (initial) pesticide residue on short grass (<20 cm tall) as a general food item category for terrestrial vertebrate species, T-REX input variables would include the following from the pesticide label: maximum pesticide application rate (pounds active ingredient [acid equivalent]/acre) and pesticide half-life (days) in soil. Although there are other food item categories (tall grasses; broadleaf plants and small insects; and fruits, pods, seeds and large insects), short grass was selected because it would yield maximum EECs (240 ppm per lb ai/acre) for worse-case risk assessments. Short grass is not representative of forage for carnivorous species (e.g., raptors), but it would characterize the maximum potential exposure through the diet of avian and mammalian prey items. Consequently, this approach would provide a conservative screening tool for pesticides that do not biomagnify.

For RQ calculations in T-REX, the model would require the weight of surrogate species and Mineau scaling factors (Mineau et. al. 1996). Body weights of bobwhite quail and mallard are included in T-REX by default, but body weights of other organisms (Table 3) would be entered manually. The Mineau scaling factor accounts for small-bodied bird species that may be more sensitive to pesticide exposure than would be predicted only by body weight. Mineau scaling factors would be entered manually with values ranging from 1 to 1.55 that are unique to a particular pesticide or group of pesticides. If specific information to select a scaling factor is not available, then a value of 1.15 would be used as a default. Alternatively, zero would be entered if it is known that body weight does not influence toxicity of pesticide(s) being assessed. The upper bound estimate output from the T-REX Kanaga nomogram would be used as an EEC for calculation of RQs. This approach would yield a conservative estimate of ecological risk.

Table 3. Average body weight of selected terrestrial wildlife species frequently used in research to establish toxicological endpoints (Dunning 1984).

Species	Body Weight (kg)
Mammal (15 g)	0.015
House sparrow	0.0277
Mammal (35 g)	0.035
Starling	0.0823
Red-winged blackbird	0.0526
Common grackle	0.114
Japanese quail	0.178
Bobwhite quail	0.178
Rat	0.200
Rock dove (aka pigeon)	0.542
Mammal (1000 g)	1.000
Mallard	1.082
Ring-necked pheasant	1.135

7.2.1.1.2 Terrestrial – granular application

Granular pesticide formulations and pesticide-treated seed would pose a unique route of exposure for avian and mammalian species. The pesticide is applied in discrete units which birds or mammals might ingest accidentally with food items or intentionally as in the case of some bird species actively seeking and picking up gravel or grit to aid digestion or seed as a food source. Granules may also be consumed by wildlife foraging on earthworms, slugs or other soft-bodied soil organisms to which the granules may adhere.

Terrestrial wildlife RQs for granular formulations or seed treatments would be calculated by dividing the maximum milligrams of active ingredient (ai) exposed (e.g., EEC) on the surface of an area equal to 1 square foot by the appropriate LD_{50} value multiplied by the surrogate's body weight (Table 3). An adjustment to surface area calculations would be made for broadcast, banded, and in-furrow applications. An adjustment also would be made for applications with and without incorporation of the granules. Without incorporation, it would be assumed that 100% of the granules remain on the soil surface available to foraging birds and mammals. Press wheels push granules flat with the soil surface, but they are not incorporated into the soil. If granules are incorporated in the soil during band or T-band applications or after broadcast applications, it would be assumed only 15% of the applied granules remain available to wildlife. It would be assumed that only 1% of the granules are available on the soil surface following in-furrow applications.

EECs for pesticides applied in granular form and as seed treatments would be determined considering potential ingestion rates of avian or mammalian species (e.g., 10-30% body weight/day). This would provide an estimate of maximum exposure that may occur as a result of granule or seed treatment spills such as those that commonly occur at end rows during application and planting. The availability of granules and seed treatments to terrestrial vertebrates would also be considered by calculating the loading per unit area (LD_{50}/ft^2) for comparison to USEPA Level of Concerns (US Environmental Protection

Agency 1998). The T-REX version 1.2.3 (US Environmental Protection Agency 2005*b*) contains a submodel which automates Kanaga exposure calculations for granular pesticides and treated seed.

The following formulas will be used to calculate EECs depending upon the type of granular pesticide application:

- In-furrow applications assume a typical value of 1% granules, bait, or seed remain unincorporated.

$$mg\ a.i./ft.^2 = [(lbs.\ product/acre)(\%\ a.i.)(453{,}580\ mg/lbs)(1\%\ exposed))] / \{[(43{,}560\ ft.^2/acre)/(row\ spacing\ (ft.))] / (row\ spacing\ (ft.)\}$$

or

$$mg\ a.i./ft^2 = [(lbs\ product/1000\ ft.\ row)(\%\ a.i.)(1000\ ft\ row)(453{,}580\ mg/lb.)(1\%\ exposed)$$

$$EEC = [(mg\ a.i./ft.^2)(\%\ of\ pesticide\ biologically\ available)]$$

- Incorporated banded treatments assume that 15% of granules, bait, seeds are unincorporated.

$$mg\ a.i./ft.^2 = [(lbs.\ product/1000\ row\ ft.)(\%\ a.i.)(453{,}580\ mg/lb.)(1\text{-}\%\ incorporated)] / (1{,}000\ ft.)(band\ width\ (ft.))$$

$$EEC = [(mg\ a.i./ft.^2)(\%\ of\ pesticide\ biologically\ available)]$$

- Broadcast treatment without incorporation assumes 100% of granules, bait, seeds are unincorporated.

$$mg\ a.i./ft.^2 = [(lbs.\ product/acre)(\%\ a.i.)(453{,}590\ mg/lb.)] / (43{,}560\ ft.^2/acre)$$

$$EEC = [(mg\ a.i./ft.^2)(\%\ of\ pesticide\ biologically\ available)]$$

Where:

- *% of pesticide biologically available = 100% without species specific ingestion rates*

- *Conversion for calculating mg a.i./ft.^{2} using ounces: 453,580 mg/lb. /16 = 28,349 mg/oz.*

The following equation would used to calculate a RQ based on the EEC calculated by one of the above equations. The EEC would divided by the surrogate LD_{50} toxicological endpoint multiplied by the body weight (Table 3) of the surrogate.

$$RQ = EEC / [LD_{50}\ (mg/kg) * body\ weight\ (kg)]$$

As with other risk assessments, a RQ>LOC would be a presumption of unacceptable ecological risk. A RQ<LOC would be a presumption of acceptable risk with only minor, temporary, or localized effects to species.

7.2.1.2 Aquatic exposure

Exposures to aquatic habitats (e.g., wetlands, meadows, ephemeral pools, water delivery ditches) would be evaluated separately for ground-based pesticide treatments of habitats managed for fish and wildlife compared with cropland/facilities maintenance. The primary exposure pathway for aquatic organisms from any ground-based treatments likely would be particle drift during the pesticide application.

However, different exposure scenarios would be necessary as a result of contrasting application equipment and techniques as well as pesticides used to control pests on agricultural lands (especially those cultivated by cooperative farmers for economic return from crop yields) and facilities maintenance (e.g., roadsides, parking lots, trails) compared with other managed habitats on the refuge. In addition, pesticide applications may be done <25 feet of the high water mark of aquatic habitats for habitat management treatments; whereas, no-spray buffers (≥25 feet) would be used for croplands/facilities maintenance treatments.

7.2.1.2.1 Habitat treatments

For the worst-case exposure scenario to non-target aquatic habitats, EECs (Table 4) would be would be derived from Urban and Cook (1986) that assumes an intentional overspray to an entire, non-target water body (1-foot depth) from a treatment <25 feet from the high water mark using the max application rate (acid basis [see above]). However, use of BMPs for applying pesticides (see Section 4.2) would likely minimize/eliminate potential drift to non-target aquatic habitats during actual treatments. If there would be unacceptable (acute or chronic) risk to fish and wildlife with the simulated 100% overspray (RQ>LOC), then the proposed pesticide use may be disapproved or the PUP would be approved at a lower application rate to minimize/eliminate unacceptable risk to aquatic organisms (RQ=LOC).

Table 4. Estimated Environmental Concentrations (ppb) of pesticides in aquatic habitats (1 foot depth) immediately after direct application (Urban and Cook 1986).

Lbs/acre	EEC (ppb)
0.10	36.7
0.20	73.5
0.25	91.9
0.30	110.2
0.40	147.0
0.50	183.7
0.75	275.6
1.00	367.5
1.25	459.7
1.50	551.6
1.75	643.5
2.00	735.7
2.25	827.6
2.50	919.4
3.00	1103.5
4.00	1471.4
5.00	1839
6.00	2207
7.00	2575
8.00	2943
9.00	3311
10.00	3678

7.2.1.2.2 Cropland/facilities maintenance treatments

Field drift studies conducted by the Spray Drift Task Force, which is a joint project of several agricultural chemical businesses, were used to develop a generic spray drift database. From this database, the

AgDRIFT computer model was created to satisfy USEPA pesticide registration spray drift data requirements and as a scientific basis to evaluate off-target movement of pesticides from particle drift and assess potential effects of exposure to wildlife. Several versions of the computer model have been developed (i.e., v2.01 through v2.10). The Spray Drift Task Force AgDRIFT® model version 2.01 (SDTF 2003, AgDRIFT 2001) would be used to derive EECs resulting from drift of pesticides to refuge aquatic resources from ground-based pesticide applications >25 feet from the high water mark. The Spray Drift Task Force AgDRIFT model is publicly available at http://www.agdrift.com. At this website, click "AgDRIFT 2.0" and then click "Download Now" and follow the instructions to obtain the computer model.

The AgDRIFT model is composed of submodels called tiers. Tier I Ground submodel would be used to assess ground-based applications of pesticides. Tier outputs (EECs) would be calculated with AgDRIFT using the following input variables: max application rate (acid basis [see above]), low boom (20 inches), fine to medium droplet size, EPA-defined wetland, and a ≥25-foot distance (buffer) from treated area to water.

7.2.2 Use of information on effects of biological control agents, pesticides, degradates, and adjuvants

NEPA documents regarding biological and other environmental effects of biological control agents, pesticides, degradates, and adjuvants prepared by another federal agency, where the scope would be relevant to evaluation of effects from pesticide uses on refuge lands, would be reviewed. Possible source agencies for such NEPA documents would include the Bureau of Land Management, US Forest Service, National Park Service, US Department of Agriculture-Animal and Plant Health Inspection Service, and the military services. It might be appropriate to incorporate by reference parts or all of existing document(s). Incorporating by reference (40 CFR 1502.21) is a technique used to avoid redundancies in analysis. It also would reduce the bulk of a Service NEPA document, which only would identify the documents that are incorporated by reference. In addition, relevant portions would be summarized in the Service NEPA document to the extent necessary to provide the decision maker and public with an understanding of relevance of the referenced material to the current analysis.

In accordance with the requirements set forth in 43 CFR 46.135, the Service would specifically incorporate through reference ecological risk assessments prepared by the US Forest Service (http://www.fs.fed.us/r6/invasiveplant-eis/Risk-Assessments/Herbicides-Analyzed-InvPlant-EIS.htm) and Bureau of Land Management (http://www.blm.gov/wo/st/en/prog/more/veg_eis.html). These risk assessments and associated documentation also are available in total with the administrative record for the Final Environmental Impact Statement entitled *Pacific Northwest Region Invasive Plant Program – Preventing and Managing Invasive Plants* (US Forest Service 2005) and *Vegetation Treatments Using Herbicides on Bureau of Land Management Lands in 17 Western States Programmatic EIS (PEIS)* (Bureau of Land Management 2007). In accordance with 43 CRF 46.120(d), use of existing NEPA documents by supplementing, tiering to, incorporating by reference, or adopting previous NEPA environmental analyses would avoid redundancy and unnecessary paperwork.

As a basis for completing "Chemical Profiles" for approving or disapproving refuge PUPs, ecological risk assessments for the following herbicide and adjuvant uses prepared by the US Forest Service would be incorporated by reference:

- 2,4-D
- Chlorosulfuron
- Clopyralid
- Dicamba
- Glyphosate

- Imazapic
- Imazapyr
- Metsulfuron methyl
- Picloram
- Sethoxydim
- Sulfometuron methyl
- Triclopyr
- Nonylphenol polyethylate (NPE) based surfactants

As a basis for completing "Chemical Profiles" for approving or disapproving refuge PUPs, ecological risk assessments for the following herbicide uses as well as evaluation of risks associated with pesticide degradates and adjuvants prepared by the Bureau of Land Management would be incorporated by reference:

- Bromacil
- Chlorsulfuron
- Diflufenzopyr
- Diquat
- Diuron
- Fluridone
- Imazapic
- Overdrive (diflufenzopyr and dicamba)
- Sulfometuron methyl
- Tebuthiuron
- Pesticide degradates and adjuvants (*Appendix D – Evaluation of risks from degradates, polyoxyethylene-amine (POEA) and R-11, and endocrine disrupting chemicals*)

7.2.3 Assumptions for ecological risk assessments

There are a number of assumptions involved with the ecological risk assessment process for terrestrial and aquatic organisms associated with utilization of the US Environmental Protection Agency's (2004) process. These assumptions may be risk neutral or may lead to an over- or under-estimation of risk from pesticide exposure depending upon site-specific conditions. The following describes these assumptions, their application to the conditions typically encountered, and whether or not they may lead to recommendations that are risk neutral, underestimate, or overestimate ecological risk from potential pesticide exposure.

- Indirect effects would not be evaluated by ecological risk assessments. These effects include the mechanisms of indirect exposure to pesticides: consuming prey items (fish, birds, or small mammals), reductions in the availability of prey items, and disturbance associated with pesticide application activities.
- Exposure to a pesticide product can be assessed based upon the active ingredient. However, exposure to a chemical mixture (pesticide formulation) may result in effects that are similar or substantially different compared to only the active ingredient. Non-target organisms may be exposed directly to the pesticide formulation or only various constituents of the formulation as they dissipate and partition in the environment. If toxicological information for both the active ingredient and formulated product are available, then data representing the greatest potential toxicity would be selected for use in the risk assessment process (US Environmental Protection Agency 2004). As a result, this conservative approach may lead to an overestimation of risk characterization from pesticide exposure.

- Because toxicity tests with listed or candidate species or closely related species are not available, data for surrogate species would be most often used for risk assessments. Specifically, bobwhite quail and mallard duck are the most frequently used surrogates for evaluating potential toxicity to federally listed avian species. Bluegill sunfish, rainbow trout, and fathead minnow are the most common surrogates for evaluating toxicity for freshwater fishes. However, sheep's head minnow can be an appropriate surrogate marine species for coastal environments. Rats and mice are the most common surrogates for evaluating toxicity for mammals. Interspecies sensitivity is a major source of uncertainty in pesticide assessments. As a result of this uncertainty, data is selected for the most sensitive species tested within a taxonomic group (birds, fish, and mammals) given the quality of the data is acceptable. If additional toxicity data for more species of organisms in a particular group are available, the selected data will not be limited to the species previously listed as common surrogates.
- The Kanaga nomogram outputs maximum EEC values that may be used to calculate an average daily concentration over a specified interval of time, which is referred to as a time-weighted-average (TWA). The maximum EEC would be selected as the exposure input for both acute and chronic risk assessments in the screening-level evaluations. The initial or maximum EEC derived from the Kanaga nomogram represents the maximum expected instantaneous or acute exposure to a pesticide. Acute toxicity endpoints are determined using a single exposure to a known pesticide concentration typically for 48 to 96 hours. This value is assumed to represent ecological risk from acute exposure to a pesticide. On the other hand, chronic risk to pesticide exposure is a function of pesticide concentration and duration of exposure to the pesticide. An organism's response to chronic pesticide exposure may result from either the concentration of the pesticide, length of exposure, or some combination of both factors. Standardized tests for chronic toxicity typically involve exposing an organism to several different pesticide concentrations for a specified length of time (days, weeks, months, years or generations). For example, avian reproduction tests include a 10-week exposure phase. Because a single length of time is used in the test, time response data is usually not available for inclusion into risk assessments. Without time response data it is difficult to determine the concentration which elicited a toxicological response.
- Using maximum EECs for chronic risk estimates may result in an overestimate of risk, particularly for compounds that dissipate rapidly. Conversely, using TWAs for chronic risk estimates may underestimate risk if it is the concentration rather than the duration of exposure that is primarily responsible for the observed adverse effect. The maximum EEC would be used for chronic risk assessments although it may result in an overestimate of risk. TWAs may be used for chronic risk assessments, but they will be applied judiciously considering the potential for an underestimate or overestimate of risk. For example, the number of days exposure exceeds a Level of Concern may influence the suitability of a pesticide use. The greater the number of days the EEC exceeds the Level of Concern translates into greater the ecological risk. This is a qualitative assessment, and is subject to reviewer's expertise in ecological risk assessment and tolerance for risk.
- The length of time used to calculate the TWA can have a substantial effect on the exposure estimates and there is no standard method for determining the appropriate duration for this estimate. The T-REX model assumes a 21-week exposure period, which is equivalent to avian reproductive studies designed to establish a steady-state concentration for bioaccumulative compounds. However, this does not necessarily define the true exposure duration needed to elicit a toxicological response. Pesticides, which do not bioaccumulate, may achieve a steady-state concentration earlier than 21 weeks. The duration of time for calculating TWAs will require justification and it will not exceed the duration of exposure in the chronic toxicity test (approximately 70 days for the standard avian reproduction study). An alternative to using the duration of the chronic toxicity study is to base the TWA on the application interval. In this case, increasing the application interval would suppress both the estimated peak pesticide concentration and the TWA. Another alternative to using TWAs would be to consider the number of days that a chemical is predicted to exceed the LOC.

- Pesticide dissipation is assumed to be first-order in the absence of data suggesting alternative dissipation patterns such as bi-phasic. Field dissipation data would generally be the most pertinent for assessing exposure in terrestrial species that forage on vegetation. However, this data is often not available and it can be misleading particularly if the compound is prone to “wash-off”. Soil half-life is the most common degradation data available. Dissipation or degradation data that would reflect the environmental conditions typical of refuge lands would be utilized, if available.
- For species found in the water column, it would be assumed that the greatest bioavailable fraction of the pesticide active ingredient in surface waters is freely dissolved in the water column.
- Actual habitat requirements of any particular terrestrial species are not considered, and it is assumed that species exclusively and permanently occupy the treated area, or adjacent areas receiving pesticide at rates commensurate with the treatment rate. This assumption would produce a maximum estimate of exposure for risk characterization. This assumption would likely lead to an overestimation of exposure for species that do not permanently and exclusively occupy the treated area (US Environmental Protection Agency 2004).
- Exposure through incidental ingestion of pesticide contaminated soil is not considered in the USEPA risk assessment protocols. Research suggests <15% of the diet can consist of incidentally ingested soil depending upon species and feeding strategy (Beyer et al. 1994). An assessment of pesticide concentrations in soil compared to food item categories in the Kanaga nomogram indicates incidental soil ingestion will not likely increase dietary exposure to pesticides. Inclusion of soil into the diet would effectively reduce the overall dietary concentration compared to the present assumption that the entire diet consists a contaminated food source (Fletcher et al. 1994). An exception to this may be soil-applied pesticides in which exposure from incidental ingestion of soil may increase. Potential for pesticide exposure under this assumption may be underestimated for soil-applied pesticides and overestimated for foliar-applied pesticides. The concentration of a pesticide in soil would likely be less than predicted on food items.
- Exposure through inhalation of pesticides is not considered in the USEPA risk assessment protocols. Such exposure may occur through three potential sources: spray material in droplet form at time of application, vapor phase with the pesticide volatilizing from treated surfaces, and airborne particulates (soil, vegetative matter, and pesticide dusts). The USEPA (1990) reported exposure from inhaling spray droplets at the time of application is not an appreciable route of exposure for birds. According to research on mallards and bobwhite quail, respirable particle size (particles reaching the lung) in birds is limited to maximum diameter of 2 to 5 microns. The spray droplet spectra covering the majority of pesticide application scenarios indicate that less than 1% of the applied material is within the respirable particle size. This route of exposure is further limited because the permissible spray drop size distribution for ground pesticide applications is restricted to ASAE medium or coarser drop size distribution.
- Inhalation of a pesticide in the vapor phase may be another source of exposure for some pesticides under certain conditions. This mechanism of exposure to pesticides occurs post application and it would pertain to those pesticides with a high vapor pressure. The USEPA is currently evaluating protocols for modeling inhalation exposure from pesticides including near-field and near-ground air concentrations based upon equilibrium and kinetics-based models. Risk characterization for exposure with this mechanism is unavailable.
- The effect from exposure to dusts contaminated with the pesticide cannot be assessed generically as partitioning issues related to application site soils and chemical properties of the applied pesticides render the exposure potential from this route highly situation specific.
- Dermal exposure may occur through three potential sources: direct application of spray to terrestrial wildlife in the treated area or within the drift footprint, incidental contact with contaminated vegetation, or contact with contaminated water or soil. Interception of spray and incidental contact with treated substrates may pose risk to avian wildlife (Driver et al. 1991). However, available research related to wildlife dermal contact with pesticides is extremely limited, except dermal toxicity

values are common for some mammals used as human surrogates (rats and mice). The USEPA is currently evaluating protocols for modeling dermal exposure. Risk characterization may be underestimated for this route of exposure, particularly with high risk pesticides such as some organophosphates or carbamate insecticides. If protocols are established by the USEPA for assessing dermal exposure to pesticides, they will be considered for incorporation into pesticide assessment protocols.

- Exposure to a pesticide may occur from consuming surface water, dew or other water on treated surfaces. Water soluble pesticides have potential to dissolve in surface runoff and puddles in a treated area may contain pesticide residues. Similarly, pesticides with lower organic carbon partitioning characteristics and higher solubility in water have a greater potential to dissolve in dew and other water associated with plant surfaces. Estimating the extent to which such pesticide loadings to drinking water occurs is complex and would depend upon the partitioning characteristics of the active ingredient, soils types in the treatment area, and the meteorology of the treatment area. In addition, the use of various water sources by wildlife is highly species-specific. Currently, risk characterization for this exposure mechanism is not available. The USEPA is actively developing protocols to quantify drinking water exposures from puddles and dew. If and when protocols are formally established by the USEPA for assessing exposure to pesticides through drinking water, these protocols will be incorporated into pesticide risk assessment protocols.
- Risk assessments are based upon the assumption that the entire treatment area would be subject to pesticide application at the rates specified on the label. In most cases, there is potential for uneven application of pesticides through such plausible incidents such as changes in calibration of application equipment, spillage, and localized releases at specific areas in or near the treated field that are associated with mixing and handling and application equipment as well as applicator skill. Inappropriate use of pesticides and the occurrence of spills represent a potential underestimate of risk. It is likely not an important factor for risk characterization. All pesticide applicators are required to be certified by the state in which they apply pesticides. Certification training includes the safe storage, transport, handling, and mixing of pesticides, equipment calibration and proper application with annual continuing education.
- The USEPA relies on Fletcher (1994) for setting the assumed pesticide residues in wildlife dietary items. The USEPA (2004) “believes that these residue assumptions reflect a realistic upper-bound residue estimate, although the degree to which this assumption reflects a specific percentile estimate is difficult to quantify”. Fletcher’s (1994) research suggests that the pesticide active ingredient residue assumptions used by the USEPA represent a 95^{th} percentile estimate. However, research conducted by Pfleeger et al. (1996) indicates USEPA residue assumptions for short grass was not exceeded. Behr and Habig (2000) compared USEPA residue assumptions with distributions of measured pesticide residues for the USEPA’s UTAB database. Overall residue selection level will tend to overestimate risk characterization. This is particularly evident when wildlife individuals are likely to have selected a variety of food items acquired from multiple locations. Some food items may be contaminated with pesticide residues whereas others are not contaminated. However, it is important to recognize differences in species feeding behavior. Some species may consume whole above-ground plant material, but others will preferentially select different plant structures. Also, species may preferentially select a food item although multiple food items may be present. Without species specific knowledge regarding foraging behavior characterizing ecological risk other than in general terms is not possible.
- Acute and chronic risk assessments rely on comparisons of wildlife dietary residues with LC_{50} or NOEC values expressed as concentrations of pesticides in laboratory feed. These comparisons assume that ingestion of food items in the field occurs at rates commensurate with those in the laboratory. Although the screening assessment process adjusts dry-weight estimates of food intake to reflect the increased mass in fresh-weight wildlife food intake estimates, it does not allow for gross energy and assimilative efficiency differences between wildlife food items and laboratory feed.

Differences in assimilative efficiency between laboratory and wild diets suggest that current screening assessment methods are not accounting for a potentially important aspect of food requirements.

- There are several other assumptions that can affect non-target species not considered in the risk assessment process. These include possible additive or synergistic effects from applying two or more pesticides or additives in a single application, co-location of pesticides in the environment, cumulative effects from pesticides with the same mode of action, effects of multiple stressors (e.g., combination of pesticide exposure, adverse abiotic and biotic factors) and behavioral changes induced by exposure to a pesticide. These factors may exist at some level contributing to adverse affects to non-target species, but they are usually characterized in the published literature in only a general manner limiting their value in the risk assessment process.
- It is assumed that aquatic species exclusively and permanently occupy the water body being assessed. Actual habitat requirements of aquatic species are not considered. With the possible exception of scenarios where pesticides are directly applied to water, it is assumed that no habitat use considerations specific for any species would place the organisms in closer proximity to pesticide use sites. This assumption produces a maximum estimate of exposure or risk characterization. It would likely be realistic for many aquatic species that may be found in aquatic habitats within or in close proximity to treated terrestrial habitats. However, the spatial distribution of wildlife is usually not random because wildlife distributions are often related to habitat requirements of species. Clumped distributions of wildlife may result in an under- or over-estimation of risk depending upon where the initial pesticide concentration occurs relative to the species or species habitat.
- For species found in the water column, it would be assumed that the greatest bioavailable fraction of the pesticide active ingredient in surface waters is freely dissolved in the water column. Additional chemical exposure from materials associated with suspended solids or food items is not considered because partitioning onto sediments likely is minimal. Adsorption and bioconcentration occurs at lower levels for many newer pesticides compared with older more persistent bioaccumulative compounds. Pesticides with RQs close to the listed species level of concern, the potential for additional exposure from these routes may be a limitation of risk assessments, where potential pesticide exposure or risk may be underestimated.
- Mass transport losses of pesticide from a water body (except for losses by volatilization, degradation and sediment partitioning) would not be considered for ecological risk assessment. The water body would be assumed to capture all pesticide active ingredients entering as runoff, drift, and adsorbed to eroded soil particles. It would also be assumed that pesticide active ingredient is not lost from the water body by overtopping or flow-through, nor is concentration reduced by dilution. In total, these assumptions would lead to a near maximum possible water-borne concentration. However, this assumption would not account for potential to concentrate pesticide through the evaporative loss. This limitation may have the greatest impact on water bodies with high surface-to-volume ratios such as ephemeral wetlands, where evaporative losses are accentuated and applied pesticides have low rates of degradation and volatilization.
- For acute risk assessments, there would be no averaging time for exposure. An instantaneous peak concentration would be assumed, where instantaneous exposure is sufficient in duration to elicit acute effects comparable to those observed over more protracted exposure periods (typically 48 to 96 hours) tested in the laboratory. In the absence of data regarding time-to-toxic event, analyses and latent responses to instantaneous exposure, risk would likely be overestimated.
- For chronic exposure risk assessments, the averaging times considered for exposure are commensurate with the duration of invertebrate life-cycle or fish-early life stage tests (e.g., 21-28 days and 56-60 days, respectively). Response profiles (time to effect and latency of effect) to pesticides likely vary widely with mode of action and species and should be evaluated on a case-by-case basis as available data allow. Nevertheless, because the USEPA relies on chronic exposure toxicity endpoints based on a finding of no observed effect, the potential for any latent toxicity effects

or averaging time assumptions to alter the results of an acceptable chronic risk assessment prediction is limited. The extent to which duration of exposure from water-borne concentrations overestimate or underestimate actual exposure depends on several factors. These include the following: localized meteorological conditions, runoff characteristics of the watershed (e.g., soils, topography), the hydrological characteristics of receiving waters, environmental fate of the pesticide active ingredient, and the method of pesticide application. It should also be understood that chronic effects studies are performed using a method that holds water concentration in a steady state. This method is not likely to reflect conditions associated with pesticide runoff. Pesticide concentrations in the field increase and decrease in surface water on a cycle influenced by rainfall, pesticide use patterns, and degradation rates. As a result of the dependency of this assumption on several undefined variables, risk associated with chronic exposure may in some situations underestimate risk and overestimate risk in others.

- There are several other factors that can affect non-target species not considered in the risk assessment process. These would include the following: possible additive or synergistic effects from applying two or more pesticides or additives in a single application, co-location of pesticides in the environment, cumulative effects from pesticides with the same mode of action, effects of multiple stressors (e.g., combination of pesticide exposure, adverse abiotic [not pesticides] and biotic factors), and sub-lethal effects such as behavioral changes induced by exposure to a pesticide. These factors may exist at some level contributing to adverse affects to non-target species, but they are not routinely assessed by regulatory agencies. Therefore, information on the factors is not extensive limiting their value for the risk assessment process. As this type of information becomes available, it would be included, either quantitatively or qualitatively, in this risk assessment process.
- USEPA is required by the Food Quality Protection Act to assess the cumulative risks of pesticides that share common mechanisms of toxicity, or act the same within an organism. Currently, USEPA has identified four groups of pesticides that have a common mechanism of toxicity requiring cumulative risk assessments. These four groups are: the organophosphate insecticides, N-methyl carbamate insecticides, triazine herbicides, and chloroacetanilide herbicides.

7.3 Pesticide Mixtures and Degradates

Pesticide products are usually a formulation of several components generally categorized as active ingredients and inert or other ingredients. The term active ingredient is defined by the FIFRA as preventing, destroying, repelling, or mitigating the effects of a pest, or it is a plant regulator, defoliant, desiccant, or nitrogen stabilizer. In accordance with FIFRA, the active ingredient(s) must be identified by name(s) on the pesticide label along with its relative composition expressed in percentage(s) by weight. In contrast, inert ingredient(s) are not intended to affect a target pest. Their role in the pesticide formulation is to act as a solvent (keep the active ingredient is a liquid phase), an emulsifying or suspending agent (keep the active ingredient from separating out of solution), or a carrier such as clay in which the active ingredient is impregnated on the clay particle in dry formulations. For example, if isopropyl alcohol would be used as a solvent in a pesticide formulation, then it would be considered an inert ingredient. FIFRA only requires that inert ingredients identified as hazardous and associated percent composition, and the total percentage of all inert ingredients must be declared on a product label. Inert ingredients that are not classified as hazardous are not required to be identified.

The USEPA (September 1997) issued Pesticide Regulation Notice 97-6 which encouraged manufacturers, formulators, producers, and registrants of pesticide products to voluntarily substitute the term “other ingredients” for “inert ingredients” in the ingredient statement. This change recognized that all components in a pesticide formulation potentially could elicit or contribute to an adverse effect on non-target organisms and, therefore, are not necessarily inert. Whether referred to as “inerts” or “other ingredients,” these constituents within a pesticide product have the potential to affect species or environmental quality. The USEPA categorizes regulated inert ingredients into the following four lists (http://www.epa.gov/opprd001/inerts/index.html):

- List 1 – Inert Ingredients of Toxicological Concern
- List 2 – Potentially Toxic Inert Ingredients
- List 3 – Inerts of Unknown Toxicity
- List 4 – Inerts of Minimal Toxicity

Several of the List 4 compounds are naturally-occurring earthen materials (e.g., clay materials, simple salts) that would not elicit toxicological response at applied concentrations. However, some of the inerts (particularly the List 3 compounds and unlisted compounds) may have moderate to high potential toxicity to aquatic species based on MSDSs or published data.

Comprehensively assessing potential effects to non-target fish, wildlife, plants, and/or their habitats from pesticide use is a complex task. It would be preferable to assess the cumulative effects from exposure to the active ingredient, its degradates, and inert ingredients as well as other active ingredients in the spray mixture. However, it would only be feasible to conduct deterministic risk assessments for each component in the spray mixture singly. Limited scientific information is available regarding ecological effects (additive or synergistic) from chemical mixtures that typically rely upon broadly encompassing assumptions. For example, the US Forest Service (2005) found that mixtures of pesticides used in land (forest) management likely would not cause additive or synergistic effects to non-target species based upon a review of scientific literature regarding toxicological effects and interactions of agricultural chemicals (ATSDR 2004, US EPA-ORD 2000). Moreover, information on inert ingredients, adjuvants, and degradates is often limited by the availability of and access to reliable toxicological data for these constituents.

Toxicological information regarding "other ingredients" may be available from sources such as the following:

- TOMES (a proprietary toxicological database including USEPA's IRIS, the Hazardous Substance Data Bank, the Registry of Toxic Effects of Chemical Substances [RTECS]).
- USEPA's ECOTOX database, which includes AQUIRE (a database containing scientific papers published on the toxic effects of chemicals to aquatic organisms).
- TOXLINE (a literature searching tool).
- Material Safety Data Sheets (MSDSs) from pesticide suppliers.
- Other sources such as the Farm Chemicals Handbook.

Because there is a lack of specific inert toxicological data, inert(s) in a pesticide may cause adverse ecological effects. However, inert ingredients typically represent only a small percentage of the pesticide spray mixture, and it would be assumed that negligible effects would be expected to result from inert ingredient(s).

Although the potential effects of degradates should be considered when selecting a pesticide, it is beyond the scope of this assessment process to consider all possible breakdown chemicals of the various product formulations containing an active ingredient. Degradates may be more or less mobile and more or less hazardous in the environment than their parent pesticides (Battaglin et al. 2003). Differences in environmental behavior (e.g., mobility) and toxicity between parent pesticides and degradates would make assessing potential degradate effects extremely difficult. For example, a less toxic and more mobile, bioaccumulative, or persistent degradate may have potentially greater effects on species and/or degrade environmental quality. The lack of data on the toxicity of degradates for many pesticides would represent a source of uncertainty for assessing risk.

An USEPA-approved label specifies whether a product can be mixed with one or more pesticides. Without product-specific toxicological data, it would not possible to quantify the potential effects of these mixtures. In addition, a quantitative analysis could only be conducted if reliable scientific information allowed a determination of whether the joint action of a mixture would be additive, synergistic, or antagonistic. Such information would not likely exist unless the mode of action would be common among the chemicals and receptors. Moreover, the composition of and exposure to mixtures would be highly site- and/or time-specific and, therefore, it would be nearly impossible to assess potential effects to species and environmental quality.

To minimize or eliminate potential negative effects associated with applying two or more pesticides as a mixture, the use would be conducted in accordance with the labeling requirements. Labels for two or more pesticides applied as a mixture should be completely reviewed, where products with the least potential for negative effects would be selected for use on the refuge. This is especially relevant when a mixture would be applied in a manner that may already have the potential for an effect(s) associated with an individual pesticide (e.g., runoff to ponds in sandy watersheds). Use of a tank mix under these conditions would increase the level of uncertainty in terms of risk to species or potential to degrade environmental quality.

Adjuvants generally function to enhance or prolong the activity of pesticide. For terrestrial herbicides, adjuvants aid in the absorption into plant tissue. Adjuvant is a broad term that generally applies to surfactants, selected oils, anti-foaming agents, buffering compounds, drift control agents, compatibility agents, stickers, and spreaders. Adjuvants are not under the same registration requirements as pesticides and the USEPA does not register or approve the labeling of spray adjuvants. Individual pesticide labels identify types of adjuvants approved for use with it. In general, adjuvants compose a relatively small portion of the volume of pesticides applied. Selection of adjuvants with limited toxicity and low volumes would be recommended to reduce the potential for the adjuvant to influence the toxicity of the pesticide.

7.4 Determining Effects to Soil and Water Quality

The approval process for pesticide uses would consider potential to degrade water quality on and off refuge lands. A pesticide can only affect water quality through movement away from the treatment site. After application, pesticide mobilization can be characterized by one or more of the following (Kerle et al. 1996):

- Attach (sorb) to soil, vegetation, or other surfaces and remain at or near the treated area;
- Attach to soil and move off-site through erosion from run-off or wind;
- Dissolve in water that can be subjected to run-off or leaching.

As an initial screening tool, selected chemical characteristics and rating criteria for a pesticide can be evaluated to assess potential to enter ground and/or surface waters. These would include the following: persistence, sorption coefficient (K_{oc}), groundwater ubiquity score (GUS), and solubility.

Persistence, which is expressed as half-life ($t_{½}$), represents the length of time required for 50% of the deposited pesticide to degrade (completely or partially). Persistence in the soil can be categorized as the following: non-persistent <30 days, moderately persistent = 30 to 100 days, and persistent >100 days (Kerle et. al. 1996). Half-life data is usually available for aquatic and terrestrial environments.

Another measure of pesticide persistence is dissipation time (DT_{50}). It represents the time required for 50% of the deposited pesticide to degrade and move from a treated site; whereas, half-life describes the rate for degradation only. As for half-life, units of dissipation time are usually expressed in days. Field or foliar dissipation time is the preferred data for use to estimate pesticide concentrations in the environment. However, soil half-life is the most common persistence data cited in published literature. If field or foliar dissipation data is not available, soil half-life data may be used. The average or representative half-life value of most important degradation mechanism will be selected for quantitative analysis for both terrestrial and aquatic environments.

Mobility of a pesticide is a function of how strongly it is adsorbed to soil particles and organic matter, its solubility in water, and its persistence in the environment. Pesticides strongly adsorbed to soil particles, relatively insoluble in water, and not environmentally persistent would be less likely to move across the soil surface into surface waters or to leach through the soil profile and contaminate groundwater. Conversely, pesticides that are not strongly adsorbed to soil particles, are highly water soluble, and are persistent in the environment would have greater potential to move from the application site (off-site movement).

The degree of pesticide adsorption to soil particles and organic matter (Kerle et. al. 1996) is expressed as the soil adsorption coefficient (K_{oc}). The soil adsorption coefficient is measured as micrograms of pesticide per gram of soil (μg/g) that can range from near zero to the thousands. Pesticides with higher Koc values are strongly sorbed to soil and, therefore, would be less subject to movement.

Water solubility describes the amount of pesticide that will dissolve in a known quantity of water. The water solubility of a pesticide is expressed as milligrams of pesticide dissolved in a liter of water (mg/l or ppm). Pesticide with solubility <0.1 ppm are virtually insoluble in water, 100-1000 ppm are moderately soluble, and >10,000 ppm highly soluble (US Geological Survey 2000). As pesticide solubility increases, there would be greater potential for off-site movement.

The Groundwater Ubiquity Score (GUS) is a quantitative screening tool to estimate a pesticide's potential to move in the environment. It utilizes soil persistence and adsorption coefficients in the following formula.

$$\text{GUS} = \log_{10}(t_{½}) \times [4 - \log_{10}(K_{oc})]$$

The potential pesticide movement rating would be based upon its GUS value. Pesticides with a GUS <0.1 would considered to have an extremely low potential to move toward groundwater. Values of 1.0-2.0 would be low, 2.0-3.0 would be moderate, 3.0-4.0 would be high, and
>4.0 would have a very high potential to move toward groundwater.

Water solubility describes the amount of pesticide dissolving in a specific quantity of water, where it is usually measured as mg/l or parts per million (ppm). Solubility is useful as a comparative measure because pesticides with higher values are more likely to move by run-off or leaching. GUS, water solubility, $t_{½}$, and K_{oc} values are available for selected pesticides from the OSU Extension Pesticide Properties Database at http://npic.orst.edu/ppdmove.htm. Many of the values in this database were derived from the SCS/ARS/CES Pesticide Properties Database for Environmental Decision Making (Wauchope et al. 1992).

Soil properties influence the fate of pesticides in the environment. The following six properties are mostly likely to affect pesticide degradation and the potential for pesticides to move off-site by leaching (vertical movement through the soil) or runoff (lateral movement across the soil surface).

- Permeability is the rate of water movement vertically through the soil. It is affected by soil texture and structure. Coarse textured soils (e.g., high sand content) have a larger pore size and they are generally more permeable than fine textured soils (i.e., high clay content). The more permeable soils would have a greater potential for pesticides to move vertically down through the soil profile. Soil permeability rates (inches/hour) are usually available in county soil survey reports.

- Soil texture describes the relative percentage of sand, silt, and clay. In general, greater clay content with smaller the pore size would lower the likelihood and rate water that would move through the soil profile. Clay also serves to adsorb (bind) pesticides to soil particles. Soils with high clay content would adsorb more pesticide than soils with relatively low clay content. In contrast, sandy soils with coarser texture and lower water holding capacity would have a greater potential for water to leach through them. Coarse texture soils permit higher rates of gas exchange than clay soils and may influence microbial transformation rates depending on whether the primary decomposition pathway is aerobic or anaerobic.
- Soil structure describes soil aggregation. Soils with a well developed soil structure have looser, more aggregated, structure that would be less likely to be compacted. Both characteristics would allow for less restricted flow of water through the soil profile resulting in greater infiltration.
- Organic matter would be the single most important factor affecting pesticide adsorption in soils. Many pesticides are adsorbed to organic matter which would reduce their rate of downward movement through the soil profile. Also, soils high in organic matter would tend to hold more water, which may make less water available for leaching.
- Soil moisture and infiltration rates (related to the composition of different sized particles as well as physical features such as soil density) affects how fast water would move through the soil. If soils are already wet or saturated before rainfall or irrigation, excess moisture would runoff rather than infiltrate into the soil profile. Soil moisture also would influence microbial and chemical activity in soil, which effects pesticide degradation.
- Soil pH would influence chemical reactions that occur in the soil which in turn determines whether or not a pesticide will degrade, rate of degradation, and, in some instances, which degradation products are produced.

Based upon the aforementioned properties, soils most vulnerable to groundwater contamination would be sandy soils with low organic matter. In contrast, the least vulnerable soils would be well-drained clayey soils with high organic matter. Consequently, pesticides with the lowest potential for movement in conjunction with appropriate best management practices (see below) would be used in an IPM framework to treat pests while minimizing effects to non-target biota and protecting environmental quality.

Along with soil properties, the potential for a pesticide to affect water quality through run-off and leaching would consider site-specific environmental and abiotic conditions including rainfall, water table conditions, and topography (Huddleston 1996).

- Water is necessary to separate pesticides from soil. This can occur in two basic ways. Pesticides that are soluble move easily with runoff water. Pesticide-laden soil particles can be dislodged and transported from the application site in runoff. The concentration of pesticides in the surface runoff would be greatest for the first runoff event following treatment. The rainfall intensity and route of water infiltration into soil, to a large extent, determine pesticide concentrations and losses in surface runoff. The timing of the rainfall after application also would have an effect. Rainfall interacts with pesticides at a shallow soil depth (¼ to ½ inch), which is called the mixing zone (Baker and Miller 1999). The pesticide/water mixture in the mixing zone would tend to leach down into the soil or runoff depending upon how quickly the soil surface becomes saturated and how rapidly water can infiltrate into the soil. Leaching would decrease the amount of pesticide available near the soil surface (mixing zone) to runoff during the initial rainfall event following application and subsequent rainfall events.
- Terrain slope would affect the potential for surface runoff and the intensity of runoff. Steeper slopes would have greater potential for runoff following a rainfall event. In contrast, soils that are relatively flat would have little potential for runoff, except during intense rainfall events. In addition, soils in lower areas would be more susceptible to leaching as a result of receiving excessive water from surrounding higher elevations.

- Depth to groundwater would be an important factor affecting the potential for pesticides to leach into groundwater. If the distance from the soil surface to the top of the water table is shallow, pesticides would have less distance to travel to reach groundwater. Shallower water tables that persist for longer periods would be more likely to experience groundwater contamination. Soil survey reports are available for individual counties. These reports provide data in tabular format regarding the water table depths and the months during which it is persists. In some situations, a hard pan exists above the water table that would prevent pesticide contamination from leaching.

7.5 Determining Effects to Air Quality

Pesticides may volatilize from soil and plant surfaces and move from the treated area into the atmosphere. The potential for a pesticide to volatilize is determined by the pesticide's vapor pressure which would be affected by temperature, sorption, soil moisture, and the pesticide's water solubility. Vapor pressure is often expressed in mm Hg. To make these numbers easier to compare, vapor pressure may be expressed in exponent form ($I \times 10^{-7}$), where I represents a vapor pressure index. In general, pesticides with $I<10$ would have a low potential to volatilize; whereas, pesticides with $I>1{,}000$ would have a high potential to volatilize (Oregon State University 1996). Vapor pressure values for pesticides are usually available in the pesticide product MSDS or the USDA Agricultural Research Service (ARS) pesticide database.

7.6 Preparing a Chemical Profile

The following instructions would be used by Service personnel to complete Chemical Profiles for pesticides. Specifically, profiles would be prepared for pesticide active ingredients (e.g., glyphosate, imazapic) that would be contained in one or more trade name products that are registered and labeled with USEPA. All information fields under each category (e.g., Toxicological Endpoints, Environmental Fate) would be completed for a Chemical Profile. If no information is available for a specific field, then "No data is available in references" would be recorded in the profile. Available scientific information would be used to complete Chemical Profiles. Each entry of scientific information would be shown with applicable references.

Completed Chemical Profiles would provide a structured decision-making process utilizing quantitative assessment/screening tools with threshold values (where appropriate) that would be used to evaluate potential biological and other environmental effects to refuge resources. For ecological risk assessments presented in these profiles, the "worst-case scenario" would be evaluated to determine whether a pesticide could be approved for use considering the maximum single application rate specified on pesticide labels for habitat management and croplands/facilities maintenance treatments pertaining to refuges. Where the "worst-case scenario" likely would only result in minor, temporary, and localized effects to listed and non-listed species with appropriate BMPs (see Section 5.0), the proposed pesticide's use in a PUP would have a scientific basis for approval under any application rate specified on the label that is at or below rates evaluated in a Chemical Profile. In some cases, the Chemical Profile would include a lower application rate than the maximum labeled rate in order to protect refuge resources. As necessary, Chemical Profiles would be periodically updated with new scientific information or as pesticides with the same active ingredient are proposed for use on the refuge in PUPs.

Throughout this section, threshold values (to prevent or minimize potential biological and environmental effects) would be clearly identified for specific information presented in a completed Chemical Profile. Comparison with these threshold values provides an explicit scientific basis to approve or disapprove PUPs for habitat management and cropland/facilities maintenance on refuge lands. In general, PUPs would be approved for pesticides with Chemical Profiles where there would be no exceedances of threshold values. However, BMPs are identified for some screening tools that would minimize/eliminate potential effects (exceedance of the threshold value) as a basis for approving PUPs.

Date: Service personnel would record the date when the Chemical Profile is completed or updated. Chemical Profiles (e.g., currently approved pesticide use patterns) would be periodically reviewed and updated, as necessary. The most recent review date would be recorded on a profile to document when it was last updated.

Trade Name(s): Service personnel would accurately and completely record the trade name(s) from the pesticide label, which includes a suffix that describes the formulation (e.g., WP, DG, EC, L, SP, I, II or 64). The suffix often distinguishes a specific product among several pesticides with the same active ingredient. Service personnel would record a trade name for each pesticide product with the same active ingredient.

Common chemical name(s): Service personnel would record the common name(s) listed on the pesticide label or material safety data sheet (MSDS) for an active ingredient. The common name of a pesticide is listed as the active ingredient on the title page of the product label immediately following the trade name, and the MSDS, Section 2: Composition/ Information on Ingredients. A Chemical Profile is completed for each active ingredient.

Pesticide Type: Service personnel would record the type of pesticide for an active ingredient as one of the following: herbicide, dessicant, fungicide, fumigant, growth regulator, insecticide, pisicide, or rodenticide.

EPA Registration Number(s): This number (EPA Reg. No.) appears on the title page of the label and MSDS, Section 1: Chemical Product and Company Description. It is not the EPA Establishment Number that is usually located near it. Service personnel would record the EPA Reg. No. for each trade name product with an active ingredient based upon PUPs.

Pesticide Class: Service personnel would list the general chemical class for the pesticide (active ingredient). For example, malathion is an organophosphate and carbaryl is a carbamate.

CAS (Chemical Abstract Service) Number: This number is often located in the second section (Composition/Information on Ingredients) of the MSDS. The MSDS table listing components usually contains this number immediately prior to or following the % composition.

Other Ingredients: From the most recent MSDS for the proposed pesticide product(s), Service personnel would include any chemicals in the pesticide formulation not listed as an active ingredient that are described as toxic or hazardous, or regulated under the Superfund Amendments and Reauthorization Act (SARA), Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), Toxic Substances Control Act (TSCA), Occupational Safety and Health Administration (OSHA), State Right-to-Know, or other listed authorities. These are usually found in MSDS sections titled “Hazardous Identifications”, “Exposure Control/Personal Protection”, and “Regulatory Information”. If concentrations of other ingredients are available for any compounds identified as toxic or hazardous, then Service personnel would record this information in the Chemical Profile by trade name. MSDS(s) may be obtained from the manufacturer, manufacturer’s website or from an on-line database maintained by Crop Data Management Systems, Inc. (see list below).

Toxicological Endpoints

Toxicological endpoint data would be collected for acute and chronic tests with mammals, birds, and fish. Data would be recorded for species available in the scientific literature. If no data are found for a particular taxonomic group, then “No data available is references” would be recorded as the data entry.

Throughout the Chemical Profile, references (including toxicological endpoint data) would be cited using parentheses (#) following the recorded data.

Mammalian LD_{50}: For test species in the scientific literature, Service personnel would record available data for oral lethal dose (LD_{50}) in mg/kg-bw (body weight) or ppm-bw. Most common test species in scientific literature are the rat and mouse. The lowest LD_{50} value found for a rat would be used as a toxicological endpoint for dose-based RQ calculations to assess acute risk to mammals (see Table 1 in Section 7.1).

Mammalian LC_{50}: For test species in the scientific literature, Service personnel would record available data for dietary lethal concentration (LC_{50}) as reported (e.g., mg/kg-diet or ppm-diet). Most common test species in scientific literature are the rat and mouse. The lowest LC_{50} value found for a rat would be used as a toxicological endpoint for diet-based RQ calculations to assess acute risk (see Table 1 in Section 7.1).

Mammalian Reproduction: For test species listed in the scientific literature, Service personnel would record the test results (e.g., Lowest Observed Effect Concentration [LOEC], Lowest Observed Effect Level [LOEL], No Observed Adverse Effect Level [NOAEL], No Observed Adverse Effect Concentration [NOAEC]) in mg/kg-bw or mg/kg-diet for reproductive test procedure(s) (e.g., generational studies [preferred], fertility, new born weight). Most common test species available in scientific literature are rats and mice. The lowest NOEC, NOAEC, NOEL, or NOAEL test results found for a rat would be used as a toxicological endpoint for RQ calculations to assess chronic risk (see Table 1 in Section 7.1).

Avian LD_{50}: For test species available in the scientific literature, Service personnel would record values for oral lethal dose (LD_{50}) in mg/kg-bw or ppm-bw. Most common test species available in scientific literature are the bobwhite quail and mallard. The lowest LD_{50} value found for an avian species would be used as a toxicological endpoint for dose-based RQ calculations to assess acute risk (see Table 1 in Section 7.1).

Avian LC_{50}: For test species available in the scientific literature, Service personnel would record values for dietary lethal concentration (LC_{50}) as reported (e.g., mg/kg-diet or ppm-diet). Most common test species available in scientific literature are the bobwhite quail and mallard. The lowest LC_{50} value found for an avian species would be used as a toxicological endpoint for dietary-based RQ calculations to assess acute risk (see Table 1 in Section 7.1).

Avian Reproduction: For test species available in the scientific literature, Service personnel would record test results (e.g., LOEC, LOEL, NOAEC, NOAEL) in mg/kg-bw or mg/kg-diet consumed for reproductive test procedure(s) (e.g., early life cycle, reproductive). Most common test species available in scientific literature are the bobwhite quail and mallard. The lowest NOEC, NOAEC, NOEL, or NOAEL test results found for an avian species would be used as a toxicological endpoint for RQ calculations to assess chronic risk (see Table 1 in Section 7.1).

Fish LC_{50}: For test freshwater or marine species listed in the scientific literature, Service personnel would record a LC_{50} in ppm or mg/L. Most common test species available in the scientific literature are the bluegill, rainbow trout, and fathead minnow (marine). Test results for many game species may also be available. The lowest LC_{50} value found for a freshwater fish species would be used as a toxicological endpoint for RQ calculations to assess acute risk (see Table 1 in Section 7.1).

Fish Early Life Stage (ELS)/Life Cycle: For test freshwater or marine species available in the scientific literature, Service personnel would record test results (e.g., LOEC, NOAEL, NOAEC, LOAEC) in ppm for test procedure(s) (e.g., early life cycle, life cycle). Most common test species available in the scientific literature are bluegill, rainbow trout, and fathead minnow. Test results for other game species may also be available. The lowest test value found for a fish species (preferably freshwater) would be used as a toxicological endpoint for RQ calculations to assess chronic risk (see Table 1 in Section 7.1).

Other: For test invertebrate as well as non-vascular and vascular plant species available in the scientific literature, Service personnel would record $LC_{50,}$ $LD_{50,}$ LOEC, LOEL, NOAEC, NOAEL, or EC_{50} (environmental concentration) values in ppm or mg/L. Most common test invertebrate species available in scientific literature are the honey bee and the water flea (*Daphnia magna*). Green algae (*Selenastrum capricornutum*) and pondweed (*Lemna minor*) are frequently available test species for aquatic non-vascular and vascular plants, respectively.

Ecological Incident Reports: After a site has been treated with pesticide(s), wildlife may be exposed to these chemical(s). When exposure is high relative to the toxicity of the pesticides, wildlife may be killed or visibly harmed (incapacitated). Such events are called ecological incidents. The USEPA maintains a database (Ecological Incident Information System) of ecological incidents. This database stores information extracted from incident reports submitted by various federal and state agencies and non-government organizations. Information included in an incident report is date and location of the incident, type and magnitude of affects observed in various species, use(s) of pesticides known or suspected of contributing to the incident, and results of any chemical residue and cholinesterase activity analyses conducted during the investigation.

Incident reports can play an important role in evaluating the effects of pesticides by supplementing quantitative risk assessments. All incident reports for pesticide(s) with the active ingredient and associated information would be recorded.

Environmental Fate

Water Solubility: Service personnel would record values for water solubility (S_w), which describes the amount of pesticide that dissolves in a known quantity of water. S_w is expressed as mg/L (ppm). Pesticide S_w values would be categorized as one of the following: insoluble <0.1 ppm, moderately soluble = 100 to 1000 ppm, highly soluble >10,000 ppm (US Geological Survey 2000). As pesticide S_w increases, there would be greater potential to degrade water quality through run-off and leaching.

Sw would be used to evaluate potential for bioaccumulation in aquatic species [see **Octanol-Water Partition Coefficient (K_{ow})** below].

Soil Mobility: Service personnel would record available values for soil adsorption coefficient (K_{oc} [μg/g]). It provides a measure of a chemical's mobility and leaching potential in soil. K_{oc} values are directly proportional to organic content, clay content, and surface area of the soil. K_{oc} data for a pesticide may be available for a variety of soil types (e.g., clay, loam, sand).

K_{oc} values would be used in evaluating the potential to degrade groundwater by leaching (see **Potential to Move to Groundwater** below).

Soil Persistence: Service personnel would record values for soil half-life ($t_{½}$), which represents the length of time (days) required for 50% of the deposited pesticide to degrade (completely or partially) in the soil. Based upon the $t_{½}$ value, soil persistence would be categorized as one of the following: non-persistent <30 days, moderately persistent = 30 to 100 days, and persistent >100 days (Kerle et. al. 1996).

Threshold for Approving PUPs:

If soil $t_{½}$ ≤100 days, then a PUP would be approved without additional BMPs to protect water quality. If soil $t_{½}$ >100 days, then a PUP would only be approved with additional BMPs specifically to protect water quality. One or more BMPs such as the following would be included in the **Specific Best Management Practices (BMPs) section** *to minimize potential surface run-off and leaching that can degrade water quality:*

- *Do not exceed one application per site per year.*
- *Do not use on coarse-textured soils where the ground water table is <10 feet and average annual precipitation >12 inches.*
- *Do not use on steep slopes if substantial rainfall is expected within 24 hours or ground is saturated.*

Along with K_{oc}, soil $t_{½}$ values would be used in evaluating the potential to degrade groundwater by leaching (see **Potential to Move to Groundwater** below).

Soil Dissipation: Dissipation time (DT_{50}) represents the time required for 50% of the deposited pesticide to degrade and move from a treated site; whereas, soil $t_{½}$ describes the rate for degradation only. As for $t_{½}$, units of dissipation time are usually expressed in days. Field dissipation time would be the preferred data for use to estimate pesticide concentrations in the environment because it is based upon field studies compared to soil $t_{½}$, which is derived in a laboratory. However, soil $t_{½}$ is the most common persistence data available in the published literature. If field dissipation data is not available, soil half-life data would be used in a Chemical Profile. The average or representative half-life value of most important degradation mechanism would be selected for quantitative analysis for both terrestrial and aquatic environments.

Based upon the DT_{50} value, environmental persistence in the soil also would be categorized as one of the following: non-persistent <30 days, moderately persistent = 30 to 100 days, and persistent >100 days.

Threshold for Approving PUPs:

If soil DT_{50} ≤100 days, then a PUP would be approved without additional BMPs to protect water quality. If soil DT_{50} >100 days, then a PUP would only be approved with additional BMPs specifically to protect water quality. One or more BMPs such as the following would be included in the **Specific Best Management Practices (BMPs) section** *to minimize potential surface run-off and leaching that can degrade water quality:*

- *Do not exceed one application per site per year.*
- *Do not use on coarse-textured soils where the ground water table is <10 feet and average annual precipitation >12 inches.*
- *Do not use on steep slopes if substantial rainfall is expected within 24 hours or ground is saturated.*

Along with K_{oc}, soil DT_{50} values (preferred over soil $t_{½}$) would be used in evaluating the potential to degrade groundwater by leaching (see **Potential to Move to Groundwater** below), if available.

Aquatic Persistence: Service personnel would record values for aquatic $t_{½}$, which represents the length of time required for 50% of the deposited pesticide to degrade (completely or partially) in water. Based upon the $t_{½}$ value, aquatic persistence would be categorized as one of the following: non-persistent <30 days, moderately persistent = 30 to 100 days, and
persistent >100 days (Kerle et. al. 1996).

Threshold for Approving PUPs:

If aquatic $t_{½}$ ≤100 days, then a PUP would be approved without additional BMPs to protect water quality. If aquatic $t_{½}$ >100 days, then a PUP would only be approved with additional BMPs specifically to protect water quality. One or more BMPs such as the following would be included in the **Specific Best Management Practices (BMPs) section** *to minimize potential surface run-off and leaching that can degrade water quality:*

- *Do not exceed one application per site per year.*
- *Do not use on coarse-textured soils where the ground water table is <10 feet and average annual precipitation >12 inches.*
- *Do not use on steep slopes if substantial rainfall is expected within 24 hours or ground is saturated.*

Aquatic Dissipation: Dissipation time (DT_{50}) represents the time required for 50% of the deposited pesticide to degrade or move (dissipate); whereas, aquatic $t_{½}$ describes the rate for degradation only. As for $t_{½}$, units of dissipation time are usually expressed in days. Based upon the DT_{50} value, environmental persistence in aquatic habitats also would be categorized as one of the following: non-persistent <30 days, moderately persistent = 30 to 100 days, and persistent >100 days.

Threshold for Approving PUPs:

If aquatic DT_{50} ≤100 days, then a PUP would be approved without additional BMPs to protect water quality.
If aquatic DT_{50} >100 days, then a PUP would only be approved with additional BMPs specifically to protect water quality. One or more BMPs such as the following would be included in the **Specific Best Management Practices (BMPs) section** *to minimize potential surface run-off and leaching that can degrade water quality:*

- *Do not exceed one application per site per year.*
- *Do not use on coarse-textured soils where the ground water table is <10 feet and average annual precipitation >12 inches.*
- *Do not use on steep slopes if substantial rainfall is expected within 24 hours or ground is saturated.*

Potential to Move to Groundwater: Groundwater Ubiquity Score (GUS) = $\log_{10}$(soil $t_{½}$) x [4 – $\log_{10}(K_{oc})$]. If a DT_{50} value is available, it would be used rather than a $t_{½}$ value to calculate a GUS score. Based upon the GUS value, the potential to move toward groundwater would be recorded as one of the following categories: extremely low potential<1.0, low - 1.0 to 2.0, moderate - 2.0 to 3.0, high - 3.0 to 4.0, or very high>4.0.

Threshold for Approving PUPs:

If GUS ≤4.0, then a PUP would be approved without additional BMPs to protect water quality.
If GUS >4.0, then a PUP would only be approved with additional BMPs specifically to protect water quality. One or more BMPs such as the following would be included in the **Specific Best Management Practices (BMPs) section** *to minimize potential surface run-off and leaching that can degrade water quality:*

- *Do not exceed one application per site per year.*

- *Do not use on coarse-textured soils where the ground water table is <10 feet and average annual precipitation >12 inches.*
- *Do not use on steep slopes if substantial rainfall is expected within 24 hours or ground is saturated.*

Volatilization: Pesticides may volatilize (evaporate) from soil and plant surfaces and move off-target into the atmosphere. The potential for a pesticide to volatilize is a function of its vapor pressure that is affected by temperature, sorption, soil moisture, and the pesticide's water solubility. Vapor pressure is often expressed in mm Hg. To make these values easier to compare, vapor pressure would be recorded by Service personnel in exponential form ($I \times 10^{-7}$), where I represents a vapor pressure index. In general, pesticides with I<10 would have low potential to volatilize; whereas, pesticides with I >1,000 would have a high potential to volatilize (Oregon State University 1996). Vapor pressure values for pesticides are usually available in the pesticide product MSDS or the USDA Agricultural Research Service (ARS) pesticide database (see **References**).

Threshold for Approving PUPs:

If I≤1000, then a PUP would be approved without additional BMPs to minimize drift and protect air quality.
If I>1000, then a PUP would only be approved with additional BMPs specifically to minimize drift and protect air quality. One or more BMPs such as the following would be included in the **Specific Best Management Practices (BMPs) section** *to reduce volatilization and potential to drift and degrade air quality:*

- *Do not treat when wind velocities are <2 or >10 mph with existing or potential inversion conditions.*
- *Apply the large-diameter droplets possible for spray treatments.*
- *Avoid spraying when air temperatures >85°F.*
- *Use the lowest spray height possible above target canopy.*
- *Where identified on the pesticide label, soil incorporate pesticide as soon as possible during or after application.*

Octanol-Water Partition Coefficient (K_{ow}): The octanol-water partition coefficient (K_{ow}) is the concentration of a pesticide in octanol and water at equilibrium at a specific temperature. Because octanol is an organic solvent, it is considered a surrogate for natural organic matter. Therefore, K_{ow} would be used to assess potential for a pesticide to bioaccumulate in tissues of aquatic species (e.g., fish). If K_{ow} >1000 or S_w<1 mg/L AND soil $t_{½}$>30 days, then there would be high potential for a pesticide to bioaccumulate in aquatic species such as fish (US Geological Survey 2000).

Threshold for Approving PUPs:

If there is not a high potential for a pesticide to bioaccumulate in aquatic species, then the PUP would be approved.
If there is a high potential to bioaccumulate in aquatic species (K_{ow}>1000 or S_w<1 mg/L AND soil $t_{½}$>30 days), then the PUP would not approved, except under unusual circumstances where approval would only be granted by the Washington Office.

Bioaccumulation/Bioconcentration: The physiological process where pesticide concentrations in tissue would increase in biota because they are taken and stored at a faster rate than they are metabolized or excreted. The potential for bioaccumulation would be evaluated through bioaccumulation factors (BAFs) or bioconcentration factors (BCFs). Based upon BAF or BCF values, the potential to bioaccumulate would be recorded as one of the following: low – 0 to 300, moderate – 300 to 1000, or high >1000 (Calabrese and Baldwin 1993).

Threshold for Approving PUPs:

If BAF or BCF≤1000, then a PUP would be approved without additional BMPs.
If BAF or BCF>1000, then a PUP would not approved, except under unusual circumstances where approval would only be granted by the Washington Office.

Worst-Case Ecological Risk Assessment

Max Application Rates (acid equivalent): Service personnel would record the highest application rate of an active ingredient (ae basis) for habitat management and cropland/facilities maintenance treatments in this data field of a Chemical Profile. These rates can be found in Table CP.1 under the column heading "Max Product Rate – Single Application (lbs/acre – AI on acid equiv basis)". This table would be prepared for a chemical profile from information specified in labels for trade name products identified in PUPs. If these data are not available in pesticide labels, then write "NS" for "not specified on label" in this table.

EECs: An estimated environmental concentration (ECC) represents potential exposure to fish and wildlife (birds and mammals) from using a pesticide. EECs would be derived by Service personnel using an USEPA screening-level approach (US Environmental Protection Agency 2004). For each max application rate [see description under **Max Application Rates (acid equivalent)**], Service personnel would record 2 EEC values in a Chemical Profile; these would represent the worst-case terrestrial and aquatic exposures for habitat management and croplands/facilities maintenance treatments. For terrestrial and aquatic EEC calculations, see description for data entry under **Presumption of Unacceptable Risk/Risk Quotients**, which is the next field for a Chemical Profile.

Presumption of Unacceptable Risk/Risk Quotients: Service personnel would calculate and record acute and chronic risk quotients (RQs) for birds, mammals, and fish using the provided tabular formats for habitat management and/or cropland/facilities maintenance treatments. RQs recorded in a Chemical Profile would represent the worst-case assessment for ecological risk. See Section 7.2 for discussion regarding the calculations of RQs.

For aquatic assessments associated with habitat management treatments, RQ calculations would be based upon selected acute and chronic toxicological endpoints for fish and the EEC would be derived from Urban and Cook (1986) assuming 100% overspray to an entire 1-foot deep water body using the max application rate (ae basis [see above]).

For aquatic assessments associated with cropland/facilities maintenance treatments, RQ calculations would be done by Service personnel based upon selected acute and chronic toxicological endpoints for fish and an EEC would be derived from the aquatic assessment in AgDRIFT® model version 2.01 under Tier I ground-based application with the following input variables: max application rate (acid basis [see above]), low boom (20 inches), fine to medium/coarse droplet size, 20 swaths, EPA-defined wetland, and 25-foot distance (buffer) from treated area to water.

See Section 7.2.1.2 for more details regarding the calculation of EECs for aquatic habitats for habitat management and cropland/facilities maintenance treatments.

For terrestrial avian and mammalian assessments, RQ calculations would be done by Service personnel based upon dietary exposure, where the "short grass" food item category would represent the worst-case scenario. For terrestrial spray applications associated with habitat management and cropland/facilities maintenance treatments, exposure (EECs and RQs) would be determined using the Kanaga nomogram method through the USEPA's Terrestrial Residue Exposure model (T-REX) version 1.2.3. T-REX input variables would include the following: max application rate (acid basis [see above]) and pesticide half-life (days) in soil to estimate the initial, maximum pesticide residue concentration on general food items for terrestrial vertebrate species in short (<20 cm tall) grass.

For granular pesticide formulations and pesticide-treated seed with a unique route of exposure for terrestrial avian and mammalian wildlife, see Section 7.2.1.1.2 for the procedure that would be used to calculate RQs.

All calculated RQs in both tables would be compared with Levels of Concern (LOCs) established by USEPA (see Table 2 in Section 7.2). If a calculated RQ exceeds an established LOC value (in brackets inside the table), then there would be a potential for an acute or chronic effect (unacceptable risk) to federally listed (T&E) species and nonlisted species. See Section 7.2 for detailed descriptions of acute and chronic RQ calculations and comparison to LOCs to assess risk.

Threshold for approving PUPs:

If RQs≤LOCs, then a PUP would be approved without additional BMPs.
If RQs>LOCs, then a PUP would only be approved with additional BMPs specifically to minimize exposure (ecological risk) to bird, mammal, and/or fish species. One or more BMPs such as the following would be included in the **Specific Best Management Practices (BMPs) section** *to reduce potential risk to non-listed or listed species:*

- *Lower application rate and/or fewer number of applications so RQs ≤LOCs*
- *For aquatic assessments (fish) associated with cropland/facilities maintenance, increase the buffer distance beyond 25 feet so RQs ≤LOCs.*

Justification for Use: Service personnel would describe the reason for using the pesticide based control of specific pests or groups of pests. In most cases, the pesticide label will provide the appropriate information regarding control of pests to describe in the section.

Specific Best Management Practices (BMPs): Service personnel would record specific BMPs necessary to minimize or eliminate potential effects to non-target species and/or degradation of environmental quality from drift, surface runoff, or leaching. These BMPs would be based upon scientific information documented in previous data fields of a Chemical Profile. Where necessary and feasible, these specific practices would be included in PUPs as a basis for approval.

If there are no specific BMPs that are appropriate, then Service personnel would describe why the potential effects to refuge resources and/or degradation of environmental quality is outweighed by the overall resource benefit(s) from the proposed pesticide use in the BMP section of the PUP. See Section 4.0 of this document for a complete list of BMPs associated with mixing and applying pesticides appropriate for all PUPs with ground-based treatments that would be additive to any necessary, chemical-specific BMPs.

References: Service personnel would record scientific resources used to provide data/information for a chemical profile. Use the number sequence to uniquely reference data in a chemical profile.

The following on-line data resources are readily available for toxicological endpoint and environmental fate data for pesticides:

1. California Product/Label Database. Department of Pesticide Regulation, California Environmental Protection Agency. (http://www.cdpr.ca.gov/docs/label/labelque.htm#regprods)

2. ECOTOX database. Office of Pesticide Programs, US Environmental Protection Agency, Washington, DC. (http://cfpub.epa.gov/ecotox/)

3. Extension Toxicology Network (EXTOXNET) Pesticide Information Profiles. Cooperative effort of University of California-Davis, Oregon State University, Michigan State University, Cornell University and University of Idaho through Oregon State University, Corvallis, Oregon. (http://extoxnet.orst.edu/pips/ghindex.html)

4. FAO specifications and evaluations for plant protection products. Pesticide Management Unit, Plant Protection Services, Food and Agriculture Organization, United Nations. (http://www.fao.org/WAICENT/FAOINFO/AGRICULT/AGP/AGPP/Pesticid/)

5. Human health and ecological risk assessments. Pesticide Management and Coordination, Forest Health Protection, US Department of Agriculture, US Forest Service. (http://www.fs.fed.us/foresthealth/pesticide/risk.htm)

6. Pesticide Chemical Fact Sheets. Clemson University Pesticide Information Center. (http://entweb.clemson.edu/pesticid/Document/Labels/factshee.htm)

7. Pesticide Fact Sheets. Published by Information Ventures, Inc. for Bureau of Land Management, Dept. of Interior; Bonneville Power Administration, U.S. Dept. of Energy; and Forest Service, US Department of Agriculture. (http://infoventures.com/e-hlth/pesticide/pest-fac.html)

8. Pesticide Fact Sheets. National Pesticide Information Center. (http://npic.orst.edu/npicfact.htm)

9. Pesticide Fate Database. US Environmental Protection Agency, Washington, DC. (http://cfpub.epa.gov/pfate/home.cfm).

10. Pesticide product labels and material safety data sheets. Crop Data Management Systems, Inc. (CDMS) (http://www.cdms.net/pfa/LUpdateMsg.asp) or multiple websites maintained by agrichemical companies.

11. Registered Pesticide Products (Oregon database). Oregon Department of Agriculture. (http://www.oda.state.or.us/dbs/pest_products/search.lasso)

12. Regulatory notes. Pest Management Regulatory Agency, Health Canada, Ontario, Canada. (http://www.hc-sc.gc.ca/pmra-arla/)

13. Reptile and Amphibian Toxicology Literature. Canadian Wildlife Service, Environment Canada, Ontario, Canada. (http://www.cws-scf.ec.gc.ca/nwrc-cnrf/ratl/index_e.cfm)

14. Specific Chemical Fact Sheet – New Active Ingredients, Biopesticide Fact Sheet and Registration Fact Sheet. U.S Environmental Protection Agency, Washington, DC. (http://www.epa.gov/pestidides/factsheets/chemical_fs.htm)

15. Weed Control Methods Handbook: Tools and Techniques for Use in Natural Areas. The Invasive Species Initiative. The Nature Conservancy. (http://tnsweeds.ucdavis.edu/handbook.html)

16. Wildlife Contaminants Online. US Geological Survey, Department of Interior, Washington, D.C. (http://www.pwrc.usgs.gov/contaminants-online/)

17. One-liner database. 2000. US Environmental Protection Agency, Office of Pesticide Programs, Washington, D.C.

Chemical Profile

Date:			
Trade Name(s):		**Common Chemical Name(s):**	
Pesticide Type:		**EPA Registration Number:**	
Pesticide Class:		**CAS Number:**	
Other Ingredients:			

Toxicological Endpoints

Mammalian LD_{50}:	
Mammalian LC_{50}:	
Mammalian Reproduction:	
Avian LD_{50}:	
Avian LC_{50}:	
Avian Reproduction:	
Fish LC_{50}:	
Fish ELS/Life Cycle:	
Other:	

Ecological Incident Reports

Environmental Fate

Water solubility (S_w):	
Soil Mobility (K_{oc}):	
Soil Persistence ($t_{½}$):	
Soil Dissipation (DT_{50}):	
Aquatic Persistence ($t_{½}$):	
Aquatic Dissipation (DT_{50}):	
Potential to Move to Groundwater (GUS score):	
Volatilization (mm Hg):	
Octanol-Water Partition Coefficient (K_{ow}):	
Bioaccumulation/Biocentration:	**BAF:`** **BCF:**

Worst Case Ecological Risk Assessment

Max Application Rate (ai lbs/acre – ae basis)	**Habitat Management:** **Croplands/Facilities Maintenance:**
EECs	**Terrestrial (Habitat Management):** **Terrestrial (Croplands/Facilities Maintenance):** **Aquatic (Habitat Management):** **Aquatic (Croplands/Facilities Maintenance):**

Habitat Management Treatments:

Presumption of Unacceptable Risk		**Risk Quotient (RQ)**	
		Listed (T&E) Species	**Nonlisted Species**
Acute	Birds	[0.1]	[0.5]
	Mammals	[0.1]	[0.5]
	Fish	[0.05]	[0.5]
Chronic	Birds	[1]	[1]
	Mammals	[1]	[1]

	Fish	[1]	[1]

Cropland/Facilities Maintenance Treatments:

Presumption of Unacceptable Risk		**Risk Quotient (RQ)**	
		Listed (T&E) Species	**Nonlisted Species**
Acute	Birds	[0.1]	[0.5]
	Mammals	[0.1]	[0.5]
	Fish	[0.05]	[0.5]
Chronic	Birds	[1]	[1]
	Mammals	[1]	[1]
	Fish	[1]	[1]

Justification for Use:	
Specific Best Management Practices (BMPs):	
References:	

Table CP.1 Pesticide Name

Trade Name[a]	Treatment Type[b]	Max Product Rate – Single Application (lbs/acre or gal/acre)	Max Product Rate -Single Application (lbs/acre - AI on acid equiv basis)	Max Number of Applications Per Season	Max Product Rate Per Season (lbs/acre/season or gal/acre/season)	Minimum Time Between Applications (Days)

[a]From each label for a pesticide identified in pesticide use proposals (PUPs), Service personnel would record application information associated with possible/known uses on Service lands.
[b]Treatment type: H – habitat management or CF – cropland/facilities maintenance. If a pesticide is labeled for both types of treatments (uses), then record separate data for H and CF applications.

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Appendix L. Transportation Access Analysis
Ridgefield National Wildlife Refuge
Ridgefield, Washington

U.S. Fish & Wildlife Service *published by FHWA*

Transportation Access Analysis

Ridgefield National Wildlife Refuge
Ridgefield, Washington

Transportation Access Analysis
Ridgefield National Wildlife Refuge
Ridgefield, Washington

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May 2009

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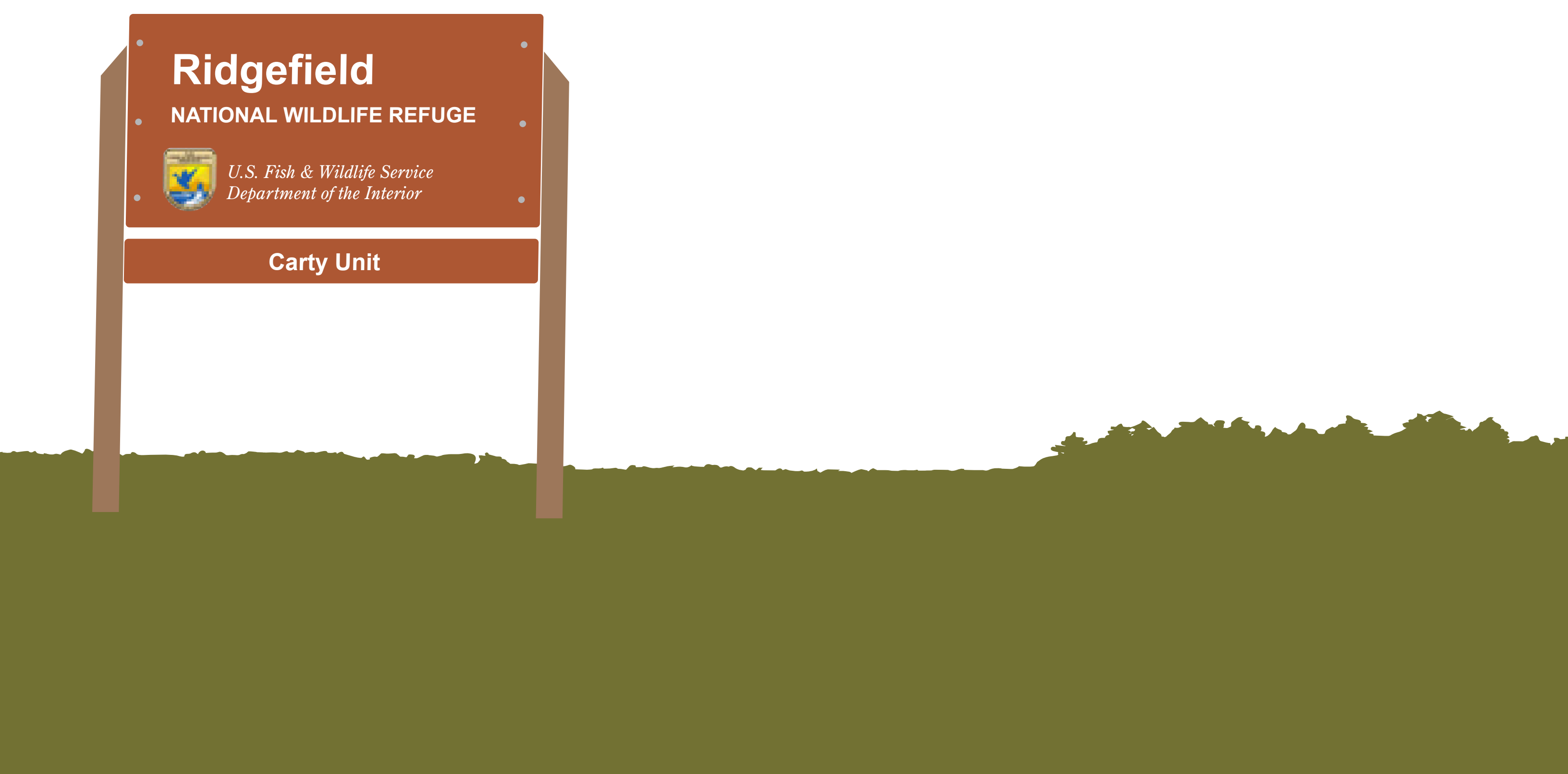


Transportation Access Analysis
Ridgefield National Wildlife Refuge

May 2009

Executive Summary

Introduction

The purpose of this report is to provide the US Fish and Wildlife Service (USFWS) with an analysis of their current transportation needs and alternatives for meeting those needs within the Ridgefield National Wildlife Refuge (NWR).

The intent is to give the USFWS information they can use in the decision making process for providing public access to the Refuge, which is one of their objectives. Likewise, the USFWS can use the information from this report to assist with the development of a plan called the Ridgefield NWR Comprehensive Conservation Plan (CCP). The CCP is a management plan for improving fish and wildlife habitat conditions and Refuge infrastructure for wildlife and public use on the Refuge over the next 15 years.

Current Transportation Conditions

The existing transportation system has several problems. The existing at-grade railroad crossing into the River "S" Unit is dangerous. The narrow, winding entrance road, and the one-lane bridge into the River "S" Unit and to the auto tour route are too narrow for existing and future Refuge visitors. The pedestrian access to the Oaks to Wetlands Wildlife Trail and to the Cathlapotle Plank house in the Carty Unit does not comply with the Americans with Disabilities Act (ADA) guidelines.

In addition to being too narrow, the existing bridge accessing the Refuge River "S" Unit has a remaining lifespan of about seven years. If the bridge is not repaired or replaced, it eventually will become unusable.

Transportation Needs

For the Ridgefield NWR, the USFWS needs a transportation system that: allows visitors safe, efficient access to the Refuge; accommodates the volume and types of traffic for current and future uses; and that provides ADA access for those with disabilities. In addition to providing for all of the needs above, the USFWS has to have a transportation system that meets the Refuge's primary objective of the long-term protection and enhancement of fish, wildlife, and their habitat.

Criteria Used to Rank and Compare Alternatives

Refuge Resources compares impacts of the alternatives to the Refuge's wildlife, habitats, and cultural resources; and the Refuge's ability to conduct its wildlife and habitat management activities.

Safety and ADA Compliance compares the relative safety of each alternative, and how well each alternative meets ADA guidelines.

Accommodates Increased Visitation compares how well each alternative accommodates projected increases in visitation.

Impact to Visitors compares how well each alternative meets the Refuge's goal of quality opportunities for waterfowl hunting, wildlife observation and photography, fishing, interpretation, and environmental education. Included in this analysis is the quality of visitor experience provided, ease of visitor access, and how well each alternative minimizes conflicts between or within different user groups.

Impact to Community compares impacts of the alternatives to neighboring landowners and/or renters, and the local community. This includes impacts of increased visitor traffic through neighborhoods and through town, impacts of constructed elements on view-sheds, and impacts of the alternatives on community development projects (for example the proposed Port of Ridgefield development).

Cost/Feasibility compares costs of land acquisition, construction, and maintenance. It also includes with feasibility of implementing the alternative (i.e. Section 4(f) and NEPA compliance).

Alternatives

Through the public scoping process and subsequent development of the draft CCP, the Refuge has developed five alternatives addressing public access. All of the proposed alternatives, with the exception of the "No Build" alternative, includes replacing the current pedestrian bridge at the Carty Unit with a bridge that meets ADA guidelines.

Alternative 1 – The 'No Build' alternative. Access to the Refuge would remain unchanged and without improvements, other than repair of the existing bridge to the River "S" Unit, or replacement with a like structure.

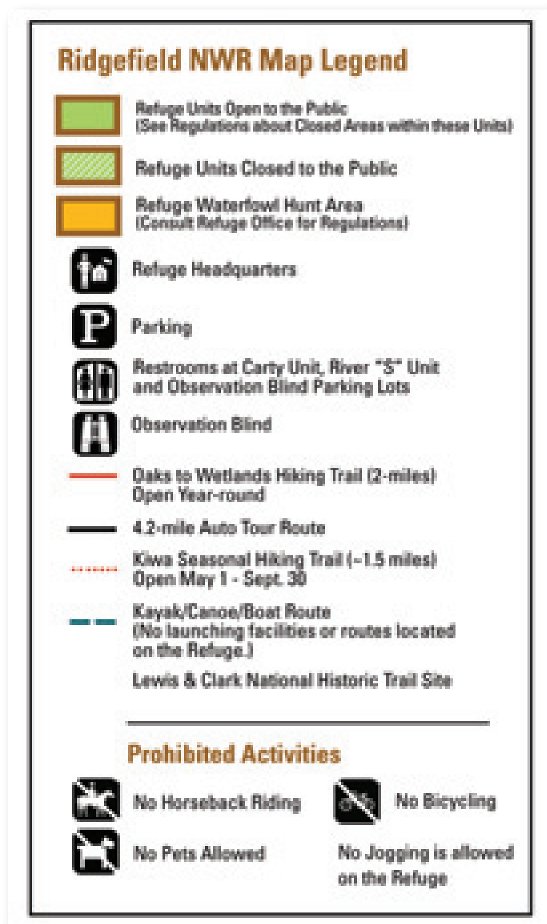
Alternative 2 – Acquire the parcel of land that the current entrance road traverses, from Hillhurst Road to the River "S" Unit. Widen the existing entrance road from Hillhurst Road to the bridge. Replace the single-lane bridge spanning Lake River with an elevated, two-lane bridge spanning Lake River and the railroad tracks.

Alternative 3 – Create a new access point into the Refuge from the Port of Ridgefield's overpass. The Port of Ridgefield is planning to construct a bridge over the railroad tracks from the junction of Main Street and State Route 501/Pioneer Street to the Port property. The new access point would branch from the Port's proposed bridge, over Lake River and the houseboat community to the River "S" Unit.

In addition, construction of an access road from the end of the new bridge, south to the existing auto tour route would be necessary. This road would be about 0.75 miles long and would run along the base of the existing dike. It would be asphalt at the toe of the bridge and graveled thereafter.

Alternative 4 – Similar to alternative 3, this would create a new access point into the Refuge from the Port of Ridgefield's property (north of the houseboat community). Once the Port of Ridgefield's bridge across the railroad tracks is complete, a smaller bridge would be constructed from the Port side of Lake River to the Refuge River "S" Unit that would include a lift span for larger vessels. Like alternative 3, an access road would be constructed to connect this access point to the auto tour route.

Alternative 5 – Under this alternative, a southern access from the Ridgeport Dairy Unit would be reopened. Work under this alternative would include reconstructing State Route 501 (Lower River Road) from milepost 11 to milepost 12.5, widening the road from one lane to two lanes, and constructing an approximately 4-mile-long access road north through the Ridgeport Dairy Unit to the auto tour route on the River "S" Unit.



Graphic Summary of Alternatives by Criteria

	Refuge Resources	Safety & ADA Compliance	Increased Visitation	Impacts to Visitors	Impacts to Community	Cost & Feasibility
Alt 1	Green	Red	Red	Yellow*	Red	Green
Alt 2	Yellow	Green	Green	Green	Green	Orange
Alt 3	Yellow	Green	Green	Yellow	Red	Red
Alt 4	Yellow	Green	Green	Yellow	Green	Yellow
Alt 5	Red	Green	Green	Red	Orange	Red

*Rating if the existing bridge to the River "S" Unit is replaced. Otherwise rating would be red.

Key for color coding:

Green	No impact or slight impact, or fully meets criteria
Yellow	Minor impact, or somewhat meets these criteria
Orange	Moderate impact, or significant obstacles to meeting criteria
Red	Major impact, or does not meet criteria

Introduction

"provide...a management plan for improving fish and wildlife habitat conditions and Refuge infrastructure, for wildlife and public use on Ridgefield NWR over the next 15 years."

The purpose of this report is to provide the USFWS with an analysis of their current transportation needs and alternatives for meeting those needs within the Ridgefield National Wildlife Refuge (NWR).

The intent is to give the USFWS information they can use in the decision making process for providing public access to the Refuge, which is one of their objectives. Likewise, the USFWS can use the information from this report to assist with the development of the Ridgefield NWR Comprehensive Conservation Plan (CCP).

The CCP is a management plan for improving fish and wildlife habitat conditions and Refuge infrastructure for wildlife and public use on the Refuge over the next 15 years. This transportation analysis will become an appendix to the CCP. To better understand the need for this transportation analysis and the CCP, a history of the Refuge and the reason it exists is helpful.

History of the Ridgefield National Wildlife Refuge

Along with three other Refuges in the Willamette Valley of Oregon, the Ridgefield NWR was established in 1965 to secure vital winter habitat for dusky Canada geese and other wintering waterfowl. An additional purpose of the Ridgefield NWR was to provide waterfowl hunting opportunities.

The Ridgefield NWR has about 5,300 acres of marshes, grasslands and woodlands. The Refuge consists of five different units, and a variety of wildlife can be found on the Refuge. Waterfowl, sandhill cranes, shorebirds, and a great variety of songbirds stop at the Refuge during spring and fall migrations. Some bird species such as mallards, great blue herons, and red-tailed hawks are year-round residents that nest on the Refuge. Black-tailed deer are the largest mammal on the Refuge. Coyote, raccoon, skunk, beaver, river otter and brush rabbits are occasionally seen.

For the Ridgefield NWR as a whole, the main objective is to protect and enhance fish, wildlife, and their habitat. At the same time, the USFWS offers wildlife-dependent public use in designated portions of the Refuge. The Carty Unit has a trail open year-round, and the River “S” Unit has a trail open seasonally and an Auto Tour Route open year-round. Access to duck blinds is available seasonally.

In order to manage these different uses in the most effective manner, the USFWS is in the process of developing the Ridgefield NWR Comprehensive Conservation Plan, which this transportation analysis will be part of.

Ridgefield NWR Comprehensive Conservation Plan

The Comprehensive Conservation Plan (CCP) will provide the USFWS, the National Wildlife Refuge System (NWRS), Refuge partners, and citizens with a management plan for improving fish and wildlife habitat conditions and Refuge infrastructure for wildlife and public use on the Ridgefield NWR over the next 15 years. An approved CCP will ensure that the USFWS manages the Refuge to achieve its purpose, vision, goals, and objectives and fulfills the mission of the NWRS.

More specifically, the purpose of the CCP is to provide reasonable, scientifically grounded guidance for the long-term conservation of native plants and animals and for improving the Refuge's grassland, wetland, riparian, and oak woodland habitats. The CCP will identify appropriate actions for protecting and sustaining the cultural and biological features of the Refuge, its wintering waterfowl populations and habitats, the migratory landbird, waterbird, and shorebird populations that use the Refuge, and threatened, endangered, or rare species.

A final and vital purpose of the CCP is to provide guidance on, and evaluation of, the public-use programs on the Refuge.

Current Public Access to the Ridgefield NWR

Currently, the public is provided access to the Ridgefield NWR through the Carty Unit and the River "S" Unit.

Access to the Carty Unit is pedestrian access only. People can park near the Refuge headquarters and access the Oaks to Wetlands Wildlife Trail and the Cathlapotle Plank house via a pedestrian bridge. The pedestrian bridge that accesses the Carty Unit is very steep and does not meet the American's with Disabilities Act (ADA) requirements.

Access to the River "S" Unit is open to vehicles and pedestrians. The existing infrastructure includes a 4.2-mile auto tour route and a 1.2-mile seasonal hiking trail. Visitors access this unit from Hillhurst Road via a single-lane road through private property (the USFWS has an easement for the access road) to an at-grade rail crossing of the Burlington Northern Santa Fe (BNSF) Railway. They then cross Lake River on a 330-foot-long, single-lane, wooden bridge to a parking lot and the auto tour route.

The existing one-lane road and bridge are too narrow for the types and volume of traffic accessing the Refuge, and they do not provide for safe access to the Refuge. Furthermore, information that the USFWS collected indicates that vehicle traffic and visitation is increasing on the Refuge, and they expect that trend to continue. In addition, the existing at-grade railroad crossing is directly adjacent to the narrow, winding entrance road on one side and the one-lane bridge on the other side. The combination creates a dangerous situation that needs to be corrected.

However, the existing easement through private land will limit the options to correct the existing deficiencies along the current alignment because no agreement with the current land owner is in place to make changes to the access road. Furthermore, the intent behind the original agreement is that someday access to the Refuge would be moved. In fact, the easement granted to the Refuge stipulates that the easement shall remain in effect until such time that a southern access point can be developed at the

Ridgeport Dairy Unit, although no time restrictions exist in terms of expiration for this easement.

Furthermore, the only southern route that could be developed for access to the Refuge is State Route 501, and this road has several problems.

Exsisting single lane bridge at Lake River

In the spring of 2004, the Washington State Department of Transportation (WSDOT) closed a section of State Route 501 adjacent to the southern end of the Refuge because of heavy erosion. The WSDOT never repaired the route, and in 2006 they transferred jurisdiction of this section of State Route 501 to Clark County. Clark County has not reopened this road, and no plans for reconstruction of this route are found in the Clark County 2008-2013 Transportation Improvement Program.

Furthermore, the Clark County Parks and Recreation 2006 Regional Trail and Bikeway Systems Plan identify this route as a potential extension of the Lewis and Clark Greenway Trail for bicycle and pedestrian use.

This Southern access would have an impact to the Refuge administrative maintenance and operations functions. This alternative would not provide direct access from the Refuge headquarters office to the auto tour route and duck blinds. A 30-mile detour through Vancouver would be required to bring staff vehicles and heavy equipment from the Refuge headquarters and shop in Ridgefield to the River S Unit.

As discussed in Alternative 3, reopening this connection of State Route 501 into the Refuge may reignite earlier plans to build a State highway through the Refuge from Lower River Road to Pioneer Street.

Transportation Needs

For the Ridgefield NWR, the USFWS needs a transportation system that: allows visitors safe, efficient access to the Refuge; accommodates the volume and types of traffic for current and future uses; and that provides ADA access for those with disabilities. In addition to providing for all of the needs above, the USFWS has to have a transportation system that meets the Refuge's primary objective of the long-term protection and enhancement of fish, wildlife, and their habitat.

Goals and Objectives

To help identify appropriate solutions, the USFWS identified the following goals and objectives as the most important to the Refuge:

Refuge Purpose and Resources

-Conserve native plant and wildlife, with emphasis on dusky Canada geese and other waterfowl; sandhill cranes; and Federally listed species
-Conserve and enhance grassland, wetland, riparian, and oak woodland habitats for wildlife
-Protect cultural resources
-Provide quality waterfowl hunting opportunities

Wildlife Dependent Public Uses

-Provide quality opportunities for waterfowl hunting, wildlife observation and photography, fishing, interpretation, and environmental education
-Reduce impacts of public use on the Refuge's wildlife, habitat, and cultural resources
-Reduce/minimize conflicts between user groups

Refuge Transportation Access

-Provide safe, unobstructed, and the most direct access to the River "S" unit for both visitors and Refuge staff
-Provide access to the Carty Unit that meets ADA guidelines
-Accommodate projected increases in visitation and vehicle traffic to and from the Refuge
-Accommodate access for heavy vehicles/equipment needed for construction, maintenance and habitat management

Other Criteria

-Cost, design feasibility and sustainability
-Coordination/cooperation with neighboring landowners (Port of Ridgefield, BNSF, private landowners)
-Impacts to Refuge visitors, neighboring landowners, and the local community
-NEPA and Section 4(f) considerations

Alternatives for Refuge Access

To address the problems and concerns with the Refuge's current transportation access, the USFWS developed five different alternatives. Each alternative is based on meeting the National Wildlife Refuge System mission, the purpose of the Refuge and needs for transportation access. In addition, consideration is given to the cost of construction, design feasibility and sustainability; impact to the gateway communities and visitor experience; followed by a summary of Section 4(f) Regulation and National Environmental Policy Act (NEPA) implications of each alternative.

To ensure that consideration was given to all these factors, the USFWS developed a list of criteria that was used to compare and rank the five alternatives.

Criteria Used to Rank and Compare Alternatives

Refuge Resources compares impacts of the alternatives to the Refuge's wildlife, habitats, and cultural resources; and the Refuge's ability to conduct its wildlife and habitat management activities.

-Green means that the alternative has minimal or no impacts compared to the 'No Action' alternative.
-Yellow indicates that the alternative would have minor negative impacts on the Refuge's ability to manage or provide habitat (which could be minimized relatively easily through design or mitigation).
-Orange means moderate impacts that would be difficult to mitigate.
-Red means major impacts that would prevent the Refuge from meeting its purposes.

Included in this analysis is anticipated impacts to wildlife, habitat, and cultural resources caused by increased visitation, and the impacts of the alternative on Refuge operations (staff travel time, fuel expenditures, ability to get heavy equipment to work sites).

Safety and ADA Compliance compares the relative safety of each alternative, and how well each alternative meets ADA guidelines.

-Green means the alternative addresses existing safety concerns and is ADA compliant.
-Yellow means there are some safety concerns, but these could be mitigated through design, signage, and regulations.
-Orange means significant concerns that would be difficult to mitigate.
-Red means concerns significant enough that the alternative should not be implemented.

Accommodates Increased Visitation compares how well each alternative accommodates projected increases in visitation.

-Green meaning the alternative can accommodate significant increases in visitation.
-Red meaning that visitation above the present level cannot be accommodated without significant negative impacts to the visitor experience, or to wildlife and habitat resources.

Impact to Visitors compares how well each alternative meets the Refuge's goal of quality opportunities for waterfowl hunting, wildlife observation and photography, fishing, interpretation, and environmental education. Included in this analysis is the quality of visitor experience provided, ease of visitor access, and how well each alternative minimizes conflicts between or within different user groups.

-Green means the alternative allows for quality public use, with easy access and minimal conflicts between or within user groups.
-Yellow through red means lower quality and/or increasing conflicts.

Impact to Community compares impacts of the alternatives to neighboring landowners and/or renters, and the local community. This includes impacts of increased visitor traffic through neighborhoods and through town, impacts of constructed elements on view-sheds, and impacts of the alternatives on community development projects (for example the proposed Port of Ridgefield development).

-Green to red means little or no impacts to high impacts.

Cost/Feasibility compares costs of land acquisition, construction, and maintenance. It also includes with feasibility of implementing the alternative (ie NEPA compliance and Section 4(f)).

-Green to red means low cost and basic NEPA process to high cost and more complex NEPA process.

Access Alternatives

Through the public scoping process and subsequent development of the draft CCP, the Refuge has developed five alternatives addressing public access. All of the proposed alternatives, with the exception of the "No Build" alternative, include replacing the current pedestrian bridge at the Carty Unit with a bridge that meets ADA guidelines.

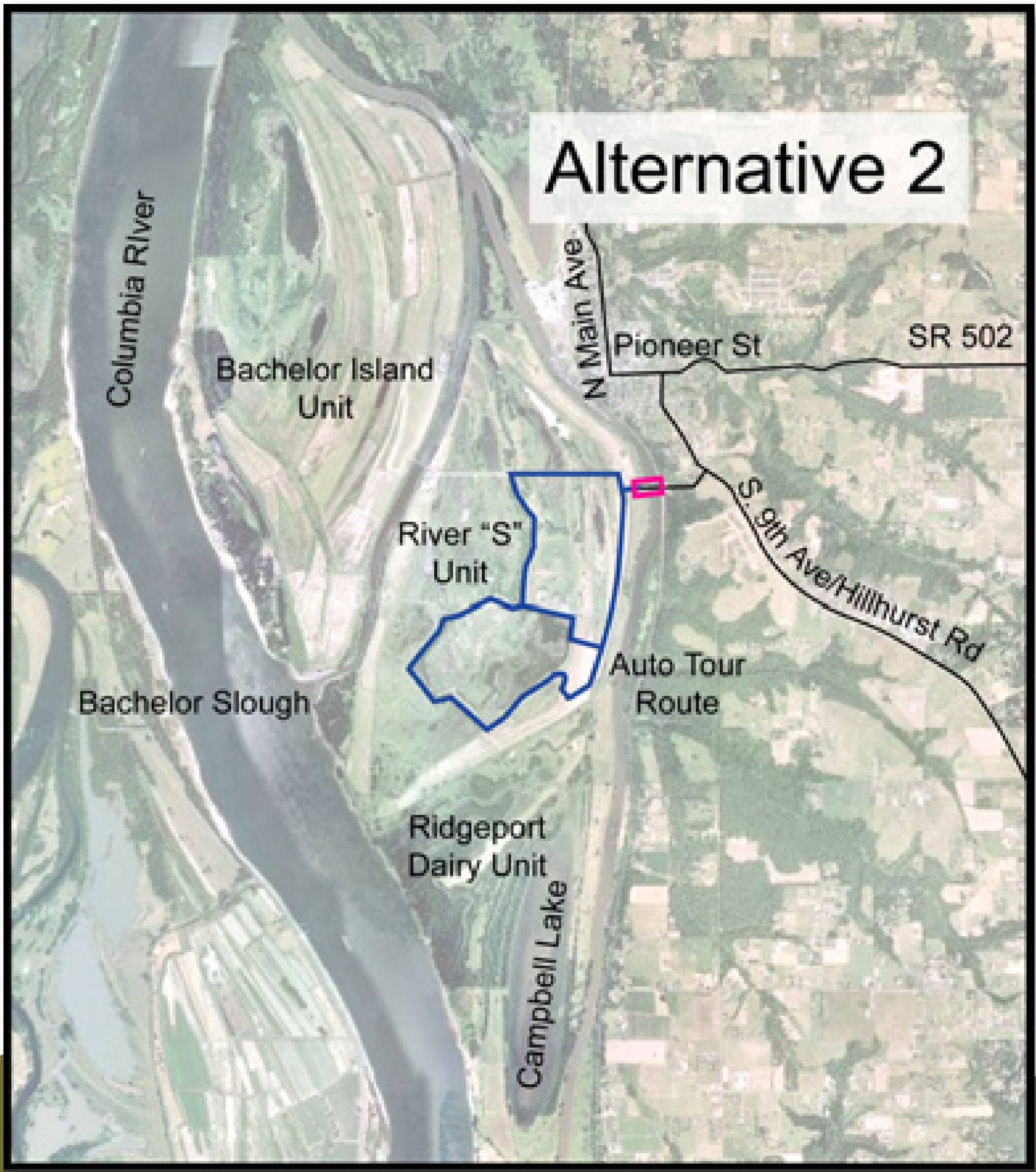
Alternative 1 – The "No Build" alternative

- Access to the Refuge would remain unchanged and without improvements, other than repair of the existing bridge to the River "S" Unit, or replacement with a like structure.

Alternative 2 – Retain the existing access points with improvements.

These improvements would include:

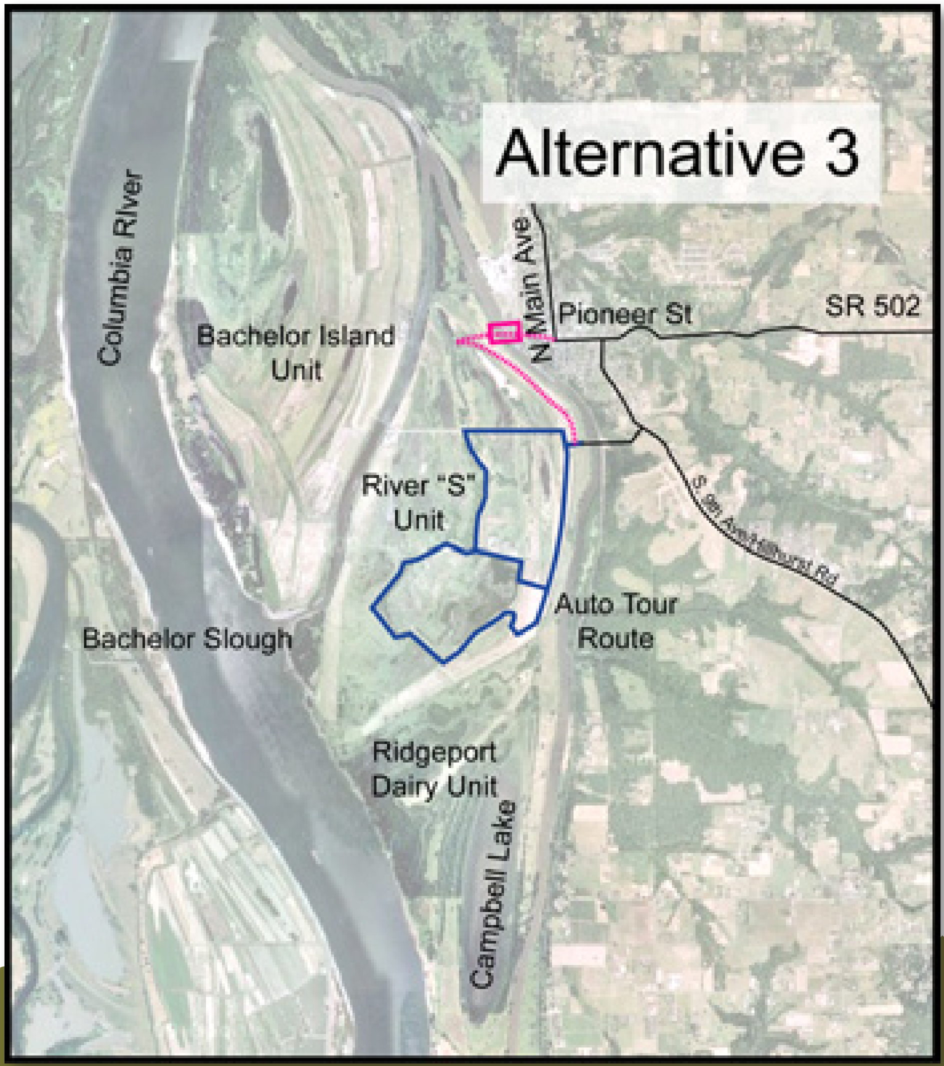
- Acquire the 33-acre parcel of land the current entrance road traverses, from Hillhurst Road to the River "S" Unit. (Current access is granted through an easement.)
- Widen and pave the existing entrance road from Hillhurst Road to the beginning of the bridge across Lake River.
- Replace the single lane bridge spanning Lake River with a two lane bridge spanning Lake River and the railroad tracks.



Alternative 3 – Create a new access point into the Refuge from the Port of Ridgefield's overpass. The Port of Ridgefield is planning to construct a bridge over the railroad tracks from the junction of Main Street and State Route 501/Pioneer Street to the Port property.

Alternative 3 includes:

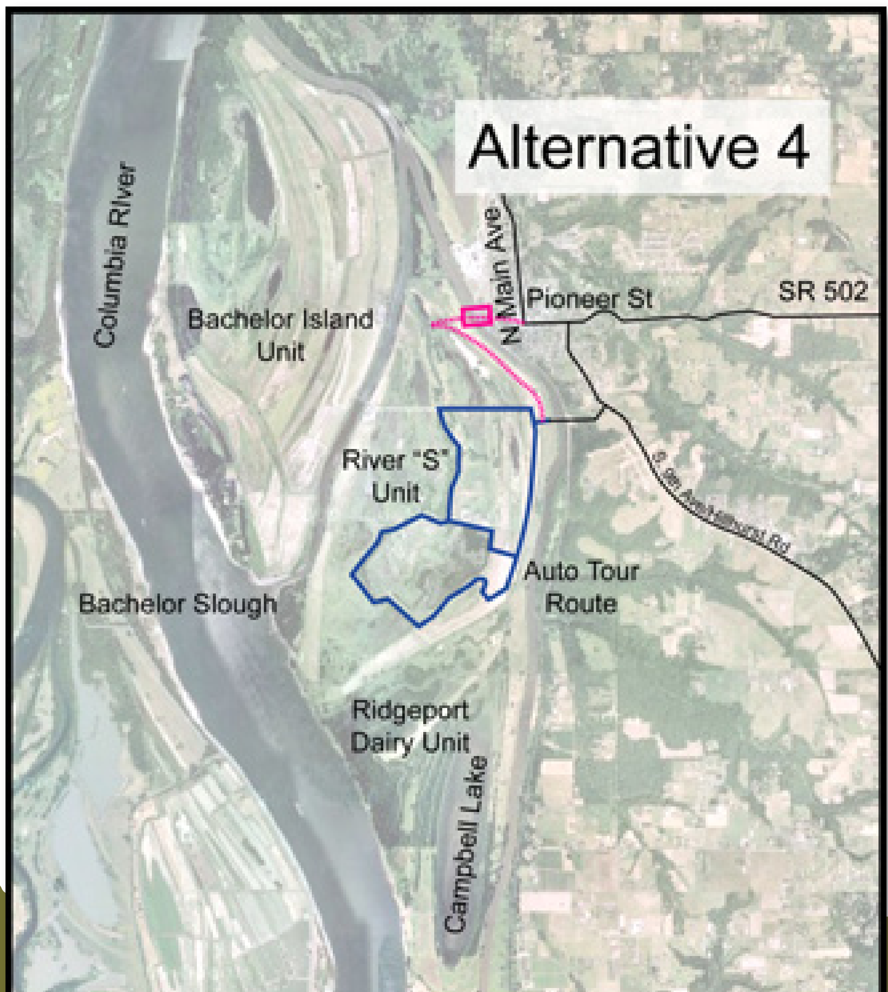
- Build a branch off of the Port of Ridgefield's proposed bridge that would access the River "S" Unit from downtown Ridgefield at the junction of Main Street and State Route 501/Pioneer Street.
- Construct an access road from the end of the new bridge, south to the existing auto tour route. This road would be about 0.75 miles long and run along the base of the existing dike. It would be asphalt at the toe of the bridge and graveled thereafter.



Alternative 4 – Again building from the Port of Ridgefield's plan to construct a bridge over the railroad tracks from the junction of Main Street and State Route 501/Pioneer Street to the Port property,

Alternative 4 includes:

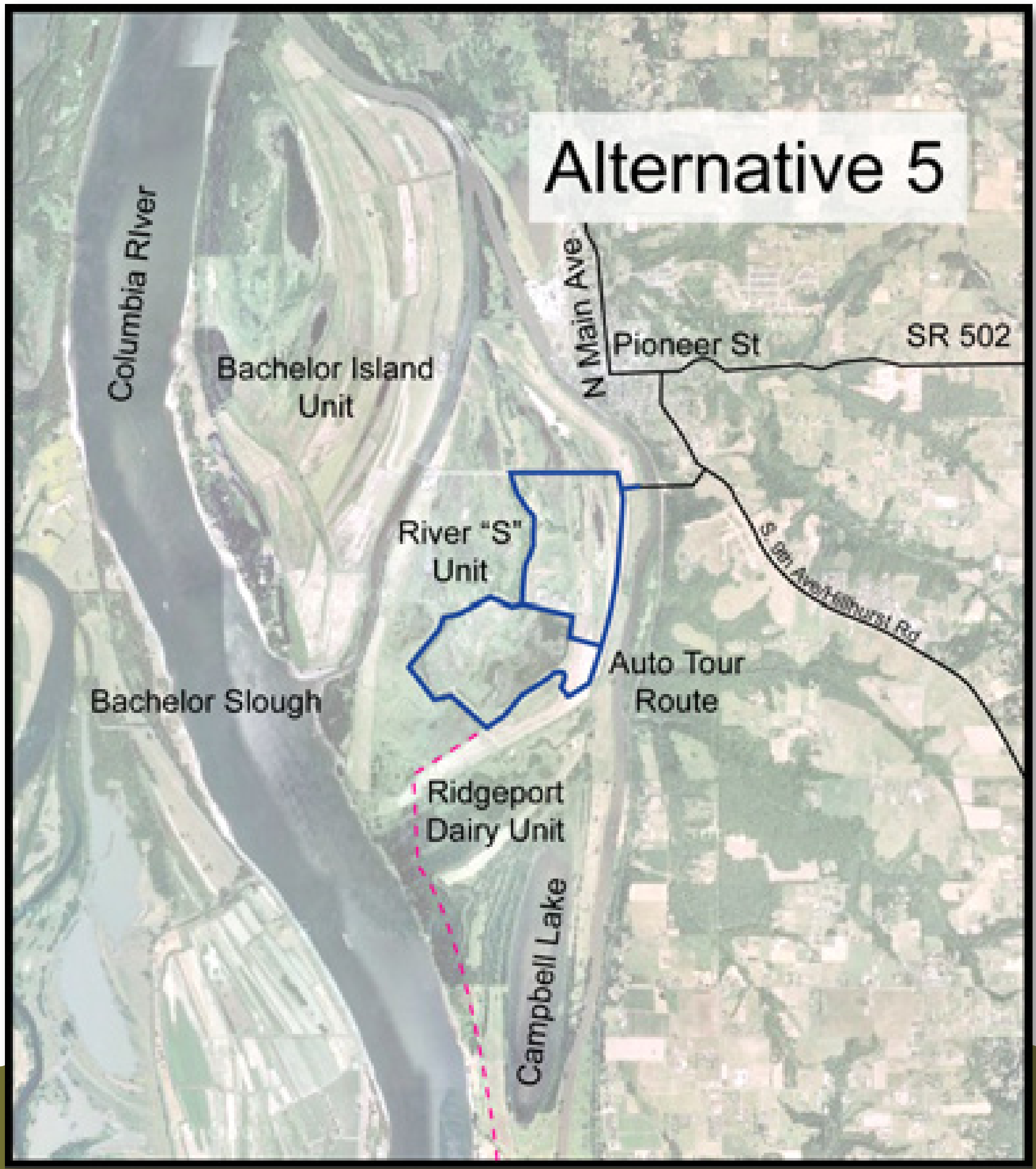
- Build a smaller, two lane bridge with a lift-span from the Port of Ridgefield's property, north of the houseboat community, over Lake River to access the River "S" Unit.
- Construct an access road from the end of the new bridge, south to the existing auto tour route. This road would be about 0.75 miles long and run along the base of the exiting dike. It would be asphalt at the toe of the bridge and graveled thereafter.
- The existing bridge would be removed and the easement from Hillhurst Road to the existing bridge would be abandoned.



Alternative 5 – Reopen a southern access from the Ridgeport Dairy Unit.

Alternate 5 includes:

- Reconstruction of State Route 501/Lower River Road from mile post marker 11 for approximately 1 ½ miles. Widen this from one lane to two lanes.
- Construct an approximately 4 mile access road north through the Ridgeport Dairy Unit to the auto tour route on River "S" Unit.
- The existing access point at Hillhurst Road and bridge would be retained for use by USFWS and emergency vehicles only.



Comparison of Alternative

Alternative 1 (No Build)

	Refuge Resources	Safety & ADA Compliance	Increased Visitation	Impacts to Visitors	Impacts to Community	Cost & Feasibility
Alt 1	Green	Red	Red	Yellow*	Red	Green

**Rating if the existing bridge is replaced. Otherwise rating would be red.*

Key Issues: The 'No Build' alternative does not adequately address safety issues of the at-grade rail crossing, increased visitation, and ADA access concerns

Refuge Resources: In the short term, no additional impacts to Refuge resources are expected under this alternative. However, the existing bridge has a limited remaining lifespan (estimated at 10 years in 2005). If the bridge is not repaired or replaced with a like structure, eventually it will become unusable. The Refuge's ability to manage habitat will remain the same only if the bridge is repaired or replaced. If the bridge fails or becomes unsafe to use, this will have a major impact on Refuge operations and will require closure of the River 'S' Unit to public use.

Safety & ADA compliance: The one-lane, graveled entrance road is narrow, has blind corners, and is prone to slumping and washouts. Two cars can pass each other, but with difficulty. Trees also fall across the road. The current easement does not allow for widening or improvement of the road. In addition, the easement does not include the width necessary for the automatic gate when it is in the open position. The at-grade railroad crossing is dangerous and increases the potential for accidents. At times, visitors have been trapped on the River S Unit for up to 5 hours when trains have stopped on the tracks. The Refuge is concerned with the potential for visitors to be trapped on the Refuge in an emergency situation. These problems are likely to increase because the BNSF plans to increase both the number and speed of trains between Seattle and Portland. The existing pedestrian bridge to the Carty Unit is not accessible to visitors with disabilities.

Accommodates Increased Visitation: The current trend of increased visitation to the Refuge is likely to continue, albeit at a slower rate than in alternatives 3 and 4. The narrow entrance road and one-lane bridge would continue to limit the ability of the Refuge to accommodate significantly increased visitation without negative impacts to visitor's experiences. For example: traffic backups when trains pass; difficulty of passing on the one-lane road; visitors having to wait for opposing traffic to cross the one-lane bridge. If present visitation trends continue, the situation is likely to become untenable.

Impact to Visitors: The current entrance road, which winds through a wooded canyon, provides a gradual transition from a suburban to a rural (Refuge) environment that enhances the visitor experience. However, as previously noted, there are significant safety concerns with the current entrance road. Traffic backups when trains pass have a negative impact to the visitor experience. The Refuge's ability to provide public use opportunities will remain the same only if the bridge is repaired or replaced. If the bridge fails or becomes unsafe to use, this will require closure of the River 'S' Unit to public use. The Refuge would no longer be able to operate the auto tour route or the waterfowl hunting program.

Impact to Community: The property through which the existing entrance road runs is slated for residential development. When this occurs, more than 100,000 Refuge visitors per year will be routed through a residential neighborhood. This will be especially problematic during the hunting season, when hunters begin to stack up on the entrance road at 4 in the morning.

Cost/Feasibility: This is the lowest cost of all alternatives. The cost of this alternative would include replacement of the aging one-lane bridge and moving or replacing the automatic gate when private land along the entrance road is developed.

NEPA and 4(f): Under Alternative 1 no action would be taken. Because no federal action would be taken, there would be no requirements under NEPA or under Section 4(f). Of all the alternatives, this one would have the least costs associated with environmental clearance.

Existing pedestrian bridge over railroad tracks

Alternative 2 Improve Current Access

	Refuge Resources	Safety & ADA Compliance	Increased Visitation	Impacts to Visitors	Impacts to Community	Cost & Feasibility
Alt 2	Yellow	Green	Green	Green	Green	Orange

Refuge Resources: Impacts to habitat/wildlife would be short-term during construction. However, significant tree felling on the Hillhurst Road parcel would be necessary to widen the entrance road. There would be minor impacts to wildlife and habitat because of the larger footprint for the bridge footing. Impacts to federally listed species are slight. The widened entrance road and bridge would benefit Refuge operations.

Safety & ADA compliance: Safety along the entrance road would be improved by widening. Implementation of this alternative would require the purchase of land to allow for road improvement and bridge construction. Elimination of the at-grade railroad crossing would increase safety. The existing bridge to the Carty Unit would be replaced with a new bridge that would be accessible to visitors with disabilities.

Accommodates Increased Visitation: This alternative would accommodate the anticipated increased visitation. The current trend of increasing visitation is likely to continue, albeit at a slower rate than in Alternative 3. Removal of the at-grade railroad crossing would decrease the possibility of traffic backups on the entrance road and on the auto tour route.

Impact to Visitors: The current entrance road, which winds through a wooded canyon, provides a gradual transition from a suburban to a rural (Refuge) environment, and therefore, enhances the visitor experience. Widening the road would enhance the visitor experience and increase safety. The visitor experience would be further improved compared to Alternative 1 because traffic on the entrance road would not back up when trains pass.

Key Issues: The success of Alternative 2 hinges on two things: The ability to procure the parcel of land adjacent to the River "S" Unit; The availability of funding. This alternative meets the Purpose and Need, as well as the evaluation criteria. However, the cost of constructing a two-lane bridge with sufficient height and length to clear both the railroad tracks and the navigable waters of Lake River is high.

Impact to Community: Of all the alternatives, Alternative 2 would have the lowest impact to the community. The purchase of land adjoining the entrance road would eliminate potential of routing Refuge traffic through a residential neighborhood. However, this alternative does not provide the linkages to community development projects or to pedestrian and bicycle trails that alternatives 3 and 4 do.

Cost/Feasibility: The cost of building the bridge to eliminate the at-grade crossing and span navigable waters will be high. Land acquisition will be necessary to improve the entrance road and to build the bridge.

NEPA and 4(f): Under Alternative 2, issues related to NEPA and to Section 4(f) would be less complicated than with alternatives 3, 4, and 5. It is possible that Alternative 2 could be cleared under NEPA with a Categorical Exclusion (CE) and could be cleared under Section 4(f) requirements with an exemption or a programmatic agreement. Of all the action alternatives (alternatives 2 through 5), this one would be the least costly and take the least amount of time for environmental clearance.

Alternative 3 Link to Port of Ridgefield Proposed Bridge

	Refuge Resources	Safety & ADA Compliance	Increased Visitation	Impacts to Visitors	Impacts to Community	Cost & Feasibility
Alt 3	Yellow	Green	Green	Yellow	Red	Red

Key Issues: This alternative would increase the transportation footprint on the Refuge, would negatively impact a houseboat community, and would reduce the number of duck blinds available for the hunting user group. The cost of mitigating impacts to the houseboat community and of constructing the bridge would be high.

The Port of Ridgefield (Port) currently is analyzing alternatives for a Rail Overpass Project to provide a safer and more efficient passage from downtown Ridgefield across the BNSF Railroad tracks into the Port and waterfront area. The preferred alternative for the Rail Overpass Project proposes an overpass from the intersection of State Route 501/Pioneer Street and N. Main Avenue in downtown Ridgefield.

Alternative 3 would tie directly into the Port's preferred alternative. Tying into the proposed Rail Overpass would create a new access point into the River "S" Unit. Alternative 3 would span the railroad tracks and Lake River. A new entrance road would be constructed, which would connect to the existing auto tour road in the River "S" Unit.

Refuge Resources: Minor additional impacts to Refuge resources (habitat) would occur because of the larger area required for the bridge footings and because the construction of a connector road along the toe of the dike to the auto tour route would be required. A small seasonal wetland, located at the toe of the levee in East Hall Field, would be impacted under this alternative. There is the potential for light to moderate decreases in wildlife use of the north end of the River "S" Unit because of vehicular traffic on the two-lane road. Impacts to federally listed species would be slight.

Safety & ADA compliance: This alternative would result in a safer overall system than for Alternative 1 because visitors would no longer use the existing entrance road. This alternative eliminates the at-grade rail crossing to the River 'S' Unit. The existing bridge to the Carty Unit would be replaced with a new bridge that would be accessible to visitors with disabilities.

Accommodates Increased Visitation: This alternative would accommodate increased visitation. However, this alternative also is likely to cause visitation to increase at higher rates than current projections (see discussion below).

Impact to Visitors: There are both positive and negative aspects to this alternative. This alternative likely would cause visitation to increase at higher rates than what the Refuge experiences currently. Because the Refuge would be accessed directly from downtown Ridgefield, the entrance is more visible and the Refuge is therefore likely to get more casual visitors. This alternative also is likely to increase the number of local visitors making short, frequent visits to the Refuge.

At a certain level of visitation, the quality of the visitor experience will be compromised to the point where measures to reduce auto traffic or limit visitor numbers will need to be taken. The character of the entrance would be changed from the gradual transition to a rural environment provided by the current entrance road, to a much more "urban" experience (going directly from town, over a high 2 lane span, to the Refuge).

On the other hand, this alternative would have the potential for linking the Refuge to walking and bicycling trails, which could decrease motor vehicle use and increase pedestrian use. This would have several benefits, such as decreasing vehicle emissions and increasing health benefits for visitors.

There is the potential for people who did not intend to visit the Refuge to take the left-hand turn to the Refuge; they would then have to double back on the Refuge. The straight stretch of two-lane road linking the bridge to the auto tour route is more likely to encourage speeding.

Two hunting blinds would need to be moved; however, Refuge staff feels that this can be accomplished without decreasing hunting opportunities. This would, however, create a tighter hunting environment.

Impact to Community: There are both positive and negative aspects to this alternative. It eliminates the potential of Refuge traffic through a residential neighborhood. It provides a much tighter link between the town of Ridgefield and the Refuge because the Refuge can be accessed directly from downtown. This alternative also would provide a direct link between the Refuge and the Port of Ridgefield's proposed waterfront development (and in the future to biking trails and walking trails). On the other hand, recent discussions with the Ridgefield gateway committee indicates that they would be opposed to this alternative because of the visual barrier the elevated bridge would create.

The proposed site for the new bridge would span a houseboat community on Lake River. Houseboats would need to be relocated for Alternative 3. Right of way acquisition in this industrial zoned area could be expensive. A review would be needed to determine whether Alternative 3 would result in "…disproportionately high and adverse human health and environmental effects on minorities and low-income populations." This would include the short-term (construction related) and the long-term impacts and benefits to the houseboat community.

Cost/Feasibility: This alternative has the highest cost of all alternatives because of the size of the bridge and because of the high cost of right of way acquisition in the industrial-zoned area on the east side of Lake River.

An approximately 0.75-mile-long new access road from the end of the off ramp of the bridge on Refuge property south to the existing auto tour route would need to be constructed. The Refuge originally proposed placing the new road alignment along the top of a dike that parallels Lake River. During a scoping field trip on December 19, 2007, between the WFLHD and the Refuge, Rich Barrows, Geotechnical Engineer for the WFLHD, suggested the new road alignment should follow the toe of the existing dike because it would have far less impacts than increasing the size of the dike in order to accommodate two lanes of traffic. Paralleling the toe of the dike would minimize wildlife disturbance and impacts to habitat.

NEPA and 4(f): Alternative 3 would be more difficult to clear than Alternative 2. Alternative 3 would need to be evaluated under either an Individual or Programmatic Evaluation for Section 4(f) impacts, and Alternative 3 would cost more and take longer to clear through the NEPA process than Alternative 2.

Cathlapotle Plank house in the Carty Unit

Alternative 4 Build a Bridge from Port Property

	Refuge Resources	Safety & ADA Compliance	Increased Visitation	Impacts to Visitors	Impacts to Community	Cost & Feasibility
Alt 4	Yellow	Green	Green	Yellow	Green	Yellow

Refuge Resources: This alternative would result in additional minor impacts to Refuge resources (habitat) because of the area required for the bridge footings and because construction of a connector road along the toe of the dike to the auto tour route would be required. A small seasonal wetland, located at the toe of the levee in East Hall Field, would be impacted under this alternative. There is the potential for light to moderate decrease in wildlife use of the north end of the River "S" Unit because of auto traffic on the two-lane road. Impacts to federally listed species would be slight.

Key Issues: This alternative assumes the completion of the Port of Ridgefield Rail Overpass.

Safety & ADA compliance: This alternative would result in a safer overall system than for Alternative 1 because visitors would no longer use the existing entrance road. This alternative eliminates the at-grade rail crossing to the River 'S' Unit. The existing bridge to the Carty Unit would be replaced with a new bridge that would be accessible to visitors with disabilities.

Accommodates Increased Visitation: This alternative would accommodate increased visitation. However, this alternative also is likely to cause visitation to increase at higher rates than the Refuge experiences currently (see discussion below).

Impact to Visitors: There are both positive and negative aspects to this alternative. This alternative likely would cause visitation to increase at higher rates than what the Refuge experiences currently. Because the Refuge would be accessed directly from downtown Ridgefield, the entrance is more visible and the Refuge is therefore likely to get more casual visitors. This alternative also is likely to increase the number of local visitors making short, frequent visits to the Refuge.

At a certain level of visitation, the quality of the visitor experience will be compromised to the point where measures to reduce auto traffic or limit visitor numbers will need to be taken. The character of the entrance would be changed from the gradual transition to a rural environment provided by the current entrance road, to a much more “urban” experience.

On the other hand, this alternative would have the potential for linking the Refuge to walking and bicycling trails, which could decrease motor vehicle use and increase pedestrian use. This would have several benefits, such as decreasing vehicle emissions and increasing health benefits for visitors.

There is the potential for people who did not intend to visit the Refuge to take the left-hand turn to the Refuge; they would then have to double back on the Refuge. The straight stretch of two-lane road linking the bridge to the auto tour route is more likely to encourage speeding.

Two hunting blinds would need to be moved; however, Refuge staff feels that this can be accomplished without decreasing hunting opportunities. This would, however, create a tighter hunting environment.

Impact to Community: This alternative eliminates the potential of Refuge traffic through a residential neighborhood. It provides a much tighter link between the town of Ridgefield and the Refuge because the Refuge can be accessed directly from downtown. This alternative also would provide a direct link between the Refuge and the Port of Ridgefield’s proposed waterfront development. In the future, there also would be the potential to develop transportation linkages from the Refuge to waking and bicycling trails.

Cost/Feasibility: Costs associated with this alternative are lower than Alternative 3 due to the some what smaller bridge and lower cost of right of way acquisition in the industrialized-zone area on the east side of Lake River.
An approximately 0.75-mile-long new access road from the end of the off ramp of the bridge on Refuge property south to the existing auto tour route would need to be constructed. The Refuge originally proposed placing the new road alignment along the top of a dike that parallels Lake River. During a scoping field

trip on December 19, 2007, between the WFLHD and the Refuge, Rich Barrows, Geotechnical Engineer for the WFLHD, suggested the new road alignment should follow the toe of the existing dike because it would have far less impacts than increasing the size of the dike in order to accommodate two lanes of traffic. Paralleling the toe of the dike would minimize impacts to wildlife.

NEPA and 4(f): Alternative 4 would require a similar effort as Alternative 3 for environmental clearance. Alternative 4 would need to be evaluated under either an Individual or Programmatic Evaluation for Section 4(f) impacts, and Alternative 4 would have similar costs and take about the same amount of time to clear through the NEPA process as Alternative 3.

Deterioration of existing State Route 501

Alternative 5 *Reopen Southern Access*

	Refuge Resources	Safety & ADA Compliance	Increased Visitation	Impacts to Visitors	Impacts to Community	Cost & Feasibility
Alt 5	Red	Green	Green	Red	Orange	Red

Key Issues: Alternative 5 impacts core habitat for dusky Canada geese and sandhill cranes, and it does not provide direct access for Refuge maintenance.

Refuge Resources: Under this alternative, major negative impacts to Refuge purposes species (dusky Canada geese and sandhill cranes) would occur. The road would be placed through or adjacent to their core habitat areas, including an important roost site for sandhill cranes (Campbell Lake). Likewise, there would be major negative impacts to Refuge operations because of the distance from the Refuge headquarters to this proposed entrance. A 30-mile detour through Vancouver would be necessary to get Refuge vehicles and heavy equipment from the Refuge headquarters in Ridgefield to the River "S" Unit. This would result in increased driving time, staff time, and fuel costs. This alternative could benefit cooperative grazers by providing them with more direct access to pastures. This alternative would, however, require new gates and fencing, which would increase costs. The entire road, from Lower River Road parking lot to River S would need to be upgraded (it is currently only one lane.) This would require removing Oregon ash trees in an area of high-quality habitat with a fairly intact under-story.

Safety & ADA compliance: Under this alternative, safe access would be provided. This alternative would eliminate the at-grade railroad crossing. The potential for more law enforcement issues may increase because of the distance from this entrance to the Refuge Headquarters; however, this could be offset by the potential for an increased amount of vehicle traffic on the Refuge, which may lessen the attractiveness of the south end to vandals.

Accommodates Increased Visitation: This alternative could accommodate increased visitation. However, visitation would be unlikely to increase at current rates (and possibly would decline) because the southern access point is less conveniently located than the current one.

Impact to Visitors: Currently, many visitors make short, frequent visits to the Refuge (i.e. for their lunch hour or an afternoon) and these visitors would be put off by a greatly increased drive time to the Refuge entrance. This alternative also would greatly increase the difficulty of conducting the waterfowl hunting program because of the distance from the entrance to the Refuge Headquarters. Likewise, under this alternative, the ability of Refuge staff to conduct special bird viewing tours would be eliminated because of the increased drive time from the Refuge Headquarters.

Some visitors, especially "hard-core" birders, may appreciate the increased access to the south end of the Refuge and the lower visitor numbers; however, the increased disturbance to wildlife under this alternative may end up reducing wildlife use of the area and therefore, viewing opportunities. Potentially, the Refuge (with the exception of the Carty Unit) would need to be closed seasonally to public use to prevent unacceptable levels of disturbance to wildlife.

Impact to Community: This alternative would hinder the cooperative efforts between the Refuge and the City of Ridgefield, would hinder the ability to put on the Bird Fest, and would hinder the ability for Ridgefield to promote itself as a gateway community to the Refuge and to link to Port development. The reduced visitation could decrease economic benefit of the Refuge to the community. On the positive side, this alternative eliminates the potential for Refuge traffic through a residential neighborhood and does not impact houseboat residents.

Cost/Feasibility: Although a new bridge is not required under this alternative, implementing Alternative 5 would require repair and widening of the existing dike, which is severely eroded at several points. Additionally, it would require that 4 miles of road from the Lower River Road parking lot to the River "S" Unit be upgraded (it is currently only one lane). The portion of the road through the Roth Unit would need to be elevated to prevent flooding. The Refuge does not own the dike or dike road. Based on previous discussions, it appears unlikely that the County would abandon its right of way. To date the County has not expressed interest in repairing or maintaining the dike and road for its own needs. Implementing this alternative would require purchase of right of way with a maintenance agreement in order for the USFWS to fund repair/construction.

NEPA and 4(f) – This alternative would meet some of the transportation needs of the Refuge, but the noise and visual impacts through one of the Refuge's prime foraging and roosting areas for dusky Canada geese and sandhill cranes is not consistent with Refuge purposes. Alternative 5 would be the least optimal and probably the most complicated in terms of cost, schedule, and clearance under NEPA and the Section 4(f) process.

Ridgefield Wildlife Refuge
Photography By Roxanne Bash

Summary of Key Issues

Alternative 1 – The 'No Build' alternative does not adequately address safety issues of the at-grade rail crossing, increased visitation, and ADA access concerns

*Alternative 2 –*The success of Alternative 2 hinges on two things: The ability to procure the parcel of land adjacent to the River "S" Unit; The availability of funding. This alternative meets the Purpose and Need, as well as the evaluation criteria. However, the cost of constructing a two-lane bridge with sufficient height and length to clear both the railroad tracks and the navigable waters of Lake River is high.

Alternative 3 – This alternative would increase the transportation footprint on the Refuge, would negatively impact a houseboat community, and would reduce the number of duck blinds available for the hunting user group. The cost of mitigating impacts to the houseboat community and of constructing the bridge would be high.

Alternative 4 – This alternative assumes the completion of the Port of Ridgefield Rail Overpass.

Alternative 5 – Alternative 5 impacts core habitat for dusky Canada geese and sandhill cranes, and it does not provide direct access for Refuge maintenance.

For additional information please see the
Ridgefield National Wildlife Refuge Comprehensive Conservation Plan
or contact: Robert Flores, Project Leader, 360-887-4106

U.S. Department of Transportation

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Appendix M. Land Protection Plan

Ridgefield National Wildlife Refuge
Clark County, Washington

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

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Land Protection Plan

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1.1 INTRODUCTION

This Land Protection Plan (LPP) provides a description of the biological resources, threats to the resources, habitat protections needed, and land acquisition methods for private and State held lands within the existing approved boundary of the Ridgefield National Wildlife Refuge. Individual tracts within the approved boundaries and their priority for acquisition are depicted in Table 1. Contingent upon funding availability, the Service would purchase fee title or easement interests from willing sellers of privately owned land. There is also the potential for entering into cooperative management agreements with the Washington Department of Natural Resources and the Washington Department of Transportation for tracts within the approved boundary. Should the U.S. Fish and Wildlife Service (Service) acquire these tracts, this LPP describes in conceptual terms the proposed management. Specific management actions and their associated impacts are evaluated elsewhere in the Comprehensive Conservation Plan.

Potential expansion of the refuge acquisition boundary will be considered separately as part of a larger land protection planning study for the Lower Columbia River area (see Chapter 2 of this CCP, Actions Common to All Alternatives, page 2-6).

On May 18, 1965, the Migratory Bird Commission, under the authority of the Migratory Bird Treaty Act of 1929, approved the establishment of Ridgefield National Wildlife Refuge and identified a 6,130.8-acre acquisition boundary for the Refuge. Since the Refuge was established the acquisition boundary has been modified to encompass 6,170 acres. To date, a total of 5,217.7 acres within the approved boundary are currently under fee title, agreement, or lease. As opportunities arise with willing sellers, the Service may either enter into management agreements or directly purchase lands within the approved boundary. Until lands are formally acquired, owners of land within a refuge boundary retain all the rights, privileges, and responsibilities of land ownership. Additionally, secure and well managed in-holdings may similarly serve purpose species and resources. Expanding the Refuge through acquisitions help meet the National Wildlife Refuge System goals of preserving, restoring, and enhancing, in their natural state ecosystems (when practicable), all endangered or threatened species, migratory birds, anadromous fish, and a natural diversity and abundance of fish, wildlife, and plants on refuge lands. Acquiring lands within the approved boundary helps the Refuge fulfill its purposes and ensures that the land will be managed for wildlife needs in perpetuity.

1.2 PROJECT DESCRIPTION

This project involves a review and prioritization of the inholdings at Ridgefield National Wildlife Refuge. The inholdings were evaluated based on their wildlife value and the protection of wetlands, managed pastures, oak woodlands, mixed coniferous forest, floodplain forests, and associated riparian communities.

1.3 THREATS TO AND CONDITION OF THE BIOLOGICAL RESOURCES

This section describes the biological resources associated with each inholding tract, the threats facing them, and their current condition. The locations of the tracts are shown in Figure 1.

Tracts 18, 22, 27 and 42

These tracts account for approximately 994 acres within the approved Refuge boundary, between Gee Creek and the Lewis River. The tracts are discussed collectively due to their location near the north boundary of the Refuge and common habitat types. Tract 18 represents approximately 992 acres of the total acreage. The remaining three tracts are very small parcels on the periphery of Tract 18. All parcels are in private ownership.

The habitat of Tract 18 includes bottomland riparian forest including Pacific willow, Oregon ash, and black cottonwood stands. The tract also contains creeks, sloughs, wetlands, and lakes that are hydrologically linked to both river levels and tidal influences. These low velocity backwaters are important to anadromous fish for off-channel rearing sites. In addition, Tract 18 contains Lancaster Lake, which was formerly connected to the Gee Creek system, but is now separated by an earthen dike. The uplands of Tract 18 are populated by oak woodlands, grasslands, and pastures. A large forested knoll ("Middle Lands"), composed of Grande Ronde basalt exposed by Ice Age floods, was historically logged but reforested by the Morgan family after they acquired the property in the 1940s.

The primary economic use of Tract 18 is cattle grazing and waterfowl hunting leases. Interspersed wetlands and grazed pastures, combined with minimal human activity on these private properties, have created conditions favorable to wintering waterfowl. A limited number of hunting leases are let, creating a minor disturbance during the winter period. With the land owner's permission, Tract 18 contains a seasonal portion of the Refuge's Oaks to Wetlands Trail. Refuge visitation along the trail likely represents a larger disturbance to adjoining wetlands in Tract 18 than uses derived from the private parcel.

Property ownership has been secure with parcels passing between generations. Barring any major management changes, these parcels are generally secure and are in good stewardship.

Tract 24

This 306-acre parcel is on the northwest corner of Bachelor Island. The parcel is a membership-owned private waterfowl hunting club, Bachelor Island Conservation Farms. The majority of the tract is comprised of Canvasback Lake. Canvasback Lake is a regular roosting location for sandhill cranes (State endangered) in Washington. Canvasback Lake also supports a significant number of waterfowl, shorebirds, and wading birds. Tract 24 contains bottomland riparian forests consisting of Pacific willow, Oregon ash, and black cottonwood forests. Several small upland areas are farmed by members of the hunting club. These agricultural practices attract wintering waterfowl that forage on the grains. The parcel is largely undeveloped with the exception of a small building and a roadway connecting the building to the remainder of the parcel. The primary use of the land is for waterfowl hunting which includes a small farming operation. The club contains a limited number of lifetime members to maintain a quality hunting program. The club also hunts limited days throughout the season to maintain program quality.

The land ownership of Tract 24 is currently stable and the tract's management is consistent with wildlife values. Over time, the parcel will transition into new club members bringing the potential of commercial interests and development. Even minor infrastructure changes on the parcel could significantly reduce wetland values and impact sandhill cranes and other waterbirds.

Tracts 40, 40a (Roth Lowlands)

Tracts 40 (43 acres) and 40a (2 acres) contains a mixture of riparian bottomland forest, wet meadows during seasonal flood events, and pastures between Lake River and Campbell Lake. The two parcels are in a single private ownership. The riparian forests are comprised of Pacific willow in the lower elevation flats transitioning to black cottonwood. These riparian forests are home to resident and migrant neotropical songbirds. Scattered individual Oregon white oaks occupy the highest terraces above the influence of frequent flood events. Scattered oak trees throughout the area have value in attracting and sustaining oak obligate wildlife species like slender-billed white-breasted nuthatches. Dusky Canada geese and other waterfowl are known to concentrate in the pastures and wet meadows of this parcel.

The primary economic use of these parcels is cattle grazing and waterfowl hunting leases. The parcel contains several hunt blinds that are leased to waterfowl hunters. Acquisition of Tract 40 is important to preclude future development or commercial interests that would detract for its overall value to wildlife. Disturbance is a major threat to wildlife on the Roth property and adjoining Refuge land. Depending on the season, disturbance can be either hunting or agricultural practices. Hunting in this area is in close proximity to roosting sandhill cranes which are highly susceptible to disturbance. Disturbances occurring on the parcel may additionally reduce dusky Canada goose and waterfowl use on adjacent Refuge pastures and wetlands.

Tract 2 (Washington Department of Transportation)

Tract 2 is a narrow, linear, approximately 32-acre parcel that lies within the east side of the Refuge's Ridgeport Dairy Unit, parallel to Lake River. The parcel is predominantly pasture and wet meadow, with a narrow strip of riparian vegetation along Lake River. Tract 2 is contiguous with a tract of land owned by WA DOT, a west right of way for State Route 501 that lies outside the current acquisition boundary between Campbell Lake and the Roth Lowlands Addition. Being a property of the State, Tract 2 has secure ownership. However, the parcel has eminent threats with the continued industrial and public use development within the Vancouver Bottoms increasing the demand for corridors to link transportation, services, utilities, and communities. Development of a transportation corridor east of Post Office and Campbell Lakes would reduce wildlife sanctuary values in the Roth and Ridgeport Dairy Units. The wetlands, fields, and lakes of the Roth and Ridgeport Dairy Units hold high densities of dusky Canada geese, swans, and other waterfowl. Campbell Lake is also a primary roosting location for sandhill cranes (State endangered) in Washington.

Tract 2aa (Washington DNR)

Tract 2aa includes approximately 180 acres on the southwest shoreline of Bachelor Island. It largely consists of dredge spoils deposited from river channel maintenance. Over time, riparian bottomland forests have pioneered this accreted terrain. The inlet of a historic blind slough was filled, plugging the entrance and establishing Turtle Lake of Bachelor Island. The lake, shoreline, and riparian forests created by the dredge deposits are now property of the Washington Department of Natural Resources (DNR). Turtle Lake sees considerable waterfowl use including ducks, geese, and swans. Turtle monitoring has established high densities of painted turtles in Turtle Lake. Notably, the sandy soil substrate and light vegetative cover in uplands adjacent to Turtle Lake create ideal conditions for turtle nesting. The forests support riparian obligate resident wildlife and neotropical migrants. The riparian forest has supported up to two nesting pairs of bald eagles.

With the land in the public domain, there are limited economic or commercial activities on this parcel. The parcel does, however, see significant public use throughout the year. Waterfowl hunters are known to moor their boats on the shore of the island and hike into Turtle Lake to hunt. In defiance of State Regulations, several permanent blinds have been constructed on Turtle Lake. Several years ago, a hunt blind was constructed in the top of a cottonwood tree for pass shooting geese. This tree was cut down in protest by hunters along the shoreline of Bachelor Island. Presumably, the tree blind was impacting hunters using the shoreline. The following waterfowl season a second tree blind was constructed and remains in the canopy of the forests. Year-round kayakers and canoeists use the shoreline of Bachelor Island for a picnic area, rest spot, and hiking. Spring and summer bring large surges in public use. The beach is a popular spot for summer beach camping. Arriving by boat, campers will spend extended periods along the shoreline. Lacking facilities, the campers will dig pit toilets in the woods and higher terraces. Campers will erect driftwood in the sand as a frame for tarp covered shanties. Often these structures are left standing at the end of the camping season with deteriorated tarps littering the beach. Associated with summer shoreline camping is bank fishing and water sports. These include boating, jet skis, and tow-behind water toys. Bachelor Island is immediately opposite the Sauvie Island clothing-optional beach. With increasing frequency, nudists are boating to Bachelor Island in search of a more remote or secluded location. Between public use and materials deposited along the beach from the river, the shoreline is littered with trash and debris. Floodwaters have brought in large chemical drums and rafts of tires. Contaminants must be considered, both intentionally dumped or deposited by flood events. Another concern with the parcel is its attraction to those conducting illegal activities and the law enforcement required to prevent these activities.

Tract 2b (Washington DNR)

This approximately 7.4-acre tract includes waters surrounding a 3.6-acre island at the confluence of Gee Creek and the Columbia River. With the land in the public domain, there are limited economic or commercial activities on this parcel. Previous attempts to acquire this parcel from DNR were deemed not in the interest of the State.

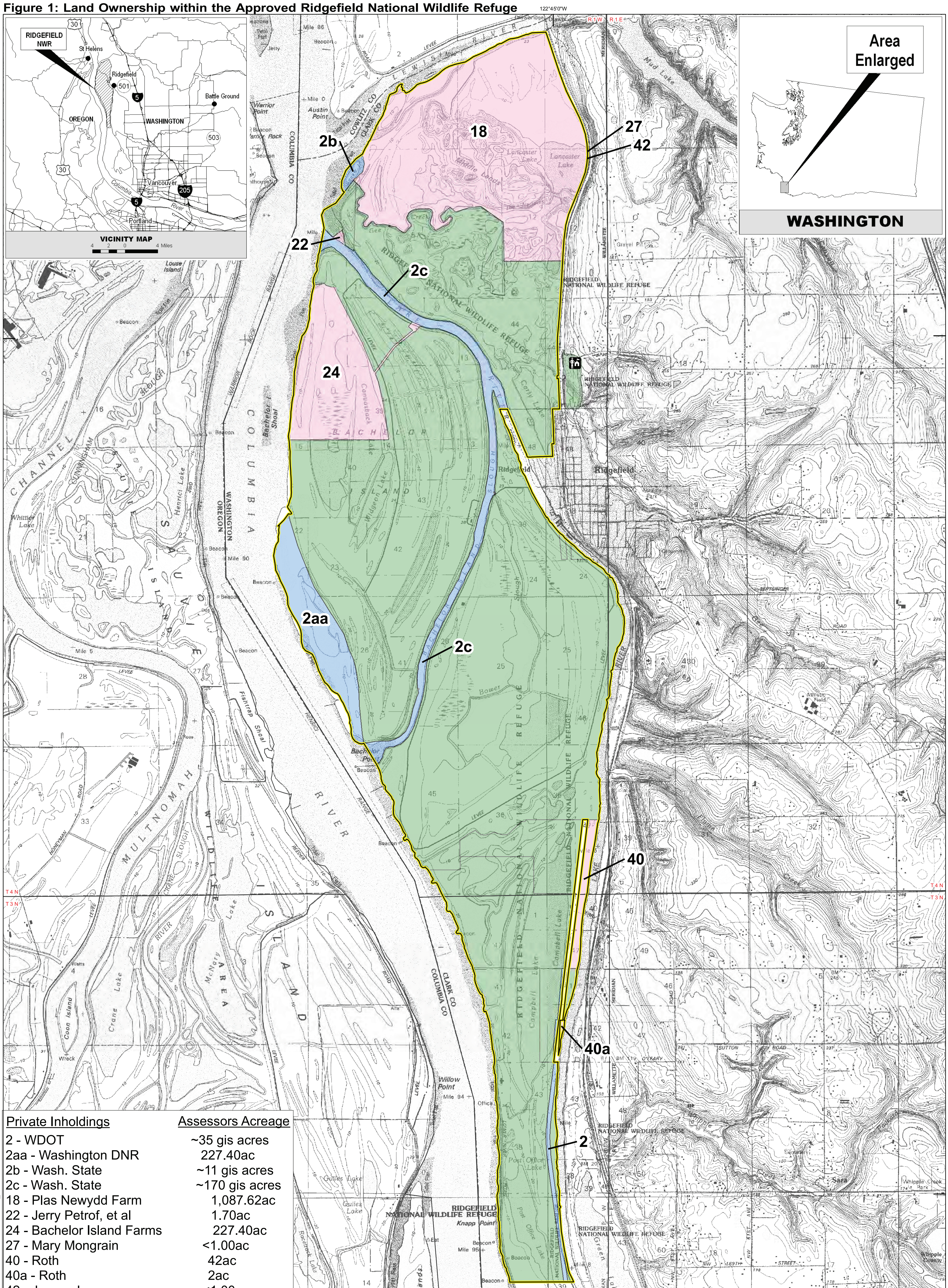
Tract 2c (Washington DNR)

This approximately 170-acre tract includes the navigable waters (below mean high tide) of Bachelor Slough and a portion of Lake River, from the northern tip of Bachelor Island to the northern tip of the River ‘S’ Unit (River ‘S’ Point). With the land in the public domain, there are limited economic or commercial activities on this parcel. The primary activities currently occurring on this parcel are motorized and nonmotorized boating, e.g. kayaking. In the past the Refuge desired to acquire rights or an easement to this tract in order to control hunting.

1.4 HABITAT PROTECTION METHODS

With regard to the private land, the Service would pursue either fee title or easement interests from willing sellers. The Service would pursue a cooperative management agreement with Washington DNR for Tract 2aa, and with the Washington Department of Transportation for Tract 2.

Figure 1: Land Ownership within the Approved Ridgefield National Wildlife Refuge



Private Inholdings	Assessors Acreage
2 - WDOT	~35 gis acres
2aa - Washington DNR	227.40ac
2b - Wash. State	~11 gis acres
2c - Wash. State	~170 gis acres
18 - Plas Newydd Farm	1,087.62ac
22 - Jerry Petrof, et al	1.70ac
24 - Bachelor Island Farms	227.40ac
27 - Mary Mongrain	<1.00ac
40 - Roth	42ac
40a - Roth	2ac
42 - James Joyce	<1.00ac

Produced in the Division of Realty & Refuge Information
Portland, Oregon
Land Status Current to: 3/25/2010
Map Date: 03/25/2010
Basemap: 24k USGS Quad
Meridian: Boise
File: 10-099-1.mxd

Scale: 1:20,000

0 0.5 1 Miles

0 0.5 1 Kilometers

Legend

- USFWS Approved Acquisition Boundary
- USFWS Managed
- State Inholdings
- Private Inholdings

UTM ZONE 10
NAD 83

1.5 LAND PROTECTION PRIORITIES

The Service assigned each property a Tract Number associated with the name of the landowner and provided the County Assessor's Parcel Number (APN) for each parcel (Table 1). The Service also assigned each parcel a priority for protection based on the value of the parcel for conservation and management purposes. A preferred method of protection was determined for each parcel as well, considering the options of cooperative agreement, fee title, and easement. Service policy is to acquire the minimum interest in land necessary to achieve refuge resource conservation goals and to include entire ownerships (mainly for appraisal purposes) in the project area, even though only a portion may contain wildlife habitat of interest.

Table 1. Land Protection Priorities for Ridgefield National Wildlife Refuge

Service Tract Number	Landowner of Record	County APN Number and Parcel Acreage[1]	Parcel Acreage Within Refuge Boundary[2]	Protection Priority[3]	Preferred Protection Method[4]
18	Plas Newydd Farm	217593-000 (575.68 ac; 447.69 within Refuge boundary) 217798-000 (247.91 ac) 218003-000 (232.95 ac) 217594-000 (24.06 ac)	992.43 (GIS acres)	1	F
22	Jerry Petroff, et al.	217800-000 (1.7 ac)	1.70	1	F
27	Mary E. Mongrain	218005-000 (3.5 ac)	.11	1	F
42	James Joyce	218030-000 (2.5 ac)	.02	1	F
24	Bachelor Island Farms, Inc.	218560-000 (227.4 ac)	305.6 (GIS acres)	2	F
2	Washington Department of Transportation	N/A (32.37 ac)	32.37 (GIS acres)	3	C
40	Sidney Roth	220429-000 (45.35 ac)	43	4	F
40a	Sidney Roth	190130-000 (9.05 ac)	2	4	F
2aa	Washington Department of Natural Resources	218551-000 (180 ac)	180 (GIS acres)	5	C
2b	Washington DNR	N/A (7.4 ac)	7.4 (GIS acres)	6	C
2c	Washington DNR	N/A (170 ac)	170 (GIS acres)	7	C

[1]Total parcel acreages, including areas outside Refuge acquisition boundary. Acreages do not include water bodies within parcels.
[2] Includes water bodies within Refuge acquisition boundary
[3]Protection priorities are in the order of "1," "2," "3," etc. with "1" being the highest priority for acquisition.
[4] The preferred method of protection is symbolized "C" for cooperative agreement between agencies and "F" for fee title acquisition from willing sellers.

1.6 FUNDING

Federal funds to acquire these lands could become available primarily through annual appropriations by Congress from the Land and Water Conservation Fund, Migratory Bird Conservation Fund monies, and Bonneville Power Administration mitigation funds.

1.7 CONCEPTUAL MANAGEMENT

Lands acquired by the Service would be managed as part of the National Wildlife Refuge System under the National Wildlife Refuge System Administration Act of 1966, as amended. The following discussion covers the proposed management for the unacquired tracts within the approved acquisition boundary of Ridgefield National Wildlife Refuge.

<u>Tracts 18, 22, 27 and 42:</u> These parcels contain several habitat types that would compliment refuge management and conservation efforts: tidal wetlands, a large permanent wetland (Lancaster Lake), managed pastures, floodplain/riparian forest, oak woodlands, and coniferous forest. Acquisition of this land would consolidate the Refuge's boundary from the Burlington Northern Santa Fe Railroad line west to the Columbia River, and from the current Carty Unit boundary north to the Lewis River. Service acquisition would permanently safeguard the landscape from future commercial interest and threats, and protect habitats found on these parcels. Baseline surveys and surveys for rare species would be conducted.

Tract 18 contains several hundred acres of improved pastures, largely consisting of introduced "tame" pasture grasses. Cattle grazing and related activities on Tract 18 have maintained pastures well suited for wintering waterfowl on these parcels. Existing pasture areas would be managed to provide green browse for Canada and cackling geese. However, if ecologically feasible, a portion of acquired grasslands may be restored to native plant communities: wet meadow, emergent wetland, native upland prairie, floodplain/riparian forest, and/or oak woodland. Site conditions and adjacency to intact tracts of these habitats would dictate suitable restoration locations for these native plant communities. For example, low elevation grasslands adjoining remnant riparian areas are well suited for expansion of riparian areas through either direct planting or exposing soils to natural seedfall. Acquisition of lands could afford the Service the opportunity to restore these communities to sufficient widths and complexities to achieve a full array of beneficial ecological functions to support a diverse array of riparian dependant plants and animals. Management of floodplain and riparian forest areas would involve reducing nonnative invasive plant species and reestablishing components of the native shrub/herbaceous layer, where necessary.

Oregon white oak habitats in Southwestern Washington are rare and declining. Oregon white oak woodlands are a priority habitat for conservation efforts in the State of Washington. The Refuge's woodlands represent some of the most intact remnants of oak communities in the area. Acquisition of adjoining oak communities would be important to protect and manage an intact contiguous woodland for oak obligate species. Oak woodlands acquired by the Service would be protected from fragmentation. Management of the woodlands may include Himalayan blackberry control along woodland edges with herbicide or mechanically. Coniferous forests occur predominately above the floodplain on the basalt knoll ("Middle Lands") of Tract 18. Acquired forested uplands within Tract 18 would be managed to protect water quality in the lower Gee Creek watershed, and provide habitat for migratory landbirds and rare plant species.

Management of tidal wetlands would retain Columbia River hydrology, allowing for movements of anadromous salmonids (listed, proposed for listing, or candidates for listing under the Endangered Species Act) from the Columbia River to Refuge rearing habitats. The feasibility of restoring the historic connection of Lancaster Lake to Gee Creek could be explored for its potential to provide additional off-channel rearing habitat for juvenile salmonids. If acquired by the Service, these parcels could also be considered in feasibility studies for the reintroduction of Federally and State-listed species such as Columbian white-tailed deer and western pond turtle.

Tract 24: Acquisition of the parcel would consolidate the Service's ownership of all of Canvasback Lake and secure the largest waterbody within the Refuge's approved boundary. Acquisition of the Parcel would help the Refuge meet its purposes and ensure that the land will be managed for wildlife needs in perpetuity. Securing sandhill crane roosts from human disturbance and development pressures is a regional priority due to limited known crane roosts in the area.

Canvasback Lake would be managed to provide habitat for breeding and migrating waterfowl. Active management would reduce invasive plant species while promoting native tall and short emergent plant species. With removal of a small dike and water control structure, Canvasback Lake could be reconnected to the Columbia River. Management options would assess the restoration of Columbia River hydrology, allowing for movements of anadromous salmonids from the Columbia River to Refuge rearing habitats. Tracts of floodplain/riparian forest on this parcel would complement Refuge's efforts to restore forest to the south of this parcel, and create a larger contiguous blocks of riparian/floodplain forest on Bachelor Island.

Parcels 40, 40a: The acquisition of Parcels 40 and 40a would help meet Refuge goals by securing known dusky Canada goose, sandhill crane, and waterfowl habitat while reducing disturbance threats to established sanctuary areas of the Refuge. Cattle grazing and related activities on Parcel 40 have maintained pastures well suited for wintering waterfowl. Portions of the tracts could be considered for riparian restoration to create a wider riparian corridor along Lake River.

Parcel 2: Acquisition of Parcel 2 would preclude activities and development along this parcel and protect the core sanctuary areas and habitat values within the south end of the Refuge. The Service would greatly reduce future threats to this tract and adjoining critical habitats within sanctuary areas by purchasing or acquiring management authority of Parcel 2. Depending upon site conditions this parcel could continue to be managed primarily as improved pasture, or could be considered for riparian restoration to create a wider riparian corridor along Lake River.

Parcel 2aa: Inclusion of this parcel in the Refuge must be cautiously evaluated based upon the historic degree of non-wildlife dependent public uses, the potential of these uses to expand, the effort it may take to manage or regulate public use, and potential contaminants within the floodplain. Acquisition of this parcel would reduce disturbance to a nesting colony of great blue herons, and would secure a larger contiguous area of bottomland/riparian forest on Bachelor Island. The parcel could be evaluated as a potential reintroduction site for western pond turtles. If the parcel were acquired, existing public uses would have to be evaluated for appropriateness and compatibility.

Parcels 2b and 2c: Parcels 2b and 2c are lands designated as navigable waters by the State of Washington. Therefore even if the lands were acquired by the Service, current use of these waters by motorized and nonmotorized boats would continue.

1.8 COORDINATION

The Service held public scoping meetings in Ridgefield and Vancouver, Washington on September 14 and 20, 2006, regarding development of the Comprehensive Conservation Plan (CCP) for the Ridgefield National Wildlife Refuge. The Service provided a Planning Update describing the CCP effort at the public scoping meetings and to the Refuge' mailing list. The purpose, need, and alternatives for the conservation and management of refuge fish, wildlife, and plants and protection of their habitat was presented and discussed at the public scoping meetings.

Prior to the public scoping meetings, the Service sent letters to the Washington Department of Fish and Wildlife, the Oregon Department of Fish and Wildlife, the Chinook Indian Tribe, Cowlitz Indian Tribe, Clark County, Congressional officials, and other interested organizations and individuals informing them of the development of the CCP and inviting their participation.

This Land Protection Plan was issued for public review and comment as part of the Ridgefield NWR Draft Comprehensive Conservation Plan and Environmental Assessment (DCCP/EA). The plan was also provided as CDs to a mailing list of 432 recipients, and were made available on the FWS Region 1 Planning website. Printed copies of the DCCP/EA were available upon request. The 30-day review occurred from June 16 through July 16, 2010. We did not receive specific comments regarding the land protection plan, and no changes have been made at this time.

Appendix N. Comments and Responses

Table of Contents

Introduction

The Service made the Ridgefield NWR Draft CCP and Environmental Assessment, including draft Compatibility Determinations, available for review and comment for a 30-day period consistent with Service NEPA and National Wildlife Refuge System Administration Act requirements. Planning updates and copies of the Draft CCP/EA on CD were mailed to 432 recipients, and both the planning update and the Draft CCP/EA were posted on the Region 1 Planning website. A news release was also sent to regional and local media outlets. The public review and comment period closed on July 16, 2010.

The Service received written comment letters from 16 interested parties: 10 individual commenters, the Washington Department of Fish and Wildlife, the Oregon Department of Fish and Wildlife, and the Port of Ridgefield; and four nongovernmental organizations: the Washington Waterfowl Association, Lower Columbia River Chapter; the Vancouver Audubon Society; and the Ridgefield Junction Neighborhood Association.

Following are our response to those comments. The comments received did not address any topics which have not already been addressed in the NEPA planning process for the Ridgefield NWR CCP. Responding to these comments did not require changes to the Ridgefield NWR CCP, or to the Compatibility Determinations included with the CCP. At the request of the Washington Department of Fish and Wildlife, we included a strategy for sandhill crane monitoring in the CCP (Chapter 2, Objective 7.2) since it was consistent with both refuge purposes and the CCP goals and objectives.

N.1 Doug Hargin, Washington Waterfowl Association, June 25, 2010

Comment Letter 1

Doug Hargin
<dhargin@msn.com>
06/25/2010 09:42 AM

To Robert Flores <bob_flores@fws.gov>, Rick Scott <rickscott@columbiaautomation.com>, Doug Majury <dpmajury@comcast.net>
cc
bcc
Subject CCP Planning Update 4 Response

Hi Bob. We had our monthly meeting last night. The Ridgefield NWR CCP was our main area of discussion. To put it mildly the members are disappointed. Many are livid. We have rallied our members and other hunters to give written input and attend and engage at all the CCP meetings for over a year. Our input has been ignored and our time wasted base on the way the four alternatives have been worded pertaining to waterfowl hunting at the refuge. Whether by chance or design the the four options have been crafted in such a way as to frustrate the waterfowl hunter.

- **Option 1**, stay the same is just not going to happen after the time and effort put into the process. It is in reality a non-option.
- **Option 2**, "preferred by the refuge". This option for the hunter is equivalent to option one. After years of aquisition and promises we have no increase in hunting opportunity. We have in fact lost blinds from where we started years ago.
- **Option 3** would reflect what we experienced in last years hunting season. Closed goose hunting on the south end of the River S unit. This is based on the theory that more Dusky's congregate in this area.
- **Option 4** at first appears to be exactly what the hunter's comments asked for. Close down or modify the tour route on hunt days. Open up Bachelor Island to hunting. Then the hammer comes down. **Close the most productive hunt area on the refuge down?** Why a trade? Why close down an area we have hunted since this refuge was opened?

The only option we can endorse is number four, **with the CAVEAT** that **WE DO NOT CLOSE THE SOUTH END OF THE RIVER S UNIT TO AT LEAST DUCK HUNTING!** Barring this scenario the waterfowl hunt program has remained virtually unchanged through this process. With the acquisition of acreage the Ridgefield Complex has added since its inception. It is unfathomable that the the hunters have actually lost hunting blinds/opportunities over this same growth period for the refuge. WWA and other hunters viewed the CCP process as a way to rectify this situation. The way it stands at this moment, it appears to have been a waste of our time and effort.

Bob we respect and appreciate you and your staff. However the CCP is not currently crafted in a way that is acceptable to our members and a majority of the hunters we have contacted.

Sincerely,

DOUG HARGIN - SEC/TREASURER
RICK SCOTT - CHAPTER PRESIDENT
DOUG MAJURY - CHAPTER VICE PRESIDENT
LOWER COLUMBIA CHAPTER
WASHINGTON WATERFOWL ASSOCIATION

Response 1.
Service Response to Washington Waterfowl Association
Thank you for your comment. We have considered your request to combine Alternatives 3 and 4, thereby adding 250 acres to the hunting program. Being based adjacent to a major metropolitan area, the refuge is important to many user groups and is visited by thousands of people each year that engage in a variety of recreational activities. Opening additional refuge wetland areas to any public use through this planning process would effectively reduce the refuge's value to wintering waterfowl, dusky Canada geese, and other purpose species. A major resource concern is the loss of suitable habitat for ducks, geese, swans, cranes, and other purposes species. It is estimated that over half of the historic riverine wetlands, including 90% of tidally influenced freshwater wetlands, in the lower Columbia River have been lost or substantially degraded. During the lifetime of the CCP, there will be a continuing trend of loss, degradation, and fragmentation of wildlife habitat coupled with burgeoning population growth in the Portland-Vancouver metropolitan area. These factors will put greater pressure on wetland obligate species, including swans, ducks, geese, herons, and sandhill cranes. Wildlife will place higher demands on the remaining wetlands, as they congregate in greater densities in suitable habitat. For these reasons, it is not feasible to significantly increase the number of acres for any public use on the refuge.

Hunting is a very important public use on the refuge and is included in the 1964 Consolidated Report of the Proposed Ridgefield National Wildlife Refuge as a justification for the refuge's establishment. The refuge has stated our commitment to maintaining at least the current number of hunt blinds and area of influence to provide a significant number of hunting opportunities. Blind locations may need to be changed to permit safe operation of the new access road and bridge described in Alternative 2, but the refuge is committed to establishing new blinds to replace those lost. As stated in our many discussions with the hunting community and as described in the CCP, the refuge considers the impact on hunting opportunities when conducting wetland and pasture management as well as crop production (i.e. local waterfowl flyways, baiting issues, etc.). The refuge is required to consider a large number of factors in developing and operating the public use program including public interests, safety, impacts to resources, and how these programs achieve refuge purposes. This process is described in detail in Appendices A and B in the CCP (Appropriate Use and Compatibility Determinations).

In developing the CCP, the refuge must consider the goals and objectives contained in the Pacific Flyway Management Plan for the Dusky Canada Goose (2008) and the Northwest Oregon/Southwest Washington Canada Goose Agricultural Depredation Control Plan (1998). As a signatory to these plans, the Service has agreed to take steps to increase the numbers of these birds using the Refuge through both public use management and habitat management. As you are aware, dusky Canada goose numbers have been declining and remain well below management goals. Cackling Canada geese populations are also below management goals. Both these species, but especially the cackling geese, make use of the pastures and wetlands on Bachelor Island. The refuge has decided that maintaining the existing sanctuary area on Bachelor Island and implementing various habitat improvements described in the CCP will help these species reach established management goals, while still providing significant public use opportunities on the refuge.

N.2 Marc Krsul, Ridgefield Junction Neighborhood Association, June 2010

RJNA

Ridgefield
Junction
Neighborhood
Association

Comment Letter 2

Bob Flores, Project Leader
Ridgefield National Wildlife Refuge Complex
P.O. Box 457
Ridgefield, WA 98642

RE: Ridgefield National Wildlife Refuge Planning Update 4, June 2010

Dear Mr. Flores,

I am submitting this letter on behalf of the Ridgefield Junction Neighborhood Association (RJNA) in response to the latest Refuge planning update that was released on June 4, 2010.

The RJNA represents residents within the Ridgefield School District boundaries and provides a vehicle within which these citizens and community leaders can actively support the preservation and enhancement of the quality of life for the residents of not only Ridgefield, but Northern Clark County. Some of our members have been actively involved in Ridgefield's Downtown / Waterfront ongoing Integration Project. Many of the following comments are common to both groups.

After reviewing the Ridgefield National Wildlife Refuge Planning Update - CCP/EA update we offer the following comments.

1. Under your preferred alternative we strongly support the construction of a new bridge from Port of Ridgefield property to the River "S" Unit.

2. We also support the walking and limited vehicle access from Port property to the Plankhouse.

3. We are very supportive of the new seasonal 1.5-mile dike-top trail on the River "S" Unit. We would encourage you to work closely with the City and the Port in developing connectivity between down town and the Refuge.

4. We hope that you are successful in providing for artifact storage and curation at the new Refuge Visitor Center and that the James Carty collection can be returned to Ridgefield as were his wishes.

5. We support the proposed Nature Center / office and understand that a separate EA was prepared. We did not have the opportunity to review that EA but we cannot support the Center's location on the Carty Unit. However, we do support your second alternative (its location on Port property) identified in Section 1.8.2.

RJNA

Ridgefield
Junction
Neighborhood
Association

The following reasons support our position:

- Brownfield redevelopment vs. Greenfield

- Port's offer of four acres – FREE

- The proximity of the proposed Visitor Center located on the Carty Unit opposes your stance on connecting the Refuge to downtown. A connection through Overlook Park would be more appropriate

- Efficient use of existing utilities and infrastructure located within the City on Port property

- Improve connectivity between downtown, waterfront, neighborhoods and the Refuge – trail system

- As a major Port tenant, it could stimulate the community's economy and assist in the redevelopment of the waterfront

- Reduced Safety concerns along Main Street north of Gee Creek (foot traffic)

- Traffic impact and overuse of the road along Gee Creek – who will pay for this?

- When the new Refuge bridge is constructed to the River "S" Unit from Port property, the Nature Center / office will be readily accessible to all Refuge visitors, not just those visiting the Carty unit

- Your planned trail / limited vehicle access route from Port property to the Carty Unit would be immediately accessible from the Nature Center / office

Thank you for your consideration of our comments. Please do not hesitate to contact the RJNA if you have any questions regarding this matter.

Respectfully Submitted,

Marc Krsul, President
Ridgefield Junction Neighborhood Association
(360) 433-5822

Response 2.
Service Response to Ridgefield Junction Neighborhood Association
Thank you for your comments of support for future safe access needs of the refuge. Your comment concerning the Carty collection is consistent with strategies within Goal 2.5.1 to pursue funding and space to store/curate artifact collections currently stored off-site. Your comments are also consistent with strategies within Goal 2.6.3 to produce exhibits incorporating artifacts found on the refuge. It would be desirable to integrate the Carty collection into the exhibitory of a future Nature Center.

Your comments relating to Section 1.8.2 address Issues Outside the Scope of the CCP. Funding timelines required that the placement of a Nature Center and location of a Pedestrian Bridge be addressed in a separate Environmental Assessment. During initial scoping of the various alternatives for the Nature Center, the Refuge discussed the project and sought comments from the Port and the residents of Ridgefield on numerous occasions. We held public meetings, presented project updates to the public through local media outlets, and solicited public and agency comments.

As part of the EA, the Refuge did state our commitment to working with the City of Ridgefield to improve the connectivity with downtown Ridgefield through the future City of Ridgefield public trail which would parallel NW Main Ave. and join the Refuge trail system through the southern boundary of the Carty Unit near the proposed Nature Center.

For additional information on the Visitor Center, the final version of the Environmental Assessment and Finding of No Significant Impact is available at the Refuge's website. The public comment period for this EA has closed and the Finding of No Significant Impact was issued on April 29, 2010.

A Visitor Center sited on Port property would require a road to be built to transport participants in our environmental and cultural education programs to the Carty Unit and Plankhouse. This road would require considerable amounts of wetland fill and would require the refuge to obtain a Section 404 permit from the Corps of Engineers. With regard to impacts to jurisdictional wetlands, the Corps can only permit the "least environmentally-damaging practicable alternative (LEDPA)." The proposed Visitor Center site on the Carty Unit is a practicable alternative that would have fewer wetland impacts and thus is the only alternative that meets the LEDPA criteria.

N.3 Timothy C. Bourdet, July 11, 2010

Comment Letter 3

"tcbvlb3208 tds.net"
<tcbvlb3208@tds.net>
07/11/2010 10:27 PM

To FW1PlanningComments@fws.gov
cc
Subject "Ridgefield NWR DCCP/EA"

We need all the public lands open for hunting and fishing as possible. They are payed for by the taxpayer's of America and should be able to be used by them for recreation, closing them cuts revenue to local businesses and the Refuges themselves. It would be a shame to lose more public lands,there are few enough as it is. Please consider this in any proposals you make.

Thank You,
Timothy C. Bourdet
Disabled sportman and NRA Life Member

Response 3.
Service Response to Timothy C. Bourdet
Your comments request that proposals consider the loss of public lands to hunting and fishing. Additionally, you request that public lands be opened to hunting and fishing opportunities. Please note that all Alternatives within the Draft CCP/EA include maintaining hunting and fishing programs on the Ridgefield National Wildlife Refuge. With the ongoing loss of undeveloped land in the vicinity of the refuge, refuge lands are becoming even more important to wildlife. The Refuge has sought to comply with provisions in the Pacific Flyway Management Plan for the Dusky Canada Goose (2008) and the Northwest Oregon/Southwest Washington Canada Goose Agricultural Depredation Control Plan (1998). As signatories to these plans, the Service has agreed to take steps to increase the numbers of these birds using the Refuge through both public use management and habitat management. The refuge recognizes the importance of providing public recreation opportunities, but also recognizes the importance of sanctuary areas to dusky Canada geese and cackling geese, both of which are below their target populations. Therefore the Refuge has decided not to convert the existing sanctuary areas to public use areas. Hunting and fishing are appropriate uses of the Refuge System when compatible, that is when they do not materially interfere with or detract from the fulfillment of the mission of the Refuge System or the purposes for which the refuge was established. Please consult Appendix B for hunting and fishing Compatibility Determinations that describe the scope of these public uses and the stipulations necessary to ensure that these public uses are compatible.

N.4 Dan Latkovich, July 12, 2010

Comment Letter 4

outdoormandan@comcast.net
07/12/2010 02:52 PM

To FW1PlanningComments@fws.gov
cc
Subject Ridgefield NWR DCCP/EA

Bob:
I feel a need to register my disappointment at the four alternatives offered in the Draft CCP/EA. Your staff has a golden opportunity to set forth the framework of activities that would benefit the many and varied users of the Refuge over the next decade and beyond, yet there appears to be unnecessary compromises for the three alternatives that are different than the current management practices (Alternative 1). Some examples would include the following:

1. Even for those of us who only occasionally take the Auto Tour Route, the designated hunting area is still always closed - even though it is used for hunting only three and a half months of the year -and could be open the rest of the time for more wildlife viewing.
2. There is no appreciable increase in hunting opportunities for waterfowl hunters, even though the Refuge was in part created for that very purpose. And when I'm told by the Refuge staff the reason I (and others) don't get more reservations for the thirty dates I apply for every year is because they get "upwards of 200 requests for reservation days, even during the week" it is painfully clear the demand has far outweighed the available supply of nineteen non-handicap blinds. Moving the Check Station and creating two more blinds is a great idea and should be done post-haste regardless of the alternative chosen. It would be a good start.
3. Why open up Bachelor only to close down some of the most productive blinds in the current configuration? When you consider the need described in #2 (above) and the fact that this last year we proved we can successfully hunt ducks and not Duskies in the lower blinds, it makes no sense to close one and open another when you could have both for the many waterfowlers who want to hunt at the Refuge every year.
4. What indicates the need for more nesting and feeding areas for Duskies or any other waterfowl for that matter? One of the reasons the hunter success rate is as low as it is at the Ridgefield Refuge is because there are so many other places the birds have to

land and nest; they are not induced to land in the ponds that have hunting blinds. I've heard other hunters say that- ethical or not –they do sky-bust and unfortunately cripple birds because they often times only get passing shots, regardless of their decoy spreads and calling. It may be different if food crops were planted or there was a way to control the amount of water in the ponds and lakes at the Refuge but apparently there currently isn't. The ponds and lakes are so large the birds have a multitude of spots to nest and feed already.

5. Are you sure Blind #4 has to go with a new two-lane bridge installed in that area? Can't it be relocated? It is another very productive blind that would be a shame to lose.

I don't know if this 'two cents worth' from me will make any difference but there you have it. I know it is a big job for you and your staff to try and please as many people as you can and do what is right for the natural resources you are responsible for preserving. You all have my respect.

Sincerely,
Dan Latkovich

Response 4.
Service Response to Dan Latkovich
Thank you for your comment. The Draft CCP/EA has not proposed expansion of wildlife observation/photography into habitat for wintering waterfowl due to conflicts with resource protection. In developing the CCP, the refuge must consider the goals and objectives contained in the Pacific Flyway Management Plan for the Dusky Canada Goose (2008) and the Northwest Oregon/Southwest Washington Canada Goose Agricultural Depredation Control Plan (1998). As a signatory to these plans, the Service has agreed to take steps to increase the numbers of these birds using the Refuge through both public use management and habitat management. As you are aware, dusky Canada goose numbers have been declining and remain well below management goals. Cackling Canada geese populations are also below management goals. Both these species, but especially the cackling geese, make use of the pastures and wetlands on Bachelor Island. The refuge has decided that maintaining the existing sanctuary area on Bachelor Island and implementing various habitat improvements described in the CCP will help these species reach established management goals, while still providing significant public use opportunities on the refuge.

The Draft CCP/EA supports waterfowl hunting as a compatible and appropriate use at the Ridgefield National Wildlife Refuge. Under all alternatives within the DCCP/EA, the refuge will continue to provide, at minimum, its current waterfowl hunting opportunity. Alternative 4 proposes a slight increase in the overall acreage of the hunt program. Hunting is a very important public use on the refuge and is included in the 1964 Consolidated Report of the Proposed Ridgefield National Wildlife Refuge as a justification for the establishment of the refuge. The refuge has stated our commitment to maintaining at least the current number of hunt blinds and area of influence to provide a significant number of hunting opportunities. Blind locations may need to be changed to permit safe operation of the new access road and bridge described in Alternative 2, but the refuge is committed to establishing new blinds to replace those lost. As stated in our many discussions with the hunting community and as described in the CCP, the refuge considers the impact on hunting opportunities when conducting wetland and pasture management as well as crop production (i.e. local waterfowl flyways, baiting issues, etc.). The refuge is required to consider a large number of factors in developing and operating the public use program including public interests, safety, impacts to resources, and how these programs achieve refuge purposes. This process is described in detail in Appendices A and B (Appropriate Use Findings and Compatibility Determinations) in the CCP.

Opening both River 'S' Unit and Bachelor Island unit to public uses through this planning process would effectively reduce the refuge's value to wintering waterfowl, dusky Canada geese, and other purposes species. A major resource concern is the loss of suitable habitat for ducks, geese, swans, cranes, and other purposes species. It is estimated that over half of the historic riverine wetlands, including 90% of tidally influenced freshwater wetlands, in the lower Columbia River have been lost or substantially degraded. During the lifetime of the CCP, there will be a continuing trend of loss, degradation, and fragmentation of wildlife habitat coupled with burgeoning population growth in the Portland-Vancouver metropolitan area. These factors will put greater pressure on wetland obligate species, including swans, ducks, geese, herons, and sandhill cranes. Wildlife will place higher demands on the remaining wetlands, as they congregate in greater densities in suitable habitat. For these reasons, it is not feasible to significantly increase the number of acres for any public use on the refuge.

The placement of the bridge proposed in Alternative 2 is conceptual and its location is limited by the Port of Ridgefield's plans for their economic revitalization (Miller's Crossing) of their property. But given the presumed location of the bridge, Blind 4 would be situated very near the bridge.

N.5 Joe Swenson, July 12, 2010

Comment Letter 5

Joe Swenson
<caphas_z@hotmail.com>
07/12/2010 11:58 AM

To <fw1planningcomments@fws.gov>
cc
Subject Ridgefield Refuge's Draft CCP/EA

To Whom It May Concern,

Regarding Ridgefield Refuge's Draft CCP/EA I would prefer Alternative 2. Thank you for considering my vote.

Joe Swenson
Battle Ground, WA

Hotmail is redefining busy with tools for the New Busy. Get more from your inbox. See how.

Response 5.
Service Response to Joe Swenson
Thank you for your comments.

N.6 Jeff Boechler, North Willamette Watershed District Manager, Oregon Department of Fish and Wildlife, July 14, 2010

Comment Letter 6

Oregon

Theodore R. Kulongoski, Governor

Department of Fish and Wildlife
Northwest Region
17330 SE Evelyn Street
Clackamas, OR 97015-9514
(971) 673-6000
(971) 673-6070

July 14, 2010

Mr. Bob Flores
Project Leader
Ridgefield National Wildlife Refuge Complex
P.O. Box 457
Ridgefield, WA 98642

Dear Bob:

Thanks for the opportunity to comment on the Ridgefield NWR CCP document and for the involvement of ODFW personnel in the planning process. Our department cannot emphasize enough the importance of coordinated management between Ridgefield and state wildlife areas in Oregon and Washington.

With escalating issues in the Willamette Valley and lower Columbia River with management of migrant geese, in particular cackling and dusky Canada geese, it is imperative that the refuge maintain existing forage areas for wintering geese and enhance and expand goose habitat areas to the extent possible. Forage management practices should include all potential possibilities including grazing, crop planting and mowing. There are minimal public lands in this region and it is imperative that state and federal lands be managed to try to hold geese as much as possible to assist in reducing crop depredations on private lands. Geese currently move back and forth between public and private lands in Oregon and Washington

In addition to providing suitable habitat for geese the department would also express that public use management and enforcement is of utmost importance. Any hunting programs on the area need to be designed to minimize potential impacts to the dusky Canada goose population. The department believes that some core use areas for dusky Canada geese are currently open for hunting and these blinds should be eliminated. In addition, outside of hunting frameworks, all core goose use areas should have minimal to no public disturbance. For example, Bachelor Island has significant use by cackling Canada geese and should be maintained as sanctuary so geese being hazed or hunted off of private lands have sanctuary. This will assist with depredation complaints on private lands. Also, flyway biologists have noted delayed spring migration by geese, primarily cackling Canada geese well beyond the normal April 15 time frame. Area closures listed in your plan need to have the flexibility to be moved into a May time period if further delay in migration is documented. The department recommends annual assessment of hunting programs and public use management on Ridgefield NWR with department, Washington Department of Fish and Wildlife and USFWS personnel annually. This assessment should also include state areas in both states and could be further expanded to discuss ongoing goose habitat management programs.

The department would also recommend reducing the potential impact on disturbance of wintering geese by closing the south end of the current car tour route, thus reducing total open road from 4.3 to 2.6 miles. This reduced open road would only be necessary from October 1 to April 30 while most geese are present. Outside of those dates the current open road tour route could be maintained. In addition, if a new public access location does materialize, the total miles of open road should be reduced accordingly.

The department supports a study (as proposed in all alternatives) that would determine the feasibility of establishing a nonessential experimental population (NEP) of Columbian White-tailed deer on the refuge. Concerns associated with any reintroduction would be dispersal of deer onto private or state lands in Oregon which may impact recreational hunting and/or increase agricultural and ornamental damage. The department would support the NEP designation which would allow for management flexibility should deer move onto private or state lands in Oregon.

Thank you again for the opportunity for comment and we look forward to further communications on management of federal and state lands on the lower Columbia River. Questions or comments can be addressed to me or Brad Bales in our Salem office.

Sincerely,

Jeff Boechler
North Willamette Watershed District Manager

Response 6.
Service Response to Oregon Department of Fish and Wildlife

Throughout the development of the alternatives, the Refuge has sought to comply with provisions in the Pacific Flyway Management Plan for the Dusky Canada Goose (2008) and the Northwest Oregon/Southwest Washington Canada Goose Agricultural Depredation Control Plan (1998). As a signatory to these plans, the Service has agreed to take steps to increase the numbers of these birds using the Refuge through both public use management and habitat management. Since the Service is a cooperating wildlife agency for the welfare and management of the dusky Canada goose population, refuge management actions will continue to adhere to the recommendations prescribed in the Pacific Flyway Management Plan for the Dusky Canada Goose. To protect dusky Canada geese, the refuge's hunt program tiers to the annual recommendations of the Pacific Flyway Council regarding annual harvest quotas designed to protect dusky populations. The Refuge maintains its own quota (currently 5 birds) and prohibits on-refuge goose hunting once the refuge's annual dusky harvest quota has been reached (see Appendix B, Compatibility Determination-Waterfowl Hunting). To ensure compliance to season limits for dusky Canada geese and other waterfowl, the refuge's hunt program conducts periodic law enforcement sweeps, has a staff present on all hunt days, requires mandatory check in/out for all hunters, and operates an on-site check station serving only the refuge's hunt program. These measures are all intended to minimize the potential impacts to dusky Canada geese populations within the framework of the Pacific Flyway Management Plan for the Dusky Canada Goose.

Starting in the mid-1990s staff of the Ridgefield National Wildlife Refuge also started to note delayed migration of cackling geese. In 1998 the refuge implemented area closures on the River 'S' Unit until May 1st to prevent undue disturbance to migrating waterfowl. This date is consistent with all alternatives within the Draft CCP/EA. If further migration delays continue, the Refuge has mechanisms to implement changes to the seasonal opening and closing of public use areas. Also, the refuge has extended weekly goose surveys into late April to ensure that counts and collar search data are collected for migrating geese to assist us in determining the needs of geese using the refuge.

The refuge acknowledges the value of annual coordination with Oregon Department of Fish and Wildlife and Washington Department of Fish and Wildlife in the management of shared resources and wildlife. Please see Section 2.3.1, Features Common to all Alternatives, which states that the Service would continue to maintain regular discussions with the Washington and Oregon Departments of Fish and Wildlife (WDFW and ODFW). Key topics of discussion would include management of dusky Canada geese, cackling geese, and other waterfowl; depredation; updates of waterfowl management and depredation plans; wildlife monitoring; hunting and fishing seasons and regulations; and management of Federal and State-listed species.

The refuge examined alternatives that would remove hunt blinds from the southern portion of the hunt area to help reduce the harvest of dusky Canada geese and re-route the Auto Tour Route to reduce goose and crane disturbance in the southern portion of the River S Unit. Public and agency input was also solicited. Visitors who use the Auto Tour route were strongly opposed to re-routing the route, even on a seasonal basis. Hunters were opposed to removing the hunt blinds from this area, since these blinds typically provide quality duck hunting opportunities. Any major reconfiguration of the auto tour route on the River 'S' Unit would route public use through areas proximal to waterfowl habitat. The proposed shortened route would provide public access to the vicinity of Ruddy Lake, north Rest Lake, and South Big Meadow. Portions of all of these fields could be considered areas frequently used by dusky Canada and cackling geese. The proposed shortened route would include the dike along north Rest Lake which is used as a roost for dusky Canada and cackling geese. Data that show a direct link between the auto tour route in its current configuration and declines in wildlife use are lacking. Goose surveys before and after the tour route was expanded to its current configuration do not show a clear trend. Without compelling evidence that the current auto tour route has reduced wildlife use, the Preferred Alternative in the Draft CCP/EA proposed the route remain in its current location and seasonality, except for eliminating a small jog protruding into Swartz Field.

The Refuge appreciates your support of Section 2.4.7, Objective 7.5 to partner with the Columbian White-tailed Deer Recovery Team to conduct a feasibility study for the establishment of a viable population of CWT deer. Outreach and coordination with interested parties (agencies, NGOs, agricultural organizations, and landowners) will be a critical part of determining the feasibility of any introduction. The feasibility study will examine the potential of animal dispersal and subsequent impacts to recreational activities, proximal landowners, and local depredation. Establishment of a population of CWT deer will require a shift and/or the addition of refuge resources for CWT management and protection. Refuge biological resources are currently focused on wetland and pasture management for dusky Canada geese, cackling geese, sandhill cranes, and other waterfowl. The feasibility study will identify additional tasks that may be required, including, but not limited to predator management, crop production, forest restoration, and invasive species control. The feasibility study will also identify the status of any CWT deer that would be relocated.

N.7 Arland D. Richardson, July 14, 2010

Comment Letter 7

ADRJOAN@aol.com
07/14/2010 04:04 PM

To FW1PlanningComments@fws.gov
cc
Subject Ridgefield NWR DCCP/EA

As a long time Volunteer, Refuge supporter, and Hunter, I would like to offer a few thoughts and comments on the CCP/EA.
Access: From a background in Roadway and Bridge engineering, I would think that a new access structure at the current location that eliminates the at grade R/R crossing as proposed in Alt. 3, would have a significantly smaller footprint and environmental impact when compared to the proposal of a new structure and mile long new access roadway of the other proposals. A new northern access would significantly impact the fields, wetlands and hunting area in that section of the Refuge

Wildlife Observation/Auto Tour: A change in the auto route that may merit consideration, is to construct and reroute the roadway just west of the observation blind parking area. The route could follow the existing dike and access road at that location , reconnecting to the existing route near the slough crossing to the south. This route would eliminate the narrow, circuitous route though the trees and brush along the main slough. This change would seem to offer better wildlife viewing particularly during the fall and spring migration periods

Hunting: With shrinking hunting access throughout the area and the ever increasing demand for quality hunting opportunities,any plan that would decrease hunting opportunities should **Not** be considered. Any losses of hunting area and blinds must be mitigated with replacement blinds and hunting areas.
The 15 year plan provides a golden opportunity to provide at least some minor expansion of the hunting program. Given the nearly 6000 acres of the total refuge habitat, there seems to be little credibility to the reluctance to even minor expansion of the hunting area without tradeoffs of the most productive portion of the existing hunting area. I expect most interests would even support closing the 3 southern most blinds to goose hunting, leaving them open to duck hunting, as practiced last year, if alternate goose hunting was provided elsewhere.

In Summary, if the proposed alternates are inflexible, I would expect most, including myself, would find Alternate 2 acceptable as it seems to provide some positive improvements and does minimal damage to the hunting program. However if the proposals are still flexible, I sincerely believe that additional positive changes such as those noted above, can be implemented without tradeoffs and negative impact on the habitat and the overall wildlife population.

Sincerely,

Arland D. Richardson
PO Box 398
Woodland, WA 98674

(360) 225-7791
adrjoan@aol.com

Response 7.
Service Response to Arland D. Richardson

Thank you for your input on the topic of access and transportation issues at the refuge. The Transportation Access Analysis prepared May 2009 by the Western Federal Lands Highway Division (Appendix L) analyzed the option of replacing the River ‘S’ Bridge in its current location with a bridge that spans both Lake River and the BNSF railroad tracks. This report showed that the road from Hillhurst to the bridge would need to be widened. To accommodate this widening, a significant number of trees would have to be removed in an area with steep slopes that is subject to frequent slides. The cost of the project is also high based upon the span required to eliminate the at-grade railroad crossing and span Lake River (a navigable waterway). The project would also require land acquisition to place the existing roadway and project’s footprint into refuge ownership.

The Service road that cuts through Midlands Field was discussed internally by the planning team as a route to seasonally truncate the auto tour route, and presented in public meetings and informational documents. Besides truncating the auto tour route, this would also take the auto tour route away from hunt blinds 16, 17, 18, and 19. Unfortunately, Midlands Field and the west shoreline of Rest Lake are considered areas frequently used by foraging and roosting dusky Canada geese and a newly developed road would likely result in additional disturbance to dusky Canada geese. Additionally, use of this road would have the auto tour route border the majority of Rest Lake, potentially expanding disturbance to an important wetland within the sanctuary portions of the River ‘S’ Unit. The refuge does recognize the importance of wetlands along the auto tour route and has proposed straightening of the southeast corner of the tour route to reduce disturbance to dusky Canada geese and sandhill cranes using Schwartz Field.

We have considered your request to combine Alternatives 3 and 4, thereby adding 250 acres to the hunting program. During the development of the various Alternatives, the Refuge conducted three public meetings with opportunities for public comments, met with numerous user groups, and provided information updates through the mail, on-line and through local media outlets. Throughout this process, we received comments from many users, including but not limited to hunters, photographers, birders, and environmental educators. Throughout the CCP development, we have sought to provide user groups with compatible recreation opportunities while fulfilling our mission to provide high quality habitat for migrating and wintering dusky Canada geese, cackling geese, sandhill cranes and other waterfowl. Throughout the development of the alternatives, the Refuge also sought to comply with treaty obligations under the Migratory Bird Act provisions in the Pacific Flyway Management Plan for the Dusky Canada Goose (2008) and the Northwest Oregon/Southwest Washington Canada Goose Agricultural Depredation Control Plan (1998). As signatories to these plans, the Service has agreed to take steps to increase the numbers of these birds using the Refuge through both public use management and habitat management. Opening additional refuge wetland areas to any public use through this planning process would effectively reduce the refuge’s value to wintering waterfowl, dusky Canada geese, and other purposes species. A major resource concern is the loss of suitable habitat within the lower Columbia River area for ducks, geese, swans, cranes, and other purposes species. It is estimated that over half of the historic riverine wetlands, including 90% of tidally influenced freshwater wetlands, in the lower Columbia River have been lost or substantially degraded. During the lifetime of the CCP, there will be a continuing trend of loss, degradation, and fragmentation of wildlife habitat coupled with burgeoning population growth in the Portland-Vancouver metropolitan area. These factors will put greater pressure on wetland obligate species, including swans, ducks, geese, herons, and sandhill cranes. Wildlife will place higher demands on the remaining wetlands, as they congregate in greater densities in suitable habitat. For these reasons, it is not feasible to significantly increase the number of acres for any public use on the refuge. The refuge has not proposed any reduction in the number of hunt blinds. One or two blinds may be removed to allow safe operation of the new access road from the Port to the Auto Tour Route. However, these would be replaced by new blinds that could be installed following the relocation of the existing Waterfowl Check Station.

N.8 Albert O'Connor, July 15, 2010

Comment Letter 8

July 15, 2010

Mr. Bob Flores, Project Leader
Ridgefield National Wildlife Refuge Complex
P.O. Box 457
Ridgefield, WA 98642

Dear Mr. Flores:

I do not support any of your alternatives. I would support Alternatives 2 providing it included 207 acres on the south end of River 'S' Unit open to duck hunting, but closed to goose hunting to reduce take of dusky geese and 250 acres on Bachelor Island would be open to waterfowl hunting. Thanks!

Sincerely,

Albert O'Connor

15417 NE Parkinen Road
Brush Prairie, WA 98606

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Response 8.
Service Response to Albert O'Connor
During the development of the various Alternatives, the Refuge conducted three public meetings with opportunities for public comments, met with numerous user groups, and provided informational updates via email, website and through local media outlets. Throughout this process, we received comments from many users, including but not limited to hunters, photographers, birders, and environmental educators. Throughout the CCP development, we have sought to provide user groups with compatible recreation opportunities while fulfilling our mission to provide high quality habitat for migrating and wintering dusky Canada geese, cackling geese, sandhill cranes and other waterfowl. A major factor has been our need to comply with provisions in the Pacific Flyway Management Plan for the Dusky Canada Goose (2008) and the Northwest Oregon/Southwest Washington Canada Goose Agricultural Depredation Control Plan (1998). As a signatory to these plans, the Service has agreed to take steps to increase the numbers of these birds using the Refuge through both public use management and habitat management. In addition, current land use patterns show a continual loss of undeveloped land in the vicinity of the refuge, increasing the importance of refuge lands to wildlife. The refuge recognizes the importance of sanctuary areas to dusky Canada geese and cackling geese, both of which are below their target populations. Bachelor Island provides sanctuary and high quality habitat for dusky Canada geese and a large number of cackling geese. It is also an important foraging and roosting area for sandhill cranes. Therefore, because of pressures on species in need of protection and the habitat needs of these species, the Refuge has decided not to convert sanctuary areas such as Bachelor Island, to public use areas.

N.9 Karen Wood, July 15, 2010

Comment Letter 9

"Karen Wood" <kwood@pacifier.com>
07/15/2010 06:02 PM

To <FW1PlanningComments@fws.gov>
cc
Subject Ridgefield NWR DCCP/EA

I appreciate the time and effort of FWS staff to develop the Comprehensive Conservation Plan. It appears to be well documented and thought out and does a good job of balancing the needs of wildlife with the desires of people to enjoy them.

After reviewing the Alternatives Summary Table in Planning Update 4, I have the following comments:

- I agree with selection of Alternative 2 over Alternative 3 or 4 as the Preferred Alternative for the following reasons:
  - Seems to be the best alternative for improved access to River S unit
  - Allows pedestrian access to both River S and Carty Unit from Ridgefield, which in particular might reduce traffic on the auto tour route
  - Maintains existing waterfowl hunting but does not expand it (recognizing the significant and increasing use of the refuge by people who prefer to enjoy wildlife alive, not dead)
  - Auto tour route remains open year round with minor reduction in length to reduce wildlife disturbance
- Proposals I like most that are common among Alternative 2, 3, and 4 include:
  - More habitat restoration and invasives control to improve various habitat areas
  - Monitoring wildlife disturbance--I think it is extremely important to reduce public use if unacceptable levels of disturbance are occurring. As much as I love going to the refuge to enjoy nature and watch birds, I would gladly give up some of that use if it is having detrimental effects on the wildlife.
  - Increased inventory, research, and monitoring of invasive species and control of invasive species
  - Baseline surveys and inventories to guide future management actions
  - New seasonal 1.5-mile dike-top wildlife observation trail on River S unit
  - Construction of new nature center--would help visitors learn about the refuge and its wildlife
  - Expanded environmental education--to me an important use of the refuge is to connect people, both children and adults, to nature

General comments:

- I look forward to seeing the many proposed improvements to the refuge implemented as funding becomes available. When prioritizing what is funded first, I hope proposals that improve habitat for wildlife will be given higher priority. Although there are many uses of the refuge by the public, and I look forward to improvements in those areas, too, wildlife needs to come first. Especially as the area around the refuge develops, maintaining and improving habitat will become more important.
- The refuge will become more important as an area where people can connect with nature, as local population grows and natural areas are developed. But wildlife needs should come first. If need be, the number of refuge users should be restricted, especially on the ever popular auto tour route.

I did not have time to read all of the DCCP/EA, but appreciated receiving a copy of it on CD. Based on what I did read and skimming through the rest of the document, there is a wealth of information in the CCP, and I plan to keep it as a resource for future use.

Thank you for the opportunity to comment and your efforts to improve Ridgefield NWR.

Karen Wood
14910 NE 46th St
Vancouver, WA 98682
kwood@pacifier.com

Response 9.
Service Response to Karen Wood
Thank you for your comments. The refuge is committed to providing high quality habitat for our priority species as well as opportunities for wildlife-dependent recreation and public use.

N.10 Nathan Pamplin, Deputy Assistant Director, Washington Department of Fish and Wildlife, July 15, 2010

Comment Letter 10

"Pamplin, Nathan (DFW)" <Nathan.Pamplin@dfw.wa.gov>
07/15/2010 05:57 PM

To <FW1PlanningComments@fws.gov>
cc "Kraege, Don (DFW)" <Don.Kraege@dfw.wa.gov>
Subject Ridgefield NWR DCCP/EA

To Whom it May Concern:

Thank you for the opportunity to provide comments on the Ridgefield National Wildlife Refuge (NWR) Draft Comprehensive Conservation Plan and Environmental Assessment (DCCP/EA). We also greatly appreciate the efforts of the Ridgefield NWR and other USFWS Region 1 staff to include Washington Department of Fish and Wildlife (WDFW) in all stages of the planning process. We are pleased to see many of the changes we proposed during the planning process included in the DCCP/EA. We are supportive of most elements in the preferred alternative (Alternative 2). However, there are several issues in the DCCP/EA that need to be reconsidered.

One of our remaining concerns involves expansion of sanctuary for dusky and cackling Canada geese. The dusky Canada goose population has declined significantly during the past 5 years. We believe that the changes in hunting blind configurations on the refuge last year addressed harvest impacts to dusky geese and encouraged more habitat use during fall and winter. In addition, the increases proposed for pasture and cropland acreage will greatly assist in improving the capacity of the Refuge to provide habitat for Canada geese. However, it is imperative that geese have unrestricted access to quality habitat during the main agricultural damage period after the hunting season. The preferred alternative lists Bachelor Island, Roth, and Ridgeport Dairy as closed to all access to provide sanctuary. During the planning process, WDFW also recommended reduction in the auto tour route during critical use periods to expand sanctuary for dusky and cackling Canada geese. To address these concerns, we recommend that the wording from Alternative 4 regarding the auto tour route be substituted for the wording in Alternative 2.

WDFW believes that there is potential for nesting sandhill cranes in the area. Sandhill cranes have been reported on Sauvie Island during summer, and expanded surveys are being discussed to document potential breeding activity. We would support inclusion of language in the document to recognize this potential and develop a strategy to encourage nesting if feasible.

We appreciate the opportunity to comment on the DCCP-EA, and look forward to continued cooperative management of our public lands in the lower Columbia River floodplain. If you have questions regarding these comments, please contact Don Kraege, WDFW Waterfowl Section Manager, at don.kraege@dfw.wa.gov or (360) 902-2522.

Sincerely,

Nate Pamplin

Nathan Pamplin
Deputy Assistant Director
Wildlife Program
Washington Department of Fish and Wildlife
600 Capitol Way North
Olympia, WA 98501
(360) 902-2693
Nathan.Pamplin@dfw.wa.gov

Response 10.
Service Response to Washington Department of Fish and Wildlife

Thank you for your comment concerning reducing the auto tour route during critical use periods for dusky Canada and cackling geese. Any major reconfiguration of the auto tour route on the River 'S' Unit would route public use through areas proximal to waterfowl habitat. The proposed shortened route would be routed in the vicinity of Ruddy Lake, Rest Lake, and South Big Meadow. Portions of all of these fields and wetlands are frequently used by both dusky Canada geese and cackling geese. Data that show a direct link between the auto tour route in its current configuration and declines in wildlife use are lacking. Goose surveys before and after the tour route was expanded to its current configuration do not show a clear trend. Without compelling evidence that the current auto tour route has reduced wildlife use, the Preferred Alternative in the Draft CCP/EA proposed the route remain in its current location and seasonality, except for eliminating a small jog to reduce disturbance to sandhill cranes and dusky geese using Schwartz Field.

We appreciate and agree with your comments on the importance of sanctuary areas for dusky Canada geese and cackling geese. The refuge considers the goals and objectives contained in the Pacific Flyway Management Plan for the Dusky Canada Goose (2008) and the Northwest Oregon/Southwest Washington Canada Goose Agricultural Depredation Control Plan (1998) when planning any action.

As a signatory to these plans, the Service has agreed to take steps to increase the numbers of these birds using the Refuge through both public use management and habitat management. The refuge has decided that maintaining the existing sanctuary areas on the refuge and implementing various habitat improvements described in the CCP will help these species reach established goals.

Recently, refuge staff has noted periodic summer observations of sandhill cranes on the Bachelor Island Unit. In recognition of the breeding potential of sandhill cranes in the region, a strategy will be added to Chapter 2.4.7, Objective 7.2 (Conduct Surveys) related to the monitoring for cranes during the breeding season and documentation of nesting attempts. Under the preferred Alternative of the Draft CCP/EA, large contiguous sanctuary areas would be maintained with adequate potential nesting habitat for sandhill cranes on the Bachelor Island, Roth, and Ridgeport Dairy Units.

N.11 Russ Kashow, July 15, 2010

Comment Letter 11

"Russ Kashow"
<russkashow@comcast.net>
07/15/2010 10:04 AM

To <FW1PlanningComments@fws.gov>
cc "Scott Ririe" <scott@ririe.net>
Subject Ridgefield NWR DCCP/EA

To whom it may concern,

I am a regular patron at the River S unit and really enjoy the winter auto tour in its entirety and love to see the wildlife that is present during these times. I also take my children to see the birds and other animals that city kids don't get to see very often and it would be a shame to lose these educational opportunities for the region. This is a great place to go and major changes would cause a loss of revenue for the Fish and Wildlife service. I would submit my support for option 1, 2 or 3 as it seems the best fit for both hunters and observers.

Thanks
Russ Kashow

Response 11.
Service response to Russ Kashow

Thank you for your comments.

N.12 Gretchen Starke, Vancouver Audubon Society, July 16, 2010

Comment Letter 12

VANCOUVER AUDUBON SOCIETY

P.O. Box 1966 Vancouver, WA 98668-1966
www.vancouveraudubon.org

c/o 308 NE 124th Avenue
Vancouver, Washington
July 16, 2010

Bob Flores, Project Leader
Ridgefield NWR Complex
PO Box 457
Ridgefield, Washington 98642
(360) 887-4106

RE: Draft CCP/EA Alternatives

Dear Mr. Flores:

The members of the Vancouver Audubon Society use the Ridgefield National Wildlife Refuge a great deal. It provides unparalleled birding opportunities so close to Vancouver. We are extremely interested, therefore, in the proposed management plan for the refuge. Many of our members also bring visitors from out of town to the refuge, especially during the peak birding season from late fall to early spring.

We have two main interests: conservation and protection of birds and bird habitat and the opportunity to view these birds. As such, we believe that Alternative 2, the preferred alternative, provides the best balance between these two concerns.

Considering two specifics in Alternative 2, the bridge over the railroad tracks desperately needs replacing. I note that the hunting blind in the way of the bridge would be replaced, so that should not be an issue. We appreciate the proposed hiking trail on the dike. Any further opportunities to hike is welcome.

The extensive measures to improve habitat are welcome. These will protect many species of birds to the benefit of birders and hunters alike.

I noted in *The Columbian* of July 15 that hunters are unhappy about the failure of the plan to provide for a an increase in hunting blinds. The article stated that the hunting groups wanted to open up Bachelor Island for hunting. Some hunters wanted to go so far as to close the driving loop during hunting season.

As we stated in our letter last year, we have no problem with hunting on the refuge. Hunting is a legitimate use and one of the uses for which the refuge was established. It should be allowed to continue. We do not think, however, that hunting should drive out the more passive use of wildlife observation. We would strongly oppose any closing of the River S driving loop simply for the convenience of hunters. As to the issue of hunting blinds on Bachelor Island, while we as a group would have no problem with that, consistent with protection of sensitive species, I did note in the draft document under Alternatives Considered but Not Developed that opening up Bachelor Island to hunting would cause problems concerning "conflicts with resource protection, and the ability of the refuge to provide adequate sanctuary area for dusky Canada geese, cackling geese, and other species." If this is the case, protection of the birds from undue disturbance should take precedent over the desires of any user group.

I would add that, if the economy of nearby communities is a consideration, birding is an economic engine. The City of Ridgefield benefits from those who visit the refuge to view birds and then spend money in town. The Birdfest celebration each year draws visitors from as far away as Vancouver B.C.

In sum, because of the proposed replacement of the bridge over the railroad tracks, the proposed hiking trail, the habitat improvement, and, most importantly, the balance between protection of the birds from disturbance and the opportunity to view them, the Vancouver Audubon Society supports the adoption by the Ridgefield National Wildlife Refuge of Alternative 2. Thank you.

Sincerely,

Gretchen Starke
Conservation Chair,
Vancouver Conservation Chair
(360) 892-8617

Response 12.
Services Response to Vancouver Audubon Society

Thank you for your comments and support of the refuge. Your point is well taken that protection of sensitive species from undue disturbance is important in the planning of any public use program. All six priority public uses (defined in the Refuge Improvement Act to include hunting, fishing, wildlife observation, photography, environmental education and interpretation) are considered to be appropriate uses. The refuge then goes through a detailed assessment process to determine whether they are compatible with refuge purposes and to what extent they will affect refuge management actions and other wildlife-dependent recreational activities (see Appendices A and B, Appropriate Use Findings and Compatibility Determinations, for more specific information). An important part of the planning process is determining which public uses would be allowed (i.e. are appropriate and compatible) and what conditions would have to be in place to prevent the use from detracting from the refuge purposes, which are "to provide wintering habitat for dusky Canada goose and other waterfowl," "provide breeding and migration use by waterfowl," and "provide substantial public shooting opportunities." By policy, any public use may not materially interfere with or detract from the fulfillment of the mission of the Refuge System or purposes for which the refuge was established. In order to comply with our refuge purposes, and as signatories to the Pacific Flyway Management Plan for the Dusky Canada Goose (2008) and the Northwest Oregon/Southwest Washington Canada Goose Agricultural Depredation Control Plan (1998), the Service is committed to increase the numbers of these birds using the Refuge through both public use management and habitat management. Habitat improvements and the maintenance of sanctuary areas are important components in managing for dusky Canada geese and cackling geese, as the populations of both species are currently below management goals.

N.13 Brent Grening, Port of Ridgefield, July 16, 2010

Comment Letter 13

Port of Ridgefield
Raising Tomorrow's Standard Today

Commissioners – Joe Melroy • Scott Hughes • Bruce Wiseman
Executive Director – Brent Grening

July 16, 2010

Mr. Bob Flores
Ridgefield National Wildlife Refuge Complex
P.O. Box 457
Ridgefield, WA 98642

RECEIVED
JUL 30 2010

RE: Comments to Draft CCP

Dear Mr. Flores:

The Port of Ridgefield strongly supports the mission and purpose of the U.S. Fish and Wildlife Service and the Ridgefield National Wildlife Refuge. Further, it is our firm belief that new refuge offices and interpretive center are needed at the Ridgefield Refuge. The Port strongly supports current efforts to plan for all these facilities.

This letter is written to provide comments regarding the Service's draft Comprehensive Conservation Plan. The comments offered herein concern the proposed siting of the administrative offices and nature/interpretive center. Specifically, we are concerned that both the selection process, public process and selection of the preferred alternative were inadequate and that the analysis did not address potentially significant onsite and offsite impact associated with construction and operation of the proposed facility.

The following concerns should be considered prior to selection of the preferred site for any new construction and formal adoption of the CCP:

1. The site selection criteria used in the analysis and selection process were not clearly defined nor did they consider the full economic, social and environmental costs and benefits to the city of Ridgefield.

2. City plans and development goals were not considered during the site selection process. City leadership should have been consulted and their vision for the community should have been considered prior to selection of the proposed site.

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3. The preferred site was selected without fully addressing the goals set forth for the federal government and by local community. These goals include enhancing the host communities environmental sustainability and economic development.

4. The proposed site does not place urban services in urban areas. The selected site could require extension of improvements such as roads, sidewalks and water and sewer infrastructure. Construction of the proposed facility should at a minimum include the costs of improving North Main Avenue between downtown Ridgefield and the proposed location. Potentially the improvements could include widening the roadway and the addition of sidewalks and bike paths on both sides of the street. These improvements would require filling and mitigation for impacts to the wetlands associated with Gee Creek. The monetary costs and environmental impacts of required infrastructure have not been adequately estimated or considered in the current draft. Nor have these potential impacts been adequately explained to the citizens of Ridgefield.

5. Location of the site encourages "urban sprawl" a phenomenon where urban services expand unnecessarily into urban areas and increase the cost of providing urban levels of service.

6. The proposed sites do not easily or efficiently accommodate visitors to downtown Ridgefield visiting the interpretive center. The proposed site is disconnected to the downtown core and the urban and retail services provided therein – therefore a visitor to downtown Ridgefield would reasonably have to drive to the refuge facilities. The services preferred location does not promote the "walkable compact urban center" desired by the citizens of Ridgefield. The Ridgefield community is working to improve its environmental and economic sustainability. The social, economic and environmental costs of locating the proposed facility have not adequately considered the long-term impacts to the sustainability of the community. Further analysis of these impacts is warranted prior to formal selection of the preferred site.

7. The proposed site does not enhance, compliment or strengthen the city as a gateway to the refuge or as a destination for visitors to the refuge. Other potential sites within Ridgefield city limits would do more to create a livable, sustainable and enjoyable community.

8. The proposed location does not connect to current and proposed public transit routes serving Ridgefield. The costs of serving the proposed facility with public transit are not adequately estimated and need to be considered prior to final site selection and adoption of the CCP.

9. The site selection process conducted by the service did not thoroughly indentify or consider alternative sites, nor did the process present these alternatives to the public for consideration and comment. There are several potential locations for the facility located within the city limits of Ridgefield, including property at the intersection of North Main and Pioneer Street, the Port of Ridgefield site and others.

10. The proposed site does not allow visitors arriving in Ridgefield via boat to conveniently walk to the interpretive center. The same is true for visitors who in the future may arrive in Ridgefield via passenger train.

11. The increased operating costs and traffic impacts associated with locating the proposed facility well away from the access road onto the southern units of the refuge appear not been estimated or considered in the site selection process.

Again, the Port of Ridgefield supports the development of Refuge offices and an interpretive center in Ridgefield. Given the long-term nature of the proposed develop we believe there is time to consider alternatives and to estimate the full social, environment and operational costs.

Sincerely,

Brent A. Grening
YWB

Brent A. Grening
Executive Director
Port of Ridgefield

Response 13.
Service Response to Port of Ridgefield
Thank you for your comments and strong support for Refuge's mission and purposes, and for the facilities needs on Ridgefield National Wildlife Refuge (specifically, a bridge to River 'S' Unit, a footbridge to Carty Unit, and a Nature Center/Office).
Funding timelines required that the Refuge prepare a separate Environmental Assessment for the construction and operation of a Nature Center and associated pedestrian bridge. During initial scoping of the various alternatives for the Nature Center, the Refuge discussed the project and sought comments from the Port of Ridgefield (Port), City of Ridgefield, and the residents of Ridgefield on numerous occasions. We held public meetings and a workshop, presented project updates to the public through local media outlets, and solicited public and agency comments. The public comment for the Nature Center Environmental Assessment has closed, and a Finding of No Significant Impact was issued on April 29, 2010.

As part of the Nature Center EA, the Refuge did state our commitment to working with the City of Ridgefield to improve the connectivity with downtown Ridgefield through the future City of Ridgefield public trail that would parallel NW Main Avenue and join the Refuge trail system through the southern boundary of the Carty Unit near the proposed Nature Center.

As part of the Environmental Assessment process, the refuge used a traffic study produced by Kittleson & Associates, Inc., who were contracted by the Service. The traffic study included a review of the Port's 2007 traffic study. The refuge's study concluded that the Nature Center would have minimal impact to the traffic operations along the adjacent roadway network.

Many of your concerns were addressed in the Nature Center EA. For additional information on the Nature Center, the final version of the Environmental Assessment and Finding of No Significant Impact is available at the Ridgefield National Wildlife Refuge website.

A Nature Center sited on Port property would require a road to be built to transport participants in our environmental and cultural education programs to the Carty Unit and Plankhouse. The lack of such access would severely prevent the Refuge from meeting our environmental and cultural education goals. This road would require considerable amounts of wetland fill and would require the refuge to obtain a Section 404 permit from the Corps of Engineers. With regard to impacts to jurisdictional wetlands, the Corps can only permit the "least environmentally-damaging practicable alternative (LEDPA)." The proposed Visitor Center site on the Carty Unit is a practicable alternative that would have fewer wetland impacts and thus is the only alternative that meets the LEDPA criteria.

N.14 Scott Ririe, July 16, 2010

Comment Letter 14

"Scott Ririe" <scott@ririe.net>
07/16/2010 02:39 PM

To <FW1PlanningComments@fws.gov>
cc "Russ Kashow" <russkashow@comcast.net>, "Scott Ririe" <scott@ririe.net>
Subject Ridgefield NWR DCCP/EA-Comments

To whom it may concern,

I was just recently made aware of the long-term comprehensive plans for the Ridgefield Wildlife Refuge, which includes four alternatives. First of all, I am a very frequent visitor to the River-S unit, sometimes visiting a couple of times a week during the fall and winter months, and several times/month during spring and summer. I have an annual pass and I love viewing and identifying birds and enjoy photographing them for pleasure and as a hobby. In other words, I spend hours at the refuge. Oftentimes I will bring my family with me and it is one of many memorable experiences my children have of growing up in this area.

In reviewing the four alternatives, I would strongly oppose alternative #4. This plan as written will reduce the tour route from 4.3 miles to 2.6 miles which effectively will eliminate much access to the refuge and limit our ability to view much of the wildlife we see today in the tour's current configuration. If anything, I would rather see the auto tour expanded not, reduced or shortened. This option seems to favor the duck hunters at the expense of those that come to enjoy viewing the wildlife.

I could live with options 1, 2, or 3, however option two would probably be my preference, although I hate to see the auto tour shortened at all. Having visited the Sacramento Wildlife Refuge and driving their auto tour, I think we have an opportunity to provide more access, not less; something to consider.

Thank you for considering my input,

Scott

Scott Ririe
30109 NE 124th Ave
Battle Ground, WA 98604

scott@ririe.net
360.687.9851 (home)
360.687.7268 (work)

Response 14.
Service Response to Scott Ririe
Thank you for your comments. During the development of the various Alternatives, the Refuge conducted three public meetings with opportunities for public comments, met with numerous user groups, and provided informational updates on-line and through local media outlets. Throughout this process, we received comments from many users including, but not limited to, hunters, photographers, birders, and environmental educators. Throughout the CCP development, we have sought to provide user groups with compatible recreation opportunities while fulfilling our mission to

provide high quality habitat for migrating and wintering dusky Canada geese, cackling geese, sandhill cranes and other waterfowl. All alternatives except the current management alternative (Alternative 1) would provide additional public use opportunities in terms of a new seasonal walking trail. Alternatives 2 and 3 will also provide new wildlife viewing opportunities along the new 1.1- mile access road.

During the development of alternatives, the refuge received numerous public comments in favor of maintaining the existing auto tour route. As described in our preferred alternative, the refuge proposes to maintain the existing auto tour route with the exception of eliminating the turn in the southeast corner of the route. Eliminating this turn will decrease disturbance to sandhill cranes and dusky Canada geese using Schwartz Field, while preserving wildlife viewing opportunities.

N.15 Joe Hendrix, July 16, 2010

Comment Letter 15

JOE JEANETTE HENDRIX
<elkman@q.com>
07/16/2010 02:24 PM

To <fw1planningcomments@fws.gov>
cc
Subject ridgefield dccplea

The current plan being proposed by FWS does not adequately address the needs and concerns of waterfowl hunters of the Pacific NW. The managers of the Ridgefield Wildlife Refuge have continually shortchanged the waterfowl hunter in regards to other user groups. I firmly believe the refuge should open up Bachelor Island to waterfowl hunters, and continue to allow duck hunting in blinds 17, 18 and 19 and Goose and duck hunting in all other blinds 1 thru 16.

25% of the refuge was supposed to be opened up for hunters and yet the managers have never met that promise.

Sportsmen are the best conservationists in the world today. Sportsmen pressed for the end of market hunting, pressed states to enact laws to protect and enhance wildlife and have started private programs and clubs like Ducks Unlimited that have been a Godsend to North America. Most of these were brought about before the FWS was formed by Congress. You could easily reach out to Washington Waterfowl Association, Vancouver Wildlife League and other sportsman conservation groups across the Pacific Northwest, but you have always refused to do so. And though I could continue to go on about sportsmen and conservation practices they use every day, I feel my words would fall on deaf ears.

Sportsmen and women have demonstrated in the past they can and will take control of our nation's wildlife needs. It's unfortunate our National Wildlife refuges are being run in such a manner. The day may come when the system is taken away by the taxpayers and given to a truly great conservation organization like D.U. to be run in the manner for which our National Wildlife Refuge system was designed.

Sincerely,

Joe Hendrix

Response 15.
Service Response to Joe Hendrix

Hunting is an appropriate use of the Refuge System when compatible. It is also considered a priority public use of the Refuge System and therefore receives enhanced consideration over non-priority uses. On Ridgefield National Wildlife Refuge hunting is considered a compatible public use within the scope and stipulations described in the Compatibility Determinations in Appendix B. Most of Ridgefield NWR was purchased under the authority of the Migratory Bird Conservation Act (Act). The Act states the amount of the Refuge open to waterfowl hunting, up to the maximum 40%, is variable and subject to the mandate that the Refuge meet the needs of wildlife first. Throughout the development of the alternatives, the Refuge has sought to comply with provisions in the Pacific Flyway Management Plan for the Dusky Canada Goose (2008) and the Northwest Oregon/Southwest

Washington Canada Goose Agricultural Depredation Control Plan (1998). As a signatory to these plans, the Service has agreed to take steps to increase the numbers of these birds using the Refuge through both public use management and habitat management. In addition, current land use patterns in southwest Washington and northwest Oregon show a continual loss of undeveloped land in the vicinity of the refuge, increasing the importance of refuge lands to wildlife. Because of urban growth the refuge recognizes the importance of providing sanctuary areas to dusky Canada geese and cackling geese, both of which are below their target populations. Dusky Canada goose numbers in particular, have been in a long-term decline and the refuge is committed to improving our habitat management to benefit this species. Bachelor Island provides high quality habitat and is used by dusky Canada geese and a large number of cackling geese. It is also an important foraging and roosting area for sandhill cranes. Therefore the Refuge has decided not to convert sanctuary areas such as Bachelor Island, to public use areas.

During the development of the various Alternatives, the Refuge conducted three public meetings with opportunities for public comments, met with numerous user groups (including three meetings with the Washington Waterfowl Association), and provided informational updates on-line and through local media outlets. Throughout this process, we received comments from many users including, but not limited to, hunters, photographers, birders, and environmental educators. Throughout the CCP development, we have sought to provide user groups with compatible recreation opportunities while fulfilling our mission to provide high quality habitat for migrating and wintering dusky Canada geese, cackling geese, sandhill cranes, and other waterfowl.

N.16 A.G. Hackett, July 16, 2010

Comment Letter 16

aghackett@aol.com
07/16/2010 12:31 PM

To fw1planningcomments@fws.gov
cc
Subject Proposals from Waterfowl hunters

Total disregard of our participation, our comments and suggestions. Looks like you have a plan and the plan is to reduce, and shut down as much hunting as is possible. I really do not understand why and I do not understand why we can not share this resource
on a fair basis.

Just Disgusting.

Please provide me with the name and address of you regional and National headquarters as I will be sending a formal letter to all.

Response 16.
Service Response to A.G. Hackett

Your comments state that the Draft CCP/EA intends to reduce or eliminate waterfowl hunting at the Ridgefield National Wildlife Refuge. Please reference Chapter 2, Features Common to All Alternatives, specifically the section titled "Maintain waterfowl hunting opportunities." This section states the refuge will continue to provide, at minimum, its current waterfowl hunting opportunity. The location of hunt areas and blinds vary by Alternatives within the Draft CCP/EA. Specifically, Goal 2.6.1 identifies a range of alternatives that would maintain or potentially increase acreage of the waterfowl hunting area and how the hunting blinds would be relocated to maintain opportunity.

During the development of the various alternatives, the Refuge conducted public meetings with opportunities for public comments, met with numerous user groups (including three meetings with the Washington Waterfowl Association), and provided informational updates on-line and through local media outlets. The Refuge consulted with the Washington and Oregon Departments of Fish and Wildlife. Throughout this process, we received comments from many users including, but not limited to, hunters, photographers, birders, and environmental educators. These comments led to modifications of the alternatives throughout the development of the plan to try to best meet the needs of the various user groups while accomplishing our mission to provide high quality habitat for migrating and wintering dusky Canada geese, cackling geese, sandhill cranes, and other waterfowl.

The refuge recognizes the importance of wildlife-dependent recreation such as hunting and is committed to providing hunting opportunities. Under the preferred alternative, the waterfowl hunt area remains the same as the existing conditions, and the hunter check station would be relocated to the current Auto Tour entrance. This will allow the refuge to construct one or two additional hunt blinds in the Teal Marsh area to compensate for the loss of blind 4, which would have to be removed to safely operate the new bridge and access road.

U.S. Department of the Interior
U.S. Fish & Wildlife Service
Ridgefield National Wildlife Refuge
28908 NW Main Ave.
Ridgefield, WA 98642-0457

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http://www.fws.gov

National Wildlife Refuge System Information
1 800/344 WILD

September 2010

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

Cover Photo:
Cackling geese